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UNITED STATES GEOLOGICAL SURVEY

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Water-Supply Paper 526

SURFACE WATER SUPPLY OF THE
UNITED STATES

1921

PART VI. MISSOURI RIVER BASIN

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Prepared in cooperation with the
STATES OF MONTANA, WYOMING, IOWA, COLORADO,
KANSAS, AND MISSOURI



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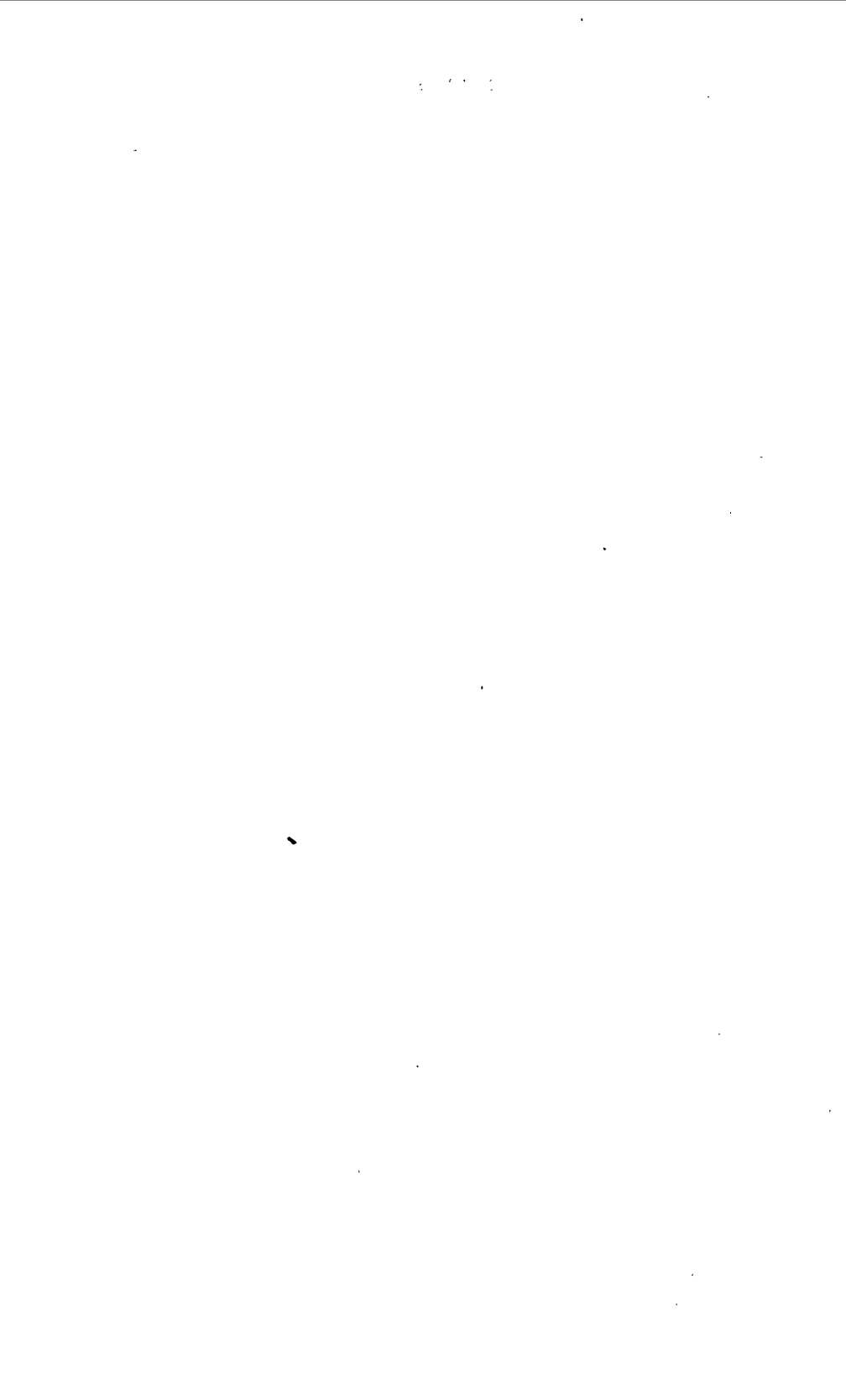
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SURFACE WATER SUPPLY OF MISSOURI RIVER BASIN, 1921

AUTHORIZATION AND SCOPE OF WORK

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1921.

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 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 of utilizing the water resources.

Annual appropriation for the fiscal years ending June 30, 1895-1922

1895.....	\$12, 500. 00
1896.....	20, 000. 00
1897 to 1900, inclusive.....	50, 000. 00
1901 to 1902, inclusive.....	100, 000. 00
1903 to 1906, inclusive.....	200, 000. 00
1907.....	150, 000. 00
1908 to 1910, inclusive.....	100, 000. 00
1911 to 1917, inclusive.....	150, 000. 00
1918.....	175, 000. 00
1919.....	148, 244. 10
1920.....	175, 000. 00
1921.....	180, 000. 00
1922.....	180, 000. 00

In the execution of the work many private and State organizations have cooperated either by furnishing data 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 pages 9 and 10.

Measurements of stream flow have been made at about 5,200 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1921, 1,350 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.

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 a 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 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, and acre-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 other are computed.

“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 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 in inches.

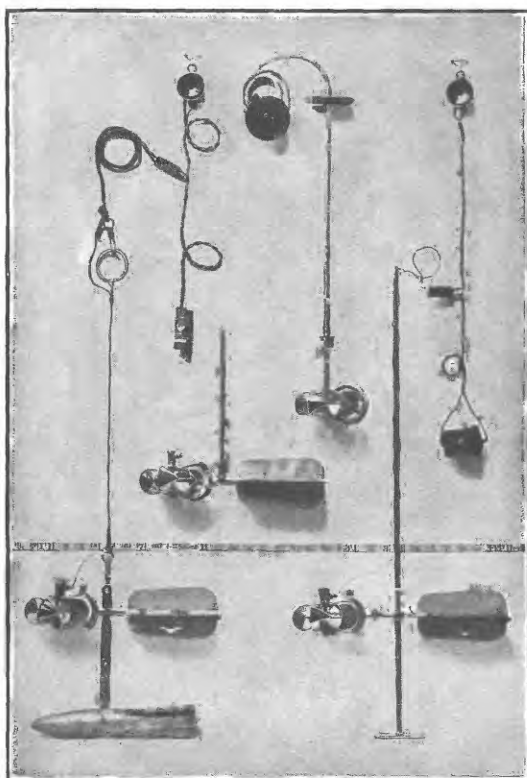
An “acre-foot,” equivalent to 43, 560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

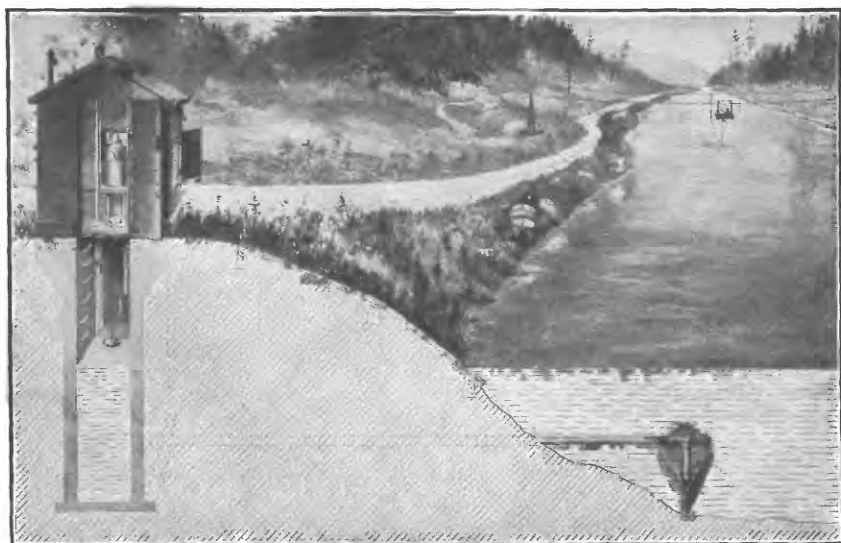
“Stage-discharge relation,” an abbreviation for the term “relation of gage height to discharge.”

“Control,” a term used to designate the section or sections of the stream below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

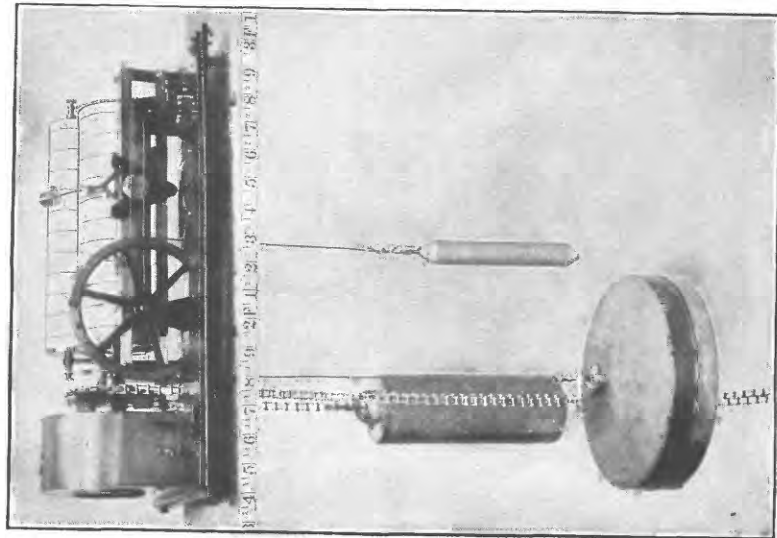
The “point of zero flow” for a given gaging station is that point on the gage—the gage height—to which the surface of the stream would fall if there were no flow



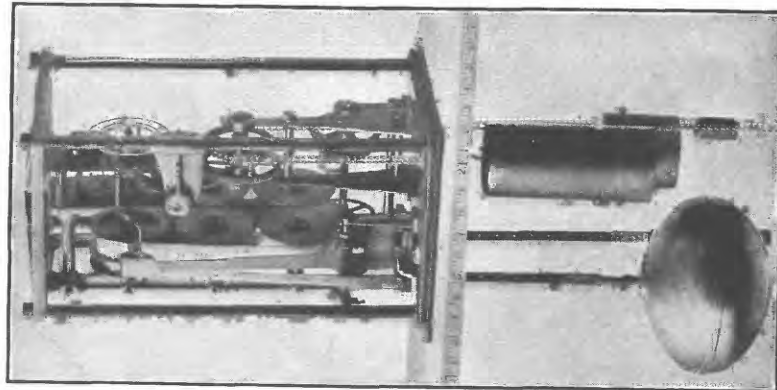
A. PRICE CURRENT METERS.



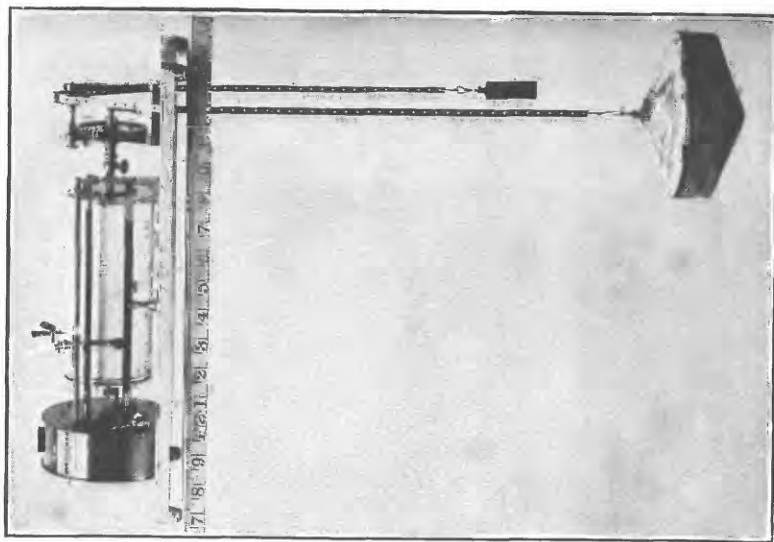
B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.



B. GURLEY PRINTING.
WATER-STAGE RECORDERS.



C. FRIEZ.

EXPLANATION OF DATA

The data presented in this report cover the year beginning October 1, 1920, and ending September 30, 1921. At the beginning 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 ice, 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 the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations 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 that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter. (See Pls. I, II.) 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. The application of the daily gage heights to these rating tables gives 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 stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of control, 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, in general, 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 height may not be the true mean discharge, for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day, or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow 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 headed "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 average flow computations recorded in the remaining columns, which are defined on page 2, are based.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS

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

A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods of applying daily gage heights to the rating table to obtain the daily discharge.¹

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," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and run-off in inches may be subject to gross errors caused by the inclusion of large non-contributing districts in the measured drainage area, by lack of information concerning water diverted for irrigation or other use, or by inability to interpret the effect of artificial regulation of the flow of the river above the station. "Second-feet per square mile" and "Run-off in inches" are therefore not computed if such errors

¹ For a more detailed discussion of the accuracy of stream-flow data see Grover, N. C., and Hoyt, J. C. Accuracy of stream-flow data: U. S. Geol. Survey Water-Supply Paper 400, pp. 53-59, 1916.

appear probable. The computations are also omitted for stations on streams draining areas in which the annual rainfall is less than 20 inches. All figures representing "second-feet per square mile" and "run-off in inches" previously published by the Survey should be used with caution because of possible inherent but unknown sources of error.

Many gaging stations on streams in the irrigated sections of the United States are located above most of the diversions from those streams, and the discharge recorded does not show the water supply available for further development, as prior appropriations below the stations must first be satisfied. To give an idea of the amount of prior appropriations, a paragraph on diversions is presented in each station description. Where figures are given these can not be considered exact but as being the best information available.

The table of monthly discharge gives only a general idea of the flow at the station and should not be used for other than 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 previously published.

PUBLICATIONS

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, annual reports, and monographs.

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 slope 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 slope basins in California.

XII. North Pacific slope basins; in three volumes:

A. Pacific slope basins in Washington and upper Columbia River basin.

B. Snake River basin.

C. Lower Columbia River basin and Pacific slope basins in Oregon.

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 offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., 704 Journal Building.
Trenton, N. J., State House.
Asheville, N. C., 316 Jackson Building.
Chattanooga, Tenn., 37 Municipal Building.
Columbus, Ohio, Orton Hall, Ohio State University.
Chicago, Ill., 1404 Kimball Building.
Madison, Wis., care of Railroad Commission of Wisconsin.
Ames, Iowa, State Highway Commission Building.
Rolla, Mo., Rolla Building, School of Mines and Metallurgy.
Topeka, Kans., 23 Federal Building.
Helena, Mont., 52 Montana National Bank Building.
Denver, Colo., 403 Post Office Building.
Salt Lake City, Utah, 313 Federal Building.
Idaho Falls, Idaho, 228 Federal Building.
Boise, Idaho, 615 Idaho Building.
Tacoma, Wash., 406 Federal Building.
Portland, Oreg., 606 Post Office Building.
San Francisco, Calif., 328 Customhouse.
Los Angeles, Calif., 600 Federal Building.
Tucson, Ariz., 210 Agricultural Building, University of Arizona.
Austin, Tex., State Capitol.
Honolulu, Hawaii, 25 Capitol 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 records have been obtained at about 5,200 points in the United States, and the data obtained have been published in the reports tabulated below:

PUBLICATIONS

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 to 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.
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.
W 401 to 414-----	do-----	1915.
W 431 to 444-----	do-----	1916.
W 451 to 464-----	do-----	1917.
W 471 to 484-----	do-----	1918.
W 501 to 514-----	do-----	1919 and 1920.
W 521 to 534-----	do-----	1921.

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 1920. 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 for Machias River at Whitneyville, Maine, 1903 to 1920, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, 431, 451, 471, and 501, 521, which contain records for the New England streams from 1903 to 1921. Results of miscellaneous measurements are published by drainage basins.

Numbers of water-supply papers containing results of stream measurements, 1899-1921

Year	I North Atlantic slope (St. John River to York River)	II South Atlantic and 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 ^a 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.....	35	b 35, 36	36	36	36	c 36, 37	37	37	d 37, 38	38, * 39	38, * 39	38	38	38
1900.....	47, * 48	49	48, * 49	49	49	49, * 50	50	50	51	51	51	51	51	51
1901.....	65, 75	65, 75	65, 75	65, 75	65, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902.....	82	b 82, 83	83	83	83	84	84	84	85	85	85	85	85	85
1903.....	97	b 97, 98	98	98	98	99	99	99	100	100	100	100	100	100
1904.....	n 124, * 125	p 126, 127	128	128	128	130, * 131	k 128, 131	132	133	133, * 134	134	135	135	135
1905.....	n 165, * 166	p 167, 168	169	170	171	172	k 169, 173	174	176, * 177	176, * 177	177	178	178	177, 178
1906.....	n 201, * 202	p 203, 204	205	206	207	208	k 205, 209	210	211	212, * 213	213	214	214	214
1907-S.....	241	242	243	244	245	246	247	248	249	250, * 251	251	252	252	252
1909.....	261	262	263	264	265	266	267	268	269	270, * 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	332	332-B	332-C
1913.....	351	352	353	354	355	356	357	358	359	360	361	362-A	362-B	362-C
1914.....	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915.....	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916.....	431	432	433	434	435	436	437	438	439	440	441	442	443	444
1917.....	451	452	453	454	455	456	457	458	459	460	461	462	463	464
1918.....	471	472	473	474	475	476	477	478	479	480	481	482	483	484
1919-20.....	501	502	503	504	505	506	507	508	509	510	511	512	513	514
1921.....	521	522	523	524	525	526	527	528	529	530	531	532	533	534

^a Rating tables and index to Water-Supply Papers 35-38 contained in Water-Supply Paper 38. Monthly discharge 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.

^h Monthly discharge for 1900 in Twenty-second Annual Report, Part IV.

ⁱ Wissahickon and Schuylkill rivers to James River.

^j Saloto River.

^k Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.

^l Tributaries of Mississippi from east.

^m Lake Ontario and tributaries to St. Lawrence River proper.

ⁿ Hudson Bay only.

^o New England rivers only.

^p Hudson River to Delaware River, inclusive.

^q Susquehanna River to Yackin River, inclusive.

^r Platte and Kansas rivers.

^s Great Basin in California, except Truckee and Carson river basins.

^t Below junction with Gila.

^u Rogue, Umpqua, and Siletz rivers only.

COOPERATION

Much of the work in Montana has been carried on under cooperative agreement with the United States Bureau of Reclamation, the work being done by the Geological Survey and the expense borne by the Bureau of Reclamation. 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 several Carey Act projects and irrigation districts in Montana. In addition to the amount expended by engineers of the Geological Survey a State hydrographer was employed who worked directly with the Geological Survey.

The expense of work on the Crow Indian Reservation in Montana was borne by the Office of Indian Affairs.

Officials of the Yellowstone National Park have furnished gage readings for gaging stations in operation in the park.

All stations in Wyoming were maintained in cooperation with the State through F. C. Emerson, State engineer. The United States Bureau of Reclamation paid for the maintenance of the stations on North Platte River above Pathfinder, Sage Creek above Pathfinder, Bull Lake Creek near Lenore, and Dinwoody Creek near Lenore. The United States Indian Service paid for the installation and maintenance of the stations on North Fork of Little Wind River at Fort Washakie, South Fork of Little Wind River near Fort Washakie, Dry Creek near Lenore, Meadow Creek near Lenore, and Willow Creek near Lenore.

The Laramie Water Co. furnished gage heights and provided the transportation necessary to obtain data for the stations on Laramie River and Pioneer canal near Woods, and assisted in the maintenance of other stations in the Laramie basin.

The L. Z. Leiter Estate furnished gage heights for Piney Creek at Ucross and transportation to a number of stations in the vicinity.

The Douglas Reservoirs Co. furnished gage heights and some discharge measurements for La Prele Creek near Douglas and transportation to the station.

Fred Firnekas, water commissioner of Wyoming, furnished data relating to diversion from the headwaters of Clear Creek.

In Iowa the work was carried on in cooperation with the State Highway Commission through F. R. White, chief engineer.

In Colorado the State engineer, A. J. McGune, paid the gage observers at the stations on South Platte River at South Platte and North Fork of South Platte River at South Platte.

The city of Denver furnished records for South Platte River at the intake in Platte Canyon. The city engineer of Loveland furnished the field data for Thompson River near Drake and transportation to the stations when check measurements were made.

In Kansas the work was done in cooperation with the Kansas Water Commission, H. A. Price, secretary. The station on Kansas River at Topeka was maintained in cooperation with the United States Weather Bureau; the North Topeka Drainage District, V. R. Parkhurst, engineer; and the South Side Levee District No. 6. The station on Smoky Hill River near Abilene was maintained in cooperation with the United States Weather Bureau.

In Missouri the work has been maintained in cooperation with the State Geological Survey, through H. A. Buehler, State geologist. The United States Weather Bureau has permitted the use of the gage on Grand River near Gallatin. George Wirth read the gage on South Grand River near Brownington, and the Dixon brothers read the gage on Sac River near Stockton, without charge.

DIVISION OF WORK

Data for stations in the upper Missouri basin and North Dakota were collected and prepared for publication under the direction of W. A. Lamb, district engineer, assisted by A. H. Tuttle, E. F. Chandler, H. S. Price, E. L. Grant, L. H. Hershner, and by G. H. Ellis, State hydrographer of Montana.

Data for two stations in the Yellowstone National Park were collected and prepared for publication under the direction of C. G. Paulsen, district engineer, assisted by A. G. Fiedler, L. L. Bryan, and Miss E. H. Haugse.

The field data for the stations in Wyoming and Colorado were collected under the direction of Robert Follansbee by P. V. Hodges and J. B. Spiegel. Ratings and computations were made by P. V. Hodges and J. B. Spiegel, assisted by Mrs. Esther D. Rae.

Data for stations in Iowa were collected and prepared for publication under the direction of E. D. Burchard, district engineer, assisted by R. W. Clyde, drainage engineer for the Iowa State Highway Commission.

Data for stations in Kansas were collected and prepared for publication up to April 5, 1921, by R. C. Rice, district engineer, and

after that date by E. L. Williams, district engineer, assisted by A. K. Gowans, H. B. Kinnison, and Miss Maude A. Ten Eyck.

Data for stations in Missouri were collected and prepared for publication under the direction of E. L. Williams, district engineer, assisted by Reginald Waldo, V. L. Austin, and H. E. Zoller.

The records were reviewed and manuscript assembled by J. S. S. Jones and E. E. R. Dornbach.

GAGING-STATION RECORDS

MISSOURI RIVER PROPER

BEAVERHEAD RIVER AT BARRATTS, MONT.

LOCATION.—In SW. $\frac{1}{4}$ SW. $\frac{1}{4}$ sec. 20, T. 8 S., R. 9 W., on highway bridge at point where highway crosses railroad, 1 mile above Barratts, Beaverhead County, 2 miles below mouth of Grasshopper Creek, and 10 miles southwest of Dillon.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 12, 1907, to September 30, 1921.

GAGE.—Chain gage on downstream side of bridge; read by T. Masuno and Amilio Fantini. Prior to June 22, 1908, a staff gage at same datum was used.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Banks high, covered with brush, and not subject to overflow. Stream bed clean and rocky. Two channels at low and medium stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.20 feet June 18 (discharge, 2,070 second-feet); minimum stage, 0.93 foot October 1–10 and January 31 to February 12 (discharge, 219 second-feet).

1907–1921: Maximum stage recorded, 6.0 feet June 19 and 20, 1908 (discharge, 3,640 second-feet); minimum stage, 0.50 foot July 28, 29, August 19–31, September 1, 10–17, 1919 (discharge, 106 second-feet).

ICE.—Stage-discharge relation probably not affected by ice.

DIVERSIONS.—Numerous diversions are made above the station.

REGULATION.—Operation of gates in dam used to store flood waters of Red Rock Creek near Monida affects the flow at the station.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used October 1 to March 5 and April 19 to July 18 is well defined between 200 and 1,600 second-feet. Curve used March 6 to April 18 well defined between 300 and 1,100 second-feet. Curve used July 19 to September 30 well defined between 250 and 450 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except from February 13 to March 5, April 19 to May 7, and June 16 to July 18 when the indirect method was used. Records poor.

Discharge measurements of Beaverhead River at Barratts, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 10.....	1. 18	389	May 25.....	2. 83	1, 140	July 19.....	1. 00	286
Apr. 18.....	2. 43	1, 030	June 15.....	3. 44	1, 530	Sept. 22.....	1. 24	364

Daily discharge, in second-feet, of Beaverhead River at Barratts, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	219	388	313	279	219	420	467	930	1,410	493	432	286
2	219	388	313	279	219	424	580	930	1,440	476	392	286
3	219	388	313	279	219	428	630	779	1,500	454	392	286
4	219	388	313	279	219	476	580	696	1,560	458	392	320
5	219	388	313	279	219	707	580	773	1,620	458	392	320
6	219	388	279	279	219	680	580	773	1,670	420	392	354
7	219	388	279	279	219	630	534	854	1,750	380	392	354
8	219	388	279	279	219	580	556	950	1,820	346	392	354
9	219	364	279	279	219	447	605	980	1,940	346	392	392
10	219	349	279	279	219	427	630	930	2,020	349	392	392
11	248	349	279	279	219	407	680	830	2,050	313	392	392
12	279	331	279	279	219	367	732	780	2,010	313	392	354
13	279	313	279	279	251	367	732	760	1,860	316	392	354
14	313	313	279	279	254	367	903	770	1,680	282	354	354
15	313	352	279	279	257	407	1,090	790	1,540	282	392	354
16	313	388	279	279	260	407	1,230	770	1,750	286	432	354
17	313	388	279	279	263	447	1,130	890	2,030	286	432	354
18	313	429	279	279	266	630	1,030	1,010	2,070	286	392	354
19	313	429	279	248	269	786	1,030	1,180	1,520	286	392	354
20	313	471	279	248	272	680	1,060	1,220	1,390	286	392	392
21	313	471	279	248	279	534	1,080	1,220	1,170	270	392	392
22	349	471	279	248	282	447	1,080	1,230	990	286	392	354
23	349	429	279	248	302	447	1,070	1,170	871	286	392	354
24	349	429	279	248	342	447	1,070	1,120	790	286	354	354
25	349	388	279	248	404	447	1,070	1,140	707	320	354	354
26	349	388	279	248	408	407	1,010	1,160	685	373	320	354
27	349	352	279	248	412	417	1,010	1,230	604	392	286	354
28	349	352	279	248	416	427	942	1,290	584	392	320	354
29	388	352	279	248	-----	437	936	1,390	535	392	286	354
30	388	352	279	248	-----	447	936	1,390	540	354	286	354
31	388	-----	279	219	-----	457	-----	1,400	-----	392	286	-----

NOTE.—No gage-height record May 8-24 and May 26 to June 14; discharge estimated by comparison with flow of Jefferson River.

Monthly discharge of Beaverhead River at Barratts, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	388	219	294	18,100
November	471	313	385	22,900
December	313	279	284	17,500
January	279	219	265	16,300
February	416	219	270	15,000
March	786	367	484	29,800
April	1,230	467	852	50,700
May	1,400	696	1,010	62,100
June	2,070	535	1,400	83,300
July	493	270	350	21,500
August	432	286	374	23,000
September	392	286	351	20,900
The year	2,070	219	527	381,000

JEFFERSON RIVER NEAR SILVERSTAR, MONT.

LOCATION.—In sec. 23, T. 2 S., R. 6 W., at highway bridge at Cornforth's ranch, on road from Silverstar, Madison County, to Iron Rod, a station on Ruby Valley branch of Northern Pacific Railway, 5 miles below junction of Beaverhead and Bighole rivers.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 11, 1910, to September 30, 1916; July 22, 1920; to September 30, 1921.

GAGE.—Chain on downstream side of bridge; read by Ray Cornforth.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed composed of gravel; practically permanent. Left bank high and clean. Right bank covered with brush and subject to overflow during extreme floods. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.78 feet 6.20 p. m. June 11 (discharge, 13,400 second-feet); minimum stage 2.16 feet August 2-13 (discharge, 571 second-feet).

1910-1916; 1920-21: 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).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Numerous irrigating ditches divert water above and below station.

REGULATION.—Flow partly regulated by two dams; one on Red Rock Creek near Monida stores water for irrigation, and one on Bighole River near Divide is used for power development.

ACCURACY.—Stage-discharge relation not permanent. Two well-defined rating curves used October 1 to December 31 and March 5 to September 30. Gage read to hundredths or half-tenths once daily, occasionally twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Jefferson River near Silverstar, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge	Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 16.....	2.82	1,130	May 24.....	5.45	7,050
Mar. 11.....	2.75	1,210	July 20.....	2.51	881
Apr. 23.....	3.50	2,330			

Daily discharge, in second-feet, of Jefferson River near Silverstar, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	928	1,320	1,230	-----	1,340	2,180	8,890	2,990	585	748
2	928	1,320	1,230	-----	1,420	2,180	9,030	2,880	571	748
3	928	1,290	1,230	-----	2,000	2,370	9,450	2,880	571	822
4	928	1,290	1,230	-----	2,090	2,470	9,870	2,880	571	902
5	928	1,260	1,210	1,250	2,280	2,680	10,300	2,870	571	944
6	928	1,260	1,210	1,250	2,370	2,880	10,700	2,570	571	944
7	928	1,260	1,210	1,250	2,000	3,200	11,200	2,370	571	944
8	928	1,320	1,180	1,220	1,920	3,640	11,700	2,090	571	944
9	952	1,340	1,180	1,220	1,920	3,860	12,500	1,920	571	1,030
10	976	1,370	1,160	1,200	1,920	3,750	13,100	1,830	571	1,080
11	976	1,320	1,130	1,140	1,920	3,420	13,400	1,740	571	1,130
12	976	1,290	1,130	1,140	2,000	3,310	13,200	1,690	571	1,210
13	1,030	1,260	1,130	1,120	2,280	3,310	12,300	1,660	571	1,210
14	1,050	1,290	1,130	1,120	2,780	3,420	11,200	1,500	678	1,240
15	1,080	1,320	1,130	1,120	2,880	3,640	10,300	1,380	678	1,240
16	1,130	1,340	1,130	1,120	3,100	3,640	10,000	1,180	860	1,270
17	1,160	1,370	1,130	1,120	3,100	4,320	9,590	1,080	881	1,270
18	1,160	1,370	1,130	1,140	3,100	5,060	10,000	1,030	881	1,270
19	1,180	1,370	1,100	1,140	3,100	6,100	8,340	965	860	1,290
20	1,180	1,340	1,100	1,170	3,420	6,470	7,530	887	841	1,320
21	1,210	1,340	1,100	1,200	3,100	6,730	6,730	841	803	1,320
22	1,210	1,340	1,100	1,250	3,100	6,990	5,720	784	765	1,290
23	1,260	1,320	1,130	1,360	3,100	6,860	5,010	748	765	1,270
24	1,320	1,320	1,130	1,400	2,990	6,860	4,550	730	748	1,240
25	1,340	1,290	1,130	1,420	2,880	6,990	4,320	695	730	1,240
26	1,340	1,290	1,130	1,420	2,780	7,120	4,090	646	730	1,210
27	1,340	1,260	1,160	1,360	2,680	7,530	3,980	646	765	1,160
28	1,340	1,260	1,160	1,340	2,370	7,940	3,640	631	803	1,130
29	1,340	1,230	1,160	1,310	2,370	8,610	3,420	615	803	1,080
30	1,320	1,230	1,180	1,310	2,280	8,610	3,200	599	784	1,030
31	1,320	-----	1,180	1,310	-----	8,750	-----	599	765	-----

NOTE.—No records Jan. 1 to Mar. 4.

Monthly discharge of Jefferson River near Silverstar, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	1,340	928	1,120	68,900
November	1,370	1,230	1,310	78,000
December	1,230	1,100	1,160	71,300
January	-----	-----	-----	-----
February	-----	-----	-----	-----
March 5-31	1,420	1,120	1,240	66,400
April	3,420	1,340	2,490	148,000
May	8,750	2,180	5,000	307,000
June	13,400	3,200	8,580	511,000
July	2,990	599	1,480	91,000
August	881	571	696	42,800
September	1,320	748	1,120	66,600

MISSOURI RIVER AT FORT BENTON, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 26, T. 24 N., R. 8 E., on highway bridge at Fort Benton, Chouteau County.

DRAINAGE AREA.—24,600 square miles.

RECORDS AVAILABLE.—July 1, 1902, to September 30, 1921; previous to April 28, 1910, gage-height record furnished by United States Weather Bureau.

GAGE.—Stevens continuous water-stage recorder installed on pier October 10, 1920; referenced to chain gage on upstream side of bridge. Mott gage read April 11, 1907, to July 30, 1917. Gage heights for 1911-1917 are referred to datum used by United States Army Engineers from 1880 to 1890, which is 0.43 foot higher than that used by United States Geological Survey in 1910.

CHANNEL AND CONTROL.—Channel composed of coarse gravel and sand. Control is rock ledge covered with heavy boulders, 1,000 feet below gage; may shift slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.45 feet at 3.30 p. m. June 16 (discharge, 32, 200 second-feet); minimum stage, -0.26 foot at 2.30 p. m. August 11 (discharge, 2, 080 second-feet).

1902-1921: Maximum stage recorded, 9.90 feet May 27, 1917 (discharge, 55,200 second-feet); maximum stage recorded by United States Weather Bureau, 15.3 feet June 7, 1908 (discharge not computed); minimum discharge, 1,420 second-feet August 17, 1919; minimum stage recorded by United States Weather Bureau, -0.5 foot August 7-10, 17, and 18, 1910 (discharge not computed).

Prior to 1918 open-season records only; flow may have been lower during winter.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Numerous diversions from tributaries.

REGULATION.—Flow partly regulated by operation of storage reservoirs and power plants of Montana Power Co. above station.

ACCURACY.—Stage-discharge relation permanent except when affected by ice December to March. Rating curve well defined between 2,500 and 50,000 second-feet. Mean daily gage height October 1-10, November 12-17 and April 19-23 from observer's readings twice daily to hundredths. December 16 to March 18 no gage readings; discharge computed from flow at Volta plant, by engineers of Great Falls Power Co. October 11 to December 15 and March 19 to September 30, except as noted, mean daily gage height determined from graph of Stevens water-stage recorder. Daily discharge, except during period December 16 to March 18, ascertained by applying mean daily gage height to rating table. Records for open channel good; others fair.

Discharge measurements of Missouri River at Fort Benton, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 10	H. S. Price	0.67	3,710
Dec. 12	W. A. Lamb .....	.90	4,810

Daily discharge, in second-feet, of Missouri River at Fort Benton, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	4,940	5,300	5,490	3,780	3,990	5,660	5,270	10,300	24,800	10,800	4,330	3,280
2.....	4,670	5,460	5,580	3,550	4,090	5,840	5,270	10,100	25,600	10,000	3,890	3,050
3.....	4,610	5,830	5,640	3,500	3,770	3,870	5,210	9,480	26,200	11,600	3,520	3,320
4.....	3,940	5,330	5,460	3,530	4,000	6,020	5,150	9,560	26,300	11,800	3,220	3,300
5.....	3,890	5,150	5,210	3,900	4,360	5,760	6,160	9,160	27,100	9,920	3,320	3,300
6.....	3,970	5,240	5,180	4,520	4,450	5,980	5,900	8,720	27,900	9,840	3,250	3,420
7.....	4,380	5,090	4,940	4,980	4,210	5,530	5,770	9,400	28,500	10,000	3,080	3,730
8.....	4,050	5,460	4,880	4,360	3,600	5,430	6,130	11,100	29,300	10,800	3,120	3,830
9.....	4,000	5,270	4,880	3,130	3,350	5,580	7,880	13,500	29,400	10,800	3,280	3,760
10.....	4,300	5,900	4,970	3,670	4,140	5,460	7,880	15,700	30,100	9,520	3,220	3,630
11.....	3,480	5,770	5,000	3,830	4,780	5,310	8,140	16,400	30,200	8,920	3,220	3,420
12.....	4,210	5,930	4,970	4,400	4,780	5,120	7,440	16,900	30,400	8,220	3,080	3,380
13.....	4,610	5,800	5,090	4,440	4,580	4,740	8,490	17,200	30,800	9,160	3,180	3,760
14.....	4,330	5,300	4,670	3,790	4,480	4,320	11,300	16,500	30,600	8,370	3,520	3,420
15.....	4,500	5,490	5,150	3,860	4,120	4,940	12,100	15,900	31,100	7,060	3,420	3,100
16.....	4,020	5,300	2,940	4,270	4,780	5,000	12,000	15,200	31,500	7,060	3,150	3,250
17.....	4,530	3,150	2,760	4,200	5,380	6,120	11,800	14,900	31,500	6,950	3,220	3,480
18.....	4,000	4,820	4,990	3,940	5,380	5,940	11,400	14,800	31,100	6,500	3,500	4,000
19.....	4,130	5,000	4,910	3,740	5,130	5,090	11,200	15,000	30,300	5,930	3,220	4,470
20.....	3,810	5,300	4,170	4,000	4,430	5,150	14,800	17,400	29,100	5,360	3,200	4,440
21.....	3,630	6,430	3,350	4,340	4,180	5,240	14,300	21,500	27,100	4,970	3,220	4,790
22.....	4,560	6,880	3,090	4,030	5,290	5,180	13,900	22,600	25,000	5,090	3,400	4,820
23.....	4,610	6,700	3,190	3,730	5,720	5,210	13,000	23,400	24,000	4,880	3,150	4,560
24.....	4,020	7,120	3,790	3,950	5,600	5,460	12,000	23,900	17,300	4,790	3,150	4,580
25.....	4,610	6,950	3,680	4,210	5,300	5,550	11,600	24,600	12,700	4,880	3,180	4,790
26.....	5,210	6,230	3,710	3,930	4,760	5,580	10,800	24,500	9,320	4,530	3,120	4,880
27.....	5,490	5,740	3,370	4,030	4,980	5,740	10,700	25,400	9,160	4,610	3,200	4,700
28.....	6,430	5,640	3,720	3,880	5,030	5,770	10,400	24,800	9,520	4,820	3,320	4,610
29.....	6,160	6,060	4,090	4,140	-----	5,520	10,200	25,400	11,300	4,760	3,220	4,760
30.....	5,930	5,640	3,670	4,190	-----	5,520	10,400	25,400	11,900	4,730	3,200	4,500
31.....	5,090	-----	3,590	4,140	-----	5,550	-----	24,800	-----	4,610	3,280	-----

Monthly discharge of Missouri River at Fort Benton, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	6,430	3,480	4,520	278,000
November.....	7,120	3,150	5,640	336,000
December.....	5,640	2,760	4,390	270,000
January.....	4,980	3,130	4,000	246,000
February.....	5,720	3,350	4,600	255,000
March.....	6,120	4,320	5,390	331,000
April.....	14,800	5,150	9,550	568,000
May.....	25,400	8,720	17,200	1,080,000
June.....	31,500	9,160	24,600	1,460,000
July.....	11,800	4,530	7,460	459,000
August.....	4,330	3,080	3,300	203,000
September.....	4,880	3,050	3,400	234,000
The year.....	31,500	2,760	7,880	5,700,000

GRASSHOPPER CREEK BASIN

GRASSHOPPER CREEK NEAR DILLON, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 26, T. 8 S., R. 10 W., 5 miles above Barratts and 14 miles above Dillon, Beaverhead County.

DRAINAGE AREA.—360 square miles (measured on Forest Service map of Beaverhead National Forest).

RECORDS AVAILABLE.—March 10 to September 30, 1921.

GAGE.—Vertical staff attached to a 2 by 6 inch stake driven in stream bed and braced to banks; read by Mrs. Laura Anderson.

DISCHARGE MEASUREMENTS.—Made by wading at gage or from bridge one-eighth mile above.

CHANNEL AND CONTROL.—Banks high and covered with brush for one-eighth mile above gage. Bed composed of boulders and coarse gravel; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.60 feet at 7 a. m. June 10 (discharge, 516 second-feet); minimum stage, 4.45 feet August 26 and September 2 (discharge, 10 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Considerable water diverted for irrigation above gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed owing to effect of moss in June and July. Rating curve used March 10 to July 18 well defined between 50 and 300 second-feet; curve used July 19 to September 30 well defined between 20 and 50 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except from June 16 to July 18, when indirect method was used. Records good.

Discharge measurements of Grasshopper Creek near Dillon, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
Mar. 10.....	<i>Feet</i> 4.74	<i>Sec.-ft.</i> 54	May 25.....	<i>Feet</i> 5.50	218	July 19.....	<i>Feet</i> a 4.57	22.2
Apr. 18.....	4.90	82	June 15.....	5.75	269	Sept. 22.....	a 4.69	38.1

^a Stage-discharge relation affected by moss.

Daily discharge, in second-feet, of Grasshopper Creek near Dillon, Mont., for the year ending Sept. 30, 1921

Day .	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....		50	47	354	65	23	15
2.....		67	47	390	79	23	10
3.....		97	47	326	87	23	18
4.....		97	55	274	99	20	46
5.....		72	47	299	87	20	39
6.....		44	63	420	74	20	32
7.....		36	91	382	60	20	32
8.....		33	91	374	55	18	26
9.....		40	81	456	47	18	30
10.....	47	50	105	480	47	18	46
11.....	40	63	63	376	40	20	46
12.....	60	67	60	326	40	20	39
13.....	33	72	55	326	39	30	35
14.....	36	81	63	304	39	26	32
15.....	23	122	72	286	32	32	35
16.....	40	111	118	323	29	39	39
17.....	85	85	155	393	23	32	32
18.....	133	77	184	423	20	23	32
19.....	101	72	200	296	20	20	32
20.....	67	77	200	241	20	20	35
21.....	47	67	171	207	20	20	39
22.....	50	63	171	178	20	20	39
23.....	50	72	178	155	18	15	36
24.....	60	67	178	140	15	15	32
25.....	36	50	184	124	15	15	32
26.....	21	47	184	109	18	10	29
27.....	27	47	194	101	18	18	26
28.....	33	47	224	89	20	20	26
29.....	47	47	286	85	15	32	26
30.....	47	47	307	81	18	20	26
31.....	40		299		20	20	

Monthly discharge of Grasshopper Creek near Dillon, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 10-31.....	133	21	51.0	2,280
April.....	122	33	65.6	3,900
May.....	307	47	136	8,360
June.....	480	81	277	16,500
July.....	99	15	38.7	2,380
August.....	39	10	21.6	1,350
September.....	46	10	32.1	1,910
The period.....				36,600

BOULDER RIVER BASIN

BOULDER RIVER AT BASIN, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 18, T. 6 N., R. 5 W., half a mile above mouth of Basin Creek and $1\frac{1}{2}$ miles above mouth of Cataract Creek, at Basin, Jefferson County.

DRAINAGE AREA.—226 square miles.

RECORDS AVAILABLE.—February 26, 1921, to September 30, 1921; June 6, 1919, to October 27, 1920, at station $1\frac{1}{2}$ miles downstream; discharge not comparable.

GAGE.—An overhanging cable and weight; read by Mrs. Arthur Mason.

DISCHARGE MEASUREMENTS.—Made by wading at gage or from railway bridge 600 feet below.

CHANNEL AND CONTROL.—One channel at all stages; bed composed of gravel and large boulders. Banks high and clean.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.36 feet at 6.30 p. m. May 26 (discharge, 952 second-feet); minimum stage, 0.66 foot at 6.30 p. m. September 1 and 2 (discharge, 8.6 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except during period of ice effect. Rating curve well defined between 10 and 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Boulder River at Basin, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 28	Lamb and Ellis.....	1.02	37.0	May 26	G. H. Ellis.....	3.30	909
Feb. 26	do.....	1.16	52	June 9	W. A. Lamb.....	2.65	498
Apr. 16	W. A. Lamb.....	2.00	228	July 18	G. H. Ellis.....	1.07	39.4
19	G. H. Ellis.....	1.96	180	Sept. 2	W. A. Lamb.....	.66	10.9

Daily discharge, in second-feet, of Boulder River at Basin, Mont., for the year ending Sept. 30, 1921

Day	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....		84	70	114	571	92	29	9.2
2.....		78	162	155	565	101	30	12
3.....		94	253	155	552	152	30	24
4.....		164	126	197	565	155	28	24
5.....		133	66	249	571	143	28	24
6.....		72	75	414	565	103	23	24
7.....		59	82	464	546	92	23	20
8.....		53	81	601	552	82	21	20
9.....		52	41	577	613	70	21	29
10.....		52	60	571	504	65	20	30
11.....		35	78	540	364	64	20	26
12.....			105	469	288	61	26	26
13.....		40	120	475	273	65	29	27
14.....			159	475	231	64	27	30
15.....			231	481	284	52	27	29
16.....		47	240	493	319	48	29	30
17.....		87	222	498	296	43	27	30
18.....		65	197	516	246	42	24	30
19.....		72	219	910	222	37	28	30
20.....		78	211	840	213	36	24	34
21.....		57	152	910	194	34	16	35
22.....		55	179	896	174	34	14	37
23.....		55	179	854	155	29	13	31
24.....		56	166	889	130	28	12	30
25.....		46	143	910	162	29	12	29
26.....	69	39	146	931	124	45	12	24
27.....	122	39	118	924	112	49	16	24
28.....	99	38	128	903	91	42	20	24
29.....		49	133	861	103	35	16	21
30.....		48	114	534	99	30	14	20
31.....		43		528		30	12	

NOTE.—Stage-discharge relation affected by ice Mar. 12-15, braced figure shows estimated mean daily discharge.

Monthly discharge of Boulder River at Basin, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
February 26-28.....	122	69	96.7	575
March.....	164	35	61.6	3,790
April.....	253	41	142	8,450
May.....	931	114	591	36,300
June.....	613	91	323	19,200
July.....	155	28	63.0	3,870
August.....	30	12	21.6	1,330
September.....	37	9.2	26.1	1,550
The period.....				75,100

WILLOW CREEK BASIN

WILLOW CREEK NEAR WILLOW CREEK, MONT.

LOCATION.—In sec. 18, T. 1 S., R. 1 E., at highway bridge at Harwood's ranch, 7 miles south of Willow Creek post office, Gallatin County.

DRAINAGE AREA.—166 square miles.

RECORDS AVAILABLE.—September 5, 1919, to September 30, 1921.

GAGE.—Chain attached to handrail on upstream side of bridge; read by Mrs. Susie Howls. September 5, 1919, to June 14, 1920, gage set at independent datum, half a mile downstream.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading on riffle 50 feet below gage.

CHANNEL AND CONTROL.—Stream bed composed of sand and gravel. Banks low and covered with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.72 feet June 19 (discharge, 280 second-feet); minimum stage, 2.94 feet September 1 (discharge, 17 second-feet).

1919–1921: Maximum stage recorded, 4.75 feet June 17–18, 1920 (discharge, 286 second-feet); minimum discharge, 5.5 second-feet September 6, 1919.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Numerous diversions for irrigation both above and below gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent for lower station; seriously affected by ice and sagging willows for upper station. Rating curve used September 5, 1919, to March 31, 1920, fairly well defined between 5 and 250 second-feet; curve used June 14 to September 30, 1920, and October 1, 1920 to September 30, 1921, fairly well defined between 10 and 250 second-feet. Gage read to hundredths once daily, except during periods of rapid change when it was read twice daily. Daily discharge ascertained by applying gage height to rating table, except for periods September 25, 1920, to April 6, 1921, and May 18–22, 1921, when indirect method was used. Records fair.

COOPERATION.—The South Bench Irrigation District furnishes the observer and local transportation for hydrographer.

Discharge measurements of Willow Creek near Willow Creek, Mont., during the years ending Sept. 30, 1919–1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
1919		<i>Feet</i>	<i>Sec.-ft.</i>	1921		<i>Feet</i>	<i>Sec.-ft.</i>
Sept. 5	C. S. Heidel	0.84	6.0	Jan. 12	G. H. Ellis	^a 3.62	17.9
Nov. 6	do	1.75	62	Feb. 8	do	^a 3.60	11.4
				Mar. 22	do	^c 3.28	44.8
1920				Apr. 29	do	3.12	33.0
Jan. 28	do	^a 2.84	40	May 23	do	3.76	104
June 14	do	^b 4.50	245	June 16	do	4.35	218
July 23	G. H. Ellis	3.70	120	July 21	do	3.10	35.5
Aug. 27	do	2.92	14.9				
Oct. 15	do	^c 3.40	39.8				

^a Stage-discharge relation affected by ice.

^b Reading on old gage 3.20 feet.

^c Stage-discharge relation affected by brush and weeds.

Daily discharge, in second-feet, of Willow Creek near Willow Creek, Mont., for the years ending Sept. 30, 1919–1921

Day	Sept. 1919	Day	Sept. 1919	Day	Sept. 1919
1.		11.	6.8	21.	6.8
2.		12.	6.2	22.	7.0
3.		13.	6.5	23.	7.5
4.		14.	6.5	24.	7.5
5.	6.0	15.	7.0	25.	7.5
6.	5.5	16.	7.2	26.	7.5
7.	6.0	17.	7.0	27.	7.5
8.	7.8	18.	7.0	28.	7.5
9.	7.2	19.	7.2	29.	8.9
10.	6.5	20.	6.0	30.	8.2

Daily discharge, in second-feet, of Willow Creek near Willow Creek, Mont., for the years ending Sept. 30, 1919-1921—Continued

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1919-20												
1	7.5	26			60					221	65	28
2	8.9	26								232	59	30
3	8.9	43								253	56	25
4	8.9	49								251	48	23
5	8.9	77								251	45	23
6	9.6	65			56					205	62	25
7	8.9	60			41					174	56	31
8	8.9	49			39					151	54	30
9	10	53			20					128	51	28
10	10	49								128	65	33
11	14	38			20	83				136	66	30
12	12	39				67				136	91	23
13	10	39				65				128	66	23
14	11	58				70			247	124	62	35
15	11	67				73			251	118	48	30
16	9.6	65			43	46			239	106	48	28
17	9.6	53			44	39			286	106	45	23
18	13	54			44	47			286	124	38	25
19	15	53			46	58			237	158	40	28
20	12	47			41	49			213	144	38	25
21	13	47			46	67			205	133	35	23
22	15	41			49	107			197	128	25	28
23	8.9	44			43	119			221	118	17	30
24		41			51	65			221	109	17	48
25		31			54	49			216	114	15	42
26		33			33	49			245	98	15	35
27		12			43	35			197	91	15	34
28					38	27			197	70	20	33
29		12			22	44			200	70	23	34
30						58			216	65	21	31
31						56				76	25	
1920-21												
1	26	61	70			31	39	34	86	76	30	17
2	29	57	54			64	46	33	65	98	29	42
3	28	57	39			39	50	40	79	90	26	28
4	27	64	45			39	59	38	79	72	30	22
5	27	77	45			51	50	48	101	55	24	20
6	25	64	51			28	51	50	101	48	26	22
7	28	67	57			32	54	73	124	43	24	20
8	29	70	56			20	59	96	187	33	20	20
9	26	70	56			22	56	104	280	34	26	49
10	26	51	57			30	51	68	224	37	22	37
11	37	64	51			31	54	55	267	37	24	34
12	36	20	57			25	56	56	236	39	30	37
13	33		54				56	56	236	30	26	39
14	32		51				56	55	211	29	42	40
15	40		45		15		54	56	228	32	59	39
16	40		51	20		34	51	66	219	28	32	42
17	40		45				54	66	189	22	28	37
18	45	25	51				51	66	146	26	30	39
19	39		45				55	54	122	29	32	37
20	39		45			42	55	39	92	30	32	37
21	39		51			44	49	38	84	32	26	37
22	45		34			45	51	42	84	33	26	37
23	51		39			44	59	104	92	32	28	34
24	28		33			43	56	88	92	28	30	36
25	51	29				42	52	80	95	42	32	32
26	51	52				43	49	70	76	44	28	30
27	51	51				40	44	74	79	39	30	30
28	51	51	30			40	46	79	70	34	30	28
29	51	32				44	37	94	79	30	30	28
30	51	64				44	34	86	66	32	22	30
31	57					43		79		30	19	

NOTE.—Discharge not determined for periods of ice effect, Oct. 24-31, 1919, Dec. 1, 1919, to Jan. 31, 1920, Mar. 1-10, 1920. Braced figures show mean daily discharge for periods indicated. No records Apr. 1 to June 13, 1920. Discharge interpolated because of missing gage heights Oct. 22, 29, Nov. 7, Dec. 2, 9, 1920, Mar. 30 Apr. 25, May 1, 27, July 4, and Aug. 14, 1921.

Monthly discharge of Willow Creek near Willow Creek, Mont., for the years ending Sept. 30, 1919-1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1919				
September 5-30.....	8.9	5.5	7.01	362
1919-20				
October 1-23.....	15	7.5	10.7	488
November.....	67	12	43.2	2,570
February.....	60	20	39.8	2,290
March 11-31.....	119	27	60.6	2,520
June 14-30.....	286	197	228	7,690
July.....	253	65	140	8,610
August.....	91	15	42.9	2,640
September.....	48	23	29.5	1,760
1920-21				
October.....	57	25	38.0	2,340
November.....	77	20	43.4	2,580
December.....	70		44.9	2,760
January.....			^a 20	1,230
February.....			^a 15	833
March.....	64	20	37.5	2,310
April.....	59	34	51.1	3,040
May.....	104	33	64.1	3,940
June.....	280	65	136	8,090
July.....	98	22	40.8	2,510
August.....	59	19	28.8	1,770
September.....	49	17	32.7	1,950
The year.....	280		46.1	33,400

^a Estimated.

MADISON RIVER BASIN

MADISON RIVER NEAR YELLOWSTONE, MONT.

LOCATION.—About 250 feet upstream from old footbridge at fording place of old Gallatin trail, 300 feet north of stage road to Yellowstone, in front of Riverside ranger station, and 4 miles east of Yellowstone and west boundary of Yellowstone National Park. Gibbon and Firehole rivers unite to form Madison River 8 miles upstream.

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

RECORDS AVAILABLE.—June 16, 1913, to September 30, 1921.

GAGE.—Friez water-stage recorder installed October 20, 1918, on left bank. Prior to October 20, 1918, a vertical staff at different datum located on left bank, 500 feet downstream, was used exclusively. On account of unfavorable ice and snow conditions in the vicinity of the recording gage, the staff gage is used during winter. Recorder inspected and staff gage read by park rangers attached to Riverside ranger station.

DISCHARGE MEASUREMENTS.—Made from cable located one-third of a mile below gage and by wading.

CHANNEL AND CONTROL.—One channel at all stages. Bed of stream composed of gravel and boulders; somewhat rough; control at recorder and at staff gage is different, but believed to be practically permanent. Aquatic growth is present during greater part of year and at times affects the stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water-stage recorder, 4.55 feet at 1 a. m. June 11 (discharge, 1,440 second-feet); minimum stage (staff gage), 1.24 feet on several days during November, February, March, and April (discharge, 392 second-feet).

1913-1921: Maximum stage recorded, 2.64 feet (vertical staff) at 6 p. m. June 10, 1917 (discharge, 1,950 second-feet); minimum stage, 3.67 feet from 2 to 10 a. m. July 23, 1919 (discharge, 316 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice. Temperature of water, except during extremely cold weather, kept above freezing point by numerous hot springs and geysers.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent at recording gage; changed slightly at staff gage. Three fairly well defined rating curves used; one, October 1 to November 6 and June 4 to September 30; one, November 12 to April 11; and one, April 16 to May 28. Staff gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. For period when recorder was operated mean daily gage height was obtained by inspection of recorder graph. Records good except for winter months, for which they are fair.

Discharge measurements of Madison River near Yellowstone, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Staff gage height	Record- ing gage height	Dis- charge
June 29	A. G. Fiedler	Feet	Feet	Sec.-ft.
Aug. 27	L. L. Bryan	1.52	3.92	611
		1.36	3.79	494

Daily discharge, in second-feet, of Madison River near Yellowstone, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	460	410	432	432	432	408	392	506	1,300	590	502	460
2	460	420	432	458	432	408	432	564		686	491	450
3	440	420	a 446	a 458	432	a 442	476	597		674	502	502
4	430	420	a 461	458	a 432	476	494	642		638	491	579
5	420	420	476	a 452	a 432	476	476	735		1,370	491	535
6	420	420	432	a 445	432	a 454	458	735	1,370	557	480	491
7	440	a 415	432	a 438	408	432	783	1,370	546	480	480	480
8	450	a 410	432	432	408	432	783	1,300	546	480	480	480
9	430	a 405	432	432	432	392	a 408	783	1,230	546	480	480
10	460	a 401	432		408	432	408	735	1,370	557	480	480
11	491	a 396	432		a 420	432	458	783	1,300	557	470	480
12	a 470	392	432	425	432	432	a 460	834	1,160	557	470	470
13	a 450	432	432		432	432	a 462	886	1,100	568	480	470
14	430	432	432		458	458	a 464	834	1,040	546	535	460
15	440	432	430		432	a 449	a 466	1,110	957	535	502	460
16	440	432	432	432	408	a 440	468	1,110	918	524	524	460
17	460	432	a 440	458	a 408	432	483	1,350	892	513	491	470
18	470	521	a 449	476	a 398	432	483	1,280	866	513	470	480
19	460	570	458	432	392	432	531	1,170	905	502	460	513
20	450	521	458		a 392	432	506	1,050	853	491	460	568
21	440	a 504	a 455	430	a 392	432	468	995	762	502	450	535
22	440	a 486	a 452		392	432	506	1,110	723	502	440	491
23	440	a 468	a 449		a 432	392	432	580	1,170	710	491	480
24	440	a 450	a 446		392	432	531	1,290	686	480	470	480
25	450	432	a 442		a 400	432	483	1,280	662	535	470	480
26	440	432	a 439	432	408	408	468	1,230	626	546	460	480
27	410	476	a 436	432	392	432	452	1,350	614	513	460	460
28	410	432	432	458	392	392	468	1,290	614	502	470	460
29	410	a 432	432	a 445		408	483		614	491	502	460
30	410	a 432	476	432		392	468	1,290	590	480	470	460
31	420		432	432		392				480	460	

a Interpolated.

NOTE.—Staff-gage readings Nov. 12 to May 28. Discharge estimated on account of ice Dec. 15, Jan. 10-15, and 20-22. Braced figures indicate mean discharge for the periods included.

*Monthly discharge of Madison River near Yellowstone, Mont., for the year ending
Sept. 30, 1921*

[Drainage area, 410 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October.....	491	410	441	1.08	1.24	27,100
November.....	570	392	442	1.08	1.20	26,300
December.....	476	-----	442	1.08	1.24	27,200
January.....	476	-----	438	1.07	1.23	26,900
February.....	458	392	413	1.01	1.05	22,900
March.....	476	392	429	1.05	1.21	26,400
April.....	589	392	469	1.14	1.27	27,900
May.....	1,350	506	994	2.42	2.79	61,100
June.....	1,370	590	993	2.42	2.70	59,100
July.....	686	480	541	1.32	1.52	33,300
August.....	535	440	479	1.17	1.35	29,500
September.....	579	450	485	1.18	1.32	28,900
The year.....	1,370	392	548	1.34	18.12	397,000

GALLATIN RIVER BASIN

GALLATIN RIVER NEAR SALESVILLE, MONT.

LOCATION.—On north line of sec. 33, T. 3 S., R. 4 E., at highway bridge 4 miles south of Salesville, Gallatin County.

DRAINAGE AREA.—860 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 1, 1895, to June 30, 1905; August 9, 1910, to July 31, 1913; March 9 to June 30, 1921.

GAGE.—Chain on downstream side of bridge. Same datum as used in 1910 to 1913. Read by Paul Davis.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and boulders; fairly permanent. Banks high. Two channels at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period March 29 to June 30, 8.40 feet at 6 p. m. June 11 (discharge, 6,510 second-feet); minimum stage, 2.72 feet at 8 a. m. March 30 (discharge, 286 second-feet).

1895-1905; 1910-1913; 1921: Maximum discharge, 10,750 second-feet June 18, 1896; minimum estimated discharge, 150 second-feet March 2, 1896.

DIVERSIONS.—The West Gallatin Canal Co.'s ditch, with a decreed right of 151 second-feet, and Gilman Todd ditch, with decreed right of 15 second-feet, are the only diversions above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 300 and 4,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Gallatin River near Salesville, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
Mar. 29.....	<i>Feet</i> 2.82	<i>Sec.-ft.</i> 392	May 22.....	<i>Feet</i> 5.15	<i>Sec.-ft.</i> 2,050	July 25.....	<i>Feet</i> 3.65	<i>Sec.-ft.</i> 709
Apr. 25.....	3.02	391	June 17.....	6.35	3,540			

Daily discharge, in second-feet, of Gallatin River near Salesville, Mont., for the period Mar. 29 to June 30, 1921

Day	Mar.	Apr.	May	June	Day	Mar.	Apr.	May	June
1-----		347	672	3,640	16-----		408	1,500	4,420
2-----		384	648	3,740	17-----		464	1,540	3,610
3-----		412	590	3,690	18-----		459	1,580	3,610
4-----		358	585	4,170	19-----		468	1,900	3,280
5-----		316	642	5,380	20-----		478	2,220	3,300
6-----		316	859	5,490	21-----		446	2,640	3,230
7-----		316	1,050	6,120	22-----		412	2,240	3,190
8-----		330	1,250	6,180	23-----		396	2,320	2,930
9-----		326	1,360	6,090	24-----		362	2,400	3,050
10-----		316	1,300	6,240	25-----		404	2,900	2,800
11-----		309	1,230	6,390	26-----		459	3,350	2,680
12-----		330	1,080	6,390	27-----		532	3,610	2,570
13-----		316	1,230	5,680	28-----		568	3,540	2,520
14-----		319	1,340	5,380	29-----	316	642	3,510	2,560
15-----		354	1,420	5,190	30-----	299	697	3,640	2,580
					31-----	312		3,710	

Monthly discharge of Gallatin River near Salesville, Mont., for the period Apr. 1 to June 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April-----	697	316	408	24,300
May-----	3,710	585	1,870	115,000
June-----	6,390	2,520	4,200	250,000

CROW CREEK BASIN

CROW CREEK NEAR RADERSBURG, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 25, T. 6 N., R. 1 W., 300 feet below mouth of Slim Sam Creek and 5 miles northwest of Radersburg, Broadwater County.

DRAINAGE AREA.—90 square miles.

RECORDS AVAILABLE.—April 13 to June 29, 1901; May 25, 1919, to September 30, 1921.

GAGE.—Overhanging wire gage on left bank; read by William Gray. Gage used in 1901 set at independent datum.

DISCHARGE MEASUREMENTS.—Made from foot log at high stages or by wading at low stages.

CHANNEL AND CONTROL.—Bed of stream composed of gravel and boulders; channel is straight 100 feet above and below gage; no definite control. Banks high and covered with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 2.40 feet May 26 (discharge, 374 second-feet); minimum discharge, 3.2 second-feet, by measurement of February 7 when channel was obstructed by ice.

1901; 1919–1921: Maximum stage recorded, 3.20 feet June 8, 1920 (discharge, 817 second-feet); minimum discharge, 3.2 second-feet, by measurement of February 7, 1921, when channel was obstructed by ice.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None of importance above gage, but all normal flow used below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by sediment in channel. Rating curve fairly well defined between 6 and 300 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by indirect method for shifting control March 22 to September 30 and by applying daily gage height to rating table for remainder of open-channel record. Records poor.

COOPERATION.—Maintained in cooperation with the Jacqueth-Gerharz Engineering Co., of Great Falls, Mont.

Discharge measurements of Crow Creek near Radersburg, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 6	Ellis and Steere ^a	0.66	7.5	May 11	W. A. Lamb.....	1.45	157
Feb. 7	G. H. Ellis.....	0.77	3.2	May 28	G. H. Ellis.....	2.28	324
Mar. 16	do.....	0.60	7.4	July 25	do.....	.81	30.1
Apr. 15	Ellis and Steere.....	.86	25.7				

^a Engineer for Jacqueth-Gerharz Engineering Co.

^b Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Crow Creek near Radersburg, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	23	23	11				10	19	145	54	28	10
2	18	10	16				14	20	172	21	24	8.8
3	23	23	13				22	25	156	64	21	20
4	16	10	16				23	36	158	74	18	23
5	19	16	19				14	63	147	84	21	14
6	15	18	16				19	74	212	99	15	18
7	16	17	20				22	150	221	86	17	14
8	22		11			7.0	16	202	356	76	11	11
9	19		12				23	218	274	70	13	25
10	18		16				28	150	205	78	25	14
11	19		20				19	157	212	78	11	14
12	18		16				20	145	181	63	11	11
13	43	15	15				16	130	166	59	9.1	13
14	19		14				19	125	140	61	13	18
15	22		13		3		26	130	166	24	21	52
16	19		12	7		7.4	24	142	187	21	13	17
17	26		11				28	101	128	41	17	16
18	43	20	11				30	318	97	81	15	13
19	22	19				7.0	30	181	88	36	21	17
20	23	18					17	225	81	33	18	23
21	23	20					13	332	67	28	9.7	12
22	30	20				6.2	24	231	78	30	17	17
23	8.8	17				7.3	30	238	60	29	9.1	13
24	28	20	10				11	21	278	81	32	11
25	19	18					10	30	278	79	30	10
26	22	16				10	21	374	64	18	13	13
27	22	20				7.3	20	324	56	31	15	13
28	28	23					11	17	324	52	17	9.7
29	26	24					10	15	164	58	31	9.1
30	18	23	11				13	15	153	52	24	11
31	22	10				8.8		93		25	13	9.7

NOTE.—Stage-discharge relation affected by ice; discharge estimated from observer's notes, temperature records, and discharge measurements Nov. 8-17, Dec. 19-29, 31, Jan. 1 to Mar. 15, and Mar. 17-21. Discharge interpolated Dec. 13-17. Braced figures show estimated mean daily discharge for periods indicated.

Monthly discharge of Crow Creek near Radersburg, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	43	8.8	22.3	1,370
November.....	24	10	17.5	1,040
December.....	20	10	12.7	781
January.....			7	430
February.....			3	167
March.....	13		7.81	480
April.....	30	10	20.9	1,240
May.....	374	19	174	10,700
June.....	356	52	138	8,210
July.....	99	17	48.3	2,970
August.....	28	9.1	15.4	947
September.....	52	8.4	15.9	946
The year.....	374		40.5	29,300

* Estimated.

PRICKLY PEAR CREEK BASIN

PRICKLY PEAR CREEK NEAR CLANCY, MONT.

LOCATION.—In S. $\frac{1}{2}$ sec. 34, T. 9 N., R. 3 W., at private bridge on Haab's ranch, one-fourth mile below mouth of Lump Gulch Creek and $1\frac{1}{4}$ miles north of Clancy, Jefferson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 15, 1908, to September 30, 1916, and July 28 to September 30, 1921.

GAGE.—Vertical staff on downstream side of right abutment of bridge; read by Fred E. Haab.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.37 feet at 6 p. m. September 9 (discharge, 43 second-feet); minimum stage, 1.00 foot at 8 p. m. September 2 (discharge, 18 second-feet).

1908-1916; 1921: Maximum stage recorded, 4.0 feet June 17, 1915 (discharge, 465 second-feet); minimum discharge, 12 second-feet, August 4-26, 1910.

DIVERSIONS.—Several small diversions from main stream and tributaries above gage; practically all water is appropriated and used for irrigation below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 15 and 50 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Prickly Pear Creek near Clancy, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		Feet	Sec.-ft.
July 28	A. H. Tuttle.....	1.31	36.6
Aug. 9	Tuttle and Lamb.....	1.05	20.9
Sept. 19	A. H. Tuttle.....	1.27	37.6

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Daily discharge, in second-feet, of Prickly Pear Creek near Clancy, Mont., for the year ending Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		27	19	11.....		22	36	21.....		23	30
2.....		27	19	12.....		22	37	22.....		21	28
3.....		28	25	13.....		19	31	23.....		20	29
4.....		27	24	14.....		20	34	24.....		19	28
5.....		27	23	15.....		35	31	25.....		20	27
6.....		25	20	16.....		36	36	26.....		20	27
7.....		21	20	17.....		31	34	27.....		24	26
8.....		21	21	18.....		25	34	28.....	37	23	25
9.....		20	39	19.....		25	34	29.....	31	25	25
10.....		20	39	20.....		24	31	30.....	33	26	30
								31.....	28	19	

Monthly discharge of Prickly Pear Creek near Clancy, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 28-31.....	37	28	32.2	255
August.....	36	19	23.9	1,470
September.....	39	19	28.7	1,710
The period.....				3,440

DUCTHMAN CREEK NEAR ALHAMBRA, MONT.

LOCATION.—In SW. $\frac{1}{4}$ sec. 28, T. 8 N., R. 3 W., at farm bridge on Marks's ranch, three-fourths mile above mouth and 2 miles southeast of Alhambra, Jefferson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 27 to September 30, 1921.

GAGE.—Staff gage on right abutment of bridge; read by I. W. Marks.

DISCHARGE MEASUREMENTS.—Made by wading below gage or from bridge.

CHANNEL AND CONTROL.—Bed of stream composed of boulders and gravel. Control is rock ledge 20 feet below gage; not likely to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.86 foot July 27 (discharge, 4.4 second-feet); minimum stage, 0.63 foot at 8.15 p. m. August 9 (discharge, 0.8 second-foot).

DIVERSIONS.—Several small diversions above gage. Practically entire flow of creek is used during irrigation season.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 1 and 6 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

COOPERATION.—Maintained in cooperation with Jefferson County Farm Bureau.

Discharge measurements of Dutchman Creek near Alhambra, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
July 27	A. H. Tuttle.....	Feet 0.86	Sec.-ft. 4.4
Sept. 2	W. A. Lamb.....	.67	1.2

Daily discharge, in second-feet, of Dutchman Creek near Alhambra, Mont., for the year ending Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1-----		1.9	1.1	11-----		0.9	2.3	21-----		1.4	2.6
2-----		1.8	1.4	12-----		1.1	1.9	22-----		1.2	2.6
3-----		1.8	2.6	13-----		1.1	2.3	23-----		1.2	2.3
4-----		1.6	2.3	14-----		1.6	3.0	24-----		1.1	2.3
5-----		1.6	1.6	15-----		2.3	2.6	25-----		1.1	1.9
6-----		1.6	1.6	16-----		2.6	2.6	26-----		1.4	1.6
7-----		1.5	1.6	17-----		2.1	3.0	27-----	4.4	2.3	1.6
8-----		1.1	1.4	18-----		1.6	3.1	28-----	3.0	1.8	1.6
9-----		.9	3.1	19-----		1.5	3.3	29-----	2.3	1.5	1.6
10-----		.9	2.4	20-----		1.5	3.1	30-----	2.1	1.4	1.6
								31-----	2.1	1.1	-----

Monthly discharge of Dutchman Creek near Alhambra, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 27-31-----	4.4	2.1	2.78	27.6
August-----	2.6	.9	1.50	92.2
September-----	3.3	1.1	2.20	131
The period-----				251

WARM SPRINGS CREEK AT ALHAMBRA, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 16, T. 8 N., R. 3 W., 30 feet below private bridge at Alhambra Hotel, Jefferson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 27 to September 30, 1921.

GAGE.—Vertical staff attached to retaining wall on right bank at rear of hotel; read by M. J. Sullivan.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Bed of stream composed of large boulders and gravel.

Control is 30 feet below gage; fairly permanent. One channel at all stages.

Banks fairly high but stream may overflow at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.74 foot August 15 (discharge, 7.9 second-feet); minimum stage, 0.54 foot August 24-26 and August 31 to September 2 (discharge, 2.2 second-feet).

DIVERSIONS.—Several small ditches divert water for irrigation of land along both sides of creek, when there is sufficient water supply for prior rights.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 2 and 10 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Warm Springs Creek at Alhambra, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
July 27	A. H. Tuttle-----	0.70	6.4
Aug. 9	Tuttle and Lamb-----	.58	3.0
Sept. 19	A. H. Tuttle-----	.69	6.1

Daily discharge, in second-feet, of Warm Springs Creek at Alhambra, Mont., for the year ending Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		4.1	2.2	11.....		3.1	4.1	21.....		3.5	5.2
2.....		4.1	2.2	12.....		3.1	5.2	22.....		3.1	5.2
3.....		4.7	4.7	13.....		3.1	5.2	23.....		2.7	4.7
4.....		4.1	4.1	14.....		4.1	6.4	24.....		2.2	4.7
5.....		3.1	3.5	15.....		7.9	6.4	25.....		2.2	4.7
6.....		3.1	3.1	16.....		7.2	6.4	26.....		2.2	4.1
7.....		2.7	3.1	17.....		3.1	7.2	27.....	6.4	3.5	4.1
8.....		2.7	3.1	18.....		4.1	7.2	28.....	5.8	3.1	4.7
9.....		3.1	7.2	19.....		4.1	7.2	29.....	5.2	2.7	4.7
10.....		2.7	5.8	20.....		4.1	5.8	30.....	4.7	2.7	4.7
								31.....	4.1	2.2	

Monthly discharge of Warm Springs Creek at Alhambra, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 27-31.....	6.4	4.1	5.24	52
August.....	7.9	2.2	3.50	215
September.....	7.2	2.2	4.90	292
The period.....				559

CLANCY CREEK AT CLANCY, MONT.

LOCATION.—In NE. $\frac{1}{2}$ sec. 9, T. 8 N., R. 3 W., just above highway crossing at Haynes's ranch at Clancy, half a mile above confluence with Prickly Pear Creek, Jefferson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 28 to September 30, 1921.

GAGE.—Vertical staff. Read by J. M. Haynes.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Composed of gravel, boulders and loose sand.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.45 foot at 11.30 a. m. July 28 and at 5 p. m. September 9 (discharge, 4.7 second-feet); minimum stage, 0.23 foot September 1, 2, and 6-8 (discharge, 1.7 second-feet).

DIVERSIONS.—Several small ditches divert water above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 6 second-feet. Gage read to hundredths once or twice daily. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Clancy Creek at Clancy, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
July 28	A. H. Tuttle.....	<i>Feet</i>	<i>Sec.-ft.</i>
Aug. 9	Tuttle and Lamb.....	0.44	4.6
Sept. 19	A. H. Tuttle.....	.26	1.9
		.35	2.9

Daily discharge, in second-feet of Clancy Creek at Clancy, Mont., for the year ending Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1		2.9	1.7	11		1.8	3.7	21		2.3	2.9
2		3.0	1.7	12		2.2	3.6	22		2.1	2.7
3		2.1	2.0	13		2.2	3.7	23		2.1	2.7
4		1.9	1.9	14		2.2	3.9	24		2.1	2.9
5		2.0	1.9	15		2.9	3.7	25		2.1	3.0
6		2.0	1.7	16		4.1	3.6	26		2.0	3.0
7		2.0	1.7	17		3.4	2.9	27		2.1	3.0
8		1.9	1.7	18		2.9	2.9	28	4.5	2.1	3.4
9		2.0	3.4	19		2.7	2.9	29	3.4	1.8	3.3
10		2.0	3.9	20		2.6	2.9	30	3.2	1.8	3.3
								31	3.0	1.8	

Monthly discharge of Clancy Creek at Clancy, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 23-31	4.5	3.0	3.52	27.9
August	4.1	1.8	2.29	141
September	3.9	1.7	2.85	170
The period				339

LUMP GULCH CREEK NEAR CLANCY, MONT.

LOCATION.—In lot 5, sec. 1, T. 8 N., R. 4. W., at Foley ranch, half a mile below Buffalo Creek and 4 miles west of Clancy, Jefferson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 26 to September 30, 1921.

GAGE.—Vertical staff on left bank one-fourth mile below ranch buildings; read by M. Foley.

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

CHANNEL AND CONTROL.—Bed of stream composed of large boulders and gravel; stream overflows right bank at high stages. One channel at all stages. Control is rock ledge 10 feet below gage; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.90 foot at 7 p. m. August 10 (discharge, 18 second-feet); minimum stage, 0.12 foot at 6.40 p. m. August 28 (discharge, 1.0 second-foot).

DIVERSIONS.—Several small ditches divert water during irrigation season when there is sufficient water to supply the prior rights on Prickly Pear Creek below.

REGULATION.—Placer mining operations about 3 miles upstream cause considerable fluctuation in stage when in operation.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1 and 23 second-feet. Gage read to hundredths twice daily; read three or four times daily when placer mining was in operation. Daily discharge ascertained by applying mean daily gage height to rating table, except for days when placer mining was in operation when hourly method was used. Records good.

COOPERATION.—Station maintained in cooperation with Clancy Farm Bureau Association.

Discharge measurements of Lump Gulch Creek near Clancy, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
July 26	A. H. Tuttle.....	<i>Feet</i> 0.88	<i>Sec.-ft.</i> 17.1
Aug. 9	Tuttle and Lamb.....	.16	1.3
Sept. 19	A. H. Tuttle.....	.39	3.8

Daily discharge, in second-feet, of Lump Gulch Creek near Clancy, Mont., for the year ending Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		2.6	* 2.0	11.....		* 3.1	2.6	21.....		2.3	3.2
2.....		* 4.1	* 1.4	12.....		* 2.9	2.7	22.....		1.9	3.4
3.....		* 1.4	* 2.7	13.....		* 2.0	2.9	23.....		2.0	3.0
4.....		* 3.8	1.4	14.....		* 2.1	* 5.1	24.....		2.0	2.9
5.....		* 3.0	1.8	15.....		* 4.4	2.6	25.....		* 1.5	2.9
6.....		* 2.7	1.3	16.....		4.1	4.1	26.....	4.3	* 1.5	* 3.9
7.....		1.2	* 1.8	17.....		2.0	4.8	27.....	4.6	* 2.4	* 3.2
8.....		* 3.2	* 1.5	18.....		1.6	2.9	28.....	2.2	1.1	* 3.4
9.....		* 2.2	1.7	19.....		2.9	3.4	29.....	* 3.2	* 4.3	* 3.2
10.....		* 4.1	2.9	20.....		1.8	3.4	30.....	* 4.1	* 2.5	* 2.4
								31.....	1.3	* 2.6	

* Computed by hourly method.

Monthly discharge of Lump Gulch Creek near Clancy, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 26-31.....	4.6	1.3	3.28	39
August.....	4.4	1.1	2.56	157
September.....	5.1	1.3	2.82	168
The period.....				364

TENMILE CREEK NEAR RIMINI, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 20, T. 9 N., R. 5 W., opposite Moose Creek ranger station, 500 feet above mouth of Moose Creek, and 3 miles north of Rimini, Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 13, 1915, to September 30, 1921.

GAGE.—Friez water-stage recorder on left bank opposite ranger station; inspected by D. H. Lewis, forest ranger. Prior to March 5, 1918, gage was 75 feet upstream and set at a different datum.

DISCHARGE MEASUREMENTS.—Made from footbridge just above gage or by wading.

CHANNEL AND CONTROL.—Concrete control constructed March 4, 1918. Left bank high and steep; will not be overflowed but will be eroded. Right bank subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.52 feet at 10 p. m. May 17 (discharge, 373 second-feet); minimum stage, 0.18 foot at 9 a. m. August 5 (discharge, 1.8 second-feet).

1915-1921: Maximum stage, 4.87 feet at 2 p. m. May 15, 1917 (discharge, 948 second-feet); minimum discharge 0.9 second-foot September 22, 1920.

ICE.—Stage-discharge relation slightly affected by ice.

DIVERSIONS.—Small ditch diverts in summer for water supply of Helena.

REGULATION.—Small reservoir of water-supply system of Helena is above the station.

ACCURACY.—Stage-discharge relation affected by ice and by slight change in low-water control. Two rating curves used during year both well defined and applicable October 1 to May 17 and May 18 to September 30. Mean daily gage height, October 3–16 and April 1 to September 30, obtained from graph of water-stage recorder when recorder was in operation. Staff gage readings once daily from December 17 to March 30. Daily discharge for open-water periods ascertained by applying mean daily gage height to rating table or by interpolation or estimation. Records fair.

Discharge measurements of Tenmile Creek near Rimini, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 8	W. A. Lamb.....	0.49	5.5	Apr. 9	W. A. Lamb.....	0.80	18.8
Jan. 17	Lamb and Ellis.....	.43	5.0	May 9	.....do.....	1.82	188
Feb. 25	W. A. Lamb.....	.50	5.8	June 8	.....do.....	1.75	152
Apr. 1	.....do.....	.61	10.0	Sept. 1	.....do.....	.42	6.2

Daily discharge, in second-feet, of Tenmile Creek near Rimini, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5.0			5.0	4.5	5.4	13	29	219	20.0	2.2	5.9
2	5.0			5.0	4.5	5.5	16	30	211	25.0	2.1	5.9
3	5.0			4.8	4.2	6.8	21	30	216	34.0	2.0	5.6
4	5.0			4.5	4.5	6.8	18	50	231	30.0	1.9	5.6
5	5.5			5.0	4.8	7.1	16	85	205	25.0	1.8	4.5
6	6.4			4.8	4.8	6.8	16	120	186	22.0	2.5	3.6
7	9.4			4.5	4.5	5.8	16	155	170	23.0	3.0	5.9
8	5.5			4.5	4.2	5.8	14	170	160	22.0	5.9	6.4
9	5.3			4.5	4.5	5.8	18	170	153	25.0	8.1	6.7
10	3.2			4.3	5.0	5.8	19	160	130	23.0	7.5	5.1
11	3.2			4.0	5.8	5.8	21	158	109	21.0	5.9	5.4
12	5.3			3.8	5.3	5.8	22	148	90	19.0	5.9	5.8
13	6.8			3.2	4.5	6.1	26	141	75	17.0	5.6	6.2
14	6.8			3.8	4.7	5.3	29	141	66	15.0	5.3	6.6
15	7.1			4.2	4.9	5.0	37	130	75	13.0	5.1	7.0
16	5.8			4.5	5.1	5.8	38	121	99	12.0	5.6	7.4
17			5.8	5.0	5.3	7.4	41	180	85	11.0	5.9	7.8
18			5.5	4.5	5.0	7.1	43	307	78	10.0	5.3	8.1
19			5.3	4.2	5.0	6.4	44	274	70	8.8	5.3	8.4
20			5.3	5.0	5.0	7.1	45	260	62	8.4	5.6	8.1
21			5.0	4.5	4.8	7.0	37	252	52	7.5	5.6	7.3
22			5.0	4.2	5.0	5.8	31	244	46	6.4	5.1	7.3
23			5.0	4.2	6.1	6.8	34	237	39	5.1	5.3	7.0
24			5.0	4.2	7.1	6.8	31	230	36	3.6	5.9	7.0
25			5.0	4.2	5.8	6.8	33	223	33	3.4	6.1	6.4
26			5.0	4.2	5.8	6.8	31	216	33	4.9	6.4	6.1
27			5.0	4.2	5.3	6.4	31	209	30	4.0	7.0	6.4
28			5.0	4.5	5.4	7.4	31	202	25	3.1	6.4	5.9
29			5.5	5.0		7.4	30	186	20	2.8	5.1	7.3
30			5.5	4.5		8.0	30	175	15	2.5	4.2	7.5
31			4.2	4.8		10.0		183		2.3	4.5	

* Stage-discharge relation affected by ice; discharge estimated.

NOTE.—For the following days of missing gage height daily discharge interpolated or estimated by comparison with records of Tenmile Creek near Helena: Oct. 1, 2, Feb. 14–16, 23, Mar. 1, 8, 21, Apr. 10, May 2–6, 21–27, June 27 to July 2, July 10–13, 31, Aug. 1–4, 13, 14, and Sept. 11–16.

Monthly discharge of Tenmile Creek near Rimini, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October 1-16.....	9.4	3.2	5.64	179
December 16-31.....	5.8	4.2	4.82	153
January.....	5.0	3.2	4.44	273
February.....	7.1	4.2	5.05	280
March.....	10.0	5.0	6.54	402
April.....	45	13	27.7	1,650
May.....	307	29	168	10,300
June.....	231	15	101	6,010
July.....	34	2.3	13.9	855
August.....	8.1	1.8	4.97	306
September.....	8.4	3.6	6.47	385

TENMILE CREEK NEAR HELENA, MONT.

LOCATION.—In SW. $\frac{1}{4}$ SE. $\frac{1}{4}$ sec. 22, T. 10 N., R. 4 W., opposite Broadwater Hotel, near Helena, Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 8, 1908, to September 30, 1921.

GAGE.—Staff, on right bank; read by Henry Johnson.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge 500 feet below gage.

CHANNEL AND CONTROL.—Bed of stream coarse gravel and boulders; shifts occasionally. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.70 feet May 19 (discharge, 456 second-feet); minimum stage, 1.10 feet August 9-16 (water standing in pools).

1908-1921: Maximum stage recorded, 5.60 feet at 6.30 p. m. May 28, 1917 (discharge, 865 second-feet); no flow afternoon of July 10, 1918, June 26 to September 30, 1919, and July 31 to September 16, 1921.

ICE.—Stage-discharge relation slightly 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.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except when affected by ice, in November; Rating curve well defined below 300 second-feet. Gage read once daily to half-tenths. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Tenmile Creek near Helena, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 10	H. S. Price.....	2.15	9.3	May 9	W. A. Lamb.....	3.90	241
Mar. 17	W. A. Lamb.....	2.30	17.5	June 8	do.....	3.50	152
Apr. 11	do.....	2.47	27.2	Sept. 1	do.....	1.35	a, 1

^a Estimated.

Daily discharge, in second-feet, of Tenmile Creek near Helena, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Sept
1.....	0.3	4.5	4.5	4.5	7.5	9.5	17	49	170	17	-----
2.....	.5	4.5	4.5	4.5	7.5	9.5	26	54	170	17	-----
3.....	.7	11.5	4.5	4.5	7.5	9.5	41	54	152	20	-----
4.....	.7	11.5	4.5	4.5	4.5	11.5	37	60	152	26	-----
5.....	.7	4.5	4.5	4.5	1.5	14.2	37	90	161	30	-----
6.....	.7	4.5	4.5	4.5	2.5	14.2	30	127	170	20	-----
7.....	.7	4.5	4.5	1.5	3.5	11.5	20	190	161	14.2	-----
8.....	1.0	11.5	4.5	1.5	4.5	11.5	20	236	152	11.5	-----
9.....	1.0	11.5	4.5	1.5	7.5	9.5	14.2	236	135	7.5	-----
10.....	1.0	4.5	4.5	1.5	9.5	9.5	20	212	127	6.0	-----
11.....	1.0	1.5	4.5	1.5	7.5	9.5	30	224	104	6.0	-----
12.....	1.0	1.5	4.5	1.5	9.5	7.5	33	201	97	3.5	-----
13.....	1.5	1.5	2.5	4.5	7.5	6.0	45	201	84	6.0	-----
14.....	1.5	1.5	2.5	4.5	7.5	6.0	49	190	65	3.5	-----
15.....	4.5	1.5	2.5	7.5	7.5	6.0	71	190	65	2.5	-----
16.....	4.5	4.5	2.5	7.5	3.5	7.5	65	180	104	1.2	-----
17.....	4.5	7.5	2.5	4.5	2.5	17.0	71	180	104	.8	0.1
18.....	4.5	7.5	4.5	6.0	3.5	26.0	71	170	90	.7	.1
19.....	4.5	4.5	4.5	7.5	4.5	17.0	77	456	77	.6	.1
20.....	4.5	4.5	4.5	6.0	6.0	9.5	77	370	71	.5	.1
21.....	4.5	4.5	4.5	4.5	7.5	7.5	65	342	60	.6	.1
22.....	7.5	2.5	4.5	4.5	7.5	11.5	65	342	54	.5	.3
23.....	7.5	2.5	6.0	7.5	7.5	11.5	65	314	37	.5	.5
24.....	7.5	2.5	7.5	14.2	14.2	54	54	288	30	.3	.5
25.....	7.5	4.5	3.5	11.5	14.2	54	54	288	33	.3	.5
26.....	7.5	4.5	4.5	11.5	9.5	49	49	288	30	.3	.5
27.....	7.5	4.5	6.0	11.5	9.5	45	45	288	23	.4	.5
28.....	7.5	7.5	6.0	9.5	9.5	49	49	262	20	.3	.5
29.....	7.5	7.5	7.5	1.5	-----	14.2	49	224	11.5	.1	.5
30.....	11.5	4.5	7.5	2.5	-----	14.2	45	170	17	.1	.5
31.....	11.5	-----	4.5	4.5	-----	11.5	-----	144	-----	-----	-----

NOTE.—Stage-discharge relation affected by ice Nov. 19-27; mean daily discharge estimated. No flow July 31 to Sept. 16.

Monthly discharge of Tenmile Creek near Helena, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	11.5	0.3	4.09	251
November.....	11.5	1.5	6.23	371
December.....	7.5	2.5	4.27	263
January.....	7.5	1.5	4.35	267
February.....	14.2	1.5	7.01	389
March.....	26	6.0	11.3	695
April.....	77	14.2	46.4	2,760
May.....	456	49	214	13,200
June.....	170	11.5	90.9	5,410
July.....	30	.0	6.38	392
August.....	.0	.0	.00	0
September.....	.5	.0	.16	9.5
The year.....	456	.0	33.1	24,000

LITTLE PRICKLY PEAR CREEK BASIN

LITTLE PRICKLY PEAR CREEK NEAR MARYSVILLE, MONT.

LOCATION.—In SW. $\frac{1}{4}$ sec. 18, T. 12 N., R. 6 W., at highway bridge on ranch of Casper Trauffer, one-fourth mile below mouth of Deadman Creek and 6 miles northwest of Marysville, Lewis and Clark County.

DRAINAGE AREA.—69 square miles (measured on topographic map).

RECORDS AVAILABLE.—May 24, 1913, to September 30, 1921, at present site; April 12 to May 23, 1913, one-fourth mile above present site; May 18, 1909, to December 31, 1911, at station formerly maintained above mouth of Deadman Creek.

GAGE.—Vertical staff spiked to upstream side of left abutment of highway bridge; read by Casper Trauffer.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand and gravel; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.08 feet at 6 p. m. May 20 and 7 a. m. May 21 (discharge, 160 second-feet); minimum stage, 0.80 foot February 21–23 (discharge, 8.0 second-feet).

1909–1911 and 1913–1921: Maximum stage recorded, 3.8 feet May 25 and 26, 1917 (discharge, 454 second-feet); minimum discharge, 1.2 second-feet March 7–13, 1911.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Two or three small ditches take water from the stream above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water in May. Rating curve used October 1 to May 27 well defined between 15 and 130 second-feet; that used May 28 to September 30 fairly well defined between 10 and 100 second-feet. Gage read to hundredths twice daily April 3 to July 9; once daily during remainder of year. Daily discharge ascertained by indirect method for shifting control May 19–27; for rest of year by applying gage height to rating table. Records good.

Discharge measurements of Little Prickly Pear Creek near Marysville, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
Jan. 17	Lamb and Ellis	Feet 0.81	Sec.-ft. 8.2	June 4	Ellis and Heidel	Feet 1.62	Sec.-ft. 94
Apr. 20	W. A. Lamb	1.45	63	Aug. 30	C. S. Heidel	.88	15.6

Daily discharge, in second-feet, of Little Prickly Pear Creek near Marysville, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	18	17	15	13	8.0	10	17	42	102	46	26	18
2	18	17	14	12	8.0	10	24	42	99	45	26	18
3	18	17	14	12	8.0	10	32	42	98	45	26	18
4	18	17	14	12	8.0	10	33	42	97	44	26	17
5	18	17	14	12	8.0	10	33	47	97	41	24	17
6	18	17	14	10	8.0	10	31	65	97	39	24	17
7	18	15	14	10	8.0	10	31	91	97	38	23	17
8	18	15	14	9.2	7.0	10	27	108	97	36	23	17
9	18	15	14	9.2	7.0	12	27	114	95	33	23	17
10	18	15	14	9.2	7.0	12	30	109	92	32	23	17
11	18	15	14	9.2	15	14	32	110	90	31	23	17
12	18	15	14	9.2	12	12	34	112	83	31	21	17
13	18	14	14	9.2	12	13	38	104	77	31	21	17
14	18	14	13	9.2	10	12	42	98	69	31	21	17
15	18	14	13	9.2	9.2	12	50	96	69	31	21	17
16	18	14	13	9.2	9.2	12	52	94	82	29	21	17
17	18	14	13	9.2	9.2	15	55	90	77	29	21	17
18	17	14	13	9.2	9.2	21	57	86	72	28	20	17
19	17	15	13	9.2	9.2	18	60	128	68	28	20	17
20	17	15	13	9.2	9.2	15	63	155	63	28	20	17
21	17	15	13	9.2	8.0	15	63	158	59	28	20	17
22	17	15	13	9.2	8.0	15	60	156	55	28	20	16
23	17	15	12	8.0	8.0	15	60	147	52	26	20	16
24	17	15	12	8.0	10	17	58	144	55	26	20	16
25	17	15	12	8.0	10	17	55	139	57	26	20	16
26	17	15	12	8.0	10	17	52	139	54	28	20	16
27	17	15	12	8.0	10	17	49	139	52	28	20	16
28	17	15	12	8.0	10	17	46	132	49	28	20	16
29	17	15	12	8.0	-----	17	45	116	47	28	20	16
30	17	15	12	8.0	-----	15	43	102	47	28	18	16
31	17	-----	13	8.0	-----	17	-----	99	-----	26	18	-----

Monthly discharge of Little Prickly Pear Creek near Marysville, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	18	17	17.5	1,080
November.....	17	14	15.2	904
December.....	15	12	13.3	818
January.....	13	8.0	9.39	577
February.....	15	8.0	9.11	506
March.....	21	10	13.8	848
April.....	63	17	43.3	2,580
May.....	158	42	105	6,460
June.....	102	47	74.9	4,460
July.....	46	26	32.1	1,970
August.....	26	18	21.6	1,330
September.....	18	16	16.8	1,000
The year.....	158	8.0	31.1	22,500

LITTLE PRICKLY PEAR CREEK NEAR CANYON CREEK, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 9, T. 12 N., R. 5 W., at wagon bridge on Carbis ranch, below mouth of Canyon Creek, $1\frac{1}{2}$ miles from Canyon Creek post office, Lewis and Clark County.

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

RECORDS AVAILABLE.—April 1, 1909, to December 31, 1911, and April 12, 1913, to September 30, 1921.

GAGE.—Vertical staff attached to lower side of left abutment of bridge; read by Melville Carbis.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Sand and gravel; shifting. Banks overgrown with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.80 feet May 18–22 (discharge, 319 second-feet); minimum stage, 0.30 foot July 28–29 (discharge, 0.5 second-foot).

1909–1911, 1913–1921: Maximum stage recorded, 4.8 feet May 29, 1913 (discharge, 665 second-feet); creek reported dry June 21–28, July 1–9, 21–22, August 1–2, 1910; July 22–27, 29 and 31, 1911.

ICE.—Stage-discharge relation slightly affected by ice.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year except for periods of ice effect. Rating curve well defined below 350 second-feet. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Little Prickly Pear Creek near Canyon Creek, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Apr. 20	W. A. Lamb.....	Feet 1.90	Sec.-ft. 149	Aug. 30	C. S. Heidel.....	Feet 0.38	Sec.-ft. 1.8
June 4	Ellis and Heidel.....	1.94	157				

Daily discharge, in second-feet, of Little Prickly Pear Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	24	20	28	37	28	57	57	106	204	37	2	4
2.....	24	20	24	37	28	57	57	93	186	37	2	4
3.....	24	20	24	37	28	57	57	93	168	37	2	4
4.....	20	20	20	28	28	57	57	93	160	28	2	4
5.....	20	20	20	28	28	57	68	151	151	28	2	4
6.....	20	20	28	24	28	57	68	186	151	28	2	6
7.....	20	20	28	20	37	57	68	240	135	28	2	6
8.....	20	20	28	20	47	57	68	240	135	28	2	6
9.....	20	20	28	20	47	57	80	240	120	28	2	8
10.....	20	20	28	28	57	47	80	259	120	28	2	8
11.....	24	20	28	28	47	47	80	259	120	28	2	8
12.....	24	20	28	28	37	47	93	259	106	28	2	8
13.....	24	20	32	32	37	47	93	259	93	20	2	8
14.....	24	20	32	32	28	37	93	279	93	20	2	13
15.....	20	20	28	37	28	37	106	279	80	13	4	13
16.....	20	20	28	37	28	37	120	279	80	13	4	13
17.....	20	20	24	28	28	37	120	299	80	13	4	13
18.....	20	20	24	28	37	37	120	319	80	13	4	13
19.....	20	20	24	20	37	37	120	319	80	8	4	20
20.....	20	20	28	13	37	37	151	319	80	8	4	20
21.....	20	20	28	13	37	47	135	319	68	8	4	20
22.....	20	20	28	16	47	47	135	319	68	4	4	20
23.....	20	20	16	16	47	47	135	299	68	2	4	20
24.....	20	20	16	16	57	47	135	299	68	2	2	16
25.....	20	20	28	16	68	57	135	279	68	2	2	16
26.....	20	20	16	16	68	57	120	279	68	2	2	16
27.....	20	20	28	20	68	57	120	279	68	2	4	20
28.....	20	20	28	20	68	57	106	259	68	2	4	20
29.....	20	20	28	20	47	106	259	68	68	5	4	20
30.....	20	20	37	20	47	106	240	68	68	5	4	20
31.....	20	20	37	28	47	47	222	222	222	2	4	20

NOTE.—Stage-discharge relation affected by ice Nov. 15-23, 30 and Dec. 23-26; discharge estimated. Braced figures show mean daily discharge for periods indicated.

Monthly discharge of Little Prickly Pear Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	24	20	20.9	1,290
November.....	20	20	20.0	1,190
December.....	37	20	27.7	1,700
January.....	37	13	24.6	1,510
February.....	68	28	41.4	2,300
March.....	57	37	48.9	3,010
April.....	151	57	99.6	5,930
May.....	319	93	246	15,100
June.....	204	68	103	6,130
July.....	37	5	16.1	990
August.....	4	2	2.9	178
September.....	20	4	12.4	738
The year.....	319	5	55.4	40,100

CANYON CREEK NEAR CANYON CREEK, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 31, T. 13 N., R. 5 W., on Van Cleve's ranch, 300 feet above mouth of Cottonwood Creek and 4 miles from Canyon Creek post office. Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 14 to September 30, 1921.

GAGE.—Overhanging wire gage fastened to smokehouse; read by George B. Van Cleve.

COTTONWOOD CREEK NEAR CANYON CREEK, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 31, T. 13 N., R. 5 W., on Van Cleve's ranch, a few hundred feet above junction with Canyon Creek and 4 miles northwest of Canyon Creek post office, Lewis and Clark County.

DRAINAGE AREA.—170 square miles.

RECORDS AVAILABLE.—May 14 to September 30, 1921.

GAGE.—Vertical staff; read by George B. Van Cleve.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gravel riffle 15 feet below gage forms low-water control. Water flows in one channel through ponds, over sharp riffle, and under fallen timber. Banks high and wooded.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.96 foot May 18, 21, 23–27, June 9, 17, 25 (discharge, 2.6 second-feet); minimum discharge, 0.9 second-foot June 14 and September 1.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve fairly well defined between 1 and 3 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Indirect method for shifting channel used August 13 to September 30. Records fair.

Discharge measurements of Cottonwood Creek near Canyon Creek, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
May 14	C. S. Heidel	0.82	1.2
June 4	Ellis and Heidel	.87	1.6
Aug. 30	C. S. Heidel	.86	1.1

Daily discharge, in second-feet, of Cottonwood Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1		2.1	1.9	1.9	0.9	16	1.5	1.2	1.5	1.8	2.2
2		1.9	1.9	1.9	1.0	17	1.2	2.6	1.5	1.7	2.2
3		1.9	1.9	1.7	1.0	18	2.6	2.1	1.4	1.7	2.0
4		1.6	1.9	1.7	1.1	19	2.1	2.1	1.4	1.7	2.0
5		1.5	1.9	1.5	1.6	20	2.1	1.9	1.4	1.6	1.8
6		1.4	1.9	1.4	1.5	21	2.6	1.7	1.4	1.6	1.8
7		1.2	1.9	1.7	1.4	22	2.1	1.2	1.5	1.4	1.8
8		1.2	1.7	1.9	1.6	23	2.6	1.2	1.4	1.2	2.0
9		2.6	1.5	1.9	2.0	24	2.6	1.2	1.2	1.4	1.8
10		1.5	1.4	1.5	2.1	25	2.6	2.6	1.2	1.0	1.6
11		1.5	1.5	1.5	2.2	26	2.6	2.1	1.2	1.1	1.6
12		1.5	1.5	1.5	2.0	27	2.6	1.9	1.2	1.1	1.6
13		1.7	1.7	1.4	2.2	28	2.3	1.9	1.5	1.1	1.6
14	1.2	.9	1.7	1.6	2.2	29	2.3	1.9	1.4	1.1	1.6
15	1.4	1.0	1.7	1.6	2.2	30	2.1	1.9	1.5	1.1	1.6
						31	2.3		1.5	1.1	

DISCHARGE MEASUREMENTS.—Made from bridge 300 feet above gage or by wading.

CHANNEL AND CONTROL.—Channel composed of coarse gravel and boulders. Control is solid rock outcrop in creek bed just below gage. Banks are covered with timber and dense brush; may be subject to overflow at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorder during year, 3.98 feet at 8.30 a. m. May 20 (discharge, 306 second-feet); minimum stage, 2.14 feet at 6 a. m. September 1 (discharge, 10 second-feet.)

DIVERSIONS.—One small ditch diverts water for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation probably permanent. Rating curve fairly well defined between 10 and 140 second-feet. Gage read to hundredths twice daily except June 9 to September 30, when it was read once daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Canyon Creek near Canyon Creek, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
May 14	C. S. Heidel	3.15	124
June 4	Heidel and Ellis	3.06	79
Aug. 30	C. S. Heidel	2.16	10.6

Daily discharge, in second-feet, of Canyon Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1.		98	33	14	10	16.	91	57	19	11	15
2.		93	30	13	11	17.	96	59	17	12	15
3.		91	33	12	11	18.	100	52	17	11	14
4.		96	30	13	11	19.	291	52	17	11	14
5.		95	33	11	12	20.	306	54	17	11	14
6.		96	27	11	12	21.	284	54	14	11	14
7.		93	30	11	11	22.	254	70	14	11	14
8.		91	33	11	12	23.	229	70	14	11	14
9.		104	21	11	12	24.	202	43	13	11	14
10.		76	21	11	12	25.	198	62	14	11	14
11.		64	21	11	13	26.	188	57	14	11	14
12.		64	21	11	14	27.	162	54	14	11	14
13.		62	21	11	14	28.	139	33	14	11	14
14.		108	52	21	11	29.	114	33	13	11	14
15.		100	54	21	11	30.	100	36	13	11	14
						31.	93		13	11	

Monthly discharge of Canyon Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 14-31	306	91	170	6,070
June	104	33	67.2	4,000
July	33	13	20.4	1,250
August	14	11	11.3	695
September	15	10	13.2	786
The period				12,800

Monthly discharge of Cottonwood Creek near Canyon Creek, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 14-31.....	2.6	1.2	2.16	77.1
June.....	2.6	.9	1.70	101
July.....	1.9	1.2	1.55	95.3
August.....	1.9	1.0	1.50	92.2
September.....	2.2	.9	1.74	104
The period.....				470

DEARBORN RIVER BASIN

DEARBORN RIVER NEAR CLEMONS, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 26, T. 18 N., R. 7 W., 300 feet above highway bridge on Dr. Kenck's ranch, 2 miles below mouth of Falls Creek, and 5 miles southeast of Clemons, Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 28 to September 30, 1921. Observation at station half a mile above mouth of Falls Creek, 1908 to 1911.

GAGE.—Overhanging wire gage on right bank; read by J. C. Barrett.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Channel composed of large cobblestones and gravel; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 3.22 feet at 8 p. m. May 25 and 7 p. m. May 27 (discharge, 965 second-feet); minimum stage, 0.94 foot September 12-13 (discharge, 18 second-feet).

DIVERSIONS.—Several small diversions above gage.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 30 and 1,000 second-feet. Gage read twice daily to hundredths. Mean daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Dearborn River near Clemons, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 21.....	1.98	254
May 22.....	3.17	926
June 24.....	2.06	272
July 22.....	1.20	50

Daily discharge, in second-feet, of Dearborn River near Clemons, Mont., for the year ending Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....		165	480	234	61	21	16.....		378	464	145	43	41
2.....		153	514	245	58	21	17.....		417	412	200	41	42
3.....		172	502	238	56	21	18.....		437	365	153	42	46
4.....		184	536	187	43	19	19.....		770	355	98	42	59
5.....		279	634	142	43	19	20.....		914	351	58	35	59
6.....		407	734	98	43	19	21.....		928	337	59	33	56
7.....		673	720	100	43	19	22.....		928	329	49	33	56
8.....		741	727	98	43	20	23.....		848	316	45	31	56
9.....		653	608	102	43	20	24.....		863	299	43	30	54
10.....		707	615	102	41	19	25.....		950	272	45	30	52
11.....		720	621	102	43	19	26.....		943	279	46	28	52
12.....		653	566	98	43	18	27.....		958	249	43	28	49
13.....		508	535	100	43	18	28.....	175	560	238	52	25	51
14.....		480	496	85	43	30	29.....	175	548	227	56	23	52
15.....		443	469	85	43	41	30.....	159	458	388	59	22	49
							31.....		474		63	21	

Monthly discharge of Dearborn River near Clemons, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 28-30.....	175	159	170	1,010
May.....	958	153	591	36,300
June.....	734	227	455	27,100
July.....	245	43	104	6,400
August.....	61	21	38.6	2,370
September.....	59	18	36.6	2,180
The period.....				75,400

SUN RIVER BASIN

NORTH FORK OF SUN RIVER NEAR AUGUSTA, MONT.

LOCATION.—In sec. 36, T. 22 N., R. 9 W. (unsurveyed), at Sun River diversion dam, 18 miles northwest of Augusta, Lewis and Clark County.

DRAINAGE AREA.—596 square miles (measured by United States Bureau of Reclamation).

RECORDS AVAILABLE.—January 1, 1916, to September 30, 1921, at present site. From August 5, 1889, to December 31, 1890, and October 31, 1903, to December 31, 1915, at station in sec. 33, T. 22 N., R. 7 W., at Henningson ranch, 8 miles downstream. The flow is practically the same at both points.

GAGE.—Inclined staff on right abutment of dam; read by employees of the Bureau of Reclamation. Stevens continuous water-stage recorder used during a part of 1916.

DISCHARGE MEASUREMENTS.—Made from highway bridge half a mile below gage.

CHANNEL AND CONTROL.—Control is crest of diversion dam, a concrete structure with an arch section 153.3 feet in length, and a gravity section 59.2 feet in length, separated by a pier.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.40 feet May 26 (discharge, 7,050 second-feet); minimum stage, 0.34 foot December 21-22 (discharge, 118 second-feet).

1889-1890; 1903-1921: Maximum stage recorded, 11.4 feet at 2 a. m. June 21, 1916 (discharge, 32,300 second-feet); minimum stage, 0.0 foot April 7 and 8, 1915 (discharge, 15 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—The intake of the Pishkun canal of United States Bureau of Reclamation is at the dam. A total of 55,000 acre-feet was diverted during the year.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve based on formula $Q=3.1 L h^{1.6}$, which has been closely checked by discharge measurements. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Gage heights furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of North Fork of Sun River near Augusta, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	217	184	141	180	152	152	152	557	3,820	767	152	217
2.....	217	184	141	180	152	152	291	557	3,820	767	184	217
3.....	217	184	141	185	152	152	659	608	5,580	767	184	217
4.....	217	184	141	141	152	152	461	767	5,580	767	217	217
5.....	217	184	130	152	152	152	372	1,130	4,890	767	217	217
6.....	217	184	130	152	152	152	291	1,260	5,820	767	254	217
7.....	217	184	130	152	152	152	217	2,330	5,580	767	254	217
8.....	217	184	130	152	152	152	184	3,230	5,580	557	254	217
9.....	217	184	130	141	152	152	152	2,500	4,670	461	254	217
10.....	217	184	130	141	152	152	152	2,590	4,020	372	254	217
11.....	217	184	130	141	152	152	217	2,590	4,020	372	254	217
12.....	217	184	130	141	152	152	372	2,330	4,020	332	254	217
13.....	217	184	130	152	152	152	557	2,330	3,420	332	276	217
14.....	217	184	130	152	152	152	659	2,330	3,420	291	276	254
15.....	217	184	130	152	152	152	659	2,330	3,230	291	276	254
16.....	217	184	130	152	152	152	659	2,330	2,680	291	276	254
17.....	217	184	130	152	152	152	767	2,330	3,160	291	276	254
18.....	217	184	130	152	152	152	883	2,330	3,160	291	276	254
19.....	217	184	124	152	152	152	944	6,800	2,000	217	276	254
20.....	217	184	124	152	152	152	883	6,060	2,000	217	276	232
21.....	217	172	118	152	152	152	883	5,580	2,000	217	254	217
22.....	217	165	118	152	152	152	883	5,580	2,000	217	254	217
23.....	204	152	124	152	152	152	767	5,350	2,000	217	232	217
24.....	184	152	124	152	152	152	659	5,580	1,840	124	217	217
25.....	184	141	124	152	152	152	659	5,580	1,840	124	217	184
26.....	184	141	124	152	152	152	659	7,050	1,760	152	217	152
27.....	184	141	124	152	152	152	659	5,820	1,680	152	217	124
28.....	184	141	124	152	152	152	659	5,580	1,390	152	217	124
29.....	184	141	124	152	-----	152	659	3,420	1,130	152	217	124
30.....	184	141	124	152	-----	152	608	2,860	767	124	217	124
31.....	184	-----	124	152	-----	152	-----	2,950	-----	124	217	-----

Monthly discharge of North Fork of Sun River near Augusta, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	217	184	208	12,800
November.....	184	141	172	10,200
December.....	141	118	129	7,930
January.....	152	130	148	9,100
February.....	152	152	152	8,440
March.....	152	152	152	9,350
April.....	944	152	554	33,000
May.....	7,050	557	3,310	204,000
June.....	5,820	767	3,230	192,000
July.....	767	124	369	22,700
August.....	276	152	239	14,700
September.....	254	124	209	12,400
The year.....	7,050	118	741	537,000

SUN RIVER AT FORT SHAW, MONT.

LOCATION.—In SW. $\frac{1}{4}$ sec. 1, T. 20 N., R. 2 W., at highway bridge at Fort Shaw, Cascade County.

DRAINAGE AREA.—1,475 square miles (measured by United States Bureau of Reclamation).

RECORDS AVAILABLE.—May 16, 1912, to September 30, 1921. A station on Sun River at Sun River, maintained from 1905 to 1912, gave results for practically the same drainage area.

GAGE.—Chain gage since November 24, 1916; read by Arthur Woods and other employees of United States Bureau of Reclamation. Prior to September 1, 1913, chain gage fastened to footbridge near right bank 1,000 feet downstream. Staff gage September 1, 1913, to November 23, 1916, on right bank 400 feet above highway bridge. The three gages are referred to different datums.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream, gravel and rock; fairly permanent; shifting at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.4 feet May 26 (discharge, 6,440 second-feet); minimum stage, 3.55 feet July 17 (discharge, 136 second-feet).

1905-1921: Maximum stage recorded, 13.4 feet June 7, 1908 (discharge 18,400 second-feet); minimum stage, 2.99 feet November 8, 11, and 12, 1919 (discharge, 49 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

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 there are the Fort Shaw and Pishkun canals of the United States Bureau of Reclamation and a few small ditches constructed since the adjudication.

REGULATION.—Willow Creek reservoir has a capacity of 16,650 acre-feet.

ACCURACY.—Stage-discharge relation affected by ice and by slight change in control. Rating curve applicable for periods of open channel is fairly well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except for periods of ice effect. Records fair.

Discharge measurements of Sun River at Fort Shaw, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge
May 22.....	Feet 8.10	Sec.-ft. 5,160
July 22.....	4.05	312

Daily discharge, in second-feet, of Sun River at Fort Shaw, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	296	316	259	225	296	225	209	664	3,580	742	225	266
2.....	296	316	259	225	259	194	209	664	3,390	742	231	266
3.....	296	296	259	225	225	194	209	664	3,390	742	231	266
4.....	296	277	259	225	225	194	209	664	3,980	677	248	285
5.....	316	277	259	225	225	225	225	664	4,580	580	200	304
6.....	316	259	225	225	194	225	259	1,100	4,980	549	200	304
7.....	316	259	225	225	194	225	337	2,060	5,390	612	178	304
8.....	316	259	194	225	194	225	337	2,780	5,810	880	186	304
9.....	316	259	194	225	225	194	337	2,780	4,780	677	186	304
10.....	316	259	167	225	225	194	337	2,780	4,180	612	183	345
11.....	316	225	167	225	225	180	337	2,590	3,980	437	172	345
12.....	316	194	167	225	225	167	337	2,400	3,680	413	178	324
13.....	316	167	167	225	259	194	380	2,230	3,580	389	200	324
14.....	316	167	194	225	296	225	427	2,060	3,480	285	172	324
15.....	316	194	209	225	259	259	537	2,060	3,010	231	256	345
16.....	316	225	194	214	225	296	664	2,060	2,630	186	200	345
17.....	316	259	194	204	194	296	696	2,060	2,260	136	248	345
18.....	316	296	167	194	167	259	886	3,160	1,930	189	231	345
19.....	316	296	167	194	225	242	902	3,940	1,780	312	266	345
20.....	316	296	-----	167	259	242	940	5,980	1,780	549	277	345
21.....	316	296	-----	167	259	225	1,020	5,790	1,780	612	248	304
22.....	316	277	-----	154	259	225	940	5,600	1,640	304	231	324
23.....	316	259	-----	154	296	225	866	5,390	1,640	206	231	304
24.....	316	259	-----	167	296	225	729	5,390	1,520	200	216	304
25.....	316	259	-----	194	259	225	664	6,020	1,410	216	200	266
26.....	316	259	-----	209	225	225	664	6,440	1,410	324	200	244
27.....	316	259	-----	225	225	209	664	6,230	1,080	248	231	222
28.....	316	259	-----	296	225	209	664	4,580	1,040	259	285	200
29.....	316	259	-----	380	-----	209	664	3,580	880	231	266	216
30.....	316	259	-----	337	-----	209	664	3,010	810	231	266	231
31.....	316	-----	225	337	-----	209	-----	3,200	-----	222	266	-----

NOTE.—Stage-discharge relation affected by ice Dec. 20-30, discharge not computed; discharge estimated Jan. 16-17; and Feb. 17-19 on account of ice effect.

Monthly discharge of Sun River at Fort Shaw, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet.			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	316	296	313	19,200
November.....	316	167	258	15,400
January.....	380	154	225	13,800
February.....	296	167	237	13,200
March.....	296	167	221	13,600
April.....	1,020	209	543	32,300
May.....	6,440	664	3,180	196,000
June.....	5,810	810	2,850	170,000
July.....	880	136	419	25,800
August.....	285	172	223	13,700
September.....	345	200	298	17,700

WILLOW CREEK NEAR AUGUSTA, MONT.

LOCATION.—In NW. $\frac{1}{4}$ SW. $\frac{1}{4}$ sec. 26, T. 21 N., R. 7 W., at Clark Co.'s ranch, just below mouth of Little Willow Creek and 7 miles northwest of Augusta, Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 8, 1905, to May 14, 1911; April 1, 1912, to September 30, 1921.

GAGE.—Chain on right bank, 300 feet back of Thomas Clark's house; read by Thomas Clark.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge 1,000 feet below gage.

CHANNEL AND CONTROL.—An old dam of timber and rock 20 feet below gage forms the principal control; shifts slightly at long intervals.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.60 feet May 20-22 (discharge, 58 second-feet); minimum stage, 0.10 foot July 1, 2, July 5 to September 10 (discharge, 1.6 second-feet).

1905-1911; 1912-1921: Maximum stage recorded, 10.8 feet June 23, 1916 (discharge, 1,150 second-feet); minimum discharge, dry July 17, 1910.

ICE.—Stage-discharge relation not affected by ice, as springs keep creek open.

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

REGULATION.—None. Willow Creek dam, about 2 miles below station, forms a reservoir with a present capacity of 16,640 acre-feet, for use on Fort Shaw unit of Sun River project.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined between 2 and 200 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Willow Creek near Augusta, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 22.....	0.98	25.4
May 22.....	1.63	59
Aug. 28.....	.10	1.8

Daily discharge, in second-feet, of Willow Creek near Augusta, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	10	13	10		6.2	13	22	47	1.6	1.6	1.6
2	10	13	10		6.2	13	22	44	1.6	1.6	1.6
3	10	13	10		6.2	13	22	44	2.4	1.6	1.6
4	10	13	10		7.5	13	24	44	2.4	1.6	1.6
5	10	13	10		8.8	13	28	50	1.6	1.6	1.6
6	10	13	10		10	14	37	47	1.6	1.6	1.6
7	10	12	8.8		12	14	42	44	1.6	1.6	1.6
8	10	12	8.8		12	14	42	44	1.6	1.6	1.6
9	10	12	8.8		10	14	42	32	1.6	1.6	1.6
10	10	10	8.8		8.8	16	40	32	1.6	1.6	1.6
11	10	10	8.8		8.8	16	37	32	1.6	1.6	3.3
12	10	10	7.5		8.8	16	37	28	1.6	1.6	4.2
13	10	10	7.5		10	16	37	24	1.6	1.6	4.2
14	12	12	8.8		10	16	34	20	1.6	1.6	4.2
15	12	12	8.8		12	24	32	16	1.6	1.6	4.2
16	12	13	10		12	28	32	20	1.6	1.6	3.3
17	12	13	10		12	28	32	22	1.6	1.6	3.3
18	12	13	10		16	30	32	20	1.6	1.6	3.3
19	12	13	8.8		16	30	53	18	1.6	1.6	3.3
20	13	13	8.8		16	30	58	18	1.6	1.6	3.3
21	13	12	7.5		14	28	58	18	1.6	1.6	3.3
22	13	12	7.5		14	26	58	13	1.6	1.6	3.3
23	13	12	6.2		13	24	56	10	1.6	1.6	3.3
24	13	10	6.2		13	22	53	8.8	1.6	1.6	3.3
25	13	10	5.0		13	22	56	7.5	1.6	1.6	3.3
26	13	10	5.0		13	22	56	6.2	1.6	1.6	3.3
27	13	10	5.0	6.2	14	22	56	6.2	1.6	1.6	3.3
28	13	10	6.2	6.2	14	22	56	6.2	1.6	1.6	3.3
29	13	10	6.2		13	22	56	6.2	1.6	1.6	3.3
30	13	10	7.5		13	22	53	6.2	1.6	1.6	3.3
31	13		7.5		13		50		1.6	1.6	

Monthly discharge of Willow Creek near Augusta, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	13	10	11.5	707
November	13	10	11.6	690
December	10	5.0	8.19	504
January	16	6.2	11.5	707
February	30	13	20.1	1,200
March	58	22	42.4	2,610
April	50	6.2	24.5	1,460
May	2.4	1.6	1.65	101
June	1.6	1.6	1.60	98.4
July	4.2	1.6	2.85	170
August				
September				

SOUTH FORK OF SUN RIVER AT AUGUSTA, MONT.

LOCATION.—In NW. $\frac{1}{4}$ SE. $\frac{1}{4}$ sec. 17, T. 20 N., R. 6 W., at highway bridge on road from Augusta to Craig, half a mile from Augusta, Lewis and Clark County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 2, 1904, to September 30, 1921.

GAGE.—Vertical staff fastened to right abutment on downstream side of bridge; read by W. J. Auchard. From April 17, 1907, to November 23, 1908, gage was located 100 yards above bridge and referred to a different datum.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of gravel; no definite control. One channel at low and medium stages; at high stages water overflows right bank a quarter of a mile above gage and there are two to four channels. Control subject to change at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.6 feet May 20 (discharge, 339 second-feet); minimum discharge, no flow June 28, 29, July 3-6, and August 31 to September 4.

1905-1921: Maximum stage recorded, 6.2 feet June 2, 1908 (discharge, 4,300 second-feet); minimum discharge, no flow July 28-30, 1910; August 19 to September 7, September 12-16, 18-26, 1919; June 28, 29, July 3-6, August 31 to September 4, 1921.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Water diverted to irrigate valley land both above and below station. During dry seasons the entire summer flow is utilized.

REGULATION.—None. Melting snow in mountains causes small diurnal fluctuation during spring.

ACCURACY.—Stage-discharge relation not permanent; affected by change in control during ice period and by backwater from small dam September 5-30. Two rating curves used during year; one, applicable October 1 to December 31, well defined between 25 and 800 second-feet, the other applicable March 1 to August 31, well defined between 7 and 400 second-feet. Gage read once daily to half-tenths October 1 to July 24; thereafter, to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of South Fork of Sun River at Augusta, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 22.....	1.61	80
May 23.....	2.55	321
June 24.....	1.15	43.4
July 22.....	.52	7.0

Daily discharge, in second-feet, of South Fork of Sun River at Augusta, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	30	30	26	46	38	72	128	2.1	5.6	0
2	30	30	26	46	38	72	120	2.1	4.4	0
3	34	30	26	46	63	72	111	.0	4.4	0
4	34	30	26	34	58	72	111	.0	4.4	0
5	30	30	26	34	54	72	111	.0	4.4	-----
6	30	30	23	34	54	86	104	.0	4.4	-----
7	26	30	23	34	50	171	96	.5	3.8	-----
8	23	30	23	31	46	228	83	.5	3.8	-----
9	23	30	23	34	46	244	72	.5	3.2	-----
10	26	30	23	38	50	228	72	1.0	3.2	-----
11	26	30	23	38	54	228	72	1.0	2.8	-----
12	26	30	30	46	58	198	83	1.0	2.3	-----
13	30	30	30	34	63	198	68	1.0	1.9	-----
14	30	30	30	46	63	171	54	1.0	1.4	-----
15	30	30	23	46	111	160	46	1.0	1.4	-----
16	30	30	30	46	72	148	83	1.0	.2	-----
17	30	30	30	46	72	148	72	6.2	1.4	-----
18	30	30	30	50	104	148	72	6.2	.8	-----
19	30	30	30	50	96	262	63	6.2	.6	-----
20	30	30	30	46	96	339	54	6.2	.2	-----
21	30	30	30	42	83	319	54	6.2	.6	-----
22	30	30	23	42	83	319	46	6.2	.6	-----
23	30	30	23	38	90	299	46	6.2	.6	-----
24	30	30	23	38	83	280	46	6.2	.6	-----
25	30	30	23	38	83	228	42	5.6	.6	-----
26	30	30	23	34	78	228	38	6.2	.8	-----
27	30	30	26	31	78	228	34	4.4	.8	-----
28	30	30	26	34	78	198	0	4.4	.6	-----
29	30	30	23	38	78	171	0	4.4	.4	-----
30	30	30	23	34	72	138	2.1	4.4	.2	-----
31	30	-----	23	34	-----	128	-----	4.4	.0	-----

NOTE.—Stage-discharge relation affected by back water from small dam Sept. 5-30; discharge not computed. Discharge interpolated Aug. 28-31; no records Jan. 1 to Feb. 28.

Monthly discharge of South Fork of Sun River at Augusta, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	34	23	29.3	1,800
November	30	30	30.0	1,790
December	30	23	25.7	1,580
March	50	31	39.6	2,430
April	111	38	69.7	4,150
May	339	72	189	11,600
June	128	0	66.1	3,930
July	6.2	0	3.10	191
August	5.6	0	1.95	120

MARIAS RIVER BASIN

TWO MEDICINE RIVER NEAR GLACIER PARK, MONT.

LOCATION.—At highway bridge over Two Medicine River, half a mile below lower Two Medicine dam, on road to Two Medicine Chalets, 4 miles northwest of Glacier Park railway station, Glacier County.

DRAINAGE AREA.—56 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 26, 1918, to September 30, 1921.

GAGE.—Stevens continuous water-stage recorder on downstream side of left abutment of highway bridge, referred to vertical staff gage, outside of well.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Bed of stream is smooth and regular; channel free from vegetable matter. A gravel and cobblestone riffle 75 feet below gage forms the control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.44 feet at 2 a. m. May 27 (discharge, 1,100 second-feet); minimum stage, 3.70 feet at 10 a. m. December 24 (discharge, 10 second-feet).

1918-1921: Maximum stage recorded, 7.85 feet June 11, 1918 (discharge, 1,390 second-feet); minimum stage, 3.70 feet December 24, 1921 (discharge, 10 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—Stream subject to regulation by gate operation at lower Two Medicine dam.

ACCURACY.—Stage-discharge relation permanent except during periods of ice effect. Rating curve well defined between 20 and 1,200 second-feet. Mean daily gage height obtained from graph of water-stage recorder. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Two Medicine River near Glacier Park, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 11	W. A. Lamb	5.10	138	July 31	W. A. Lamb	4.93	108
May 24	do	7.20	946	Aug. 17	Lamb and Grant	4.54	59
June 14	do	6.90	758				

Daily discharge, in second-feet, of Two Medicine River near Glacier Park, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Apr.	May	June	July	Aug.	Sept.
1	80	63	64		131	601	368	106	43
2	78	36	53		123	646	382	100	42
3	82	69	51		123	669	368	94	42
4	87	69	53		131	646	339	89	41
5	92	64	59		154	693	312	85	40
6	98	59	69		199	848	237	84	39
7	104	56	46		290	982	154	80	37
8	107	55			400	1,010		78	36
9	114	53			491	996		76	36
10	125	52			535	937		72	36
11	139	51			556	866		69	36
12	131	51			535	818		68	35
13	125	51			483	768		67	36
14	118	51			418	757		65	36
15	114	49			365	742		63	33
16	111	42	40		330	693		62	32
17	106	41			304	618		61	31
18	101	52			298	568		59	31
19	98	54			362	543		59	31
20	93	50			552	539		58	30
21	88	57			732	543		57	30
22	85	60			854	564		55	32
23	82	61			911	580		54	32
24	76	61	23		937	543		53	
25	75	64		216	976	503		50	
26	74	62		202	1,070	519		50	
27	70	63		181	1,070	515		49	
28	69	64		161	930	472		47	
29	68	63		154	732	422		46	
30	67	60		145	618	403		43	
31	64				580		109	42	

NOTE.—Stage-discharge relation affected by ice Dec. 8-23, discharge estimated; also Dec. 25-28, discharge not computed. Discharge interpolated Oct. 4, 5; no record Dec. 29 to Apr. 24, July 8-30, and Sept. 24-30.

Monthly discharge of Two Medicine River near Glacier Park, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	139	64	94.2	5,790
November.....	69	41	56.1	3,340
December 1-24.....	64	23	44.1	2,100
April 25-30.....	216	145	176	2,090
May.....	1,070	123	522	32,100
June.....	1,010	403	667	39,700
August.....	106	42	65.8	4,050
September 1-23.....	43	30	35.5	1,620

TWO MEDICINE RIVER AT FAMILY, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 2, T. 31 N., R. 9 W., at Holy Family Mission, Glacier County, 16 miles southeast of Browning and 6 miles above mouth of Badger Creek, the nearest tributary.

DRAINAGE AREA.—368 square miles.

RECORDS AVAILABLE.—April 26, 1907, to September 30, 1921.

GAGE.—Overhanging chain gage on left bank 30 feet below previous gage which was washed away during night of May 3, 1918. Read by John Lehnertz. For history of older gages see water-supply paper for years prior to 1919.

DISCHARGE MEASUREMENTS.—Made by wading near gage or from wagon bridge 3 miles above.

CHANNEL AND CONTROL.—Gravel control; permanent during year. Banks high and not subject to overflow except at extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.58 feet at 6.30 a. m. May 21 (discharge, 2,920 second-feet); minimum stage, 2.32 feet February 5-7 (discharge, 36 second-feet).

1907-1921: Maximum stage recorded, 8.15 feet June 9, 1909 (discharge, 7,600 second-feet); undoubtedly higher in June, 1908, but gage was washed out and no record obtained; minimum stage, 2.02 feet September 6, 7, and 8, 1919 (discharge, 4.4 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Water diverted 2 miles above gage by ditch which supplies 100 acres on farm at the Holy Family Mission. From May 8 to September 30 a total diversion of 17,852 acre-feet was made by the United States Bureau of Reclamation above the station to irrigate lands near Seville on Blackfeet Indian Reservation.

REGULATION.—Flow regulated by operation of reservoir at lower Two Medicine Lake.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve used during year well defined between 20 and 1,600 second-feet and fairly well defined above. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Two Medicine River at Family, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Dis-charge
May 28.....	Feet	Sec.-ft.
June 13.....	5.23	2,280
July 23.....	4.63	1,240
	2.70	103

Daily discharge, in second-feet, of Two Medicine River at Family, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	137	117	96	94	46	294	1,030	477	1,220	443	70	47
2.....	145	114	98	96	43	332	1,950	438	1,300	523	66	47
3.....	148	122	96	96	41	368	1,830	619	1,110	443	60	44
4.....	156	124	96	91	39	354	1,120	887	970	392	62	46
5.....	164	130	98	91	36	341	822	1,420	1,170	354	60	46
6.....	179	130	96	96	36	341	655	2,030	1,640	279	57	43
7.....	188	127	94	91	36	332	350	2,600	2,070	252	60	44
8.....	191	122	94	91	39	306	373	2,540	2,450	234	64	44
9.....	204	127	94	87	43	267	319	2,290	2,030	227	62	46
10.....	207	124	89	85	43	231	294	2,070	2,070	207	68	44
11.....	197	114	89	81	39	173	241	1,620	1,640	194	66	46
12.....	185	112	89	78	41	159	336	1,240	1,340	167	64	46
13.....	179	105	85	74	43	142	433	1,100	1,240	159	68	46
14.....	185	103	85	74	46	134	669	1,010	1,060	153	68	43
15.....	188	98	89	78	43	134	986	970	970	153	70	44
16.....	194	98	87	78	57	148	1,140	895	911	150	70	44
17.....	191	100	83	83	68	164	978	920	1,080	153	70	43
18.....	182	98	81	87	66	173	879	1,160	1,020	153	66	43
19.....	170	94	81	96	62	188	961	2,050	806	148	64	43
20.....	170	96	78	100	60	197	961	2,580	713	134	66	43
21.....	156	89	76	94	64	191	1,560	2,720	560	117	64	43
22.....	145	89	78	85	64	176	1,940	2,280	511	105	60	44
23.....	132	94	78	76	96	164	1,560	1,900	465	103	60	41
24.....	127	96	74	70	134	161	936	1,830	412	96	57	39
25.....	122	94	74	70	179	148	911	2,050	345	89	57	43
26.....	122	96	72	62	259	140	879	2,280	345	85	57	49
27.....	122	91	72	62	279	145	782	2,120	392	83	53	55
28.....	127	94	76	66	290	161	721	1,990	362	78	53	57
29.....	124	89	81	62	-----	185	560	1,600	354	72	49	60
30.....	117	94	83	60	-----	224	530	1,280	402	70	49	60
31.....	117	-----	85	57	-----	245	-----	1,060	-----	68	46	-----

Monthly discharge of Two Medicine River at Family, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	207	117	160	9,840
November.....	130	89	106	6,310
December.....	98	72	85.4	5,250
January.....	100	57	81.0	4,980
February.....	290	36	81.9	4,550
March.....	368	140	217	13,300
April.....	1,950	241	890	53,000
May.....	2,720	438	1,620	99,600
June.....	2,450	345	1,030	61,300
July.....	523	68	190	11,700
August.....	70	46	61.5	3,780
September.....	60	39	46.1	2,740
The year.....	2,720	36	382	276,000

MARIAS RIVER NEAR SHELBY, MONT.

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

DRAINAGE AREA.—2,610 square miles.

RECORDS AVAILABLE.—April 4, 1902, to January 12, 1908; April 23, 1911, to September 30, 1921.

GAGE.—Chain gage on downstream side of bridge; read by Emma Moser. Original gage used to 1908 located 100 feet below present gage; during 1911 and 1912 records from Bristol water-stage recorder; all gages at practically the same datum.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Gravel and boulders; control shifts. Left bank steep and high; not subject to overflow. Right bank gently sloping; will be overflowed at extreme stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.34 feet May 20–21 (discharge, 5,230 second-feet); minimum stage, 2.04 feet September 2–3 (discharge, 58 second-feet).

1902–1907; 1911–1921: Maximum stage recorded, 14.9 feet June 24, 1907 (discharge, 29,500 second-feet); minimum stage, 1.5 feet August 20, 1919 (discharge, 10 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—The Valier-Montana Land & Water Co.'s project and the Black-foot project of the United States Bureau of Reclamation divert water from the principal tributaries above this station; there are also a number of smaller diversions.

REGULATION.—Water is stored in reservoirs on tributaries above the station; the principal ones are Two Medicine on Two Medicine River, Four Horns on Badger Creek, Swift dam on Birch Creek, and Lake Francis on Dupuyer Creek.

ACCURACY.—Stage-discharge relation affected by ice and by change in control. Two rating curves used during year; the first, applicable October 1 to January 1, is fairly well defined between 300 and 500 second-feet; the second, applicable February 27 to September 30, is well defined between 200 and 5,600 second-feet. Gage read to hundredths once daily. Daily discharge during open-channel periods ascertained by applying daily gage height to rating table. Records fair prior to March 31; thereafter good.

Discharge measurements of Marias River near Shelby, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 18	A. H. Tuttle.....	4.24	1,630	June 23	W. A. Lamb.....	4.32	1,760
27	W. A. Lamb.....	3.80	1,200	Aug. 1	.....do.....	2.64	322
May 23	.....do.....	6.32	5,190	28	.....do.....	2.25	125

Daily discharge, in second-feet, of Marias River near Shelby, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	283	368	215	533	-----	675	630	1,160	3,310	1,060	326	92
2.....	249	329	215	-----	-----	750	990	1,160	3,310	1,240	326	58
3.....	215	329	342	-----	-----	750	1,350	1,240	3,310	1,430	326	58
4.....	215	329	342	-----	-----	876	1,450	1,440	3,490	1,330	326	154
5.....	215	329	270	-----	-----	908	1,450	2,490	3,310	1,150	271	71
6.....	170	310	270	-----	-----	868	1,350	3,530	3,310	1,060	271	130
7.....	215	291	329	-----	-----	828	1,350	3,530	4,430	1,060	326	172
8.....	215	272	329	-----	-----	750	1,450	3,710	3,490	972	326	181
9.....	215	253	533	-----	-----	675	1,250	3,710	3,310	588	239	326
10.....	421	234	463	-----	-----	750	1,070	3,710	3,490	588	239	326
11.....	421	215	394	-----	-----	675	1,070	3,170	3,490	735	172	260
12.....	435	215	270	-----	-----	750	1,160	3,530	2,960	660	181	326
13.....	435	215	270	-----	-----	828	1,180	2,660	2,880	588	172	271
14.....	435	215	329	-----	-----	750	1,670	2,490	2,880	588	172	326
15.....	394	215	270	-----	-----	988	1,780	2,660	2,960	518	219	326
16.....	394	215	-----	-----	-----	1,070	1,560	2,470	2,770	452	219	271
17.....	533	463	-----	-----	-----	1,160	1,060	2,310	2,280	386	172	271
18.....	533	463	-----	-----	-----	1,160	1,330	2,160	2,440	373	244	271
19.....	477	463	-----	-----	-----	988	1,190	5,030	2,280	326	244	271
20.....	477	463	-----	-----	-----	-----	1,050	5,230	2,200	326	176	271
21.....	435	215	-----	-----	-----	1,000	1,020	5,230	2,130	326	107	219
22.....	435	463	-----	-----	-----	-----	1,050	5,030	1,860	326	107	271
23.....	435	463	-----	-----	-----	-----	1,780	5,190	1,370	326	122	326
24.....	421	463	-----	-----	-----	1,000	1,670	4,730	1,430	326	138	326
25.....	421	449	-----	-----	-----	630	1,560	4,730	1,640	326	122	271
26.....	421	449	-----	-----	-----	616	1,450	4,260	1,760	326	122	271
27.....	226	215	-----	-----	802	2,350	1,320	4,640	1,640	386	122	219
28.....	226	215	-----	-----	675	1,780	1,450	4,640	1,530	660	130	229
29.....	491	215	533	-----	-----	988	1,350	3,880	1,530	398	130	229
30.....	491	215	533	-----	-----	464	1,250	3,510	1,330	386	92	239
31.....	368	-----	533	-----	-----	630	-----	3,330	-----	326	92	-----

NOTE.—No records Oct. 1, 2, Apr. 2, 19, June 2, 20, July 2, 16, and Aug. 20; discharge interpolated. Stage-discharge relation affected by ice Nov. 6-10; discharge interpolated. Discharge not computed Dec. 16-28. Discharge estimated Mar. 20-23. No records Jan. 2 to Feb. 26.

Monthly discharge of Marias River near Shelby, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	533	170	365	22,400
November.....	463	215	318	18,900
March.....	2,350	464	924	56,800
April.....	1,780	630	1,310	78,000
May.....	5,230	1,160	3,440	212,000
June.....	4,430	1,330	2,600	155,000
July.....	1,430	326	630	38,700
August.....	326	92	201	12,400
September.....	326	58	234	13,900

MARIAS RIVER NEAR CHESTER, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 11, T. 29 N., R. 5 E., at highway bridge on Pugsley's ranch, 20 miles south of Chester, Liberty County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 3 to September 30, 1921, when station was discontinued.

GAGE.—Cable and weight gage on downstream handrail of bridge near left abutment; read by Leonard D. Pugsley.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of heavy clay and gravel with some heavy boulders. Control is bar of same material 300 feet below gage. Two channels at low stages. Banks fairly high.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.19 feet, May 27 (discharge, 5,070 second-feet); minimum stage, 1.64 feet August 28 (discharge, 88 second-feet).

ICE.—None during period of record.

DIVERSIONS.—None of importance on main stream but many on tributaries. The principal ones are those of United States Bureau of Reclamation on Two Medicine River and Badger Creek and those of Valier-Montana Land & Water Co. on Birch Creek.

REGULATION.—Storage on Birch Creek, Two Medicine River, and Badger Creek probably reduces flood flow.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined between 200 and 2,000 second-feet, fairly well above 2,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except during high water, for which they are fair.

Discharge measurements of Marias River near Chester, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 3	A. H. Tuttle	2.65	510
19	do	3.80	1,490
Aug. 1	W. A. Lamb	2.34	281

Daily discharge, in second-feet, of Marias River near Chester, Mont., for the year ending Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1	-----	1,100	2,140	1,500	333	114	16	1,670	2,180	2,540	750	164	236
2	-----	965	3,140	1,190	291	114	17	1,610	2,320	2,540	591	197	197
3	486	1,010	3,300	1,290	323	129	18	1,440	2,110	2,390	548	184	228
4	2,180	920	3,220	1,290	323	114	19	1,440	1,920	2,180	519	184	236
5	1,850	1,010	3,060	1,190	302	107	20	1,560	3,060	1,850	479	177	220
6	-----	1,290	3,300	1,190	281	100	21	1,920	4,500	1,790	415	197	197
7	1,060	1,610	3,750	1,100	263	96	22	1,730	4,700	1,730	390	164	213
8	903	2,460	3,860	878	258	114	23	1,610	4,610	1,690	339	147	132
9	835	3,570	3,990	869	263	132	24	1,560	4,610	1,710	333	136	136
10	750	3,460	3,910	835	245	136	25	1,500	4,500	1,710	281	136	164
11	750	3,540	3,510	750	228	236	26	1,290	4,920	1,710	333	132	213
12	717	3,700	3,140	717	213	236	27	1,190	5,070	1,390	333	123	190
13	390	3,140	2,920	701	197	197	28	1,010	4,580	1,500	402	88	197
14	1,010	2,840	2,690	684	164	197	29	1,060	4,550	1,610	415	93	197
15	1,290	2,390	2,660	637	205	216	30	1,140	3,570	1,390	390	103	197
							31	-----	3,100	-----	390	103	-----

Monthly discharge of Marias River near Chester, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 3-30.....	2, 180	390	1, 260	70, 000
May.....	5, 070	920	3, 000	184, 000
June.....	3, 990	1, 390	2, 540	151, 000
July.....	1, 500	281	701	43, 100
August.....	333	88	201	12, 400
September.....	236	96	173	10, 300
The period				471, 000

BADGER CREEK NEAR FAMILY, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 19, T. 31 N., R. 8 W., at new highway bridge 4 miles east of Family, Glacier County.

DRAINAGE AREA.—241 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 20, 1907, to September 30, 1921.

GAGE.—Chain gage installed May 28, 1921, on upstream side of highway bridge; read by Joe Trombley and Steve Henault. Gage used 1909 to May 27, 1921, set to same datum and located 10 feet upstream. Original staff gage and succeeding chain gage washed out by floods.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading near gage.

CHANNEL AND CONTROL.—Two channels at medium and low stages; several channels at high stages. Banks low and subject to overflow above gage. Control slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.44 feet May 20 and 26 (discharge, 1,600 second-feet); minimum stage, 3.80 feet July 22-23 (discharge, 32 second-feet).

1907-1921: Maximum discharge, 1,910 second-feet June 12, 1917; minimum stage recorded, 3.50 feet, August 19, 1919 (discharge, 2.0 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—United States Bureau of Reclamation canal diverts natural flow of Badger Creek above station to irrigate land in the eastern part of the Blackfeet Indian Reservation north of Birch Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by slight shift of control. Two rating curves used; one, applicable October 1 to December 23, well defined for range in stage; the other, applicable from March 27, well defined between 50 and 1,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Badger Creek near Family, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 10.....	4. 21	114	June 13.....	5. 17	500	Aug. 16.....	3. 89	51
May 28.....	5. 70	904	July 23.....	3. 90	51			

Daily discharge, in second-feet, of Badger Creek near Family, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	82	82	82	-----	120	257	905	226	62	42
2.....	43	82	82	-----	120	257	694	226	55	42
3.....	52	93	82	-----	120	257	461	179	51	42
4.....	52	93	82	-----	295	257	316	179	51	42
5.....	52	93	82	-----	257	295	905	150	51	42
6.....	52	93	61	-----	223	687	950	136	51	42
7.....	49	82	-----	-----	207	896	923	136	51	123
8.....	43	-----	-----	-----	176	1,080	860	136	51	123
9.....	105	-----	-----	-----	162	1,030	316	123	51	123
10.....	105	-----	-----	-----	191	1,120	694	110	51	136
11.....	105	-----	-----	-----	191	1,120	552	97	51	136
12.....	117	-----	-----	-----	207	852	552	85	51	136
13.....	117	-----	-----	-----	257	687	520	73	51	136
14.....	117	-----	-----	-----	295	687	520	73	51	136
15.....	117	-----	-----	-----	380	852	490	62	51	123
16.....	117	-----	-----	-----	335	941	408	62	51	123
17.....	117	-----	-----	-----	335	687	361	42	51	123
18.....	112	-----	-----	-----	380	766	361	42	51	123
19.....	105	-----	-----	-----	429	1,210	361	42	51	123
20.....	105	82	-----	-----	403	1,600	361	42	51	123
21.....	105	82	-----	-----	380	1,310	340	42	51	123
22.....	105	82	-----	-----	335	1,450	340	32	42	123
23.....	105	82	-----	-----	335	1,310	318	32	42	123
24.....	105	82	-----	-----	295	941	261	42	42	123
25.....	93	82	-----	-----	295	1,410	243	42	42	123
26.....	117	82	-----	-----	295	1,600	243	62	42	123
27.....	117	82	-----	107	335	1,410	318	62	42	136
28.....	105	82	-----	107	314	932	318	62	42	136
29.....	105	93	-----	107	295	656	261	62	51	97
30.....	105	82	-----	107	295	656	210	62	51	62
31.....	105	-----	-----	107	-----	750	-----	62	51	-----

NOTE.—Stage-discharge relation affected by ice Nov. 8-19. Discharge not computed Dec. 7-23. No record Dec. 24 to Mar. 26.

Monthly discharge of Badger Creek near Family, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	117	43	94.4	5,800
December 1-6.....	82	61	78.5	934
March 27-31.....	107	107	107	1,060
April.....	429	120	275	16,400
May.....	1,600	257	902	55,500
June.....	950	210	512	30,500
July.....	226	32	89.8	5,520
August.....	62	42	49.5	3,040
September.....	136	42	107	6,370

BIRCH CREEK AT SWIFT DAM, NEAR DUPUYER, MONT.

LOCATION.—Near southwest corner of sec. 23, T. 28 N., R. 10 W., just below Swift dam, 20 miles west of Dupuyer, Pondera County, and 34 miles southwest of Valier.

DRAINAGE AREA.—75 square miles (revised; measured on topographic maps).

RECORDS AVAILABLE.—March 26, 1913, to September 30, 1921.

100120—25†—wsp 526—5

GAGE.—Vertical iron gage on right bank 800 feet below dam; read by O. F. Parish. Original gage was staff on right bank one-fourth of a mile below dam. June 5 to July 16, 1913, a temporary gage on left bank immediately below dam was used to obtain high-water records. Overflow from spillway is referred to vertical staff set in concrete stilling well at west end of spillway crest; zero of gage is at elevation of spillway crest, 4,947 feet above sea-level datum.

DISCHARGE MEASUREMENTS.—Made from footbridge 300 feet above gage or by wading near gage.

CHANNEL AND CONTROL.—Bed composed of clean, coarse gravel and boulders; slightly shifting; banks high at gage; not subject to overflow. Spillway is a curved concrete crest 2 feet wide and 379 feet long.

EXTREMES OF DISCHARGE.—Maximum discharge during year, 724 second-feet May 26 (combined discharge over spillway and through gates); minimum discharge, 2 second-feet February 16–20 (estimated on account of ice).

1913–1921: Maximum discharge, 5,275 second-feet June 21, 1916; minimum discharge, no flow January 2–3, 1920. Minimum flow is controlled and maximum partly regulated by valves at dam.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Two small ditches divert water just below dam and above gage; known locally as Cote ditch and Jones ditch.

REGULATION.—Flow is regulated by operation of gates at dam, except during periods of extremely high water.

ACCURACY.—Stage-discharge relation permanent. Rating curve for channel below outlet gates well defined between 0 and 600 second-feet. Discharge over spillway estimated by engineers for Valier-Montana Land & Water Co. from one measurement and comparison with records for other stations on the stream. Gages read to hundredths twice daily. Daily discharge, except during ice periods, ascertained by applying mean daily gage heights to rating tables for spillway and outlet channel separately and for days of considerable fluctuation in stage, when hourly discharge was averaged. Discharges thus computed were added to obtain the total daily flow. Records May 25 to June 23 and during ice periods are fair; others good.

COOPERATION.—All field data furnished by Valier-Montana Land & Water Co.; computation of daily and monthly discharge made by United States Geological Survey.

Discharge measurements of Birch Creek at Swift dam, near Dupuyer, Mont., during the year ending Sept. 30, 1921

Outlet channel

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Dec. 1	H. A. Noble ^a	1.54	3.8	Apr. 18	H. A. Noble.....	2.95	269
Jan. 13	do.....	1.67	^b 7.6	May 16	George Ebner.....	2.90	237
Feb. 17	do.....	1.46	^b 2.0	June 21	H. A. Noble.....	1.65	6.8
Apr. 2	George Ebner ^c	1.50	2.7	July 5	Ellis ^c and Ebner.....	3.39	503

Spillway channel

1920				1921			
July 3	E. G. Studley ^a	0.26	363	May 26	Ebner and Heidel.....	0.64	844
				June 21	H. A. Noble.....	.33	223

^a Engineers for Valier-Montana Land & Water Co.

^b Stage-discharge relation affected by ice.

^c State hydrographer.

NOTE.—Measurements show only discharge through gates.

Daily discharge, in second-feet, of Birch Creek at Swift dam, near Dupuyer, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	67	4.5	3.2	6.5	4.5	3.2	3.0	244	461	610	297	84
2.....	36	4.8	2.8	6.5	4.5	3.2	3.2	240	444	580	267	84
3.....	5.2	5.2	2.8	6.5	4.5	3.2	3.2	240	411	544	260	84
4.....	5.2	5.2	2.8	6.2	4.5	3.2	3.2	240	444	504	227	84
5.....	3.9	5.2	2.8	5.8	4.5	3.2	3.2	240	446	454	204	84
6.....	3.9	5.2	2.8	7.0	4.5	3.2	3.2	236	598	360	176	84
7.....	3.9	5.2	2.8	7.0	4.5	3.2	3.2	240	616	365	162	84
8.....	4.2	5.2	2.8	7.0	4.5	3.2	3.2	244	581	365	137	86
9.....	4.5	5.2	2.8	7.0	3.9	3.2	3.2	244	563	355	123	88
10.....	4.5	5.2	2.8	7.0	3.2	3.2	3.2	244	594	355	123	113
11.....	3.5	5.2	2.8	7.0	3.2	3.2	3.2	244	428	355	120	240
12.....	3.2	5.2	2.8	7.3	3.2	3.2	3.2	244	380	348	120	294
13.....	3.2	5.2	2.8	7.6	3.2	3.2	3.2	240	351	328	123	330
14.....	3.0	4.5	2.8	7.6	3.2	3.2	69	236	351	320	123	330
15.....	3.2	4.5	2.8	7.6	3.2	3.2	267	236	351	326	112	321
16.....	3.2	4.5	3.0	7.6	2.0	3.2	262	152	321	328	93	330
17.....	3.2	4.5	3.0	7.6	2.0	3.2	262	5.2	267	350	88	254
18.....	3.2	4.5	3.0	7.6	2.0	3.2	262	5.2	267	356	88	9.2
19.....	3.5	4.5	3.0	7.6	2.0	3.2	262	5.5	254	357	86	19
20.....	3.5	4.5	3.0	7.6	2.0	3.2	262	5.8	242	374	84	18
21.....	3.5	4.5	3.0	7.6	3.2	3.2	262	5.8	230	411	84	19
22.....	3.9	4.5	3.0	7.6	3.2	3.2	262	6.5	230	418	84	22
23.....	3.9	4.5	3.0	7.6	3.2	3.2	262	13	315	423	84	27
24.....	3.9	4.5	3.0	7.6	3.2	2.8	262	16	310	413	84	31
25.....	4.2	4.5	3.0	7.6	3.2	2.6	262	83	435	413	84	37
26.....	4.2	4.5	3.0	4.5	3.2	2.6	262	724	525	402	88	40
27.....	4.2	4.5	3.5	4.5	3.2	2.8	262	687	600	391	88	42
28.....	4.5	4.5	5.5	4.5	3.2	2.8	258	494	610	368	88	40
29.....	4.5	4.5	5.5	4.5		2.8	258	380	602	355	88	37
30.....	4.5	4.5	5.5	4.5		2.8	254	351	618	337	84	39
31.....	4.5		5.8	4.5		2.8		395		330	84	

NOTE.—Above table shows total flow through outlet valves and over spillway. Spillway was overflowed May 3 to June 4. Stage-discharge relation affected by ice Dec. 24-29, Jan. 7-24, and Feb. 16-20; discharge estimated from current-meter measurements, temperature records, and observer's notes. Discharge interpolated Oct. 2 and Nov. 20 when gage was not read.

Monthly discharge of Birch Creek at Swift dam, near Dupuyer, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	67	3.0	6.99	430
November.....	5.2	4.5	4.77	284
December.....	5.8	2.8	3.26	200
January.....	7.6	4.5	6.66	410
February.....	4.5	2.0	3.38	188
March.....	3.2	2.6	3.08	189
April.....	267	3.0	143	8,510
May.....	724	5.2	224	13,800
June.....	618	230	428	25,500
July.....	610	320	393	24,200
August.....	297	84	128	7,870
September.....	330	9.2	112	6,660
The year.....	724	2.0	122	88,200

BIRCH CREEK NEAR DUPUYER, MONT.

LOCATION.—In sec. 28, T. 29 N., R. 8 W., at Keeple's ranch, half a mile above head gates of B canal of Valier-Montana Land & Water Co., 12 miles north-west of Dupuyer, Pondera County, and 20 miles above mouth of Dupuyer Creek.

DRAINAGE AREA.—110 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 25, 1907, to September 30, 1921.

GAGE.—Steel bar graduated to tenths and driven into bed of stream; also an enameled gage in well in bank at same section; read by Wade Starleigh.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 400 feet below gage.

CHANNEL AND CONTROL.—Bed composed of clean gravel; control is gravel bar 250 feet below gage; shifts slightly. Banks are of medium height covered with brush and subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.94 feet May 27 (discharge, 674 second-feet); minimum stage, 3.09 feet April 7 (discharge, 3.0 second-feet).

1907-1921: Maximum stage recorded, 10.0 feet June 21, 1916 (discharge estimated, 5,000 second-feet); minimum discharge, 3.0 second-feet April 7, 1921.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Two or three small ditches divert above station.

REGULATION.—Flow is largely controlled by operation of gates at Birch Creek reservoir, 12 miles upstream; storage capacity of reservoir is 30,000 acre-feet.

ACCURACY.—Stage-discharge relation not permanent; affected by ice November 1 to April 3 and by change in control. Two rating curves used during open-water season; one applicable October 1-31 well defined for range in stage; other applicable April 4 to September 30 well defined between 10 and 700 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table, except during period of ice effect. Records for open channel good; others fair.

COOPERATION.—All field data furnished by Valier-Montana Land & Water Co.; computation of daily and monthly discharge made by United States Geological Survey.

Discharge measurements of Birch Creek near Dupuyer, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 16	H. A. Noble.....	3.33	16.8	Mar. 4	Noble and Ebner.....	^a 3.24	11.0
Nov. 16	do.....	^a 3.72	13.7	May 16	Ebner and Noble.....	4.82	256
Dec. 1	Noble and Ebner.....	3.18	6.8	26	Ebner and Heidel.....	5.90	659
22	Noble and Speir.....	^a 4.16	6.1	June 21	H. A. Noble.....	4.88	243
Jan. 5	George Ebner.....	^a 4.19	9.5	July 5	Ellis and Ebner.....	5.57	478
22	H. A. Noble.....	^a 5.05	7.6	Aug. 5	Noble and Palin.....	4.68	196
Feb. 8	George Ebner.....	^a 4.57	4.6	7	Ebner and Tidyman.....	4.09	83
21	H. A. Noble.....	^a 4.92	8.0	Sept. 23	J. A. Tidyman.....	3.70	37.7

^a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Birch Creek near Dupuyer, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	77	12	7	10	7	7	6	244	474	618	318	77
2.....	84	12	7	10	7	12	7	241	470	614	262	77
3.....	71	12	7	10	7	10	7	232	430	606	250	77
4.....	70	12	7	9	7	10	8	235	462	526	227	77
5.....	29	11	7	9	6	12	6	232	564	510	207	78
6.....	25	11	7	9	6	11	6	247	610	395	187	78
7.....	26	11	7	9	6	11	3	244	614	387	160	77
8.....	25	12	7	9	5	13	12	247	601	376	153	78
9.....	24	12	7	9	6	12	9	250	597	372	128	90
10.....	23	12	8	9	8	12	7	250	506	365	126	89
11.....	23	13	7	9	8	10	6	250	486	365	122	179
12.....	22	13	7	9	7	8	6	253	462	361	120	200
13.....	22	13	8	9	7	8	6	244	410	335	122	284
14.....	21	14	7	9	7	8	8	241	422	332	116	290
15.....	21	14	6	9	7	10	134	238	387	328	109	297
16.....	20	14	6	9	6	11	182	238	391	321	98	297
17.....	20	13	6	8	6	16	207	45	328	336	83	310
18.....	19	12	6	8	6	16	227	35	310	350	86	65
19.....	19	10	6	8	6	12	235	37	304	342	84	44
20.....	19	9	6	8	7	10	238	34	284	365	83	38
21.....	19	9	6	8	8	10	241	31	290	402	83	37
22.....	18	8	6	8	8	12	241	30	271	418	83	35
23.....	18	9	6	8	8	15	244	27	265	418	83	35
24.....	18	9	6	8	8	17	238	27	339	418	81	35
25.....	18	10	6	8	8	8	235	27	462	410	81	38
26.....	17	10	6	8	8	10	235	656	515	406	80	43
27.....	16	10	7	8	7	8	238	674	568	406	78	46
28.....	16	9	7	8	6	8	241	522	606	402	78	49
29.....	15	8	8	8	-----	10	244	498	601	365	81	42
30.....	17	7	10	8	-----	11	241	391	610	341	78	41
31.....	16	-----	10	7	-----	12	-----	391	-----	318	73	-----

NOTE.—Stage-discharge relation affected by ice Nov. 1 to Apr. 3 discharge estimated by Valier-Montana Land & Water Co. from discharge measurements, temperature records, and observers' notes. Discharge interpolated Oct. 10-15, 17-25, June 26, July 17, 30, Aug. 22, and Sept. 14.

Monthly discharge of Birch Creek near Dupuyer, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	84	15	27.4	1,680
November.....	14	7	11.0	654
December.....	10	6	6.9	424
January.....	10	7	8.6	529
February.....	8	5	6.9	383
March.....	17	7	11.0	676
April.....	244	3	124	7,380
May.....	674	27	236	14,500
June.....	614	265	455	27,100
July.....	618	318	403	24,800
August.....	318	73	126	7,750
September.....	310	35	107	6,370
The year.....	674	• 3	127	92,200

DUPUYER CREEK NEAR VALIER, MONT.

LOCATION.—In NE. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 33, T. 29 N., R. 6 W., at Cowell ranch, 1,000 feet above diversion dam at head of D canal from Dupuyer Creek to Lake Frances reservoir and outlet of B canal, which diverts water from Birch Creek to Dupuyer Creek, 6 miles below mouth of Sheep Creek, and 11 miles southwest of Valier, Pondera County.

DRAINAGE AREA.—111 square miles (measured by Valier-Montana Land & Water Co.).

RECORDS AVAILABLE.—July 17, 1912, to September 30, 1921.

GAGE.—Vertical staff on right bank since June 23, 1916; read by Cecil Carey and others.

DISCHARGE MEASUREMENTS.—Made by wading at low stages. High-water measurements made from cable 30 feet below gage or from bridge 5 miles below gage.

CHANNEL AND CONTROL.—Bed of stream composed of fine gravel; right bank high and steep; left bank slopes gradually and is overflowed only at flood stage. Control at certain stages formed by riffle 400 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.80 feet May 20 (discharge, 230 second-feet); minimum stage, 2.49 feet, August 26, 27 (discharge, 2.8 second-feet).

1912-1921: Maximum stage recorded, 6.5 feet on June 21, 1916, determined by level from flood marks (discharge, 2,180 second-feet); minimum discharge, no flow September 19, 1919.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—A number of small ditches divert water for irrigation from Dupuyer Creek and tributaries; many of the numerous water-right filings have been perfected by use.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by ice and by a slight change in control. Two rating curves used; one applicable October 1-21, fairly well defined between 20 and 280 second-feet; one applicable April 8 to September 30 well defined between 3 and 240 second-feet. Gage read to hundredths once daily. Discharge estimated during period of ice effect; otherwise ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Results of discharge measurements and computation of daily discharge furnished by Valier-Montana Land & Water Co.

Discharge measurements of Dupuyer Creek near Valier, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 12	H. A. Noble.....	3.06	* 13.4	Mar. 22	H. A. Noble.....	3.01	34.9
Dec. 2	do.....	2.85	21.6	28	do.....	2.96	27.2
21	do.....	3.09	* 7.4	Apr. 13	do.....	3.10	43.1
30	George Ebner.....	3.29	* 20.0	May 9	do.....	3.53	143
Jan. 17	H. A. Noble.....	3.27	* 10.8	20	do.....	3.80	230
Feb. 1	do.....	3.42	* 9.8	July 6	Ellis and Noble.....	2.75	12.1
18	do.....	3.27	* 10.8	18	H. A. Noble.....	2.52	3.34
Mar. 2	do.....	2.89	* 11.1	Sept. 29	Ebner and Tidyma.....	2.76	13.1

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Dupuyer Creek near Valier, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	9	12	22	18	10	15	20	51	85	16	9.0	3.0
2	8	12	22	16	10	14	23	55	90	15	8.2	3.0
3	10	12	20	15	10	16	56	51	96	24	6.6	3.2
4	10	12	20	15	10	12	46	48	92	24	5.8	3.0
5	8	13	18	15	10	12	32	47	129	21	5.4	5.0
6	8	13	16	15	10	18	30	67	103	14	5.0	5.0
7	8	13	15	14	10	20	16	106	90	12	9.0	5.0
8	8	14	14	14	11	20	32	131	87	11	9.0	4.8
9	5	14	13	14	12	24	34	137	94	9.0	8.2	5.2
10	3	14	12	13	14	12	34	129	85	7.8	7.0	11
11	3	14	12	13	18	12	44	118	79	7.8	7.8	13
12	3	14	11	13	24	10	48	116	67	7.4	4.8	13
13	7	14	11	12	18	9	45	108	62	5.0	4.2	14
14	8	14	10	12	18	8	50	101	55	5.0	4.0	13
15	8	14	10	12	14	10	56	90	48	4.8	3.8	14
16	8	14	9	11	12	12	58	83	55	3.6	3.8	14
17	8	14	9	11	11	25	58	81	60	3.2	4.6	13
18	8	15	10	11	11	35	62	79	55	3.2	4.0	13
19	10	15	12	12	11	20	67	134	50	3.2	4.2	13
20	10	15	9	12	11	15	79	230	47	3.2	4.0	12
21	10	15	7	11	11	15	77	199	40	3.4	4.0	12
22	10	15	7	11	10	27	75	196	34	3.2	3.8	11
23	9	16	7	10	10	35	71	167	34	3.2	3.6	11
24	10	16	8	10	14	18	65	152	30	3.0	3.0	11
25	10	18	8	10	20	20	62	143	26	3.0	3.0	11
26	10	18	10	10	20	16	56	131	22	3.0	2.8	11
27	10	20	13	10	18	20	51	134	21	4.2	2.8	12
28	11	20	15	10	18	33	50	121	13	10.2	3.4	12
29	11	20	17	10	-----	16	51	116	11	7.0	3.0	13
30	11	21	20	10	-----	15	53	106	11	7.3	3.0	13
31	11	-----	18	10	-----	18	-----	94	-----	8.2	3.0	-----

NOTE.—Stage-discharge relation affected by ice Oct. 22 to Apr. 7; discharge computed from measurements and observers' notes.

Monthly discharge of Dupuyer Creek near Valier, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	11	3	8.48	521
November	21	12	15.0	892
December	22	7	13.1	906
January	18	10	12.3	756
February	24	10	13.4	744
March	35	8	17.8	1,090
April	79	16	50.0	2,980
May	230	47	114	7,010
June	129	11	59.0	3,510
July	24	3.0	8.27	508
August	9.0	2.8	4.96	305
September	14	3.0	10.0	595
The year	230	2.8	27.2	19,700

CUT BANK CREEK NEAR BROWNING, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 15, T. 33 N., R. 11 W., on Blackfeet Reservation, on left bank 100 feet above highway bridge on road from Browning to Babb, 6 miles north of Browning, Glacier County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 17, 1918, to September 30, 1921.

GAGE.—Stevens continuous water-stage recorder 100 feet above highway bridge.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Control is sandstone ledge and boulders 40 feet below gage; shifting. Channel straight 75 feet above and 125 feet below gage. Banks high and are not overflowed except at extremely high stages. Two small channels on right bank carry water at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 4.12 feet at 6 p. m. May 26 (discharge, 1,030 second-feet); minimum stage, 0.83 foot at 8 a. m. November 4 (discharge, 26 second-feet).

1918-1921: Maximum stage, 4.12 feet May 26, 1921 (discharge, 1,030 second-feet); minimum stage, 0.25 foot September 19, 1919 (discharge, 10 second-feet).

ICE.—Records discontinued during winter.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed by shifting control. Two rating curves used; one applicable October 1 to November 6 and April 1 to May 12, well defined between 30 and 700 second-feet; the other applicable May 13 to September 30, well defined between 100 and 1,100 second-feet. Mean daily gage height determined from graph of water-stage recorder. Daily discharge ascertained by applying mean daily gage height to rating table. Indirect method for shifting control used May 8-12. Records good.

Discharge measurements of Cut Bank Creek near Browning, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge	Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 25.....	1.85	160	June 13.....	3.37	596
May 27.....	3.81	839	July 23.....	1.75	111

Daily discharge, in second-feet, of Cut Bank Creek near Browning, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July
1.....	57	37	-----	49	124	588	298
2.....	64	43	-----	104	123	639	284
3.....	69	42	-----	218	130	598	256
4.....	66	36	-----	159	142	530	225
5.....	79	33	-----	131	182	655	207
6.....	92	30	-----	101	272	811	198
7.....	102	-----	-----	95	364	865	194
8.....	102	-----	-----	89	529	853	196
9.....	94	-----	46	81	562	775	203
10.....	85	-----	48	88	525	709	198
11.....	81	-----	48	102	511	665	186
12.....	77	-----	-----	130	421	698	173
13.....	74	-----	-----	172	343	634	159
14.....	68	-----	-----	184	281	665	153
15.....	68	-----	-----	205	252	629	151
16.....	64	-----	-----	188	242	563	145
17.....	61	-----	-----	190	225	489	142
18.....	62	-----	-----	221	221	456	136
19.....	61	-----	-----	246	400	456	127
20.....	56	-----	-----	248	736	460	120
21.....	53	-----	-----	236	823	464	117
22.....	52	-----	-----	220	805	489	115
23.....	49	-----	-----	203	799	521	111
24.....	52	-----	-----	176	805	452	-----
25.....	50	-----	-----	157	907	439	-----
26.....	52	-----	-----	150	985	447	-----
27.....	51	-----	-----	146	931	393	-----
28.....	49	-----	-----	148	687	364	-----
29.....	50	-----	-----	146	510	330	-----
30.....	49	-----	-----	139	464	317	-----
31.....	47	-----	-----	-----	497	-----	-----

NOTE.—No records Nov. 7 to Mar. 8, Mar. 12-31, and July 24 to Sept. 30. Discharge interpolated Oct. 9 and Apr. 22.

Monthly discharge of Cut Bank Creek near Browning, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	102	47	65.7	4,040
November 1-6.....	43	30	36.8	437
April.....	248	49	157	9,340
May.....	985	123	477	29,300
June.....	865	317	565	33,600
July 1-23.....	298	111	178	8,120

DRY FORK OF MARIAS RIVER AT FOWLER, MONT.

LOCATION.—Near center of sec. 31, T. 30 N., R. 1 W., at highway bridge one-fourth mile northeast of railway depot at Fowler, Pondera County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 25 to August 20, 1920; fragmentary.

GAGE.—Weight and cable on downstream guardrail of bridge; read by Harry Kendall.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Gravel bar forms riffle 25 feet below bridge. Stream makes sharp turn above bridge. Banks high and not likely to be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period April 12 to September 20, 6.20 feet at 8 a. m. April 14 (discharge estimated, 1,220 second-feet); minimum discharge, no flow July 22 and 23.

ICE.—None during period of record.

DIVERSIONS.—Practically entire normal flow diverted for irrigation.

REGULATION.—Water passing this station is largely seepage and waste from Valier-Montana Land & Water Co.'s irrigation project.

ACCURACY.—Stage-discharge relation affected by shifting channel. Three rating curves used. Gage read to hundredths twice daily. Daily discharge determined by indirect method April 12 to May 3 and directly for remainder of period. Records poor.

Discharge measurements of Dry Fork of Marias River at Fowler, Mont., during the year ending Sept. 30, 1920

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 25	Heidel and Gerharz.....	3.52	163	July 31	W. A. Lamb.....	^a 3.50	8.4
Apr. 12	W. A. Lamb.....	3.04	47.2	Aug. 20	Ellis and Heidel.....	^b 2.65	^c 3.0
May 18	A. H. Tuttle.....	3.05	23.3				

^a Temporary gage at independent datum.

^b Gage height by levels from bench mark.

^c Estimated.

Daily discharge, in second-feet, of Dry Fork of Marias River at Fowler, Mont., for the period Mar. 25 to Aug. 20, 1920

Day	Mar.	Apr.	May	June	July	Aug.	Day	Mar.	Apr.	May	June	July	Aug.
1.....			70	2.6		4.6	16.....		224	24	1.9		5.3
2.....			68	3.6		7.4	17.....		130	16	343		4.7
3.....			36	6.4		14	18.....		74	22	122		4.1
4.....			74	12		8.0	19.....		83	14	46		3.5
5.....			94	18		6.5	20.....		141	9.5	26	0.2	3.0
6.....			76	18		6.5	21.....		186	9.0	23	.1	
7.....			56	22		5.6	22.....		205	5.6	25	.0	
8.....			48	19		6.5	23.....		76	3.6	26	.0	
9.....			43	5.3		14	24.....		74	5.6	26	.5	
10.....			33	3.0		7.4	25.....	163	64	5.2	21	.7	
11.....			26	8.0		9.2	26.....	224	36	4.0	16	1.5	
12.....		60	88	4.4		16	27.....	204	43	3.8	17	.7	
13.....		280	177	1.5		8.0	28.....	204	64	6.0		1.4	
14.....		1,120	68	1.9		6.5	29.....	211	60	1.7		3.8	
15.....		581	40	2.0		5.9	30.....	204	45	.7		5.0	
							31.....	200		2.0		4.6	

NOTE.—No record Apr. 1-11 and June 28 to July 19. Discharge interpolated June 25 and Aug. 15-19.

Monthly discharge of Dry Fork of Marias River at Fowler, Mont., for the period Mar. 25 to Aug. 20, 1920

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 25-31.....	224	163	201	2,790
April 12-30.....	1,120	36	187	7,050
May.....	177	.7	36.4	2,240
June 1-27.....	343	1.5	30.4	1,630
July 20-31.....	5.0	.0	1.54	36.7
August 1-20.....	16	3.0	7.34	291

WILLOW CREEK NEAR DEVON, MONT.

LOCATION.—In NW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 10, T. 33 N., R. 2 E., at highway bridge 12 miles north of Devon, Toole County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 18 to September 30, 1921.

GAGE.—Wire gage on upstream handrail of highway bridge; read by Mrs. J. R. Garrison.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Control formed by riffle of boulders and gravel 75 feet below gage. One channel at all stages. Both banks clean and are overflowed at gage height of 4 feet. All water goes under bridge until gage height 7 feet is reached, when entire flat is covered.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.5 feet at 8 p. m. July 14 (discharge, from extension of rating curve, 430 second-feet); minimum stage, water standing in pools May 28 to June 5, June 9 to July 6, July 29-30, and August 1 to September 30.

ICE.—None during period of record.

DIVERSIONS.—No data.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent except July 7-12, when it was affected by backwater from dam constructed 700 feet below gage. Rating curve well defined between 10 and 105 second-feet. Gage read to tenths twice daily April 18 to July 13; thereafter to half-tenths. Daily discharge ascertained by applying mean daily gage height to rating table, except July 7-12, when discharge was estimated. Records good.

COOPERATION.—Maintained in cooperation with Toole County Irrigation District.

Discharge measurements of Willow Creek near Devon, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
Apr. 18	Tuttle and MacHale	<i>Fed.</i>	<i>Sec.-ft.</i>
July 9	G. H. Ellis	0.98	20.8
		1.45	• 1.5

^a Stage-discharge relation affected by backwater from dam; discharge estimated.

Daily discharge, in second-feet, of Willow Creek near Devon, Mont., for the year ending Sept. 30, 1921

Day	Apr.	May	June	July	Day	Apr.	May	June	July
1		9.5			16		15		50
2		5.9			17		9.5		35
3		5.9			18	22	9.5		35
4		5.9			19	22	9.5		5.7
5		4.8			20	22	9.5		4.4
6		7.0	0.6		21	22	4.8		2.6
7		9.5	.6	2.0	22	22	4.8		1.0
8		20	.6	2.0	23	18	4.8		.6
9		26		1.5	24	18	1.3		.6
10		20		2.5	25	15	1.3		.6
11		15		.5	26	14	1.3		.6
12		12		.5	27	12	.6		.6
13		9.5		23	28	12			.6
14		9.5		• 197	29	11			
15		15		177	30	9.5			
					31				.6

NOTE.—No flow May 28 to June 5, June 9 to July 6, July 29–30, Aug. 1 to Sept. 30.

Monthly discharge of Willow Creek near Devon, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 18–30	22	9.5	16.9	436
May	26	0	7.98	491
June	6	0	.06	3.6
July	197	0	17.5	1,080
August	0	0	.0	0
September	0	0	.0	0
The period.				2,010

TETON RIVER AT STRABANE, MONT.

LOCATION.—In SE. $\frac{1}{4}$ NE. $\frac{1}{4}$ sec. 35, T. 25 N., R. 7 W., at highway bridge on Peebles ranch, at Strabane, Teton County, 16 miles above Chouteau.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 26, 1904, to December 31, 1906, and June 1, 1908, to September 30, 1921.

GAGE.—Chain gage on upstream side of highway bridge, used since March 23, 1911; read by James Peebles. History of previous gages in Water-Supply Paper 476 and in earlier papers.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Composed of coarse gravel; subject to shift. Several channels at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.59 feet at 4 p. m. May 19, 11 a. m. and 4 p. m. May 20 (discharge, 396 second-feet); minimum stage, 1.50 feet December 20 to January 9 (no flow).

1908-1921: Maximum stage recorded, 7.8 feet June 21, 1916 (discharge, 3,810 second-feet); minimum discharge, no flow December 20 to January 9, 1921.

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—Several canals head above station, the largest being the Teton Cooperative Reservoir Co.'s canal, which diverts water $1\frac{1}{2}$ miles above gage.

REGULATION.—Discharge affected by operation of canal head gates.

ACCURACY.—Stage-discharge relation affected by drift which lodged under bridge. Rating curve used October 1 to June 12 well defined between 20 and 250 second-feet. Rating curve used June 13 to September 30, 1921, well defined between 40 and 250 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by indirect method for shifting control October 1 to June 12 and by applying mean daily gage height to rating table June 13 to September 30. Records fair.

Discharge measurements of Teton River at Strabane, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge
Apr. 22	Feet 1.04	Sec.-ft. 23.0
May 23	3.13	273
June 12	3.02	215

Daily discharge, in second-feet, of Teton River at Strabane, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	52	41	1	0	1	1	1	58	217	129	69	46
2	52	39	1	0	1	1	1	59	268	129	69	46
3	52	35	1	0	1	1	1	62	270	129	66	46
4	52	35	1	0	1	1	1	66	270	129	66	46
5	54	15	1	0	1	1	1	70	263	134	66	46
6	54	6	1	0	1	1	1	85	289	134	66	46
7	52	2	2	0	1	1	1	117	300	125	66	46
8	52	2	2	0	1	1	2	168	284	116	66	46
9	52	2	2	0	1	1	2	191	268	116	66	46
10	52	1	2	1	1	1	2	117	237	108	66	46
11	52	1	2	1	1	1	2	113	220	102	62	44
12	52	1	2	1	1	1	2	111	210	98	62	44
13	52	1	2	1	1	12	2	113	210	96	62	44
14	52	1	2	1	1	26	2	111	216	96	59	44
15	52	1	2	1	1	26	2	113	221	94	59	44
16	52	1	1	1	1	26	2	111	232	90	59	44
17	52	1	1	1	1	26	8	110	232	90	56	44
18	52	1	1	1	1	26	27	113	226	90	56	44
19	52	1	1	12	1	26	26	378	221	90	56	44
20	52	1	0	26	1	26	24	396	221	90	53	44
21	52	1	0	1	1	26	23	260	218	90	51	44
22	52	1	0	1	1	1	21	260	218	90	51	44
23	52	1	0	1	1	1	21	281	218	90	51	44
24	52	1	0	26	1	1	21	286	218	90	48	44
25	52	1	0	26	1	1	21	289	208	90	48	44
26	52	1	0	26	1	1	21	286	193	100	48	44
27	52	1	0	26	1	1	20	311	169	88	48	47
28	52	1	0	26	1	1	20	314	147	82	48	47
29	52	1	0	26	-----	1	37	224	138	78	46	47
30	52	1	0	1	-----	1	59	121	133	75	46	47
31	50	-----	0	1	-----	1	-----	153	-----	75	46	-----

Monthly discharge of Teton River at Strabane, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	54	50	52.1	3,200
November.....	41	1	6.6	393
December.....	2	0	.9	55.3
January.....	26	0	6.7	412
February.....	1	1	1.0	55.5
March.....	26	1	7.8	480
April.....	59	1	12.5	744
May.....	396	58	176	10,800
June.....	300	133	224	13,300
July.....	134	75	101	6,210
August.....	69	46	57.4	3,530
September.....	47	44	45.1	2,080
The year.....	396	0	57.9	41,800

DEEP CREEK NEAR CHOUTEAU, MONT.

LOCATION.—In SW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 15, T. 23 N., R. 5 W., at Hugh Robinson's ranch, 5 miles southwest of Chouteau, Teton County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 24, 1911, to September 30, 1921.

GAGE.—Overhanging chain gage on right bank, 400 feet above house of gage reader, Hugh Robinson.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bar of gravel 50 feet below gage forms principal control; shifts occasionally. Channel clean and fairly permanent. Right bank high and not subject to overflow; left bank may be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.15 feet at 8 a. m. May 19 (discharge, 490 second-feet); minimum stage, 5.15 feet August 26 to September 2 (discharge by indirect method, 13 second-feet).

1911–1921: Maximum stage recorded, 10.5 feet June 21, 1912 (discharge by extension of rating curve, 3,050 second-feet); minimum stage, 4.90 feet July 23–27, 1919 (discharge, 3.0 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—A few small ditches divert from creek above gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by slight change in control. Rating curve used is well defined between 20 and 200 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying gage height to rating table except for periods affected by ice or by shifting control. Indirect method used August 1 to September 30. Records good for periods of open channel; others fair.

Discharge measurements of Deep Creek near Chouteau, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 9.....	5.21	19.7	June 12.....	6.10	122
Apr. 22.....	5.65	51	Aug. 28.....	5.14	13.0

Daily discharge, in second-feet, of Deep Creek near Chouteau, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	22	31	28	24	35	39	160	44	21	13
2	22	31	24	24	35	44	147	44	20	13
3	22	35	22	24	39	39	147	48	20	14
4	22	35	22	31	54	39	147	54	20	14
5	22	39	24	31	48	39	160	44	20	14
6	22	39	28	28	44	39	173	44	20	14
7	22	31	24	28	35	104	173	44	20	14
8	22	22	28	35	44	147	188	39	18	14
9	22	24	28	24	48	160	173	35	18	14
10	22	24	28	24	48	136	147	35	18	16
11	22	22	26		59	114	136	31	17	16
12	24	22	24		59	114	124	28	17	16
13	28	22	22		54	104	114	31	16	16
14	28	22	22	20	54	87	104	28	16	16
15	24	24	22		54	87	96	28	16	16
16	24	28	22		59	80	114	24	16	16
17	24	31	22	39	54	80	96	24	16	16
18	24	35	20	54	48	80	96	24	16	16
19	24	35		50	54	350	87	24	16	16
20	24	35		46	59	323	80	22	15	14
21	24	28		42	59	268	72	24	15	14
22	28	24		39	54	286	72	22	14	14
23	28	24	20	31	48	251	66	19	14	14
24	24	28		35	48	251	59	19	14	14
25	24	31		31	44	268	59	19	13	14
26	24	28		28	44	286	59	48	13	14
27	24	19		24	39	286	54	31	13	14
28	24	23	48	31	39	224	48	31	13	14
29	24	28	39	31	39	188	44	28	13	14
30	25	28	31	35	39	173	48	28	13	14
31	28		31	35		160		24	13	

NOTE.—Stage-discharge relation affected by ice Nov. 11-15, 28. Dec. 11-27, 31. Mar. 19-21 discharge estimated from observer's notes and temperature records. Discharge estimated Dec. 19-27., Mar. 1 and 11-16. Braced figures show mean daily discharge for period indicated. No record Jan. 1 to Mar. 1.

Monthly discharge of Deep Creek near Chouteau, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	28	22	24.0	1,480
November	39	19	28.3	1,680
December	48		24.7	1,520
March	54		30.5	1,880
April	59	35	47.9	2,850
May	350	39	157	9,650
June	188	44	108	6,430
July	54	19	31.9	1,960
August	21	13	16.2	996
September	16	13	14.6	869

MUDDY CREEK NEAR BYNUM, MONT.

LOCATION.—In NW. $\frac{1}{4}$ SE. $\frac{1}{4}$ sec. 22, T. 26 N., R. 6 W., 200 feet above mouth of Blackleaf Creek, and 2 miles above Bynum, Teton County.

DRAINAGE AREA.—82 square miles.

RECORDS AVAILABLE.—May 24, 1912, to September 30, 1921.

GAGE.—Wire gage on right bank since May 20, 1920; read by George F. Miller.

History of previous gages in Water-Supply Paper 476 and earlier reports.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; may shift. Left bank high and not subject to overflow; right bank gently sloping; apparently one channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.04 feet October 13, 14, 22, and 23 (discharge, 2.5 second-feet); minimum discharge, no flow at times during March, April, May, July, August, and September.

1912-1921: Maximum stage recorded, 6.9 feet June 21, 1916, determined by leveling from flood marks (discharge from extension of rating curve, 976 second-feet); no flow at times during August, September, and October, 1912; July, August, September, November, and December, 1919; January, February, and March, 1920; March, April, May, July, August, and September, 1921.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Three small ditches divert above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 40 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Muddy Creek near Bynum, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage Height	Discharge
	<i>Feet</i>	<i>Sec.-feet</i>
April 23.....	1.96	^a 0.5
May 23.....	1.96	^a .5
June 13.....	2.03	^a .2

^a Estimated.

Daily discharge, in second-feet, of Muddy Creek near Bynum, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	1.6	1.6	1.6	0.0	0.0	0.0	0.2	0.3	0.0	0.0
2.....	1.6	1.6	1.6	.0	.0	.0	.3	.2	.0	.0
3.....	1.6	1.6	1.6	.0	.0	.0	.4	.3	.0	.0
4.....	1.6	1.6	1.6	.0	.2	.0	.5	.2	.0	.0
5.....	1.6	1.6	1.6	.0	.0	.0	.9	.2	.0	.0
6.....	1.6	1.6	1.6	.0	.0	.1	.9	.2	.0	.0
7.....	1.6	1.6	1.6	.0	.2	.2	.4	.1	.0	.0
8.....	1.6	1.6	1.4	.0	.2	.2	.4	.1	.0	.0
9.....	1.6	1.6	1.4	.0	.1	.1	.4	.0	.0	.0
10.....	1.6	1.6	1.4	1.4	.2	.0	.4	.0	.0	.0
11.....	1.6	1.4	1.4	.2	.2	.0	.4	.0	.0	.0
12.....	1.6	1.4	1.4	.2	.2	.0	.3	.0	.0	.0
13.....	2.5	1.4	1.4	.2	.2	.0	.3	.0	.0	.0
14.....	2.5	1.4	1.4	.0	.2	.0	.2	.0	.0	.0
15.....	2.0	1.4	1.4	.0	.2	.0	.1	.0	.0	.0
16.....	1.6	1.4	1.4	.0	.2	.0	1.4	.0	.0	.0
17.....	1.6	1.6	1.4	.1	.1	.1	.5	.0	.0	.1
18.....	1.4	1.6	1.4	.2	.1	.1	.5	.0	.0	.1
19.....	2.0	1.4	1.4	.0	.1	.3	.5	.0	.0	.1
20.....	2.0	1.4	1.4	.0	.1	.1	.4	.0	.0	.0
21.....	2.0	1.6	-----	.0	.0	.0	.4	.0	.0	.0
22.....	2.5	1.6	-----	.0	.0	.0	.3	.0	.0	.0
23.....	2.5	1.6	-----	.0	.0	.0	.3	.0	.0	.0
24.....	2.0	1.6	-----	.0	.0	.0	.3	.0	.0	.0
25.....	2.0	1.6	-----	.0	.0	.0	.3	.0	.0	.0
26.....	2.0	1.6	-----	.1	.0	.0	.3	.0	.0	.0
27.....	2.0	1.6	-----	.0	.0	.0	.2	.0	.0	.0
28.....	1.6	1.6	-----	.0	.0	.0	.1	.0	.0	.0
29.....	2.0	1.6	-----	.2	.0	.0	.1	.0	.0	.0
30.....	2.0	1.6	-----	.0	.0	.2	.4	.0	.0	.0
31.....	1.6	-----	-----	.0	-----	.1	-----	.0	.0	-----

NOTE.—No records Dec. 21 to Feb. 28.

Monthly discharge of Muddy Creek near Bynum, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	2.5	1.4	1.84	113
November.....	1.6	1.4	1.55	92.2
December 1-20.....	1.6	1.4	1.47	58.3
March.....	1.4	0	.08	4.92
April.....	.2	0	.08	4.76
May.....	.3	0	.05	3.07
June.....	1.4	.1	.40	23.8
July.....	.3	0	.05	3.07
August.....	0	0	.00	0
September.....	.1	0	.01	.60

BLACKLEAF CREEK NEAR BYNUM, MONT.

LOCATION.—In NW. $\frac{1}{4}$ SE. $\frac{1}{4}$ sec. 22, T. 26 N., R. 6 W., 200 feet above mouth of creek and 2 miles above Bynum, Teton County.

DRAINAGE AREA.—65 square miles.

RECORDS AVAILABLE.—May 24, 1912, to September 30, 1921.

GAGE.—Chain gage on left bank, 100 feet west of an abandoned barn; read by George F. Miller.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Banks fairly high and not likely to be overflowed. Bed composed of fine sand and gravel. Control a gravel riffle; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.88 feet at 10.35 a. m. May 7 (discharge, 8.2 second-feet); minimum stage, creek dry October 1-25 and July 5 to September 30.

1912-1921: Maximum stage recorded, 5.85 feet June 21, 1916, determined by leveling from flood marks (discharge from extension of rating curve, 600 second-feet); no flow several months in 1914, 1918, 1919, 1920, and 1921.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Most of the flow at low stages is diverted above the station for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent for year. Rating curve well defined below 40 second-feet. Gage read to quarter-tenths once daily. Daily discharge determined by applying gage height to rating table. Records good.

Discharge measurements of Blackleaf Creek near Bynum, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
April 23.....	2.58	* 0.75
May 23.....	2.68	* 1.5
June 13.....	2.52	* 1.0

* Estimated.

Daily discharge, in second-feet, of Blackleaf Creek near Bynum, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July
1		0.5	0.4	0.0	0.7	0.2	0.8	0.0
2		.5	.4	.0	1.0	.2	1.0	.0
3		.5	.7	.1	1.0	.1	.7	.1
4		.8	.9	.2	2.5	.1	.8	.1
5		1.0	.9	.1	1.6	.1	2.5	
6		.5	.7	.1	1.6	.2	2.5	
7		.8	.7	.1	.4	8.2	2.5	
8		.8	.9	.1	1.0	2.1	2.1	
9		.8	.9	.1	1.0	1.6	2.1	
10		.8	.7		1.6	.8	1.7	
11		.8	.7		2.9	.4	1.3	
12		.8	.7		2.5	.2	.9	
13		.8	.7	.1	2.1	.2	.5	
14		.8	.7		1.6	.2	.1	
15		.8	.7		1.6	.1	.0	
16		.8	.7		1.0	.2	.6	
17		.8	.7	2.3	.8	.2	.2	
18		.8	.7	5.5	.8	.1	.2	
19		.8	.7	2.7	.7	.8	.1	
20		.8	.9	1.2	.7	.8	.1	
21		1.0		.9	.4	2.5	.1	
22		1.0		.9	.2	1.6	.1	
23		1.0		.5	.2	.8	.1	
24		.8		.8	.2	.8	.1	
25		.8		.5	.1	.4	.6	
26	0.6	.8		1.2	.1	.2	.1	
27	.6	.8		.8	.1	.2	.0	
28	.6	.5		1.2	.1	.2	.0	
29	.6	.5		1.8	.1	.4	.0	
30	.8	.5		1.8	.4	.4	.0	
31	.8			.9		.2		

NOTE.—No records Dec. 21 to Feb. 28. Stage-discharge relation affected by ice Mar. 10-16; discharge estimated. Creek dry July 5 to Sept. 30.

Monthly discharge of Blackleaf Creek near Bynum, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	0.8	0.0	0.13	7.99
November	1.0	.5	.76	45.2
December 1-20	.9	.4	.72	28.6
March	5.5	.0	.79	48.6
April	2.9	.1	.96	57.1
May	8.2	.1	.79	48.6
June	2.5	.0	.73	43.4
July	.1	.0	.01	.4
August	.0	.0	.0	.0
September	.0	.0	.0	.0

JUDITH RIVER BASIN

JUDITH RIVER NEAR UTICA, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 17, T. 13 N., R. 12 E., at private bridge on Noel's ranch, 10 miles above Utica, Judith Basin County, and 20 miles from Hobson, nearest railway station.

DRAINAGE AREA.—320 square miles.

RECORDS AVAILABLE.—October 1, 1919, to September 30, 1921.

GAGE.—Wire gage fastened to downstream handrail of bridge; read by Willis Noel.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Gravel bar forms low-water control which has not shifted since station was established. One channel at all stages. Both banks are low, wooded, and subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.03 feet at 6.10 p. m. May 28 (discharge, 218 second-feet); minimum stage, 1.03 feet March 19 to May 7 (discharge, 1.2 second-feet).

1919-1921: Maximum stage recorded, 4.25 feet June 18, 1920 (discharge, 484 second-feet); minimum stage, 1.00 foot November 16 to December 1, 1919 (discharge, 0.5 second-foot).

ICE.—Stage-discharge relation not affected by ice. Springs above gage keep the stream open.

DIVERSIONS.—Several ditches divert water for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 400 second-feet. Gage read to hundredths twice daily October 1 to December 31; once daily January 1 to September 30. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Judith River near Utica, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 3	C. S. Heidel	1.47	15.4	Mar. 4	G. H. Ellis	1.05	3.4
Jan. 4	G. H. Ellis	1.20	5.0	May 12	do	2.12	66
Feb. 3	do	1.12	3.0	June 27	do	2.12	71

Daily discharge, in second-feet, of Judith River near Utica, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	19	14	9.2	5.5	3.5	1.8	1.2	1.2	148	54	30	14
2	16	12	8.8	5.5	3.5	1.8	1.2	1.2	155	50	30	14
3	16	14	8.8	5.5	3.5	1.8	1.2	1.2	159	50	29	14
4	16	14	8.8	5.5	3.5	1.8	1.2	1.2	148	50	29	14
5	15	14	8.5	5.0	3.0	1.8	1.2	1.2	145	49	27	14
6	14	13	8.5	5.0	3.0	1.8	1.2	1.2	145	49	23	14
7	14	14	8.2	5.0	3.0	1.8	1.2	1.2	145	49	23	14
8	14	14	7.9	4.5	3.0	1.8	1.2	69	141	47	19	14
9	14	14	7.6	5.5	3.0	1.8	1.2	66	135	47	19	14
10	14	14	7.6	5.0	3.0	1.8	1.2	62	145	47	14	14
11	15	14	7.6	4.5	3.0	1.8	1.2	69	141	47	15	14
12	14	13	7.3	4.5	3.0	1.8	1.2	66	135	47	14	14
13	14	12	7.0	4.5	3.0	1.8	1.2	64	135	45	15	14
14	14	12	7.3	4.5	3.0	1.8	1.2	62	141	45	14	14
15	14	12	7.0	4.0	3.0	1.8	1.2	60	116	44	14	14
16	14	12	7.0	4.0	3.0	1.8	1.2	58	135	44	14	14
17	14	12	7.0	4.0	3.0	1.8	1.2	58	138	44	14	14
18	14	11	6.7	4.0	3.0	1.8	1.2	60	141	42	14	14
19	14	11	6.4	4.0	3.0	1.2	1.2	60	135	42	14	14
20	12	11	6.4	4.0	3.0	1.2	1.2	66	155	32	15	14
21	14	11	6.4	4.0	3.0	1.2	1.2	73	132	32	15	14
22	14	11	6.4	4.0	3.0	1.2	1.2	87	128	32	15	14
23	14	11	6.4	4.0	3.0	1.2	1.2	128	100	34	15	14
24	14	11	6.1	4.5	2.5	1.2	1.2	160	94	34	15	14
25	14	11	5.8	4.5	2.5	1.2	1.2	157	88	34	15	14
26	14	11	6.1	4.0	2.5	1.2	1.2	186	77	34	15	14
27	14	10	5.8	4.0	2.0	1.2	1.2	214	67	36	14	12
28	13	10	5.8	4.0	2.0	1.2	1.2	218	65	36	14	12
29	13	9.9	6.1	3.5	-----	1.2	1.2	206	61	36	14	14
30	13	9.9	6.1	4.0	-----	1.2	1.2	168	59	36	14	14
31	14	-----	5.8	3.5	-----	1.2	-----	171	-----	34	14	-----

Monthly discharge of Judith River near Utica, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	19	12	14.3	879
November.....	14	9.9	12.1	720
December.....	9.2	5.8	7.11	437
January.....	5.5	3.5	4.45	274
February.....	3.5	2.0	2.95	164
March.....	1.8	1.2	1.55	95.3
April.....	1.2	1.2	1.20	71.4
May.....	218	1.2	83.8	5,150
June.....	159	59	124	7,380
July.....	54	32	42.0	2,580
August.....	30	14	17.6	1,080
September.....	14	12	13.9	827
The year.....	218	1.2	27.1	19,700

SAGE CREEK AT WINDHAM, MONT.

LOCATION.—In SE. $\frac{1}{4}$ sec. 12, T. 15 N., R. 12 E., 150 feet west of highway bridge on main road one-fourth mile south of Windham, Judith Basin County.

DRAINAGE AREA.—58 square miles.

RECORDS AVAILABLE.—March 16, 1920, to September 30, 1921.

GAGE.—Vertical staff; read by A. D. Peters.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand and gravel. One channel at all stages; straight for 10 feet above and 50 feet below gage. Both banks fairly high; not likely to be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.76 feet at 9 a. m. May 9 (discharge, 10.2 second-feet); minimum stage, 2.16 feet at 6 p. m. April 7 and 9 a. m. April 10 (discharge, 0.1 second-foot).

1920-1921: Maximum stage recorded, 3.55 feet May 12, 1920 (discharge, 50 second-feet); minimum stage, 2.16 feet April 7 and 10, 1921 (discharge, 0.1 second-foot).

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—No data.

REGULATION.—No data.

ACCURACY.—Stage-discharge relation shifting throughout year, and affected by dam July 29-30 and August 4 to September 30. Rating curve fairly well defined between 2 and 8 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, October 1 to December 31 and June 1 to August 3 (except July 29 and 30) by indirect method for shifting channel March 1 to May 31. Records fair.

Discharge measurements of Sage Creek at Windham, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 3	C. S. Heidel.....	2.44	2.1
Mar. 5	G. H. Ellis.....	2.43	3.2
May 12	do.....	2.40	2.0

Daily discharge, in second-feet, of Sage Creek at Windham, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.
1.....	2.5	1.2	1.5	1.6	2.5	1.0	2.0	1.4	2.0
2.....	1.9	1.9	1.3	1.3	2.8	1.5	1.5	1.7	2.5
3.....	2.0	2.5	1.2	1.6	1.6	1.5	1.3	2.7	2.8
4.....	2.0	2.2	1.6	1.6	2.0	1.4	1.4	2.2	
5.....	1.9	1.9	1.2	.9	.7	1.6	1.5	1.9	
6.....	1.9	1.7	1.5	1.6	.9	1.4	1.2	1.7	
7.....	1.4	1.7	1.6	.7	.6	1.7	1.0	1.5	
8.....	1.9	2.3	1.3	.4	.2	4.1	1.3	1.5	
9.....	2.0	1.7	1.4	.4	.6	7.8	1.4	1.4	
10.....	1.9	1.3	1.0	.4	.2	2.7	1.4	3.1	
11.....	1.9	1.0	.9	1.0	2.8	2.0	1.2	2.7	
12.....	2.0	.8	.5	.5	2.7	2.3	.9	1.3	
13.....	2.8	1.3	.7	.8	4.5	2.3	.7	2.5	
14.....	2.3	1.0	.6	1.6	2.0	2.2	.9	2.5	
15.....	2.5	1.3	.7	1.6	2.2	1.9	1.3	2.0	
16.....	2.3	1.4	.7	2.2	1.7	2.0	3.3	2.2	
17.....	2.3	1.6	1.0	2.8	2.0	2.2	2.8	2.0	
18.....	2.7	1.9	1.3	4.3	2.3	1.7	1.9	2.3	
19.....	2.5	2.2	1.2	1.6	1.9	1.7	1.5	1.4	
20.....	2.5	2.0	.8	1.6	2.2	1.6	1.5	2.2	
21.....	2.3	2.3	.6	2.5	1.9	1.6	1.5	2.0	
22.....	2.2	1.6	.5	3.1	1.9	1.5	1.6	1.7	
23.....	1.7	2.2	.6	2.8	1.5	1.5	1.3	2.2	
24.....	2.3	1.4	.6	1.6	1.7	1.5	1.2	1.6	
25.....	2.7	1.6	1.0	1.7	2.0	1.5	2.0	1.7	
26.....	2.5	1.7	.6	.6	1.6	1.5	1.7	2.7	
27.....	2.3	.9	1.6	1.3	1.7	1.0	1.5	2.5	
28.....	2.5	1.0	1.7	1.7	1.5	1.0	.9	2.2	
29.....	2.5	1.4	1.6	2.0	1.7	1.3	1.5	2.2	
30.....	2.5	1.6	2.2	1.7	1.5	1.0	1.4	2.2	
31.....	2.5		.4	3.1		1.2		2.3	

NOTE.—Discharge estimated July 29-30. No record Jan. 1 to Feb. 28. Stage-discharge relation affected by backwater from dam Aug. 4 to Sept. 30; discharge not computed.

Monthly discharge of Sage Creek at Windham, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	2.8	1.4	2.23	137
November.....	2.5	.8	1.62	96.4
December.....	2.2	.4	1.08	66.4
March.....	4.3	.4	1.63	100
April.....	4.5	.2	1.78	106
May.....	7.8	1.0	1.91	117
June.....	3.3	.7	1.49	88.7
July.....	3.1	1.3	2.05	126

WOLF CREEK NEAR STANFORD, MONT.

LOCATION.—In SE. $\frac{1}{4}$ sec. 26, T. 16 N., R. 11 E., at buildings on ranch of A. K. Neubert, 6 miles southwest of Stanford, Judith Basin County.

DRAINAGE AREA.—120 square miles (measured on topographic map).

RECORDS AVAILABLE.—March 16, 1920, to September 30, 1921.

GAGE.—Vertical staff attached to upstream corner of right abutment of bridge; read by A. K. Neubert.

DISCHARGE MEASUREMENT.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Sand and gravel, shifting. Banks clean and subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.93 foot June 8-9 (discharge, 71 second-feet); minimum stage, pool level July 26 to September 30.

1920-1921: Maximum stage recorded, 3.35 feet June 16, 1920 (discharge, 322 second-feet); minimum stage, pool level July 26 to September 30, 1921.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Numerous small diversions for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by shifting control. Rating curve used October 1 to February 22, well defined between 5 and 15 second-feet. Curve used February 23 to September 30, well defined between 3 and 10 second-feet. Gage read to hundredths once daily, with occasional breaks. Daily discharge ascertained by applying daily gage height to rating table, except February 23-26, when indirect method for shifting control was used. Records fair.

Discharge measurements of Wolf Creek near Stanford, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 2	C. S. Heidel.....	0.09	10.3	Mar. 5	G. H. Ellis.....	0.03	4.8
Jan. 3	G. H. Ellis.....	.04	6.7	May 12	.....do.....	.08	6.2
Feb. 3	.....do.....	.04	6.9				

Daily discharge, in second-feet, of Wolf Creek near Stanford, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July
1.....	10	9.9	8.8	-----	8.2	-----	5.6	5.6	-----	7.9
2.....	10	-----	8.8	-----	8.2	-----	-----	-----	-----	-----
3.....	10	9.9	8.8	6.7	7.6	-----	-----	-----	-----	9.0
4.....	10	9.9	8.8	-----	8.2	-----	5.0	5.6	30	12
5.....	10	-----	8.2	-----	7.6	4.3	-----	5.6	46	-----
6.....	10	9.9	8.2	-----	-----	-----	-----	-----	62	14
7.....	-----	9.3	-----	-----	-----	-----	-----	7.9	62	-----
8.....	10	-----	7.6	-----	7.0	-----	-----	9.0	71	14
9.....	-----	9.3	7.6	-----	7.0	-----	7.9	-----	71	-----
10.....	10	8.2	7.6	-----	7.0	-----	6.3	7.9	-----	12
11.....	-----	-----	7.0	-----	7.0	-----	-----	7.9	62	-----
12.....	-----	8.2	7.0	-----	7.0	-----	5.6	7.0	62	11
13.....	-----	8.2	7.0	-----	7.0	-----	5.6	-----	-----	11
14.....	10	-----	-----	-----	7.0	-----	-----	6.3	-----	9.0
15.....	-----	-----	-----	8.2	7.0	5.3	5.6	-----	46	-----
16.....	10	-----	-----	8.2	6.4	5.0	-----	7.0	-----	9.0
17.....	10	-----	-----	8.2	6.4	-----	5.6	-----	46	-----
18.....	10	-----	7.0	8.2	5.9	5.6	-----	7.9	46	7.9
19.....	-----	8.2	7.0	8.2	5.9	5.6	5.6	-----	-----	7.0
20.....	10	8.8	7.0	-----	5.9	-----	5.6	-----	30	-----
21.....	-----	8.8	7.0	8.2	5.9	5.6	5.0	9.0	30	7.0
22.....	10	8.8	7.0	8.2	5.9	-----	-----	9.0	-----	6.3
23.....	10	8.8	7.0	8.2	18	5.6	5.6	-----	22	-----
24.....	10	-----	7.0	-----	17	5.0	-----	-----	12	6.3
25.....	10	8.8	7.0	8.2	32	-----	5.6	9.2	11	-----
26.....	10	8.8	7.0	8.2	47	5.6	-----	9.0	-----	-----
27.....	-----	8.8	7.0	8.2	-----	-----	5.0	-----	7.9	-----
28.....	10	8.8	7.0	8.2	-----	5.6	5.0	9.0	-----	-----
29.....	-----	8.8	-----	8.2	-----	-----	5.6	9.0	7.9	-----
30.....	-----	8.8	-----	8.2	-----	5.0	5.0	-----	-----	-----
31.....	10	-----	-----	8.2	-----	5.6	-----	9.0	-----	-----

NOTE.—No record for days on which discharge is not given. No flow July 26 to Sept. 30. Stage-discharge relation affected by ice Jan. 6-13; discharge not computed.

MUSSELSELL RIVER BASIN**MUSSELSELL RIVER AT HARLOWTON, MONT.**

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

DRAINAGE AREA.—1,110 square miles.

RECORDS AVAILABLE.—July 11, 1907, to September 30, 1921.

GAGES.—Chain gage on upstream side of bridge; read by Marko Simoff and Athan J. Sackopoulos. Description of earlier gages in previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; bar or ridge across stream 75 feet below gage; shifts. Banks fairly high and probably not subject to overflow. One channel past gage at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.52 feet on June 9 (discharge, 564 second-feet); minimum stage, 2.38 feet September 1 and 2 (discharge, 5.4 second-feet).

1907–1921: Maximum stage recorded, 7.3 feet (corrected to present datum) May 27, 1917 (discharge, 4,020 second-feet); minimum stage, stream dry August 4–11, 1910, and September 10–15, 1919.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Numerous ditches divert from river and from tributaries above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by change of control. Two rating curves used during year; one, applicable October 1 to May 14, is well defined between 50 and 1,000 second-feet; the other, applicable May 15 to September 30, is well defined between 30 and 1,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except May 7–14 when indirect method for shifting control was used. Discharge not computed November 14 to March 17 on account of effect of ice. Records good except during period of shifting control.

Discharge measurements of Musselshell River at Harlowton, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge	Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 14.....	3.10	69	June 25.....	3.41	152
Mar. 16.....	3.22	100	Aug. 1.....	2.88	34.2
May 13.....	3.74	254			

Daily discharge, in second-feet, of Musselshell River at Harlowton, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	47	74		83	65	355	55	29	5.4
2	47	79		88	65	390	79	36	5.4
3	47	88		122	61	394	235	25	6.0
4	48	96		157	54	418	183	24	7.5
5	50	105		154	54	474	158	23	7.2
6	50	105		122	61	516	139	20	7.8
7	54	108		99	91	479	173	18	8.1
8	54	116		93	161	502	183	16	8.1
9	54	110		99	378	564	164	14	9.8
10	54	108		93	447	525	151	13	13
11	56	129		83	342	457	158	12	14
12	58	119		93	301	406	154	13	16
13	60	110		99	258	374	154	14	20
14	60			105	242	355	228	14	26
15	60			105	218	318	170	13	35
16	61			129	222	297	139	11	40
17	61			129	215	470	106	12	44
18	60		136	122	196	355	92	12	45
19	58		136	126	235	318	81	9.0	45
20	61		150	122	280	286	69	8.4	47
21	61		96	115	283	249	57	8.4	50
22	58		113	110	318	215	50	7.5	57
23	58		108	110	333	183	41	8.1	50
24	58		113	113	355	167	30	7.8	50
25	61		110	110	363	142	26	6.0	49
26	61		99	93	398	131	23	6.0	47
27	60		86	79	410	117	22	6.9	45
28	58		79	74	457	92	24	7.8	38
29	61		79	74	435	79	20	8.1	35
30	60		83	69	378	71	18	8.1	18
31	61		79		355		18	6.6	

Monthly discharge of Musselshell River at Harlowton, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	61	47	56.7	3,490
November 1-13	129	74	104	2,680
March 18-31	150	79	105	2,920
April	157	69	106	6,310
May	457	54	259	15,900
June	564	71	323	19,200
July	235	18	103	6,330
August	36	6.0	13.5	830
September	57	5.4	28.3	1,680

CARELESS CREEK NEAR LIVING SPRINGS, MONT.

LOCATION.—In SE. $\frac{1}{4}$ sec. 20, T. 10 N., R. 18 E., at highway bridge three-quarters of a mile above mouth of West Careless Creek, 3 miles east of Living Springs, Wheatland County, and 8 miles north of Hedgesville.

DRAINAGE AREA.—18.5 square miles.

RECORDS AVAILABLE.—April 17, 1920, to September 30, 1921.

GAGE.—Staff gage on downstream side of left abutment of highway bridge; read by J. C. Buller.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of gravel and shale. Control 50 feet below gage; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year ending September 30, 1920, 1.06 feet at 6 a. m. May 25 (discharge, 67 second-feet); minimum stage, 0.04 foot August 25 (discharge, 0.2 second-foot).

Maximum stage recorded during year ending September 30, 1921, 0.86 foot at 8 a. m. May 9 (discharge, 46 second-feet); minimum discharge no flow April 20 to May 7.

1920-1921: Maximum stage recorded, 1.06 feet May 25, 1920 (discharge, 67 second-feet); minimum discharge, channel dry April 20 to May 7, 1921.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Several diversions above station for irrigation.

ACCURACY.—Stage-discharge relation affected by slight change in control; affected by ice November 10-18, December 6-31, 1920, March 2, 7, 9, 14, 16, 17, and April 7, 1921. Rating curve applicable April 17 to June 10, 1920, is well defined between 5 and 34 second-feet; that applicable June 11, 1920, to September 30, 1921, is well defined between 1 and 35 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except from May 9 to July 10, 1921, for which the indirect method was used. Records fair.

COOPERATION.—Station maintained in cooperation with Hedgesville Commercial Club.

Discharge measurements of Careless Creek near Living Springs, Mont., during the years ending Sept. 30, 1920 and 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
1920		<i>Feet</i>	<i>Sec.-ft.</i>	1921		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 17	W. A. Lamb.....	0.50	4.9	Mar. 3	G. H. Ellis.....	0.20	1.2
June 5	do.....	.73	26.4	May 11	do.....	.54	26.8
23	G. H. Ellis.....	.75	28.4				
Oct. 14	do.....	.34	3.1				

Daily discharge, in second-feet, of Careless Creek near Living Springs, Mont., for the years ending Sept. 30, 1920 and 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1920							1920						
1		2.6	40	21	3.5	1.6	16		24	39	7.1	1.8	1.6
2		1.5	33	19	3.3	2.2	17	4.9	40	44	5.5	1.3	1.5
3		.8	28	19	2.8	2.2	18	4.2	49	39	4.7	.9	1.8
4		.2	27	23	2.5	2.1	19	3.9	56	35	4.7	.6	1.8
5		.3	27	21	2.2	2.0	20	3.6	51	31	3.5	.6	1.8
6		.3	31	19	2.8	2.1	21	3.2	56	27	3.0	.8	1.5
7		.2	40	16	4.7	2.1	22	3.6	58	28	3.3	1.5	1.6
8		.3	45.	15	2.1	2.0	23	3.2	59	27	4.2	1.4	2.8
9		.3	46	14	2.0	2.1	24	2.9	59	23	5.5	.7	2.1
10		.4	49	14	2.2	2.2	25	2.9	64	26	4.7	.2	2.1
11		.6	49	12	2.3	2.1	26	2.6	55	27	4.2	1.0	2.1
12		1.5	42	11	3.0	2.0	27	2.3	52	26	3.7	1.5	2.1
13		9.6	44	9.3	2.3	1.9	28	2.6	52	23	3.3	1.6	2.1
14		14	44	8.7	2.1	2.0	29	2.3	55	22	4.7	1.5	2.1
15		18	40	7.9	1.9	1.8	30	2.3	49	21	4.5	1.5	2.1
							31		40		4.2	1.6	

Daily discharge, in second-feet, of Careless Creek near Living Springs, Mont., for the years ending Sept. 30, 1920 and 1921—Continued

Day	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1920-21											
1	1.9	4.0	3.3		1.1	1.1	0.0	24	14	0.7	0.6
2	2.0	3.0	3.7		1.2	1.0	.0	25	22	2.2	.4
3	2.0	2.3	3.7		1.4	.9	.0	24	25	2.0	.9
4	2.2	4.0	4.0		1.2	1.0	.0	23	27	.8	1.3
5	2.2	4.0	2.3		1.4	.9	.0	25	27	1.8	1.3
6	2.2	3.7			1.9	.6	.0	24	34	1.5	1.3
7	2.2	3.7			1.6	.4	.0	24	38	1.5	1.3
8	2.2	2.3			1.2	.3	7.9	27	33	1.3	1.2
9	2.2	2.5			1.3	.8	45	26	24	1.2	1.6
10	2.5				1.4	1.2	31	24	19	1.5	1.6
11	2.5				1.0	1.1	27	21	14	1.9	1.8
12	2.8				1.2	1.2	25	19	13	1.8	1.9
13	2.5				.9	1.1	21	17	12	1.8	1.9
14	2.8	2.0			1.4	1.1	21	16	12	1.3	2.2
15	2.8				2.0	1.0	20	15	10	1.0	1.9
16	2.8				1.8	.8	16	17	8.7	1.0	1.9
17	2.8				1.8	.8	15	18	8.3	.9	1.9
18	2.8				1.6	.7	14	18	7.5	.9	1.9
19	2.8	2.3			2.0	.3	18	18	7.1	.9	1.9
20	3.0	2.3			1.8	.0	22	18	6.7	.8	2.3
21	3.0	2.3			1.6	.0	27	16	6.3	1.0	2.0
22	3.0	2.3			2.2	.0	27	14	6.7	1.3	1.9
23	3.0	2.1			1.2	.0	27	12	5.5	1.3	1.9
24	2.8	3.3			1.2	.0	25	14	4.0	1.3	2.0
25	2.8	3.7			1.1	.0	25	14	3.7	1.3	1.9
26	2.8	2.2			1.8	.0	24	10	3.7	1.3	1.9
27	2.5	2.3		1.2	1.3	.0	26	12	4.2	1.3	1.9
28	2.3	5.1		1.2	1.1	.0	27	11	2.5	1.4	1.9
29	2.3	3.7			1.2	.0	25	12	2.0	1.3	2.1
30	2.2	2.1			.6	.0	23	12	2.2	1.3	2.1
31	2.5				1.0		21		1.2	1.2	

NOTE.—Discharge interpolated Mar. 2, 7, 9, 14, 16, 17, and Apr. 7, 1921. No records Jan. 1 to Feb. 26.

Monthly discharge of Careless Creek near Living Springs, Mont., for the years ending Sept. 30, 1920 and 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1920				
April 17-30	4.9	2.3	3.18	88.3
May	64	.2	28.1	1,730
June	49	21	34.1	2,030
July	23	3.0	9.70	596
August	4.7	.2	1.88	116
September	2.8	1.5	1.98	118
The period				4,680
1920-21				
October	3.0	1.9	2.53	156
November	5.1	2.0	2.71	161
December 1-5	4.0	2.3	3.40	34
March	2.2	.6	1.40	86
April	1.2	.0	.55	33
May	45	.0	18.1	1,110
June	27	10	18.3	1,090
July	38	1.2	13.0	799
August	2.2	.7	1.32	81
September	2.3	.4	1.69	101

WEST CARELESS CREEK NEAR LIVING SPRINGS, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 20, T. 10 N., R. 18 E., at highway bridge at Robert Anderson's ranch, $2\frac{1}{2}$ miles east of Living Springs, Wheatland County, and 8 miles north of Hedgesville.

DRAINAGE AREA.—20 square miles.

RECORDS AVAILABLE.—April 17, 1920, to September 30, 1921.

GAGE.—Vertical staff on left bank fastened to a support of an irrigation flume, 500 feet above highway bridge; read by Robert Anderson.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—A gravel riffle 10 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.70 foot at 7 p. m. July 3 (discharge, 27 second-feet); minimum stage, creek at pool level August 28 to September 30.

1920-1921: Maximum stage recorded, 0.70 foot July 3, 1921 (discharge, 27 second-feet); minimum discharge, no flow August 28 to September 30, 1921.

ICE.—Stage-discharge relation probably affected by ice.

DIVERSIONS.—Some irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 0.5 and 10 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

COOPERATION.—Station maintained in cooperation with Hedgesville Commercial Club.

Discharge measurements of West Careless Creek near Living Springs, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 14.....	0.16	^a 0.5
Mar. 3.....	.31	2.4
May 11.....	.28	1.4

^a Discharge estimated.

Daily discharge, in second-feet, of West Careless Creek near Living Springs, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May	June	July	Aug.
1.....	0.3	1.1	3.0	2.4	-----	2.1	1.4	3.6	4.0	2.1
2.....	.3	1.1	3.0	-----	-----	2.2	1.4	3.0	7.4	2.1
3.....	.4	1.1	3.0	-----	2.7	2.2	1.8	3.0	22.0	1.8
4.....	.4	1.1	3.0	-----	2.7	2.4	1.8	3.0	23.0	1.8
5.....	.4	1.1	3.0	-----	3.3	3.0	1.8	3.0	15.0	1.4
6.....	.6	1.1	3.0	-----	3.6	3.6	1.8	2.4	6.9	1.4
7.....	.6	1.1	3.0	-----	3.0	4.3	1.8	2.4	4.9	1.4
8.....	.6	1.1	3.0	-----	2.4	4.0	3.3	2.4	4.3	1.4
9.....	.6	1.1	3.0	-----	-----	4.9	4.9	2.4	4.3	1.4
10.....	.6	1.1	3.0	-----	-----	5.5	3.3	2.4	4.3	1.4
11.....	.6	1.1	3.0	-----	-----	4.6	2.1	2.1	4.3	1.3
12.....	.6	1.1	2.7	-----	-----	4.3	1.8	2.1	4.3	1.1
13.....	.6	1.1	2.4	-----	2.0	4.3	1.8	1.8	4.3	1.1
14.....	.6	1.1	2.4	-----	-----	2.4	1.8	1.8	3.6	1.1
15.....	.6	1.1	2.1	-----	-----	1.6	2.1	1.8	3.6	.8
16.....	.6	1.1	2.1	-----	-----	8	2.4	2.1	3.0	.8
17.....	.6	1.1	2.1	-----	-----	1.0	2.4	2.4	3.0	.8
18.....	.6	1.1	2.1	-----	-----	1.1	2.7	3.6	2.4	.8
19.....	.6	1.1	2.1	-----	4.3	1.4	3.0	3.0	2.4	.7
20.....	.6	1.1	2.1	-----	4.6	1.4	3.0	2.4	2.4	.7
21.....	.6	1.1	2.1	-----	4.3	1.4	3.3	2.2	2.2	.6
22.....	.6	1.3	2.1	-----	4.3	1.4	3.6	1.9	2.1	.6
23.....	.7	1.4	2.1	-----	4.0	1.4	4.3	1.8	2.1	.6
24.....	.7	1.8	2.1	-----	4.0	1.6	4.3	5.5	2.1	.6
25.....	.8	2.1	2.1	-----	3.6	1.8	4.3	4.0	2.1	.6
26.....	.8	2.1	2.4	-----	3.6	1.8	4.3	3.6	2.1	.6
27.....	1.1	2.4	2.4	-----	3.0	1.8	4.3	3.0	2.1	.6
28.....	1.1	3.0	2.4	-----	2.4	1.8	4.3	2.4	2.2	.0
29.....	1.1	3.0	2.4	-----	2.4	1.4	4.6	2.4	2.1	.0
30.....	1.1	3.0	2.4	-----	2.1	1.4	4.3	2.4	2.1	.0
31.....	1.1	-----	2.4	-----	2.1	-----	4.0	-----	2.1	.0

NOTE.—Stage-discharge relation affected by ice Mar. 9-18, discharge estimated. No record Jan. 2 to Mar. 2. No flow Aug. 28 to Sept. 30.

Monthly discharge of West Careless Creek near Living Springs, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	1.1	0.3	0.66	40.6
November.....	3.0	1.1	1.44	85.7
December.....	3.0	2.1	2.52	155
March 3-31.....	4.6	-----	2.84	163
April.....	5.5	.8	2.43	145
May.....	4.9	1.4	2.97	183
June.....	5.5	1.8	2.66	158
July.....	23	2.1	4.93	303
August.....	2.1	.0	.95	58.4
September.....	.0	.0	.00	0

ROBERTS CREEK AT HEDGESVILLE, MONT.

LOCATION.—Near center of sec. 17, T. 8 N., R. 18 E., at highway bridge 500 feet south of railway track at Hedgesville, Wheatland County.

DRAINAGE AREA.—300 square miles (measured on topographic map).

RECORDS AVAILABLE.—March 20, 1920, to September 30, 1921.

GAGE.—Wire gage fastened to upstream handrail of bridge; read by A. J. Jarvis.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Stream bed composed of gravel and small boulders; probably permanent. Road fills at ends of bridge, which confine stream in ordinary stages, are occasionally overtopped by floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year ending September 30, 1920, 4.80 feet March 20 and 21 (discharge, 332 second-feet); stream was at pool stage (no flow) August 25-27 and September 19-22.

Maximum stage recorded during year ending September 30, 1921, 9.15 feet at 2 a. m. June 17 (estimated discharge, 2,290 second-feet); stream was at pool stage (no flow) January 16, 17, February 16, 17, March 5-15, August 21 to September 14, and September 22-30.

1920-1921: Maximum stage recorded, 9.15 feet June 17, 1921 (estimated discharge, 2,290 second-feet); stream was at pool stage (no flow) August 21 to September 14 and September 22-30, 1920, August 25-27, and September 19-22, 1921.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except for period of ice effect.

Rating curve well defined below 60 second-feet. Above gage height 2.5 feet rating curve is determined from measurements of water area and estimates of velocities. Gage read to hundredths twice daily, oftener during flood periods. Daily discharge determined by applying mean daily gage height to rating table, except May 9-11, June 8, 17, July 2, 13, and September 21, 1921, when there was considerable change in stage and hourly method was used. Records of discharge below 60 second-feet are good; above that are estimates.

Discharge measurements of Roberts Creek at Hedgesville, Mont., during the years ending Sept. 30, 1920 and 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
1920		<i>Feet</i>	<i>Sec.-ft.</i>	1921		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 17	W. A. Lamb.....	2.04	42.7	Mar. 3	G. H. Ellis.....	0.90	6.33
June 5	do.....	1.08	3.3	May 10	do.....	2.32	59
Oct. 22	G. H. Ellis.....	1.14	5.7	11	do.....	1.43	26.4
	do.....	.87	a. 25				

^a Estimated.

Daily discharge, in second-feet, of Roberts Creek at Hedgesville, Mont., for the years ending Sept. 30, 1920 and 1921

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1920							
1.		220	28	5.5	4.0	4.9	0.2
2.		214	62	4.0	3.5	5.2	.2
3.		75	20	4.6	3.3	1.5	.2
4.		79	12	3.8	84	.8	.2
5.		50	9.7	3.5	44	.8	.2
6.		42	54	3.5	7.6	1.2	.2
7.		12	64	3.5	6.4	22	.2
8.		10	24	3.5	6.4	.7	.2
9.		318	14	3.5	6.1	1.1	.1
10.		155	12	3.5	4.6	1.3	.1
11.		37	80	4.0	3.3	.7	.1
12.		32	133	4.0	3.0	.7	.1
13.		24	62	4.0	2.6	.7	.1
14.		20	30	4.0	2.3	.6	.1
15.		18	18	3.5	2.3	.3	.1
16.		32	11	3.0	2.3	.3	.1
17.		60	9.1	3.0	2.3	.3	.1
18.		9.7	7.3	4.9	2.1	.3	.1
19.		7.9	5.8	8.8	1.5	.3	.0
20.	332	13	5.2	7.9	1.1	.3	.0
21.	332	26	5.2	6.4	1.1	.2	.0
22.	304	9.7	4.0	5.2	1.1	.2	.0
23.	234	8.5	3.5	5.8	1.0	.2	1.3
24.	227	8.5	3.5	6.7	.8	.1	.2
25.	220	7.3	3.5	7.6	1.3	.0	.2
26.	208	7.0	3.5	11	1.0	.0	.2
27.	241	7.9	3.3	16	.8	.0	.2
28.	166	12	2.6	12	.7	.3	.1
29.	269	9.7	3.8	7.0	1.0	.2	.1
30.	283	10	5.2	6.1	.7	.2	.1
31.	262		5.5		.7	.2	

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1920-21												
1.	0.2	0.2	0.3	2.6	1.1	0.2	1.5	0.2	1.8	1.5	1.2	0.0
2.	.2	.2	.2	2.1	1.1	.2	1.5	.2	1.5	108	.7	.0
3.	.2	.2	.2	1.6	1.1	.2	1.5	.2	2.6	200	.3	.0
4.	.2	.2	.2	1.8	1.1	.2	1.5	.2	1.8	54	.3	.0
5.	.2	.2	.2	2.1	1.1	.2	1.5	.2	1.0	18	.3	.0
6.	.2	.2	.2	1.3	1.1	.0	1.3	.2	.8	12	.3	.0
7.	.2	.2	.2	1.3	1.1	.0	1.0	.4	.7	6.7	.3	.0
8.	.2	.2	.2	1.3	1.1	.0	1.0	5.5	52	5.5	.3	.0
9.	.2	.2	.2	1.3	1.1	.0	1.0	230	26	4.9	.2	.0
10.	.2	.2	.2	1.3	1.2	.0	.4	84	2.3	2.8	.2	.0
11.	.2	.2	.2	1.1	1.5	.0	1.1	17	1.5	2.6	.2	.0
12.	.2	.2	.2	1.1	2.1	.0	1.6	5.8	1.0	1.8	.2	.0
13.	.2	.2	.2	1.1	2.1	.0	6.4	5.2	.7	24	.2	.0
14.	.2	.2	.2	1.1	1.3	.0	4.9	3.8	.7	14	.2	.0
15.	.2	.2	.2	1.5	1.0	.0	3.0	3.8	.3	6.4	.1	.1
16.	.2	.1	.3	.0	.0	.2	2.8	3.8	.7	4.3	.1	.1
17.	.2	.1	.3	.0	.0	.6	2.8	3.5	681	2.8	.1	.1
18.	.2	.2	.2	.8	1.0	.3	1.3	2.8	65	1.8	.1	.1
19.	.2	.2	.2	1.2	1.0	.2	1.0	2.8	22	1.2	.1	.1
20.	.2	.2	.2	1.2	1.0	.6	.8	2.8	11	1.0	.1	11
21.	.2	.2	.1	1.2	1.0	.8	.7	2.8	8.5	.4	.0	.8
22.	.2	.2	.1	1.2	1.0	1.0	.6	2.8	6.1	.3	.0	.0
23.	.2	.2	.1	1.2	3.3	1.0	.7	1.6	4.9	.3	.0	.0
24.	.2	.2	.2	1.2	1.6	1.0	.7	1.2	4.9	.3	.0	.0
25.	.2	.2	.2	1.3	.7	1.0	.3	1.0	2.8	.3	.0	.0
26.	.2	.2	.3	1.5	.7	1.0	.3	1.0	2.8	.3	.0	.0
27.	.2	.2	.6	1.5	.8	1.0	.3	1.0	2.8	19	.0	.0
28.	.2	.2	3.5	1.5	.8	1.0	.3	1.0	2.6	20	.0	.0
29.	.2	.2	6.7	1.2		1.1	.3	1.0	2.1	3.5	.0	.0
30.	.2	.2	3.8	1.2		1.3	.2	1.0	1.6	3.3	.0	.0
31.	.2		3.5	1.2		1.5		1.2		2.6	.0	

NOTE.—Stage-discharge relation affected by ice Dec. 18-25, 1920; discharge estimated.

Monthly discharge of Roberts Creek at Hedgesville, Mont., for the years ending Sept. 30, 1920 and 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1920				
March 20-31.....	332	166	256	6,090
April.....	318	7.0	51.2	3,050
May.....	133	2.6	22.7	1,400
June.....	16	3.0	5.66	337
July.....	84	.7	6.55	403
August.....	22	.0	1.47	90.4
September.....	1.3	.0	.17	10.1
The period.....				11,400
1920-21				
October.....	.2	.2	.20	12.3
November.....	.2	.1	.19	11.3
December.....	6.7	.1	.75	46.1
January.....	2.6	.0	1.29	79.3
February.....	3.3	.0	1.14	63.3
March.....	1.5	.0	.46	28.3
April.....	6.4	.2	1.41	83.9
May.....	230	.2	12.5	769
June.....	681	.3	30.4	1,810
July.....	200	.3	16.9	1,040
August.....	1.2	.0	.18	11.1
September.....	11	.0	.41	24.4
The year.....	681	.0	5.50	3,980

FLATWILLOW CREEK NEAR FLATWILLOW, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 19, T. 12 N., R. 25 E., on Flatwillow Land & Livestock Co.'s ranch, 12 miles above Flatwillow, Fergus County, and 30 miles north of Roundup.

DRAINAGE AREA.—About 195 square miles (measured on 1916 map of Fergus County).

RECORDS AVAILABLE.—April 17, 1918, to September 30, 1921. From May 1, 1911, to April 17, 1918, at station 4 miles downstream and below head works of canal of Flatwillow Carey Act project.

GAGE.—Vertical staff on right bank 4 feet above private wagon bridge; read by F. W. Henkel and Mrs. Gertrude Western.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Stream bed composed of adobe and gravel; current sluggish. Low-water control is gravel riffle 25 feet below gage; may shift during high water. Drift, catching on fence just below control causes slight backwater effect after each high-water period.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.30 feet at 4.20 p. m. May 10 (discharge, 148 second-feet); minimum stage, 0.52 foot September 6, 7 (discharge, 3.0 second-feet).

1911-1921: Maximum stage recorded, 9.0 feet at old location June 4-11, 1917, estimated by observer (discharge, 454 second-feet in creek and 500 second-feet additional in canal); minimum stage, 2.1 feet at old location September 3, 4, 1912 (discharge, 1.0 second-foot).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Several small diversions above gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected slightly by drift collecting below gage and by ice. Rating curve well defined between 5 and 150 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table with correction for effect of ice. Indirect method for shifting control used October 1-5. Records for open channel good; others fair.

Discharge measurements of Flatwillow Creek near Flatwillow, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 5	C. S. Heidel.....	a1. 20	25. 0	May 14	G. H. Ellis.....	2. 85	119
Nov. 24	G. H. Ellis.....	1. 32	32. 0	June 9	C. S. Heidel.....	1. 78	56
Jan. 5	do.....	b1. 93	30. 1	Aug. 2	G. H. Ellis.....	. 66	7. 3
Mar. 17	do.....	b1. 18	27. 8				

^a Stage-discharge relation affected by drift lodged against fence in channel.

^b Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Flatwillow Creek near Flatwillow, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	26	32	32	30	32	21	34	70	44	9. 6	5. 9
2	26	32	33	30	32	21	32	70	42	6. 8	6. 5
3	26	31	31	30	32	21	27	71	48	6. 8	6. 2
4	26	31	31	30	32	21	20	66	52	6. 8	7. 4
5	26	32	31	30	32	22	19	57	57	7. 1	8. 0
6	27	32	30	30	32	21	19	53	52	7. 1	3. 0
7	27	32	30	29	32	22	18	47	44	7. 4	3. 0
8	27	32	31	29	32	21	27	43	37	7. 7	3. 5
9	27	32	31	28	27	23	32	52	27	7. 1	3. 8
10	26	32	31	28	27	24	148	50	26	7. 4	7. 4
11	27	32	31	25	27	32	134	47	24	6. 8	14
12	27	32	30	25	27	36	129	46	22	6. 8	15
13	26	24	30	25	25	30	128	44	21	7. 4	16
14	26	24	30	25	25	33	121	42	19	11	15
15	26	24	30	30	25	34	110	40	17	14	16
16	26	24	30	30	27	36	102	44	16	14	16
17	25	36	30	30	27	38	97	52	14	14	15
18	25	36	30	30	32	36	89	67	8. 8	14	16
19	25	36	30	30	32	37	87	61	8. 0	10	15
20	28	36	30	30	27	38	97	57	6. 8	10	15
21	28	36	30	30	27	38	93	53	6. 2	14	17
22	30	36	25	30	26	38	94	46	5. 0	13	18
23	30	36	25	30	27	38	94	44	5. 0	13	19
24	30	33	25	30	27	37	88	45	5. 0	12	20
25	30	33	25	30	26	36	86	44	6. 5	12	20
26	31	33	25	30	27	36	85	43	12	12	19
27	31	33	30	30	26	37	81	63	74	10	19
28	31	33	30	30	25	37	80	57	23	5. 0	19
29	31	33	30	30	25	36	78	53	14	5. 0	19
30	31	32	30	30	26	30	75	44	6. 8	6. 2	19
31	32		30	30	25		73		6. 5	5. 6	

NOTE.—Stage-discharge relation affected by ice Nov. 13–20, Dec. 12–31, Jan. 1–6, 9–31, Feb. 1–28, Mar. 1, 3, 5–7 and 13–15; discharge estimated for all periods, not computed for February.

Monthly discharge of Flatwillow Creek near Flatwillow, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	32	25	27. 7	1, 700
November	36	24	32. 0	1, 900
December	33	25	29. 6	1, 820
January	30	25	29. 2	1, 800
March	32	25	28. 1	1, 730
April	38	21	31. 0	1, 840
May	148	18	77. 3	4, 750
June	71	40	52. 4	3, 120
July	74	5. 0	24. 2	1, 490
August	14	5. 0	9. 34	574
September	20	3. 0	13. 2	786

FLATWILLOW CREEK AT PETROLIA, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 25, T. 14 N., R. 28 E., 2 miles above junction with Box Elder Creek, 1 mile from Petrolia, Fergus County, and 16 miles from Winnett.

DRAINAGE AREA.—650 square miles (measured on county map).

RECORDS AVAILABLE.—June 11 to September 30, 1921.

GAGE.—Vertical staff in three sections; read by John W. Beck, jr.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel at all stages, straight for 200 feet above but curved sharply to right just below gage. Control is gravel riffle just around bend. Left bank high; right bank low and covered with thick brush and trees.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.0 feet at 6.20 p. m. June 27 (discharge by extension of rating curve, 1,280 second-feet); minimum discharge, no flow August 12 to September 17.

ICE.—None during period of record.

DIVERSIONS.—Numerous ditches divert water above station for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 150 second-feet. Gage read to tenths once daily until August 2; thereafter to hundredths. Daily discharge ascertained by applying gage height to rating table. Records fair.

Discharge measurements of Flatwillow Creek at Petrolia, Mont., during the year ending Sept. 30, 1921

Date.	Made by—	Gage height.	Discharge.
June 11	C. S. Heidel	<i>Feet.</i> 2.00	<i>Sec.-ft.</i> 60
Aug. 3	G. H. Ellis	.95	a. 01

^a Estimated.

Daily discharge, in second-feet, of Flatwillow Creek at Petrolia, Mont., for the year ending Sept. 30, 1921

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1		58	2.0		16	116	12		
2		58	2.0		17	58	7		
3		58	1.0		18	192	2		4.6
4		49	1.0		19	243	2		25
5		58	1.2		20	116	2		25
6		58	1.6		21	68	2		24
7		49	1.6		22	68	2		22
8		40	1.4		23	58	2		19
9		40	1.2		24	58	2		18
10		32	1.0		25	49	2		18
11	68	32	1.0		26	40	2		16
12	58	25	.5		27	1,280	2		14
13	58	18			28	650	2		13
14	49	18			29	68	2		12
15	49	12			30	68	2		12
					31		2		

NOTE.—No flow Aug. 13 to Sept. 17.

Monthly discharge of Flatwillow Creek at Petrolia, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
June 11-30.....	1, 280	40	171	6, 780
July.....	58	0	21.0	1, 290
August.....	2.0	0	.50	30.7
September.....	25	0	7.42	442
The period.....				8, 540

MILK RIVER BASIN

SOUTH FORK OF MILK RIVER NEAR INTERNATIONAL BOUNDARY

LOCATION.—In NW. $\frac{1}{4}$ sec. 29, T. 37 N., R. 9 W., at Richard Croff's ranch, just above Kennedy Coulee, Glacier County, 5 miles south of international boundary and 30 miles northeast of Browning.

DRAINAGE AREA.—288 square miles (measured on topographic map).

RECORDS AVAILABLE.—April 28, 1905, to September 30, 1921.

GAGE.—Stevens continuous water-stage recorder on left bank 400 feet below site of gage used since April 13, 1913. Same datum for all stages.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of clay and small boulders. Growth of aquatic plants affects stage-discharge relation at low stages during summer. Banks are high and not subject to overflow, except during extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.48 feet at 1 a. m. April 13 (discharge, 533 second-feet); minimum stage, 1.18 feet at noon September 7 (discharge, 0.8 second-foot).

1905-1921: Maximum stage recorded, 15.4 feet June 6, 1908, determined from high-water marks; flood width 850 feet and flood cross section about 2,600 square feet; discharge not computed; minimum discharge, no flow August 1-8, August 18 to September 2, 1919.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by change of control during winter. Two rating curves used; one, well defined, applicable October 1-31; the other, well defined between 5 and 200 second-feet, applicable April 11 to September 30. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph, except during periods of ice effect or of shifting control. Indirect method used October 7-31. Records good.

COOPERATION.—Station maintained in cooperation with United States Bureau of Reclamation, and Reclamation Service, Department of Interior, Canada.

100120-25†—wsp 526—7

*Discharge measurements of South Fork of Milk River near international boundary
during the year ending Sept. 30, 1921*

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 7	A. W. P. Lowrie ^a	1.51	12.8	Apr. 10	A. W. P. Lowrie	2.25	114
15	W. A. Lamb	1.49	13.7	24	W. A. Lamb	2.40	146
Nov. 6	T. Hermann ^a	1.49	17.9	May 16	A. W. P. Lowrie	2.35	139
30	do.	1.56	17.2	27	W. A. Lamb	2.51	182
Dec. 17	do.	1.30	2.7	June 8	A. W. P. Lowrie	2.32	134
Jan. 5	do.	1.43	7.3	21	W. A. Lamb	1.96	62
31	do.	1.34	3.5	July 11	A. W. P. Lowrie	1.67	28.0
Feb. 21	do.	1.88	6.6	30	W. A. Lamb	1.55	16.2
Mar. 8	W. A. Lamb	1.75	33.0	Aug. 12	O. H. Hoover ^a	1.43	9.5
13	A. W. P. Lowrie	1.79	33.0	24	W. A. Lamb	1.37	5.2
29	do.	1.81	38.0				

^a Canadian engineers.

^b Stage-discharge relation affected by ice.

*Daily discharge, in second-feet, of South Fork of Milk River near international
boundary for the year ending Sept. 30, 1921*

Day	Oct.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	10.6		88	81	126	43	17.1	2.0
2	11.1		90	102	130	46	17.8	1.25
3	11.1		91	126	140	66	16.4	1.25
4	12.7		92	121	143	74	14.2	1.0
5	14.1		93	136	231	64	12.7	1.0
6	14.7		95	175	222	48	11.6	1.0
7	12.2		95	237	151	39	10.5	.9
8	12.2	33	100	246	133	37	10.0	1.75
9	12.2	33	103	246	128	31	8.9	2.8
10	11.1	33	114	208	121	29	8.9	6.5
11	10.0	33	148	188	102	26	8.9	9.5
12	10.0	33	315	188	91	28	8.9	10.0
13	10.6	33	396	188	84	28	8.9	10.5
14	12.2	33	318	175	78	29	8.4	11.1
15	12.7	34	268	148	74	26	7.8	11.6
16	8.5	36	255	136	82	23	7.8	11.1
17	6.2	37	240	136	100	20	7.3	11.1
18	17.5	38	228	121	102	18.5	7.3	11.6
19	16.1	38	243	183	82	15.6	7.3	11.1
20	16.8	38	202	396	70	13.4	6.9	11.6
21	16.1	39	164	281	65	11.6	7.3	12.2
22	18.8	40	164	231	62	9.5	7.8	12.2
23	14.1	41	164	214	59	8.4	6.9	11.1
24	20	41	143	199	58	9.5	6.2	11.6
25	21	41	112	170	54	10.5	6.2	12.7
26	22	40	93	167	52	15.6	5.0	12.7
27	22	39	93	178	49	23	4.3	12.7
28	22	38	93	170	43	22	3.9	10.0
29	24	38	102	153	41	21	3.5	6.2
30	23	85	104	130	45	17.8	3.2	5.8
31	18.1	88		128		16.4	2.5	

NOTE.—Stage-discharge relation affected by ice Nov. 6 to Apr. 10; data insufficient for computation of discharge Nov. 1 to Mar. 7; from Mar. 8 to Apr. 10 discharge computed from four current-meter measurements, temperature records, and comparison with flow of North Fork of Milk River. Discharge interpolated on account of missing gage heights Aug. 10-11.

Monthly discharge of South Fork of Milk River near international boundary for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	24	6.2	15.0	922
March 8-31.....	88	33	40.9	1,950
April.....	396	88	160	9,520
May.....	396	81	179	11,000
June.....	231	41	97.3	5,790
July.....	74	8.4	28.1	1,730
August.....	17.8	2.5	8.53	524
September.....	12.7	.90	7.86	468

MILK RIVER AT MILK RIVER, ALBERTA.

LOCATION.—In NE. $\frac{1}{4}$ sec. 21, T. 2 N., R. 16 W. fourth meridian, at Milk River Alberta.

DRAINAGE AREA.—1,104 square miles (measured by engineers of Department of Interior, Canada).

RECORDS AVAILABLE.—July 1, 1909, to September 30, 1921; prior to January 1, 1912, open-water records only.

GAGE.—Stevens continuous water-stage recorder installed June 17, 1919, on right bank 50 feet above railroad bridge. July 1, 1909, to February 16, 1916, a vertical staff; February 17, 1916, to June 16, 1919, chain gage on railway bridge.

DISCHARGE MEASUREMENTS.—Made from traffic bridge 100 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed of stream sand and gravel. Right bank high and clean; subject to overflow at extreme stages. Left bank low. Possibly two channels at extremely low water. Control shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.36 feet April 3 (stage-discharge relation affected by ice; discharge, 1,619 second-feet); minimum discharge, 6.2 second-feet February 1 (stage-discharge relation affected by ice).

1909-1921: Maximum stage recorded, 8.50 feet February 17, 1916 (discharge, 3,467 second-feet); minimum discharge, 0.44 second-foot, December 15, 1919.

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—From May 13 to August 20, flow increased by water from United States Bureau of Reclamation Service St. Mary canal.

DIVERSIONS.—None of importance.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by shifting control. Four fairly well defined rating curves used as follows: October 1-16; October 17-31; April 11 to May 5, May 14-21, July 7-23, and August 28 to September 5; May 6-13, May 22 to July 6, July 24 to August 27, and September 6-30. Daily discharge ascertained by applying to rating table mean daily gage height obtained from inspection of recorder graph, except October 17-31 and July 7-23, when chain gage was read, and April 11 to June 10 and August 28 to September 30 when indirect method was used. Discharge during periods of ice effect, October 23 and November 1 to April 10, computed from discharge measurements, temperature records, and observer's notes. Records for open-channel flow, good; others, fair.

COOPERATION.—Data collected and compiled jointly with Dominion Water Power Branch, Canada. Prior to October 1, 1920, station maintained by Reclamation Service, Department of Interior, Canada.

Discharge measurements of Milk River at Milk River, Alberta, during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 15	T. Hermann ^a	^b 0.95	27.0	June 10	S. G. Dawson.....	2.51	409
Nov. 12	do.....	^c 1.35	24.0	22	W. A. Lamb.....	2.59	472
Dec. 4	do.....	^c 1.37	24.0	July 24	S. G. Dawson.....	2.19	285
23	do.....	^c 1.40	15.0	Aug. 1	W. A. Lamb.....	2.23	311
Jan. 11	do.....	^c 1.76	9.1	6	S. G. Dawson.....	2.17	279
Feb. 12	do.....	^c 2.80	^d 90	17	O. H. Hoover ^a	1.37	85
Mar. 10	A. W. Lowrie ^a	^c 2.86	104	18	E. L. Grant.....	1.23	56
23	do.....	^c 2.91	110	19	do.....	1.21	62
Apr. 1	do.....	^c 2.72	278	27	W. A. Lamb.....	.94	21.0
May 6	do.....	^b 1.88	228	Sept. 6	A. W. P. Lowrie.....	.81	10.4
21	S. G. Dawson ^e	^b 2.85	608	30	do.....	.97	30.0

^a Engineer, Dominion Water Power Branch, Canada.

^b Chain gage reading.

^c Stage-discharge relation affected by ice.

^d Estimated.

^e Engineer, Reclamation Service, Canada.

Daily discharge, in second-feet, of Milk River at Milk River, Alberta, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	25	42	21	13.4	6.2	85	278	212	350	350	304	11.1
2	23	37	26	20	11.6	71	689	191	392	345	300	8.0
3	23	40	37	19.6	14.0	37	1,619	169	439	406	293	12.5
4	24	33	24	19.6	17.2	78	880	218	480	463	283	14.0
5	25	45	27	18.0	15.6	45	866	198	468	420	283	9.8
6	25	42	18.8	18.8	17.2	89	222	246	524	379	283	10.8
7	25	31	25	17.2	14.8	30	140	274	565	366	280	13.2
8	27	26	18.8	17.2	22	73	80	315	453	362	277	16.4
9	28	36	14.8	7.4	24	58	99	315	429	339	267	19.6
10	29	44	29	11.6	32	103	95	322	406	339	255	21
11	29	32	24	9.2	60	54	236	293	429	319	267	22
12	29	26	22	11.0	89	54	280	271	449	319	290	23
13	27	26	20	12.2	74	51	510	222	449	323	280	24
14	26	28	26	14.0	35	57	701	269	463	344	205	23
15	27	31	18.0	11.0	39	50	505	375	463	348	165	21
16	27	31	16.4	17.2	23	58	408	295	453	362	155	25
17	28	37	14.8	16.4	24	66	375	315	490	352	85	27
18	33	35	17.2	17.2	12.8	71	352	295	530	339	66	30
19	36	35	13.8	17.2	12.8	80	319	344	542	339	59	28
20	41	33	10.4	18.0	14.0	78	319	418	512	339	48	28
21	41	41	15.6	18.8	18.8	115	319	665	490	331	38	26
22	45	42	16.4	18.8	26	107	255	474	468	319	34	25
23	46	32	15.6	18.0	31	109	246	402	415	319	31	26
24	48	32	14.0	18.8	58	105	242	368	388	297	27	25
25	36	32	12.2	22	62	89	239	345	474	297	25	24
26	34	32	9.2	21	62	119	201	333	358	311	23	23
27	37	36	8.0	20	83	119	182	345	345	322	21	22
28	37	21	14.0	23	83	140	182	354	341	318	18.1	27
29	41	33	18.0	22	-----	178	191	358	341	311	14.7	30
30	41	22	15.6	22	-----	152	204	350	354	311	11.7	30
31	41	-----	14.0	13.4	-----	207	-----	337	-----	311	11.1	-----

Monthly discharge of Milk River at Milk River, Alberta, for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	48	23	32.4	1,990
November.....	45	21	33.8	2,010
December.....	37	8.0	18.6	1,140
January.....	23	7.4	16.9	1,040
February.....	89	6.2	34.9	1,940
March.....	207	30	88.0	5,410
April.....	1,619	80	374	22,300
May.....	665	169	319	19,600
June.....	565	341	442	26,300
July.....	463	297	342	21,000
August.....	304	11.1	152	9,350
September.....	30	8.0	21.5	1,280
The year.....	1,619	6.2	156	75,600

MILK RIVER AT EASTERN CROSSING OF INTERNATIONAL BOUNDARY

LOCATION.—In NE. $\frac{1}{4}$ sec. 6, T. 37 N., R. 9 E., at international boundary, 30 miles north of Rudyard, Hill County, Mont., and 37 miles south of Many Berries, Alberta.

DRAINAGE AREA.—2,514 square miles (measured by engineers of Department of the Interior, Canada).

RECORDS AVAILABLE.—August 7, 1909, to September 30, 1921. From 1909 to 1912 records obtained by Irrigation Branch, Department of Interior, Canada; from April 1, 1913, by United States Geological Survey.

GAGE.—Stevens continuous water-stage recorder on left bank, referred to staff gage in well; zero of gage at elevation 2,698.92 feet above sea level. Recorder inspected by Robert L. Connor. For description of previous gages see Water-Supply Paper 476 and earlier reports.

CHANNEL AND CONTROL.—Bar composed of heavy boulders, gravel, and sand forms riffle at medium and low stages; shifts frequently.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.15 feet at 11 p. m. April 4 (discharge, 1,770 second feet); minimum stage, 0.41 foot October 5, 6 (discharge, 8.4 second-feet); smaller discharge probably occurred during winter.

1909–1921: Maximum stage recorded, 9.60 feet April 9, 1917 (discharge 4,860 second-feet); minimum stage, channel reported dry August 3–17, 22, 23, 1914.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—Low-water flow materially increased by water from St. Mary canal during May, June, July, and August.

ACCURACY.—Stage-discharge relation not permanent; affected by shifting control and by ice. Two rating curves used during year; one applicable October 1–31, fairly well defined; the other, applicable April 1 to September 30, well defined between 10 and 500 second-feet. Gage read to hundredths twice weekly, November 15 to December 31, and once daily, September 9–30. Mean daily gage height, October 1 to November 14 and March 16 to August 23, obtained by inspection of recorder graph. Daily discharge ascertained by indirect method for shifting control October 1–6, 19–31, and July 29 to August 24; by applying mean daily gage height to rating table October 7–18, April 1 to July 28, and September 9–30; by hourly method April 4, 5, and June 16. Records good April to July; others poor.

COOPERATION.—Station maintained jointly with Dominion Water Power Branch, Department of Interior, Canada.

Discharge measurements of Milk River at eastern crossing of international boundary during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Oct. 7	McDonald ^a and Er- rington ^a	<i>Feet</i> 0.42	<i>Sec.-ft.</i> 8.4	July 22	E. L. Grant	<i>Feet</i> 1.86	<i>Sec.-ft.</i> 270
25	H. S. Price	.72	31.0	23	T. Hermann	1.84	259
Mar. 9	W. A. Lamb	^b 1.20	103	Aug. 2	W. A. Lamb	1.84	283
Apr. 28	do.	1.84	264	12	T. Hermann	1.75	249
May 31	T. Hermann ^a	2.15	376	21	E. L. Grant	1.09	84
31	Tuttle and Price	2.15	369	24	T. Hermann	.80	49
June 21	Grant and Tuttle	2.32	454	24	E. L. Grant	.82	51
July 1	T. Hermann	2.12	352	Sept. 19	W. S. McDonald	.46	16.8

^a Engineers of Dominion Water Power Branch, Canada.

^b Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Milk River at eastern crossing of international boundary for the year ending Sept. 30, 1921

Day	Oct.	Apr.	May	June	July	Aug.	Sept.
1	11.2	170	206	369	369	284	29
2	11.2	165	208	357	369	284	26
3	10.5	254	208	378	412	274	23
4	9.8	1,160	208	382	462	287	20
5	8.4	1,160	206	412	457	261	17
6	8.4	690	203	429	462	261	15
7	9.8	429	225	438	466	258	13
8	11	251	330	438	466	261	11
9	13	170	447	520	457	264	9.5
10	14	203	365	434	443	254	22
11	17	192	349	398	416	254	37
12	18	177	365	398	407	248	48
13	17	211	338	365	386	242	41
14	17	251	323	378	369	245	35
15	17	567	294	407	357	261	39
16	17	672	284	389	342	277	60
17	18	480	274	666	326	216	27
18	21	407	312	540	315	197	21
19	42	342	323	471	315	174	16
20	43	330	330	466	298	133	13
21	39	323	369	466	284	103	12
22	40	298	434	471	267	76	10
23	39	277	535	471	264	69	10
24	32	284	495	466	261	49	10
25	31	274	438	443	258	47	10
26	26	258	420	403	258	44	9.5
27	29	254	386	369	277	41	10
28	30	254	349	349	277	38	22
29	26	228	357	330	267	35	19
30	25	214	378	349	267	32	17
31	24	374	-----	-----	270	30	-----

NOTE.—Stage-discharge relation affected by ice Nov. 1 to Mar. 31. Data insufficient to compute discharge. Gage heights unreliable Aug. 25 to Sept. 8; discharge interpolated.

Monthly discharge of Milk River at eastern crossing of international boundary for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	43	8.4	21.8	1,340
April	1,160	165	365	21,700
May	535	203	333	20,500
June	666	330	425	25,300
July	466	258	350	21,500
August	284	30	177	10,900
September	60	9.5	21.8	1,300

MILK RIVER AT HAVRE, MONT.

LOCATION.—In SW. $\frac{1}{4}$ SW. $\frac{1}{4}$ sec. 4, T. 32 N., R. 16 E., at highway bridge at Havre, Hill County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 15, 1898, to September 30, 1921.

GAGE.—Chain gage fastened to upstream rail of bridge; read by Stephen O'Neal.

Owing to shifting of river bed it has often been necessary to move gage from one end of bridge to the other, but the datum has not been changed except when gage was moved to upstream side of bridge July 13, 1920, and datum lowered 4.00 feet. Staff gage on right bank 20 feet below bridge and at same datum as chain gage was read July 21 to September 30, 1919.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of fine gravel and sand; shifts frequently. Both banks are overflowed at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.05 feet at 9 a. m. April 6 (discharge, 1,450 second-feet); minimum discharge estimated, 0.5 second-foot from measurement of February 6.

1898–1921: Maximum stage recorded, 17.2 feet March 12, 1916 (discharge not determined); minimum discharge, channel dry 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, and July 29 to August 22, 1914.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None.

REGULATION.—From May 11 to August 20, 1921, a total of 54,900 acre-feet was added to flow of Milk River through operation of St. Mary canal.

ACCURACY.—Stage-discharge relation seriously affected by shifting control and by ice. Standard rating curve well defined above 60 second-feet. Gage read to hundredths twice daily May 24 to September 30; once daily during remainder of year. October 1 to January 31 excluding periods of ice effect and September 3–30, daily discharge ascertained* by applying mean daily gage height to rating table. Indirect method for shifting control used April 1 to September 2, except for few scattered days. Records fair.

Discharge measurements of Milk River at Havre, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 23	H. S. Price.....	1.97	36.7	May 24	H. S. Price.....	4.32	962
Dec. 13	W. A. Lamb.....	^a 2.27	16.6	25	do.....	4.10	764
Feb. 6	H. S. Price.....	^a 2.24	^b 5	27	Tuttle and Price.....	3.62	448
Mar. 10	W. A. Lamb.....	^a 2.77	39.1	29	H. S. Price.....	3.43	376
Apr. 2	H. S. Price.....	3.26	293	June 8	do.....	3.69	432
6	do.....	4.98	1,370	13	do.....	3.51	383
8	do.....	4.06	518	20	Tuttle and Grant.....	3.84	481
11	do.....	3.32	319	30	E. L. Grant.....	3.58	419
15	Price and Parker ^c	3.75	527	July 14	do.....	3.62	382
20	H. S. Price.....	3.77	517	15	do.....	3.70	442
28	W. A. Lamb.....	3.20	305	23	do.....	3.32	240
29	H. S. Price.....	3.19	305	29	do.....	3.42	299
May 3	do.....	2.98	254	Aug. 5	do.....	3.51	344
10	do.....	4.28	806	20	do.....	3.10	168
13	do.....	3.85	511	23	do.....	2.63	84
23	do.....	3.62	485	25	do.....	2.42	59

^a Stage-discharge relation affected by ice.

^b Estimated.

^c Engineer of U. S. Bureau of Reclamation.

Daily discharge, in second-feet, of Milk River at Havre, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Apr.	May	June	July	Aug.	Sept.
1	12	21	51	13	332	287	426	372	302	20
2	8	23	49	13	284	249	417	455	322	18
3	12	30	49	9	306	281	387	546	353	6
4	13	30	49	5	339	256	376	679	336	12
5	14	21	42	14	1,000	219	400	723	339	10
6	13	25	36	26	1,420	228	391	626	254	10
7	13	20	34	20	990	216	395	632	267	6
8	18	18	34	13	646	236	426	552	279	7
9	22	16	32	21	372	346	450	475	276	9
10	18	14	28	20	342	818	626	400	276	20
11	14	12	24	19	325	570	470	404	265	35
12	14	10	20	18	281	600	422	391	259	53
13	15	10	17	17	312	496	387	626	249	55
14	15	10		17	336	450	395	391	243	53
15	15	20		16	496	383	404	455	236	72
16	15	35		16	658	312	404	485	243	79
17	15	36	14	16	1,010	299	778	465	254	88
18	14	40		16	871	376	730	383	249	119
19	21	28		17	620	357	836	361	221	108
20	29	23		17	512	400	470	312	169	62
21	47	21	14	18	480	413	490	290	141	32
22	49	34	18	16	440	404	496	279	103	22
23	40	25	15	16	409	455	529	246	85	18
24	42	26		18	336	730	518	243	71	17
25	40	28		15	368	745	470	223	59	13
26	38	30	12	13	353	518	435	241	56	9
27	44	40		18	342	445	431	287	47	6
28	39	40		10	287	409	400	281	39	6
29	38	44	17	10	299	400	372	287	34	6
30	40	47	15	9	353	413	417	299	29	6
31	40		14	8		413		296	27	

NOTE.—Stage-discharge relation affected by ice for short periods Nov. 7 to Mar. 31; Nov. 7-15, 24-25, Dec. 2-13, 31, Jan. 1, 11-15, 17-20, 30, and 31. Discharge computed from discharge measurements, observer's notes, and temperature records. * Flow estimated Dec. 14-20 and 24-28. Data insufficient for computation of discharge February and March. Braced figures indicate mean discharge for periods indicated.

Monthly discharge of Milk River at Havre, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	49	8	24.7	1,520
November	47	10	25.9	1,540
December	51		23.1	1,420
January	26	5	15.3	941
April	1,420	284	504	30,000
May	818	216	410	25,200
June	836	372	472	28,100
July	723	223	410	25,200
August	353	27	196	12,100
September	119	6	32.6	1,940

MILK RIVER AT MALTA, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 17, T. 30 N., R. 30 E., at old highway bridge at Malta, Phillips County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 31, 1902, to September 30, 1921.

GAGE.—Chain fastened to guardrail on downstream side of bridge; read by employees of United States Bureau of Reclamation. The gage has been moved several times to different points on bridge, but datum was not changed.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of gravel. Partial control at gage at low water, but principal control is riffle half a mile below gage; shifts during high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.50 feet May 14 (discharge, 1,510 second-feet); minimum stage, 0.68 foot September 25, 27, and 29 (discharge, 21 second-feet).

1902–1921: Maximum stage recorded, 20.17 feet March 27, 1918 (discharge, 11,500 second-feet); no flow during periods in 1904, 1905, 1906, and 1910.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Seven irrigation canals, used to irrigate about 25,000 acres of land, divert water from Milk River and its tributaries between Havre and Malta.

REGULATION.—Part of flood flow is diverted into Nelson reservoir, 14 miles northeast of Malta, and held for use in irrigation.

ACCURACY.—Stage-discharge relation permanent except during period of ice effect. Rating curve well defined between 100 and 4,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Milk River at Malta, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 26	H. S. Price.....	3.11	741
June 26	Grant and Tuttle.....	2.38	388
July 6	.....do.....	3.12	757

Daily discharge, in second-feet, of Milk River at Malta, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.	744	59		324	387	131	230	106	33
2.	694	59		236	379	110	596	101	31
3.	187	61		106	192	114	605	96	38
4.	135	64		61	122	122	640	80	38
5.	114	59		61	118	128	674	64	35
6.	71	59		62	131	135	784	44	31
7.	61			64	118	140	764	54	26
8.	61			170	131	149	724	46	28
9.	66			1,240	170	159	664	44	30
10.	64			1,210	387	152	519	44	33
11.	64			857	903	144	122	44	33
12.	54			447	909	135	86	46	36
13.	52			126	903	144	482	36	35
14.	52			271	1,510	142	429	36	29
15.	54			605	1,290	65	210	38	28
16.	52			519	888	51	360	44	31
17.	54			187	805	91	510	48	29
18.	54			92	704	96	659	48	28
19.	57			135	464	96	395	59	28
20.	57			1,080	455	110	175	77	28
21.	57			1,670	464	596	66	61	26
22.	42			1,150	464	567	140	48	23
23.	46			694	455	371	243	42	25
24.	46			674	438	149	301	36	23
25.	44			704	438	69	286	35	21
26.	44			704	447	421	286	35	23
27.	44		74	846	324	491	181	33	21
28.	46		66	734	118	347	159	35	23
29.	54		68	548	122	114	103	31	21
30.	46		71	412	674	172	96	33	35
31.	54		644		135		110	33	

NOTE.—Stage-discharge relation affected by ice Nov. 7 to Mar. 26; discharge not computed. Discharge interpolated because of missing gage height June 5, 30, July 4, 16, 17, Aug. 2, and Sept. 8 and 9.

Monthly discharge of Milk River at Malta, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	744	42	105	6,460
November 1-6.....	64	59	60.2	716
March 27-31.....	644	66	185	1,830
April.....	1,670	61	533	31,700
May.....	1,510	118	485	29,800
June.....	596	51	190	11,300
July.....	784	66	374	23,000
August.....	106	31	50.9	3,130
September.....	38	21	29.0	1,730

NORTH FORK OF MILK RIVER ABOVE OUTLET OF ST. MARY CANAL, NEAR BROWNING, MONT.

LOCATION.—In SW. $\frac{1}{4}$ sec. 16, T. 37 N., R. 11 W., on Blackfeet Indian Reservation, $1\frac{1}{4}$ miles above outlet of canal, 3 miles south of international boundary and 30 miles north of Browning, Glacier County.

DRAINAGE AREA.—60 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 20 to August 20, 1921. Station maintained during period when St. Mary canal is in operation.

GAGE.—Stevens continuous water-stage recorder on left bank, referred to staff gage outside of gage well.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—One channel at all stages. Banks high, not subject to overflow. Control is gravel bar; subject to shift.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 1.02 feet at 8.30 a. m. July 3 (discharge, 24 second-feet); minimum stage, 0.58 foot at 10 p. m. July 20 (discharge, 7.9 second-feet).

REGULATION.—None.

DIVERSIONS.—Practically none.

ACCURACY.—Stage-discharge relation affected by shifting control. Rating curve poorly defined. Mean daily gage height determined from inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table June 20 to July 13; for remainder of period, discharge ascertained by indirect method for shifting control. Records fair.

COOPERATION.—Station maintained jointly with Dominion Water Power Branch, Department of Interior, Canada.

Discharge measurements of North Fork of Milk River above outlet of St. Mary canal, near Browning, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
June 20	W. A. Lamb	0.72	13.5	Aug. 4	A. W. P. Lowrie	0.66	10.0
July 12	A. W. P. Lowrie ^a	.63	10.3	13	O. H. Hoover ^a	.67	12.4
30	W. A. Lamb	.67	10.8				

^a Engineer, Dominion Water Power Branch, Canada.

Daily discharge, in second-feet, of North Fork of Milk River above outlet of St. Mary canal, near Browning, Mont., for the period June 20 to Aug. 20, 1921

Day	June	July	Aug.	Day	June	July	Aug.	Day	June	July	Aug.
1		11.7	10.7	11		10.3	11.0	21	13.5	8.2	
2		13.9	10.0	12		10.7	11.0	22	12.8	8.2	
3		18.6	9.6	13		10.7	11.7	23	12.8	8.2	
4		15.0	9.6	14		10.3	11.7	24	12.8	8.6	
5		12.8	9.6	15		10.0	11.4	25	12.4	9.3	
6		12.1	10.0	16		9.6	11.0	26	12.1	12.8	
7		11.7	10.0	17		9.3	11.4	27	11.7	11.7	
8		11.7	10.3	18		9.3	11.7	28	11.4	11.0	
9		10.7	10.0	19		8.9	12.1	29	11.4	10.7	
10		10.3	10.7	20	13.5	8.9	12.1	30	11.7	10.3	
								31		10.3	

Monthly discharge of North Fork of Milk River above outlet of St. Mary canal, near Browning, Mont., for the period June 20 to Aug. 20.

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
June 20-30	13.5	11.4	12.4	271
July	18.6	8.2	10.8	664
August 1-20	12.1	9.6	10.8	428

NORTH FORK OF MILK RIVER NEAR INTERNATIONAL BOUNDARY

LOCATION.—In NE. $\frac{1}{4}$ sec. 11, T. 1, R. 23 W. fourth meridian, 300 yards above highway bridge at Peters ranch, 2 miles north of international boundary, and 18 miles east of Kimball, Alberta.

DRAINAGE AREA.—101 square miles (measured on topographic maps).

RECORDS AVAILABLE.—January 1, 1913, to September 30, 1921. July, 1909, to December, 1912, records obtained by Irrigation Branch, Department of Interior, Canada, 2 miles downstream; May, 1911, to December, 1912, records obtained at Alexander Dubray's ranch, 2 miles south of international boundary.

GAGE.—Stevens water-stage recorder on left bank, referred to chain gage outside well; inspected by Charles Barnett.

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—Bed of stream at gage, and principal control composed of clay and small boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.17 feet at 6.30 p. m. June 20 (discharge, 473 second-feet); minimum flow, 6.0 second-feet January 29 (stage-discharge relation affected by ice).

1909–1921: Maximum stage recorded, 4.14 feet May 8, 1920 (discharge, 1,070 second-feet); minimum discharge, 5 second-feet February 12, 1916 (stage-discharge relation affected by ice).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—During May, June, July, and August 54,920 acre-feet was turned into river above station by St. Mary canal.

ACCURACY.—Stage-discharge relation not permanent; affected by ice November 6 to April 8 and by shifting control May 17–27 and August 26 to September 30. Five well-defined rating curves used; October 1–13, October 14 to November 5, April 9 to May 27, May 28 to August 30, September 1–22, and September 23–30. Mean daily gage height October 1–13, April 10 to August 30, and September 23–30 (except several days in July and August when clock stopped) ascertained from inspection of recorder graph. Chain gage read to hundredths once daily October 14 to April 9 and September 2–21. Daily discharge ascertained by applying mean daily gage height to rating table except for periods of ice effect and of shifting control. Records fair.

COOPERATION.—Station maintained jointly with Dominion Water-Power Branch, Department of Interior, Canada.

Discharge measurements of North Fork of Milk River near international boundary during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 7	A. W. P. Lowrie ^a	1.27	13.7	May 16	A. W. P. Lowrie.....	2.37	193
Nov. 6	T. Hermann ^a	1.39	18.3	27	W. A. Lamb.....	2.42	221
Dec. 1	.....do.....	1.29	14.2	July 11	A. W. P. Lowrie.....	2.82	340
17	.....do.....	1.69	11.5	30	W. A. Lamb.....	2.75	315
Jan. 5	.....do.....	1.27	7.6	Aug. 12	O. H. Hoover ^a	2.45	237
30	.....do.....	1.75	8.2	13	.....do.....	2.11	146
Feb. 21	.....do.....	2.60	11.5	15	.....do.....	1.62	51
Mar. 13	A. W. P. Lowrie.....	2.37	11.2	24	W. A. Lamb.....	1.23	15.3
28	.....do.....	2.98	31.0	25	O. H. Hoover.....	1.15	11.4
Apr. 9	.....do.....	1.63	42.0	Sept. 23	A. W. P. Lowrie.....	1.12	7.0

^a Engineer, Dominion Water-Power Branch, Canada.

^b Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of North Fork of Milk River near international boundary for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	13.4	16.0	14.2	8.1	8.0	14.8	100	27	272	354	323	*9.7
2	13.4	15.2	14.0	7.8	7.8	16.0	352	38	303	358	320	10.0
3	13.4	*16.1	11.8	10.9	8.0	16.0	127	34	318	385	320	*10.1
4	13.8	*17.0	12.0	12.0	6.9	17.2	*94	28	315	368	318	10.3
5	13.0	18.0	14.0	7.6	7.0	11.3	*61	36	318	354	315	*10.0
6	13.4	18.4	12.0	8.0	7.6	10.5	28	39	323	351	312	*9.7
7	13.8	17.6	12.0	8.3	8.0	12.0	24	41	320	351	306	9.2
8	13.8	17.0	12.0	9.3	7.8	11.8	*33	46	320	351	300	*9.8
9	14.2	16.0	11.6	7.7	11.6	9.8	42	43	329	348	295	10.3
10	14.2	15.6	12.4	10.9	14.0	11.1	26	35	345	345	306	*11.3
11	14.2	14.4	12.0	10.2	16.4	11.3	56	31	374	342	*281	12.2
12	14.2	14.0	12.0	9.8	14.8	12.8	143	32	382	338	255	*11.9
13	15.0	13.2	12.4	8.7	16.8	11.3	208	78	411	338	159	*11.6
14	14.8	14.0	13.2	8.0	14.8	12.0	91	175	424	338	118	11.3
15	*15.9	14.4	14.4	8.5	10.9	15.2	62	178	428	338	69	*10.8
16	*17.0	15.6	11.8	7.8	7.0	14.0	54	191	424	*332	*46	10.3
17	18.0	15.2	11.5	8.0	7.0	12.0	56	198	424	*326	*31	*9.8
18	*18.0	16.0	10.7	9.8	6.9	17.6	53	201	454	320	*24	9.2
19	18.0	16.0	10.7	10.9	6.9	26.0	56	232	454	320	*18.7	*9.9
20	*17.9	15.6	10.0	9.8	8.2	20.0	43	188	464	*320	*18.7	*8.6
21	*17.7	17.2	9.8	8.7	11.6	19.6	42	180	459	*319	*20.0	8.4
22	17.6	15.2	10.2	6.9	10.5	22.0	41	178	407	*319	*18.0	*7.6
23	*17.0	15.2	8.9	7.8	18.4	25.0	38	180	392	*318	*16.8	6.9
24	16.4	15.2	7.8	14.2	18.8	26.0	29	175	385	318	15.4	8.0
25	*16.8	13.6	8.0	12.8	19.6	29.0	25	209	371	318	11.9	8.0
26	17.2	14.0	8.5	11.3	21.0	26.0	24	227	354	315	9.6	7.8
27	*17.6	14.4	7.0	12.8	15.2	24.0	24	219	354	318	9.8	8.0
28	*18.0	14.4	7.5	14.0	14.8	31.0	29	225	358	318	9.0	8.6
29	18.4	14.0	7.4	6.0	-----	50.0	32	228	354	318	9.3	9.3
30	*17.6	14.0	7.9	8.2	-----	60.0	32	236	354	320	9.6	9.0
31	*16.8	-----	8.9	8.0	-----	75.0	-----	255	-----	326	*9.3	-----

* Gage height missing; discharge estimated or interpolated.

NOTE.—Discharge ascertained by indirect method May 17-27 and Aug. 26 to Sept. 30; by hourly method Apr. 12, 13, and May 13. Stage-discharge relation affected by ice Nov. 6 to Apr. 8; discharge ascertained from current-meter measurements, observer's notes, and temperature records.

Monthly discharge of North Fork of Milk River near international boundary for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	18.4	13.0	15.8	972
November	18.4	13.2	15.4	916
December	14.4	7.0	10.9	670
January	14.2	6.0	9.46	582
February	21.0	6.9	11.7	650
March	75	9.8	21.6	1,330
April	352	24	67.5	4,020
May	255	27	135	8,300
June	464	272	373	22,200
July	385	315	335	20,600
August	323	9.0	138	8,480
September	12.2	6.9	9.55	568
The year	464	6.0	95.7	69,300

BEAVER CREEK NEAR HAVRE, MONT.

LOCATION.—5 miles southwest of Havre and 2 miles south of old buildings at Fort Assiniboine, on military reservation, Hill County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 4, 1918, to September 30, 1921.

GAGE.—Vertical staff fastened to cottonwood tree on left bank, 100 feet upstream from broken down footbridge over creek; read by W. E. Wiltner.

DISCHARGE MEASUREMENTS.—Made by wading at gage.

CHANNEL AND CONTROL.—Bed composed of gravel. Control is ford 50 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.00 feet at 9 a. m. July 3 (discharge, 152 second-foot); minimum stage, 0.42 foot September 8 (discharge, 0.8 second-foot).

1918-1921: Maximum stage recorded, 4.90 feet July 13, 1920 (discharge, computed by logarithmic extension of rating curve, 500 second-foot); minimum stage, 0.22 foot June 26-28, 1919 (discharge, 0.1 second-foot).

ICE.—Records discontinued during winter.

DIVERSIONS.—Some small diversions above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined between 3 and 90 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Beaver Creek near Havre, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 2	H. S. Price.....	1.03	26.7	June 13	H. S. Price.....	0.82	13.1
19	do.....	1.09	33.8	July 13	Grant and Tuttle.....	.98	25.1
May 6	do.....	1.19	40.6	Aug. 25	E. L. Grant.....	.52	3.1
16	do.....	1.19	40.6				

Daily discharge, in second-feet, of Beaver Creek near Havre, Mont., for the year ending Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1		22	25	7.8	18	1.4	16	33	44	19	25	38	11
2		20	24	7.4	15	1.4	17	26	41	34	27	12	11
3		20	23	140	11	1.4	18	25	38	21	22	7.8	8.5
4		28	22	112	9.8	1.4	19	25	40	20	17	7.0	8.5
5		32	21	98	9.0	1.1	20	26	40	16	15	6.6	7.8
6		39	20	76	8.5	1.1	21	26	39	13	14	5.2	7.8
7		43	20	50	8.1	1.0	22	26	39	11	12	4.2	7.0
8		47	25	42	7.8	.8	23	25	41	9.8	9.8	4.0	7.0
9		90	22	38	7.8	1.2	24	25	31	11	9.8	3.1	7.0
10		79	19	33	7.0	5.2	25	27	30	9.8	10	2.3	7.0
11		66	18	29	7.0	12	26	24	30	9.8	27	1.7	6.3
12	23	57	17	26	6.3	7.8	27	21	26	8.1	32	1.7	7.0
13	28	52	14	25	5.5	7.8	28	18	26	6.6	21	1.7	7.8
14	36	50	13	45	4.8	8.1	29	21	26	5.9	16	1.7	8.5
15	36	46	15	45	3.7	8.5	30	22	25	6.6	14	1.7	8.5
							31		23		13	1.7	

Monthly discharge of Beaver Creek near Havre, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 12-30.....	36	18	25.9	976
May.....	90	20	39.7	2,446
June.....	34	5.9	16.7	994
July.....	140	7.4	34.2	2,106
August.....	38	1.7	7.41	456
September.....	12	.8	6.03	356
The period.....				7,320

LITTLE BOXELDER CREEK NEAR HAVRE, MONT.

LOCATION.—At Kinsella's ranch, 26 miles southeast of Havre, Hill County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 8, 1919, to September 30, 1921. At PX ranch 3 miles below from May 4, 1918, to May 22, 1919. Discharge at two stations not comparable. June 8 to September 30, 1919, discharge measurement only.

GAGE.—Vertical staff with enamel face on left bank 200 feet east of house of Lawrence I. Kinsella, who reads gage. Gage washed out July 13, 1920; reestablished at different datum.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed of stream composed of cobblestones and gravel. Banks are low and subject to overflow at high stages. Right bank covered with brush. Control is cobblestone and gravel bar 30 feet below gage; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year ending September 30, 1920, 1.90 feet May 11 (discharge, 49 second-feet); minimum stage, 0.82 foot October 5-10, 16-20, 26-28, November 6-11, 22-30 (discharge 0.4 second-foot).

Maximum stage recorded during year ending September 30, 1921, 1.72 feet at 7.30 p. m. July 4 (discharge, 38 second-feet); minimum stage, 0.52 foot October 1-5, 17, and 18 (discharge, 0.9 second-foot).

1919-1921: Maximum stage recorded in 1920; minimum stage recorded in 1919.

DIVERSIONS.—Several small diversions above gage.

REGULATION.—None.

ICE.—Stage-discharge relation seriously affected by ice.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by shifting control. Two rating curves used; both well defined between 1 and 10 second-feet; one applicable October 1, 1919, to July 12, 1920, and other applicable from July 14, 1920. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table previous to April 1, 1921; indirect method used April 1 to September 30, 1921. Records poor.

Discharge measurements of Little Boxelder Creek near Havre, Mont., during the years ending Sept. 30, 1919-1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
1919		<i>Feet</i>	<i>Sec.-ft.</i>	1920		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 25 ^a	Tuttle and Edwards...	1.17	5.3	Aug. 13	H. S. Price.....	0.52	1.0
May 22 ^a	R. F. Edwards.....	.96	1.2				
June 8	.....do.....	.88	1.0	1921			
1920				Apr. 29	W. A. Lamb.....	.89	10.4
May 13	R. F. Edwards.....	1.60	31.4	June 10	H. S. Price.....	.86	6.6
July 14	H. S. Price.....	6.94	9.5	July 13	Grant and Tuttle.....	1.02	8.8
				Aug. 8	E. L. Grant.....	.84	4.5

^a Measurement 3 miles below present site.

^b Datum changed; gage washed out July 13, 1920.

Daily discharge, in second-feet, of Little Boxelder Creek near Havre, Mont., for the years ending Sept. 30, 1920 and 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1919-20										
1.....	1.2	0.6			20	19	11	5.0	0.9	1.4
2.....	1.0	.6			19	19	9.3	5.0	.9	1.4
3.....	.8	.6			19	21	9.3	3.1	1.1	1.1
4.....	.6	.6			21	24	8.6	3.1	.9	.9
5.....	.4	.6			21	35	8.6	3.7	.7	.9
6.....	.4	.4			23	36	7.8	3.7	.7	.9
7.....	.4	.4			24	43	7.8	3.7	.7	.9
8.....	.4	.4			24	43	7.1	3.7	.7	.9
9.....	.4	.4			24	48	7.1	3.7	.7	.7
10.....	.4	.4			24	45	6.4	3.7	.7	.7
11.....	.6	.4			25	49	5.7	3.1	.9	.9
12.....	.6	.6			25	48	5.7	3.1	.9	.9
13.....	.6	.6			25	45	5.7	6.3	.9	.9
14.....	.6	.6			24	31	6.4	9.5	.7	.9
15.....	.6	.6			24	30	7.1	5.8	.7	.9
16.....	.4	1.0			23	28	7.1	4.0	.7	.9
17.....	.4	1.8			23	26	8.6	4.0	.7	.9
18.....	.4	1.8			21	24	14	3.2	.7	.9
19.....	.4	1.0			20	24	13	2.4	.7	.9
20.....	.4	.8			20	21	11	2.1	.7	.9
21.....	.6	.6		12	19	17	7.8	2.1	.7	.9
22.....	.8	.4		12	18	16	5.7	2.1	.9	.9
23.....	.6	.4		12	16	14	9.3	2.1	.9	1.6
24.....	.6	.4		12	15	14	9.3	1.8	.9	1.1
25.....	.6	.4		13	12	14	11	1.4	.9	.9
26.....	.4	.4		15	12	14	9.3	1.4	.9	.9
27.....	.4	.4		16	12	13	7.8	1.4	1.1	.9
28.....	.4	.4		16	12	12	7.1	1.1	1.4	.9
29.....	.6	.4		18	12	12	6.4	1.1	.9	.9
30.....	.6	.4		20	18	12	5.7	.9	1.4	.9
31.....	.8			20		11		.9	1.4	
1920-21										
1.....	.9	1.4	1.6		7.4	10	8.0	2.8	6.3	2.9
2.....	.9	1.4	1.6		43	11	8.0	2.8	5.8	2.6
3.....	.9	1.4	1.6		32	13	8.0	27	5.2	2.6
4.....	.9	1.4	1.6		17	14	7.4	38	4.4	2.9
5.....	.9	1.4	1.6		13	18	6.9	33	4.4	2.9
6.....	1.1	1.4	1.6		6.0	18	6.6	25	4.8	2.6
7.....	1.1	1.6	1.6		3.8	19	6.0	20	4.4	2.6
8.....	1.4	1.6	1.6		3.8	20	6.0	16	4.4	2.6
9.....	1.4	1.4	1.6		4.6	32	9.9	12	4.4	2.6
10.....	1.1	1.4	1.6		9.1	31	6.6	10	4.4	2.9
11.....	1.1	1.4	1.6		9.1	28	6.0	10	4.0	3.2
12.....	1.1	1.4	1.6		9.1	26	6.0	8.8	4.0	3.6
13.....	1.1	1.4	1.6		18	24	5.5	8.8	4.0	4.0
14.....	1.4	1.4	1.6		18	20	4.4	28	4.0	4.4
15.....	1.4	1.4	1.4		18	20	4.4	9.9	3.6	4.8
16.....	1.1	1.4	1.4		18	17	6.3	8.0	4.4	5.8
17.....	.9	1.4	1.4		18	17	6.0	7.4	7.4	5.8
18.....	.9	1.4	1.4		17	17	5.0	6.9	5.2	5.8
19.....	1.1	1.6	1.4		18	17	4.6	6.9	4.8	5.2
20.....	1.4	1.6	1.4		18	17	4.4	6.9	4.4	4.8
21.....	1.4	1.6	1.4		18	15	4.0	5.0	4.4	4.8
22.....	1.8	1.6	1.4		17	14	3.6	5.0	3.6	4.8
23.....	1.6	1.6	1.4		16	13	3.1	4.6	3.6	4.8
24.....	1.4	1.4	1.1		13	11	3.1	4.2	3.6	4.4
25.....	1.6	1.4	1.1		12	11	3.4	4.2	3.6	4.4
26.....	1.8	1.4	1.4		11	9.9	2.9	14	3.6	4.0
27.....	1.6	1.4	1.6	2.6	11	9.9	2.9	9.9	3.6	4.0
28.....	1.4	1.4	1.6	2.6	11	9.9	2.9	6.6	3.2	4.0
29.....	1.4	1.4	1.4	2.6	11	9.1	2.8	4.6	3.2	6.9
30.....	1.4	1.4	1.4	2.9	11	9.1	2.8	4.6	2.9	5.2
31.....	1.4		1.4	3.6		9.1		6.0	2.9	

NOTE.—Stage-discharge relation affected by ice Dec. 7, 1919, to Mar. 20, 1920, and Jan. 1 to Mar. 26, 1921; discharge not computed. Discharge interpolated July 13, 1920.

Monthly discharge of Little Boxelder Creek near Havre, Mont., for the years ending ending Sept. 30, 1920 and 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1919-20				
October.....	1.2	0.4	.56	34.4
November.....	1.8	.4	.61	36.3
March 21-31.....	20	12	15.1	329
April.....	25	12	19.8	1,180
May.....	49	11	26.1	1,600
June.....	14	5.7	8.22	489
July.....	9.5	.9	3.17	195
August.....	1.4	.7	.87	53.5
September.....	1.6	.7	.96	57.1
1920-21				
October.....	1.8	.9	1.25	76.9
November.....	1.6	1.4	1.45	86.3
December.....	1.6	1.1	1.45	89.2
March 27-31.....	3.6	2.6	2.86	28.4
April.....	43	3.8	14.4	857
May.....	32	9.1	16.5	1,010
June.....	9.9	2.8	5.25	312
July.....	38	2.8	11.5	707
August.....	7.4	2.9	4.27	263
September.....	6.9	2.6	4.06	242

CLEAR CREEK NEAR BEARPAW, MONT.

LOCATION.—In sec. 35, T. 30 N., R. 17 E., 200 feet below mouth of Wind Creek, 25 miles southeast of Havre, and 8 miles north of Bearpaw, Blaine County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 4, 1918, to September 30, 1921; fragmentary.

GAGE.—Wire gage on right bank opposite observer's house and 400 feet below highway; read by William Ross.

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

CHANNEL AND CONTROL.—Bed composed of cobblestones and gravel. Control 30 feet below gage; slightly shifting. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 1.96 feet April 16 and May 7 (discharge, 46 second-feet); minimum stage, 0.76 foot March 5 (discharge, 0.8 second-foot).

1918-1921: Maximum stage recorded, 2.31 feet May 10, 1920 (discharge, 79 second-feet); minimum discharge, no flow July 12 to September 30, 1919,

ICE.—Station not operated during winter.

DIVERSIONS.—No data.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined between 5 and 30 second-feet. Gage read twice weekly with occasional readings additional. Daily discharge for days when gage was read ascertained by applying gage height to rating table; discharge for other days not computed. Records fair.

Discharge measurements of Clear Creek near Bearpaw, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		Feet	Sec.-ft.			Feet	Sec.-ft.
Apr. 29	W. A. Lamb.....	1.56	22.6	July 13	Grant and Tuttle.....	1.35	13.5
June 10	H. S. Price.....	1.22	10.2	Aug. 8	E. L. Grant.....	1.05	5.2

Daily discharge, in second-feet, of Clear Creek near Bearpaw, Mont., for the year ending Sept. 30, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1							
2		40				12	
3							
4				16			
5	0.8				22	6.5	
6							
7			46	12			5.6
8						5.4	
9				15	16		
10				9.8		5.2	
11							
12	18						
13				4.0	24	4.3	5.8
14			40				
15				11		4.0	
16		46	31		26		
17				12			
18					19	5.6	
19	18						
20			28	4.0			
21							
22							
23		40	23		11	1.2	
24							5.2
25				8.7	8.1		
26	23		25				
27						2.9	
28							
29					19		5.0
30		34	19	4.7			
31	18						

FORT BELKNAP CANAL NEAR CHINOOK, MONT.

LOCATION.—On line between secs. 20 and 21, T. 33 N., R. 18 E., at highway bridge three-fourths mile below head gates of canal on Milk River, 1 mile north of Lohman, and 8 miles west of Chinook, Blaine County.

RECORDS AVAILABLE.—June 21, 1903, to September 30, 1921.

GAGE.—Stevens eight-day water-stage recorder installed May 19, 1921, on upstream side of bridge, referred to staff gage on downstream pile of left abutment. Staff gage read by Jerry Keller. For description of older gages, see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from gaging bridge 1,000 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of heavy clay. Check weir 1 mile below causes backwater when in use. Backwater also from aquatic plants during later part of irrigation season.

ACCURACY.—Use of check weir changes stage-discharge relation. Two rating curves used; one applicable May 4 to June 15 (check weir in place), fairly well defined between 32 and 70 second-feet; other applicable June 16 to September 30, fairly well defined between 18 and 80 second-feet. Daily gage height from inspection of recorder graph, May 22 to August 26, except August 18–21; other gage heights from staff-gage readings. Daily discharge ascertained by applying mean daily gage height to rating table except for few days when hourly method was used.

Water in Fort Belknap canal is diverted from north bank of Milk River in SE. $\frac{1}{4}$ sec. 20, T. 33 N., R. 18 E., to irrigate lands on north side of river. Water can be wasted into Lodge Creek north of Chinook, 8 miles below head gates. Check gates erected in the main canal to divert water into laterals often cause back water for several miles above and, as these gates are put in under a variety of conditions, velocities during the season differ widely at same gage height.

Discharge measurements of Fort Belknap canal near Chinook, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
May 4	H. S. Price.....	1.88	37.1	June 22	Grant and Tuttle.....	2.46	74
11	do.....	2.44	66	July 4	E. L. Grant.....	1.96	45.6
19	Tuttle and Parker ^a	2.27	58	12	Grant and Tuttle.....	1.79	^c 34.1
24	H. S. Price.....	2.20	51	19	E. L. Grant.....	1.97	49.0
June 2	A. H. Tuttle.....	2.19	^b 58	27	do.....	1.66	31.5
8	Tuttle and Price.....	2.20	53	Aug. 4	do.....	1.59	31.4
14	H. S. Price.....	2.22	57	22	do.....	1.46	24.6
16	A. H. Tuttle.....	2.38	72	26	do.....	1.30	20.5

^a Engineer, U. S. Bureau of Reclamation.

^b Possibly in error owing to meter trouble.

^c Trouble with plants in canal.

Daily discharge, in second-feet, of Fort Belknap canal near Chinook, Mont., for the period May 4 to Sept. 24, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1.....		49	49	31	15	16.....	52	71	37	29	16
2.....		50	51	32	14	17.....	58	79	42	25	16
3.....		48	50	31	14	18.....	56	77	45	27	16
4.....	38	49	50	32	14	19.....	55	72	48	27	16
5.....	57	52	50	27	14	20.....	55	78	52	27	16
6.....	58	52	48	26	13	21.....	55	78	52	27	16
7.....	64	52	48	28	14	22.....	52	74	53	24	16
8.....	68	51	41	30	15	23.....	53	68	45	22	16
9.....	76	51	39	30	16	24.....	53	58	35	21	16
10.....	66	53	38	31	16	25.....	50	54	36	19	-----
11.....	66	62	36	31	16	26.....	50	53	36	20	-----
12.....	63	53	37	30	16	27.....	49	56	34	20	-----
13.....	70	53	35	31	16	28.....	49	55	37	18	-----
14.....	64	54	35	30	16	29.....	50	52	34	18	-----
15.....	61	55	37	30	16	30.....	51	51	31	18	-----
						31.....	49	-----	32	15	-----

NOTE.—Boards removed from check weir below gage, June 15. Daily discharge ascertained by hourly method, June 4, 10, 11, 16-19, 23, July 8, 23, 29, and Aug. 16. Canal closed Sept. 25-30.

Monthly discharge of Fort Belknap canal near Chinook, Mont., for the period May 4 to Sept. 24, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 4-31.....	76	38	56.7	3,150
June.....	79	48	58.7	3,490
July.....	53	31	41.7	2,560
August.....	32	15	26.0	1,600
September 1-24.....	16	13	15.4	733
The period.....	-----	-----	-----	11,500

NEW PARADISE VALLEY CANAL NEAR CHINOOK, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 5, T. 32 N., R. 20 E., 500 feet above siphon, $1\frac{1}{4}$ miles below head gates, and 6 miles southeast of Chinook, Blaine County.

RECORDS AVAILABLE.—June 12, 1920, to August 13, 1921. During 1920 records obtained at site 200 feet below head gates.

GAGE.—Stevens eight-day water-stage recorder on right bank, referenced to staff gage.

DISCHARGE MEASUREMENTS.—Made from gaging bridge just above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of heavy clay with some gravel; subject to slight erosion at high stages. Control for open channel located at siphon 500 feet below, but check gates 2 miles below cause backwater when in use.

ACCURACY.—Stage-discharge relation unstable; subject to sudden changes due to variation in checks and quantity of water diverted above them. Rating for open channel poorly defined. Mean daily gage height ascertained from inspection of recorder graph. Daily discharge ascertained by indirect method or hourly method except for 20 days when mean daily gage height was applied to rating table. Records fair.

Canal diverts water from right bank of Milk River in NW. $\frac{1}{4}$ sec. 6, T. 32 N., R. 20 E., for irrigation in Paradise Valley south of river. Old Paradise Valley and Cook canals used as laterals for the new system.

Discharge measurements of New Paradise Valley canal near Chinook, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
May 4	H. S. Price.....	0.84	17.8	June 28	Tuttle and Grant.....	1.07	73
14	do.....	.20	5.7	July 1	E. L. Grant.....	1.00	75
19	Tuttle and Parker.....	.41	15.9	16	do.....	.00	19.5
June 2	A. H. Tuttle.....	.79	47.1	18	do.....	.48	31.7
9	Price and Tuttle.....	.74	34.7	19	do.....	.56	34.8
15	A. H. Tuttle.....	1.22	64	28	do.....	.31	28.6
17	do.....	2.05	105	Aug. 3	do.....	— .38	5.8
23	Tuttle and Grant.....	1.93	120	6	do.....	— .38	5.3
25	do.....	1.28	82				

* Engineer, U. S. Bureau of Reclamation.

Daily discharge, in second-feet, of New Paradise Valley canal near Chinook, Mont., for the period Apr. 25 to Aug. 13, 1921

Day	Apr.	May	June	July	Aug.	Day	Apr.	May	June	July	Aug.
1.....	-----	19	42	75	13	16.....	-----	5.3	81	30	-----
2.....	-----	20	46	75	8.6	17.....	-----	10	108	31	-----
3.....	-----	13	42	65	7.8	18.....	-----	2.5	67	33	-----
4.....	-----	18	28	65	7.1	19.....	-----	15	79	34	-----
5.....	-----	18	30	51	6.3	20.....	-----	7.8	102	30	-----
6.....	-----	22	27	54	5.6	21.....	-----	4.8	87	34	-----
7.....	-----	21	24	46	5.6	22.....	-----	2.0	84	38	-----
8.....	-----	28	27	48	5.6	23.....	-----	1.7	103	45	-----
9.....	-----	26	41	46	5.3	24.....	-----	1.5	114	57	-----
10.....	-----	18	65	43	5.0	25.....	-----	5	2.2	85	56
11.....	-----	8	81	52	5.0	26.....	-----	12	14	66	53
12.....	-----	20	68	63	5.0	27.....	-----	20	26	68	14
13.....	-----	14	62	63	4.8	28.....	-----	26	32	73	29
14.....	-----	7.4	67	51	-----	29.....	-----	13	24	69	20
15.....	-----	1.5	66	42	-----	30.....	-----	22	28	67	24
						31.....	-----	35	-----	25	-----

NOTE.—Discharge obtained by hourly method, May 19–21, 25, 26, 28–31; June 1, 3, 4, 6, 8, 9, 11, 12, 15–27; July 3–7, 11–14, 16, 20, 23–31; by indirect method, Apr. 25 to May 19, May 27 to June 30, and July 17–31, except days when hourly method was used.

Monthly discharge of New Paradise Valley canal near Chinook, Mont., for the period Apr. 25 to Aug. 13, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 25-30.....	26	5	16.3	194
May.....	35	1.5	15.0	922
June.....	114	24	65.6	3,900
July.....	75	14	44.9	2,760
August 1-13.....	13	4.8	6.52	168
The period.....				7,940

LODGE CREEK NEAR INTERNATIONAL BOUNDARY

LOCATION.—In SE. $\frac{1}{4}$ sec. 12, T. 1, R. 29 W. third meridian, at Willow Creek barracks of Royal Northwest Mounted Police, 1 mile north of international boundary, in Saskatchewan, Canada, 30 miles northwest of Havre, Mont.

DRAINAGE AREA.—806 square miles (measured by Reclamation Service, Department of the Interior, Canada.)

RECORDS AVAILABLE.—April 1, 1917, to September 30, 1921. April 25, 1910, to October 31, 1916, records obtained by Irrigation Branch, Department of the Interior, Canada.

GAGE.—Stevens continuous water-stage recorder installed in 1919 on right bank, referred to inside staff gage; inspected by W. B. Minhinick. Previous to 1919 inclined staff on right bank at same location.

DISCHARGE MEASUREMENTS.—Made from cable or by wading. Some low-water measurements made with weir.

CHANNEL AND CONTROL.—Composed of heavy boulders, gravel, and sand; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.14 feet at 6 p. m. April 16 (discharge, 1,110 second-feet); minimum stage, no flow October 1-31, March 1-3, August 3 to September 16, and September 20-30. 1917-1921: Maximum stage recorded, 12.90 feet March 31, 1918 (discharge estimated, 2,700 second-feet; stage-discharge relation affected by ice); minimum stage, creek dry several months each year.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Several small ditches divert water for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage discharge relation permanent except during period of ice effect. Rating curve well defined below 150 second-feet and fairly well defined between 150 and 900 second-feet. Mean daily gage height ascertained by inspection of recorder graph except March 4-14, May 12-18, 24-27, and June 16 to July 5, when staff gage was read. Daily discharge ascertained by applying mean daily gage height to rating table, except April 3-6 and 14-18, when hourly method was used.

COOPERATION.—Station maintained jointly with Dominion Water Power Branch, Department of Interior, Canada.

Discharge measurements of Lodge Creek near international boundary, during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 6	McDonald ^a and Errington ^a	-----	0.0	Apr. 28	H. S. Price	2.32	63
27	C. Errington	-----	.0	28	T. Hermann ^a	1.60	7.3
Nov. 10	do	-----	.0	June 11	H. S. Price	1.38	.87
Mar. 6	G. S. Wenden ^a	^b 2.06	40.0	July 2	T. Hermann	1.32	c .33
21	do	^b 1.45	2.4	6	do	1.23	c .23
22	H. S. Price	^b 1.40	2.0	22	do	1.30	c .31
31	G. S. Wenden	3.13	158	Aug. 10	do	-----	.0
Apr. 8	do	2.34	65	23	do	-----	.0
15	J. W. H. Wilkes ^a	6.07	823	Sept 18	W. S. McDonald ^a	1.11	d .01

^a Engineer, Dominion Water Power Branch, Canada.

^b Stage-discharge relation affected by ice.

^c Measured by weir.

^d Estimated.

Daily discharge, in second-feet, of Lodge Creek near international boundary for the year ending Sept. 30, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1.	0.0	119	47	5.0	0.50	0.02	-----
2.	.0	102	42	4.0	.31	.01	-----
3.	.0	260	36	3.4	.31	-----	-----
4.	29	562	34	2.5	.29	-----	-----
5.	27	485	33	2.2	.28	-----	-----
6.	47	319	45	1.91	.23	-----	-----
7.	28	139	51	1.36	.23	-----	-----
8.	19	75	92	1.10	.22	-----	-----
9.	7.7	52	313	1.10	.20	-----	-----
10.	4.4	38	870	.87	.20	-----	-----
11.	3.7	31	339	.87	.18	-----	-----
12.	2.8	24	152	.98	.25	-----	-----
13.	2.8	19	88	.87	.25	-----	-----
14.	1.42	180	64	.87	.22	-----	-----
15.	1.45	735	49	.87	.18	-----	-----
16.	2.6	1,074	71	.23	.18	-----	-----
17.	2.6	818	57	.32	8.2	-----	0.01
18.	2.4	518	49	53	9.1	-----	.01
19.	2.4	376	43	88	4.3	-----	.01
20.	2.4	365	40	49	1.91	-----	-----
21.	2.2	337	34	30	.63	-----	-----
22.	2.4	260	27	19.8	.31	-----	-----
23.	3.1	204	26	12.9	.27	-----	-----
24.	5.1	156	27	6.4	.23	-----	-----
25.	6.1	130	26	5.2	.20	-----	-----
26.	6.9	100	21	3.2	.20	-----	-----
27.	85	79	11.7	3.2	.20	-----	-----
28.	136	65	7.3	2.00	.20	-----	-----
29.	101	56	6.6	1.42	.16	-----	-----
30.	165	51	5.9	.50	.10	-----	-----
31.	180	-----	5.3	-----	.06	-----	-----

NOTE.—No flow Oct. 1-31, Mar. 1-3, Aug. 3 to Sept. 16, and Sept. 20-30. Stage-discharge relation affected by ice Nov. 1 to Mar. 26. Discharge not computed Nov. 1 to Feb. 28; computed Mar. 4-26 on basis of current-meter measurements, temperature records, and observer's notes.

Monthly discharge of Lodge Creek near international boundary for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March.....	180	0.0	28.4	1,750
April.....	1,074	19	258	15,400
May.....	870	5.3	89.4	5,500
June.....	88	.23	10.1	601
July.....	9.1	.06	.97	59.7
August.....	.02	.00	.00	0
September.....	.01	.00	.00	0
The period.....				23,300

BATTLE CREEK AT INTERNATIONAL BOUNDARY

LOCATION.—In SE. $\frac{1}{4}$ sec. 4, T. 1, R. 26 W. fourth meridian, one-fourth mile above point where creek crosses international boundary, in Saskatchewan, Canada, just across line from Buckley ranch, 35 miles north of Chinook, Mont.

DRAINAGE AREA.—730 square miles.

RECORDS AVAILABLE.—April 1, 1917, to September 30, 1921.

GAGE.—Stevens continuous water-stage recorder, referred to two vertical staff gages, one in well and one outside; inspected by John Buckley and Thomas Downen.

DISCHARGE MEASUREMENTS.—Made from cable 45 feet below gage or by wading; occasional low-water measurements by weir.

CHANNEL AND CONTROL.—Bed composed of heavy boulders with sand and gravel; not likely to shift except at extreme stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 4.71 feet at 7.30 a. m. April 17 (discharge, 690 second-feet); minimum stage, no flow October 1–27 and August 15 to September 25.

1917–1921: Maximum stage recorded, 8.50 feet April 13, 1917 (discharge, 3,200 second-feet); minimum stage, no flow during portions of each year.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Several small ditches divert water for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year except for period of ice effect. Rating curve fairly well defined between 5 and 400 second-feet. Mean daily gage height ascertained from inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Open-water records good for days when gage was in operation; other records fair.

COOPERATION.—Station maintained jointly with Dominion Water Power Branch, Department of Interior, Canada.

Discharge measurements of Battle Creek at international boundary during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 6	McDonald ^a and Errington ^a	-----	0.0	May 2	Price and Parker ^c	2.95	79
27	C. Errington	-----	0	28	Price and Tuttle	2.76	55
Nov. 9	do	^b 2.28	13.4	28	T. Herman ^a	2.75	50
Mar. 5	G. S. Wenden ^a	^b 2.86	47	June 19	A. H. Tuttle	2.35	11.4
12	do	^b 2.35	8.9	29	Tuttle and Grant	2.13	2.9
20	do	^b 2.47	17.3	July 6	T. Herman	2.14	3.6
30	do	^b 3.56	121	22	do	2.19	4.8
Apr. 6	do	3.95	339	Aug. 10	do	1.90	4.2
14	T. W. Wilkes ^a	3.02	81	23	do	1.51	0
				Sept. 18	W. S. McDonald	1.47	0

^a Engineer, Dominion Water Power Branch, Canada.

^b Stage-discharge relation affected by ice.

^c Engineer, U. S. Bureau of Reclamation.

^d Measured by weir.

Daily discharge, in second-feet, of Battle Creek at international boundary for the year ending Sept. 30, 1921

Day	Oct.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	-----	3.0	82	76	42	3.6	3.0	-----
2	-----	2.5	90	75	40	3.3	1.6	-----
3	-----	2.0	70	71	40	2.0	1.0	-----
4	-----	10.0	80	74	37	2.8	.55	-----
5	-----	46.0	115	71	34	4.2	.4	-----
6	-----	45.0	265	71	32	3.3	.3	-----
7	-----	45.0	240	75	29	3.9	.18	-----
8	-----	40.0	160	88	24	3.6	.25	-----
9	-----	30.0	77	107	21	4.0	.45	-----
10	-----	19.8	45	122	17.8	4.0	.35	-----
11	-----	10.3	73	123	14.4	4.0	.25	-----
12	-----	9.0	60	108	12.8	4.0	.18	-----
13	-----	10.3	78	95	11.2	4.0	.10	-----
14	-----	11.0	83	88	8.0	5.0	.02	-----
15	-----	12.3	101	84	5.9	150	-----	-----
16	-----	13.0	384	80	6.2	100	-----	-----
17	-----	13.7	610	75	12.0	20	-----	-----
18	-----	15.0	428	70	10.4	9.5	-----	-----
19	-----	15.8	300	68	12.0	7.5	-----	-----
20	-----	17.4	304	64	11.1	6.5	-----	-----
21	-----	19.8	396	63	10.2	5.5	-----	-----
22	-----	10.0	384	70	9.2	5.0	-----	-----
23	-----	13.0	279	71	8.3	3.3	-----	-----
24	-----	20.0	199	74	7.4	2.2	-----	-----
25	-----	50.0	146	64	6.5	1.45	-----	-----
26	-----	40.0	127	58	5.6	1.6	-----	3.1
27	-----	30.0	108	53	4.7	1.6	-----	6.2
28	3.0	70	94	53	3.8	1.15	-----	5.9
29	5.3	94	87	50	3.0	1.15	-----	5.3
30	5.6	122	82	45	2.8	1.3	-----	5.3
31	6.5	90	-----	44	-----	2.2	-----	-----

NOTE.—Discharge computed by hourly method Oct. 28 and Sept. 26; by indirect method, Oct. 29–31. Gage not operating June 20–28 and July 9–21; discharge interpolated or estimated by comparison with records of flow at another station on the stream. Stage-discharge relation affected by ice Mar. 1 to Apr. 12; discharge ascertained by study of temperature and gage-height records, current-meter measurements, and observer's notes. No gage-height record Nov. 1 to Feb. 28. No flow Oct. 1–27 and Aug. 15 to Sept. 15.

Monthly discharge of Battle Creek at international boundary for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	6.5	0.0	0.66	40.6
March.....	122	2.0	30.0	1,840
April.....	610	45	185	11,000
May.....	123	44	75.2	4,620
June.....	42	2.8	16.1	958
July.....	150	1.15	12.0	738
August.....	3.0	.0	.28	17.2
September.....	6.2	.0	.86	51.2

BATTLE CREEK NEAR CHINOOK, MONT.

LOCATION.—In sec. 3, T. 33 N., R. 19 E., at new highway bridge $4\frac{1}{2}$ miles north of Chinook, Blaine County, and 7 miles above junction with Milk River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 22, 1905, to September 30, 1921.

GAGE.—Chain gage on downstream side of bridge; read by Mrs. R. B. Snedecor. Prior to April 9, 1918, a chain gage on left bank 500 feet upstream, at same datum.

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

CHANNEL AND CONTROL.—Bed composed of sand; shifting. Banks high and not subject to overflow. At low water principal control is sand bar; no well-defined control at high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.95 feet at 9 a. m. April 19 (discharge, 641 second-feet); minimum stage, 0.12 foot August 29 to September 1 (discharge, 0.5 second-foot).

1905–1921: Maximum stage recorded, 16.50 feet March 31, 1918 (discharge estimated, 12,000 second-feet); minimum discharge, creek dry frequently during period.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Three canals divert about 20 second-feet above the station in the United States, and several small pumping plants supply water from above the station for irrigating the bottom land along the valley. About 15 ditches divert water from this creek in Canada. Below, Matheson canal diverts water used to irrigate land in Milk River valley near mouth of Battle Creek. For record of diversion by Matheson canal, see page 115.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by shifting control. Rating curve well defined between 12 and 2,300 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except October 1 to December 31 and June 6 to September 30, when indirect method was used. Records fair.

Discharge measurements of Battle Creek near Chinook, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 12	H. S. Price.....	1.08	55	June 15	A. H. Tuttle.....	0.42	11.5
16	Price and Parker a.....	1.44	99	22	Tuttle and Grant.....	.39	6.7
May 14	H. S. Price.....	1.72	136	July 18	E. L. Grant.....	1.30	86
30	A. H. Tuttle.....	1.04	55	28	do.....	.53	13.9
June 9	Tuttle and Price.....	.76	29.4	Aug. 6	do.....	.26	1.8

^a Engineer, U. S. Bureau of Reclamation.

Daily discharge, in second-feet, of Battle Creek near Chinook, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.7	0.8	1.4	10	248	113	42	4.2	7.8	0.5
2	.7	.8	1.6	10	138	97	38	4.5	6.0	.6
3	.7	.8	1.8	10	96	85	37	5.4	4.8	.6
4	.7	.8	4.2	11	80	88	35	4.8	3.3	.6
5	.7	.8	10	12	75	78	37	4.5	2.6	.6
6	.7	.8	11	12	125	75	36	4.2	2.0	.7
7	.7	.8	12	12	260	74	34	3.9	2.4	.8
8	.8	.8	15	12	203	80	33	3.6	2.4	.8
9	.8	.8	17	12	121	101	31	3.3	2.2	.8
10	.8	.8	16	12	75	174	28	3.3	1.8	.8
11	.7	.8	19	12	60	176	21	3.0	1.6	.8
12	.7	.8	20	12	55	213	18	3.0	1.4	.9
13	.7	.8	20		47	205	16	2.8	1.2	1.0
14	.7	.8	20		43	160	15	81	.8	.8
5	.7	.8	22		45	163	11	542	.7	.8
16	.7	.8	22		89	126	10	162	.6	.8
17	.7	.9			562	104	12	176	.6	.8
18	.7	.9			488	96	11	74	.6	.8
19	.8	1.0			373	84	9.4	47	.8	.8
20	.8	1.0			275	80	8.4	30	.8	.9
21	.8	1.0			329	74	7.5	19	.8	1.0
22	.8	1.0	15		377	73	6.6	15	.8	.9
23	.8	1.2			355	75	5.4	11	.8	.9
24	.8	1.2			333	84	5.4	9.4	.8	.9
25	.8	1.4			279	79	5.4	8.1	.6	.9
26	.8	1.4		121	223	74	5.4	16	.6	.9
27	.8	1.4	27	213	174	64	5.1	13	.6	.8
28	.8	1.4	28	165	144	61	4.5	22	.6	.8
29	.8	1.4	30	254	126	60	4.2	37	.5	.8
30	.8	1.4	30	279	113	49	3.9	19	.5	.8
31	.8		30	223		45		10	.5	

NOTE.—Stage-discharge relation affected by ice Dec. 17-26; discharge estimated. No record Jan. 1 to Feb. 28. Discharge not computed Mar. 13-25.

Monthly discharge of Battle Creek near Chinook, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	0.8	0.7	0.75	46.2
November	1.4	.8	.98	58.3
December	30	1.4	16.4	1,010
April	562	43	197	11,700
May	213	45	100	6,150
June	42	3.9	17.9	1,070
July	542	2.8	43.3	2,660
August	7.8	.5	1.66	102
September	1.0	.5	.80	47.4

MATHESON CANAL NEAR CHINOOK, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 29, T. 33 N., R. 20 E., at farm bridge over canal, one-fourth mile north of the main road and 3 miles east of Chinook, Blaine County.

RECORDS AVAILABLE.—April 10, 1905, to September 30, 1921 (irrigation season only).

GAGE.—Vertical staff nailed to post on right bank 10 feet below head gates of canal; read by Charles L. Cowan.

DISCHARGE MEASUREMENTS.—Made by wading below gage.

CHANNEL AND CONTROL.—Bed of canal composed of clay; no well-defined control.

Weeds grow in bottom of canal during summer.

ACCURACY.—Stage-discharge relation affected by slight shift due principally to weeds in canal. Rating curve fairly well defined between 2 and 16 second-feet. Gage read once daily to half-tenths, occasionally to quarter-tenths or hundredths. Daily discharge ascertained by applying daily gage height to rating table April 16 to May 25 and June 15–17; indirect method used for remainder of season. Records fair.

Canal diverts water from Battle Creek for irrigation of land on north side of Milk River Valley. Water can be wasted into a small tributary of Milk River.

Discharge measurements of Matheson canal near Chinook, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 16	Price and Parker °	5.80	14.2	June 21	Grant and Tuttle	5.05	1.7
22	H. S. Price	6.06	16.5	July 4	E. L. Grant	5.13	.0
May 26	Price and Tuttle	4.86	2.5	18	do	5.13	.6
June 2	A. H. Tuttle	5.00	4.4	28	do	5.51	5.6
17	do	4.92	3.1	Aug. 4	do	4.15	.0

° Engineer, United States Bureau of Reclamation.

° Stage-discharge relation affected by growth of weeds.

Daily discharge, in second-feet, of Matheson canal near Chinook, Mont., for the period Apr. 16 to Aug. 7, 1921

Day	Apr.	May	June	July	Aug.	Day	Apr.	May	June	July	Aug.
1		0.2	3.4	0.0	0.6	16	14	0.2	2.1	2.1	
2		.0	4.4	.0		17	25	.2	3.0	2.1	
3		.0	3.4	.0		18	26	.4	1.8	1.4	
4		2.1	3.4	.1		19	17	1.1	2.1	2.1	
5		8.4	2.5	.0		20	16	2.1	.8	2.1	
6		8.4	2.5	.2		21	14	2.9	1.3	2.1	
7		5.9	2.0	.4		22	17	2.9	.6	1.1	
8		3.8	2.4	.0		23	17	3.8	.6	1.4	
9		8.4	1.3	.0		24	13	2.5	.4	.4	
10		7.1	1.0	.0		25	9.8	2.1	.6	.0	
11		3.8	.1	.0		26	5.9	2.3	.6	.8	
12		4.3	.0	.0		27	4.8	1.8	.0	2.7	
13		2.9	.0	.0		28	2.9	1.2	.0	4.4	
14		1.4	.0	.0		29	1.4	1.5	.0	2.5	
15		.4	.8	3.8		30	.4	3.2	.0	2.5	
						31		4.2		1.1	

NOTE.—No flow after Aug. 1.

Monthly discharge of Matheson canal near Chinook, Mont., for the period Apr. 16 to Aug. 7, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 16–30	26	0.4	12.3	366
May	8.4	.0	2.89	178
June	4.4	.0	1.37	81.5
July	4.4	.0	1.07	65.8
August 1–7	.6	.0	.09	1.2
The period				692

HARLEM CANAL NEAR ZURICH, MONT.

LOCATION.—In SW. $\frac{1}{4}$ sec. 33, T. 33 N., R. 21 E., 500 feet below head gates of canal and $1\frac{1}{2}$ miles southeast of Zurich, Blaine County.

RECORDS AVAILABLE.—June, 1903, to September 30, 1921.

GAGE.—Vertical staff on right bank; read by John Palm. Stevens eight-day water-stage recorder placed 5 feet downstream from staff April 20, 1919, for use while water from St. Mary River is being turned into Milk River.

DISCHARGE MEASUREMENTS.—Made by wading or from gaging bridge 300 feet above gage.

CHANNEL AND CONTROL.—Bed of canal composed of earth. Checkweirs several miles below gage cause some backwater when used during high stages. Aquatic plants growing in canal during irrigation season may cause backwater.

ACCURACY.—Stage-discharge relation permanent during season. Rating curve well defined between 16 and 70 second-feet. Mean daily gage height determined from inspection of recorder graph, May 19 to August 26, except as indicated in footnote to table of daily discharge; rest of season from one or two readings on staff gage. Daily discharge ascertained by applying mean daily gage height to rating table except for a few days when the hourly method was used. Records good.

Harlem canal diverts water from Milk River for irrigation on north side of river near Harlem. Water can be wasted into Milk River but most of that diverted is used.

Discharge measurements of Harlem canal near Zurich, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 16	Price and Parker ^a	1.96	58	June 24	Tuttle and Grant.....	1.88	52
22	H. S. Price.....	2.98	104	28	do.....	1.77	45.8
May 5	do.....	2.89	88	July 1	E. L. Grant.....	1.56	36.3
18	do.....	1.56	38.9	16	do.....	1.47	36.7
18	Tuttle and Parker.....	1.55	38.6	25	do.....	1.34	31.7
26	Price and Tuttle.....	1.12	25.0	Aug. 1	do.....	1.38	33.7
29	A. H. Tuttle.....	1.40	35.5	7	do.....	1.18	27.4
June 3	do.....	1.93	51	9	do.....	1.02	21.8
6	do.....	1.85	53	22	do.....	.82	16.8

^a Engineer, U. S. Bureau of Reclamation.

Daily discharge, in second-feet, of Harlem canal near Zurich, Mont., for the year ending Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....		89	51	36	33	17	16.....	52	52	44	39	14	13
2.....		92	52	40	27	11	17.....	44	40	50	37	14	17
3.....		94	53	41	21	9.8	18.....	56	40	54	37	8.3	21
4.....		97	53	42	22	7.6	19.....	56	56	51	36	7.0	24
5.....		94	50	42	22	4.3	20.....	68	56	47	35	6.5	28
6.....		90	52	42	24	2.5	21.....	84	56	52	34	24	30
7.....		91	52	38	27	.8	22.....	94	57	49	34	21	29
8.....	19	92	52	36	25	.0	23.....	96	56	48	32	16	24
9.....	37	64	53	37	23	.0	24.....	91	57	47	30	13	21
10.....	37	72	52	36	22	.0	25.....	89	56	44	32	10	19
11.....	37	76	55	37	22	1.7	26.....	90	33	47	30	10	14
12.....	37	70	54	36	22	2.1	27.....	88	31	48	20	18	11
13.....	37	72	52	31	22	3.0	28.....	94	34	31	22	23	8.8
14.....	48	76	48	36	20	6.5	29.....	94	34	30	26	24	7.4
15.....	56	64	41	36	14	11	30.....	96	34	30	31	21	6.1
							31.....		43		32	19	

NOTE.—Discharge ascertained from one or two staff-gage readings daily, Apr. 8 to May 18, June 14, 15, 21, 22, 29, 30, July 1, 8-17, Aug. 15-22, and Aug. 27 to Sept. 30; by hourly method, May 19, 26, 30, 31, June 4, 5, 11-13, 16-20, 24, 26, 28, July 24, 26, Aug. 2, and 6. Water turned in April 8 at noon.

Monthly discharge of Harlem canal near Zurich, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 8-30.....	96	19	65.2	2,970
May.....	97	31	63.5	3,900
June.....	55	30	48.1	2,860
July.....	42	20	34.6	2,130
August.....	33	6.5	19.2	1,180
September.....	30	.0	11.7	696
The period.....				13,700

PEOPLES CREEK NEAR DODSON, MONT.

LOCATION.—On Fort Belknap Indian Reservation, 800 feet above United States Bureau of Reclamation diversion dam and 7 miles southeast of Dodson, Phillips County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 30, 1918, to September 30, 1919, and May 16 to September 30, 1921.

GAGE.—Overhanging chain gage on right bank; read by Mrs. A. J. Schulz.

DISCHARGE MEASUREMENTS.—Made by wading or from cable at gage.

CHANNEL AND CONTROL.—Bed composed of sand. Control is sand bar 100 feet downstream from gage; probably shifts; at high stages control is drowned out. Banks are fairly high but are overflowed at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.90 feet July 3 (discharge, 750 second-feet); minimum stage, no flow August 11 to September 12.

1918-1919 and 1921: Maximum stage recorded, 4.20 feet March 25, 1919 (discharge not determined); minimum stage, no flow at times during each year.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—No data.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve poorly defined.

Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records poor.

Discharge measurements of Peoples Creek near Dodson, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 27	Smyth and Smith ^a	3.02	35.6	May 16	Tuttle and Smith.....	0.98	25.2
Mar. 25	Price and Smith.....	2.18	52	July 11	Grant and Tuttle.....	.82	10.4

^a Engineers, U. S. Bureau of Reclamation.

Daily discharge, in second-feet, of Peoples Creek near Dodson, Mont., for the year ending Sept. 30, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1-----		2.4	270	3.6	-----	16-----	25	0.0	51	-----	1.4
2-----		2.8	452	2.0	-----	17-----	23	11	17	-----	1.7
3-----		3.6	750	1.7	-----	18-----	21	17	9.0	-----	1.7
4-----		2.4	275	1.4	-----	19-----	193	51	4.0	-----	1.7
5-----		5.0	111	1.4	-----	20-----	17	21	3.2	-----	1.4
6-----		11	99	1.1	-----	21-----	12	5.0	2.4	-----	1.1
7-----		5.0	61	.4	-----	22-----	12	.1	1.1	-----	.5
8-----		2.0	36	.3	-----	23-----	11	.0	1.1	-----	.2
9-----		1.1	8	.2	-----	24-----	9.0	116	.5	-----	.2
10-----		.5	12	.1	-----	25-----	8.0	84	.5	-----	.2
11-----		.4	11	-----	-----	26-----	6.0	9.0	.8	-----	.2
12-----		.3	9.0	-----	-----	27-----	4.0	3.2	1.7	-----	.1
13-----		.2	8.0	0.8	-----	28-----	2.8	.5	.4	-----	.1
14-----		.0	7.0	1.1	-----	29-----	2.4	.4	14	-----	.5
15-----		.0	116	1.4	-----	30-----	2.4	9.0	3.6	-----	.5
						31-----	2.4	-----	2.8	-----	-----

NOTE.—No gage-height record before May 16. No flow Aug. 11 to Sept. 12. Discharge June 26 estimated by ditch rider.

Monthly discharge of Peoples Creek near Dodson, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 16-31-----	193	2.4	21.9	695
June-----	116	.0	12.1	720
July-----	750	.4	75.5	4,640
August-----	3.6	.0	.39	24.0
September-----	1.7	.0	.49	29.2
The period-----	-----	-----	-----	6,110

FRENCHMAN RIVER AT INTERNATIONAL BOUNDARY

LOCATION.—In SW. $\frac{1}{4}$ sec. 4, T. 1, R. 10 W. third meridian, at Balls ranch in Saskatchewan, just across international boundary from sec. 6, T. 37 N., R. 34 E.

DRAINAGE AREA.—1,875 square miles (measured by Department of Interior, Canada).

RECORDS AVAILABLE.—April 1, 1917, to September 30, 1921.

GAGE.—Stevens continuous water-stage recorder referred to staff gage in well inspected by Mrs. W. B. Chamberlain.

DISCHARGE MEASUREMENTS.—Made from cable just above gage or by wading. CHANNEL AND CONTROL.—Principal control for low and medium stages is bar of boulders and gravel; at high stages control is drowned out.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.72 feet at 6 p. m. April 19 (discharge, 882 second-feet); minimum stage, no flow August 30 to September 11.

1917-1921: Maximum stage recorded, 9.99 feet April 30, 1917 (discharge, 2,780 second-feet); minimum stage, no flow July 28 to August 8, August 26 to September 30, 1919, October 1-8, 1919, March 1-12, 1920, and August 30 to September 11, 1921.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Several ditches divert water for irrigation in Saskatchewan 60 miles above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by ice and by shifting control.

Two rating curves used: One applicable October 1 to November 6 well defined; the other, applicable April 12 to September 30 fairly well defined between 10 and 300 second-feet. Mean daily gage height ascertained by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table, October 1–4, May 16–19, June 5–18, and June 29 to July 10; by hourly method, April 18, May 20, and June 19, 20; by indirect method for shifting control, October 5 to November 6, April 12 to May 15, and July 12 to September 30. Records fair.

COOPERATION.—Station maintained jointly with Dominion Water Power Branch, Department of Interior, Canada.

Discharge measurements of Frenchman River at international boundary during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Oct. 2	McDonald * and Errington *	<i>Feet</i>	<i>Sec.-ft.</i>	Mar. 29	W. S. McDonald	<i>Feet</i>	<i>Sec.-ft.</i>
22	C. Errington	1.76	2.5	30	do.	^b 3.17	130
Nov. 1	do.	1.98	12.8	31	do.	^b 3.15	129
Mar. 3	W. S. McDonald	2.03	16.2	Apr. 1	do.	^b 3.13	167
4	do.	^b 3.21	117	1	do.	^b 3.16	135
5	do.	^b 3.09	93	1	do.	^b 3.16	139
6	do.	^b 2.96	66	2	do.	^b 3.07	120
7	do.	^b 4.20	338	4	do.	^b 3.84	373
8	do.	^b 3.93	306	5	do.	^b 3.85	365
9	do.	^b 3.51	152	6	do.	^b 3.97	430
10	do.	^b 3.21	110	7	do.	^b 4.48	713
11	do.	^b 3.13	92	8	do.	^b 4.34	667
11	do.	^b 3.20	76	9	do.	^b 4.25	635
11	do.	^b 3.20	78	11	do.	^b 2.95	119
11	do.	^b 3.20	76	12	do.	3.27	202
12	do.	^b 3.03	45.0	13	do.	^b 3.29	216
14	do.	^b 3.48	61	15	do.	^b 3.12	176
15	do.	^b 3.59	75	16	do.	3.07	160
16	do.	^b 3.16	54	May 19	T. Hermann *	2.77	109
17	do.	^b 3.04	52	June 5	H. S. Price	2.36	53
18	do.	^b 3.47	120	July 10	Tuttle and Grant	1.92	16.0
19	do.	^b 3.43	202	15	T. Hermann	3.07	165
21	do.	^b 4.23	424	Aug. 6	do.	2.35	9.9
22	do.	^b 4.25	439	20	do.	2.21	2.0
26	do.	^b 3.69	262	Sept. 10	W. S. McDonald	2.00	^c 0.02
28	do.	^b 3.27	154	29	do.	2.36	13.2

* Engineer, Dominion Water Power Branch, Canada.

^b Stage-discharge relation affected by ice.

^c Estimated.

Daily discharge, in second-feet, of Frenchman River at international boundary for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	2.2	14.6	-----	199	136	124	62	17.2	17.8	-----
2.....	2.2	16.0	-----	150	120	116	60	24	16.6	-----
3.....	2.2	16.7	-----	118	321	114	58	17.2	16.6	-----
4.....	2.6	14.0	-----	93	398	111	55	28	14.2	-----
5.....	3.4	14.0	-----	66	364	109	53	22	12.5	-----
6.....	3.4	12.0	-----	352	429	106	53	20	9.4	-----
7.....	2.2	-----	-----	306	713	102	52	19.7	8.4	-----
8.....	1.75	-----	-----	152	667	99	51	19.1	7.0	-----
9.....	1.75	-----	-----	110	636	99	49	18.4	6.6	-----
10.....	1.97	-----	-----	91	373	100	44	17.2	5.8	-----
11.....	3.0	-----	-----	76	183	96	41	70	5.8	-----
12.....	3.8	-----	-----	43	231	92	39	159	5.0	1.7
13.....	3.4	-----	-----	53	237	92	40	542	4.6	6.2
14.....	4.2	-----	-----	57	265	94	38	449	3.6	5.8
15.....	5.8	-----	-----	76	195	109	35	181	3.9	6.2
16.....	6.4	-----	-----	54	166	124	29	135	9.4	18.4
17.....	7.1	-----	-----	52	146	124	35	120	4.3	30
18.....	7.9	-----	-----	120	590	114	37	85	2.9	23
19.....	7.9	-----	-----	216	850	109	112	52	2.9	16.6
20.....	12.0	-----	-----	390	732	314	273	35	1.7	17.2
21.....	12.6	-----	-----	424	492	178	118	22	1.9	14.2
22.....	11.4	-----	-----	442	400	120	106	19.1	1.5	12.0
23.....	14.0	-----	-----	390	299	109	91	16.6	1.5	12.0
24.....	14.9	-----	-----	340	240	100	78	14.7	1.1	11.5
25.....	15.8	-----	20	310	203	91	67	14.2	1.1	12.0
26.....	16.7	-----	175	260	181	85	56	15.3	.9	11.5
27.....	17.6	-----	300	210	161	79	47	32	.72	11.5
28.....	18.4	-----	250	140	144	74	38	28	.36	12.5
29.....	19.2	-----	-----	130	131	70	25	32	.18	13.6
30.....	19.0	-----	-----	130	124	67	17.2	26	-----	14.7
31.....	17.5	-----	-----	167	-----	64	-----	21	-----	-----

NOTE.—Stage-discharge relation affected by ice Feb. 25 to Apr. 11; discharge ascertained from current-meter measurements, hydrographs, temperature records, and observer's notes. No gage-height record Nov. 7 to Feb. 24, May 21 to June 4, and June 21-28; discharge May 21 to June 4 and June 21-28, computed from comparison with records for another station on the river. No flow Aug. 30 to Sept. 11.

Monthly discharge of Frenchman River at international boundary for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	19.2	1.75	8.46	520
November 1-6.....	16.7	12.0	14.6	174
February 25-28.....	300	20	186	1,480
March.....	442	43	184	11,300
April.....	850	120	338	20,100
May.....	314	64	109	6,700
June.....	273	17.2	62.0	3,690
July.....	542	14.2	73.3	4,510
August.....	17.8	.00	5.43	334
September.....	30	.00	8.35	497

BEAVER CREEK NEAR MALTA, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 30, T. 28 N., R. 33 E., at highway bridge at Hales Crossing; at site of proposed reservoir of United States Bureau of Reclamation, 28 miles southeast of Malta, Phillips County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 31, 1917, to September 30, 1921; fragmentary.

GAGE.—Chain gage on downstream handrail of bridge; read by Charles Hales.

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

CHANNEL AND CONTROL.—Channel is straight for 150 feet above and 200 feet below gage. Banks are high and practically without vegetation. Left bank is overflowed at gage height 18.5 feet. Control for low water is gravel and cobblestone bar 400 feet below gage; probably shifting. Above gage height 12.5 feet, river cuts across first oxbow loop below and has marked increase in slope.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.75 feet May 12 (discharge, 783 second-feet); minimum stage no flow June 6 and 7.

1917–1921: Maximum stage recorded, 19.5 feet April 6, 1917 (discharge, 4,990 second-feet); minimum stage, no flow during periods in each year.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Several diversions from tributaries above.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by ice and by a slight change in control. Rating curve well defined above 10 second-feet. Gage read to tenths once daily; occasionally twice daily. Daily discharge ascertained by applying daily gage height to rating table except during periods of ice effect. Records poor.

Daily discharge, in second-feet, of Beaver Creek near Malta, Mont., for the period Feb. 27 to Aug. 10, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Day	Mar.	Apr.	May	June	July	Aug.
1		20	9.5	6.5	37	28	16		264	54	24	42	
2		24	32	4.0	28	24	17		124	48	20	42	
3		28	92	4.0	264	24	18		100	28	28	37	
4		24	246	1.5	363	20	19		37	28	372	37	
5		16	264	1.5	354	24	20		32	24	558	28	
6		12.5	273	0	309	16	21		32	24	570	28	
7		4.0	354	0	282	16	22		28	24	479	28	
8		6.5	418	372	264	12.5	23		28	16	210	24	
9		4.0	484	228	183	9.5	24	246	24	16	116	24	
10		12.5	594	92	61	9.5	25	124	20	20	61	20	
11		32	674	37	61		26	92	12.5	24	61	20	
12		61	783	28	54		27	76	16	16	54	12.5	
13		174	674	28	54		28	68	16	12.5	48	28	
14		282	423	32	48		29	68	20	12.5	54	42	
15		282	61	28	48		30	54	16	9.5	61	48	
							31	54		9.5		54	

NOTE.—Stage-discharge relation affected by ice during winter; discharge, Mar. 24 and 25, estimated. No gage-height record Oct. 1 to Feb. 26, Mar. 9–23, and Aug. 11 to Sept. 30.

Monthly discharge of Beaver Creek near Malta, Mont., for the period Feb. 27 to Aug. 10, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 24–31	246	54	97.8	1,550
April	282	4.0	58.4	3,480
May	783	9.5	185	11,400
June	570	0	119	7,080
July	363	12.5	94.3	5,800
August 1–10	28	9.5	18.4	365
The period				29,700

BEAVER CREEK NEAR BOWDOIN, MONT.

LOCATION.—In SW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 16, T. 30 N., R. 32 E., at county highway bridge $2\frac{1}{2}$ miles southeast of Bowdoin, Phillips County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 9, 1920, to September 30, 1921, at present site March 21, 1918, to September 30, 1919, records obtained in sec. 23, T. 31 N., R. 32 E. Records at two stations not comparable.

GAGE.—Wire gage on upstream handrail of bridge; read by Boyd Morris.

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

CHANNEL AND CONTROL.—Bed of stream composed of clay, free from vegetation. Banks fairly high but subject to overflow at extremely high stages. No well-defined control. Overflow channel diverts water into Bowdoin Lake 1 mile above gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.40 feet, at 7 a. m. May 13 (discharge, 923 second-feet); minimum stage, no flow at times during most months.

1920-1921: Maximum stage recorded, 15.8 feet, June 20, 1920 (discharge, 3,720 second-feet); minimum stage, no flow at times during each year.

DIVERSIONS.—Numerous small diversions above station.

REGULATION.—None.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined above 36 second-feet and fairly well defined below. Gage read five times a week to hundredths below gage height 3.30 feet and to half-tenths above. Daily discharge ascertained by applying daily gage height to rating table except as indicated in footnote to daily-discharge table. Records poor.

Discharge measurements of Beaver Creek near Bowdoin, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 3	H. K. Smith ^a -----	1.68	17.5	July 7	Grant and Tuttle-----	^b 6.43	326
May 11	do-----	4.88	264	11	do-----	2.69	84
June 24	do-----	^b 6.02	246				

^a Engineer, U. S. Bureau of Reclamation.

^b Stage-discharge relation affected by drift lodged in fence below gage.

Daily discharge, in second-feet, of Beaver Creek near Bowdoin, Mont., for the year ending Sept. 30, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Day	Mar.	Apr.	May	June	July	Aug.
1-----		11	^a 0.2		220	0.0	16-----		280	83	0.4	546	
2-----		9.2	^a 1		^a 215	^a 0	17-----		165	34	^a .5	^a 407	
3-----		7.0	^a 0		^a 210	^a 0	18-----		46	33	^a .5	268	
4-----		4.6	^a 0		204	14	19-----		14	^a 18	^a 70	130	
5-----		2.4	^a 0		208	^a 7	20-----		9.0	3.8	138	81	
6-----		.6	^a 0		212	^a 3	21-----		^a 9.2	4.2	138	39	
7-----		.0	^a 3.1		329	^a 2	22-----		9.4	4.2	475	^a 20	
8-----		.0	6.2	(^a)	^a 304	^a 1	23-----		14	2.8	746	1.6	
9-----		.0	6.2	(^a)	280	^a .5	24-----		9.0	2.2	338	.7	
10-----		.0	^a 122	(^a)	235	(^a)	25-----		5.0	1.8	115	^a 3.6	
11-----		.0	238	(^a)	89		26-----		41	2.4	^a 70	6.4	
12-----		138	819	(^a)	93		27-----		56	1.0	.8	24	^a 10
13-----		240	923	(^a)	53		28-----		56	.6	^a .5	77	^a 13
14-----		374	870		24		29-----		25	.2	^a .2	147	17
15-----		286	451	0.3	794		30-----		21	.3	.0	204	^a 8.5
							31-----		15		^a .0		.0

^a Gage not read; discharge interpolated.

NOTE.—Discharge ascertained by indirect method for shifting control May 1-16 and June 19 to Aug. 10. No flow Oct. 1 to Dec. 31, June 1-14, and Aug. 10 to Sept. 30. No records Jan. 1 to Mar. 2 and Mar. 4-22.

Monthly discharge of Beaver Creek near Bowdoin, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 26-31.....	56	15	35.7	425
April.....	374	0	54.6	3,250
May.....	923	0	117	7,190
June.....	746	0	84.8	5,050
July.....	794	0	162	9,960
August.....	14	0	.89	54.7
September.....	0	0	.0	.0
The period.....				25,900

BEAVER CREEK NEAR HINSDALE, MONT.

LOCATION.—One-fourth mile south of northeast corner of sec. 28, T. 31 N., R. 35 E., at highway bridge on main road to Saco, half a mile north of railroad, 5 miles west of Hinsdale, Valley County, and 6 miles above mouth of creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 1, 1918, to September 30, 1921.

GAGE.—Wire gage on downstream side of bridge near left bank; read by A. S. Garcia.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Composed of gravel and boulders; not likely to shift. At high water brush and vegetation on banks may cause backwater.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.20 feet at 7.30 a. m. June 22 (discharge, 1,380 second-feet; stage-discharge relation affected by backwater from construction dam); minimum stage, no flow October 30 to November 2 and August 30 to September 10.

1918-1921: Maximum stage recorded, 16.55 feet August 23, 1918 (discharge, 2,580 second-feet); minimum stage, no flow July 19-23, August 15-21, August 26 to September 1, September 5-28, October 10, 1919, October 30 to November 2, 1920, and August 30 to September 10, 1921.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Numerous diversions above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by changes in construction dam 300 feet below gage. Rating curve well defined between 15 and 700 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except April 13 to July 14, when indirect method was used. Records fair.

Discharge measurements of Beaver Creek near Hinsdale, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 26	H. S. Price.....	3.18	106	June 22	Smith and Clarke ^b	9.97	1,340
Apr. 25	.....do.....	1.26	43.5	July 7	Grant and Tuttle.....	1.76	96
May 20	.....do.....	1.76	93	July 9	.....do.....	2.60	252
June 6	.....do.....	1.12	20.2				

^a Stage-discharge relation affected by ice.

^b Engineers, U. S. Bureau of Reclamation.

NOTE.—Measurements from Apr. 25 to July 7 affected by backwater from construction dam 300 feet below gage.

Daily discharge, in second-feet, of Beaver Creek near Hinsdale, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.6	0.0		132	17	18	104	1.8	0.0
2	.6	.0		128	13	17	72	1.0	.0
3	.7	.2		127	49	17	149	.9	.0
4	.5	.6		100	32	19	162	.8	.0
5	.6	2.0		93	12	12	108	.4	.0
6	.5	7.4		62	5.5	18	132	.5	.0
7	.4	2.4		55	3.6	19	101	24	.0
8	.4	1.4		54	2.6	14	192	31	.0
9	.3	.9		57	2.4	4.3	264	28	.0
10	.4	.8		70	114	2.8	308	29	.0
11	.4			39	285	2.2	340	28	1.2
12	.2			40	199	1.4	324	28	15
13	.2			127	160	1.6	224	28	25
14	.1			239	116	6.8	159	19	56
15	.2			221	146	28	172	2.0	18
16	.3			196	839	29	541	1.6	13
17	.2			236	551	54	1,290	2.4	4.9
18	.1			239	256	46	414	2.8	4.9
19	.1			216	148	82	216	2.0	3.6
20	.2			184	92	495	132	2.0	2.0
21	.2			151	80	774	100	2.0	1.6
22	.4			114	54	1,270	81	2.0	1.2
23	.3			87	39	261	54	2.0	1.2
24	.5			63	31	167	31	1.6	1.2
25	.3			47	38	271	28	1.4	.9
26	.4		106	36	26	250	31	1.0	.7
27	.3		108	29	25	263	33	.3	.4
28	.2		110	28	25	172	31	.3	.3
29	.1		111	29	36	114	17	.1	.3
30	.0		154	19	33	98	10	.0	.7
31	.0		197		29		4.3	.0	

NOTE.—Stage-discharge relation affected by ice during winter; discharge Mar. 26-28 and 30 ascertained from one current-meter measurement, temperature records, and observer's notes. Discharge not computed Nov. 11 to Dec. 31. No record Jan. 1 to Mar. 25.

Monthly discharge of Beaver Creek near Hinsdale, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	0.7	0.0	0.31	19.1
November 1-10	7.4	0	1.57	31.1
March 26-31	197	106	131	1,560
April	239	19	107	6,370
May	839	2.4	112	6,890
June	1,270	1.4	151	8,980
July	1,290	4.3	188	11,600
August	31	0	7.87	484
September	56	0	5.07	302

PORCUPINE CREEK AT NASHUA, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 31, T. 28 N., R. 42 E., 500 feet above ford, one-fourth mile above highway bridge, and three-eighths mile north of Nashua, Valley County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 11, 1908, to September 30, 1921.

GAGE.—Vertical staff nailed to trees on left bank; read by Mrs. Rosie L. Brocksmith.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge one-fourth mile below gage.

CHANNEL AND CONTROL.—Channel composed of heavy clay and fine gravel. Right bank high, wooded, and not overflowed; left bank is overflowed at high stages. Control at gravel bar 50 feet below gage; is drowned out at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.4 feet at 9 a. m. June 21 (discharge, 935 second-feet); minimum stage, 3.2 feet occurred frequently during year (discharge, 0.8 second-foot).

1908-1921: Maximum stage recorded, 18.0 feet April 11, 1916, determined by leveling from flood marks (discharge, from extension of rating curve, 2,700 second-feet); minimum stage, no flow for several periods during each year.

ICE.—Station not operated during winter.

DIVERSIONS.—During irrigation season canal of United States Bureau of Reclamation will divert entire flow above station.

REGULATION.—Reservoir of United States Reclamation Service on middle fork of stream partially regulates flood flow; storage capacity, 3,800 acre-feet.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined between 1.0 and 100 second-feet. Gage read to half-tenths once daily; twice daily during periods of rapidly changing stage. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Porcupine Creek at Nashua, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
Apr. 16	A. H. Tuttle	<i>Feet</i> 4.17	<i>Sec.-ft.</i> 21.2
June 4	H. S. Price	3.20	.8

Daily discharge, in second-feet, of Porcupine Creek at Nashua, Mont., for the year ending Sept. 30, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1		69	0.8	0.8	26	0.8	1.8
2		69	.8	.8	26	.8	1.8
3		90	.8	.8	459	.8	.8
4		79	.8	.8	114	.8	.8
5		54	.8	.8	64	.8	.8
6		39	.8	.8	54	1.8	.8
7		26	.8	.8	44	1.8	.8
8		18	.8	.8	30	3.0	3.0
9		15	.8	.8	22	3.0	1.8
10		12	.8	.8	16	3.0	7.3
11		14	2.4	.8	12	1.8	12
12		15	2.4	.8	11	1.8	12
13		39	2.4	.8	396	.8	12
14		34	.8	.8	34	1.8	9.5
15		26	.8	.8	18	.8	9.5
16		20	.8	.8	39	.8	9.5
17		15	.8	9.5	18	1.8	9.5
18		12	.8	133	12	1.8	9.5
19		8.4	.8	268	8.4	1.8	9.5
20		7.3	1.8	865	6.3	1.8	9.5
21		6.3	11	915	3.0	1.8	7.3
22		6.3	1.8	875	3.0	1.8	6.3
23		4.5	1.8	252	1.8	1.8	6.3
24		4.5	2.4	147	.8	.8	4.5
25		351	3.8	2.4	133	.8	4.5
26		576	3.8	2.4	79	.8	3.0
27		316	.8	1.8	30	.8	3.0
28		276	.8	1.8	44	.8	3.0
29		140	.8	.8	30	.8	3.0
30		196	1.3	.8	26	.8	3.0
31		204	.8	.8	.8	.8	

Monthly discharge of Porcupine Creek at Nashua, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
* March 25-31.....	576	140	294	4,080
April.....	90	.8	23.2	1,380
May.....	11	.8	1.60	98.4
June.....	915	.8	127	7,560
July.....	459	.8	46.0	2,830
August.....	3.0	.8	1.40	86.1
September.....	12	.8	5.54	330
The period.....				16,400

POPLAR RIVER BASIN

POPLAR RIVER NEAR POPLAR, MONT.

LOCATION.—In S. $\frac{1}{2}$ sec. 8, T. 28 N., R. 51 E., at camp of United States Bureau of Reclamation 5 miles north of Poplar, Roosevelt County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1921, at present site.

Records obtained August 15, 1908, to May 1, 1911, in S. $\frac{1}{2}$ 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 camp of United States Bureau of Reclamation in NE. $\frac{1}{4}$ sec. 4, T. 29 N., R. 51 E., 18 miles north of Poplar.

GAGE.—Chain gage on left bank; read by Frank Bogart.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge at Poplar.

CHANNEL AND CONTROL.—Bed composed of gravel, clay, and boulders; likely to shift slightly at extreme stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.90 feet at 8 a. m. June 21 (discharge, 1,620 second-feet); minimum stage, 4.70 feet September 1-9 (discharge, 6 second-feet).

1908-1921: Maximum stage recorded, 12.0 feet April 10, 1912; determined by leveling from flood marks (discharge, from extension of rating curve 10,000 second-feet); minimum stage, no flow December 16, 17, 1918; river frozen practically solid.

ICE.—Station not operated October 1 to March 23.

DIVERSIONS.—East and West Poplar River canals divert water above gage for irrigation. When system of reservoirs is completed about 28,000 acres may be irrigated.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined between 50 and 200 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Poplar River near Poplar, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 13	A. H. Tuttle.....	5.80	132
May 11	.....do.....	5.48	73
June 2	H. S. Price.....	5.37	64

Daily discharge, in second-feet, of Poplar River near Poplar, Mont., for the year ending Sept. 30, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1		318	74	68	144	55	6
2		258	74	66	132	52	6
3		239	74	62	132	46	6
4		185	74	55	122	44	6
5		170	68	46	122	41	6
6		120	62	41	112	36	6
7		73	62	41	104	36	6
8		56	62	41	95	36	6
9		83	62	41	88	41	6
10		110	68	36	88	32	12
11		130	68	29	80	32	19
12		98	68	27	80	27	25
13		132	68	27	74	27	34
14		116	68	23	185	27	38
15		112	68	27	402	27	46
16		104	68	34	336	27	52
17		104	68	34	306	25	59
18		104	62	624	290	23	59
19		104	62	602	239	23	62
20		104	68	412	211	23	62
21		104	74	1,520	185	21	70
22		95	74	1,120	137	19	88
23		95	88	536	95	18	116
24	888	92	95	472	88	16	109
25	1,300	88	104	521	78	13	92
26	822	80	112	336	68	12	83
27	382	80	137	276	74	12	80
28	267	80	144	233	68	11	78
29	513	80	116	185	62	9	74
30	468	80	88	155	57	9	74
31	326		74		57	9	

Monthly discharge of Poplar River near Poplar, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 24-31	1,300	267	621	9,850
April	318	56	120	7,140
May	144	62	79.2	4,870
June	1,520	23	256	15,200
July	402	57	139	8,550
August	55	9	26.7	1,640
September	116	6	46.2	2,750
The period				50,000

BIG MUDDY CREEK BASIN

BIG MUDDY CREEK AT RESERVE, MONT.

LOCATION.—In N. $\frac{1}{2}$ sec. 24, T. 33 N., R. 55 E., at highway bridge at Reserve, Sheridan County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 29, 1920, to September 30, 1921.

GAGE.—Wire gage on downstream guardrail of bridge; read by Carl Larsen. Prior to April 24, 1921, gage heights obtained by measuring down from bench mark. Datum unchanged.

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

CHANNEL AND CONTROL.—Bed composed of gravel and boulders in heavy clay. Banks subject to overflow at extreme stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.2 feet June 19 (discharge, from extension of rating curve, 1,070 second-feet); minimum stage, 2.3 feet October 11–22 (discharge, 3.9 second-feet).

1920–1921: Maximum stage recorded, 13.65 feet March 31, 1920; stage discharge relation affected by ice (discharge, from current-meter measurement, 1,280 second-feet); minimum stage, 1.6 feet August 26–29, 1920 (discharge, 0.8 second-foot).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by shifting control and by ice.

Two rating curves used. One curve, applicable October 1 to November 8, fairly well defined above 5 second-feet; other, applicable April 3 to September 30, fairly well defined between 20 and 700 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Big Muddy Creek at Reserve, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
Apr. 14	Tuttle and Kerr	Feet	Sec.-ft.
May 12	do	2.18	25.6
June 20	S. A. Kerr	2.32	31.8
		10.0	615

* Engineer, U. S. Bureau of Reclamation.

Daily discharge, in second-feet, of Big Muddy Creek at Reserve, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Apr.	May	June	July	Aug.	Sept.
1	15	13	70	31	31	81	24	14
2	13	11	70	31	30	73	23	13
3	13	9.5	71	32	29	71	23	13
4	11	9.5	67	36	28	* 66	23	* 12
5	* 9.5	6.5	55	34	* 28	* 60	* 23	12
6	8.0	6.5	55	29	28	54	* 22	* 12
7	8.0	* 6.5	55	60	36	* 54	* 22	12
8	6.5	6.5	63	* 60	* 36	53	22	* 12
9	4.7		51	60	36	55	22	12
10	4.7		34	59	36	* 50	21	* 18
11	3.9		31	79	38	44	20	24
12	3.9		31	* 60	* 38	172	21	28
13	3.9		31	42	38	424	19	33
14	3.9		28	27	40	354	* 20	35
15	3.9		33	* 28	49	151	20	35
16	3.9		32	28	52	163	20	41
17	3.9		42	28	110	* 136	19	50
18	3.9		41	28	222	110	18	50
19	3.9		32	28	1,070	106	19	59
20	3.9		36	31	711	100	18	57
21	3.9		39	31	446	79	18	67*
22	3.9		40	31	268	51	18	63
23	21		37	37	178	44	18	* 61
24	17		32	87	435	* 40	17	59
25	15		33	100	424	37	16	* 55
26	15		32	87	215	34	16	51
27	13		31	59	181	31	16	42
28	11		29	34	140	29	15	* 39
29	11		24	* 32	108	29	15	36
30	13		26	31	100	28	15	35
31	13			31		27	14	

* Gage not read; discharge interpolated.

NOTE.—Stage-discharge relation affected by ice Nov. 9 to Apr. 2; discharge estimated Apr. 1 and 2, not computed for remainder of period.

Monthly discharge of Big Muddy Creek at Reserve, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	21	3.9	8.68	534
November 1-8.....	13	6.5	8.62	137
April.....	71	24	41.7	2,480
May.....	100	27	44.2	2,720
June.....	1,070	28	173	10,300
July.....	424	27	90.8	5,580
August.....	24	14	19.3	1,190
September.....	67	12	35.0	2,080

BIG MUDDY CREEK NEAR CULBERTSON, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 20, T. 29 N., R. 54 E., 300 feet above ford at Kraft ranch, 11 miles above mouth, and 16 miles northwest of Culbertson, Roosevelt County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 19, 1909, to September 30, 1921, at present station; July 14, 1908, to July 19, 1909, records obtained at Boyd's ranch, 8 miles below.

GAGE.—Wire gage on left bank installed September 17, 1918, to replace inclined staff at same location and datum; read by Jacob Kraft.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge either 9 miles below or 20 miles above.

CHANNEL AND CONTROL.—Control is gravel and boulder bar; drowned out at high stages. Banks are of mud and are overflowed only at extreme stages. Aquatic plants growing in channel sometimes affect stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.58 feet March 26 (discharge, 868 second-feet); minimum stage, no flow September 6-11.

1909-1921: Maximum stage reported, 11.4 feet March 31, 1916 (discharge, 1,550 second-feet); minimum stage, no flow September 16-18, 1915, June 23 to July 3, 1920, and September 6-11, 1921.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Several small diversions above gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by slight change in control during winter. Two rating curves used: One applicable October 1 to December 3, well defined below 1,500 second-feet; other applicable March 21 to September 30, well defined between 50 and 1,500 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

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Discharge measurements of Big Muddy Creek near Culbertson, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge.
Apr. 15	A. H. Tuttle	<i>Feet</i> 2.98	<i>Sec.-ft.</i> 43.9
May 13	do	2.34	11.0
June 3	H. S. Price	2.30	10.7

Daily discharge, in second-feet, of Big Muddy Creek near Culbertson, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	14	12	14		175	7.9	13	142	16	0.6
2	19	12	16		165	8.5	12	142	14	.6
3	26	13	16		160	7.9	10	68	14	.4
4	26	13	16		155	7.9	10	68	13	.4
5	25	13			136	7.3	10	25	12	.4
6	24	14			127	7.3	9.4	25	11	.0
7	24	14			100	7.3	7.6	23	11	.0
8	20	13			77	7.0	5.2	23	10	.0
9	18	12			70	6.7	5.2	24	10	.0
10	18	12			70	22	4.0	26	7.0	.0
11	17	12			68	22	4.0	44	7.6	.0
12	16	12			68	20	4.6	50	7.6	.4
13	16	11			58	12	4.6	50	7.0	.8
14	15	10			57	12	4.6	52	4.0	1.2
15	14	10			36	12	5.2	806	4.0	1.6
16	10	9.4			30	11	6.4	815	3.6	1.6
17	8.5	8.8			28	10	6.4	242	3.6	2.0
18	8.2	8.2			26	7.0	7.0	206	3.6	2.0
19	7.6	8.8			22	8.2	7.0	115	3.6	2.4
20	7.0	9.4			22	9.4	806	75	2.4	2.8
21	7.0	9.4		499	18	8.2	824	56	2.4	3.2
22	7.0	8.8		534	16	8.2	828	44	1.6	3.6
23	7.6	8.8		648	16	8.2	837	33	1.6	3.8
24	7.6	9.4		659	13	9.7	850	32	1.6	4.0
25	8.8	9.7		703	14	12	740	30	1.2	4.6
26	8.8	10		868	11	14	696	26	1.2	5.2
27	9.1	11		499	9.7	39	667	23	1.2	5.8
28	9.4	12		329	9.1	40	476	22	1.0	7.0
29	10	12		258	7.9	18	476	20	.8	8.8
30	11	13		210	7.9	17	142	18	.8	10
31	11			186		15		17	.8	

NOTE.—Stage-discharge relation affected by ice during winter; discharge estimated Dec. 4. No record Dec. 5 to Mar. 20.

Monthly discharge of Big Muddy Creek near Culbertson, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	26	7.0	13.9	855
November	14	8.2	11.1	660
December 1-4	16	14	15.5	123
March 21-31	867	186	490	10,800
April	175	7.9	59.1	3,520
May	40	6.7	13.0	799
June	850	4.0	249	14,800
July	815	17	108	6,640
August	16	.8	5.78	355
September	10	.0	2.44	145

YELLOWSTONE RIVER BASIN

YELLOWSTONE RIVER NEAR CANYON HOTEL, YELLOWSTONE NATIONAL PARK

LOCATION.—Half a mile upstream from Upper Falls and Canyon ranger station, $1\frac{1}{4}$ miles south of Canyon Hotel, and 13 miles below outlet of Lake Yellowstone.

DRAINAGE AREA.—1,280 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 21, 1913, to September 30, 1921 (fragmentary).

GAGE.—Stevens continuous water-stage recorder installed July 31, 1920, 450 feet above Chittenden Bridge, to replace Friez recorder, which had been used since October 11, 1916; inspected by park rangers. For descriptions of earlier gages see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made by wading or from cable one-fifth mile above gage.

CHANNEL AND CONTROL.—One channel at all stages. Bed composed of gravel and boulders; control formed by upper portion of Upper Yellowstone Falls and is practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from water stage recorder, 3.45 feet June 19 (discharge, 5,480 second-feet); minimum stage, 0.47 foot March 11 (discharge, 704 second-feet). Smaller discharge probably occurred during period of no record.

1913-1921: Maximum stage recorded, 4.50 feet June 27, 1918 (discharge, 8,550 second-feet); minimum discharge, 664 second-feet September 6, 1919.

ICE.—Stage-discharge relation affected by ice; gage readings discontinued during winter.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1,000 and 6,000 second-feet. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph. Records good.

COOPERATION.—Gage-height record furnished by park rangers attached to Canyon ranger station.

Discharge measurements of Yellowstone River near Canyon Hotel, Yellowstone National Park, during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft</i>
July 3	A. G. Fiedler.....	3.09	4,640
..... 4	do.....	3.04	4,560
Aug. 26	I. L. Bryan.....	1.46	1,530

Daily discharge, in second-feet, of Yellowstone River near Canyon Hotel, Yellowstone National Park, for the year ending Sept. 30, 1921

Day	Oct.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.	1,300		806	887	3,270	4,790	2,490	1,460
2.	1,290		819	998	3,270	4,680	2,490	1,440
3.	1,270		819	1,070	3,380	4,680	2,400	1,440
4.	1,250		806	1,200	3,480	4,570	2,360	1,410
5.	1,230		806	1,390	3,580	4,460	2,260	1,370
6.			806	1,340	3,800	4,340	2,190	1,360
7.			806	1,390	3,910	4,240	2,150	1,320
8.			800	1,330	4,020	4,120	2,100	1,320
9.			800	1,230	4,240	4,120	2,070	1,310
10.			800	1,250	4,340	4,020	2,050	1,270
11.		704	793	1,380	4,570	3,910	2,000	1,260
12.		720	793	1,410	4,790	3,910	1,950	1,260
13.		845	793	1,450	5,020	3,910	1,920	1,240
14.		832	793	1,460	5,140	3,690	1,920	1,210
15.		832	800	1,480	5,250	3,690	1,910	1,190
16.		832	806	1,520	5,250	3,580	1,880	1,180
17.		859	806	1,630	5,360	3,480	1,840	1,170
18.		852	800	1,630	5,480	3,480	1,820	1,160
19.		845	800	1,670	5,480	3,380	1,780	1,160
20.		845	806	1,660	5,480	3,270	1,730	1,150
21.		901	800	1,730	5,250	3,170	1,700	1,120
22.		873	819	1,680	5,250	3,170	1,660	1,100
23.		832	838	1,800	5,250	3,070	1,600	1,100
24.		826	819	2,070	5,140	2,970	1,600	1,080
25.		859	812	2,200	5,140	2,970	1,600	1,070
26.		832	819	2,310	5,140	2,970	1,560	1,060
27.		819	812	2,400	5,020	2,870	1,540	1,050
28.		838	812	2,970	5,020	2,780	1,520	1,040
29.		826	819	2,970	4,900	2,680	1,500	1,010
30.		838	826	2,970	4,900	2,580	1,470	1,010
31.		812		3,170		2,580	1,460	

Monthly discharge of Yellowstone River near Canyon Hotel, Yellowstone National Park, for the year ending Sept. 30, 1921

[Drainage area, 1,280 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October 1-5	1,300	1,230	1,270	0.992	0.184	12,600
March 11-31	901	704	830	.648	.506	34,600
April	838	793	808	.631	.704	48,100
May	3,170	887	1,730	1.35	1.56	106,000
June	5,480	3,270	4,670	3.65	4.07	278,000
July	4,790	2,580	3,620	2.83	3.26	223,000
August	2,490	1,460	1,890	1.48	1.71	116,000
September	1,460	1,010	1,210	.945	1.05	72,000

YELLOWSTONE RIVER AT CORWIN SPRINGS, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 30, T. 8 S., R. 8 E., at highway bridge in canyon at Corwin Springs, Park County, 8 miles below Gardiner, northern entrance to Yellowstone National Park.

DRAINAGE AREA.—2,630 square miles.

RECORDS AVAILABLE.—September 2, 1910, to September 30, 1921.

GAGE.—Chain gage fastened to floor of bridge on downstream side near right bank; read by Mrs. Lena Bassett. Before October 25, 1911, staff gage set to same datum and fastened to pile besides concrete abutment on right bank.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge.
CHANNEL AND CONTROL.—Bed of stream composed of small rocks; apparently permanent. No well-defined control. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.3 feet June 12 (discharge, 19,300 second-feet); minimum stage, 0.75 foot January 7 (discharge, 890 second-feet).

1910-1921: Maximum stage recorded, 11.5 feet on June 14 and 15, 1918 (discharge, from extension of rating curve, 26,500 second-feet); minimum discharge January 8-10, 1920 (estimated because of ice effect, 720 second-feet).

Ice—Stage-discharge relation slightly affected by ice.

DIVERSIONS.—None from main stream above station.

REGULATION.—Yellowstone Lake furnishes natural but uncontrolled regulation.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 1,000 and 18,300 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table except on days of missing records, when discharge was interpolated. Records good.

The following discharge measurement was made by A. H. Tuttle:

August 14, 1921: Gage height, 2.65 feet; discharge, 2,670 second-feet.

Daily discharge, in second-feet, of Yellowstone River at Corwin Springs, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	1,900	1,400	1,220	960	960	1,040	1,070	1,600	11,600	8,230	3,330	2,050
2.....	1,900	1,400	1,220	960	960	1,040	1,070	1,960	10,400	8,230	3,330	2,050
3.....	1,900	1,400	1,220	960	960	1,130	1,180	2,740	11,000	7,220	3,120	2,050
4.....	1,900	1,400	1,220	960	960	1,130	1,260	3,060	13,400	7,220	3,120	2,140
5.....	1,800	1,400	1,220	960	960	1,130	1,140	4,420	13,700	7,220	3,060	2,140
6.....	1,800	1,400	1,220	960	960	1,140	1,140	4,600	14,900	6,730	2,930	2,030
7.....	1,800	1,400	1,140	890	960	1,140	1,130	4,070	17,100	6,490	2,930	2,030
8.....	1,750	1,400	1,140	960	960	1,140	1,010	4,420	17,700	6,370	2,860	2,030
9.....	1,750	1,400	1,140	960	960	1,100	1,010	3,610	18,300	6,020	2,800	2,010
10.....	1,700	1,400	1,140	960	985	1,080	1,140	3,470	18,300	6,020	2,800	1,990
11.....	1,700	1,260	1,010	910	985	985	1,140	3,610	18,900	6,020	2,800	1,900
12.....	1,700	1,310	910	920	985	985	1,180	3,750	19,300	5,590	2,680	1,900
13.....	1,700	1,310	910	930	960	1,010	1,220	3,900	18,900	5,380	2,680	1,900
14.....	1,700	1,310	910	940	1,070	1,100	1,220	4,070	18,300	5,280	2,680	1,900
15.....	1,700	1,310	910	950	1,010	1,070	1,220	4,600	16,400	5,180	2,580	1,780
16.....	1,700	1,310	922	960	1,010	1,070	1,310	4,980	14,900	5,080	2,560	1,780
17.....	1,700	1,310	935	960	910	1,070	1,310	6,490	13,400	4,790	2,490	1,720
18.....	1,700	1,310	935	910	910	1,070	1,310	6,490	12,500	4,600	2,470	1,720
19.....	1,700	1,380	960	910	910	1,070	1,310	6,490	11,900	4,420	2,450	1,700
20.....	1,600	1,400	1,010	910	960	1,070	1,360	5,590	11,000	4,240	2,430	1,700
21.....	1,600	1,310	1,010	910	960	1,100	1,310	5,380	10,700	4,070	2,300	1,700
22.....	1,600	1,220	1,010	910	960	1,140	1,220	5,590	11,300	3,900	2,270	1,700
23.....	1,600	1,220	1,010	960	985	1,160	1,420	6,610	11,600	3,750	2,250	1,700
24.....	1,600	1,220	985	960	985	1,080	1,400	8,230	11,300	3,750	2,230	1,700
25.....	1,600	1,220	985	960	1,010	1,070	1,310	9,030	11,200	3,750	2,210	1,640
26.....	1,500	1,220	960	960	1,010	1,010	1,260	9,030	10,600	3,680	2,190	1,600
27.....	1,450	1,220	960	960	1,010	1,010	1,220	11,900	9,870	3,610	2,140	1,580
28.....	1,450	1,220	960	960	1,010	1,040	1,180	15,500	9,310	3,610	2,190	1,560
29.....	1,400	1,220	960	960	-----	1,070	1,180	14,900	8,760	3,470	2,140	1,500
30.....	1,400	1,220	960	960	-----	1,070	1,140	11,600	8,490	3,400	2,120	1,460
31.....	1,400	-----	960	960	-----	1,100	-----	12,600	-----	3,330	2,080	-----

NOTE.—No gage-height record Dec. 16, Jan. 12-15, Feb. 8 and 9; discharge interpolated.

Monthly discharge of Yellowstone River at Corwin Springs, Mont., for the year ending Sept. 30, 1921

[Drainage area, 2,630 square miles]

Month	Discharge in second-feet				Run-off	
	Maximum	Minimum	Mean	Per square mile	Inches	Acre-feet
October.....	1,900	1,400	1,670	0.635	0.73	103,000
November.....	1,400	1,220	1,320	.502	.56	78,600
December.....	1,220	910	1,030	.392	.45	63,300
January.....	960	890	945	.359	.41	58,100
February.....	1,070	910	974	.370	.39	54,100
March.....	1,160	985	1,080	.411	.47	66,400
April.....	1,420	1,010	1,220	.464	.52	72,600
May.....	15,500	1,600	6,270	2.38	2.74	386,000
June.....	19,300	8,490	13,500	5.13	5.72	803,000
July.....	8,230	3,330	5,180	1.97	2.27	319,000
August.....	3,330	2,080	2,590	.985	1.14	159,000
September.....	2,140	1,460	1,820	.692	.77	108,000
The year.....	19,300	890	3,140	1.19	16.17	2,270,000

YELLOWSTONE RIVER AT FORSYTH, MONT.

LOCATION.—In SW. $\frac{1}{4}$ SW. $\frac{1}{4}$ sec. 14, T. 6 N., R. 40 E., at highway bridge at Forsyth, Rosebud County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 16 to September 30, 1921.

GAGE.—Cable gage fastened to upstream side of bridge; read by Andrew Anderson.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders. One channel at all stages. Left bank high; right bank protected by levee, but may be overflowed at flood stage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.10 feet at 1.20 p. m. June 21 (discharge, 49,200 second-feet); minimum stage 0.22 foot September 2 and 3 (discharge, 3,640 second-feet).

ICE.—None during period of record.

DIVERSIONS.—Numerous diversions above station for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent for period of record. Rating curve well defined between 3,000 and 50,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Gage heights furnished by city of Forsyth.

Discharge measurements of Yellowstone River at Forsyth, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
May 15.....	3.06	12,600
June 21.....	8.85	47,500
July 31.....	1.56	7,400

Daily discharge, in second-feet, of Yellowstone River at Forsyth, Mont., for the period July 16 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1-----		7,060	3,680	11-----		5,780	4,430	21-----	11,400	5,590	4,430
2-----		6,870	3,640	12-----		5,470	4,660	22-----	11,000	5,470	4,300
3-----		6,420	3,640	13-----		4,910	4,910	23-----	10,200	4,520	4,210
4-----		6,230	3,640	14-----		4,660	5,180	24-----	9,450	4,430	4,210
5-----		5,780	3,760	15-----		4,520	4,910	25-----	9,080	4,210	4,000
6-----		5,590	3,920	16-----	15,000	4,480	5,020	26-----	8,720	3,920	4,080
7-----		6,100	4,660	17-----	14,600	4,430	4,910	27-----	8,370	3,800	4,080
8-----		6,230	4,520	18-----	14,200	5,910	4,910	28-----	8,580	3,880	4,000
9-----		6,160	4,210	19-----	13,300	5,470	4,810	29-----	8,370	3,800	4,000
10-----		6,100	4,300	20-----	12,100	5,780	4,660	30-----	8,030	3,720	3,880
								31-----	7,510	3,680	-----

Monthly discharge of Yellowstone River at Forsyth, Mont., for the period July 16 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 16-31-----	15,000	7,510	10,600	336,000
August-----	7,060	3,680	5,190	319,000
September-----	5,180	3,640	4,320	257,000
The period-----				912,000

YELLOWSTONE RIVER AT INTAKE, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 36, T. 18 N., R. 56 E., at lower Yellowstone diversion dam at Intake, Dawson County, 18 miles below Glendive.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 1, 1911, to September 30, 1921 at present site. Records obtained by War Department and Department of Agriculture 1893 to 1903, and by Geological Survey August 1, 1903, to December 31, 1910, at Glendive.

GAGE.—Chain gage on left abutment of dam showing depth of water on crest; read by Matt Griebler, employee of United States Bureau of Reclamation.

DISCHARGE MEASUREMENTS.—Made from bridge at Glendive or from ferryboat 100 feet below dam.

CHANNEL AND CONTROL.—Dam forming the principal control is rock-filled timber crib structure on pile foundation, 700 feet long, crossing the river at right angles to current, and raising low-water level about 4 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.6 feet at 8.40 a. m. June 21 (discharge, 159,000 second-feet); minimum stage, 1.1 feet September 24-25 (discharge, 3,660 second-feet).

1903-1921: Maximum stage recorded in 1921; minimum stage, 0.7 foot July 17 to August 1 and August 19-25, 1919 (discharge, 2,270 second-feet).

ICE.—River freezes over dam and it is not known to what extent the stage-discharge relation may be affected.

DIVERSIONS.—Lower Yellowstone canal, which diverts water to irrigate 66,000 acres of land, heads at the left abutment of dam. Of several diversions from main stream above station United States Bureau of Reclamation Huntley project and Billings Carey Act project are the largest. There are also numerous diversions from tributaries.

REGULATIONS.—Yellowstone Lake and Shoshone reservoir form the only important regulation above, and control only a small part of the flood flow.

ACCURACY.—Stage-discharge relation permanent except during ice period. Rating curve well defined below 80,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Yellowstone River at Intake, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	6,740	6,740	10,500	6,240	5,760	43,600	38,800	7,800	4,040
2	6,740	6,740	15,200	6,740	5,760	45,700	38,100	8,650	4,040
3	6,740	6,740	14,800	6,740	5,300	45,700	40,800	8,940	4,040
4	6,240	6,740	11,500	6,240	5,080	42,200	34,300	8,080	4,040
5	6,240	6,740	12,500	6,240	4,860	39,400	32,000	7,530	4,040
6	6,240	6,740	12,200	5,760	4,650	41,500	29,600	7,260	4,040
7	6,740	6,740	11,100	5,760	4,440	50,100	26,400	6,740	4,040
8	7,260	6,240	11,500	5,760	4,860	53,000	23,900	6,240	4,040
9	7,260	6,240	11,800	6,240	6,240	56,800	20,400	6,240	4,040
10	6,740	6,240	10,200	5,760	9,540	65,200	19,000	5,760	4,040
11	6,740	5,760	9,540	5,530	12,900	72,200	18,200	5,530	4,040
12	6,740	5,760	10,800	5,300	17,700	73,000	17,700	5,530	4,040
13	6,240	5,760	11,100	5,300	20,900	76,800	16,800	5,760	4,440
14	6,240	5,760	9,240	5,300	23,900	81,600	15,600	5,530	4,860
15	5,760	6,240	7,800	5,300	17,300	88,000	14,800	5,300	5,080
16	6,240	6,240	7,530	5,300	12,500	84,800	13,600	5,300	4,860
17	5,760	6,740	7,260	5,300	11,800	83,200	13,200	5,300	4,650
18	5,760	6,740	7,000	5,300	11,500	83,200	12,900	5,760	4,440
19	5,760	6,740	6,740	5,300	12,500	118,000	12,200	5,760	4,440
20	5,300	6,740	6,240	5,300	14,800	135,000	11,500	5,530	4,440
21	5,300	6,740	6,740	5,300	16,400	142,000	11,500	5,300	4,240
22	5,300	6,740	7,000	5,530	19,100	68,300	10,800	5,300	4,040
23	5,300	7,000	6,740	5,760	21,400	51,500	10,500	4,860	3,850
24	5,760	7,260	6,240	5,760	25,900	44,300	10,200	4,860	3,660
25	6,240	7,000	6,000	5,760	23,900	41,500	10,200	4,860	3,660
26	6,240	6,740	5,760	5,760	20,400	40,800	9,540	4,860	3,850
27	6,240	6,740	5,760	6,240	21,400	46,400	8,940	4,440	4,040
28	6,740	6,740	5,760	6,240	27,500	42,900	8,650	4,440	4,040
29	6,740	6,740	6,240	5,760	33,100	40,800	8,360	4,440	4,240
30	6,740	6,740	6,240	5,760	36,200	39,400	8,360	4,440	4,440
31	6,740	-----	6,240	-----	41,500	-----	8,080	4,440	-----

NOTE.—Stage-discharge relation affected by ice during winter; discharge not computed Dec. 1 to Feb. 28.

Monthly discharge of Yellowstone River at Intake, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	7,260	5,300	6,280	386,000
November	7,260	5,760	6,560	390,000
March	15,200	5,760	8,820	542,000
April	6,740	5,300	5,750	342,000
May	41,500	4,440	16,100	990,000*
June	142,000	39,400	64,600	3,840,000
July	40,800	8,080	17,900	1,100,000
August	8,940	4,440	5,830	358,000
September	5,080	3,660	4,190	249,000

SHIELDS RIVER AT CLYDE PARK, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 33, T. 2 N., R. 9 E., at highway bridge 2 miles above mouth of Brackett Creek and one-fourth mile northwest of Northern Pacific Railway station at Clyde Park, Park County.

DRAINAGE AREA.—544 square miles (measured on topographic maps).

RECORDS AVAILABLE.—March 31 to September 30, 1921.

GAGE.—Cable gage attached to downstream side of bridge; read by Joseph J. Tecca.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—One channel at all stages; bed composed of clean, small gravel; may shift. Banks low and covered with timber and brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.14 feet at 7 a. m. June 9 (discharge, 1,190 second-feet); minimum stage, 1.06 August 9 (discharge, 5.4 second-feet).

ICE.—None during period of record.

DIVERSIONS.—Numerous diversions above and below gage for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during period. Rating curve well defined between 50 and 500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good, except for discharge below 50 second-feet.

Discharge measurements of Shields River at Clyde Park, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge	Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 31.....	1.48	72	June 18.....	2.32	419.
Apr. 26.....	1.78	165	July 26.....	1.44	61
May 21.....	2.34	456			

Daily discharge, in second-feet, of Shields River at Clyde Park, Mont., for the period Mar. 31 to Sept. 30, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....		94	140	560	86	36	38
2.....		155	127	539	67	33	40
3.....		240	148	584	163	26	47
4.....		231	163	667	295	21	56
5.....		159	274	860	360	21	56
6.....		148	305	890	407	19	58
7.....		130	360	790	497	16	58
8.....		121	477	974	730	10	61
9.....		94	703	1,180	649	5.4	63
10.....		118	632	1,050	539	16	63
11.....		118	553	1,010	407	19	63
12.....		121	484	860	321	20	63
13.....		133	413	800	279	22	65
14.....		152	425	750	264	19	69
15.....		191	348	721	226	19	76
16.....		199	343	616	187	16	76
17.....		199	316	504	166	16	74
18.....		195	300	425	144	16	79
19.....		195	407	383	124	15	81
20.....		195	451	354	105	16	81
21.....		191	464	326	97	15	76
22.....		183	490	254	84	19	76
23.....		191	511	226	76	20	76
24.....		187	497	212	76	21	76
25.....		163	539	191	72	24	76
26.....		159	649	183	56	22	76
27.....		155	760	159	49	22	76
28.....		152	694	111	49	27	76
29.....		152	640	108	47	30	76
30.....		152	584	99	43	34	76
31.....	76	532			41	34	

Monthly discharge of Shields River at Clyde Park, Mont., for the period Mar. 31 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	240	94	162	9,640
May.....	760	127	443	27,200
June.....	1,180	99	546	32,500
July.....	730	41	216	13,300
August.....	36	5.4	20.9	1,290
September.....	81	38	67.6	4,020
The period.....				88,000

BRACKETT CREEK NEAR CLYDE PARK, MONT.

LOCATION.—In NW. $\frac{1}{4}$ NE. $\frac{1}{4}$ sec. 2, T. 1 N., R. 8 E., at site of proposed storage dam 4 miles above mouth of creek and 5 miles from Clyde Park, Park County.

DRAINAGE AREA.—56.5 square miles (measured on topographic map).

RECORDS AVAILABLE.—March 30 to September 30, 1921.

GAGE.—Vertical staff on left bank in canyon at side of road; read by Mrs. Mary C. May.

DISCHARGE MEASUREMENTS.—Made by wading at gage or from bridge one-fourth mile above.

CHANNEL AND CONTROL.—Stream bed composed of gravel, boulders, and bedrock. Right bank covered with brush; road built in left bank. Water will flood the road at elevation of 5.00 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.02 feet at 7.30 a. m. May 9 (discharge, 179 second-feet); minimum stage, 0.40 foot at 7.30 p. m. August 31 and September 7 (discharge, 7.0 second-feet).

ICE.—Stage-discharge relation not affected by ice. Spring enters creek just above gage and channel remains open.

DIVERSIONS.—Numerous small ditches for irrigation both above and below gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 10 and 120 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Brackett Creek near Clyde Park, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 30.....	0.59	13.2	June 18.....	0.98	41.0
Apr. 26.....	.91	38.8	July 26.....	.57	11.8
May 21.....	1.46	102			

Daily discharge, in second-feet, of Brackett Creek near Clyde Park, Mont., for the period Mar. 30 to Sept. 30, 1921

Day	Mar.	Apr.	May	June	July	Aug.	Sept.
1		15	37	106	33	15	7.6
2		24	39	108	42	14	8.2
3		36	54	110	52	13	8.8
4		43	66	119	52	14	8.8
5		34	93	120	50	13	8.5
6		26	106	127	48	10	8.5
7		25	127	117	52	10	7.9
8		24	151	126	46	10	7.6
9		29	172	127	44	10	8.8
10		25	144	106	35	10	8.2
11		25	127	97	33	11	8.8
12		26	124	75	32	9.7	10
13		27	115	68	32	10	9.4
14		39	98	69	31	10	10
15		49	97	67	30	9.7	12
16		43	91	58	29	10	12
17		47	84	56	20	10	13
18		49	94	51	19	10	13
19		56	112	45	20	9.4	12
20		55	111	46	15	8.8	13
21		47	107	43	15	10	14
22		54	100	45	15	9.4	14
23		60	123	46	15	9.7	14
24		49	115	38	16	9.4	14
25		44	116	38	15	9.4	15
26		42	131	36	14	9.7	15
27		40	123	34	15	9.4	13
28		36	110	33	14	9.4	14
29		35	100	29	15	9.1	15
30	12	35	99	28	17	9.1	13
31	12		99		14	7.6	

Monthly discharge of Brackett Creek near Clyde Park, Mont., for the period Mar. 30 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April	60	15	38.0	2,260
May	172	37	105	6,460
June	127	28	72.2	4,300
July	52	14	28.4	1,750
August	15	7.6	10.3	633
September	15	7.6	11.2	666
The period				16,100

BIG TIMBER CREEK NEAR BIG TIMBER, MONT.

LOCATION.—Near center of SW. $\frac{1}{4}$ NE. $\frac{1}{4}$ sec. 6, T. 2 N., R. 14 E., at Iverson ranch, $2\frac{1}{2}$ miles below junction of forks of Big Timber Creek and 10 miles northwest of Big Timber, Sweet Grass County.

DRAINAGE AREA.—64 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 13, 1912, to September 30, 1921.

GAGE.—Vertical staff nailed to downstream side of left abutment of farm bridge, installed April 16, 1921; read by Iver Iverson. From April 5, 1918, to April 16, 1921, records from wire gage 500 feet below bridge, set to different datum. For description of earlier gages see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifting. Left bank is very high and clean; right bank low, wooded, and subject to overflow.

EXTREMES OF DISCHARGE.—Maximum discharge recorded during year, 442 second-feet at 8 p. m. June 8; minimum discharge, 11 second-feet March 28–30.

1912–1921: Maximum stage recorded, 6.9 feet July 15, 1918, determined from high-water marks (discharge, 1,960 second-feet); minimum discharge, 7 second-feet March 20, 1915.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Numerous irrigating ditches divert water above and below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and shifting control. Rating table used to April 15 well defined between 20 and 600 second-feet; table used April 16 to September 30, well defined between 5 and 200 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage height to rating table, except as indicated in footnote to table of daily discharge. Records good.

Discharge measurements of Big Timber Creek near Big Timber, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
Apr. 1	G. H. Ellis.....	<i>Feet</i> 1.34	<i>Sec.-ft.</i> 12.7	May 20	G. H. Ellis.....	<i>Feet</i> 1.94	<i>Sec.-ft.</i> 72
16	do.....	1.40	18.3	June 18	C. S. Heidel.....	2.50	196
May 15	W. A. Lamb.....	1.78	57	July 28	G. H. Ellis.....	1.72	25.8

Daily discharge, in second-feet, of Big Timber Creek near Big Timber, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	26	24	27	17	* 13	18	112	181	25	45
2.....	26	24	27	17	19	18	134	201	25	43
3.....	31	* 24	27	* 17	19	18	171	152	22	47
4.....	31	24	* 27	17	19	25	196	143	20	49
5.....	31	24	* 27	17	19	47	319	166	19	45
6.....	* 31	19	27	17	19	60	313	191	16	41
7.....	31	19	* 27		19	93	296	191	15	38
8.....	31	* 21	27		19	100	417	178	15	36
9.....	31	* 22	27		19	96	313	176	16	* 40
10.....	31	24	27	18	19	76	285	164	43	45
11.....	31		27		19	67	291	161	45	36
12.....	* 31				19	60	280	149	50	36
13.....	31	22		21	19	57	263	134	60	36
14.....	* 31			* 19	19	52	247	127	60	34
15.....	31		26	* 18	19	55	* 234	125	57	36
16.....	25	28		16	18	52	221	119	45	34
17.....	35	* 28		20	18	60	247	104	47	32
18.....	30	28	26	20	19	* 80	206	87	45	38
19.....	30	28	26	20	24	100	211	79	47	38
20.....	35	28		25	24	* 102	186	74	50	43
21.....	* 32	28		25	22	104	191	67	45	41
22.....	30	28	26	* 22	22	125	196	51	43	41
23.....	30	28		20	22	125	206	55	47	43
24.....	25	28		20	20	112	196	40	45	43
25.....	30	23	26	20	20	138	211	34	41	43
26.....	* 28	* 23	26	20	19	191	191	31	* 43	38
27.....	25	23	26	16	19	201	201	29	45	36
28.....	25	24	26	11	19	143	191	29	43	41
29.....	20	* 26	* 26	* 11	19	117	196	24	* 45	45
30.....	25	28	26	11	18	138	186	25	47	43
31.....	25		26	16		112		24	45	

* Gage-height missing; discharge interpolated.

NOTE.—Stage-discharge relation affected by ice during winter; discharge estimated Nov. 11–15, 28, Dec. 6, 9, 12–17, 20–24, 26, 27, 31, and Mar. 7–12. Stage-discharge relation affected by shifting control July 8 to Aug. 19; discharge computed by indirect method. Braced figures indicate mean discharge for periods included.

Monthly discharge of Big Timber Creek near Big Timber, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	35	20	29.2	1,800
November.....	28	19	24.5	1,460
December.....	27	26	26.4	1,620
March.....	25	11	18.1	1,110
April.....	24	13	19.4	1,150
May.....	201	18	88.5	5,440
June.....	417	112	230	13,700
July.....	201	24	107	6,580
August.....	60	15	39.1	2,400
September.....	49	32	40.2	2,390

SWEETGRASS CREEK ABOVE MELVILLE, MONT.,

LOCATION.—Near center of sec. 27, T. 5 N., R. 13 E., on T. S. Lavold's ranch, 9 miles northwest of Melville, Sweet Grass County.

DRAINAGE AREA.—59.6 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 21, 1913, to September 30, 1921; May 5, 1907, to December 31, 1912, records obtained at C. M. Rein's ranch in SW. $\frac{1}{4}$ sec. 24, T. 5 N., R. 12 E., 17 miles northwest of Melville. No diversions or tributaries between two stations.

GAGE.—Vertical staff on left bank three-fourths of a mile above house of T. S. Lavold, who reads gage:

DISCHARGE MEASUREMENTS.—Made by wading, or from bridge near observer's house.

CHANNEL AND CONTROL.—Bed composed of gravel and boulders; may shift during high water. Banks are high, not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.32 feet at 3.15 p. m. June 9 (discharge, 651 second-feet); minimum stage, 0.23 foot April 10-13 and 21-26 (discharge, 5.9 second-feet).

1907-1912: Maximum stage recorded at old section, 5.15 feet June 1, 1908 (discharge, 1,490 second-feet); minimum stage, 1.42 feet April 18, 19, 1911, and April 23-30, 1912 (discharge, 8.6 second-feet).

1913-1921: Maximum stage recorded at present site, 2.85 feet June 11, 1918 (discharge, 1,510 second-feet); minimum stage, 0.1 foot November 25-30, 1918 (discharge, 3 second-feet).

ICE.—Stage-discharge relation affected by ice during most winters.

DIVERSIONS.—Two small ditches divert water above gage; quantity diverted is negligible.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water in June. Both rating curves well defined between 10 and 780 second-feet; used October 1 to June 9 and June 10 to September 30. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Sweetgrass Creek above Melville, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge
Apr. 1.....	Feet 0.25	Sec.-ft. 11.3
May 20.....	1.28	153
July 28.....	.93	86

Daily discharge, in second-feet, of Sweetgrass Creek above Melville, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	25	19	19	15	14	8.0	6.5	7.1	215	232	78	40
2.....	17	19	19	14	14	8.0	7.7	7.1	243	226	75	40
3.....	25	19	19	14	14	8.0	7.1	7.1	258	226	72	40
4.....	25	19	13	14	14	8.0	7.1	5.9	434	226	69	38
5.....	25	19	13	14	14	8.0	7.1	5.9	519	232	67	38
6.....	25	19	13	14	14	8.0	6.5	7.1	532	232	67	38
7.....	25	19	13	14	14	8.0	7.1	8.4	457	232	65	38
8.....	25	19	13	14	14	8.0	7.1	26	532	226	65	38
9.....	25	19	13	14	14	8.0	7.1	30	651	226	65	38
10.....	25	19	13	14	14	8.0	5.9	28	519	226	64	38
11.....	25	19	13	14	13	8.0	5.9	29	457	226	64	38
12.....	25	19	13	14	13	8.0	5.9	23	457	232	64	40
13.....	23	17	13	14	13	8.0	5.9	32	422	240	64	40
14.....	23	17	13	14	13	8.0	6.5	104	258	240	62	40
15.....	23	19	13	14	13	7.4	6.5	104	229	240	59	40
16.....	23	19	13	12	13	9.4	6.5	104	222	246	56	40
17.....	23	19	13	12	13	13	6.5	108	236	150	56	40
18.....	23	19	13	12	13	13	6.5	113	243	136	56	40
19.....	23	19	13	12	13	13	6.5	117	215	124	56	40
20.....	23	19	13	12	12	16	6.5	151	215	120	54	40
21.....	23	19	13	12	14	15	5.9	222	212	102	51	40
22.....	23	19	13	12	14	15	5.9	236	212	102	51	38
23.....	23	19	13	12	14	16	5.9	258	218	102	51	33
24.....	23	19	13	14	14	16	5.9	282	218	99	51	33
25.....	23	19	11	14	14	16	5.9	299	226	96	47	33
26.....	23	19	11	14	14	16	5.9	308	226	90	47	33
27.....	19	19	15	14	14	16	6.5	274	226	90	47	33
28.....	19	19	15	14	8.0	16	7.1	258	226	86	44	33
29.....	19	19	15	14	-----	16	7.1	215	240	86	44	31
30.....	19	19	15	14	-----	16	7.1	222	246	84	42	31
31.....	19	-----	14	14	-----	16	-----	236	-----	81	40	-----

Monthly discharge of Sweetgrass Creek above Melville, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	25	17	22.9	1,410
November.....	19	17	18.9	1,120
December.....	19	11	13.7	842
January.....	15	12	13.5	830
February.....	14	8.0	13.4	744
March.....	16	7.4	11.5	707
April.....	7.7	5.9	6.52	388
May.....	308	5.9	123	7,560
June.....	651	212	319	19,000
July.....	246	81	170	10,500
August.....	78	40	57.8	3,550
September.....	40	31	37.4	2,230
The year.....	651	5.9	67.4	48,900

SWEETGRASS CREEK BELOW MELVILLE, MONT.

LOCATION.—In SW. $\frac{1}{4}$ sec. 27, T. 4 N., R. 15 E., at Crum's ranch, one-fourth of a mile above head of diversion canal of Big Timber Carey project and 6 miles southeast of Melville, Sweet Grass County.

DRAINAGE AREA.—137 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 1, 1909, to November 10, 1916, and August 8, 1917, to September 30, 1921 at present site; May 4, 1907, to April 1, 1909, at Adam's ranch $2\frac{1}{2}$ miles downstream.

GAGE.—Vertical staff attached to downstream face of wing dam, 200 feet upstream from observer's house; read by Ruth D. Crum.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge half a mile above gage.

CHANNEL AND CONTROL.—Bed composed of clean gravel; control is gravel riffle 40 feet below gage; shifting. Right bank low; subject to overflow during high stages; left bank high at gage; may be subject to overflow 300 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.85 feet at 8 a. m. June 9 (discharge, 735 second-feet); minimum stage, 1.27 feet May 4-5 (discharge, 16 second-feet).

1909-1921: Maximum stage recorded, 4.2 feet during high water of June, 1916, estimated from high-water marks (discharge, from extension of rating table, 1,700 second-feet); minimum stage, 1.12 feet August 16-18, 1919 (discharge, 8 second-feet).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—There are adjudicated rights of over 500 second-feet from Sweetgrass Creek; numerous ditches divert water both above and below station. Diversion canal of Big Timber Carey project, having capacity of 600 second-feet, diverts water half a mile below gage into two reservoirs of 6,000 and 12,000 acre-foot capacity.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by shifting control and by ice. Three rating curves used; one, applicable October 24 to November 28, fairly well defined between 40 and 600 second-feet; others, applicable April 16 to June 10 and June 11 to September 30, well defined between 20 and 300 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Sweetgrass Creek below Melville, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 1	G. H. Ellis.....	1.37	21.3	June 16	C. S. Heidel.....	2.74	209
16	Ellis and Heidel.....	1.34	18.8	July 28	G. H. Ellis.....	1.26	21.4
May 20	G. H. Ellis.....	2.11	104				

Daily discharge, in second-feet, of Sweetgrass Creek below Melville, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Apr.	May	June	July	Aug.	Sept.
1.....		42		18	282	187	16	22
2.....		42		18	278	322	15	23
3.....		35		17	337	261	34	25
4.....		28		16	379	194	40	26
5.....		31		16	515	207	42	25
6.....		28		18	503	286	38	25
7.....		26		26	483	364	35	25
8.....		31		62	603	345	33	23
9.....		33		71	667	304	34	27
10.....		34		43	587	264	43	30
11.....		35		26	579	240	46	31
12.....		37		23	507	213	48	31
13.....		35		20	467	213	49	31
14.....		33		61	439	213	46	31
15.....		32		74	387	175	45	34
16.....		31	19	82	372	152	40	32
17.....		29	19	89	427	131	29	30
18.....		28	20	96	311	131	25	24
19.....		37	20	115	296	117	24	23
20.....		26	20	108	220	104	24	23
21.....		28	19	172	203	76	24	23
22.....		30	19	282	213	68	22	24
23.....		32	20	275	223	58	23	25
24.....		37	27	19	233	213	55	23
25.....		33	26	19	244	240	50	21
26.....		33	32	19	372	227	37	23
27.....		37	30	19	455	197	22	19
28.....		37	47	19	333	187	20	27
29.....		42		19	268	187	18	26
30.....		29		17	282	184	16	25
31.....		37			250		16	23

NOTE.—Stage-discharge relation affected by ice during winter; discharge interpolated Nov. 10 and 13-17. No record Oct. 1-23 and Nov. 29 to Apr. 15.

Monthly discharge of Sweetgrass Creek below Melville, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October 24-31.....	42	29	35.6	565
November 1-28.....	47	26	32.3	1,790
April 16-30.....	20	17	19.1	568
May.....	455	16	134	8,240
June.....	667	184	357	21,200
July.....	364	16	157	9,650
August.....	49	15	31.0	1,910
September.....	34	22	26.4	1,570

EAST ROSEBUD RIVER NEAR ROSCOE, MONT.

LOCATION.—In NW $\frac{1}{4}$ sec. 31, T. 6 S., R. 18 E., at Branger's ranch, 7 miles above Roscoe, Carbon County.

DRAINAGE AREA.—98 square miles (measured on topographic map).

RECORDS AVAILABLE.—September 8, 1920, to June 30, 1921; fragmentary.

GAGE.—Overhanging cable gage on right bank; read by Mrs. D. N. Branger.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—One channel of clean gravel and boulders. No well-defined control. Banks high and wooded.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 6.3 feet at 6 a. m. June 12 (discharge, 1,980 second-feet); minimum stage, 1.42 feet February 27 and 28 (discharge, 25 second-feet).

ICE.—Stage-discharge relation slightly affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during period of record. Rating curve well defined between 20 and 300 second-feet. Gage read to hundredths once daily or tri-weekly October 8 to January 30; twice daily January 31 to March 31 and May 22 to June 30. Daily discharge ascertained by applying gage height to rating table. Records good for discharge below 400 second-feet.

Discharge measurements of East Rosebud River near Roscoe, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
Sept. 8	C. S. Heidel.....	Feet 2.48	Sec.-ft. 185	Jan. 31	G. H. Ellis.....	Feet 1.62	37.7
Oct. 8	.....do.....	1.92	75	Mar. 1	.....do.....	1.46	28.0
				May 19	.....do.....	2.75	277
				July 29	.....do.....	2.96	319

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of East Rosebud River near Roscoe, Mont., for the period Oct. 8, 1920, to June 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	May	June
1.....		44	44	33	39	28		540
2.....		44	^b 44	33	39	27		556
3.....		45	^b 44	33	38	28		690
4.....		45	44	33	40	28		822
5.....		45	42	33	39	28		939
6.....		46	^b 42	^a 33	40	28		1,060
7.....		47	^b 41	^b 33	40	28		1,150
8.....	75	47	41	33	41	28		1,460
9.....	75	48	^b 40	34	41	28		1,520
10.....	75	48	^b 40	33	39	28		1,530
11.....	75	47	39	35	39	28		1,750
12.....	72	47	40	44	40	28		1,850
13.....	69	47	39	39	40	28		1,640
14.....	69	48	38	37	40	28		1,440
15.....	67	49	^a 38	38	41	28		1,250
16.....	66	50	38	37	38	28		1,050
17.....	66	^a 52	44	35	37	28		965
18.....	63	54	39	35	38	28		894
19.....	62	50	39	34	39	28		777
20.....	59	48	^b 39	34	39	28		630
21.....	59	47	39	33	38	28		664
22.....	56	^b 47	^b 38	33	36	28	233	686
23.....	55	^b 46	^b 38	33	34	28	255	647
24.....	54	46	^b 38	33	30	28	261	606
25.....	51	^b 46	37	33	30	28	311	597
26.....	48	^b 45	^b 36	33	31	28	384	610
27.....	48	45	36	33	30	29	630	610
28.....	46	45	^b 36	33	28	28	614	593
29.....	45	^b 45	35	34		29	589	577
30.....	44	^b 44	^b 34	33		28	639	552
31.....	44		^b 34	41		29	601	

* Stage-discharge relation affected by ice; discharge interpolated.

^b Gage not read; discharge interpolated. No record Apr. 1 to May 21.

Monthly discharge of East Rosebud River near Roscoe, Mont., for the period Oct. 8, 1920, to June 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October 8-31.....	75	44	60.1	2,860
November.....	54	44	46.9	2,790
December.....	44	34	39.2	2,410
January.....	44	33	34.6	2,130
February.....	41	28	37.3	2,070
March.....	29	27	28.1	1,730
May 22-31.....	639	233	452	8,970
June.....	1,850	540	955	56,800

CLARK FORK NEAR CLARK, WYO.

LOCATION.—Sec. 8, T. 56 N., R. 102 W., at highway bridge 9 miles below mouth of canyon and 4 miles south of Clark, Park County. Nearest tributary, Pat O'Hara Creek, enters 400 feet upstream.

DRAINAGE AREA.—929 square miles (measured on base map of Wyoming; scale 1:500,000).

RECORDS AVAILABLE.—April 20, 1919, to September 30, 1921.

GAGE.—Gurley water-stage recorder installed April 24, 1921, referred to chain gage used previously; inspected by R. G. Hopkins. Datum lowered twice, but all gage heights have been referred to present datum.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders. Control is gravel bar several hundred feet downstream; apparently permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 7.35 feet at 2 a. m. June 12 (discharge, 10,500 second-feet); minimum discharge occurs during winter.

1919-1921: Maximum stage occurred in 1921; minimum discharge occurred during winter, when gage was not operated.

ICE.—Stage-discharge relation affected by ice; observations discontinued during winter.

DIVERSIONS.—One canal diverts water from Clark Fork just above station; maximum measured discharge, 34 second-feet. Prior to July 1, 1921, adjudicated diversions for 98 second-feet from Clark Fork below station in Wyoming, and 82 second-feet from tributaries above.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curves used October 1 to November 30, and April 1 to September 30, both well defined below 9,000 second-feet. Chain gage read to hundredths twice daily before April 24. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Clark Fork near Clark, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 24	J. B. Spiegel.....	0.91	288
June 15	P. V. Hodges.....	5.87	7,340
Sept. 18	.....do.....	.86	268

Daily discharge, in second-feet, of Clark Fork near Clark, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Apr.	May	June	July	Aug.	Sept.
1.....	362	213	290	301	4, 740	3, 420	990	390
2.....	342	185	262	594	4, 290	3, 330	920	386
3.....	330	243	264	1, 140	4, 650	2, 620	850	390
4.....	326	237	298	1, 270	5, 700	2, 260	795	485
5.....	322	228	298	1, 730	6, 520	1, 990	759	466
6.....	318	222	298	1, 920	6, 940	1, 990	702	448
7.....	318	219	301	1, 730	7, 820	2, 060	635	430
8.....	318	222	301	1, 800	8, 920	2, 190	576	412
9.....	306	188	304	1, 610	9, 260	2, 330	564	394
10.....	310	152	301	1, 430	9, 260	2, 400	546	376
11.....	314	185	308	1, 490	9, 700	2, 330	540	358
12.....	306	165	304	1, 350	9, 920	2, 330	540	354
13.....	294	158	308	1, 450	9, 480	2, 400	582	340
14.....	286	180	308	1, 470	8, 700	2, 330	614	322
15.....	286	201	362	1, 860	7, 160	2, 190	663	308
16.....	286	231	350	1, 800	5, 900	2, 120	663	298
17.....	286	240	298	1, 860	6, 310	2, 060	628	280
18.....	283	234	284	2, 280	5, 500	1, 860	570	268
19.....	283	228	271	2, 470	4, 740	1, 730	524	259
20.....	283	240	274	2, 120	3, 840	1, 610	487	265
21.....	272	222	287	2, 060	3, 840	1, 550	450	268
22.....	240	240	336	2, 260	4, 380	1, 440	450	271
23.....	234	210	370	2, 620	4, 930	1, 350	445	277
24.....	225	219	280	2, 760	5, 120	1, 240	435	274
25.....	249	210	259	3, 840	5, 310	1, 200	430	268
26.....	269	210	259	4, 110	4, 740	1, 180	422	262
27.....	258	213	250	5, 500	4, 200	1, 120	404	247
28.....	249	162	250	6, 100	4, 020	900	399	235
29.....	243	150	244	5, 120	3, 840	940	394	232
30.....	231	165	241	4, 930	3, 670	920	399	229
31.....	222	-----	-----	5, 310	-----	910	399	-----

NOTE.—No record Dec. 1 to Mar. 31. Discharge estimated or interpolated Apr. 1-2 and Sept. 5-10 when gage was not read.

Monthly discharge of Clark Fork near Clark, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	362	222	286	17, 600
November.....	243	150	206	12, 300
April.....	370	241	294	17, 500
May.....	6, 100	301	2, 460	151, 000
June.....	9, 920	3, 670	6, 110	364, 000
July.....	3, 420	910	1, 880	116, 000
August.....	990	394	573	35, 200
September.....	485	229	326	19, 400

CLARK FORK AT CHANCE, MONT.

LOCATION.—In NW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 32, T. 9 S., R. 22 E., at highway bridge at Chance, Carbon County, just above mouth of Sand Coulee, half a mile north of Wyoming-Montana boundary, and 10 miles south of Belfry, nearest post office.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 28 to September 30, 1921.

GAGE.—Vertical staff nailed to face of left abutment under bridge; read by E. E. Harkin.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—One channel straight for several hundred feet above and below gage. Bed composed of clean boulders and gravel. Both banks high and clean; may be overflowed at extreme stages. Control may be affected by debris deposited by Sand Coulee.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 2.08 feet July 28–30 (discharge, 858 second-feet); minimum stage, 1.10 feet September 30 (discharge, 226 second-feet).

ICE.—None during period of record.

DIVERSIONS.—Numerous irrigation ditches above and below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent for period of record. Rating curve well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records fair.

Discharge measurements of Clark Fork at Chance, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
July 28	Heidel and Kimball	<i>Feet</i> 2.08	<i>Sec.-ft.</i> 893
Aug. 18	A. H. Tuttle	1.64	470

Daily discharge, in second-feet, of Clark Fork at Chance, Mont., for the period July 28 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		841	450	11.....		718	370	21.....		523	287
2.....		841	443	12.....		695	359	22.....		516	278
3.....		824	430	13.....		695	354	23.....		516	268
4.....		816	430	14.....		642	354	24.....		509	260
5.....		798	418	15.....		614	343	25.....		495	251
6.....		798	412	16.....		593	332	26.....		495	243
7.....		774	406	17.....		565	327	27.....		488	239
8.....		758	394	18.....		537	316	28.....	858	476	230
9.....		734	388	19.....		523	311	29.....	858	476	230
10.....		718	376	20.....		523	297	30.....	858	469	226
								31.....	850	462	-----

Monthly discharge of Clark Fork at Chance, Mont., for the period July 28 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 28–31.....	858	850	856	6,790
August.....	841	462	627	38,600
September.....	450	226	334	19,900
The period.....				65,300

CLARK FORK AT EDGAR, MONT.

LOCATION.—In SW. $\frac{1}{4}$ SW. $\frac{1}{4}$ sec. 24, T. 4 S., R. 23 E., at highway bridge half a mile east of Edgar, Carbon County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 29 to September 30, 1921.

GAGE.—Wire gage with enamel scale, fastened to guardrail on downstream side of bridge; read by Lewis Bowen.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—No well-defined control; probably is channel for some distance below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 3.20 feet at 10.50 a. m. August 2 (discharge, 815 second-feet); minimum stage, 2.43 feet at 8.30 a. m. September 2 (discharge, 330 second-feet).

ICE.—No ice during period of record.

DIVERSIONS.—Numerous ditches divert water for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during period of record. Rating curve well defined between 300 and 6,500 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Clark Fork at Edgar, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
July 29	Heidel and Kimball	Feet	Sec.-ft.
Aug. 18	A. H. Tuttle	3.15	778
		2.78	538

Daily discharge, in second-feet, of Clark Fork at Edgar, Mont., for the period July 29 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1		677	340	11		523	453	21		436	409
2		815	330	12		493	470	22		426	404
3		778	355	13		487	475	23		404	404
4		762	376	14		505	404	24		392	420
5		733	392	15		568	464	25		360	409
6		670	414	16		594	453	26		360	420
7		656	404	17		587	448	27		350	398
8		642	376	18		523	431	28		355	398
9		568	398	19		487	431	29	778	376	392
10		529	414	20		481	420	30	733	392	398
								31	677	340	

Monthly discharge of Clark Fork at Edgar, Mont., for the period July 29 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 29-31	778	677	729	4,340
August	815	340	525	32,300
September	475	330	412	24,500
The period				61,100

ROCK CREEK AT ROCKVALE, MONT.

LOCATION.—Near west quarter corner of sec. 2, T. 4 S., R. 23 E., half a mile south of Rockvale, Carbon County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 6, 1920, to September 30, 1921.

GAGE.—Cable gage on upstream side of bridge near left abutment.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—One channel at bridge but it spreads over wide shallow control of clean gravel; not permanent. Banks low, wooded, and subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 4.40 feet at 6 a. m. June 12 when stage-discharge relation was affected by shifting control (discharge, 1,400 second-feet); minimum stage, 0.26 foot July 16 (discharge, 0.6 second-foot).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—During irrigation season practically entire flow is used above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by shifting control and by ice. Rating curve used October 6 to May 25, well defined between 110 and 400 second-feet; curve used May 26 to September 30 well defined between 10 and 800 second-feet and extended above and below these limits. Gage read to hundredths once daily October 6 to January 1 and March 3 to May 7; twice daily May 8 to September 30. Daily discharge ascertained by indirect method for shifting control May 26 to June 18; otherwise by applying gage height to rating table. Records fair.

Discharge measurements of Rock Creek at Rockvale, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 7	C. S. Heidel.....	2.52	132	May 18	G. H. Ellis.....	3.05	350
Jan. 10	G. H. Ellis.....	a3.36	73	June 20	do.....	2.76	631
Feb. 1	do.....	a3.13	100	July 29	C. S. Heidel.....	.62	b 7.0
Mar. 2	do.....	2.53	121	30	G. H. Ellis.....	.64	11.1

a Stage-discharge relation affected by ice.

b Estimated.

Daily discharge, in second-feet, of Rock Creek at Rockvale, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1		163	155	115	143	98	775	145	11	9.0
2			155	121	143	88	725	145	9.5	8.5
3			155	135	143	83	1,010	156	6.5	19
4			155	143	151	79	895	147	4.2	15
5			163	151	175	75	980	123	1.6	15
6	123		163	143	175	79	1,000	65	5.0	14
7	119		163	151	143	127	1,060	6.0	5.0	12
8	110			135	135	312	1,170	1.0	6.0	14
9	110			127	135	630	1,270	.8	25	17
10	110			135	135	559	1,300	1.0	22	22
11	110			135	171	397	1,320	.9	9.0	72
12	110			145	179	330	1,380	60	8.5	83
13	110			155	171	298	1,260	62	17	88
14	110			165	175	294	1,110	23	21	113
15	110			175	167	312	995	4.0	30	123
16	110			175	167	630	940	.6	28	113
17	115			175	175	294	1,000	1.4	4.8	102
18	123			179	175	366	1,010	2.0	3.0	95
19	131			215	159	496	768	5.5	2.8	78
20	131			175	143	415	526	17	1.4	80
21	131			143	143	370	340	22	1.4	83
22	123	163		127	127	392	308	27	1.8	86
23	110	163		143	135	415	316	28	2.6	95
24	110	155		143	112	460	308	22	7.5	95
25	110	139		143	112	505	308	16	8.5	74
26	123	139		151	108	550	286	8.5	9.0	65
27	123	139		135	108	640	279	17	10	60
28	123	147		108	112	785	272	25	18	55
29	123	155		135	108	775	216	11	16	55
30	123	155		127	108	755	165	10	15	53
31	163			135		755		13	10	

Monthly discharge of Rock Creek at Rockvale, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October 6-31.....	163	110	119	6, 140
March.....	215	108	146	8, 980
April.....	179	108	144	8, 570
May.....	785	75	399	24, 500
June.....	1, 380	165	776	46, 200
July.....	156	.6	37.6	2, 310
August.....	30	1.4	10.4	640
September.....	123	8.5	60.4	3, 590

PRYOR CREEK ABOVE PRYOR, MONT.

LOCATION.—In SW. $\frac{1}{4}$ sec. 31, T. 5 S., R. 26 E., on Crow Indian Reservation, one-fourth mile above headworks of Pryor Creek ditch and 8 miles southwest of Pryor, Big Horn County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 15 to September 30, 1921.

GAGE.—Stevens eight-day water-stage recorder on right bank, referred to staff gage with enamel face in the well; inspected by J. B. Campbell.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Bed of stream composed of large boulders and gravel. Control is rock ledge covered with gravel and boulders, 50 feet below gage; may shift slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.00 feet at 8 a. m. May 8 (discharge, 57 second-feet); minimum stage, 0.66 foot at 6 p. m. July 24 (discharge, 5.3 second-feet).

ICE.—Station not in operation during winter.

DIVERSIONS.—None above gage. Pryor Creek ditch diverts one-fourth of a mile below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during period of record. Rating curve well defined between 5 and 12 second-feet and fairly well defined above. Mean daily gage height determined from inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records excellent.

Discharge measurements of Pryor Creek above Pryor, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 15	W. A. Lamb.....	0.72	6.4	June 27	W. A. Lamb.....	0.87	8.7
May 14	do.....	1.40	25.7	Aug. 24	A. H. Tuttle.....	.73	6.3

Daily discharge, in second-feet, of Pryor Creek above Pryor, Mont., for the period Apr. 15 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1-----		6.2	13	8.8	5.8	5.9	16-----	6.1	22	9.6	6.9	6.9	7.3
2-----		6.5	12	9.4	5.6	6.2	17-----	6.2	20	9.9	6.7	6.7	7.2
3-----		6.8	12	9.6	5.6	6.5	18-----	6.1	20	9.9	6.4	6.7	7.2
4-----		7.1	11	9.0	5.6	6.5	19-----	6.1	21	10	6.4	6.7	7.2
5-----		7.4	11	8.6	5.8	6.9	20-----	6.2	18	9.9	6.1	6.5	7.3
6-----		7.7	11	8.4	5.8	7.0	21-----	6.1	17	9.4	6.1	6.5	7.2
7-----		11	10	8.4	5.6	7.1	22-----	5.9	17	9.2	5.9	6.4	7.0
8-----		49	10	8.1	5.9	7.2	23-----	6.2	16	9.0	5.9	6.2	7.0
9-----		44	10	8.3	6.5	7.3	24-----	6.1	15	9.0	5.5	6.4	7.2
10-----		44	9.9	8.3	6.7	7.4	25-----	5.9	15	9.4	5.6	6.1	7.0
11-----		42	9.4	8.3	6.5	7.5	26-----	5.8	12	9.2	5.9	6.1	7.0
12-----		34	9.0	7.7	6.5	7.5	27-----	5.6	12	8.6	5.8	6.1	6.9
13-----		28	9.2	7.5	6.5	7.5	28-----	5.6	11	8.6	5.6	6.1	6.9
14-----		25	9.4	7.3	6.5	7.5	29-----	5.6	9.4	8.4	5.6	6.1	7.0
15-----	6.1	23	9.6	7.0	6.5	7.5	30-----	5.9	9.9	8.4	5.5	5.9	7.0
							31-----		12		5.6	5.9	

* NOTE.—Gage not read Apr. 30 to May 5, Sept. 2, and 6-10; discharge interpolated.

Monthly discharge of Pryor Creek above Pryor, Mont., for the period Apr. 15 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 15-30-----	6.2	5.6	5.97	189
May-----	49	6.2	19.0	1,170
June-----	12.9	8.4	9.84	586
July-----	9.6	5.5	7.10	437
August-----	6.9	5.6	6.22	382
September-----	7.5	5.9	7.06	420
The period-----				3,180

PRYOR CREEK AT PRYOR, MONT.

LOCATION.—In NE. $\frac{1}{4}$ sec. 5, T. 5 S., R. 26 E., 100 feet above footbridge at Pryor, Big Horn County, on Crow Indian Reservation.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 19 to September 30, 1921.

GAGE.—Staff gage on left bank; read by J. B. Campbell.

CHANNEL AND CONTROL.—Bed composed of large boulders and gravel. Control of same material, 50 feet below gage; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.66 feet at 1 p. m. May 14 (discharge, by current-meter measurement, 40 second-feet); minimum stage, 0.86 foot June 24-25 (discharge, 3.4 second-feet).

ICE.—Station not in operation during winter.

DIVERSIONS.—Pryor Creek ditch diverts water 8 miles upstream for irrigation of land along east side of valley.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during period of record. Rating curve well defined between 5 and 50 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table except as indicated in table of daily discharge. Records good.

Discharge measurements of Pryor Creek at Pryor, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 15	W. A. Lamb.....	1.46	26.3	June 26	W. A. Lamb.....	0.97	6.3
May 14	do.....	1.66	40.5	Aug. 24	A. H. Tuttle.....	1.09	10.8

Daily discharge, in second-feet, of Pryor Creek at Pryor, Mont., for the period June 19 to Sept. 30, 1921

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1		6.5	8.9	10.6	16		9.6	10.3	12.8
2		7.5	8.9	11.4	17		9.6	10.3	12.6
3		11.8	8.2	11.8	18		9.6	10.4	13.0
4		9.6	8.6	12.6	19	4.9	8.9	10.6	13.0
5		7.5	8.2	13.0	20	4.4	8.6	10.6	12.6
6		8.6	8.6	11.8	21	3.9	8.6	11.0	12.6
7		8.2	8.2	11.8	22	4.3	8.6	10.3	12.6
8		8.2	8.6	11.8	23	3.9	8.6	10.3	12.6
9		7.8	9.2	11.8	24	3.4	8.6	10.6	12.6
10		7.8	9.6	12.6	25	3.4	8.6	11.8	11.8
11		7.8	9.6	13.4	26	6.5	8.9	11.8	11.4
12		10.3	9.6	13.4	27	6.5	8.6	11.8	11.8
13		10.3	9.6	13.4	28	6.2	8.6	11.8	12.6
14		9.6	9.6	13.4	29	6.2	8.6	11.4	12.6
15		9.6	10.3	13.1	30	6.5	8.9	10.6	13.4
					31		8.6	11.4	

NOTE.—Gage not read June 20, July 4, August 18, 26, Sept. 15, and 16; discharge interpolated.

Monthly discharge of Pryor Creek at Pryor, Mont., for the period June 19 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
June 19-30.....	6.5	3.4	5.01	119
July.....	11.8	6.5	8.79	540
August.....	11.8	8.2	10.0	615
September.....	13.4	10.6	12.5	744
The period.....				2,120

PRYOR CREEK AT COBURN, MONT.

LOCATION.—In SE. $\frac{1}{4}$ sec. 35, T. 1 S., R. 27 E., on Crow Indian Reservation at Coburn, Yellowstone County, 12 miles southwest of Billings and 13 miles above mouth of creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 13, 1911, to September 30, 1921.

GAGE.—Chain gage on left bank, opposite observer's house; read by H. R. Horsley and T. E. Edgar.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and clay. Control for low stages is gravel bar 300 feet below gage; at medium stage there is no well-defined control. Both banks high and not subject to overflow except at extreme stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.60 feet at 6.20 a. m. June 9 (discharge, 635 second-feet); minimum stage, 3.65 feet July 22 (discharge, 10 second-feet).

1911-1921: Maximum discharge recorded, 746 second-feet May 20, 1912; minimum discharge, no flow June 30, July 6-21, and July 25-31, 1919.

DIVERSIONS.—Water sufficient to irrigate approximately 1,000 acres near Pryor is diverted about 30 miles above Coburn.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 20 and 200 second-feet. Gage read to half tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Pryor Creek at Coburn, Mont., during the year ending Sept. 30, 1921

[Made by W. A. Lamb]

Date	Gage height	Discharge
Apr. 12.....	<i>Feet</i> 4.32	<i>Sec.-ft.</i> 54
May 13.....	4.55	74

Daily discharge, in second-feet, of Pryor Creek at Coburn, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Apr.	May	June	July	Aug.	Sept.
1.....	35	34	42	-----	39	137	17	13	20
2.....	31	36	44	-----	38	68	17	13	20
3.....	32	36	45	-----	38	53	39	12	20
4.....	30	37	45	-----	38	47	31	14	20
5.....	31	37	50	-----	38	45	30	13	23
6.....	28	39	50	-----	38	44	23	13	24
7.....	30	44	51	-----	42	55	20	13	24
8.....	33	45	58	-----	55	256	20	13	24
9.....	35	36	59	-----	145	486	17	14	28
10.....	32	37	55	-----	286	79	14	16	28
11.....	34	37	53	-----	129	55	14	17	28
12.....	36	36	55	45	90	45	31	17	28
13.....	35	37	55	53	77	45	32	17	28
14.....	34	42	58	47	68	42	17	17	28
15.....	35	45	59	42	63	38	14	17	31
16.....	35	44	55	44	63	39	14	17	31
17.....	37	45	58	44	66	38	14	17	31
18.....	39	45	53	42	66	38	13	17	31
19.....	42	43	55	42	66	34	12	17	31
20.....	40	40	53	42	66	37	12	17	31
21.....	39	36	53	44	63	32	12	17	31
22.....	36	37	53	42	61	30	10	17	31
23.....	36	37	55	42	59	20	11	17	31
24.....	36	40	58	42	55	20	12	17	31
25.....	37	44	53	42	51	20	12	17	31
26.....	37	42	53	42	47	20	12	17	31
27.....	38	44	53	42	42	20	12	17	31
28.....	37	44	58	42	38	17	12	17	31
29.....	37	44	59	42	39	17	12	20	31
30.....	40	42	58	42	47	45	12	20	31
31.....	33	-----	58	-----	224	-----	12	20	-----

NOTE.—No record Jan. 1 to Apr. 11.

Monthly discharge of Pryor Creek at Coburn, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	42	28	35.2	2,160
November.....	45	34	40.2	2,390
December.....	59	42	53.7	3,300
April 12-30.....	53	42	43.3	1,630
May.....	286	38	72.2	4,440
June.....	486	17	64.1	3,810
July.....	39	10	17.1	1,050
August.....	20	12	16.1	990
September.....	31	20	28.0	1,670

LOST CREEK NEAR PRYOR, MONT.

LOCATION.—In SE. $\frac{1}{4}$ sec. 34, T. 5 S., R. 26 E., 100 feet above intake to Lost Creek ditch on Crow Indian Reservation and 7 miles southeast of Pryor, Big Horn County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 27 to September 30, 1921.

GAGE.—Stevens eight-day water-stage recorder on right bank, installed September 17, 1921; inspected by J. B. Campbell. June 27 to August 25 temporary staff gage at same location, with datum 0.51 foot lower; August 25 to September 16 vertical staff with enamel face attached to gage shelter at datum of recorder.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of large boulders and gravel. Control is rock outcrop 10 feet below gage; will not shift but may be affected by growth of moss.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.81 foot June 27, 30, July 5 and 9 (discharge, 2.8 second-feet); minimum stage, 0.72 foot August 27 and September 7 (discharge, 1.9 second-feet).

ICE.—Station not in operation during winter.

DIVERSIONS.—None above station; practically entire flow is diverted in Lost Creek ditch for use during irrigation season.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined between 1.0 and 4.0 second-feet. Gage read to hundredths twice a week from June 27 to September 16. Mean daily gage height, September 17-30, determined from inspection of recorder graph. Daily discharge ascertained by applying gage height to rating table. Discharge interpolated for days of no gage readings. Records fair.

Discharge measurements of Lost Creek near Pryor, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
June 27	W. A. Lamb.....	Feet	Sec.-ft.
Aug. 25	A. H. Tuttle.....	0.81	2.8
		.74	2.1

Daily discharge, in second-feet, of Lost Creek near Pryor, Mont., for the period June 27 to Sept. 30, 1921

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1		2.8	2.4	1.9	16		2.6	2.3	2.0
2		2.8	2.4	1.9	17		2.6	2.2	2.0
3		2.8	2.4	1.9	18		2.6	2.2	2.1
4		2.8	2.4	1.9	19		2.6	2.2	2.1
5		2.8	2.4	1.9	20		2.6	2.2	2.1
6		2.8	2.4	1.9	21		2.6	2.2	2.1
7		2.8	2.4	1.9	22		2.6	2.2	2.1
8		2.8	2.4	1.9	23		2.6	2.1	2.2
9		2.8	2.4	1.9	24		2.6	2.1	2.2
10		2.8	2.4	1.9	25		2.5	2.1	2.3
11		2.7	2.4	1.9	26		2.5	2.1	2.3
12		2.7	2.3	2.0	27	2.8	2.5	2.0	2.3
13		2.6	2.3	2.0	28	2.8	2.5	2.0	2.4
14		2.6	2.3	2.0	29	2.8	2.4	1.9	2.4
15		2.6	2.3	2.0	30	2.8	2.4	1.9	2.4
					31		2.4	1.9	

Monthly discharge of Lost Creek near Pryor, Mont., for the period June 27 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
June 27-30	2.8	2.8	2.80	22.5
July	2.8	2.4	2.64	162
August	2.4	1.9	2.23	137
September	2.4	1.9	2.06	123
The period				444

WIND RIVER AT RIVERTON, WYO.

LOCATION.—T. 2 S., R. 4 E., at highway bridge three-quarters of a mile east of Riverton, Fremont County. Popo Agie River enters three-quarters of a mile below.

DRAINAGE AREA.—2,320 square miles (measured on base map of Wyoming; scale, 1: 500,000).

RECORDS AVAILABLE.—May 15, 1911, to October 31, 1912; April 1, 1915, to September 30, 1921. From May 14, 1906, to November 1, 1908, station maintained at Walker's ferry 1 mile above present station. No streams enter between; records directly comparable.

GAGE.—Friez water-stage recorder referred to chain gage used prior to April 4, 1917, and located on downstream side of first pier bent from left bank; inspected by employees of Bureau of Reclamation.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Control at gravel bar just below gage; shifting. Right bank will be overflowed at extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.7 feet from 6 to 10 p. m. June 8 (discharge, 12,200 second-feet); minimum discharge occurred during winter when stage-discharge relation was affected by ice.

1906-1908; 1911-1912; 1915-1921: Maximum discharge recorded, 12,300 second-feet on June 14, 1906. Minimum discharge, 226 second-feet or February 27, 1919 (current-meter measurement).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Water is diverted from Wind River and its tributaries for irrigation of about 35,000 acres. Under Wyoming law of 1 second-foot for 70 acres this would require 500 second-feet.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve used October 1 to May 28 well defined within range of stage; that used June 4 to September 30 well defined below 7,000 second-feet. Operation of water-stage recorder satisfactory during open-water season; chain gage read weekly during winter. Daily discharge during open-water flow ascertained by applying to rating table the mean daily gage height obtained by inspection of recorder graph. Open-water records excellent below 7,000 second-feet; above, fair.

Discharge measurements of Wind River at Riverton, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 15	P. V. Hodges.....	6.92	500	July 12	Comstock ^b and Web-ber.	8.46	2,480
Jan. 16	J. B. Spiegel.....	a 7.73	253	18	P. V. Hodges.....	8.40	2,430
Feb. 20	P. V. Hodges.....	a 7.30	272	Aug. 9	do.....	7.55	1,140
May 1	J. B. Spiegel.....	6.67	333	Sept. 28	do.....	6.84	490
June 24	P. V. Hodges.....	9.60	5,170				

^a Stage-discharge relation affected by ice.

^b Project manager for U. S. Bureau of Reclamation.

Daily discharge, in second-feet, of Wind River at Riverton, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	
1.....	585	530	275	278	268	335	270	345	5,960	4,000	1,610	1,100	
2.....	578						274	360	5,850	3,760	1,910	1,070	
3.....	562						288	466	5,800	3,410	1,760	1,080	
4.....	548						345	647	5,770	2,880	1,610	1,120	
5.....	534						534	840	6,240	2,320	1,400	1,090	
6.....	520	323	265	252	278	335	520	1,120	7,200	2,070	1,340	976	
7.....	506						408	1,240	9,620	1,990	1,270	881	
8.....	492						345	1,220	10,800	2,070	1,200	794	
9.....	499						340	1,090	10,300	2,070	1,140	731	
10.....	492						350	987	9,980	2,160	1,200	697	
11.....	520	288	246	265	278	335	345	921	10,300	2,410	1,200	706	
12.....	506						390	987	10,800	2,590	1,140	680	
13.....	506						345	1,110	11,200	2,590	1,200	664	
14.....	506						390	1,180	10,700	2,590	1,340	648	
15.....	499						450	1,350	10,300	2,590	1,760	624	
16.....	499	288	246	265	278	335	541	1,750	10,300	2,590	1,990	616	
17.....	472						335	499	2,140	10,200	2,500	1,790	585
18.....	466						336	492	3,250	7,880	2,500	1,580	548
19.....	499						335	499	3,230	6,240	2,410	1,380	518
20.....	555						325	485	2,580	5,180	2,410	1,180	511
21.....	570	288	246	265	278	335	320	446	2,220	4,500	2,320	1,100	504
22.....	562						315	414	2,170	4,500	2,240	1,050	511
23.....	548						310	426	2,270	4,630	2,160	1,010	511
24.....	541						310	440	3,400	4,900	1,990	1,000	511
25.....	492						310	414	3,660	5,040	1,910	1,020	504
26.....	513	288	246	265	278	335	378	3,276	4,900	1,840	1,070	504	
27.....	520						270	384	3,480	4,500	1,760	1,080	490
28.....	499						270	345	3,940	4,240	1,610	1,060	483
29.....	485						253	335	5,000	4,000	1,470	1,070	469
30.....	541						257	350	6,180	4,000	1,340	1,170	469
31.....	578					265	6,070		1,270	1,180			

NOTE.—Stage-discharge relation affected by ice Nov. 1 to Mar. 15; discharge based on temperature and gage-height records, two discharge measurements, and observer's notes. No gage-height record Apr. 1, 12-15, May 29 to June 3 and Aug. 17-19; discharge based on comparison with flow of Big Horn River at Thermopolis, Wyo. Braced figures show mean discharge for periods indicated.

Monthly discharge of Wind River at Riverton, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	585	466	522	32, 100
November.....			340	20, 200
December.....			270	16, 600
January.....			265	16, 300
February.....			280	15, 600
March.....			318	19, 600
April.....	541	270	401	23, 900
May.....	6, 180	345	2, 210	136, 000
June.....	11, 200	4, 000	7, 190	428, 000
July.....	4, 000	1, 270	2, 320	143, 000
August.....	1, 990	1, 000	1, 320	81, 200
September.....	1, 120	469	686	40, 800
The year.....	11, 200		1, 340	973, 000

BIG HORN RIVER AT THERMOPOLIS, WYO.

LOCATION.—In sec. 36, T. 43 N., R. 95 W., at highway bridge between Thermopolis and Hot Springs, Hot Springs County. Nearest tributary, Buffalo Creek, enters 3 miles upstream.

DRAINAGE AREA.—8,080 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 28, 1900, to December 31, 1905; June 30, 1910, to October 7, 1912; April 1, 1915, to September 30, 1921. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Chain gage on downstream handrail of bridge; read by Miss Gladys Johnson and Miss Hannah Radford. Staff gage used previously was set to datum 1.0 foot higher.

DISCHARGE MEASUREMENTS.—Made from two-span bridge.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control for low and medium stages a short distance below; shifts at intervals. High-water control is canyon entrance half a mile downstream. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year from high-water mark, 13.43 feet on June 10 (discharge, 20,700 second-feet); minimum stage, 0.86 foot at 5.30 p. m. December 18 (discharge, 333 second-feet).

1900–1905; 1910–1921: Maximum stage recorded in 1921; minimum discharge, 180 second-feet April 5, 1904.

ICE.—Stage-discharge relation slightly affected by ice for short periods.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 16 second-feet from Big Horn River above station and 214 second-feet below. In addition adjudicated diversion of 366 second-feet for power above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice for short periods. Rating curve used October 1 to June 9 and July 1 to September 30, fairly well defined below 10,000 second-feet. Curve used June 10 to June 30 poorly defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records below 10,000 second-feet, good; above, they are fair.

Discharge measurements of Big Horn River at Thermopolis, Wyo., during the year ending Sept. 30, 1921

[Made by P. V. Hodges]

Date	Gage height	Discharge	Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 19.....	1.88	976	July 27.....	3.04	2,250
June 23.....	5.78	7,920	Sept. 27.....	1.66	850
July 20.....	3.55	3,240			

Daily discharge, in second-feet, of Big Horn River at Thermopolis, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	892	1,040	470	475	502	2,220	590	660	10,300	6,840	1,660	1,240
2.....	868	990	486	530	502	1,790	625	660	10,500	6,670	2,380	1,240
3.....	852	584	611	475	425	1,790	590	660	11,000	5,520	2,220	1,240
4.....	860	625	639	475	402	1,790	590	660	9,640	5,020	2,220	1,240
5.....	876	1,120	639	475	400	1,530	740	780	8,980	4,860	2,220	1,410
6.....	828	990	632	530	400	1,290	900	945	9,970	4,520	1,790	1,410
7.....	812	963	684	590	394	1,240	990	1,240	12,900	3,860	1,790	1,410
8.....	812	900	700	500	395	1,240	900	3,540	15,700	3,700	1,790	1,240
9.....	836	840	554	465	400	1,180	820	4,690	19,700	3,540	1,530	1,240
10.....	844	650	508	435	410	1,130	820	3,700	20,700	3,370	1,530	1,080
11.....	868	412	508	410	425	1,080	860	3,200	20,200	3,200	1,530	1,080
12.....	860	380	566	390	450	1,040	820	2,540	19,800	3,700	1,530	900
13.....	836	400	572	385	500	945	820	2,380	20,200	3,860	1,530	1,080
14.....	860	435	554	390	560	1,040	860	2,380	20,500	3,860	1,530	1,080
15.....	860	530	597	425	820	945	860	2,380	19,700	3,700	2,070	900
16.....	844	700	578	450	1,100	860	900	2,710	18,600	3,700	2,880	820
17.....	860	772	475	560	1,660	820	945	2,880	18,300	3,540	3,040	820
18.....	876	876	335	590	1,180	740	1,080	4,360	16,900	3,540	2,540	860
19.....	828	999	330	560	1,080	820	1,080	5,840	13,900	3,370	2,540	860
20.....	844	963	315	560	945	820	1,080	5,680	11,300	3,370	1,930	860
21.....	990	927	315	780	740	780	1,080	4,360	9,800	3,370	2,070	860
22.....	1,080	1,020	315	860	700	700	990	4,360	8,200	3,200	1,410	860
23.....	999	1,070	300	860	625	700	990	3,540	7,720	3,120	1,410	990
24.....	1,020	876	315	780	560	660	900	4,360	8,200	2,880	1,410	990
25.....	981	788	315	625	530	660	900	6,500	8,360	2,540	1,410	1,180
26.....	963	748	315	402	1,790	660	900	6,010	8,840	2,380	1,410	860
27.....	981	716	345	450	2,540	625	860	5,840	8,520	2,380	1,290	860
28.....	999	732	380	450	2,070	625	780	5,840	7,880	2,220	1,410	860
29.....	918	780	480	560	-----	625	700	7,500	6,920	2,070	1,290	860
30.....	860	625	480	530	-----	590	660	8,820	6,920	1,790	1,290	860
31.....	836	-----	450	530	-----	590	-----	10,500	-----	1,660	1,530	-----

NOTE.—Stage-discharge relation affected by ice Nov. 8-10, 12-15, Dec. 19-27, Jan. 8-14, Feb. 5-13, 15-18; discharge based on one discharge measurement, and temperature and gage-height records. From May 5 to Sept. 30, gage heights read on gage of State Highway Department and referred to chain gage by means of relation curve. Shifting-control method used May 31 to June 9, July 1-10, July 23 to Aug. 5, and Sept. 16-30.

Monthly discharge of Big Horn River at Thermopolis, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	1,080	812	892	54,800
November.....	1,120	380	782	46,500
December.....	700	300	476	29,300
January.....	860	385	532	32,700
February.....	2,540	394	804	44,700
March.....	2,220	590	1,020	62,700
April.....	1,080	590	854	50,800
May.....	19,500	660	3,860	237,000
June.....	20,700	6,920	13,000	774,000
July.....	6,840	1,660	3,590	221,000
August.....	3,040	1,290	1,810	111,000
September.....	1,410	820	1,040	61,900
The year.....	20,700	300	2,380	1,730,000

BIG HORN RIVER NEAR HARDIN, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 19, T. 1 S., R. 34 E., at highway bridge on Crow Indian Reservation, half a mile above junction of Big Horn and Little Horn Rivers, 2 miles from Hardin, Big Horn County.

DRAINAGE AREA.—20,700 square miles.

RECORDS AVAILABLE.—June 16, 1904, to September 30, 1921.

GAGE.—Chain gage attached to downstream side of west span of highway bridge; read by H. R. Kean. For description of earlier gages see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed composed of clean gravel; slightly shifting. Banks high and not subject to overflow except at extreme stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.35 feet June 14 (discharge, 33,600 second-feet); minimum discharge, 1,010 second-feet December 23–25; stage-discharge relation affected by ice.

1904–1921: Maximum discharge recorded, 40,800 second-feet, June 17, 1908; minimum stage, 2.28 feet July 15–18, 1919 (discharge, 516 second-feet).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Water diverted a few miles above station by private company for irrigation of land on west side of river. Water is also diverted from Shoshone River at Corbett dam, Wyo., by United States Bureau of Reclamation, and many private ditches divert water from tributaries above station.

REGULATION.—Shoshone reservoir above Cody, Wyo., controls the flow of Shoshone River.

ACCURACY.—Stage-discharge relation affected by ice and by shifting control. Two rating curves used, one applicable October 1 to June 13, well defined between 1,200 and 24,000 second-feet; other applicable June 13 to September 30, fairly well defined between 2,000 and 16,000 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying gage height to rating table except as indicated in footnote to daily-discharge table. Records for open channel good; others fair.

Discharge measurements of Big Horn River near Hardin, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Dec. 28	W. A. Lamb	a 4.05	1,340	Feb. 26	H. S. Price	3.40	2,550
Jan. 20	do	a 3.83	2,590	May 13	W. A. Lamb	4.50	5,020
29	H. S. Price	a 3.69	2,210	June 26	do	7.05	15,400
Feb. 9	do	a 3.60	1,930	Aug. 19	A. H. Tuttle	3.74	2,580

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Big Horn River near Hardin, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,780	2,360	4,130	1,560	2,200	3,460	1,680	1,430	15,400	11,300	2,240	1,270
2	1,820	2,400	4,380	1,680	2,280	4,250	1,820	1,310	15,700	11,100	1,850	1,270
3	1,900	2,440	4,500	1,680	2,120	3,900	1,800	1,260	14,500	10,000	1,640	1,270
4	2,040	2,440	4,380	1,430	2,040	3,460	1,820	1,220	16,700	9,800	1,640	1,330
5	2,120	2,440	4,380	1,560	1,970	3,250	1,850	1,200	14,800	8,640	1,710	1,480
6	2,040	2,440	4,380	1,820	1,970	3,060	1,560	1,180	13,900	7,770	2,420	1,920
7	1,970	2,440	4,380	1,820	1,820	2,780	1,800	1,180	13,000	6,410	2,330	1,640
8	1,680	2,440	4,500	1,820	1,900	2,740	1,900	4,010	18,100	5,570	2,190	1,580
9	1,900	2,360	4,500	1,680	1,930	2,600	2,040	7,210	19,500	5,120	2,190	1,600
10	1,900	2,360	4,250	1,560	2,040	2,520	2,200	10,900	21,800	4,700	1,920	1,710
11	1,900	2,360	4,130	1,560	2,200	2,360	2,120	7,600	22,600	4,320	1,710	1,580
12	1,900	2,360	3,350	1,490	2,520	2,200	2,000	6,290	29,300	4,320	1,680	1,640
13	1,900	1,560	2,960	1,490	2,690	2,120	1,820	4,980	31,000	4,390	1,390	1,740
14	1,970	1,560	2,440	1,560	2,960	2,280	1,710	4,250	33,600	4,570	1,510	1,640
15	1,990	1,560	2,360	1,620	3,250	2,360	1,710	4,500	31,600	4,570	1,580	1,600
16	1,970	1,620	1,680	1,680	3,060	2,440	1,760	3,780	31,100	4,440	2,330	1,580
17	2,040	1,680	1,620	1,970	2,120	2,600	1,620	3,900	29,200	4,320	2,510	1,649
18	2,040	2,280	1,560	2,200	1,970	2,690	1,490	4,010	28,900	3,950	2,800	1,640
19	2,040	2,690	1,430	2,270	1,900	2,780	1,460	4,760	26,700	3,840	2,600	1,600
20	2,120	3,250	1,200	2,600	1,970	2,600	1,620	5,950	25,200	3,840	2,550	1,600
21	2,200	3,350	1,100	2,690	1,970	2,520	1,680	7,210	21,400	3,720	2,510	1,510
22	2,200	3,670	1,100	2,780	2,280	2,360	1,680	7,400	18,000	3,290	2,080	1,480
23	2,240	3,600	1,010	2,690	2,440	2,600	1,680	6,470	15,100	3,190	1,780	1,450
24	2,240	3,560	1,010	2,690	3,350	2,600	1,660	6,120	14,200	3,090	1,580	1,450
25	2,280	2,870	1,010	2,520	2,520	2,200	1,620	6,290	14,200	2,980	1,390	1,450
26	2,360	2,600	1,100	2,520	2,440	2,040	1,580	10,100	14,500	2,930	1,310	1,430
27	2,360	2,200	1,100	2,600	2,360	1,900	1,580	11,100	14,500	2,930	1,190	1,430
28	2,360	2,200	1,310	2,520	2,360	1,900	1,580	10,600	14,200	2,890	1,100	1,430
29	2,360	2,200	1,370	2,200	-----	1,900	1,580	10,600	13,900	2,800	1,100	1,430
30	2,360	3,150	1,500	2,120	-----	1,900	1,620	12,700	12,400	2,700	1,270	1,430
31	2,360	-----	1,560	2,200	-----	1,800	-----	15,700	-----	2,510	1,270	-----

NOTE.—Stage-discharge relation affected by ice Dec. 19 to Feb. 14, Feb. 18-24, and Mar. 10-24; discharge computed from five discharge measurements, temperature and gage-height records, and observer's note. Indirect method for shifting control used June 13-17.

Monthly discharge of Big Horn River near Hardin, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	2,360	1,760	2,070	127,000
November	3,670	1,560	2,480	148,000
December	4,500	1,010	2,570	158,000
January	2,780	1,430	2,020	124,000
February	3,350	1,820	2,310	128,000
March	4,250	1,800	2,580	159,000
April	2,200	1,460	1,730	103,000
May	15,700	1,180	5,970	367,000
June	33,600	12,400	20,200	1,200,000
July	11,300	2,510	5,030	309,000
August	2,800	1,100	1,850	114,000
September	1,920	1,270	1,530	91,000
The year	33,600	1,010	4,180	3,030,000

DINWOODY CREEK NEAR LENORE, WYO.

LOCATION.—In sec. 10, T. 5 N., R. 5 W., at highway bridge on road from Riverton to Dubois, 14 miles northwest of Lenore, on Wind River Diminished Reservation. No tributary between station and mouth, a quarter of a mile below.

DRAINAGE AREA.—114 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 15, 1918, to September 30, 1921. Station maintained at same site from January 16 to October 31, 1909.

GAGE.—Gurley water-stage recorder at left bridge abutment; referred to datum of gage used during 1909; inspected by Cloyd Miller.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders. Control consists of large boulders 25 feet downstream; fairly permanent. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.5 feet at 5 p. m. June 12 (discharge, 1,460 second-feet); minimum discharge, 8.2 second-feet January 14; from current-meter measurement.

1918-1921: Maximum discharge recorded in 1921; minimum discharge recorded in 1921.

ICE.—Stage-discharge relation affected by ice during winter.

DIVERSIONS.—One small ditch diverts water from Dinwoody Creek above station.

REGULATION.—Natural regulation to limited extent by Dinwoody Lake and numerous other small lakes on headquarters.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined below 800 second-feet. Operation of water-stage recorder satisfactory during open water. Chain gage read twice weekly during winter. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph, except as indicated in footnote to daily-discharge table. Records excellent except for winter and for discharge above 800 second-feet for which they are fair.

Discharge measurements of Dinwoody Creek near Lenore, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 14	P. V. Hodges	0.98	34.3	June 28	P. V. Hodges	2.66	636
Jan. 14	J. B. Spiegel	(a)	8.2	Aug. 5	do	2.25	343
Feb. 23	P. V. Hodges	1.88	12.0	Sept. 30	do	1.07	49.5
May 20	J. B. Spiegel	1.84	207				

^a Gage not read.

^b Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Dinwoody Creek near Lenore, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	50	36	}	}	}	}	14	20	408	870	442	385
2	48	35					14	19	353	690	442	390
3	46	33					14	19	331	538	402	391
4	44	25					16	19	319	402	362	371
5	43	25					17	19	348	323	358	289
6	40	28	}	18	12	13	17	20	474	292	358	246
7	38						18	28	1,260	303	335	192
8	37						19	37	1,210	340	327	154
9	35						18	47	1,210	408	344	126
10	35						18	57	1,210	487	353	117
11	40	18	}	}	}	15	18	61	1,310	545	353	107
12	39						18	61	1,410	626	371	96
13	38						18	62	1,360	626	413	90
14	37						15	64	1,310	660	468	83
15	41						14	76	1,160	652	487	78
16	38	}	}	10	11	14	23	94	1,210	643	461	72
17	37						15	22	1,260	652	390	76
18	38						16	22	189	940	660	73
19	38						14	22	201	690	652	299
20	39						13	22	201	560	643	60
21	39	30	}	}	}	13	22	177	468	690	284	62
22	38						14	22	157	442	690	292
23	39						14	22	154	508	634	308
24	39						13	22	180	600	592	315
25	37						13	22	174	740	584	344
26	36	28	}	14	12	14	21	180	740	584	371	47
27	35						15	21	195	670	545	362
28	35						16	20	267	652	474	365
29	35						16	20	367	720	435	350
30	35						16	18	435	880	435	370
31	37					15		435		435	375	46

NOTE.—Stage-discharge relation affected by ice Nov. 7 to Mar. 11; discharge based on two discharge measurements, temperature and gage-height records, and observer's notes. No gage-height record Oct. 1-13, Mar. 12, 14-15, 17, 19, 21, 22, 24, 26, 27, 29, 31, Apr. 1, 4, and Aug. 28 to Sept. 2; discharge based on comparison with flow of Bull Lake Creek near Lenore, Wyo. Braced figures show mean discharge for periods indicated.

Monthly discharge of Dinwoody Creek near Lenore, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	50	35	38.9	2,390
November			26.1	1,550
December			25.5	1,570
January			14.0	861
February			11.6	644
March			14.0	861
April	24	14	19.4	1,150
May	435	19	134	8,240
June	1,410	319	825	49,100
July	870	292	552	33,900
August	487	284	364	22,400
September	391	44	133	7,910
The year	1,410		180	131,000

DRY CREEK NEAR LENORE, WYO.

LOCATION.—In SW. $\frac{1}{4}$ sec. 12, T. 4 N., R. 5 W., half a mile above head of Dry Creek ditch and 12 miles west of Lenore on Wind River Diminished Reservation. Little Dry Creek enters 2 miles below.

DRAINAGE AREA.—73 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 19 to September 30, 1921.

GAGE.—Gurley water-stage recorder on left bank; inspected by United States Indian Service employee.

DISCHARGE MEASUREMENTS.—Made from cable 100 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders, which shift during extreme high water. No well-defined control. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from high-water mark, 3.9 feet about June 12 (discharge, 1,100 second-feet); minimum discharge occurs during winter.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—One small ditch diverts water above station.

REGULATION.—Diurnal fluctuation during spring from alternate melting and freezing of mountain snow. No artificial regulation.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used May 19 to June 4, fairly well defined, that used June 7 to September 30 well defined below 500 second-feet. Operation of water-stage recorder satisfactory except as indicated in table of daily discharge. Daily discharge except for days of missing gage height, ascertained by applying to rating table the mean daily gage height obtained by inspection of recorder graph. Records for discharge below 500 second-feet good, above, they are fair.

Discharge measurements of Dry Creek near Lenore, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 14	J. B. Spiegel		3	June 28	P. V. Hodges	1.96	270
Feb. 23	P. V. Hodges		2.2	Aug. 5	do	.92	65
May 19	J. B. Spiegel	1.20	82	Sept. 30	do	.30	15.0

* Estimated.

Daily discharge, in second-feet, of Dry Creek near Lenore, Wyo., for the period May 19 to Sept. 30, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1		192	238	103	54	16		545	166	58	22
2		212	220	104	53	17		555	160	57	20
3		183	160	90	53	18		505	158	55	20
4		207	126	76	52	19	80	465	150	52	20
5		670	112	62	45	20	71	425	146	49	19
6		900	122	59	40	21	75	385	146	48	19
7		1,000	134	55	38	22	112	350	140	49	19
8		950	146	53	33	23	130	315	125	48	18
9		900	154	55	32	24	140	280	112	49	18
10		850	162	55	30	25	130	250	109	48	17
11		805	185	53	27	26	130	238	103	48	17
12		1,050	175	55	28	27	150	250	94	46	16
13		805	175	57	26	28	150	259	86	50	16
14		670	175	58	25	29	162	256	77	58	15
15		585	175	58	23	30	197	250	77	56	15
						31	250		90	55	

NOTE.—No gage-height record May 24-31, June 5, 6, 8-10, 12-14, 16-18, 20-22, 24, 25, 27, July 6, 7, 27, 28, 30, 31, Aug. 3, 4, and Sept. 18-29; discharge based on comparison with flow of Dinwoody and Meadow creeks near Lenore, Wyo.

Monthly discharge of Dry Creek near Lenore, Wyo., for the period May 19 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 19-31.....	250	71	137	3,530
June.....	1,050	183	511	30,400
July.....	238	77	142	8,730
August.....	104	46	58.7	3,610
September.....	54	15	27.7	1,650
The period.....				47,900

BULL LAKE CREEK NEAR LENORE, WYO.

LOCATION.—Near north line of sec. 17, T. 3 N., R. 2 W., at highway bridge, 14 miles southeast of Lenore, on Wind River Diminished Reservation. No tributary between station and mouth, a quarter of a mile below.

DRAINAGE AREA.—132 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 18, 1918, to September 30, 1921. During 1909, eight discharge measurements made at same section.

GAGE.—Stevens water-stage recorder attached to downstream end of center pier of bridge, inspected by John Winchester.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of large boulders; probably permanent. Control at small rapids just below gage; slightly shifting at long intervals. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from high-water mark, 4.3 feet on July 12 (discharge, 2,950 second-feet); minimum stage, 0.49 foot March 21-25 (discharge, 18 second-feet).

1918-1921: Maximum discharge, 3,990 second-feet June 16, 1918; minimum discharge, 17.8 second-feet February 1, 1919, from current-meter measurement.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 3 second-feet above station.

REGULATION.—Natural regulation by Bull Lake, which has an area of 4 square miles.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined below 2,200 second-feet. Operation of water-stage recorder not satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph, except as indicated in footnote to daily-discharge table. Records excellent except for periods of no gage heights, for which they are fair.

Discharge measurements of Bull Lake Creek near Lenore, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 14	P. V. Hodges.....	0.87	84	May 14	J. B. Spiegel.....	1.45	245
Jan. 14	J. B. Spiegel.....	(a)	33.8	June 27	P. V. Hodges.....	3.17	1,670
Feb. 22	P. V. Hodges.....	.60	32.0	Aug. 4	do.....	2.04	642

^a Stage-discharge relation affected by ice; no gage height obtained.

Daily discharge, in second-feet, of Bull Lake Creek near Lenore, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	118	90			30	19	77	1,440	1,550	626	600
2.....	114	83			27	19	81	1,400	1,550	658	500
3.....	110				26	19	102	1,340	1,420	707	450
4.....	102				25	22	136	1,260	1,240	666	432
5.....	90				25	37	176	1,180	1,060	588	425
6.....	83				26	47	210	1,510	964	550	404
7.....	77	90			26	49	251	2,200	928	550	380
8.....	64	92			29	51	279	2,300	964	542	300
9.....	54	86			29	47	294	2,300	1,080	535	250
10.....	54				30	47	294	2,400	1,140	550	200
11.....	90				32	47	284	2,600	1,160	550	182
12.....	86				27	47	262	2,950	1,160	575	170
13.....	86				26	47	254	2,650	1,200	600	163
14.....	86	79	34		25	51	251	2,400	1,200	666	156
15.....	83				23	72	279	2,000	1,200	642	149
16.....	86		42		20	86	390	2,100	1,200	618	142
17.....	86				25	90	572	2,200	1,180	626	135
18.....	90				23	93	707	1,800	1,180	666	129
19.....	90				21	95	741	1,600	1,180	758	126
20.....	112				19	100	642	1,500	1,160	792	114
21.....	115				18	100	558	1,400	1,140	811	112
22.....	110			32	18	100	520	1,400	1,120	758	109
23.....	108				18	100	550	1,420	1,110	732	109
24.....	105				18	100	658	1,540	1,010	707	107
25.....	100				18	97	732	1,730	955	707	100
26.....	95				19	95	766	1,800	928	716	96
27.....	81			33	19	90	820	1,730	820	707	92
28.....	79			33	19	84	1,070	1,630	758	674	88
29.....	70				20	78	1,420	1,590	707	690	84
30.....	81				19	72	1,510	1,560	642	732	81
31.....	95				20		1,500		626	741	

NOTE.—Stage-discharge relation affected by ice Nov. 3 to Feb. 26. No gage-height record Mar. 18, 19, 25, 26, Apr. 21-23, 27-29, June 7-11, 13-22, Aug. 11-13, Sept. 1-3, 7-10, 13-17, 25-28; discharge ascertained from comparison with flow of Dinwoody Creek.

Monthly discharge of Bull Lake Creek near Lenore, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	118	54	90.3	5,550
November.....			^a 75	4,460
December.....			^a 50	3,070
January.....			^a 40	2,460
February.....			^a 35	1,940
March.....	32	18	23.2	1,430
April.....	100	19	66.7	3,970
May.....	1,510	77	529	32,500
June.....	2,950	1,180	1,830	109,000
July.....	1,550	626	1,080	66,400
August.....	811	535	659	40,500
September.....	600	81	213	12,700
The year.....	2,950		392	284,000

^a Estimated.

MIDDLE FORK OF POPO AGIE RIVER NEAR LANDER, WYO.

LOCATION.—In center of sec. 24, T. 32 N., R. 101 W., at Middle Fork ranger station, above the "Sinks" and 11 miles southeast of Lander, Fremont County. Nearest tributary enters from south 3 miles below.

DRAINAGE AREA.—84 square miles (measured on Forest Service atlas).

RECORDS AVAILABLE.—April 1, 1911, to June 30, 1912; April 9, 1918, to August 15, 1921.

GAGE.—Stevens water-stage recorder since October 1, 1919; referred to vertical staff fastened to downstream side of Forest Service bridge; inspected by forest ranger. Gage used in 1911-12 was vertical staff a short distance downstream, referred to different datum.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders; somewhat shifting. No well-defined control. Banks not subject to overflow except during extreme high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.1 feet on June 7 (computed discharge at diversion dam 2 miles below, 2,720 second-feet); minimum discharge occurred during winter.

1918-1921: Maximum discharge recorded in 1921; minimum discharge, 6 second-feet on February 4, 7, 8, 1919.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—None above station. Prior to July 1, 1921, adjudicated diversions of 180 second-feet from Middle Fork below station.

REGULATION.—Alternate melting and freezing of mountain snow causes diurnal fluctuation during spring; no artificial regulation.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve fairly well defined below 1,200 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph except during periods of missing gage height. Records good except for periods of missing gage heights for which they are fair.

COOPERATION.—Gage-height record furnished by United States Forest Service.

Discharge measurements of Middle Fork of Popo Agie River near Lander, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 16	P. V. Hodges.....	0.24	31.3	May 2	J. B. Spiegel.....	0.75	54
Jan. 15	J. B. Spiegel.....	(a)	13.5	June 25	P. V. Hodges.....	2.40	752
Feb. 21	P. V. Hodges.....	.00	16.1	Aug. 8	—do.....	.82	92

^a Stage-discharge relation affected by ice; no gage height obtained.

Discharge measurements of Middle Fork of Popo Agie River above and below the "Sinks" in sec. 17, T. 32 N., R. 100 W.

Date.	Discharge in second-feet		Date	Discharge in second-feet	
	Above "Sinks"	Below "Sinks"		Above "Sinks"	Below "Sinks"
Feb. 28, 1919.....	9.2	12.6	Feb. 21, 1921.....	16.1	20.6
Jan. 15, 1921.....	13.5	14.8	Jan. 16, 1922.....	17.8	24.5

Daily discharge, in second-feet, of Middle Fork of Popo Agie River near Lander, Wyo., for the period Oct. 1, 1920, to Aug. 15, 1921

Day	Oct.	Mar.	Apr.	May	June	July	Aug.
1.....	47	-----	29	35	870	-----	-----
2.....	43	-----	36	54	846	-----	-----
3.....	42	-----	44	70	814	-----	-----
4.....	40	-----	50	85	862	-----	-----
5.....	39	-----	50	119	878	-----	103
6.....	39	-----	38	141	2,300	-----	100
7.....	38	-----	28	139	2,720	-----	95
8.....	36	-----	25	150	2,300	-----	90
9.....	28	-----	25	135	2,300	-----	90
10.....	24	-----	30	137	2,170	-----	88
11.....	26	-----	38	160	2,170	-----	85
12.....	28	-----	48	170	2,100	-----	84
13.....	30	-----	60	180	2,200	-----	96
14.....	33	-----	60	204	2,000	-----	125
15.....	36	-----	45	336	1,800	-----	98
16.....	38	-----	30	356	1,720	-----	-----
17.....	39	-----	40	395	1,300	-----	-----
18.....	38	25	50	405	782	-----	-----
19.....	34	23	55	364	750	340	-----
20.....	41	24	59	320	755	-----	-----
21.....	44	24	52	344	758	-----	-----
22.....	37	22	65	348	774	-----	-----
23.....	39	22	74	368	798	-----	-----
24.....	35	23	60	480	814	-----	-----
25.....	32	26	53	435	750	-----	-----
26.....	30	23	48	475	702	-----	-----
27.....	28	25	43	600	670	-----	-----
28.....	26	25	40	734	663	170	-----
29.....	26	25	37	806	650	-----	-----
30.....	26	25	34	766	640	-----	-----
31.....	24	26	-----	818	-----	-----	-----

NOTE.—No gage-height record Oct. 11–15, 24–31, Apr. 6–19, June 13–15, 17, 20, 29–30; discharge based on temperature and precipitation records and comparison with flow of South Fork of Little Wind River near Fort Washakie. Shifting-control method used Apr. 20 to May 27. Stage-discharge relation affected by ice during winter; discharge not computed.

Monthly discharge of Middle Fork of Popo Agie River near Lander, Wyo., for the period Oct. 1, 1920, to Aug. 15, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	47	24	34.4	2,120
March 18–31.....	26	22	24.1	669
April.....	74	25	44.8	2,670
May.....	818	35	327	20,100
June.....	2,720	640	1,300	77,400

NORTH FORK OF LITTLE WIND RIVER AT FORT WASHAKIE, WYO.

LOCATION.—In SW. $\frac{1}{4}$ sec. 33, T. 1 N., R. 1 W., at Fort Washakie, on Wind River Diminished Reservation. North and South forks unite a quarter of a mile below.

DRAINAGE AREA.—241 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 13 to September 30, 1921.

GAGE.—Gurley water-stage recorder on left bank a quarter of a mile above highway bridge; inspected by United States Indian Service employee.

DISCHARGE MEASUREMENTS.—Made from cable at gage.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders. Control is small rapids just below gage; apparently permanent. Left bank subject to overflow at gage height of 3 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 4.1 feet at 11 p. m. June 6 (discharge 2,250 second-feet); minimum stage occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Several small ditches divert water above station.

REGULATION.—In spring, alternate melting and freezing of mountain snow cause diurnal fluctuation; no artificial regulation.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 1,200 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph except May 13 to 31 when shifting-control method was used. Records good.

Discharge measurements of North Fork of Little Wind River at Fort Washakie, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 13	J. B. Spiegel	2.18	33.5	June 27	P. V. Hodges	2.18	617
Feb. 22	P. V. Hodges	1.11	128	Aug. 2	do.	1.11	128
May 13	J. B. Spiegel	1.20	137	Sept 29	do.	.62	38.9
May 21	do.	1.50	220				

Daily discharge, in second-feet, of North Fork of Little Wind River at Fort Washakie, Wyo., for the period May 13 to Sept. 30, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1.		1,080	444	139	60	16.	230	1,380	236	100	55
2.		953	432	132	60	17.	262	1,110	233	95	53
3.		820	387	130	60	18.	311	820	226	89	52
4.		799	325	126	62	19.	266	778	220	85	52
5.		869	269	123	64	20.	223	652	213	81	50
6.		1,700	236	117	64	21.	230	538	204	77	49
7.		2,070	223	115	64	22.	254	532	204	78	47
8.		1,970	220	108	65	23.	273	597	204	71	47
9.		1,800	223	106	65	24.	486	631	199	73	47
10.		1,770	230	104	67	25.	360	680	190	71	47
11.		1,830	258	100	65	26.	355	645	182	69	44
12.		1,910	258	98	64	27.	512	597	174	67	43
13.	145	1,710	254	100	65	28.	862	538	164	67	40
14.	154	1,560	251	104	60	29.	1,040	493	154	64	40
15.	185	1,500	247	102	58	30.	1,120	462	141	64	39
						31.	1,140		134	62	

Monthly discharge of North Fork of Little Wind River at Fort Washakie, Wyo., for the period May 13 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 13-31.....	1, 140	145	443	16, 700
June.....	2, 070	462	1, 090	64, 900
July.....	444	134	237	14, 600
August.....	139	62	93.9	5, 770
September.....	67	39	55.0	3, 270
The period.....				105, 000

SOUTH FORK OF LITTLE WIND RIVER NEAR FORT WASHAKIE, WYO.

LOCATION.—In SE. $\frac{1}{4}$ sec. 1, T. 1 S., R. 2 W., $2\frac{1}{2}$ miles above junction with North Fork at Washakie on Wind River Diminished Reservation.

DRAINAGE AREA.—121 square miles (measured on base maps of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 11 to September 30, 1921.

GAGE.—Gurley water-stage recorder on right bank 500 feet above head gate of Ray ditch; inspected by United States Indian Service employee.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet below gage.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders; apparently permanent. No well-defined control. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 5.8 feet at 6 a. m. June 12 (discharge, 2,280 second-feet); minimum stage occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—A few small ditches divert water above station. Several ditches divert water below station, largest being Ray ditch which irrigates 6,000 acres.

REGULATION.—In spring alternate melting and freezing of mountain snow cause diurnal fluctuation; no artificial regulation.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined below 1,200 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph. Records good.

Discharge measurements of South Fork of Little Wind River near Fort Washakie, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 13	J. B. Spiegel.....		24.7	June 27	P. V. Hodges.....	2.92	743
Feb. 22	P. V. Hodges.....		14.2	Aug. 2	do.....	1.62	172
May 13	J. B. Spiegel.....	1.57	147	Sept. 29	do.....	.86	42.7

Daily discharge, in second-feet, of South Fork of Little Wind River near Fort Washakie, Wyo., for the period May 11 to Sept. 30, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1-----		790	619	160	75	16-----	338	1,270	390	122	57
2-----		718	588	167	74	17-----	366	1,550	378	115	53
3-----		596	457	155	86	18-----	390	805	370	105	53
4-----		601	358	138	97	19-----	330	770	342	112	54
5-----		664	318	131	92	20-----	230	640	322	92	56
6-----		1,430	322	128	84	21-----	270	632	318	90	56
7-----		1,690	346	121	79	22-----	298	704	318	85	54
8-----		1,600	366	115	75	23-----	294	795	310	84	51
9-----		1,430	386	112	71	24-----	422	800	278	85	48
10-----		1,540	410	114	74	25-----	374	840	254	86	50
11-----	174	1,680	511	112	72	26-----	394	736	226	85	48
12-----	184	1,810	452	114	67	27-----	542	686	198	85	45
13-----	167	1,600	418	124	64	28-----	755	660	170	81	43
14-----	188	1,400	398	135	64	29-----	845	646	148	78	42
15-----	270	1,390	374	130	62	30-----	855	637	140	78	40
						31-----	880		150	78	

Monthly discharge of South Fork of Little Wind River near Fort Washakie, Wyo., for the period May 11 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 11-31-----	880	167	408	17,000
June-----	1,810	596	1,040	61,900
July-----	619	140	343	21,100
August-----	167	78	110	6,760
September-----	97	40	62.9	3,740
The period-----				110,000

OWL CREEK NEAR EMBAR, WYO.

LOCATION.—In sec. 33, T. 9 N., R. 2 E., 5 miles east of Embar, Hot Springs County. Red Creek enters just above station.

DRAINAGE AREA.—272 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—July 19 to September 30, 1921.

GAGE.—Inclined staff on left bank; read by Clyde Duncan.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Control is riffle 100 feet downstream, which may shift during high water. Left bank subject to overflow above stage of 3.5 feet.

EXTREMES OF DISCHARGE.—Data insufficient.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions from Owl Creek of 60 second-feet above station, and 275 second-feet below.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation apparently permanent. Rating curve fairly well defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Owl Creek near Embar, Wyo., during the year ending Sept. 30, 1921

[Made by P. V. Hodges]

Date	Gage height	Discharge
July 19.....	<i>Feet</i> 1.75	<i>Sec.-ft.</i> 62
28.....	1.00	11.8
Sept. 27.....	1.00	11.7

Daily discharge, in second-feet, of Owl Creek near Embar, Wyo., for the period July 19 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		12	12	11.....		38	120	21.....	30	19	12
2.....		38	12	12.....		38	120	22.....	27	19	12
3.....		38	12	13.....		38	120	23.....	22	15	12
4.....		12	12	14.....		38	120	24.....	17	24	12
5.....		12	12	15.....		38	92	25.....	15	19	12
6.....		12	19	16.....		92	92	26.....	14	19	12
7.....		38	24	17.....		92	92	27.....	13	19	12
8.....		12	19	18.....		38	12	28.....	12	12	13
9.....		12	24	19.....	62	24	12	29.....	12	12	14
10.....		38	24	20.....	38	24	12	30.....	12	12	15
								31.....	12	12	

NOTE.—No gage-height record Sept. 25, 26, 28-30; discharge interpolated.

Monthly discharge of Owl Creek near Embar, Wyo., for the period July 19 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
July 19-31.....	62	12	22.0	567
August.....	92	12	27.9	1,720
September.....	120	12	36.3	2,160
The period.....				4,450

NOWOOD CREEK AT BONANZA, WYO.

LOCATION.—In sec. 13, T. 49 N., R. 91 W., at Bonanza, Big Horn County.

Nearest tributary, Paintrock Creek, enters some distance above.

DRAINAGE AREA.—1,790 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—July 29, 1910, to October 31, 1912; April 1, 1915, to September 30, 1921.

GAGE.—Chain gage on left bank, 1,000 feet below store at Bonanza; read by Miss Leona Graves.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge located a quarter of a mile below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control is small rapids 100 feet downstream; shifts between narrow limits.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.5 feet at 9 a. m. June 19 (discharge, 2,950 second-feet); minimum stage, 1.95 feet August 3 (discharge, 33 second-feet).

1910-1912; 1915-1921: Maximum stage recorded, 7.8 feet June 12 and 13, 1918 (discharge, 4,080 second-feet); minimum stage, 1.55 feet from July 27 to 31, 1919 (discharge, 1.5 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 81 second-feet from Nowood Creek above station and 48 second-feet below, all for irrigation; in addition, a decree for power diversion of 115 second-feet below.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve used October 1 to December 9 and curve used March 7 to September 30 both well defined below 2,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records good.

Discharge measurements of Nowood Creek at Bonanza, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Apr. 27	J. B. Spiegel	Feet 2.76	Sec.-ft. 211	July 22	P. V. Hodges	Feet 2.15	Sec.-ft. 63
June 20	P. V. Hodges	5.00	1,640	Sept. 23	do	2.53	136

Daily discharge, in second-feet, of Nowood Creek at Bonanza, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	204	231	201	-----	199	193	1,930	514	40	56
2	204	220	228	-----	199	193	1,380	482	37	54
3	211	220	231	-----	199	193	1,610	429	33	108
4	204	220	217	-----	216	232	1,530	392	53	73
5	198	217	211	-----	308	408	1,530	346	40	66
6	195	220	175	-----	332	570	2,100	288	43	71
7	191	217	165	267	288	750	2,280	246	40	71
8	185	211	150	232	250	880	2,460	225	46	71
9	185	204	148	216	232	880	2,100	199	51	71
10	185	156	-----	216	232	690	1,930	177	50	85
11	191	173	-----	216	232	630	1,770	174	54	91
12	214	173	-----	216	232	630	1,770	232	50	95
13	217	211	-----	216	232	570	1,690	171	63	115
14	224	204	-----	216	232	514	1,300	146	63	125
15	224	238	-----	199	232	514	1,300	125	63	132
16	217	234	-----	199	232	630	1,300	115	66	130
17	220	234	-----	216	232	750	1,020	120	70	132
18	220	238	-----	216	216	1,090	1,090	111	61	130
19	220	228	-----	216	232	1,160	2,750	97	70	128
20	217	211	-----	216	232	1,020	1,690	87	66	135
21	228	211	-----	232	250	1,020	1,380	70	59	138
22	217	207	-----	216	250	1,230	1,160	63	66	143
23	211	204	-----	216	232	1,300	1,020	59	70	138
24	201	198	-----	216	232	1,380	1,090	53	63	128
25	217	195	-----	199	250	1,690	1,020	50	64	128
26	217	179	-----	199	232	1,380	1,300	46	61	128
27	217	160	-----	199	232	1,460	950	50	53	125
28	198	155	-----	199	216	1,850	750	50	56	128
29	214	156	-----	199	216	2,750	690	70	61	132
30	211	182	-----	199	199	2,750	570	53	56	140
31	224	-----	-----	199	-----	2,280	-----	37	63	-----

NOTE.—Stage-discharge relation affected by ice Nov. 27, 28, and Dec. 6-8; discharge based on temperature and gage-height records, and observer's notes. Shifting-control method used Sept. 1-30. Discharge not computed Dec. 10-17; no record Dec. 18 to Mar. 6.

Monthly discharge of Nowood Creek at Bonanza, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	228	185	209	12,900
November.....	238	155	204	12,100
December 1-9.....	231	148	192	3,430
March 7-31.....	267	199	213	10,600
April.....	332	199	236	14,000
May.....	2,750	193	1,020	62,700
June.....	2,750	570	1,480	88,100
July.....	514	37	171	10,500
August.....	70	33	55.8	3,430
September.....	143	54	109	6,490

TENSLEEP CREEK NEAR TENSLEEP, WYO.

LOCATION.—In sec. 12, T. 47 N., R. 88 W., 800 feet east of county bridge at Burke's ranch, 5 miles above Tensleep, Washakie County. Nearest tributary, Canyon Creek, enters a quarter of a mile upstream.

DRAINAGE AREA.—228 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—September 21, 1910, to December 31, 1912; April 19, 1915, to September 30, 1921.

GAGE.—Stevens water-stage recorder on left bank opposite vertical rock cliff; referred to inclined gage used before May 11, 1918; inspected by Mrs. Zina McCreery. Datum lowered 1.00 foot September 26, 1916.

DISCHARGE MEASUREMENTS.—Made from cable 100 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control is rapids just below gage; shifts slightly at long intervals. Right bank is vertical rock cliff; left bank subject to overflow at extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage, from high-water mark, 5.3 feet on June 18 (discharge, 1,680 second-feet); minimum stage, 0.93 foot at 9 a. m. February 19 (discharge, 40 second-feet).

1910-1912; 1915-1921: Maximum stage recorded, 6.8 feet at 4 a. m. June 11, 1918 (discharge, 2,360 second-feet); minimum stage, 0.90 foot at 10 a. m. March 6, 1920 (discharge, 34 second-feet).

ICE.—Stage-discharge relation not affected by ice.

DIVERSIONS.—Diversion of about 8 second-feet for power above station. Prior to July 1, 1921, adjudicated diversions of 1.2 second-feet above station and 36 second-feet below for irrigation.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation not permanent; slightly affected by shifting control. Rating curve well defined below 1,400 second-feet. Operation of water-stage recorder satisfactory except for short periods, as indicated in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph except for periods when recorder did not operate. Records good except for periods of missing gage heights, for which they are fair.

Discharge measurements of Tensleep Creek near Tensleep, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 16	P. V. Hodges.....	1.03	50
Apr. 28	J. B. Spiegel.....	1.03	46.8
July 21	P. V. Hodges.....	1.34	90

Daily discharge, in second-feet, of Tensleep Creek near Tensleep, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	90			52	49	49	47	48	728	216	62	48
2	84			53	54	48	46	56	850	192	72	48
3	82			54	49	45	44	92	700	160	76	70
4	80			54	54	48	49	140	600	150	78	50
5	76			54	52	49	51	216	592	140	76	45
6	76			54	49	49	49	300	975	140	69	45
7	76			53	54	48	47	362	975	140	69	46
8	75			52	54	48	46	300	1,020	140	63	48
9	76			51	54	48	46	216	825	140	60	48
10	58			50	54	48	47	203	775	131	57	54
11	52			49	54	48	47	203	728	140	54	56
12	52			49	56	48	46	203	825	140	55	58
13	51			49	53	48	44	180	638	131	56	58
14	57			49	49	48	49	192	470	122	63	58
15	68			49	50	48	50	228	510	122	67	59
16	70			49	51	47	50	315	432	114	62	59
17	72			49	48	48	52	345	415	114	55	60
18	72			54	44	47	50	490	470	114	50	60
19	73			52	40	47	52	470	470	114	50	60
20	70			51	46	46	50	415	470	106	50	58
21	69			49	52	43	44	490	398	88	50	55
22	69			56	48	45	45	570	362	88	50	55
23	72			55	49	45	45	615	398	88	50	60
24				54	51	44	46	760	362	80	49	66
25				53	51	44	45	760	362	75	48	61
26				52	51	44	44	530	415	74	48	58
27				51	53	45	43	705	345	70	48	58
28				50	49	44	50	900	285	64	48	57
29				50		46	51	1,100	255	62	50	57
30				49		45	50	1,200	228	57	50	56
31				49		45		1,020		56	50	

NOTE.—No gage-height record Oct. 24 to Dec. 31, Jan. 1, 3-5, 7-10, 12, 14-16, 19, 23-29, Feb. 5, 8, 10, 15, 17, 18, 20, Mar. 7-12, Apr. 15, 16, May 28, June 2-4, 19, Aug. 19-22, 26-31, Sept. 1-5, 14-17, 23; discharge based on comparison with flow of Shell and Paintrock creeks. Shifting-control method used May 31 to Sept. 30. Braced figures show mean discharge for periods indicated.

Monthly discharge of Tensleep Creek near Tensleep, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	90	51	70.3	4,320
November			65	3,870
December			60	3,690
January	56	49	51.5	3,170
February	56	40	50.6	2,810
March	49	43	46.6	2,870
April	52	43	47.5	2,830
May	1,200	48	439	27,000
June	1,020	228	563	33,500
July	216	56	115	7,070
August	78	48	57.6	3,540
September	70	45	55.7	3,310
The year	1,200		135	98,000

PAINTROCK CREEK NEAR HYATTVILLE, WYO.

LOCATION.—In sec. 25, T. 50 N., R. 89 W., at mouth of canyon, 6 miles above Hyattville, Big Horn County. Luman Creek enters three-quarters of a mile downstream.

DRAINAGE AREA.—164 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 8, 1920, to September 30, 1921.

GAGE.—Gurley water-stage recorder on right bank 1,000 feet upstream from bridge at State fish hatchery; inspected by I. E. Francisco and H. E. Dillon. August 8-21, 1920, temporary chain gage at bridge 1,000 feet downstream; independent datum.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders. Control is large boulders 25 feet downstream; practically permanent. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during period of record, from water-stage recorder, 5.2 feet at midnight May 28 (discharge, 2,560 second-feet); minimum stage, 0.29 foot from 10 a. m. to 1 p. m. February 17 (discharge, 14 second-feet).

ICE.—Stage-discharge relation slightly affected by ice.

DIVERSIONS.—Above all diversions except that for Rhinehart ditch which diverts water for irrigation of 12 acres.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice for periods during winter. Rating curve well-defined below 1,000 second-feet. Operation of water-stage recorder was satisfactory except as indicated in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph except for periods of missing gage-height record. Records excellent for open-water season when recorder was operating properly; others fair.

Discharge measurements of Paintrock Creek near Hyattville, Wyo., for the period July 23, 1920, to Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
1920		<i>Feet</i>	<i>Sec.-ft.</i>	1921		<i>Feet</i>	<i>Sec.-ft.</i>
July 23	J. B. Spiegel.....	^a 2.82	273	Feb. 17	P. V. Hodges.....	0.37	18.3
Aug. 7	Spiegel and Grosbach..	^a 2.12	104	Apr. 28	J. B. Spiegel.....	.57	25.3
Aug. 24	H. E. Grosbach.....	.96	62	June 21	P. V. Hodges.....	2.72	495
				July 21	do.....	1.02	77
				Sept. 25	do.....	.65	35.3

^a Temporary chain gage 1,000 feet downstream.

Daily discharge, in second-feet, of Paintrock Creek near Hyattville, Wyo., for the period Aug. 8, 1920, to Sept. 30, 1921

Day	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....		61	45	34				21	22	36	1,050	205	57	35
2.....		61	44	32				21	23	45	1,100	195	63	35
3.....		60	43	37				21	25	80	940	188	61	35
4.....		60	42	32				21	27	125	850	167	61	36
5.....		57	40	32				21	28	220	800	139	57	36
6.....		55	40	32			21 ^v	22	25	280	1,070	129	55	36
7.....		68	39	32			22	24	334	1,070	129	53	35	
8.....	104	101	38	32			21	25	255	1,000	129	53	35	
9.....	106	107	38	29			22	22	188	946	135	63	35	
10.....	126	105	38	27			22	26	167	962	135	53	35	
11.....	141	101	40	20			22	28	181	1,030	135	53	37	
12.....	188	92	41	16			22	27	176	902	129	53	38	
13.....	182	82	40	17			22	27	154	730	117	54	40	
14.....	152	76	41	18			23	25	143	760	110	56	40	
15.....	120	68	40		22		22	24	178	775	110	58	40	
16.....	106	61	41		20		20	23	23	260	605	110	55	40
17.....	96	57	40		20		18	23	26	364	593	108	50	39
18.....	93	52	40					23	28	512	700	104	48	38
19.....	91	51	40					23	30	436	680	100	47	37
20.....	82	50	40					23	31	373	605	90	47	36
21.....	76	50	41					23	30	445	506	77	46	35
22.....	79	57	38			20		23	31	548	478	71	46	35
23.....	72	64	31					22	35	554	445	70	43	34
24.....	65	68	29					22	33	620	492	68	40	34
25.....	61	63	39					22	31	660	421	67	39	33
26.....	57	60	37					22	31	484	420	67	37	33
27.....	55	55	30					22	29	597	415	65	35	32
28.....	65	52	36					22	29	1,230	365	61	35	32
29.....	76	50	35					22	28	1,530	285	60	35	31
30.....	71	46	35					22	28	1,360	240	59	35	31
31.....	67		35					22		1,090		58	35	-----

NOTE.—No gage-height record Aug. 23 and 25, 1920; discharge interpolated; also Mar. 20-25, Apr. 14-15, May 24, 25, June 1-4, 18, 26-30, July 1, 2, Aug. 28 to Sept. 2, 1921; discharge based on comparison with No Wood Creek at Bonanza and Paintrock Creek near Bonanza. Intake stopped up July 1-31, Aug. 11-21, and Sept. 10-24, 1921; discharge determined from comparative hydrograph of Paintrock Creek near Bonanza and Tensleep Creek near Tensleep.

Monthly discharge of Paintrock Creek near Hyattville, Wyo., for the period Aug. 8, 1920, to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
1920				
August 8-31.....	188	55	97.1	4,620
September.....	107	46	66.3	3,950
1920-21				
October.....	45	29	38.6	2,370
November.....			a 23	1,370
December.....			a 20	1,230
January.....			a 20	1,230
February.....			a 20	1,110
March.....	23	21	22.1	1,360
April.....	35	22	27.4	1,630
May.....	1,530	36	440	27,100
June.....	1,100	240	708	42,100
July.....	205	58	109	6,700
August.....	63	35	48.8	3,000
September.....	40	31	35.6	2,120
The year.....	1,530		126	91,300

^a Estimate based on temperature and gage-height records, current-meter measurement, and observer's notes.

PAINTROCK CREEK NEAR BONANZA, WYO.

LOCATION.—In sec. 19, T. 49 N., R. 90 W., at Paumer ranch, $1\frac{1}{2}$ miles above Bonanza, Big Horn County. No tributary between station and mouth of creek, half a mile below.

DRAINAGE AREA.—398 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—July 28, 1910, to October 31, 1912; April 19, 1915, to September 30, 1921.

GAGE.—Chain gage on right bank 300 feet below ranch since April 11, 1917; read by Mrs. William Paumer. For description of former gages see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from cable 65 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control is rapids with bed of small boulders 150 feet below gage; shifting. Right bank subject to overflow at stage of 2 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.0 feet at 8 a. m. May 29 (discharge, 1,770 second-feet); minimum stage, 0.80 foot at 4 p. m. August 19 (discharge, 2.0 second-feet).

1910-1913; 1915-1921: Maximum stage recorded, 5.3 feet at 8 a. m. June 12, 1918 (discharge, 3,390 second-feet); minimum stage, 0.67 foot on July 27, 1919 (discharge, 0.7 second-foot).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 68 second-feet from Paintrock Creek, all above station.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve used October 1 to November 30 well defined; that used March 15 to September 30 well defined below 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to table of daily discharge. Records good.

Discharge measurements of Paintrock Creek near Bonanza, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 27	J. B. Spiegel	1.34	37.6
June 20	P. V. Hodges	2.73	625
July 22	do.	1.03	10.7

Daily discharge, in second-feet, of Paintrock Creek near Bonanza, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	64	70		47	21	940	199	21	12
2	62	70		44	21	1,120	186	17	12
3	60	70		48	19	820	164	19	13
4	55	70		48	31	820	142	15	11
5	54	68		50	107	820	112	10	12
6	52	66		55	156	1,160	87	10	12
7	52	66		55	272	1,070	74	10	12
8	49	64		55	224	1,160	66	9	13
9	50	66		50	156	1,070	66	9	14
10	52	70		53	121	980	59	12	14
11	58	80		53	127	940	62	12	15
12	62	80		52	127	900	48	12	17
13	68	90		52	102	860	38	13	18
14	68	85		48	94	645	32	13	18
15	70	90	45	48	97	680	27	13	19
16	72	80	45	45	167	680	23	14	20
17	72	70	45	45	207	545	25	12	21
18	72	62	45	48	449	715	24	6	20
19	70	62	45	52	449	750	20	3	21
20	70	58	45	52	336	680	15	7	25
21	74	55	42	50	362	610	13	7	25
22	68	55	44	50	545	545	12	7	27
23	64	52	45	47	610	610	12	9	21
24	66	52	44	48	645	578	11	10	21
25	74	55	44	45	715	480	12	9	20
26	70	55	42	48	578	480	14	8	20
27	66	60	45	38	785	480	14	8	21
28	70	82	45	31	1,070	362	30	7	21
29	72	92	47	31	1,500	286	30	8	24
30	68	92	44	25	1,400	242	32	10	30
31	70		45		1,200		18	11	

NOTE.—Shifting-control method used Oct. 1-15. No gage-height record Nov. 11-17; discharge based on comparison with flow of Nowood Creek at Bonanza.

Monthly discharge of Paintrock Creek near Bonanza, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	74	49	64.3	3,950
November	92	52	69.6	4,140
March 15-31	47	42	44.5	1,500
April	55	25	47.1	2,800
May	1,500	19	409	25,100
June	1,160	242	734	43,700
July	199	11	53.8	3,310
August	21	3	10.7	658
September	30	11	18.3	1,090

GREYBULL RIVER AT MEETEETSE, WYO.

LOCATION.—In sec. 4, T. 48 N., R. 100 W., at Meeteetse, Park County. Nearest tributary, Meeteetse Creek, enters 3 miles downstream.

DRAINAGE AREA.—690 square miles (measured on topographic map).

RECORDS AVAILABLE.—July 18, 1920, to September 30, 1921.

GAGE.—Gurley water-stage recorder on left bank, 1,000 feet above highway bridge at Meeteetse, since August 29, 1920; inspected by C. H. Wagner. Prior to August 29, staff gage $4\frac{1}{2}$ miles upstream. Flow at two points not exactly comparable; small amount of water is diverted from the river, and some return water enters the river between the two points.

DISCHARGE MEASUREMENTS.—Made from cable located 400 feet downstream.

CHANNEL AND CONTROL.—Bed composed of boulders and coarse gravel. Control is ledge rock 20 feet downstream.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 5.4 feet at 9 p. m. June 6 (discharge, 4,970 second-feet); minimum stage occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 102 second-feet from Greybull River above station and 755 second-feet below station; adjudicated diversion of 149 second-feet from tributaries entering above.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve used October 1 to June 5 fairly well defined below 800 second-feet; that used June 6 to September 30 fairly well defined below 2,000 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating tables mean daily gage height obtained by inspection of recorder graph, except June 1-5 when shifting-control method was used. Records below 1,000 second-feet, good; those above, fair.

Discharge measurements of Greybull River at Meeteetse, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
Apr. 22	J. B. Spiegel.....	<i>Feet</i> 1.16	<i>Sec.-ft.</i> 108	July 25	P. V. Hodges.....	<i>Feet</i> 1.66	<i>Sec.-ft.</i> 310
June 17	P. V. Hodges.....	3.45	1,840	Sept. 19	do.....	1.02	178

Daily discharge, in second-feet, of Greybull River at Meeteetse, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	139	-----	86	97	1,240	1,030	368	186
2.....	137	-----	100	291	1,310	850	388	196
3.....	135	-----	117	495	1,430	578	364	196
4.....	131	-----	124	639	1,970	512	294	194
5.....	130	-----	97	738	2,480	465	270	188
6.....	130	-----	86	618	3,640	536	250	185
7.....	126	-----	80	480	3,320	542	232	191
8.....	122	-----	78	455	3,480	536	216	185
9.....	124	-----	78	316	2,760	512	228	191
10.....	128	-----	82	294	2,760	450	235	204
11.....	133	-----	107	324	2,680	542	222	194
12.....	126	-----	114	395	2,760	512	238	196
13.....	126	-----	105	435	2,600	512	265	191
14.....	122	-----	121	435	2,360	485	560	191
15.....	124	-----	124	554	2,200	512	669	188
16.....	115	105	94	794	2,600	420	584	184
17.....	126	100	115	920	2,050	392	435	179
18.....	131	97	130	1,240	1,700	354	327	174
19.....	122	79	158	910	1,500	512	291	172
20.....	131	67	135	746	1,300	485	300	169
21.....	133	67	117	738	1,460	460	288	167
22.....	121	76	112	837	1,670	405	273	169
23.....	112	78	147	1,000	1,760	405	265	169
24.....	110	70	110	1,500	1,760	364	260	167
25.....	135	61	104	1,370	1,610	339	248	166
26.....	126	70	90	1,260	1,510	354	230	163
27.....	114	74	84	1,630	1,410	315	216	160
28.....	114	74	86	1,840	1,270	291	235	155
29.....	114	78	84	1,780	1,170	258	204	153
30.....	110	72	80	1,700	1,150	240	196	152
31.....	110	73	-----	1,660	-----	255	191	-----

Monthly discharge of Greybull River at Meeteetse, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	139	110	124	7,620
March 16-31.....	105	61	77.6	2,460
April.....	158	78	105	6,250
May.....	1,840	97	855	52,600
June.....	3,640	1,150	2,030	121,000
July.....	1,030	240	465	28,600
August.....	669	191	301	18,500
September.....	204	152	179	10,700

SHELL CREEK AT SHELL, WYO.

LOCATION.—Near west edge of sec. 26, T. 53 N., R. 91 W., 450 feet above head gate of Shell canal, three-quarters of a mile northeast of Shell, Big Horn County. Nearest tributary, Trapper Creek, enters a short distance above.

DRAINAGE AREA.—256 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1921. From July 1, 1911, to October 31, 1914, station maintained by Wyoming Irrigation Co., and records published in reports of State engineer.

GAGE.—Vertical staff on left bank; read by employee of Wyoming Irrigation Co. For description of earlier gages see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from highway bridge in Shell or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control is gravel bar just below gage; shifting. Banks subject to overflow at stage of 3.8 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.73 feet at 6 a. m. May 29 (discharge, 1,490 second-feet); minimum stage, 1.25 feet at 5 p. m. April 29 (discharge, 30 second-feet).

1913-1921: Maximum stage from high-water mark, 8.35 feet (original datum) June 11, 1918 (discharge, 1,910 second-feet); minimum discharge probably occurred during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 8 second-feet from Shell Creek above station, and 106 second-feet below.

REGULATION.—Flow partly controlled by storage of water in Adelaide reservoir on Shell Creek, 25 miles above Shell; capacity of reservoir, 1,410 acre-feet. Water stored in reservoir beginning of high-water period and released in latter part of summer.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice during winter. Rating curves used October 1 to May 27, and May 28 to September 30, both fairly well defined below 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except January 1 to June 30, when shifting-control method was used. Records October to June, good; July to September, excellent.

COOPERATION.—Gage-height record furnished by Wyoming Irrigation Co.

Discharge measurements of Shell Creek at Shell, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Apr. 25	J. B. Spiegel	<i>Feet</i> 1.31	<i>Sec.-ft.</i> 38.8	July 23	P. V. Hodges	<i>Feet</i> 1.57	102
June 19	P. V. Hodges	2.67	420	Sept. 21	do	1.23	56

Daily discharge, in second-feet, of Shell Creek at Shell, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	83	72	72	63	57	46	40	38	755	190	98	58
2	81	72	72	63	57	46	40	40	959	189	95	58
3	80	72	72	63	57	46	43	48	959	188	82	63
4	78	72	72	61	57	46	43	53	1,010	178	75	65
5	75	72	75	63	57	46	40	70	606	160	75	64
6	75	72	64	64	53	46	38	78	630	143	75	60
7	73	72	64	61	53	46	36	103	780	128	75	55
8	73	72	66	63	53	47	36	91	705	114	74	56
9	75	72	66	59	53	48	36	80	561	107	73	57
10	77	69	69	59	53	47	39	93	472	108	72	61
11	77	69	69	56	53	43	40	115	412	105	71	63
12	75	69	69	59	53	40	41	113	393	99	70	61
13	75	69	69	67	53	43	41	104	393	96	69	61
14	73	69	69	66	53	46	41	89	358	95	68	58
15	73	75	69	70	52	46	41	94	323	92	65	58
16	75	77	69	64	49	43	41	113	323	86	66	56
17	77	77	69	64	49	43	39	165	274	83	63	55
18	77	77	69	64	49	43	39	250	289	79	63	54
19	78	72	69	60	49	43	41	295	432	105	63	56
20	78	77	69	61	48	41	41	250	393	110	62	57
21	78	72	69	60	48	41	41	310	386	107	63	56
22	75	72	69	56	48	43	41	380	316	104	63	55
23	75	72	66	53	48	43	41	400	283	102	62	53
24	75	72	63	60	48	43	41	420	277	99	64	52
25	73	72	63	60	48	43	37	460	262	100	62	52
26	73	72	66	60	48	43	36	345	247	102	61	51
27	73	72	60	60	48	43	33	612	228	98	61	50
28	72	67	60	60	48	43	33	1,070	215	96	61	50
29	72	72	64	60	48	43	33	1,180	202	95	61	52
30	72	72	64	60	48	36	32	1,180	190	92	61	54
31	72	72	64	60	48	37	37	805	190	93	61	54

NOTE.—No gage-height record Oct. 16, July 1, 2, and Aug. 7-13; discharge interpolated.

Monthly discharge of Shell Creek at Shell, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	83	72	75.4	4,640
November	77	67	72.1	4,290
December	75	60	67.4	4,140
January	70	53	61.3	3,770
February	57	48	51.5	2,860
March	48	36	43.6	2,680
April	43	32	38.8	2,310
May	1,180	38	305	18,800
June	1,010	190	454	27,000
July	190	79	114	7,010
August	98	61	68.8	4,230
September	65	50	56.7	3,370
The year	1,180	32	118	85,100

SHOSHONE RIVER NEAR ISHAWOOA, WYO.

LOCATION.—In SW. $\frac{1}{4}$ sec. 23, T. 51 N., R. 104 W., 500 feet below Hartung's private bridge, $1\frac{1}{2}$ miles north of Ishawooa, Park County. Nearest tributary, Bull Creek, enters $1\frac{1}{2}$ miles downstream.

DRAINAGE AREA.—532 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 7, 1915, to September 30, 1921.

GAGE.—Chain gage installed July 24, 1921, to replace staff gage at bridge 500 feet upstream used since May 24, 1918; read by Albert Hartung. For description of original gage see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from suspension bridge, or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of coarse gravel; shifting.

No well-defined control. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.0 feet at 7 a. m. June 12 (discharge, 4,900 second-feet); minimum discharge probably occurred during winter.

1915-1921: Maximum stage recorded, 7.0 feet June 14, 1918 (discharge, 7,740 second-feet); minimum discharge probably occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 30 second-feet from Shoshone River above station, and 164 second-feet between station and Shoshone reservoir.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation not permanent at original site; apparently permanent at new site. Rating curve used October 1 to May 28 fairly well defined; that used May 29 to July 28 poorly defined; curve used for remainder of year well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as indicated in footnote to daily-discharge table. Records fair.

Discharge measurements of Shoshone River near Ishawooa, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 21	J. B. Spiegel.....	1.06	155	July 24	P. V. Hodges.....	a 2.01	513
June 15	P. V. Hodges.....	4.62	2,880	Sept. 19	----do-----	a 1.45	198

^a Reading on gage in new location.

Daily discharge, in second-feet, of Shoshone River near Ishawooa, Wyo., for the year ending Sept. 30, 1921.

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	142	106	-----	88	160	1,840	1,660	414	230
2.....	135	109	-----	90	480	1,900	1,340	407	222
3.....	133	106	-----	109	770	1,840	965	518	230
4.....	129	103	-----	148	940	2,370	800	379	238
5.....	129	103	-----	152	1,210	2,430	800	341	242
6.....	127	103	-----	119	1,210	2,940	965	300	218
7.....	121	103	-----	112	940	3,560	1,060	288	218
8.....	121	106	-----	106	730	3,850	1,060	261	204
9.....	117	105	-----	112	540	3,700	1,060	242	207
10.....	123	104	-----	115	480	4,150	1,060	246	256
11.....	127	103	-----	150	480	4,450	1,240	234	242
12.....	119	102	-----	148	510	4,600	1,060	234	242
13.....	119	101	100	148	540	4,000	1,140	347	226
14.....	114	100	96	160	650	3,700	965	502	214
15.....	115	99	95	190	1,030	3,140	965	450	207
16.....	110	98	93	150	1,120	3,560	965	435	214
17.....	114	96	92	175	1,310	2,880	880	359	195
18.....	112	94	93	175	1,650	2,490	800	323	192
19.....	109	91	92	175	1,310	1,900	800	305	198
20.....	114	90	93	160	1,030	1,660	725	272	198
21.....	110	90	92	148	940	2,010	725	261	198
22.....	106	91	90	133	1,120	2,250	590	246	207
23.....	99	91	91	135	1,310	2,620	560	230	201
24.....	102	88	93	127	1,650	2,490	530	246	195
25.....	103	87	90	123	1,650	2,250	560	242	192
26.....	102	86	84	121	1,650	1,900	560	230	192
27.....	106	87	89	119	2,020	1,900	470	218	189
28.....	103	86	88	115	2,280	1,900	415	393	189
29.....	106	85	88	110	2,620	1,900	386	256	186
30.....	106	85	91	114	2,310	1,780	353	250	183
31.....	104	-----	86	-----	2,250	-----	365	234	-----

NOTE.—No gage-height record Nov. 5, 6, 9-15, and 29; discharge interpolated. Shifting-control method used Mar. 13 to May 1 and May 29 to June 6. Discharge from readings on new gage after July 29.

Monthly discharge of Shoshone River near Ishawooa, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	142	99	115	7,070
November.....	109	85	96.6	5,750
March 13-31.....	100	84	91.4	3,440
April.....	190	88	134	7,970
May.....	2,620	160	1,190	73,200
June.....	4,600	1,660	2,730	182,000
July.....	1,660	353	834	51,300
August.....	518	218	312	19,200
September.....	256	183	211	12,600

SHOSHONE RIVER AT CORBETT DAM, WYO.

LOCATION.—In NE. $\frac{1}{4}$ sec. 7, T. 53 N., R. 100 W., at Corbett diversion dam, 8 miles below Cody, Park County.

DRAINAGE AREA.—Not measured at this station; 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, 1921.

GAGE.—Stevens eight-day water-stage recorder 40 feet upstream from crest of dam, referred to staff gage at same location; gage heights represent height of water above crest.

DETERMINATION OF DISCHARGE.—Discharge computed by considering the dam as a weir and the sluice gate as submerged orifices. The formula for discharge over the crest, developed by United States Bureau of Reclamation is $Q=3.80 BH^{1.61}$.

CHANNEL AND CONTROL.—The crest of the dam forms a permanent control. Slope of upstream face of dam is 1:1. Low-water elevation of river raised 10.2 feet. Length between abutments, 400 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.21 feet June 13 (discharge over dam, 9,940 second-feet; through Corbett tunnel, 903 second-feet; total 10,800 second-feet); minimum stage, 0.27 foot October 1 (discharge over dam, 188 second-feet; through Corbett tunnel, 123 second-feet; total, 311 second-feet).

1908-1921: Maximum stage recorded, 5 feet June 15, 1918 (total discharge, 18,700 second-feet); no flow October 21 to November 19, 1909.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—Little water is diverted above station.

REGULATION.—Shoshone reservoir, having a capacity of 456,000 acre-feet, located 16 miles above, partly regulates the flow.

ACCURACY.—Stage-discharge relation practically permanent; rating curve fairly well defined. Mean daily gage height obtained from recorder graph. Combined daily discharge ascertained by applying mean daily gage height to rating table and adding daily flow in canal. Records good.

COOPERATION.—Complete data furnished by United States Bureau of Reclamation; figures slightly changed to agree with rules of computation used by the Geological Survey.

Combined daily discharge, in second-feet, of Shoshone River and Garland canal at Corbett dam, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	311	743	3,540	687	743	743	938	912	1,490	3,890	1,090	890
2	762	743	3,540	687	743	743	989	864	1,660	3,670	1,150	839
3	762	743	3,540	687	743	724	898	949	1,640	3,140	1,060	821
4	762	743	3,540	687	897	724	752	1,050	1,620	2,740	1,170	774
5	762	743	3,540	687	897	724	612	1,160	1,500	2,350	1,130	715
6	762	743	3,540	687	897	724	641	945	1,740	3,210	990	791
7	762	743	3,540	687	856	724	600	1,140	1,630	2,360	962	821
8	762	743	3,540	687	856	1,150	663	1,510	1,460	2,480	1,140	829
9	762	743	3,540	687	918	2,180	706	937	1,530	2,480	1,140	808
10	762	743	3,340	687	918	2,180	619	960	2,800	2,420	1,120	756
11	743	743	2,210	687	743	2,180	524	875	6,880	2,380	1,010	730
12	743	743	1,930	687	651	2,180	532	966	9,740	2,390	767	772
13	743	743	706	687	668	2,180	472	830	10,800	2,400	778	738
14	743	743	706	687	687	2,180	528	961	10,700	2,380	750	660
15	743	743	706	687	687	1,910	544	987	9,660	2,370	806	689
16	743	743	706	687	706	2,240	564	985	9,810	2,160	793	702
17	743	743	706	687	706	2,380	474	1,040	9,060	2,060	781	619
18	743	1,470	706	1,000	706	2,010	628	945	7,470	2,000	822	592
19	743	2,040	706	2,150	634	2,440	848	1,040	6,140	1,700	810	540
20	743	2,260	706	2,150	651	2,440	1,010	875	5,270	1,540	682	567
21	743	2,260	706	2,150	743	2,440	1,010	999	4,150	1,570	687	592
22	724	2,260	706	1,960	781	2,410	1,020	988	4,100	1,520	697	614
23	724	1,670	706	724	818	1,670	970	1,060	4,610	1,290	719	615
24	724	744	706	724	800	1,020	770	1,180	5,510	1,320	736	601
25	724	743	706	724	781	918	739	1,130	5,480	1,370	749	577
26	724	743	687	724	762	876	872	1,240	5,050	1,430	757	576
27	724	743	687	724	743	860	937	1,380	4,730	1,340	756	554
28	724	1,386	687	724	743	842	968	1,210	4,470	1,250	917	583
29	724	2,380	687	724	-----	860	935	1,490	4,230	1,240	1,090	615
30	724	3,540	687	724	-----	868	909	1,240	3,120	1,080	971	605
31	706	-----	687	706	-----	815	-----	1,480	-----	1,000	892	-----

NOTE.—Daily discharge does not include water sluiced into river below dam and above station on canal.

Monthly discharge of Shoshone River, Garland canal, and sluices at Corbett dam, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet	
	Maximum	Minimum	Mean ^a	Through sluice gates ^a	Total
October.....	762	311	728	243	45,000
November.....	3,540	743	1,160	-----	69,000
December.....	3,540	687	1,700	-----	105,000
January.....	2,150	687	890	-----	54,700
February.....	918	634	767	-----	42,600
March.....	2,440	724	1,490	-----	91,600
April.....	1,020	472	756	2,520	47,500
May.....	1,510	830	1,080	3,660	70,100
June.....	10,800	1,460	4,920	3,250	296,000
July.....	3,890	1,000	2,080	3,200	131,000
August.....	1,170	682	899	5,320	60,600
September.....	890	540	686	4,580	45,400
The year.....	10,800	311	1,420	22,800	1,060,000

^a Estimated by U. S. Bureau of Reclamation.

NORTH FORK OF SHOSHONE RIVER NEAR WAPITI, WYO.

LOCATION.—In sec. 15, T. 52 N., R. 104 W., at Thermond ranch, 6 miles east of Wapiti, Park County; below all tributaries entering above Shoshone reservoir.

DRAINAGE AREA.—800 square miles (measured chiefly on topographic map).

RECORDS AVAILABLE.—January 1 to September 30, 1921.

GAGE.—Stevens continuous water-stage recorder on right bank; inspected by United States Bureau of Reclamation employee.

DISCHARGE MEASUREMENTS.—Made from cable 100 feet upstream.

CHANNEL AND CONTROL.—Bed composed by boulders and coarse gravel; control is rock riffle a short distance downstream; apparently permanent. Backwater from Shoshone reservoir reaches a point 2 miles below gage.

EXTREMES OF DISCHARGE.—No data available.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversion of 26 second-feet from North Fork above station and 7 second-feet below.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of North Fork of Shoshone River near Wapiti, Wyo., for the year ending Sept. 30, 1921

Day	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	149	140	154	180	558	3,680	2,310	786	350
2.....	148	140	155	221	1,550	3,580	2,210	713	346
3.....	147	141	155	360	1,790	3,670	1,950	662	400
4.....	146	142	156	432	2,170	5,090	1,750	649	559
5.....	145	142	156	420	2,360	5,220	1,620	649	434
6.....	144	143	157	284	2,230	5,440	1,630	570	343
7.....	143	143	157	221	2,110	5,860	1,710	524	338
8.....	142	144	158	210	1,880	6,610	1,710	519	351
9.....	141	144	158	192	1,600	7,170	1,730	519	343
10.....	140	145	159	224	1,470	7,040	1,680	502	497
11.....	140	145	159	320	1,460	7,390	1,630	502	414
12.....	140	146	160	280	1,500	7,310	1,590	486	386
13.....	140	146	160	334	1,820	6,920	1,540	497	355
14.....	140	147	161	389	2,010	6,340	1,410	564	326
15.....	140	147	161	395	2,520	5,570	1,380	662	326
16.....	140	148	162	342	2,450	5,140	1,320	553	311
17.....	140	148	162	405	2,590	4,700	1,250	497	304
18.....	140	149	163	385	2,770	3,720	1,170	470	293
19.....	140	149	163	380	2,450	2,930	1,130	449	297
20.....	140	150	164	356	2,170	2,620	1,080	419	326
21.....	140	150	164	320	2,120	2,600	1,030	409	326
22.....	140	151	164	308	2,430	2,890	930	404	347
23.....	140	151	164	365	2,670	3,040	900	391	347
24.....	140	152	164	320	3,300	3,120	842	395	318
25.....	140	152	162	288	3,430	2,980	1,200	409	300
26.....	140	153	162	273	3,360	2,730	1,130	381	290
27.....	140	153	157	292	4,260	2,700	850	386	283
28.....	140	154	157	284	4,380	2,580	787	429	277
29.....	140	-----	168	276	4,130	2,530	773	391	277
30.....	140	-----	155	248	3,920	2,450	733	381	267
31.....	140	-----	159	-----	4,170	-----	733	359	-----

Monthly discharge of North Fork of Shoshone River near Wapiti, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
January.....	149	140	141	8,670
February.....	154	140	147	8,160
March.....	168	154	160	9,840
April.....	432	180	310	18,400
May.....	4,380	558	2,500	154,000
June.....	7,390	2,450	4,450	265,000
July.....	2,310	733	1,350	83,000
August.....	786	359	501	30,800
September.....	559	267	344	20,500
The period.....	-----	-----	-----	598,000

SOAP CREEK NEAR ST. XAVIER, MONT.

LOCATION.—In sec. 20, T. 5 S., R. 32 E., at Henry Reed's ranch, 9 miles south of St. Xavier, Big Horn County, and 1 mile above mouth.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 11, 1911, to September 30, 1921. April 25, 1914, to June 12, 1915, at Frank Annerer's ranch about half a mile above present site; September 11, 1911, to November 30, 1913, in W. $\frac{1}{2}$ NW. $\frac{1}{4}$ sec. 2, T. 6 S., R. 32 E., one-fourth of a mile above headworks of Soap Creek ditch.

GAGE.—Overhanging chain gage on right bank opposite house of observer, Henry Reed. For description of earlier gages see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge 1 mile above gage.

CHANNEL AND CONTROL.—Bed of stream at control is composed of gravel and silt; shifts slightly. Stage-discharge relation affected at times by aquatic plants in channel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.65 feet at 6.20 p. m. May 9 (discharge, 305 second-feet); minimum stage, 2.29 feet July 19 (discharge, 1.1 second-feet).

1911–1921: Maximum stage recorded, 12.8 feet May 11, 1914 (discharge, from extension of rating curve, 438 second-feet); minimum stage recorded, no flow August 29, 30, and September 18–25, 1920.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Soap Creek ditch diverts above station for irrigation during summer.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by shifting control. Two rating curves used during year; one, applicable October 1 to November 16, and August 26 to September 30, fairly well defined below 40 second-feet; other applicable March 20 to August 25, fairly well defined between 12 and 82 second-feet. Gage read to hundredths twice daily. Daily discharge October 1 to November 16, March 20 to May 7, and August 26 to September 30 ascertained by applying mean daily gage height to rating table. Indirect method of shifting control used May 8 to August 25. Records fair.

Discharge measurements of Soap Creek near St. Xavier, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
1922		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 14	W. A. Lamb.....	3.01	19.8
May 12	do.....	2.79	11.2
Aug. 23	A. H. Tuttle.....	2.54	3.0

Daily discharge, in second-feet, of Soap Creek near St. Xavier, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.	19	14		35	5.6	8.5	2.9	5.4	4.0
2.	37	15		34	6.2	8.9	3.3	5.8	5.1
3.	37	15		24	6.6	9.6	5.3	5.3	6.7
4.	37	15		21	7.3	9.3	3.9	5.2	4.3
5.	38	15		22	7.6	8.9	3.7	4.1	4.4
6.	38	15		23	8.0	8.4	3.4	3.9	4.4
7.	29	15		24	56	8.0	2.9	3.7	4.3
8.	23	15		22	187	7.3	2.4	4.4	4.1
9.	26	15		21	197	6.9	2.1	4.4	5.4
10.	30	15		22	80	6.9	2.0	4.6	5.9
11.	31	16		22	21	6.9	2.1	4.1	5.7
12.	33	16		22	14	7.1	3.0	3.9	6.0
13.	37	17		22	9.8	7.5	2.5	4.4	6.2
14.	32	17		21	9.1	7.8	2.6	4.4	6.4
15.	33	17		21	9.8	7.6	2.4	4.0	7.1
16.	24	17		21	10	4.7	2.4	5.4	8.5
17.	38			14	8.5	5.8	2.1	6.0	7.8
18.	38			8.9	8.2	8.9	1.6	5.8	6.4
19.	37			4.4	8.5	34	1.1	5.4	5.4
20.	36		32	13	8.7	8.2	2.9	4.8	5.4
21.	34		32	13	9.1	5.8	6.6	4.7	5.4
22.	32		30	5.6	8.7	5.8	6.4	5.0	5.7
23.	24		23	30	8.4	4.3	5.8	4.0	6.0
24.	19		17	34	8.5	5.2	6.2	3.9	6.0
25.	20		16	33	10	4.7	4.0	3.9	5.9
26.	20		16	21	7.8	3.3	4.6	3.8	6.2
27.	18		16	16	8.9	3.3	4.7	3.8	6.4
28.	16		16	12	8.7	2.8	4.7	3.5	6.6
29.	15		36	8.0	9.1	.8	4.7	4.0	6.4
30.	15		42	6.6	9.4	.8	4.6	8.1	6.2
31.	14		37		9.4		4.8	5.1	

Monthly discharge of Soap Creek near St. Xavier, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	38	14	28.4	1,750
November 1-16.....	17	14	15.6	495
March 20-31.....	42	16	26.1	621
April.....	35	4.4	19.9	1,180
May.....	197	5.6	24.7	1,520
June.....	34	.8	7.27	433
July.....	6.6	1.1	3.60	221
August.....	8.1	3.5	4.67	287
September.....	8.5	4.0	5.81	346

ROTTENGRASS CREEK NEAR ST. XAVIER, MONT.

LOCATION.—In NW. $\frac{1}{4}$ sec. 6, T. 5 S., R. 23 E., one-fourth mile above crossing of Big Horn canal on Crow Indian Reservation, 4 miles south of St. Xavier, Big Horn County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 9, 1911, to September 30, 1921; fragmentary.

GAGE.—Overhanging chain gage on left bank; read by W. H. Ferguson.

DISCHARGE MEASUREMENTS.—Made from footbridge 500 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and silt. Banks high and steep; not subject to overflow below gage height of 11 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during years ending September 30, 1920 and 1921, 10.8 feet March 22, 1920 (discharge, from extension of rating curve, 442 second-feet); minimum discharge, no flow October 1, 1919, to February 1, 1920, and August 15 to September 30, 1921.

1911–1921: Maximum stage recorded, 11.3 feet March 30, 1917 (discharge, from extension of rating curve, 500 second-feet); minimum discharge, no flow August 22, 1919, to February 1, 1920, and August 15 to September 30, 1921.

ICE.—Stage-discharge relation not seriously affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined between 3 and 80 second-feet. Gage read to tenths once or twice a week. Daily discharge ascertained by applying gage height to rating table. Records fair.

Discharge measurements of Rottengrass Creek near St. Xavier, Mont., during the years ending Sept. 30, 1920 and 1921

[Made by W. A. Lamb]

Date		Gage height	Discharge
1920		Feet	Sec.-ft.
Mar. 27.....	-----	4.73	42.4
1921			
Apr. 15.....	-----	2.72	3.3
May 12.....	-----	4.24	27.1

Daily discharge, in second-feet, of Rottengrass Creek near St. Xavier, Mont., for the years ending Sept. 30, 1920 and 1921

Day	Feb.	Mar.	July	Aug.	Sept.	Day	Feb.	Mar.	July	Aug.	Sept.
1920						1920					
1.....						16.....					
2.....			45	14		17.....		105		4.0	
3.....		4.0			2.3	18.....					3.1
4.....						19.....		264			
5.....		4.0	264			20.....					2.3
6.....	2.3				4.0	21.....			14		
7.....				14		22.....		442			
8.....			18			23.....					
9.....	4.0		18			24.....					
10.....				10	4.0	25.....					2.3
11.....		33				26.....		125		4.0	
12.....		45	45	6.0		27.....		42			2.3
13.....	18					28.....					
14.....		264	18			29.....		45	14		
15.....		125			4.0	30.....		28		4.0	
						31.....					

Daily discharge, in second-feet, of Rottengrass Creek near St. Xavier, Mont., for the years ending Sept. 30, 1920 and 1921—Continued

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.
1920-21									
1.								4.0	2.3
2.	3.1		14			4.9			
3.							6.0		
4.	4.0	4.0			8.2				
5.								3.1	2.3
6.						4.9	4.0		
7.			8.2		10				
8.	4.0					80		3.1	
9.									1.1
10.		4.0					4.0		
11.	4.0				8.2			3.1	
12.						28			
13.							4.0		
14.						10			
15.	4.0	6.0			3.1			2.3	
16.			4.0		6.0	7.1			
17.									
18.					4.9				
19.								3.1	
20.	4.0	7.1							
21.				7.1		7.1			
22.						4.9	4.0		
23.			4.0	7.1	4.0			2.3	
24.		10							
25.				8.2	4.0			2.3	
26.							3.1		
27.	7.1	10							
28.				8.2		4.0			
29.	7.1		4.0				3.1		
30.					6.0				
31.				8.2		6.0			

NOTE.—No flow Oct. 1 to Feb. 1, 1920, and Aug. 15 to Sept. 30, 1921. No gage-height record on other days of missing discharge record.

LITTLE HORN RIVER NEAR WYOLA, MONT.

LOCATION.—In W. $\frac{1}{2}$ SW. $\frac{1}{4}$ sec. 28, T. 8 S., R. 35 E., one-fourth mile below proposed headworks of Little Horn canal No. 3, 16 miles above Lodgegrass Creek, and 4 miles southwest of Wyola, Big Horn County.

DRAINAGE AREA.—260 square miles.

RECORDS AVAILABLE.—September 7, 1911, to September 30, 1921.

GAGE.—Overhanging chain gage on right bank; read by C. N. Radcliffe.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders and gravel; shifts occasionally at high stages. Left bank high and not subject to overflow; right bank high but subject to overflow about 100 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.50 feet May 29 (discharge, 560 second-feet); minimum stage, 4.00 feet July 19-23, August 31 to September 20, and September 22-25 (discharge, 53 second-feet).

1912-1921: Maximum stage recorded, 7.1 feet June 22, 1917 (discharge, 1,580 second-feet); minimum discharge, 32 second-feet April 10 and 12, 1915.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Small amount diverted for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by shifting control and by ice.

Rating curve used October 1 to December 31 well defined; that used March 20 to September 30 well defined between 50 and 200 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage height to rating table, except as indicated in footnote to daily-discharge table. Records fair.

Discharge measurements of Little Horn River near Wyola, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
Apr. 13	W. A. Lamb	<i>Feet</i> 4.10	<i>Sec.-ft.</i> 68
May 13	do	4.45	150
Aug. 21	A. H. Tuttle	4.08	68

Daily discharge, in second-feet, of Little Horn River near Wyola, Mont., for the the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	101	101	91		110	88	538	110	78	53
2	101	101	91		99	88	515	99	69	53
3	101	101	91		99	88	515	99	69	53
4	101	101	91		99	88	493	99	69	53
5	101	101	101		110	88	493	99	69	53
6	101	101	91		110	99	493	99	69	53
7	101	101	91		110	156	493	99	69	53
8	101	101	91		110	178	493	99	78	53
9	101	101	91		110	163	493	99	88	53
10	101	101	91		110	135	493	99	88	53
11	101	101	91		110	122	471	99	88	53
12	113	101	91		110	122	493	99	88	53
13	113	101	91		84	130	493	99	88	53
14	113	101	91		99	110	471	88	88	53
15	113	101	91		99	135	471	88	88	53
16	113	101	91		99	149	471	88	88	53
17	113	101	81		99	163	471	78	88	53
18	113	113	81		99	211	493	61	88	53
19	113	101	81		99	228	450	53	88	53
20	101	101	81	101	99	254	428	53	88	53
21	101	101	81	101	99	344	386	53	88	59
22	101	101	81	101	99	303	303	53	88	53
23	101	101	81	101	99	365	264	53	88	53
24	101	101	81	112	99	365	228	61	88	53
25	101	91	75	112	99	365	194	69	88	53
26	101	91	70	112	99	407	163	78	88	61
27	101	91	70	101	99	471	135	88	88	61
28	101	91	80	101	99	538	135	88	78	61
29	101	91	91	101	99	560	110	88	69	61
30	101	91	91	101	99	538	110	88	61	61
31	101		91	112		538		88	53	

NOTE.—Shifting-control method used Oct. 1 to Dec. 24 and Dec. 29-31. Stage-discharge relation affected by ice Dec. 25-28; discharge interpolated. No gage-height record Jan. 1 to Mar. 19.

Monthly discharge of Little Horn River near Wyola, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	113	101	104	6,400
November	113	91	99.4	5,910
December	101	70	86.5	5,320
March 20-31	112	101	105	2,500
April	110	84	102	6,070
May	560	88	246	15,100
June	538	110	392	23,300
July	110	53	84.3	5,180
August	88	53	80.7	4,960
September	61	53	54.5	3,240

LITTLE HORN RIVER NEAR CROW AGENCY, MONT.

LOCATION.—In W. $\frac{1}{2}$ sec. 18, T. 3 S., R. 35 E., at Chicago, Burlington & Quincy Railroad bridge 2 miles south of Crow Agency, Big Horn County, 14 miles above junction with Big Horn River.

DRAINAGE AREA.—1,190 square miles.

RECORDS AVAILABLE.—September 7, 1911, to September 30, 1921; March 24, 1905, to June 30, 1906, station at Crow Agency, 2 miles below present station. Crow Agency ditch diverts water between the stations.

GAGE.—Stevens water-stage recorder on right bank since December 4, 1916; inspected by Charles Carpenter. For description of earlier gages see previous water-supply papers.

DISCHARGE MEASUREMENTS.—Made from upstream side of highway bridge, 200 feet below gage, or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of gravel. Banks high; not subject to overflow below gage height of about 14 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.2 feet May 9 (discharge, 917 second-feet); minimum discharge, no flow July 28 to August 6.

1905–1906 and 1912–1921: Maximum stage recorded, 11.79 feet May 11, 1920 (discharge, 5,970 second-feet); minimum discharge occurred in 1921.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Several diversions for irrigation from main stream and tributaries above station.

REGULATION.—Flow during irrigation season practically controlled by gate operations above station.

ACCURACY.—Stage-discharge relations affected by ice; practically permanent during open water. Rating curve well defined between 40 and 4,000 second-feet. Mean daily gage height obtained by inspection of recorder graph October 1 to December 6, February 11–19, April 3–25, June 26 to July 4, and August 20 to September 30; for rest of period, gage read to half-tenths once daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records good.

Discharge measurements of Little Horn River near Crow Agency, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Apr. 13	W. A. Lamb.....	<i>Feet</i> 4.23	<i>Sec.-ft.</i> 124	June 26	W. A. Lamb.....	<i>Feet</i> 4.40	<i>Sec.-ft.</i> 161
May 13	.....do.....	4.70	265	Aug. 20	A. H. Tuttle.....	3.85	43.9

Daily discharge, in second-feet, of Little Horn River near Crow Agency, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Apr.	May	June	July	Aug.	Sept.
1	114	185	142	116	605	116	0	40
2	121	191	142	92	605	142	0	39
3	137	156	142	92	560	139	0	46
4	148	137	139	92	518	142	0	48
5	164	134	153	92	560	70	0	50
6	159	129	159	116	560	70	0	54
7	173	176	156	142	605	70	2	54
8	173	216	150	296	560	70	8	52
9	179	228	150	917	560	70	12	56
10	185	212	148	330	560	70	19	66
11	188	200	145	296	560	70	28	77
12	191	194	142	263	518	231	38	83
13	191	156	126	263	478	401	38	85
14	185	170	116	231	439	200	28	83
15	179	182	119	231	330	142	28	81
16	173	170	111	231	296	116	28	79
17	188	156	102	263	296	70	28	74
18	197	200	102	263	296	50	28	79
19	194	197	97	263	296	28	33	81
20	182	200	102	296	231	12	42	72
21	185	200	121	296	231	19	44	72
22	191	216	132	330	200	19	48	70
23	185	191	219	330	170	8	48	68
24	176	167	79	478	170	8	44	66
25	185	166	70	605	170	12	45	66
26	188	164	116	518	170	116	48	66
27	182	162	116	478	176	142	46	64
28	197	160	116	518	179	0	46	68
29	200	158	116	560	170	0	45	79
30	206	156	116	605	142	0	44	94
31	196	-----	-----	605	-----	0	40	-----

NOTE.—Stage-discharge relation affected by ice during winter; discharge interpolated Nov. 25-29; discharge not computed Dec. 1 to Mar. 31. Discharge interpolated or estimated Oct. 31 and Apr. 1.

Monthly discharge of Little Horn River near Crow Agency, Mont., for the year ending Sept. 30, 1921.

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	206	114	178	10,900
November	228	129	178	10,600
April	219	70	128	7,620
May	917	92	329	20,200
June	605	142	374	22,300
July	401	0	84.0	5,160
August	48	0	27.7	1,700
September	94	39	67.1	3,990

LODGEGRASS CREEK NEAR WYOLA, MONT.

LOCATION.—In SE. $\frac{1}{4}$ sec. 6, T. 8 S., R. 34 E., at Sampson's ranch on Crow Indian Reservation, 8 miles west of Wyola, Big Horn County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 13 to September 30, 1921.

GAGE.—Overhanging wire gage on left bank, 300 feet above ford; read by Mrs. A. C. Sampson.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of heavy gravel and boulders embedded in heavy clay. Right bank high; not subject to overflow; left bank fairly high, covered with brush, and subject to overflow at high stages. Current fairly swift. Moss grows in abundance and may cause backwater. Control 50 feet below gage; appears fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.42 feet at 8 a. m. May 28 (discharge, 182 second-feet); minimum stage, 4.17 feet September 1 (discharge, 9.8 second-feet).

ICE.—None during period of record.

DIVERSIONS.—Two small ditches divert water above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined between 10 and 130 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Lodgegrass Creek near Wyola, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		Feet	Sec.-ft.
May 12	W. A. Lamb.....	4.54	31.5
Aug. 22	A. H. Tuttle.....	4.25	13.3

Daily discharge, in second-feet, of Lodgegrass Creek near Wyola, Mont., for the period May 13 to Sept. 30, 1921

Day	May	June	July	Aug.	Sept.	Day	May	June	July	Aug.	Sept.
1.....		169	33	15	10	16.....	31	110	18	17	17
2.....		180	37	14	11	17.....	33	104	17	17	16
3.....		147	35	14	12	18.....	39	114	17	14	16
4.....		143	35	14	12	19.....	49	110	17	14	17
5.....		180	35	14	11	20.....	49	94	13	14	17
6.....		160	33	14	11	21.....	57	79	14	11	16
7.....		160	31	11	11	22.....	71	68	16	11	14
8.....		165	27	14	14	23.....	96	68	16	11	14
9.....		176	26	14	14	24.....	106	54	16	11	17
10.....		176	24	14	14	25.....	123	54	16	12	17
11.....		158	20	12	17	26.....	138	51	16	12	16
12.....		158	23	12	17	27.....	167	47	16	11	16
13.....	29	154	27	17	17	28.....	176	47	16	11	14
14.....	29	136	20	17	16	29.....	149	43	14	10	14
15.....	29	125	18	18	17	30.....	167	40	16	11	14
						31.....	154		17	12	

Monthly discharge of Lodgegrass Creek near Wyola, Mont., for the period May 13 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 13-31.....	176	29	89.1	3,360
June.....	176	40	114	6,780
July.....	37	13	21.9	1,350
August.....	18	10	13.4	824
September.....	17	10	14.6	869
The period.....				13,200

LODGEGRASS CREEK NEAR LODGEGRASS, MONT.

LOCATION.—In sec. 30, T. 6 S., R. 35 E., half a mile above Lodgegrass ditch on Mogan's ranch and 7 miles southwest of Lodgegrass, Big Horn County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 13 to September 30, 1921; September 8, 1911, to December 28, 1915, comparable records one-fourth mile downstream. March 24, 1916, to September 30, 1920, records at station in S. $\frac{1}{2}$ sec. 13, T. 6 S., R. 35 E., one-fourth mile south of Lodgegrass.

GAGE.—Cantilever cable and weight on left bank 100 feet east of observer's house; read by Mrs. Grace E. Mogan.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed of stream, coarse gravel and clay. Control is gravel bar 50 feet below. Banks fairly high; right bank covered with brush.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.47 feet at 7.10 p. m. May 7 (discharge, 148 second-feet); minimum stage, 1.12 feet at 7 p. m. September 2 (discharge, 2.7 second-feet).

1911-1915 and 1921: Maximum discharge recorded, 695 second-feet June 13, 1915; minimum discharge occurred in 1921.

1916-1920: Maximum discharge recorded, 624 second-feet June 15, 1918; minimum discharge, no flow July 12 to September 30, 1919.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Several small diversions from main stream and tributaries above gage. Lodgegrass ditch diverts about half a mile below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined between 10 and 115 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Lodgegrass Creek near Lodgegrass, Mont., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
Apr. 13	W. A. Lamb	Feet	Sec.-ft.
May 12	do	1.44	20.4
Aug. 22	A. H. Tuttle	1.57	30.1
		1.29	9.5

Daily discharge, in second-feet, of Lodgegrass Creek near Lodgegrass, Mont., for the period Apr. 13 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1		8.6	134	35	18	3.8	16	16	30	97	22	14	13
2		8.6	130	40	18	3.0	17	15	30	86	21	13	13
3		7.8	124	43	17	3.8	18	15	31	95	21	12	11
4		8.2	124	39	15	6.0	19	15	41	93	22	11	11
5		7.3	128	37	14	8.6	20	15	50	86	22	10	9.6
6		7.8	134	37	14	8.2	21	15	48	75	18	9.6	9.6
7		63	132	36	14	7.8	22	15	53	70	19	9.1	8.6
8		76	134	32	14	7.3	23	15	77	66	19	8.6	6.4
9		70	138	32	14	7.3	24	11	84	71	18	8.2	5.2
10		70	134	30	11	9.1	25	10	91	48	16	8.2	5.2
11		55	128	30	9.6	11	26	10	102	47	16	8.2	4.4
12		33	124	51	8.2	11	27	9.6	118	44	18	7.8	3.8
13		19	30	123	30	9.1	28	9.6	140	43	15	7.3	3.4
14		21	29	110	28	13	29	10	128	41	15	6.8	3.8
15		18	29	102	27	14	30	9.1	130	38	14	6.0	3.8
							31		134		15	5.2	

*Monthly discharge of Lodgegrass Creek near Lodgegrass, Mont., for the period
Apr. 13 to Sept. 30, 1921*

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April 13-30.....	21	9.1	13.8	493
May.....	140	7.3	57.9	3,560
June.....	138	38	96.6	5,750
July.....	51	14	26.4	1,620
August.....	18	5.2	11.2	689
September.....	13	3.0	7.82	465
The period.....				12,600

TONGUE RIVER NEAR DAYTON, WYO.

LOCATION.—In SE. $\frac{1}{4}$ sec. 2, T. 56 N., R. 87 W., at mouth of canyon $3\frac{1}{2}$ miles southwest of Dayton, Sheridan County. Nearest tributary, Amsden Creek, enters $1\frac{1}{2}$ miles downstream.

DRAINAGE AREA.—204 square miles (measured on topographic map).

RECORDS AVAILABLE.—November 18, 1918, to September 30, 1921.

GAGE.—Stevens water-gage recorder on left bank 1,000 feet below head gate of Highline canal; inspected by Hugh Watson.

DISCHARGE MEASUREMENTS.—Made from cable 100 feet downstream or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders and coarse gravel, well compacted. Control 200 feet downstream; shifts slightly during high water.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.27 feet at 4 a. m. May 30 (discharge, 714 second-feet); minimum discharge, 26 second-feet at 10 a. m. November 12.

1919-1921: Maximum stage recorded, 4.35 feet at midnight June 10, 1920 (discharge, 1,700 second-feet); minimum stage, 1.00 foot at 9 p. m. November 29, 1919 (discharge, 15 second-feet).

ICE.—Stage-discharge relation slightly affected by ice for short periods.

DIVERSIONS.—Only diversion above station is Highline canal. During 1921, diversion amounted to 4,940 acre-feet between April 28 and September 30. Prior to July 1, 1921, adjudicated diversions of 256 second-feet below station in Wyoming, of which 75 second-feet is for power.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice during winter. Rating curve used October 1 to January 31, well defined within range of stage; that used February 1 to September 30, well defined below 800 second-feet. Operation of water-stage recorder was satisfactory up to August 3, when the intake became partly clogged. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph, except as indicated in footnote to daily-discharge table. Records up to August 3 excellent, except for periods of shifting control, for which they are fair.

Discharge measurements of Tongue River and Highline canal near Dayton, Wyo., during the year ending Sept. 30, 1921

[Made by P. V. Hodges]

River			Canal		
Date	Gage height	Discharge	Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 12.....	1.52	59	June 13.....	1.64	14.7
June 13.....	2.60	330	Sept. 17.....	1.21	8.2
Sept. 17.....	a 2.04	63			

a Intake to gage well clogged.

Daily discharge, in second-feet, of Tongue River near Dayton, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	60	52	52	47	58	61	62	77	508	211	155	
2.....	60	49	52	48	58	58	69	110	432	219	167	
3.....	64	64	50	50	58	57	84	155	427	222	152	
4.....	67	52	48	52	60	64	96	177	412	214	129	
5.....	67	53	49	52	57	62	91	205	412	208	120	
6.....	67	54	47	50	57	51	69	200	443	200	114	
7.....	67	54	50	46	53	57	66	224	438	192	106	
8.....	67	58	52	47	58	46	66	203	438	187	100	
9.....	65	42	49	54	60	50	69	195	407	179	94	
10.....	65	40	52	49	58	55	72	214	377	174	88	
11.....	76	41	52	49	58	55	82	250	368	182	84	
12.....	76	31	53	54	58	50	82	250	345	182	80	
13.....	76	42	49	53	60	62	84	230	320	184	72	
14.....	71	48	48	54	60	58	108	222	308	187		
15.....	68	53	48	53	58	53	100	224	320	179		
16.....	60	56	53	52	47	55	70	280	316	174		
17.....	65	56	54	55	44	61	87	305	273	174		
18.....	70	56	55	55	52	62	102	392	290	174		
19.....	65	60	54	54	62	61	110	392	485	177		
20.....	67	58	49	55	66	51	108	336	368	177		
21.....	64	55	49	53	64	48	100	387	312	177		
22.....	53	52	50	53	61	55	96	432	276	169		
23.....	41	56	52	54	61	61	110	438	263	174		
24.....	53	52	53	56	61	56	95	417	266	174		
25.....	65	48	52	56	61	48	82	448	256	179		
26.....	61	53	55	57	60	55	80	407	250	190		
27.....	38	54	60	56	60	53	78	491	236	184		
28.....	57	50	60	55	60	57	66	623	227	169		
29.....	60	50	55	56	-----	62	67	609	222	164		
30.....	55	52	54	54	-----	53	73	595	216	157		
31.....	53	-----	52	57	-----	54	-----	496	-----	155		

NOTE.—Indirect method for shifting control used Dec. 3 to Jan. 31. Gage-height record unreliable owing to partial clogging of inlet Aug. 4 to Sept. 30; discharge based on one discharge measurement and comparison with flow of Shell and Little Goose creeks. Braced figures indicate mean discharge for the periods included.

Monthly discharge of Tongue River near Dayton, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	76	38	62.7	3,860
November.....	64	31	51.4	3,060
December.....	60	47	51.9	3,190
January.....	57	46	52.8	3,250
February.....	66	44	58.2	3,230
March.....	64	46	55.8	3,430
April.....	110	62	84.1	5,000
May.....	623	77	322	19,800
June.....	508	216	340	20,200
July.....	222	155	183	11,300
August.....	167	-----	88.9	5,470
September.....	-----	-----	64	3,810
The year.....	623	31	118	85,600

LITTLE GOOSE CREEK NEAR BIG HORN, WYO.

LOCATION.—In sec. 30, T. 54 N., R. 84 W., at highway bridge at Hilman ranch, 3 miles southwest of Big Horn, Sheridan County. Nearest tributary, Tepee Creek, enters 7 miles upstream.

DRAINAGE AREA.—71 square miles (measured on topographic map).

RECORDS AVAILABLE.—May 4, 1919, to September 30, 1921.

GAGE.—Chain gage fastened to downstream side of bridge; read by Fred Hilman.

DISCHARGE MEASUREMENTS.—Made from single-span bridge, or by wading.

CHANNEL AND CONTROL.—Bed composed of embedded gravel and boulders.

Control 30 feet downstream at small rapids; apparently permanent. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.3 feet at 7 a. m. May 27 (discharge, 215 second-feet); minimum stage, 0.22 foot in afternoon September 30 (discharge, 6 second-feet).

1919-1921: Maximum stage recorded, 3.5 feet at 7 a. m. June 12, 1920 (discharge, 595 second-feet); minimum stage occurred in 1921.

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Four ditches, Last Chance, D. Cross, Red Hill, and Peralta divert water above station. The Peralta receives its supply from Cross Creek, which is diverted into Little Goose Creek. Prior to July 1, 1921, adjudicated diversions of 180 second-feet from creek below station.

REGULATION.—None, except by diversion of ditches above.

ACCURACY.—Stage-discharge relation practically permanent; slightly affected by ice during winter. Rating curve well defined below 500 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records good.

Discharge measurements of Little Goose Creek near Big Horn, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Feb. 11	Hodges and Hilman ^a	0.64	11.3
June 12	P. V. Hodges.....	1.94	126
Sept. 16	.....do.....	.68	13.4

^a Gage reader.

Daily discharge, in second-feet, of Little Goose Creek near Big Horn, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	15	17	14	14	13	13	14	23	151	60	63	16
2.....	16	17	15	13	13	13	13	24	138	59	63	16
3.....	15	18	14	13	13	12	14	25	146	57	61	15
4.....	15	18	14	13	13	13	14	27	138	57	59	16
5.....	14	18	14	13	13	13	15	36	142	56	55	16
6.....	15	18	15	13	13	13	15	43	157	62	51	16
7.....	15	18	14	13	14	13	14	91	185	66	50	16
8.....	15	18	15	13	13	13	13	102	172	70	50	16
9.....	15	16	14	13	13	13	14	91	172	71	50	16
10.....	15	14	14	13	13	13	15	84	159	76	50	14
11.....	15	12	14	13	13	13	16	79	144	91	47	14
12.....	15	12	14	13	13	13	16	80	136	91	46	14
13.....	15	14	14	13	13	13	17	85	124	88	44	14
14.....	15	14	14	13	13	13	18	85	102	88	40	13
15.....	16	16	15	13	13	13	18	84	102	88	37	12
16.....	16	16	15	13	13	13	19	79	104	83	33	12
17.....	16	16	15	12	13	13	19	83	102	84	26	11
18.....	16	18	14	12	13	14	21	85	99	82	25	11
19.....	16	18	14	12	13	14	23	87	98	79	24	11
20.....	16	17	15	12	13	14	22	89	96	79	21	10
21.....	16	17	14	12	12	14	24	94	91	80	19	9
22.....	16	16	12	12	12	14	24	107	88	78	17	8
23.....	16	16	10	12	13	14	23	96	88	79	16	8
24.....	16	16	10	13	13	15	24	126	84	78	15	8
25.....	17	16	10	13	13	14	22	140	80	80	16	7
26.....	18	16	11	13	13	14	22	172	76	76	16	7
27.....	18	16	12	13	13	15	23	200	73	75	19	7
28.....	18	16	14	13	13	15	22	172	70	74	18	7
29.....	18	14	15	13	-----	15	19	215	67	72	16	7
30.....	19	15	14	12	-----	15	22	215	64	68	15	6
31.....	19	-----	14	12	-----	15	-----	159	-----	64	16	-----

NOTE.—Stage-discharge relation affected by ice Nov. 9-18, Dec. 22-28; discharge determined from temperature and gage-height records and observer's notes. No gage heights Jan. 31 to Feb. 2, June 26 to July 1; discharge interpolated.

Monthly discharge of Little Goose Creek near Big Horn, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	19	14	16.0	984
November.....	18	12	16.1	958
December.....	15	10	13.6	836
January.....	14	12	12.7	781
February.....	14	12	13.0	722
March.....	15	12	13.6	836
April.....	24	13	18.5	1,100
May.....	215	23	99.3	6,110
June.....	185	64	115	6,840
July.....	91	56	74.5	4,580
August.....	63	15	34.8	2,140
September.....	16	6	11.8	702
The year.....	215	6	36.7	26,600

POWDER RIVER AT ARVADA, WYO.

LOCATION.—In sec. 16, T. 54 N., R. 77 W., at highway bridge at Arvada, Sheridan County. Nearest tributary, Wildhorse Creek, an intermittent stream, enters a quarter of a mile downstream.

DRAINAGE AREA.—6,050 square miles (measured on topographic maps and base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 4, 1919, to September 30, 1921. From July 22, 1915, to April 29, 1919, station maintained just above mouth of Clear Creek, 16 miles downstream. Except for run-off following infrequent heavy rains, discharge at two points fairly comparable.

GAGE.—Chain gage fastened to downstream side of single-span bridge; read by Dr. M. R. Stuttford.

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

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Control 200 feet downstream at small rapids composed of sand and gravel, which may shift during high water. Right bank subject to overflow at stage of 7 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.2 feet at 9 a. m. June 3 (discharge, 6,680 second-feet); minimum discharge, no flow September 9–14 and 16–18.

1919–1921: Maximum stage recorded, 8.25 feet June 19, 1920 (discharge, 10,700 second-feet); minimum discharge, no flow at times during summers of 1919 and 1921.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Practically no diversions from Powder River in Wyoming, but adjudicated diversions for 1,436 second-feet from tributaries entering above.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve well defined below 4,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table, except as indicated in footnote, to daily-discharge tables. Records good except for periods affected by ice and by shifting control, and periods of missing gage heights, for which they are fair.

Discharge measurements of Powder River at Arvada, Wyo., during the year ending Sept. 30, 1921

[Made by P. V. Hodges]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
June 9.....	3.08	1,660
Sept. 15.....	— .13	^a 0.2

^a Estimated

Daily discharge, in second-feet, of Powder River at Arvada, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	85	306	85	-----	345	420	380	280	200	1
2.....	90	300	256	-----	345	380	455	540	312	1
3.....	85	275	447	-----	312	312	3,920	495	130	1
4.....	95	345	373	-----	312	312	455	296	57	1
5.....	95	319	325	-----	345	312	680	98	90	1
6.....	92	387	280	-----	415	455	900	88	68	1
7.....	90	387	373	-----	495	740	1,130	73	56	1
8.....	95	378	170	-----	540	965	2,540	70	44	1
9.....	95	359	154	-----	455	1,190	1,960	66	30	0
10.....	105	220	100	-----	435	1,190	1,190	1,500	18	0
11.....	115	85	200	-----	415	795	1,020	2,870	15	0
12.....	124	80	165	-----	380	740	960	2,740	9	0
13.....	118	80	130	-----	380	690	960	905	15	0
14.....	439	85	43	415	380	635	1,000	635	750	0
15.....	415	90	40	380	380	660	1,600	220	1,480	1
16.....	373	125	125	380	380	685	1,480	635	312	0
17.....	210	175	-----	345	455	540	1,020	250	124	0
18.....	200	190	-----	345	380	495	685	115	35	0
19.....	220	220	-----	345	345	635	2,220	98	25	1
20.....	232	550	-----	345	380	585	3,140	115	9	4
21.....	256	500	-----	420	345	540	2,540	98	7	5
22.....	280	495	-----	495	415	520	1,240	88	5	6
23.....	306	479	-----	455	495	495	685	34	4	6
24.....	320	415	-----	415	520	840	540	30	3	6
25.....	332	387	-----	415	540	1,190	495	26	2	7
26.....	293	387	-----	415	585	1,480	600	905	2	6
27.....	280	345	-----	380	585	905	300	455	1	7
28.....	306	319	-----	345	560	960	300	415	1	7
29.....	268	170	-----	280	540	540	280	415	1	8
30.....	306	130	-----	280	455	540	250	146	1	9
31.....	306	-----	-----	345	-----	495	-----	175	1	-----

NOTE.—Stage-discharge relation affected by ice Nov. 2-3, 17-20, Dec. 15-16; discharge based on temperature and gage-height records and observer's notes. No gage-height record Oct. 6, 10, 11, 24, 31, Nov. 8, 10, 12-16, 21, 30, Dec. 5, 12, Mar. 21, 27, Apr. 10, 24, 28, May 1, 4, 8, 12, 13, 15, 22, 24, June 5, 6, 13, 14, 26-28, July 4, 10, 24, 31, Aug. 7, 14, 21, 25, 30, Sept. 15, 18, 19, 24; discharge based on climatological data and observer's notes. Shifting-control method used June 1-25.

Monthly discharge of Powder River at Arvada, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	439	85	214	13,200
November.....	550	80	286	17,000
December 1-16.....	447	40	204	6,470
March 14-31.....	495	280	378	13,500
April.....	585	312	430	25,600
May.....	1,480	312	685	42,100
June.....	3,920	250	1,160	69,000
July.....	2,870	26	480	29,500
August.....	1,480	1	123	7,560
September.....	9	0	2.7	161

CLEAR CREEK NEAR BUFFALO, WYO.

LOCATION.—In sec. 6, T. 50 N., R. 82 W., just above power house of Buffalo Manufacturing Co., 4 miles west of Buffalo, Johnson County.

DRAINAGE AREA.—120 square miles (measured on topographic map).

RECORDS AVAILABLE.—June 16, 1917, to September 30, 1921, at present site. From June 1 to September 30, 1894, and from May 2, 1896, to February 28, 1900, station maintained at measuring flume 1 mile upstream; flow at two points comparable. From October 24, 1902, to December 31, 1904, and May 8, 1911, to June 11, 1912, at highway bridge in Buffalo; flow not comparable with that for other stations as several ditches divert water between.

GAGE.—Chain gage on left bank, 300 feet above power house; read by Mrs. Ruby Bell.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of large boulders. Control at large boulders 10 feet downstream; shifts slightly at infrequent intervals. Bank not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.6 feet at 6 a. m. June 8 (discharge, 785 second-feet); minimum discharge occurred during winter.

1917–1921: Maximum stage recorded, 4.2 feet June 18, 1917 (discharge, 1,120 second-feet); minimum discharge occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Pipe line of Buffalo Manufacturing Co. diverts water from Clear Creek, 1½ miles upstream. A separate record of flow through pipe line is kept and flow added to that at gaging station to give total flow of creek. Four Lakes and French Creek canal and North Fork and French Creek canal divert water from Clear Creek above station. During 1921, 8,140 acre-feet were diverted between May 13 and August 3.

Prior to July 1, 1921, adjudicated decrees for diversions of 372 second-feet below station.

REGULATION.—Alternate melting and freezing of mountain snow during spring causes diurnal fluctuation in flow. No artificial regulation.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve well defined below 600 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; shifting-control method used June 6 to June 20. Records good except for periods of shifting control and of ice effect, for which they are fair.

Discharge measurements of Clear Creek and power-plant tailrace near Buffalo, Wyo., during the year ending Sept. 30, 1921

[Made by P. V. Hodges]

Date	Creek		Tailrace discharge
	Gage height	Discharge	
Feb. 10.....	<i>Feet</i> 0.84	<i>Sec.-ft.</i> 3.6	<i>Sec.-ft.</i> 3.6
June 10.....	2.74	386	8.8

Daily discharge, in second-feet, of Clear Creek near Buffalo, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	26	15	5	5	5	13	14	258	83	27	16
2	24	15	4	4	4	16	29	210	82	40	14
3	24	16	5	4	5	23	49	204	74	33	14
4	24	16	5	4	9	28	38	198	66	53	16
5	23	17	4	5	8	21	63	240	62	44	19
6	23	18	4	5	4	12	66	458	54	42	18
7	23	20	5	5	9	12	135	435	50	42	17
8	23	21	5	4	9	6	98	225	47	33	18
9	23	25	5	5	10	7	68	458	44	31	18
10	26	26	5	4	7	16	72	355	47	31	18
11	25	31	5	3	10	17	85	355	63	29	18
12	24	37	5	3	10	16	83	315	53	27	17
13	24	27	5	3	10	14	62	375	47	27	23
14	24	21	5	4	9	23	49	292	47	31	23
15	23	16	5	4	9	12	50	335	43	27	23
16	23	18	5	4	9	16	66	275	43	29	22
17	23	18	5	4	10	5	74	225	44	27	22
18	24	21	5	4	10	25	91	240	48	23	21
19	21	20	5	4	13	30	128	275	51	23	20
20	19	18	5	3	7	34	116	240	42	23	21
21	19	16	5	4	4	41	128	174	37	22	20
22	21	16	4	3	9	34	150	150	37	20	18
23	21	18	3	4	10	40	171	138	36	19	18
24	21	21	3	4	10	31	195	150	35	18	16
25	20	18	5	4	4	25	275	132	36	18	16
26	18	19	4	4	5	18	225	125	32	18	16
27	16	18	5	4	4	14	258	121	31	16	15
28	18	16	5	4	5	9	395	110	31	16	15
29	18	16	5		9	9	502	100	29	17	16
30	13	14	5		4	15	435	93	30	16	16
31	13		4		4		315		29	16	

NOTE.—Stage-discharge relation affected by ice Jan. 22-24; discharge determined from temperature and gage-height records and observer's notes.

Monthly discharge of Clear Creek near Buffalo, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	26	13	21.5	1,320
November	37	14	19.6	1,170
December			a 8	492
January	5	3	4.7	289
February	5	3	4.0	222
March	13	4	7.6	467
April	41	5	19.4	1,150
May	502	14	145	8,920
June	458	93	242	14,400
July	83	29	46.9	2,880
August	53	16	27.0	1,660
September	23	14	18.1	1,080
The year	502		47.0	34,000

a Estimated.

Combined monthly discharge of Clear Creek and power-plant tailrace near Buffalo, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second- feet, mean	Run-off in acre-feet	Month	Discharge in second- feet, mean	Run-off in acre-feet
October.....	27.5	1,690	May.....	152	9,350
November.....	24.1	1,430	June.....	252	15,000
December.....	12.0	738	July.....	54.9	3,380
January.....	8.7	535	August.....	34.0	2,090
February.....	8.0	444	September.....	24.1	1,430
March.....	11.6	713			
April.....	23.9	1,420	The year.....	52.8	38,200

PINEY CREEK AT KEARNEY, WYO.

LOCATION.—In sec. 26, T. 53 N., R. 83 W., at highway bridge 300 yards south of Kearney, Johnson County.

DRAINAGE AREA.—117 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—September 6, 1902, to June 30, 1906; May 13, 1911, to October 31, 1912; April 24, 1915, to August 10, 1917; May 1, 1919, to September 30, 1921. State engineer maintained station at this point during 1913.

GAGE.—Chain gage on downstream side of bridge; read by R. E. Martin. Gage used from 1902 to 1906 at same site but referred to different datum.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders. Control is well-defined rapids 100 feet downstream; apparently permanent. Above gage height of about 5 feet there is flow in small channel along left bank which diverts water from Piney Creek some distance above station.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.9 feet at 6 p. m. June 7 (discharge, 796 second-feet); minimum stage, 0.98 foot at 7 p. m. August 24 (discharge, 6 second-feet).

1902–1906; 1911–1921: Maximum discharge recorded, 1,660 second-feet May 24, 1906; minimum discharge occurred in 1921.

ICE.—Stage-discharge relation affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 293 second-feet from Piney Creek above station.

REGULATION.—Operation of reservoirs on headwaters of Piney Creek and diversion of ditches above station affect flow at station.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice during winter. Rating curve well defined below 800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage to rating table. Records good.

Discharge measurements of Piney Creek at Kearney, Wyo., during the year ending September 30, 1921

Date	Made by—	Gage height	Dis- charge
		<i>Feet</i>	<i>Sec.-ft.</i>
June 10	P. V. Hodges	3.00	349
August	W. A. Ingham	1.88	62

^a Engineer for Leiter estate. Date of measurement unknown.

Daily discharge, in second-feet, of Piney Creek at Kearney, Wyo., for the year ending September 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	30	42	-----	35	58	228	7	23	13
2	30	40	-----	40	73	175	15	21	17
3	31	42	-----	45	101	162	12	36	18
4	29	40	-----	50	108	150	11	37	20
5	26	40	-----	50	150	353	11	32	21
6	22	37	-----	46	68	472	13	30	16
7	24	39	-----	46	36	688	16	25	27
8	24	42	-----	37	214	688	20	21	24
9	24	55	-----	43	244	472	23	20	30
10	31	78	-----	43	244	313	26	17	34
11	55	75	-----	36	214	260	24	14	34
12	47	73	-----	50	188	150	25	13	39
13	50	71	-----	49	175	108	26	13	41
14	48	55	27	57	130	162	26	11	41
15	48	45	28	66	120	244	22	12	41
16	37	40	27	50	118	150	24	10	41
17	40	35	27	55	124	150	26	16	44
18	39	30	31	66	175	139	52	12	39
19	38	30	34	59	175	607	50	12	25
20	40	30	31	62	162	200	47	10	29
21	40	34	28	68	188	108	38	7	32
22	38	36	34	67	200	63	40	15	29
23	30	36	31	79	214	72	41	11	26
24	30	36	40	73	228	44	36	8	24
25	40	36	30	50	244	46	34	8	22
26	45	39	31	56	188	15	36	9	26
27	28	41	31	45	188	7	31	9	15
28	44	41	35	48	332	11	29	11	27
29	50	40	33	44	607	8	30	13	28
30	51	31	36	44	472	7	22	13	26
31	41	-----	25	-----	294	-----	22	13	-----

NOTE.—Stage-discharge relation affected by ice Nov. 14-20; discharge ascertained by comparison with flow of Clear Creek near Buffalo.

Monthly discharge of Piney Creek at Kearney, Wyo., for the year ending September 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	55	22	37.1	2,280
November	78	30	43.6	2,590
March 14-31	40	25	31.1	1,110
April	79	35	52.0	3,090
May	607	36	195	12,000
June	688	7	208	12,400
July	52	7	26.9	1,650
August	37	7	16.2	996
September	44	13	28.3	1,680

PINEY CREEK AT UCROSS, WYO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 18, T. 53 N., R. 80 W., at highway bridge a quarter of a mile from Ucross, Sheridan County. No tributary between station and mouth, half a mile below.

DRAINAGE AREA.—253 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 12, 1917, to September 30, 1921.

GAGE.—Chain gage attached to highway bridge; read by Miss Sybil Kipp.

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

CHANNEL AND CONTROL.—Bed composed of silt and gravel. Control is riffle of compact gravel 50 feet downstream; shifts at long intervals. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.4 feet at 6 and 7 p. m. June 8 (discharge, 560 second-feet); minimum stage, 1.25 feet August 3 (discharge, 3 second-feet).

1917-1921: Maximum stage recorded, 5 feet on morning of June 11, 1918, from high-water mark (discharge, 1,900 second-feet); minimum stage, 1 foot at 8 p. m. July 30, 1920 (discharge, 1.0 second-foot).

ICE.—Stage-discharge relation affected by ice; records discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 61 second-feet from Piney Creek between Kearney and Ucross.

REGULATION.—Headwaters are chain of small mountain lakes, the largest of which, Cloud Peak, is used as reservoir for irrigation. Alternate melting and freezing of mountain snow in spring of year causes some diurnal fluctuation.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve well defined below 800 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

The following discharge measurement was made by P. V. Hodges:
June 11, 1921; Gage height, 2.81 feet; discharge, 299 second-feet.

Daily discharge, in second-feet, of Piney Creek at Ucross, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Apr.	May	June	July	Aug.	Sept.
1.	21	25	-----	35	290	24	4	7
2.	20	25	-----	25	290	22	4	7
3.	20	26	-----	35	220	22	3	7
4.	19	27	-----	33	190	14	6	6
5.	18	28	-----	33	160	15	14	5
6.	18	29	-----	60	175	13	14	7
7.	18	30	-----	79	272	14	13	15
8.	20	31	-----	238	147	15	7	15
9.	22	32	-----	238	370	18	6	20
10.	22	33	66	220	330	21	6	21
11.	29	34	74	205	330	24	6	22
12.	53	35	64	184	310	25	6	30
13.	35	35	74	155	255	18	7	32
14.	47	31	64	129	238	32	6	35
15.	40	27	64	83	220	29	7	40
16.	35	-----	49	100	255	35	10	49
17.	37	-----	46	105	255	34	18	47
18.	35	-----	46	105	255	38	15	49
19.	35	-----	42	129	290	44	14	45
20.	40	-----	49	155	190	40	30	53
21.	40	-----	38	129	105	36	21	22
22.	40	-----	49	126	76	32	21	22
23.	35	-----	52	193	35	37	24	21
24.	35	-----	46	166	21	35	24	21
25.	28	-----	32	157	8	27	22	37
26.	40	-----	36	132	44	14	22	47
27.	40	-----	46	190	35	13	13	38
28.	35	-----	38	280	27	7	15	37
29.	30	-----	32	420	13	6	20	44
30.	28	-----	36	392	14	4	20	50
31.	25	-----	-----	310	-----	4	16	-----

NOTE.—Stage-discharge relation affected by ice Oct. 29 to Nov. 12 and Nov. 14; discharge ascertained from temperature and gage-height records and comparison with flow of Piney Creek at Kearney. No gage-height record Oct. 1-6, May 28-29, July 20-21; discharge interpolated.

Monthly discharge of Piney Creek at Ucross, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	53	18	31.0	1,910
November 1-15.....	35	25	29.9	890
April 10-30.....	74	32	49.7	2,070
May.....	420	25	156	9,590
June.....	370	8	181	10,800
July.....	44	4	23.0	1,410
August.....	30	3	13.4	824
September.....	53	5	28.4	1,690

UPPER SEVENMILE CREEK NEAR GLENDIVE, MONT.

LOCATION.—In SW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 28, T. 16 N., R. 54 E., at ranch of William Easton, 10 miles southwest of Glendive, Dawson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 19 to June 18, 1921.

GAGE.—Vertical staff fastened to left bank.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Control is wide riffle of fine gravel over which water flows in two channels. Left bank high; right bank clean and is overflowed at moderate stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.70 feet at 10 p. m. June 18 (discharge estimated, 1,250 second-feet); minimum discharge, no flow May 27, 30, June 6-8, and 12-16.

ICE.—Records discontinued during winter. Probably no flow.

DIVERSIONS.—A few small ditches divert water for hay land.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent for period. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Upper Sevenmile Creek near Glendive, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec. ft.</i>
Mar. 19.....	1.38	1.0
May 17.....	1.26	* 1

* Estimated.

Daily discharge, in second-feet, of Upper Sevenmile Creek near Glendive, Mont., for the period Mar. 19 to June 18, 1921

Day	Mar.	Apr.	May	June	Day	Mar.	Apr.	May	June
1		1.0	0.7	0.2	16		0.4	0.2	0.0
2		.5	.6	.4	17		.4	.2	5.8
3		.4	.5	.3	18		.4	.2	358.0
4		.5	.4	.3	19	1.0	.4	.2	
5		.6	.3	.2	20	1.8	.4	.3	
6		.7	.2	.0	21	3.2	.4	.2	
7		.6	.2	.0	22	2.4	.4	.2	
8		.5	.3	.0	23	1.8	.5	.2	
9		.8	.6	.5	24	1.0	.5	.2	
10		2.2	.5	.3	25	1.0	.4	.1	
11		.8	.4	.2	26	.8	.4	.1	
12		.8	.5	.0	27	.4	.4	.0	
13		.6	.4	.0	28	.6	.5	.1	
14		.5	.4	.0	29	.8	.6	.1	
15		.6	.3	.0	30	.7	1.0	.1	
					31	.7		.0	

Monthly discharge of Upper Sevenmile Creek near Glendive, Mont., for the period Mar. 19 to June 18, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 19-31	3.2	0.4	1.25	32.2
April	2.2	.4	.61	36.3
May	.7	.0	.28	17.2
June 1-18	358	.0	20.3	725
The period				811

DEER CREEK NEAR GLENDIVE, MONT.

LOCATION.—In NW. $\frac{1}{4}$ NW. $\frac{1}{4}$ sec. 12, T. 16 N., R. 55 W. at ranch of Ed Olson, 5 miles northwest of Glendive, Dawson County, and 3 miles above confluence with Yellowstone River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 19 to June 19, 1921.

GAGE.—Vertical staff in bed of stream near right bank 100 feet above ford; read by Mrs. Ed Olson.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Control is riffle of small gravel 100 feet below gage. Channel straight for 100 feet above and below gage. Banks are low and subject to overflow; both clean, except for few large trees.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.00 feet at 1 p. m. June 19 (discharge from extension of rating curve, 2,000 second-feet); minimum discharge, no flow March 27 to May 8, May 18 to June 8, and June 12-17.

ICE.—None during period of record. Creek probably dry throughout winter.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve fairly well defined below 30 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Deer Creek near Glendive, Mont., during the year ending Sept. 30, 1921

[Made by G. H. Ellis]

Date	Gage height	Discharge
Mar. 19.....	<i>Feet</i> 1.36	<i>Sec.-ft.</i> 21.5
May 17.....	.69	a, 10

a Estimated.

Daily discharge, in second-feet, of Deer Creek near Glendive, Mont., for the period Mar. 19 to June 19, 1921

Day	Mar.	May	June	Day	Mar.	May	June	Day	Mar.	May	June
1.....				11.....		11	0.3	21.....	21		
2.....				12.....		8.8		22.....	18		
3.....				13.....		7.1		23.....	6.2		
4.....				14.....		5.4		24.....	5.6		
5.....				15.....		3.7		25.....	5.6		
6.....				16.....		2.0		26.....	.3		
7.....				17.....		.3		27.....			
8.....				18.....			830	28.....			
9.....		51	8.2	19.....	22		1,090	29.....			
10.....		26	1.9	20.....	21			30.....			
								31.....			

NOTE.—Creek dry Mar. 27 to May 8, May 18 to June 8, and June 12-17.

Monthly discharge of Deer Creek near Glendive, Mont., for the period Mar. 19 to June 19, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
March 19-31.....	22	0	7.67	198
April.....	0	0	.0	0
May.....	51	0	3.72	229
June 1-19.....	1,090	0	102	3,840
The period.....				4,270

LITTLE MISSOURI RIVER BASIN**LITTLE MISSOURI RIVER NEAR ALZADA, MONT.**

LOCATION.—Near southwest corner of T. 8 S., R. 60 E., at Walker ranch, 2 miles below mouth of Thompson Creek and 4 miles below Alzada, Carter County

DRAINAGE AREA.—780 square miles.

RECORDS AVAILABLE.—JUNE 18, 1911, to September 30, 1921.

GAGE.—Overhanging chain gage on right bank since April 17, 1912; read by John Walker. Vertical staff on left bank, 150 feet downstream, used before chain gage. Datum of chain gage 0.08 foot lower than that of staff gage

DISCHARGE MEASUREMENTS.—Made by wading or from cable.

CHANNEL AND CONTROL.—Bed composed of gravel; shifts during high water; current sluggish. Two channels at medium and one at high stage. Control is gravel riffle a short distance downstream; shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.07 feet at 6.30 a. m. June 29 (discharge, 915 second-feet); minimum discharge, no flow May 11, 29–31, July 27, 28, August 12 to September 15, and 27–30.

1911–1921: Maximum stage recorded, 15.3 feet April 6, 1912 (discharge, 4,550 second-feet); minimum discharge, no flow at times during each year.

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Small amount of water diverted above station for irrigation.

REGULATION.—None of importance. Some flood water is stored in coulees on tributaries for use in irrigating small tracts.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 1,800 second-feet. Gage read to quarter or third-tenths twice daily. Discharge ascertained by applying mean daily gage height to rating table. Records good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Little Missouri River near Alzada, Mont., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	0.9	0.7	1.7	-----	5.3	0.2	0.1	136	30	-----
2	1.5	1.9	1.9	-----	3.9	.2	1.7	36	17	-----
3	1.9	2.1	1.7	-----	3.9	.2	.9	35	28	-----
4	2.1	1.5	1.7	50	2.5	.2	.7	25	25	-----
5	1.1	.9	1.9	37	3.2	.4	.4	24	12	-----
6	1.1	.9	1.9	29	3.5	.2	.4	15	6.5	-----
7	.7	.7	1.9	28	2.8	.3	.3	12	3.5	-----
8	.4	.5	2.5	12	2.5	.2	25	8.0	2.1	-----
9	.5	1.9	2.5	13	2.1	.1	18	5.0	.5	-----
10	1.1	1.3	2.1	12	1.9	.1	10	2.3	.4	-----
11	.5	1.1	2.5	9.5	1.5	.0	5.6	.9	.2	-----
12	1.9	.9	2.3	7.0	1.3	.2	3.9	22	-----	-----
13	3.6	.9	2.1	5.6	1.3	.2	2.1	107	-----	-----
14	2.5	.7	1.7	5.0	1.5	.1	1.3	79	-----	-----
15	1.3	.7	1.9	4.2	1.1	.2	.2	118	-----	-----
16	.5	.4	1.9	4.6	.9	.2	.9	32	-----	42
17	.5	.7	1.3	5.6	.9	.1	.4	16	-----	64
18	.5	.4	1.7	8.0	.5	.2	.2	11	-----	37
19	.5	.4	1.7	6.5	.5	.2	743	7.5	-----	19
20	.5	22	1.5	7.5	.4	.2	786	4.2	-----	9.5
21	.5	33	1.3	5.0	.4	.2	789	2.3	-----	5.3
22	.5	19	1.5	7.0	.4	.2	430	1.3	-----	1.7
23	1.1	20	1.5	48	.2	.2	91	.7	-----	.5
24	.7	10	1.5	107	.2	.2	34	.5	-----	.4
25	.9	6.5	1.5	111	.2	.4	21	.2	-----	.2
26	1.1	4.2	1.7	42	.2	.2	22	.2	-----	.2
27	.9	2.5	1.5	29	.2	.2	128	.0	-----	-----
28	.9	2.3	1.7	17	.2	.1	273	.0	-----	-----
29	.7	3.9	1.9	10	.2	.0	844	7.5	-----	-----
30	.5	2.3	1.9	7.0	.2	.0	447	5.3	-----	-----
31	.5	-----	1.7	5.0	-----	.0	-----	51	-----	-----

NOTE.—Stage-discharge relation affected by ice Jan. 1 to Mar. 3; discharge not computed. No flow where discharge is not given.

Monthly discharge of Little Missouri River near Alzada, Mont., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	3.6	0.4	1.03	63.3
November.....	33	.4	4.81	286
December.....	2.5	1.3	1.80	111
March 4-31.....	111	4.2	22.6	1,260
April.....	5.3	.2	1.46	86.9
May.....	4	.0	.17	10.4
June.....	844	.1	156	9,280
July.....	136	.0	24.7	1,520
August.....	30	.0	4.04	248
September.....	64	.0	5.99	356

HEART RIVER BASIN

HEART RIVER NEAR RICHARDTON, N. DAK.

LOCATION.—In sec. 21, T. 138 N., R. 92 W., opposite residence of W. F. Church 11 miles south of Richardton, Stark County, and 1 mile below highway bridge.

DRAINAGE AREA.—1,250 square miles.

RECORDS AVAILABLE.—May 18, 1903, to September 30, 1921. From 1903 to 1911 at highway bridge at northwest corner of section 28.

GAGE.—Chain gage on cantilever timber on right bank; read by W. F. Church. Auxiliary chain gage on highway bridge 1 mile above, for use in case of accident to regular gage. The two gage datums are so related that readings at the bridge are approximately 20.0 feet less than on the gage regularly used.

DISCHARGE MEASUREMENTS.—From highway bridge or by wading.

CHANNEL AND CONTROL.—Channel fairly permanent, but control, one-fourth mile below, was sometimes changed by building of beavers' dams through parts of the year.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 28.6 feet June 19 (discharge, 714 second-feet); minimum stage, 23.9 feet August 25 (discharge, 0.1 second-foot).

1903-1921: Maximum stage recorded, 25.9 feet June 10, 1906 (discharge, 8,020 second-feet); minimum stage, no flow during periods in 1903, 1905, 1914, and 1919.

ICE.—Stage-discharge relation seriously affected by ice.

ACCURACY.—Stage-discharge relation not permanent; affected by ice and by shifting control. Two fairly well defined rating curves used; one applicable October 1 to March 20; other applicable to September 30. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage height to rating table, except for period of ice effect. Records fair.

The following discharge measurement was made by E. F. Chandler:

September 2, 1921: Gage height, 24.62 feet; discharge, 17.8 second-feet.

Daily discharge, in second-feet, of Heart River near Richardton, N. Dak., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.8	6		0.6		6	32	11	8	103	1.4	28
2	1.8	6				6	28	11	4.6	66	1.4	20
3	1.8	6				6	28	11	2.6	55	.6	8
4	1.8	6				6	20	8	3.3	55	1.4	11
5	1.8	6				.4	24	8	1.8	46	1.4	8
6	1.8	6				.4	24	8	2.6	46	1.4	6
7	1.4	6				.4	20	8	4.6	28	.6	4.6
8	1.4	6				.4	14	11	4.6	28	.6	4.6
9	1.4	6				.4	11	36	4.6	17	.6	4.6
10	1.4	6				.4	28	14	4.6	14	.6	6
11	1.4	6				.4	20	11	4.6	11	.6	4.6
12	1.4	6				.3	17	17	4.6	8	.2	4.6
13	1.4	6				.2	20	20	2.6	6	.4	4.6
14	1.4	4				.2	20	8	1.8	6	.4	4.6
15	1.4	2	3.2	.8	0.6	.2	17	8	11	6	.4	4.6
16	1.4	1.4				.2	17	8	8	8	.4	11
17	1.4	1.4				5	14	8	36	4.6	.4	14
18	1.4	1.4				20	14	6	41	6	.2	6
19	1.4	1.4				40	14	8	714	2.6	.2	6
20	1.4	1.4				60	17	8	332	8	.2	8
21	1.4	1.7				170	20	11	154	28	.2	8
22	1.4	2				170	20	8	71	20	.2	8
23	3.2	2				154	17	8	50	11	.2	8
24	3.2	2				154	14	8	71	8	.2	8
25	3.2	2				96	14	8	50	6	.1	8
26	3.2	2				83	14	8	36	4.6	.2	8
27	3.2	2				71	14	8	8	4.6	.2	4.6
28	17	2.2			.6	60	14	8	8	3.3	.2	4.6
29	10	2.2				50	11	8	124	2.6	.3	4.6
30	8	2.4				41	14	8	203	2.6	110	2.6
31	8			.8		41		8		1.8	50	

Monthly discharge of Heart River near Richardton, N. Dak., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	17	1.4	2.97	183
November	6	1.4	3.72	221
December			a 2.16	133
January			a .7	43
February			a .6	33
March	170	.2	39.9	2,450
April	32	11	18.4	1,090
May	36	6	10.3	633
June	714	1.8	65.7	3,910
July	103	1.8	19.9	1,220
August	110	.1	5.65	347
September	28	2.6	7.77	462
The year	714		14.8	10,700

^a Estimated.

CHEYENNE RIVER BASIN

BELLE FOURCHE RIVER NEAR BELLE FOURCHE, S. DAK.

LOCATION.—In sec. 2, T. 8 N., R. 2 E., at diversion dam of Belle Fourche irrigation project, 1½ miles below Belle Fourche, Butte County.

DRAINAGE AREA.—4,270 square miles.

RECORDS AVAILABLE.—May 10 to November 30, 1906; January 1, 1912, to September 30, 1921. May 26, 1903, to June 23, 1906, at western edge of Belle Fourche. The records at these stations are not directly comparable, as Redwater River enters between and water is also diverted from Belle Fourche River.

GAGE.—Inclined staff 100 feet from crest of diversion dam, and gage in canal
See "Computation of discharge."

COMPUTATION OF DISCHARGE.—The following information was supplied by the United States Bureau of Reclamation: Records of daily discharge represent the entire flow of river at diversion dam and have been corrected for water diverted through Inlet canal and passed through sluice gates. The diversion dam acts as a weir; the crest is 400 feet long; the gage is 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 quantity diverted is determined at a gaging station maintained on Inlet canal, and the 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 prior to July 1, 1919, adjudicated diversions of 14 second-feet from Belle Fourche River and 258 second-feet from the tributaries. Below the station authorized diversions of 3,102 second-feet from Belle Fourche River.

ACCURACY.—The United States Bureau of Reclamation considers the records fair.
COOPERATION.—Complete records furnished and stations maintained by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Belle Fourche River near Belle Fourche, S. Dak., for the year ending Sept. 30, 1921.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	276	204	176	216	216	1,360	209	105	159	781	549	13
2.....	276	200	177	218	214	1,450	209	101	152	797	564	11
3.....	276	190	176	198	221	929	210	98	71	635	186	13
4.....	276	180	176	198	222	421	210	89	124	579	237	13
5.....	276	170	176	201	222	371	221	55	105	706	119	13
6.....	249	175	176	228	201	333	219	92	443	531	118	14
7.....	249	175	175	202	201	328	168	81	553	437	117	18
8.....	249	175	175	201	201	244	168	76	2,100	318	117	17
9.....	249	175	175	184	202	228	210	96	1,460	224	104	22
10.....	249	171	175	202	202	257	189	112	1,440	152	71	33
11.....	249	164	176	199	209	267	221	106	950	301	44	53
12.....	249	157	174	190	211	223	221	101	328	104	56	53
13.....	249	155	175	217	211	198	221	96	251	70	58	3
14.....	249	141	173	145	212	214	149	92	383	48	63	53
15.....	249	137	113	201	216	327	149	93	376	47	69	88
16.....	249	165	165	201	195	210	149	93	214	202	101	79
17.....	249	176	164	183	473	245	200	98	118	136	109	74
18.....	249	171	166	209	642	227	168	99	594	115	68	79
19.....	271	175	166	226	408	235	177	81	512	310	64	79
20.....	271	175	166	228	381	249	140	81	738	156	58	84
21.....	271	176	156	203	229	238	145	76	1,530	67	53	87
22.....	271	175	94	201	216	223	135	78	3,860	61	53	87
23.....	271	176	107	201	189	223	108	80	2,420	123	36	80
24.....	271	173	94	203	254	224	109	68	1,000	188	44	73
25.....	271	173	150	215	323	216	112	88	819	120	52	46
26.....	271	244	146	221	520	218	110	242	517	95	44	46
27.....	271	203	137	224	2,040	210	106	99	230	58	26	50
28.....	271	224	172	228	1,540	211	110	98	546	190	19	77
29.....	204	223	200	246	-----	211	110	113	725	484	18	70
30.....	204	223	194	217	-----	211	110	256	674	120	19	86
31.....	204	-----	245	224	-----	209	-----	168	-----	774	15	-----

NOTE.—Figures have been changed slightly to comply with rules of computations used by U. S. Geol. Survey.

Monthly discharge of Belle Fourche River near Belle Fourche, S. Dak., for the year ending Sept 30, 1921.

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	276	204	256	15, 700
November.....	244	137	181	10, 800
December.....	245	94	164	10, 100
January.....	246	145	207	12, 700
February.....	2, 040	189	378	21, 000
March.....	1, 450	198	345	21, 200
April.....	221	106	165	9, 820
May.....	256	55	104	6, 400
June.....	3, 860	71	780	46, 400
July.....	797	47	288	17, 700
August.....	564	15	105	6, 460
September.....	88	3	50. 5	3, 000
The year.....	3, 860	3	250	181, 000

LITTLE SIOUX RIVER BASIN

LITTLE SIOUX RIVER AT CORRECTIONVILLE, IOWA

LOCATION.—In sec. 1, T. 88 N., R. 43 W., at Illinois Central Railroad bridge half a mile southwest of Correctionville, Woodbury County, and 54 miles above mouth of river.

DRAINAGE AREA.—2,490 square miles (revised).

RECORDS AVAILABLE.—May 28, 1918, to September 30, 1921.

GAGE.—Chain gage attached to upstream guardrail of center span of railroad bridge; read by Edwin H. Worrell.

DISCHARGE MEASUREMENTS.—Made from bridge one-fourth mile above gage; flood measurements from railroad bridge at gage.

CHANNEL AND CONTROL.—Bed composed of sand and clay; no well-defined control. Banks subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.55 feet at 7 a. m. May 27 (discharge, 3,960 second-feet); minimum stage, 2.20 feet at 7.30 a. m. August 30 (discharge, 37 second-feet).

1918-1921: Maximum stage recorded, 19.57 feet June 12, 1919 (discharge estimated, 20,700 second-feet); minimum discharge occurred in 1921.

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—There is a small power development at Correctionville, but it is assumed that this has no appreciable effect on the stage.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve fairly well defined below 3,000 second-feet. Gage read to hundredths once daily; more frequently during periods of rapidly changing stage. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Little Sioux River at Correctionville, Iowa, during the year ending Sept. 30, 1921

[Made by E. D. Burchard]

Date	Gage height	Discharge
Oct. 14.....	Feet 3. 19	Sec.-ft. 224
May 19.....	5. 20	884

Daily discharge, in second-feet, of Little Sioux River at Correctionville, Iowa, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	316	438	470	-----	781	605	406	3,140	605	285	285
2	315	406	502	-----	781	570	438	3,360	536	345	375
3	308	438	536	-----	710	570	438	3,080	470	152	345
4	300	536	536	-----	675	605	640	2,810	470	142	345
5	293	536	502	-----	605	605	745	2,750	502	122	200
6	-----	286	605	470	-----	536	605	817	2,810	470	152
7	-----	278	605	470	-----	536	640	962	2,480	406	112
8	-----	271	605	470	-----	570	675	781	2,020	345	94
9	-----	264	640	406	-----	536	675	745	1,710	345	86
10	-----	256	710	406	-----	536	710	745	1,580	345	142
11	-----	249	640	406	-----	470	745	675	1,500	285	68
12	-----	242	605	406	-----	438	745	605	1,540	285	56
13	-----	234	375	406	-----	285	781	605	1,580	285	68
14	-----	227	375	406	-----	270	781	536	1,670	285	68
15	-----	285	438	406	-----	345	781	536	1,800	241	62
16	-----	255	536	375	-----	470	745	502	1,460	285	94
17	-----	255	605	315	-----	470	675	470	1,430	214	78
18	-----	255	605	255	-----	470	536	470	1,400	214	55
19	-----	227	640	227	-----	438	502	889	1,370	164	62
20	-----	227	605	227	-----	470	536	925	1,340	152	55
21	-----	255	570	-----	470	470	1,040	1,220	152	60	570
22	-----	285	536	-----	1,180	470	1,110	1,110	142	406	536
23	-----	255	536	-----	1,110	470	345	1,150	1,040	132	375
24	-----	255	470	-----	1,040	470	570	1,340	999	122	200
25	-----	285	470	-----	962	470	470	1,670	962	112	112
26	-----	270	470	-----	889	470	745	2,020	853	122	86
27	-----	255	502	-----	781	536	345	3,800	781	94	94
28	-----	255	502	-----	745	536	345	3,630	745	103	62
29	-----	255	502	-----	-----	570	345	3,080	675	122	42
30	-----	255	502	-----	-----	605	345	2,970	640	152	36
31	-----	255	-----	-----	605	-----	-----	2,920	-----	112	78

NOTE.—Stage-discharge relation affected by ice during winter; discharge not computed. No gage-height record Oct. 1, 3-13, June 17-19, Aug. 21, and Sept. 12; discharge estimated from observer's notes or interpolated.

Monthly discharge of Little Sioux River at Correctionville, Iowa, for the year ending Sept. 30, 1921

[Drainage area, 2,490 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	316	227	265	0.121	0.14
November	710	375	533	.243	.27
December 1-20	536	227	410	.187	.14
February 22-28	1,180	745	958	.437	.11
March	781	270	518	.237	.27
April	781	345	585	.267	.30
May	3,800	406	1,210	.553	.64
June	3,360	640	1,660	.758	.85
July	605	94	267	.122	.14
August	406	36	121	.055	.06
September	745	86	436	.199	.22

BOYER RIVER BASIN

BOYER RIVER AT LOGAN, IOWA

LOCATION.—In sec. 24, T. 79 N., R. 43 W., at highway bridge south of Logan, Harrison County, 30 miles above junction with Missouri River.

DRAINAGE AREA.—810 square miles (revised from base map of Iowa; scale, 1:500,000).

RECORDS AVAILABLE.—May 24, 1918, to September 30, 1921.

GAGE.—Chain gage attached to upstream handrail of highway bridge; read by C. F. Peckenpough.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge.
CHANNEL AND CONTROL.—Channel is a dredged ditch with clay bottom and sides. Banks are overflowed during extreme floods. Control consists of remains of old grist mill dam on limestone ledge 500 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.2 feet at 8 a. m. September 10 (discharge, 3,500 second-feet); minimum stage, 1.74 feet at 8 a. m. September 1 (discharge estimated, 52 second-feet).

1918–1921: Maximum stage recorded, 17.9 feet June 5, 1918 (discharge estimated, 6,960 second-feet); minimum discharge, no flow September 27–29, 1918.

ICE.—Stage-discharge relation affected by ice during extremely cold weather, Control rarely freezes over.

ACCURACY.—Stage-discharge relation affected by ice November 11, 15, and December 18–20. Rating curve used prior to February 16, well defined between 100 and 3,000 second-feet. New rating not well defined. Extensions to both ratings approximate, owing to lack of discharge measurements. Gage read once daily to hundredths except for days of rapidly changing stage. Daily discharge ascertained by applying daily gage height to rating table except for period in which stage-discharge relation was affected by ice for which it was obtained by correcting daily gage height on basis of observer's notes, weather records, and comparison with flow at open-water stations. Records poor.

The following discharge measurements was made by E. D. Burchard:

July 20, 1921: Gage height, 2.60 feet; discharge, 182 second-feet.

Daily discharge, in second-feet, of Boyer River at Logan, Iowa, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	104	621	249		243	234	216	1,060	138	1,690	52
2	112	539	231		252	234	225	460	130	1,200	75
3	112	326	231		225	216	252	425	122	560	52
4	88	286	214		225	198	243	535	380	271	189
5	80	267	188		271	198	252	390	198	180	75
6	88	286	188		252	207	243	271	243	154	87
7	88	306	188		234	920	243	252	172	122	69
8	88	326	146		225	390	225	271	146	100	69
9	65	326	163		216	320	252	280	146	87	900
10	80	240	172		216	234	271	620	138	100	2,600
11	88	200	188		225	225	290	460	122	990	500
12	36	146	180		198	225	300	370	114	485	216
13	88	129	180		216	225	243	271	122	216	138
14	96	146	146		216	225	225	234	1,490	122	154
15	231	438	146		216	310	216	1,200	510	94	620
16	104	438	80	2,290	207	330	207	370	280	100	620
17	146	513	112	1,060	216	350	198	290	198	94	320
18	136	146	100	460	207	271	1,890	252	2,050	87	243
19	138	163	80	510	198	252	620	198	435	81	234
20	129	154	60	310	207	252	410	216	198	75	390
21	80	172		370	207	510	290	234	135	75	180
22	112	188		330	198	410	300	198	130	2,650	163
23	146	180		252	198	310	271	189	130	590	138
24	129	172		271	198	271	252	180	130	330	122
25	112	180		290	180	310	243	180	122	172	107
26	120	172		252	410	300	207	172	100	122	94
27	112	172		243	370	290	1,070	225	94	100	100
28	96	188		234	370	216	560	180	94	87	63
29	112	197			310	207	560	180	114	75	75
30	129	231			290	216	460	154	172	75	87
31	326				252		390		100	63	

NOTE.—Stage-discharge relation affected by ice Nov. 11, 15, discharge estimated. No record Dec. 21 to Feb. 15. Discharge estimated from a gage-height graph Sept. 9–11.

Monthly discharge of Boyer River at Logan, Iowa, for the year ending Sept. 30, 1921

[Drainage area, 810 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	326	36	115	0.142	0.16
November	621	129	262	.323	.36
December 1-20	249	60	162	.200	.15
February 16-28	2,290	234	529	.653	.32
March	410	180	240	.296	.34
April	920	198	295	.364	.41
May	1,970	198	404	.499	.58
June	1,200	154	346	.427	.48
July	2,050	94	279	.344	.40
August	2,650	63	360	.444	.51
September	2,600	52	291	.359	.40

PLATTE RIVER BASIN**NORTH PLATTE RIVER NEAR NORTHGATE, COLO.**

LOCATION.—In sec. 11, T. 11 N., R. 80 W., at highway bridge on interstate highway 6 miles south of Colorado-Wyoming line and 6 miles northwest of Northgate, Jackson County. Camp, Threemile, and Sixmile creeks enter North Platte between station and State line. These streams have very little flow except during spring.

DRAINAGE AREA.—1,440 square miles (measured on Colorado topographic map; scale, 1:500,000).

RECORDS AVAILABLE.—May 23, 1915, to September 30, 1921.

GAGE.—Gurley water-stage recorder installed April 8, 1918, referred to outside staff gage; inspected by H. H. Quaintance. Original gage was staff on middle pier of bridge referred to same datum.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand, gravel, and small boulders. Control is small rapids 200 feet downstream; shifts at intervals. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 6.2 feet at 4 a. m. June 17 (discharge, 6,640 second-feet); minimum discharge occurred during winter.

1915-1921: Maximum stage recorded in 1921; minimum discharge probably occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Court decrees for diversions of 98 second-feet from North Platte River and 3,310 second-feet from tributaries in Colorado. During 1921, Rist and McNabb ditch diverted 2,720 acre-feet from tributary of North Platte River to Cache la Poudre basin.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve well defined below 4,500 second-feet. Operation of water-stage recorder satisfactory except as explained in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph. Records excellent except for periods of missing gage heights and of ice effect, for which they are fair.

Discharge measurements of North Platte River near Northgate, Colo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 22	P. V. Hodges	2.80	929
June 12	J. B. Spiegel	4.83	4,040
July 21	do.	2.58	848

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of North Platte River near Northgate, Colo., for the year ending Sept. 30, 1921

Day	Oct.	Apr.	May	June	July	Aug.	Sept.
1	244		1,120	2,730	1,190	600	458
2	240		1,140	2,730	1,100	630	416
3	228		1,110	2,650	1,040	650	375
4	220		1,330	2,650	990	630	355
5	220		1,530	3,050	1,180	620	340
6	212		1,790	3,370	1,150	600	325
7	204		2,060	3,800	1,110	593	310
8	196		2,060	4,360	880	572	295
9	188		1,920	4,360	752	551	280
10	184		1,450	4,170	698	572	265
11	180		1,250	4,170	700	608	252
12	184		1,120	4,080	750	565	236
13	212		1,190	4,260	750	530	224
14	244		1,280	4,550	720	565	220
15	260		1,410	5,310	700	640	220
16							
17	265		1,670	6,070	800	579	216
18	244		1,790	6,260	1,100	488	216
19	224		1,790	5,120	1,040	422	212
20	224		1,920	3,800	1,130	380	240
21	220		1,720	3,050	980	360	244
22							
23	232		1,260	2,350	860	360	232
24	252		1,200	1,920	960	360	216
25	252	632	1,360	1,790	1,050	395	204
26	252	680	1,530	1,720	1,130	476	236
27	252	680	1,720	1,720	970	482	188
28							
29	250	620	1,990	1,720	870	464	180
30	250	580	2,060	1,600	833	446	177
31	250	544	2,060	1,490	698	422	171
	250	530	2,200	1,410	648	428	166
	250	632	2,420	1,300	624	452	162
	250		2,650		565	446	

NOTE.—Stage-discharge relation affected by ice Oct. 24-31; discharge ascertained from study of temperature and gage-height records, and by comparison with Big Creek near Big Creek, Wyo. No gage-height record Apr. 25-27, July 2, 11-16, 23, Aug. 1-6, Sept. 5-10; discharge based on comparison with flow of Big Creek near Big Creek. No records Nov. 1 to Apr. 22.

Monthly discharge of North Platte River near Northgate, Colo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	265	180	230	14,100
April 23-30	680	530	612	9,710
May	2,650	1,120	1,650	101,000
June	6,260	1,300	3,250	193,000
July	1,190	565	904	55,600
August	650	360	512	31,500
September	458	162	254	15,100

NORTH PLATTE RIVER AT SARATOGA, WYO.

LOCATION.—At highway bridge at Saratoga, Carbon County. Nearest tributary, Spring Creek, enters 2 miles above.

DRAINAGE AREA.—2,880 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—June 9, 1903, to October 31, 1906; April 1 to December 17, 1909; April 27, 1911, to October 31, 1912; April 1, 1915, to September 30, 1921. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Chain gage on upstream side of bridge; read by Mrs. R. R. Riggs. Gage read prior to 1911 was vertical staff, 100 yards below bridge; at independent datum.

DISCHARGE MEASUREMENTS.—Made from two-span highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control is rapids, 500 feet downstream; shifts slightly. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.0 feet at 10 a. m., June 12 (discharge, 15,700 second-feet); minimum discharge occurred during winter.

1903–1906; 1909; 1911–1921: Maximum stage, 11.06 feet present datum June 8, 1909, determined from high-water mark (discharge from extension of rating curve, 18,000 second-feet); minimum stage, 3.45 feet October 1, 1919 (discharge, 130 second feet).

ICE.—Stage-discharge relation seriously affected by ice.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 83 second-feet from North Platte River between Saratoga and State line.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve used October 1 to May 29 well defined; curve used May 30 to September 30 well defined up to 7,000 second-feet and fairly well defined above. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as indicated in footnote to daily-discharge table. Open-water records up to May 31, good; June 1 to September 30, excellent. Records for period of ice effect, fair.

Discharge measurements of North Platte River at Saratoga, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
Feb. 7	P. V. Hodges.....	<i>Feet</i> 4.04	<i>Sec.-ft.</i> 313
June 14	J. B. Spiegel.....	9.54	14,000
July 19	.....do.....	5.52	2,280

^a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of North Platte River at Saratoga, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	390	485	340	322	322	520	590	970	11,900	3,560	1,440	672
2	340	390	340			485	555	2,110	10,400	3,360	1,520	720
3	390	390	365			520	860	2,020	10,800	3,170	1,440	770
4	365	420	340			760	915	2,560	11,200	2,980	1,440	720
5	365	420	295			915	1,220	2,940	11,900	2,790	1,300	672
6	365	450	295	318	326	810	915	3,550	11,900	2,600	1,170	625
7	365	485				1,030	915	4,240	13,000	2,600	1,050	625
8	365	555				760	1,220	3,770	14,200	2,240	930	540
9	295	520				670	1,160	3,550	13,400	2,070	820	502
10	295	295				590	715	3,340	13,800	1,900	990	502
11	340	295		265	340	590	715	2,940	14,200	1,740	1,170	502
12	365	255				330	590	860	2,750	14,900	1,590	930
13	390	365				340	630	1,030	2,750	14,600	2,420	930
14	450	520				340	670	970	3,340	13,800	2,600	1,050
15	420	450				340	760	1,030	3,770	14,600	2,240	930
16	450	420	265	326	390	715	760	3,340	14,600	2,420	1,440	372
17	450	450				340	860	670	4,000	14,600	2,240	1,170
18	450	520				340	915	810	5,520	12,300	2,240	990
19	485	520				340	1,290	915	5,780	11,500	2,240	820
20	450	520				340	1,760	1,030	5,000	6,580	2,240	770
21	520	485		295	520	840	1,220	4,490	6,580	2,070	720	465
22	520	450				340	1,670	1,160	4,740	6,380	1,980	625
23	485	420				340	1,510	1,090	5,260	5,770	2,070	625
24	485	450				340	970	1,160	6,300	5,770	2,070	625
25	450	450				365	1,360	1,220	6,300	5,280	2,070	625
26	420	450		326	590	1,220	1,090	7,130	4,970	1,980	625	345
27	450	450				420	590	970	7,970	4,710	1,900	720
28	450	318				450	970	9,090	4,710	1,740	720	345
29	450	295				630	970	9,370	3,990	1,590	625	300
30	450	365				590	970	11,500	3,560	1,440	625	322
31	450					590		11,900		1,300	625	

NOTE.—Stage-discharge relation affected by ice Dec. 7 to Feb. 12 and 16-21; discharge based on temperature and gage-height records, observer's notes, and one discharge measurement. Braced figures show mean discharge for period included. Shifting-control method used May 25-29. No gage-height record Nov. 25 and Apr. 24; discharge interpolated.

Monthly discharge of North Platte River at Saratoga, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	520	295	417	25,600
November	555	255	429	25,500
December			283	17,400
January			322	19,800
February	520		345	19,200
March	1,840	450	879	54,000
April	1,220	555	956	56,900
May	11,900	970	4,910	302,000
June	14,900	3,560	10,200	607,000
July	3,560	1,300	2,250	138,000
August	1,520	625	969	59,600
September	770	300	470	28,000
The year	14,900		1,870	1,350,000

NORTH PLATTE RIVER ABOVE PATHFINDER RESERVOIR, WYO.

LOCATION.—In sec. 27, T. 26 N., R. 84 W., 900 feet below mouth of Lost Creek and three-quarters of a mile below mouth of Black Canyon, Carbon County. Backwater from Pathfinder reservoir reaches within $2\frac{1}{2}$ miles of station.

DRAINAGE AREA.—7,410 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—October 7, 1913, to September 30, 1921.

GAGE.—Friez water-stage recorder on right bank; inspected by H. J. Slack and J. S. Smith.

DISCHARGE MEASUREMENTS.—Made from cable at gage.

CHANNEL AND CONTROL.—Bed composed of small boulders. Gage at lower end of pool 600 feet long. Control is rapids; shifts infrequently. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 5.86 feet at noon June 17 (discharge, 17,500 second-feet); minimum stage, 0.64 foot at 11 p. m. September 30 (discharge, 300 second-feet).

1913-1921: Maximum stage recorded, 6.2 feet June 26, 1917 (discharge, 18,800 second-feet); minimum stage, 0.38 foot August 30, 1919 (discharge, 134 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 94 second-feet from North Platte River between this station and Saratoga.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation not permanent; affected by ice during winter. Rating curve used October 1 to May 31 and curve used June 1 to September 30 are both well defined below 16,000 second-feet. Operation of water-stage recorder satisfactory except as indicated in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph during periods when recorder was operating, except May 21 to 31 when shifting-control method was used. Records excellent except for periods of missing gage heights, for which they are fair.

Discharge measurements of North Platte River above Pathfinder reservoir, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 18	P. V. Hodges.....	1.95	1,450
June 26	J. B. Spiegel.....	3.79	6,290
Aug. 24	.....do.....	1.29	744

Daily discharge, in second-feet, of North Platte River above Pathfinder reservoir, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	548	620	480	-----	850	1,400	13,600	4,380	1,690	678
2	530	650	500	-----	830	1,670	13,900	4,090	1,990	660
3	523	565	490	-----	820	2,240	13,300	3,670	1,880	660
4	516	537	482	-----	942	2,460	13,000	3,410	1,880	644
5	509	530	470	-----	1,290	2,820	13,300	3,100	1,700	636
6	495	581	450	-----	1,620	3,300	14,200	3,050	1,560	628
7	476	620	450	-----	1,540	4,360	14,500	3,100	1,410	604
8	450	670	450	-----	1,290	4,830	15,400	2,780	1,280	580
9	450	720	450	-----	1,190	4,830	16,600	2,440	1,170	559
10	445	770	450	-----	1,080	4,670	17,200	2,260	1,120	545
11	445	540	450	-----	1,010	4,210	17,500	2,100	1,070	517
12	460	520	450	-----	970	4,070	16,900	2,020	1,040	510
13	485	621	450	-----	1,040	4,070	17,200	2,190	1,110	496
14	520	650	450	-----	1,220	3,930	17,200	2,290	1,390	475
15	560	680	450	-----	1,280	4,070	17,200	2,310	1,110	454
16	551	645	450	-----	1,290	4,360	17,200	2,330	1,020	428
17	558	600	450	-----	1,260	5,000	17,500	2,310	1,180	416
18	573	720	462	1,400	1,130	5,910	16,900	2,310	1,130	410
19	605	880	-----	1,460	1,060	7,170	15,100	2,350	1,020	398
20	681	792	-----	1,750	1,140	6,950	11,800	2,720	916	392
21	700	744	-----	2,360	1,350	6,520	9,860	2,760	850	392
22	700	717	-----	2,320	1,500	6,310	8,130	2,330	800	398
23	621	690	-----	2,090	1,500	6,730	7,200	2,110	780	398
24	590	660	-----	1,760	1,500	7,630	6,740	2,110	750	404
25	570	630	-----	1,600	1,590	9,120	6,300	2,200	723	404
26	570	600	-----	1,350	1,620	10,400	6,300	2,280	714	380
27	560	581	-----	1,180	1,620	10,200	6,100	2,260	732	355
28	565	550	-----	1,010	1,480	10,400	5,700	1,920	750	335
29	575	520	-----	870	1,410	11,800	5,340	1,740	732	320
30	581	450	-----	830	1,400	11,800	4,830	1,620	714	310
31	600	-----	-----	890	-----	13,300	-----	1,560	696	-----

NOTE.—No gage-height record Oct. 1, 10-15, 21, 22, 24-29, 31, Nov. 1, 2, 7-12, 14-19, 23-26, 28-30, Dec. 1-3, 5-10, 12-17; discharge based on comparative hydrograph of North Platte River at Saratoga. Discharge interpolated Mar. 27. No record Dec. 19 to Mar. 17.

Monthly discharge of North Platte River above Pathfinder reservoir, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	700	445	549	33,800
November	880	450	635	37,800
December 1-18	500	450	480	16,400
March 18-31	2,360	830	1,490	41,400
April	1,620	820	1,260	75,000
May	13,300	1,400	6,000	369,000
June	17,500	4,830	12,500	744,000
July	4,380	1,560	2,520	155,000
August	1,990	696	1,130	69,500
September	678	310	490	28,600

NORTH PLATTE RIVER BELOW PATHFINDER RESERVOIR, WYO.

LOCATION.—In sec. 24, T. 29 N., R. 84 W., a quarter of a mile below Pathfinder dam, Natrona County. Nearest tributary, Canyon Creek, enters reservoir 2 miles above.

DRAINAGE AREA.—10,700 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 9, 1905, to September 30, 1921.

GAGE.—Chain gage on left bank; read by employee of United States Bureau of Reclamation.

DISCHARGE MEASUREMENTS.—Made from cable, 50 feet above gage.

EXTREMES OF DISCHARGE.—No data.

WINTER FLOW.—Practically cut off by storage in reservoir.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 448 second-feet from tributaries entering the North Platte between this station and the one above the reservoir. Near Whalen, 150 miles below, water from Pathfinder reservoir is diverted by Interstate and Fort Laramie canals and used to irrigate land in Wyoming and Nebraska.

REGULATION.—Pathfinder dam forms a reservoir having a capacity of 1,070,000 acre-feet, which materially changes natural run-off of river.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of North Platte River below Pathfinder reservoir, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1,500	15	15	15	120	120	100	2,220	1,840	5,740	5,470	3,880
2	1,500	15	15	15	120	120	20	2,220	4,270	6,040	5,470	3,940
3	1,500	15	15	15	120	120	20	2,220	6,720	5,860	5,450	3,230
4	1,500	15	15	15	120	120	20	2,220	8,790	5,790	5,430	3,320
5	1,500	15	15	15	120	120	20	2,220	10,200	6,020	5,440	3,960
6	1,500	15	15	15	120	120	20	2,220	11,300	5,740	5,400	3,950
7	1,500	15	15	15	120	120	20	2,220	12,200	5,820	4,720	3,940
8	1,500	15	15	15	120	120	20	2,220	13,000	5,730	4,430	3,940
9	1,500	15	15	15	120	120	20	2,230	14,000	5,890	4,480	2,930
10	1,500	15	15	15	120	120	20	2,230	15,000	5,290	4,440	2,890
11	1,500	15	15	15	120	125	20	2,230	15,600	5,470	4,290	2,890
12	1,500	15	15	140	120	125	20	2,230	16,000	5,540	4,110	2,890
13	1,500	15	15	120	120	125	20	2,240	16,400	5,540	4,330	2,650
14	1,500	15	15	120	120	125	20	2,240	16,600	5,490	4,540	2,890
15	1,180	15	15	120	120	135	3,030	2,240	16,700	5,450	5,270	2,890
16	1,160	15	15	120	120	165	3,200	2,240	16,700	5,410	3,290	2,880
17	1,200	15	15	120	120	100	3,200	2,240	16,700	5,420	4,090	2,870
18	1,500	15	15	120	120	100	1,280	2,240	16,800	5,460	4,130	2,870
19	1,160	15	15	120	120	100	1,980	2,240	16,600	5,450	4,130	2,870
20	1,160	15	15	120	120	100	2,220	2,250	16,000	5,430	4,130	2,870
21	1,160	15	15	120	120	100	2,220	2,250	14,800	5,430	4,130	2,870
22	270	15	15	120	120	100	2,220	2,280	13,200	5,430	4,120	2,870
23	15	15	15	120	120	100	2,830	2,280	10,700	5,450	4,080	2,870
24	15	15	15	120	120	100	3,180	2,280	10,100	5,470	3,910	2,870
25	15	15	15	120	120	100	3,180	2,280	9,040	5,470	3,940	2,870
26	15	15	15	120	120	100	3,180	2,270	8,150	5,460	3,690	2,870
27	15	15	15	120	120	100	2,920	2,270	7,530	5,450	3,410	2,870
28	15	15	15	120	120	100	3,180	2,270	7,060	5,460	3,550	2,870
29	15	15	15	120	120	100	2,920	2,180	6,600	5,470	3,490	20
30	15	15	15	120	120	100	2,570	2,180	6,170	5,470	3,350	1,560
31	15	15	15	120	120	100	2,000	2,000	5,470	5,470	3,890	-----

NOTE.—Quantities changed slightly to conform to computation rules of U. S. Geol. Survey.

Monthly discharge of North Platte River below Pathfinder reservoir, Wyo., for the year ending September 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	1,500	15	965	59,300
November.....	15	15	15	893
December.....	15	15	15	922
January.....	140	15	83.4	5,130
February.....	120	120	120	6,660
March.....	165	100	113	6,950
April.....	3,200	20	1,460	86,900
May.....	2,270	2,000	2,230	137,000
June.....	16,800	1,840	11,800	702,000
July.....	6,040	5,290	5,570	342,000
August.....	5,470	3,290	4,340	267,000
September.....	3,960	20	2,970	177,000
The year.....	16,800	15	2,480	1,790,000

NORTH PLATTE RIVER ABOVE AND BELOW WHALEN, WYO.

LOCATION.—In sec. 11, T. 26 N., R. 65 W., at diversion dam at Whalen, Goshen County. Nearest important tributary is Cottonwood Canyon Creek, an intermittent stream which enters $1\frac{1}{2}$ miles below.

DRAINAGE AREA.—16,300 square miles (measured on base map of Wyoming; scale, 1" : 500,000).

RECORDS AVAILABLE.—May 1, 1909, to September 30, 1921. Records above Whalen represent total flow above dam and those below Whalen, quantity passing through sluice gates or over dam (overfall weir). Difference between two records represents amount diverted by Interstate and Fort Laramie canals.

GAGE.—To determine flow over dam a vertical staff is used, its zero being crest of dam. The discharge is then computed by a weir formula. There are four sluice gates in dam, through which discharge is computed. In river below dam is a second gage with zero 10 feet lower than the first, used only in computing discharge through gates when openings are submerged. Discharge through head gates of Interstate and Fort Laramie canals is computed from gate openings. Vertical staffs located in canals below head gates are used in computing discharge when head gate openings are submerged.

DISCHARGE MEASUREMENTS.—Made from cable 1 mile below dam, in order to check the coefficients used in discharge computations.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions from North Platte River of 432 second-feet between Pathfinder reservoir and Whalen gaging station, exclusive of diversion by the United States Bureau of Reclamation. Between Whalen and State line there are adjudicated diversions of 429 second-feet.

REGULATION.—Discharge represents chiefly effect of Pathfinder reservoir which stores water for use in Interstate and Fort Laramie canals.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of North Platte River above Whalen, Wyo., for the year ending Sept. 30, 1921

Day . . .	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.-----	2,000	263	143	230	297	444	332	3,560	3,430	6,690	5,330	3,130
2.-----	1,950	232	176	239	317	403	341	3,550	3,060	6,070	5,310	3,550
3.-----	1,910	378	278	239	315	403	259	3,160	7,990	6,950	5,410	3,540
4.-----	2,020	384	272	239	277	403	317	3,020	5,440	6,080	5,400	3,600
5.-----	1,990	522	312	249	277	403	307	3,070	7,320	5,710	5,240	3,100
6.-----	1,990	372	306	203	245	403	388	2,980	8,680	5,830	5,150	3,190
7.-----	2,030	245	212	211	206	403	642	3,240	10,100	6,180	5,150	3,460
8.-----	2,010	224	193	212	206	403	542	3,290	11,800	5,670	5,190	3,480
9.-----	1,980	214	153	221	235	403	363	3,660	12,100	6,040	4,650	3,550
10.-----	1,950	178	162	203	397	403	370	3,570	12,500	5,630	4,280	3,490
11.-----	2,090	178	188	203	285	403	213	3,460	13,200	5,800	4,310	2,900
12.-----	2,030	120	182	185	285	378	290	3,390	13,600	5,390	4,280	2,760
13.-----	2,160	79	133	185	337	355	290	3,280	14,000	5,480	4,200	2,600
14.-----	2,130	113	163	176	802	355	188	3,170	14,800	5,420	4,030	2,620
15.-----	2,080	153	60	195	1,700	355	228	3,100	15,000	5,650	4,230	2,430
16.-----	2,020	265	133	194	1,010	351	213	3,080	15,800	5,510	5,150	2,560
17.-----	2,020	287	172	203	865	275	573	3,060	17,500	5,680	4,900	2,650
18.-----	1,600	379	172	194	454	385	1,440	3,090	15,600	5,520	3,360	2,500
19.-----	1,680	455	188	197	342	345	3,220	3,170	15,800	5,510	3,980	2,550
20.-----	1,940	516	204	221	440	344	2,900	3,160	16,000	5,990	3,990	2,580
21.-----	2,250	450	152	229	328	407	2,030	3,056	16,100	5,810	4,000	2,590
22.-----	1,770	426	113	229	270	403	2,160	2,990	14,300	5,440	4,010	2,670
23.-----	1,760	233	133	325	462	403	2,860	2,850	12,400	5,390	3,980	2,660
24.-----	1,730	250	146	310	500	403	2,530	6,030	11,000	5,690	4,010	2,660
25.-----	1,440	298	198	322	740	403	3,050	3,800	9,840	5,510	3,990	2,620
26.-----	1,260	222	160	323	721	399	3,700	4,130	9,100	5,630	3,650	2,700
27.-----	1,060	253	170	280	721	421	3,710	4,170	8,240	5,460	3,750	2,720
28.-----	898	222	178	315	567	374	3,720	3,620	7,750	5,560	3,700	2,760
29.-----	606	143	178	315	-----	374	3,580	3,420	7,370	5,300	3,480	3,000
30.-----	261	163	214	287	-----	455	3,720	3,330	7,060	5,260	3,460	2,960
31.-----	295	-----	298	287	-----	455	-----	3,390	-----	5,280	3,610	-----

Daily discharge, in second-feet, of North Platte River below Whalen, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.-----	1,070	233	113	200	267	414	302	2,510	2,600	4,830	3,520	1,220
2.-----	1,020	202	146	209	287	373	311	2,470	2,230	4,010	3,630	1,620
3.-----	1,080	348	248	209	285	373	229	2,080	7,160	5,670	3,750	1,630
4.-----	1,190	354	242	209	247	373	287	1,940	4,810	4,120	3,740	1,700
5.-----	1,160	492	282	219	247	373	277	1,940	6,700	3,630	3,580	1,290
6.-----	1,160	342	276	173	215	373	358	1,830	8,050	3,750	3,430	1,390
7.-----	1,200	215	182	181	176	373	612	2,210	9,680	4,070	3,430	1,630
8.-----	1,180	194	163	182	176	373	512	2,260	11,400	3,560	3,470	1,670
9.-----	1,150	184	123	191	205	373	333	2,580	11,700	3,900	2,880	1,720
10.-----	1,120	148	132	173	367	373	340	2,440	12,100	3,540	2,480	1,740
11.-----	1,260	148	158	173	255	373	183	2,330	12,600	3,710	2,600	1,170
12.-----	1,200	90	152	155	254	348	260	2,210	13,100	3,510	2,460	1,060
13.-----	1,330	79	103	155	307	325	260	2,100	13,400	3,390	2,380	1,030
14.-----	1,300	83	133	146	802	325	158	1,990	13,900	3,290	2,110	1,030
15.-----	1,250	123	50	165	1,670	325	198	1,920	14,000	3,510	2,310	835
16.-----	1,190	235	103	164	984	321	133	1,900	14,700	3,410	3,230	970
17.-----	1,190	257	142	173	835	245	143	1,880	17,400	3,560	2,990	1,150
18.-----	772	349	142	164	424	355	1,230	1,910	15,600	3,430	1,450	1,000
19.-----	848	425	158	167	312	315	2,640	2,040	15,800	3,450	2,050	1,040
20.-----	1,100	486	174	191	410	314	2,170	2,080	16,000	3,940	2,050	1,080
21.-----	1,370	420	122	199	298	377	1,260	1,970	16,000	3,720	2,050	1,180
22.-----	892	396	83	199	240	373	1,350	1,810	14,200	3,320	2,070	1,310
23.-----	880	203	103	295	432	373	2,010	1,770	12,400	3,300	2,040	1,440
24.-----	847	220	116	280	470	373	1,600	4,950	10,300	3,600	2,070	1,490
25.-----	613	268	168	292	710	373	2,070	2,720	8,860	3,420	2,090	1,480
26.-----	550	192	120	293	691	369	2,720	3,050	7,870	3,640	1,700	1,480
27.-----	430	223	140	250	691	391	2,730	3,090	6,860	3,510	1,840	1,510
28.-----	368	192	148	285	537	344	2,740	2,540	6,210	3,360	1,820	1,540
29.-----	276	113	148	285	-----	344	2,600	2,590	5,670	3,400	1,590	1,950
30.-----	231	133	184	257	-----	425	2,720	2,500	5,220	3,360	1,560	1,920
31.-----	265	-----	268	257	-----	425	-----	2,560	-----	3,380	1,710	-----

NOTE.—Quantities changed slightly to conform to computation rules of U. S. Geol. Survey.

Monthly discharge of North Platte River above Whalen, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	2,250	261	1,710	105,000
November.....	522	79	274	16,300
December.....	312	60	185	11,400
January.....	325	176	239	14,700
February.....	1,700	206	486	27,000
March.....	455	275	391	24,000
April.....	3,720	188	1,480	88,100
May.....	6,030	2,850	3,410	210,000
June.....	17,500	3,060	11,200	666,000
July.....	6,950	5,260	5,710	351,000
August.....	5,330	3,360	4,360	268,000
September.....	3,600	2,430	2,920	174,000
The year.....	17,500	60	2,700	1,960,000

Monthly discharge of North Platte River below Whalen, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	1,370	231	951	58,500
November.....	492	79	245	14,600
December.....	282	50	156	9,590
January.....	295	146	209	12,900
February.....	1,670	176	457	25,400
March.....	425	245	361	22,200
April.....	2,740	133	1,090	64,900
May.....	4,950	1,770	2,330	143,000
June.....	17,400	2,230	10,500	625,000
July.....	5,870	3,290	3,690	227,000
August.....	3,750	1,450	2,520	155,000
September.....	1,950	835	1,380	82,100
The year.....	17,400	50	1,990	1,440,000

BIG CREEK NEAR BIG CREEK, WYO.

LOCATION.—In sec. 32, T. 13 N., R. 81 W., at Big Creek ranger station, 2 miles west of Big Creek post office, Carbon County. No important tributary within several miles.

DRAINAGE AREA.—123 square miles (measured on base maps of Wyoming and Colorado; scale, 1:500,000).

RECORDS AVAILABLE.—May 7, 1911, to June 30, 1912; April 4, 1915, to September 30, 1921. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Stevens water-stage recorder on left bank, installed in 1918, and referred to previously used vertical staff nearby; inspected by forest ranger. Datum of gage raised 0.90 foot September 1, 1919.

DISCHARGE MEASUREMENTS.—Made from bridge a quarter of a mile below gage, or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders. Control is riffle at gage; shifts slightly. Right bank subject to overflow at stage of 3.3 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year not recorded, as water-stage recorder was not in operation; minimum stage occurred during winter. 1913–1921: Maximum discharge, 1,300 second-feet June 23, 1917, from comparison with flow of Encampment River; minimum stage recorded, 1.10 feet September 2, 1915 (discharge, 5 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, no adjudicated diversions from Big Creek above station in Wyoming, but below, diversions amount to 94 second-feet. In Colorado, Independence ditch diverts from Big Lake to North Platte drainage basin approximately 80 second-feet, usually from June 10 to July 10 each year. Storage filing for 27,548 acre-feet in Big Lake which supplies Independence ditch.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation apparently practically permanent. Rating curve well defined below 200 second-feet. Operation of water-stage recorder satisfactory except for days of no gage-height record. Mean daily gage height obtained by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table, except as indicated in footnote to table of daily discharge. Records fair.

COOPERATION.—Gage-height record furnished by United States Forest Service.

Discharge measurements of Big Creek near Big Creek, Wyo., during the year ending Sept. 30, 1921

[Made by J. B. Spiegel]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
June 12.....	3.20	770
July 21.....	1.30	128

Daily discharge, in second-feet, of Big Creek near Big Creek, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	37		52	104	570	263	112	75
2.....	37		59	128	548	229	115	68
3.....	35		75	148	570	186	108	67
4.....	33		98	150	615	166	100	65
5.....	33		83	166	660	166	93	65
6.....			60	186	750	161	86	58
7.....			65	166	952	143	83	50
8.....			56	164	990	133	83	42
9.....			48	140	930	128	79	45
10.....			39	148	930	131	98	46
11.....			68	164	920	146	86	45
12.....			74	178	908	172	77	42
13.....			64	180	862	150	70	40
14.....		52	72	192	940	156	100	40
15.....		50	56	207	1,060	158	122	39
16.....		48	51	256	1,050	201	88	33
17.....		51	45	263	950	195	77	32
18.....		54	56	285	800	170	74	31
19.....		57	81	271	630	160	72	34
20.....		60	88	242	580	140	72	32
21.....		64	68	260	580	143	70	31
22.....		51	67	305	560	164	79	29
23.....		45	92	337	520	210	79	27
24.....		39	74	390	480	210	70	27
25.....		34	65	410	420	200	70	27
26.....		34	55	460	380	180	70	27
27.....		33	45	500	341	150	67	27
28.....		32	60	540	333	104	67	26
29.....		31	78	570	313	98	67	26
30.....		31	94	548	285	92	67	25
31.....		46		570		98	67	

NOTE.—No gage-height record Mar. 26-28, Apr. 1, 8, 9, 25-29, May 24-28, June 11, 14-26, July 18-20, 23-27, Aug. 3-5, Sept. 6, 7; discharge based on comparison with flow of North Platte River near Northgate, Colo.

Monthly discharge of Big Creek near Big Creek, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October 1-5.....	37	33	35.0	350
March 14-31.....	64	31	45.1	1,610
April.....	98	39	66.3	3,950
May.....	570	104	278	17,100
June.....	1,060	285	679	40,400
July.....	263	92	161	9,900
August.....	122	67	82.8	5,090
September.....	75	25	40.7	2,420

FRENCH CREEK NEAR FRENCH, WYO.

LOCATION.—In sec. 5, T. 14 N., R. 81 W., at Jenkins ranch, 2½ miles southeast of French, Carbon County. No tributary between station and mouth, 2 miles below.

DRAINAGE AREA.—60 square miles (measured on topographic map).

RECORDS AVAILABLE.—April 30, 1911, to October 31, 1912; April 1, 1915, to September 30, 1921. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on left abutment of highway bridge, since June 2, 1920; read by Mrs. Mary S. Jenkins. Original gage, 1 mile upstream until April 10, 1918, when it was moved to point 480 feet below present location. No determined relation between different datums.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of large boulders. Control 50 feet downstream; apparently permanent. Left bank subject to overflow at extreme high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.0 feet at 6 p. m. June 10-13 (discharge, 1,680 second-feet); minimum stage occurred during winter.

1911-12; 1915-1921: Maximum discharge occurred in 1921; minimum discharge 6 second-feet April 1, 1915.

ICE.—Stage-discharge relation seriously affected by ice; records discontinued during winter.

DIVERSIONS.—Prior to July 1, 1919, adjudicated diversions of 4.3 second-feet from French Creek; part above station not known.

REGULATION.—Alternate melting and freezing of mountain snow causes diurnal fluctuation during spring of year; no artificial regulation.

ACCURACY.—Stage-discharge relation not permanent; rating curve fairly well defined below 1,400 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for period June 15 to September 30, when shifting-control method was used. Records good except for periods of shifting control for which they are fair.

Discharge measurements of French Creek near French, Wyo., during the year ending Sept. 30, 1921

[Made by J. B. Spiegel]

Date	Gage height	Dis-charge
June 13.....	<i>Feet</i> 2.50	<i>Sec.-ft.</i> 1,180
July 20.....	.94	104

Daily discharge, in second-feet, of French Creek near French, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	19	38	-----	36	47	1,030	319	85	40
2.....	19	38	-----	32	70	930	292	85	38
3.....	19	38	-----	38	108	930	240	70	37
4.....	19	38	-----	38	108	980	215	56	38
5.....	19	47	-----	38	152	1,230	215	56	35
6.....	19	38	-----	38	152	1,180	170	38	37
7.....	19	38	-----	38	152	1,130	170	49	36
8.....	19	38	-----	38	152	1,330	148	47	34
9.....	19	38	-----	38	130	1,430	148	42	34
10.....	19	38	-----	38	130	1,480	126	38	34
11.....	19	38	-----	38	108	1,480	130	38	32
12.....	19	38	-----	38	108	1,480	130	47	32
13.....	19	38	27	32	108	1,380	130	59	32
14.....	27	38	27	27	152	1,230	130	56	30
15.....	23	38	32	27	200	1,180	130	56	30
16.....	19	38	38	38	250	1,130	152	56	31
17.....	27	38	29	38	302	1,080	132	56	29
18.....	27	38	36	38	302	980	118	49	29
19.....	27	38	38	38	275	790	105	49	29
20.....	29	38	29	38	275	465	94	49	29
21.....	32	38	47	38	250	472	175	49	30
22.....	29	38	38	38	302	472	108	52	30
23.....	27	38	27	38	330	510	200	56	30
24.....	38	38	19	38	395	437	200	49	28
25.....	38	38	27	38	430	437	152	43	28
26.....	47	38	27	32	430	444	85	40	29
27.....	42	38	27	32	502	444	70	40	29
28.....	38	38	29	32	615	388	56	37	29
29.....	38	38	27	36	745	376	38	37	29
30.....	38	38	27	38	880	314	38	37	29
31.....	38	-----	36	-----	1,030	-----	130	40	-----

NOTE.—No gage-height record Nov. 2, 3, 14–16, 29, 30; July 17–19; discharge interpolated.

Monthly discharge of French Creek near French, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	47	19	26.8	1,650
November.....	47	38	38.3	2,280
March 13–31.....	47	19	30.9	1,160
April.....	38	27	36.1	2,150
May.....	1,030	47	296	18,200
June.....	1,480	314	905	53,900
July.....	319	38	147	9,040
August.....	85	37	50.4	3,100
September.....	40	28	31.9	1,900

ENCAMPMENT RIVER AT ENCAMPMENT, WYO.

LOCATION.—In sec. 6, T. 14 N., R. 83 W., at lower end of smelter grounds at Encampment, Carbon County. Nearest tributary, North Fork, enters 1 mile above.

DRAINAGE AREA.—219 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 2, 1911, to October 31, 1912; May 29, 1915, to September 30, 1921. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Chain gage on left bank at old tailing flume which crosses river; read by Margaret Clements and Charles Dotson. Prior to June 6, 1912, gage was 175 feet downstream and, although referred to same datum, read approximately 1 foot lower, owing to slope of river.

DISCHARGE MEASUREMENTS.—Made from cable 125 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders; shifts at long intervals. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.5 feet at 4 p. m. May 29 (discharge, 4,660 second-feet); minimum stage occurred during winter.

1911-12; 1915-1921: Maximum discharge occurred in 1921; minimum stage, 3.40 feet July 24, 1919 (discharge, 3 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; records discontinued during winter.

DIVERSIONS.—Three large irrigation ditches divert water 1 mile above station. Water also diverted below station. Prior to July 1, 1921, adjudicated diversions from Encampment River amounting to 78 second-feet.

REGULATION.—Diurnal fluctuation during spring, caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used: One, from October 1 to November 12, well defined; other, from March 20 to September 30, well defined below 3,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records good.

Discharge measurements of Encampment River at Encampment, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 21	P. V. Hodges.....	4.17	82
June 13	J. B. Spiegel.....	7.62	2,980
July 20	.....do.....	4.78	254

Daily discharge, in second-feet, of Encampment River at Encampment, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	72	55		42	162	2,920	940	138	41
2.....	43	46		56	222	2,760	780	136	40
3.....	20	58		82	375	2,610	780	133	40
4.....	36	58		91	490	2,760	570	102	39
5.....	43	74		126	630	2,760	465	87	38
6.....	20	61		118	900	2,920	442	82	38
7.....	49	46		102	800	3,460	420	82	37
8.....	43	50		113	630	3,270	375	76	36
9.....	33	58		89	740	3,270	335	76	36
10.....	20	74		82	665	3,270	335	165	35
11.....	46	74		91	570	3,660	335	87	34
12.....	33	74		138	700	3,270	295	72	34
13.....	43			113	630	3,270	335	56	33
14.....	58			138	820	2,920	335	82	32
15.....	40			143	1,030	3,090	355	76	32
16.....	58			138	1,340	2,610	355	42	31
17.....	61			126	1,560	2,180	315	24	30
18.....	66			102	1,860	2,050	278	30	30
19.....	66			160	1,620	1,560	250	45	36
20.....	66		74	171	1,230	1,340	246	40	32
21.....	65		69	177	1,340	1,280	201	32	36
22.....	60		91	165	1,680	1,180	242	48	32
23.....	60		98	165	1,800	1,180	210	42	36
24.....	55		59	157	2,050	1,180	195	42	32
25.....	50		59	149	2,460	1,230	165	42	30
26.....	61		72	141	2,610	1,290	152	45	30
27.....	74		91	133	2,760	1,270	138	36	30
28.....	78		91	133	3,270	1,200	138	42	28
29.....	55		91	143	4,060	1,130	91	42	27
30.....	66		72	152	4,260	1,020	118	42	25
31.....	74		62		3,270		126	42	

NOTE.—No gage-height record Oct. 1, Apr. 24-26, May 7, June 26-30, Aug. 30-31, Sept. 1-17, 27-30; discharge based on comparison with flow of Big Creek near Big Creek. Stage-discharge relation affected by ice Oct. 21-25; discharge estimated.

Monthly discharge of Encampment River at Encampment, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	78	20	52.1	3,200
November 1-12.....	74	46	60.7	1,440
March 20-31.....	98	59	77.4	1,840
April.....	177	42	125	7,440
May.....	4,260	162	1,500	92,200
June.....	3,660	1,020	2,260	134,000
July.....	940	91	333	20,500
August.....	165	24	674	44,400
September.....	41	25	33.7	2,010

JACK CREEK AT MATHESON RANCH, NEAR SARATOGA, WYO.

LOCATION.—In sec. 36, T. 17 N., R. 86 W., at Matheson ranch, 14 miles southwest of Saratoga, Carbon County. Nearest tributary, North Jack Creek, enters some distance below.

DRAINAGE AREA.—32 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—August 23, 1913, to September 19, 1917; April 20, 1919, to September 30, 1921.

GAGE.—Vertical staff on left abutment of wagon bridge 1,000 feet below ranch house; read by Miss Eva Frisby. Gage originally 200 feet above present site; moved 800 feet farther upstream August 15, 1915, and used until June 13, 1917. No definite relation between datums.

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

CHANNEL AND CONTROL.—Bed composed of mud. Control is small rapids 100 feet downstream; fairly permanent. Banks subject to overflow at stage of 3.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.4 feet at 10 a. m. June 10 (discharge, 330 second-feet); minimum discharge probably occurred during winter.

1913-1917; 1919-1921: Maximum discharge occurred in 1921; minimum discharge, creek dry August 18 to 23, 1919.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 102 second-feet from Jack Creek, practically all below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve well defined below 60 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records good except during May and June, for which they are fair.

Discharge measurements of Jack Creek at Matheson ranch, near Saratoga, Wyo., during the year ending Sept. 30, 1921

[Made by J. B. Spiegel]

Date	Gage height	Discharge
June 14.....	Feet 4.10	Sec.-ft. 270
July 19.....	1.37	26.4

Daily discharge, in second-feet, of Jack Creek at Matheson ranch, near Saratoga, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	May	June	July	Aug.	Sept.	Day	Oct.	May	June	July	Aug.	Sept.
1.....			215	62	27	7	16.....	10	96	200	34	9	5
2.....			250	59	18	7	17.....		127	185	37	8	5
3.....			215	56	13	7	18.....		147	165	34	9	6
4.....			215	47	14	6	19.....		139	131	34	8	5
5.....			250	47	10	6	20.....		96	99	23	8	7
6.....			185	32	14	7	21.....		123	99	23	7	6
7.....			250	34	8	5	22.....		139	99	25	8	6
8.....			215	37	8	5	23.....		160	99	20	8	5
9.....			250	30	9	5	24.....		192	99	17	7	6
10.....	8		250	30	12	6	25.....		185	107	15	7	6
11.....	8		165	30	10	5	26.....		185	100	16	7	5
12.....	8		200	44	9	5	27.....		200	94	17	7	5
13.....	9		185	37	9	5	28.....		230	88	18	7	6
14.....	10	59	250	44	15	6	29.....		230	82	12	8	6
15.....	10	68	250	30	10	6	30.....		250	75	16	6	6
							31.....		215		13	7	

NOTE.—No gage-height record June 26-30; discharge interpolated.

Monthly discharge of Jack Creek at Matheson ranch, near Saratoga, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
May 14-31.....	250	59	158	5,640
June.....	250	75	169	10,100
July.....	62	12	31.4	1,930
August.....	27	6	9.9	609
September.....	7	5	5.8	345
The period.....				18,600

MEDICINE BOW RIVER NEAR MEDICINE BOW, WYO.

LOCATION.—In sec. 7, T. 20 N., R. 79 W., at private bridge at Johnson ranch, 14 miles southwest of Medicine Bow, Carbon County. Nearest tributary, Wagonhound Creek, enters 3 miles below.

DRAINAGE AREA.—178 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—June 4, 1911, to November 30, 1912; May 5, 1915, to September 30, 1917; May 1, 1919, to September 30, 1921. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on downstream side of left abutment; read by Mrs. S. W. Johnson. Gage used during 1911 and 1912 was 600 feet upstream and referred to different datum.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control is riffle of well-compacted gravel and small boulders, 75 feet downstream; shifts at long intervals. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year not recorded, as gage was destroyed by high water; minimum stage probably occurred during winter.

1911-1917; 1919-1921: Maximum stage recorded, 5.4 feet at 7.30 a. m. June 23, 1917 (discharge, 2,810 second-feet); minimum discharge, no flow at times in 1911, 1916, and 1919.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 208 second-feet from Medicine Bow River above the station and 173 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used: One, used October 1 to May 31, fairly well defined below 1,000 second-feet; other, used June 1 to September 30, well defined below 700 second-feet. Gage read to hundredths twice daily. Daily discharge obtained by applying mean daily gage height to rating table, except as indicated in footnote to table of daily discharge. Records fair October 1 to May 31 and good thereafter.

Discharge measurements of Medicine Bow River near Medicine Bow, Wyo., during the year ending Sept. 30, 1921

[Made by J. B. Spiegel]

Date	Gage height	Discharge
June 15.....	Feet 3.92	Sec.-ft. 1,110
Aug. 30.....	1.40	11

Daily discharge, in second-feet, of Medicine Bow River near Medicine Bow, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	18	47	-----	59	160	1,420	148	37	11
2.....	14	47	-----	62	182	1,300	133	37	11
3.....	15	47	-----	83	182	1,100	113	37	11
4.....	18	47	-----	98	192	1,220	91	37	11
5.....	16	43	-----	88	210	1,420	73	30	11
6.....	16	40	-----	65	210	1,260	51	28	11
7.....	16	37	-----	44	230	1,260	55	24	11
8.....	18	37	-----	44	250	1,540	53	20	11
9.....	14	34	-----	50	286	1,220	46	19	11
10.....	14	34	-----	59	345	1,340	34	19	11
11.....	14	44	-----	76	520	1,220	34	24	11
12.....	19	50	-----	87	286	1,540	29	22	11
13.....	23	47	47	70	230	1,220	28	19	11
14.....	32	47	56	88	230	1,180	24	22	11
15.....	32	44	64	88	242	1,100	24	45	8
16.....	28	42	65	50	286	1,260	22	42	8
17.....	28	40	76	59	335	1,030	20	32	5
18.....	28	48	125	70	430	775	27	20	4
19.....	28	47	120	83	460	605	31	19	4
20.....	28	43	88	94	460	315	37	24	4
21.....	28	44	65	83	520	292	78	24	4
22.....	32	47	60	76	585	292	120	22	4
23.....	40	47	44	88	655	292	87	22	4
24.....	40	42	37	94	730	292	87	24	4
25.....	38	42	54	79	730	292	66	20	4
26.....	38	42	37	70	620	292	39	17	4
27.....	34	42	65	70	770	292	37	13	4
28.....	34	42	59	83	1,050	230	34	11	4
29.....	34	42	50	94	1,130	169	28	12	4
30.....	34	42	59	120	1,380	162	28	12	4
31.....	40	-----	50	-----	1,420	-----	26	11	-----

NOTE.—Stage-discharge relation affected by ice Nov. 24-30; discharge estimated. Stage-discharge relation affected by shifting control June 1-8; discharge computed by indirect method. No gage-height record June 10-14; discharge based on observer's notes and comparison with flow of French Creek near French and North Platte River at Saratoga.

Monthly discharge of Medicine Bow River near Medicine Bow, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	40	14	26.2	1,610
November.....	50	34	43.2	2,570
March 13-31.....	125	37	64.3	2,420
April.....	120	44	75.8	4,510
May.....	1,420	160	494	30,400
June.....	1,540	162	864	51,400
July.....	148	20	55.3	3,400
August.....	45	11	24.0	1,480
September.....	11	4	7.6	452

SAGE CREEK ABOVE PATHFINDER RESERVOIR, WYO.

LOCATION.—In sec. 3, T. 26 N., R. 84 W., at footbridge at Vivion ranch, 25 miles above Pathfinder dam, Carbon County. No tributary between station and mouth, 2 miles below.

DRAINAGE AREA.—182 square miles (measured on base map of Wyoming; scale 1: 500,000).

RECORDS AVAILABLE.—March 20, 1915, to September 30, 1921.

GAGE.—Vertical staff on left bank, 5 feet above footbridge; read by Miss Christina Bennard.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders embedded in sand. Control is riffle short distance below gage; shifts slightly. Banks are overflowed at stage of 6.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.70 feet at 6 p. m. May 18 (discharge, 92 second-feet); minimum discharge, no flow July 6-8.

1915-1921: Maximum stage recorded, 6.5 feet, night of April 9, 1920, from high-water mark (discharge from extension of rating curve, 1,080 second-feet); minimum discharge, no flow, in 1919 and 1921.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 15 second-feet from Sage Creek, all above station, and 29 second-feet from tributaries above mouth.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curves well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as indicated in footnote to daily-discharge table. Records good.

Discharge measurements of Sage Creek above Pathfinder reservoir, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 18	P. V. Hodges.....	2.26	39.8
June 26	J. B. Spiegel.....	1.32	a. 8
Aug. 24	do.....	1.48	2.5

^a Estimated.

Daily discharge, in second-feet, of Sage Creek above Pathfinder reservoir, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	1.1	4.2		18	13	30	0.5	4.6	1.7
2	1.1	4.8		20	17	30	.6	16	1.6
3	1.1	5.2		27	23	32	.6	2.7	1.7
4	1.1	5.4		34	20	26	.4	2.6	1.5
5	1.1	6.6		37	18	28	.1	2.3	1.4
6	1.1	8.1		36	21	29	.0	1.7	1.5
7	1.1	9.8		20	42	81	.0	1.7	1.3
8	1.1	11		17	44	26	.0	1.5	1.2
9	1.1			14	46	21	.1	16	1.2
10	1.1			12	46	18	.4	1.3	1.1
11	1.1			15	38	12	.6	.5	1.3
12	1.1			18	38	13	.5	.1	1.3
13	1.1			18	33	12	.6	.5	1.0
14	1.1			20	35	6.1	6.4	30	1.2
15	1.1			21	33	8.0	77	9.6	1.4
16	1.1	8		13	50	17	13	6.1	1.5
17	1.1			7.3	64	6.1	5.8	2.8	1.5
18	1.1		39	10	84	4.4	3.2	2.6	1.5
19	2.0		49	9.6	77	6.1	21	1.6	1.5
20	3.1		34	16	67	9.6	11	1.6	1.5
21	3.1		22	10	61	5.8	5.2	2.6	1.4
22	3.1		23	8.0	57	4.9	3.0	2.7	1.6
23	3.1		26	8.8	59	3.2	1.5	2.7	1.5
24	3.1		19	15	62	2.0	1.2	2.4	1.6
25	3.1		17	15	64	.7	.6	2.2	1.5
26	3.4	6.0	18	19	58	.7	.6	1.7	1.5
27	3.4	6.0	11	22	50	1.0	.4	1.6	1.5
28	3.6	6.3	15	16	48	1.4	.8	1.6	1.5
29	4.2	7.5	16	13	42	.6	.6	1.7	1.6
30	4.8	7.5	14	15	36	.4	.2	1.6	1.5
31	4.0		12		33		.1	1.7	

NOTE.—Stage-discharge relation affected by ice Nov. 9-25, 29, and 30; discharge estimated. Braced figure represents mean discharge for period indicated.

Monthly discharge of Sage Creek above Pathfinder reservoir, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	4.8	1.1	2.06	127
November	11	4.2	7.41	440
March 18-31	49	11	22.5	625
April	37	7.3	17.5	1,040
May	84	13	44.5	2,740
June	32	.4	12.9	768
July	77	.0	5.03	309
August	30	.1	4.14	255
September	1.7	1.0	1.44	86

DEWEESE CREEK NEAR ALCOVA, WYO.

LOCATION.—In sec. 18, T. 27 N., R. 84 W., at Weaver ranch, near entrance of creek into Pathfinder reservoir, Carbon County.

DRAINAGE AREA.—41 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—March 4, 1917, to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 4.4 second-feet from Deweese Creek above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Deweese Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1-----	14	15	15	14	1	1	16-----	14	15	16	3	1	1
2-----	7	14	15	14	1	1	17-----	14	15	16	3	1	1
3-----	9	14	15	14	1	1	18-----	11	15	16	2	1	1
4-----	11	14	15	14	1	1	19-----	18	15	16	2	1	1
5-----	12	14	15	14	1	1	20-----	16	15	14	2	1	1
6-----	14	14	26	14	1	1	21-----	15	15	14	2	1	1
7-----	15	14	21	14	1	1	22-----	14	15	14	2	1	2
8-----	16	14	15	14	1	1	23-----	14	15	14	2	1	1
9-----	14	14	15	14	1	1	24-----	14	15	14	1	1	1
10-----	12	14	18	14	1	1	25-----	14	15	14	1	1	1
11-----	12	14	18	4	1	1	26-----	14	15	14	1	1	1
12-----	14	16	16	4	1	1	27-----	20	15	14	1	1	1
13-----	15	19	16	3	1	1	28-----	15	15	14	1	1	1
14-----	16	14	16	3	1	1	29-----	15	15	14	1	1	1
15-----	18	14	16	3	1	1	30-----	15	15	14	1	1	1
							31-----		15		1	1	

Daily discharge of Deweese Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April-----	20	7	14.1	839
May-----	19	14	14.8	910
June-----	26	14	15.6	928
July-----	14	1	5.9	363
August-----	1	1	1.0	61
September-----	1	1	1.0	60
The period-----				3,160

NOTE.—Monthly means computed by U. S. Geol. Survey.

SAND CREEK NEAR ALCOVA, WYO.

LOCATION.—In sec. 25, T. 28 N., R. 85 W., at Weaver ranch, 20 miles southwest of Alcova, Natrona County. No tributary between station and Pathfinder reservoir, the flow line of which is half a mile below.

DRAINAGE AREA.—70 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1921.

GAGE.—Vertical staff; read by Clarence Burch.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 28 second-feet, from Sand Creek, all above station.

REGULATION.—None.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Sand Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Sept.	Day	Apr.	May	June	July	Sept.
1.....	5	5	12	7	-----	16.....	4	12	12	7	1
2.....	4	5	12	7	-----	17.....	5	12	12	5	1
3.....	5	5	12	7	-----	18.....	5	12	12	2	1
4.....	5	5	12	7	-----	19.....	5	12	12	-----	1
5.....	5	12	12	7	-----	20.....	5	12	12	-----	1
6.....	6	12	12	7	-----	21.....	5	12	12	-----	1
7.....	7	12	12	7	-----	22.....	5	12	12	-----	1
8.....	5	12	12	7	-----	23.....	5	12	12	-----	1
9.....	5	12	12	7	-----	24.....	5	12	12	-----	1
10.....	5	12	12	7	-----	25.....	5	12	12	-----	1
11.....	5	12	12	7	-----	26.....	5	12	7	-----	1
12.....	5	12	12	7	-----	27.....	12	12	7	-----	1
13.....	5	12	12	7	-----	28.....	12	12	7	-----	1
14.....	4	12	12	7	-----	29.....	12	12	7	-----	1
15.....	4	12	12	7	-----	30.....	12	12	7	-----	1
						31.....	-----	-----	-----	-----	-----

NOTE.—No flow July 19 to Sept. 3.

Monthly discharge of Sand Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	12	4	5.9	351
May.....	12	5	11.1	682
June.....	12	7	11.2	666
July.....	7	0	3.8	234
August.....	0	0	.0	0
September.....	1	0	.9	54
The period.....	-----	-----	-----	1,990

NOTE.—Monthly means computed by U. S. Geol. Survey.

SWEETWATER RIVER NEAR ALCOVA, WYO.

LOCATION.—In sec. 17, T. 29 N., R. 86 W., at Schoonmaker ranch, 27 miles west of Alcova, Natrona County. Backwater from Pathfinder reservoir reaches point 5 miles below. Nearest tributary, Dry Creek, enters 6 miles below.

DRAINAGE AREA.—2,270 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—August 28, 1913, to September 30, 1921.

GAGE.—Vertical staff on left bank at old bridge abutment 200 feet above foot-bridge; read by W. H. Grieve.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control is small rapids 25 feet downstream; shifts during high water. Banks are high and not subject to overflow.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 170 second-feet from Sweetwater River, above the station. The original diversions below the station have been inundated by the Pathfinder reservoir.

REGULATION.—None.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Sweetwater River near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.-----	120	218	1,040	183	78	28	16.-----	224	616	1,130	96	59	39
2.-----	127	210	1,000	170	64	26	17.-----	240	607	1,140	98	52	45
3.-----	127	212	1,050	165	72	31	18.-----	283	647	1,180	106	53	47
4.-----	124	227	1,060	150	67	32	19.-----	270	877	1,190	108	53	45
5.-----	131	261	1,070	141	63	30	20.-----	276	868	1,170	115	53	50
6.-----	183	303	1,130	131	70	27	21.-----	294	845	1,300	121	57	57
7.-----	280	532	1,180	131	60	30	22.-----	303	835	1,060	106	50	60
8.-----	335	662	1,200	127	70	39	23.-----	325	835	698	93	47	63
9.-----	297	710	1,200	117	64	35	24.-----	328	825	747	96	42	63
10.-----	280	897	1,220	104	63	40	25.-----	332	829	744	83	37	63
11.-----	247	1,010	1,230	113	53	39	26.-----	368	705	595	75	39	59
12.-----	221	790	1,250	98	53	35	27.-----	361	943	507	83	32	55
13.-----	224	715	1,180	98	50	39	28.-----	320	1,010	418	72	40	55
14.-----	232	667	1,100	98	57	35	29.-----	254	983	249	72	35	59
15.-----	218	585	1,120	108	70	45	30.-----	236	1,040	224	64	28	60
							31.-----		1,030		75	26	-----

Monthly discharge of Sweetwater River near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.-----	368	120	252	15,000
May.-----	1,040	210	693	42,600
June.-----	1,300	224	979	58,300
July.-----	183	64	110	6,760
August.-----	78	26	53.5	3,290
September.-----	63	26	44.4	2,640
The period.-----				129,000

NOTE.—Monthly means computed by U. S. Geol. Survey.

HORSE CREEK NEAR ALCOVA, WYO.

LOCATION.—In sec. 22, T. 30 N., R. 85 W., at highway bridge near Bothwell ranch, 16 miles west of Alcova, Natrona County. No tributary between station and Pathfinder reservoir, the flow line of which is half a mile below gage.

DRAINAGE AREA.—119 square miles (measured on base map of Wyoming; scale 1:500,000).

RECORDS AVAILABLE.—March 23, 1915, to September 30, 1921.

GAGE.—Vertical staff located on right bank at downstream side of bridge; read by S. A. Sanford.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel; control located a short distance below gage.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 11 second-feet from Horse Creek.

REGULATION.—None.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Horse Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1	3	2	4	3	3	3	16	2	3	4	3	3	3
2	3	2	4	3	3	3	17	2	3	4	3	3	3
3	3	2	4	3	3	3	18	2	3	4	3	3	3
4	3	2	4	3	3	3	19	2	3	4	3	3	3
5	3	2	4	3	3	3	20	2	3	4	3	3	3
6	3	2	4	3	3	3	21	2	3	4	3	3	3
7	3	2	30	3	3	3	22	2	3	4	3	3	3
8	3	3	30	3	3	3	23	2	3	4	3	3	3
9	3	3	20	3	3	3	24	2	3	4	3	3	3
10	3	3	4	3	3	3	25	2	3	4	3	3	3
11	3	3	4	3	3	3	26	2	3	4	3	3	3
12	3	3	4	3	3	3	27	2	3	4	3	3	3
13	3	3	4	3	3	3	28	2	3	4	3	3	3
14	2	3	4	3	3	3	29	2	4	4	3	3	3
15	2	3	4	3	3	3	30	2	4	4	3	3	3
							31		4		3	3	

Monthly discharge of Horse Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April	3	2	2.4	143
May	4	2	2.9	178
June	30	4	6.3	375
July	3	3	3.0	184
August	3	3	3.0	184
September	3	3	3.0	179
The period				1,240

NOTE.—Monthly means computed by U. S. Geol. Survey.

CANYON CREEK NEAR ALCOVA, WYO.

LOCATION.—In sec. 2, T. 28 N., R. 85 W., at Irvine ranch, 12 miles southwest of Alcova, Natrona County. No tributary between station and Pathfinder reservoir, the flow line of which is a mile below gage.

DRAINAGE AREA.—54 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—April 1, 1915, to September 30, 1921.

GAGE.—Vertical staff; read by F. J. Irvine.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 4.0 second-feet from Canyon Creek, and 15 second-feet from tributaries entering above.

REGULATION.—None.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Canyon Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1-----	8	9	1	1	1	1	16-----	6	4	1	1	1	1
2-----	7	7	1	1	2	1	17-----	5	5	1	1	1	1
3-----	8	7	1	1	1	1	18-----	4	5	1	1	1	1
4-----	9	7	1	1	1	1	19-----	4	4	1	1	1	1
5-----	9	4	1	1	1	1	20-----	4	3	4	1	1	1
6-----	9	4	1	1	1	1	21-----	5	2	1	1	1	1
7-----	8	7	2	1	1	1	22-----	5	1	1	1	1	1
8-----	8	11	1	1	1	1	23-----	5	1	1	1	1	1
9-----	6	10	1	1	1	1	24-----	8	1	1	1	1	1
10-----	6	7	1	1	1	1	25-----	6	1	1	1	1	1
11-----	6	6	1	1	1	1	26-----	8	1	1	1	1	1
12-----	6	4	3	1	1	1	27-----	10	1	1	0	1	1
13-----	6	4	2	1	1	1	28-----	11	1	1	1	1	1
14-----	6	4	1	1	2	1	29-----	10	1	1	0	1	1
15-----	6		1		1	1	30-----	10	1	1	1	1	1
							31-----		1		0	1	

Monthly discharge of Canyon Creek near Alcova, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April-----	11	4	7.0	417
May-----	11	1	4.1	253
June-----	4	1	1.2	7
July-----	1	0	.9	55
August-----	2	1	1.1	68
September-----	1	1	1.0	60
The period-----				923

NOTE.—Monthly means computed by U. S. Geol. Survey.

BATES CREEK NEAR CASPER, WYO.

LOCATION.—In sec. 12, T. 31 N., R. 82 W., near mouth of creek, 21 miles south-west of Casper, Natrona County.

DRAINAGE AREA.—383 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—April 10, 1916, to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 74 second-feet from Bates Creek and 26 second-feet from tributaries, all above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Bates Creek near Casper, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Day	Apr.	May	June	July
1.....	14	83	-----	-----	16.....	11	40	1	29
2.....	23	65	-----	-----	17.....	2	200	1	-----
3.....	59	34	-----	-----	18.....	2	29	19	-----
4.....	74	40	-----	-----	19.....	2	29	9	-----
5.....	74	52	-----	-----	20.....	6	7	1	-----
6.....	52	46	-----	-----	21.....	6	-----	11	-----
7.....	40	46	-----	-----	22.....	2	-----	11	-----
8.....	14	74	-----	-----	23.....	6	-----	9	-----
9.....	11	74	-----	-----	24.....	6	-----	6	-----
10.....	11	93	-----	-----	25.....	2	-----	1	-----
11.....	14	119	-----	-----	26.....	2	-----	1	-----
12.....	19	119	1	-----	27.....	2	-----	1	-----
13.....	11	119	425	-----	28.....	6	-----	1	-----
14.....	14	93	2	-----	29.....	2	-----	-----	-----
15.....	11	74	7	83	30.....	2	-----	-----	-----
					31.....	-----	-----	-----	-----

NOTE.—No flow May 21 to June 11, June 29 to July 14, and July 17 to Sept. 30.

Monthly discharge of Bates Creek near Casper, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	74	2	16.7	994
May.....	200	0	46.3	2,850
June.....	425	0	16.9	1,010
July.....	83	0	3.6	221
August.....	0	0	0	0
September.....	0	0	0	0
The period.....	-----	-----	-----	5,080

NOTE.—Monthly means computed by U. S. Geol. Survey.

DEER CREEK AT GLENROCK, WYO.

LOCATION.—In sec. 4, T. 33 N., R. 75 W., near mouth of creek at Glenrock, Converse County.

DRAINAGE AREA.—216 square miles (revised measurement on map in Bulletin 626).

RECORDS AVAILABLE.—April 11, 1916, to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 49 second-feet from Deer Creek and 45 second-feet from tributaries, all above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Deer Creek at Glenrock, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....	56	239	56	1	1	1	16.....	90	301	83	1	1	1
2.....	44	285	164	1	1	1	17.....	153	285	71	1	1	1
3.....	254	301	205	1	1	1	18.....	131	285	51	1	1	1
4.....	314	239	164	1	1	1	19.....	239	254	61	1	1	1
5.....	266	266	106	1	1	1	20.....	193	314	47	3	1	1
6.....	205	346	71	1	1	1	21.....	122	330	40	3	1	1
7.....	106	360	56	1	1	1	22.....	164	219	66	1	1	1
8.....	61	450	56	1	1	1	23.....	131	131	44	1	1	1
9.....	83	480	98	1	1	1	24.....	219	122	33	1	1	1
10.....	106	435	51	1	1	1	25.....	193	131	40	1	1	1
11.....	106	405	36	1	1	1	26.....	254	131	24	1	1	1
12.....	205	420	33	1	1	1	27.....	254	114	19	1	1	1
13.....	98	346	33	1	1	1	28.....	180	122	11	1	1	1
14.....	83	330	90	1	1	1	29.....	193	12	19	1	1	1
15.....	122	285	122	1	1	1	30.....	285	27	8	1	1	1
							31.....		40		1		

Monthly discharge of Deer Creek at Glenrock, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	314	44	164	9,760
May.....	480	12	258	15,900
June.....	205	8	65.3	3,890
July.....	3	1	1.1	68
August.....	1	1	1.0	61
September.....	1	1	1.0	60
The period.....				29,700

NOTE.—Monthly means computed by U. S. Geol. Survey.

BOXELDER CREEK NEAR CAREYHURST, WYO.

LOCATION.—In sec. 7, T. 33 N., R. 73 W., near mouth of creek, $1\frac{1}{2}$ miles east of Careyhurst, Converse County.

DRAINAGE AREA.—202 square miles (revised measurement on map in Bulletin 626).

RECORDS AVAILABLE.—May 17 to October 31, 1911; April 9, 1916, to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 80 second-feet from Boxelder Creek, and 52 second-feet from tributaries, all above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Boxelder Creek near Careyhurst, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....	23	111	129	14	5	5	16.....	31	297	41	5	5	5
2.....	23	111	297	14	5	5	17.....	31	321	31	5	5	5
3.....	31	111	65	14	5	5	18.....	31	321	31	5	9	5
4.....	65	171	5	14	5	5	19.....	80	297	95	111	9	5
5.....	31	195	31	14	5	5	20.....	80	297	80	65	9	5
6.....	23	195	23	9	5	5	21.....	80	270	80	14	5	5
7.....	23	297	9	9	5	5	22.....	61	246	53	9	5	5
8.....	23	397	5	9	5	5	23.....	61	270	18	9	5	5
9.....	23	384	14	9	5	5	24.....	61	297	31	9	5	5
10.....	23	371	9	9	5	5	25.....	80	346	31	9	5	5
11.....	23	346	5	9	5	5	26.....	80	371	31	9	5	5
12.....	23	321	5	5	5	5	27.....	95	346	31	9	5	5
13.....	23	246	5	5	5	5	28.....	111	297	14	9	5	5
14.....	31	246	31	5	5	5	29.....	111	171	14	9	5	5
15.....	80	246	31	5	5	5	30.....	111	171	14	9	5	5
							31.....		149		9	5	

Monthly discharge of Boxelder Creek near Careyhurst, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	111	23	52.4	3,120
May.....	397	111	265	16,300
June.....	297	5	42.0	2,500
July.....	111	5	14.2	873
August.....	9	5	5.4	332
September.....	5	5	5.0	298
The period.....				23,400

NOTE.—Monthly means computed by U. S. Geol. Survey.

LA PRELE CREEK NEAR DOUGLAS, WYO.

LOCATION.—In sec. 6, T. 31 N., R. 73 W., just above high-water line of La Prele reservoir, 16 miles southwest of Douglas, Converse County. Nearest tributary, an unnamed stream 1 mile above.

DRAINAGE AREA.—146 square miles (revised measurement on map in Bulletin 626).

RECORDS AVAILABLE.—August 25, 1919, to September 30, 1921.

GAGE.—Gurley water-stage recorder on right bank; inspected by Wayne Kennedy.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of well-compacted sand and gravel. Low-water control, concrete slab $1\frac{1}{2}$ feet wide near cable; high-water control is rapids 150 feet downstream; should be permanent. Banks will be overflowed at stage of 6 feet, but entire flow passes under cable.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 8.5 feet at 11 p. m. May 25 (discharge, 570 second-feet); minimum stage from water-stage recorder, 3.38 feet 8 a. m. to 4 p. m. September 3 (discharge, 1.4 second-feet).

1919–1921: Maximum stage from high-water mark, 11.4 feet May 11, 1920 (discharge from extension of rating curve, 1,220 second-feet); minimum stage, 3.29 feet on October 2, 1919 (discharge, 0.4 second-foot).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 42 second-feet from La Prele Creek above station, and 36 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent except as affected by ice.

Rating curve fairly well defined below 600 second-feet. Operation of water-stage recorder fairly satisfactory. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph, except as explained in footnote to table of daily discharge. Records good, except during winter period, for which they are fair.

COOPERATION.—Field data furnished by Douglas Reservoirs Co. Check measurements made by United States Geological Survey.

Discharge measurements of La Prele Creek near Douglas, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 11	Spiegel and Roush.....	4.07	10.0
Apr. 6	F. M. Roush.....	4.04	23.5
July 14	Hodges and Roush.....	3.52	4.7

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of La Prele Creek near Douglas, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	3.9	8.6	7.0	13	13	9	17	124	114	15	8.3	1.6
2.....	3.9	10	6.3			10	17	124	92	13	12	1.5
3.....	8.6	8.0	6.7			10	20	124	92	12	9.7	1.4
4.....	8.6	8.6				15	28	129	80	12	8.3	2.0
5.....	8.6	8.6				18	33	140	65	11	7.0	2.0
6.....	9.3	8.6		13	13	16	26	145	67	9.3	7.0	2.0
7.....	9.3	8.4				16	22	212	65	8.6	6.7	1.7
8.....	9.3	8.2				16	19	205	64	8.3	6.3	1.7
9.....	9.7	8.0				15	18	186	56	6.0	6.3	1.6
10.....	4.7	8.0	8			15	18	162	51	4.4	5.0	1.6
11.....	4.7	8.0		12	12	15	22	140	43	3.7	4.2	1.6
12.....	5.0	8.0				14	22	134	40	3.7	3.9	1.7
13.....	4.7	8.0				14	21	123	35	3.4	3.4	1.7
14.....	5.0	9.0				14	26	114	31	4.4	4.7	1.8
15.....	4.7	10				18	29	115	29	8.3	4.2	1.8
16.....	4.4	10		12	12	18	26	123	34	4.4	3.4	1.9
17.....	3.9	9.3				21	30	129	27	5.0	3.4	2.0
18.....	3.9	9.3				29	35	145	26	17	3.2	2.1
19.....	4.2	9.7				38	40	162	48	26	3.0	2.1
20.....	4.7	8.6	9			18	45	150	48	13	3.0	2.0
21.....	4.4	8.6		10	10	17	50	135	41	10	3.0	1.8
22.....	4.4	8.9				16	60	121	37	9.3	3.0	2.1
23.....	4.4	8.0				15	90	129	32	7.6	3.0	2.1
24.....	5.0	8.3				14	70	340	28	6.7	3.0	2.1
25.....	5.0	8.6				13	60	319	26	15	3.0	2.9
26.....	5.0	8.3		8	8	13	50	355	25	16	3.0	2.9
27.....	5.0	7.6				13	40	250	24	11	2.8	2.9
28.....	5.0	7.3				14	50	187	24	9.7	2.5	2.9
29.....	6.0	7.0				15	90	178	26	8.3	2.3	2.7
30.....	7.3	7.0				16	134	148	19	7.3	2.0	2.5
31.....	8.0					16	144	134	14	6.0	2.0	

NOTE.—No gage-height record Nov. 6-12, 28, Mar. 27-31, Apr. 1, 17-22, 24-29, May 20-21, June 4, 26, Aug. 21, 27, Sept. 11-17, discharge interpolated, except for days in April, for which discharge is based on climatologic records. Stage-discharge relation affected by ice Nov. 13-15, 29-30, Dec. 4 to Feb. 26; discharge based on temperature and gage-height records, and one discharge measurement. Braced figures show mean discharge for periods indicated.

Monthly discharge of La Prele Creek near Douglas, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	9.7	3.9	5.83	358
November.....	10.0	7.0	8.48	505
December.....			8.1	498
January.....			12.3	756
February.....			11.8	655
March.....	38	9.0	16.2	996
April.....	134	17	40.3	2,400
May.....	355	114	167	10,300
June.....	114	19	46.3	2,760
July.....	26	3.4	9.53	586
August.....	12	2.0	4.60	283
September.....	2.9	1.4	2.02	120
The year.....	355	1.4	27.9	20,200

WAGON HOUND CREEK NEAR LABONTE, WYO.

LOCATION.—In sec. 16, T. 31 N., R. 71 W., at Eastman ranch, near mouth of creek, 3 miles east of Labonte, Converse County.

DRAINAGE AREA.—125 square miles (revised measurement on map in Bulletin 626).

RECORDS AVAILABLE.—April 11, 1916, to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 25 second-feet from Wagon Hound Creek and 12 second-feet from tributaries, all above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Wagon Hound Creek near Labonte, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....	3	121	25	5	1	1	16.....	3	5	25	1	1	1
2.....	3	154	25	5	1	1	17.....	3	5	25	1	1	1
3.....	3	107	39	5	1	1	18.....	3	5	25	1	1	1
4.....	4	44	37	5	1	1	19.....	3	5	25	1	1	1
5.....	5	29	25	5	1	1	20.....	1	5	25	1	1	1
6.....	5	29	25	5	1	1	21.....	9	5	19	1	1	1
7.....	5	23	79	5	1	1	22.....	7	5	19	1	1	1
8.....	3	35	97	1	1	1	23.....	8	13	13	1	1	1
9.....	3	27	35	1	1	1	24.....	22	37	11	1	1	1
10.....	3	25	41	1	1	1	25.....	41	61	11	1	1	1
11.....	3	19	37	1	1	1	26.....	44	367	11	79	1	1
12.....	3	13	31	1	1	1	27.....	49	88	11	1	1	1
13.....	3	5	25	1	1	1	28.....	49	46	11	1	1	1
14.....	3	5	25	1	1	1	29.....	49	35	7	1	1	1
15.....	3	5	25	1	1	1	30.....	72	25	7	1	1	1
							31.....		25		1	1	-----

NOTE.—Monthly means computed by U. S. Geol. Survey.

*Monthly discharge of Wagon Hound Creek near Labonte, Wyo., for the period
Apr. 1 to Sept. 30, 1921*

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	72	1	13.8	821
May.....	367	5	44.3	2,720
June.....	97	7	27.2	1,620
July.....	79	1	4.4	271
August.....	1	1	1.0	61
September.....	1	1	1.0	60
The period.....				5,550

LABONTE CREEK NEAR LABONTE, WYO.

LOCATION.—In sec. 15, T. 31 N., R. 71 W., at Soden ranch, near mouth of creek, 2 miles east of Labonte, Converse County.

DRAINAGE AREA.—303 square miles (revised measurement on map in Bulletin 626).

RECORDS AVAILABLE.—April 12, 1916, to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 43 second-feet from Labonte Creek and 16 second-feet from tributaries, all above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

*Daily discharge, in second-feet, of Labonte Creek near Labonte, Wyo., for the period
Apr. 1 to Sept. 30, 1921*

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....	37	247	115	31	14	9	16.....	73	145	99	12	12	9
2.....	37	241	92	31	12	9	17.....	86	168	92	25	6	9
3.....	43	241	99	25	12	9	18.....	115	168	92	25	6	9
4.....	43	241	105	16	12	9	19.....	156	145	83	25	6	9
5.....	51	241	105	12	12	9	20.....	185	135	83	25	6	9
6.....	73	275	99	12	12	9	21.....	203	124	83	23	6	9
7.....	63	305	124	12	12	9	22.....	185	124	83	19	6	9
8.....	59	411	79	12	12	9	23.....	145	145	83	16	6	9
9.....	51	411	83	12	12	9	24.....	185	358	63	16	6	9
10.....	51	384	83	12	12	9	25.....	275	384	55	16	6	9
11.....	51	358	86	12	12	9	26.....	305	305	47	16	6	9
12.....	51	305	83	12	12	9	27.....	305	223	43	16	6	9
13.....	51	241	86	12	12	9	28.....	275	168	31	16	3	9
14.....	55	185	99	12	12	9	29.....	247	145	31	16	3	9
15.....	63	145	92	51	12	9	30.....	185	124	31	16	6	9
							31.....		124		16	6	

*Monthly discharge of Labonte Creek near Labonte, Wyo., for the period Apr. 1 to
Sept. 30, 1921*

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	305	37	123	7,320
May.....	411	124	233	14,300
June.....	124	31	81.0	4,820
July.....	51	12	18.5	1,140
August.....	14	3	9.0	553
September.....	9	9	9.0	536
The period.....				28,700

NOTE.—Monthly means computed by U. S. Geol. Survey.

HORSESHOE CREEK NEAR GLENDO, WYO.

LOCATION.—In sec. 26, T. 29 N., R. 68 W., at Hauf ranch, near mouth of creek, 4 miles southeast of Glendo, Platte County.

DRAINAGE AREA.—203 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—April 16, 1916, to September 30, 1919; April 1 to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 86 second-feet from Horseshoe Creek and 6 second-feet from tributaries, all above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Horseshoe Creek near Glendo, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....	12	97	55	22	1	1	16.....	28	88	88	17	1	1
2.....	12	88	128	22	1	1	17.....	28	88	88	7	1	1
3.....	12	88	151	17	1	1	18.....	55	79	88	1	1	1
4.....	12	97	128	17	1	1	19.....	55	79	88	1	1	1
5.....	12	107	88	17	1	1	20.....	62	62	88	1	1	1
6.....	7	128	151	17	1	1	21.....	62	55	79	1	1	1
7.....	7	128	151	12	1	1	22.....	71	41	79	1	1	1
8.....	12	151	740	7	1	1	23.....	79	41	71	1	1	1
9.....	12	151	216	7	1	1	24.....	79	230	71	1	1	1
10.....	17	139	202	3	1	1	25.....	88	202	71	1	1	1
11.....	12	128	151	1	1	1	26.....	88	189	62	1	1	1
12.....	17	128	151	1	1	1	27.....	88	118	55	1	1	1
13.....	28	118	128	1	1	1	28.....	97	88	55	1	1	1
14.....	22	107	128	1	1	1	29.....	97	71	47	1	1	1
15.....	17	107	118	41	1	1	30.....	97	55	35	1	1	1
							31.....		55		1	1	

Monthly discharge of Horseshoe Creek near Glendo, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	97	7	42.8	2,550
May.....	230	41	107	6,580
June.....	740	35	125	7,440
July.....	41	1	7.2	443
August.....	1	1	1.0	61
September.....	1	1	1.0	60
The period.....				17,100

NOTE.—Monthly means computed by U. S. Geol. Survey.

COTTONWOOD CREEK NEAR WENDOVER, WYO.

LOCATION.—In sec. 16, T. 27 N., R. 67 W., near mouth of creek, 1½ miles south of Wendover, Platte County.

DRAINAGE AREA.—159 square miles (revised measurement on map in Bulletin 626).

RECORDS AVAILABLE.—April 19, 1916, to September 30, 1921.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 32 second-feet from Cottonwood Creek and 4 second-feet from tributaries, all above station.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Cottonwood Creek near Wendover, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....	3	2	93	9	1	3	16.....	2	3	207	3	1	7
2.....	3	2	37	7	1	3	17.....	2	3	118	3	1	7
3.....	2	2	207	5	1	3	18.....	2	3	74	3	1	7
4.....	2	2	82	5	1	4	19.....	2	3	107	3	1	7
5.....	1	2	118	5	1	4	20.....	2	3	93	3	1	7
6.....	1	2	131	5	1	4	21.....	2	3	91	3	2	7
7.....	1	2	171	5	1	5	22.....	2	3	91	3	2	7
8.....	1	2	427	5	1	5	23.....	2	3	91	3	2	7
9.....	1	2	277	2	1	7	24.....	2	3	79	3	2	7
10.....	2	2	154	2	1	6	25.....	2	3	46	1	2	7
11.....	2	2	122	2	1	6	26.....	2	3	46	1	2	7
12.....	2	2	118	2	1	6	27.....	2	3	43	1	2	7
13.....	2	3	109	2	1	7	28.....	2	3	36	1	2	7
14.....	2	3	91	2	1	7	29.....	2	3	23	1	2	7
15.....	2	3	86	4	1	7	30.....	2	3	12	1	2	7
							31.....		184		1	2	

Monthly discharge of Cottonwood Creek near Wendover, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	3	1	1.9	113
May.....	184	2	8.5	523
June.....	427	12	113	6,720
July.....	9	1	3.1	191
August.....	2	1	1.4	86
September.....	7	3	6.1	363
The period.....				8,000

NOTE.—Monthly means computed by U. S. Geol. Survey.

LARAMIE RIVER NEAR GLENDEVEY, COLO.

LOCATION.—In SW. $\frac{1}{4}$ sec. 25, T. 10 N., R. 76 W., at highway bridge 3 miles east of Glendevy, Larimer County. Nearest tributary, Nunn Creek, enters just above station.

DRAINAGE AREA.—101 square miles (measured on topographic map).

RECORDS AVAILABLE.—June 24, 1904, to October 31, 1905; August 18, 1910, to October 19, 1913; April 11 to September 30, 1916; April 26, 1919, to September 30, 1921. Records for 1914, 1915, 1917, and 1918 published by State engineer.

GAGE.—Bristol float-type water-stage recorder installed April 26, 1919, at right bridge pier to replace Bristol pressure gage used previously; inspected by E. L. Farnham.

DISCHARGE MEASUREMENTS.—Made from four-span bridge or by wading.

CHANNEL* AND CONTROL.—Bed composed of boulders and sand. Control is boulder riffle just below bridge; shifts at long intervals.

EXTREMES OF DISCHARGE.—Maximum stage during year not recorded, water-stage recorder not operating. Minimum discharge occurred during winter.

1904–1905; 1910–1921: Maximum stage recorded, 5.0 feet on June 1, 1914 (discharge, 1,380 second-feet); minimum stage recorded, 1.5 feet on February 14–15, 1911 (discharge, 5 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Court decrees for diversion of 49 second-feet from Laramie River and 545 second-feet from tributaries entering above. Of the latter amount 400 second-feet represent diversions into Cache la Poudre basin through Skyline ditch. In addition, the United States Supreme Court has granted a decree for an annual diversion of 15,500 acre-feet through the Laramie-Poudre tunnel for use in the Greeley-Poudre Irrigation District. During 1921 a total of 25,100 acre-feet were diverted into Cache la Poudre basin.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used: One, October 1 to June 10 and August 11 to September 30 well defined below 1,000 second-feet; other, June 11 to August 10 well defined between 200 and 1,000 second-feet. Operation of water-stage recorder satisfactory except during June. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph, except as indicated in footnote to table of daily discharge. Records good, except during June, for which they are fair.

Discharge measurements of Laramie River near Glendevay, Colo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
May 2	P. V. Hodges.....	1.55	71	Aug. 11	W. T. Blight a.....	1.35	57
June 11	J. B. Spiegel.....	4.00	920	Sept. 5	J. B. Spiegel.....	1.20	40
30	.....do.....	2.41	265				

a State hydrographer.

Daily discharge, in second-feet, of Laramie River near Glendevay, Colo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	31	20	6	-----	20	52	610	266	110	53
2.....	31	19	6	-----	23	78	588	266	104	44
3.....	31	19	-----	-----	31	92	565	233	86	44
4.....	33	16	-----	-----	37	111	588	214	77	40
5.....	32	13	-----	-----	37	124	542	207	70	39
6.....	29	10	-----	-----	29	147	520	189	64	37
7.....	27	9	-----	-----	25	172	805	173	62	36
8.....	24	8	-----	-----	26	145	830	167	60	39
9.....	24	8	-----	-----	26	135	850	167	62	37
10.....	21	10	-----	-----	27	127	880	158	76	34
11.....	22	6	-----	-----	29	125	920	162	65	31
12.....	23	7	-----	-----	31	149	945	160	62	29
13.....	27	7	-----	-----	25	164	895	163	67	27
14.....	30	7	-----	-----	26	162	960	158	78	26
15.....	29	7	-----	-----	19	194	1,020	149	91	25
16.....	34	6	-----	-----	23	208	1,000	149	65	29
17.....	27	6	-----	-----	16	222	700	144	53	30
18.....	26	6	-----	-----	17	262	700	167	48	30
19.....	26	6	-----	-----	22	246	600	149	47	33
20.....	28	6	-----	37	26	222	500	128	50	30
21.....	29	6	-----	33	26	251	450	114	45	25
22.....	24	9	-----	33	27	279	425	133	45	23
23.....	24	6	-----	35	47	312	450	189	60	24
24.....	20	6	-----	30	46	350	400	147	52	25
25.....	21	7	-----	30	31	359	350	119	49	31
26.....	23	6	-----	30	27	327	325	104	46	31
27.....	8	-----	-----	27	26	417	300	85	43	30
28.....	20	6	-----	29	26	508	290	77	39	29
29.....	22	6	-----	26	26	520	280	71	35	29
30.....	22	6	-----	23	36	565	275	67	45	29
31.....	20	-----	-----	20	-----	655	-----	73	49	-----

NOTE.—No gage-height record Nov. 4-6, 18-20, Apr. 8-9, June 8-10, 14-24, 26-29; discharge based on comparison with flow of Laramie River at Jelm and Woods, Wyo. Stage-discharge relation affected by ice Oct. 27, 30-31, Nov. 1-2; discharge interpolated. Shifting-control method used July 23 to Aug. 31.

Monthly discharge of Laramie River near Glendevy, Colo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre- feet
	Maximum	Minimum	Mean	
October.....	34	20	25.9	1,590
November.....	20	6	8.7	518
March 20-31.....	37	20	29.4	700
April.....	47	16	27.8	1,650
May.....	655	52	248	15,200
June.....	1,020	275	619	36,800
July.....	266	67	153	9,410
August.....	110	35	61.5	3,780
September.....	53	23	32.4	1,930

LARAMIE RIVER NEAR JELM, WYO.

LOCATION.—In sec. 15, T. 12 N., R. 77 W., just below highway bridge at Boswell ranch, a quarter of a mile below Colorado-Wyoming line, 4 miles south of old Jelm, Albany County. Stuck Creek enters 1 mile upstream.

DRAINAGE AREA.—297 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 7, 1911, to September 30, 1921. From June 22, 1904, to October 31, 1905, station maintained at Decker's ranch, half a mile south of State line. Records at two stations comparable, as there are no tributaries or diversions of importance between them.

GAGE.—Friez water-stage recorder on right bank 30 feet below bridge; inspected by Mrs. C. D. Oviatt. Recorder moved September 4, 1921, from middle pier of bridge, where it had been located since April 26, 1919. Datum unchanged since station was established.

DISCHARGE MEASUREMENTS.—Made from two-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. Control a short distance downstream; shifts slightly at long intervals. Left bank is overflowed at gage height 3.0 feet; flow passes through three well-defined high-water channels.

EXTREMES OF DISCHARGE.—Maximum stage during year not recorded, water-stage recorder not in operation; minimum discharge occurred during winter. 1904-1905; 1911-1921: Maximum stage, 4.2 feet at noon June 8, 1920, from high-water mark (discharge, 3,840 second-feet); minimum discharge occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Between station near Glendevy and this station, court decrees for diversion of 292 second-feet from Laramie River, and 329 second-feet from intervening tributaries.

REGULATION.—Diurnal fluctuation during spring caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used June 9 to July 9 well defined between 1,000 and 3,000 second-feet. Curve used for remainder of year well defined. Operation of water-stage recorder satisfactory except for periods of missing gage heights. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph, except as indicated in footnote to table of daily discharge. Records good except for June and July, for which they are fair.

Discharge measurements of Laramie River near Jelm, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
May 1	P. V. Hodges.....	1.29	121	July 22	J. B. Spiegel.....	1.59	222
June 11	J. B. Spiegel.....	3.41	2,020	Aug. 11	W. T. Blight.....	1.28	129
30	do.....	2.15	561	Sept. 3	J. B. Spiegel.....	1.15	92

Daily discharge, in second-feet, of Laramie River near Jelm, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Apr.	May	June	July	Aug.	Sept.
1.....	57	-----	124	1,620	542	163	111
2.....	55	-----	148	1,520	524	199	
3.....	53	-----	179	1,470	530	173	97
4.....	55	-----	218	1,500	536	154	82
5.....	55	-----	250	1,540	465	131	76
6.....	53	-----	278	1,560	407	108	70
7.....	55	-----	347	1,750	380	102	62
8.....	53	-----	318	2,160	356	97	60
9.....	53	-----	288	1,990	344	95	62
10.....	55	-----	267	2,010	344	118	61
11.....	57	-----	260	2,030	340	121	61
12.....	66	-----	281	2,030	340	99	61
13.....	75	-----	307	2,020	330	202	56
14.....	73	-----	343	2,000	320	170	54
15.....	71	-----	384	2,150	310	242	50
16.....	67	-----	430	2,100	299	154	49
17.....	66	-----	470	1,600	270	116	49
18.....	67	-----	597	1,600	384	97	55
19.....	67	-----	611	1,410	299	93	76
20.....	73	-----	506	1,090	250	102	62
21.....	64	-----	566	863	225	97	55
22.....	62	-----	668	792	253	95	50
23.....	60	-----	780	800	355	108	49
24.....	55	-----	930	809	267	118	49
25.....	55	-----	940	818	208	108	54
26.....	58	-----	820	716	192	97	55
27.....	56	-----	940	614	176	84	54
28.....	54	-----	1,330	626	157	78	52
29.....	54	-----	1,410	632	147	99	52
30.....	54	82	1,500	602	131	86	50
31.....	52	-----	1,600	-----	131	97	-----

NOTE.—No gage-height record Oct. 24-31, May 8, June 12-14, 16, 17, 26, July 3, 10-15, Sept. 17-18; discharge based on comparison with flow at neighboring stations. Shifting-control method used April 30 to May 3, June 4-8, 21-30, July 1-9.

Monthly discharge of Laramie River near Jelm, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	75	52	59.7	3,670
May.....	1,600	124	584	35,900
June.....	2,160	602	1,410	83,900
July.....	542	131	317	19,500
August.....	242	78	123	7,560
September.....	111	49	62.4	3,710

LARAMIE RIVER AND PIONEER CANAL NEAR WOODS, WYO.

LOCATION.—In sec. 36, T. 14 N., R. 77 W., at diversion dam for Pioneer canal, 2 miles from Woods post office, Albany County. Nearest important tributary, Fox Creek, enters 3 miles above.

DRAINAGE AREA.—409 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—April 16 to December 31, 1912; October 1, 1914, to September 30, 1921. For 1913 and 1914 records published by State engineer. From July 1, 1890, to June 30, 1892, April 12, 1896, to September 30, 1900, and May 7 to November 11, 1911, a station was maintained at Woods Landing in sec. 11, T. 13 N., R. 77 W. Records not directly comparable, as Fox Creek enters between, and a few small ditches divert water.

GAGE.—Bristol float-type water-stage recorder installed May 8, 1920, to replace Bristol pressure gage, whose datum is crest of dam; inspected by employee of Laramie Water Co. Gage was moved September 23, 1915, to upper wingwall of head gates, and although actually above canal intake, it still indicates flow over dam, as it is in pool formed by diversion dam. Gage originally at left end of dam just below Pioneer canal head gates. Chain gage in Pioneer canal is located at Johnson bridge, $1\frac{1}{2}$ miles below intake; read by employee of Laramie Water Co.

DISCHARGE MEASUREMENTS.—Made from cable, 2,000 feet above dam. Measurements of Pioneer canal made at Johnson Bridge and this quantity is subtracted from flow at cable to determine flow at diversion dam.

CHANNEL AND CONTROL.—Gage is in pool formed by concrete diversion dam 2 feet high. Control is dam and is permanent. Banks are high and will not be overflowed. Bed of canal composed of shale which changes somewhat; control is concrete drop, 1 mile downstream.

EXTREMES OF DISCHARGE.—Laramie River: Maximum stage during year from water-stage recorder, 3.75 feet at 2 p. m. June 16 (discharge, 2,680 second-feet); minimum discharge occurred during winter.

Pioneer canal: Maximum stage recorded, 2.76 feet June 17 (discharge, 222 second-feet); minimum discharge, canal dry except for small amount of leakage through head gates.

1912–1921: Maximum stage recorded 4.4 feet from 8 a. m. to noon June 23, 1917 (river discharge, 3,310 second-feet; combined discharge, 3,820 second-feet); combined minimum discharge occurred during winter.

Pioneer canal: Maximum stage recorded, 5.8 feet June 19, 1917 (discharge, 818 second-feet); minimum discharge, canal dry except for small amount of leakage through head gates.

ICE.—Stage-discharge relation affected by ice; records discontinued during winter.

DIVERSIONS.—By decree of district court dated December 27, 1912, adjudicated diversions of approximately 10 second-feet from Laramie River between the State line and Pioneer dam, exclusive of the Pioneer canal, which has rights for 282 second-feet. Enlargement of Pioneer canal has storage rights of 68,500 acre-feet in Lake Hattie.

REGULATION.—None, as pond above dam is too small to have any appreciable effect on flow. Operation of canal head gates affects discharge over dam.

ACCURACY.—Laramie River station: Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory except as indicated in footnote to daily-discharge table. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspection of recorder graph. Records excellent except for periods when recorder was out of order, for which they are fair.

Pioneer canal station: Gage-height record fragmentary. Daily discharge approximate.

Discharge measurements of Laramie River near Woods, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
Apr. 30	P. V. Hodges.....	<i>Feet</i>	<i>Sec.-ft.</i>
Sept. 5	J. B. Spiegel.....	0.54	127
		.31	51

NOTE.—See paragraph on "Discharge measurements."

Daily discharge, in second-feet, of Laramie River near Woods, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	46	73	93	-----	48	153	1,920	434	125	90
2	46	87	63	-----	51	185	1,830	392	173	93
3	46	55	60	-----	63	226	1,780	372	153	81
4	44	51	60	-----	87	327	1,740	345	138	71
5	42	68	63	-----	99	419	1,700	412	118	53
6	35	68	68	-----	81	499	1,650	284	110	42
7	33	73	63	-----	73	600	1,650	247	102	40
8	31	76	58	-----	71	514	1,800	208	100	33
9	33	65	60	-----	65	448	2,010	185	104	35
10	40	71	58	-----	58	412	2,100	173	115	35
11	48	63	58	81	65	358	2,100	181	135	35
12	44	65	-----	81	78	378	2,100	185	125	26
13	40	73	-----	55	71	462	2,010	185	200	20
14	60	81	-----	68	73	530	1,920	203	185	17
15	63	84	-----	73	81	600	2,010	181	242	15
16	60	78	-----	73	58	720	2,370	181	145	15
17	63	76	-----	73	96	800	1,920	217	99	19
18	63	87	-----	76	96	1,000	1,650	280	81	19
19	63	84	-----	90	90	1,040	1,650	345	71	26
20	63	81	-----	96	111	880	1,120	231	73	28
21	65	102	-----	81	102	960	920	181	81	22
22	68	71	-----	81	87	1,000	800	190	81	20
23	70	76	-----	71	114	1,160	760	202	47	22
24	71	48	-----	68	177	1,380	720	242	103	22
25	71	60	-----	65	145	1,470	760	165	90	22
26	76	65	-----	48	131	1,250	720	153	78	31
27	51	65	-----	58	125	1,250	600	138	60	31
28	58	60	-----	65	111	1,650	600	128	55	31
29	68	76	-----	60	108	1,740	545	111	55	30
30	73	99	-----	44	125	1,780	492	105	93	30
31	71	-----	-----	44	-----	1,920	-----	108	76	-----

NOTE.—No gage-height record June 8, July 18, Aug. 6-14, Sept. 28-30; discharge based on comparison with flow of Laramie River near Jelm.

Monthly discharge of Laramie River near Woods, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	76	31	55.0	3,380
November	102	48	72.7	4,330
December 1-11	93	58	64.0	1,400
March 11-31	96	44	69.1	2,880
April	177	48	91.3	5,430
May	1,920	153	842	51,800
June	2,370	492	1,460	86,900
July	434	105	225	13,800
August	242	47	110	6,760
September	93	15	35.1	2,090

Discharge measurements of Pioneer canal near Woods, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 30	P. V. Hodges	0.68	12.4
June 10	J. B. Spiegel	1.85	93
Sept. 5	do	1.18	32

Daily discharge, in second-feet, of Pioneer canal near Woods, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Apr	May	June	July	Aug.	Sept.
1		9	12	77	109	53	36
2			12	77	109	53	34
3		12	13	77	108	52	33
4			13	92	108	52	32
5			13	90	107	51	32
6			14	88	105	51	30
7			14	88	105	50	28
8			14	90	105	50	26
9		12	15	92	105	49	24
10			15	96	105	49	22
11			15	92	105	48	20
12			40	97	105	48	18
13			40	200	105	47	16
14			40	200	105	47	14
15			41	220	105	46	14
16			42	230	105	43	14
17			44	222	105	40	14
18			46	220	105	40	16
19			47	180	105	40	18
20		10	47	150	60	40	20
21			47	120	60	39	20
22			47	116	60	39	19
23			48	114	60	39	19
24			48	112	58	39	18
25		6	48	112	56	39	18
26			49	112	56	39	17
27			49	111	56	38	16
28			90	111	55	38	16
29			85	110	55	37	15
30		12	80	110	54	37	14
31		6	77		54	37	

NOTE.—Gage read Oct. 3, 25, 31, Apr. 1, 9, 20, 30, May 11, 14, 19, 21, 27, June 2, 3, 9-12, 17, 24, July 3, 6, 12, 19, 22, 25, Aug. 15, 17, 24, 31, Sept. 3, 5, 16, 20. Discharge for periods when gage was not read based on study of gage-height graph of Laramie River near Woods, and observer's notes. Shifting-control method used during August and September.

Monthly discharge of Pioneer canal near Woods, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April			^a 10	595
May	90	12	38.9	2,390
June	230	77	127	7,560
July	109	54	86.9	5,340
August	53	37	44.2	2,720
September	36	14	21.1	1,260
The period				19,900

^a Estimated.

Combined monthly discharge of Laramie River and Pioneer canal near Woods, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	82	37	61.0	3,750
November.....	108	54	78.7	4,680
December 1-11.....	99	64	70.0	1,530
March 11-31.....	105	53	78.1	3,250
April.....	225	60	101	6,010
May.....	2,030	230	881	54,200
June.....	2,480	546	1,590	94,600
July.....	543	159	312	19,200
August.....	288	86	154	9,470
September.....	127	29	56.2	3,340

NOTE.—Canal gates closed in October. A leakage of 6 second-feet assumed for October, November, and December, and of 9 second-feet for March.

LARAMIE RIVER AT TWO RIVERS, WYO.

LOCATION.—In sec. 5, T. 17 N., R. 74 W., at highway bridge at Two Rivers, Albany County. Nearest tributary, Little Laramie River, enters a quarter of a mile below.

DRAINAGE AREA.—1,290 square miles (measured on base map of Wyoming, scale 1: 500,000).

RECORDS AVAILABLE.—May 6, 1911, to October 31, 1912; October 1, 1913, to September 30, 1921. Station maintained by State engineer during 1913 and 1914.

GAGE.—Friez water-stage recorder on left bank installed May 2, 1920, 45 feet downstream from bridge and site of Bristol gage used from 1915 to 1919. Datum unchanged since 1915. Gage used in 1912 was referred to datum 0.74 foot lower. Gage on left bank 400 feet above bridge used during 1913 and 1914.

DISCHARGE MEASUREMENTS.—Made from cable 350 feet above gage.

CHANNEL AND CONTROL.—Bed of stream composed of sand and gravel; shifting. No well-defined control. Banks are high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 6.15 feet on June 17 (discharge, 2,340 second-feet); minimum stage probably occurred during winter.

1911-1921: Maximum stage recorded, 6.4 feet June 22, 1917 (discharge, 2,600 second-feet); minimum discharge, zero, September 22 to 25, 1911.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—By decree of district court dated December 27, 1912, adjudicated diversions of 414 second-feet from Laramie River between this station and station near Woods.

REGULATION.—Operation of ditches above station affects low-water flow.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used; each well defined below 1,000 second-feet. Operation of water-stage recorder satisfactory except for days shown in footnote to daily-discharge table. Mean daily gage height obtained by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table except for days of missing record or when indirect method was used. Records good except for days with no gage-height record and during period of high water, for which they are fair.

Discharge measurements of Laramie River at Two Rivers, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 5	J. B. Spiegel.....	1.20	62	July 1	J. B. Spiegel.....	2.85	442
May 5	P. V. Hodges.....	1.53	131	Sept. 2	.....do.....	1.25	81
June 9	J. B. Spiegel.....	5.70	1,630				

Daily discharge, in second-feet, of Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Apr.	May	June	July	Aug.	Sept.
1	80	35	96	1,740	450	185	84
2	79	40	94	1,800	400	185	84
3	77	45	101	1,820	362	196	81
4	74	50	111	1,800	350	192	89
5	74	61	131	1,780	350	188	81
6	71	72	165	1,740	350	185	78
7	69	87	218	1,700	338	185	74
8	71	113	269	1,650	312	175	70
9	71	67	302	1,620	276	165	67
10	69	74	271	1,700	264	147	64
11	67	79	248	1,940	264	135	61
12	71	84	242	1,860	253	129	58
13	72	89	223	1,860	242	133	53
14	63	92	228	1,860	230	133	46
15	45	103	264	2,120	242	143	43
16	58	100	293	2,030	253	153	38
17	82	100	325	2,150	242	179	37
18	91	96	375	2,100	253	161	36
19	89	111	425	2,000	264	145	36
20	89	115	510	1,800	264	134	35
21	91	111	540	1,700	270	122	37
22	98	111	910	1,350	300	111	42
23	94	101	540	1,910	300	107	42
24	94	98	620	740	270	103	40
25	92	103	740	660	250	103	36
26	86	121	860	620	240	105	35
27	84	123	820	580	230	100	34
28	77	121	800	540	218	94	35
29	74	111	1,000	510	196	87	36
30	72	98	1,500	480	185	84	35
31	55	-----	1,650	-----	185	84	-----

NOTE.—No gage heights Apr. 1-4, 11-12, May 27-31, June 1-8, 17-20, July 21-26, Aug. 4-5, 20-21; discharge based on study of flow of Laramie River near Woods, Wyo. Discharge June 9-16 computed by shifting-control method.

Monthly discharge of Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	98	45	76.7	4,720
April.....	123	35	90.4	5,380
May.....	1,650	94	480	29,500
June.....	2,150	480	1,510	89,800
July.....	450	185	278	17,100
August.....	140	84	140	8,610
September.....	89	34	52.9	3,150

LARAMIE RIVER AT FORT LARAMIE, WYO.

LOCATION.—At highway bridge in sec. 28, T. 26 N., R. 64 W., at Fort Laramie, Goshen County. No tributary of importance between station and mouth, $1\frac{1}{2}$ miles below.

DRAINAGE AREA.—4,580 square miles (measured on base map of Wyoming; scale, 1: 500,000).

RECORDS AVAILABLE.—April 4, 1915, to September 30, 1921.

GAGE.—Vertical staff; read by W. J. Waitman.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—No data.

EXTREMES OF DISCHARGE.—Data not available.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—By decree of district court dated December 27, 1912, adjudicated diversions of 905 second-feet between station at Two Rivers and Fort Laramie.

REGULATION.—Flow regulated by Wheatland reservoir located 70 miles upstream in main channel of river having a capacity of 110,000 acre-feet. Stored water from reservoir diverted from river a few miles below reservoir.

COOPERATION.—Complete records furnished by United States Bureau of Reclamation.

Daily discharge, in second-feet, of Laramie River at Fort Laramie, Wyo., for the period Apr. 1 to Sept. 30, 1921

Day	Apr.	May	June	July	Aug.	Sept.	Day	Apr.	May	June	July	Aug.	Sept.
1.....	177	154	203	460	105	45	16.....	112	241	1,790	323	105	45
2.....	158	154	248	386	140	45	17.....	112	229	1,860	242	105	45
3.....	158	140	292	386	140	45	18.....	112	229	1,940	242	105	45
4.....	150	140	319	752	140	20	19.....	109	203	1,940	187	105	20
5.....	150	140	308	386	140	20	20.....	107	203	1,940	187	45	20
6.....	140	140	339	323	105	20	21.....	150	203	1,860	187	45	20
7.....	140	150	594	242	105	20	22.....	192	203	1,860	140	45	20
8.....	136	150	912	187	105	45	23.....	180	177	1,860	105	45	20
9.....	128	345	1,550	187	105	45	24.....	180	177	1,790	105	45	20
10.....	117	393	1,790	187	105	45	25.....	180	177	1,700	242	45	20
11.....	117	383	1,820	187	45	20	26.....	195	446	1,700	140	45	20
12.....	112	337	1,790	187	45	20	27.....	195	393	992	105	45	20
13.....	112	298	1,790	386	45	45	28.....	195	292	752	105	45	20
14.....	112	264	1,700	187	45	45	29.....	177	292	507	105	72	8
15.....	112	264	1,700	187	45	45	30.....	154	275	460	140	45	8
							31.....		203		140	45	

NOTE.—Quantities for June changed slightly to conform to computation rules used by the U. S. Geol. Survey.

Monthly discharge of Laramie River at Fort Laramie, Wyo., for the period Apr. 1 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
April.....	195	107	146	8,690
May.....	446	140	239	14,700
June.....	1,940	203	1,280	76,200
July.....	752	105	236	14,500
August.....	140	45	77.5	4,770
September.....	45	8	29.2	1,740
The period.....				121,000

LITTLE LARAMIE RIVER NEAR FILMORE, WYO.

LOCATION.—In sec. 9, T. 15 N., R. 77 W., at private bridge at May ranch, $1\frac{1}{2}$ miles south of Filmore, Albany County. No tributary of importance between station and junction of North, Middle, and South forks, 4 miles above.

DRAINAGE AREA.—155 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—July 5, 1902, to August 15, 1903; May 14, 1911, to October 31, 1912; April 1, 1915, to September 30, 1921. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Vertical staff on downstream side of left abutment; read by Claude May. Gage used since April 1, 1915, referred to datum 0.21 foot lower than gage at same location used during 1911 and 1912.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and small boulders; slightly shifting at long intervals. No well-defined control. During high water there is flow through channel around right end of bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.6 feet at 6 p. m. June 7 (discharge, 1,880 second-feet); minimum stage, 0.64 foot at 8 a. m. and 6 p. m. September 28 (discharge, 23 second-feet).

1902, 1903, 1911–1913, 1915–1921: Maximum stage recorded, 4.85 feet at 7 a. m. June 14, 1918 (discharge, 1,920 second-feet); minimum stage, 0.25 foot, September 19, 20, 1913 (discharge, 1 second-foot).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 43 second-feet from Little Laramie above station and 254 second-feet from tributaries entering above.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 1,800 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except for short intervals in November when stage-discharge relation was affected by ice; discharge interpolated. Records good.

The following discharge measurement was made by J. B. Spiegel:

June 10: Gage height, 4.05 feet; discharge, 1,440 second-feet.

Daily discharge, in second-feet, of Little Laramie River near Filmore, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	39	44		33	66	1, 170	306	122	42
2	37	46		33	62	1, 170	300	152	40
3	37	42		34	63	1, 100	296	122	38
4	34	40		37	72	1, 170	289	101	37
5	34	41		40	86	1, 240	266	104	37
6	34	42		37	105	1, 320	235	96	35
7	33	42		37	126	1, 640	232	99	35
8	33	41		34	122	1, 100	230	107	33
9	34	40		34	116	1, 400	220	113	31
10	36	40		35	97	1, 400	182	99	31
11	40	34		39	93	1, 240	172	93	31
12	40	33		40	96	1, 320	180	79	30
13	41	32		40	88	1, 240	212	89	28
14	46	34		37	93	1, 240	190	85	28
15	49	36	45	36	102	1, 400	208	93	27
16	42	42	45	33	136	1, 100	208	79	27
17	40	42	45	50	158	960	152	68	27
18	39	41	48	84	232	960	172	56	27
19	37	41	45	76	232	960	168	59	27
20	39	43	39	51	195	585	161	73	26
21	38	43	36	44	220	558	170	68	27
22	36	42	36	40	260	480	240	58	26
23	34	41	36	40	310	530	165	73	26
24	35	43	36	56	435	480	168	58	26
25	36	42	33	60	558	480	143	54	26
26	34	40	33	47	480	480	124	47	24
27	34	42	34	48	505	412	122	46	24
28	36	40	35	50	700	390	124	45	23
29	40	38	36	72	960	370	120	44	24
30	44	36	35	82	1, 030	330	101	46	24
31	44		33		1, 100		105	44	

NOTE.—Stage-discharge relation affected by ice Nov. 3-5, 9, 12-15, and 28-30; discharge interpolated.

Monthly discharge of Little Laramie River near Filmore, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	49	33	37.9	2, 330
November	46	32	40.1	2, 390
December	48	33	38.2	1, 290
January	84	33	46.0	2, 740
February	1, 100	62	287	17, 600
March	1, 640	330	941	56, 000
April	306	101	193	11, 900
May	152	44	79.7	4, 900
June	42	23	29.6	1, 760

LITTLE LARAMIE RIVER AT TWO RIVERS, WYO.

LOCATION.—On line between secs. 5 and 6, T. 17 N., R. 74 W., at highway bridge half a mile south of Two Rivers, Albany County. No tributary between station and mouth, half a mile below.

DRAINAGE AREA.—310 square miles (measured on base map of Wyoming; scale, 1: 500,000).

RECORDS AVAILABLE.—May 6, 1911, to October 31, 1912; October 1, 1913, to September 30, 1921. State engineer maintained station at this point during 1913.

GAGE.—Stevens water-stage recorder installed May 4, 1921, at site and datum of Bristol gage used previously. Gage used during 1913 and 1914 was 400 feet downstream and referred to different datum.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifting at long intervals. No well-defined control. Banks not subject to overflow, except during extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 6.2 feet at 4 p. m., June 15 (discharge, 1,550 second-feet); minimum discharge, 2 second-feet September 25, 26, 28-30.

1911-1921: Maximum discharge, 1,740 second-feet on June 4, 1914; minimum discharge, zero, as river frequently becomes dry in the fall, due to irrigation above.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during the winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions from Little Laramie River of 422 second-feet between station near Filmore and this station; none below station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water of May and June. Rating curve used to May 26 is well defined below 1,400 second-feet; that used after is well defined below 150 second-feet. Operation of water-stage recorder fairly satisfactory. Mean daily gage height obtained by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to table of daily discharge. Records fair.

Discharge measurements of Little Laramie River at Two Rivers, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Apr. 5	J. B. Spiegel.....	2.16	43.1	July 1	J. B. Spiegel.....	3.14	112
May 4	P. V. Hodges.....	1.92	16.6	Sept. 2	.....do.....	2.16	11
June 9	J. B. Spiegel.....	6.00	1,360				

Daily discharge, in second-feet, of Little Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	May	June	July	Aug.	Sept.
1	9		13	960	107	31	7
2	7		13	1,050	84	33	9
3	8		13	1,150	57	33	12
4	8		13	1,220	63	33	10
5	8		13	1,280	92	23	8
6	7	6	14	1,320	100	13	9
7	9		28	1,320	70	10	10
8	7		33	1,310	51	7	10
9	4	5	30	1,280	41	10	10
10	5		27	1,000	37	22	10
11	4		20	1,000	33	28	8
12	6		14	1,000	37	27	7
13	7		14	1,000	41	26	7
14	12		14	1,000	46	27	7
15	28		15	1,370	46	33	6
16	22	21	16	1,280	63	37	6
17	32		17	1,280	57	33	5
18	29		18	1,200	63	22	5
19	21		19	950	70	13	4
20	19		20	700	77	10	4
21	19		17	480	57	16	4
22	17		16	375	70	22	3
23	16		17	315	141	23	3
24	15		27	262	123	29	3
25	14		48	238	123	31	2
26	13		90	212	100	27	2
27	12		250	212	70	23	3
28	11		400	190	51	21	2
29	10		570	160	37	19	2
30	10		700	132	31	16	2
31	6		830		28	10	

¹ NOTE.—No gage heights Oct. 23-28, May 1-4, 13-18, 27-31, June 1-8, 18-20, Aug. 5, 21, Sept. 12-18; discharge for days of missing gage heights in May and June based on comparison of flow of Little Laramie near Filmore; for those in October, August, and September, interpolated. Discharge June 9-17 computed by shifting-control method.

Monthly discharge of Little Laramie River at Two Rivers, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	32	4	12.7	781
May	830	13	107	6,580
June	1,370	132	842	50,100
July	141	28	66.6	4,100
August	37	7	22.8	1,400
September	12	2	6.0	357

NORTH LARAMIE RIVER NEAR WHEATLAND, WYO.

LOCATION.—In sec. 2, T. 25 N., R. 70 W., a quarter of a mile above head gate of North Laramie Land Co.'s ditch and 18 miles northwest of Wheatland. Platte County. No tributary of importance within 10 miles of station.

DRAINAGE AREA.—366 square miles (measured on base map of Wyoming, scale 1:500,000).

RECORDS AVAILABLE.—November 6, 1914, to September 30, 1921.

GAGE.—Stevens water-stage recorder installed March 7, 1918, and referred to datum of previous gage; inspected by Sam Wilson.

DISCHARGE MEASUREMENTS.—Made from cable near gage or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Control 40 feet downstream at rapids which are permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year not known, as recorder did not operate during period of highest water. Minimum stage probably occurred during winter.

1915-1921: Maximum stage, 6.2 feet on April 7, 1920, from high-water mark (discharge from extension of rating curve, 3,020 second-feet); minimum discharge, no flow during greater part of July, August, and September 1919.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions of 37 second-feet from North Laramie River, above station, and 27 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 1,000 second-feet. Operation of water-stage recorder satisfactory for short periods. Mean daily gage height obtained by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records fair.

COOPERATION.—Gage-height record furnished by North Laramie Land Co.

Discharge measurements of North Laramie River near Wheatland, Wyo., during the year ending Sept. 30, 1921

[Made by P. V. Hodges]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
May 6.....	1.94	173
July 1.....	1.40	64

Daily discharge, in second-feet, of North Laramie River near Wheatland, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....				33	160	200	68	40	10-
2.....				34	160	190	63	40	
3.....				33	160	180	57	40	
4.....				30	160	275	55	41	
5.....				34	165	200	55	42	
6.....				49	180	200	56	38	
7.....				53	266	190	56	39	
8.....				47	376	500	57	34	
9.....		12		39	485	900	50	38	
10.....				30	485	500	50	34	
11.....				28	408	400	74	30	
12.....				26	352	300	74	27	
13.....				35	316	200	74	23	
14.....				40	296	200	74	23	
15.....				55	281	400	81	23	
16.....				43	260	600	78	22	10-
17.....				72	245	300	75	21	
18.....		12		100	233	200	66	20	
19.....				129	233	300	49	20	
20.....				158	206	200	46	36	
21.....		12		152	178	188	43	38	
22.....				129	180	170	41	38	
23.....				155	172	152	42	33	
24.....				160	188	135	42	28	
25.....				168	186	122	42	22	
26.....				165	184	108	42	16	
27.....				170	182	104	42	11	
28.....				170	180	95	41	9	
29.....				175	180	83	41	9	
30.....	7		29	180	190	77	41	9	
31.....			35		200		41	8	

NOTE.—No gage heights Apr. 17-18, 27-30, May 1-5, 20, 25-27, 29-31, June 1-3, 5-20, July 5-7, 13-14, 16, 25-30, Aug. 10-11, 24-26, 29-31; discharge based on weather records and observer's notes.

Monthly discharge of North Laramie River near Wheatland, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....			10	615
November.....			12	714
April.....	180	28	89.7	5,340
May.....	485	160	240	14,800
June.....	900	77	256	15,200
July.....	81	41	55.4	3,410
August.....	42	8	27.5	1,690
September.....			10	595

NOTE.—Mean monthly discharge for October and November estimated; for September, based on a study of flow of La Prele Creek near Douglas and observer's notes.

CHUGWATER CREEK AT CHUGWATER, WYO.

LOCATION.—In sec. 31, T. 21 N., R. 66 W., 300 feet above highway bridge, half a mile from railroad station at Chugwater, Platte County. No tributary within several miles.

DRAINAGE AREA.—359 square miles (measured on base map of Wyoming; scale, 1:500,000).

RECORDS AVAILABLE.—May 22, 1911, to November 6, 1912; January 1, 1915, to September 30, 1921, when station was discontinued. State engineer maintained station at this point during 1913 and 1914.

GAGE.—Chain on left bank 300 feet above bridge, installed April 6, 1916, at same datum and location as vertical staff used previously; read by C. D. Smith. Prior to February 6, 1912, gage was on bridge and referred to different datum.

DISCHARGE MEASUREMENTS.—Made from single-span bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand which is shifting. No well-defined control. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.2 feet at 4 p. m. July 31 (discharge, 169 second-feet); minimum stage, 1.10 feet from July 10 to 13 (discharge, 3.8 second-feet.)

1911–1921: Maximum stage recorded, 4.5 feet at 8 a. m., Sept. 4, 1915 (discharge, 350 second-feet); minimum discharge, zero, for several days during 1913.

ICE.—Stage-discharge relation slightly affected by ice.

DIVERSIONS.—Prior to July 1, 1921, adjudicated diversions from Chugwater Creek of 75 second-feet above station, and 98 second-feet below.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 50 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Chugwater Creek at Chugwater, Wyo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 18	J. B. Spiegel.....	1.40	15.5	July 16	P. V. Hodges.....	1.46	13.9
May 6	P. V. Hodges.....	1.37	11.2	18	do.....	1.46	12.7

Daily discharge, in second-feet, of Chugwater Creek at Chugwater, Wyo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	13	11	13	9.5	13	35	27	12	13	8.6	91	12
2.....	13	10	26	7.5	14	38	25	12	20	8.6	16	7.7
3.....	13	11	18	8.3	13	39	23	12	16	8.6	16	7.2
4.....	13	23	14	9.2	13	38	20	12	22	7.2	18	7.7
5.....	13	21	12	9.0	11	43	19	12	19	5.9	13	9.2
6.....	13	20	11	8.0	11	51	17	12	19	5.9	12	9.2
7.....	13	20	11	9.0	10	51	17	12	17	5.9	9.8	9.2
8.....	13	20	16	11	11	50	16	13	15	4.9	8.9	8.6
9.....	13	16	15	11	10	43	15	18	30	4.9	8.6	8.0
10.....	13	10	14	11	14	43	13	17	38	4.1	7.0	8.0
11.....	13	9	14	10	17	44	12	13	30	4.1	43	7.5
12.....	13	8	16	11	21	46	12	11	24	4.1	28	7.5
13.....	14	9	7.7	11	23	46	11	10	21	4.1	53	7.5
14.....	16	10	7.5	11	25	45	10	9.5	26	7.0	71	7.2
15.....	15	10	8.0	12	20	44	9.5	9.5	40	40	38	7.0
16.....	15	16	8.9	13	13	45	9.2	9.2	36	12	22	7.0
17.....	14	24	8.3	15	12	46	9.8	10	17	10	19	7.0
18.....	14	21	9.5	15	13	46	10	10	17	8.6	18	7.0
19.....	15	19	8.5	18	13	46	10	9.2	16	8.0	14	7.0
20.....	15	16	8.0	16	13	47	11	9.8	19	7.7	12	7.0
21.....	16	15	8.0	14	12	50	10	9.8	15	7.5	10	6.4
22.....	16	16	8.6	12	15	44	11	10	14	7.0	9.2	6.4
23.....	16	19	8.3	12	20	40	11	10	13	7.0	8.3	6.4
24.....	16	20	8.3	10	25	39	11	11	13	7.0	8.3	6.4
25.....	16	20	8.5	11	30	35	12	15	13	7.0	9.8	6.4
26.....	16	16	10	11	32	36	12	15	23	7.0	7.7	6.4
27.....	16	19	10	12	32	33	13	16	13	6.4	7.7	6.4
28.....	16	15	12	13	34	31	13	16	11	15	7.2	6.4
29.....	16	13	13	12	-----	29	13	16	10	7.7	8.0	6.4
30.....	15	9	14	11	-----	29	12	16	9	7.0	20	6.4
31.....	13	-----	19	12	-----	29	-----	15	-----	67	25	-----

Monthly discharge of Chugwater Creek at Chugwater, Wyo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	16	13	14.4	885
November.....	24	8	15.5	922
December.....	26	7.5	11.8	726
January.....	18	7.5	11.5	707
February.....	34	10	17.5	972
March.....	51	29	41.3	2,540
April.....	27	9.2	13.8	821
May.....	18	9.2	12.4	762
June.....	40	9	19.7	1,170
July.....	70	4.1	12.2	750
August.....	91	7.0	20.6	1,270
September.....	12	6.4	7.42	442
The year.....	91	4.1	16.5	12,000

NOTE.—No gage heights Oct. 1, 2; discharge estimated. July 14–15, discharge based on high-water mark and rainfall data. Stage-discharge relation affected by ice Nov. 11–13, Dec. 19–21, 24–25, Jan. 5–7; discharge estimated. Discharge Dec. 1 to Aug. 31 computed by shifting-control method.

SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

LOCATION.—In sec. 25, T. 7 S., R. 70 W., 375 feet below point where North Fork of South Platte enters at South Platte, Jefferson County.

DRAINAGE AREA.—2,610 square miles (measured on map in Hayden's atlas).

RECORDS AVAILABLE.—March 28, 1902, to September 30, 1921. Records at Platte Canyon and at Deansbury, a few miles below, extend back to 1887, with the exception of 1893 and 1894. Earlier records, 1887–1892, were taken by State engineer, and records from 1895 to 1896 were taken under direction of Denver Power & Irrigation Co.

GAGE.—Stevens water-stage recorder on right bank installed April 4, 1919, to replace Bristol water-stage recorder used since March 14, 1910; inspected by Mrs. Mata Wallbrecht. From March 28, 1902, to May 7, 1905, gage was at highway bridge, 150 feet upstream; moved to present site at latter date and datum raised 0.80 foot higher.

DISCHARGE MEASUREMENTS.—Made from cable near gage or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse sand and fine gravel; shifts. Control 35 feet downstream at well-defined rapids; shifts considerably at times. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 8.95 feet from 5 to 9 p. m. June 7 (discharge, 6,320 second-feet); minimum discharge occurred during winter.

1888–1892; 1895–1900; 1902–1921: Maximum stage recorded during 1921; minimum discharge occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice, observations discontinued during winter.

DIVERSIONS.—No water is diverted between this station and that on the North Fork at South Platte. Above the station there are court decrees for 85,600 and 79,000 acre-feet for Antero and Cheesman reservoirs, respectively, all of which passes the gage before being diverted. Also decrees for diversions of 1,075 second-feet from South Platte River, together with 3,326 second-feet, and 46,000 acre-feet for a reservoir from tributaries above the station.

REGULATION.—Flow regulated to certain extent by Antero and Cheesman reservoirs on the South Platte about 60 and 20 miles above the forks, respectively.

ACCURACY.—Stage-discharge relation not permanent. Rating curves used not well defined. Operation of water-stage recorder satisfactory. Mean daily gage height obtained by inspection of recorder graph. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of South Platte River at South Platte, Colo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 15	P. V. Hodges.....	1.35	116	June 19	Robert Follansbee.....	6.34	2,640
30	.....do.....	1.49	126	July 7	J. B. Spiegel.....	4.43	1,570
31	.....do.....	1.36	111	16	.....do.....	4.91	2,220
May 19	.....do.....	4.40	1,240	28	.....do.....	5.10	1,990
27	.....do.....	4.02	1,120	Aug. 19	.....do.....	3.68	1,100
June 18	Robert Follansbee.....	6.78	3,100	Sept. 13	.....do.....	3.01	632

Daily discharge, in second-feet, of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	222	210	111	185	114	778	1,250	1,320	1,900	1,540
2	262	160	156	170	117	862	1,250	1,250	1,880	1,540
3	272	149	151	145	120	952	1,410	1,170	1,810	1,540
4	269	153	134	160	125	1,010	2,340	1,190	1,620	1,480
5	269	136	128	160	209	1,030	3,040	1,410	1,460	1,360
6	266	138	130	145	215	1,060	4,650	1,610	1,300	1,300
7	262	132	107	120	202	1,020	6,140	1,500	1,150	1,180
8	246	126		100	179	898	5,700	1,300	1,120	1,060
9	246	122		52	171	868	5,240	1,210	1,090	1,030
10	243	100		60	159	832	4,800	1,180	1,180	820
11	240	105		100	163	796	4,630	1,210	1,120	760
12	578	93		110	179	1,010	4,440	1,240	1,120	625
13	800	95		110	179	1,180	4,250	1,330	1,270	625
14	429	130		110	228	1,230	4,180	1,480	1,330	610
15	279	122		116	300	1,290	4,290	1,840	1,420	595
16	246	104		116	80	1,280	4,030	2,150	1,330	585
17	250	114		116	190	1,280	3,750	2,060	1,270	515
18	240	120		120	366	1,330	3,140	2,120	1,200	496
19	234	114		118	444	1,260	2,690	2,300	1,130	496
20	225	104		128	625	1,150	2,470	2,370	1,030	436
21	228	86		120	675	1,160	2,260	2,410	1,030	392
22	228	67		111	724	1,140	2,070	2,160	1,000	380
23	207	80		222	988	1,130	1,880	2,200	1,180	373
24	202	65		334	1,170	1,270	1,890	2,230	1,480	380
25	210	65		631	952	1,220	1,840	2,350	1,390	376
26	222	84		314	826	1,170	1,860	2,230	1,510	376
27	222	93		241	736	1,160	1,670	2,200	1,570	388
28	216	74		108	675	1,250	1,490	1,930	1,510	392
29	222	50		118	645	1,220	1,450	1,810	1,510	376
30	219	58		118	695	1,190	1,400	1,670	1,510	373
31	231			111		1,250		1,600	1,570	

NOTE.—No gage-height record Mar. 1-14, Apr. 15-17, July 25, Aug. 4-5, 17-18; discharge based on comparison of discharge at Platte Canyon as obtained by Denver municipal waterworks. Discharge Mar. 15 to Sept. 30 computed by shifting-control method.

Monthly discharge of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	800	202	274	16,800
November	210	50	108	6,430
December			112	6,890
January			119	7,320
February			119	6,610
March	334	52	147	9,040
April	1,170	80	415	24,700
May	1,330	778	1,110	68,200
June	6,140	1,250	3,050	181,000
July	2,410	1,170	1,740	107,000
August	1,900	1,000	1,350	83,000
September	1,540	373	747	44,400
The year	6,140		776	561,000

NOTE.—Monthly discharge for December, January, and February computed from records obtained by Denver municipal waterworks at Platte Canyon, by reducing them 1.4 per cent for difference in drainage area.

NORTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

LOCATION.—In sec. 25, T. 7 S., R. 70 W., one-third of a mile above railroad station at South Platte, Jefferson County. No tributary between station and mouth at South Platte.

DRAINAGE AREA.—449 square miles (measured on Hayden's atlas).

RECORDS AVAILABLE.—June 4, 1909, to September 30, 1910; April 1, 1913, to September 30, 1921.

GAGE.—Inclined staff on left bank; read by Mrs. Mata Wallbrecht.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and sand. Principal control a short distance below gage; shifting at intervals. Banks not subject to much overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.9 feet at 4 a. m. June 8 (discharge, 1,910 second-feet); minimum discharge occurred during winter.

1909-1910; 1913-1921: Maximum stage recorded during 1921; minimum discharge occurred during winter.

ICE.—Stage-discharge relation affected by ice, observations discontinued during winter.

DIVERSIONS.—Court decrees for diversion of 36 second-feet from North Fork and 63 second-feet from tributaries above station. Small quantities of water are also diverted at various times for a number of small ice and fish ponds.

REGULATION.—Diurnal fluctuation during spring caused by alternate melting and freezing of mountain snow.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records good except from July 1 to September 30, which are fair.

Discharge measurements of North Fork of South Platte River at South Platte, Colo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Jan. 6	P. V. Hodges.....	2.3	52	June 19	Robert Follansbee....	4.22	1,010
Mar. 15	do.....	1.80	69	July 7	J. B. Spiegel.....	3.38	516
Apr. 30	do.....	1.84	70	16	do.....	3.40	572
Apr. 20	do.....	2.70	286	28	do.....	3.42	580
May 19	do.....	3.55	657	Aug. 19	do.....	2.88	256
27	do.....	3.46	579	Sept. 13	do.....	2.80	239

* Stage-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, 1921

Day	Oct.	Nov.	Dec.	Mar	Apr.	May	June	July	Aug.	Sept.
1.....	134	102	102	-----	66	530	820	598	598	340
2.....	127	92	112	-----	71	575	820	575	598	340
3.....	123	102	134	-----	71	620	770	552	575	340
4.....	123	102	112	-----	77	670	1,140	552	508	302
5.....	119	102	-----	-----	77	720	1,360	620	440	285
6.....	112	112	-----	-----	69	870	1,520	552	440	268
7.....	112	92	-----	-----	62	820	1,690	508	440	268
8.....	112	82	-----	-----	55	720	1,860	440	400	250
9.....	112	79	-----	-----	74	670	1,800	440	380	235
10.....	112	66	-----	-----	69	670	1,740	400	380	220
11.....	112	74	-----	-----	80	670	1,690	420	380	220
12.....	112	63	-----	-----	92	670	1,640	420	360	220
13.....	123	63	-----	66	80	670	1,520	462	360	235
14.....	134	119	-----	52	77	670	1,470	530	400	235
15.....	134	112	-----	62	80	670	1,420	620	485	235
16.....	141	82	-----	59	100	670	1,300	598	360	235
17.....	127	134	-----	71	206	670	1,140	530	268	235
18.....	123	119	-----	62	145	670	1,080	770	235	220
19.....	123	119	-----	62	193	620	975	670	250	220
20.....	119	112	-----	66	285	575	870	598	302	206
21.....	123	66	-----	62	320	575	870	575	285	206
22.....	112	63	-----	62	340	575	770	552	250	206
23.....	123	74	-----	220	530	575	770	670	360	180
24.....	106	102	-----	250	670	670	770	670	620	180
25.....	112	106	-----	268	530	670	770	670	440	180
26.....	123	112	-----	250	485	670	770	620	440	180
27.....	123	134	-----	166	530	770	720	598	440	168
28.....	127	79	-----	76	440	820	670	575	380	156
29.....	127	98	-----	71	440	770	670	552	380	156
30.....	119	82	-----	71	440	870	620	530	360	156
31.....	112	-----	-----	63	-----	870	-----	575	380	-----

NOTE.—No gage heights Apr. 15-16; discharge estimated. Discharge July 1-13, Aug. 1 to Sept. 30 computed by shifting-control method.

Monthly discharge of North Fork of South Platte River at South Platte, Colo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	141	106	121	7,440
November.....	134	63	94.8	5,640
March 13-31.....	268	52	108	4,070
April.....	670	55	225	13,400
May.....	870	530	686	42,200
June.....	1,860	620	1,130	67,200
July.....	770	400	563	34,600
August.....	620	235	403	24,800
September.....	340	156	229	13,600

CLEAR CREEK NEAR GOLDEN, COLO.

LOCATION.—In sec. 32, T. 3 S., R. 70 W., in canyon $1\frac{1}{2}$ miles above Golden, Jefferson County. Only important tributary between station and mouth, Ralston Creek, enters 12 miles below.

DRAINAGE AREA.—380 square miles.

RECORDS AVAILABLE.—May 4, 1919, to September 30, 1921; December 4, 1908, to December 31, 1909; June 8 to September 24, 1911; January 29, 1912, to May 3, 1919, records available for station half a mile upstream where flow is practically the same.

GAGE.—Lallie water-stage recorder on left bank 200 feet upstream from Colorado & Southern Railway section house; inspected by employee of Farmers' Reservoir & Irrigation Co.

DISCHARGE MEASUREMENTS.—Made from cable near gage or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and sand; shifting. Control 100 feet downstream at small rapids, composed of small boulders and coarse gravel; shifts during extremely high water. Banks not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage obtained by high-water mark, 5.1 feet at 10 p. m. July 31 (discharge, 4,420 second-feet); minimum discharge occurred during winter.

1908; 1911–1921: Maximum stage, that of 1921; minimum discharge measured, 18 second-feet on January 11, 1918.

ICE.—Stage-discharge relation seriously affected by ice; records discontinued during winter except for occasional discharge measurements.

DIVERSIONS.—Court decree for diversion of 53 second-feet from the headwaters of Fraser River to the West Fork of Clear Creek. During year, 100 acre-feet diverted. Above station there is a court decree for a diversion of 26 second-feet by Golden ditch located three-fourths mile upstream. The diversion by this ditch past gaging station was about 4,880 acre-feet.

REGULATION.—Alternate melting and freezing of mountain snow causes diurnal fluctuation during spring.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined below 1,800 second-feet. Operation of water-stage recorder fairly satisfactory. Mean daily gage heights obtained by inspection of recorder graph. Daily discharge ascertained by applying to rating table mean daily gage height, except as explained in footnote to table of daily discharge. Records fair.

COOPERATION.—Gage heights furnished by Farmers' Reservoir & Irrigation Co.

Discharge measurements of Clear Creek near Golden, Colo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Dec. 30	Hodges and Spiegel	1.55	78	July 5	Spiegel and Hodges	2.72	828
Jan. 11	P. V. Hodges	1.70	63	Aug. 13	J. B. Spiegel	2.50	677
Mar. 1	Hodges and Peck	.83	59	Aug. 30	P. V. Hodges	1.76	495
May 16	P. V. Hodges	2.28	689				297
June 4	Spiegel and Hodges	3.05	1,630				

* Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Clear Creek near Golden, Colo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	151	88	61	67	354	1,370	1,060	578	314
2	140	88	59	67	439	1,300	935	498	299
3	140		58	67	535	1,240	935	498	283
4	138		57	70	668	1,690	820	411	274
5	133		55	72	620	1,830	715	360	265
6	135		54	70	670	2,110	1,180	330	244
7	133		53	62	690	2,250	620	304	236
8	130		50	59	600	2,320	620	299	214
9	128		55	67	550	2,950	668	283	207
10	128		62	66	520	2,950	668	294	204
11	118	72	70	69	500	2,950	668	299	200
12	121		64	76	498	2,950	620	253	194
13	118		66	74	366	3,020	668	283	187
14	128		62	88	425	2,670	768	309	178
15	126		69	94	498	2,570	768	314	174
16	135		72	118	668	2,530	820	294	178
17	133		69	168	820	2,450	878	249	174
18	130		70	151	820	2,350	878	232	171
19	126		69	171	820	2,170	878	236	168
20	123		74	218	715	1,850	935	244	160
21	130		69	214	715	1,600	840	257	140
22	123		70	253	1,060	1,430	820	261	130
23	109		72	384	1,060	1,390	820	330	128
24	116		64	446	995	1,400	768	320	126
25	133		72	330	995	1,430	715	314	133
26	135		78	274	935	1,430	715	299	135
27	138		66	244	878	1,400	620	299	130
28	92		62	222	1,060	1,340	578	302	126
29	90		70	222	1,060	1,300	498	304	121
30	90		76	274	1,180	1,060	460	320	126
31	90		62		1,370		768	309	

NOTE.—No gage heights Mar. 2-9, May 6-11, June 10, 15-21, 23-25, 27-28, July 21, Aug. 27-28; discharge based on a comparison of flow of North Fork of South Platte at South Platte and Thompson River near Drake, Colo., except Mar. 2-9, for which it is based on temperature records. Discharge June 11 to Sept. 5 computed by shifting-control method.

Monthly discharge of Clear Creek near Golden, Colo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	151	90	125	7,690
November			* 80	4,760
December			* 70	4,300
January			* 65	4,000
February			* 55	3,050
March	78	50	64.8	3,980
April	446	59	159	9,460
May	1,370	354	745	45,800
June	3,020	1,060	1,980	118,000
July	1,180	460	765	47,000
August	578	232	319	19,600
September	314	121	187	11,100
The year	3,020		384	279,000

* Estimated by means of three discharge measurements and weather records.

NORTH BOULDER CREEK AT SILVER LAKE, COLO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 28, T. 1 N., R. 73 W., at outlet of Silver Lake, in Colorado National Forest, Boulder County.

DRAINAGE AREA.—8.7 square miles (measured by special survey).

RECORDS AVAILABLE.—August 20, 1913, to September 30, 1921.

GAGE.—Friez water-stage recorder which records head on weir.

DISCHARGE MEASUREMENTS.—Made by means of standard sharp-crested weir 10 feet long having low-water section 5 feet long.

EXTREMES OF DISCHARGE.—No data.

ICE.—Weir kept open during winter.

DIVERSIONS.—None above station.

REGULATION.—Winter flow increased by storage in Silver Lake (capacity, 2,080 acre-feet).

COOPERATION.—Records furnished by city engineer at Boulder.

Daily discharge, in second-feet, of North Boulder Creek at Silver Lake, Colo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	84	69	28	16	18	17	20	20	75	106	-----	52
2-----	56	70	25	20	18	17	20	20	88	106	-----	52
3-----	52	70	22	18	15	16	14	20	87	128	-----	54
4-----	54	70	22	22	15	17	13	26	86	128	-----	51
5-----	41	67	22	20	17	17	13	28	87	113	-----	51
6-----	42	67	22	16	17	20	13	33	133	114	55	44
7-----	40	67	22	16	17	20	14	36	142	108	55	38
8-----	39	67	25	19	18	20	14	36	142	104	55	34
9-----	39	69	24	17	17	22	13	36	164	100	53	29
10-----	45	69	23	16	18	17	12	36	185	104	54	28
11-----	45	65	22	16	16	17	13	36	191	104	55	22
12-----	45	65	22	16	17	18	14	39	198	105	55	22
13-----	45	64	25	17	17	20	17	40	186	105	55	21
14-----	55	59	22	19	17	20	17	42	170	105	55	21
15-----	59	59	27	19	17	22	29	41	183	105	63	20
16-----	58	59	24	26	18	22	30	48	178	106	55	20
17-----	65	55	24	34	17	20	28	48	177	-----	56	20
18-----	67	54	24	34	17	20	26	31	142	-----	56	22
19-----	67	54	25	34	17	20	24	31	142	-----	55	22
20-----	67	54	25	31	17	17	23	31	142	-----	55	22
21-----	69	58	25	28	17	17	22	31	142	-----	55	23
22-----	71	58	25	26	19	17	22	32	142	-----	54	23
23-----	71	54	25	22	17	20	21	34	142	-----	51	23
24-----	71	54	25	22	17	20	20	38	142	-----	53	23
25-----	71	54	21	22	18	19	22	44	142	-----	55	22
26-----	71	54	18	18	17	21	22	45	98	-----	58	22
27-----	71	61	18	17	16	21	22	45	101	-----	59	21
28-----	70	54	16	16	16	21	22	52	63	-----	57	21
29-----	70	54	16	18	-----	17	22	58	94	-----	56	21
30-----	70	44	14	18	-----	18	22	58	100	-----	54	21
31-----	68	-----	16	18	-----	18	-----	63	-----	-----	53	-----

Monthly discharge of North Boulder Creek at Silver Lake, Colo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October-----	84	39	59.3	3,650
November-----	70	44	60.6	3,610
December-----	28	14	22.4	1,380
January-----	34	16	21.0	1,290
February-----	19	15	17.0	944
March-----	22	16	19.0	1,170
April-----	30	12	19.5	1,160
May-----	63	20	38.0	2,340
June-----	198	63	135	8,030
July 1-16-----	128	100	109	3,460
August 6-31-----	63	51	55.3	2,850
September-----	54	20	28.8	1,710

THOMPSON RIVER¹ NEAR DRAKE, COLO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 2, T. 5 N., R. 71 W., at Halfway, 1 mile east of Drake, Larimer County. Nearest tributary, North Fork, enters at Drake.

DRAINAGE AREA.—274 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 18, 1917, to September 30, 1921.

GAGE.—Vertical staff attached to rock cliff at right bank a hundred yards above hotel, used since June 16, 1921; read by employee of city of Loveland. Original gage, Bristol pressure gage at old highway bridge half a mile downstream; inspected by employee of city of Loveland. No relation between datum of gages.

DISCHARGE MEASUREMENTS.—Made from two-span bridge near gage or by wading.

CHANNEL AND CONTROL.—Bed composed of small boulders and coarse gravel; shifting during high water. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage from high-water mark, 6.7 feet on June 7 (discharge, 3,000 second-feet); minimum discharge occurred during winter.

1918-1921: Maximum stage from high-water mark, 9.5 feet on original gage July 31, 1919 (discharge not computed); minimum discharge occurred during winter.

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—Court decrees for diversions of 73 second-feet from river and tributaries above station and 2,277 second-feet below, also decrees for storage of 81,000 acre-feet below station.

REGULATION.—Alternate melting and freezing of mountain snow during spring causes diurnal fluctuation of discharge. No artificial regulation.

ACCURACY.—Stage-discharge relation not permanent. Rating curve used October 1 to May 4 well defined. Curve used May 5 to June 11 not well defined. Curve used June 16 to September 30 well defined below 2,000 second-feet. Operation of water-stage recorder fairly satisfactory. Staff gage read to tenths once daily after June 16. Mean daily gage height obtained by inspection of recorder graph. Daily discharge before June 16 obtained by applying to rating table mean daily gage height or by applying daily gage reading thereafter, except as explained in footnote to table of daily discharge. Records fair.

COOPERATION.—Field data furnished by city of Loveland. Check measurements made by United States Geological Survey.

Discharge measurements of Thompson River near Drake, Colo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height		Dis-charge	Date	Made by—	Gage height		Dis-charge
		Chain gage	Staff gage				Chain gage	Staff gage	
		Inches	Feet	Sec.-ft.			Inches	Feet	Sec.-ft.
Oct. 26	L. C. Osborn	18.0		48.9	June 5	L. C. Osborn	55	4.90	1,570
Nov. 23	do			36.2	11	do	66	4.80	1,990
Dec. 14	do			24.8	20	do	54.8	4.30	1,290
Jan. 5	do			35.5	24	do	46	3.80	834
13	Hodges and Osborn			23.4	July 8	do	36	3.30	442
31	L. C. Osborn			26.6	15	do	43.5	3.60	584
Feb. 8	do			23.7	26	do		3.25	445
25	do			21.0	Aug. 17	P. V. Hodges		2.78	271
Mar. 17	do	16.2		33.8	22	L. C. Osborn		2.70	238
Apr. 30	do	28.5	2.74	207	Sept. 19	do		2.30	159
May 12	do	33.5	3.20	285	23	do		2.10	122

¹ Published in previous reports as Big Thompson Creek.

Daily discharge, in second-feet, of Thompson River near Drake, Colo., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	110	44		31	245	1,000	730	305	275
2	103	44		29	270	962	810	380	245
3	96	48		31	332	950	730	380	232
4	96	48		36	375	1,400	580	340	140
5	96	48		41	435	1,570	580	305	131
6	93	44		44	483	2,500	520	305	122
7	90	44		35	523	3,000	520	275	122
8	88	44		26	400	2,050	495	275	105
9	86			34	386	2,000	470	245	140
10	84			31	341	2,000	470	275	140
11	82			36	317	1,990	470	275	140
12	82			38	311	1,940	580	275	131
13	80			43	317	1,880	730	245	122
14	78			49	326	1,890	580	275	122
15	80			43	362	1,920	580	305	105
16	80			22	365	1,810	650	275	140
17	80		33	68	379	1,810	650	257	140
18	80		33	104	335	1,680	650	245	140
19	78		31	131	479	1,320	730	245	150
20	76		32	198	414	1,100	650	245	140
21	76		29	196	404	810	615	245	130
22	76		30	242	421	810	650	245	125
23	76		31	391	447	810	730	245	122
24	76		29	411	573	855	650	245	122
25	76		31	305	604	900	580	305	120
26	58		32	252	555	900	460	275	120
27	48		25	210	560	1,000	470	245	110
28	47		25	190	675	900	470	245	100
29	46		32	180	784	900	420	245	90
30	44		31	200	794	810	380	245	80
31	44		28		1,040		305	245	

NOTE.—No gage heights Oct. 6-10, June 3-4, 6-10, 12-15, Sept. 20-22, 24-30. Discharge for days of missing gage heights estimated; for June, based on comparison of flow of St. Vrain near Lyons and high-water mark; for September, based on comparison with flow of Clear Creek near Golden. Discharge May 1 to June 11 computed by shifting-control method.

Monthly discharge of Thompson River near Drake, Colo., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	110	44	77.6	4,770
November			• 38	2,260
December			• 25	1,540
January			• 25	1,540
February			• 22	1,220
March			• 26	1,600
April	411	22	122	7,260
May	1,040	245	460	28,300
June	3,000	810	1,450	86,300
July	810	305	578	35,500
August	380	245	275	16,900
September	275	80	137	8,150
The year	3,000		270	195,000

• Estimated by means of six discharge measurements and weather records.

NISHNABOTNA RIVER BASIN

WEST NISHNABOTNA RIVER AT WHITE CLOUD, IOWA

LOCATION.—In sec. 2, T. 71 N., R. 41 W., at highway bridge 3 miles above mouth of Silver Creek and near crossing of Chicago, Burlington & Quincy Railroad and Wabash Railway at White Cloud, Mills County, 4 miles southeast of Malvern.

DRAINAGE AREA.—920 square miles (revised measurement on map compiled by United States Geological Survey; scale, 1:500,000).

RECORDS AVAILABLE.—May 23, 1918, to September 30, 1921.

GAGE.—Chain attached to downstream handrail of high bridge; read by Charles N. Hammack.

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

CHANNEL AND CONTROL.—No well-defined control. Bed of stream composed of sand and gravel. Banks subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.6 feet at noon, September 20 (discharge estimated, 11,400 second-feet). Minimum stage, 3.11 feet at 5 p. m. July 31 and 7 a. m. August 1 (discharge, 87 second-feet).

1918–1921: Maximum stage recorded, 18.0 feet April 19, 1920 (discharge estimated, 12,000 second-feet); minimum stage, 2.96 feet September 15–18, 1918 (discharge estimated, 9 second-feet).

ICE.—Stage-discharge relation slightly affected by ice during extremely cold weather.

REGULATION.—Grist mill 200 feet above gage, when in operation, may affect stage.

ACCURACY.—Stage-discharge relation changed during high water in June. Rating curves used are well defined between 150 and 3,000 second-feet and extended beyond these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as indicated in footnote to daily-discharge table. Records good.

Discharge measurements of West Nishnabotna River at White Cloud, Iowa, during the year ending Sept. 30, 1921

[Made by E. D. Burchard]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 19.....	4.20	227
July 20.....	4.53	255
21.....	4.15	196

Daily discharge, in second-feet, of West Nishnabotna River at White Cloud, Iowa, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	185	450	225	185	185	211	285	225	269	156	265	90
2	185	1,620	198	185	204	211	371	218	5,160	162	505	198
3	179	2,500	198	198	204	218	318	218	860	190	395	140
4	179	1,270	198	192	211	225	353	218	265	455	310	156
5	173	640	198	204	204	239	301	211	190	340	205	150
6	173	660	211	204	192	254	211	198	162	220	168	135
7	173	811	225	200	192	254	564	218	140	205	175	106
8	173	877	225	200	198	225	269	211	130	198	150	93
9	167	877	218	200	198	225	225	211	120	162	135	310
10	161	589	204	204	225	204	211	254	435	125	135	1,060
11	161	285	198	208	250	218	204	371	1,060	115	140	710
12	173	225	204	211	350	225	198	750	435	93	125	555
13	185	211	353	204	400	239	254	429	205	93	120	355
14	173	211	516	190	500	225	390	353	156	375	125	220
15	409	211	285	180	2,000	225	269	301	205	415	101	205
16	450	198	198	170	1,800	218	225	254	220	235	120	980
17	390	170	218	160	1,500	254	225	192	235	150	140	980
18	335	198	207	167	750	225	239	198	205	162	110	415
19	318	225	196	185	285	225	254	640	205	182	101	3,220
20	318	225	185	167	198	218	254	564	150	220	480	10,000
21	301	218	175	173	198	225	254	371	168	220	340	980
22	301	239	170	179	204	225	429	335	168	182	145	435
23	285	239	175	211	211	225	285	335	156	162	110	235
24	225	225	185	211	211	239	269	301	168	150	135	235
25	198	211	192	185	211	225	239	429	162	168	145	455
26	192	198	192	173	204	239	225	2,320	150	175	120	205
27	198	198	185	179	211	301	218	2,800	168	182	135	162
28	192	211	180	192	225	409	211	614	156	145	97	150
29	192	225	170	192	-----	429	211	429	156	135	93	110
30	198	239	175	185	-----	353	211	371	162	115	97	120
31	198	-----	185	173	-----	285	-----	335	-----	106	90	-----

NOTE.—Stage-discharge relation affected by ice Dec. 18-19, 21-23, 28-30; Jan. 6-11, 14-17, Feb. 11-18; discharge based on gage heights, observer's notes, and weather records.

Monthly discharge of West Nishnabotna River at White Cloud, Iowa, for the year ending Sept. 30, 1921

[Drainage area, 920 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	450	161	230	0.251	0.29
November	2,560	179	491	.534	.60
December	516	170	214	.233	.27
January	211	160	189	.206	.24
February	2,000	185	419	.456	.47
March	429	204	248	.269	.31
April	564	198	272	.296	.33
May	2,800	192	480	.522	.60
June	5,160	120	414	.450	.50
July	455	93	193	.210	.24
August	505	90	178	.193	.22
September	10,000	90	772	.840	.94
The year	10,000	90	340	.370	5.01

EAST NISHNABOTNA RIVER AT RED OAK, IOWA

LOCATION.—In sec. 20, T. 72 N., R. 38 W., at highway bridge on Coolbaugh Street in Red Oak, Montgomery County, 35 miles above junction with West Nishnabotna River.

DRAINAGE AREA.—890 square miles (revised measurement on map compiled by United States Geological Survey; scale, 1:500,000).

RECORDS AVAILABLE.—May 22, 1918, to September 30, 1921.

GAGE.—Chain attached to downstream handrail of bridge; read by C. D. Forsbeck.

DISCHARGE MEASUREMENTS.—Made from upstream side of Burlington Railroad bridge half a mile below gage and by wading.

CHANNEL AND CONTROL.—Sand and mud bottom, fairly permanent gravel control. Banks are overflowed at high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.24 feet at 7.15 a. m. September 22 (discharge, 2,720 second-feet); minimum stage 2 feet at 7.30 a. m. September 1 (discharge, 31 second-feet).

1918-1921: Maximum stage recorded, 13.60 feet, May 29, 1918 (discharge, 3,740 second-feet); minimum stage, 1.53 feet, September 28, 1918 (discharge, estimated, 13 second-feet).

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 30 and 4,100 second-feet. Gage read once daily to hundredths and twice during days of rapidly changing stage. Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of East Nishnabotna River at Red Oak, Iowa, during the year ending Sept. 30, 1921

[Made by E. D. Burchard]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 18.....	^a 2.89	95
May 12.....	3.30	199
July 21.....	3.28	201

^a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of East Nishnabotna River at Red Oak, Iowa, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	128	100	145		108	100	388	108	42	31
2	124	260	130		115	100	1,330	90	54	47
3	108	331	161		97	100	2,440	145	2,140	42
4	92	243	145		89	100	2,560	145	1,360	52
5	79	185	115		89	92	685	130	469	65
6	67	130	130		100	92	553	130	277	54
7	64	145	115		94	89	388	130	209	45
8	65	260	108	185	89	92	313	130	153	42
9	72	177	115	161	89	100	260	75	122	41
10	61	153	108	130	89	145	260	58	115	428
11	62	161	115	130	89	461	243	52	94	350
12	62	130	115	138	89	193	260	62	94	295
13	60	115	122	138	89	209	260	60	94	260
14	78	100	115	138	100	138	193	62	86	243
15	70	95	115	138	108	115	209	331	75	228
16	243	90	92	145	122	100	511	209	145	844
17	243	90	70	145	145	100	685	145	100	892
18	177	95	60	130	161	94	277	130	86	916
19	153	122		122	185	86	177	100	83	752
20	130	115		100	161	79	177	490	145	1,360
21	115	115		100	145	79	145	243	115	2,480
22	115	130		100	130	79	145	268	108	2,700
23	108	130		108	130	83	130	100	65	2,440
24	100	130		108	115	79	130	100	60	553
25	100	138	50	100	108	72	130	100	100	428
26	100	145		108	100	67	130	94	89	350
27	94	115		161	89	67	185	62	60	350
28	75	122		177	100	511	122	60	55	315
29	78	130		130	97	388	145	58	47	243
30	72	130		145	100	145	145	56	28	201
31	89			115		108		50	32	

NOTE.—Discharge Oct. 1-11 computed by shifting-control method. Stage-discharge relation affected by ice Nov. 15-18 and Dec. 19-31; discharge based on one discharge measurement, observer's notes, and temperature record. Figure in brace shows estimated mean daily discharge for period indicated. No records Jan. 1 to Mar. 7.

Monthly discharge of East Nishnabotna River at Red Oak, Iowa, for the year ending Sept. 30, 1921

[Drainage area, 890 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	243	60	103	0.116	0.13
November	331	90	146	.164	.18
December	161		87.9	.099	.11
March 8-31	185	100	131	.147	.13
April	185	89	111	.125	.14
May	511	67	128	.144	.17
June	2,560	122	453	.509	.57
July	490	50	128	.144	.17
August	2,140	32	217	.244	.28
September	2,700	31	568	.638	.71

NODAWAY RIVER BASIN**NODAWAY RIVER AT CLARINDA, IOWA**

LOCATION.—In sec. 32, T. 69 N., R. 36 W., at Fred C. Brummet highway bridge, just east of Clarinda, Page County, 7 miles above mouth of East Nodaway River.

DRAINAGE AREA.—740 square miles (revised measurement on map compiled by the United States Geological Survey; scale, 1:500,000).

RECORDS AVAILABLE.—May 17, 1918, to September 30, 1921.

GAGE.—Chain attached to upstream handrail of middle span of bridge; read by W. S. Grimes.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge and by wading.

CHANNEL AND CONTROL.—Dredged channel with sand and clay bottom. Loam banks that are overflowed at 14-foot stage. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 7.1 feet at 11.50 a. m. May 20 (discharge estimated, 1,960 second-feet); minimum stage, 1.58 feet at 11.30 a. m. July 31 (discharge, 10 second-feet).

1918-1921: Maximum stage recorded 11.25 feet April 11, 1919 (discharge estimated, 6,060 second-feet); minimum stage, 1.30 feet August 25, 1919 (discharge, practically zero).

ICE.—Stage-discharge relation affected by ice for short periods during extremely cold weather.

DIVERSION.—The city of Clarinda pumps its water supply from the river a few hundred feet above gage.

ACCURACY.—Stage-discharge relation permanent, except when affected by ice. Rating curve well defined below 1,100 second-feet. Gage read to hundredths once daily and twice daily during periods of rapidly changing stage. Daily discharge ascertained by applying daily gage height to rating table, except as shown in footnote to daily-discharge table. Records fair.

Discharge measurement of Nodaway River at Clarinda, Iowa, during the year ending Sept. 30, 1921

[Made by E. D. Burchard]

Date	Gage height	Dis-charge
	<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 18.....	1.81	20.4
May 12.....	3.11	257
July 21.....	2.31	82

Daily discharge, in second-feet, of Nodaway River at Clarinda, Iowa, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	22	48	58			50	50	60	1,130	17	17	20
2.....	22	41	58			50	44	70	1,660	100	68	25
3.....	22	37	58			46	33	81	1,830	50	35	18
4.....	22	35	55			44	33	73	904	661	63	18
5.....	22	31	53			44	35	70	291	81	239	17
6.....	22	55	50		10	41	35	68	239	53	60	15
7.....	23	68	46			39	37	68	170	41	35	15
8.....	23	76	44			37	31	65	100	35	33	14
9.....	25	49	42			37	29	133	78	29	27	11
10.....	25	39	39			35	18	192	86	23	23	1,170
11.....	27	35	39			35	24	192	81	25	20	948
12.....	31	33	39			39	29	335	48	27	15	413
13.....	33	21	42			58	44	151	239	50	18	171
14.....	44	22	46			92	76	50	70	124	68	15
15.....	53	22	48			175	48	63	50	264	35	18
16.....	37	21		15	480	46	70	47	320	20	32	171
17.....	33	21			264	39	78	40	133	15	151	239
18.....	31	20			150	37	103	42	83	35	50	192
19.....	37	32			100	33	116	1,400	68	239	48	264
20.....	33	32			81	31	133	1,960	53	320	264	1,260
21.....	25	30		20	73	33	124	1,000	46	97	83	948
22.....	22	28			76	35	116	100	44	48	41	1,080
23.....	18	28			76	35	100	50	37	39	53	820
24.....	20	26			76	36	68	40	39	27	100	381
25.....	20	27			76	37	70	38	46	25	48	142
26.....	18	27			70	63	76	40	35	22	320	97
27.....	15	27			65	50	53	42	31	18	73	78
28.....	15	27			60	44	46	36	27	15	44	44
29.....	14	80				48	39	28	20	14	37	41
30.....	27	100				63	41	24	17	11	29	35
31.....	39					76		36		10	27	

NOTE.—No gage-height record Oct. 6, Nov. 15-17, Nov. 26 to Dec. 1, Dec. 28, Jan. 1, 3, 14, 24, 27, 30, 31, Feb. 7, Mar. 7, 24, Apr. 11, 16, May 11, 21-23, June 7, and July 11; discharge estimated or interpolated. Stage-discharge relation affected by ice Dec. 16 to Feb. 13; discharge based on weather records and observer's notes and comparison with records of West Nodaway River at Villisca. Discharge for Nov. 8-25 computed by shifting-control method.

Monthly discharge of Nodaway River at Clarinda, Iowa, for the year ending Sept. 30, 1921

[Drainage area, 740 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	53	14	26.5	0.036	0.04
November.....	100	20	37.9	.051	.06
December.....	58		33.5	.046	.05
January.....			15	.020	.02
February.....	480		73.0	.099	.10
March.....	76	31	44.7	.066	.07
April.....	133	13	59.6	.081	.09
May.....	1,960	24	213	.288	.33
June.....	1,830	17	275	.372	.42
July.....	661	10	72.6	.098	.11
August.....	320	15	67.3	.091	.10
September.....	1,260	11	299	.404	.45
The year.....	1,960	10	101	.136	1.84

WEST NODAWAY RIVER AT VILLISCA, IOWA

LOCATION.—In sec. 28, T. 71 N., R. 36 W., at Chicago, Burlington & Quincy Railroad bridge (Clarinda branch) half a mile west of Villisca, Montgomery County, and 1 mile above junction with Middle Nodaway River.

DRAINAGE AREA.—360 square miles (revised measurement on map compiled by the United States Geological Survey; scale, 1:500,000).

RECORDS AVAILABLE.—May 20, 1918, to September 30, 1921.

GAGE.—Chain attached to upstream guardrail of bridge; read by J. S. Dunn. Datum lowered 2.0 feet November 18, 1920.

DISCHARGE MEASUREMENTS.—Made by wading or from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of sand and mud; no well-defined control. Banks were overflowed frequently prior to dredging of new channel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.60 feet at 8.20 a. m. June 3 (discharge, 384 second-feet); minimum stage, 1.14 feet at 8.20 a. m. July 9 (discharge, 1 second-foot).

1918-1921: Maximum stage recorded, 16.40 feet old datum April 23, 1919 (discharge, 3,780 second-feet); minimum discharge, 1 second-foot several times in August, September, and October, 1918, and July 9, 1921.

ICE.—Stage-discharge relation affected by ice during periods of extremely cold weather.

ACCURACY.—Stage-discharge relation permanent except when affected by ice in December, January, and February. Rating curves used are fairly well defined between 5 and 400 second-feet. Gage read to hundredths once daily.

Daily discharge ascertained by applying daily gage height to rating table except as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of West Nodaway River at Villisca, Iowa, during the year ending Sept. 30, 1921

[Made by E. D. Burchard]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 18.....	1.79	10.8
May 12.....	2.59	86
July 21.....	1.45	12.8

Daily discharge, in second-feet, of West Nodaway River at Villisca, Iowa, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	23	34	35	}	}	45	28	30	58	27	4	3
2.....	10	39	29			43	40	34	290	10	27	8
3.....	9	29	27			47	32	43	384	24	28	21
4.....	9	28	23			66	25	49	164	37	17	23
5.....	9	29	24			35	25	28	129	27	25	25
6.....	28	27	24	}	6	36	44	31	94	32	23	8
7.....	10	28	11			37	26	32	47	25	15	5
8.....	9	29	10			51	44	52	40	5	6	2
9.....	9	28	28			39	25	72	58	1	17	4
10.....	9	28	34			32	26	86	46	6	11	274
11.....	9	19	21	}	}	45	26	113	47	10	8	168
12.....	27	11	16			45	26	88	40	15	4	61
13.....	30	33	11			39	28	64	32	7	6	52
14.....	31	26	9			10	33	33	52	29	35	6
15.....	24	18	7			40	43	51	44	178	15	43
16.....	24	18	6	}	}	60	47	102	35	47	32	110
17.....	18	18				55	45	129	47	65	36	39
18.....	11	12				45	34	64	39	47	39	32
19.....	29	67				43	34	65	40	34	92	20
20.....	11	37				44	40	58	34	21	29	64
21.....	11	58		}	10	45	45	57	29	32	17	44
22.....	31	79				46	51	51	27	26	9	25
23.....	13	107				49	45	51	25	12	11	20
24.....	12	23	5			45	37	43	38	29	10	10
25.....	11	17				52	27	35	33	12	10	7
26.....	27	12		}	6	47	45	49	21	26	25	29
27.....	11	24				44	36	26	21	39	17	12
28.....	8	26				41	28	26	43	47	5	10
29.....	6	27					43	25	45	10	4	8
30.....	28	23					43	25	47	10	4	6
31.....	31						44	72		4	5	

NOTE.—Gage not read Sundays; discharge interpolated. Stage-discharge relation affected by ice Dec. 17 to Feb. 18; discharge based on weather records and observer's notes. Braced figures show mean daily discharge for periods indicated.

Monthly discharge of West Nodaway River at Villisca, Iowa, for the year ending Sept. 30, 1921

[Drainage area, 360 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October.....	31	6	17.0	0.047	0.05
November.....	107	11	31.8	.088	.10
December.....	35		12.6	.035	.04
January.....			6.2	.017	.02
February.....	60		26.6	.074	.08
March.....	66	27	41.3	.115	.13
April.....	129	25	42.8	.119	.13
May.....	113	21	45.6	.127	.15
June.....	384	10	69.8	.194	.22
July.....	92	1	20.0	.056	.06
August.....	110	4	20.8	.058	.07
September.....	318	2	69.1	.192	.21
The year.....	384		33.5	.093	1.26

PLATTE RIVER BASIN (IOWA, MO.)**PLATTE RIVER AT CONCEPTION JUNCTION, MO.**

LOCATION.—In NE. $\frac{1}{4}$ sec. 11, T. 63 N., R. 34 W., at highway bridge 1 mile north of Conception Junction, Nodaway County, 6 miles below Honey Creek and 14 miles above Long Creek.

DRAINAGE AREA.—492 square miles.

RECORDS AVAILABLE.—July 11 to September 30, 1921.

GAGE.—Chain on downstream side of highway bridge; read by C. D. Curtin.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand, silt, and small gravel; shifting.

Low-water control is a light gravel bar 100 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record 9.32 feet at 6.30 a. m., September 13 (discharge, 638 second-feet); minimum stage, 1.88 feet at 7 a. m. September 5 (discharge, 2 second-feet).

DIVERSIONS.—None.

REGULATION.—Reservoir at Parnell is emptied on Saturday nights, but the effect is hardly noticeable.

ACCURACY.—Stage-discharge relation permanent. Rating curve well-defined between 16 and 100 second-feet and extended beyond these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Platte River at Conception Junction, Mo., during the year ending Sept. 30, 1921

[Made by E. L. Williams]

Date	Gage height	Discharge
	<i>Feet</i>	<i>Sec. ft.</i>
July 1.....	2.42	18.6
Aug. 17.....	3.34	82.6
Sept. 22.....	2.76	35.7

Daily discharge, in second-feet, of Platte River at Conception Junction, Mo., for the period July 11 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		12	8	11.....	36	10	76	21.....	6	33	30
2.....		118	9	12.....	22	8	523	22.....	4	27	36
3.....		40	7	13.....	18	8	564	23.....	4	25	22
4.....		127	6	14.....	17	20	370	24.....	4	26	27
5.....		145	2	15.....	14	10	226	25.....	4	24	27
6.....		56	3	16.....	14	51	145	26.....	4	23	19
7.....		33	4	17.....	10	190	88	27.....	4	22	10
8.....		22	2	18.....	9	343	50	28.....	4	20	6
9.....		16	3	19.....	8	136	36	29.....	4	16	7
10.....		13	4	20.....	8	68	32	30.....	3	10	6
								31.....	11	9	

Monthly discharge of Platte River at Conception Junction, Mo., for the period July 11 to Sept. 30, 1921

Month	Discharge in second-feet		
	Maximum	Minimum	Mean
July 11-31.....	36	3	9.9
August.....	343	8	53.6
September.....	564	2	77.7

KANSAS RIVER BASIN

REPUBLICAN RIVER AT SCANDIA, KANS.

LOCATION.—In NE. $\frac{1}{4}$ sec. 17, T. 3 S., R. 4 W., at highway bridge at Scandia, Republic County, 4 miles below Dry Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 27, 1919, to September 30, 1921.

GAGE.—Vertical staff in three sections: 0.0 foot to 3.34 feet on cut-off pile on left bank 5 feet from first pier; 2.0 to 13.7 feet, painted on left face of downstream pier at right end of first left truss span; 11.65 to 16.0 feet, fastened to southwest corner of Missouri Pacific Railway station, 250 feet from left end of bridge; read by Charles P. Nordman.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand; shifting. Low sand bars covered with small vegetation. No well-defined control; not permanent. The Chicago, Rock Island & Pacific Railway bridge and approach fill one-half mile downstream is the control at high stages. Bank full stage, 9 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.0 feet at midnight May 20 (discharge, by extension of rating curve, 6,670 second-feet); minimum discharge, 107 second-feet on September 8 and 16.

1919-1921: Maximum stage recorded, 10.9 feet September 19, 1919 (discharge, 13,600 second-feet); minimum stage, 1.4 feet September 15, 1919 (discharge, 50 second-feet).

Highwater mark of June 20, 1915, painted on Missouri Pacific Railway station, corresponds to a stage of 14.2 feet.

ICE.—Stage-discharge relation seriously affected by ice for short periods.

REGULATION.—Flow affected by operation of power plant at Superior, Nebr.

DIVERSIONS.—Some water is diverted for irrigation in western Nebraska.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves, well defined between 200 and 1,500 second-feet, used during year. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table and by indirect method for shifting control, as explained in footnote to daily-discharge table. Records good.

Discharge measurements of Republican River at Scandia, Kans., during the year ending Sept. 30, 1921

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 12	A. K. Gowans.....	1.94	212	May 12	E. L. Williams.....	3.81	1,480
Feb. 2	do.....	2.96	784	June 22	H. B. Kinnison.....	3.20	910
Mar. 3	do.....	2.86	676	Aug. 10	do.....	2.12	159

Daily discharge, in second-feet, of Republican River at Scandia, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	212	710	605	540	780	745	540	710	745	456	226	203
2.....	219	605	570	540	745	710	510	745	2,980	453	204	175
3.....	212	540	570	540	745	675	510	675	4,940	508	333	149
4.....	204	510	605	540	745	675	540	640	4,600	1,190	289	131
5.....	198	510	605	510	745	675	570	605	4,260	2,660	238	159
6.....	190	675	570	510	745	675	605	570	2,980	2,070	228	152
7.....	184	1,020	540	510	820	675	2,070	570	1,650	1,520	238	134
8.....	184	860	540	510	940	640	1,400	640	1,290	1,140	219	110
9.....	176	710	570	510	820	675	745	745	1,290	859	193	116
10.....	173	605	570	510	780	675	675	710	1,160	652	203	122
11.....	187	540	605	510	745	640	675	1,060	1,520	614	288	122
12.....	190	540	570	510	745	675	675	1,400	1,790	539	316	116
13.....	194	540	570	510	745	675	605	1,020	1,400	451	370	116
14.....	198	540	540	480	820	675	605	780	1,160	393	298	122
15.....	745	480	540	480	1,020	675	640	745	1,290	340	255	113
16.....	780	480	540	480	1,790	640	940	605	1,160	315	780	116
17.....	570	480	540	480	1,520	605	940	570	940	239	1,790	420
18.....	390	510	540	480	1,290	605	820	570	745	251	1,790	175
19.....	710	450	540	480	1,290	605	745	540	2,980	279	1,100	163
20.....	540	434	540	510	1,060	605	780	2,360	2,510	259	730	2,360
21.....	444	444	540	540	860	605	860	4,940	1,650	229	450	2,360
22.....	710	450	510	570	940	605	860	2,660	1,200	450	395	2,600
23.....	510	480	510	605	860	570	820	1,520	978	447	320	2,510
24.....	480	510	480	640	820	570	780	1,160	774	391	450	1,280
25.....	900	510	450	675	820	570	820	980	700	313	370	730
26.....	745	540	480	675	780	605	820	860	558	247	288	550
27.....	640	570	510	675	745	570	820	860	590	204	251	420
28.....	605	540	540	675	710	480	710	780	493	222	271	293
29.....	510	570	540	675	-----	480	640	675	461	430	255	219
30.....	480	605	540	860	-----	510	675	570	398	320	239	191
31.....	540	-----	540	820	-----	540	-----	570	-----	261	223	-----

NOTE.—Stage-discharge relation affected by ice, Dec. 29 to Jan. 23, discharge estimated from observer's notes, and a study of precipitation and temperature records. Discharge determined by indirect method for shifting control June 23 to Aug. 9.

Monthly discharge of Republican River at Scandia, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Month	Discharge in second-feet		
	Maximum	Minimum	Mean		Maximum	Minimum	Mean
October.....	900	173	420	May.....	4,940	540	1,030
November.....	1,020	434	565	June.....	4,940	398	1,640
December.....	605	450	546	July.....	2,660	204	603
January.....	860	480	566	August.....	1,790	193	439
February.....	1,790	710	908	September.....	2,660	110	550
March.....	745	480	623	The year.....	4,940	110	719
April.....	2,070	510	780				

REPUBLICAN RIVER AT WAKEFIELD, KANS.

LOCATION.—In NE. $\frac{1}{4}$ sec. 5, T. 10 S., R. 4 E., at highway bridge one-fourth mile north of Union Pacific Railroad station at Wakefield, Clay County, 25 miles above confluence with Smoky Hill River, 65 miles below Salt Creek, first important tributary above.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 21, 1917, to September 30, 1921.

GAGE.—Chain on upstream side of highway bridge at center of middle span; read by S. R. Winsor. An auxiliary high-water vertical staff, from 13.6 to 20.3 feet is spiked to large cottonwood tree on right bank 25 feet below bridge.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand; shifting. No well-defined control. Bank full stage 11 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.60 feet at 6.30 p. m. June 5 (discharge, 4,880 second-feet); minimum stage, 2.20 feet at 5.50 p. m. September 16 (discharge, 50 second-feet).

1917–1921: Maximum stage recorded, 11.05 feet June 10, 1919 (discharge, 18,200 second-feet); minimum stage, 1.6 feet at 7 p. m. September 12, 1917 (discharge, 40 second-feet).

The flood of June, 1915, which covered the entire valley, probably reached a stage of 20.0 feet.

ICE.—Stage-discharge relation seriously affected by ice for short periods during winter.

REGULATION.—Flow is affected by operation of water-power plant at Clay Center.

ACCURACY.—Stage-discharge relation not permanent. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table, and by indirect method for shifting control as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Republican River at Wakefield, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 20	A. K. Gowans.....	3.36	672	May 6	E. L. Williams.....	3.47	658
Feb. 16	do.....	3.50	747	June 20	H. B. Kinnison.....	3.98	898
Mar. 9	do.....	3.44	635	Aug. 8	do.....	2.76	279

Daily discharge, in second-feet, of Republican River at Wakefield, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	386	535	657	587	714	754	612	680	646	550	379	224
2.....	375	505	657	587	934	790	550	680	612	1,120	840	195
3.....	360	565	624	555	894	749	550	680	581	581	411	176
4.....	360	695	624	555	820	713	492	718	1,430	756	315	133
5.....	329	629	624	555	820	703	521	680	4,520	3,160	296	117
6.....	334	597	624	525	784	664	521	646	3,820	3,160	300	129
7.....	334	597	624	525	784	688	521	612	2,850	4,340	252	97
8.....	291	629	624	525	647	688	581	1,020	2,560	2,560	272	97
9.....	285	799	592	525	714	644	930	2,560	2,160	1,540	262	94
10.....	262	909	592	495	934	646	1,320	3,000	1,780	1,120	224	97
11.....	267	695	592	466	857	646	798	2,700	1,900	840	257	117
12.....	249	662	592	466	820	612	718	2,030	1,540	975	219	82
13.....	247	565	624	437	784	612	718	1,780	1,540	840	200	66
14.....	234	505	624	437	784	612	718	1,780	1,900	718	172	94
15.....	234	535	624	437	748	680	680	1,120	1,680	550	200	82
16.....	234	505	592	437	748	680	646	930	1,540	465	550	60
17.....	287	565	592	466	784	680	756	840	3,320	438	344	58
18.....	1,480	629	560	495	1,570	612	1,020	718	4,160	975	267	94
19.....	954	695	560	520	1,570	612	1,070	680	1,780	4,160	233	73
20.....	602	624	495	748	1,460	612	975	612	1,120	1,780	1,320	66
21.....	535	592	587	857	1,340	612	756	581	2,030	798	975	82
22.....	763	500	619	748	1,560	612	718	1,320	1,780	550	840	121
23.....	597	500	619	894	1,050	612	680	3,160	1,430	438	680	1,780
24.....	505	500	587	857	1,000	612	840	2,030	1,220	384	581	1,430
25.....	662	560	587	784	919	612	840	1,540	1,070	550	521	1,540
26.....	597	624	587	714	874	612	756	1,320	930	646	438	1,320
27.....	729	624	587	714	832	612	756	1,120	756	465	384	885
28.....	799	624	555	714	832	581	885	975	680	411	344	612
29.....	763	657	555	714	-----	581	930	798	646	354	324	550
30.....	597	657	555	680	-----	550	756	718	612	315	257	465
31.....	597	-----	587	680	-----	581	-----	718	-----	324	248	-----

NOTE.—Stage-discharge relation affected by ice Dec. 22 to Jan. 18; discharge estimated from observer's notes, gage heights, and precipitation and temperature records. Indirect method for shifting control applied Oct. 1 to Mar. 9.

Monthly discharge of Republican River at Wakefield, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Month	Discharge in second-feet		
	Maximum	Minimum	Mean		Maximum	Minimum	Mean
October.....	1,480	234	492	May.....	3,160	581	1,250
November.....	909	500	609	June.....	4,520	581	1,750
December.....	657	495	597	July.....	4,340	315	1,160
January.....	894	437	603	August.....	1,320	172	416
February.....	1,570	647	949	September.....	1,780	58	365
March.....	790	550	644				
April.....	1,320	492	754	The year.....	4,520	58	797

KANSAS RIVER AT OGDEN, KANS.

LOCATION.—In SE. $\frac{1}{4}$ sec. 12, T. 11 S., R. 6 E., at highway bridge three-fourths mile southeast of Ogden, Riley County, one-fourth mile below Sevenmile Creek, 2 miles below Clark Creek, and 10 miles below point where Smoky Hill and Republican rivers unite to form Kansas River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 19, 1917, to September 30, 1921.

GAUGE.—Chain on upstream side of highway bridge near middle of center span; read by Arthur Estes. A vertical staff from 21.0 to 29.8 feet is spiked to aspen tree on upstream side of road 200 feet from right end of bridge.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand; shifting. No well-defined control. Old truss spans of a former bridge form an obstruction in channel 200 feet below bridge. Bank full stage 18 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.40 feet May 10, 12 (discharge, 8,310 second-feet); minimum stage, 4.65 feet at 7 a. m. September 8 (discharge, 210 second-feet).

1917-1921: Maximum stage recorded, 15.85 feet March 16, 1919 (discharge 25,300 second-feet); minimum discharge that of 1921.

ICE.—Stage-discharge relation seriously affected by ice for short periods.

REGULATION.—Flow affected by the operation of power plants on tributary streams.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used; one from October 1 to 20, poorly defined, the other from March 10 to September 30, fairly well defined from 200 to 3,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table and by indirect method for shifting control as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Kansas River at Ogden, Kans., during the year ending Sept. 30, 1921.

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 20	A. K. Gowans	5.96	1,230	May 5	E. L. Williams	5.89	1,050
Jan. 27	do	5.94	1,170	June 20	H. B. Kinnison	7.34	2,550
Mar. 10	do	5.61	839	Aug. 8	do	5.58	771
Apr. 11	E. L. Williams	6.34	1,490				

Daily discharge, in second-feet, of Kansas River at Ogden, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	760	895	980	335	1,070	980	650	1,160	1,250	1,250	1,120	575
2	700	810	980	334	1,250	980	650	1,160	980	1,850	2,270	445
3	590	725	980	428	1,350	1,020	650	1,020	938	1,550	2,270	369
4	640	810	938	534	1,250	852	725	980	810	1,550	1,650	315
5	615	1,020	938	563	1,120	895	688	1,020	1,750	1,650	1,160	346
6	590	852	852	624	1,120	895	725	1,020	4,400	2,990	938	380
7	590	810	938	690	1,160	1,020	810	1,020	4,580	3,570	768	305
8	590	938	938	688	980	895	810	1,450	4,950	5,330	768	275
9	590	768	895	457	938	895	895	2,380	7,070	4,230	650	285
10	540	1,120	895	470	1,020	852	1,350	6,830	5,330	3,130	810	330
11	640	1,120	852	367	1,160	810	1,550	7,310	4,580	3,130	650	352
12	540	980	938	318	1,120	810	1,450	8,310	3,730	3,420	575	1,250
13	540	938	938	276	980	852	1,550	6,830	3,570	2,730	540	980
14	565	768	768	387	1,120	895	1,350	5,930	3,420	2,050	505	1,070
15	494	852	725	410	1,020	852	1,350	3,730	3,270	1,750	540	852
16	540	810	768	435	938	810	1,250	2,610	2,730	1,450	1,120	688
17	494	852	768	516	938	852	1,070	2,160	2,730	1,250	3,570	385
18	565	810	895	575	1,160	810	1,250	1,750	4,950	1,160	2,730	265
19	1,460	895	852	810	1,650	810	1,350	1,550	4,230	1,750	2,160	1,350
20	1,280	938	725	768	1,650	725	1,650	1,250	2,610	4,230	1,350	1,950
21	895	810	768	980	1,750	810	1,650	1,160	2,270	2,160	1,850	1,350
22	768	852	540	1,120	1,550	768	1,550	1,020	2,990	1,650	1,550	938
23	980	688	444	1,020	1,350	895	1,250	1,950	3,420	1,250	1,250	1,070
24	852	725	348	1,250	1,250	852	1,250	2,860	2,490	895	1,120	2,610
25	810	810	417	1,120	1,160	688	1,250	2,050	2,050	768	1,020	2,050
26	938	895	440	1,160	1,070	768	1,160	1,850	1,950	980	768	1,950
27	938	852	439	1,160	980	725	1,160	1,550	1,750	1,020	852	1,750
28	980	810	413	1,020	1,120	810	1,160	1,350	1,650	938	612	1,550
29	1,020	1,020	387	1,160	-----	768	1,350	1,160	1,550	725	650	1,160
30	980	980	386	1,160	-----	725	1,250	1,160	1,350	612	612	852
31	938	-----	360	1,160	-----	768	-----	1,250	-----	895	415	-----

NOTE.—Stage-discharge relation affected by ice Dec. 23 to Jan. 17, discharge estimated from observer's notes, and a study of gage heights and precipitation and temperature records. Indirect method for shifting control used Oct. 21 to Dec. 22, and Jan. 18 to Mar. 9.

Monthly discharge of Kansas River at Ogden, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Month	Discharge in second-feet		
	Maximum	Minimum	Mean		Maximum	Minimum	Mean
October.....	1,460	494	756	April.....	1,650	650	1,160
November.....	1,120	688	872	May.....	8,310	980	2,480
December.....	980	348	726	June.....	7,070	810	2,980
January.....	1,250	276	722	July.....	5,330	612	2,000
February.....	1,750	938	1,190	August.....	3,570	415	1,190
March.....	1,020	725	842	September.....	2,610	265	935
				The year.....	8,310	265	1,320

KANSAS RIVER AT WAMEGO, KANS.

LOCATION.—In SE. $\frac{1}{4}$ sec. 9, T. 10 S., R. 10 E., at highway bridge on Main Street in Wamego, Pottawatomie County, 3 miles below Antelope Creek and 7 miles above Vermilion River.

DRAINAGE AREA.—53,200 square miles (measured by United States Weather Bureau).

RECORDS AVAILABLE.—January 1, 1919, to September 30, 1921. The United States Weather Bureau has intermittent records of stage since June 15, 1914.

GAGE.—Chain on downstream side of bridge; read by B. A. Larson.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand; shifting. No well-defined control. Bank full stage, 15 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.2 feet at 6 p. m. June 17 (discharge, 24,600 second-feet); minimum stage, 2.0 feet at 6 p. m. September 8 (discharge, 680 second-feet).

1919–1921: Maximum stage recorded, 14.6 feet June 12, 1919 (discharge 43,000 second-feet); minimum stage that of 1921.

ICE.—Stage-discharge relation not seriously affected by ice.

REGULATION.—Flow is affected by operation of power plants on tributary streams.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined from 500 to 25,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

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

Discharge measurements of Kansas River at Wamego, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 22	A. K. Gowans.....	2.85	1,710	May 5	E. L. Williams.....	2.76	1,580
Feb. 1	.....do.....	2.69	1,550	June 20	H. B. Kinnison.....	4.98	6,140
Mar. 1	.....do.....	2.78	1,650	Aug. 8	.....do.....	2.78	1,600

Daily discharge, in second-feet, of Kansas River at Wamego, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1-----	1,180	1,250	1,600	1,390	1,600	1,670	1,320	1,670	1,980	2,060	2,470	1,000
2-----	1,180	1,180	1,530	1,390	1,460	2,220	1,250	1,600	1,980	11,400	4,790	1,000
3-----	1,060	1,320	1,530	1,460	1,530	1,600	1,320	1,600	2,140	17,800	4,330	1,000
4-----	1,060	1,320	1,530	1,530	1,460	1,600	1,320	1,530	4,790	10,400	4,100	945
5-----	1,120	1,320	1,460	1,600	1,600	1,530	1,250	1,530	3,450	11,400	3,040	890
6-----	1,060	1,530	1,460	1,600	1,530	1,600	1,320	1,600	3,450	20,000	2,650	835
7-----	1,000	1,820	1,460	1,600	1,530	1,530	1,250	1,670	6,030	15,700	2,140	890
8-----	1,000	1,820	1,320	1,460	1,600	1,600	1,460	2,220	6,870	12,800	1,530	730
9-----	1,000	1,670	1,320	1,600	1,600	1,530	1,460	4,790	8,770	10,100	1,530	730
10-----	835	1,600	1,390	1,530	1,600	1,530	1,320	19,300	8,120	5,770	1,600	835
11-----	890	1,530	1,320	1,530	1,530	1,460	1,320	11,100	8,120	4,330	1,670	780
12-----	945	1,390	1,320	1,600	1,600	1,460	1,320	12,500	6,300	4,790	1,460	1,180
13-----	890	1,390	1,390	1,600	1,980	1,390	1,670	11,400	5,270	4,790	1,250	2,220
14-----	890	1,600	1,390	1,460	1,460	1,320	2,300	8,440	5,270	3,880	2,220	1,390
15-----	890	1,600	1,320	1,460	1,460	1,320	1,900	6,300	4,560	3,040	2,300	1,250
16-----	835	1,600	1,250	1,460	1,530	1,390	2,060	4,790	4,330	2,840	1,740	1,060
17-----	835	1,390	1,320	1,390	1,460	1,320	1,980	3,450	14,200	3,040	5,770	1,120
18-----	780	1,320	1,320	1,320	1,530	1,390	1,900	3,040	19,300	3,450	4,330	1,060
19-----	1,000	1,460	1,320	1,390	1,600	1,320	1,740	2,650	13,500	9,760	3,660	1,250
20-----	2,140	1,460	1,320	1,250	1,670	1,320	1,820	2,220	5,770	12,100	3,040	2,300
21-----	1,900	1,600	1,250	1,390	2,140	1,250	2,300	1,980	3,880	10,800	2,140	2,740
22-----	1,600	1,460	1,250	1,320	2,300	1,320	2,560	1,820	2,740	5,770	2,380	3,880
23-----	1,460	1,320	1,320	1,390	2,060	1,460	2,060	1,980	4,560	3,880	2,300	4,330
24-----	1,390	1,320	1,320	1,600	1,980	1,390	1,900	2,650	3,880	2,220	2,140	3,880
25-----	1,320	1,250	1,180	1,820	1,740	1,390	1,740	3,450	3,240	2,220	1,820	3,880
26-----	1,250	1,180	1,180	1,670	1,670	1,320	2,060	2,840	3,140	1,900	1,600	3,040
27-----	1,320	1,250	1,250	1,600	1,740	1,320	1,980	3,040	6,030	1,900	1,460	2,740
28-----	1,390	1,390	1,320	1,670	1,670	1,390	1,740	2,470	3,880	1,820	1,390	2,220
29-----	1,530	1,460	1,460	1,670	-----	1,320	1,740	2,140	2,470	1,670	1,120	1,820
30-----	1,460	1,530	1,460	1,670	-----	1,320	1,820	2,060	2,140	1,670	1,120	1,600
31-----	1,390	-----	1,390	1,670	-----	1,320	-----	1,740	-----	1,740	1,120	-----

Monthly discharge of Kansas River at Wamego, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October-----	2,140	780	1,180	72,600
November-----	1,820	1,180	1,440	85,700
December-----	1,600	1,180	1,360	83,600
January-----	1,820	1,250	1,520	93,500
February-----	2,300	1,460	1,670	92,800
March-----	2,220	1,250	1,450	89,200
April-----	2,560	1,250	1,710	102,000
May-----	19,300	1,530	4,180	257,000
June-----	19,300	1,980	5,670	337,000
July-----	20,000	1,670	6,610	406,000
August-----	5,770	1,120	2,390	147,000
September-----	4,330	730	1,750	104,000
The year-----	20,000	730	2,590	1,870,000

KANSAS RIVER AT TOPEKA, KANS.

LOCATION.—In Topeka, Shawnee County, midway between Topeka Avenue and Harrison Street, 300 feet below Chicago, Rock Island & Pacific Railway bridge, 1,900 feet above Melan Arch highway bridge on Kansas Avenue, and $1\frac{1}{2}$ miles above Soldier Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 24 to August 31, 1904, and June 12, 1917, to September 30, 1921.

GAGE.—Gurley long distance water-stage recorder on right bank. Referred to inside staff and outside slope gage, set to same datum as chain gage; read by Harold N. Rickardson. For history of previous gages, see Water-Supply Paper 476.

DISCHARGE MEASUREMENTS.—Made from downstream side of Sardou Avenue highway bridge, 1 mile below gage, from Brickyard highway bridge 3 miles above gage, and by wading.

CHANNEL AND CONTROL.—Bed composed of sand and silt; shifting. A number of sand dips, on the right bank above and below the gage maintain a deep channel along the right bank. No well-defined control, although the Melan arch bridge, with heavy concrete piers, affects the stage-discharge relation, which is fairly permanent. Banks protected by levees, within which the water is confined at all stages.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 16.3 feet at 7 p. m. May 10 (discharge, 43, 100 second-feet); minimum stage, from water-stage recorder, 3.20 feet October 17 and 18 (discharge, 950 second-feet).

1917–1921: Maximum stage recorded, 20.0 feet March 16, 1919 (discharge, 68,000 second-feet); minimum stage, 3.15 feet September 28, 1918 (discharge, 705 second-feet).

1904: Maximum stage recorded, 22.05 feet on July 7 (discharge not computed on account of unknown datum).

ICE.—Stage-discharge relation seriously affected by ice and ice jams. The sand dip keeps the channel partly open except during extremely cold weather.

REGULATION.—The effect of the operation of power plants on the tributaries is not appreciable.

ACCURACY.—Stage-discharge relation permanent except when affected by ice and ice jams. Operation of water-stage recorder satisfactory, except when intake pipe, or electric circuit troubles caused breaks or discrepancies in the record. Auxiliary slope gage read once daily and more frequently during high water and periods of gage trouble. Rating curve, fairly well defined. Daily discharge ascertained by applying mean daily gage height to rating table, except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Kansas River at Topeka, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 18	A. K. Gowans.....	3.22	966	Mar. 30	Williams and Gowans	3.88	1,540
Feb. 10	.....do.....	4.12	1,730	May 9	E. L. Williams.....	10.65	15,800
Mar. 15	.....do.....	4.0	1,640	July 22	H. B. Kinnison.....	8.13	9,300

Daily discharge, in second-feet, of Kansas River at Topeka, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	1,180	1,320	1,360	1,240	1,950	1,720	1,360	1,830	2,010	2,760	1,830	1,360
2.....	1,210	1,240	1,320	1,240	1,830	1,720	1,280	1,890	2,070	7,880	2,760	1,280
3.....	1,210	1,210	1,320	1,240	1,830	1,830	1,240	1,830	2,070	26,500	4,800	1,320
4.....	1,140	1,140	1,320	1,240	1,950	1,630	1,210	1,720	1,890	16,000	4,610	1,320
5.....	1,070	1,140	1,280	1,320	2,010	1,720	1,210	1,680	3,380	9,480	4,060	1,140
6.....	1,070	1,240	1,210	1,360	1,950	1,630	1,180	1,680	3,380	20,200	3,380	1,040
7.....	1,010	1,540	1,210	1,450	1,890	1,630	1,280	1,830	4,610	18,700	2,760	1,070
8.....	1,040	1,630	1,210	1,210	1,780	3,380	980	2,260	5,180	14,000	2,070	1,040
9.....	1,010	1,630	1,210	1,280	1,830	2,540	1,450	12,500	7,880	11,700	2,010	1,140
10.....	980	1,540	1,280	1,210	1,780	1,950	1,360	31,900	8,940	8,940	2,470	1,720
11.....	980	1,210	1,210	1,140	1,680	1,830	1,450	24,300	8,670	6,000	4,420	980
12.....	980	1,360	1,210	1,070	1,720	1,780	1,630	12,800	7,140	4,610	2,330	1,580
13.....	1,010	1,450	1,240	1,070	1,890	1,720	1,890	13,100	6,000	5,180	1,720	5,580
14.....	1,100	1,360	1,210	1,100	1,950	1,680	2,010	10,300	5,580	4,990	1,580	3,220
15.....	1,010	1,280	1,140	1,100	1,680	1,680	2,010	8,140	4,800	4,240	3,060	1,680
16.....	1,010	1,210	1,180	1,100	1,830	1,680	2,010	6,440	4,800	3,710	2,760	1,400
17.....	950	1,210	1,140	1,100	1,720	1,680	1,950	5,180	5,790	3,710	6,220	1,450
18.....	980	1,210	1,210	1,100	1,720	1,540	1,830	4,060	31,400	3,540	9,210	1,450
19.....	1,040	1,210	1,180	1,100	1,720	1,580	1,780	3,540	14,800	4,800	3,880	1,450
20.....	1,210	1,210	1,180	1,100	2,200	1,630	2,140	3,060	10,600	9,750	3,380	1,400
21.....	1,830	1,240	1,180	1,100	2,680	1,630	2,200	2,610	6,440	11,700	3,060	2,260
22.....	1,240	1,210	1,240	1,140	2,680	1,500	2,470	2,680	4,420	8,940	2,610	2,540
23.....	1,580	1,210	1,240	1,360	2,610	1,500	2,470	2,760	5,180	5,380	2,760	4,060
24.....	1,400	1,210	1,240	2,200	2,400	1,500	1,950	2,760	5,380	3,880	2,760	4,420
25.....	1,450	1,140	1,240	3,060	2,200	1,540	1,830	3,710	4,240	2,910	2,760	3,380
26.....	1,240	1,140	1,240	2,540	2,010	1,360	1,680	3,380	4,060	2,760	2,260	3,710
27.....	1,140	1,140	1,240	2,140	1,890	1,360	1,780	3,060	7,140	2,400	2,010	3,220
28.....	1,360	1,150	1,240	1,950	1,830	1,360	1,830	3,060	6,440	2,400	1,830	2,680
29.....	1,280	1,210	1,240	2,070	-----	1,360	1,780	2,760	4,060	2,330	1,720	2,330
30.....	1,320	1,280	1,240	1,890	-----	1,500	1,720	2,330	2,910	2,140	1,540	1,890
31.....	1,360	-----	1,240	1,950	-----	1,450	-----	2,010	-----	1,950	1,450	-----

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Jan. 6, and Jan. 13–23, daily discharge estimated from a study of gage-height charts, ice notes, and precipitation and temperature records. Recorder out of order and mean daily gage height obtained from curve passing through plotted daily gage height readings for Sept. 1–12, Feb. 22–23, Mar. 26 to Apr. 6, May 26 to June 16, June 21 to July 1, July 20–26, and Aug. 5–11.

Monthly discharge of Kansas River at Topeka, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	1,830	950	1,170	71,900
November.....	1,630	1,140	1,280	76,200
December.....	1,360	1,140	1,230	75,600
January.....	3,060	1,070	1,460	89,800
February.....	2,680	1,680	1,970	109,000
March.....	3,380	1,360	1,700	105,000
April.....	2,470	980	1,700	101,000
May.....	31,900	1,680	5,840	359,000
June.....	31,400	1,890	6,380	380,000
July.....	26,500	1,950	7,530	463,000
August.....	9,210	1,450	3,030	186,000
September.....	5,580	980	2,100	125,000
The year.....	31,900	950	2,960	2,140,000

KANSAS RIVER AT BONNER SPRINGS, KANS.

LOCATION.—In NW. $\frac{1}{4}$ sec. 32, T. 11 S., R. 23 E., at highway bridge at Bonner Springs, Wyandotte County, half a mile below Wolf Creek, half a mile from Atchison, Topeka & Santa Fe Railway bridge, 18 miles above mouth of river.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 8, 1917, to September 30, 1921.

GAGE.—Chain on upstream side of highway bridge at center of second span from left bank; read by B. L. Rehm.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of sand and silt; shifting. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 19 feet at 6 a. m. May 11 (discharge, 76,500 second-feet); minimum stage, 3.45 feet October 11 and 14 (discharge, 1,220 second-feet).

1917-1921: Maximum stage recorded, 22.2 feet March 17, 1919 (discharge, 109,000 second-feet); minimum stage, 3.15 feet September 30, 1918 (discharge, 805 second-feet).

ICE.—Stage-discharge relation seriously affected by ice and ice jams for short periods.

REGULATION.—Flow may be slightly affected by operation of Bowersock mill and power plant at Lawrence.

ACCURACY.—Stage-discharge relation practically permanent except when affected by ice in December and January. Rating curve fairly well defined from 1,500 to 60,000 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Kansas River at Bonner Springs, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Oct. 28	A. K. Gowans.....	<i>Feet</i> 3.83	<i>Sec.-ft.</i> 1,710	June 13	H. B. Kinnison.....	<i>Feet</i> 7.15	<i>Sec.-ft.</i> 7,870
Feb. 14	.....do.....	4.09	2,100				

Daily discharge, in second-feet, of Kansas River at Bonner Springs, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	1,950	1,670	1,810	1,670	2,560	1,950	2,100	2,560	4,000	4,400	2,720	2,100
2.....	1,810	1,670	1,950	1,670	2,400	1,950	1,950	2,560	3,600	4,000	2,890	2,720
3.....	1,670	1,670	1,670	1,670	2,400	1,950	1,950	2,560	3,600	9,380	2,560	3,240
4.....	1,670	1,670	1,810	1,670	2,250	1,810	1,810	2,560	4,000	28,300	3,060	3,600
5.....	1,670	1,540	1,950	1,540	2,400	1,810	1,670	2,400	3,600	17,300	5,620	3,600
6.....	1,670	1,540	1,950	1,670	2,400	1,950	1,670	2,400	5,200	13,500	7,840	2,560
7.....	1,540	1,810	1,810	1,540	2,250	1,810	1,670	2,560	5,200	21,500	8,340	2,100
8.....	1,540	2,100	1,810	1,950	2,400	12,800	1,670	5,620	6,680	16,400	4,400	1,540
9.....	1,540	2,400	1,670	1,810	2,250	12,100	1,810	18,600	10,500	12,800	3,420	1,670
10.....	1,410	2,250	1,670	1,670	2,250	5,000	1,950	56,500	13,100	11,100	2,890	1,540
11.....	1,280	1,810	1,810	1,670	2,100	3,600	1,950	71,400	11,100	8,600	13,100	1,950
12.....	1,410	1,950	1,670	1,540	2,100	3,060	1,810	46,300	9,380	7,130	18,200	2,250
13.....	1,410	1,810	1,670	1,670	1,950	2,720	1,950	24,500	8,340	5,830	6,460	4,000
14.....	1,280	2,100	1,810	1,410	2,100	3,600	2,400	16,000	7,130	9,120	3,600	7,840
15.....	1,540	2,100	1,810	1,410	1,950	2,400	2,560	12,800	6,460	6,460	2,890	5,410
16.....	1,670	1,950	1,810	1,410	1,950	2,250	3,240	10,500	6,460	5,620	4,200	4,000
17.....	1,540	1,670	1,950	1,410	1,950	2,250	4,600	9,120	6,040	4,600	16,000	3,240
18.....	1,410	1,670	1,810	1,410	1,950	2,400	4,000	7,600	6,040	4,800	17,300	2,720
19.....	1,410	1,670	1,670	1,410	1,950	2,250	4,000	6,680	31,700	5,000	9,380	4,000
20.....	1,280	1,670	1,670	1,280	1,950	1,950	3,800	6,460	16,400	5,410	5,830	6,460
21.....	1,280	1,670	1,670	1,540	1,950	2,560	4,200	5,830	10,500	9,380	4,800	6,040
22.....	1,670	1,670	1,670	1,810	2,400	2,890	3,800	5,200	6,900	10,500	4,400	4,200
23.....	2,250	1,810	1,670	2,100	2,560	2,400	3,420	4,800	5,830	8,600	3,600	3,800
24.....	2,100	1,670	1,670	2,400	2,720	2,250	3,240	4,600	6,250	6,250	3,600	4,400
25.....	1,950	1,670	1,410	3,420	2,560	2,250	3,800	4,400	7,130	5,000	3,420	7,600
26.....	1,810	1,670	1,670	4,800	2,400	2,250	4,200	4,600	6,460	4,000	3,420	5,000
27.....	1,810	1,670	1,670	3,600	2,250	2,250	3,060	5,620	6,460	3,600	3,240	4,800
28.....	1,670	1,540	1,670	2,890	2,100	2,250	2,560	5,410	8,600	3,600	3,240	4,400
29.....	1,670	1,670	1,670	2,720	-----	1,950	2,560	5,200	8,340	3,600	2,560	3,800
30.....	1,670	1,810	1,670	2,720	-----	1,950	2,720	4,800	5,830	3,240	2,400	3,420
31.....	1,670	-----	1,670	2,720	-----	1,950	-----	4,200	-----	2,890	2,100	-----

NOTE.—Stage-discharge relation affected by ice Dec. 22, 23, Dec. 27 to Jan. 6, and Jan. 15-23, daily discharge estimated from observer's notes, precipitation and temperature records, and comparison with flow of Kansas River at Topeka.

Monthly discharge of Kansas River at Bonner Springs, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	2,250	1,280	1,620	99,600
November.....	2,400	1,540	1,790	107,000
December.....	1,950	1,410	1,740	107,000
January.....	4,800	1,280	2,010	124,000
February.....	2,720	1,950	2,230	124,000
March.....	12,800	1,810	3,050	188,000
April.....	4,600	1,670	2,740	163,000
May.....	71,400	2,400	11,800	726,000
June.....	16,400	3,600	8,030	478,000
July.....	28,300	2,890	8,450	520,000
August.....	18,200	2,100	5,730	352,000
September.....	7,840	1,540	3,800	226,000
The year.....	71,400	1,280	4,430	3,210,000

SMOKY HILL RIVER AT ELLSWORTH, KANS.

LOCATION.—In SE. $\frac{1}{4}$ sec. 20, T. 15 S., R. 8 W., at Pioneer Memorial highway bridge at Ellsworth, Ellsworth County, 2 miles below Turkey Creek and 2 miles above Oxide Creek.

DRAINAGE AREA.—7,580 square miles.

RECORDS AVAILABLE.—April 17, 1895, to October 31, 1905, and July 23, 1918, to September 30, 1921.

GAGE.—Chain on upstream handrail of center span of concrete arch bridge; read by E. A. Forkner.

1895–1905: Staff gage in two sections on south bank pier of old highway bridge; datum not same as for chain gage.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand; shifting. Bank full stage, 20 feet. Control at low stages is a water main crossing the river just below bridge; at medium stages shifting occurs. A sand dip operating 200 feet below the bridge probably affects stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.1 feet at 11 p. m. July 6 (discharge, 3,150 second-feet); minimum stage, 1.72 feet December 29, 30 (discharge, 2 second-feet).

1895–1905; 1918–1921: Maximum stage recorded, 16.55 feet (gage at old highway bridge) July 5, 1895 (discharge, 21,000 second-feet); minimum discharge that of 1921.

ICE.—Stage-discharge relation not seriously affected by ice.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; rating curve fairly well defined from 50 to 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by indirect method for shifting control. Records poor.

Discharge measurements of Smoky Hill River at Ellsworth, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 8	A. K. Gowans.....	1.90	14	May 18	E. L. Williams.....	2.08	37
Feb. 6	.....do.....	2.00	38	June 21	H. B. Kinnison.....	2.50	131
Mar. 5	.....do.....	1.93	28	Aug. 9	.....do.....	2.23	57
Apr. 13	E. L. Williams.....	2.16	54				

Daily discharge, in second-feet, of Smoky Hill River at Ellsworth, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	24	52	49	31	70	30	18	71	18	70	132	24
2.....	24	49	41	33	50	29	19	53	29	67	186	24
3.....	20	45	39	59	40	29	19	42	97	263	110	22
4.....	20	42	34	66	42	29	24	38	137	108	92	24
5.....	18	41	34	74	35	27	97	35	263	92	82	22
6.....	15	45	36	84	39	29	179	33	880	635	76	21
7.....	14	53	41	77	38	29	66	38	835	2,440	68	21
8.....	13	49	42	80	35	29	74	495	600	880	66	21
9.....	12	47	45	150	40	29	53	110	530	565	61	20
10.....	11	47	44	84	38	28	76	396	428	412	59	81
11.....	10	46	42	74	40	27	59	137	349	290	57	19
12.....	8	46	40	66	35	27	49	67	334	250	53	35
13.....	8	94	42	59	34	30	52	49	290	211	47	24
14.....	8	52	44	47	38	31	49	47	304	191	66	20
15.....	9	39	44	38	40	29	380	40	334	164	53	16
16.....	8	26	47	38	38	29	250	39	250	137	66	13
17.....	9	52	52	42	41	29	80	36	211	120	101	11
18.....	9	52	57	44	44	27	61	34	174	116	82	27
19.....	9	47	66	45	63	27	63	33	143	106	70	24
20.....	10	45	57	47	60	25	61	31	139	94	61	21
21.....	32	42	52	42	56	25	66	32	128	90	47	16
22.....	45	41	54	41	36	26	56	30	167	87	44	13
23.....	36	40	49	39	34	27	52	29	181	80	41	13
24.....	36	47	36	49	32	25	47	27	172	146	36	13
25.....	38	56	28	66	31	24	74	26	157	198	34	11
26.....	46	45	13	122	31	22	49	24	124	349	32	10
27.....	56	42	10	97	31	20	45	85	104	290	31	8
28.....	52	40	9	63	31	20	41	31	94	196	27	8
29.....	47	57	8	49	-----	19	38	30	84	141	27	6
30.....	44	54	8	46	-----	20	56	27	77	126	31	6
31.....	52	-----	15	56	-----	20	-----	23	-----	112	28	-----

Monthly discharge of Smoky Hill River at Ellsworth, Kans, for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	56	8	24.0	1,480
November.....	94	26	47.8	2,840
December.....	66	8	38.0	2,340
January.....	150	31	61.5	3,780
February.....	70	31	40.8	2,270
March.....	31	19	26.4	1,620
April.....	380	18	75.1	4,470
May.....	495	23	70.6	4,340
June.....	880	18	254	15,100
July.....	2,440	67	291	17,900
August.....	186	27	63.4	3,900
September.....	35	6	17.7	1,050
The year.....	2,440	6	84.4	61,100

SMOKY HILL RIVER NEAR ABILENE, KANS.

LOCATION.—In SE. $\frac{1}{4}$ sec. 23, T. 13 S., R. 1 E., at highway bridge at Sand Springs 3 miles above Holland Creek, 4 miles west of Abilene, Dickinson County, 9 miles below Solomon River and 10 miles above Riverside Light, Power & Gas Co.'s dam.

DRAINAGE AREA.—18,700 square miles (measured by United States Weather Bureau).

RECORDS AVAILABLE.—June 18, 1918, to September 30, 1921, when station was discontinued. The United States Weather Bureau has published records of gage heights since November 22, 1904.

GAGE.—Chain on downstream handrail of highway bridge, installed July 6, 1917; read by Mrs. R. A. Grubbs. An auxiliary vertical staff, from 17.0 to 25.3 feet, painted on concrete reservoir, is located on left bank, 250 feet above bridge; and a vertical staff, from 26.9 to 30.0 feet is printed on northwest corner of pump house at Sand Springs. All gages refer to the same datum.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of sand and silt. No well-defined control. Bank full stage, 22 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.4 feet May 11 and 12 (discharge, 5,760 second-feet); minimum stage, 0.80 foot, September 7 and 8 (discharge, estimated because of backwater from dam, 34 second-feet).

1918–1921: Maximum stage recorded, 21.3 feet June 14, 1919 (discharge, 12,800 second-feet); minimum discharge, that of 1921.

1904–1918: Maximum stage recorded by United States Weather Bureau, 24.0 feet, June 11, 1903; minimum stage 0.5 foot on various dates. On May 29, 1903, the river reached a stage of 28.4 feet, from levels by United States Weather Bureau on high-water mark set by T. W. Sherman.

ICE.—Stage-discharge relation seriously affected by ice for short periods. The water from Sand Springs enters just above gage and retards ice formation at the gage.

REGULATION.—Flow is affected by the operation of small water power plants on the main stream and its tributaries.

ACCURACY.—Stage-discharge relation not permanent; affected by backwater from dam. Rating curve fairly well defined from 100 to 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table; except for periods of backwater as indicated in footnote to table of daily discharge gage heights were corrected before discharge was determined. Records poor.

Discharge measurements of Smoky Hill River near Abilene, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 10	A. K. Gowans.....	1.35	178	Apr. 12	E. L. Williams.....	3.27	572
Jan. 28	.....do.....	2.19	307	May 12	.....do.....	3.26	574
Feb. 5	.....do.....	2.04	273	May 6	.....do.....	1.67	266
Feb. 17	.....do.....	1.80	216	June 21	H. B. Kinnison.....	3.36	697
Mar. 8	.....do.....	1.83	184				

^a Stage-discharge relation affected by backwater from dam.

Daily discharge, in second-feet, of Smoky Hill River near Abilene, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	165	190	275	149	275	190	202	322	145	245	750	125
2.....	185	260	275	145	245	190	190	356	190	275	998	94
3.....	161	275	305	185	245	202	215	373	145	260	645	178
4.....	205	190	305	215	245	260	202	373	165	190	373	322
5.....	260	215	339	215	260	245	230	339	1,150	645	305	75
6.....	180	245	260	215	260	145	190	202	1,670	1,540	290	45
7.....	198	275	215	202	245	145	230	260	2,170	1,890	322	34
8.....	190	290	202	202	275	165	190	305	2,990	2,260	245	36
9.....	172	245	275	190	275	190	275	356	2,670	1,710	190	101
10.....	175	245	280	180	290	190	962	4,430	2,070	2,880	190	84
11.....	165	260	275	165	275	190	926	5,610	1,940	2,460	190	373
12.....	125	275	245	190	275	215	645	5,610	2,260	1,420	145	543
13.....	125	290	190	202	190	245	543	3,330	1,760	998	215	715
14.....	215	290	202	202	190	275	339	1,540	1,500	820	305	260
15.....	275	260	245	230	190	275	230	1,220	998	715	215	107
16.....	275	245	178	245	190	178	275	820	962	611	926	215
17.....	215	275	165	245	190	165	339	441	750	543	1,590	998
18.....	185	215	190	190	165	275	543	339	1,070	543	1,200	1,890
19.....	290	230	245	245	245	611	645	407	1,300	509	441	1,460
20.....	475	245	215	260	230	339	890	407	926	926	215	785
21.....	339	215	260	215	275	230	715	305	645	645	305	750
22.....	373	245	99	230	202	215	441	339	475	441	260	1,260
23.....	339	215	99	230	215	215	275	290	509	275	215	926
24.....	215	178	145	245	215	202	390	260	645	245	215	611
25.....	215	190	165	305	245	305	407	190	577	260	178	577
26.....	305	230	165	373	190	373	407	215	577	190	145	645
27.....	305	230	165	373	215	275	407	245	645	178	125	407
28.....	305	275	165	275	215	245	424	190	441	260	91	190
29.....	275	290	161	305	-----	275	441	121	305	441	190	260
30.....	260	275	157	339	-----	245	407	125	245	645	80	305
31.....	230	-----	155	275	-----	230	-----	190	-----	680	116	-----

NOTE.—Stage-discharge relation affected by backwater from dam, Nov. 1 to Dec. 22, Jan. 18 to Mar. 18, Apr. 1-19, and May 25 to Sept. 30; discharge estimated from discharge measurements, a study of gage height and precipitation records, and information relative to the dam. Stage-discharge relation affected by ice Dec. 23 to Jan. 17; discharge estimated from observer's notes and a study of precipitation and temperature records.

Monthly discharge of Smoky Hill River near Abilene, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	475	125	239	14,700
November.....	290	178	245	14,600
December.....	339	99	213	13,100
January.....	373	145	233	14,300
February.....	290	165	233	12,900
March.....	611	145	242	14,900
April.....	962	190	419	24,900
May.....	5,610	121	952	58,500
June.....	2,990	145	1,060	63,100
July.....	2,880	178	830	51,000
August.....	1,590	80	378	23,200
September.....	1,890	34	479	28,500
The year.....	5,610	34	461	334,000

SALINE RIVER AT TESCOTT, KANS.

LOCATION.—In SE. $\frac{1}{4}$ sec. 16, T. 12 S., R. 5 W., at highway bridge one-fourth mile below an old dam, half a mile south of Tescott, Ottawa County, half a mile above Dry Creek, 4 miles below Table Rock Creek, and 40 miles above mouth of river.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 3, 1919, to September 30, 1921.

GAGE.—Chain on downstream side of highway bridge at center of span; read by W. A. Seidmore.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and silt; shifting. Bank full stage, 25 feet. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 18.70 feet at 9.30 a. m. September 16 (discharge from extension of curve, 2,910 second-feet); minimum stage, 1.6 feet at 9.30 a. m. October 11 (discharge, 4 second-feet).

1919-1921: Maximum stage recorded, that of 1921; minimum discharge, that of 1921.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Flow is affected by operation of mills at Shady Bend and Lincoln.

ACCURACY.—Stage-discharge relation not permanent; affected by ice for a few days in December and January. Rating curve used fairly well defined from 10 to 1,250 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table and by indirect method for shifting control as explained in footnote to table of daily discharge. Records fair.

Discharge measurements of Saline River at Tescott, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 9	A. K. Gowans	2.14	9.8	May 18	E. L. Williams	3.18	47
Feb. 7	do.	2.93	34	June 21	H. B. Kinnison	3.58	77
Mar. 6	do.	2.96	35	Aug. 9	do.	2.93	40

Daily discharge, in second-feet, of Saline River at Tescott, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5.9	58	16	22	35	12	11	40	12	51	147	5.0
2	8.9	47	16	22	31	12	11	37	14	33	63	5.5
3	7.9	70	29	19	22	16	7	37	23	51	52	6.9
4	8.9	58	16	29	27	19	6	28	22	162	46	9.8
5	5.9	58	42	70	27	35	5.5	37	176	280	46	23
6	5.9	58	42	47	27	29	9	42	260	260	46	8.4
7	5.9	37	37	42	34	9	95	82	290	162	46	7.4
8	7.9	29	37	42	29	16	250	822	260	111	33	6.3
9	10	37	42	64	29	22	192	1,310	280	101	42	6.8
10	6	102	42	64	24	22	144	950	174	101	33	6.3
11	4	95	29	76	22	25	123	500	108	87	29	6.8
12	6	95	37	19	20	25	123	270	87	78	25	6.0
13	6	102	29	19	35	27	102	270	85	75	25	8.2
14	9	82	29	18	31	25	85	168	64	51	51	6.2
15	9	82	29	16	33	16	85	152	55	42	290	2,550
16	19	82	22	14	42	16	137	109	55	42	270	2,520
17	19	82	22	14	31	22	241	73	55	42	111	1,210
18	19	27	37	43	33	22	137	70	55	54	86	894
19	9	27	47	13	31	16	130	102	60	52	36	1,210
20	9	58	37	13	31	20	95	50	60	42	36	990
21	19	52	37	14	22	19	47	50	78	49	32	486
22	16	42	16	19	31	13	28	83	60	49	32	254
23	22	37	13	42	33	13	44	71	60	44	18	105
24	9	16	11	31	26	13	102	59	55	42	32	82
25	19	16	10	31	19	11	42	48	51	38	40	9
26	27	11	9	16	16	11	58	43	75	49	6.6	29
27	37	70	8.5	16	16	7	42	60	46	338	6.6	37
28	37	42	7.5	29	13	11	50	30	33	374	6.6	22
29	37	64	7	31	-----	11	37	31	33	195	5.5	22
30	42	29	7	29	-----	16	42	34	42	264	5.5	27
31	58	-----	22	42	-----	11	-----	30	-----	163	5.0	-----

NOTE.—Stage-discharge relation affected by ice Dec. 23-30, and Jan. 13-21; discharge estimated from observer's notes and a study of precipitation and temperature records. Gage not read Oct. 8, Nov. 21, May 1, 29, June 5, 16-20, 22-24; discharge estimated or interpolated. Discharge determined by indirect method May 22 to Sept. 30.

Monthly discharge of Saline River at Tescott, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	58	4	16.3	1,000
November.....	102	11	55.5	3,300
December.....	47	7	25.3	1,560
January.....	76	13	31.2	1,920
February.....	42	13	27.5	1,530
March.....	35	7	17.5	1,080
April.....	250	5.5	82.7	4,920
May.....	1,310	28	183	11,500
June.....	290	12	90.9	5,410
July.....	374	33	112	6,890
August.....	290	5	54.9	3,380
September.....	2,550	5	352	20,900
The year.....	2,550	4	87.3	63,200

SOUTH FORK OF SOLOMON RIVER AT ALTON, KANS.

LOCATION.—In SW. $\frac{1}{4}$ sec. 12, T. 7 S., R. 15 W., 1,000 feet downstream from remains of old dam and three-fourths mile south of Alton, Osborne County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 31, 1919, to September 30, 1921.

GAGE.—Staff gage painted on downstream cylinder bridge pier on north side of second span from left bank, with low-water section fastened to form work at base of same pier; high-water section reading from 13.0 to 23.0 feet, painted on downstream side of left bridge abutment; read by James K. Thompson.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel, shifting; two channels for low stages. No well-defined control. Bank full stage, 21 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.0 feet June 5 (discharge, 426 second-feet); minimum stage, 0.22 foot September 4, 13 (discharge, 1 second-foot).

1919-1921: Maximum stage recorded, 19.5 feet September 19, 1919 (discharge, 9,340 second-feet); minimum discharge, 1 second-foot August 3, 1920, and September 4, 1921.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Rating curves used fairly well defined below 2,000 second-feet. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records poor.

Discharge measurements of South Fork of Solomon River at Alton, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 11	A. K. Gowans.....	0.76	14	May 19	E. L. Williams.....	0.84	35
Feb. 4	do.....	1.00	48	June 22	H. B. Kinnison.....	.81	30
Mar. 4	do.....	.83	33	Aug. 10	do.....	.43	6.2
Apr. 14	E. L. Williams.....	.86	43				

Daily discharge, in second-feet, of South Fork of Solomon River at Alton, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	13	51	47	45	52	35	27	43	41	39	16	2.0
2.....	13	51	41	45	52	38	29	41	30	41	10	2.0
3.....	13	55	42	45	43	38	29	41	28	38	8	2.6
4.....	13	55	45	45	54	37	29	39	87	34	6	1.2
5.....	12	51	45	43	45	35	30	35	336	78	5	1.5
6.....	13	56	40	43	38	38	35	35	147	153	5	1.5
7.....	13	56	40	42	43	38	35	34	103	183	5	2.0
8.....	13	61	37	41	38	43	38	33	280	103	5	1.8
9.....	13	55	35	41	41	43	38	34	95	47	5	1.8
10.....	14	51	40	40	44	43	35	80	131	50	6	1.5
11.....	9	54	41	40	53	43	37	67	103	41	7.5	1.5
12.....	9	55	41	38	56	39	38	69	84	28	14	1.5
13.....	9	55	41	37	64	35	33	64	69	22	11	3.8
14.....	9	49	41	37	48	35	35	53	67	18	11	25
15.....	13	47	37	35	45	34	47	44	66	16	7	10
16.....	13	48	34	35	44	34	66	41	60	14	11	5.0
17.....	19	47	38	34	44	34	66	38	50	11	13	2.0
18.....	23	41	40	34	43	33	91	34	43	10	28	2.6
19.....	23	41	41	43	41	33	82	34	43	4.7	38	76
20.....	23	41	41	45	39	33	76	33	42	3.8	38	184
21.....	33	42	41	55	39	32	66	33	37	3.5	23	172
22.....	28	48	41	45	41	29	66	32	33	2.6	10	54
23.....	54	48	41	52	41	29	66	29	33	6.0	9.5	34
24.....	62	59	41	54	38	29	60	29	30	7.5	7.5	35
25.....	45	48	42	60	38	33	47	29	29	16	7.5	34
26.....	41	42	42	48	39	34	52	29	26	28	4.7	27
27.....	41	45	43	48	37	34	43	26	25	24	4.4	25
28.....	40	42	45	48	35	26	42	24	22	19	3.2	20
29.....	37	45	45	43	-----	25	41	37	21	31	2.6	16
30.....	34	45	45	48	-----	25	43	76	28	21	2.3	14
31.....	45	-----	45	48	-----	25	-----	54	-----	19	2.0	-----

NOTE.—Stage-discharge relation affected by ice Dec. 17 to Jan. 18. Discharge based on gage heights, observer's notes, and a study of temperature and precipitation records.

Monthly discharge of South Fork of Solomon River at Alton, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	62	9	23.9	1,470
November.....	61	41	49.5	2,950
December.....	47	34	41.2	2,530
January.....	60	34	43.8	2,690
February.....	64	35	44.1	2,450
March.....	43	25	34.3	2,110
April.....	91	27	47.4	2,820
May.....	80	24	41.6	2,560
June.....	336	21	730	4,340
July.....	183	2.6	35.9	2,210
August.....	38	2	10.5	646
September.....	184	1.2	25.3	1,510
The year.....	336	1.2	39.1	28,300

SOLOMON RIVER AT NILES, KANS.

LOCATION.—In NW. $\frac{1}{4}$ sec. 31, T. 12 S., R. 1 W., at highway bridge three-fourths mile west of Niles, Ottawa County, and 7 miles above mouth of river.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 6, 1897, to November 30, 1903, and May 15, 1919, to September 30, 1921.

GAGE.—Chain on downstream handrail of bridge, 65 feet from left abutment; read by Ellsworth Boyle. Wire gage used 1897–1903, set at different datum, spiked to floor of old highway bridge.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and silt, shifting. Bank full stage, 22 feet. No well-defined control. Backwater occurs at station when Smoky Hill River is at flood stage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.1 feet at 7 a. m., May 10 (discharge, 5,150 second-feet); minimum stage, -0.49 foot, September 5 and 15 (discharge, 17 second-feet).

1897-1903; 1919-1921: Maximum stage recorded, 33.8 feet old datum June 3, 1903 (discharge, 10,600 second-feet); minimum discharge 7 second-feet in July and August, 1901.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Flow is affected by operation of mills and power plants upstream.

ACCURACY.—Stage-discharge relation not permanent. Two rating curves used, fairly well defined between 50 and 400 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table and by indirect method for shifting control as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Solomon River at Niles, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 10	A. K. Gowans.....	0.65	104	Apr. 15	E. L. Williams.....	1.23	187
Jan. 28	.....do.....	1.36	170	May 6	.....do.....	.87	138
Feb. 17	.....do.....	.77	110	June 21	H. B. Kinnison.....	1.81	244
Mar. 8	.....do.....	.76	110	Aug. 9	.....do.....	.98	149

Daily discharge, in second-feet, of Solomon River at Niles, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	86	144	174	94	129	106	120	174	145	270	530	66
2.....	70	119	154	106	134	114	120	140	125	145	342	66
3.....	106	144	184	106	134	119	120	150	125	150	282	76
4.....	119	144	144	106	134	124	110	150	736	110	222	36
5.....	114	129	124	106	144	106	140	140	1,290	810	186	18
6.....	106	134	134	110	134	102	140	145	1,760	1,080	198	47
7.....	94	134	144	124	134	102	140	162	2,290	2,030	162	30
8.....	82	144	114	129	119	106	150	162	2,400	1,160	135	43
9.....	110	144	134	129	134	100	470	3,420	938	1,110	145	100
10.....	98	144	129	102	144	120	830	4,700	530	700	120	58
11.....	55	194	134	144	134	115	390	2,250	736	390	105	47
12.....	74	204	144	110	119	120	282	1,760	810	282	100	210
13.....	106	134	129	124	114	130	222	986	646	234	100	110
14.....	110	154	124	134	119	110	174	700	514	222	71	58
15.....	98	144	124	144	119	110	186	530	414	198	428	17
16.....	74	154	129	94	114	120	198	366	342	174	682	58
17.....	110	154	119	102	114	125	354	282	330	162	1,030	85
18.....	134	144	129	106	144	115	282	258	594	125	294	342
19.....	129	119	134	110	124	120	318	234	390	456	246	342
20.....	174	119	119	114	129	95	318	234	270	414	294	234
21.....	154	124	129	124	124	85	246	222	246	210	222	150
22.....	154	134	129	119	129	105	198	210	210	150	162	135
23.....	144	110	129	98	124	115	198	140	222	130	150	115
24.....	129	119	124	154	124	150	210	162	186	115	145	222
25.....	119	124	124	204	134	135	222	198	210	95	125	278
26.....	154	144	114	194	129	115	186	186	258	95	105	246
27.....	154	144	110	184	129	110	150	198	234	90	85	198
28.....	124	154	114	174	110	90	162	174	186	85	71	174
29.....	119	154	114	164	-----	95	186	135	125	258	39	125
30.....	134	154	110	144	-----	115	162	135	150	174	100	130
31.....	154	-----	106	144	-----	135	-----	145	-----	282	76	-----

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Jan. 19, discharge estimated from observer's notes and a study of precipitation and temperature records. Gage heights missing and discharge estimated Nov. 26 to 30 and Dec. 28 and 29. Indirect method for shifting control used Mar. 9 to May 5.

Monthly discharge of Solomon River at Niles, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	174	55	116	7,130
November.....	204	110	142	8,450
December.....	184	106	130	7,990
January.....	204	94	129	7,930
February.....	144	110	128	7,110
March.....	150	85	113	6,950
April.....	830	110	233	13,900
May.....	4,700	135	608	37,400
June.....	2,400	125	580	34,500
July.....	2,030	85	384	23,600
August.....	1,030	39	224	13,800
September.....	342	17	127	7,560
The year.....	4,700	17	243	176,000

NORTH FORK OF SOLOMON RIVER AT KIRWIN, KANS.

LOCATION.—In SW. $\frac{1}{4}$ sec. 34, T. 4 S., R. 16 W., at highway bridge half a mile below mill dam, half a mile south of Kirwin, Phillips County, three-fourths mile below Bow Creek, and $1\frac{1}{2}$ miles above Deer Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 30, 1919, to September 30, 1921.

GAGE.—Chain on downstream handrail of bridge; read by Dan W. Fisk. High water staff gage reading from 14.0 to 27.0 feet, in three sections fastened to trees in the immediate vicinity of the gage; set to same datum as chain gage.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and silt; shifting. No well-defined control; bank full stage, 13 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.7 feet, at 11 a. m. June 2 (discharge, 1,440 second-feet); minimum stage, 2.24 feet at 6 p. m. September 8 (discharge, 1.4 second-feet).

1919–1921: Maximum stage recorded, 22.5 feet September 18, 1919 (discharge, 15,500 second-feet); minimum stage that of 1921.

ICE.—Stage-discharge relation affected by ice.

REGULATION.—Flow is affected by regulation of mill dam half a mile upstream.

ACCURACY.—Stage-discharge relation not permanent; rating curve, fairly well defined below 3,000 second-feet. Gage read to hundredths twice daily.

Daily discharge ascertained by indirect method for shifting control. Records poor.

Discharge measurements of North Fork of Solomon River at Kirwin, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 12	A. K. Gowans.....	3.21	35	May 19	E. L. Williams.....	3.14	36
Feb. 3	do.....	3.14	40	June 22	H. B. Kinnison.....	3.04	34
Mar. 4	do.....	3.10	38	Aug. 10	do.....	2.76	28
Apr. 14	E. L. Williams.....	3.14	43				

Daily discharge, in second-feet, of North Fork of Solomon River at Kirwin, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	26	40	35	18	31	35	34	24	524	477	70	2.6
2	30	26	39	18	43	36	38	27	1,040	226	50	3.4
3	7.6	38	32	18	44	40	24	22	801	84	32	8.6
4	22	38	39	22	44	38	40	29	908	75	26	3.6
5	31	37	27	22	48	34	31	31	294	73	26	18
6	31	37	37	22	37	36	40	27	176	48	26	6.4
7	27	33	37	22	22	40	37	34	178	55	22	3.8
8	27	39	36	22	28	39	70	26	188	45	22	1.7
9	33	40	27	22	42	33	48	232	110	51	9.8	33
10	6	36	36	23	42	36	36	375	90	40	42	2.0
11	28	28	39	23	48	39	25	95	76	40	38	2.4
12	31	33	32	23	43	40	45	70	68	32	24	14
13	28	28	36	23	35	34	33	56	57	37	40	3.4
14	38	24	20	23	40	44	35	40	50	30	22	10
15	33	14	12	22	33	35	34	46	50	25	72	9.2
16	122	12	14	23	38	44	50	41	40	26	79	37
17	29	20	19	23	43	43	150	30	40	24	31	42
18	28	31	15	46	32	39	102	31	45	28	27	4.8
19	29	34	26	52	26	43	68	45	39	13	19	32
20	29	34	12	62	27	30	60	32	37	46	16	84
21	45	32	16	51	20	31	50	34	39	36	16	69
22	39	37	16	45	37	40	42	27	36	36	32	50
23	50	37	16	42	32	41	42	27	34	27	24	36
24	49	32	17	50	26	35	35	27	32	18	35	28
25	34	32	17	45	39	40	35	26	26	356	32	13
26	34	26	17	42	37	35	38	31	26	336	8.6	12
27	29	42	17	29	26	31	32	30	30	144	26	20
28	34	32	17	48	32	36	29	18	28	82	8.6	8
29	30	36	17	54	45	20	21	34	66	4.4	34	34
30	37	23	17	26	43	22	182	36	50	13	34	34
31	37	18	28	28	32	32	645	230	12	12	-----	-----

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Jan. 16; discharge estimated from observer's notes and a study of temperature and precipitation records.

Monthly discharge of North Fork of Solomon River at Kirwin, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	122	6	34.0	2,090
November	42	12	31.7	1,890
December	39	12	24.4	1,500
January	62	18	31.9	1,960
February	48	20	35.5	1,970
March	45	30	37.6	2,310
April	150	20	14.8	2,670
May	645	18	76.8	4,720
June	1,040	26	171	10,200
July	477	13	92.1	5,660
August	79	4.4	29.2	1,800
September	84	1.7	20.9	1,240
The year	1,040	1.7	52.5	38,000

BIG BLUE RIVER AT HULL, KANS.

LOCATION.—In NW $\frac{1}{4}$ sec. 3, T. 2 S., R. 7 E., at highway bridge one-fourth mile west of Hull, Marshall County, 4 miles below Elk Creek and 2 and 3 miles, respectively, above Deer and Horseshoe creeks.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 24, 1919, to September 30, 1921.

GAGE.—Slightly inclined staff gage, reading from 2.0 feet to 26.1 feet, fastened to masonry pier on right bank. A high water staff gage, reading from 26.0 feet to 32.0 feet, is spiked to an elm tree 75 feet west of gage and 40 feet north of highway. Gage read by James Pribyl.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed is gravel, fairly permanent. Control for low stages at rapids half a mile below. Bank full stage, 22 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 17.5 feet at 8 p. m. July 4 (discharge, 13,200 second-feet); minimum stage, 2.5 feet at 7 a. m. October 2 (discharge, 112 second-feet).

1919-1921: Maximum stage recorded, that of 1921; minimum stage, 2.2 feet, September 27, 1920 (discharge, 85 second-feet). In May, 1903, a stage equivalent to 31.7 feet on the gage was established by observer.

ICE.—Stage-discharge relation seriously affected by ice.

REGULATION.—Flow affected by operation of power plants upstream.

ACCURACY.—Stage-discharge relation permanent, except when affected by ice in December and January. Rating curve well defined between 200 and 3,000 second-feet. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as explained in footnote to table of daily discharge. Records good.

Discharge measurements of Big Blue River at Hull, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 21	A. K. Gowans	4.36	376	May 11	E. L. Williams	7.16	1,610
Jan. 26	do	3.73	243	June 23	H. B. Kinnison	3.60	254
Mar. 2	do	3.75	276	Aug. 11	do	4.78	477
May 11	E. L. Williams	7.69	1,980				

Daily discharge, in second-feet, of Big Blue River at Hull, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	160	248	455	172	282	300	282	248	220	160	380	300
2	140	234	405	160	234	248	300	300	1,160	220	380	300
3	140	340	340	160	282	264	282	282	1,740	220	360	264
4	140	380	282	172	300	264	234	220	1,050	4,690	360	264
5	172	405	234	196	300	234	300	208	855	4,490	405	208
6	208	455	248	208	300	234	320	248	430	2,060	405	264
7	234	455	282	208	264	264	264	234	485	1,210	340	208
8	234	430	264	220	220	282	320	340	485	545	380	248
9	234	380	300	220	220	282	264	545	485	545	515	234
10	248	360	300	220	264	300	264	1,490	545	455	725	150
11	234	340	300	220	300	300	234	1,610	1,200	405	650	264
12	208	300	300	220	220	282	264	515	800	405	515	208
13	196	264	300	220	220	264	234	485	600	380	430	264
14	172	300	264	234	234	248	234	405	500	615	405	282
15	140	282	248	234	248	234	264	380	500	855	360	545
16	160	234	234	234	248	264	282	340	1,200	650	380	340
17	234	282	220	234	264	264	340	282	10,000	485	430	615
18	264	300	220	234	300	264	340	300	5,800	3,300	360	855
19	430	282	234	264	340	282	360	300	1,000	3,060	340	855
20	360	264	264	264	380	300	360	300	500	1,550	300	2,000
21	340	264	264	264	430	282	340	248	300	810	300	3,730
22	300	300	264	300	455	264	320	220	220	765	300	2,000
23	300	300	248	300	380	264	300	234	220	685	320	810
24	282	300	220	300	300	264	282	234	208	650	380	650
25	160	300	208	300	282	264	264	282	220	580	340	545
26	172	264	196	320	282	264	234	405	234	545	282	485
27	184	300	196	380	360	300	234	340	400	485	320	340
28	208	248	184	300	300	282	300	300	450	430	264	340
29	234	264	172	300	-----	300	282	380	350	360	234	360
30	264	380	172	300	-----	300	264	234	200	380	282	340
31	300	-----	172	300	-----	264	-----	208	-----	380	300	-----

NOTE.—Stage-discharge relation affected by ice Dec. 21 to Jan. 11; discharge estimated from observer's notes and a study of precipitation and temperature records. Gage heights missing and discharge estimated from flow of Big Blue River at Randolph for June 11-21 and 27-30.

Monthly discharge of Big Blue River at Hull, Kans., for the year ending Sept. 30, 1921

Month	• Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October.....	430	140	227	14, 000
November.....	455	234	315	18, 700
December.....	455	172	258	15, 900
January.....	380	160	247	15, 200
February.....	455	220	293	16, 300
March.....	300	234	272	16, 700
April.....	360	234	258	17, 000
May.....	1, 490	208	391	24, 000
June.....		208	1, 080	64, 300
July.....	4, 690	160	1, 040	64, 000
August.....	725	234	379	23, 800
September.....	3, 730	150	609	36, 200
The year.....		140	450	326, 000

BIG BLUE RIVER AT RANDOLPH, KANS.²

LOCATION.—In SW. $\frac{1}{4}$ sec. 12, T. 7 S., R. 6 E., at highway bridge half a mile above Fancy Creek, 15 miles below Black Vermilion River, 32 miles above mouth of river, and three-fourths of a mile east of Randolph, Riley County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 17, 1918, to September 30, 1921.

GAGE.—Chain on upstream handrail of bridge, 64 feet east of right bank pier; read by Mrs. Ollie Webb. A vertical staff gage, from 6.0 to 30.9 feet, on right bank of pier, and a vertical staff from 29.0 to 33.5 feet, painted on concrete foundation for old oil tank on right bank 500 feet west of chain gage, are used during floods.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; shifting. No well-defined control. Bank full stage, 20 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 21.52 feet, at 6.45 a. m. July 2 (discharge, by extension of rating curve, 22,000 second-feet); minimum stage, 2.20 feet at 7.40 a. m. September 12 (discharge, by extension of rating curve, 224 second-feet).

1918-1921: Maximum discharge, 22,300 second-feet, June 11, 1919; minimum discharge that of 1921. On May 31, 1903, a stage equivalent to 31.7 feet on the gage was established by Mr. John Nord, Randolph, Kans.

ICE.—Stage-discharge relation affected by ice for short periods during winter.

REGULATION.—Flow is affected by operation of power plant at Blue Rapids.

ACCURACY.—Stage-discharge relation changed during high water in May. Rating curves used before and after May 9 are fairly well defined between 400 and 6,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except as shown in footnote to table of daily discharge. Records good.

² Known locally as "Blue River."

Discharge measurements of Big Blue River at Randolph, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
Oct. 21	A. K. Gowan	<i>Feet</i> 3.60	<i>Sec.-ft.</i> 679	May 10	E. L. Williams	<i>Feet</i> 6.22	<i>Sec.-ft.</i> 2,290
Jan. 27	do	3.41	581	June 23	H. B. Kinnison	3.62	628
Mar. 1	do	3.10	446	Aug. 11	do	3.33	480
May 10	E. L. Williams	6.32	2,380				

Daily discharge, in second-feet, of Big Blue River at Randolph, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug	Sept.
1	410	505	505	505	470	540	470	580	432	432	1,970	368
2	410	505	505	505	505	470	540	505	512	19,400	2,120	368
3	385	505	505	540	470	505	440	540	3,900	9,680	1,690	398
4	360	505	505	540	505	404	385	505	1,200	6,360	1,690	276
5	385	620	505	580	505	505	470	440	1,340	17,000	1,270	368
6	410	750	470	705	505	470	505	440	1,130	12,600	890	368
7	360	750	505	705	470	470	470	470	1,070	7,980	770	316
8	385	705	505	660	505	470	470	2,170	1,410	4,330	610	340
9	410	620	505	660	440	470	540	3,720	1,340	2,690	512	294
10	410	660	505	620	440	470	505	3,140	1,690	1,550	512	316
11	410	620	505	620	540	440	440	3,600	1,970	1,130	470	340
12	385	620	505	580	505	470	505	3,900	1,010	1,010	610	260
13	385	580	505	580	505	470	470	1,480	1,010	1,200	1,830	294
14	410	540	505	580	440	470	470	1,010	830	950	1,410	316
15	385	505	505	540	505	470	505	770	715	1,070	830	368
16	440	540	505	540	470	440	505	770	2,040	1,340	660	660
17	440	540	470	540	580	470	540	660	17,900	830	470	610
18	660	505	470	505	750	470	505	660	9,680	3,230	960	770
19	620	540	470	505	750	440	660	560	2,040	8,370	560	1,070
20	705	505	505	505	660	470	800	512	950	6,960	715	1,130
21	660	505	505	580	620	440	750	470	830	4,220	512	2,280
22	620	470	470	750	620	470	660	560	660	1,970	1,130	3,700
23	580	470	505	620	580	440	540	432	610	1,480	1,010	2,360
24	470	505	540	580	505	440	470	512	560	1,200	660	1,410
25	505	505	540	580	505	440	505	432	560	950	512	1,070
26	540	470	470	580	505	440	505	830	610	770	432	830
27	540	505	470	540	505	470	505	770	1,010	715	432	610
28	505	540	470	505	470	620	470	660	610	770	432	512
29	505	540	470	540	580	505	505	560	610	770	368	512
30	470	505	505	505	505	470	505	470	512	830	398	470
31	470	505	505	505	505	505	432	432	1,130	340	340	432

NOTE.—Stage-discharge relation affected by ice Dec. 22 to Jan. 19; discharge estimated from observer's notes, gage height, and precipitation and temperature records.

Monthly discharge of Big Blue River at Randolph, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	705	360	472	29,000
November	750	470	554	33,000
December	540	470	497	30,600
January	750	505	574	35,300
February	750	440	530	29,400
March	620	440	475	29,200
April	800	385	520	30,900
May	3,900	432	1,050	64,600
June	17,900	432	1,980	118,000
July	19,400	432	3,960	243,000
August	2,120	340	863	53,100
September	3,700	260	766	45,600
The year	19,400	260	1,025	742,000

GRAND RIVER BASIN

GRAND RIVER NEAR GALLATIN, MO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 16, T. 59 N., R. 27 W., at Chicago, Rock Island & Pacific Railway bridge 1,000 feet below highway bridge, 5 miles above Honey Creek, 14 miles above Big Muddy Creek, and $2\frac{1}{2}$ miles north of Gallatin, Daviess County.

DRAINAGE AREA.—2,250 square miles (measured on base map of Missouri and Iowa).

RECORDS AVAILABLE.—June 30 to September 30, 1921.

GAGE.—United States Weather Bureau chain gage on downstream guardrail of railroad bridge; read by Ralph Lukehart.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and silt; shifting. No well-defined control. Bank full stage, 20 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record 11.80 feet at 7.30 a. m. September 13 (discharge, 3,860 second-feet); minimum stage, 2.08 feet August 31 and September 1 (discharge, 27 second-feet). The United States Weather Bureau has published a maximum stage of 39.3 feet for the flood of 1909.

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 50 and 900 second-feet and extended above and below these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Grand River near Gallatin, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
June 24	Reginald Waldo.....	<i>Feet</i> 3.08	<i>Sec.-ft.</i> 141	Aug. 13	E. L. Williams.....	<i>Feet</i> 2.60	<i>Sec.-ft.</i> 76.9
July 9	do.....	2.55	62.3	Sept. 22	do.....	5.33	708

Daily discharge, in second-feet, of Grand River near Gallatin, Mo., for the period June 30 to Sept. 30, 1921

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1.....		254	44	27	16.....		214	204	630
2.....		234	406	34	17.....		120	332	458
3.....		150	1,350	264	18.....		75	1,050	264
4.....		134	854	630	19.....		62	1,400	214
5.....		121	332	113	20.....		53	298	168
6.....		98	264	60	21.....		46	204	690
7.....		88	195	44	22.....		42	159	600
8.....		68	121	58	23.....		63	99	297
9.....		63	83	52	24.....		60	69	3,040
10.....		63	70	55	25.....		51	76	2,300
11.....		72	60	55	26.....		45	57	1,090
12.....		62	64	1,400	27.....		37	43	332
13.....		54	71	3,200	28.....		36	38	186
14.....		52	298	1,050	29.....		40	33	134
15.....		332	722	854	30.....	214	41	29	101
					31.....		49	27	-----

Monthly discharge of Grand River near Gallatin, Mo., for the period July 1 to Sept. 30, 1921

[Drainage area, 2,250 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
July.....	332	36	92.9	0.041	0.05
August.....	1,400	27	292	.130	.15
September.....	3,200	27	613	.272	.30

THOMPSON RIVER AT DAVIS CITY, IOWA

LOCATION.—In sec. 35, T. 68 N., R. 26 W., at highway bridge at Davis City, Decatur County, 22 miles below mouth of Long Creek.

DRAINAGE AREA.—670 square miles (revised measurement on map compiled by United States Geological Survey; scale, 1: 500,000).

RECORDS AVAILABLE.—May 14, 1918, to September 30, 1921.

GAGE.—Chain attached to downstream handrail of bridge; read by W. L. Severe.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading. Flood stages from railroad bridge 500 feet below gage.

CHANNEL AND CONTROL.—Left bank is overflowed during floods. Control varies with the stage. At low water the rock-fill dam at Chicago, Burlington & Quincy Railroad pumping station 300 feet below gage forms control. High stages controlled by stretch of natural channel. Channel composed of gravel. Banks brushy. Control fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.10 feet at 12.30 p. m. May 11 (discharge, 4,940 second-feet); minimum discharge, 9 second-feet May 29, 30.

1918-1921: Maximum stage recorded, 18.52 feet March 24, 1919 (discharge, 12,500 second-feet). A stage of 22.8 feet referred to present datum occurred on August 8, 1885 (discharge, approximately 17,600 second-feet). Minimum discharge, 1 second-foot September 18-24, 27-29, and October 15 16, 1918.

ICE.—Stage-discharge relation affected by ice.

ACCURACY.—Stage-discharge relation permanent except when affected by ice in December, January, and February. Rating curves used are well defined. Gage read to hundredths once daily and twice daily during periods of rapidly changing stage. Daily discharge ascertained by applying daily gage height to rating table, except for winter period December 20 to February 13 when stage-discharge relation was affected by ice; discharge was computed by use of observer's notes and weather records. Records good. Winter flow fair.

Discharge measurements of Thompson River at Davis City, Iowa, during the year ending Sept. 30, 1921

[Made by E. D. Burchard]

Date	Gage height	Dis- charge	Date	Gage height	Dis- charge
	<i>Feet</i>	<i>Sec.-ft.</i>		<i>Feet</i>	<i>Sec.-ft.</i>
Nov. 17.....	2.24	25.7	May 13.....	4.13	567
May 11.....	14.06	4,920	July 22.....	2.10	16.8
May 13.....	4.30	652	Sept. 20.....	2.67	94

Daily discharge, in second-feet, of Thompson River at Davis City, Iowa, for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	30	25	40			148	78	932	870	54	11	13
2	30	34	46			148	70	1,150	4,300	70	96	16
3	30	40	87			160	70	394	3,600	40	238	16
4	30	70	78			160	61	116	460	40	96	18
5	25	46	78			160	61	116	328	34	34	34
6	25	34	70		25	160	46	106	197	54	25	46
7	22	25	54			160	46	137	148	96	22	18
8	18	25	54			160	54	160	116	30	22	16
9	13	34	54			148	61	172	312	18	18	46
10	13	34	46			126	61	1,080	296	18	22	160
11	13	34	40			116	46	4,460	266	18	16	1,490
12	13	40	40		240	116	46	1,610	238	18	13	1,020
13	16	40	40		270	137	40	590	160	18	13	770
14	18	40	30		296	552	46	266	126	18	13	535
15	61	40	30		411	296	160	252	184	22	18	160
16	54	30	30	20	498	137	462	224	435	22	116	30
17	46	30	30		377	126	609	197	210	22	46	106
18	61	30	25		281	116	1,020	172	137	22	18	160
19	78	25	25		160	137	2,640	160	54	18	22	126
20	61	25			126	148	1,840	137	61	18	46	106
21	46	25			116	106	534	116	61	18	22	96
22	40	25			116	61	296	96	46	16	22	126
23	34	34			126	54	210	78	61	13	22	78
24	34	40			116	46	210	70	54	13	25	61
25	34	46	25		126	61	184	61	46	13	30	54
26	30	46			137	78	116	61	46	11	25	40
27	30	54			137	78	78	70	46	13	22	30
28	25	46			137	78	78	13	34	16	16	22
29	25	34				78	61	9	30	16	13	22
30	25	34				78	96	9	46	11	12	18
31	25					78		328		11	11	

Monthly discharge of Thompson River at Davis City, Iowa, for the year ending Sept. 30, 1921

[Drainage area, 670 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
October	78	13	32.4	0.048	0.06
November	70	25	36.2	.054	.06
December	87		38.6	.058	.07
January			20	.030	.04
February	498		141	.210	.22
March	552	46	136	.203	.23
April	2,640	40	313	.467	.52
May	4,460	9	430	.642	.74
June	4,300	30	432	.645	.72
July	96	11	25.8	.039	.04
August	238	11	36.3	.054	.06
September	1,490	13	181	.270	.30
The year	4,460		151	.225	3.06

THOMPSON RIVER NEAR HICKORY, MO.

LOCATION.—In SW. $\frac{1}{4}$ sec. 17, T. 60 N., R. 24 W., at Chicago, Rock Island & Pacific Railway bridge 800 feet below highway bridge, 1 mile below Wolf Creek, $1\frac{1}{2}$ miles above Muddy Creek, 3 miles above Hickory Creek, 10 miles below Weldon River, and 2 miles east of Hickory, Grundy County.

DRAINAGE AREA.—1,700 square miles (measured on base map of Missouri and United States soil survey map).

RECORDS AVAILABLE.—June 25 to September 30, 1921.

GAGE.—Chain on upstream guardrail of railroad bridge; read by William Kemp.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and silt; shifting. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 11.20 feet at 6 p. m. July 1 (discharge, 1,910 second-feet); minimum stage, 1.91 feet at 6 p. m. September 7 (discharge, 57 second-feet).

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Thompson River near Hickory, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>
June 25	Waldo and Williams	4.44	488
Aug. 13	E. L. Williams	2.16	68.5
Sept. 23	do.	3.97	206

Daily discharge, in second-feet, of Thompson River near Hickory, Mo., for the period June 25 to Sept. 30, 1921

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1.-----		1,350	79	69	16.-----		90	69	523
2.-----		1,630	140	65	17.-----		108	849	336
3.-----		489	625	61	18.-----		102	1,140	168
4.-----		208	370	74	19.-----		90	285	319
5.-----		168	140	69	20.-----		84	140	253
6.-----		140	124	59	21.-----		79	96	238
7.-----		132	124	57	22.-----		96	74	168
8.-----		116	102	90	23.-----		96	69	132
9.-----		116	102	74	24.-----		84	65	387
10.-----		124	79	65	25.-----	285	74	74	285
11.-----		102	69	124	26.-----	294	69	148	193
12.-----		96	69	102	27.-----	302	69	148	178
13.-----		90	69	421	28.-----	310	79	90	124
14.-----		90	69	935	29.-----	319	74	90	96
15.-----		96	74	676	30.-----	523	69	79	79
					31.-----		79	74	-----

NOTE.—Discharge interpolated June 26-28.

Monthly discharge of Thompson River near Hickory, Mo., for the period June 25 to Sept. 30, 1921

[Drainage area, 1,700 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
June 25-30	523	285	339	0.199	0.04
July	1,630	69	203	.119	.14
August	1,140	65	185	.109	.13
September	935	57	214	.126	.14

MEDICINE CREEK NEAR GALT, MO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 27, T. 62 N., R. 22 W., at Omaha, Quincy, & Kansas City Railroad bridge, 1 mile above mouth of West Medicine Creek and $1\frac{1}{2}$ miles east of Galt, Grundy County.

DRAINAGE AREA.—225 square miles (measured on United States soil survey maps).

RECORDS AVAILABLE.—July 6 to September 30, 1921.

GAGE.—Chain bolted to upstream guardrail of bridge; read by C. R. Rusk.

DISCHARGE MEASUREMENTS.—Made from downstream side of highway bridge 1,000 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of silt and sand; shifting. Driftwood obstructions are characteristic of the stream. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 9.10 feet at 8.10 a. m., August 19 (discharge, 830 second-feet); minimum stage, 0.14 foot July 29, 30 (discharge, 2 second-feet).

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined from 10 to 800 second-feet. Gage read to hundredths once daily except Sundays. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Medicine Creek near Galt, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge	Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
June 29	Waldo and Williams	2.34	102	Sept. 23	E. L. Williams	1.33	46.6
July 6	Reginald Waldo	.76	23	24	do	2.94	143
Aug. 12	E. L. Williams	.54	12.6				

Daily discharge, in second-feet, of Medicine Creek near Galt, Mo., for the period July 6 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1		2	6	11	6	22	60	21	4	42	154
2		71	73	12	6	11	91	22	3	36	154
3		204	42	13	7	10	38	23	3	26	54
4		392	29	14	10	44	74	24	2	22	146
5		82	9	15	5	77	36	25	2	18	130
6	22	42	6	16	6	469	32	26	3	14	186
7	18	212	4	17	6	436	19	27	3	14	268
8	14	382	3	18	6	800	14	28	3	22	82
9	13	106	3	19	4	830	8	29	2	17	40
10	10	34	21	20	4	88	27	30	2	14	23
								31	2	8	

NOTE.—No gage readings July 10, 17, 24, 31; Aug. 7, 14, 24; Sept. 11, 18; discharge interpolated.

Monthly discharge of Medicine Creek near Galt, Mo., for the period July 6 to Sept. 30, 1921

[Drainage area, 225 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
July 6-31	22	2	6.38	0.028	0.03
August	830	2	147	.653	.75
September	258	3	60.7	.270	.30

LOCUST CREEK NEAR MILAN, MO.

LOCATION.—In SW. $\frac{1}{4}$ sec. 8, T. 62 N., R. 20 W., at Booth highway bridge, 14 miles above East Locust Creek, 22 miles above West Locust Creek, and $3\frac{1}{2}$ miles southwest of Milan, Sullivan County.

DRAINAGE AREA.—225 square miles (measured on United States soil survey maps).

RECORDS AVAILABLE.—July 2 to September 30, 1921.

GAGE.—Chain bolted to upstream handrail of highway bridge; read by S. B. Allen.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and silt; practically permanent. Low-water control is a rock and gravel riffle 75 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 9.85 feet at 6 p. m. August 17 (discharge, 1,000 second-feet); minimum stage, 1.00 foot July 25 (discharge, 1.0 second-foot).

REGULATION.—None

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 5 and 1,200 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Locust Creek near Milan, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
June 28	Reginald Waldo	2.22	40.7	Sept. 23	E. L. Williams	4.38	229
July 2	do	2.08	33.0	23	do	4.39	200
Aug. 12	E. L. Williams	1.49	7.49	24	do	9.83	997

Daily discharge, in second-feet, of Locust Creek near Milan, Mo., for the period July 2 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.		1	4	11.	5	8	376	21.	2	58	487
2.	34	217	62	12.	4	5	114	22.	2	34	318
3.	18	622	126	13.	3	10	71	23.	2	17	217
4.	79	161	22	14.	24	58	34	24.	2	14	922
5.	241	46	15	15.	4	161	28	25.	1	10	865
6.	94	102	6	16.	5	269	21	26.	2	7	237
7.	49	94	10	17.	4	850	30	27.	2	6	114
8.	20	46	8	18.	2	690	22	28.	2	5	72
9.	9	20	6	19.	2	110	84	29.	2	4	40
10.	7	12	14	20.	2	40	68	30.	3	4	28
								31.	2	4	

Monthly discharge of Locust Creek near Milan, Mo., for the period July 2 to Sept 30, 1921

[Drainage area, 225 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
July 2-31	241	1	20.9	0.093	0.10
August	850	1	119	.529	.61
September	922	4	148	.658	.73

CHARITON RIVER BASIN

CHARITON RIVER AT ELMER, MO.

LOCATION.—In SW. $\frac{1}{4}$ sec. 2, T. 59 N., R. 16 W., at Atchison, Topeka & Santa Fe Railway bridge three-fourths mile southwest of Elmer, Macon County, 1 mile below Walnut Creek, 3 miles below Cottonwood Creek, $3\frac{1}{2}$ miles above Rock Creek, and 5 miles above Turkey Creek.

DRAINAGE AREA.—1,660 square miles (measured on base map of Missouri and Iowa; scale, 1:500,000).

RECORDS AVAILABLE.—July 7 to September 30, 1921.

GAGE.—Chain bolted to lower chord on downstream side of bridge; read by Pearl F. Wigal.

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

CHANNEL AND CONTROL.—Bed composed of hardpan and silt. No well-defined control; stage controlled by a stretch of channel below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 16.66 feet at 7.20 a. m. September 25 (discharge, 5,200 second-feet); minimum stage, 0.24 foot at 9 a. m. September 4 (discharge, 63 second-feet).

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 200 and 3,500 second-feet, extended above and below these limits. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Chariton River at Elmer, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
June 27	Waldo and Williams...	<i>Feet</i> 9.09	<i>Sec.-ft.</i> 2,100	July 7	Reginald Waldo.....	<i>Feet</i> 3.44	<i>Sec.-ft.</i> 543
27	Williams and Waldo...	11.20	2,820	Aug. 11	E. L. Williams.....	2.04	275

Daily discharge, in second-feet, of Chariton River at Elmer, Mo., for the period July 7 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		72	72	11.....	154	285	240	21.....	72	226	1,940
2.....		1,310	72	12.....	131	212	1,580	22.....	72	370	2,640
3.....		2,720	72	13.....	121	148	2,000	23.....	68	300	3,360
4.....		2,400	64	14.....	106	116	2,000	24.....	72	300	4,960
5.....		960	101	15.....	111	111	1,880	25.....	68	212	5,200
6.....		604	106	16.....	106	472	2,540	26.....	68	148	4,930
7.....	604	494	76	17.....	101	1,640	3,000	27.....	72	126	4,060
8.....	333	860	101	18.....	86	2,540	3,280	28.....	81	142	3,170
9.....	226	494	101	19.....	86	960	3,280	29.....	91	131	2,440
10.....	198	351	81	20.....	76	333	2,470	30.....	96	96	1,280
								31.....	86	81	

Monthly discharge of Chariton River at Elmer, Mo., for the period July 7: Sept. 30, 1921

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
July 7-31.....	604	68	131	0.079	0.07
August.....	2,720	72	620	.373	.43
September.....	5,200	64	1,900	1.14	1.27

OSAGE (MARAIS DES CYGNES) RIVER BASIN

OSAGE RIVER: NEAR OTTAWA, KANS.

LOCATION.—In NW. $\frac{1}{4}$ sec. 6, T. 17 S., R. 20 E., at highway bridge on East Seventh Street, $1\frac{1}{2}$ miles southeast of Ottawa, Franklin County, three-fourths mile below Shunk Creek, $1\frac{3}{4}$ miles below old dam west of Main Street highway bridge, $2\frac{3}{4}$ miles below Eightmile Creek, and $3\frac{1}{4}$ miles below waterworks dam of Ottawa.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 27, 1918, to September 30, 1921. Stream-flow measuring station formerly located at Main Street bridge at Ottawa, August 26, 1902, to October 31, 1905.

GAGE.—Stevens water-stage recorder on right bank, 100 feet upstream from high, way bridge, inspected by J. M. Lewis.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of shale; permanent. One channel except at extremely high stages when river overflows both banks. Channel straight for a considerable distance upstream and downstream from gage with steep, heavily wooded banks except in vicinity of gage. Bank-full stage, 27 feet. Point of zero flow, about gage height 1.15 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 26.6 feet at 10 p. m. August 11 (discharge, 12,000 second-feet); minimum stage, from water-stage recorder, 1.45 feet July 28 (discharge, 12 second-feet).

1918-1921: Maximum stage recorded that of 1921; minimum discharge no flow June 27, 28, 1920. Highest known stage approximately 38 feet referenced by local residents during flood of July, 1909.

ICE.—Stage-discharge relation not seriously affected by ice.

REGULATION.—Low-water flow is regulated by dams upstream.

DIVERSIONS.—The natural low-water flow of the river is stored at the waterworks dam $3\frac{1}{2}$ miles upstream for water supply to city of Ottawa. A low temporary dam at Sheldon's Bridge, 4 miles west of Ottawa, holds an auxiliary supply during droughts. A new permanent storage dam $3\frac{1}{2}$ miles upstream from the city's present dam is now under construction; it is designed to increase the available storage for Ottawa in the event of future droughts.

ACCURACY.—Stage-discharge relation permanent; affected by ice for short period. Rating curve well defined below 13,000 second-feet. Water-stage recorder checked weekly by observer, reading inside and outside staff gages to hundredths. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying mean daily gage height obtained from recorder graph by inspection and planimeter to rating table and by averaging hourly discharges. Records excellent.

¹ Called "Osage River" in accordance with decision of United States Geographic Board, dated Aug. 10, 1897. The name "Marais des Cygnes River" was adopted by the Kansas State legislature of 1919 (Session laws of 1919, ch. 322, p. 449).

Discharge measurements of Osage River near Ottawa, Kans., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
		<i>Feet</i>	<i>Sec.-ft.</i>			<i>Feet</i>	<i>Sec.-ft.</i>
Oct. 4	A. K. Gowans	1.69	37	June 14	Williams and Kinnison	3.24	297
Jan. 14	do	2.20	84	Aug. 2	H. B. Kinnison	6.34	1,440
Mar. 17	do	2.60	184	Sept. 28	do	1.82	49

a Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Osage River near Ottawa, Kans., for the year ending Sept. 30, 1921

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	63	84	77	139	323	84	264	253	491	253	15	44
2	50	91	99	157	287	77	223	223	157	184	1,040	56
3	44	99	107	148	264	70	203	193	99	139	311	63
4	38	84	99	157	253	77	184	166	84	184	522	44
5	38	77	91	139	253	63	166	148	70	139	690	38
6	32	63	84	139	233	63	157	131	56	184	148	32
7	27	63	84	131	213	77	139	243	115	123	70	27
8	27	115	77	131	203	1,470	139	3,220	1,550	91	50	21
9	27	131	70	131	184	3,840	139	7,700	7,270	63	38	21
10	21	115	63	123	184	1,470	157	10,900	8,870	50	91	21
11	16	99	63	115	175	522	131	7,820	3,600	44	9,840	21
12	16	77	63	99	166	362	50	2,260	764	38	9,730	38
13	16	63	63	99	157	299	131	880	461	38	2,300	50
14	44	56	56	84	148	275	139	690	311	63	960	44
15	193	56	70	77	139	223	193	491	253	44	403	107
16	375	56	99	84	123	193	690	403	802	27	403	63
17	157	50	115	77	115	175	920	336	403	27	6,260	32
18	84	50	123	84	107	157	586	311	233	157	8,370	38
19	63	50	107	84	99	148	461	233	166	99	1,860	77
20	50	50	99	91	91	148	349	131	131	38	461	311
21	50	50	213	131	84	375	275	175	107	27	275	403
22	63	50	1,910	228	91	1,000	223	148	99	27	203	362
23	131	50	1,250	157	99	690	193	131	184	21	157	166
24	115	44	375	654	99	491	166	115	275	16	123	203
25	139	50	336	2,670	99	403	880	99	764	15	99	362
26	243	50	243	2,620	91	1,000	1,160	115	960	14	84	123
27	275	50	193	960	91	960	461	311	1,000	14	70	70
28	193	50	166	522	91	690	375	213	3,170	77	63	56
29	139	56	139	461	-----	431	299	131	1,290	233	63	44
30	107	70	123	461	-----	403	287	184	403	213	56	32
31	91	-----	123	375	-----	336	-----	1,000	-----	21	50	-----

NOTE.—Stage-discharge relation affected by ice Dec. 26 to Jan 18; discharge estimated from observer's notes and a study of precipitation and temperature records.

Monthly discharge of Osage River near Ottawa, Kans., for the year ending Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
October	375	16	94.4	5,800
November	131	44	68.3	4,060
December	1,910	56	219	13,500
January	2,670	77	372	22,900
February	323	84	159	8,830
March	3,840	63	535	32,900
April	1,160	50	325	19,300
May	10,900	99	1,270	78,100
June	8,870	56	1,140	67,800
July	253	14	85.9	5,280
August	9,840	15	1,450	89,200
September	403	21	99.0	5,890
The year	10,900	14	488	354,000

OSAGE RIVER AT TRADING POST, KANS.

LOCATION.—In SE. $\frac{1}{4}$ sec. 5, T. 21 S., R. 25 E., at highway bridge one-fourth mile south of Trading Post, Linn County, 1 mile above Big Sugar Creek, 3 miles below Sugar Creek, and 4 miles west of Kansas-Missouri State line.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 4 to September 30, 1921.

GAGE.—Chain on upstream handrail of center span of highway bridge; read by J. Van Hercke.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed is composed of rock, gravel, and silt; permanent. Bank-full stage, about 24 feet. Control is flat solid rock outcropping 400 feet below gage, permanent.

EXTREMES OF STAGE.—Maximum stage recorded during period of record, 25.2 feet at 4.30 p. m. August 14; minimum stage, 1.72 feet at 5.40 p. m. August 10.

REGULATION.—None.

ACCURACY.—Gage read to hundredths twice daily. Rating curve not developed.

Discharge measurements of Osage River at Trading Post, Kans., during the year ending Sept. 30, 1921

[Made by H. B. Kinnison]

Date	Gage height	Dis-charge	Date	Gage height	Dis-charge	Date	Gage height	Dis-charge
June 16.....	2.47	503	Aug. 3.....	3.68	1,530	Aug. 4.....	3.48	
Aug. 2.....	1.67	102	3.....	4.73	2,900	Sept. 30.....	2.76	1,270 680

Daily gage height, in feet, of Osage River at Trading Post, Kans., for the period Aug. 4 to Sept. 30, 1921

Day	Aug.	Sept.	Day	Aug.	Sept.	Day	Aug.	Sept.
1.....		1.89	11.....	14.1	2.45	21.....	3.6	7.3
2.....		8.0	12.....	22.0	6.6	22.....	2.95	6.6
3.....		21.5	13.....	23.5	17.8	23.....	2.70	4.0
4.....	3.3	21.7	14.....	25.1	24.0	24.....	2.50	3.2
5.....	3.2	14.3	15.....	24.0	22.8	25.....	2.30	10.0
6.....	4.2	4.5	16.....	15.8	12.8	26.....	2.20	11.3
7.....	2.40	2.95	17.....	7.3	3.5	27.....	2.10	4.3
8.....	2.05	2.60	18.....	16.2	8.4	28.....	2.05	3.3
9.....	1.82	2.45	19.....	18.3	3.5	29.....	2.80	2.90
10.....	1.73	2.40	20.....	14.1	5.5	30.....	2.25	2.55
						31.....	1.98	

OSAGE RIVER AT OSCEOLA, MO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 20 T. 38 N., R. 25 W., at highway bridge in Osceola, St. Clair County, one-fourth mile above St. Louis-San Francisco Railway bridge, half a mile above Kansas City, Clinton & Springfield Railway bridge, three-fourths mile above Gallinipper Creek, $1\frac{1}{2}$ miles above suspension highway toll bridge, and 3 miles below Sac River.

DRAINAGE AREA.—8,180 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 23 to September 30, 1921. The United States Weather Bureau has obtained daily records of stage since April 1, 1910.

GAGE.—Chain on downstream handrail of bridge near center pier; read by J. T. Fields.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of solid rock, with silt and sand near banks and pier; practically permanent. Control is formed by heavy gravel bar between the railroad bridges, one-fourth mile below gage; fairly permanent. Flood stage, 20 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 17.1 feet at 8 a. m. August 16 (discharge, 31,500 second-feet); minimum stage, 1.7 feet at 8 a. m. August 4 (discharge, 740 second-feet). The flood of December, 1895, reached a stage of 33.27 feet, that of 1844 a stage of 43.3 feet, determined by United States Weather Bureau. The lowest stage recorded by United States Weather Bureau was 0.6 foot on July 11, 1911.

REGULATION.—Dams and power plants on headwaters and tributaries have no noticeable effect at the station.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Records of daily stage furnished by United States Weather Bureau.

Discharge measurements of Osage River at Osceola, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
		<i>Feet</i>	<i>Sec.-ft</i>
July 23	Reginald Waldo.....	2.97	2,510
Sept. 3	E. L. Williams.....	8.15	11,700

Daily discharge, in second-feet, of Osage River at Osceola, Mo., for the period July 23 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		5,930	1,250	11.....		1,800	2,390	21.....		21,700	13,800
2.....		3,300	5,000	12.....		12,500	7,690	22.....		19,000	10,700
3.....		1,120	13,300	13.....		17,500	15,200	23.....	2,540	8,290	9,490
4.....		740	12,300	14.....		25,700	28,200	24.....	2,890	2,690	6,500
5.....		1,250	20,100	15.....		29,300	26,600	25.....	2,390	2,540	6,690
6.....		1,940	21,700	16.....		31,500	22,600	26.....	1,800	6,890	8,490
7.....		2,540	19,800	17.....		29,500	22,400	27.....	1,390	4,100	11,100
8.....		2,540	14,000	18.....		26,800	25,500	28.....	1,120	2,540	9,890
9.....		1,660	4,280	19.....		26,500	27,200	29.....	1,120	1,940	5,550
10.....		860	3,140	20.....		23,900	22,400	30.....	3,300	1,380	3,460
								31.....	5,000	1,520	-----

NOTE.—Gage not read July 26 to Aug. 3; discharge estimated by comparison of gage readings at Warsaw and Tusumbia.

Monthly discharge of Osage River at Osceola, Mo., for the period July 23 to Sept. 30, 1921

[Drainage area, 8,180 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
July 23-31.....	5,000	1,120	2,340	0.286	0.10
August.....	31,500	740	10,300	1.26	1.45
September.....	28,200	1,250	13,400	1.64	1.83

MARMATON RIVER NEAR FORT SCOTT, KANS.

LOCATION.—In NW. $\frac{1}{4}$ sec. 21, T. 25 S., R. 25 E., at military-highway bridge 500 feet below Missouri Pacific Railroad bridge, 2 miles northeast of Fort Scott, Bourbon County, $2\frac{1}{2}$ miles below Mill Creek, and $2\frac{1}{2}$ miles west of Missouri-Kansas State line.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 5 to September 30, 1921.

GAGE.—Chain on upstream side of bridge; read by Clyde Severy.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of rock and gravel; permanent. Control is rock and gravel riffle under and extending 50 feet below bridge; permanent. Control may shift to section of river below bridge during high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 21.6 feet at 7.20 a. m. September 14 (discharge, 6,130 second-feet); minimum stage, 2.50 feet August 30 to September 1 (discharge, 1 second-foot).

REGULATION.—Some regulation by dam at Fort Scott.

ACCURACY.—Stage-discharge relation permanent, not affected by ice. Rating curve fairly well defined below 1,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Marmaton River near Fort Scott, Kans., during the year ending Sept. 30, 1921

[Made by H. B. Kinnison]

Date	Gage height	Discharge
June 16.....	3.08	31.4
Aug. 5.....	3.67	140
Sept. 30.....	3.10	44.5

Daily discharge, in second-feet, of Marmaton River near Fort Scott, Kans., for the period Aug. 5, to Sept. 30, 1921

Day	Aug.	Sept.	Day	Aug.	Sept.	Day	Aug.	Sept.
1.....		1.0	11.....	129	9.2	21.....	35	948
2.....		30	12.....	45	542	22.....	24	185
3.....		24	13.....	425	3,480	23.....	12	88
4.....		15	14.....	838	4,410	24.....	4.6	61
5.....	78	816	15.....	185	463	25.....	3.8	303
6.....	18	103	16.....	171	108	26.....	3.8	118
7.....	18	53	17.....	371	69	27.....	3.0	83
8.....	12	73	18.....	227	1,010	28.....	2.6	57
9.....	6.2	24	19.....	83	389	29.....	2.6	49
10.....	6.2	14	20.....	49	108	30.....	1.8	3.4
						31.....	1.0	-----

Monthly discharge of Marmaton River near Fort Scott, Kans., for the period Aug. 5 to Sept. 30, 1921

Month	Discharge in second-feet			Run-off in acre-feet
	Maximum	Minimum	Mean	
August 5-31.....	838	1.0	102	5,450
September.....	4,410	1.0	455	27,100
The period.....				32,600

SAC RIVER NEAR STOCKTON, MO.

LOCATION.—In W. $\frac{1}{2}$ sec. 11, T. 34 N., R. 26 W., at highway bridge on Stockton-Fair Play road, $1\frac{1}{2}$ miles above Bear Creek, $2\frac{1}{2}$ miles east of Stockton, Cedar County, $3\frac{1}{2}$ miles below junction with Little Sac River, 13 miles above dam at Caplinger Mills, and 45 miles above mouth of river.

DRAINAGE AREA.—1,160 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 21 to September 30, 1921.

GAGE.—Chain on downstream handrail of bridge; read by Hardy H. Dixon.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge.

CHANNEL AND CONTROL.—Bed composed of clean gravel and boulders, fairly permanent. No well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 19.40 feet at 6.30 a. m. August 15 (discharge, 10,500 second-feet); minimum stage, 2.37 feet at 7.25 p. m. August 10 (discharge, 182 second-feet).

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 8,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Sac River near Stockton, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
July 20	Waldo and Williams.....	<i>Feet</i> 2.92	<i>Sec.-ft.</i> 364
Sept. 2	E. L. Williams.....	3.01	397

Daily discharge, in second-feet, of Sac River near Stockton, Mo., for the period July 21 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		240	388	11.....		1,720	322	21.....		338	763
2.....		240	388	12.....		3,340	306	22.....		322	563
3.....		223	421	13.....		1,010	5,880	23.....		322	491
4.....		223	421	14.....		8,720	4,360	24.....		306	456
5.....		223	421	15.....		9,740	1,540	25.....		306	4,840
6.....		207	421	16.....		2,320	1,060	26.....		289	2,620
7.....		207	421	17.....		1,660	806	27.....		272	720
8.....		191	388	18.....		1,180	955	28.....		256	680
9.....		191	355	19.....		901	1,360	29.....		289	600
10.....		191	338	20.....		763	955	30.....		272	527
								31.....		256	491

NOTE.—Gage not read September 7; discharge interpolated.

Monthly discharge of Sac River near Stockton, Mo., for the period July 21 to Sept. 30, 1921

[Drainage area, 1,160 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
July 21-31.....	338	256	294	0.253	0.10
August.....	9,740	191	1,490	1.28	1.48
September.....	5,880	306	1,100	.948	1.06

POMME DE TERRE RIVER AT HERMITAGE, MO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 26, T. 37 N., R. 22 W., at south highway bridge in Hermitage, Hickory County, 800 feet above Mill Creek, half a mile above east highway bridge, 8 miles below Lindly Creek, 35 miles above Little Pomme de Terre River, and 37 miles above mouth of river.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 25 to September 30, 1921.

GAGE.—Chain on downstream handrail of bridge; read by James H. Phillips.

DISCHARGE MEASUREMENTS.—Made from downstream side of either highway bridge or by wading near gage.

CHANNEL AND CONTROL.—Bed composed of clean sand and gravel; shifting. Control is heavy gravel bar 50 feet below gage; fairly permanent.

EXTREMES OF STAGE.—Maximum stage recorded during period of record, 20.90 feet at 6 p. m. September 2; minimum stage, 1.63 feet at 4.10 p. m. August 5.

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Gage read to hundredths twice daily. Rating curve not developed

Discharge measurements of Pomme de Terre River at Hermitage, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Discharge
July 25	Reginald Waldo	<i>Feet</i> 1.86	<i>Sec-ft.</i> 51.1
Sept. 5	E. L. Williams	5.32	1,340

Daily gage height, in feet, of Pomme de Terre River at Hermitage, Mo., for the period July 25 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1		1.72	2.19	11		5.85	2.58	21		2.97	3.98
2		1.69	19.55	12		6.76	2.47	22		2.80	3.35
3		1.66	10.52	13		3.94	4.92	23		2.78	3.15
4		1.64	4.10	14		12.90	9.55	24		2.49	2.98
5		1.64	5.48	15		11.15	5.20	25	1.85	2.46	3.22
6		1.64	4.35	16		5.70	4.25	26	1.85	3.55	3.88
7		1.70	3.85	17		4.95	3.90	27	1.81	3.78	3.75
8		1.64	3.36	18		4.35	7.82	28	1.77	3.02	3.36
9		1.64	3.00	19		3.82	5.20	29	1.76	2.65	2.97
10		1.64	2.75	20		3.40	4.30	30	1.75	2.42	2.83
								31	1.76	2.24	

SOUTH GRAND RIVER NEAR BROWNINGTON, MO.

LOCATION.—In NW. $\frac{1}{4}$ sec. 17, T. 40 N., R. 25 W., at highway bridge on Brownington-Clinton road, 300 feet below St. Louis-San Francisco Railway bridge 500 feet below Deepwater Creek, 1 mile north of Brownington, Henry County, and 40 miles above junction with Osage River.

DRAINAGE AREA.—1,660 square miles (measured on topographic maps).

RECORDS AVAILABLE.—July 24 to September 30, 1921.

GAGE.—Chain on upstream handrail of bridge near left bank; read by George Wirth.

DISCHARGE MEASUREMENTS.—Made from downstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand and gravel; fairly permanent. Control is a heavy gravel bar 500 feet below gage; permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 25.30 feet at 4 p. m. September 7 (discharge, 18,200 second-feet); minimum stage, 1.42 feet at 8 a. m. July 29 (discharge, 36 second-feet).

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined above 60 second-feet, extended below this limit. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of South Grand River near Brownington, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge
July 23	Reginald Waldo.....	Feet 1.93	Sec.-ft. 72.7
Sept. 3	E. L. Williams.....	9.83	4470

Daily discharge, in second-feet, of South Grand River near Brownington, Mo., for the period July 24 to Sept. 30, 1921

Day	July	Aug.	Sept.	Day	July	Aug.	Sept.	Day	July	Aug.	Sept.
1.....		100	365	11.....		2,060	1,940	21.....		5,450	3,580
2.....		64	1,460	12.....		2,660	1,760	22.....		5,760	3,860
3.....		53	4,490	13.....		1,880	6,080	23.....		1,300	4,070
4.....		44	4,280	14.....		750	9,230	24.....	56	448	4,280
5.....		50	11,300	15.....		2,360	10,900	25.....	53	475	2,600
6.....		94	16,600	16.....		3,200	13,200	26.....	47	205	2,540
7.....		72	18,200	17.....		3,380	13,100	27.....	41	134	3,380
8.....		60	17,800	18.....		3,510	10,900	28.....	38	106	2,120
9.....		53	15,500	19.....		3,720	7,320	29.....	38	87	970
10.....		47	11,200	20.....		3,860	1,360	30.....	56	87	640
								31.....	240	1,020	-----

Monthly discharge of South Grand River near Brownington, Mo., for the period July 24 to Sept. 30, 1921

[Drainage area, 1,660 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
July 24-31.....	240	38	71.1	0.043	0.01
August.....	5,760	44	1,390	.837	.96
September.....	18,200	365	6,840	4.12	4.60

GASCONADE RIVER BASIN

GASCONADE RIVER NEAR WAYNESVILLE, MO.

LOCATION.—In SE. $\frac{1}{4}$ sec. 3, T. 36 N., R. 12 W., at highway bridge on Waynesville-Crocker road, $2\frac{1}{2}$ miles below Roubidoux Creek and 4 miles north of Waynesville, Pulaski County.

DRAINAGE AREA.—1,680 square miles (measured on United States soil survey maps).

RECORDS AVAILABLE.—June 9 to September 30, 1921. The Missouri State Engineering Experiment Station obtained records at this point from August 15, 1914, to July 31, 1921.⁴

GAGE.—Chain on upstream side of bridge.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of clean sand, gravel, and boulders; shifting. Control is flat bar of coarse gravel and boulders 300 feet below gage; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period of record, 7.3 feet at 8 a. m. June 26 (discharge, 5,760 second-feet); minimum stage, 2.36 feet at 5.15 p. m. August 8 (discharge, 164 second-feet). The Missouri Engineering Experiment Station gives a maximum discharge of 36,400 second-feet during the flood of August, 1915, and a minimum discharge of 111 second-feet in November, 1917, and October, 1918.

REGULATION.—Natural regulation through large springs.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Gasconade River near Waynesville, Mo., during the year ending Sept. 30, 1921

Date	Made by—	Gage height	Dis-charge	Date	Made by—	Gage height	Dis-charge
June 9	Reginald Waldo	<i>Feet</i> 4.93	<i>Sec.-ft.</i> 2,280	Sept. 1	E. L. Williams	<i>Feet</i> 2.50	<i>Sec.-ft.</i> 214
July 19	do	3.12	484	14	Reginald Waldo	5.96	3,440

Daily discharge, in second-feet, of Gasconade River near Waynesville, Mo., for the period June 9 to Sept. 30, 1921

Day	June	July	Aug.	Sept.	Day	June	July	Aug.	Sept.
1		3,380	246	209	16	1,280	360	400	1,140
2		5,400	246	282	17	1,090	320	400	865
3		3,380	246	246	18	910	320	340	955
4		2,480	205	320	19	910	1,760	282	910
5		2,360	209	360	20	660	1,000	282	740
6		1,640	205	264	21	590	590	246	590
7		1,400	202	246	22	520	460	246	490
8		1,000	185	212	23	400	580	229	460
9	2,360	1,000	198	205	24	1,180	360	264	380
10	1,880	910	229	246	25	5,580	320	229	400
11	2,360	750	301	205	26	5,760	340	209	400
12	2,720	590	340	320	27	2,480	301	209	380
13	2,480	590	340	780	28	2,960	301	380	340
14	1,880	520	246	3,950	29	4,250	246	264	320
15	1,520	460	340	1,640	30	4,720	264	246	520
					31		246	212	

NOTE.—Discharge July 11 interpolated.

⁴ See Studies relating to the water resources of Missouri: Missouri Univ. Eng. Exper. Sta. ser. 22, vol. 21, No. 35.

Monthly discharge of Gasconade River near Waynesville, Mo., for the period June 9 to Sept. 30, 1921

[Drainage area, 1,680 square miles]

Month	Discharge in second-feet				Run-off in inches
	Maximum	Minimum	Mean	Per square mile	
June 9-30.....	5,760	400	2,200	1.31	1.07
July.....	5,400	246	1,080	.643	.74
August.....	400	185	264	.157	.18
September.....	3,950	205	612	.364	.41

MISCELLANEOUS DISCHARGE MEASUREMENTS

Miscellaneous discharge measurements in Missouri River drainage basin during the year ending Sept. 30, 1921

Date	Stream	Tributary to—	Locality	Gage height	Dis- charge
				<i>Feet</i>	<i>Sec.-ft.</i>
Mar. 22	Camp Creek.....	North Platte River...	Mouth, sec. 11, T. 11 N., R. 80 W.	-----	5.0
June 12	do.....	do.....	do.....	-----	5.0
July 21	do.....	do.....	do.....	-----	3.0
Mar. 22	Threemile Creek.....	do.....	Mouth, sec. 25, T. 12 N., R. 80 W.	-----	7.0
June 12	do.....	do.....	do.....	-----	.5
July 21	do.....	do.....	do.....	-----	.25
Oct. 9	North Fork of South Platte River.	South Platte River....	Gaging station at Grant, Colo.	1.57	15.7
9	Geneva Creek.....	North Fork of South Platte River.	do.....	1.34	35.0
July 22	South Grand River....	Osage River.....	3 miles southwest of Clinton, Mo.	-----	67.1
26	Niangua River.....	do.....	Just above entrance of Hahatonka Spring Creek, near Hahatonka, Mo.	-----	325
26	Hahatonka Spring.....	Niangua River.....	One-fourth mile above mouth of Hahatonka Spring Creek.	-----	97.2
27	Piney Creek.....	Gasconade River.....	Ross Bridge, 3 miles east of Big Piney, Mo.	2.20	207



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1. The first part of the document is a letter from the President of the United States to the Congress, dated January 3, 1862. It is a very important document, as it contains the President's annual message to Congress. The letter is written in a formal, dignified style, and it is one of the most important documents in the history of the United States.