Water-Supply and Irrigation Paper No. 208 Series P, Hydrographic Progress Reports, 62

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY

OF

MISSOURI RIVER DRAINAGE, 1906

BY

ROBERT FOLLANSBEE, R. I. MEEKER, AND J. E. STEWART
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

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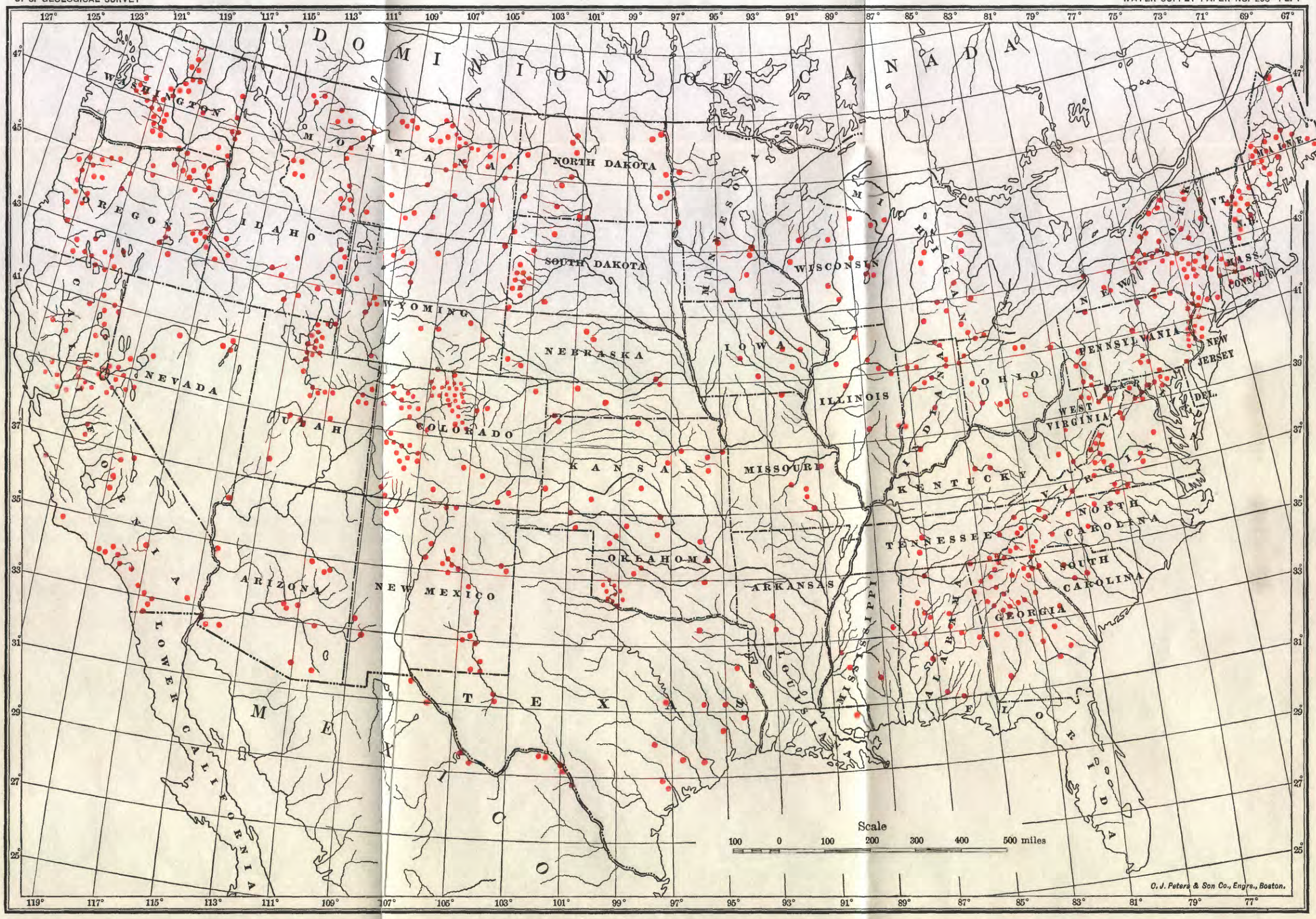


MAP OF UNITED STATES SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1906.

SURFACE WATER SUPPLY OF THE MISSOURI RIVER DRAINAGE,[a] 1906.

ROBERT FOLLANSBEE, R. I. MEEKER, and J. E. STEWART,
District Hydrographers.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than is any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing

[a] This report contains information similar to that published for previous years under the title "Report of Progress of Stream Measurements."

[b] The data presented in this paper, with the following exceptions, have been collected under the direction of Robert Follansbee, district hydrographer, assisted by W. B. Freeman, Gordon Edson, R. H. Whinery, Raymond Richards, and W. S. Hartman:

The data for streams in Nebraska were collected under the direction of Adna Dobson, State engineer, assisted by Arthur Dobson; those for South Dakota, by J. E. Stewart; those for North Dakota, by E. F. Chandler; and those for Colorado and Wyoming, by R. I. Meeker, assisted by A. J. Parshall and T. E. Brick.

All the data have been prepared for publication, under the direction of John C. Hoyt, by R. H. Bolster, F. F. Henshaw, and H. D. Padgett.

both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is, in general, impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas, and are published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data, and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows:

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)

204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.
206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of Hudson Bay and upper Mississippi River drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainage in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainage, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on the surface water supply, published from 1901 to 1906.

Number of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
Atlantic coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

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 which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile; and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

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

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and

use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage heights taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed, and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge, in case this information is desired.

In the table of monthly discharge, the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise, in the column of "Minimum," the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore, for the principal stations, tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available.

These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations, sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet deep, 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.

100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5.280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equal about 1 kilowatt.

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

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes—(1) those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data on which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams—(1) by measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{R\,s}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in determining the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir methods.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests, which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam, of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the periods of ice and floods, and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory,

as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

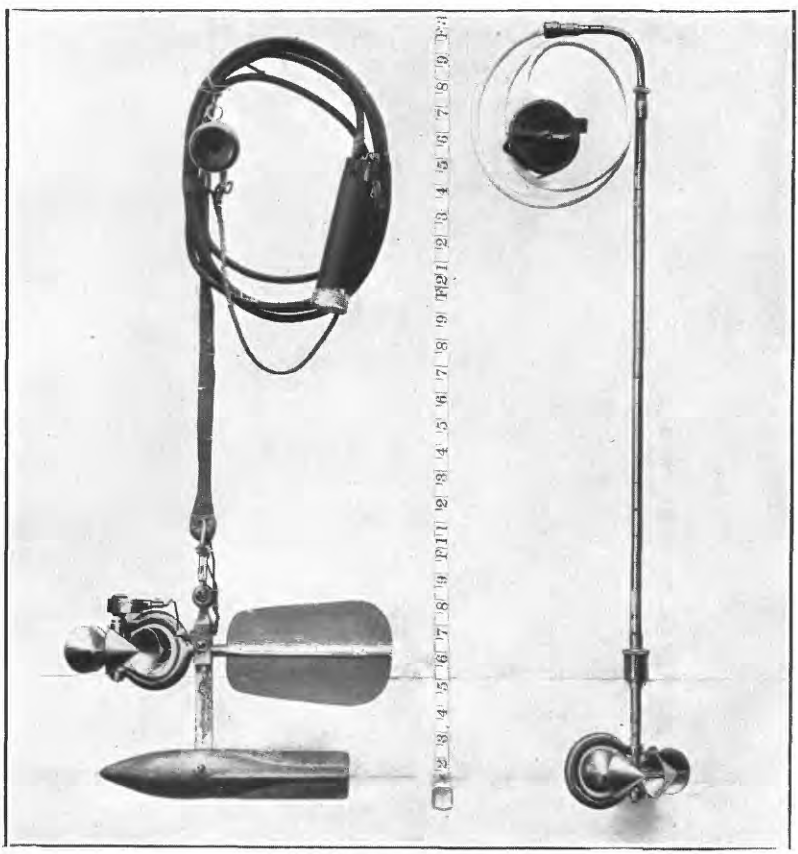
In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type so constructed that the impact of flowing water causes it to revolve and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

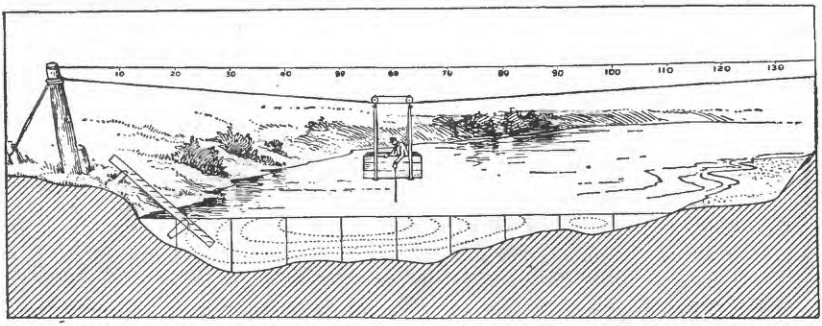


FIG. 1.—Cable station showing section of the river, car, gage, etc.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points the vertical velocity-curve is developed. This curve shows, graphically, the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two

points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, four times the mid-depth velocity, and the bottom velocity. The method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.3 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge

measurement either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period, and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice.

For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations of streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the

assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant. (2) The discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected. (3) The discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates; and discharge, mean velocity, and area as abscissas will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may,

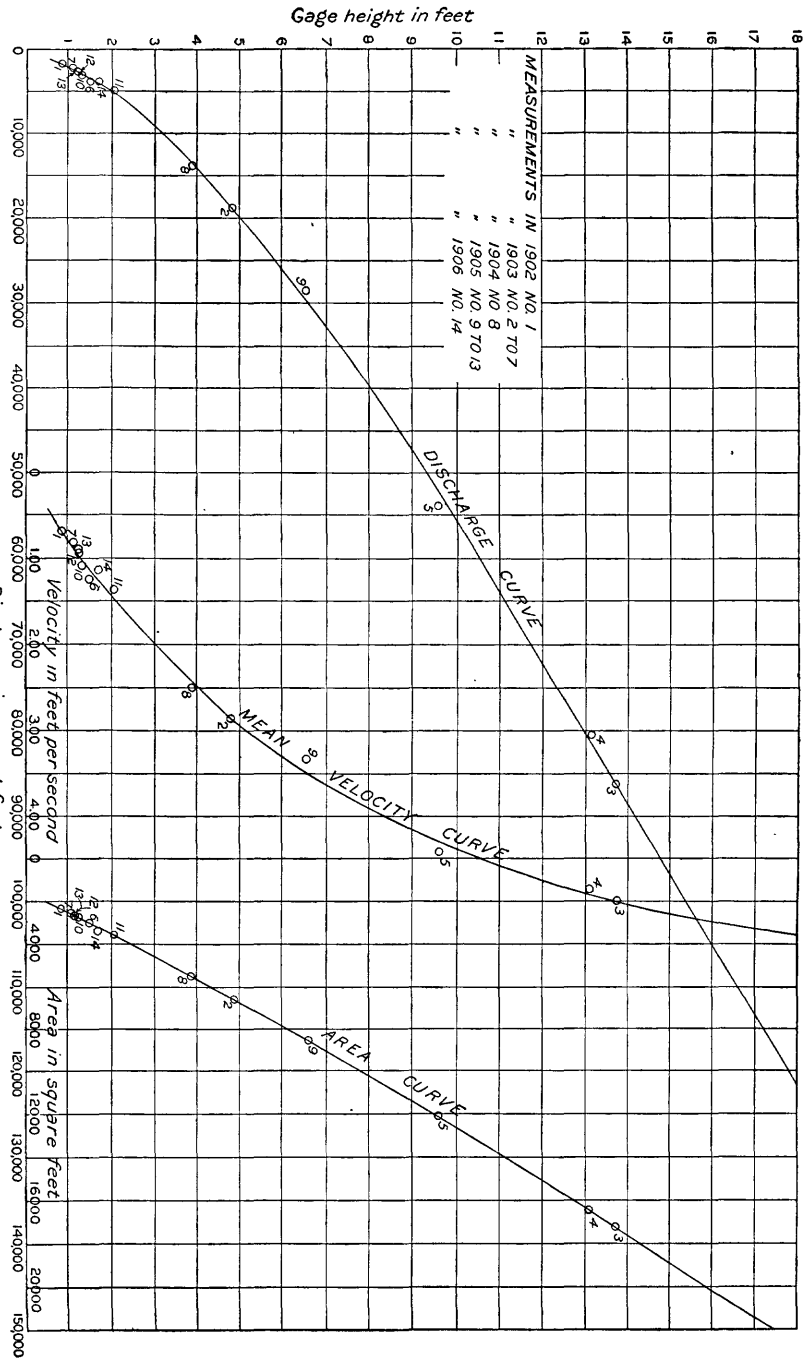


FIG. 2.—Discharge, area, and mean-velocity curves of Potomac River at Point of Rocks, Md.

however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall be either constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly, or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

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The Northern Pacific; Great Northern; Chicago, Burlington and Quincy; Montana, Colorado and Southern; and Union Pacific railroads.

MISSOURI RIVER DRAINAGE.

GENERAL FEATURES.

Missouri River and its innumerable tributaries drain an immense area in the northern and western section of the United States. The northern boundary of this area is approximately the fiftieth parallel, the southern the thirty-ninth; to the west its limit is the Rocky

Mountains, while to the east the divide between it and the upper Mississippi basin crosses eastern North and South Dakota, western Iowa, and northeastern Missouri. Its extent east and west is about 900 miles; north and south it is 600 miles; it comprises a total of 492,000 square miles.

The topography of the basin is of the most varied character, ranging from the mountainous regions of Montana, Wyoming, and Colorado to the rolling prairies of the Dakotas, Nebraska, and Kansas. The upper tributaries drain a forested region, but the main stream flows through a country almost wholly devoid of forests. The precipitation in the mountainous portion of the basin is mainly in the form of heavy snowfall, but a great part of the area lies within the arid and semiarid regions, and it is probable that the average annual precipitation throughout the entire basin is less than 20 inches.

The tributaries are mostly in the upper course of the river and from the western side of the basin. The most important of these tributaries are Musselshell, Marias, Milk, Yellowstone, Cheyenne, Platte, and Kansas rivers.

MISSOURI RIVER BASIN.

DESCRIPTION OF BASIN.

Missouri River proper is formed in southwestern Montana by the union of three streams, which were discovered by Lewis and Clark in 1806 and named by them Jefferson, Madison, and Gallatin rivers. Jefferson and Madison forks come together first, and within 2 miles they are joined by the Gallatin. The head of the Missouri thus formed lies in about latitude 45° 56′ north and longitude 111° 32′ west. Each of the three headwater rivers is about 90 feet wide, flows with great velocity, and discharges large quantities of water. The Gallatin is the most rapid of the three. The beds of all are formed of smooth pebbles and gravel and the waters are perfectly transparent.

From the junction of the three forks the course of the Missouri lies through mountain valleys and deep canyons, from which it finally issues through a gorge in a range of rocks, called by Lewis and Clark the "gates of the Rocky Mountains." Thirty-five miles above Fort Benton the river pours over a series of falls, and from that point onward it is a navigable stream. (See Pls. III and IV.)

From the mouth of the Yellowstone the Missouri follows a winding but on the whole southeasterly course until it is joined by the Kansas; thence it flows more to the east across the State of Missouri, and empties into the Mississippi 16 miles above St. Louis, 189 miles above the

mouth of the Ohio, and 2,824 miles below the junction of its three upper forks.

For the first 350 miles below the union of the three forks the Missouri is a comparatively clear stream, but approximately midway between the forks and the mouth of the Yellowstone its character gradually changes and it becomes turbid. Although a large amount of the sediment carried by the Missouri is undoubtedly brought in by the drainage of its tributaries, the greater part is derived from the caving of its banks.

The volume of the Missouri is subject to great variations, the ordinary high-water discharge at the mouth being about 28 times the low-water discharge. The freshets are caused by melting snow and heavy summer rains. The amount of snow falling on the prairies is usually small, but among the Rocky Mountains the snows begin early, continue late, and accumulate to great depths. The regular floods occur in May and June, the June rise being as a rule higher and lasting longer. Thereafter the river steadily decreases in volume, the minimum being reached during the winter months.

MISSOURI RIVER AT CASCADE, MONT.

This station was established July 20, 1902. It is located at the highway bridge at the east end of the town of Cascade, Mont., about one-fourth mile from the railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 24, where are given also references to publications that contain data for previous years.

Discharge measurements of Missouri River at Cascade, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 24	G. Edson		2,690	5.19	6,190
May 12	do		3,070	5.88	7,880
June 3	do	450	3,800	7.28	14,400
June 25	Edson and Richards	420	3,720	6.42	10,400
August 20	R. Richards	357	2,520	3.55	2,310
September 17	Grover and Follansbee	362	2,620	3.92	2,620
October 31	R. Richards	363	2,770	4.30	3,480

GREAT FALLS OF THE MISSOURI, MONTANA.

Daily gage height, in feet, of Missouri River at Cascade, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.70	4.00	4.30	5.00	5.40	7.40	5.20	3.82	3.68	4.00	4.05	7.40
2	4.70	4.00	4.30	5.00	5.40	7.35	5.20	3.72	3.72	4.00	4.10	7.38
3	4.70	3.90	4.30	5.02	5.42	7.25	5.18	3.70	3.80	4.00	4.12	7.32
4	4.70	3.90	4.30	5.10	5.50	6.95	5.12	3.68	3.88	4.00	4.18	7.28
5	4.70	3.90	4.30	5.12	5.58	6.85	5.25	3.70	3.92	4.00	4.22	7.25
6	4.70	3.90	4.30	5.18	5.65	6.75	5.50	3.82	4.02	4.00	4.28	7.12
7	4.70	3.90	4.30	5.20	5.70	6.98	5.42	3.72	3.98	4.00	4.32	7.00
8	4.70	3.90	4.30	5.18	5.78	7.12	5.30	3.58	4.02	4.00	4.38	6.85
9	4.70	3.90	4.30	5.12	5.88	7.22	5.00	3.48	4.02	4.00	4.42	6.70
10	4.70	3.90	4.30	5.05	5.95	7.25	4.75	3.40	3.98	4.00	4.50	6.58
11	4.80	4.00	4.40	4.95	6.00	7.18	4.70	3.40	3.98	4.00	4.55	6.45
12	4.80	4.10	4.80	4.85	6.08	7.08	4.70	3.40	3.98	4.00	4.62	6.32
13	4.90	4.20	5.15	4.70	6.18	7.15	4.70	3.40	3.98	4.00	4.68	6.22
14	4.70	4.30	5.30	4.60	6.25	7.20	4.75	3.40	3.98	4.00	4.75	6.12
15	4.70	4.45	5.45	4.70	6.30	7.65	4.70	3.40	3.98	4.00	4.82	6.02
16	4.70	4.60	5.60	4.75	5.98	7.75	4.65	3.40	3.98	4.00	4.92	5.92
17	4.70	4.95	5.75	4.80	6.30	7.72	4.60	3.42	3.95	4.00	5.00	5.75
18	4.80	5.20	5.95	4.90	6.30	7.82	4.60	3.45	3.98	4.00	5.05	5.55
19	4.80	5.10	6.10	4.92	6.30	7.95	4.60	3.45	4.02	4.00	5.10	5.50
20	4.60	5.00	6.10	4.98	6.30	7.85	4.60	3.45	4.12	4.00	5.18	5.60
21	4.70	4.90	6.10	5.00	6.22	7.65	4.65	3.45	4.22	4.05	5.22	5.70
22	4.80	4.80	6.10	5.00	6.18	7.45	4.60	3.45	4.32	4.05	5.32	5.80
23	4.90	4.60	6.10	5.00	6.02	6.92	4.55	3.50	4.40	4.05	5.38	5.88
24	4.80	4.45	6.10	5.00	5.95	6.58	4.52	3.55	4.40	4.05	5.45	5.90
25	4.70	4.30	6.10	5.05	6.02	6.40	4.50	3.58	4.40	4.05	7.15	5.88
26	4.50	4.30	5.00	5.05	6.20	6.28	4.45	3.60	4.38	4.05	8.30	5.78
27	4.50	4.30	5.00	5.10	6.50	6.25	4.42	3.60	4.28	4.05	8.30	5.68
28	4.50	4.30	4.60	5.10	6.90	6.16	4.40	3.65	4.18	4.05	8.05	5.58
29	4.50	.....	4.70	5.25	7.25	5.80	4.25	3.65	4.08	4.05	7.85	5.48
30	4.40	.....	4.82	5.45	7.40	5.30	4.05	3.65	4.00	4.05	7.55	5.38
31	4.30	.....	4.92	.....	7.50	.....	3.92	3.70	.....	4.05	.....	5.20

NOTE.—Ice conditions January 19–26 and March 12–25; gage heights are to top of ice. During December the river was frozen, except for an open channel in the center; gage heights are to the water surface.

Rating tables for Missouri River at Cascade, Mont.

JANUARY 1 TO MAY 31, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	2,700	4.90	4,900	5.80	7,660	6.70	11,040
4.10	2,900	5.00	5,200	5.90	8,000	6.80	11,480
4.20	3,120	5.10	5,500	6.00	8,340	6.90	11,940
4.30	3,340	5.20	5,800	6.10	8,680	7.00	12,400
4.40	3,560	5.30	6,100	6.20	9,040	7.10	12,880
4.50	3,800	5.40	6,400	6.30	9,400	7.20	13,360
4.60	4,060	5.50	6,700	6.40	9,780	7.30	13,860
4.70	4,320	5.60	7,020	6.50	10,180	7.40	14,380
4.80	4,600	5.70	7,340	6.60	10,600	7.50	14,900

JUNE 1 TO DECEMBER 31, 1906.[b]

3.40	1,950	4.60	4,220	5.80	8,060	7.00	12,740
3.50	2,060	4.70	4,480	5.90	8,420	7.10	13,160
3.60	2,180	4.80	4,760	6.00	8,780	7.20	13,580
3.70	2,320	4.90	5,060	6.10	9,160	7.30	14,020
3.80	2,480	5.00	5,360	6.20	9,540	7.40	14,460
3.90	2,660	5.10	5,680	6.30	9,920	7.50	14,900
4.00	2,840	5.20	6,000	6.40	10,300	7.60	15,340
4.10	3,040	5.30	6,320	6.50	10,700	7.70	15,800
4.20	3,260	5.40	6,660	6.60	11,100	7.80	16,260
4.30	3,480	5.50	7,000	6.70	11,500	7.90	16,720
4.40	3,720	5.60	7,340	6.80	11,900	8.00	17,180
4.50	3,960	5.70	7,700	6.90	12,320		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 and 1 measurement in the spring of 1906 and is fairly well defined. Owing to shifting conditions during high water, another rating table is necessary for the remainder of the year.

[b] This table is applicable only for open-channel conditions. It is based upon five discharge measurements made during the latter part of 1906. It is fairly well defined.

Monthly discharge of Missouri River at Cascade, Mont., for 1906.

[Drainage area, 18,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	4,900	3,340	4,170	256,000	0.228	0.26
February	5,800	2,500	3,480	193,000	.190	.20
March (17 days)	5,200	3,340	3,840	129,000	.210	.13
April	6,550	4,060	5,220	311,000	.285	.32
May	14,900	6,400	8,990	553,000	.491	.57
June	17,000	6,320	13,000	774,000	.710	.79
July	7,000	2,700	4,660	287,000	.255	.29
August	2,520	1,950	2,140	132,000	.117	.13
September	3,720	2,290	2,970	177,000	.162	.18
October	2,940	2,840	2,880	177,000	.157	.18
November	9,000	2,940	5,260	313,000	.287	.32
December	.....	.....	7,000	[a] 430,000	.382	.44
The period	.....	.....	.....	3,730,000	.....	.....

[a] Estimated.

NOTE.—Values are rated as follows: January to April, August, September, and November, fair; May to July, good; October and December approximate. Gage readings during the greater part of the year are subject to more or less error.

MISSOURI RIVER NEAR WILLISTON, N. DAK.

This station was established April 24, 1905. It is located at Bakers Ferry, 10 miles down the river from Williston, N. Dak. The conditions at this station and the bench marks are described in Water Supply Paper No. 172, page 28. The data collected at this station are valuable for irrigation purposes.

Daily gage height, in feet, of Missouri River near Williston, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	.....	.....	12.4	12.7	8.9	8.0	5.7	5.3	.....
2	.....	.....	.....	.....	.....	12.8	12.2	8.7	7.9	5.65	5.3	.....
3	.....	4.6	7.8	.....	.....	12.4	11.5	8.5	7.8	5.6	5.3	.....
4	.....	.....	.....	.....	.....	12.0	11.0	8.3	7.5	5.55	5.25	.....
5	.....	.....	.....	.....	.....	11.6	11.0	8.5	7.25	5.5	5.2	.....
6	5.4	.....	8.0	.....	.....	11.5	11.3	8.65	7.05	5.4	5.3	.....
7	.....	.....	7.8	.....	.....	12.2	11.35	8.8	7.0	5.4	5.3	.....
8	.....	.....	7.9	.....	.....	15.9	11.2	8.6	6.95	5.3	5.3	.....
9	.....	.....	7.55	.....	.....	19.0	11.15	8.4	6.8	5.2	5.5	.....
10	.....	4.7	7.6	.....	.....	20.1	11.15	8.1	6.6	5.2	5.45	.....
11	.....	.....	7.55	.....	.....	19.8	11.15	8.0	6.5	5.3	5.6	.....
12	.....	.....	7.6	.....	.....	18.3	11.0	8.2	6.4	5.25	5.6	.....
13	4.6	.....	7.9	.....	.....	14.8	10.8	7.9	6.3	5.2	5.6	.....
14	.....	.....	7.85	.....	.....	14.0	10.6	7.5	6.2	5.25	5.6	.....
15	.....	.....	7.8	.....	.....	15.05	10.6	7.3	6.3	5.25	5.7	.....
16	.....	.....	7.7	.....	.....	16.0	10.7	7.1	6.7	5.3	5.7	.....
17	.....	6.2	7.6	.....	.....	16.1	10.6	6.9	6.85	5.25	5.7	.....
18	.....	.....	7.4	.....	.....	16.1	10.6	6.85	6.6	5.2	7.8	.....
19	.....	.....	7.3	.....	.....	15.7	10.9	6.85	6.7	5.2	6.0	.....
20	4.5	.....	6.9	.....	.....	15.1	10.7	6.7	6.8	5.15	5.6	.....
21	.....	.....	6.6	.....	.....	14.9	10.5	6.6	6.9	5.15	5.65	.....
22	.....	.....	6.4	.....	.....	14.3	10.5	6.5	7.0	5.2	5.65	.....
23	.....	.....	6.3	.....	.....	13.8	10.4	6.4	6.8	5.2	5.6	.....
24	.....	6.8	6.2	.....	.....	13.3	10.2	6.4	6.5	5.2	5.5	.....
25	.....	.....	6.2	.....	.....	13.2	9.8	6.8	6.3	5.15	.....	.....
26	.....	.....	6.1	.....	13.7	13.0	9.6	8.9	6.1	5.2	.....	.....
27	4.5	.....	6.1	.....	13.9	12.7	9.5	9.9	6.0	5.2	.....	.....
28	.....	.....	6.3	.....	14.2	13.1	9.4	9.3	5.85	5.15	.....	.....
29	.....	.....	6.5	.....	13.8	13.2	9.3	8.6	5.85	5.1	.....	.....
30	.....	.....	12.3	.....	12.85	11.9	9.2	8.4	5.8	5.1	.....	.....
31	.....	.....	15.0	.....	12.6	.....	9.1	8.2	.....	5.1	.....	.....

NOTE.—Ice conditions January 1 to March 29 and November 25 to December 31. March 20 ice was 2.4 feet thick. The station was temporarily discontinued April 1 to May 25.

BLACK EAGLE FALLS MISSOURI RIVER, MONTANA.

MISSOURI RIVER AT KANSAS CITY, MO.

This station was established April 13, 1905. It is located at the Hannibal Railway bridge at the foot of Broadway street, Kansas City, Mo. The gage heights are furnished by the United States Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 32.

The following discharge measurement was made May 28, 1906:

Width, 870 feet; area of section, 14,600 square feet; gage height, 10.3 feet; discharge, 53,600 second-feet.

Daily gage height, in feet, of Missouri River at Kansas City, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.15	7.05	9.8	14.0	10.3	14.8	16.7	11.2	10.1	10.3	9.2	6.9
2	6.2	6.7	9.4	15.0	11.1	14.6	16.3	11.1	10.1	10.3	9.2	6.9
3	6.15	6.45	9.5	14.5	12.5	14.2	16.0	10.9	9.6	9.7	9.2	6.9
4	6.1	6.65	9.8	14.4	14.9	16.2	16.1	11.0	9.1	9.5	9.2	6.9
5	6.0	6.75	9.9	14.6	14.0	16.6	16.0	11.3	8.8	9.3	9.1	6.8
6	5.9	6.4	9.5	14.7	12.9	17.0	15.6	12.4	9.0	8.8	9.1	7.2
7	5.85	6.25	9.3	14.1	12.4	17.3	15.3	12.2	9.1	8.5	9.1	7.2
8	5.7	6.15	8.6	13.4	12.0	17.1	14.9	11.9	8.7	8.5	8.9	7.2
9	5.65	6.1	8.1	13.3	11.8	16.8	14.7	12.5	8.5	8.3	8.9	7.2
10	4.6	5.8	7.7	14.9	11.9	16.6	14.5	12.6	8.3	8.2	9.0	7.15
11	3.85	5.75	7.4	17.0	12.0	15.0	13.9	13.4	8.0	8.0	8.9	7.0
12	3.85	6.3	7.8	16.1	11.2	14.6	13.6	12.6	7.8	8.1	9.0	6.1
13	4.30	6.55	8.3	15.3	10.8	14.1	13.1	12.1	8.1	7.9	9.0	5.55
14	5.25	6.3	9.7	15.1	10.5	14.0	12.8	11.9	9.0	7.6	9.0	5.35
15	5.6	5.6	8.9	15.2	10.3	14.2	12.5	11.7	9.6	7.5	8.7	5.05
16	6.05	5.4	7.6	14.5	10.1	14.2	12.2	12.0	9.2	7.4	8.7	4.95
17	6.4	5.45	6.3	14.4	9.9	16.2	11.7	12.1	9.5	7.2	8.7	4.85
18	6.05	5.45	5.1	14.0	10.0	17.2	11.4	12.2	9.5	7.5	8.4	4.45
19	6.15	5.45	5.6	13.3	9.8	18.5	11.9	12.0	11.1	7.2	8.3	3.7
20	6.15	7.35	5.4	12.8	9.8	19.4	12.2	11.0	12.4	6.9	8.3	2.95
21	6.55	6.6	5.5	12.4	9.7	19.7	12.1	10.7	12.6	7.1	8.2	2.85
22	6.85	9.25	5.8	12.1	9.6	18.7	12.1	10.0	12.6	6.5	8.3	2.95
23	5.35	8.2	6.1	11.7	9.9	16.7	12.2	10.9	12.9	6.8	8.0	2.9
24	5.4	8.7	6.4	11.4	10.0	16.3	12.0	10.6	12.5	7.1	8.0	2.55
25	5.55	10.2	6.9	11.0	9.9	17.0	11.6	10.3	12.2	7.1	8.4	2.35
26	5.45	10.65	7.3	10.7	10.0	17.2	11.4	10.4	11.3	7.7	8.9	2.6
27	5.95	10.55	9.7	10.5	10.1	17.1	11.1	9.8	11.1	9.1	8.5	3.7
28	6.75	10.3	11.0	10.5	10.4	16.9	11.2	9.5	11.1	9.3	7.5	4.45
29	7.15	.....	12.0	11.0	12.3	16.9	11.0	9.2	11.2	9.3	6.7	4.95
30	7.0	.....	12.8	10.5	13.0	16.8	11.5	9.0	11.5	9.8	6.5	5.45
31	7.0	.....	12.2	.....	13.7	.....	11.8	9.9	.....	9.2	.....	5.9

MISCELLANEOUS MEASUREMENTS IN MISSOURI RIVER DRAINAGE BASIN.

The following miscellaneous measurements have been made in the Missouri River basin:

Miscellaneous discharge measurements in Missouri River basin.

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Discharge.
1905.			*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	Missouri River	Buford (above mouth of Yellowstone River).	366	2,230	4.44	9,880
March 29	do	do	369	1,960	4.40	8,610
May 10	do	do	421	2,740	2.67	7,320
May 29	do	4 miles below Buford	732	7,190	3.69	26,500
1906.						
July 10	Sixteen Mile Creek	Lombard	.....	.....	.....	20

SMITH RIVER DRAINAGE BASIN.

SMITH RIVER AT TRULY, MONT.

The gaging station was established March 7, 1905. It is located at a steel highway bridge on the county road running up Smith River Valley, in the center of sec. 35, T. 19 N., R. 2 E., Montana prime meridian, near the discontinued post-office of Truly and about 20 miles southwest of Great Falls, Mont., whence it is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 36.

Discharge measurements of Smith River at Truly, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	Morse and Edson	99	164	2.37	423
May 21	G. Edson	99	152	2.32	397
July 12	R. Richards	99	163	2.31	317
November 28 [a]	do	[a] 65	[a] 50	1.60	80

[a] Wading section.

Daily gage height, in feet, of Smith River at Truly, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
1	1.35	1.52	1.62	2.70	1.95	3.20	2.98	1.50	1.60	1.42
2	1.35	1.45	1.55	2.65	1.95	3.10	2.90	1.60	1.60	1.45
3	1.35	1.42	1.47	2.35	2.00	3.12	2.75	1.60	1.60	1.42
4	1.40	1.45	1.47	2.15	2.08	3.05	2.60	1.60	1.62	1.50
5	1.40	1.42	1.55	2.10	2.08	3.00	2.45	1.58	1.65	1.58
6	1.55	1.42	1.55	2.10	2.00	3.40	2.45	1.62	1.60	1.78
7	1.52	1.40	1.57	2.12	1.95	3.98	2.40	1.60	1.60	1.88
8	1.27	1.47	1.55	2.22	1.95	3.85	2.35	1.60	1.62	1.85
9	1.55	1.45	1.47	2.35	1.95	3.75	2.35	1.58	1.62	1.78
10	1.52	1.55	1.55	2.40	1.90	3.75	2.35	1.50	1.60	1.82
11	1.60	1.45	1.50	2.27	1.90	3.80	2.38	1.60	1.65	1.82
12	1.55	1.45	1.37	2.30	1.92	3.80	2.25	1.55	1.65	1.78
13	1.60	1.57	1.37	2.10	2.08	3.75	2.25	1.60	1.62	1.80
14	1.50	1.45	1.47	2.15	2.12	3.90	2.25	1.60	1.60	1.72
15	1.30	1.50	1.55	2.12	2.30	3.75	2.25	1.55	1.62	1.70
16	1.42	1.50	1.60	2.00	2.50	3.68	2.25	1.60	1.60	1.68
17	1.35	1.55	1.65	2.00	2.48	3.50	2.18	1.60	1.82	1.68
18	1.45	1.55	1.70	2.00	2.28	3.38	2.15	1.60	1.75	1.65
19	1.35	1.55	1.77	2.05	2.28	3.15	2.10	1.60	1.58	1.70
20	1.50	1.55	1.77	2.05	2.35	3.15	2.08	1.60	1.42	1.70
21	1.45	1.50	1.75	2.05	2.52	3.10	1.95	1.50	1.32	1.72
22	1.45	1.55	1.80	2.10	2.58	3.00	1.95	1.60	1.38	1.78
23	1.45	1.55	1.72	2.10	2.58	3.32	1.95	1.60	1.40	1.75
24	1.62	1.55	1.77	2.40	2.60	3.60	1.85	1.55	1.35	1.68
25	1.65	1.57	2.20	2.40	2.52	3.55	1.85	1.60	1.32	1.70
26	1.62	1.57	2.12	2.40	2.60	3.55	1.78	1.60	1.38	1.75
27	1.70	1.60	2.62	2.35	2.60	3.52	1.75	1.60	1.35	[a] 2.22
28	1.72	1.62	2.90	2.22	2.72	3.58	1.75	1.62	1.40	2.20
29	1.65	.....	2.77	2.20	2.98	3.60	1.60	1.60	1.45	1.95
30	1.52	.....	2.55	2.00	3.28	3.55	1.45	1.60	1.45	1.78
31	1.55	.....	2.47	.....	3.25	.....	1.45	1.60	.....	1.58

[a] Ice gorge.

NOTE.—Ice conditions January 15-30, February 4-20, and March 12-23; also November 19-December 1, December 13-21, 30, 31. Station temporarily discontinued August 1 to September 30.

SUN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Sun River rises on the eastern slope of the Rocky Mountains in northwestern Montana, flows southward for about 60 miles, then, turning abruptly, flows eastward through a canyon in the confining mountains, emerging on a level plain through which it runs for 75 miles to its junction with the Missouri at Great Falls. The basin lies between Teton River on the north, the Dearborn on the south, the Missouri on the east, and the crest of the main range of the Rockies on the west.

NORTH FORK OF SUN RIVER NEAR AUGUSTA, MONT.

This station was established October 31, 1903. It is located below the head of the Kilraven ditch, near Christian's ranch, 14 miles northwest of Augusta and 21 miles southwest of Chouteau, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 38, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Sun River near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	H. M. Morse	108	291	0.85	277
May 7	G. Edson	126	411	1.81	889
May 27	do	135	438	2.10	1,160
June 21	Edson and Richards	131	445	2.07	1,080
July 19	R. Richards	112	340	1.30	491
August 16	do	100	278	.78	280
October 4	do	105	266	.73	225
November 14	Follansbee and Richards	120	351	1.40	508

Daily gage height, in feet, of North Fork of Sun River near Augusta, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.7	1.8	2.2	2.0	1.0	1.0	0.7	1.1	1.0
2	.7	1.7	2.3	1.9	1.0	1.0	.7	1.1	1.0
3	.8	1.7	2.3	1.9	1.0	1.0	.7	1.1	1.1
4	.8	1.7	2.8	1.9	1.0	.9	.7	1.1	1.2
5	.8	1.7	3.1	1.9	1.0	.8	.7	1.0	1.2
6	.8	1.8	2.8	1.8	1.0	.8	.7	1.0	1.2
7	.8	1.8	2.7	1.8	1.0	.8	.7	1.0	1.2
8	.8	1.8	2.7	1.7	.9	.8	.6	1.0	1.1
9	.9	1.8	2.6	1.7	.9	.8	.6	1.0	1.1
10	.9	1.9	2.6	1.6	.9	.8	.6	1.0	1.1
11	1.0	2.0	2.6	1.6	.9	.8	.6	1.0	1.1
12	1.0	2.5	2.9	1.5	.9	.8	.6	1.0	1.0
13	1.0	2.7	3.1	1.5	.9	.8	.6	1.2	1.0
14	1.1	2.7	2.8	1.6	.8	.8	.6	1.4	1.0
15	1.2	2.6	2.6	1.5	.8	.8	.6	1.6	1.0

Daily gage height, in feet, of North Fork of Sun River near Augusta, Mont., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	1.2	2.4	2.5	1.5	0.8	0.8	0.6	2.5	1.0
17	1.3	2.2	2.5	1.4	.7	.8	.6	2.0	1.1
18	1.4	2.0	2.4	1.4	.7	.8	.6	1.6	1.1
19	1.4	2.0	2.2	1.4	.7	.8	.6	1.6	1.1
20	1.5	2.0	2.1	1.3	.7	.8	.6	1.6	1.1
21	1.5	2.1	2.1	1.2	.7	.8	.6	1.6	1.0
22	1.5	2.2	2.0	1.2	.8	.8	.6	1.5	1.0
23	1.6	2.2	2.0	1.2	.9	.8	.8	1.5	1.0
24	1.7	2.2	2.0	1.2	1.0	.8	1.0	1.4	1.0
25	1.8	2.2	2.0	1.2	1.0	.8	1.1	1.4	1.0
26	1.8	2.2	2.0	1.1	1.1	.7	1.2	1.3	1.0
27	1.9	2.1	2.0	1.1	1.2	.7	1.2	1.3	1.0
28	1.8	2.1	2.2	1.1	1.3	.7	1.2	1.2	1.0
29	1.8	2.2	2.2	1.1	1.2	.7	1.2	1.1	1.0
30	1.8	2.2	2.0	1.1	1.2	.7	1.1	1.0	1.0
31	.....	2.2	.....	1.0	1.1	.....	1.1	.....	1.0

NOTE.—Practically open-channel conditions during December.

Rating table for North Fork of Sun River near Augusta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	195	1.30	485	2.00	1,020	2.60	1,670
.70	225	1.40	545	2.10	1,120	2.70	1,790
.80	260	1.50	610	2.20	1,220	2.80	1,920
.90	295	1.60	680	2.30	1,330	2.90	2,050
1.00	335	1.70	755	2.40	1,440	3.00	2,180
1.10	380	1.80	835	2.50	1,550	3.10	2,320
1.20	430	1.90	925				

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is well defined.

Monthly discharge of North Fork of Sun River near Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	925	225	493	29,300
May	1,790	755	1,120	68,900
June	2,320	1,020	1,470	87,500
July	1,020	335	609	37,400
August	485	225	315	19,400
September	335	225	263	15,600
October	430	195	257	15,800
November	1,550	335	519	30,900
December	430	335	360	22,100
The period	.....	.....	.....	327,000

NOTE.—Values for 1906 are excellent.

SOUTH FORK OF SUN RIVER AT AUGUSTA, MONT.

This station was established December 2, 1904. It is located at the highway bridge on the road from Augusta to Craig, Mont., about one-half mile from Augusta. A small diversion dam immediately below the bridge affected the gage height, as the dam was frequently changed during the irrigation season. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 40, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Sun River at Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	Morse and Edson	30	41	0.91	29.0
April 13	do	29	39	.90	28.7
May 4	G. Edson	30	41	.90	33.0
May 25	do	35	60	1.56	160
May 26	do	38	73	1.80	294
May 28	do	38	76	1.85	314
May 29	do	82	134	2.39	565
June 20	Edson and Richards	32	61	1.36	156
July 17	R. Richards	30	40	.82	27.0
August 15	do	[a] 15	[a] 6.4	.54	4.8
October 3	do	[a] 25	[a] 37	.92	25.0
November 13	Follansbee and Richards	[a] 32	[a] 40	1.01	25.3

[a] Wading section.

Daily gage height, in feet, of South Fork of Sun River at Augusta, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.5	1.0	1.2	1.1	0.9	2.5	1.0	0.7	1.0	0.9	1.0	1.1
2	1.5	1.0	1.2	1.0	.9	2.5	1.0	.7	1.0	.9	1.0	1.1
3	1.5	1.0	1.2	1.0	.9	2.5	.9	.7	1.0	.9	1.0	1.1
4	1.6	1.0	1.1	1.0	.9	2.5	.8	.7	1.0	.9	1.0	1.1
5	1.6	1.0	1.1	.9	.9	2.4	.7	.6	.9	.9	1.0	1.1
6	1.7	1.0	1.2	.9	.9	2.3	.7	.6	.9	.9	1.0	1.1
7	1.7	1.0	1.2	.95	.9	2.2	.6	.6	.9	.9	1.0	1.1
8	1.7	1.0	1.2	.95	.9	2.1	.6	.6	.9	.9	1.0	1.1
9	1.7	1.2	1.2	.95	.9	1.9	.5	.6	.9	.9	1.0	1.1
10	1.7	1.2	1.2	.9	.9	1.8	.4	.6	.9	.9	1.0	1.1
11	1.7	1.2	1.3	.9	.9	1.8	.4	.6	.9	.9	1.0	1.2
12	1.8	1.3	1.3	.9	.8	1.7	.4	.6	.9	.9	1.0	1.1
13	1.8	1.3	1.3	.9	.8	1.6	.4	.6	1.0	.9	1.0	1.0
14	1.8	1.3	1.3	.9	.8	1.5	.8	.6	1.0	.9	1.0	1.0
15	1.8	1.3	1.3	.9	.7	1.4	.8	.6	1.0	.9	1.0	1.0
16	1.8	1.3	1.3	.9	.7	1.4	.8	.6	1.0	.9	1.0	1.0
17	1.8	1.3	1.3	.9	.7	1.4	.8	.5	.9	1.0	1.0	1.0
18	1.8	1.3	1.3	.9	.7	1.4	.8	.5	.9	1.0	1.1	1.0
19	1.8	1.3	1.3	.8	.7	1.4	.9	.5	1.0	1.0	1.1	1.0
20	1.8	1.3	1.3	.8	.8	1.4	.9	.5	1.0	1.0	1.1	1.0
21	1.8	1.3	1.3	.8	.8	1.4	.9	.5	1.0	1.0	1.1	1.0
22	1.8	1.3	1.3	.85	.9	1.3	1.0	.6	1.0	1.0	1.1	1.0
23	1.8	.9	1.3	.85	1.0	1.3	1.0	1.1	.9	1.0	1.1	1.0
24	1.8	.9	1.1	.85	1.0	1.3	1.0	1.1	.9	1.0	1.1	1.0
25	1.8	1.1	1.1	.85	1.4	1.2	1.0	1.1	.9	1.0	1.1	1.0
26	1.0	1.1	1.1	.85	1.1	1.2	.9	1.1	.9	1.0	1.1	1.0
27	1.0	1.1	1.1	.85	2.0	1.2	.9	1.1	.9	1.0	1.1	1.0
28	1.0	1.1	1.1	.9	2.4	1.1	.8	1.0	.9	1.0	1.1	1.0
29	1.0	.....	1.1	.9	2.5	1.1	.8	1.0	.9	1.0	1.1	1.0
30	1.0	.....	1.1	.9	2.5	1.1	.8	1.0	.9	1.0	1.1	1.0
31	1.0	.....	1.1	.....	2.5	.....	.8	1.0	.....	1.0	.....	1.0

NOTE.—Ice conditions during the greater part of January, February, and March, and December 24–31; gage heights are to top of ice.

Monthly discharge of South Fork of Sun River at Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	53	30	41.1	2,280
March	69	53	63.8	3,920
April	53	23	30.8	1,830
May	625	18	119	7,320
June	625	95	277	16,500
July	78	17	32.1	1,970
August	41	3	15.6	959
September	31	23	26.2	1,560
October	31	23	25.7	1,580
November	33	25	28.5	1,700
December	42	25	28.4	1,750
The period				41,400

NOTE.—Values are rated as follows: April, fair; May, good; the remainder of the period, approximate, owing to the instability of a small diversion dam below the station or to ice conditions.

SUN RIVER AT SUN RIVER, MONT.

This station was established July 31, 1905. It is located at the highway bridge at Sun River, Mont., 21 miles west of Great Falls, and is used to check the measurements of the river and the ditches above. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 42.

Discharge measurements of Sun River at Sun River, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	Morse and Edson	87	150	2.28	344
April 15	H. M. Morse	85	147	2.24	359
May 3	G. Edson	112	252	3.07	684
May 11	do	136	345	3.85	1,240
May 22	do	135	335	3.80	1,160
May 30	do	220	595	4.95	2,140
June 19	Edson and Richards	166	464	4.29	1,510
July 16	R. Richards	95	217	2.70	506
August 17	do	[a] 52	[a] 39.2	1.49	74
October 16	do	[a] 56	[a] 61.7	1.89	204
November 6	Follansbee and Richards	[a] 61	[a] 91.6	2.39	396
November 16	do	172	519	4.50	[b] 1,440

[a] Wading section. [b] Ice running, value doubtful.

Daily gage height, in feet, of Sun River at Sun River, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.5	2.0	2.2	3.0	4.85	3.4	1.95	2.0	1.8	2.3	3.6
2	2.0	2.1	2.0	2.3	3.0	4.8	3.3	1.95	2.0	1.83	1.9	3.6
3	2.0	2.1	2.0	2.2	3.0	4.75	3.3	1.95	1.95	1.85	.....	3.55
4	2.1	2.1	2.0	2.15	3.6	4.85	3.2	1.8	1.8	1.9	2.4	3.53
5	2.1	2.0	2.0	2.1	3.8	5.8	3.5	1.8	1.8	1.9	2.4	3.6
6	2.1	2.0	2.0	2.1	3.6	5.55	3.0	1.8	1.8	1.9	2.42	3.6
7	2.0	2.0	2.0	2.1	3.4	5.25	2.95	1.8	1.6	1.9	2.41	3.61
8	2.0	2.0	2.0	2.15	3.35	5.0	3.0	1.8	1.6	1.9	2.5	3.15
9	2.0	2.1	2.0	2.2	3.2	4.9	3.0	1.75	1.55	1.87	2.51	3.15
10	2.0	2.1	2.0	2.25	3.1	4.65	2.95	1.75	1.5	1.88	2.5	3.14
11	2.0	2.1	1.9	2.25	3.85	4.9	2.95	1.7	1.5	1.93	2.5	3.14
12	2.0	2.2	1.85	2.1	4.4	5.2	3.0	1.65	1.4	1.99	2.4	3.1
13	2.0	2.2	1.8	2.5	4.95	5.45	3.0	1.65	1.4	1.97	2.4	3.5
14	2.0	2.1	1.7	2.0	4.6	5.0	3.0	1.6	1.3	1.9	2.8	3.2
15	2.0	2.1	1.7	2.3	4.75	4.75	2.85	1.6	1.6	1.9	2.9	3.2

Daily gage height, in feet, of Sun River at Sun River, Mont., for 1906—Continued.

Days.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	2.0	2.2	1.7	2.25	4.45	4.65	2.7	1.5	1.5	1.8	4.5	3.2
17	2.0	2.2	2.2	2.4	4.1	4.6	2.7	1.5	1.65	1.8	4.2	3.2
18	2.0	2.0	2.3	2.6	3.95	4.25	2.7	1.5	1.65	1.83	4.1	3.2
19	2.0	2.0	2.3	2.6	3.8	4.15	2.65	1.45	1.65	1.87	4.1	3.0
20	2.0	2.0	2.25	2.65	3.85	3.85	2.5	1.45	1.7	1.88	3.82	3.0
21	2.5	2.1	2.4	2.75	3.85	3.8	2.45	1.45	1.8	1.88	3.81	3.0
22	2.85	2.1	2.4	3.5	3.85	3.75	2.45	1.45	1.8	1.86	3.8	3.0
23	2.8	2.1	2.4	3.4	3.95	3.7	2.25	1.8	1.8	1.83	3.9	3.0
24	2.8	2.1	2.4	3.8	3.85	3.8	2.2	1.95	1.6	1.9	3.92	3.5
25	2.8	2.0	3.0	3.9	4.0	3.75	2.2	2.1	1.7	1.9	3.72	3.5
26	2.4	2.0	2.95	3.6	4.15	3.7	2.2	2.4	1.5	1.9	3.95	3.2
27	2.4	2.0	2.95	3.45	4.2	3.6	2.2	2.4	1.6	2.0	3.97	3.2
28	2.4	2.0	2.8	3.3	4.15	3.6	2.15	2.4	1.6	2.0	4.0	3.2
29	2.4	.....	2.8	3.0	5.55	3.75	2.15	2.3	1.65	2.0	3.98	3.2
30	2.1	.....	2.7	3.0	4.95	3.75	2.0	2.3	1.7	2.0	3.9	3.4
31	2.1	.....	2.5	.....	4.6	.....	1.95	2.0	.....	2.1	.....	3.5

NOTE.—Ice conditions January 12–28, February 4–12, March 3, 11–28; the ice increased in thickness from 0.2 foot January 13 to 1 foot March 11.

Rating table for Sun River at Sun River, Mont., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	47	2.40	386	3.50	938	4.60	1,795
1.40	70	2.50	428	3.60	1,000	4.70	1,885
1.50	94	2.60	470	3.70	1,065	4.80	1,980
1.60	119	2.70	514	3.80	1,135	4.90	2,075
1.70	146	2.80	560	3.90	1,210	5.00	2,170
1.80	175	2.90	608	4.00	1,285	5.20	2,370
1.90	206	3.00	658	4.10	1,365	5.40	2,575
2.00	238	3.10	710	4.20	1,445	5.60	2,785
2.10	272	3.20	764	4.30	1,530	5.80	3,000
2.20	308	3.30	820	4.40	1,615		
2.30	346	3.40	878	4.50	1,705		

NOTE.—The above table is applicable only for open-channel conditions. It is based on fourteen discharge measurements made during 1905–6 and is well defined above gage height 1.7 feet. Below 1.7 feet the table is based on two discrepant measurements, and at gage heights 1.3 feet is only approximate.

Monthly discharge of Sun River at Sun River, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January (1–11; 30–31)	272	238	251	6,470
February	428	238	269	14,900
March (1–10; 28–31)	560	238	317	8,800
April	1,210	238	516	30,700
May	2,730	658	1,310	80,600
June	3,000	1,000	1,730	103,000
July	938	222	533	32,800
August	386	82	190	11,700
September	238	47	137	8,150
October	272	175	207	12,700
November	1,700	206	837	49,800
The period	.....	.....	.....	360,000

No estimate for ice period.

NOTE.—Values are rated as follows: January to October, excellent; the mean discharge value for November may be high on account of ice gorging, but it can probably be considered good.

WILLOW CREEK NEAR AUGUSTA, MONT.

The gaging station was established June 8, 1905. It is located at Jordan's ranch, just below the junction of Willow Creek with Little

Willow Creek, about 8 miles northwest of Augusta, Mont., in sec. 27, T. 21 N., R. 7 W., from which it is reached by driving. The conditions at this station and the bench marks are described in Water Supply Paper No. 172, page 43. The length of chain is now 13.95 feet.

Discharge measurements of Willow Creek River near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 8	Porter and Casen	13	38	2.12	58
July 13	A. P. Porter	17	12	1.19	23
August 22	Porter and Edson	16	8	.95	12
November 2	Gordon Edson	14	4	.61	3
1906.					
April 11	Morse and Edson	11	18.7	.77	10.8
May 7	G. Edson	14	4.6	.55	5.3
May 27	do	11	25.2	1.48	33.0
May 29	do	15	59.1	3.46	115
June 21	Edson and Richards	11	25.6	1.03	16.4
July 18	R. Richards	11	21.4	.87	13.5
August 16	do	16	7.5	.55	5.90
October 4	do	12	6.5	.59	7.8
November 15	Follansbee and Richards	13	8.2	.82	11.6

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Willow Creek River near Augusta, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.58	0.68	0.60	1.08	0.60	1.85	0.75	0.50	0.80	0.60	0.62	0.85
2	.58	.68	.60	.98	.52	1.78	.75	.50	.80	.60	.62	.85
3	.58	.68	.58	.80	.50	1.82	.75	.50	.78	.60	.62	.85
4	.58	.52	.60	.80	.55	2.02	.75	.55	.78	.58	.62	.88
5	.58	.55	.72	.80	.62	2.02	.65	.55	.78	.58	.62	.90
6	.60	.60	.70	.85	.60	2.05	.60	.60	.75	.58	.65	.90
7	.60	.62	.82	.85	.55	1.90	.52	.60	.72	.55	.75	1.15
8	.60	.62	.82	.82	.55	1.70	.52	.60	.70	.62	.75	.90
9	.62	.62	.62	.80	.55	1.65	.52	.60	.70	.62	.70	.65
10	.62	.62	.42	.78	.50	1.75	.50	.60	.70	.62	.70	.65
11	.62	.60	.42	.80	.50	1.70	.50	.58	.70	.62	.68	.70
12	.62	.60	.42	.80	.50	1.62	.50	.58	.75	.62	.68	.70
13	.62	.60	.42	.75	.50	1.60	.52	.60	.75	.62	.68	.90
14	.62	.60	.45	.75	.50	1.60	.52	.60	.78	.62	.70	.85
15	.62	.62	.45	.70	.58	1.60	.62	.58	.80	.62	.70	.70
16	.62	.62	.45	.70	.50	1.55	.72	.55	.75	.62	.80	.65
17	.60	.62	.45	.70	.48	1.48	.72	.55	.70	.65	.88	.80
18	.60	.68	.50	.70	.45	1.28	.72	.55	.70	.65	.82	.80
19	.60	.70	.50	.70	.40	1.22	.65	.55	.70	.65	.70	.80
20	.60	.70	.50	.70	.42	1.00	.62	.58	.70	.70	.78	.80
21	.60	.68	.50	.70	.48	1.00	.55	.58	.70	.62	.80	.80
22	.58	.65	.52	.62	.52	1.05	.55	.72	.68	.68	.80	.80
23	.60	.62	.52	.62	.70	1.00	.52	1.22	.68	.68	.80	.82
24	.70	.60	.60	.65	1.10	1.00	.52	.90	.62	.88	.80	.85
25	.68	.60	.70	.65	1.32	.85	.50	.85	.62	.85	.90	.85
26	.65	.60	.82	.65	1.85	.82	.48	.82	.62	.82	.90	.85
27	.62	.60	1.12	.65	1.55	.77	.48	.80	.62	.72	.90	.85
28	.62	.60	1.22	.65	1.60	.77	.48	.80	.60	.70	.85	.85
29	.65	.....	1.20	.62	3.10	.75	.48	.80	.60	.65	.80	.78
30	.68	.....	1.05	.60	2.45	.75	.58	.80	.60	.62	.85	.75
31	.68	.....	1.05	.....	2.08	.....	.55	.80	.....	.62	.....	.70

NOTE—No ice conditions near the gage due to the effect of springs. The stream was frozen over several hundred feet downstream, but it is considered this will not affect the flow at the gage.

Rating table for Willow Creek River near Augusta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	4	1.30	26	2.20	59	3.10	94
.50	5	1.40	29	2.30	63	3.20	98
.60	7	1.50	33	2.40	67	3.30	102
.70	9	1.60	37	2.50	70	3.40	106
.80	11	1.70	40	2.60	74	3.50	110
.90	14	1.80	44	2.70	78	3.60	114
1.00	17	1.90	48	2.80	82		
1.10	20	2.00	51	2.90	86		
1.20	23	2.10	55	3.00	90		

NOTE.—The above table is applicable only for open channel conditions. It is based on eleven discharge measurements made during 1905 and 1906 and is well defined between gage heights 0.5 foot and 1.5 feet. Above 1.5 feet the curve depends on two measurements.

Monthly discharge of Willow Creek near Augusta, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
June (8–30)	103	27	58.1	2,650
July	72	9	25.8	1,590
August	53	12	18.7	1,150
September	12	3	7.7	458
October	8	3	4.8	295
November	9	3	6.2	369
December	8	3	5.6	344
The period				6,860
1906.				
January	9	7	7.3	449
February	9	5	7.4	411
March	24	4	8.8	541
April	19	7	10.0	595
May	94	4	16.4	1,010
June	53	10	30.5	1,810
July	10	5	6.6	406
August	24	5	8.4	516
September	11	7	9.1	542
October	13	6	7.9	486
November	14	7	10.1	601
December	21	8	11.5	707
The year	94	4	11.2	8,070

NOTE.—Values are rated as follows: June to August, 1905, and July, 1906, good; September, 1905, to March, 1906, approximate, owing to insufficient data; April to June, November, and December, 1906, excellent; August to October, 1906, fair.

FORD CREEK, NEAR AUGUSTA, MONT.

The gaging station was established April 11, 1906. It is located at the ranch of Joseph Ford, 16 miles west of Augusta, and a short distance below the heading of a small irrigation ditch. No regular observations are made of the flow of this ditch, but occasional measurements are made.

The channel is straight for 50 feet above and below the section. The right bank is low, covered with dense brush, and liable to overflow; the left is high, nearly clear, and will not overflow. The bed is rocky and permanent and the current is swift.

Discharge measurements are made from a footbridge near by or by wading.

The gage, which is read twice each day by Joseph Ford, is a staff fastened to a post on the left bank of the stream in front of the observer's house. The bench mark is a spike in the root of a cottonwood tree, 15 feet east of the gage; elevation 5.89 feet above the gage datum.

Discharge measurements of Ford Creek near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	H. M. Morse	12	6.5	0.99	10.2
May 5	G. Edson	12	7.6	1.01	12.0
May 25	do	14	11.5	1.42	39.9
June 21	Edson and Richards	15	11.1	1.38	35.6
July 18	R. Richards	15	10.1	1.28	26.8
August 16	do	14	9.0	1.07	15.0
October 4	do	13	7.6	.98	11.8
November 14	Follansbee and Richards	14	8.5	1.16	19.3

Daily gage height, in feet, of Ford Creek near Augusta, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.1	1.8	1.3	1.0	1.05	1.0	1.0	1.2
2		1.1	1.8	1.3	1.0	1.1	1.0	.0	1.2
3		1.1	1.8	1.3	1.0	1.1	1.0	.0	1.2
4		1.05	1.7	1.25	1.0	1.1	1.0	1.1	1.2
5		1.0	1.7	1.2	1.0	1.1	1.0	1.1	1.2
6		1.0	1.7	1.2	1.0	1.1	1.0	1.1	1.2
7		1.0	1.6	1.2	1.0	1.1	1.0	1.1	1.2
8		1.0	1.5	1.2	1.05	1.1	1.0	1.1	1.5
9		1.0	1.5	1.2	1.1	1.05	1.0	1.15	2.0
10		1.0	1.5	1.2	1.1	1.0	1.0	1.1	2.0
11		1.0	1.5	1.2	1.1	1.0	1.0	1.1	2.0
12		1.0	1.5	1.2	1.1	1.0	1.0	1.1	2.0
13		1.0	1.5	1.2	1.1	1.0	1.0	1.15	2.0
14	1.0	1.0	1.45	1.2	1.1	1.0	1.0	1.2	1.5
15	1.0	1.0	1.4	1.2	1.1	1.0	1.0	1.35	1.2
16	1.0	1.0	1.4	1.2	1.0	1.0	1.0	1.45	1.2
17	1.1	1.0	1.4	1.2	1.0	1.0	1.0	1.5	1.2
18	1.1	1.0	1.4	1.3	1.0	1.0	1.0	1.4	1.2
19	1.05	1.0	1.4	1.3	1.0	1.0	1.0	1.4	1.2
20	1.05	1.0	1.4	1.3	1.0	1.0	1.0	1.35	1.2
21	1.05	1.0	1.4	1.3	1.15	1.0	1.0	1.3	1.1
22	1.1	1.0	1.4	1.3	1.3	1.0	1.0	1.3	1.1
23	1.1	1.1	1.4	1.25	1.35	1.0	1.0	1.3	1.1
24	1.1	1.25	1.3	1.2	1.25	1.0	1.0	1.3	1.1
25	1.1	1.4	1.3	1.2	1.2	1.0	1.0	1.2	1.1
26	1.1	1.5	1.3	1.2	1.1	1.0	1.1	1.25	1.1
27	1.1	1.5	1.3	1.2	1.1	1.0	1.1	1.2	1.1
28	1.1	1.5	1.3	1.2	1.1	1.0	1.1	1.2	1.1
29	1.1	1.6	1.3	1.2	1.1	1.0	1.1	1.2	1.1
30	1.1	1.6	1.3	1.1	1.1	1.0	1.1	1.2	1.1
31		1.6		1.0	1.1		1.1		1.5

NOTE.—From August 8 to 15, inclusive, the water was shut off from the irrigation ditch immediately above the gage. November 2 and 3 the entire flow of the creek was turned into the irrigation ditch. Backwater from ice gorge December 8–14, 31; discharge estimated.

Rating table for Ford Creek near Augusta, Mont., from April 15 to December 31, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	8	1.20	21	1.50	48	1.80	93
1.00	12	1.30	28	1.60	61		
1.10	16	1.40	37	1.70	76		

NOTE.—The above table is applicable only for open channel conditions. It is based on eight discharge measurements made during 1906 and is well defined between gage heights 1.0 foot and 1.4 feet.

Monthly discharge of Ford Creek near Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (14-30)	16	12	14.9	503
May	61	12	22.0	1,350
June	93	28	47.6	2,830
July	28	12	22.5	1,380
August	32	12	15.8	972
September	16	12	13.1	780
October	16	12	12.8	787
November	48	0	22.2	1,320
December	21	16	19.2	1,180
The period				11,100

NOTE.—Values for 1906 are excellent.

SMITH CREEK NEAR AUGUSTA, MONT.

The gaging station was established April 14, 1906, at J. W. Nixon's ranch, 16 miles southwest of Augusta. It is located 1 mile above Mr. Nixon's house.

The channel curves above the station, but is straight for 100 feet below. The right bank is high and will not overflow; the left is low and will overflow at high stage. The bed is rocky and permanent and the current is swift. At low water the stream sinks entirely into the gravel 1 mile below the station and reappears 1 mile farther down. It has not been definitely determined as yet whether the entire flow reappears.

Discharge measurements are made by wading near the station.

The gage, which is read daily by Mrs. J. W. Nixon, consists of an inclined rod securely fastened to a rock ledge, which is located at the ford on the road to White Sawmill. The gage is referred to a bench mark, which is a roughly chipped square on the point of the ledge; elevation, 4.09 feet above the gage datum.

Discharge measurements of Smith Creek near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	Morse and Edson	12	8.2	0.95	14.2
May 5	G. Edson	16	12.5	1.00	19.5
May 25	do	26	29.7	1.42	82.4
June 21	Edson and Richards	20	22.2	1.18	43.0
July 18	R. Richards	14	12.1	1.01	22.8
August 15	do	14	9.5	.89	12.2
October 3	do	14	9.0	.89	10.8
November 13	Follansbee and Richards	17	17.2	1.01	22.8

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Smith Creek near Augusta, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.0	1.7	1.1	0.95	0.85	0.9	0.9	1.0
2	.....	1.0	1.75	1.1	.95	.85	.9	.9	1.0
3	.....	1.0	1.8	1.1	.95	.85	.9	.9	1.0
4	.....	1.0	1.8	1.05	.95	.85	.9	.9	.95
5	.....	1.0	1.6	1.05	.95	.85	.9	.9	.95
6	.....	1.0	1.6	1.05	.95	.85	.9	.9	.95
7	.....	1.0	1.55	1.05	.95	.85	.9	.9	.9
8	.....	1.0	1.5	1.05	.95	.85	.9	.9	.9
9	.....	1.0	1.4	1.05	.95	.8	.9	.9	.9
10	.....	1.0	1.45	1.05	.9	.8	.9	.9	.9
11	.....	1.0	1.45	1.05	.9	.8	.9	.9	.9
12	.....	1.0	1.35	1.05	.9	.8	.9	.9	.9
13	.....	1.0	1.35	1.05	.9	.8	.9	1.0	.9
14	.....	1.0	1.3	1.05	.9	.8	.9	1.0	.9
15	.....	1.05	1.3	1.05	.9	.8	.9	1.0	.9
16	1.0	1.1	1.25	1.0	.9	.8	.9	1.1	.9
17	1.0	1.0	1.25	1.0	.9	.85	.9	1.1	.9
18	1.0	1.05	1.2	1.0	.9	.85	.9	1.1	.9
19	1.0	1.0	1.2	1.0	.9	.9	.9	1.1	.9
20	1.0	1.05	1.2	1.0	.9	.9	.9	1.05	.9
21	1.05	1.05	1.2	1.0	.95	.9	.9	1.05	.9
22	1.1	1.05	1.2	1.0	1.0	.9	.9	1.0	.9
23	1.05	1.1	1.15	1.0	1.1	.9	.9	1.0	.9
24	1.2	1.25	1.15	1.0	1.0	.9	1.0	1.0	.9
25	1.05	1.5	1.15	.95	1.05	.9	1.0	1.0	.9
26	1.0	1.5	1.15	.95	1.0	.9	1.0	1.0	.9
27	1.0	1.5	1.15	.95	.95	.9	1.0	1.0	.9
28	1.05	1.5	1.15	.95	.95	.9	.9	1.0	.9
29	1.0	1.6	1.15	.95	.95	.9	.9	1.0	.9
30	1.0	1.5	1.15	.95	.9	.9	.9	1.0	.9
31	.....	1.6	.....	.95	.9	.....	.9	.....	.9

NOTE.—The creek does not freeze over for several hundred yards above and below the gage.

Rating table for Smith Creek near Augusta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	6	1.10	31	1.40	79	1.70	148
.90	12	1.20	45	1.50	100	1.80	175
1.00	20	1.30	61	1.60	123		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is well-defined between gage heights 0.9 foot and 1.4 feet.

Monthly discharge of Smith Creek near Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (16-30)	45	20	23.9	711
May	123	20	42.5	2,610
June	175	38	75.7	4,500
July	31	16	22.1	1,360
August	31	12	15.5	953
September	12	6	9.4	559
October	20	12	13.0	799
November	31	12	18.6	1,110
December	20	12	13.2	812
The period	.....	.....	.....	13,400

NOTE.—Values for 1906 are excellent.

BELT CREEK DRAINAGE BASIN.

BELT CREEK NEAR BELT, MONT.

This station was established March 18, 1905. It is located at the highway bridge near Belt, Mont., in the NW. ¼, NE. ¼, sec. 18, T. 20 N., R. 7 E., 20 miles east of Great Falls, from which it is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 45. The length of the chain is now 16.75 feet.

Discharge measurements of Belt Creek near Belt, Mont., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	Porter and Bird	40	45	1.59	8.0
May 12	L. R. Stockman	40	47	1.61	7.8
June 11	A. P. Porter	55	160	3.85	578
1906.					
April 20	G. Edson	15	5.4	1.58	4.6
May 18	do	53	99	2.73	160
May 19	do	53	98	2.70	155
June 1	do	55	121	3.20	357
July 14	R. Richards	52	109	2.82	190
November 10	Follansbee and Richards	24	10	1.49	3.6

Daily gage height, in feet, of Belt Creek near Belt, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.1	1.4	1.7	1.93	1.93	3.2	4.0	2.0	1.7	0.9	1.0	.....
2	1.1	1.4	1.7	1.93	1.93	3.2	3.8	2.0	1.6	.9	1.0	2.0
3	1.1	1.4	1.8	1.93	1.93	3.2	3.7	2.0	1.5	1.0	1.0	1.9
4	1.1	.....	1.7	1.73	1.93	3.1	3.5	2.0	1.4	1.0	1.0	1.9
5	1.1	.....	1.7	1.73	1.93	4.1	3.5	1.8	1.4	1.0	1.1	1.9
6	1.1	.....	1.7	1.73	2.03	4.95	3.5	1.8	1.4	1.0	1.1	1.9
7	1.1	1.4	1.7	1.73	2.13	5.25	3.4	1.8	1.4	.8	1.5	1.9
8	1.1	1.4	1.8	1.73	2.03	4.2	3.3	1.8	1.3	.8	1.5	1.9
9	1.1	1.4	1.7	1.73	2.13	4.5	3.2	1.7	1.4	.8	1.5	1.9
10	1.1	1.4	1.7	1.73	2.13	4.4	3.0	1.7	1.4	.9	1.5	2.0
11	1.1	1.5	1.0	1.73	2.13	4.75	3.0	1.7	1.5	.9	1.5	.....
12	1.1	1.5	1.0	1.73	2.13	5.15	3.1	1.6	1.6	.9	1.5	.....
13	1.1	1.5	1.0	1.73	2.23	4.6	2.9	1.6	1.5	.9	1.5	.....
14	1.0	1.7	1.3	1.73	2.33	4.9	2.9	1.4	1.5	.9	1.5	.....
15	1.0	1.7	1.4	1.63	2.53	4.9	2.8	1.4	1.5	1.0	1.6	.....
16	1.1	1.7	1.4	1.63	2.53	4.9	2.8	1.4	1.4	1.0	1.6	.....
17	1.1	1.7	1.5	1.63	2.63	4.7	2.9	1.4	1.4	1.0	1.6	.....
18	.9	1.7	1.6	1.63	2.63	4.6	2.8	1.3	1.4	1.0	1.8	.....
19	.9	1.7	1.6	1.63	2.7	4.3	2.8	1.3	1.4	1.0	1.8	.....
20	.9	1.7	1.6	1.53	2.8	4.1	2.7	1.3	1.3	1.0	1.8	.....
21	.9	1.7	1.9	1.53	2.9	3.9	2.6	1.5	1.3	1.0	1.9	.....
22	.9	1.7	2.1	1.53	3.0	3.95	2.5	1.5	1.3	1.0	2.0	2.0
23	.9	1.7	2.1	1.53	3.0	3.9	2.5	1.5	1.2	1.0	2.0	.....
24	1.0	1.7	2.1	1.63	3.0	4.0	2.4	2.0	1.2	1.0	2.0	.....
25	1.0	1.7	2.1	1.73	3.0	4.1	2.3	2.1	1.1	1.0	2.0	.....
26	1.1	1.7	1.9	1.93	3.0	4.3	2.2	2.0	1.1	1.0	2.0	.....
27	1.1	1.7	1.9	1.93	3.0	4.3	2.2	1.8	1.1	1.0	2.0	2.0
28	1.4	1.7	1.9	1.93	3.2	4.3	2.2	1.8	1.1	1.0	2.0	.....
29	1.4	.....	1.9	1.93	3.4	4.3	2.1	1.8	1.0	1.0	2.0	1.8
30	1.4	.....	1.9	1.93	3.5	4.3	2.1	1.8	.9	1.0	2.0	.....
31	1.4	.....	1.9	.....	3.4	.....	2.1	1.8	.....	.....	.....	.....

NOTE.—Ice conditions January 1 to March 25, approximate. There was practically no flow from September 23 to November 7. Ice conditions November 17 to December 31; gage heights were to water surface.

Rating table for Belt Creek near Belt, Mont., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	0	2.30	73	3.40	387	4.40	863
1.30	1	2.40	90	3.50	429	4.50	918
1.40	2	2.50	109	3.60	472	4.60	974
1.50	4	2.60	130	3.70	516	4.70	1,031
1.60	7	2.70	154	3.80	561	4.80	1,089
1.70	12	2.80	181	3.90	607	4.90	1,149
1.80	19	2.90	211	4.00	655	5.00	1,210
1.90	27	3.00	243	4.10	705	5.10	1,272
2.00	36	3.10	276	4.20	756	5.20	1,335
2.10	46	3.20	311	4.30	809	5.30	1,399
2.20	58	3.30	348				

NOTE.—The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1905–6, and is fairly well defined between gage heights 1.5 feet and 4 feet.

Monthly discharge of Belt Creek near Belt, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March (18–31)	7	5	6.3	175
April	10	5	7.3	434
May	90	7	24.8	1,520
June	705	109	341	20,300
July	243	27	109	6,700
August [a]	36	0	8.2	504
The period				29,600
1906.				
March (26–31)	27	27	27.0	321
April	30	5	16.0	952
May	429	30	150	9,220
June	1,370	276	818	48,700
July	655	46	231	14,200
August	46	1	16.3	1,000
September	12	0	2.3	137
October	0	0	0	0
November	7	0	3.1	105
The period				74,600

[a] Creek dry for remainder of year.

NOTE.—No estimates of accuracy can be made, as the gage heights are only approximate; the above results are liable to be considerably in error.

HIGHWOOD CREEK DRAINAGE BASIN.

HIGHWOOD CREEK NEAR HIGHWOOD, MONT.

The gaging station was established March 19, 1905, and was discontinued July 31, 1906. It is located at a highway bridge leading up Highwood Creek Valley, at Smith's ranch near Highwood, in sec. 5, T. 20 N., R. 8 E., Montana prime meridian, and 30 miles east of Great Falls, from which it is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 46.

Discharge measurements of Highwood Creek near Highwood, Mont., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
March 19	Porter and Bird	16	9	0.75	8.0
May 13	Stockman and Porter	16	9	.84	8.0
June 11	A. P. Porter	25	28	1.78	91
1906.					
April 21	G. Edson	16	10	.87	8.6
May 19	do	15	8	.80	5.7
June 1	do	18	24	1.65	103
July 13	R. Richards	18	19	1.21	22.0

Daily gage height, in feet, of Highwood Creek near Highwood, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	0.61	0.70	0.66	0.99	0.85	1.65	1.58
2	.61	.72	.68	.96	.79	1.62	1.52
3	.62	.75	.66	.95	.79	1.57	1.49
4	.61	.68	.65	.90	.81	1.47	1.44
5	.62	.74	.66	.90	.79	1.42	1.42
6	.61	.72	.66	.92	.79	3.75	1.38
7	.62	.71	.68	.99	.77	4.02	1.32
8	.61	.70	.68	1.02	.71	3.65	1.25
9	.62	.68	.68	.99	.69	3.25	1.22
10	.61	.68	.68	.96	.69	2.6	1.18
11	.62	.68	.68	.96	.71	2.25	1.20
12	.61	.65	.68	.94	76	2.2	1.18
13	.62	.68	.68	.90	.79	2.07	1.20
14	.61	.68	.70	.86	.80	1.9	1.18
15	.62	.66	.70	.86	.83	1.85	1.12
16	.61	.65	.70	.84	.83	1.8	1.08
17	.62	.64	.69	.84	.83	1.75	1.05
18	.61	.62	.70	.84	.83	1.65	1.05
19	.62	.61	.69	.84	.81	1.6	1.01
20	.61	.60	.70	.84	.82	1.55	0.99
21	.62	.60	.66	.84	.89	1.52	.96
22	.61	.62	.68	.86	.95	1.6	.93
23	.62	.64	.66	.87	.95	1.9	.98
24	.62	.68	.69	.99	.99	1.97	.92
25	.65	.66	.91	1.01	1.02	1.95	.86
26	.65	.68	.94	.99	1.02	1.85	.81
27	.68	.68	.92	.96	1.02	1.79	.79
28	.68	.68	.89	.95	1.02	1.79	.76
29	.70	.....	.89	.93	1.25	1.72	.75
30	.69	.....	.88	.91	1.52	1.64	.76
31	.70	.....	.89	.....	1.55	.....	.79

NOTE.—Ice conditions January 1 to March 15.

Rating table for Highwood Creek near Highwood, Mont., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.10	0	0.70	6	1.30	31	1.90	164
.20	1	.80	7	1.40	41	2.00	216
.30	2	.90	9	1.50	54	2.10	276
.40	3	1.00	12	1.60	71	2.20	346
.50	4	1.10	17	1.70	94	2.30	416
.60	5	1.20	23	1.80	124		

NOTE.—The above table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1905 and 1906, and is fairly well defined between gage heights 0.7 foot and 1.3 feet. Outside these limits the rating is only approximate.

Monthly discharge of Highwood Creek near Highwood, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March (19–31)	7	6	6.5	168
April	8	6	6.9	411
May	14	6	9.4	578
June	416	10	57.7	3,430
July	20	6	8.9	547
August	6	0	1.5	92
September	0	0	0	0
October	4	0	.3	18
November	5	4	5.0	298
December	6	5	5.3	326
The period				5,870
1906.				
March (16–31)	10	6	7.4	235
April	13	8	9.8	583
May	62	6	12.3	756
June (1–5; 11–30)		44	132	6,540
July	68	7	22.0	1,350
The period				9,460

NOTE.—Values are rated as follows: March to May, July, November, and December, 1905, and March to May, and July, 1906, good; June, 1905, fair; August and October, 1905, and June, 1906, approximate. June 6–10, 1906, the stage was too high to estimate.

MARIAS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Marias River rises on the eastern slope of the main divide of the Rocky Mountains and flows in a general southeasterly direction to its junction with the Missouri. Throughout its entire length the river flows in a canyon and has a fall not exceeding 5 feet per mile. Its principal tributaries are Cutbank Creek, Willow Creek, and Cottonwood Creek, which enter from the north, and Two Medicine Creek, Birch Creek, and Teton River from the south. The most important of these is the Teton, which has its source in the Rocky Mountains, flows eastward in a course approximately parallel to that of Sun River, crossing and recrossing the sixth standard parallel north, and emptying into Marias River about 1 mile above the point where the latter joins the Missouri.

MARIAS RIVER NEAR SHELBY, MONT.

This station was established April 4, 1902, and discontinued June 30, 1906. It is located at the highway bridge near James A. Johnson's ranch, 7 miles south of Shelby, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 48, where are given also references to publications that contain data for previous years.

Discharge measurements of Marias River near Shelby, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	Freeman and Edson	280	280	2.36	470
May 2	W. B. Freeman	149	321	2.75	756
July 14	W. S. Hartman	155	318	2.70	758
August 27	do	163	393	3.31	1,420
September 25	do	135	202	2.09	289
October 27	Follansbee and Richards	160	356	3.05	1,070

Daily gage height, in feet, of Marias River near Shelby, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.05	3.1	2.6	2.1	2.9	4.25	17	2.05	2.9	2.2	2.6	3.2	4.2
2	2.05	3.1	2.6	2.1	2.9	4.3	18	2.07	2.9	2.15	2.6	3.2	4.1
3	2.05	3.15	2.6	2.2	2.9	4.4	19	2.1	2.9	2.15	2.6	3.25	4.1
4	2.05	3.15	2.6	2.3	2.8	4.5	20	2.1	2.85	2.2	2.7	3.3	4.05
5	2.05	3.15	2.5	2.3	2.85	4.5	21	2.15	2.8	2.2	2.8	3.4	4.0
6	2.0	3.1	2.5	2.3	2.85	4.6	22	2.2	2.8	2.2	2.8	3.6	3.9
7	2.0	3.1	2.5	2.3	2.9	4.75	23	2.5	2.8	2.25	2.8	3.8	3.8
8	2.0	3.1	2.45	2.3	2.9	4.8	24	2.5	2.75	2.25	2.8	3.8	3.7
9	2.0	3.05	2.45	2.35	2.9	4.9	25	2.55	2.75	2.3	2.9	3.9	3.6
10	2.0	3.05	2.4	2.4	2.9	4.8	26	2.6	2.7	2.4	2.9	3.9	3.6
11	2.0	3.05	2.4	2.5	2.95	4.8	27	3.0	2.65	2.5	2.8	3.9	3.5
12	2.0	3.05	2.35	2.5	2.95	4.7	28	3.0	2.6	2.6	2.85	4.0	3.5
13	2.05	3.0	2.3	2.5	3.05	4.65	29	3.05	.....	2.8	2.85	4.1	3.5
14	2.05	3.0	2.25	2.6	3.1	4.5	30	3.07	.....	2.9	2.9	4.15	3.6
15	2.05	2.95	2.2	2.6	3.1	4.5	31	3.07	.....	3.0	.....	4.2	.....
16	2.05	2.95	2.2	2.6	3.15	4.4							

NOTE.—Ice conditions January 23 to March 26.

Rating table for Marias River near Shelby, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	250	2.80	820	3.60	1,780	4.40	3,100
2.10	305	2.90	920	3.70	1,930	4.50	3,290
2.20	365	3.00	1,020	3.80	2,080	4.60	3,480
2.30	430	3.10	1,130	3.90	2,240	4.70	3,680
2.40	500	3.20	1,250	4.00	2,400	4.80	3,880
2.50	570	3.30	1,370	4.10	2,570	4.90	4,090
2.60	650	3.40	1,500	4.20	2,740	5.00	4,300
2.70	730	3.50	1,640	4.30	2,920		

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1906 and is well defined between gage heights 2.0 feet and 5.0 feet.

Monthly discharge of Marias River near Shelby, Mont., for 1906.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January (1-22)	365	250	278	12,100	0.106	0.09
March (27-31)	1,020	570	796	7,890	.305	.06
April	920	305	634	37,700	.243	.27
May	2,740	820	1,460	89,800	.559	.64
June	4,090	1,640	2,820	168,000	1.08	1.20
The period	.....	.....	.....	315,000	.....	.....

NOTE.—No estimate for ice period, January 23 to March 26. Values for 1906 are probably good, although many of the gage heights are only approximate.

CUTBANK CREEK AT CUTBANK, MONT.

The gaging station was established August 4, 1905. It is located in the gorge just below the steel-trestle bridge of the Great Northern Railway, three-fourths mile west of Cutbank. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 50.

Discharge measurements of Cutbank Creek at Cutbank, Mont., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 31	W. B. Freeman	31	18	2.81	22
September 27	H. M. Morse	26	12	2.77	12
October 19	Freeman and Morse	48	44	3.30	58
November 19	W. B. Freeman	42	22	3.11	47
1906.					
April 3	Edson and Freeman	50	35	3.28	[a] 86
May 3	W. B. Freeman	50	35	3.21	86
May 24	do	51	66	3.44	212
June 10	Freeman and Hartman	95	95	3.66	382
July 13	W. S. Hartman	62	54	3.37	161
August 28	do	.....	67	3.44	194
September 20	do	45	26	3.07	57
October 26	Follansbee and Richards	45	31	3.09	63

[a] Ice running.

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Cutbank Creek at Cutbank, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	3.9	3.6	3.45	3.25	4.0	3.5	3.0	3.3	3.0	3.3	3.2
2	3.4	4.0	3.7	3.3	3.2	3.5	3.5	3.0	3.3	3.0	3.3	3.2
3	3.55	4.0	3.5	3.55	3.2	3.8	3.5	3.0	3.25	3.0	3.3	3.55
4	3.4	4.0	3.7	3.45	3.3	3.8	3.5	3.0	3.2	3.0	3.3	3.55
5	3.4	4.1	3.7	3.35	3.35	3.95	3.4	3.0	3.2	3.0	3.2	3.55
6	3.45	4.1	3.55	3.35	3.3	4.05	3.4	3.0	3.2	3.0	3.2	3.45
7	3.4	3.9	3.75	3.4	3.3	3.9	3.4	3.0	3.2	3.0	3.2	3.25
8	3.6	3.95	3.65	3.35	3.3	3.8	3.45	3.0	3.1	3.0	3.2	3.4
9	3.7	4.15	3.55	3.3	3.2	3.7	3.4	3.0	3.1	3.0	3.1	.....
10	3.45	4.1	3.45	3.2	3.3	3.7	3.4	3.0	3.1	3.1	3.2	.....
11	3.15	4.1	3.4	3.1	3.3	3.7	3.4	3.0	3.1	3.1	3.3	.....
12	3.45	3.95	3.1	3.1	3.4	3.8	3.4	3.0	3.1	3.1	3.2	.....
13	3.3	3.9	3.5	3.05	3.5	3.9	3.35	3.0	3.1	3.1	3.3	3.8
14	3.3	4.0	3.9	3.0	3.5	3.95	3.4	3.0	3.1	3.1	3.4	.....
15	3.5	3.85	3.65	3.0	3.5	3.85	3.35	3.0	3.1	3.1	3.5	.....
16	3.5	3.75	3.5	3.0	3.6	3.7	3.3	3.0	3.1	3.1	3.6	.....
17	3.7	3.8	3.5	3.0	3.5	3.7	3.3	3.0	3.1	3.1	3.8	.....
18	3.45	3.85	3.55	3.0	3.4	3.65	3.3	3.0	3.1	3.1	3.1	.....
19	3.15	4.0	3.45	3.0	3.4	3.6	3.3	3.0	3.1	3.1	3.25	.....
20	3.15	3.9	3.6	3.1	3.4	3.6	3.25	3.0	3.1	3.1	3.75	4.0
21	3.25	3.9	3.5	3.1	3.4	3.5	3.2	3.0	3.1	3.1	3.8	.....
22	3.4	3.8	3.6	3.1	3.4	3.5	3.2	3.05	3.0	3.1	3.8	.....
23	3.35	3.85	3.2	3.2	3.4	3.6	3.2	3.2	3.0	3.1	3.75	.....
24	3.85	3.8	3.45	3.35	3.5	3.55	3.2	3.3	3.0	3.1	3.6	.....
25	3.85	3.6	3.65	3.4	3.55	3.5	3.2	3.45	3.0	3.1	3.5	.....
26	3.8	3.6	3.85	3.4	3.65	3.5	3.2	3.6	3.0	3.1	3.6	.....
27	3.8	3.65	3.8	3.35	3.8	3.5	3.15	3.5	3.0	3.3	3.5	3.8
28	3.8	3.5	3.85	3.3	3.75	3.6	3.1	3.4	3.0	3.5	3.5	.....
29	3.8	.....	3.65	3.3	4.0	3.6	3.1	3.4	3.0	3.4	3.4	.....
30	3.85	.....	3.55	3.3	4.3	3.55	3.1	3.3	3.0	3.4	3.3	.....
31	3.9	.....	3.5	.....	4.25	.....	3.1	3.3	.....	3.3	.....	.....

NOTE.—Ice conditions January 1–March 31; gage heights were to water surface in hole in ice. River frozen entirely across December 9–31; gage heights were to water surface. The following comparative readings were made:

Comparative ice and water readings, in feet, at Cutbank, Mont.

Date.	Water surface.	Top of ice.	Thickness of ice.
December 13	3.8	4.1	0.6
December 20	4.0	4.2	.7
December 27	3.8	4.2	.6

Above and below the gage the thickness of ice was 1.0–1.4 feet.

Rating table for Cutbank Creek at Cutbank, Mont.

JANUARY 1–DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	5	2.80	17	3.10	46	3.40	103
2.60	7	2.90	24	3.20	63	3.50	127
2.70	11	3.00	33	3.30	82	3.60	155

JANUARY 1 1906, TO DECEMBER 31, 1906.[b]

3.00	45	3.40	180	3.80	520	4.20	1,020
3.10	62	3.50	250	3.90	630	4.30	1,170
3.20	87	3.60	330	4.00	750		
3.30	125	3.70	420	4.10	880		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 and is not well defined.

[b] This table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1906 and is well defined between gage heights 3.0 feet and 3.7 feet.

Monthly discharge of Cutbank Creek at Cutbank, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
August (4–31)	82	17	45.2	2,510
September	20	11	14.5	863
October	155	17	74.0	4,550
November	73	5	45.9	2,730
The period				10,700
1906.				
April	290	45	115	6,840
May	1,170	87	283	17,400
June	815	250	436	25,900
July	250	62	142	8,730
August	330	45	84.4	5,190
September	125	45	65.9	3,920
October	250	45	74.8	4,600
November	520	62	216	12,900
December			[a] 200	12,300
The period				97,800

[a] Estimated.

NOTE.—Values are rated as follows: August and September, 1905, and December, 1906, approximate; October, 1905, fair; November, 1905, and April, 1906, good; May to November, 1906, excellent.

TETON RIVER NEAR BELLEVIEW, MONT.

This station was established November 26, 1904, and was discontinued December 31, 1906. It is located in sec. 35, T. 25 N., R. 35 W., Montana prime meridian, about 16 miles above Chouteau, Mont. The nearest post-office is Belleview, Mont. The conditions at this station are described in Water-Supply Paper No. 172, page 52, where are given also references to publications that contain data for previous years.

May 8, 1906, the gage was moved 1½ miles up stream to Mr. Bjornstad's new ranch. There is no connection between the old and new gages. The bench mark of the present gage is a spike below a blaze in a 14-inch cottonwood tree 100 feet back of gage; elevation, 9.70 feet above gage datum.

Discharge measurements of Teton River near Belleview, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	G. Edson	38	27	0.02	25.2
May 9	do	35	32	[a] 2.90	43.1
June 22	Edson and Richards	45	58	[a] 3.51	17.0

[a] New gage at different section.

Daily gage height, in feet, of Teton River near Belleview, Mont., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.	Dec.
1			0.8	3.4	3.5		3.1		3.15
2			.8	3.5	3.45		3.1	3.1	3.15
3			.8	3.65	3.5		3.1	3.1	3.25
4			.8	4.0	3.4		3.1	3.1	3.25
5			.8	4.1			3.1	3.05	3.2
6			.8	4.05	3.35		3.1	3.05	3.25
7			.8	3.9	3.3		3.1	3.1	3.25
8			.85	3.9	3.35			3.1	3.1
9			2.9	3.95	3.3	3.2	3.1	3.1	3.1
10			2.9	3.95	3.3		3.05	3.1	3.1
11	0.15		3.0		3.2		3.05	3.1	3.1
12	.25		3.1	4.0	3.3	3.2	3.05		3.1
13	.1		3.1	4.0	3.3	3.15	3.05	3.15	3.1
14	.15		3.1	3.85		3.15	3.05	3.15	3.1
15	.35		3.2		3.2	3.15		3.25	
16	.1		3.2	3.9	3.2	3.15	3.05	3.4	3.1
17			3.1	3.6	3.25	3.1	3.05	3.3	3.1
18				3.5	3.2	3.1	3.05	3.3	3.05
19		2.5	3.1	3.45	3.25		3.05	3.25	3.0
20		2.5	3.1	3.4	3.25	3.1	3.05	3.3	3.0
21				3.45	3.25	3.1	3.05	3.25	3.0
22			3.1	3.5	3.2	3.1	3.0	3.2	
23			3.1	3.5	3.15	3.1	3.05	3.2	
24			3.2	3.5	3.1	3.1	3.05	3.2	3.1
25		.7	3.25	3.45	3.1	3.1	3.05	3.2	3.1
26		.7	3.4	3.6	3.1	3.1	3.1	3.15	3.1
27		.7	3.3	3.65	3.1	3.1	3.1	3.1	3.1
28		.8	3.3	3.6	3.1	3.1	3.1	3.1	3.1
29		.8	3.45	3.6	3.1	3.1	3.1	3.2	3.1
30		.8	3.4	3.55	3.1	3.1	3.15	3.15	3.0
31			3.35		3.1		3.15		

NOTE.—Beginning May 9, the gage heights refer to the new gage, 1½ miles farther up the river.

TETON RIVER NEAR CHOUTEAU, MONT.

This station was established November 30, 1904, and was discontinued July 31, 1906. It is located at the highway bridge on the road from Chouteau to Augusta, Mont., and is about 1½ miles from the town of Chouteau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 53, where are given also references to publications that contain data for previous years.

Discharge measurements of Teton River near Chouteau, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 13	Morse and Edson	13	5.2	1.75	7.2
May 9	G. Edson	12	4.7	1.70	4.6
June 23	Edson and Richards	12	6.1	1.71	7.8

Daily gage height, in feet, of Teton River near Chouteau, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1			1.86		1.70		
2							1.70
3				1.69			
4			1.85				
5							
6					1.70		
7			1.85	1.7			
8							
9					1.70	1.80	1.60
10							
11			1.85	1.67			
12					1.71		
13				1.75			
14			1.84			1.97	
15							
16				1.65	1.65		1.62
17	1.85	1.90	2.40				
18	1.85	1.90				1.92	
19							
20	1.90			1.60			1.50
21					1.70	1.90	
22	1.85	1.88					
23			1.85			1.71	
24				1.55	1.55		
25		1.85					
26							
27						1.77	
28				1.60	1.60		
29			1.87				
30							
31							

NOTE.—Ice conditions January 15 to March 29.

Monthly discharge of Teton River near Chouteau, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	7	1	3.9	232
May	6	1	4.1	252
June (9-30)	30	7	15.7	684
July (1-20)	6	1	2.8	111
The period				1,220

NOTE.—No estimate for ice period. The above results are approximate only, owing to lack of data. Discharge obtained directly from rating curve; missing days interpolated.

MILK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Milk River rises in the undulating foothills of the Rocky Mountains in northwestern Montana, near the boundary line between the United States and Canada. Its headwaters flow northeastward into Canada and for about 100 miles its course is eastward, parallel with the international boundary; it then turns to the southeast, passes across the northern part of Montana, and empties into the Missouri.

SOUTH FORK OF MILK RIVER NEAR BROWNING, MONT.

This station was established April 28, 1905. It is located at Croff's ranch, 35 miles northeast of Browning, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 55.

Discharge measurements of South Fork of Milk River near Browning, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 13	W. B. Freeman	42	40	3.32	13.5
September 16	Richards and Hartman	29	19	3.27	11.2
October 24	Follansbee and Richards	33	27	3.48	24.7

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of South Fork of Milk River near Browning, Mont., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.60	3.50	5.42	3.55	3.00	3.25	3.15	3.35
2	.....	3.25	3.50	4.87	3.52	3.00	3.25	3.15	3.32
3	.....	3.30	3.50	4.47	3.50	3.00	3.25	3.15	3.38
4	.....	3.25	3.55	4.27	3.45	3.10	3.25	3.15	3.30
5	.....	3.55	3.55	4.17	3.40	3.15	3.20	3.25	3.35
6	.....	4.15	3.55	4.10	3.40	3.15	3.18	3.25	3.18
7	.....	4.10	3.50	4.02	3.40	3.15	3.15	3.25	3.30
8	.....	4.00	3.50	3.95	3.40	3.15	3.15	3.25	3.40
9	.....	3.87	3.45	3.90	3.32	3.10	3.15	3.25	3.42
10	.....	3.65	3.40	3.85	3.25	3.10	3.10	3.25	3.50
11	.....	3.62	3.35	3.77	3.20	3.05	3.10	3.25	3.48
12	.....	3.60	3.35	3.75	3.20	3.02	3.15	3.25	3.55
13	.....	3.57	3.32	3.75	3.22	3.00	3.20	3.25	3.50
14	.....	3.55	3.30	3.75	3.40	3.00	3.22	3.25	3.62
15	.....	3.55	3.30	3.70	3.38	3.00	3.25	3.25	3.65
16	3.25	3.55	3.52	3.65	3.35	2.95	3.25	3.25	3.40
17	3.25	3.57	3.55	3.62	3.30	2.95	3.25	3.30	3.38
18	3.25	3.60	3.50	3.60	3.30	2.90	3.20	3.35	3.65
19	3.25	3.60	3.47	3.55	3.30	2.90	3.20	3.35	3.62
20	3.25	3.60	3.50	3.55	3.20	2.90	3.18	3.35	3.58
21	3.25	3.60	3.55	3.55	3.20	3.00	3.15	3.35	3.55
22	3.25	3.50	3.67	3.82	3.15	3.32	3.15	3.35	3.52
23	3.25	3.50	3.62	4.35	3.15	3.65	3.15	3.42	3.48
24	3.25	3.60	3.92	4.17	3.10	3.68	3.15	3.52	3.45
25	3.25	3.60	4.25	4.05	3.10	3.65	3.12	3.45	3.40
26	3.30	3.60	4.50	3.90	3.10	3.58	3.10	3.45	3.40
27	3.52	3.55	4.40	3.72	3.10	3.50	3.12	3.50	3.42
28	3.75	3.55	4.25	3.67	3.10	3.38	3.15	3.48	3.42
29	3.90	3.50	5.20	3.62	3.05	3.35	3.15	3.42	3.40
30	3.87	3.50	4.90	3.60	3.05	3.30	3.15	3.40	3.40
31	3.85	.....	5.50	.....	3.02	3.25	.....	3.38	.....

NOTE.—Ice conditions March 16–24, also April 3–5.

Rating table for South Fork of Milk River near Browning, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	1.5	3.60	37	4.30	146	5.00	301
3.00	2.5	3.70	48	4.40	166	5.10	325
3.10	5	3.80	61	4.50	187	5.20	350
3.20	8	3.90	76	4.60	209	5.30	375
3.30	13	4.00	92	4.70	231	5.40	401
3.40	19	4.10	109	4.80	254	5.50	427
3.50	27	4.20	127	4.90	277		

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1906 and on the form of the 1905 curve. It is not well defined.

Monthly discharge of South Fork of Milk River near Browning, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March (16–31)	76	10	25.7	816
April	118	10	40.2	2,390
May	427	13	76.1	4,680
June	406	32	90.7	5,400
July	32	3	12.6	775
August	46	1	10.7	658
September	10	5	7.3	434
October	29	6	14.3	879
November	42	7	23.6	1,400
The period				17,400

NOTE.—Values are rated as follows: March, approximate; April, August, and September, good; May and June, fair; July, October, and November, excellent.

MILK RIVER AT HAVRE, MONT.

This station was established May 15, 1898. It is located at the highway bridge at Havre, Mont. Gage heights are furnished by the United States Weather Bureau. The conditions at this station and the bench marks [a] are described in Water Supply Paper No. 172, page 57, where are given also references to publications that contain data for previous years.

Discharge measurements of Milk River at Havre, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	W. B. Freeman	80	79	4.07	115
April 20	Freeman and Morse	50	58	3.77	68
May 2	W. B. Freeman	47	42	3.39	42
May 27	do	85	87	4.18	134
May 30	do	158	202	5.00	414
May 30	do	158	300	5.62	951
May 31	do	160	406	6.43	1,130
June 9	Freeman and Hartman	165	889	8.40	2,630
June 9	do	165	964	8.80	3,120
June 14	Freeman and Morse	153	282	5.65	1,030
July 18	W. S. Hartman	48	64	3.39	65
August 26	do			2.60	5
October 28	Follansbee and Richards			2.33	2

[a] The bench mark is 25.26 feet above datum of gage.

Daily gage height, in feet, of Milk River at Havre, Mont., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.7	4.2	3.4	5.7	4.6	2.7	2.5	2.3	2.2
2	.....	3.7	3.9	3.4	5.5	4.5	2.6	2.5	2.3	2.2
3	.....	3.7	3.8	3.15	5.4	4.5	2.6	2.5	2.3	2.2
4	.....	3.7	4.0	3.5	5.4	4.3	2.6	2.5	2.3	2.2
5	.....	3.6	4.3	3.4	5.5	4.0	2.6	2.4	2.3	2.2
6	.....	3.4	4.3	3.4	5.3	4.0	2.6	2.4	2.3	2.2
7	.....	3.2	4.0	3.4	5.6	3.9	2.6	2.4	2.3	2.2
8	.....	3.2	4.0	3.4	9.45	3.8	2.6	2.4	2.3	2.2
9	.....	3.1	4.0	3.3	8.7	3.7	2.6	2.4	2.3	2.2
10	.....	3.0	4.0	3.3	7.2	3.6	2.5	2.4	2.3	2.2
11	.....	.....	4.1	3.3	7.75	3.6	2.5	2.4	2.3	2.25
12	.....	.....	4.1	3.3	7.1	3.6	2.5	2.4	2.3	2.3
13	.....	.....	4.3	3.3	6 6	3.5	2.5	2.4	2.3	2.6
14	.....	.....	4.4	3.45	5.8	3.4	2.4	2.4	2.3	2.6
15	.....	.....	4.3	3.3	5.4	3.4	2.4	2.4	2.3	2.8
16	.....	.....	4.3	3.5	5.1	3.3	2.4	2.4	2.3	.....
17	2.4	.....	4.2	3.6	4.9	3.3	2.4	2.4	2.2	.....
18	2.4	.....	3.95	3.5	4.8	3.3	2.4	2.4	2.2	.....
19	2.4	.....	3.8	3.4	4.9	3.3	2.4	2.4	2.2	.....
20	2.4	.....	3.7	3.4	4.6	3.1	2.4	2.4	2.2	.....
21	2.4	.....	3.7	3.95	4.6	3.1	2.4	2.4	2.2	.....
22	2.4	.....	3.65	3.5	4.7	3.0	2.7	2.3	2.2	.....
23	2.4	.....	3.5	3.4	4.9	2.9	2.8	2.3	2.2	.....
24	2.4	.....	3.4	3.5	4.7	2.9	2.7	2.3	2.2	.....
25	2.5	3.0	3.4	4.0	4.6	2.9	2.6	2.3	2.2	.....
26	3.7	3.0	3.3	4.1	4.9	2.8	2.6	2.3	2.2	.....
27	3.7	4.0	3.4	4.2	4.7	2.8	2.5	2.3	2.2	.....
28	.....	4.0	3.3	4.4	4.8	2.8	2.5	2.3	2.2	.....
29	.....	4.1	3.3	4.6	4.95	2.7	2.5	2.3	2.2	.....
30	.....	4.2	3.4	5.65	4.8	2.7	2.5	2.3	2.2	.....
31	.....	4.4	.....	6.55	.....	2.7	2.5	.....	2.2	.....

NOTE.—Ice conditions January 1 to March 26; also November 12 to December 31.

Rating table for Milk River at Havre, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	21	4.40	183	5.70	712	7.00	1,540
3.20	26	4.50	210	5.80	766	7.20	1,690
3.30	32	4.60	239	5.90	822	7.40	1,840
3.40	38	4.70	271	6.00	880	7.60	2,000
3.50	46	4.80	305	6.10	940	7.80	2,165
3.60	55	4.90	342	6.20	1,000	8.00	2,340
3.70	65	5.00	381	6.30	1,065	8.20	2,520
3.80	77	5.10	422	6.40	1,130	8.40	2,700
3.90	90	5.20	466	6.50	1,195	8.60	2,880
4.00	104	5.30	512	6.60	1,260	8.80	3,060
4.10	120	5.40	560	6.70	1,330	9.00	3,240
4.20	138	5.50	610	6.80	1,400	9.20	3,440
4.30	159	5.60	660	6.90	1,470	9.40	3,640

NOTE.—The above table is applicable only for open channel conditions. It is based on discharge measurements made during 1906 and is well defined. After June 9 the above table was applied indirectly.

Monthly discharge of Milk River at Havre, Mont., for 1906.

[Drainage area, 7,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (27-31)	183	104	130	1,290	0.018	0.003
April	183	32	94.6	5,630	.013	.01
May	1,230	24	119	7,320	.016	.02
June	3,690	420	935	55,600	.128	.14
July	390	9	101	6,210	.014	.02
August	14	3	5.2	320	.00071	.0008
September	4	2	2.8	167	.00038	.0004
October	2	1	1.5	92	.0002	.0002
November (1-15) [a]	1	1	1.0	30	.0001	.0001
The period				76,700		

[a] No flow after November 16.

NOTE.—Values are rated as follows: March and April, excellent; May, good; June, fair; July to September, approximate. No flow remainder of year.

MILK RIVER AT MALTA, MONT.

This station was established July 31, 1902. It is located at the highway bridge on the main road one-half mile east of the railroad station at Malta, Mont. The gage was read during 1906 by M. W. Walcott. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 59, where are given also references to publications that contain data for previous years.

Discharge measurements of Milk River at Malta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	W. B. Freeman			0.80	10
June 2	Freeman and Hartman	152	661	6.49	3,190
June 3	do	152	722	6.82	3,260
June 5	do	125	392	4.53	1,780
June 11	W. S. Hartman	188	2,570	17.65	10,600
June 11	do	188	2,540	17.56	9,720
June 13	do	185	2,380	16.66	9,740
June 13	Morse and Hartman	175	2,060	16.21	9,000
June 14	do	175	2,100	14.82	8,100
June 14	W. S. Hartman	175	1,960	14.03	7,980
June 16	do	163	1,160	9.28	4,920
June 16	do	157	936	7.90	3,970
July 11	do	90	164	2.53	416
July 26	do		40	1.41	78
October 30	Follansbee and Richards	80	95	1.68	118

Daily gage height, in feet, of Milk River at Malta, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.2	0.2	0.2	0.2	0.6	4.7	5.0	1.2	1.0	1.1	1.4	.....
2	.2	.2	.2	.2	.7	6.2	4.4	1.2	1.1	.....	.....	.....
3	.2	.2	.2	.2	.7	6.95	3.9	1.2	1.1	1.1	1.4	1.4
4	.2	.2	.2	.2	.6	4.7	3.5	1.2	1.1	.....	1.4	.....
5	.2	.2	.2	.2	.6	4.0	3.3	1.2	1.1	.....	.....	1.4
6	.2	.2	.2	.2	.6	4.0	3.1	1.2	1.1	1.1	1.4	.....
7	.2	.2	.2	.2	.6	4.0	3.0	1.1	1.1	1.0	.....	.....
8	.2	.2	.2	.2	.6	17.5	2.9	1.1	1.1	.....	1.4	1.4
9	.2	.2	.2	1.0	.6	18.33	2.7	1.1	1.1	.....	.....	.....
10	.2	.2	.2	.6	.6	17.92	2.6	1.0	1.1	1.0	1.4	.....

Daily gage height, in feet, of Mill River at Malta, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	0.2	0.2	0.2	1.1	0.5	16.7	2.5	1.0	1.1	.....	.....	.....
12	.2	.2	.2	1.2	.5	17.5	2.4	1.0	1.1	.....	1.4	.....
13	.2	.2	.2	1.2	.6	17.33	2.0	1.0	1.1	1.0	.....	.....
14	.2	.2	.2	1.2	.6	15.0	2.2	1.0	1.2	1.1	1.5	.....
15	.2	.2	.2	1.2	.6	12.3	1.9	1.0	1.2	.....	.....	.....
16	.2	.2	.2	1.1	.6	8.66	1.8	1.0	2.5	.....	.....	.....
17	.2	.2	.2	1.0	.5	5.9	1.6	1.0	2.3	1.1	1.5	.....
18	.2	.2	.2	1.0	.5	5.0	1.6	.9	2.0	.....	.....	.....
19	.2	.2	.2	.9	.5	4.55	1.6	.9	1.5	.....	1.5	.....
20	.2	.2	.2	.8	.5	4.1	1.5	.9	1.4	1.2	.....	.....
21	.2	.2	.2	.8	.6	3.8	1.5	.9	1.3	.....	.....	.....
22	.2	.2	.2	.8	.5	3.65	1.5	1.0	1.2	1.2	1.4	.....
23	.2	.2	.2	.8	.5	3.65	1.4	1.0	1.2	.....	.....	.....
24	.2	.2	.2	.7	.8	3.85	1.3	1.0	1.2	.....	1.4	.....
25	.2	.2	.2	.7	1.5	4.15	1.2	1.0	1.2	1.0	.....	.....
26	.2	.2	.2	.7	3.0	4.6	1.2	1.0	1.2	.....	1.4	.....
27	.2	.2	.2	.6	3.0	4.4	1.2	1.0	1.2	1.0	.....	.....
28	.2	.2	.2	.6	2.6	8.9	1.2	1.0	1.1	.....	.....	.....
29	.2	.....	.2	.6	2.6	7.75	1.2	1.0	1.1	1.1	1.4	.....
30	.2	.....	.2	.7	3.8	6.1	1.2	1.0	1.1	1.7	1.4	.....
31	.2	.....	.2	.....	4.0	.....	1.2	1.0	.....	1.5	.....	.....

NOTE.—River frozen over January 1 to April 8, approximately, November 29 to December 31.

Rating table for Milk River at Malta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	1	1.60	107	2.50	412	3.40	939
.80	6	1.70	129	2.60	463	3.50	1,003
.90	12	1.80	153	2.70	517	3.60	1,067
1.00	19	1.90	180	2.80	573	3.70	1,132
1.10	28	2.00	210	2.90	631	3.80	1,198
1.20	39	2.10	243	3.00	691	3.90	1,264
1.30	53	2.20	280	3.10	751	4.00	1,330
1.40	69	2.30	320	3.20	813	4.20	1,464
1.50	87	2.40	364	3.30	875	4.40	1,598

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–6 and is well defined. Above gage height 4 feet the rating curve is a tangent, the difference being 67 per tenth.

Monthly discharge of Milk River at Malta, Mont., for 1906.

[Drainage area, 14,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	39	0	10.0	595	0.00071	0.001
May	1,330	0	159	9,780	.011	.01
June	10,900	1,100	4,150	247,000	.296	.33
July	2,000	39	399	24,500	.028	.03
August	39	12	22.8	1,400	.0016	.002
September	412	19	63.4	3,770	.0045	.005
October	129	19	31.6	1,940	.0023	.003
November	87	69	73.5	4,370	.0052	.006
The period	.....	.....	.....	293,000	.....	.....

NOTE.—No flow January 1 to April 8. Values are rated as follows: May to July, good, April and August to November, approximate, owing to frequent errors in gage readings.

WEST FORK OF MILK RIVER AT CHINOOK, MONT.

This station was established March 6, 1906. It is located at the highway bridge three-fourths mile east of Chinook.

The channel is comparatively straight for 75 yards above and 50 yards below the station. Both banks are high and overflow only at the highest stages, when the surrounding country is flooded. There is considerable brush on the banks. The bed is composed of mud and may shift somewhat. The current is sluggish.

Discharge measurements are made from the highway bridge to which the gage is attached. The initial point for soundings is at the west end of the bridge.

The gage, which is read twice each day by Miss Cassie M. Prosser, is of the standard chain type. It is attached to the upstream side of the bridge; length of chain, 20.33 feet. The bench mark is the head of a bolt holding the plate girder to the bedplate at the southeast corner of the railroad bridge 100 feet above the highway bridge; elevation, 18.55 feet above the gage datum.

Discharge measurements of West Fork of Milk River at Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	Morse and Freeman			3.02	[a] 13
April 25	do			2.90	[a] 1.0
May 28	W. B. Freeman	41	223	6.50	212
May 28	do	42	241	6.95	242
May 29	do	50	333	9.07	413
May 29	do	50	346	9.32	420
May 30	do	60	433	10.70	619
May 31	Freeman and Hartman	75	816	16.17	1,490
May 31	do	78	835	16.42	1,470
June 1	W. B. Freeman	90	866	16.58	1,800
June 2	Freeman and Hartman	68	583	12.66	1,010
June 2	do	62	518	11.79	948
June 5	do	38	171	5.30	148
June 12	Freeman and Morse	70	664	13.92	1,030
June 16	W. B. Freeman	37	191	5.57	179
June 25	Freeman and Hartman	68	605	13.26	901
July 23	W. S. Hartman	21	27	2.30	7.8
August 11	Morse and Hartman			2.73	.2

[a] Estimated.

Daily gage height, in feet, of West Fork of Milk River at Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.9	16.5	4.8	2.5	2.85	3.1	3.4	
2		2.9	13.5	4.45	2.5	2.95	3.1	3.4	
3		2.9	8.55	4.4	2.5	2.85	3.2	3.4	
4		2.9	6.45	4.25	2.55	2.85	3.15	3.3	
5		2.9	5.3	4.0	2.6	2.85	3.1	3.45	
6		2.9	7.97	3.8	2.6	2.85	3.1	3.4	
7		2.95	11.0	3.65	2.55	2.85	3.1	3.4	
8		2.95	16.3	3.65	2.65	2.85	3.1	3.45	
9	3.7	2.9	16.75	3.55	2.65	2.9	3.25	3.5	
10	3.55	2.9	16.9	3.45	2.65	2.9	3.3	3.5	
11	3.6	2.9	16.8	2.9	2.65	2.95	3.3	3.5	3.2
12	3.3	2.9	13.5	2.75	2.65	2.95	3.3	3.5	
13	3.2	2.95	10.65	2.85	2.65	2.85	3.3	3.5	
14	3.15	2.9	7.8	2.9	2.65	2.9	3.4	3.5	
15	2.95	2.9	6.3	2.65	2.75	3.1	3.5	3.5	3.2

Daily gage height, in feet, of West Fork of Milk River at Chinook, Mont., for 1906—Con.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	2.9	2.9	5.5	2.4	2.75	2.9	3.6	3.5	.....
17	2.9	2.9	5.0	2.4	2.85	2.9	3.5	3.5	.....
18	3.0	2.9	4.6	2.4	2.85	2.85	3.4	3.4	3.2
19	3.1	3.0	4.25	2.4	2.85	2.9	3.4	3.4	.....
20	3.1	2.9	4.0	2.4	2.85	3.1	3.5	3.4	.....
21	3.0	3.0	3.9	2.35	2.85	3.1	3.6	3.4	.....
22	3.0	3.0	3.75	2.3	2.95	3.1	3.6	3.4	3.2
23	3.0	3.0	12.26	2.3	2.95	3.05	3.5	3.4	.....
24	3.0	3.0	8.56	2.2	2.95	3.15	3.5	3.5	.....
25	2.9	3.0	12.86	2.2	2.85	3.1	3.5	3.5	.....
26	2.9	3.05	10.9	2.2	2.85	3.1	3.5	3.5	.....
27	2.9	3.0	8.15	2.2	2.85	3.2	3.4	3.5	.....
28	2.9	6.1	7.4	2.2	2.9	3.2	3.4	3.5	3.2
29	2.9	9.25	6.05	2.2	2.9	3.1	3.4	3.5	.....
30	2.9	11.35	5.2	2.3	2.85	3.1	3.4	3.5	.....
31	.....	16.35	.....	2.5	2.85	.....	3.4	.....	.....

NOTE.—No flow January 1 to April 8; practically none after August 8.

Daily discharge, in second-feet, of West Fork of Milk River at Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	.....	2	1,830	103	3	17	2	2	142	8	.....
2	.....	2	1,160	82	3	18	9	2	116	8	.....
3	.....	2	430	80	2	19	14	9	90	8	.....
4	.....	2	220	72	2	20	14	2	74	8	.....
5	.....	2	148	58	2	21	9	9	68	7	.....
6	.....	2	312	48	1	22	9	9	60	6	.....
7	.....	5	630	42	1	23	9	9	792	6	.....
8	.....	5	1,550	42	1	24	9	9	364	6	.....
9	48	2	2,450	36	0	25	2	9	875	5	.....
10	40	2	3,000	34	.....	26	2	12	618	5	.....
11	43	2	2,650	10	.....	27	2	9	327	5	.....
12	26	2	968	13	.....	28	2	181	270	4	.....
13	20	5	586	15	.....	29	2	430	182	4	.....
14	17	2	300	17	.....	30	2	690	128	4	.....
15	5	2	298	10	.....	31	.....	1,580	.....	3	.....
16	2	2	175	8	.....						

NOTE.—Practically no flow January 1 to April 9 and after August 9.

Monthly discharge of West Fork of Milk River at Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (9–30)	48	2	13.1	572
May	1,580	2	96.9	5,960
June	3,000	60	694	41,300
July	103	3	24.4	1,500
August (1–8)	3	1	1.9	30
The period				49,400

NOTE.—From January 1 to April 8 and from August 9 to December 31 there was practically no flow. Values are rated as follows: April and August, approximate, May to July, fair.

NORTH FORK OF MILK RIVER NEAR CHINOOK, MONT.

This station was established April 22, 1905. It is located at Snedecor's ranch, about 4½ miles north of Chinook, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 61. A standard chain gage was erected July 20, 1906, on the site of the old inclined board gage. It reads the same as the old gage.

Discharge measurements of North Fork Milk River near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	W. B. Freeman	55	74	1.89	116
April 18	Freeman and Morse	51	48	1.42	56
April 25	do	55	33	1.17	31.3
May 7 [a]	W. B. Freeman	28	27	1.00	19.5
May 19 [a]	do	28	24	.90	14.7
May 26	do	50	74	1.91	116
May 29	do	54	99	2.38	211
May 30	do	74	465	7.66	1,960
May 30	do	75	508	8.16	2,360
May 31	do	71	400	6.80	1,270
June 1	Freeman and Hartman	66	306	5.20	882
June 2	do	58	183	3.44	460
June 8	W. S. Hartman	86	687	9.66	2.400
June 13	W. B. Freeman	78	529	8.55	2,260
June 25	Freeman and Hartman	58	86	1.89	176
July 18	W. S. Hartman	[a] 38	[a] 35	1.16	41.1
August 11	Morse and Hartman	[a] 36	[a] 14	.49	11.6
September 21	W. S. Hartman	[a] 33	[a] 20	.55	22.8
October 29	Follansbee and Richards	[a] 34	[a] 32	.80	35.8

[a] Wading section.

Daily gage height, in feet, North Fork of Milk River near Chinook, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.90	1.00	1.00	1.57	1.07	5.15	1.86	0.60	0.70	0.65	0.80	1.10
2	.90	1.10	1.00	1.47	1.07	3.60	1.76	.60	.70	.65	.80	1.10
3	.90	1.10	1.00	1.42	1.07	3.07	1.70	.60	.69	.65	.80	1.20
4	.90	1.10	1.00	1.37	1.07	2.60	1.62	.60	.66	.65	.80	1.20
5	.90	1.10	.90	1.42	1.07	2.22	1.52	.60	.64	.65	.80	.....
6	.90	1.10	.80	1.62	1.07	2.02	1.39	.60	.62	.65	.80	.....
7	.90	1.10	.80	1.92	1.02	8.15	1.38	.60	.60	.64	.80	.....
8	.90	1.10	.80	1.72	1.02	12.60	1.34	.60	.50	.62	.85	.....
9	.90	1.10	.80	1.67	.97	5.65	1.30	.60	.50	.55	.85	.....
10	.90	1.10	.80	1.77	.97	6.45	1.25	.58	.50	.48	.90	.....
11	.90	1.10	.80	1.82	.92	6.22	1.20	.51	.50	.40	.90	.....
12	.90	1.10	.80	1.84	.87	6.65	1.16	.49	.50	.68	.90	.....
13	.90	1.10	.80	1.74	.82	8.32	1.10	.48	.50	.70	.90	.....
14	.90	1.10	.80	1.62	.82	4.29	1.05	.46	.58	.70	.90	.....
15	.90	1.10	.80	1.52	.82	3.16	1.03	.45	.80	.70	.92	.....
16	.90	1.10	.80	1.47	.82	4.75	.98	.45	.60	.70	.95	.....
17	.90	1.10	.80	1.47	.82	2.34	.88	.45	.60	.70	.95	.....
18	.90	1.10	.80	1.47	.77	2.11	.85	.45	.59	.75	.95	.....
19	.90	1.00	.80	1.37	.92	1.96	.84	.45	.56	.75	.95	.....
20	.90	1.00	.80	1.37	.90	2.04	.81	.45	.54	.80	.95	.....
21	.90	1.00	.80	1.32	1.35	1.76	.76	.45	.50	.80	.95	.....
22	.90	1.00	.80	1.30	1.25	1.66	.74	.45	.50	.80	.95	.....
23	.90	1.00	.80	1.27	1.20	2.01	.72	.50	.50	.80	.95	.....
24	.90	1.00	.80	1.22	1.50	2.01	.69	.55	.55	.80	.95	.....
25	.90	1.00	.80	1.17	1.90	2.04	.68	.55	.55	.80	.95	.....
26	.90	1.00	.90	1.17	1.90	2.44	.66	.60	.60	.80	.95	.....
27	.90	1.00	.90	1.12	1.75	2.29	.65	.60	.60	.80	.95	.....
28	.90	1.00	.90	1.12	2.05	2.19	.65	.62	.60	.80	.95	.....
29	.90	.....	1.10	1.12	2.82	2.49	.64	.70	.60	.80	.95	.....
30	.90	.....	1.30	1.12	7.47	2.16	.63	.70	.60	.80	.95	.....
31	.90	.....	1.40	.....	7.40	.....	.62	.70	.....	.80	.....	.....

NOTE.—Ice conditions January 1 to March 16. From November 18 to December 31 the river was frozen to the bottom at the gage, but at the farther side there was considerable flow; thickness of ice, 0.5 foot to 1 foot.

Rating tables for North Fork Milk River near Chinook, Mont.

MARCH 27, 1906, TO JUNE 13, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	11	2.10	154	3.40	443	5.40	961
.90	15	2.20	175	3.50	467	5.60	1,020
1.00	20	2.30	196	3.60	491	5.80	1,084
1.10	26	2.40	217	3.70	515	6.00	1,153
1.20	34	2.50	239	3.80	539	6.20	1.226
1.30	43	2.60	261	3.90	563	6.40	1,303
1.40	53	2.70	283	4.00	588	6.60	1,384
1.50	64	2.80	305	4.20	638	6.80	1,467
1.60	76	2.90	328	4.40	689	7.00	1,551
1.70	89	3.00	351	4.60	741	8.00	1,985
1.80	103	3.10	374	4.80	794		
1.90	118	3.20	397	5.00	848		
2.00	135	3.30	420	5.20	904		

JUNE 14, 1906, TO NOVEMBER 14, 1906.[b]

0.40	10	1.50	112	2.60	330	3.70	576
.50	15	1.60	127	2.70	352	3.80	599
.60	21	1.70	144	2.80	374	3.90	622
.70	27	1.80	163	2.90	396	4.00	645
.80	35	1.90	183	3.00	418	4.20	693
.90	43	2.00	204	3.10	440	4.40	741
1.00	52	2.10	225	3.20	462	4.60	790
1.10	62	2.20	246	3.30	484	4.80	840
1.20	73	2.30	267	3.40	507		
1.30	85	2.40	288	3.50	530		
1.40	98	2.50	309	3.60	553		

[a] This table is applicable only for open-channel conditions. It is based on thirteen discharge measurements made during the first part of 1906, and is well defined between gage heights 0.9 foot and 5 feet. Above 5 feet gage height the table is rather uncertain, as the high-water measurements are not very consistent.

[b] This table is applicable only for open-channel conditions It is based on four discharge measurements made during the latter part of 1906 and the form of the curve before high water. It is not very well defined.

Monthly discharge of North Fork of Milk River near Chinook, Mont., for 1906.

[Drainage area, 1,420 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (28-31)	53	15	34.2	271	0.024	0.003
April	121	28	61.6	3,670	.043	.05
May	1,750	10	155	9,530	.109	.13
June	4,600	137	709	42,200	.499	.56
July	175	22	63.5	3,900	.045	.05
August	27	12	18.0	1,110	.013	.01
September	35	15	20.0	1,190	.014	.02
October	35	10	28.2	1,730	.020	.02
November	43	35	39.3	2,340	.028	.03
The period				65,900		

NOTE.—Values are rated as follows: March and July, good; April to June, excellent; August to November, fair.

BEAVER CREEK NEAR ASHFIELD, MONT.

This station was established July 5, 1903, at bridge No. 455 of the Great Northern Railway, one-half mile west of Ashfield, Mont. It was abandoned December 31, 1903, because the results were affected by backwater from a dam erected a mile below about a month after

the establishment of the station. A new station was established at a point 2½ miles farther upstream and beyond the influence of the dam. It is near the ranch house of R. H. Thomas, about 18 miles from Malta and 3 miles south of Ashfield, Mont., the nearest post-office. This station was discontinued August 30, 1906. The conditions at the station and the bench marks are described in Water-Supply Paper No. 172, page 63, where are given also references to publications that contain data for previous years.

Discharge measurements of Beaver Creek near Ashfield, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 4	Freeman and Hartman	70	422	8.59	594
July 14	W. B. Freeman	[a] 17	[a] 13	0.05	19.2

[a] Wading section.

Daily gage heights and discharge of Beaver Creek near Ashfield, Mont., for 1906.

Day.	May.		June.		July.		Day.	May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1			9.0	695	11.9	3,700	17			6.2	270	−0.1	10
2			10.3	1,230	10.8	1,670	18			5.4	220	−.2	8
3			10.4	1,290	7.3	365	19			4.4	164	−.2	8
4			8.85	660	5.0	195	20			3.75	132	−.2	8
5			7.3	365	3.9	139	21			2.9	95	−.4	4
6			5.1	202	3.0	98	22			2.3	70	−.4	4
7			7.9	450	2.5	78	23			2.5	78	−.5	2
8			([a])	5,000	1.7	50	24			2.5	78	−.5	2
9			([a])	6,650	1.1	34	25	1.0	30	2.1	63	−.6	1
10			([a])	6,100	.8	25	26	6.4	280	1.6	47	−.6	1
11			([a])	5,500	1.2	36	27	9.2	785	1.5	44	−.6	1
12			12.3	5,000	.9	28	28	10.6	1,380	1.9	55	−.7	0
13			11.9	3,700	.5	20	29	10.8	1,500	5.1	202		
14			11.05	2,120	.1	16	30	9.8	1,010	12.0	4,000		
15			8.6	590	.0	12	31	9.6	935				
16			6.8	315	−.1	10							

[a] Gage not read on account of high water. Discharge estimated from high-water marks.

NOTE.—Practically no flow January 1 to May 25 and July 29 to December 31.

Monthly discharge of Beaver Creek near Ashfield, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 25–31	1,500	30	846	11,700
June	6,650	44	1,510	89,800
July 1–27	3,700	1	242	13,000
The period				114,500

NOTE.—Values are approximate.

BEAVER CREEK OVERFLOW NEAR BOWDOIN, MONT.

This station was established June 29, 1903, and was discontinued August 30, 1906. It is located on an overflow channel of Beaver

Creek, about 4 miles southeast of the Great Northern Railway section house at Bowdoin, Mont., and is best reached by team from Malta, Mont., 14 miles distant. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 65, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 4, 1906:

Width, 108 feet; area of section, 376 square feet; gage height, 8.08 feet; discharge 476 second-feet.

Daily gage heights and discharge of Beaver Creek overflow near Bowdoin, Mont., for 1906.

Day.	May.		June.		July.		Day.	May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1			8.55	710	9.2	1,160	17			6.5	128		
2			8.7	800	8.1	480	18			6.1	90		
3			8.65	765	6.6	140	19			5.4	43		
4			8.2	520	5.9	76	20			5.1	27		
5			7.2	224	5.3	37	21			4.9	20		
6			6.3	108	4.8	16	22			4.6	10		
7			7.9	400	4.3	5	23			4.7	13		
8			10.0	(a)	4.1	4	24			4.8	15		
9			10.8	(a)	3.9	3	25	6.65	145	4.5	8		
10			10.0	(a)	3.8	2	26	7.95	420	4.4	8		
11			9.4	1,320	3.7	1	27	8.65	765	4.3	5		
12			9.05	1,000	3.7	1	28	8.8	860	6.2	100		
13			8.8	860			29	8.7	800	8.85	900		
14			8.0	440			30	8.25	545	10.1	(a)		
15			7.6	310			31	8.25	545				
16			6.7	150									

a Discharge probably in excess of 2,000 second-feet.

NOTE.—Practically no flow January 1 to May 25 and July 13 to December 31.

Monthly discharge of Beaver Creek overflow near Bowdoin, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 25–31	860	145	583	8,090
June 1–7, 11–29	1,320	5	345	17,800
July 1–12	1,160	1	160	3,810
The period				29,700

NOTE.—On June 8–10 and June 30 the flow was probably in excess of 2,000 second-feet (not included above). Values are wholly dependent on the constancy of the conditions of flow, being either good or approximate accordingly.

ROCK CREEK NEAR HINSDALE, MONT.

This station was established March 28, 1906. It is located just below the diversion dam for Rock Creek canal, and 7 miles north of Hinsdale.

The channel is straight for a considerable distance above and below the station. The banks are high and overflow only at very high stages. They are covered with scattering brush. During the latter part of the year flow ceases and the water is ponded at the station.

Discharge measurements are made by means of a cable and car located 200 yards below the gage. Low-water measurements must be made by wading.

The gage, which is read daily by F. E. Halbert, is of the standard type extending from posts set in the left bank; length of chain, 19.47 feet. The bench mark is a spike 8 inches above the ground, in the west side of a 10-inch cottonwood tree 70 feet east of the gage; elevation, 12.63 feet above the gage datum.

July 21, 1906, the discharge was estimated at 0.5 second-foot at a gage height of 1.38 feet.

Daily gage height, in feet, of Rock Creek near Hinsdale, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
[illegible]	1.3	1.2	4.75	2.3	17	1.2	1.0	5.8	1.2
[illegible]	1.3	1.2	3.5	2.3	18	1.2	1.1	4.9	1.3
3	1.3	1.3	2.6	2.3	19	1.2	1.1	3.9	1.3
4	1.3	1.4	2.3	2.2	20	1.2	1.2	2.5	1.3
5	1.3	1.5	1.8	2.1	21	1.2	1.2	1.8	.....
6	1.4	1.5	1.4	1.9	22	1.2	1.2	1.5	.....
7	1.65	1.5	11.0	1.8	23	1.2	1.2	2.5	.....
8	1.4	1.5	18.4	1.8	24	1.2	1.2	2.5	.....
9	1.3	1.0	(a)	1.7	25	1.2	7.75	2.7	.....
10	1.3	1.0	7.2	1.4	26	1.2	10.2	2.4	.....
11	1.3	1.0	(a)	1.4	27	1.2	4.8	2.4	.....
12	1.3	1.0	(a)	1.1	28	1.2	3.4	2.4	.....
13	1.3	1.0	11.3	1.1	29	1.2	4.0	2.3	.....
14	1.2	1.0	9.3	1.0	30	1.2	9.5	2.3	.....
15	1.2	1.0	7.3	1.1	31	.....	6.3	.....	.....
16	1.2	1.0	6.4	1.2					

[a] No record on account of high water.

NOTE.—Practically no flow after July 20.

PRIVATE CANALS IN MILK RIVER VALLEY.

DESCRIPTION OF CANALS.

During 1906 a number of stations were maintained on private canals in Milk River Valley, mainly for the purpose of ascertaining the extent of the private water rights. With one exception—the Rock Creek canal near Hinsdale, in Valley County—these canals are located in Chouteau County and are used for the irrigation of lands in the vicinity of Harlem and Chinook.

The canals are all built on small grades and in soil which is easily eroded. In many of them deposition of silt has taken place, and in nearly all there is a growth of weeds and moss. At low stages the water is uniformly sluggish. In order to divert water into the laterals, checks are erected in the main channels, and these checks often produce backwater affects for long distances above. They were put up under a great variety of conditions, and as a result many different velocities are found to exist at the same gage height during the season; in order to establish the correct relation between gage height and discharge it has been found necessary in several instances to make several rating curves for the same canal station. During

June, 1906, occurred one of the greatest floods on Milk River that had been known. This injured several of the canal systems so severely that irrigation was not practiced to any great extent for the remainder of the season.

PARADISE VALLEY CANAL NEAR CHINOOK, MONT.

The station was established in June, 1903. It is reached by driving along the south river road from Chinook, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 67, where are given also references to publications that contain data for previous years.

Discharge measurements of Paradise Valley canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 13	W. B. Freeman	15	6.0	0.94	3.05
May 5	do	9	3.4	.67	1.30
May 23	do	17	12.0	1.19	5.4
June 27	Freeman and Hartman	25	19.2	1.60	9.78
July 19	Hartman and Morse	30	25.3	1.79	14.3
July 25	W. S. Hartman	20	13.4	1.45	7.48
August 25	do				.0
September 5	do				.0

Daily gage height, in feet, of Paradise Valley canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		0.80	1.88	1.15	1.24	17	1.20	0.50		1.54	
2		.80	2.00	1.25	1.20	18	1.10	.50		1.71	
3		.80	2.00	1.25	1.15	19	.90	.55		1.78	
4		.70	2.00	1.21	1.10	20	.80	.55		1.76	
5		.65	2.00	1.18	1.00	21	.70	1.40		1.60	
6		.65	1.80	1.30	1.00	22	.70	1.50		1.53	
7		.65		1.20	.91	23	.80	1.10		1.52	
8	0.60	.65	1.40	1.10	.89	24	1.10	.95		1.56	
9	.65	.65		1.02	.83	25	.80	.90		1.48	
10	1.30	.65		1.80	.80	26	.80	1.23	1.65	1.43	
11	1.55	.60		1.61	.71	27	.80	1.55	1.60	1.38	
12	1.45	.60		1.58	.66	28	.70	1.95	1.50	1.29	
13	1.55	.60		1.50	.62	29	.80	1.85	1.55	1.21	
14	1.05	1.00		1.33	.50	30	.80	1.70	1.20	1.15	
15	1.30	.80		1.55	.40	31		1.80		1.17	
16	1.30	.50		1.62							

NOTE.—No flow from June 9 to 25 nor after August 15.

Monthly discharge of Paradise Valley canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (8-30)	9.1	0.9	3.7	169
May	18.0	.4	4.0	246
June	19.4	.0	5.6	333
July	13.8	3.6	7.7	474
August (1-15)	5.4	.0	2.7	80
The season				1,300

NOTE.—Values are approximate owing to great and irregular fluctuation of daily stages.

COOK CANAL NEAR CHINOOK, MONT.

The station was established April 10, 1905. It is located at a small wooden highway bridge on the road running parallel to the Great Northern Railway about 3 miles east of Chinook. The gage was read during 1906 by Herbert Reynolds. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 70.

Discharge measurements of Cook canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	W. B. Freeman	14	24.0	2.97	19.7
April 19	Freeman and Morse	14	24.1	2.73	18.9
April 23	do	14	17.9	2.21	6.00
May 5	W. B. Freeman				.00
May 23	do	14	26.9	2.80	16.6
May 28	do	14	31.6	3.58	35.1
June 5	Freeman and Hartman	14	39.8	3.79	43.9
June 26	do	14	25.9	2.85	19.4
July 19	Morse and Hartman	14	32.6	3.15	25.7
July 24	W. S. Hartman	14	33.0	3.23	24.3
August 11	do	12	25.8	2.86	8.38
August 25	do	14	30.5	2.91	9.18
September 3	do	14	20.7	2.25	3.40
September 21	do			2.12	[a] 2.5

[a] Estimated.

Daily gage height, in feet, of Cook canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		1.6	3.7	2.9	3.0	2.5	17	1.7	1.25	2.6	3.3	2.7	2.1
2		1.6	3.2	2.8	3.1	2.3	18	[b] 2.7	1.2	2.4	3.2	2.7	2.1
3		1.6	2.95	2.8	3.0	2.1	19	2.7	1.2	2.3	3.1	2.8	2.1
4		1.6	2.8	2.4	3.0	2.2	20	2.3	1.1	2.3	3.1	2.8	2.2
5		1.6	3.8	2.3	3.1	2.1	21	2.2	1.7	2.3	3.0	2.8	2.2
6	2.97	1.55	3.7	2.3	3.2	2.1	22	2.2	[b] 2.8	3.3	3.0	2.9	2.2
7		1.55	3.8	3.3	3.1	2.1	23	2.1	2.75	3.5	3.0	2.9	2.2
8		1.45	(a)	3.3	3.0	2.1	24	[a] 1.8	2.5	3.3	3.1	2.9	2.4
9	1.6	1.45		3.3	3.0	2.1	25	1.7	2.8	3.0	3.3	2.9	2.5
10	1.6	1.4		3.2	2.9	2.0	26	1.6	3.3	2.9	3.1	2.9	2.3
11	1.7	1.4	3.9	3.0	2.9	2.0	27	1.6	3.35	2.8	3.2	2.9	2.3
12	[b] 3.3	1.4	3.85	2.9	2.7	2.0	28	1.6	3.35	3.3	3.0	2.9	2.0
13	3.0	1.4	3.4	2.6	2.8	2.0	29	1.6	3.8	2.85	3.0	3.1	2.1
14	[a] 1.6	1.3	3.25	2.6	2.8	2.0	30	1.6	3.9	2.8	3.1	3.2	2.2
15	1.7	1.25	2.9	3.4	2.6	2.0	31		4.1		3.1	2.9	
16	1.7	1.25	2.6	3.3	2.7	2.1							

[a] Head-gate closed. [b] Head-gate open.

NOTE.—From June 8 to 21 the water in the canal was not used for irrigation, but was allowed to run into Milk River at the crossing.

Monthly discharge of Cook canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 4-30 (27 days)	27.5	0.0	5.9	316
May	57.0	.0	9.5	584
June (16 days)	44.0	16.5	26.0	826
July	32.5	9.3	22.2	1,360
August	12.0	6.1	9.0	553
September	5.2	1.8	2.7	161
The season				3,000

NOTE.—Values are approximate owing to great and irregular fluctuation of daily stages.

MATHESON CANAL NEAR CHINOOK, MONT.

The station was established April 10, 1905. It is located at a footbridge 200 feet below the head-gates. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 72.

Discharge measurements of Matheson canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	W. B. Freeman	9	8.8	2.36	7.10
April 7	do	10	13.8	2.81	15.3
April 9	do	9	8.7	2.30	7.62
April 23	Freeman and Morse	9	6.4	1.92	4.63
May 5	W. B. Freeman	9	4.5	1.75	2.37
May 23	do	9	12.5	2.65	10.3
May 28	do	10	14.6	2.83	11.8
June 5	Freeman and Hartman	9	12.6	2.61	8.80
June 26	do	7	2.5	2.12	2.49
July 19	H. M. Morse	9	5.6	2.51	7.04
July 24	W. S. Hartman	7	2.0	2.11	.37
August 11	Morse and Hartman	.....	.....	1.95	[a].25
August 25	W. S. Hartman	10	7.3	2.70	2.27
September 3	do	10	10.9	3.10	4.71
September 21	do	10	9.8	2.97	5.42

[a] Estimated.

Daily gage height, in feet, of Matheson canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.4	2.7	2.2	2.0	3.1	17	2.4	1.4	2.3	2.6	1.7	3.2
2	.....	1.8	3.2	2.0	1.9	3.0	18	2.2	1.3	2.3	2.7	1.9	3.1
3	.....	1.8	3.2	2.0	1.8	3.1	19	1.7	1.2	2.3	2.4	2.0	3.0
4	.....	1.8	2.8	1.9	1.5	3.1	20	2.2	1.7	2.25	2.3	2.9	3.0
5	.....	1.75	2.5	1.8	1.9	3.2	21	2.2	2.8	2.2	2.5	2.8	3.0
6	2.36	1.3	2.7	1.8	1.8	3.1	22	2.2	2.9	2.2	2.3	2.9	3.0
7	2.81	1.1	.....	1.7	1.8	3.1	23	1.9	2.65	2.2	2.1	3.0	2.9
8	2.3	1.3	.....	1.7	1.5	3.1	24	1.7	2.7	2.2	1.1	3.0	2.9
9	2.3	1.3	.....	1.8	2.0	3.1	25	1.7	2.9	2.2	1.0	3.1	3.0
10	2.3	1.3	.....	3.1	2.0	2.7	26	1.7	3.2	2.2	1.6	2.9	3.0
11	2.7	1.3	2.7	3.1	1.8	2.7	27	1.7	3.2	2.2	1.0	2.8	3.0
12	2.7	1.3	2.7	2.9	1.9	2.9	28	1.6	2.8	2.2	1.2	2.8	2.9
13	2.6	1.3	2.55	2.7	1.9	3.0	29	1.6	3.0	2.1	2.0	2.7	2.6
14	2.0	1.1	2.5	1.8	1.7	3.1	30	1.4	3.2	2.1	2.1	2.9	2.6
15	2.0	1.4	2.4	1.8	1.6	3.1	31	.....	3.2	.....	2.0	3.0	.....
16	2.1	1.4	2.35	1.7	1.6	3.2							

NOTE.—June 7-10 the canal was bank full. A discharge of the maximum capacity (28 second-feet) was assumed.

Monthly discharge of Matheson canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (29 days)	15.3	1.0	5.8	334
May	17.7	0	5.5	338
June	28.0	2.3	9.3	553
July	16.0	0	3.4	209
August	6.1	0	1.6	98
September	7.3	1.6	5.1	304
The season	.....	.....	.....	1,840

NOTE.—Values are approximate, owing to great and irregular fluctuation of daily stages.

HARLEM CANAL NEAR ZURICH, MONT.

The station was established in June, 1903. It is located about 500 feet below the head-gates of the canal, which are 1½ miles southeast of the Great Northern Railway section house at Zurich, and is best reached by driving from Harlem or Chinook. The gage was read during 1906 by George Henson. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 74, where are given also references to publications that contain data for previous years.

Discharge measurements of Harlem canal near Zurich, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	W. B. Freeman	8	4.5	0.48	0.90
April 9	do	22	36.9	2.20	40.2
April 19	Freeman and Morse	19	34.7	2.16	40.7
April 23	do	14	15.2	.95	8.6
May 5	W. B. Freeman			.25	*a*. 25
May 23	do	20	35.3	2.13	35.3

a Estimated.

Daily gage height, in feet, of Harlem canal near Zurich, Mont., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1		0.3	3.3	17	*c* 0.8	0.5	
2		.3	2.9	18	.7	.5	
3		.3	2.2	19	*b* 2.2	.6	
4		.3	2.0	20	2.1	*b* 1.1	
5		.3	3.3	21	1.5	1.1	
6		.3	2.8	22	1.5	1.1	
7		.3	1.6	23	*c* 1.1	1.95	
8		.3	(*a*)	24	.6	2.0	
9	*b* 2.2	.3		25	.6	1.9	
10	2.1	.3		26	.3	1.8	
11	2.0	.3		27	.3	2.6	
12	2.3	.3		28	.3	2.85	
13	2.2	*b* 3.0		29	.3	3.45	
14	*c*. 8	2.1		30	.3	3.55	
15	.8	*c*. 95		31		3.45	
16	*b* 2.6	.5					

a Dam washed out. Canal closed for remainder of the season.
b Head-gate open.
c Head-gate closed.

Monthly discharge of Harlem canal near Zurich, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (9-30)	53.0	0.3	18.0	785
May	91.0	.3	21.2	1,300
June (1-7)	80.0	22.0	54.6	758
The season				2,840

NOTE.—Values are approximate, owing to great and irregular fluctuation of the daily stages.

AGENCY DITCH NEAR HARLEM, MONT.

The station was established July 14, 1905. It is located at the highway bridge about one-fourth of a mile below the head-gates. The gage was read during 1906 by J. W. Ijams. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 75.

Discharge measurements of Agency ditch near Harlem, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	W. B. Freeman	24	55.7	4.40	49.8
April 21	Freeman and Morse	20	31.1	3.38	10.6
April 27	W. B. Freeman	22	39.2	3.76	23.6
May 10	do	24	57.1	4.50	48.1
July 21	Morse and Hartman	24	41.7	4.34	6.5

Daily gage height, in feet, of Agency ditch near Harlem, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	4.1	5.7	3.85	3.6	3.8	17	4.2	4.5	3.35	4.5	3.5	3.9
2	.....	4.37	5.55	3.8	3.6	3.8	18	4.05	4.5	3.4	4.5	3.5	3.9
3	.....	4.32	5.15	3.7	3.6	3.8	19	3.8	4.5	3.85	4.4	3.5	3.9
4	.....	4.4	5.0	3.65	3.6	3.8	20	3.58	4.5	4.0	4.4	3.5	3.9
5	.....	4.4	4.8	3.6	3.6	3.8	21	3.4	4.7	4.0	4.15	3.5	3.9
6	.....	4.4	4.7	3.5	3.6	3.8	22	3.3	4.7	4.0	3.95	3.5	3.9
7	.....	4.4	4.55	3.4	3.6	3.8	23	3.22	4.65	4.2	3.7	3.5	3.9
8	.....	4.4	4.3	3.3	3.6	3.8	24	3.4	4.6	4.35	3.7	3.5	3.9
9	3.45	4.4	4.05	3.2	3.6	3.9	25	3.6	4.85	4.25	3.7	3.5	3.9
10	4.4	4.5	3.95	.....	3.6	3.9	26	3.68	4.55	4.2	3.7	3.5	3.9
11	4.65	4.5	3.85	.....	3.6	3.9	27	3.75	4.25	4.15	3.7	3.5	3.9
12	4.6	4.65	3.7	.....	3.6	3.9	28	3.85	4.05	4.0	3.7	3.5	3.9
13	4.35	5.05	3.6	.....	3.5	3.9	29	3.9	4.25	4.1	3.7	3.6	3.9
14	4.2	5.35	3.5	4.4	3.5	3.9	30	4.0	5.65	4.0	3.6	3.7	3.9
15	4.2	4.95	3.4	4.45	3.5	3.9	31	.....	5.95	.....	3.6	3.8	.....
16	4.35	4.65	3.4	4.5	3.5	3.9							

FORT BELKNAP CANAL NEAR CHINOOK, MONT.

The station was established June 21, 1903. It is located at the highway crossing 1 mile below the head-gates of the canal and is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 77, where are given also references to publications that contain data for previous years.

Discharge measurements of Fort Belknap canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 5	W. B. Freeman	42	75.8	3.68	134
April 11	do	36	65.3	3.46	107
April 18	Babb and Morse	34	59.8	3.25	105
April 18	Babb and Freeman	34	59.8	3.25	106
April 22	Freeman and Morse	24	28.8	2.23	26.6
April 24	do	26	32.0	2.29	29.0
May 8	W. B. Freeman	8	2.3	.72	.91
May 22	do	30	52.2	2.93	64.6
July 3	do	20	16.3	1.62	11.0
July 20	H. M. Morse	30	47.8	2.85	61.6
July 27	W. S. Hartman	27	36.5	2.45	22.3
August 11	H. M. Morse	21	20.2	1.82	4.84
August 24	do	29	44.0	2.71	12.2
September 4	W. S. Hartman	13	6.3	1.05	5.46
September 21	do	24	28.5	2.11	14.7

Daily gage height, in feet, of Fort Belknap canal near Chinook, Mont., for 1906.

Day.	April.	May.	June.	July.	Day.	April.	May.	June.	July.
1	3.8		3.4	[a] 1.9	17	3.6			3.25
2	3.6		3.4	1.9	18	3.15			3.2
3	3.6		3.4	1.9	19	2.68			3.05
4	3.4		3.4	1.9	20	2.4			2.85
5	3.65		3.4	1.9	21	2.35	[a] 2.8		2.95
6	3.9		3.4	1.9	22	2.3	3.0		2.85
7	3.65		(b)	1.9	23	2.1	2.58		2.75
8	3.6			2.2	24	2.05	2.6		2.6
9	3.55			2.7	25	2.18	2.7		2.3
10	3.5			2.7	26	2.0	3.4		2.2
11	3.46			2.85	27	1.8	3.6		2.0
12	3.55			3.15	28	(b)	3.7		1.9
13	3.55			3.4	29		3.85		(c)
14	3.85			3.3	30		3.85		
15	3.8			3.5	31		4.0		
16	3.6			3.25					

[a] Head-gate open. [b] Head-gate closed. [c] Practically dry for remainder of season

Monthly discharge of Fort Belknap canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 1-27	163	15	95.9	5,140
May 21-31	237	43	127	2,770
June 1-6	130	130	130	1,550
July 1-28	147	7	50.9	2,830
The season				12,300

NOTE.—Values are approximate, owing to great and irregular fluctuation of daily stages.

RESER DITCH NEAR CHINOOK, MONT.

A temporary gaging station was established July 10, 1905. It is located about 1 mile below the head-gates of the ditch. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 79.

Discharge measurements of Reser ditch near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 28	W. B. Freeman	7	3.2	2.08	1.6
June 6	Freeman and Hartman	10	13.0	3.02	8.5

Daily gage height, in feet, of Reser ditch, near Chinook, Mont.

April 28	2.08	June 1 [a]	2.07
May 27	3.00	June 2	2.05
May 28	3.00	June 3	2.08
May 29	3.25	June 4	2.07
May 30	3.00	June 5	2.03
May 31	3.00	June 6	3.00

[a] Dam was washed out during June flood of Milk River and ditch was closed for remainder of the season.

WEST FORK DITCH NEAR CHINOOK, MONT.

A temporary gaging station was established on this ditch June 16, 1905, about 200 feet below the head-gates. During 1906 the gage was read by C. A. Shuler. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 81.

Discharge measurements of West Fork ditch near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	W. B. Freeman				0
May 29	do	12	15.6	3.66	20.0
June 26	W. S. Hartman	4	1.7	2.16	1.62
July 19	Morse and Hartman	7	5.2	2.65	5.38
July 25	W. S. Hartman	5	2.4	2.23	1.99
August 11	do				0

Daily gage height, in feet, of West Fork ditch, near Chinook, Mont.

May 29	3.3	June 14	3.5
May 31	4.3	June 15	3.4
June 1	3.9	June 22	2.8
June 2	3.7	June 26	2.15
June 4	3.3	July 10	[b] 3.1
June 5	3.95	July 11	3.05
June 6	3.8	July 12	3.0
June 7	4.0	July 13	3.0
June 8	([a])	July 19	2.9
June 12	[b] 3.8	July 20	2.8
June 13	3.6	July 25	2.25

NOTE.—No flow prior to May 28.

Monthly discharge of West Fork ditch, near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (2 days)			24.0	95
June (12 days)	26	2	17.9	426
July (7 days)	11	2	8.0	111
The period				632

NOTE.—Values are approximate, owing to great and irregular fluctuation of daily stages.

WINTER-ANDERSON CANAL NEAR CHINOOK, MONT.

This station was established April 22, 1906. It is 5 miles east of Chinook and one-half mile west of James Cook's house. On account of the small grade the current is rather sluggish at all stages. The bed is composed of mud and silts up during the season. Discharge measurements are made by wading a short distance above the gage. The gage, which was read daily during the irrigation season by Julius Bosch, consists of a rod situated a short distance downstream from the highway bridge crossing the canal. The bench mark is the head of a spike 0.3 foot above ground in the north side of corner fence post on the south side of the road 50 feet west of the gage; elevation, 8.58 feet above the gage datum.

[a] Head-gate closed. [b] Head-gate open.

Discharge measurements of Winter-Anderson canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
April 22	Morse and Freeman	11	12.1	3.20	10.0
May 5	W. B. Freeman			2.25	[a] .75
May 23	do			2.45	[a] 1.0
June 12	do	9	35.5	3.61	22.3
June 27	W. S. Hartman	11	8.8	2.90	4.51
July 25	do				0

[a] Estimated.

Daily gage height, in feet, of Winter-Anderson canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		2.7	3.5	2.88	17			2.9	2.2
2			3.85	2.8	18		2.0	2.9	2.2
3		[a] 2.3	3.75	2.8	19			2.9	2.2
4		2.3		2.8	20		2.0	2.9	2.2
5			3.3	2.75	21		[b] 2.8	2.9	2.18
6			3.3	2.7	22			2.9	2.14
7		2.3		2.6	23	2.8	2.45	2.9	2.1
8			3.8	2.58	24		2.3	2.9	2.1
9		2.3		2.47	25	2.7	2.4	2.9	2.1
10			4.6	2.4	26			2.9	2.1
11		2.1	4.1	2.4	27	2.7	2.6	2.9	2.24
12			3.5	2.3	28	2.7	2.7	2.9	2.4
13			3.3	2.24	29		2.85	3.0	2.1
14		2.3	3.0	2.1	30	2.7		2.9	2.4
15			3.0	2.3	31		3.55		[c] 2.1
16		2.1	2.95	2.3					

[a] Head-gate closed. [b] Head-gate open. [c] Canal dry for remainder of season.

Monthly discharge of Winter-Anderson canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (23–30)	3.6	2.8	3.0	48
May	20.2	.0	2.1	129
June	68	4.7	14.9	887
July	4.6	.2	1.2	74
The season				1,140

NOTE.—Values are approximate owing to great and irregular fluctuation of daily stages.

ROCK CREEK CANAL NEAR HINSDALE, MONT.

The gaging station was established July 5, 1905. It is located about 300 feet below the head-gates of the canal. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 83.

Discharge measurements of Rock Creek canal near Hinsdale, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 9	W. S. Hartman	22	18.1	0.20	13.1
July 22	W. B. Freeman			− .10	[a] 8.0
August 14	do			− .45	[a] 1.0

[a] Estimated.

Daily gage height, in feet, of Rock Creek canal near Hinsdale, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	0.1	0.75	0.0	−0.3	−0.3	17	0.8	0.5	2.3	0.1	−0.3	−0.3
2	.....	.1	.6	.0	−.3	−.3	18	.7	.4	2.1	.1	−.3	−.3
3	.....	.1	.6	.0	−.3	−.3	19	.5	.2	2.0	.1	−.3	−.3
4	.....	.1	.7	.0	−.3	−.3	20	.5	.1	1.8	.1	−.3	−.3
5	.....	.1	1.0	.0	−.3	−.3	21	.4	.1	1.6	.0	−.3	−.3
6	.....	.05	1.0	.0	−.3	−.3	22	.4	.1	1.1	−.1	−.3	−.3
7	1.2	.05	2.4	.0	−.3	−.3	23	.3	.1	.5	.0	−.3	−.3
8	.8	.05	(a)	.0	−.3	−.3	24	.3	.1	.0	.0	−.3	−.3
9	.6	.05	(a)	.5	−.3	−.3	25	.2	1.95	.0	−.1	−.3	−.3
10	.1	.05	5.1	.4	−.3	−.3	26	.2	1.8	.0	−.1	−.3	−.3
11	.3	.05	(a)	.3	−.3	−.3	27	.2	1.3	.0	−.2	−.3	−.3
12	.5	.05	(a)	.2	−.3	−.3	28	.1	1.2	.0	−.2	−.3	−.3
13	.9	.05	6.9	.2	−.3	−.3	29	.1	1.2	.0	−.2	−.3	−.3
14	.9	.05	4.8	.2	−.3	−.3	30	.1	1.4	.0	−.3	−.3	−.3
15	.7	.1	2.6	.2	−.3	−.3	31	.....	1.3	.....	−.3	−.3	.....
16	.6	.4	2.5	.2	−.3	−.3							

a Above gage, maximum gage height 11 feet.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the Milk River basin in 1906:

Miscellaneous discharge measurements in Milk River drainage basin in 1906.

Date.	Stream.	Locality.	Area of section.	Gage height.	Discharge.
			Sq. ft.	*Feet.*	*Sec.-ft.*
July 3	Clear Creek	Yantic	26	.....	67
July 6	Snake Creek	Harlem	5.8	.....	5.8
July 12	Beaver Creek	Gravel crossing 10 miles south of Lake Bowdoin.	.....	.....	20
July 16	Larb Creek	Near Malta	.....	.....	2.0
July 19	Milk River	Glasgow	490	.....	430
July 20	West Fork Milk River	1 mile below West Fork ditch dam at ford.	.....	2.40	10
July 24	White Creek	Mills's ranch	.....	.....	.25
July 23	Frenchman Irrigation Company canal.	Saco	3.5	.....	2.3
July 24	Frenchman Creek	Saco, 5 miles above mouth	40	.....	50
July 25	Cottonwood Creek	18 miles northeast of Malta	.....	.....	5.0
July 25	Whitewater Creek	Upper reservoir	.....	.....	4.0
July 27	Alkali Creek	5 miles west of Malta	.....	.....	1.0
July 27	Peoples Creek	Fort Belknap Indian Reservation.	.....	.....	6.0
July 31	Havre Irrigation Company canal.	Fort Assinniboine	5.4	.....	6.0
July 31	Beaver Creek	do	5.8	.....	6.8
July 31	do	Pacific Junction	5.2	.....	5.6
June 29	Fifteenmile Coulee	Zurich	8.4	.....	8.8
June 29	Sixmile Coulee	½ mile above mouth	4.0	.....	4.8
June 29	Threemile Coulee	Chinook	4.3	.....	4.7
April 23	Milk River	Below Harlem canal	23	1.32	46
May 5	do	do	41	1.58	60
May 23	do	do	30	1.41	30

FLOODS IN MILK RIVER BASIN.

By William B. Freeman.

FLOOD OF JUNE 6-13, 1906.

In the early part of June, 1906, occurred the most destructive flood ever witnessed in the Milk River Valley since its settlement. The flood was brought about by very excessive precipitation over the entire lower drainage basin of the river at that time, following a somewhat abnormal rainfall in the latter part of May.

PREVIOUS FLOODS.

On a few occasions in the past the water in the main channel of the river has risen to a much greater height in the upper portion extending from Havre to Malta. These floods, however, have taken place in the early spring and have been caused by the rapid run-off from melted snow, accompanied by ice gorges. It is doubtful whether during the twenty-five years the valley has been inhabited there has ever been so large an actual flow of water in the lower part of Milk River as in the 1906 flood, and it is certain that many of the tributary creeks and coulees have never risen to such an excessive height.

In the flood of March, 1899, Milk River was out of its banks nearly the whole length of the valley, and most of the towns along it were partly or wholly submerged. From high-water marks in the streets of Havre the maximum gage height was estimated to be 18.80 feet, an elevation of 2,480 feet above sea level, Havre datum. The Great Northern Railway suffered great damage through washouts and loss on account of delays, while the private loss and inconvenience resulting from the flooding of houses, etc., was quite large. There was also considerable loss of domestic stock, but the damage to farm lands was small at such an early season. At this time Milk River reached a stage above any previous one within the memory of the oldest inhabitant. However, people who have lived in the vicinity of Glasgow for twenty years or more state that, at the time of their arrival in the country, there were drift logs and other high-water marks at least 2 feet above the 1899 mark. It is not known how this flood was brought about, but it is probable that it occurred within the last thirty years.

From the best authority it would appear that at Glasgow the flood height of the river in the 1906 flood was a few inches higher than in 1899, while at Havre at was several feet lower.

DRAINAGE AREA.

Milk River rises in the foothills in northwestern Montana near the west slope of the Rockies. At Havre, about 200 miles below the

head, it has a drainage area of 7,300 square miles, made up of hills and rolling plateaus; there is practically no wooded or mountain country in this area. During the June flood, 1906, only about 2,500 square miles above Havre were affected by a large rainfall.

Between the last-named point and Glasgow the river drains a large strip of country extending from the Bear Paws and Little Rockies on the south to the Cypress Hills in Canada on the north. The valley of Milk River throughout this distance of 150 miles has an average width of from 2 to 3 miles, while many of its tributaries, notably Beaver Creek, Larb Creek, Frenchman, Whitewater, and others, have also wide valleys. The lower drainage area of the river is similar in a general way to that above Havre, except for the broad valleys and the large percentage of comparatively flat bench lands. Except for a somewhat straggling growth of cottonwoods and willows along the different streams, practically no timber is to be found. The estimated drainage area of Milk River at Malta is 14,040 square miles, while at Glasgow it is approximately 23,600 square miles. Among the most important tributaries of lower Milk River are Big Sandy Creek (near Havre), Clear Creek, North and West Forks of Milk River, Thirtymile Creek, Snake Creek, Peoples Creek, Alkali Creek, Beaver Creek, Larb Creek (a branch of Beaver Creek), Big Cottonwood Creek, Whitewater, Frenchman, Rock Creek, Brazil Creek, and Willow Creek. In addition, there are numerous other small creeks and coulees, most of which were bank full or overflowing during the flood.

The United States Geological Survey has established gaging stations on Milk River at Malta and Havre, Beaver Creek near Ashfield, North and West Forks of Milk River near Chinook, and Rock Creek near Hinsdale. The record on the Milk at Havre extends over a period of nine years, on the Milk at Malta and Beaver Creek of less than five years, while the other stations have been maintained for very short periods.

RAINFALL.

This flood was preceded by a time of drought extending over a period exceeding two years, while the months immediately preceding were especially dry. It commenced to rain about the middle of May and from that time until the end of the month the average precipitation in the valley was from 4 to 5 inches, much above the average for the month of May. This was followed by an average rainfall of nearly 4 inches from June 6 to 13, inclusive, considerably over half of which fell in twenty-four hours. The ground was already thoroughly saturated, while all the water holes and reservoirs had been filled wholly or in part. This fact taken in connection with the enormous drainage area accounts for the large volume of run-off water.

There are four Weather Bureau stations within the area affected by the flood, all in the river valley, viz, Havre, Chinook, Malta, and Glasgow. The first-named is a regular station while the others are maintained by voluntary observers.

In the following table is given the daily precipitaion at each of these stations during the flood period and that immediately before and after:

Precipitation, in inches, at stations in Milk River basin during May and June, 1906.

Date.	Havre.		Chinook.		Malta.		Glasgow.	
	May.	June.	May.	June.	May.	June.	May.	June.
1	0	0	0.30	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0.29	0	0	0	T.	0	0	0
4	0	0.04	.....	0	0	0	0	0
5	0	0	0	0	0	0.10	0	0
6	0	0.46	0	0.94	0	0.98	0	2.30
7	0	1.36	0	2.17	0	3.22	0	0.95
8	0	0.21	0	0.42	0	0.38	0	0.52
9	0	0	0	0	0	0	0	0.20
10	0	0.08	0	0.07	0	0	0	0.06
11	0	0	0	0	0	0	0	0
12	T.	0.42	0.57	0.25	T.	0	0	0
13	0.24	0.06	0.09	0.07	0.80	0.53	0.48	0.67
14	0.01	0	0	0	T.	0	0.76	0.22
15	0.09	0	0.24	0	0	0	T.	0
16	0	0.03	0	0	T.	0	0.06	0.05
17	0.03	0.08	0	0	0	0	0.02	0.18
18	0	0.08	0	0	0	0	0	0
19	0	0.23	0	0.14	0.80	0.29	0	0.23
20	0.11	0	0.36	0.35	0	T.	0.05	0
21	0.15	0.43	0.21	0	T.	0	0.46	0
22	T.	0.31	0	0.30	0.06	0.79	0.13	0.32
23	T.	0.11	0.04	0.05	1.05	1.10	1.41	1.07
24	0.65	0.02	0.65	0	0.80	0	0.13	0
25	0.31	0	0.45	0	0.21	0	0.55	0
26	0.35	0	0.06	0	0	0	0.71	0
27	0.05	T.	0.32	0	0	1.94	0.08	0
28	0.09	0.45	0.05	0.91	0.21	0	0.19	0.35
29	0.41	0	0.39	0	0.47	0	0.01	0
30	0.54	0	0.58	0	0.25	0	0.60	0
31	0	.....	0.08	.....	0	.....	0.05	.....
Total	3.32	4.37	4.39	5.67	4.65	9.33	5.69	7.12

In the following tables is given the monthly precipitation at these stations for 1906 and for three years previous, as well as the average monthly precipitation:

Monthly precipitation, in inches, at stations in Milk River basin, 1903–1906.

HAVRE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1903	0.33	0.21	0.52	0.95	3.47	1.51	5.23	2.52	0.48	0.21	0.50	0.10	16.03
1904	0.15	0.57	0.86	0.34	2.24	2.29	0.43	0.51	0.26	0.51	T.	0.45	8.61
1905	0.85	0.14	0.15	0.70	0.83	1.72	0.86	0.30	0.12	0.37	0.60	0.12	6.76
1906	0.17	0.11	0.31	0.09	3.32	4.37	0.17	1.63	0.93	0.57	0.74	.....	.....
Normal	a. 62	0.48	0.55	0.97	1.98	2.90	2.08	1.32	1.11	0.64	0.74	0.54	14.25

CHINOOK.

1903	.....	.....	0.48	0.67	3.40	1.52	2.78	2.03	0.54	0.28	0.02	0.05	.....
1904	0.11	0.36	0.81	0.58	2.11	2.26	0.73	0.83	0.25	.....	.....	0.77	.....
1905	0.71	0.08	T.	0.25	2.00	3.50	2.66	0.41	0.48	0.55	.....	T.	.....
1906	0.04	0.05	0.15	0.35	4.39	5.67	0.00	1.83	0.94	0.56	0.26	.....	.....
Normal	b. 46	0.38	0.52	0.66	2.76	2.60	1.44	1.17	0.78	0.57	0.80	0.41	.....

a Twenty-four years record. b Normal monthly from records of from three to ten years.

Monthly precipitation, in inches, at stations in Milk River basin, 1903–1906—Cont'd.

MALTA.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1905[a]	.....	.....	.....	.....	2.22	3.80	2.31	0.01	0.37	0.40	0.55	0.04	.....
1906	0.02	0.00	0.02	0.25	4.65	9.33	0.00	1.12	1.86	0.50	.....	.....	.....

GLASGOW.

1903	0.17	0.07	0.18	0.12	5.33	.....	1.37	1.02	0.14	0.09	0.44	0.07	.....
1904	1.50	0.55	4.06	0.75	0.70	1.59	0.35	0.42	0.21	0.22	.....	1.44	.....
1905	0.13	0.22	0.65	.....	.....	.....	2.47	0.18	0.72	0.10	0.30	0.17	.....
1906	0.06	0.05	0.14	1.92	5.69	7.12	0.34	1.26	1.78	.....	0.25	.....	.....
Normal	[b] 0.51	0.63	1.46	1.02	2.55	2.49	0.88	0.48	0.64	0.79	0.75	0.54	.....

[a] Station established May, 1905. [b] Record from ten to thirteen years.

DISCHARGE.

The following table gives the daily discharge at the various regular stations maintained by the United States Geological Survey in the Milk River Valley from May 1 to July 15, 1906, inclusive:

Daily mean discharge, in second-feet, of streams in Milk River basin, May 1 to July 15, 1906.

Day.	Milk River at Havre.			Milk River at Malta.			North Fork Milk River at Chinook.			Beaver Creek at Ashfield.		
	May.	June.	July.	May.	June.	July.	May.	June.	July.	May.	June.	July.
1	38	712	390	0	1,800	2,000	24	890	175	.....	695	3,700
2	38	610	360	1	2,800	1,600	24	491	155	.....	1,230	1,670
3	24	560	360	1	3,310	1,260	24	367	144	.....	1,290	365
4	46	560	275	0	1,800	1,000	24	261	130	.....	660	195
5	38	610	190	0	1,330	875	24	179	115	.....	365	139
6	38	512	190	0	1,330	751	24	139	97	.....	202	98
7	38	660	160	0	1,330	691	21	2,050	95	.....	450	78
8	38	3,690	140	0	10,400	631	21	4,600	90	.....	5,000	50
9	32	2,970	110	0	10,900	517	18	1,040	85	.....	6,650	34
10	32	1,780	100	0	10,700	463	18	1,320	79	.....	6,100	25
11	32	2,310	100	0	9,840	412	16	1,230	73	.....	5,500	36
12	32	1,860	100	0	10,400	364	14	1,400	69	.....	5,000	28
13	32	1,550	78	0	10,300	210	12	2,130	62	.....	3,700	20
14	43	1,070	67	0	8,700	280	12	715	57	.....	2,120	16
15	32	865	67	0	6,890	180	12	453	55	.....	590	17
16	46	700	.....	0	4,450	.....	12	828	.....	.....	315	.....
17	55	600	.....	0	2,600	.....	12	275	.....	.....	270	.....
18	46	550	.....	0	2,000	.....	10	227	.....	.....	220	.....
19	38	600	.....	0	1,700	.....	16	196	.....	.....	164	.....
20	38	420	.....	0	1,400	.....	15	212	.....	.....	132	.....
21	97	420	.....	0	1,200	.....	48	155	.....	.....	95	.....
22	46	460	.....	0	1,100	.....	38	137	.....	.....	70	.....
23	38	550	.....	0	1,100	.....	34	206	.....	.....	78	.....
24	46	460	.....	6	1,230	.....	64	206	.....	.....	78	.....
25	104	420	.....	9	1,430	.....	118	212	.....	30	63	.....
26	120	550	.....	691	1,730	.....	118	296	.....	280	47	.....
27	138	460	.....	691	1,600	.....	96	265	.....	785	44	.....
28	183	500	.....	463	4,610	.....	144	244	.....	1,380	55	.....
29	239	550	.....	463	3,840	.....	310	307	.....	1,500	202	.....
30	686	480	.....	1,200	2,740	.....	1,750	228	.....	1,010	4,000	.....
31	1,230	.....	.....	1,330	.....	.....	1,720	.....	.....	935	.....	.....

NOTE.—For daily discharge of West Fork of Milk River see p. 48.

RUN-OFF.

The percentage of the run-off from some of the larger drainage areas averaging less than 10 per cent of the rainfall is surprisingly small. This is especially so in consideration of the fact that the soil was thoroughly soaked by rains a short time previously. It can be accounted for only by the large percentage of gravelly soil and comparatively flat bench lands. In this connection it may be stated that, on comparing the run-off from the whole drainage area of the Milk at Havre with the Havre rainfall from 1899 to 1905, inclusive, it has been found that the average annual run-off is only about 4.5 per cent of the rainfall.

The rainfall at Chinook represents about the average for the drainage area of Milk River at Malta for the flood period from June 6 to June 13. On this basis the following table has been prepared.

Ratio of run-off to rainfall in Milk River basin, June 6–13, 1906.

Stream.	Drainage area.	Rainfall.	Approximate run-off.		Ratio of run-off to rainfall.
			Acre-feet.	Inches.	
	Sq. miles.	*Inches.*			
Milk River at Havre	[a] 2,500	[b] 2.59	30,400	0.23	0.089
West Fork of Milk River at Chinook	1,318	3.92	24,000	.34	.087
North Fork of Milk River at Chinook	1,422	3.92	27,600	.36	.092
Milk River at Malta	[a] 9,200	3.92	129,000	.26	.066

[a] Drainage area affected by flood only, not total area of river.
[b] Havre rainfall.

The following data are interesting as showing the rates of maximum discharge during this flood, though the discharges in most cases are but estimates made from measured flood cross sections, slopes of stream beds, and velocities, computed by Kutter's formula:

Maximum discharge and run-off in Milk River basin, June 6–13, 1906.

Stream.	Locality.	Approximate drainage area.	Maximum discharge.	Run-off per square mile.
		Sq. miles.	*Sec.-feet.*	*Sec.-feet.*
Fifteenmile Creek	Chinook	40	1,650	41
Frenchman Creek	Saco	1,700	6,500	4
Fogey Creek	Harlem	25	375	15
Le Noir Coulee (on Beaver Creek)	Malta	16	8,600	538
Milk River	Havre	[a] 2,500	4,000	1.6
North Fork of Milk River	Chinook	1,432	7,700	5.4
Milk River	Malta	[a] 9,200	11,250	1.2
West Fork of Milk River	Chinook	1,318	3,000	2.3
Rock Creek	Hinsdale	976	18,000	18
Savoy Creek	Savoy	93	1,800	19
Second Creek (on Larb Creek)	Saco	25	1,700	68
Threemile Coulee	Chinook	26	1,750	67
Wayne Creek	Harlem	95	3,200	34
Yadley Coulee	Malta	[b] 20	2,750	138

[a] Only this area affected by flood. [b] Estimated.

EXTENT OF FLOOD.

Commencing on the night of June 6 the various tributaries of Milk River rose rapidly, though some of the longer ones did not reach their maximum until June 10. During the interval a flood condition existed from Fort Assinniboine to Glasgow, aptly described in the headlines of the Great Falls Tribune for June 9, "Milk River Valley One Big Lake."

In the vicinity of Assinniboine and Pacific Junction the whole bottom was submerged by the flood waters of Beaver Creek, while the Great Northern tracks were under water in many places. The flat at Yantic was covered by the waters of Clear Creek. The West and North forks of Milk River overflowed the valley east of Chinook, while Thirtymile Creek submerged the country east and west of Harlem, a part of the town, and a considerable length of the Great Northern tracks. Saco and all the country above was covered for days by the waters of Beaver Creek, while much of the country between there and Hinsdale was also flooded. Rock Creek was out of its banks by several feet, and the other streams were correspondingly high.

Traffic on the Great Northern from June 6 to June 9 was practically suspended on account of washouts and submerged tracks, while it was several days more before the road could resume its schedule. The highways in the valley, and especially along the railway track, were impassable for days, many of them being under several feet of water.

Between Malta and Glasgow Milk River was out of its banks in many places, overflowing the bottom lands, while the south side of Glasgow was flooded.

Many people living along the banks of the river and its tributaries were forced to leave their homes, but no loss of life resulted directly from the flood.

The following extract is taken from the Great Falls Tribune for June 9, 1906:

Reports received by the Tribune last evening from the flooded country in Chouteau and Valley counties show increasingly bad conditions, and there is every reason to fear even greater floods, as the dams of many great reservoirs have gone out, releasing millions of gallons of impounded water that will flow into the Milk River. * * * The country around Harlem and Chinook is a solid lake; scarcely a fence post is visible along the Great Northern in places. At Glasgow many are moving from their homes to higher land. Harlem and Hinsdale are full of refugees, and at Hinsdale the only available boat is being used to rescue imperiled ranchers and their families for several miles in every direction.

Thousands of sheep have been drowned, and there is every reason to fear enormous loss of lambs.

The rainfall at places in Valley County since May 1 has been 11 inches—nearly equal to the normal annual rainfall.

DETAILS OF FLOOD, BY BASINS.

Milk River.—The damage done by Milk River itself in this flood was comparatively small. Several small railway dams at water-tank pumping plants were washed out, while one or two small railway pumping plants were injured. All of the bridges on the river stood the flood in good shape.

There are five irrigation dams between Havre and Harlem, three of which are brush and rock-fill structures. One of these latter, the Harlem dam, was taken out about 4 a. m. on June 8. It failed by the water cutting through between the dam and the left or north bank, as there was no sheet piling nor other protection against this action. The material composing the bank is of a sandy formation and melts away before the action of water. The space cut through was gradually enlarged to a width of nearly 100 feet. Only a small portion of the end of the dam was washed away. The structure was about 10 feet high and 200 feet long, built on the style of a beaver dam at a cost of $4,000. It has been found that dams of this type, when properly joined to the banks and after they have settled, resist the action of water in a remarkable manner. This can be seen from the number of such structures that resisted this one flood.

The Fort Belknap Indian Agency dam near Harlem, a rock-fill timber structure, worth about $25,000, was slightly damaged, and it was necessary to do considerable work on the banks in the way of riprapping to prevent the water from cutting a channel around it.

The Paradise Valley dam, the Winter-Anderson dam, and the Belknap dam near Yantic were practically unharmed by the flood waters. The first two are of the brush type, the second being a comparatively small, cheap structure. The Belknap dam is in the main a timber, rock-fill dam, 7 feet high, with a spillway of about 130 feet. It was last built in 1904, at a cost of $5,000.

The banks of the river were scoured and cut away for considerable distances in many places, while a shifting of the bed and channel of the stream was also very apparent.

The river was bank full from Chinook to Malta and between Malta and Glasgow it was over its banks at low places, flooding the bottom lands to a depth of several feet in different localities. Many ranches and houses were under water and there was the usual loss of domestic stock, etc. It is probable, however, that the total damage done by the Milk River itself did not exceed $30,000.

At Glasgow the water rose to the backyard of the court-house, and at Malta a gage height of 19 feet was attained. (See p. 81 for elevation of high water at different points on this stream.)

Beaver Creek (Chouteau County).—This creek was at a high stage during the early June flood and continued to do damage for several days

after its first subsidence on account of cloud-bursts, etc. The stream was out of its banks for a long distance along its course. Part of the flood water rushed down the Havre Irrigation Company's ditch, the head gates of which were open, and scoured the upper portion, and broke through the banks in many places. The small dam at the head of this ditch was also practically destroyed. The waterway provided through the Montana Central track was apparently insufficient. For over a day the water was running over it to a depth of a foot or more. For several days there was a large pond formed above the track exceeding one-fourth mile in width. The wave action from this lake, probably in connection with the rush of water, did considerable damage to the embankment for a distance of 300 to 400 yards west of Assinniboine Station. The upper side of the embankment was badly eroded and the ballast was washed from under the ties. The track was washed through at one place about one-fourth mile east of the station, and a section of the main-line track of the Great Northern was taken out at Pacific Junction by this creek, and traffic was delayed for several hours on different occasions. The greater part of the damage done by this creek was sustained by the Great Northern.

The drainage area of the stream is estimated at from 40 to 50 square miles, of which the greater part is situated in the Bear Paw Mountains. A conservative estimate of the maximum discharge in the flood is 4,000 second-feet. A flood cross section taken 1 mile below Fort Assinniboine showed an area of 1,300 square feet. With the slope of 7.5 feet per 1,000 feet, obtained from topographic sheets, and an assumed coefficient of roughness of 0.045 in Kutter's formula, the velocity was found to be 8.0 feet per second; but on account of the shape of the channel at this point and for other reasons it is believed to have been not much in excess of 3 feet per second.

Red Rock Coulee.—This coulee was reported to be out of its banks and overflowing considerable land along its course. The channel of the Fort Belknap canal was filled by the flood waters, but the canal was practically undamaged. The Ross and MacClaren reservoirs on the coulee were destroyed. The drainage area of the coulee is over 40 square miles and the flow of water was no doubt considerable, though no estimate of it was made.

West Fork of Milk River.—This stream had been over its east, or left, bank for a couple of days in the latter part of May, the overflowing water escaping eastward through a slough. In the flood from June 8 to 11 it reached a much higher stage. The water went over the right, or west, bank also, flooding a large area, including the north side of Chinook, which was submerged for a couple of days, forcing people to temporarily abandon their homes. The maximum gage height attained was 17 feet, at which height it is probable that

not over half the total flow was contained within the banks of the creek. It is estimated that the maximum flow in this flood was 3,000 second-feet.

On June 7 at 2 p. m. the Reser Irrigation dam on this stream, about 12 miles north of Chinook, was washed out. The water tore through the center of the structure, taking everything bodily for a width of about 40 feet. This dam was a timber-crib, rock-fill dam of the weir type. It was built in 1904 at a cost of probably $1,500. The width of the spillway was about 90 feet, and as the left bank is low there was an extension earthen embankment on that side. The structure was firmly joined by sheet piling to the right bank and to the earthen embankment at the left. On Friday, June 8, the breaking of the Garthofner and Hedge reservoir dams on a branch of West Fork caused an enormous amount of impounded water to be let loose. The loss due to the destruction of these two dams was about $3,000. Probably the only dam left standing on this creek was that of the West Fork Irrigation Company, a rock-fill timber structure last built in 1904. Including the cost of the old brush dam, part of which still remains, the total cost was about $2,500. It has a width of spillway of 80 feet.

The total damage done by the flood on this stream is estimated at $15,000.

North Fork of Milk River.—During this flood the North Fork reached a height much greater than any within the memory of the oldest inhabitant. The maximum gage height attained during the night of June 7 was 16.63 feet. The flood area of the cross section at the gaging station was 1,500 square feet and the discharge, estimated from Kutter's formula (using a slope of 4 feet per mile and an assumed n=.035), was 7,700 feet.

Even at this point, which is well up in the hills, the stream overflowed its right bank, while the lower portion of the creek for 5 to 6 miles above its mouth was out of its banks and overflowed surrounding fields. The high-water mark is within 3 feet of the level of the floor, at the highest point, of the county highway bridge along the Great Northern Railway, and within 5 feet of the bottom of the plate-girder railway bridge.

The Matheson dam, on this stream, was badly damaged, the Matheson canal was entirely under water, and all the bridges and flume crossings along it were washed out, though no great damage was done to the canal. The railway embankment was damaged but slightly, but the highway along it was completely submerged, rendering travel impossible.

By far the greatest loss on North Fork was that due to the drowning of stock, especially sheep. Several outfits were "lambing" at various places along this stream and the tributary coulees. In many

cases it was impossible for them to move out before they were surrounded by the rising waters. Thousands of lambs were thus entrapped and drowned, while many others perished in the storm. Not a few sheep perished in the same manner.

Outside of the stock loss, which is large but difficult to estimate, the total damage done by the flood waters of this creek probably did not exceed $5,000.

Thirtymile (or Parallel) Creek.—Probably as much damage was done by this creek as by any of the tributaries of Milk river. It usually carries considerable water during the spring floods, but is dry as a rule for the remainder of the year except during heavy storms. At intervals of a mile or two along its lower course earthen dams have been built to divert and store the run-off water. These dams have the effect of raising the water and causing the banks of the stream to overflow from a much smaller flow than they otherwise would. Of course the stream channel is entirely inadequate in any case to carry any large amount of flood water. At a point a few miles above Harlem the flood cross section was found to be 1,950 square feet and the estimated discharge was 8,880 feet.

It started to rain at Harlem on the morning of June 6 and poured incessantly for twenty-four hours. Early on June 7 the creek was out of its banks and running over the north side of Harlem; people were commencing to leave their homes. The water rose rapidly until noon, when the whole north side was under from 2 to 4 feet of water. At that time there were nearly 1,000 second-feet flowing down the main street of Harlem, the water being above the hubs of an ordinary wagon. At 8 o'clock that evening it had fallen somewhat, and the next morning the creek was pretty well back into its banks. (Pl. V.)

The tracks of the Great Northern Railway prevented the water from flooding over the south side of Harlem. A sheet of water, backed up by the track, extended from nearly 2 miles above Harlem to 3 to 4 miles below. In the stock yards, a mile east of Harlem, there were 3 to 4 feet of water, and the right-of-way fence posts were invisible at points along the railroad. South of the railway track and east of Harlem a river 3 to 4 miles wide was flowing into Milk River. Many houses and ranches were surrounded or submerged to a depth of 3 feet or more. At low places along the railroad the water was almost on a level with it, and the upper side of the embankment was being cut away and the ballast washed from under the ties, causing the track to settle; at one or two trestles the embankment was washed through. Every bridge, trestle, and culvert in the track for a distance of 5 to 6 miles was carrying water to its maximum capacity, while the water level in the lake above the track was rising rather than falling. In order to allow the impounded water to escape and to save the track it was necessary to cut channels through it in several places.

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FLOOD OF JUNE 7, 1906, AT HARLEM, MONT.

The following clipping is taken from the Great Falls Tribune of June 8 regarding this flood:

Harlem, June 8.—One of the heaviest rainfalls that has ever been known in this part of the country fell in the Milk River Valley, beginning at 9 a. m. Wednesday. The town and entire valley is one solid lake of water. The residents on the north side of the railroad track had to be taken from their homes by wagons to hotels and other places of refuge. All cellars and most houses are filled with water. Bridges and railroad tracks are washed out and trains tied up all along the line. Considerable damage to sheep and stock is reported. Reports reached here this afternoon that Sprinkle Brothers' entire band of 4,000 sheep were drowned in Thirtymile Creek the past two days. Miles of railroad right-of-way fence are under water and every country road is a river. The damage to property and stock is estimated at $40,000.

The above estimate of the loss is probably rather large.

On Fifteenmile Coulee, which heads a short distance from Thirtymile Creek, there was also a great loss due to the drowning of stock.

Threemile Coulee.—The large earthen reservoir dam on Threemile Coulee, built by the Indian Department, was taken out during this flood. It was destroyed mainly by wave action in the reservoir. The cost of this structure was probably $2,000 to $3,000, and the damage done amounted to a few hundred. The reservoir has a length of over a mile and a width of about one-fourth mile. From approximate data on the time of filling the reservoir, it is believed that the maximum flow was nearly 2,000 second-feet and the run-off about 3,000 acre-feet.

Peoples Creek.—This creek was out of its banks for a long distance, and it is stated that all the country near its mouth into Milk River was a regular lake. A flood cross section was taken at the Ereaux ranch, about 3 miles from the mouth. Both banks had overflowed a short distance above the section, forming islands on both sides at that point. It is estimated that the maximum flow was in excess of 4,000 second-feet. As this creek rises in the Bear Paw and Little Rocky mountains, it is likely that there was considerable flow for several days. As a rule, it carries water for a long time after the other streams in the vicinity are dry.

Little damage was done by this creek, that due to the flooding of the bottom land being slight.

Beaver Creek (Valley County).—Beaver Creek carried an amount of water during the spring of 1906 greatly in excess of any discharge for several years. In the latter part of May the gage height at the gaging station was nearly 11 feet, while in the big June flood it rose to a height of about 12.60 feet, as shown by high-water marks; again in the latter part of June a height of over 12 feet was attained. In April, 1904, the gage height was within a foot of the highest for the present season, while the estimated maximum discharge is not much over a fourth that for 1906.

The maximum gage height attained by the Beaver Creek overflow channel on June 9 was 11.56 feet, while the discharge must have been considerably over one-half that in the main channel. Lake Bowdoin, which is supplied mainly by this stream, rose several feet in height and the water level was up along the railroad embankment for miles. The latter was badly scoured by wave action; the softening of the roadbed made travel necessarily slow and dangerous. A great area of bottom hay land on the south side of the track was included within the high-water contour of the lake, and, as the latter subsided slowly, part of this land was made valueless for the season. A portion of the north end of the Brady dam on this lake was washed out. The approximate high-water level of the lake for the season was 2,210.3, Havre datum.

On the upper waters of Beaver Creek great damage was done by the breaking of the reservoir dams of B. D. Phillips's irrigation system. It has been stated that this loss is in the neighborhood of $30,000.

All along Beaver Creek Valley the flood waters covered the whole flat, while many of the tributaries also carried enormous volumes of water. This was especially so in the later June flood, which was confined mainly to the lower tributaries. Among them may be mentioned Clanton and Le Noir coulees, which carried veritable rivers. The fall of these coulees is from 40 to 50 feet per mile and the flood waters rushing from them tore up the ground. It is estimated that Le Noir coulee, with a drainage area of 16 square miles, had a maximum discharge of 8,600 second-feet. This does not seem possible, but is based on flood cross sections and velocities computed by Kutter's formula. Between 100 and 200 acres on Sanford's ranch, at the mouth of the coulee, were submerged to a depth of several feet and the crops washed out of the ground. A great many hogs were drowned on this ranch by the flood waters. It is a peculiar fact that the Sanford reservoir dam on this coulee, an earthen dam 425 feet long, withstood the flood, though it was topped by the rushing waters to a depth of 1.5 feet.

Along the whole course of Beaver Creek and its tributaries it is probable that there was a great loss due to the drowning of stock.

The railroad dams at Ashfield and Saco, rock-crib structures, were practically put out of commission by the action of the successive floods.

The creek went out of its banks above Saco, and for days that town was under water, in many places the depth being over 3 feet, while the inhabitants went around the streets in rafts and boats. The elevation of the high-water level at Saco was 2,175, Havre datum.

All of the lower valley of Beaver Creek between Saco and the mouth was inundated. It is probable that the total damage done by the flood on this stream was fully $50,000.

Larb Creek.—This creek has a valley very similar to that of Beaver Creek, of which it is a tributary, and, as on that stream, the whole creek bottom was flooded. A flood cross section was taken about a mile above the mouth of Second Creek, from which the maximum discharge was estimated at 6,800 second-feet. Many of the tributaries also carried large amounts of water. Where Larb Creek emerges into the Beaver Creek flat the high-water line was in many places within 100 feet of the stakes of the proposed "A" line canal of the Milk River project.

The damage due to the flood waters of Larb Creek was not very great, though there was probably considerable loss of stock.

Hay and Buffalo coulees.—These coulees emerge from the hills south of Vandalia and have a drainage area of about 8 square miles each. On the evening of June 6, after the heavy rain, the water came down them with a great rush and soon the whole flat below was covered. The only outlet through the Great Northern Railway track provided for this water was a small trestle at the east end of the Vandalia switch, and some distance east of this a concrete culvert about 4 feet high and a cast-iron pipe about 40 inches in diameter. On account of hills to the east and west there was no other escape for the water than through these three openings, and the greater part of it went to the smaller ones. These were, of course, entirely inadequate to carry it, and the result was that the water was backed up nearly to the level of the track, the embankment of which is upward of 15 feet high in places. The upper side of the embankment was softened and a whole work train going across was overturned into this pond on account of the yielding of the track. A little later the track was washed out near the culvert for 100 feet or more and traffic was suspended for days.

Willow Creek near Glasgow.—The greatest damage done by the flood waters of this stream was the total annihilation of the Cutting-Patten-Truscott reservoir dam on the morning of June 7. In the latter part of May the reservoir had been filled to its maximum capacity during the heavy rains, but had not been appreciably damaged, though the Lenz dam, a smaller structure on the creek, went out.

At the time the first-named dam failed it is stated that the water-level was hardly as high as in the first flood, but its destruction was caused by the heavy wind which had been blowing incessantly against it for twenty-four hours preceding its failure. The dam was cut to pieces by the waves, which beat on it and over it, and by the subsequent rush of the impounded waters.

This dam was a well-made earthen embankment about 1,800 feet long, varying in height from 7 to 12 feet except at the creek channel, where it was probably 20 feet high. At that part of the dam there

was a center plank wall composed of 2-inch planking nailed to piles, and this portion of the dam was also puddled. The top width of the dam was 14 feet, the upstream slopes were 3:1 and the lower 2:1. The upstream side was riprapped with bundles of willows fastened at the water surface. There was ample wasteway provided at the left side of the dam. A conservative estimate of the loss due to the destruction of this dam is $10,000.

The reservoir comprises an area of about 400 acres. At one time before its destruction a rise of 3 inches per hour was noted in the reservoir, which would mean a discharge of 1,200 second-feet. It is probable that the maximum was at least twice that amount. The rise of the water surface in an ordinary flood was 4 inches in twenty-four hours.

A large area of country below the reservoir was flooded, and the highway bridge immediately below was taken out. The total flood loss on this stream was probably in excess of $20,000.

Rock Creek.—This stream rose to a great height during the early June flood. From high-water marks the maximum gage height was 18.35 feet, and it is estimated that the maximum discharge was 18,000 second-feet. At the Rock Creek Canal dam the creek channel could not begin to carry the water, and it was spread over the bottom for nearly a mile in width and to a depth of several feet. The height over the Rock Creek canal dam was about 9 feet, and it is estimated that the gage height was 11 feet on the Rock Creek canal gage. The headworks of the ditch were washed out, and the ditch bottom was badly scoured. It is probable that the canal was completely under water at places near the head. Several small structures along the canal were taken out and the embankment gave away at one or two coulee crossings.

The Rock Creek canal dam was not damaged in the least by the flood water. It is a very well-built rock-crib timber structure, the width at the crest being 140 feet, and the height above the creek bottom about 6 feet. It was built in 1902.

The total damage done by the flood on this creek was probably not in excess of $5,000.

Frenchman Creek.—Though this creek with its drainage area of 1,700 square miles is probably the most dependable tributary of Milk River, the maximum flood flow was not nearly as large as that for many of the smaller branches. Owing to the great length of the drainage basin, the flood waters from the lower portion had passed by before the waters from above came down. From a flood cross section it is estimated that the maximum flow during the present year was 6,500 second-feet. At the same point in 1903 a high-water mark about 1.50 feet above that of the present season was attained. Practically no damage to structures was done on this stream, though

there was no doubt some stock loss. The only important dam on this creek, that of the Frenchman Irrigation Company, was unharmed. This is a rock-crib structure 85 feet wide at the crest and 5½ feet high. It was built about 1899.

Whitewater Creek.—No estimate of the flood flow of this creek was made by Kutter's formula, but with its drainage area of 700 square miles the maximum must have been at least 3,500 second-feet. There are several small earthen dams along the course of this creek and two large mill-reservoir dams situated 13 and 18 miles, respectively, above the mouth of the creek. The upper dam was partly destroyed, a section 50 yards wide being taken out at the creek channel and the whole upper side of the embankment being badly pitted and caved by the wave action. The dam consists of an earthen embankment about 1,000 feet long. It is 25 feet high at the creek bed and from that point the height gradually diminishes until it runs out into the higher ground at the ends. The top width is between 10 and 12 feet and side slope 1½:1. It was completed in 1905 but has not been riprapped on the upper side. This is what probably led to its failure.

The lower dam was similar in construction to the other, but was riprapped with gravel and small bowlders. It withstood the wave action, though it was badly pitted. The water level in the reservoir was within 3 feet of the top of the dam. The length of the dam is 1,200 feet and the greatest height about 18 feet.

The total cost of these two dams was probably $15,000, and the damage done will amount to about $3,000.

Other streams.—At many places between Tampico and Glasgow the road as well as many fields were submerged by the flood waters of Antelope Creek, Brazil Creek, and intermediate coulees, or from the back water and overflow water of Milk River itself. Outside of a small amount of damage to buildings and the inconvenience resulting from the high water there was comparatively little loss on these streams.

The Mahon-Hoyt earthen reservoir dam on Brazil Creek was washed through in one place and damaged by the wave action to the extent of $500 or more.

Several streams to the north and east of Malta, such as Big and Little Cottonwood and Assinniboine creeks, rose to great heights, attaining their maximum probably in the later June flood. Every coulee and stream for miles was taxed to its maximum capacity and many overflowed their banks. As this area is sparsely populated little loss was sustained, though the roads were rendered impassable and several small bridges were washed out.

RÉSUMÉ.

The actual property loss resulting from this flood was probably about $250,000. Of this the Great Northern Railway Company

sustained a considerable amount, the greater part of which would have been prevented had ample waterway in their tracks been provided. The washouts were caused mainly by the water impounded by the track embankments.

A great many dams were destroyed, only a small percentage of the earthen reservoir dams on the tributaries of Milk River successfully withstanding the flood. Had these dams stood, a great deal of the submergence of the valley lands would have been prevented, though the combined capacities of all these reservoirs would have been entirely insufficient to store the run-off waters. The high wind which blew so steadily from the west during the greater part of the early June flood was in large measure the cause of the failure of most of these embankments, as they were not constructed in a manner to enable them to resist the action of waves for any continued period. The railway embankments were also badly scoured and pitted by the waves in the lakes formed above them.

Had the earthen dams been well riprapped a great many would probably have stood. However, to insure their safety, it would have been necessary for the riprap to extend from the upstream side, over the top, and down for a short distance on the lower face, as the waves in many cases beat over them when the reservoirs were full. The failure of one or two timber structures was unlooked for and could hardly have been avoided.

Had this flood occurred in a thickly populated community the damage would have unquestionably been large, but the area affected was very sparsely populated. In the total length of 200 miles of flooded country it is doubtful whether the population is in excess of 5,000 people.

A flood of this magnitude is not likely to occur again for many years. In that time the reservoirs destroyed will undoubtedly be rebuilt, in addition to many more. Profiting by this experience gained in this flood, people will probably build their dams more substantially, especially in the case of the larger ones, the destruction of which involves the loss of thousands of dollars. It would be a comparatively easy matter to store a large enough per cent of the run-off of a flood of this magnitude so that the remainder could easily be carried by the natural channels, the destruction of property thus being avoided.

Over large drainage areas in this vicinity the per cent of run-off is apt to be small, the immediate run-off not being much in excess of 10 to 15 per cent of the rainfall, while not a very large rate is to be expected. However, on very small areas covering from 10 to 20 square miles very excessive rates may occur, exceeding even 500 second-feet per square mile for short periods. This is especially true when the slopes are steep and the drainage area is comparatively broad.

The people in the Milk River Valley and the surrounding country at the present time do not depend primarily on farming and irrigation for a living. In the whole valley and its tributaries there are probably not over 50,000 acres of land which have any kind of irrigation which is to be depended on in the least. It is essentially a stock country. During the continued drought preceding this flood the range had been eaten off and dried up until it was practically barren. Most of the water holes, even, which are used for the watering of range stock, were dry. In the valleys there was likewise no moisture and no water for irrigation, and therefore the small hay crops obtained in 1905 were about to be followed by practically none in 1906. It was becoming evident that stock must either be left to starve or transferred to different ranges. The continued rains beginning the middle of May had the effect of transforming this barren waste into a veritable garden spot. The range grass sprang up again as if by magic, and at the end of the storm it was better than it had been for years. The stockman had been saved. The flood waters in many places in the valley, irrigating the hay fields as they ran over them, did a great deal more good than harm.

Though much stock, especially lambs, perished during this long storm, the benefits resulting to this industry many times offset the loss on the range and the damage done in the valley. Under the existing conditions in Milk River Valley this flood, therefore, was more beneficial than otherwise.

FLOOD OF JUNE 27, 1906.

On June 27, in the vicinity of Malta, there occurred a very excessive local rainfall of short duration. It covered a territory extending probably 15 miles east and west of Malta. The tributaries in that vicinity rose to a much greater height than in the early June flood, and in many cases to unprecedented heights. From the records of the voluntary weather observer at Malta the total precipitation in this storm was 1.94 inches, of which 1.75 inches fell in an hour and fifteen minutes.

Within a short time every stream and coulee was carrying a phenomenal amount of water. Coulees which had not carried water for years became rushing torrents. West of Wagner the waterways provided in the railway track were entirely inadequate, and the country north of it was a large pond. At the culvert 1½ miles west of Wagner the track was washed through for a distance of 100 yards.

Wagner was practically all under water. At the depot the level of high water was only about 3 feet below the general track level. East of Wagner there was a lake extending from the railroad track to the foothills and continuing along the track several miles. The highways were submerged at points both east and west of the station to a depth of 3 to 4 feet.

Exeter Creek carried an enormous volume of flood water, overflowing its banks and following along the railroad track for several miles to the east. At the culvert at Exeter siding, a short distance west of the main trestle crossing, a section of track was badly damaged, while the track was washed through at a trestle a mile or two to the eastward, delaying traffic for several hours. From the appearance of a field which was overflowed the velocity was evidently considerable.

A flood section, taken about 1 mile north of the railway track, shows an area of 880 square feet and the estimate discharge of 4,400 second-feet.

Yadley Coulee, a small tributary on the north side of Milk River, carried a remarkable amount of water in this storm. It was higher by several feet than at any time in the last fourteen years, and probably it was never at a higher stage. Where it emerges from the hills onto the flat the water was on a level with the floor of Davidson's house. This creek has a fall of over 50 feet to the mile, from which it would appear that the velocity was very large. Some idea of this can be gained from the fact that a large cottonwood tree in the coulee was torn out by the roots and carried for 300 yards onto the flat. A flood cross section taken about 1 mile above Davidson's house showed a total area of 430 square feet and the estimated discharge of 2,700 square feet.

There is no well-defined channel for this coulee after it leaves the hills, and it is stated that the flood waters followed along Milk River for a distance of 7 miles before entering it.

The cloud-burst also covered part of the drainage area of Beaver Creek, being especially violent on some of the western tributaries of this creek.

This flood evidently extended as far west as Dodson Creek, though the latter did not rise to as great a height as in the earlier June flood. Alkali Creek did not get as high by 4 feet as in the earlier flood. This was due partly to the fact that the washing out of several reservoir dams in the first flood caused a greater rush of water. The damage done on both of these last-named creeks probably did not exceed $5,000.

MAXIMUM DISCHARGE AND HEIGHTS OF WATER DURING THE FLOODS.

The following table gives the approximate flood cross section and maximum discharge of many of the streams in the Milk River Valley. They were computed from levels taken about a month after the floods occurred. The high-water marks used were in most cases quite reliable. The discharges are in the main based on velocities computed by Kutter's formula, using values of "n" varying between 0.035 and 0.050. In many cases, on account of backwater and for other reasons, other values have been used for the velocities than those computed. A few of the estimates of discharge are practically assumptions.

Estimated flood discharge of streams in Milk River basin, June, 1906.

Stream.	Locality.	Location of section.	Height of high water above stream bed.	Slope of stream bed per 1,000 feet.	Flood cross section.	Estimated maximum discharge.
			Feet.	*Feet.*	*Sq. ft.*	*Sec.-ft.*
Alkali Creek	Malta	½ mile above crossing of proposed Malta south canal.	16.50	1.0	970	5,300
Antelope Creek	Tampico	4 miles above Milk River, SW. ¼ sec. 32, T. 29 N., R. 38 E.	11.50	2.3	2,300	2,300
Assinniboine Creek	Malta	1 mile above Milk River, 7 miles north of Malta.	6.80	5.0	650	2,150
Beaver Creek	Ashfield [a]	At U. S. G. S. gage, 3 miles south of Ashfield. [b]	13.60	.....	3,350	6,650
Clanton Coulee	Branch of Beaver Creek.	SE. ¼ sec. 25, T. 30 N., R. 21 E.	10.00	4.2	1,180	4,250
Cottonwood Creek	do	Center sec. 10, T. 29 N., R. 32 E.	7.50	6.0	500	2,850
Le Noir Coulee:						
North Branch	do	SW. ¼ sec. 7, T. 29 N., R. 32 E.	7.2	10.0	450	3,600
South Branch	do	SW. ¼ sec. 7, T. 29 N., R. 32 E.	5.7	9.5	1,100	5,000
Lonetree Coulee	do	NW. ¼ sec. 27, T. 30 N., R. 32 E.	2.7	10.0	35	150
Smith Coulee	do	NW. ¼ sec. 20, T. 29 N., R. 32 E.	3.3	3.0	150	450
Beaver Creek	Fort Assinniboine	Fort Assinniboine Military Reservation, 1 mile north of Fort Assinniboine.	8.0	7.5	1,300	3,900
Big Cottonwood Creek.	Malta	T. 33 N., R. 30 E., 18 miles north of Malta, 1 mile north of main road to Malta.	13.5	1.0	3,450	10,000
Brazil Creek	Glasgow	1 mile south Mahon-Hoyt reservoir, NE. ¼ sec. 24, T. 28 N., R. 38 E.	10.5	.....	1,300	2,000
Buggy Creek	do	2 miles above Milk River, NE. ¼ sec. 29, T. 30 N., R. 38 E.	6.0	2.5	2,000	3,400
Cherry Creek	do	2½ miles north of Great Northern Rwy., NW. ¼ sec. 24, T. 29 N., R. 39 E.	10.2	1.5	330	1,240
Clear Creek	Yantic	1½ miles south of Yantic, SW. ¼ sec. 33, T. 33 N., R. 18 E.	6.0	7.6	700	2,000
Dodson Creek	Dodson	1 mile north of Great Northern Rwy., SW. ¼ sec. 29, T. 31 N., R. 27 E.	6.3	0.8	440	1,200
Eureka Creek	Haro	¼ mile north of Great Northern Rwy., T. 31 N., R. 26 E.	8.6	1.0	200	750
Exeter Coulee	Exeter	1 mile west of Exeter siding, 300 yards north of Great Northern Rwy.	3.3	10.0	45	250
Exeter Creek	do	1 mile north of Great Northern Rwy., SE. ¼ sec. 4, T. 30 N., R. 29 E.	7.7	2.8	900	4,400
Fifteenmile Creek	Zurich	50 yards south of Great Northern Rwy., NW. ¼ sec. 32, T. 33 N., R. 21 E.	8.2	3.0	425	1,650
Fogey Creek	Harlem	1 mile north of Great Northern Rwy., NE. ¼ sec. 15, T. 32 N., R. 23 E.	5.8	3.8	130	375
Frenchman Creek	Saco	At Taylor's ranch, NE. ¼ sec. 34, T. 33 N., R. 34 E.	13.00	2.5	930	6,500
Larb Creek	do	SW. ¼ sec. 11, T. 30 N., R. 34 E.	17.0	1.5	[c] 5,300	7,000
First Creek	Branch of Larb Creek.	2 miles above Larb Creek, middle of sec. 28, T. 31 N., R. 34 E.	6.0	5.0	1,325	2,650
Second Creek	do	1½ miles above Larb Creek, SW. ¼ sec. 4, T. 30 N., R. 34 E.	6.8	2.0	470	1,700
Little Cottonwood Creek.	Malta	At ford on main road to Malta, north side of Milk River.	8.0	3.6	530	2,600
Milk River	Havre	Gaging station at Havre highway bridge. [d]	.....	.....	.....	4,000
Do	Malta	Gaging station at Malta highway bridge. [e]	20.0	.....	[c] 2,800	11,250
Milk, North Fork	Chinook	Gaging station 4½ miles north of Chinook. [f]	17.3	0.75	1,500	7,700
Milk, West Fork	do	Gaging station ½ mile east of Chinook. [g]	.....	.....	.....	3,000
Peoples Creek	Dodson	At Ereaux's house, 3 miles above mouth, Fort Belknap Indian Reservation.	9.30	0.90	720	3,000

[a] Beaver Creek Overflow, which comes out above, probably carried as much water as the main channel.
[b] Gage height, 12.60.
[c] Approximate.
[d] Gage height, 10.0.
[e] Gage height, 19.0.
[f] Gage height, 16.63.
[g] Gage height, 16.90.

Estimated flood discharge of streams in Milk River basin, June, 1906—Continued.

Stream.	Locality.	Location of section.	Height of high water above stream bed.	Slope of stream bed per 1,000 feet.	Flood cross section.	Estimated maximum discharge.
			Feet.	*Feet.*	*Sq. ft.*	*Sec.-ft.*
Peoples Creek	Overflow	Water from Peoples Creek above section.				1,500
Rock Creek	Hinsdale	Just below gaging station,[a] SW. ¼ sec. 3, T. 31 N., R. 36 E.	20.00	0.75	10,100	18,000
Savoy Creek	Savoy	¾ mile north of Great Northern Rwy., NW. ¼ sec. 31, T. 32 N., R. 25 E.	11.20	1.20	560	1,800
Sixmile Coulee	Chinook	½ mile above Milk River, SW. ¼ sec. 5, T. 32 N., R. 20 E.	3.0	4.7	33	120
Snake Creek	Harlem	At Taylor's ranch, ½ mile above mouth, NE. ¼ sec. 17, T. 32 N., R. 22 E.	7.6	1.8	185	850
Taylor Coulee	Malta	50 yards above road crossing, ½ mile southwest of Malta.	3.3	13.0	70	325
Thirtymile Creek (Parallel Creek)	Harlem	3 miles northwest of Harlem, NW. ¼ sec. 34, T. 33 N., R. 22 E.	7.5	1.9	1,950	8,800
Threemile Coulee	Chinook	Near bridge, ¼ mile south of Milk River, SW. ¼ sec. 1, T. 32 N., R. 19 E.	11.5	1.90	590	1,750
Do	Harlem	At Reservation reservoir, 7 miles east of Fort Belknap Agency.				2,000
Wayne Creek	do	Near Great Northern Rwy. bridge, 8 miles east of Harlem.	11.3	3.40	725	3,200
White Creek	Saco	At Mill's ranch, NE. ¼ sec. 3, T. 32 N., R. 33 E.	7.5	1.80	500	1,400
Whitebear Creek	Harlem	About 12 miles east of Fort Belknap Agency, and 1½ miles above Milk River.	6.5	0.70	500	1,200
Whitewater Creek	Saco	T. 33 N., R. 32 E.				3,500
Willow Creek	Glasgow	At Cutting-Patten-Truscott reservoir.				3,000
Yadley Coulee	Malta	1½ miles north of Malta, ¼ mile above Davidson's house.	5.2	10.0	430	2,750

[a] Gage height, 18.35.

In the following table are given various high-water marks on the Milk River and tributaries attained during 1906. In a few cases they are referred to the Great Northern track, but for most of them the elevation above sea level is given. For these elevations the Havre datum has been used; to reduce to the Malta datum subtract 0.82 foot.

Maximum heights of water in Milk River basin, June, 1906.

Stream.	Location.	Elevation of high-water marks.			Remarks.
		General.	Above sea level.	Above stream bed.	
			Feet.	*Feet.*	
Beaver Creek	NE. ¼ sec. 28, T. 29 N., R. 32 E.		2,241.2		
Do	Near middle of sec. 4, T. 29 N, R. 32 E.		2,231.6		
Do	At Ashfield post-office, SE. ¼ sec. 23, T. 31 N., R. 32 E.		2,206.0		
Do	Main street of Saco, Mont.		2,174.9		
Brazil Creek	At proposed crossing of "A" line canal, station 4009, Milk River project.		2,123.5		
Clear Creek	200 yards south of Great Northern Rwy. at Yantic.		2,444.0	9.00	
Eureka Creek	Great Northern Rwy. trestle, ½ mile east of Haro siding.	4 feet below top of rail.		7.50	

Maximum heights of water in Milk River basin, June, 1906—Continued.

Stream.	Location.	Elevation of high-water marks.			Remarks.
		General.	Above sea level.	Above stream bed.	
			Feet.	*Feet.*	
Exeter Creek	Great Northern trestle, ½ mile east of Exeter siding.	4.80 feet below top of rail.	.....	8.70	
Lake Bowdoin	Along Great Northern, 4 miles east of Bowdoin siding, sec. 5, T. 30 N., R. 32 E.	5.3 feet below top of rail.	2,210.2	.....	
Lake at Wagner[a]	At Great Northern depot at Wagner.	4 feet below top of rail.	2,265.1	.....	
Milk River	Gaging station at Havre highway bridge.	.....	2,471.0	.....	Gage datum=2,461.25.
Do	Gaging station at Malta highway bridge.	.....	2,261.0	20.00	Gage zero=2,242.2 Havre datum.
Do	Near mouth of Buggy Creek, NW. ¼ sec. 33, T. 30 N., R. 38 E.	.....	2,106.6	.....	
Do	At court-house at Glasgow	.....	2,086.1	.....	
Milk River, North Fork.	Great Northern bridge, 7 miles east of Chinook.	9 feet below top of rail.	2,386.6	.....	
Savoy Creek	Great Northern trestle, 1½ miles east of Savoy.	2.9 feet below top of rail.	.....	8.20	
Thirtymile Creek	At Barton's store, Main street of Harlem.	.....	2,367.7	.....	Level of street =2,365.3.
Wayne Creek	At Great Northern bridge, 8 miles east of Harlem.	1.7 feet below bottom of bridge girder.	.....	11.30	

[a] Lake formed here by flood waters from coulees in this vicinity.

MUSSELSHELL RIVER DRAINAGE BASIN.

MUSSELSHELL RIVER AT SHAWMUT, MONT.

This station was established August 12, 1902, for the purpose of determining the amount of water available for irrigation and storage. It is located at Crawford's ranch, one-eighth mile from the post-office at Shawmut, Mont., and 25 miles east of Harlowtown. The gage was read during 1906 by G. T. Garner. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 87, where are given also references to publications that contain data for previous years.

Discharge measurements of Musselshell River at Shawmut, in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 23	J. H. Sloan	55	69	1.01	66
May 15	do	55	70	1.20	83
June 20	do	72	159	2.25	376
August 7	do	63	61	1.00	60
September 22[a]	do	.....	1.6	.40	1.8
1906.					
March 30	H. M. Morse	70	131	2.28	302
May 16	G. Edson	74	129	1.95	301
July 9[a]	Morse and Richards	38	24	.65	19.5
August 27[a]	R. Richards	38	22	.69	27.1
November 26[a b]	do	17	27	2.65	76

[a] Wading section. [b] River frozen.

Daily gage height, in feet, of Musselshell River at Shawmut, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.0	1.5	1.2	2.2	.....	2.2	1.1	0.5	0.7	0.75	1.75	.....
2	1.0	1.8	1.2	2.2	.....	2.1	1.1	.5	.65	.75	1.7	.....
3	1.0	1.7	1.3	2.1	.....	2.0	1.05	.4	.65	.7	1.65	2.4
4	1.0	1.5	1.4	2.1	.....	1.9	1.0	.4	.6	.7	1.7	.....
5	1.0	1.5	1.4	2.0	.....	2.1	1.0	.4	.65	.75	1.75	2.4
6	1.0	1.5	1.4	1.9	.....	2.1	1.0	.4	.6	.75	1.8	.....
7	1.0	1.4	1.4	1.8	.....	2.2	1.0	.4	.6	.75	1.8	.....
8	1.0	1.4	1.4	1.9	.....	2.2	.....	.4	.6	.8	1.8	.....
9	1.0	1.4	1.3	1.9	.....	2.3	.65	.4	.6	.8	1.85	.....
10	1.0	1.4	1.3	2.0	.....	2.0	.9	.4	.6	.8	2.0	.....
11	1.0	1.4	1.2	2.05	.....	2.2	1.0	.4	.6	.85	2.6	2.4
12	1.0	1.4	1.2	1.8	.....	2.0	.7	.4	.6	.85	2.8	.....
13	1.0	1.4	1.1	1.8	.....	1.9	.6	.4	.6	.8	2.8	.....
14	1.0	1.4	1.1	1.7	1.95	2.0	.5	.4	.75	.85	2.85	2.4
15	1.0	1.4	1.1	1.65	1.95	2.0	1.3	.4	.8	.85	2.8	.....
16	1.0	1.4	1.1	1.7	1.95	2.0	1.4	.4	.8	.85	2.9	.....
17	1.0	1.4	1.1	1.9	1.85	2.15	1.0	.4	.8	.9	3.0	.....
18	1.0	1.4	1.1	2.0	1.8	2.2	1.0	.4	.75	.9	3.0	.....
19	1.0	1.35	1.15	1.9	1.7	2.1	.9	.4	.75	.9	3.0	2.4
20	1.0	1.35	1.15	1.8	1.6	1.95	.8	.4	.7	.9	3.0	.....
21	1.0	1.3	1.2	1.8	1.6	1.8	.7	.4	.7	.95	3.0	2.5
22	1.0	1.2	1.3	1.9	1.75	1.6	.7	.4	.75	1.0	3.0	.....
23	1.0	1.2	1.3	1.9	1.75	1.55	.7	.5	.8	1.05	3.0	.....
24	1.0	1.2	1.4	1.8	1.8	1.6	.6	.5	.8	1.1	3.0	.....
25	1.0	1.0	1.4	1.9	2.0	1.7	.5	.5	.8	1.15	2.6	.....
26	1.5	1.0	1.4	1.9	2.35	1.7	.5	.....	.85	1.2	2.6	.....
27	1.5	1.0	2.0	1.8	2.45	1.6	.5	.7	.85	1.3	2.6	.....
28	1.1	1.1	.....	1.75	2.4	1.5	.5	.7	.8	1.4	2.6	2.6
29	1.2	.....	.....	1.75	2.15	1.4	.5	.7	.8	1.5	2.6	.....
30	1.2	.....	.....	1.7	2.5	1.3	.5	.7	.8	1.6	2.6	.....
31	1.4	.....	2.1	.....	2.4	.....	.5	.7	.....	1.7	.....	.....

NOTE.—Ice conditions January 1 to February 12 and March 10–20; thickness of ice, 0.5 foot, approximately. River frozen entirely across November 17 to December 31; gage heights were to water surface; thickness of ice, 0.4 foot.

Rating table for Musselshell River at Shawmut, Mont., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	2	1.40	122	2.40	410	3.40	880
.50	7	1.50	143	2.50	450	3.50	935
.60	15	1.60	166	2.60	490	3.60	990
.70	24	1.70	190	2.70	535	3.70	1,045
.80	34	1.80	216	2.80	580	3.80	1,100
.90	46	1.90	245	2.90	625	3.90	1,160
1.00	58	2.00	275	3.00	675	4.00	1,220
1.10	71	2.10	305	3.10	725	4.20	1,340
1.20	86	2.20	340	3.20	775	4.40	1,465
1.30	103	2.30	375	3.30	825	4.60	1,595

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1905-6 and is well defined between gage heights 0.4 foot and 2.5 feet.

Monthly discharge of Musselshell River at Shawmut, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March	245	71	113	6,950
April	103	52	81.4	4,840
May	154	46	91.5	5,630
June	1,580	166	603	35,900
July	1,330	11	139	8,550
August	410	11	52.1	3,200
September	11	2	5.7	340
October	71	4	26.7	1,640
November (1-26)	71	46	59.8	3,080
The period	.....	.....	.....	70,100

Monthly discharge of Musselshell River at Shawmut, Mont., for 1905–6—Continued.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1906.				
February (13–24)	122	58	97.6	3,100
March (1–10; 21–27; 31)	305	86	129	4,610
April	340	178	242	14,400
May (14–31)	450	166	281	10,000
June	375	103	254	15,100
July	122	7	38.8	2,390
August	24	2	6.7	418
September	40	15	25.5	1,520
The period				51,500

NOTE.—Values are rated as follows: March to May and July, 1905, excellent; June, August, October, and November, 1905, July and September, 1906, good; September, 1905, April to June and August, 1906, fair; February and March, 1906, approximate.

MUSSELSHELL RIVER AT LAVINA, MONT.

This station was established June 7, and was discontinued July 27, 1906. It is located at the highway bridge in the southern part of the town of Lavina.

The channel is straight for 180 feet above the bridge, but curves below, commencing at the bridge. The right bank is low and subject to overflow; the left is high and not subject to overflow. The bed of the stream is of mud and may shift somewhat.

Discharge measurements were made from the upstream side of the bridge.

The chain gage is fastened to the upstream side of the bridge. The observer was W. J. Phillips. The bench mark is a cross drilled in the concrete of the north side of the east abutment; elevation, 14.60 feet above the gage datum.

Discharge measurements of Musselshell River at Lavina, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	Morse and Sloan	85	281	4.08	888
June 6	Morse and Whinery	87	261	3.73	725
June 7	A. H. Whinery	86	221	3.26	519

Daily gage height, in feet, of Musselshell River at Lavina, Mont., for 1906.

Day.	June.	July.	Day.	June.	July.
1		2.20	16	2.70	2.22
2		2.12	17	2.80	2.18
3		2.08	18	2.78	2.08
4		2.00	19	2.78	1.92
5		1.90	20	2.65	1.82
6		1.90	21	2.52	1.75
7	3.10	1.88	22	2.48	1.62
8	2.90	1.85	23	2.52	1.58
9	2.82	1.80	24	2.32	1.48
10	2.72	1.78	25	2.42	1.40
11	2.68	1.72	26	2.52	1.32
12	2.80	1.70	27	2.62	1.22
13	2.72	2.10	28	2.52	
14	2.62	2.22	29	2.42	
15	2.62	1.95	30	2.28	

LITTLE MUDDY RIVER DRAINAGE BASIN.

LITTLE MUDDY RIVER NEAR WILLISTON, N. DAK.

This station was established February 4, 1904. It is located in sec. 19, T. 155 N., R 100 W., the gage in the southwest quarter and the cable in the northeast quarter, about 7 miles by road from Williston, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 89, where are given also references to publications that contain data for previous years. The length of the chain is now 22.44 feet. The data collected at this station are valuable for irrigation purposes.

Discharge measurements of Little Muddy River near Williston, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 22	E. F. Chandler	8	8.8	2.66	16.4
April 22	do	8	7.7	2.66	[a] 18.2
May 28	do	30	17.8	2.92	30.2
September 4	do	8	7.6	2.45	8.8

[a] Float measurement.

Daily gage height, in feet, of Little Muddy River near Williston, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.5			3.75	2.85	3.1	2.9	2.5	2.5	2.5	2.5
2				4.0	2.9	3.1	2.8	2.5	2.4	2.5	2.5
3				4.25	2.9	3.0	2.8	2.6	2.5	2.5	2.5
4		2.5		4.2	2.9	2.9	2.7	2.4	2.4	2.5	2.5
5			2.5	3.8	2.85	3.0	2.8	2.5	2.4	2.5	2.5
6				3.45	2.75	3.15	2.7	2.4	2.4	2.5	2.5
7				3.15	2.7	5.7	2.8	2.5	2.4	2.5	2.5
8	2.5			3.05	2.7	5.6	2.7	2.4	2.4	2.5	2.5
9				3.0	2.7	5.5	2.8	2.5	2.4	2.5	2.5
10				2.9	2.7	5.05	2.7	2.4	2.4	2.5	2.5
11		2.5		2.9	2.7	4.45	2.8	2.5	2.4	2.5	2.5
12				2.95	2.7	4.0	2.6	2.4	2.4	2.5	2.5
13				3.0	2.7	3.85	2.7	2.5	2.5	2.5	2.5
14				3.0	2.7	3.65	2.6	2.4	2.5	2.5	2.5
15	2.5		2.4	2.9	2.7	3.3	2.7	2.5	2.5	2.5	2.6
16				2.9	2.7	3.15	2.6	2.4	2.5	2.5	2.6
17				2.9	2.7	3.1	2.7	2.5	2.5	2.5	2.6
18				2.9	2.7	3.1	2.6	2.4	2.5	2.5	2.6
19		2.5		2.9	2.7	3.05	2.7	2.5	2.5	2.5	2.6
20			2.4	2.8	2.7	3.0	2.5	2.4	2.5	2.5	2.6
21				2.7	2.7	3.0	2.6	2.5	2.5	2.5	2.6
22	2.5			2.7	2.7	2.9	2.5	2.4	2.5	2.5	2.6
23				2.7	2.7	2.9	2.6	2.5	2.5	2.5	2.6
24				2.7	2.7	2.9	2.5	2.4	2.5	2.5	.....
25				2.7	2.8	2.9	2.6	2.5	2.5	2.5	.....
26				2.7	2.8	2.9	2.5	2.4	2.5	2.5	.....
27			2.8	2.7	2.85	2.9	2.6	2.5	2.5	2.5	.....
28		2.5	2.9	2.7	2.9	2.9	2.5	2.4	2.5	2.5	.....
29			2.9	2.7	2.95	2.9	2.5	2.5	2.5	2.5	.....
30			3.0	2.7	3.0	2.9	2.4	2.4	2.5	2.5	.....
31	2.5		3.1	.....	3.1	.....	2.5	2.5	.....	2.5	.....

NOTE.—Ice conditions January 1 to March 26; also November 24 to December 31. Ice increased in thickness from 1.3 feet January 1 to 1.8 feet February 1 and decreased to 0.3 foot from February 28 to March 20. Thickness of ice during December was 0.3 to 1.2 feet.

Rating table for Little Muddy River near Williston, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	6	3.30	104	4.20	391	5.10	753
2.50	9	3.40	131	4.30	428	5.20	796
2.60	14	3.50	160	4.40	466	5.30	839
2.70	20	3.60	190	4.50	505	5.40	882
2.80	27	3.70	221	4.60	545	5.50	925
2.90	35	3.80	253	4.70	585	5.60	968
3.00	45	3.90	286	4.80	626	5.70	1,011
3.10	60	4.00	320	4.90	668		
3.20	80	4.10	355	5.00	710		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is fairly well defined.

Monthly discharge of Little Muddy River near Williston, N. Dak., for 1906.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March 27–31	60	27	40.4	401	0.050	0.01
April	409	20	84.1	5,000	.105	.12
May	60	20	26.3	1,620	.033	.04
June	1,010	35	199	11,800	.249	.28
July	35	6	17.4	1,070	.022	.03
August	14	6	7.8	480	.0098	.01
September	9	6	8.0	476	.010	.01
October	9	9	9.0	553	.011	.01
November 1–23	14	9	11.0	502	.014	.01
The period				21,900		

NOTE.—Values are fair.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements of Little Muddy River were made in 1905:

Miscellaneous discharge measurements of Little Muddy River, in 1905.

Date.	Locality.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
March 1	Williston		40
March 2	do		70
March 27	do		22
June 7	8 miles above Williston	1.90	48

YELLOWSTONE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The upper Yellowstone rises in the Shoshone Mountains, in northwestern Wyoming, near the southeast corner of the Yellowstone National Park, flows northwestward for 40 or 50 miles, and then enters Yellowstone Lake, which may be considered the great source of the main river. This lake is about 15 miles long by 20 miles wide,

lies at an elevation of 7,778 feet above the sea, and is hemmed in on every side by lofty mountains from whose snow-covered slopes its chief supply of water must come, since it receives no important streams. Issuing from the lake at the north end, the stream flows northwestward for 10 or 15 miles, plunges over the Great Falls of the Yellowstone, and for the next 20 miles runs through the Grand Canyon, which is impassable throughout. About 80 miles from the lake it emerges from the Snow Mountains, and thence runs eastward and northeastward until it joins the Missouri at Fort Buford, N. Dak. The length of the Yellowstone is about 500 miles; the area of the basin is approximately 67,500 square miles.

Of the tributaries of the Yellowstone the most important is the Bighorn, which has its source in the many small streams draining the intersecting slopes of the Wind River and Shoshone Mountains in northwestern Wyoming, about 30 miles southeast of Yellowstone National Park. For approximately 75 miles it flows southeastward, its volume being constantly augmented by small streams from the south heading well back in the Wind River Range, but receiving no important additions from the north. In this portion of its course it is called Wind River, but at its southernmost point it is joined by Little Wind River, turns abruptly to the northeast, and is below known as the Bighorn. Continuing in a winding course for about 15 miles, it then turns directly north, passes through a deep canyon in the Owl Creek Range, crosses Bighorn County, Wyo., into Montana, and joins the Yellowstone about 30 miles north of Fort Custer.

The principal tributaries of the Bighorn are Wind, Little Wind, and Popo Agie rivers, which combined carry the great perennial discharge and become the headwaters; Muskrat, Poison, and Badwater creeks, which enter below the mouth of the Little Wind and drain the sand hills to the east; Muddy Creek, which follows the foothills of the Owl Creek Range; Gooseberry Creek, Gray Bull Creek, No Wood Creek, and Shoshone and Little Bighorn rivers.

The Shoshone rises on the eastern slope of the Shoshone Mountains, east of the Yellowstone National Park. It has two chief upper branches, North and South forks, which unite just before entering Shoshone Canyon, at a point about 12 miles southwest of Cody. From the junction of the forks the course of the main river is a little east of northeast to the Bighorn.

The data collected in the basin are valuable for irrigation purposes.

YELLOWSTONE RIVER AT JUNCTION, MONT.

This station was established May 10, 1906, to take the place of the one at Billings. It is located at the county highway bridge at Junction, and 1 mile north of Custer, Mont. It is about 3 miles above the mouth of Bighorn River.

The channel is straight for 1,500 feet above and 2,400 feet below the gage. The right bank is rather low and may overflow at very high stages; the left is high and will not overflow. The bed of the stream is partly bowlders and gravel, but for the most part consists of clay and sand. There is but one channel at all stages, broken by the two bridge piers. The current is moderately swift.

Discharge measurements are made from the downstream side of the bridge, which consists of three spans. The initial point for soundings is directly over the center of the northeast pile of the north abutment.

A standard chain gage, which is read daily by J. E. Thurmond, is attached to the floor of the bridge on the upstream side in the north span; length of chain, 29.65 feet. The bench mark is a rivet in the northwest pile abutment on the north side of the river, painted "U.S.G.S."; elevation, 23.33 feet above the gage zero.

Discharge measurements of Yellowstone River at Junction, Mont., in 1906.

Date.	Hydrographer.	Area of section.	Gage height.	Discharge.
		Sq. ft.	*Feet.*	*Sec.-ft.*
May 10	H. M. Morse	2,300	3.88	5,190
July 2	R. H. Whinery	3,420	5.51	14,800
August 7	R. Richards	2,900	4.62	9,080
September 5	Follansbee and Richards	2,410	3.97	5,330
September 15	Grover and Follansbee	2,290	3.87	4,390
October 11	Follansbee and Richards	2,120	3.50	3,270
November 6	R. Richards	2,070	3.42	2,930

Daily gage height, in feet, of Yellowstone River at Junction, Mont., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1		5.75	5.4	4.4	4.0	3.6	3.45	3.5
2		5.55	5.6	4.3	4.0	3.55	3.45	3.4
3		5.5	6.0	4.3	4.0	3.5	3.45	3.35
4		5.45	5.8	4.4	3.95	3.5	3.4	3.45
5		5.4	5.9	4.4	3.95	3.5	3.4	3.45
6		6.3	6.0	4.35	3.95	3.5	3.4	3.4
7		6.5	6.1	4.4	3.85	3.5	3.4	3.3
8		5.9	6.15	4.5	3.85	3.5	3.4	3.4
9		5.7	5.95	4.5	3.8	3.45	3.4	3.3
10	3.9	5.6	5.9	4.4	3.75	3.45	3.4	3.2
11	4.3	5.7	5.9	4.3	3.75	3.45	3.45	3.2
12	5.0	5.9	5.85	4.2	3.8	3.4	3.4	3.45
13	5.4	6.95	5.85	4.1	3.8	3.4	3.4	3.35
14	6.45	8.8	5.9	4.05	3.8	3.4	3.4	3.3
15	6.45	8.2	5.85	4.0	3.85	3.4	3.4	3.2
16	6.1	7.6	5.8	4.1	3.85	3.4	3.4	3.1
17	5.7	7.4	5.7	4.1	3.8	3.45	3.4	3.2
18	5.25	7.4	5.55	4.1	3.8	3.5	3.5	3.3
19	4.95	6.7	5.6	4.05	3.7	3.5	3.35	3.35
20	4.7	6.2	5.4	4.0	3.6	3.5	3.15	3.35
21	4.9	5.95	5.2	4.0	3.75	3.5	3.15	3.4
22	5.45	5.7	5.1	4.2	3.75	3.5	3.15	3.4
23	5.85	5.55	5.05	4.3	3.75	3.5	3.2	3.45
24	5.75	5.7	5.0	4.5	3.7	3.45	3.2	3.5
25	6.65	5.55	4.9	5.0	3.7	3.4	3.2	3.5
26	6.5	5.4	4.85	4.6	3.7	3.45	3.2	3.45
27	6.5	5.5	4.7	4.5	3.7	3.45	3.45	3.5
28	6.4	5.6	4.6	4.35	3.65	3.45	3.4	3.45
29	6.3	5.5	4.55	4.2	3.65	2.45	3.4	3.5
30	6.3	5.5	4.5	4.15	3.65	3.45	3.4	3.45
31	6.15	.....	4.5	4.1	.....	3.45	.....	3.4

NOTE.—Practically open-channel conditions during December.

Rating table for Yellowstone River at Junction, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	1,950	4.40	7,670	5.70	16,150	7.00	26,900
3.20	2,240	4.50	8,250	5.80	16,890	7.20	28,740
3.30	2,550	4.60	8,830	5.90	17,650	7.40	30,640
3.40	2,900	4.70	9,430	6.00	18,410	7.60	32,580
3.50	3,250	4.80	10,030	6.10	19,190	7.80	34,560
3.60	3,640	4.90	10,650	6.20	19,990	8.00	36,600
3.70	4,070	5.00	11,290	6.30	20,810	8.20	38,680
3.80	4,530	5.10	11,950	6.40	21,650	8.40	40,820
3.90	5,010	5.20	12,630	6.50	22,500	8.60	43,000
4.00	5,510	5.30	13,310	6.60	23,360	8.80	45,200
4.10	6,030	5.40	14,010	6.70	24,220		
4.20	6,570	5.50	14,710	6.80	25,100		
4.30	7,110	5.60	15,430	6.90	26,000		

NOTE.—The above table is applicable only for open-channels conditions. It is based on seven discharge measurements made during 1906 and is well defined between gage heights 3.4 feet and 6.0 feet.

Monthly discharge of Yellowstone River at Junction, Mont., for 1906.

[Drainage area, 13,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
May (10-31)	23,800	5,010	16,400	716,000	1.21	0.99
June	45,200	14,000	20,100	1,200,000	1.49	1.66
July	19,600	8,250	14,600	898,000	1.08	1.24
August	11,300	5,510	7,060	434,000	.523	.60
September	5,510	3,640	4,520	269,000	.335	.37
October	3,640	2,900	3,140	193,000	.233	.27
November	3,250	2,100	2,770	165,000	.205	.23
December	3,250	1,950	2,810	173,000	.208	.24
The period				4,050,000		

NOTE.—Values for 1906 are excellent.

YELLOWSTONE RIVER AT GLENDIVE, MONT.

This station, established in 1893 by the United States War Department, was transferred to the Department of Agriculture, which has kept daily records of river height. When a study of the lower Yellowstone Valley was begun in 1903 this station was taken up by the United States Geological Survey, whose records begin August 1, 1903. The station is located at the steel highway bridge leading northward from Glendive, about one-fourth mile from the post-office. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 97, where are given also references to publications that contain data for previous years.

Discharge measurements of Yellowstone River at Glendive, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	H. M. Morse	737	3,750	2.88	10,000
July 9	R. H. Whinery	752	5,920	6.08	30,600
August 4	R. Richards	742	4,340	3.72	15,700
September 6	Follansbee and Richards	735	3,690	2.84	10,900
September 13	Grover and Follansbee	729	3,220	2.40	8,260
October 13	R. Richards	715	2,540	1.39	5,610
November 5	do	711	2,480	1.36	4,990

Daily gage height, in feet, of Yellowstone River at Glendive, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.6	2.8	4.8	4.6	3.35	7.55	5.45	3.9	3.7	1.65	1.35
2	1.7	2.8	4.6	.....	3.1	7.1	5.4	3.75	3.5	1.6	1.35
3	1.6	2.9	4.4	4.15	2.9	6.55	5.1	3.65	3.25	1.45	1.35
4	1.5	4.2	4.2	4.0	2.7	6.05	5.15	3.95	3.05	1.45	1.35
5	1.4	4.2	3.9	3.7	2.4	5.75	5.8	4.2	2.95	1.45	1.35
6	1.7	4.2	3.9	3.4	2.5	5.8	5.9	4.15	2.8	1.4	1.3
7	1.8	4.0	3.9	3.1	2.75	8.1	5.95	4.0	2.7	1.35	1.3
8	1.8	3.6	4.1	.....	3.0	10.1	6.0	4.0	2.6	1.35	1.3
9	.....	3.1	4.5	2.6	3.0	9.25	6.05	4.0	2.5	1.35	1.3
10	.....	2.9	4.3	2.5	2.9	7.85	6.0	4.35	2.4	1.35	1.3
11	.....	2.9	4.3	2.5	2.9	6.55	5.95	4.0	2.25	1.35	1.4
12	2.2	3.1	4.1	2.55	2.9	5.95	5.95	3.6	2.3	1.35	1.3
13	2.2	3.3	4.1	2.55	3.3	5.95	5.85	3.45	2.4	1.35	1.3
14	2.2	3.1	3.2	2.55	4.4	7.9	6.0	3.25	2.6	1.35	1.3
15	2.3	3.2	2.7	2.45	5.4	8.5	5.85	3.05	2.5	1.25	1.3
16	2.2	3.2	2.2	2.35	6.75	9.3	6.1	2.9	2.4	1.25	1.3
17	2.2	3.3	2.2	2.25	6.9	9.0	6.35	3.0	2.35	1.25	1.3
18	2.1	3.4	2.0	2.1	6.55	8.55	6.2	2.85	2.5	1.25	1.3
19	2.1	3.4	2.2	1.95	6.0	8.5	5.9	2.7	2.5	1.25	.....
20	2.1	3.6	1.95	1.95	5.45	8.1	5.7	2.5	2.4	1.25	.....
21	2.1	3.7	2.2	2.1	5.05	7.3	5.7	2.55	2.3	1.25	.....
22	2.2	4.4	2.45	2.2	4.75	6.85	5.15	2.55	2.2	1.25	.....
23	2.3	4.5	3.05	2.25	5.15	6.25	5.2	3.3	2.2	1.25	.....
24	2.1	4.3	3.45	2.25	5.9	5.85	5.0	4.15	2.15	1.3	.....
25	2.0	4.3	3.75	.....	7.1	5.8	4.9	4.9	2.05	1.3	.....
26	2.0	4.2	3.95	2.9	7.8	5.55	4.8	5.85	1.95	1.25	.....
27	2.2	4.8	4.0	3.5	8.35	5.4	4.7	5.8	1.9	1.25	.....
28	2.3	4.8	6.7	3.6	8.25	5.2	4.7	5.25	1.8	1.25	.....
29	2.5	.....	8.5	3.6	8.15	5.35	4.5	4.8	1.75	1.3	.....
30	2.5	.....	6.75	3.6	7.8	5.6	4.3	4.35	1.7	1.35	.....
31	2.7	.....	5.55	.....	7.6	.....	4.1	4.0	.....	1.35	.....

NOTE.- Ice conditions Jan. 1-Mar. 29; gage readings were to top of ice after Jan. 25. Ice conditions Nov. 19-Dec. 31.

Rating table for Yellowstone River at Glendive, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	5,300	2.60	9,180	4.00	15,400	5.80	27,500
1.30	5,530	2.70	9,540	4.10	15,950	6.00	29,200
1.40	5,760	2.80	9,920	4.20	16,500	6.20	31,000
1.50	5,990	2.90	10,300	4.30	17,050	6.40	32,900
1.60	6,240	3.00	10,700	4.40	17,650	6.60	34,900
1.70	6,490	3.10	11,120	4.50	18,250	6.80	37,000
1.80	6,740	3.20	11,540	4.60	18,850	7.00	39,200
1.90	7,020	3.30	11,980	4.70	19,500	7.20	41,400
2.00	7,300	3.40	12,440	4.80	20,150	7.40	43,700
2.10	7,580	3.50	12,900	4.90	20,800	7.60	46,100
2.20	7,860	3.60	13,380	5.00	21,500	7.80	48,500
2.30	8,160	3.70	13,860	5.20	22,900	8.00	50,900
2.40	8,480	3.80	14,360	5.40	24,300	9.00	64,000
2.50	8,820	3.90	14,880	5.60	25,900	10.00	78,000

NOTE.--The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904, and is well defined between gage heights 1.3 feet and 8 feet. Below 2.4 feet the table is the same as for 1905.

Monthly discharge of Yellowstone River at Glendive, Mont., for 1906.

[Drainage area, 66,100 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	18,800	7,160	10,700	637,000	0.162	0.18
May	55,400	8,480	25,100	1,540,000	.380	.44
June	79,400	22,900	41,500	2,470,000	.628	.70
July	32,400	16,000	26,300	1,620,000	.398	.46
August	27,900	8,820	15,400	947,000	.233	.27
September	13,900	6,490	8,820	525,000	.133	.15
October	6,360	5,120	5,610	345,000	.085	.10
November			5,570	331,000	.084	.09
The period				8,420,000		

NOTE.—No estimates for ice period. Values are rated as follows: April to June, excellent; July to November, good.

CLARK FORK AT FROMBERG, MONT.

The gaging station was established June 3, 1905. It is located on the highway bridge one-half mile east of the Northern Pacific Railway station at Fromberg, Mont. One small stream, Rock Creek, flows into the river between the gaging station and its mouth. The gage was read during 1906 by Mrs. E. V. Moran. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 100.

Discharge measurements of Clark Fork at Fromberg, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 12	H. M. Morse	190	637	5.57	2,530
June 2	Morse and Whinery	168	534	5.17	1,930
June 15	R. H. Whinery	209	1,010	7.32	5,950
June 26	do	170	493	5.00	1,750
July 28	Richards and Whinery	165	479	4.62	1,450
September 4	R. Richards	130	348	3.90	696

Daily gage height, in feet, of Clark Fork at Fromberg, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.4	3.45	3.35	3.5	4.0	5.4	5.4	4.2	4.0	3.5	3.35	3.5
2	3.4	3.4	3.35	3.6	3.7	5.1	5.75	4.1	4.0	3.45	3.35	3.5
3	3.4	3.4	3.35	3.5	4.1	5.2	5.95	4.2	3.9	3.45	3.3	3.5
4	3.4	3.5	3.35	3.4	4.2	5.2	6.0	4.2	3.9	3.5	3.3	3.5
5	3.4	3.5	3.2	3.5	4.35	4.8	6.1	4.25	3.8	3.45	3.3	3.5
6	3.4	3.5	3.35	3.45	4.3	5.8	6.25	4.45	3.8	3.45	3.35	3.5
7	3.4	3.6	3.35	3.6	4.1	5.55	6.1	4.3	3.75	3.55	3.35	3.5
8	3.4	3.6	3.35	3.6	3.9	5.45	6.1	4.2	3.6	3.45	3.35	3.5
9	3.4	4.3	3.3	3.6	3.9	5.5	6.1	4.2	3.5	3.35	3.4	3.5
10	3.4	3.6	3.3	3.7	4.45	5.6	5.95	4.25	3.5	3.35	3.4	3.5
11	3.4	3.6	3.3	3.6	5.05	6.0	6.05	4.2	3.5	3.35	3.45	3.7
12	3.4	3.6	3.3	3.6	5.45	6.5	6.15	4.1	3.4	3.35	3.45	3.6
13	3.4	3.6	.....	3.5	5.65	7.9	6.25	4.0	3.5	3.4	3.45	3.6
14	3.4	3.6	.....	3.6	6.17	7.95	6.05	4.1	3.6	3.4	3.4	3.6
15	3.5	3.6	.....	3.6	5.85	7.45	5.85	4.0	3.7	3.35	3.4	3.6

Daily gage height, in feet, of Clark Fork at Fromberg, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.5	3.55	.....	3.7	5.57	6.95	5.45	4.0	3.7	3.35	3.4	3.6
17	3.5	3.48	3.3	3.6	5.4	6.7	5.25	3.9	3.7	3.3	3.4	3.6
18	3.5	3.45	3.3	3.7	4.97	6.2	5.35	3.9	3.6	3.3	3.35	3.6
19	3.5	3.4	.....	3.7	4.8	5.8	5.45	3.9	3.6	3.3	3.35	3.6
20	3.5	3.4	.....	3.75	4.75	5.35	5.35	4.02	3.55	3.25	3.35	3.6
21	3.5	3.35	.....	3.82	5.27	5.2	5.25	5.25	3.5	3.25	3.35	3.6
22	3.5	3.35	.....	4.1	5.5	5.3	4.95	4.5	3.5	3.25	3.45	3.6
23	3.5	3.35	.....	4.55	5.7	5.2	4.9	5.8	3.5	3.25	3.45	3.55
24	3.45	3.35	4.05	4.4	6.05	5.1	5.0	6.0	3.5	3.3	3.45	3.55
25	3.45	3.35	4.0	4.22	5.8	5.0	4.85	5.8	3.5	3.3	3.45	3.55
26	3.45	3.35	3.2	4.1	6.1	5.2	4.85	4.8	3.7	3.35	3.4	3.55
27	3.45	3.35	3.8	4.0	5.8	5.2	4.65	4.25	3.7	3.35	3.4	3.5
28	3.45	3.34	3.6	4.0	5.8	5.3	4.6	4.25	3.6	3.35	3.35	3.5
29	3.45	.....	3.6	4.1	5.6	5.3	4.3	4.15	3.6	3.4	3.5	3.5
30	3.45	.....	3.55	4.0	5.7	5.3	4.4	4.2	3.5	3.35	3.5	3.5
31	3.45	.....	3.6	.....	5.6	.....	4.25	4.0	.....	3.35	.....	3.5

NOTE.—Ice conditions January 1 to 31; February to March 28; readings to top of ice except occasionally when water overflowed ice. Ice conditions December 13-22; readings to top of ice.

Rating table for Clark Fork at Fromberg, Mont., for 1905-6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	250	4.20	908	5.20	1,973	6.20	3,475
3.30	296	4.30	999	5.30	2,102	6.40	3,850
3.40	346	4.40	1,094	5.40	2,236	6.60	4,260
3.50	400	4.50	1,192	5.50	2,375	6.80	4,690
3.60	458	4.60	1,293	5.60	2,519	7.00	5,140
3.70	520	4.70	1,397	5.70	2,667	7.20	5,600
3.80	587	4.80	1,504	5.80	2,819	7.40	6,080
3.90	660	4.90	1,615	5.90	2,975	7.60	6,570
4.00	738	5.00	1,730	6.00	3,135	7.80	7,070
4.10	821	5.10	1,849				

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1905 and 1906, and is well defined between gage heights 3.5 feet and 7.5 feet.

Monthly discharge of Clark Fork at Fromberg, Mont., for 1906.

[Drainage area, 2,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,240	346	587	34,900	0.235	0.26
May	3,420	520	1,950	120,000	.780	.90
June	7,440	1,500	2,930	174,000	1.17	1.30
July	3,570	954	2,390	147,000	.956	1.10
August	3,140	660	1,120	68,900	.448	.52
September	738	346	488	29,000	.195	.22
October	400	273	330	20,300	.132	.15
November	400	296	343	20,400	.137	.15
December	.....	.....	[a] 400	24,600	.160	.18
The period	.....	.....	.....	639,000	.....	.....

[a] Flow estimated during ice period in December.

NOTE.—Values are rated as follows: April to November, excellent; December, fair.

PRYOR CREEK AT HUNTLEY, MONT.

The station was originally established August 6, 1904, and measurements were made at different sections. Pryor Creek was turned into a new channel June 15–16, 1906, by the Reclamation Service and a station was established on the steel highway bridge crossing this channel one-half mile from the railroad station at Huntley.

The channel is straight, with uniform slope for 800 feet above and below station. The banks are steep and uniformly graded. They are clean and will not overflow. The current is moderate. The bed is composed of clay and gravel and may change somewhat.

Discharge measurements are made from the highway bridge. The initial point for soundings is the center of the right abutment, lower side.

The standard chain gage, which is read twice daily by employees of the Reclamation Service, is attached to the floor of the bridge; length of chain, 16.23 feet. The bench mark is a U. S. G. S. standard bench mark, set in the concrete abutment of the bridge, on the left bank, upstream side; elevation, 14.67 feet above the gage datum.

Discharge measurements of Pryor Creek at Huntley, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	Morse and Sloan	25	82	6.27	410
March 27	do	25	82	6.27	387
April 12	J. H. Sloan	17	27	3.00	87.5
June 5	Morse and Whinery	16	19	2.22	45.3
July 3	Morse and Richards	29	14	1.13	20.3
August 8	W. S. Hartman	30	13	1.04	14.2
August 24	R. H. Whinery	35	67	3.00	219
October 5	Robert Follansbee	31	18	1.18	22.5
October 10	Follansbee and Richards	29	15	1.16	20.6

NOTE.—Beginning July 3 the gage heights refer to the gage at the new station.

Daily gage height, in feet, of Pryor Creek at Huntley, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.4	3.1	3.1	2.55	2.3	2.65	1.0	1.0	1.1	1.0	1.2
2	2.4	3.25	2.9	3.35	2.25	2.45	1.0	1.0	1.1	1.15	1.2
3	2.4	3.3	2.75	.....	2.1	2.45	1.0	1.1	1.1	1.15	1.2
4	2.4	3.3	2.7	3.35	2.25	2.25	0.9	1.1	1.1	1.2	1.2
5	2.4	3.45	2.5	3.9	2.15	2.25	0.9	1.05	1.1	1.2	1.2
6	2.4	3.5	2.75	5.7	2.2	2.05	0.9	1.05	1.1	1.2	1.2
7	2.4	3.4	3.6	5.2	2.15	2.05	1.0	1.05	1.1	1.2	1.15
8	2.4	3.4	4.0	5.05	2.15	2.5	1.0	1.0	1.1	1.2	1.2
9	2.4	3.4	4.3	3.85	2.15	2.2	1.0	1.0	1.1	1.2	1.2
10	2.5	3.4	.....	2.85	2.15	2.4	1.0	1.0	1.1	1.2	1.2
11	2.5	3.4	.....	2.55	2.05	2.1	1.0	1.0	1.1	1.2	1.2
12	2.5	3.3	.....	2.85	2.05	2.05	1.0	1.0	1.15	1.2	1.2
13	2.5	3.3	.....	3.1	2.45	1.85	1.0	1.0	1.25	1.2	1.2
14	2.5	3.3	.....	2.5	2.8	1.8	1.0	1.0	1.2	1.15	1.2
15	2.5	3.85	.....	2.4	2.45	1.0	1.0	1.0	1.2	1.15	1.25
16	2.5	4.85	2.9	2.35	2.2	1.0	1.1	1.0	1.2	1.15	1.3
17	2.5	6.0	3.5	2.3	2.1	1.0	1.1	1.0	1.2	1.2	1.3
18	2.5	8.25	3.55	2.35	2.05	1.0	1.0	1.0	1.15	1.2	1.5
19	2.5	6.9	3.65	2.35	2.05	1.2	1.0	1.0	1.1	1.2	1.5
20	2.5	6.8	3.55	2.35	2.0	1.3	1.0	0.95	1.1	1.2	1.5

Daily gage height, in feet, of Pryor Creek at Huntley, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21	2.5	4.7	3.3	2.35	1.95	1.5	1.0	1.0	1.1	1.2	1.5
22	2.5	4.6	3.25	2.35	1.95	1.4	1.0	1.1	1.1	1.2	1.6
23	2.5	3.7	4.5	2.45	2.05	1.3	1.0	3.1	1.1	1.2	1.6
24	2.5	3.75	7.0	2.65	2.05	1.2	0.9	2.9	1.1	1.2	1.6
25	2.5	3.2	.....	2.75	5.05	1.1	0.9	1.75	1.1	1.2	1.6
26	2.5	3.55	.....	2.75	3.5	1.1	0.9	1.4	1.1	1.2	1.6
27	2.5	3.0	6.4	2.6	3.0	1.1	0.9	1.2	1.1	1.2	.....
28	2.9	3.0	4.65	2.55	3.55	1.2	0.9	1.2	1.1	1.2	.....
29	2.65	.....	3.45	2.45	5.4	1.2	0.9	1.1	1.1	1.2	.....
30	2.75	.....	2.95	2.35	5.1	1.3	0.9	1.1	1.1	1.2	.....
31	3.4	.....	2.65	.....	3.05	.....	1.0	1.1	.....	1.2	.....

NOTE.—Ice conditions January 1 to March 28; readings to ice surface. The channel was changed June 15–16. Ice conditions November 18 to December 31.

Rating tables for Pryor Creek at Huntley, Mont.

MARCH 27, 1906, TO JUNE 14, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	28	2.80	77	3.80	148	4.80	240
1.90	32	2.90	83	3.90	156	4.90	250
2.00	36	3.00	89	4.00	164	5.00	260
2.10	40	3.10	96	4.10	173	5.20	282
2.20	45	3.20	103	4.20	182	5.40	304
2.30	50	3.30	110	4.30	191	5.60	327
2.40	55	3.40	117	4.40	200	5.80	351
2.50	60	3.50	124	4.50	210	6.00	375
2.60	65	3.60	132	4.60	220	6.20	400
2.70	71	3.70	140	4.70	230	6.40	426

JUNE 15, 1906, TO NOVEMBER 26, 1906.[b]

0.90	6	1.50	47	2.10	104	2.60	164
1.00	11	1.60	55	2.20	115	2.70	177
1.10	17	1.70	64	2.30	127	2.80	190
1.20	24	1.80	73	2.40	139	2.90	204
1.30	31	1.90	83	2.50	151	3.00	218
1.40	39	2.00	93				

[a] This table is applicable only for open-channel conditions. It is based on four discharge measurements made during the spring of 1906 and is not very well defined. After June 14 the following rating is necessary on account of change in channel:

[b] This table is applicable only for open-channel conditions. It is based on five discharge measurements made during the latter part of 1906 and is not well defined.

Monthly discharge of Pryor Creek at Huntley, Mont., for 1906.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	339	50	96.8	5,760	0.121	0.14
May	304	34	75.9	4,670	.095	1.10
June	68	11	35.0	2,080	.044	.05
July	17	6	9.8	603	.012	.01
August	237	8	29.5	1,810	.037	.04
September	28	17	18.6	1,110	.023	.03
October	24	11	22.8	1,400	.028	.03
November	.....	.....	[a] 24.0	1,430	.030	.03
The period	.....	.....	.....	18,900	.....	.....

[a] Latter part of month estimated.

NOTE.—No estimate for ice period. Values for 1906 are good.

BIGHORN RIVER AT FORT CUSTER, MONT.

This station was established June 16, 1904. It is located at the bridge of the Burlington and Missouri River Railroad, about one-half mile above the junction of Bighorn and Little Bighorn rivers, near the station at Fort Custer. During 1906 gage was read by W. O. Henshaw. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 108, where are given also references to publications that contain data for previous years. The gage heights for 1906 are referred to a datum that is 2 feet lower than that used in 1905.

Discharge measurements of Bighorn River at Fort Custer, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 5	J. H. Sloan	429	1,720	3.61	4,010
May 14	do	438	3,030	6.18	17,400
June 20	R. H. Whinery	439	3,270	6.75	17,100
July 31	Richards and Whinery	433	2,100	4.52	6,420
September 3	Follansbee and Richards	431	1,840	3.87	4,480
September 14	Grover and Follansbee	428	1,540	3.52	2,840
October 12	Robert Follansbee	426	1,370	3.09	1,740
November 7	R. Richards	424	1,360	2.96	1,580

Daily gage height, in feet, of Bighorn River at Fort Custer, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3.22	3.90	4.10	4.25	3.60	6.02	5.02	4.40	4.05	3.12	3.00
2	3.22	3.90	4.10	4.08	3.48	5.58	5.30	4.25	3.95	3.12	3.00
3	3.27	3.82	4.07	3.95	3.45	5.25	5.62	4.32	3.88	3.12	2.95
4	3.35	3.75	4.12	3.85	3.50	5.18	5.68	4.18	3.82	3.10	2.95
5	3.30	3.55	4.10	3.68	3.48	5.25	5.82	4.12	3.70	3.08	2.95
6	3.35	3.62	4.07	3.45	3.58	5.42	5.98	4.18	3.72	3.08	2.95
7	3.35	3.70	3.92	3.32	3.62	5.90	5.98	4.55	3.68	3.08	2.95
8	3.40	3.70	3.75	3.30	3.58	5.85	5.85	4.98	3.62	3.08	2.95
9	3.45	3.75	3.15	3.35	3.60	5.70	5.80	4.58	3.55	3.08	3.00
10	3.52	3.77	3.40	3.38	3.75	5.28	5.92	4.48	3.52	3.08	3.00
11	3.55	3.77	3.40	3.48	4.05	5.28	5.90	4.28	3.50	3.08	3.00
12	3.55	3.82	3.47	3.48	4.42	5.92	5.90	4.12	3.52	3.08	3.00
13	3.55	3.80	3.12	3.48	4.88	6.50	5.90	4.00	3.55	3.00	3.00
14	3.55	3.87	3.25	3.42	5.80	7.72	6.08	3.95	3.52	2.95	3.00
15	3.57	3.95	3.55	3.38	6.60	8.00	6.40	3.90	3.52	2.95	3.00
16	3.60	3.95	3.70	3.30	5.98	7.70	6.42	3.82	3.52	2.95	3.00
17	3.67	4.00	3.75	3.28	5.55	7.68	6.25	3.75	3.52	2.95	3.00
18	3.70	4.15	3.75	3.30	5.18	7.50	6.35	3.75	3.50	2.95	3.05
19	3.70	4.10	3.77	3.35	4.88	7.05	5.92	3.70	3.48	3.00	3.10
20	3.65	4.10	3.80	3.38	4.62	6.75	5.70	3.70	3.42	3.00	3.10
21	3.65	4.00	3.77	3.40	4.60	6.18	5.60	3.88	3.42	2.95	3.10
22	3.65	3.92	3.80	3.60	4.92	6.80	5.45	4.72	3.40	2.95	3.10
23	3.70	4.00	3.87	3.82	5.20	5.55	5.28	5.40	3.38	2.95	3.10
24	3.82	4.00	4.07	3.95	5.62	5.38	5.25	5.72	3.35	2.95	3.05
25	3.85	3.92	4.47	3.98	6.02	5.35	5.15	6.08	3.30	2.90	3.05
26	3.85	4.17	3.90	4.05	6.35	5.22	5.15	5.32	3.28	2.95	3.10
27	3.87	4.20	6.90	4.05	6.50	5.08	5.05	5.12	3.22	2.95	3.10
28	3.90	4.12	6.50	4.05	6.52	5.02	5.02	4.72	3.22	2.95	3.10
29	3.90	.....	5.55	3.85	6.48	5.12	4.82	4.45	3.18	2.95	3.10
30	3.90	.....	4.70	3.65	6.56	5.15	4.70	4.38	3.18	2.95	3.10
31	3.95	.....	4.55	.....	6.35	.....	4.50	4.20	.....	3.00	.....

NOTE.—Ice conditions January 1 to March 25.

Rating tables for Bighorn River at Fort Custer, Mont.

JANUARY 1, 1906, TO SEPTEMBER 8, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	2,230	4.10	5,110	5.10	8,560	6.20	13,980
3.10	2,450	4.20	5,410	5.20	8,960	6.40	15,180
3.20	2,680	4.30	5,720	5.30	9,380	6.60	16,440
3.30	2,920	4.40	6,040	5.40	9,820	6.80	17,760
3.40	3,170	4.50	6,370	5.50	10,280	7.00	19,140
3.50	3,430	4.60	6,710	5.60	10,760	7.20	20,560
3.60	3,700	4.70	7,060	5.70	11,260	7.40	22,040
3.70	3,970	4.80	7,420	5.80	11,780	7.60	23,580
3.80	4,250	4.90	7,790	5.90	12,300	7.80	25,160
3.90	4,530	5.00	8,170	6.00	12,840	8.00	26,800
4.00	4,820						

SEPTEMBER 9, 1906, TO NOVEMBER 30, 1906.[b]

2.90	1,400	3.20	2,090	3.40	2,600	3.60	3,150
3.00	1,620	3.30	2,340	3.50	2,870	3.70	3,440
3.10	1,850						

[a] This table is applicable only for open-channel conditions. It is based on eighteen discharge measurements made during 1904–6, and is well defined between gage heights 3 feet and 8 feet.

[b] This table is applicable only for open-channel conditions. It is based on three discharge measurements made subsequent to September 8, and is well defined between gage heights 3 feet and 3.5 feet.

Monthly discharge of Bighorn River at Fort Custer, Mont., for 1906.

[Drainage area, 20,700 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March 26–31	18,400	4,530	10,500	125,000	0.507	0.11
April	5,560	2,870	3,800	226,000	.184	.20
May	16,400	3,300	8,720	536,000	.421	.48
June	26,800	8,250	13,600	809,000	.657	.73
July	15,300	6,370	11,000	676,000	.531	.61
August	13,300	3,970	6,290	387,000	.304	.35
September	4,960	2,040	3,070	183,000	.148	.16
October	1,900	1,400	1,640	101,000	.079	.09
November	1,850	1,510	1,690	101,000	.082	.09
The period				3,140,000		

NOTE.—No estimate for ice period. Values are rated as follows: April to August, excellent; September to November, good.

LITTLE BIGHORN RIVER AT CROW AGENCY, MONT.

This station was established March 24, 1905, and was discontinued June 30, 1906. It is located at the Burlington and Missouri River Railroad bridge, one-fourth mile south of Crow Agency, Mont. During 1906 gage was read by Charles Town. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 111.

Discharge measurements of Little Bighorn River at Crow Agency, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 7[a]	H. M. Morse	77	166	3.06	275
March 8[a]	do	82	190	3.24	320
May 14	J. H. Sloan	99	383	5.23	1,490
June 19	R. H. Whinery	85	160	2.98	435
July 30	Richards and Whinery	[b]33	[b]29	2.00	108

[a] Ice above and below station. [b] Wading section.

Daily gage height, in feet, of Little Bighorn River at Crow Agency, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.3	3.5	2.3	3.5	2.4	3.5	17	2.3	4.15	2.5	2.3	3.5	3.3
2	2.3	3.5	2.45	3.1	2.4	3.4	18	2.3	3.9	2.6	2.4	3.4	3.2
3	2.4	3.3	2.7	3.0	2.3	3.3	19	2.3	4.0	2.5	2.4	3.2	3.1
4	2.3	2.9	2.7	2.8	2.3	3.3	20	2.3	3.85	2.5	2.4	3.0	2.9
5	2.4	2.8	2.4	2.7	2.4	3.2	21	2.4	3.35	2.7	2.3	3.0	2.9
6	2.4	2.7	2.4	2.8	2.4	3.5	22	2.4	3.15	2.8	2.3	3.2	2.7
7	2.4	2.5	2.9	3.1	2.4	3.6	23	2.4	4.0	2.9	2.4	3.4	2.7
8	2.4	2.4	3.3	3.0	2.4	3.6	24	2.4	4.3	3.4	2.4	3.6	2.6
9	2.4	2.4	3.4	2.9	2.3	3.3	25	2.4	3.65	4.2	2.4	3.9	2.7
10	2.4	2.5	4.3	2.8	2.3	3.2	26	2.4	3.05	5.7	2.5	4.1	2.7
11	2.4	2.5	3.5	2.6	2.2	3.2	27	2.5	2.85	7.0	2.5	4.1	2.6
12	2.3	2.6	3.7	2.5	2.2	3.3	28	2.4	2.25	5.8	2.5	4.0	2.6
13	2.3	2.7	3.3	2.5	2.5	3.3	29	2.5	.....	4.5	2.4	3.8	2.7
14	2.3	2.7	2.8	2.5	7.2	3.4	30	2.5	.....	4.1	2.4	4.0	2.6
15	2.3	2.7	2.7	2.4	3.6	3.4	31	2.8	.....	3.6	.....	3.7	.....
16	2.3	2.6	2.7	2.4	3.5	3.3							

NOTE.—Ice conditions January 14 to March 27.

Rating table for Little Bighorn River at Crow Agency, Mont., for 1905–6.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	105	3.00	430	4.00	860	5.00	1,360
2.10	130	3.10	470	4.10	910	5.20	1,465
2.20	155	3.20	510	4.20	960	5.40	1,575
2.30	185	3.30	550	4.30	1,010	5.60	1,685
2.40	215	3.40	590	4.40	1,060	5.80	1,795
2.50	250	3.50	630	4.50	1,110	6.00	1,915
2.60	285	3.60	675	4.60	1,160	7.00	2,515
2.70	320	3.70	720	4.70	1,210		
2.80	355	3.80	765	4.80	1,260		
2.90	390	3.90	810	4.90	1,310		

NOTE.—The above table is applicable only for open-channel conditions. It is based on thirteen discharge measurements made during 1905 and 1906, and is well defined between gage heights 1.9 feet and 5.0 feet.

[a] Except March 1–27, when estimates were based on two measurements made during that time.

Monthly discharge of Little Bighorn River at Crow Agency, Mont., for 1906.

[Drainage area 1,280 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January (1–13)	215	185	203	5,230	0.159	0.077
March	1,800	110	476	29,300	.372	.43
April	630	185	290	17,300	.226	.25
May	2,740	155	543	33,400	.424	.49
June	675	285	475	28,300	.372	.42
The period	.....	.....	.....	114,000	.....	.....

NOTE.—Values are rated as follows: January, good; April to June, excellent; the results for March are based on a special ice curve, and are approximate.

BIG WIND RIVER NEAR ARAPAHOE AGENCY, WYO.

This station was established May 14, and was discontinued August 25, 1906. It is located at Walkers Ferry, 7 miles northeast of Arapahoe Agency.

The channel is straight for 800 feet above and below the station. The banks are covered with heavy willow brush and are not liable to overflow. The bed of the stream is of cobblestone, with the exception of the portion near the left bank, which is composed of sand, and shifts somewhat. The current is swift.

Discharge measurements were made from the ferry at high stages and by small car suspended from the ferry cable, or by wading, at lower stages.

The gage, which was read by Andrew Walker, is a hewn timber fastened to the downstream side of the elevated approach to the ferry. The bench mark is the top of a small stump near the bank of the river 11.5 feet southeast of the gage; elevation, 6.00 feet above the gage datum. On July 13, owing to a change in channel during high water, a new gage was installed at a point 600 feet above old gage. A new curve applies from July 13.

Discharge measurements of Big Wind River near Arapahoe Agency, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 14	A. J. Parshall	236	743	3.30	4,020
May 15	do	236	660	3.00	3,400
June 8	do	236	618	2.80	3,050
June 10	do	236	581	2.60	2,570
June 12	do	237	865	3.70	5,240
June 12	do	240	1,060	4.55	7,502
June 13	do	240	1,220	5.20	9,480
July 13	do	240	902	3.50	5,830
July 18	do	240	686	2.65	3,700
July 19	do	240	734	2.85	4,150
November 13	R. I. Meeker	125	218	0.05	374

NOTE.—Beginning July 13 the gage heights for the remainder of the year refer to the new gage established on that date.

Daily gage height, in feet, of Big Wind River near Arapahoe Agency, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1		2.7	2.6	2.1	17	2.4	5.1	2.65	1.6
2		2.5	2.6	2.0	18	2.2	3.9	2.65	1.65
3		2.6	2.65	2.1	19	2.1	3.4	2.85	2.6
4		2.8	2.65	3.3	20	2.3	2.4	2.8	3.1
5		2.9	2.7	2.2	21	3.0	2.6	2.65	3.3
6		3.2	2.7	2.25	22	3.0	2.9	2.8	3.3
7		3.0	2.7	2.3	23	2.8	2.8	3.0	3.4
8		2.8	2.75	2.05	24	3.1	3.0	2.9	3.1
9		2.6	2.75	1.9	25	3.6	2.6	2.95	2.75
10		2.6	2.8	1.85	26	3.6	2.9	2.7	.....
11		3.8	2.85	1.75	27	3.7	2.7	2.5	.....
12		4.6	2.8	1.8	28	3.4	2.5	2.4	.....
13		5.2	3.45	1.7	29	3.8	2.6	2.3	.....
14	3.3	6.0	3.25	1.7	30	3.4	2.7	2.15	.....
15	3.0	5.5	3.0	1.65	31	3.0	.....	2.1	.....
16	2.8	5.2	2.85	1.7					

NOTE.—Beginning July 13 the gage heights refer to the new gage established on that date. From July 1-13 the gage heights were estimated.

Rating tables for Big Wind River near Arapahoe Agency, Wyo.

MAY 14, 1906, TO JULY 12, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	1,760	3.10	3,610	4.10	6,150	5.10	9,220
2.20	1,910	3.20	3,830	4.20	6,440	5.20	9,550
2.30	2,070	3.30	4,060	4.30	6,730	5.30	9,880
2.40	2,240	3.40	4,300	4.40	7,030	5.40	10,210
2.50	2,420	3.50	4,550	4.50	7,330	5.50	10,550
2.60	2,600	3.60	4,810	4.60	7,640	5.60	10,890
2.70	2,790	3.70	5,070	4.70	7,950	5.70	11,230
2.80	2,990	3.80	5,330	4.80	8,260	5.80	11,580
2.90	3,190	3.90	5,600	4.90	8,580	5.90	11,930
3.00	3,400	4.00	5,870	5.00	8,900	6.00	12,280

JULY 13, 1906, TO AUGUST 25, 1906.[b]

1.60	1,800	2.10	2,600	2.60	3,590	3.10	4,750
1.70	1,940	2.20	2,790	2.70	3,810	3.20	5,010
1.80	2,090	2.30	2,980	2.80	4,030	3.30	5,280
1.90	2,250	2.40	3,180	2.90	4,260	3.40	5,550
2.00	2,420	2.50	3,380	3.00	4,500	3.50	5,830

[a] This table is based on seven discharge measurements made during May and June, 1906, and is well defined between gage heights 2.5 feet and 6.0 feet.

[b] This table is based on four discharge measurements made during July–November, 1906, and is well defined between gage heights 2.5 feet and 4 feet.

Monthly discharge of Big Wind River near Arapahoe Agency, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (14-31)	5,330	1,760	3,550	127,000
June	12,300	2,240	4,480	267,000
July	5,690	2,600	3,500	215,000
August (1-25)	5,550	1,800	3,080	153,000
The period				762,000

NOTE.—Values for May to July are probably excellent; the values for August do not compare well with those for the two stations on the Little Wind River and are probably approximate.

LITTLE WIND RIVER ABOVE ARAPAHOE AGENCY, WYO.

This station was established May 11 and discontinued October 31, 1906. It is located at the Government bridge above the junction with Popo Agie River and one-half mile above the post-office at Arapahoe Agency.

The channel curves both above and below the station. The water is confined between the bridge abutments. The bed is of cobblestone, and permanent. The current is swift.

Discharge measurements were made from the downstream side of the bridge. The initial point for soundings is marked zero on the top rail of the bridge at the left bank.

The gage, which was read by G. A. Bremner, is a staff attached to the downstream side of the pile bent nearest the left bank. The bench mark is a spike in a telephone pole N. 20° W. 40 feet from the gage; elevation, 6.86 feet above the gage datum.

Discharge measurements of Little Wind River above Arapahoe Agency, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	A. J. Parshall	100	161	1.90	680
May 12	do	100	139	1.70	541
May 13	do	100	183	2.20	889
May 15	do	100	166	2.00	762
June 7	do	100	210	2.35	1,130
June 8	do	100	182	2.15	883
June 9	do	100	166	1.95	730
June 10	do	100	186	2.15	893
June 11	do	100	245	2.70	1,470
June 12	do	100	305	3.30	2,040
June 12	do	100	265	2.90	1,650
June 13	do	100	325	3.50	2,260
June 13	do	100	349	3.75	2,570
June 14	do	100	375	4.00	2,880
July 12	do	100	229	2.50	1,220
July 13	do	100	238	2.60	1,330
July 14	do	100	250	2.75	1,460
July 16	do	100	220	2.40	1,140
July 17	do	100	210	2.30	1,050
July 18	do	100	201	2.20	969
July 19	do	100	190	2.10	891
November 13	R. I. Meeker	94	63	.73	104

Daily gage height, in feet, of Little Wind River above Arapahoe Agency, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.9	2.2	1.5	1.0	0.7	17	1.6	3.95	2.3	1.0	0.85	0.5
2	.....	1.9	2.5	1.5	1.0	.7	18	1.5	3.3	2.3	.95	.8	.5
3	.....	2.2	2.5	1.5	1.0	.65	19	1.6	2.9	2.3	.95	.8	.55
4	.....	2.5	2.6	1.6	1.0	.65	20	1.7	2.6	2.1	1.4	.8	.6
5	.....	2.6	2.7	1.5	.95	.65	21	1.8	2.5	2.0	1.7	.8	.6
6	.....	2.8	2.7	1.5	.9	.6	22	2.0	2.7	2.0	1.8	.8	.6
7	.....	2.2	2.8	1.4	.9	.6	23	2.3	2.5	1.9	1.8	.8	.6
8	.....	2.1	2.9	1.3	.85	.6	24	3.0	2.3	2.0	1.4	.75	.7
9	.....	2.0	2.6	1.2	.85	.6	25	3.3	2.1	2.0	1.3	.7	.7
10	.....	2.3	2.7	1.1	.85	.6	26	2.8	2.2	1.9	1.3	.7	.7
11	1.9	2.9	2.5	1.1	.8	.6	27	2.3	2.2	1.8	1.4	.7	.7
12	1.7	3.3	2.8	1.0	.8	.6	28	3.0	2.3	1.7	1.3	.7	.7
13	2.2	3.7	2.6	1.0	.8	.55	29	2.8	2.2	1.6	1.2	.7	.8
14	2.0	3.9	2.75	1.1	.8	.5	30	2.5	2.0	1.5	1.1	.7	.75
15	1.9	4.0	2.8	1.1	.75	.5	31	2.1	.....	1.5	1.0	.....	.7
16	1.8	3.8	2.5	1.0	.85	.5							

Rating table for Little Wind River above Arapahoe Agency, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	50	1.40	365	2.30	1,030	3.20	1,955
.60	72	1.50	420	2.40	1,130	3.30	2,060
.70	97	1.60	480	2.50	1,230	3.40	2,170
.80	125	1.70	545	2.60	1,330	3.50	2,280
.90	157	1.80	615	2.70	1,430	3.60	2,390
1.00	192	1.90	685	2.80	1,535	3.70	2,500
1.10	230	2.00	760	2.90	1,640	3.80	2,610
1.20	270	2.10	845	3.00	1,745	3.90	2,725
1.30	315	2.20	935	3.10	1,850	4.00	2,840

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty-two discharge measurements made during 1906 and is well defined between gage heights 1.7 feet and 4 feet. Below gage height 1.7 feet it is based on one measurement.

Monthly discharge of Little Wind River above Arapahoe Agency, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (11–31)	2.060	420	966	40,200
June	2,840	685	1,410	83,900
July	1,640	420	1,050	64,600
August	615	174	325	20,000
September	192	97	134	7,970
October	125	50	78.3	4,810
The period				221,000

NOTE.—Values for 1906 are excellent.

LITTLE WIND RIVER BELOW ARAPAHOE AGENCY, WYO.

This station was established May 11, and was discontinued October 31, 1906. It is located at the Government bridge 200 yards below the junction of Popo Agie River and one-half mile south of the post-office at Arapahoe Agency.

The channel is straight for 500 feet above and 1,000 feet below the bridge abutments. During high water a small slough carries water not registered on gage. The bed of the stream is permanent. The water is swift except at low stages.

Discharge measurements were made from the bridge. The initial point for soundings is marked zero on top of the hand rail, downstream side, left bank.

The gage, which was read by G. A. Bremner, is a staff attached to the downstream side of the pile bent nearest the left bank. The bench mark is a spike in an 18-inch cottonwood tree N. 20° W. about 200 feet from the gage; elevation, 11.97 feet above the gage datum.

Discharge measurements of Little Wind River below Arapahoe Agency, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	A. J. Parshall	103	580	3.90	1,830
May 12	do	101	603	4.20	2,150
May 13	do	104	658	4.60	2,690
June 7	do	104	669	4.70	2,800
June 8	do	102	584	4.10	1,960
June 9	do	102	595	4.05	1,920
June 10	do	102	654	4.65	2,730
June 11	do	103	738	5.40	3,540
June 11	do	103	774	5.70	4,110
June 12	do	108	863	6.50	5,180
June 12	do	104	800	5.90	4,390
June 13	do	108	885	6.70	5,520
June 13	do	110	952	7.30	6,640
June 14	do	110	972	7.50	6,950
July 12	do	102	678	4.80	2,850
July 13	do	102	710	5.10	3,220
July 14	do	103	751	5.50	3,860
July 16	do	102	662	4.70	2,680
July 17	do	102	640	4.50	2,420
July 19	do	102	628	4.40	2,250
November 13	R. I. Meeker	96	355	1.64	270

Daily gage height, in feet, of Little Wind River below Arapahoe Agency, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	4.1	4.1	2.9	2.3	1.65	17	3.6	6.8	4.5	2.2	2.0	1.4
2	.....	4.05	4.5	2.85	2.3	1.65	18	3.4	5.9	4.5	2.1	2.0	1.4
3	.....	4.2	4.45	2.8	2.25	1.6	19	3.6	5.2	4.35	2.1	2.0	1.5
4	.....	4.4	4.5	2.9	2.2	1.6	20	4.2	4.7	4.1	3.0	2.0	1.5
5	.....	5.0	4.6	2.8	2.1	1.6	21	4.6	4.6	4.0	3.5	2.0	1.5
6	.....	5.5	4.7	2.8	2.0	1.6	22	4.7	4.85	3.95	3.7	2.0	1.5
7	.....	4.6	5.2	2.7	2.0	1.6	23	4.9	4.6	3.9	3.7	2.0	1.6
8	.....	4.15	5.0	2.6	1.95	1.6	24	6.0	4.2	3.9	3.3	1.9	1.7
9	.....	4.05	4.6	2.5	1.9	1.6	25	6.4	3.85	3.8	3.2	1.8	1.9
10	.....	4.65	4.7	2.45	1.9	1.6	26	5.7	3.9	3.6	3.2	1.8	1.9
11	3.9	5.7	4.7	2.4	1.9	1.6	27	5.3	4.0	3.35	3.3	1.75	1.9
12	4.2	6.5	4.9	2.3	1.9	1.5	28	5.55	4.2	3.25	2.6	1.7	1.9
13	4.6	7.3	5.1	2.2	1.9	1.5	29	5.5	4.0	3.1	2.5	1.7	1.85
14	4.2	7.5	5.55	2.3	1.9	1.45	30	5.0	3.6	3.05	2.5	1.7	1.8
15	4.1	6.8	5.4	2.3	1.9	1.4	31	4.3	.....	2.9	2.3	.....	1.8
16	4.0	6.75	4.7	2.2	2.0	1.4							

Rating table for Little Wind River below Arapahoe Agency, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	200	2.70	805	4.00	1,910	5.40	3,640
1.50	225	2.80	875	4.10	2,015	5.60	3,920
1.60	255	2.90	945	4.20	2,125	5.80	4,210
1.70	285	3.00	1,020	4.30	2,235	6.00	4,500
1.80	320	3.10	1,095	4.40	2,345	6.20	4,810
1.90	360	3.20	1,175	4.50	2,460	6.40	5,120
2.00	405	3.30	1,255	4.60	2,580	6.60	5,430
2.10	450	3.40	1,340	4.70	2,705	6.80	5,740
2.20	500	3.50	1,430	4.80	2,830	7.00	6,060
2.30	555	3.60	1,520	4.90	2,960	7.20	6,385
2.40	615	3.70	1,615	5.00	3,090	7.40	6,715
2.50	675	3.80	1,710	5.20	3,360	7.60	7,045
2.60	740	3.90	1,810				

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty-one discharge measurements made during 1906 and is well defined between gage heights 3.9 feet and 8.0 feet. The extension below 3.9 is based on one measurement at 1.64.

Monthly discharge of Little Wind River below Arapahoe Agency, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (11–31)	5,120	1,340	2,740	114,000
June	6,880	1,520	3,200	190,000
July	3,850	945	2,290	141,000
August	1,620	450	845	52,000
September	555	285	390	23,200
October	360	200	263	16,200
The period	.....	.....	.....	536,000

NOTE.—Values for 1906 are excellent.

SHOSHONE RIVER NEAR CODY, WYO.

This station was established April 26, 1902. It is located at the wagon bridge 1 mile northeast of Cody, Wyo., in sec. 29, T. 53 N., R. 101 W. The gage was read during 1906 by H. N. Bickel. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 113, where are given also references to publications that contain data for previous years.

Discharge measurements of Shoshone River near Cody, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 26	Brundage and Bickel	90	197	1.80	214
March 7	do	90	216	1.90	276
March 13	Brundage and Craig	90	171	1.45	114
March 28	Brundage and Polk	107	235	2.03	313
April 7	J. H. Sloan	128	346	2.75	821
March 31	Harley and Brundage	158	607	4.12	2,660
October 18	Harley and Coleman	128	265	2.12	386

Daily gage height, in feet, of Shoshone River near Cody, Wyo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.85	2.0	2.0	2.5	2.8	4.08	5.5	3.75	3.0	2.2	2.15	1.9
2	1.8	1.95	2.0	2.4	3.0	4.08	5.7	3.7	2.9	2.2	2.15	1.9
3	1.9	2.0	2.0	2.2	3.0	4.3	5.6	3.5	2.85	2.15	2.1	2.0
4	1.85	2.0	1.95	2.1	3.4	4.5	5.3	3.6	2.8	2.2	2.1	2.1
5	1.9	2.0	1.95	2.2	3.25	4.7	5.5	3.5	2.8	2.2	2.1	2.1
6	2.0	2.0	1.95	2.45	3.0	4.8	5.7	3.4	2.8	2.2	2.1	2.05
7	1.95	1.95	1.95	2.75	3.0	4.4	5.4	3.4	2.8	2.2	2.1	2.1
8	1.9	2.0	1.95	3.0	3.2	4.1	5.3	3.5	2.75	2.2	2.15	2.1
9	1.9	2.0	1.95	2.8	3.8	4.1	5.4	3.4	2.7	2.25	2.2	2.1
10	1.95	2.0	1.95	2.6	4.4	4.52	5.5	3.45	2.75	2.25	2.18	2.0
11	1.95	1.95	1.95	2.6	4.7	5.6	5.6	3.35	2.7	2.1	2.2	2.1
12	1.9	1.95	1.95	2.5	4.7	6.1	5.4	3.35	2.6	2.1	2.16	2.1
13	1.95	2.0	2.0	2.4	5.4	7.4	5.6	3.4	2.55	2.1	2.15	2.0
14	1.95	1.95	1.95	2.35	5.0	6.4	5.5	3.4	2.5	2.1	2.25	1.9
15	1.95	1.95	2.0	2.5	4.5	5.9	5.7	3.1	2.65	2.07	2.7	1.8
16	2.0	2.0	2.0	2.9	4.2	6.0	5.1	3.1	2.6	2.05	2.65	1.7
17	2.0	2.0	2.0	3.0	3.7	5.7	5.0	3.1	2.5	2.12	2.2	1.7
18	1.9	1.95	1.95	2.9	3.6	5.0	5.3	3.05	2.5	2.13	2.0	1.95
19	1.8	1.95	1.95	2.85	3.7	4.75	4.9	3.35	2.5	2.1	1.72	2.0
20	2.0	2.0	2.0	3.05	4.3	4.4	4.8	3.6	2.45	2.07	1.75	2.0
21	2.0	2.0	2.0	3.6	4.5	4.45	4.7	3.5	2.45	2.05	1.85	2.1
22	2.0	1.95	1.95	4.1	4.1	4.8	4.6	4.0	2.4	2.0	2.05	2.1
23	2.0	1.95	2.0	4.2	4.35	4.4	4.8	4.0	2.4	2.0	2.1	2.0
24	2.0	1.95	2.0	3.8	5.1	4.2	4.5	3.7	2.35	2.0	2.0	2.0
25	2.0	2.0	2.0	3.35	4.8	4.05	4.5	3.4	2.3	2.1	2.0	2.1
26	1.95	2.0	2.1	3.2	4.9	4.25	4.3	3.3	2.3	2.1	2.05	2.1
27	1.95	2.0	2.1	3.05	4.5	4.6	4.2	3.25	2.25	2.2	2.0	2.1
28	2.0	2.0	2.0	2.9	4.4	4.85	4.0	3.2	2.25	2.2	1.9	2.05
29	2.0	.....	2.1	3.1	4.9	4.45	3.9	3.1	2.2	2.15	1.9	2.0
30	1.95	.....	2.15	2.9	4.4	4.3	3.8	3.05	2.25	2.15	2.05	2.0
31	2.0	.....	2.15	.....	4.2	.....	3.8	3.0	.....	2.0	.....	1.8

NOTE.—Practically open-channel conditions during the entire year.

Rating table for Shoshone River near Cody, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	125	2.70	780	3.90	2,320	5.20	5,280
1.60	155	2.80	870	4.00	2,500	5.40	5,840
1.70	190	2.90	970	4.10	2,690	5.60	6,420
1.80	225	3.00	1,070	4.20	2,890	5.80	7,030
1.90	265	3.10	1,180	4.30	3,100	6.00	7,660
2.00	310	3.20	1,300	4.40	3,310	6.20	8,310
2.10	360	3.30	1,420	4.50	3,530	6.40	8,980
2.20	415	3.40	1,550	4.60	3,760	6.60	9,670
2.30	475	3.50	1,690	4.70	4,000	6.80	10,380
2.40	545	3.60	1,840	4.80	4,240	7.00	11,110
2.50	620	3.70	1,990	4.90	4,490		
2.60	700	3.80	2,150	5.00	4,750		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-6 and is well defined.

Monthly discharge of Shoshone River near Cody, Wyo., for 1906.

[Drainage area, 1,480 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	310	225	285	17,500	0.193	0.22
February	310	287	301	16,700	.203	.21
March	388	287	310	19,100	.209	.24
April	2,890	360	1,030	61,300	.696	.78
May	5,840	870	2,890	178,000	1.95	2.25
June	12.600	2,650	4.550	271,000	3.07	3.42
July	6,720	2,150	4,860	299,000	3.28	3.78
August	2,500	1,070	1,580	97,200	1.07	1.23
September	1,070	415	680	40,500	.459	.51
October	445	310	376	23,100	.254	.29
November	780	197	371	22,100	.251	.28
December	360	190	313	19,200	.211	.24
The year	12,600	190	1.460	1,060,000	.987	13.45

NOTE.—Values are rated as follows: January to March, approximate, on account of erroneous gage heights; April to December, excellent.

SOUTH FORK OF SHOSHONE RIVER AT MARQUETTE, WYO.

This station was established April 26, 1903, but was discontinued during 1904. It was located at the county highway bridge at Marquette, 12 miles west of Cody. April 4, 1906, the station was reestablished 1¾ miles below Marquette, one-half mile above the Shoshone dam, and one-fourth mile above the mouth of North Fork.

The channel is straight for 200 feet above and 300 feet below the gage section. The right bank is high and clean, and not liable to overflow; the left is low and wooded, but not liable to overflow. The bed of the stream is gravelly and permanent. There is an overflow channel at high water.

Discharge measurements are made from a cable and car located three-fourths mile above the gage section. Two small creeks enter the river between the cable section and gage. Their discharge is measured and added to that at the cable in order to get the flow at the gage.

The gage, which is read daily by W. T. Coleman, is a vertical staff fastened to a 20-inch cottonwood tree on the right bank. The bench mark is a spike driven into the tree to which the gage is attached; elevation, 6.50 feet above the gage datum.

Discharge measurements of South Fork of Shoshone River at Marquette, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 8	J. H. Sloan	83	143	1.65	366
April 12	G. F. Harley	79	114	1.33	199
April 14	do	77	108	1.22	169
April 17	do	95	141	1.72	336
April 21	do	135	184	2.21	583
May 9	do	135	197	2.34	628
May 12	do	138	270	2.89	1,210
May 29	do	139	306	3.14	1,530
June 11	do	139	359	3.58	2,120
October 17	do	89	65	.96	101

Daily gage height, in feet, of South Fork of Shoshone River at Marquette, Wyo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.51	2.46	3.50	2.30	1.90	1.05	1.20
2	.....	1.63	2.52	3.80	2.25	1.70	1.00	1.20
3	.....	1.62	2.78	3.60	2.05	1.70	1.00	1.20
4	1.05	1.98	2.95	3.60	2.50	1.50	1.00	1.20
5	1.15	1.77	3.08	3.60	2.15	1.55	1.00	1.20
6	1.20	1.66	2.90	3.60	2.50	1.45	.95	1.15
7	1.45	1.63	3.15	3.40	2.45	1.40	.95	1.10
8	1.68	1.75	2.48	3.45	2.20	1.50	.95	1.20
9	1.50	2.35	2.48	3.25	2.15	1.40	1.25	1.20
10	1.40	2.78	2.94	3.50	2.10	1.45	1.30	1.30
11	1.30	2.95	3.69	3.40	2.00	1.50	1.00	1.30
12	1.34	3.02	4.20	3.60	2.00	1.40	1.00	1.30
13	1.22	4.22	5.10	3.70	1.90	1.40	1.00	1.30
14	1.22	3.10	4.20	3.60	1.90	1.35	.95	1.35
15	1.32	2.89	3.55	3.60	1.90	1.40	.95	1.50
16	1.52	2.54	4.00	3.45	1.80	1.35	.95	1.50
17	1.72	2.22	3.60	3.50	1.65	1.40	.95	1.50
18	1.63	2.12	3.20	3.45	1.65	1.30	.95	.....
19	1.52	2.18	2.85	3.10	2.00	1.30	1.10	.....
20	1.72	2.70	2.60	3.00	3.00	1.30	1.10	.....
21	2.21	2.80	2.72	3.00	2.30	1.30	1.00	.....
22	2.55	2.52	3.00	3.10	2.90	1.30	1.10	.....
23	2.60	2.60	2.65	3.10	2.60	1.25	1.00	.....
24	2.25	3.42	2.35	2.90	2.50	1.25	1.15	.....
25	1.95	3.10	2.35	2.90	2.20	1.20	1.00	.....
26	1.80	3.20	2.70	2.70	2.10	1.20	1.15	.....
27	1.56	2.89	3.10	2.70	1.90	1.20	1.20	.....
28	1.58	2.85	3.10	2.50	1.90	1.10	1.20	.....
29	1.68	3.20	2.65	2.50	1.80	1.10	1.25	.....
30	1.60	2.80	2.55	2.40	1.80	1.05	1.20	.....
31	.....	2.62	.....	2.35	1.80	.....	1.20	.....

NOTE.—From November 17 to December 31 the river was gorged with ice. Gage heights interpolated June 18–19.

Rating table for South Fork of Shoshone River at Marquette, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	95	1.90	413	2.90	1,220	3.90	2,590
1.00	115	2.00	463	3.00	1,340	4.00	2,740
1.10	137	2.10	518	3.10	1,460	4.20	3,060
1.20	161	2.20	578	3.20	1,590	4.40	3,380
1.30	188	2.30	648	3.30	1,720	4.60	3,710
1.40	218	2.40	723	3.40	1,860	4.80	4,050
1.50	251	2.50	808	3.50	2,000	5.00	4,390
1.60	287	2.60	900	3.60	2,140		
1.70	326	2.70	1,000	3.70	2,290		
1.80	368	2.80	1,110	3.80	2,440		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1906 and is well defined between gage heights 1 foot and 4 feet.

Monthly discharge of South Fork of Shoshone River at Marquette, Wyo., for 1906.

[Drainage area, 500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (4-30)	900	126	325	17,400	0.650	0.65
May	3,090	255	971	59,700	1.94	2.24
June	4,560	686	1,500	89,300	3.00	3.35
July	2,440	686	1,660	102,000	3.32	3.85
August	1,340	306	577	35,500	1.15	1.33
September	413	126	215	12,800	.430	.48
October	188	105	129	7,930	.258	.30
November			[a] 127	7,560	.254	.28
December			[a] 106	6,520	.212	.24
The year				339,000		

[a] The flow during the frozen period has been estimated from that at Cody, where practically open-channel conditions exist.

NOTE.—Values are rated as follows: April to October, excellent; November and December, good.

PINEY CREEK AT KEARNEY, WYO.

This station was established September 6, 1902, and was discontinued June 30, 1906. It was located at the highway bridge about 100 yards south of the Kearney post-office, at the crossing of the stage road from Buffalo to Sheridan, on the water front of the Geier ranch. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 117, where are given also references to publications that contain data for previous years.

Discharge measurements of Piney Creek at Kearney, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	J. H. Sloan	40	72	1.52	61
June 16	R. H. Whinery	47	95	2.33	273

Daily gage height, in feet, of Piney Creek at Kearney, Wyo., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1		1.82	2.24	17	1.47	2.49	2.09
2		1.72	2.17	18	1.52	2.37	1.97
3		1.72	2.17	19	1.52	2.32	1.82
4		1.92	2.29	20	1.57	2.57	1.69
5		1.92	2.49	21	1.67	2.79	1.39
6		1.72	2.89	22	1.77	2.67	1.22
7		1.67	2.39	23	1.87	2.67	1.14
8		1.47	2.19	24	1.97	2.82	1.09
9		1.67	2.12	25	1.92	2.97	.94
10	1.52	1.77	2.09	26	1.92	2.64	.84
11	1.47	1.97	2.52	27	1.87	2.59	.97
12	1.42	2.27	2.54	28	1.87	2.84	1.09
13	1.37	2.82	2.74	29	1.92	2.94	1.04
14	1.32	2.82	2.67	30	1.87	2.47	1.12
15	1.32	2.69	2.34	31		2.34	
16	1.42	2.77	2.22				

Rating table for Piney Creek at Kearney, Wyo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	8	1.40	52	2.00	162	2.60	400
0.90	12	1.50	64	2.10	192	2.70	460
1.00	17	1.60	78	2.20	225	2.80	525
1.10	24	1.70	94	2.30	262	2.90	595
1.20	32	1.80	113	2.40	302	3.00	675
1.30	41	1.90	136	2.50	347		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1905 and 1906, and is well defined between gage heights 1.1 feet and 3 feet.

Monthly discharge of Piney Creek at Kearney, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (10-30)	154	43	91.8	3,820
May	651	60	322	19,800
June	588	10	191	11,400
The period				35,000

NOTE.—Values for 1906 are probably excellent.

MISCELLANEOUS MEASUREMENT.

On June 7, 1906, Cooley Creek was measured at Lavina, Mont.; the estimated discharge was 35 second-feet.

LITTLE MISSOURI RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Little Missouri rises in the central part of Crook County, in northeastern Wyoming, flows northeastward, crossing the southeast corner of Montana and the northwest corner of South Dakota and empties into the Missouri in North Dakota, in the Fort Berthold Indian Reservation. The stream receives numerous small tributaries, most of which are dry for the greater part of the year. The main floods occur during March, May, June, and July. During the rainy season some water is diverted from the tributaries, and a small quantity is stored for irrigation. The data collected in this basin are valuable for irrigation purposes.

LITTLE MISSOURI RIVER AT ALZADA, MONT.

This station was established April 3, 1904, at the highway bridge one-half mile northeast of Alzada. April 17, 1906, the station was moved to a footbridge just back of Mr. King's house in Alzada.

The channel is straight for 200 feet above and 150 feet below the gage. Both banks are high, but are liable to overflow at extreme high water. The bed of the stream is composed of silt, sand, and gravel, and is fairly permanent. The current is moderately swift,

except at low water. There is but one channel at all stages. Willows and brush on the banks tend to retard the flow during high water.

Discharge measurements are made at high stages from the footbridge. The initial point for sounding is the 10-foot mark on the gage. Low-water measurements are made by wading 200 feet below the gage.

The gage, which was read during 1906 once each day by Miss Essie King, is an inclined timber spiked to posts driven firmly into the bank of the stream. The bench mark is a spike driven in a large cottonwood tree at the west end of the footbridge; elevation, 14.97 feet above the gage datum.

Discharge measurements of Little Missouri River at Alzada, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	H. D. Comstock	24	23	3.05	37
May 15	J. E. Stewart	19	9	2.54	10
November 13	do			2.25	[a] 2

[a] Estimated.

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Little Missouri River at Alzada, Mont., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1			5.6	3.7	2.3	2.2	2.5	2.2	2.2
2			11.5	3.0	2.3	2.2	2.2	2.2	2.2
3			12.85	2.2	2.3	2.2	2.2	2.2	2.2
4			7.0	2.3	2.2	2.2	2.2	2.2	2.2
5			3.85	2.4	2.2	2.2	2.2	2.2	2.2
6			3.5	2.2	2.2	2.2	2.2	2.2	2.2
7			3.0	2.2	2.2	4.0	2.2	2.2	2.2
8			3.0	2.3	2.2	5.4	2.2	2.2	2.2
9			2.9	2.3	2.2	5.3	2.2	2.2	2.2
10			2.7	4.8	2.2	4.0	2.2	2.2	2.2
11	9.4		2.7	3.8	2.2	3.0	2.2	2.2	2.2
12	11.0		2.7	3.1	4.3	2.6	2.2	2.2	2.2
13	14.0		2.7	2.6	2.5	2.2	2.2	2.2	2.2
14	9.0		2.7	2.1	2.3	2.2	2.2	2.2	2.2
15	7.0		2.5	2.0	2.2	2.0	2.2	2.2	2.2
16	5.0		2.5	2.0	2.2	2.0	2.2	2.2	2.2
17	4.3	3.1	2.5	5.0	2.2	2.0	2.2	2.2	2.2
18	3.0	3.8	2.5	4.3	2.2	2.0	2.2	2.2	2.2
19	3.0	2.7	2.4	2.9	2.2	2.0	2.2	2.2	2.2
20	2.6	2.6	2.4	2.5	2.2	2.0	2.2	2.2	2.2
21	2.6	2.6	2.4	2.4	2.2	8.0	2.2	2.2	2.2
22	2.4	2.6	2.5	2.3	2.2	9.5	2.2	2.2	2.2
23	2.4	2.5	2.5	2.3	2.2	10.0	2.2	2.2	2.2
24	2.4	2.5	4.0	2.3	2.2	3.0	2.2	2.2	2.2
25	4.0	2.5	12.0	2.3	2.2	2.0	2.2	2.2	2.2
26	14.0	2.5	10.7	2.3	2.2	4.0	2.2	2.2	2.2
27	17.5	2.5	7.0	2.3	2.2	4.0	2.2	2.2	2.2
28	12.5	2.4	7.0	2.3	2.2	3.5	2.2	2.2	2.2
29	8.0	2.5	6.35	2.3	2.2	2.7	2.2	2.2	2.2
30	7.0	2.7	5.15	2.3	2.2	2.5	2.2	2.2	2.2
31	5.0		4.55		2.2	2.5		2.2	

NOTE.—Gage heights for March refer to the original station. For the remainder of the year the gage heights refer to the new station.

LITTLE MISSOURI RIVER AT CAMP CROOK, S. DAK.

This station was established September 2, 1903. It is located at the old highway bridge on the road from Camp Crook to Bellefourche, about one-half mile from Camp Crook in T. 18 N., R. 1 E. The conditions at this station are described in Water-Supply Paper No. 172, page 123, where are given also references to publications that contain data for previous years.

High-water measurements are made from the downstream side of the new highway bridge; low-water measurements are made by wading near the bridge.

A standard chain gage was established April 14, 1906. It is bolted to the hand rail on the upstream side of the bridge; length of chain, 19.20 feet, and elevation of center of pulley, 18.32 feet. The bench mark is a spike driven in a cottonwood tree 50 feet southeast of the south end of the bridge; elevation, 9.47 feet above the gage datum.

Discharge measurements of Little Missouri River at Camp Crook, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	Comstock and Stewart	126	195	1.90	432
April 15	do	134	407	3.67	1,300
April 15	do	134	415	3.98	1,380
May 15	J. E. Stewart	[a] 76	[a] 56	.65	57
November 14	do	[a] 24	[a] 12	.26	9.2

[a] Wading section.

Daily gage height, in feet, of Little Missouri River at Camp Crook, S. Dak., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3.2	0.6	1.9	0.5	0.2	3.0	0.3	0.3
2	3.0	.6	1.5	.5	.3	2.8	.3	.3
3	2.8	3.3	1.1	.4	.5	2.4	.3	.3
4	2.6	4.0	1.0	.4	.9	2.0	.3	.25
5	2.0	4.0	.9	.4	.8	1.2	.3	.25
6	1.6	4.0	2.4	.4	.7	.7	.3	.25
7	1.2	2.1	3.5	.4	.5	.6	.3	.25
8	1.2	1.1	4.9	.4	.9	.4	.3	.25
9	1.6	1.0	2.2	.3	1.0	.4	.3	.25
10	2.0	1.0	2.5	.3	1.7	.4	.3	.25
11	2.6	1.0	2.6	.3	1.8	.4	.3	.2
12	3.0	.9	1.6	.3	1.7	.4	.3	.2
13	2.6	.9	1.0	.3	1.0	.5	.3	.2
14	1.9	.8	.8	.3	.7	.5	.3	.2
15	3.8	.8	.7	.4	.5	.6	.3	.2
16	3.9	.8	.7	.4	.5	.8	.3	.2
17	2.9	.7	.6	.5	.5	.6	.3	.2
18	1.1	.6	.8	.6	.4	.6	.3	.2
19	2.9	.6	1.1	.5	.4	.4	.3	.2
20	2.8	.6	1.7	.4	.4	.4	.3	.2
21	2.8	.5	1.0	.4	.5	.4	.3	.2
22	2.7	.5	.8	.4	4.1	.4	.3	.2
23	2.6	.4	.7	.4	4.4	.4	.3	.2
24	1.3	.5	.6	.4	4.5	.3	.3	.2
25	.9	.6	.6	.3	4.4	.3	.3	.2
26	.5	4.6	.5	.3	4.3	.3	.3	.2
27	.5	5.9	.6	.3	4.2	.3	.3	.2
28	.5	6.2	.5	.25	4.1	.3	.3	.2
29	.5	6.8	.5	.2	3.5	.3	.3	.2
30	.5	3.0	.5	.2	3.3	.3	.3	.2
31	.....	2.8	.....	.2	3.2	.....	.3	.....

Rating table for Little Missouri River at Camp Crook, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	6	1.20	187	2.20	548	3.40	1,108
.30	13	1.30	218	2.30	590	3.60	1,212
.40	22	1.40	250	2.40	633	3.80	1,317
.50	34	1.50	284	2.50	677	4.00	1,424
.60	48	1.60	319	2.60	722	4.20	1,533
.70	65	1.70	355	2.70	768	4.40	1,644
.80	85	1.80	392	2.80	815	4.60	1,756
.90	107	1.90	430	2.90	862	4.80	1,868
1.00	131	2.00	468	3.00	910		
1.10	158	2.10	507	3.20	1,007		

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906 and is fairly well defined. Above gage height 4.3 the rating curve is a tangent, the difference being 56 per tenth.

Monthly discharge of Little Missouri River at Camp Crook, S. Dak., for 1906.

[Drainage area, 1,900 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,370	34	546	32,500	0.287	0.32
May	2,990	22	611	37,600	.322	.37
June	1,920	34	288	17,100	.152	.17
July	34	6	19.8	1,220	.010	.01
August	1,700	6	537	33,000	.283	.33
September	910	13	124	7,380	.065	.07
October	13	13	13.0	799	.0068	.008
November	13	6	7.6	452	.0040	.004
The period				130,000		

NOTE.—Values are rated as follows: April to June, August, and September, good; July, fair; October and November, approximate.

LITTLE MISSOURI RIVER AT MEDORA, N. DAK.

This station was established May 12, 1903. It is located at the Northern Pacific Railway bridge, one-third mile west of the railroad station at Medora, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 125, where are given also references to publications that contain data for previous years.

Discharge measurements of Little Missouri River at Medora, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	E. F. Chandler	89	269	4.77	584
August 29	do	196	733	7.54	3,290
August 30	do	189	542	6.59	2,030
August 31	do	161	412	6.01	1,230
October 12	R. Richards	[a] 38	[a] 22	3.33	33.7

[a] Wading section.

Daily gage height, in feet, of Little Missouri River at Medora, N. Dak., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.2	8.0	4.0	7.5	4.3	3.5	5.6	3.45	3.3
2	.....	5.0	6.8	4.2	7.0	4.3	3.5	5.2	3.45	3.4
3	.....	4.2	6.2	4.3	5.7	4.2	6.4	5.0	3.4	3.4
4	.....	4.0	6.6	4.3	5.7	4.3	5.0	4.8	3.4	3.4
5	.....	4.0	6.2	4.2	6.0	4.2	5.1	4.6	3.4	3.4
6	.....	4.0	5.7	4.1	7.4	4.1	5.0	4.4	3.3	3.4
7	.....	7.5	5.3	4.6	7.0	4.0	5.1	4.3	3.3	3.4
8	.....	5.6	5.1	6.0	12.0	4.0	5.0	4.2	3.3	3.4
9	.....	5.0	5.0	5.8	10.4	3.9	4.9	4.0	3.2	3.4
10	.....	4.2	5.0	5.4	9.7	3.9	4.8	3.9	3.2	3.4
11	.....	4.0	4.9	5.0	8.7	3.8	4.5	3.8	3.2	3.4
12	.....	4.0	5.3	4.8	7.0	3.7	4.4	3.7	3.2	3.4
13	.....	4.0	6.1	4.9	6.6	3.7	4.2	3.6	3.2	3.4
14	.....	4.0	5.5	5.0	5.7	3.7	4.0	5.0	3.2	3.4
15	.....	4.0	5.0	5.7	5.5	3.7	3.8	6.2	3.2	3.4
16	.....	4.0	4.8	5.6	5.2	3.7	3.7	6.0	3.2	3.4
17	2.8	4.0	4.5	5.5	5.2	3.7	3.6	5.7	3.2	3.4
18	3.0	4.0	6.0	5.0	5.2	3.6	3.6	5.3	3.2	.....
19	3.2	7.6	5.6	4.8	5.1	3.6	3.6	4.8	3.2	.....
20	3.4	7.0	5.0	4.6	4.8	3.6	3.7	4.3	3.2	.....
21	3.8	7.0	4.7	4.5	4.7	3.6	3.8	4.0	3.2	.....
22	4.0	7.0	4.3	4.4	4.6	3.6	3.9	3.7	3.2	.....
23	4.6	7.0	4.2	4.6	4.7	3.6	4.0	3.6	3.2	.....
24	4.0	7.6	4.0	4.7	4.7	3.5	4.2	3.6	3.2	.....
25	3.6	6.0	3.9	5.0	4.7	3.5	4.8	3.6	3.2	.....
26	4.9	5.8	3.9	5.8	4.6	3.5	6.0	3.5	3.3	.....
27	4.0	6.0	3.8	7.0	4.5	3.5	8.3	3.5	3.3	.....
28	4.0	5.8	3.8	5.9	4.4	3.6	8.0	3.5	3.3	.....
29	.....	5.0	3.7	6.6	4.5	3.6	7.4	3.45	3.3	.....
30	.....	4.6	3.8	8.1	4.3	3.5	6.8	3.45	3.3	.....
31	.....	10.0	.....	8.2	.....	3.5	6.0	.....	3.3	.....

NOTE.—Ice conditions January 1 to March 22; also November 18 to December 31.

Rating table for Little Missouri River at Medora, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	15	4.40	418	5.60	1,060	7.60	3,280
3.30	29	4.50	460	5.70	1,135	7.80	3,580
3.40	54	4.60	503	5.80	1,215	8.00	3,890
3.50	85	4.70	547	5.90	1,295	8.20	4,210
3.60	118	4.80	592	6.00	1,380	8.40	4,530
3.70	152	4.90	639	6.20	1,565	8.60	4,850
3.80	187	5.00	688	6.40	1,770	8.80	5,170
3.90	223	5.10	740	6.60	1,990	9.00	5,500
4.00	260	5.20	795	6.80	2,220	10.00	7,200
4.10	298	5.30	855	7.00	2,470	11.00	8,900
4.20	337	5.40	920	7.20	2,730	12.00	10,600
4.30	377	5.50	990	7.40	3,000		

NOTE.—The above table is applicable only for open-channel conditions. It is based on fifteen discharge measurements made during 1905–6 and is well defined up to 9 feet gage height.

Monthly discharge of Little Missouri River at Medora, N. Dak., for 1906.

[Drainage area, 5,780 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (23–31)	7,200	503	2,150	38,400	0.372	0.12
April	3,890	152	894	53,200	.155	.17
May	4,210	260	1,010	62,100	.175	.20
June	10,600	377	2,000	119,000	.346	.39
July	377	85	181	11,100	.031	.04
August	4,370	85	867	53,300	.150	.17
September	1,560	69	449	26,700	.078	.09
October	69	15	26.3	1,620	.0046	.01
November (1–17)	54	29	52.5	1,770	.0091	.01
The period	.....	.....	.....	367,000	.....	.....

NOTE.—Values are rated as follows: March to September, probably good; October, approximate on account of low stage and erroneous gage heights; November, fair.

KNIFE RIVER DRAINAGE BASIN.

KNIFE RIVER AT BRONCHO, N. DAK.

This station was established May 29, 1903. Its first location was at a point about 600 feet east of H. M. Haven's ranch house, where the Broncho post-office was situated at that time, and about 23 miles north of Hebron, N. Dak., on the Northern Pacific Railway. Owing to the abandonment of the Haven ranch and the removal of the post-office to the house of F. M. Smith, in the SE. ¼ sec. 4, T. 142, R. 90 W., about 3 miles up the valley, the location was abandoned and a new station was established at the ranch of Mr. Smith on March 23, 1905. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 128, where are given also references to publications that contain data for previous years. The data collected are valuable for irrigation purposes.

Discharge measurements of Knife River at Broncho, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	E. F. Chandler	34	97	4.08	35.4
April 12 [a]	do	13	11	4.08	39.0
August 27	do	[b] 17	[b] 28	3.87	13.5

[a] Made 3 miles above gage. [b] Wading section.

Daily gage height, in feet, of Knife River at Broncho, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		9.55	3.55	11.25	11.95	3.75	3.85	3.6	3.6
2		8.2	3.55	9.05	6.15	3.8	3.8	3.6	3.6
3		6.7	3.55	6.15	4.95	3.85	3.8	3.55	3.6
4		5.55	3.55	4.95	4.65	3.85	3.8	3.5	3.6
5		5.25	3.5	4.65	4.45	3.95	3.8	3.5	3.6
6		4.85	3.55	7.75	4.4	3.9	3.75	3.55	3.6
7		4.35	3.55	9.0	4.3	3.85	3.75	3.6	3.6
8		4.45	3.55	11.65	4.15	3.95	3.7	3.6	3.6
9		4.35	3.45	13.6	4.15	4.05	3.7	3.6	3.6
10		4.25	3.45	14.45	4.15	4.0	3.7	3.6	3.6
11		4.15	3.45	13.9	4.15	3.95	3.7	3.6	3.6
12		4.05	3.45	11.3	4.05	3.95	3.75	3.6	3.6
13		3.95	3.45	6.75	4.05	3.85	3.7	3.6	3.6
14		3.95	3.65	6.15	3.95	3.85	3.7	3.6	3.6
15		3.85	5.55	5.2	4.05	3.85	3.7	3.6	3.6
16		3.85	5.75	4.75	4.05	3.9	3.7	3.6	3.6
17		3.75	4.85	6.75	4.05	3.95	3.7	3.6	.....
18		3.75	5.85	10.5	4.0	3.9	3.7	3.6	.....
19		3.7	5.85	9.0	3.95	3.85	3.7	3.6	.....
20		3.65	4.7	6.95	3.95	3.9	3.7	3.6	.....
21		3.65	4.65	5.45	3.95	3.95	3.7	3.6	.....
22		3.65	4.4	4.65	3.85	3.95	3.7	3.6	.....
23		3.6	4.25	4.45	3.95	3.9	3.7	3.6	.....
24		3.55	4.15	4.35	3.95	3.85	3.7	3.6	.....
25		3.55	7.5	4.25	3.9	3.85	3.65	3.6	.....
26		3.55	14.05	4.25	3.85	3.85	3.6	3.6	.....
27	5.95	3.55	14.4	4.2	3.75	3.85	3.6	3.6	.....
28	7.0	3.55	10.15	4.15	3.85	3.9	3.6	3.6	.....
29	8.1	3.55	7.7	7.85	3.75	3.9	3.6	3.6	.....
30	9.75	3.55	9.95	12.9	3.75	3.9	3.6	3.6	.....
31	9.55	.....	13.25	.....	3.75	3.85	.....	3.6	.....

NOTE.—Ice conditions January 1 to March 26, also November 17 to December 31.

HEART RIVER DRAINAGE BASIN.

HEART RIVER NEAR RICHARDTON, N. DAK.

This station was established May 18, 1903. It is located at the iron highway bridge 10 miles south of the Northern Pacific Railway station at Richardton, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 130, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for irrigation purposes.

Discharge measurements of Heart River near Richardton, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	E. F. Chandler	64	61	5.05	38.4
August 29	do	[a] 18	[a] 12	4.50	18.2

[a] Wading section.

Daily gage height, in feet, of Heart River, near Richardton, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8.8	4.4	14.45	4.6	4.5	4.5	4.2	4.3
2	.....	7.7	4.4	10.55	4.7	4.4	4.5	4.2	4.3
3	.....	7.0	4.4	8.3	4.6	4.8	4.5	4.2	4.3
4	.....	6.7	4.4	6.9	4.7	4.7	4.5	4.2	4.3
5	6.3	6.2	4.4	6.4	4.6	4.7	4.4	4.2	4.3
6	6.1	5.7	4.4	6.0	4.7	4.6	4.4	4.2	4.3
7	6.0	5.5	4.4	7.7	4.6	4.7	4.4	4.2	4.3
8	5.9	5.5	4.4	16.4	4.7	4.5	4.3	4.2	4.3
9	5.7	5.4	4.4	21.0	4.7	4.6	4.3	4.2	4.3
10	5.6	5.3	4.4	25.9	4.8	4.5	4.3	4.2	4.3
11	.....	5.1	4.4	19.6	4.7	4.6	4.3	4.2	4.3
12	.....	5.1	4.4	11.4	4.8	4.5	4.3	4.2	4.3
13	.....	5.0	4.5	8.9	4.7	4.6	4.3	4.2	4.4
14	.....	5.0	4.6	8.5	4.8	4.5	4.3	4.2	4.4
15	.....	4.9	4.9	8.4	4.7	4.6	4.3	4.2	4.4
16	.....	4.8	5.2	8.1	4.8	4.5	4.3	4.2	4.4
17	.....	4.8	5.1	7.7	4.7	4.6	4.3	4.2	.....
18	.....	4.7	5.3	7.2	4.8	4.5	4.3	4.2	.....
19	.....	4.7	5.1	6.6	4.7	4.6	4.3	4.2	.....
20	.....	4.7	5.2	6.3	4.7	4.5	4.3	4.2	.....
21	.....	4.7	5.4	5.9	4.6	4.6	4.3	4.2	.....
22	.....	4.6	5.2	5.9	4.7	4.5	4.3	4.2	.....
23	.....	4.6	5.1	5.7	4.6	4.6	4.3	4.2	.....
24	.....	4.6	5.2	5.6	4.7	4.5	4.3	4.2	.....
25	.....	4.5	6.05	5.3	4.5	4.6	4.2	4.2	.....
26	6.9	4.5	9.8	5.2	4.6	4.5	4.2	4.2	.....
27	7.1	4.4	12.4	4.9	4.4	4.6	4.2	4.2	.....
28	7.2	4.4	11.75	4.9	4.5	4.5	4.2	4.2	.....
29	7.3	4.4	9.15	4.7	4.4	4.5	4.2	4.3	.....
30	9.25	4.4	9.4	4.7	4.5	4.5	4.2	4.3	.....
31	9.3	.....	12.75	.....	4.4	4.5	.....	4.3	.....

NOTE.—Ice conditions January 1 to March 25 and November 17 to December 31. Ice thickness increased from 2 feet January 25 to 2.6 feet February 28.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements of Heart River have been made at Mandan, N. Dak.:

Miscellaneous discharge measurements of Heart River at Mandan, N. Dak.

	Discharge in sec.-ft.
1904.	
August 3	23
September 28	11
October 26	13
1905.	
March 26	69
July 1	110
August 3	96
October 15	12
1906.	
April 8	416
August 26	59
September 13	34

CANNON BALL RIVER DRAINAGE BASIN.

CANNON BALL RIVER AT STEVENSON, N. DAK.

This station was established June 10, 1903. It is located one-half mile west northwest of the post-office at Stevenson, in sec. 20, T. 133 N., R. 82 W., and about 40 miles south of Mandan, N. Dak.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 134, where are given also references to publications that contain data for previous years. The length of the chain is now 21.43 feet. The data collected are valuable for irrigation purposes.

Discharge measurements of Cannon Ball River at Stevenson, N. Dak., 1903–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 10	F. E. Weymouth	64	89	3.10	75
July 10	E. F. Chandler	20	23	2.62	11.4
July 11	F. E. Weymouth	22	26	2.63	12.0
July 23	E. F. Chandler	30	43	3.10	56
July 24	do	19	26	2.83	19.4
July 26	do		13	2.71	7.5
October 23	do		102	3.10	[a] 35
1904.					
April 10	E. F. Chandler	158	686	7.18	2,370
July 4	Chandler and Richards	104	156	3.24	72
August 1	E. F. Chandler	37	30	2.65	6.0
August 1	R. Richards	34	21	2.64	5.2
October 25	L. L. Wilcox	7	3.8	2.58	3.5
1905.					
March 28	E. F. Chandler	114	168	3.56	99
June 29	do	40	56	3.45	123
June 30	do	68	132	3.49	114
August 3	R. Richards	68	120	3.52	102
August 28	do	38	32	2.88	20
August 29	do	34	21	2.85	19
October 17	E. F. Chandler	14	10	2.61	4.8
1906.					
April 9	E. F. Chandler	110	288	4.48	393
August 23	do	40	43	3.14	49.6
August 24	do	39	41	3.09	42.2
September 14	do	36	37	2.92	26.6

[a] Meter in poor adjustment.

NOTE.—The low-water measurements were made at different sections.

Daily gage height, in feet, of Cannon Ball River at Stevenson, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8.7	3.3	6.0	2.9	3.3	2.9	3.2	1.8
2	.....	7.7	3.3	5.6	2.6	3.5	3.3	3.2	1.8
3	.....	9.2	3.2	5.9	2.7	3.6	3.3	3.2	1.9
4	.....	5.6	3.1	6.6	2.5	3.6	3.2	3.0	1.8
5	.....	4.9	3.1	8.3	2.5	3.5	3.2	3.0	1.8
6	.....	4.6	3.0	10.2	2.3	3.3	3.1	2.9	1.9
7	.....	4.6	3.0	10.5	2.3	3.3	3.0	2.9	1.9
8	.....	4.6	2.9	9.7	2.7	3.1	2.9	2.8	1.9
9	.....	4.6	3.0	9.2	2.7	2.9	2.9	2.8	1.8
10	.....	4.65	3.1	8.9	2.5	2.9	3.0	2.8	1.8
11	.....	4.4	3.2	8.9	2.4	2.9	3.0	2.7	3.0
12	.....	4.0	3.2	9.9	2.6	2.9	3.2	2.7	3.0
13	.....	3.9	3.2	9.7	2.6	2.7	3.3	2.7	1.9
14	.....	3.85	3.4	9.1	2.5	2.7	3.2	2.7	1.9
15	.....	3.8	4.0	8.2	3.7	2.6	3.2	2.6	1.9
16	.....	3.75	4.5	7.3	3.7	2.6	3.1	2.6	1.9
17	.....	3.8	4.9	6.7	3.8	2.6	3.0	2.4	3.0
18	.....	3.6	4.9	6.7	3.7	2.6	3.0	2.4	3.2
19	6.5	3.6	5.0	6.2	3.5	3.2	3.1	2.2	3.2
20	.....	3.55	5.0	5.7	3.5	3.2	3.1	2.2	2.9
21	.....	3.4	5.0	5.3	3.5	3.0	3.0	2.1	2.9
22	.....	3.4	4.9	5.2	3.4	3.0	3.0	2.0	2.8
23	.....	3.4	4.3	5.2	3.4	3.1	2.8	2.1	2.9
24	.....	3.2	5.4	4.6	3.3	3.1	2.8	2.1	2.9
25	.....	3.2	6.3	4.2	3.3	3.1	2.7	2.0	.....
26	.....	3.15	6.4	4.2	3.2	3.2	2.7	2.0	.....
27	.....	3.1	7.3	3.9	3.1	3.3	2.9	1.9	.....
28	.....	3.2	7.6	3.9	3.0	3.2	2.9	1.9	.....
29	8.2	3.3	7.2	3.6	3.0	3.0	3.0	1.8	.....
30	.....	3.4	6.6	3.2	3.1	3.0	.....	1.8	.....
31	.....	.....	6.1	.....	3.1	2.9	.....	1.8	.....

NOTE.—Ice conditions, January 1 to March 31; thickness of ice increased from 0.7 foot, January 1, to 3.1 feet, March 8. Ice conditions, November 18 to December 31.

Rating tables for Cannon Ball River at Stevenson, N. Dak.

JUNE 10, 1903, TO JULY 15, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	3	2.70	14	3.20	63	3.70	153
2.30	4	2.80	20	3.30	77	3.80	178
2.40	6	2.90	28	3.40	92	3.90	206
2.50	8	3.00	38	3.50	110	4.00	236
2.60	11	3.10	50	3.60	130		

JULY 16, 1904, TO NOVEMBER 24, 1906.[b]

2.00	0	3.20	55	4.40	364	6.20	1,480
2.10	.5	3.30	69	4.50	400	6.40	1,660
2.20	1	3.40	86	4.60	440	6.60	1,840
2.30	2	3.50	106	4.70	485	6.80	2,020
2.40	3	3.60	128	4.80	530	7.00	2,200
2.50	4	3.70	152	4.90	580	7.20	2,400
2.60	5	3.80	178	5.00	635	7.40	2,600
2.70	9	3.90	206	5.20	750	7.60	2.800
2.80	16	4.00	236	5.40	870	7.80	3,000
2.90	24	4.10	266	5.60	1,010	8.00	3,200
3.00	33	4.20	298	5.80	1,150	9.00	4,250
3.10	43	4.30	330	6.00	1,310	10.00	5,350

[a] This table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1903 and is not well defined. Above 4 feet use the 1904-6 rating table.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-6 and is fairly well defined between gage heights 2.6 feet and 4.5 feet. Above 4.5 feet the rating curve is based on one measurement at 7.2 feet gage height.

Monthly discharge of Cannon Ball River at Stevenson, N. Dak., for 1903–1906.

[Drainage area, 3,650 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1903.						
June 10–30	62	14	33.2	1,380	0.0091	0.01
July	104	4	25.0	1,540	.0068	.10
August	1,930	12	331	20,400	.091	.01
September	1,010	4	189	11,200	.052	.06
October	50	9	21.5	1,320	.0059	.01
November 1–21	92	9	29.5	1,230	.0081	.01
The period				37,100		
1904.						
April 6–30	3,000	153	849	42,100	.233	.22
May	153	38	84.5	5,200	.023	.03
June	1,930	50	552	32,800	.151	.17
July	130	5	36.4	2,240	.010	.01
August	24	0	4.7	289	.0013	.002
September	9	0	3.4	202	.00093	.001
October	86	1.1	15.2	935	.0042	.005
November 1–29	24	3.0	11.0	633	.0030	.003
The period				84,400		
1905. [a]						
March	2,600	86	584	35,900	.160	.18
April	152	5	46.9	2,790	.013	.01
May	1,080	4	231	14,200	.063	.07
June	2,300	3	324	19,300	.089	.10
July	810	16	304	18,700	.083	.10
August	236	3	75.0	4,610	.021	.02
September	24	0	6.1	363	.0017	.002
October	24	0	6.9	424	.0019	.002
November 1–25	55	9	27.8	1,380	.0076	.007
The period				97,700		
1906. [b]						
April 3–30	1,010	43	236	12,600	.065	.07
May	2,800	24	656	40,300	.180	.21
June	5,900	55	2,300	137,000	.630	.703
July	178	2	51.6	3,170	.014	.02
August	128	5	46.0	2,830	.013	.02
September	69	9	37.7	2,240	.010	.01
October	55	0	12.3	756	.0034	.004
November 1–24	55	0	13.4	638	.0037	.003
The period				200,000		

[a] Values are rated as follows: March and May to August, good; April and September to November, fair.

[b] Values are rated as follows: April to August, good; September to November, fair.

GRAND RIVER DRAINAGE BASIN.

GRAND RIVER AT SEIM, S. DAK.

This station was established June 6, 1904. It is located just below the junction of North and South forks, about 800 feet east of the store at Seim. The gage was read during 1906 by Charles S. Wilson. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 135, where are given also references to publications that contain data for previous years. The data collected are valuable for irrigation purposes.

Discharge measurements of Grand River at Seim, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 22	J. E. Stewart	40	55	1.86	20
June 17	do	53	47	2.40	109
June 18	do		670	6.67	2,910
June 18	do		556	6.08	2,290
June 18	do		363	4.88	1,350

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Grand River at Seim, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		3.6	2.1	4.8	3.1	1.0	1.4	1.6
2		3.4	2.0	5.6	3.0	1.2	1.5	1.6
3		3.4	2.0	5.4	2.8	1.2	1.7	1.5
4		3.3	2.3	5.4	2.4	1.3	1.7	1.8
5		3.6	2.5	6.3	2.3	1.5	1.6	1.8
6		3.4	2.3	6.6	2.1	2.1	1.5	1.7
7	4.8	3.2	2.4	7.0	2.1	2.3	1.5	1.6
8	6.2	3.3	2.4	6.3	2.0	2.3	1.6	1.7
9	6.3	3.3	2.3	6.1	2.0	2.4	1.5	1.9
10	6.6	3.4	2.2	5.8	2.2	2.6	1.8	1.8
11		3.0	2.2	5.4	2.0	3.0	1.4	
12		3.2	2.1	5.6	1.8	2.8	1.7	
13		3.1	2.1	5.8	2.0	2.7	1.8	
14		3.1	2.0	6.2	2.0	2.4	1.8	
15		3.0	2.1	5.2	1.7	2.2	1.7	
16		3.1	2.1	2.4	1.8	2.1	1.6	
17		3.2	2.1	2.4	1.6	1.8	1.7	
18		3.1	2.0	5.9	1.8	1.6	1.9	
19		2.0	2.0	4.0	1.9	1.6	1.9	
20		1.8	2.0	5.6	1.6	1.8	1.6	
21		1.8	2.0	4.2	1.5	1.1	1.7	
22		1.9	2.0	3.4	1.5	1.9	1.8	
23		1.9	2.1	3.3	1.3	1.8	1.8	
24		2.0	3.1	3.8	1.3	1.1	1.7	
25		2.3	3.4	3.2	1.3	1.9	1.6	
26	5.8	2.4	4.1	3.0	1.2	1.6	1.8	
27	6.3	2.5	5.0	2.8	1.2	1.7	1.8	
28	5.2	2.5	5.0	2.6	1.2	1.8	1.8	
29	5.1	2.3	5.2	2.5	1.0	1.6	1.6	
30	4.6	2.0	5.3	2.3	1.0	1.5	1.4	
31	4.2		5.2		1.0	1.5		

Rating table for Grand River at Seim, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	0	2.60	156	3.80	620	5.00	1,440
1.50	1	2.70	182	3.90	681	5.20	1,587
1.60	3	2.80	210	4.00	745	5.40	1,735
1.70	7	2.90	239	4.10	810	5.60	1,887
1.80	16	3.00	270	4.20	876	5.80	2,046
1.90	26	3.10	304	4.30	944	6.00	2,210
2.00	38	3.20	340	4.40	1,013	6.20	2,380
2.10	53	3.30	379	4.50	1,084	6.40	2,550
2.20	70	3.40	420	4.60	1,155	6.60	2,720
2.30	89	3.50	466	4.70	1,226	6.80	2,890
2.40	110	3.60	514	4.80	1,297	7.00	3,060
2.50	132	3.70	565	4.90	1,368		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–6, and is well defined between gage heights 1.8 feet and 7 feet.

Monthly discharge of Grand River at Seim, S. Dak., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March (7-10; 26-31)	2,720	876	1,850	36,700
April	514	16	246	14,600
May	1,660	38	345	21,200
June	3,060	89	1,330	79,100
July	304	0	46.4	2,850
August	270	0	49.4	3,040
September	26	0	8.4	500
October (1-10)	26	1	9.8	194
The period				158,000

NOTE.—Values are somewhat uncertain, owing to approximate gage heights.

OWL RIVER DRAINAGE BASIN.[a]

OWL RIVER AT BIXBY, S. DAK.

This station was established June 4, 1904. It is located one-fourth mile southeast of Bixby, S. Dak., in T. 14 N., R. 13 E., about 1,000 feet below the ford. The gage was read during 1906 by John Beam. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 137, where are given also references to publications that contain data for previous years.

Discharge measurements of Owl River at Bixby, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 21	J. E. Stewart	26.6	15	1.41	9.7
June 19	do	108	512	6.65	2,320
June 20	do	89	304	4.45	1,040
June 20	do	86	273	4.09	807
June 20	do	83	219	3.47	550

Daily gage height, in feet, of Owl River at Bixby, S. Dak., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.5	4.6	1.7	1.3	1.3	1.2	1.2
2		3.3	4.1	1.6	1.2	1.3	1.2	1.2
3		4.1	3.5	1.6	1.2	1.3	1.2	1.2
4		3.5	2.8	1.6	1.2	1.3	1.2	1.2
5		3.1	2.4	1.5	1.2	1.3	1.2	1.2
6		2.8	3.1	1.5	1.2	1.3	1.2	1.3
7		2.4	2.7	1.5	1.2	1.3	1.2	1.3
8		2.1	2.8	1.4	1.2	1.3	1.2	1.4
9		1.7	2.8	1.4	1.2	1.3	1.2	1.4
10		1.4	3.4	1.4	1.2	1.3	1.2	1.3
11		1.4	3.2	1.4	1.4	1.3	1.2	1.3
12		1.3	3.2	1.4	1.4	1.3	1.2	1.3
13		1.3	2.8	1.3	1.3	1.3	1.2	1.3
14		1.8	2.6	1.3	1.3	1.3	1.2	1.3
15		2.1	2.2	1.4	1.2	1.4	1.2	1.3
16		2.1	1.6	1.4	1.2	1.5	1.2	1.2
17		2.4	1.5	1.3	1.2	1.5	1.2	1.4

[a] Called Moreau River in previous reports, but correct name decided to be Owl, by United States Board on Geographic Names.

Daily gage height, in feet, of Owl River at Bixby, S. Dak., for 1906—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
18	.....	2.4	5.8	1.3	1.2	1.5	1.2	1.4
19	.....	2.2	7.4	1.2	1.2	1.5	1.2	1.4
20	.....	2.1	4.05	1.2	1.2	1.4	1.2	1.4
21	.....	1.8	2.55	1.2	1.3	1.4	1.2	1.5
22	1.45	1.6	2.2	1.1	1.3	1.2	1.2	1.5
23	1.4	1.9	2.1	1.1	1.3	1.2	1.2	1.5
24	1.4	4.2	2.0	1.1	1.3	1.2	1.2	1.5
25	1.4	4.2	1.8	1.2	1.3	1.2	1.2	1.5
26	1.35	5.6	1.8	1.2	1.3	1.1	1.2	1.5
27	1.3	5.6	1.7	1.3	1.4	1.1	1.2	1.5
28	1.3	5.2	1.7	1.2	1.4	1.1	1.2	1.5
29	1.3	4.8	1.7	1.2	1.3	1.2	1.2	1.5
30	1.3	5.6	1.6	1.3	1.3	1.2	1.2	1.5
31	.....	4.8	.....	1.3	1.3	.....	1.2	.....

Rating table for Owl River at Bixby, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	0	2.10	111	3.00	365	3.90	743
1.30	3	2.20	133	3.10	402	4.00	791
1.40	9	2.30	156	3.20	440	4.10	843
1.50	16	2.40	180	3.30	479	4.20	898
1.60	26	2.50	205	3.40	519	4.30	954
1.70	38	2.60	233	3.50	561	4.40	1,012
1.80	53	2.70	263	3.60	605	4.50	1,070
1.90	70	2.80	295	3.70	650	4.60	1,128
2.00	90	2.90	329	3.80	696		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined between gage heights 1.35 feet and 7 feet. Above gage height 4.3 feet the rating curve is a tangent, the difference being 58 per tenth.

Monthly discharge of Owl River at Bixby, S. Dak., for 1906.

[Drainage area, 1,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (22–30)	12	3	6.3	112	0.0039	0.001
May	1,710	3	485	29,800	.303	.35
June	2,750	16	418	24,900	.261	.29
July	38	0	8.0	492	.0050	.006
August	9	0	2.3	141	.0014	.002
September	16	0	4.4	262	.0028	.003
October	0	0	0	0	.0000	.000
November	16	0	7.9	470	.0049	.005
The period	.....	.....	.....	56,200	.....	.....

NOTE.—Values are rated as follows: May and June, excellent; April and July to November, approximate.

CHEYENNE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Cheyenne River rises in the eastern part of Wyoming, flows eastward around the southern border of the Black Hills, turns to the northeast, and unites with the Missouri in the central part of South Dakota.

It drains a long narrow valley bordered by high table-lands and occasional low flats containing a few thousand acres each.

The principal tributaries are Beaver and Hat creeks, Fall River, Battle, Spring, Rapid, and Boxelder creeks, Belle Fourche River, and Sulphur Creek. The chief tributaries of the Belle Fourche are Redwater River and Whitewood Creek; Redwater River has one large tributary, Spearfish Creek.

The rainfall varies from 21 inches in the Black Hills region to 12 inches on the prairies. The main floods occur in March, May, June, and July. Many of the streams rising in the Black Hills are fed to a large extent by springs. Fall River, in particular, gets much of its water from hot springs and mineral springs.

The data collected in this basin are valuable for irrigation purposes.

CHEYENNE RIVER AT EDGEMONT, S. DAK.

This station was established June 19, 1903. It is located at the railway bridge, in the SE. ¼ sec. 36, T. 8 S., R. 2 E., 300 feet above the mouth of Cottonwood Creek.

The conditions[a] at this station and the bench marks are described in Water-Supply Paper No. 172, page 141, where are given also references to publications that contain data for previous years.

Discharge measurements of Cheyenne River at Edgemont, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	Comstock and Stewart	244	543	4.01	1,670
May 5	J. E. Stewart	214	261	3.11	555
May 28	do	230	588	4.43	1,920
May 29	do	237	706	5.14	2,440
May 31	do	203	357	3.57	927
September 5	do	[a] 30	[a] 17.3	1.72	25

[a] Wading section.

Daily gage height, in feet, of Cheyenne River at Edgemont, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.5	2.9	3.2	2.0	1.4	1.7	1.6	1.7
2		2.5	2.2	3.1	1.8	1.4	1.7	1.6	1.7
3		2.5	3.9	2.9	1.7	1.4	1.6	1.6	1.6
4		2.5	3.2	2.3	1.6	1.4	1.5	1.5	1.5
5		2.5	3.1	2.3	1.6	1.4	1.7	1.5	1.5
6		2.5	2.8	3.2	1.5	3.5	1.7	1.5	1.5
7		2.5	2.6	3.3	1.5	5.1	1.7	1.5	1.5
8		2.2	2.3	3.5	1.5	3.4	1.7	1.5	1.5
9		2.2	2.2	3.0	1.4	2.8	1.7	1.5	1.5
10		2.2	2.0	3.0	1.4	2.8	1.7	1.3	1.5
11	3.2	2.2	1.8	3.4	1.4	1.8	1.7	1.3	1.5
12	3.2	2.2	1.8	4.3	2.3	1.8	1.7	1.3	1.5
13	3.2	2.2	1.7	3.0	2.3	1.5	1.7	1.3	1.5
14	3.2	2.2	1.6	2.5	2.3	1.5	2.0	1.3	1.5
15	3.2	2.2	1.6	2.4	2.0	1.5	2.0	1.3	1.5

[a] New chain gage installed May 5, 1906; length of chain, 27.61 feet.

Daily gage height, in feet, of Cheyenne River at Edgemont, S. Dak., for 1906—Cont'd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	3.2	2.2	1.6	2.4	2.0	1.5	2.6	1.3	1.5
17	3.2	2.9	1.6	2.1	2.0	1.5	3.0	1.4	1.5
18	3.2	2.9	1.6	2.0	2.0	1.5	6.7	1.4	1.6
19	3.2	2.2	1.6	2.1	1.9	1.5	6.0	1.4	1.6
20	3.2	1.6	1.5	2.0	1.8	6.7	2.8	1.4	1.6
21	3.2	1.6	1.5	1.9	1.7	3.0	2.0	1.4	1.6
22	3.3	1.6	1.5	1.7	1.6	3.0	2.0	1.4	1.6
23	3.3	1.6	2.7	1.8	1.5	4.8	1.8	1.4	1.6
24	3.3	1.6	3.0	2.0	1.5	3.1	1.6	1.4	1.6
25	1.4	1.7	3.0	1.9	1.5	3.1	1.6	1.4	1.6
26	2.0	1.7	4.65	2.1	1.5	2.5	1.7	1.4	1.6
27	7.0	1.7	6.0	2.0	1.5	2.0	2.0	1.4	1.6
28	6.2	1.7	4.4	2.4	1.5	2.0	2.0	1.4	1.6
29	3.4	1.7	5.1	2.3	1.5	1.9	1.7	1.4	1.6
30	2.9	2.9	4.5	2.1	1.4	1.9	1.7	1.4	1.6
31	2.8	.....	3.75	.....	1.4	1.7	.....	1.4	.....

NOTE.—Ice conditions March 11-24; gage heights were to the top of ice. March 25 and 26 the gage height was uncertain.

Rating table for Cheyenne River at Edgemont, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	2	2.50	225	3.70	1,048	4.90	2,341
1.40	5	2.60	275	3.80	1,140	5.00	2,460
1.50	9	2.70	328	3.90	1,234	5.20	2,706
1.60	15	2.80	383	4.00	1,330	5.40	2,965
1.70	23	2.90	440	4.10	1,430	5.60	3,237
1.80	34	3.00	500	4.20	1,534	5.80	3,516
1.90	49	3.10	562	4.30	1,642	6.00	3,800
2.00	67	3.20	632	4.40	1,754	6.20	4,087
2.10	87	3.30	706	4.50	1,870	6.40	4,375
2.20	110	3.40	784	4.60	1,987	6.60	4,667
2.30	141	3.50	870	4.70	2,105	6.80	4,965
2.40	180	3.60	958	4.80	2,223		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1906 and the form of previous measurements, and is not very well defined. From March 27 to April 19 the table was applied indirectly.

Monthly discharge of Cheyenne River at Edgemont, S. Dak., for 1906.

[Drainage area, 7,350 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (27-31)	6,000	550	2,550	25,300	0.347	0.06
April	530	23	204	12,100	.028	.03
May	3,800	9	601	37,000	.082	.09
June	1,640	23	325	19,300	.044	.05
July	141	5	34.9	2,150	.0047	.005
August	4,820	5	477	29,300	.065	.07
September	4,820	9	353	21,000	.048	.05
October	15	2	5.8	357	.00079	.001
November	23	5	8.4	500	.0011	.001
The period	.....	.....	.....	147,000	.....	.....

NOTE.—Values are rated as follows: March and April, approximate; May, good; June to November, approximate on account of the changing conditions of flow at this station.

BEAVER CREEK NEAR EDGEMONT, S. DAK.

This station was established April 7, 1905. It is located at Anderson's ranch, about 16 miles northwest of Edgemont, S. Dak., and about 2 miles west of the Argentine water tank on the Chicago, Burlington and Quincy Railroad, just below the mouth of Pass Creek, in the S. ½ sec. 16, T. 7 S., R. 1 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 145.

Discharge measurements of Beaver Creek near Edgemont, S. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	H. D. Comstock	38	24	1.21	20
May 17	do	22	7.8	.85	4.6
June 14	do	28	14	1.24	23
June 17	do	24	9.6	.98	9.4
August 4	do	80	99	2.90	312
August 8	do	52	41	1.80	93
September 7	Stevens and Comstock	25	10.7	1.00	11.4
1906.					
May 6	J. E. Stewart	34	26.5	1.57	62.5
May 31	do	33.4	71.0	1.98	110
September 5	do	20	8.9	.88	6.4

Daily gage height, in feet, of Beaver Creek near Edgemont, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.1	1.2	2.6	1.1	0.55	0.9	1.	1.2
2		2.2	1.3	1.7	1.1	.55	.9	1.1	1.2
3		2.1	2.3	1.7	1.0	.5	.9	1.1	1.2
4		2.1	2.4	1.6	1.0	.5	.9	1.1	1.2
5		2.0	2.2	1.5	1.0	.5	.9	1.1	1.2
6		1.9	1.1	2.7	1.0	.5	.9	1.1	1.2
7		1.8	1.6	1.8	1.0	.5	.85	1.1	1.2
8		1.8	1.4	4.4	1.0	.6	.85	1.1	1.2
9		1.7	1.3	2.95	.9	.55	.8	1.1	1.2
10		1.6	1.2	3.1	.9	.5	.9	1.1	1.2
11		1.6	1.1	3.0	1.95	.5	.9	1.1	1.2
12		1.5	1.1	5.4	1.8	.45	1.0	1.1	1.2
13		1.5	1.1	2.8	1.2	.4	1.0	1.1	1.2
14		1.4	1.1	1.7	1.1	.6	1.0	1.1	1.2
15		1.3	1.05	1.5	1.0	.6	1.0	1.1	1.2
16		1.3	1.0	1.4	.9	.6	1.9	1.1	1.2
17		1.2	1.0	1.3	.85	.6	1.7	1.1	1.3
18		1.2	1.0	1.3	.8	.6	1.5	1.1	1.3
19		1.2	1.0	1.2	.8	.6	1.3	1.1	1.2
20		1.2	1.0	1.2	.8	1.5	1.2	1.1	1.2
21		1.2	1.2	1.2	.8	1.0	1.2	1.1	1.2
22		1.2	1.1	1.2	.75	1.0	1.2	1.1	1.2
23		1.2	2.65	1.15	.7	.9	1.2	1.1	1.2
24		1.2	1.6	1.5	.7	.9	1.1	1.1	1.1
25		1.2	3.3	1.2	.7	.9	1.1	1.1	1.1
26	10.1	1.2	3.75	1.1	.7	.9	1.1	1.1	1.1
27	6.6	1.1	4.0	1.2	.7	.9	1.1	1.1	1.1
28	5.6	1.0	2.8	2.0	.7	.8	1.1	1.1	1.2
29	3.8	1.0	4.1	1.2	.7	.8	1.1	1.1	1.2
30	3.4	1.1	2.4	1.2	.6	.8	1.1	1.2	1.2
31	3.0		2.0		.55	.9		1.2	

Rating table for Beaver Creek near Edgemont, S. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	1	1.70	73	2.90	313	4.20	675
.60	2	1.80	88	3.00	338	4.40	745
.70	3	1.90	106	3.10	363	4.60	815
.80	5	2.00	125	3.20	389	4.80	890
.90	7	2.10	144	3.30	415	5.00	970
1.00	10	2.20	163	3.40	442	6.00	1,370
1.10	15	2.30	183	3.50	470	7.00	1,820
1.20	22	2.40	203	3.60	498	8.00	2,320
1.30	30	2.50	223	3.70	527	9.00	2,870
1.40	39	2.60	244	3.80	556	10.00	3,470
1.50	48	2.70	266	3.90	585		
1.60	59	2.80	289	4.00	615		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1905–6 and is well defined between gage heights 0.8 foot and 3 feet.

Monthly discharge of Beaver Creek near Edgemont, S. Dak., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
April (7–30)	30	12	19.7	938
May	85	5	22.2	1,360
June	428	7	66.4	3,950
July	2,650	15	553	34,000
August	1,780	10	196	12,100
September	22	10	10.6	631
October	223	10	25.3	1,560
November	22	10	14.1	839
The period				55,400
1906.				
March (26–31)	3,530	338	1,290	15,400
April	163	10	55.3	3,290
May	645	10	131	8,060
June	1,130	15	155	9,220
July	116	1	13.4	824
August	48	0	4.9	301
September	106	5	18.8	1,120
October	22	15	15.5	953
November	30	15	21.6	1,290
The period				40,500

NOTE.—Values are rated as follows: April to June, August, October, 1905, April to June, September and November, 1906, excellent; July, 1905, March and August, 1906, fair; September and November, 1905, and July and October, 1906, good.

HAT CREEK NEAR EDGEMONT, S. DAK.

The gaging station was established April 8, 1905, 1 mile above the mouth. May 3, 1906, the station was moved to a point 2 miles above the mouth of the creek and 15 miles southeast of Edgemont, S. Dak., in the S. E. ¼ sec. 25, T. 9 S., R. 4 E.

The channel is straight for 200 feet above and 150 feet below the station. The right bank is high and clean and does not overflow; the left bank is medium high, sparsely wooded, and overflows at very high stages. The bed of the stream is composed of gravel, shale, and mud, and is fairly permanent. There is but one channel at all stages and the current is swift. The stream is frozen from about December 1 to March 10, and observations are discontinued during that period. Gage heights range from 1.5 to 11 feet.

Discharge measurements are made by wading 3 or 4 feet above the gage. The gage, which was read once each day by J. P. Kanten, consists of a 6-inch inclined pine pole spiked to posts driven firmly into the bank. The bench mark is a spike in a cottonwood tree opposite the gage and 25 feet from the water's edge; elevation, 11.16 feet above the zero of the gage.

Discharge measurements of Hat Creek near Edgemont, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 3	J. E. Stewart	45	8.8	2.76	158
May 30	do		281	4.87	1,120
June 1	do	30	35	2.61	113
September 4	do	17	10.8	2.07	13.1
September 4	do	14.8	6.3	2.07	12.4

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Hat Creek near Edgemont, S. Dak., for 1906.

Day.	May.	June.	July.	Day.	May.	June.	July.
1	2.8	2.6	2.3	17	1.8	2.1	.....
2	2.3	2.4	2.3	18	1.8	2.1	.....
3	2.8	2.3	2.1	19	1.8	2.1	.....
4	2.3	2.3	2.1	20	1.8	2.0	.....
5	2.2	2.2	2.1	21	1.7	2.0	.....
6	2.2	2.2	2.3	22	2.8	2.0	.....
7	2.4	2.2	2.0	23	2.1	2.0	.....
8	2.1	2.3	.....	24	2.0	2.5	.....
9	2.0	2.2	.....	25	3.1	3.9	.....
10	1.9	2.1	.....	26	3.5	3.9	.....
11	1.9	2.1	.....	27	3.2	2.4	.....
12	1.8	2.1	.....	28	2.8	5.1	.....
13	1.9	2.1	.....	29	4.7	2.5	.....
14	1.9	2.0	.....	30	4.9	2.8	.....
15	1.9	2.0	.....	31	3.0	.....	.....
16	1.9	2.0	.....				

Rating table for Hat Creek near Edgemont, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	1	2.60	113	3.50	400	4.40	830
1.80	2	2.70	138	3.60	440	4.50	885
1.90	4	2.80	164	3.70	482	4.60	945
2.00	7	2.90	191	3.80	526	4.70	1,005
2.10	16	3.00	221	3.90	572	4.80	1,065
2.20	30	3.10	253	4.00	620	4.90	1,130
2.30	47	3.20	287	4.10	670	5.00	1,200
2.40	68	3.30	323	4.20	720	5.10	1,270
2.50	90	3.40	361	4.30	775		

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906, and is well defined between gage heights 2.1 feet and 5.0 feet.

Monthly discharge of Hat Creek near Edgemont, S. Dak., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	1,130	1	137	8,420
June	1,270	7	114	6,780
July (1-7)	47	7	28.0	389
The period	.....	.....	.....	15,600

NOTE.—Values are rated as follows: May and June, excellent; July, good.

RAPID CREEK AT RAPID, S. DAK.

The gaging station was established June 10, 1903. It is located at a highway bridge one-half mile downstream from the Rapid River Milling Company's mill, and one-fourth mile north of the Chicago and Northwestern Railway in the SE. ¼ sec. 36, T. 2 N., R. 7 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 151, where are given also references to publications that contain data for previous years. The data collected at the station are valuable for water-power purposes.

Discharge measurements of Rapid Creek at Rapid, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Comstock and Stewart	36	101	1.69	109
April 6	do	35	91	1.50	76
May 8	J. E. Stewart	33	88	1.60	88
May 26	do	37	116	2.26	241
September 1	do	33	91	1.39	66

Daily gage height, in feet, of Rapid Creek at Rapid, S. Dak., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.60	1.50	2.15	1.55	1.50	1.55	1.55	1.45
2	1.58	1.62	2.12	1.55	2.50	1.58	1.58	1.55
3	1.58	1.70	2.20	1.55	2.80	1.58	1.55	1.45
4	1.50	1.62	2.15	1.30	2.80	1.60	1.55	1.45
5	1.50	1.65	2.10	1.35	2.80	1.60	1.55	1.45
6	1.50	1.60	2.10	1.30	2.65	1.60	1.55	1.45
7	1.50	1.60	2.10	1.30	2.60	1.60	1.50	1.45
8	1.35	1.62	2.00	1.22	2.28	1.60	1.50	1.45
9	1.38	1.65	2.00	1.20	2.28	1.60	1.55	1.55
10	1.45	1.65	1.90	1.50	1.95	1.60	1.55	1.55
11	1.40	1.55	1.90	1.65	1.85	1.55	1.55	1.45
12	1.32	1.58	1.90	1.65	1.80	1.60	1.55	1.45
13	1.45	1.65	1.90	1.60	1.70	1.60	1.55	1.45
14	1.45	1.65	1.90	1.60	1.60	1.60	1.55	1.45
15	1.40	1.60	1.80	1.55	1.55	1.60	1.55	1.45
16	1.35	1.55	1.80	1.60	1.45	1.60	1.55	1.45
17	1.42	1.60	1.80	1.50	1.45	1.55	1.55	1.45
18	1.45	1.55	1.80	1.45	1.45	1.55	1.55	.....
19	1.50	1.48	1.75	1.50	1.45	1.55	1.60	.....
20	1.55	1.40	1.75	1.50	1.50	1.55	1.65	.....
21	1.45	1.52	1.75	1.55	1.60	1.55	1.60	.....
22	1.18	1.48	1.75	1.42	1.60	1.55	1.55	.....
23	1.28	1.38	1.80	1.50	1.60	1.55	1.55	.....
24	1.50	1.62	1.92	1.50	1.52	1.55	1.55	.....
25	1.22	2.45	1.80	1.40	1.55	1.55	1.45	.....
26	1.35	2.28	1.80	1.40	1.60	1.55	1.45	.....
27	1.28	2.30	1.80	1.50	1.55	1.55	1.45	1.40
28	1.30	2.25	1.80	1.55	1.55	1.55	1.45	1.35
29	1.32	2.25	1.80	1.40	1.52	1.55	1.45	1.38
30	1.38	2.25	1.60	1.45	1.55	1.55	1.45	1.45
31	.....	2.25	.....	1.45	1.58	.....	1.45	.....

NOTE.—Ice conditions November 18–26.

Rating table for Rapid Creek at Rapid, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	45	1.70	107	2.20	223	2.70	430
1.30	54	1.80	125	2.30	256	2.80	480
1.40	65	1.90	145	2.40	292		
1.50	77	2.00	167	2.50	332		
1.60	91	2.10	193	2.60	380		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906 and is well defined between gage heights 1.3 feet and 2.5 feet.

Monthly discharge of Rapid Creek at Rapid, S. Dak., for 1906.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	91	43	67.7	4,030	0.165	0.18
May	312	63	126	7,750	.307	.35
June	223	91	148	8,810	.361	.40
July	99	45	74.3	4,570	.181	.21
August	480	71	166	10,200	.405	.47
September	91	84	87.1	5,180	.212	.24
October	99	71	81.7	5,020	.199	.23
November	84	60	70.5	4,200	.172	.19
The period				49,800		

NOTE.—Discharge estimated November 18-26. Values for April to June are probably excellent. The remainder of the year is somewhat doubtful on account of apparent errors in the gage heights.

CORBIN-MORSE DITCH AT RAPID, S. DAK.

This gaging station was established May 8, 1906. It is located at a highway bridge 300 feet north of the Rapid Creek gaging station and 100 yards below the headworks of the ditch.

Discharge measurements are made from the downstream side of the highway bridge or by wading near the gage.

The gage, which was read once each day by John Merritt, is a post set vertically at the edge of the ditch. The bench mark is the same as that on Rapid Creek.

The following discharge measurements were made in 1906 by J. E. Stewart:

May 8: Width, 5 feet; gage height, 4.31 feet; discharge, 0.65 second-feet.
September 4: Gage height, 438 feet; discharge, 1.0 second-feet.

Daily gage height, in feet, of Corbin-Morse ditch at Rapid, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		5.4	5.15	4.4	4.4	4.4	4.4
2		5.4	5.15	5.4	4.4	4.4	4.4
3		5.4	5.15	5.4	4.4	4.4	4.4
4		5.4	5.15	5.4	4.4	4.4	4.4
5		5.4	5.3	4.4	4.4	4.4	4.4
6		5.4	5.3	4.4	4.4	4.4	4.4
7		5.4	5.15	4.4	4.4	4.4	4.4
8	4.3	4.4	5.3	4.4	4.4	4.4	4.4
9	4.3	4.4	5.3	4.4	4.4	4.4	4.4
10	4.4	4.4	4.4	4.4	4.4	4.4	4.4

Daily gage height, in feet, of Corbin-Morse ditch at Rapid, S. Dak., for 1906—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	4.4	4.4	4.4	4.4	4.4	4.4	4.4
12	4.4	5.5	4.4	4.4	4.4	4.4	.....
13	4.4	5.5	4.55	4.4	4.4	4.4	.....
14	4.4	5.7	4.55	4.4	4.4	4.4	.....
15	4.4	5.7	4.55	4.4	4.4	4.4	.....
16	4.4	5.6	4.55	4.4	4.4	4.4	.....
17	4.4	5.7	4.4	4.4	4.4	4.4	.....
18	4.4	5.7	4.4	4.4	4.4	4.4	.....
19	4.4	5.7	4.4	4.4	4.4	4.4	.....
20	4.4	5.15	4.4	4.4	4.4	4.4	.....
21	4.4	5.15	4.4	4.4	4.4	4.4	.....
22	4.4	5.15	4.4	4.4	4.4	4.4	.....
23	4.4	5.15	4.4	4.4	4.4	4.4	.....
24	4.4	5.15	4.4	4.4	4.4	4.4	.....
25	4.4	5.3	4.4	4.4	4.4	4.4	.....
26	4.4	5.3	4.4	4.4	4.4	4.4	.....
27	4.4	5.3	4.4	4.4	4.4	4.4	.....
28	4.9	5.3	4.4	4.4	4.4	4.4	.....
29	5.4	5.3	4.4	4.4	4.4	4.4	.....
30	5.4	5.3	4.4	4.4	4.4	4.4	.....
31	5.4	.....	4.4	4.4	4.4	4.4	.....

BELLE FOURCHE RIVER AT BELLE FOURCHE, S. DAK.

This station was established May 26, 1903, and was discontinued June 23, 1906. It was located at the county highway bridge on the western outskirts of Belle Fourche, S. Dak., in the NW. ¼, sec. 10, T. 8 N., R. 2 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 156, where are given also references to publications that contain data for previous years.

Discharge measurements of Belle Fourche River at Belle Fourche, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	Comstock and Stewart	121	179	3.10	493
April 26	J. E. Stewart	75	77	2.10	236

Daily gage height, in feet, of Belle Fourche River at Belle Fourche, S. Dak., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	4.72	4.05	3.90	17	2.65	2.20	6.85
2	4.18	3.48	3.82	18	2.52	2.20	3.20
3	3.62	3.28	3.05	19	2.55	2.10	3.02
4	3.48	3.25	2.80	20	2.55	2.10	2.80
5	3.38	3.20	2.62	21	2.55	2.10	2.50
6	3.22	3.12	2.40	22	2.55	2.10	2.20
7	3.15	2.92	2.80	23	2.55	2.10	2.10
8	2.98	2.75	2.60	24	2.52	3.25	.....
9	2.92	2.55	3.62	25	2.55	4.32	.....
10	2.90	2.40	3.28	26	2.55	5.12	.....
11	2.90	2.40	3.08	27	2.22	4.80	.....
12	2.85	2.40	3.00	28	2.15	4.10	.....
13	2.82	3.00	2.80	29	2.12	4.45	.....
14	2.70	2.70	2.60	30	2.08	3.80	.....
15	2.75	2.30	2.45	31	.....	3.20	.....
16	2.75	2.20	2.42				

Rating table for Belle Fourche River at Belle Fourche, S. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	150	3.00	530	4.00	1,130	5.00	1,855
2.10	175	3.10	550	4.10	1,200	5.20	2,005
2.20	200	3.20	610	4.20	1,270	5.40	2,155
2.30	230	3.30	670	4.30	1,340	5.60	2,305
2.40	260	3.40	730	4.40	1,410	5.80	2,455
2.50	290	3.50	790	4.50	1,480	6.00	2,610
2.60	330	3.60	850	4.60	1,555	6.20	2,770
2.70	370	3.70	920	4.70	1,630	6.40	2,930
2.80	410	3.80	990	4.80	1,705	6.60	3,090
2.90	450	3.90	1,060	4.90	1,780	6.80	3,250

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is not well defined for 1906.

Monthly discharge of Belle Fourche River at Belle Fourche, S. Dak., for 1906.

[Drainage area, 3,250 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,640	170	473	28,100	0.146	0.16
May	1,940	175	606	37,300	.186	.21
June (1–23)	3,290	175	594	27,100	.183	.16
The period				92,500		

NOTE.—Values are rated as follows: April fair, on account of approximate gage heights; May and June, good.

BELLE FOURCHE RIVER NEAR BELLE FOURCHE, S. DAK.

This station was established May 10, 1906. It is located 250 feet below the diversion dam at the headworks of the Belle Fourche irrigation project and 1½ miles from Belle Fourche.

The channel is straight for 250 feet above and 300 feet below the station. The right bank is medium in height, sparsely wooded and subject to overflow at flood stages; the left bank is high and clean and does not overflow. The bed of the stream is shale, sand, and gravel, and is fairly permanent. There is one channel at all stages, and the current is swift.

Discharge measurements are made by means of a cable and car. The initial point for sounding is the inside edge of the frame that supports the cable on the north side of the river.

The gage, which was read twice each day by H. D. Comstock, is an inclined timber spiked to posts driven firmly into the north bank of the stream. The bench mark is a spike driven in a cottonwood tree on the left bank of the river, 150 feet below the gage; the elevation, 10.47 feet above the zero of the gage.

Discharge measurements of Belle Fourche River near Belle Fourche, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
May 19	J. E. Stewart	117	207	2.08	398
May 24	H. D. Comstock	117	370	3.51	1,060
May 25	Comstock and Green	120	503	4.62	1,870
May 26	Comstock and Magruder	135	870	7.42	4,360
May 26	do	135	826	7.05	4,230
May 26	do	132	728	6.35	3,300
May 26	do	128	638	5.65	2,780
June 11	J. E. Stewart	119	326	3.01	886
June 12	do	118	292	2.72	734
June 27	do	117	169	1.80	314
July 24[a]	H. D. Comstock	[a] 61	[a] 57	1.13	117
September 13	J. E. Stewart			.40	[b] 0
September 27	H. D. Comstock	95	137	1.52	242

[a] Wading section. [b] Water shut off by diversion dam for several hours.

Daily gage height, in feet, of Belle Fourche River near Belle Fourche, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.90	1.58	0.98	1.50	1.50	1.55
2		3.20	1.50	.95	1.45	1.45	1.55
3		2.95	1.48	.98	1.40	1.45	1.55
4		2.70	1.42	1.10	1.38	1.45	1.55
5		2.52	1.38	1.10	1.32	1.45	1.55
6		3.15	1.40	1.25	1.30	1.45	1.60
7		2.82	1.35	2.80	1.20	1.40	1.60
8		2.68	1.35	2.70	1.20	1.40	1.60
9		3.75	1.30	2.00	1.20	1.40	1.55
10	2.50	3.30	1.28	2.18	1.20	1.45	1.55
11	2.38	2.95	1.25	1.88	1.20	1.45	1.55
12	2.28	2.68	1.30	1.68	1.28	1.45	1.55
13	2.25	2.45	1.28	1.55	1.40	1.45	1.60
14	3.02	2.30	1.32	1.48	2.03	1.40	1.65
15	2.35	2.25	1.38	1.38	1.68	1.40	1.65
16	2.20	2.18	1.38	1.30	1.70	1.45	1.60
17	3.05	5.00	1.35	1.20	1.65	1.45	1.50
18	2.25	3.00	1.30	1.12	1.60	1.50	1.50
19	2.10	2.60	1.30	1.10	1.60	1.50	1.45
20	2.05	2.58	1.30	1.20	1.70	1.60	
21	2.10	2.25	1.30	1.48	1.70	1.60	
22	2.05	2.10	1.15	1.85	1.65	1.60	
23	2.08	1.98	1.15	1.62	1.60	1.60	
24	3.00	1.92	1.15	1.65	1.58	1.60	
25	5.30	1.92	1.10	2.15	1.55	1.60	
26	6.50	1.90	1.08	2.00	1.50	1.60	
27	4.55	1.80	1.02	1.80	1.50	1.60	
28	4.25	1.78	1.00	1.68	1.50	1.60	
29	4.30	1.68	1.00	1.60	1.50	1.60	
30	3.60	1.60	1.00	1.50	1.50	1.55	
31	3.20		1.00	1.50		1.55	

Rating table for Belle Fourche River near Belle Fourche, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	84	2.10	449	3.20	988	4.60	1,930
1.10	108	2.20	492	3.30	1,046	4.80	2,080
1.20	134	2.30	536	3.40	1,107	5.00	2,240
1.30	162	2.40	581	3.50	1,170	5.20	2,400
1.40	192	2.50	628	3.60	1,235	5.40	2,565
1.50	224	2.60	676	3.70	1,300	5.60	2,735
1.60	258	2.70	725	3.80	1,365	5.80	2,910
1.70	294	2.80	775	3.90	1,430	6.00	3,090
1.80	331	2.90	826	4.00	1,495	6.20	3,270
1.90	369	3.00	878	4.20	1,635	6.40	3,455
2.00	408	3.10	932	4.40	1,780		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1906 and is well defined between gage heights 1.1 feet and 8 feet. Daily discharge, May 10 to 25, was reduced 40 second-feet.

Monthly discharge of Belle Fourche River near Belle Fourche, S. Dak., for 1906.

[Drainage area, 4,270 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
May (10-31)	3,550	388	980	42,800	0.230	0.19
June	2,240	258	711	42,300	.167	.19
July	251	84	148	9,100	.035	.04
August	775	72	266	16,400	.062	.07
September	420	134	223	13,300	.052	.06
October	258	192	225	13,800	.053	.06
November	276	192	221	13,200	.052	.06
The period				151,000		

NOTE.—Values are excellent.

REDWATER RIVER AT BELLE FOURCHE, S. DAK.

The gaging station was established July 20, 1903, and was discontinued June 23, 1906. It is located at the county highway bridge in the eastern limits of Bellefourche, S. Dak., in the NW. ¼, sec. 11, T. 8 N., R. 2 E., 300 feet above the junction with Bellefourche River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 159, where are given also references to publications that contain data for previous years.

Discharge measurements of Redwater River at Belle Fourche, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 26	Comstock and Stewart	65	391	5.24	1,190
March 26	do	64	368	4.86	1,020
April 11	do	61	211	2.38	231
April 28	J. E. Stewart	64	195	2.30	198

Daily gage height, in feet, of Redwater River at Belle Fourche, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1		2.50	3.20	2.95	17		2.45	2.50	2.85
2		2.50	2.88	2.90	18		2.45	2.50	2.65
3		2.45	2.90	2.85	19		2.35	2.60	2.65
4		2.40	2.90	2.85	20		2.35	2.50	2.50
5		2.40	2.90	2.85	21		2.35	2.50	2.50
6		2.40	2.90	2.85	22		2.35	2.50	2.45
7		2.40	2.88	2.92	23		2.35	2.50	2.45
8		2.40	2.85	2.90	24		2.32	3.00	
9		2.40	2.78	2.98	25		2.35	3.85	
10		2.40	2.68	2.88	26	5.05	2.35	4.15	
11		2.40	2.60	2.80	27	4.30	2.35	3.65	
12		2.40	2.55	2.75	28	3.90	2.35	3.25	
13		2.40	2.50	2.60	29	3.50	2.35	3.15	
14		2.40	2.45	2.50	30	3.10	2.35	3.12	
15		2.40	2.45	2.50	31	2.70		3.00	
16		2.40	2.85	2.50					

Rating table for Redwater River at Belle Fourche, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	202	3.10	388	3.80	601	4.50	860
2.40	220	3.20	417	3.90	635	4.60	898
2.50	240	3.30	446	4.00	670	4.70	936
2.60	261	3.40	475	4.10	708	4.80	974
2.70	283	3.50	505	4.20	746	4.90	1,012
2.80	307	3.60	536	4.30	784	5.00	1,050
2.90	333	3.70	568	4.40	822	5.10	1,090
3.00	360						

NOTE.—The above table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1906 and is not well defined.

Monthly discharge of Redwater River at Belle Fourche, S. Dak., for 1906.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (26–31)	1,070	283	611	7,270	0.599	0.13
April	240	206	219	13,000	.215	.24
May	727	216	333	20,500	.326	.38
June (1–23)	355	230	281	12,800	.275	.24
The period				53,600		

NOTE.—Values are good.

REDWATER CANAL AT MINNESELA, S. DAK.

This station was established May 7, 1904. It is located on the bridge across the canal in the town of Minnesela, 4 miles from Belle-fourche, S. Dak., in sec. 24, T. 8 N., R. 2 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 163, where are given also references to publications that contain data for previous years.

Discharge measurements of Redwater canal at Minnesela, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 13	J. E. Stewart	16	16	2.20	19.3
August 27	do	17	23	2.55	20.6

Daily gage height, in feet, of Redwater canal at Minnesela, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.55	3.0	3.7	3.1	2.45	17		2.1	3.2	3.55	2.1	2.1
2		1.62	3.0	3.7	3.1	2.5	18		1.5	3.2	3.4	2.1	2.1
3		1.5	3.0	3.4	3.1	2.5	19		1.5	3.1	3.05	2.1	2.1
4		1.52	3.0	3.1	3.05	2.4	20		2.25	2.5	3.0	2.1	2.1
5		1.5	3.0	3.1	3.0	2.35	21		2.05	1.9	3.0	2.1	2.1
6		1.5	3.0	2.9	3.0	2.3	22		1.6	2.6	3.0	2.1	1.8
7		1.5	3.0	2.6	3.0	2.3	23		1.85	2.6	2.55	2.1	1.8
8		1.5	3.0	2.4	2.85	2.5	24		2.05	3.15	2.1	2.1	1.7
9		1.5	3.3	2.5	2.7	2.5	25		2.3	3.4	2.1	2.1	1.7
10		1.5	3.3	2.5	2.7	2.5	26		2.3	3.55	2.1	2.05	1.65
11		1.8	3.25	2.7	2.7	2.5	27	2.7	2.3	3.35	2.4	2.0	1.6
12		2.0	3.45	2.9	2.7	2.6	28	2.58	2.45	3.5	2.75	2.35	
13		2.15	3.25	3.6	2.7	2.7	29	2.05	2.6	3.4	2.7	2.4	
14		2.2	3.2	3.6	2.4	2.4	30	2.15	2.6	3.55	3.05	2.4	
15		2.2	3.2	3.35	2.1	2.1	31	2.05		3.8	3.1		
16		2.1	3.15	3.2	2.1	2.1							

NOTE.—Water turned into canal May 27 and finally turned off October 27.

Daily discharge, in second-feet, of Redwater canal at Minnesela, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		2	60	113	52	18	17		14	74	92	6	6
2		3	60	113	52	20	18		0	74	82	6	6
3		1	60	89	52	20	19		0	67	56	6	6
4		1	60	67	49	16	20		20	30	54	6	6
5		0	60	67	46	14	21		12	6	54	6	6
6		0	60	53	46	12	22		2	35	54	6	1
7		0	60	35	46	12	23		6	35	28	6	1
8		0	60	25	37	20	24		12	70	10	6	
9		0	81	30	29	20	25		23	89	10	6	
10		0	81	30	29	20	26		20	101	10	5	
11		5	78	41	29	20	27	49	20	85	21	4	
12		11	93	53	29	24	28	42	28	97	39	14	
13		16	78	105	29	29	29	15	35	89	36	16	
14		18	74	105	16	16	30	20	35	101	58	16	
15		18	74	85	6	6	31	15		122	61		
16		14	70	68	6	6							

NOTE.—The daily discharge was obtained from a series of parallel curves, each covering a short period of time.

Monthly discharge of Redwater canal at Minnesela, S. Dak., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (27-31)	49	15	28.2	280
June	35	0	10.5	625
July	122	6	70.5	4,330
August	113	10	56.3	3,460
September	52	4	22.1	1,320
October (1-23)	29	0	13.2	603
The period				10,600

NOTE.—Values can be probably considered fair.

SPEARFISH CREEK NEAR SPEARFISH, S. DAK.

This station was established March 30, 1904. It is located at the Chicago, Burlington and Quincy Railroad bridge at Bradley's ranch, 1 mile above Spearfish, S. Dak., in the SW. ¼, sec. 14, T. 6 N., R. 2 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 161, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for water-power purposes.

Discharge measurements of Spearfish Creek near Spearfish, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	H. D. Comstock	27	21	1.02	87
May 2	J. E. Stewart	30	30	1.15	119
June 3	do	26	33	1.27	136
September 7	do	27	24	1.00	65

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Spearfish Creek near Spearfish, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.1	1.15	1.3	1.1	1.0	1.0	1.0	1.0
2	.....	1.1	1.15	1.3	1.1	1.0	1.0	1.0	1.0
3	.....	1.05	1.3	1.25	1.1	1.0	1.0	1.0	1.0
4	.....	1.05	1.5	1.25	1.1	1.0	1.0	1.0	1.0
5	.....	1.0	1.3	1.25	1.1	1.0	1.0	1.0	1.0
6	.....	1.0	1.3	1.2	1.1	1.0	1.0	1.0	1.0
7	.....	1.0	1.3	1.2	1.1	1.35	1.0	1.0	1.0
8	.....	1.0	1.2	1.2	1.1	1.15	1.0	1.0	1.0
9	.....	1.0	1.2	1.2	1.1	1.1	1.0	1.0	1.0
10	.....	1.0	1.2	1.2	1.1	1.05	1.0	1.0	1.0
11	0.95	1.0	1.15	1.2	1.1	1.05	1.15	1.0	1.0
12	.95	1.0	1.15	1.2	1.1	1.05	1.1	1.0	1.0
13	.95	1.0	1.15	1.2	1.1	1.05	1.05	1.0	1.0
14	.95	1.0	1.15	1.2	1.1	1.05	1.05	1.0	1.0
15	1.05	1.0	1.15	1.2	1.1	1.0	1.05	1.0	1.0
16	1.05	1.0	1.15	1.2	1.1	1.0	1.05	1.0	1.0
17	.95	1.0	1.15	1.2	1.05	1.0	1.05	1.0	1.0
18	.95	1.0	1.15	1.2	1.05	1.0	1.05	1.0	1.0
19	.95	1.0	1.15	1.2	1.05	1.0	1.05	1.0	1.0
20	.95	1.0	1.15	1.2	1.05	1.0	1.0	1.2	1.0
21	1.0	1.0	1.15	1.15	1.05	1.0	1.0	1.05	1.0
22	1.0	1.0	1.15	1.15	1.05	1.0	1.0	1.05	1.0
23	1.0	1.0	1.15	1.15	1.0	1.0	1.0	1.05	1.0
24	1.05	1.0	1.3	1.15	1.0	1.0	1.0	1.05	1.0
25	1.05	1.0	1.5	1.15	1.0	1.0	1.0	1.05	1.0
26	1.1	1.0	1.7	1.15	1.0	1.0	1.0	1.05	1.0
27	1.1	1.0	1.6	1.15	1.0	1.0	1.0	1.05	1.0
28	1.1	1.0	1.5	1.1	1.0	1.0	1.0	1.05	1.0
29	1.1	1.05	1.45	1.1	1.0	1.0	1.0	1.05	1.0
30	1.1	1.1	1.4	1.1	1.0	1.0	1.0	1.05	1.0
31	1.1	.....	1.35	.....	1.0	1.0	.....	1.0	.....

NOTE.—Slight ice conditions during March.

Rating table for Spearfish Creek near Spearfish, S. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	61	1.20	121	1.40	164	1.60	211
1.00	80	1.30	142	1.50	187	1.70	237
1.10	100						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906, and is not well defined.

Monthly discharge of Spearfish Creek near Spearfish, S. Dak., for 1906.

[Drainage area, 230 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (11–31)	100	70	81.9	3,410	0.356	0.28
April	100	80	83.0	4,940	.361	.40
May	237	110	136	8,360	.591	.68
June	142	100	119	7,080	.517	.58
July	100	80	92.3	5,680	.401	.46
August	153	80	85.6	5,260	.372	.43
September	110	80	84.0	5,000	.365	.41
October	121	80	84 5	5,200	.367	.42
November	80	80	80.0	4,760	.348	.39
The period	.....	.....	.....	49,700	.....	.....

NOTE.—Values can probably be considered as good.

WHITE RIVER DRAINAGE BASIN.

WHITE RIVER AT INTERIOR, S. DAK.

This station was established June 24, 1904. It is located at the ford, about one-fourth mile northeast of Interior, S. Dak., in T. 3 S., R. 18 E. The gage is in three sections. The upper section is an inclined timber spiked to a stump standing on the left bank and to a post driven in the bank of the stream about 200 feet above the old gage; the middle section is a post driven in the bed of the stream near the upper section; the lower section is a post driven in the middle of the channel about 200 feet from the other two sections.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 166, where are given also references to publications that contain data for previous years.

Discharge measurements of White River at Interior, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	J. E. Stewart	157	176	2.70	335
May 24	do	112	104	2.58	192
August 30	do	148	224	3.29	483

Daily gage height, in feet, of White River at Interior, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.5	6.05	3.5	2.1	2.8	2.5	2.3	2.5
2	.....	3.5	6.6	3.8	2.1	2.4	2.4	2.2	2.4
3	.....	3.3	5.3	3.0	2.0	2.0	2.4	2.3	2.2
4	.....	2.7	4.2	3.0	2.0	2.3	2.2	2.4	2.0
5	.....	2.6	4.6	2.8	2.0	2.2	2.1	2.4	2.0
6	.....	2.5	3.0	2.8	2.8	2.1	2.0	2.4	2.0
7	.....	2.4	2.6	2.9	2.2	2.1	2.0	2.4	2.0
8	.....	2.3	2.2	3.1	2.1	2.2	2.0	2.3	2.0
9	.....	2.1	2.2	2.8	2.0	2.2	2.2	2.3	2.0
10	.....	2.1	2.0	2.6	2.0	2.2	2.2	2.2	2.0
11	2.5	2.1	1.8	2.4	1.8	2.1	2.1	2.2	2.2
12	2.5	2.9	1.8	2.4	1.7	2.1	2.1	2.2	2.3
13	2.5	2.8	1.8	2.3	1.6	2.0	4.1	2.2	2.1
14	2.5	2.5	4.0	2.3	4.2	2.0	3.2	2.2	2.0
15	2.5	2.4	3.2	2.2	3.6	2.0	3.0	2.2	2.0
16	2.5	2.3	2.2	2.6	2.9	1.8	3.2	2.2	2.0
17	2.5	2.4	2.2	4.0	2.2	1.7	3.0	2.2	2.0
18	2.5	2.5	2.2	3.7	2.2	1.7	3.0	2.2	2.0
19	2.5	2.4	2.2	3.6	2.1	3.0	4.2	5.1	2.0
20	2.5	2.4	2.2	3.3	2.1	7.4	4.8	4.2	2.0
21	2.5	2.4	2.2	3.1	2.0	7.1	4.2	4.0	2.0
22	2.5	2.5	2.3	2.7	2.0	5.5	3.0	3.6	2.0
23	2.5	2.5	3.3	2.5	2.0	4.7	2.8	3.0	2.0
24	5.5	2.8	2.5	2.5	1.8	3.2	2.8	3.0	2.0
25	8.2	3.7	2.8	2.3	1.7	3.0	3.5	2.9	2.0
26	7.0	3.2	3.6	4.1	1.7	4.2	5.2	2.7	2.0
27	6.4	2.5	2.8	3.2	4.8	3.8	4.0	2.6	2.0
28	6.0	2.4	3.2	2.5	3.1	3.8	3.4	2.4	2.0
29	4.3	2.8	5.1	2.3	2.9	3.3	3.2	2.4	2.1
30	4.0	3.9	4.0	2.3	2.7	2.7	2.3	2.3	2.1
31	3.8	.....	3.6	.....	1.9	2.7	.....	2.4	.....

NOTE.—Ice condition March 15–24.

NIOBRARA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Niobrara River rises in the mountains of eastern Wyoming, flows eastward through the northern portion of Nebraska, and empties into the Missouri in Knox County at the city of Niobrara. Its drainage basin is narrow in the upper portion, but broadens considerably near the mouth; it comprises about 9,012 square miles.

Precipitation within the basin varies from 15 to 18 inches in the upper portion, from 18 to 21 inches in the middle portion, and from 21 to 24 inches in the lower portion. Evaporation is 6, 5, and 4½ feet in the upper, middle, and lower portions, respectively. Sixty-nine per cent of the precipitation falls during April, May, June, July, and August, and about one-half of the remainder is snowfall.

The river is not subject to periodic rises of any extent, owing to the fact that the sand hills which form so large a portion of its drainage area act as storage reservoirs for the rain and snow, which are afterwards fed to the stream in the form of spring water, thus equalizing the flow and making the constancy of the discharge almost phenomenal.

The principal tributaries are Verdigris, Keya Paha, and Snake rivers, and Minnechaduza Creek. The drainage area of the Snake is similar in nearly all respects to that of the western part of the Niobrara.

The water resources of the Niobrara are at present almost wholly undeveloped, irrigation being limited to the low, narrow flood plains in the bottoms of the canyons. On Minnechaduza Creek, at Valentine, an artificial lake has been formed by a dam, and a power plant has been installed for lighting and for furnishing the city with water. On the lower portion of the Niobrara a number of mills are in operation, receiving their power from small tributaries. On Snake River possibilities for power development are phenomenal, but long transmission lines would be required to make it of practical value.

NIOBRARA RIVER NEAR VALENTINE, NEBR.

This station was established July 22, 1897, and was known as the Fort Niobrara station. June 26, 1901, it was moved about 3 miles farther upstream to the Borman Bridge, in sec. 4, T. 34, R. 28, about 3 miles southeast of the town of Valentine. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 168, where are given also references to publications that contain data for previous years. The length of the gage wire is now 11.80 feet.

Discharge measurements of Niobrara River near Valentine, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 14 [a]	Geo. W. Bates	110	160	1.55	483
April 18	do	120	228	2.10	1,120
May 1	do	120	207	1.75	998
May 11	do	120	192	1.65	819
June 30	F. S. Dobson	120	167	1.35	627
September 21	Adna Dobson	115	195	1.45	813
December 17	Geo. W. Bates		178	1.70	776

[a] Slush ice running.

Daily gage height, in feet, of Niobrara River near Valentine, Nebr., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.75	1.97	1.90	2.60	1.90	1.45	1.35	1.25	1.35	1.25	1.70
2	1.70	1.92	.....	2.35	2.00	1.50	1.35	1.25	1.30	1.40	1.70
3	1.76	1.95	.....	2.15	1.90	1.50	1.35	1.25	1.30	1.35	1.75
4	1.80	1.90	2.55	2.12	1.90	1.60	1.35	1.00	1.25	1.30	1.75
5	1.82	1.62	2.80	2.07	1.85	1.55	1.40	1.45	1.25	1.30	1.65
6	1.85	1.50	2.55	1.96	1.90	1.55	1.35	1.50	1.25	1.25	1.68
7	1.78	1.75	2.20	1.95	1.75	1.45	1.40	1.60	1.30	1.35	1.60
8	1.55	1.83	2.50	2.10	1.65	1.40	1.30	1.50	1.30	1.35	1.60
9	1.60	1.78	2.25	2.12	1.65	1.30	1.25	1.45	1.30	1.30	1.55
10	1.68	1.85	2.05	2.07	1.60	1.30	1.30	1.55	1.25	1.30	1.55
11	1.63	1.87	1.75	1.98	1.65	1.45	1.55	1.50	1.55	1.25	1.50
12	1.82	1.95	1.32	2.08	1.55	1.40	1.40	1.40	1.35	1.30	1.50
13	1.93	1.75	1.35	2.30	1.60	1.35	1.35	1.45	1.35	1.35	1.55
14	1.85	1.70	1.65	2.32	1.55	1.35	1.40	1.40	1.30	1.35	1.55
15	1.87	1.75	1.60	2.07	1.55	1.40	1.40	1.35	1.40	1.40	1.60
16	1.80	1.95	1.85	2.12	1.50	1.35	1.35	1.30	1.35	1.35	1.60
17	1.85	2.08	1.90	2.05	1.55	1.40	1.35	1.30	1.30	1.45	1.45
18	1.85	2.03	1.95	2.06	1.45	1.35	1.35	1.30	1.30	1.40	1.50
19	1.90	2.15	1.95	2.02	1.40	1.40	1.30	1.25	1.40	1.40	1.40
20	1.85	2.00	1.95	2.05	1.40	1.30	1.30	1.25	1.40	1.70	1.30
21	1.65	1.95	2.12	1.90	1.45	1.30	1.30	1.30	1.45	1.60	1.45
22	1.70	1.90	2.07	1.95	1.45	1.35	1.30	1.30	1.40	1.55	1.50
23	2.45	2.00	2.00	1.95	1.60	1.35	1.30	1.50	1.30	1.50	1.55
24	2.20	1.90	2.10	1.90	1.50	1.40	1.25	1.55	1.30	1.75	1.70
25	2.20	1.85	2.00	1.85	1.55	1.40	1.25	1.50	1.40	1.50	1.65
26	2.15	1.95	2.08	1.85	1.95	1.45	1.25	1.40	1.35	1.65	1.60
27	2.18	1.85	2.15	1.80	1.60	1.45	1.30	1.30	1.30	1.70	1.55
28	2.10	1.92	2.20	1.80	1.50	1.40	1.25	1.35	1.30	1.75	1.60
29	2.10	.....	2.25	1.75	1.60	1.40	1.25	1.50	1.30	1.85	1.70
30	2.05	.....	2.25	1.75	1.55	1.35	1.25	1.50	1.30	1.80	1.65
31	1.95	.....	2.18	.....	1.50	.....	1.25	1.30	.....	1.70	.....

NOTE.—There was considerable slush ice running during January, February, and March. The gage heights for April 25 to 29 were interpolated.

Daily discharge, in second-feet, of Niobrara River near Valentine, Nebr., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	930	1,060	835	1,710	1,180	672	632	595	700	573	985
2	875	1,000	1,080	1,350	1,300	720	632	595	660	685	985
3	940	1,040	1,340	1,120	1,170	720	632	595	660	645	1,040
4	985	985	1,590	1,080	1,160	815	632	907	625	608	1,040
5	997	685	1,950	1,030	1,100	770	675	760	625	608	930
6	1,040	595	1,590	905	1,140	770	635	810	625	573	980
7	950	805	1,120	900	957	682	675	915	665	645	870
8	705	890	1,520	1,070	840	645	600	810	665	645	870
9	750	725	1,180	1,100	835	575	573	760	665	608	820
10	828	890	940	1,050	780	577	607	865	625	608	820
11	778	895	630	945	820	690	820	815	910	573	770
12	970	985	390	1,060	725	648	685	720	710	608	770
13	1,100	770	400	1,350	775	662	645	765	710	645	820
14	1,000	725	562	1,370	730	616	685	725	670	645	820
15	1,030	755	510	1,070	735	655	685	685	760	685	870

Daily discharge, in second-feet, Niobrara River near Valentine, Nebr., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	930	965	680	1,130	690	620	645	642	715	645	870
17	990	1,120	720	1,060	735	655	652	642	675	730	730
18	990	1,060	790	1,070	655	620	652	647	675	685	770
19	1,050	1,180	790	1,020	620	657	615	610	765	685	685
20	978	995	800	1,060	620	585	615	610	765	985	607
21	768	940	985	925	660	585	620	647	810	870	730
22	815	885	945	1,000	660	620	620	650	685	820	770
23	1,750	970	860	1,020	795	620	620	830	607	770	820
24	1,400	860	995	990	705	662	585	880	607	1,040	985
25	1,400	810	875	950	750	662	590	830	685	770	930
26	1,330	915	990	980	1,200	705	590	740	645	930	870
27	1,370	785	1,060	940	805	705	625	655	607	985	820
28	1,240	855	1,140	960	710	666	590	695	607	1,040	870
29	1,240	.....	1,200	930	810	666	595	655	607	1,160	985
30	1,180	.....	1,220	960	760	630	595	660	607	1,100	930
31	1,060	.....	1,130	.....	715	.....	595	660	.....	985	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of Niobrara River near Valentine, Nebr., for 1906.

[Drainage area, 6,070 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	1,750	705	1,040	64,000	0.171	0.20
February	1,180	595	898	49,900	.148	.15
March	1,950	390	994	61,100	.164	.19
April	1,710	900	1,070	63,700	.176	.20
May	1,300	620	843	51,800	.139	.16
June	815	575	662	39,400	.109	.12
July	820	573	633	38,900	.104	.12
August	915	595	722	44,400	.119	.14
September	910	607	678	40,300	.112	.12
October	1,160	573	760	46,700	.125	.14
November	1,040	607	859	51,100	.142	.16
The period	.....	.....	.....	551,000	.....	.....

NOTE.—Owing to frequent radical changes in the conditions of flow at this station, the above values can not safely be considered as better than approximate. Some of the monthly means may, however, be considerably better and for some months, particularly for January to April, are liable to be worse.

PLATTE RIVER DRAINAGE BASIN.

GENERAL FEATURES.

Considered only with regard to extent of the area drained, the Platte is the most important tributary of the Missouri. It is formed by two forks, North Platte and South Platte, which rise, respectively, in northern and in central Colorado and unite a little southwest of the center of Nebraska. Its entire drainage basin comprises about 90,000 square miles, of which, in round numbers, 36,000 square miles belong to the North Platte and 24,000 to the South Platte. The lower course of the river is fairly well settled, but farther west the population is more scattered.

For convenience the description of the basin is divided, and the North Platte, South Platte, and Platte River proper are considered separately.

NORTH PLATTE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The source of the North Platte is in North Park, Colorado, or rather in the mountains which, rising to elevations from 4,000 to 5,000 feet above its general level, hem it in on all sides. From the steep slopes of these mountains numerous small streams descend, unite below into large creeks, and flow outward to the center of the basin. The two which may be said to form the real head of the North Platte are Grizzly and Little Grizzly creeks, but within the park the river is joined by four large tributaries, Roaring Fork and North Fork from the west and Michigan and Canadian creeks from the east. Leaving the park, the river makes a bold curve northward into Wyoming, but near Caspar, on the north side of the Caspar Range, it turns abruptly to the east and southeast, maintaining the latter course to its point of junction with the South Platte in central Nebraska.

In its northward course through Wyoming the stream receives many tributaries, the Snowy Range on the east contributing its drainage through Douglas, French, and Brush creeks, while the northeast slope of the Sierra Madre is drained by Beaver, Big Cow, and Spring creeks and Grand Encampment River. Medicine Bow and Sweetwater rivers are added to the North Platte between Saratoga and Caspar, beyond which the only important tributary is the Laramie, which enters at old Fort Laramie.

The stream is subject to periodic floods, which reach their maximum at the mouth some time during the latter part of June and are caused by the melting snow on the high ranges in which the headwater streams rise. The river runs lowest in winter, when it freezes thickly. High water prevails from the middle of April to the middle of July, when the river runs bank full.

In the mountain districts the precipitation, which is mostly in the form of snow during the winter and spring months, varies from 7 to 15 inches, the average being about 11 inches. Throughout the lower portion of the basin the precipitation is from 15 to 18 inches and the evaporation from water surface is from 5 to 6 feet.

NORTH PLATTE RIVER AT SARATOGA, WYO.

This station was established June 9, 1903. It is located at a point about 100 yards below the two-span iron-truss bridge which connects East and West Saratoga, in T. 17 N., R. 84 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 194, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River at Saratoga, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 25	A. J. Parshall	236	868	3.70	3,050
May 11	J. M. Sterrett	235	1,070	4.10	4,290
May 20	do	247	1,210	4.60	5,580
July 26	A. J. Parshall	221	624	2.50	968

Daily gage height, in feet, of North Platte River at Saratoga, Wyo., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		2.65	3.00	4.52	3.60	2.25	1.88	2.04
2		2.68	2.92	4.38	3.60	2.30	2.00	2.01
3		2.48	2.90	4.32	3.55	2.28	1.96	1.96
4		2.40	3.10	4.35	3.50	2.25	2.03	1.98
5		2.48	3.40	4.68	3.35	2.22	2.00	2.01
6		2.48	3.50	5.22	3.25	2.20	1.91	2.00
7		2.62	3.45	5.00	3.48	2.19	1.88	2.00
8		2.52	3.48	4.65	3.85	2.16	1.84	1.99
9		2.52	3.68	4.40	3.72	2.14	1.79	1.97
10		2.82	3.92	4.42	3.55	2.10	1.74	1.94
11		3.25	4.10	4.72	3.62	2.04	1.75	1.93
12		3.28	4.22	5.02	3.55	1.98	1.74	1.91
13		3.18	4.18	5.38	3.50	1.98	1.72	1.90
14		2.75	4.05	5.60	3.35	2.02	1.72	1.86
15		2.68	3.98	5.55	3.48	2.06	1.88	1.86
16		2.75	4.12	5.50	3.40	2.10	2.08	1.86
17		2.88	4.28	5.50	3.25	2.06	2.13	1.84
18		3.12	4.20	5.10	3.22	2.04	2.28	1.84
19		3.20	4.38	4.82	3.00	2.04	2.30	1.84
20		2.92	4.58	4.52	2.90	2.06	2.30	1.86
21		2.98	4.65	4.35	2.65	2.03	2.28	1.80
22		3.20	4.80	4.32	2.65	2.08	2.22	1.62
23		3.45	4.88	4.20	2.60	2.10	2.13	1.45
24		3.72	4.95	4.18	2.60	2.05	2.09	1.66
25	2.34	3.68	5.25	4.10	2.60	2.02	2.04	1.92
26	2.22	3.40	5.12	3.85	2.58	1.98	2.03	2.08
27	2.15	3.15	5.08	3.75	2.48	1.90	2.04	2.26
28	2.05	3.02	5.12	3.75	2.38	1.86	2.11	2.29
29	2.08	3.05	5.65	3.62	2.32	1.83	2.12	2.26
30	2.22	3.10	5.22	3.60	2.28	1.81	2.06	2.18
31	2.50	.....	4.90	.....	2.25	1.80	.....	2.15

Rating table for North Platte River at Saratoga, Wyo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	180	2.50	970	3.60	2,905	4.70	5,945
1.50	215	2.60	1,095	3.70	3,145	4.80	6,265
1.60	255	2.70	1,230	3.80	3,390	4.90	6,590
1.70	300	2.80	1,375	3.90	3,645	5.00	6,920
1.80	355	2.90	1,530	4.00	3,905	5.20	7,590
1.90	415	3.00	1,695	4.10	4,175	5.40	8,270
2.00	485	3.10	1,870	4.20	4,455	5.60	8,960
2.10	565	3.20	2,055	4.30	4,740	5.80	9,660
2.20	655	3.30	2,250	4.40	5,030		
2.30	750	3.40	2,455	4.50	5,325		
2.40	855	3.50	2,675	4.60	5,630		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eighteen discharge measurements made during 1905-6 and is well defined.

Monthly discharge of North Platte River at Saratoga, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March (25-31)	970	525	685	9,510
April	3,190	855	1,670	99,400
May	9,140	1,530	4,740	291,000
June	8,960	2,900	5,670	337,000
July	3,520	702	2,000	123,000
August	750	355	543	33,400
September	750	311	502	29,900
October	740	198	460	28,300
The period				952,000

NOTE.—Values for 1906 are excellent.

NORTH PLATTE RIVER AT PATHFINDER, WYO.

This station was established May 9, 1905. It is located one-half mile south of Pathfinder post-office and 500 feet below the mouth of the canyon. The Pathfinder dam site is one-fourth mile above the station.

The channel is straight for 500 feet above and below the station. The banks are high and will not overflow. The bed is composed of sand and gravel and liable to shift somewhat. The current is sluggish at low stages.

Discharge measurements are made by means of a cable and car. The initial point for soundings is a cross chiseled in the granite ledge to which the north end of the cable is attached.

The gage, which is read daily by employees of the United States Reclamation Service, is a staff fastened to the north bank 50 feet above the cable. The bench mark is a standard United States Geological Survey aluminum tablet cemented in the rock east of the north-cable anchorage; elevation, 25.26 feet above the gage datum and 5,687.4 feet above sea level.

Discharge measurements of North Platte River at Pathfinder, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 8[a]	L. V. Branch	79	381	1.80	199
February 22[a]	do	82	426	1.97	279
April 5	do	199	1,090	4.00	2,180
May 11	do	204	1,410	5.52	4,190
May 22	J. W. Sussex	209	1,840	7.40	8,180
June 22	L. V. Branch	203	1,590	6.47	6,000

[a] Measured under ice.

Daily gage height, in feet, of North Platte River at Pathfinder, Wyo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.70	2.05	4.88	4.45	8.48	4.80	2.38	2.25	2.02	2.50	1.90
2	.....	1.60	2.12	5.08	4.50	7.60	4.78	2.32	2.40	1.98	2.50	2.00
3	.....	1.62	2.08	5.05	4.32	7.00	4.72	2.30	1.75	1.90	2.50	2.00
4	.....	1.68	2.10	4.20	4.15	6.75	4.65	2.35	1.62	1.88	2.55	2.00
5	.....	1.68	2.05	3.92	4.20	6.78	4.52	2.45	1.80	1.82	2.58	2.00
6	.....	1.65	2.05	3.58	4.78	7.10	4.40	2.42	1.78	1.80	2.52	1.88
7	1.40	1.68	2.08	3.95	5.25	7.75	4.22	2.30	1.70	1.80	2.50	1.95
8	1.45	1.75	2.15	3.95	5.20	7.80	4.40	2.20	1.62	1.80	2.48	2.02
9	1.58	1.75	2.15	4.20	5.00	7.42	4.87	2.20	1.58	1.82	2.42	2.10
10	1.60	1.70	2.05	4.38	5.15	6.90	4.90	2.12	1.50	1.80	2.30	2.10
11	1.58	1.72	2.00	4.55	5.55	6.70	4.63	2.05	1.52	1.80	2.28	2.20
12	1.58	1.75	1.88	5.52	6.05	6.95	4.78	2.00	2.08	1.80	2.22	2.18
13	1.55	1.80	1.92	5.52	6.35	7.42	4.85	1.90	1.68	1.75	2.20	2.10
14	1.58	1.82	2.02	5.38	6.48	8.08	4.65	1.95	1.60	1.72	2.18	1.58
15	1.60	1.80	2.10	4.52	6.30	8.55	4.60	1.88	1.98	1.70	2.12	1.50
16	1.60	1.82	2.18	4.02	6.20	8.70	4.60	1.82	1.92	1.68	2.12	1.32
17	1.55	1.85	2.20	3.90	6.32	8.70	4.58	1.82	2.10	1.70	2.05	1.32
18	1.55	1.88	2.20	4.12	6.55	8.55	4.32	1.90	2.40	1.65	1.75	1.45
19	1.52	1.90	2.25	4.58	6.52	8.00	4.02	1.92	2.58	1.65	1.10	1.62
20	1.52	1.90	2.25	4.88	6.60	7.42	3.75	1.92	2.48	1.68	1.38	1.80
21	1.52	1.92	2.28	4.58	6.90	6.82	3.58	2.05	2.40	1.62	1.22	1.95
22	1.55	1.95	2.20	4.33	7.02	6.40	3.40	1.95	2.40	1.58	1.18	2.05
23	1.62	1.95	2.25	4.57	7.35	6.22	3.23	1.92	2.35	1.28	1.10	2.05
24	1.68	1.98	2.32	5.10	7.62	6.22	3.13	1.85	2.28	1.40	0.78	2.05
25	1.68	2.12	3.22	5.53	7.75	6.02	3.03	1.88	2.15	1.85	1.48	2.00
26	1.68	2.10	4.95	5.85	8.32	5.90	2.90	1.82	2.08	1.80	1.85	2.02
27	1.62	2.15	4.80	5.65	8.35	5.67	2.85	1.75	1.98	1.88	1.80	2.05
28	1.62	2.10	4.65	5.23	8.32	5.22	2.78	1.70	1.95	2.28	1.85	2.05
29	1.65	.....	4.50	4.65	8.50	5.02	2.65	1.65	1.98	2.35	1.75	1.88
30	1.65	.....	3.82	4.40	9.18	4.85	2.52	1.58	2.00	2.58	1.78	1.82
31	1.62	.....	3.72	.....	8.85	.....	2.42	1.90	.....	2.62	.....	1.92

NOTE.—Ice 2 feet thick during January and February. Ice commenced to melt in early part of March and river was clear at gaging station March 30. Ice conditions November 18 to December 31.

NORTH PLATTE RIVER AT GUERNSEY, WYO.

This station was established June 14, 1900. It was originally located at the highway bridge about half a mile northwest of Guernsey, Wyo., in sec. 35, T. 27 N., R. 66 W., but at the opening of the season of 1902 the gage rod was removed to the railroad bridge 300 feet above the first location. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 196, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River at Guernsey, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	A. J. Parshall	329	1,120	3.45	5,340
March 28	do	329	1.000	3.15	4,470
March 29	do	329	1,110	3.45	5,600
April 6	do	326	861	2.80	3,480
April 7	do	319	732	2.55	2,810
April 20	do	327	837	2.80	3,510
May 8	do	329	946	2.95	4,130
May 19	do	329	1,280	3.95	6,380
June 4	do	329	1,660	4.95	9,710
June 17	do	329	1,820	5.70	10,700
June 18	do	329	1,820	5.70	10,600
July 9	do	328	837	2.80	3,340
July 23	do	328	743	2.20	2,570
July 30	do	307	532	1.60	1,560
August 2	do	300	476	1.40	1,330
November 15	R. I. Meeker	235	508	1.50	1,310

Daily gage height, in feet, of North Platte River at Guernsey, Wyo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.80	3.30	5.95	3.45	1.58	0.82	0.90	1.28	1.25
2	2.65	3.25	5.80	3.28	1.48	.80	.90	1.50	1.10
3	2.75	3.15	5.60	3.20	1.38	.78	.88	1.60	1.25
4	2.90	3.15	5.13	3.12	1.32	.72	.85	1.65	1.55
5	3.10	3.15	4.90	3.10	1.30	.70	.80	1.65	1.90
6	2.90	3.07	4.65	3.05	1.40	.78	.80	1.62	2.30
7	2.53	3.05	4.65	3.00	2.05	.80	.80	1.60	1.60
8	2.43	2.95	4.70	2.95	1.70	.80	.80	1.58	1.40
9	2.35	3.20	4.95	2.85	1.45	.80	.80	1.55	1.40
10	2.50	3.45	5.20	2.75	1.32	.80	.80	1.55	1.30
11	2.75	3.53	4.95	2.75	1.22	.80	.85	1.50	1.50
12	3.00	3.53	4.65	3.15	1.10	1.40	.85	1.50	1.75
13	3.20	3.60	5.20	3.00	1.45	1.30	.85	1.50	2.00
14	3.30	3.80	5.35	2.80	1.88	1.15	.82	1.45	1.90
15	3.10	4.00	5.45	3.05	1.82	.95	.80	1.50	1.80
16	3.00	4.15	5.50	3.32	1.80	.85	.80	1.40	1.60
17	3.00	4.05	5.70	3.25	1.75	.90	.80	1.35	1.40
18	2.90	3.95	5.70	2.85	1.70	.90	.80	1.10	1.30
19	2.83	3.95	5.55	2.80	1.70	.98	.80	.95	1.30
20	2.80	4.10	5.35	2.78	1.50	1.00	.80	.80	1.50
21	2.90	4.20	5.30	2.65	1.35	1.05	.88	1.25	1.60
22	3.10	4.25	5.15	2.45	1.75	1.08	.90	1.50	1.70
23	3.30	4.30	4.80	2.15	1.92	1.10	.92	1.65	1.55
24	3.20	4.50	4.60	3.02	1.80	1.00	.98	1.80	1.50
25	3.20	4.65	4.40	2.95	1.40	1.00	1.00	1.50	1.65
26	3.45	4.80	4.25	1.78	1.32	1.00	1.00	1.30	1.55
27	3.70	5.15	4.70	1.70	1.25	1.00	1.02	1.25	1.50
28	3.85	5.70	3.95	1.68	1.18	.95	1.08	1.20	1.50
29	3.70	5.85	3.70	1.65	.95	.92	1.12	1.20	1.50
30	3.40	5.75	3.60	1.60	.90	.90	1.18	1.40	1.45
31	.....	5.75	.....	1.60	.90	.....	1.20	.....	1.35

Rating tables for North Platte River at Guernsey, Wyo.

APRIL 1 TO 30, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	2,230	2.80	3,450	3.30	4,950	3.80	6,650
2.40	2,440	2.90	3,730	3.40	5,270	3.90	7,020
2.50	2,670	3.00	4,020	3.50	5,600		
2.60	2,920	3.10	4,320	3.60	5,940		
2.70	3,180	3.20	4,630	3.70	6,290		

MAY 1 TO DECEMBER 31, 1906.[b]

0.70	440	1.80	1,820	2.90	3,850	4.00	6,370
.80	530	1.90	1,980	3.00	4,060	4.20	6,870
.90	630	2.00	2,150	3.10	4,280	4.40	7,390
1.00	730	2.10	2,320	3.20	4,500	4.60	7,920
1.10	840	2.20	2,500	3.30	4,720	4.80	8,460
1.20	960	2.30	2,680	3.40	4,950	5.00	9,000
1.30	1,090	2.40	2,860	3.50	5,180	5.20	9,560
1.40	1,220	2.50	3,050	3.60	5,410	5.40	10,120
1.50	1,360	2.60	3,240	3.70	5,640	5.60	10,690
1.60	1,510	2.70	3,440	3.80	5,880	5.80	11,270
1.70	1,660	2.80	3,640	3.90	6,120	6.00	11,850

[a] This table is applicable only for open-channel conditions. It is based on six discharge measurements made during March and April 1906, and is fairly well defined.

[b] This table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1906, and is fairly well defined between gage heights 1.4 feet and 6 feet.

Monthly discharge of North Platte River at Guernsey, Wyo., for 1906.

[Drainage area, 16,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	6,840	2,340	4,140	246,000	0.256	0.29
May	11,400	3,960	6,580	405,000	.406	.47
June	11,700	5.410	8,990	535,000	.555	.62
July	5,060	1,510	3,510	216,000	.217	.25
August	2,240	630	1,350	83,000	.083	.10
September	1,220	440	672	40,000	.041	.05
October	960	530	629	38,700	.039	.04
November	1,820	530	1,270	75,600	.078	.09
The period				1,640,000		

NOTE.—Values are rated as follows: April to August and November, good; September and October, fair.

NORTH PLATTE RIVER NEAR MITCHELL, NEBR.

This station was established June 3, 1902. It is located at a highway bridge 1 mile south of Mitchell, Nebr., in sec. 27, T. 23 N., R. 56 W., and replaces the station at Gering, Nebr. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 202, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River near Mitchell, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	F. S. Dobson	905	1,330	3.35	3,170
May 8	do		1,500	3.45	3,990
May 8	do	1,020	1,650	3.45	4,260
June 26	Arthur Dobson	1,040	2,140	4.05	6,790
July 24	do	1,570	1,110	3.12	2,630
September 1	do		485	2.45	852
October 16	Arthur Wilson	1,560	364	2.53	643
December 8	A. R. Wilson		862	2.95	2,080

Daily gage height, in feet, of North Platte River near Mitchell, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.8	5.1		2.8	2.5	2.5	2.7
2		3.7	5.3	3.7	2.8		2.5	2.7
3		3.6		3.6	2.8	2.4	2.5	2.8
4		3.5	5.0	3.5	2.8	2.4	2.5	
5		3.6	4.8	3.4		2.4	2.5	2.8
6	3.6		4.7	3.4	2.7	2.4	2.5	2.8
7	3.5	3.5	4.6	3.3	2.7	2.4		2.8
8		3.5	4.4		2.7	2.5	2.5	2.8
9	3.4	3.5	4.4	3.2	2.9		2.5	2.7
10	3.3	3.5		3.2	2.8	2.4	2.4	2.7
11	3.3	3.6	4.5	3.2	2.7	2.4	2.4	
12	3.3	3.6	4.4	3.2		2.4	2.4	2.7
13	3.4		4.2	3.3	2.7	2.5	2.4	2.7
14	3.5	3.7	4.0	3.3	2.7	2.6		2.8
15		3.8	3.9		2.6	2.6	2.4	2.9
16	3.8	3.9	4.0	3.3	2.6		2.4	2.8
17	3.8	4.0		3.4	2.5	2.6	2.4	2.8
18	3.7	4.0	4.5	3.5	2.5	2.5	2.4	
19	3.6	3.9	4.5	3.4		2.5	2.5	
20	3.5		4.4	3.3	2.4	2.5	2.5	

Daily gage height, in feet, of North Platte River near Mitchell, Nebr., for 1906—Cont'd.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21	3.5	3.9	4.4	3.2	2.4	2.5	.....	.....
22	.....	4.0	4.4	.....	2.5	2.4	2.5	.....
23	3.5	4.1	4.2	3.2	2.7	.....	2.5	.....
24	3.7	4.2	.....	3.1	2.8	2.5	2.6	.....
25	3.6	4.2	4.1	3.1	2.9	2.6	3.0	.....
26	3.6	4.4	4.2	3.0	.....	2.5	2.7	2.6
27	3.6	.....	4.0	3.0	2.9	2.4	2.6	2.6
28	3.8	4.7	4.0	3.0	2.9	2.4	.....	2.5
29	.....	5.2	4.2	.....	2.8	2.4	2.6	2.4
30	3.9	5.3	4.1	2.9	2.7	.....	2.6	2.4
31	.....	5.2	.....	2.8	2.6	.....	2.6	.....

Daily discharge, in second-feet, of North Platte River near Mitchell, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5,580	14,100	6,110	1,640	940	680	1,160
2	.....	5,070	15,700	5,070	1,640	845	680	1,160
3	.....	4,580	14,500	4,580	1,640	750	680	1,400
4	.....	4,120	13,300	4,120	1,640	680	680	1,400
5	.....	4,580	11,800	3,680	1,510	680	680	1,400
6	4,580	4,350	11,100	3,680	1,380	680	600	1,450
7	4,120	4,120	10,400	3,270	1,380	680	600	1,450
8	3,900	4,120	9,060	3,080	1,380	860	600	1,450
9	3,680	4,120	9,060	2,890	1,920	770	600	1,200
10	3,270	4,120	9,380	2,890	1,640	680	500	1,200
11	3,270	4,580	9,710	2,890	1,380	680	500	1,220
12	3,270	4,580	9,060	2,890	1,380	680	500	1,240
13	3,680	4,820	7,820	3,270	1,380	770	500	1,240
14	4,120	5,070	6,660	3,270	1,380	960	500	1,500
15	4,820	5,580	6,110	3,270	1,150	960	500	1,750
16	5,580	6,110	6,660	3,270	1,150	960	500	1,520
17	5,580	6,660	8,120	3,680	940	960	510	1,520
18	5,070	6,660	9,710	4,120	940	770	510	1,300
19	4,580	6,110	9,710	3,680	845	770	650	1,300
20	4,120	6,110	9,060	3,270	750	770	650	1,300
21	4,120	6,110	9,060	2,890	750	770	675	1,300
22	4,120	6,660	9,060	2,890	940	600	700	1,300
23	4,120	7,230	7,820	2,890	1,380	640	700	1,300
24	5,070	7,820	7,520	2,540	1,640	680	860	1,300
25	4,580	7,820	7,230	2,540	1,920	850	1,820	1,300
26	4,580	9,060	7,820	2,220	1,920	680	1,070	1,080
27	4,580	10,000	6,660	2,220	1,920	530	900	1,080
28	5,580	11,100	6,660	2,220	1,920	530	900	900
29	5,840	14,900	7,820	2,070	1,640	530	900	720
30	6,110	15,700	7,230	1,920	1,380	605	900	720
31	.....	14,900	.....	1,640	1,150	.....	900	.....

NOTE.—A rating table was used April 6 to August 31. After that date the discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of North Platte River near Mitchell, Nebr., for 1906.

[Drainage area, 24,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (25)	6,110	3,270	4,490	223,000	0.184	0.17
May	15,700	4,120	6,850	421,000	.281	.32
June	15,700	6,110	9,260	551,000	.380	.42
July	6,110	1,640	3,190	196,000	.131	.15
August	1,920	750	1,410	86,700	.058	.07
September	960	530	742	44,200	.030	.03
October	1,820	500	708	43,500	.029	.03
November	1,750	720	1,270	75,600	.052	.06
The period	.....	.....	.....	1,640,000	.....	.....

NOTE.—Conditions of flow probably did not vary greatly during 1906, although there has been considerable change since 1905. The above values can not safely be considered as better than fair. Some of the monthly means may, however, be better than fair, while those for September and October are probably only approximate.

NORTH PLATTE RIVER AT BRIDGEPORT, NEBR.

This station was established May 4, 1902. It is located at the highway bridge on the public road about one-half mile north of Bridgeport, Nebr., in sec. 28, T. 20 N., R. 50 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 204, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River at Bridgeport, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	F. S. Dobson	2,040	1,600	5.75	3,450
June 27	Arthur Dobson	2,190	2,630	6.05	6,510
July 25	do	2,200	1,180	5.51	2,310
September 2	do	.....	647	4.74	1,140
October 17	A. R. Wilson	2,200	483	4.81	822
December 7	do	2,190	819	5.55	2,190

Daily gage height, in feet, of North Platte River at Bridgeport, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.42	7.10	6.20	5.18	4.65	4.76	4.75
2	.....	6.32	7.15	6.10	5.15	4.60	4.76	4.72
3	.....	6.22	7.20	6.00	5.15	4.62	4.72	4.72
4	.....	6.18	7.10	5.90	5.18	4.62	4.72	4.72
5	.....	6.10	7.05	5.80	5.15	4.60	4.70	4.70
6	.....	6.05	7.00	5.75	5.15	4.60	4.74	4.72
7	.....	6.08	6.90	5.70	5.12	4.60	4.73	4.70
8	6.08	6.08	6.85	5.60	5.15	4.62	4.75	4.70
9	5.98	6.00	6.70	5.50	5.16	4.64	4.76	4.70
10	5.88	6.10	6.65	5.90	5.18	4.62	4.75	4.72
11	5.85	6.15	6.65	5.80	5.15	4.62	4.77	.....
12	6.00	6.12	6.60	5.70	5.15	4.60	4.75	.....
13	6.95	6.08	6.60	5.75	5.15	4.60	4.75	.....
14	6.90	6.05	6.50	5.60	5.15	4.62	4.73	.....
15	6.00	6.00	6.40	5.75	5.10	4.64	4.72	.....
16	6.10	6.45	6.40	5.80	5.00	4.60	4.73	.....
17	6.12	6.48	6.45	5.90	4.95	4.62	4.73	.....
18	6.15	6.42	6.50	6.00	4.87	4.64	4.75	.....
19	6.12	6.45	6.55	5.95	4.85	4.68	4.75	.....
20	6.08	6.40	6.60	5.95	4.80	4.70	4.73	.....
21	6.00	6.55	6.75	5.90	4.86	4.70	4.75	.....
22	5.95	6.58	6.70	5.85	4.85	4.70	4.78	.....
23	5.90	6.60	6.60	5.80	4.90	4.68	4.80	.....
24	5.98	6.65	6.50	5.78	4.90	4.65	4.84	.....
25	6.08	6.70	6.40	5.60	4.85	4.65	4.82	.....
26	6.10	6.70	6.30	5.50	4.90	4.65	4.82	.....
27	6.15	6.75	6.28	5.50	4.85	4.68	4.82	.....
28	6.18	6.95	6.25	5.45	4.82	4.70	4.80	.....
29	6.22	7.20	6.20	5.30	4.80	4.70	4.80	.....
30	6.30	7.40	6.15	5.20	4.75	4.70	4.78	.....
31	.....	7.10	.....	5.20	4.70	.....	4.75	.....

Daily discharge, in second-feet, of North Platte River at Bridgeport, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	9,400	16,600	7,800	1,120	800	850	560
2	.....	8,400	17,100	6,900	1,050	760	850	530
3	.....	7,500	17,600	6,000	1,100	800	760	530
4	.....	7,250	16,600	5,200	1,210	800	760	530
5	.....	6,550	16,100	4,400	1,150	750	720	500
6	.....	6,100	15,700	4,000	1,150	750	810	530
7	.....	6,400	14,600	3,650	1,180	750	780	400
8	6,000	6,400	14,200	3,000	1,260	800	830	400
9	5,200	5,700	12,600	2,400	1,400	840	750	400
10	4,400	6,500	12,100	5,200	1,500	800	740	400
11	4,150	7,000	12,100	4,400	1,450	800	790	.....
12	5,450	6,700	11,600	3,650	1,450	660	740	.....
13	14,500	6,400	11,600	4,050	1,500	660	740	.....
14	14,000	6,100	10,600	3,000	1,500	720	690	.....
15	5,450	5,820	9,600	4,050	1,430	760	680	.....
16	6,300	9,900	9,600	4,400	1,070	660	690	.....
17	6,450	10,200	10,200	5,200	1,000	720	690	.....
18	6,750	9,600	10,700	6,000	800	760	640	.....
19	6,450	9,900	11,200	5,600	810	850	640	.....
20	6,100	9,450	11,700	5,600	700	900	600	.....
21	5,450	10,900	13,200	5,200	900	800	640	.....
22	5,050	11,200	12,700	4,800	860	800	700	.....
23	4,750	11,400	11,700	4,400	1,090	740	750	.....
24	5,400	11,900	10,700	4,250	1,090	680	850	.....
25	6,300	12,400	9,800	3,000	1,030	680	780	.....
26	6,440	12,600	8,800	2,300	1,190	680	780	.....
27	6,900	13,000	8,600	2,300	1,120	740	780	.....
28	7,150	15,100	8,250	2,150	1,040	800	660	.....
29	7,500	17,300	7,800	2,450	1,060	800	660	.....
30	8,220	19,700	7,300	1,140	950	730	640	.....
31	.....	16,600	.....	1,140	920	.....	560	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of North Platte River at Bridgeport, Nebr., for 1906.

[Drainage area, 23,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (8-30)	14,500	4,150	6,710	306,000	0.289	0.25
May	19,700	5,700	9,790	602,000	.422	.49
June	17,600	7,300	12,000	714,000	.517	.58
July	7,800	1,140	4,120	253,000	.178	.21
August	1,500	700	1,130	69,500	.049	.06
September	900	660	760	45,200	.033	.04
October	850	560	727	44,700	.031	.04
November (1-10)	560	400	478	9,480	.021	.01
The period	.....	.....	.....	2,050,000	.....	.....

NOTE.—Values for April to July can probably be considered as fair; values for August to November can not safely be considered as better than approximate, owing to great changes in the conditions of flow during that period.

NORTH PLATTE RIVER AT NORTH PLATTE, NEBR.

This station was established October 5, 1894. It is located 3½ miles above the junction of North and South Platte rivers, at a highway bridge about one-half mile north of the city of North Platte, in sec. 28, T. 14 N., R. 30 W. It is the lowest station on the river. The conditions at this station are described in Water-Supply Paper No. 172, page 207, where are given also references to publications

that contain data for previous years. The present bench mark is the top of the southwest corner of the east concrete abutment of the new railroad bridge (same location as the old); elevation above gage datum, 8.20 feet.

Discharge measurements of North Platte River at North Platte, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 22	F. S. Dobson		3,270	2.65	5,100
April 10	do	1.920	2,320	2.80	5,930
May 9	do		2,370	2.60	5,500
July 2	Arthur Dobson	2,000	2,530	2.85	6,330
August 1	do	1,740	843	2.00	1,530
September 7	do		617	1.75	1,040
November 3	do		1.410	2.52	3,130
November 13	A. R. Wilson	1,720	1.160	2.35	2,570

Daily gage height, in feet, of North Platte River at North Platte, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.95	3.70	2.88	2.08	2.05	1.92	2.35
2		2.90	3.75	2.88	2.05	2.05	1.95	2.32
3		2.95	3.78	2.90	1.92	2.02	1.95	2.55
4		2.88	3.78	2.82	1.85	2.00	1.90	2.50
5		2.92	3.98	2.80	1.88	2.00	1.90	2.40
6		2.88	3.85	2.70	2.20	1.88	1.88	2.38
7		2.70	3.80	2.60	2.38	1.78	1.85	2.35
8		2.62	3.35	2.50	2.10	1.72	1.82	2.32
9		2.60	3.20	2.48	1.95	1.70	1.90	2.32
10	2.80	2.60	3.05	2.45	1.85	1.70	1.90	2.38
11	2.78	2.62	3.02	2.45	1.80	1.85	1.90	2.40
12	2.88	2.60	3.10	2.40	1.70	2.08	1.90	2.40
13	3.00	2.65	3.10	2.42	1.62	2.00	1.90	2.30
14	2.80	2.65	3.15	2.50	1.55	2.00	2.00	2.30
15	2.75	2.75	3.10	2.45	1.60	1.88	2.00	2.25
16	2.68	2.85	3.10	2.35	1.60	1.70	1.95	2.28
17	2.70	2.78	2.92	2.22	1.52	1.78	1.98	2.25
18	2.68	2.78	2.80	2.28	1.48	1.85	1.92	2.20
19	2.82	2.92	2.90	2.32	1.42	1.85	1.95	2.20
20	2.88	3.00	2.98	2.38	1.30	2.02	1.98	2.02
21	2.80	3.18	3.12	2.42	1.20	2.02	1.85	1.85
22	2.75	3.05	3.20	2.60	1.08	2.00	2.12	1.85
23	2.70	3.05	3.18	2.52	1.82	2.00	2.45	1.98
24	2.72	3.08	3.25	2.40	2.10	1.98	2.15	2.10
25	2.68	3.32	3.22	2.42	1.88	2.00	2.05	2.28
26	2.55	3.20	3.12	2.40	1.95	1.92	2.18	2.35
27	2.75	3.20	3.15	2.45	1.78	1.90	2.35	2.25
28	2.95	3.20	3.05	2.30	1.68	1.90	2.75	2.20
29	2.82	3.22	2.95	2.20	1.65	1.88	2.85	2.20
30	2.75	3.35	2.90	2.10	1.85	1.90	2.50	2.38
31		3.52		2.10	2.10		2.38	

Daily discharge, in second-feet, of North Platte River at North Platte, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		7,490	15,400	6,910	1,900	2,080	1,200	2,400
2		7,070	16,100	6,910	1,750	2,080	1,280	2,200
3		7,490	16,400	7,070	1,320	1,940	1,220	3,340
4		6,910	16,400	6,440	1,170	1,870	1,060	3,080
5		7,240	19,000	6,280	1,230	1,870	1,060	2,570
6		6,910	17,300	5,540	2,400	1,410	1,000	2,500
7		5,540	16,700	4,850	3,320	1,120	920	2,370
8		4,990	11,300	4,200	1,960	900	760	2,300
9		4,850	9,770	4,080	1,380	840	980	2,300
10	6,280	4,850	8,360	3,900	1,060	840	980	2,570

Daily discharge, in second-feet, of North Platte River at North Platte, Nebr., for 1906—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.
11	6,130	4,990	8,090	3,900	1,000	1,280	980	2,660
12	6,910	4,850	8,810	3,600	740	2,200	980	2,860
13	7,910	5,200	8,810	3,720	570	1,770	950	2,350
14	6,280	5,200	9,290	4,200	445	1,770	1,260	2,320
15	5,910	5,910	8,870	3,900	530	1,340	1,260	2,080
16	5,400	6,680	8,810	3,320	530	780	1,080	2,230
17	5,540	6,130	7,240	2,640	394	1,160	1,200	2,080
18	5,400	6,130	6,280	2,950	330	1,170	940	1,880
19	6,440	7,240	7,070	3,160	260	1,170	1,020	1,880
20	6,910	7,910	7,740	3,490	170	1,750	1,120	1,230
21	6,280	9,580	9,000	3,720	100	1,750	760	750
22	5,910	8,360	9,770	4,850	50	1,670	1,600	750
23	5,540	8,360	9,580	4,330	1,140	1,560	3,000	1,100
24	5,690	8,630	10,300	3,600	2,200	1,480	1,630	1,500
25	5,400	11,000	9,970	3,720	1,340	1,550	1,260	2,230
26	4,520	9,770	9,000	3,600	1,600	1,260	1,760	2,550
27	5,910	9,770	9,290	3,900	1,040	1,200	2,480	2,080
28	7,490	9,770	8,360	3,050	740	1,120	4,600	1,880
29	6,440	9,970	7,490	2,540	740	1,060	5,300	1,880
30	5,910	11,300	7,070	2,080	1,300	1,120	3,130	2,710
31	.....	13,200	.....	2,080	2,300	.....	2,520	.....

NOTE.—The daily discharge was obtained from a rating table April 10 to July 31. After that date the indirect method for shifting channel conditions was used.

Monthly discharge of North Platte River at North Platte, Nebr., for 1906.

[Drainage area, 28,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (10-30)	7,910	4,520	6,100	254,000	0.214	0.17
May	13,200	4,850	7,530	463,000	.264	.30
June	19,000	6,280	10,600	631,000	.372	.42
July	7,070	2,080	4,150	255,000	.146	.17
August	3,320	50	1,130	69,500	.040	.05
September	2,200	780	1,470	87,500	.052	.06
October	5,300	760	1,590	97,800	.056	.06
November	3,340	750	2,150	128,000	.075	.08
The period	.....	.....	.....	1,990,000	.....	.....

NOTE.—Values are rated as follows: April to July, good; August to November, fair.

MISCELLANEOUS MEASUREMENT.

A discharge measurement of North Platte River at Pinkhampton, Colo., on September 23, 1906, gave the following result:

Width, 68 feet; area of section, 52 square feet; gage height, 3.88 feet; discharge, 38 second-feet.

SOUTH PLATTE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The headwaters of the South Platte have their sources in the mountainous region surrounding the large basin near the center of the State of Colorado known as South Park and in the long eastern slopes of the high mountains forming the Continental Divide. The

general course of the stream is eastward to Lake George, thence through Platte Canyon northward to the junction with Cache la Poudre River near Greeley, and thence eastward until it joins the North Platte at the town of North Platte, Nebr.

Precipitation varies from 25 inches along the Continental Divide, where the greater part of it is snowfall, to 14 to 17 inches among the foothills. Evaporation records are meager.

In the mountainous region the flow of the South Platte and its tributaries is perennial; but in the plains area the volume is greatly diminished, owing to the fact that the normal waters are completely diverted for irrigation, the capacity of the canals far exceeding the discharge of the river. At North Platte, Nebr., just above the mouth of the river, the stream channel is dry for the greater part of the year or consists of several small channels carrying a few second-feet of water.

The tributaries of the South Platte comprise, first, the small streams that rise on the eastern slopes of the Rocky Mountains, and, second, the plains streams. The mountain streams furnish a perennial supply of water, the amount of which, however, varies with the snowfall, being light during the latter part of the summer and in the fall and winter, and large during the spring floods. This water is almost entirely diverted for irrigation and does not reach the South Platte except in times of heavy floods. The principal streams of this class are Bear, Clear, Boulder, and St. Vrain creeks and Big Thompson and Cache la Poudre rivers. The plains streams are all intermittent in their nature and furnish water only during storms or in the season of melting snow. The chief streams of this class are Cherry, Lone Tree, Kiowa, Boxelder, Bijou, Beaver, and Pawnee creeks.

The South Platte is subject to periodic floods, which occur in May and June, the magnitude varying from year to year with seasonal precipitation and temperature. At Julesburg, on the eastern margin of the basin in Colorado, the stream may vary from no flow up to 12,000 second-feet.

SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station was established March 28, 1902, at the wagon bridge crossing the South Platte about 150 feet below the junction of North and South forks at the town of South Platte, a station on the Colorado and Southern Railway about 9 miles above the mouth of the canyon. May 7, 1905, the old station was abandoned and a new station established at a point 150 feet below the county bridge. The station is very near the Colorado and Southern Railway station and is easily accessible from Denver. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 217, where

are given also references to publications that contain data for previous years.

This station is of special importance, its location being above the diverting gates of all irrigating ditches and also above the intake of the Denver Union Water Company, which derives the greater part of its supply from the South Platte, a few miles below. The location of the Cheesman storage reservoir on the South Fork 20 miles above this station and the contemplated installation of large power plants on the two forks at points above also add to the importance of the station as a base from which to secure data. Bridges across each fork above the main station allow of measurements being made on these streams, thereby checking all gagings on the main stream.

Discharge measurements of South Platte River at South Platte, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 2	M. C. Hinderlider	75	137	2.25	337
May 4	do	77	202	3.10	780
June 1	T. E. Brick	79	225	3.25	804
June 18	do	78	237	3.42	986
June 30	M. C. Hinderlider	75	148	2.40	388
October 3	R. I. Meeker	76	179	3.00	603
October 30	do	75	182	3.00	608

Daily gage height, in feet, of South Platte River at South Platte, Colo., for 1906.

Day.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.95	2.15	3.10	3.18	2.40	2.30	2.30	3.12	3.00
2	1.85	2.25	3.10	3.22	2.40	2.32	2.38	3.02	3.05
3	1.35	2.35	3.00	3.10	2.48	2.30	2.75	3.00	2.98
4	1.35	2.22	3.10	3.15	2.40	2.50	2.90	3.00	2.90
5		1.90	3.15	3.22	2.55	2.40	3.20	3.00	2.95
6		2.10	3.05	3.20	2.75	2.35	2.95	3.00	2.80
7		2.45	3.10	3.00	2.80	2.32	2.80	3.00	2.80
8		2.38	3.10	2.85	3.15	2.30	2.52	2.95	2.80
9		2.38	3.12	2.80	3.30	2.20	2.50	2.95	2.60
10		2.50	3.22	2.80	3.45	2.28	2.50	2.90	2.60
11		2.60	3.20	3.00	3.25	2.30	2.50	2.80	2.70
12		2.75	3.20	3.02	3.08	2.18	2.50	2.75	2.70
13		2.62	3.12	3.32	2.90	2.15	2.35	2.75	2.70
14		2.42	3.05	3.25	2.95	2.20	2.30	2.70	2.65
15		2.32	3.10	3.55	3.15	2.20	2.22	2.70	2.60
16		2.35	3.05	3.70	3.20	2.30	2.45	2.70	2.60
17		2.40	3.15	3.50	2.95	2.30	2.50	2.60	2.52
18		2.48	3.22	3.38	2.75	2.20	2.78	2.60	2.50
19		2.60	3.25	3.32	2.70	2.20	2.85	2.60	2.20
20		2.65	3.50	3.15	2.50	2.20	2.75	2.60	2.20
21		2.70	3.62	2.95	2.40	2.30	2.60	2.60	2.10
22		2.70	3.90	2.90	2.40	2.25	2.60	2.60	2.10
23		2.85	3.90	2.85	2.40	2.32	2.50	2.50	2.10
24		2.90	3.85	2.75	2.60	2.65	2.40	2.50	2.10
25		2.75	3.90	2.68	2.70	2.75	2.32	2.50	2.12
26		2.70	3.92	2.70	2.50	2.78	2.50	2.50	2.05
27		2.65	3.65	2.52	2.40	2.50	3.15	2.65	2.02
28		2.60	3.62	2.48	2.42	2.48	3.60	2.72	2.10
29		2.82	3.52	2.40	2.30	2.40	3.58	3.05	2.10
30		3.08	3.15	2.40	2.30	2.35	3.30	3.00	2.12
31			3.10		2.30	2.30		3.00	

Daily discharge, in second-feet, of South Platte River at South Platte, Colo., for 1906.

Day.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	224	300	780	770	388	340	320	660	608
2	198	337	780	790	388	350	350	610	630
3	100	375	730	725	420	340	495	603	590
4	100	328	780	765	388	420	565	603	560
5	.....	220	810	800	490	380	710	603	580
6	.....	285	755	790	530	350	560	603	515
7	.....	433	780	690	555	340	520	603	515
8	.....	408	765	630	725	330	410	580	515
9	.....	408	775	610	800	295	400	580	430
10	.....	452	830	610	885	325	400	560	430
11	.....	295	820	705	775	332	400	510	470
12	.....	560	820	720	690	290	400	490	470
13	.....	502	775	905	595	280	340	490	470
14	.....	410	740	865	615	295	320	470	450
15	.....	395	750	1,040	710	295	290	470	430
16	.....	405	730	1,140	740	332	380	470	430
17	.....	425	780	1,030	615	332	400	430	400
18	.....	460	820	960	525	295	510	430	390
19	.....	505	835	920	505	295	540	430	275
20	.....	530	975	830	420	295	510	430	275
21	.....	550	1,050	690	380	332	440	430	245
22	.....	550	1,220	665	380	315	440	430	245
23	.....	640	1,220	640	380	340	385	390	245
24	.....	665	1,185	575	460	470	350	390	245
25	.....	590	1,220	540	505	515	320	390	250
26	.....	570	1,230	550	420	530	385	390	230
27	.....	545	1,060	460	380	410	670	455	223
28	.....	525	1,035	440	390	405	915	480	245
29	.....	620	960	405	340	370	900	625	245
30	.....	755	750	395	340	340	750	608	250
31	.....	.....	725	.....	340	320	.....	608	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of South Platte River at South Platte, Colo., for 1906.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	755	220	468	27,800	0.179	0.20
May	1,230	725	887	54,500	.340	.39
June	1,140	395	722	43,000	.277	.31
July	885	340	519	31,900	.199	.23
August	530	280	350	21,500	.134	.15
September	915	290	480	28,600	.184	.21
October	660	390	510	31,400	.195	.22
November	630	223	395	23,500	.151	.17
The period	.....	.....	.....	262,000	.....	.....

NOTE.—Values for 1906 are probably good.

SOUTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station was established May 8, 1905, for the purpose of collecting data in regard to the run-off of the South Fork drainage basin and also to furnish information concerning power and irrigation possibilities on the stream. It is located about 500 feet above the junction of North and South forks of South Platte River, in T. 7 S., R. 20 W., and about 700 feet above the wagon bridge at which the old station on the South Platte was located. The conditions at this station and the bench marks are described in Water-Supply

Paper No. 172, page 220, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of South Platte River at South Platte, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	R. I. Meeker	16	15	[a] 2.10	32
April 2	M. C. Hinderlider	58	81	2.30	260
May 4	do	60	117	2.70	412
June 1	T. E. Brick	58	75	2.20	208
June 18	do	58	109	2.80	402
June 30	M. C. Hinderlider	50	35	1.35	79
October 3	R. I. Meeker	59	102	2.60	364
October 30	do	60	117	2.80	446

[a] Ice measurement. Gage height affected by ice.

Daily gage height, in feet, of South Fork of South Platte River at South Platte, Colo., for 1906.

Day.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.40	2.25	2.90	2.20	1.32	1.80	2.00	2.80	2.80
2	2.60	2.30	2.90	2.20	1.32	1.82	2.08	2.68	2.75
3	2.10	2.45	2.75	2.20	1.40	1.80	2.25	2.62	2.70
4	2.08	2.18	2.70	2.30	1.40	2.02	2.80	2.50	2.70
5	.....	1.70	2.80	2.30	1.90	2.00	3.10	2.50	2.65
6	.....	1.90	2.75	2.22	2.32	1.95	2.75	2.50	2.60
7	.....	2.18	2.70	2.02	2.32	1.95	2.50	2.55	2.60
8	.....	2.30	2.70	1.95	2.65	1.90	2.40	2.45	2.60
9	.....	2.25	2.70	1.90	2.80	1.90	2.30	2.45	2.50
10	.....	2.30	2.70	1.90	3.08	1.88	2.10	2.40	2.50
11	.....	2.40	2.70	1.82	2.85	2.00	2.10	2.40	2.50
12	.....	2.60	2.70	1.82	2.55	1.95	2.10	2.40	2.45
13	.....	2.55	2.68	1.95	2.40	1.80	2.02	2.40	2.45
14	.....	2.35	2.65	1.95	2.32	1.80	1.95	2.40	2.40
15	.....	2.28	2.62	2.60	2.50	1.80	1.82	2.40	2.40
16	.....	2.22	2.65	2.90	2.65	1.95	1.95	2.40	2.40
17	.....	2.20	2.48	2.80	2.40	2.00	2.20	2.30	2.40
18	.....	2.30	2.40	2.82	2.20	2.00	2.48	2.30	2.40
19	.....	2.50	2.40	2.68	2.10	1.95	2.40	2.30	1.90
20	.....	2.55	2.50	2.38	2.00	1.95	2.40	2.30	1.70
21	.....	2.50	2.75	2.05	1.90	2.00	2.30	2.30	1.70
22	.....	2.50	2.90	1.88	1.70	2.00	2.05	2.30	1.60
23	.....	2.60	2.90	1.78	1.90	2.10	2.00	2.28	1.60
24	.....	2.65	3.10	1.80	2.15	2.30	2.00	2.25	1.50
25	.....	2.60	3.35	1.85	2.20	2.65	1.92	2.20	1.50
26	.....	2.50	3.35	1.80	2.00	2.62	2.00	2.30	1.50
27	.....	2.50	2.90	1.75	1.90	2.45	2.80	2.35	1.50
28	.....	2.45	2.80	1.58	1.80	2.25	3.25	2.45	1.65
29	.....	2.62	2.58	1.42	1.80	2.08	3.38	2.60	1.70
30	.....	2.82	2.38	1.38	1.90	2.00	3.02	2.85	1.70
31	.....	.....	2.25	.....	1.80	2.00	.....	2.80	.....

NOTE.—January gage heights affected by ice condition.

Rating table for South Fork of South Platte River at South Platte, Colo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	70	1.90	165	2.50	335	3.10	615
1.40	80	2.00	190	2.60	370	3.20	670
1.50	95	2.10	215	2.70	410	3.30	730
1.60	110	2.20	240	2.80	455	3.40	790
1.70	125	2.30	270	2.90	505		
1.80	145	2.40	300	3.00	560		

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty-three discharge measurements made during 1905–6, and is well defined between gage heights 1.3 feet and 3.5 feet.

Monthly discharge of South Fork of South Platte River at South Platte, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	465	125	301	17,900
May	760	255	435	26,700
June	505	78	224	13,300
July	604	72	240	14,800
August	390	145	199	12,200
September	778	149	310	18,400
October	480	240	319	19,600
November	455	95	258	15,400
The period				138,000

NOTE.—Values are rated as follows: April and July to November, excellent; May and June, good.

SOUTH PLATTE RIVER AT DENVER, COLO.

In the spring of 1895 a river station was established at the Twenty-third Street Viaduct in the city of Denver, but observations were discontinued June 18 of the same year, as the location was found to be unfavorable for accurate measurements and the water had fallen below the gage. In July, 1895, a station was established at the Fifteenth Street Bridge. The present station is located at a point immediately below the mouth of Cherry Creek, which enters between the Fourteenth and Fifteenth street bridges. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 223, where are given also references to publications that contain data for previous years.

Discharge measurements of South Platte River at Denver, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 2	W. A. Lamb	56	41	0.75	63
March 26	do	54	55	1.07	116
April 11	M. C. Hinderlider	133	109	1.38	195
May 1	T. E. Brick	171	290	2.60	834
June 5	do	150	154	1.80	342
June 15	do	131	121	1.62	283
September 29	R. I. Meeker	169	246	2.30	657
October 6	C. L. Chatfield	161	186	1.80	397
October 24	do	170	268	2.30	716
October 29	do	170	287	2.50	881
November 8	do	169	263	2.25	758
November 13	do	162	243	2.15	660

Daily gage height, in feet, of South Platte River at Denver, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	0.70	1.00	0.70	1.08	2.70	1.90	1.48	1.52	1.70	1.92	2.50
2	.70	.90	.68	1.35	2.55	1.85	1.62	1.50	1.72	1.85	2.52
3	.70	.95	.70	1.50	2.60	1.82	1.75	1.42	1.70	1.78	2.50
4	.70	1.00	.70	1.78	2.60	1.80	1.90	1.55	1.70	1.70	2.45
5	.72	.85	1.02	1.40	2.70	1.82	1.82	1.62	1.72	1.72	2.40
6	.70	.65	.95	1.10	2.72	1.82	1.82	1.48	1.60	1.80	2.38
7	.70	.70	1.12	1.10	2.70	1.80	1.92	1.45	1.55	1.82	2.25
8	.70	.72	1.05	1.38	2.75	1.80	2.00	1.42	1.38	1.80	2.20
9	.70	.72	1.02	1.32	2.60	1.72	2.05	1.52	1.22	1.75	2.20
10	.68	.70	1.00	1.42	2.45	1.80	1.92	1.42	1.35	1.65	2.20
11	.75	.70	1.00	1.40	2.38	1.82	1.80	1.45	1.38	1.62	2.15
12	.72	.90	.88	1.40	2.22	1.90	1.65	1.48	1.45	1.70	2.15
13	.75	1.02	.75	1.30	2.10	1.92	1.42	1.62	1.62	1.72	2.15
14	.75	.75	.90	1.30	2.00	1.90	2.08	1.65	1.70	1.75	2.10
15	.78	.80	.80	1.15	2.02	1.92	2.35	1.60	1.65	1.45	2.00
16	.82	.90	.65	.85	1.95	1.85	2.00	1.50	1.60	1.48	1.92
17	.85	.90	.80	.80	1.85	2.00	1.52	1.62	1.55	1.60	1.88
18	.85	.85	.80	.78	1.85	1.95	1.38	1.58	1.88	1.68	1.80
19	.85	.90	.80	.98	1.80	1.65	1.32	1.58	1.95	1.65	1.78
20	.90	.92	.78	1.28	1.85	1.38	1.60	1.55	1.80	1.70	1.70
21	.85	.95	.98	1.35	1.80	1.42	1.62	1.45	1.60	1.75	1.80
22	.85	1.00	1.12	1.30	2.00	1.52	1.60	1.45	1.50	1.00	1.80
23	.85	1.08	1.30	1.40	2.28	2.10	1.60	1.68	1.45	2.00	1.80
24	.88	.98	1.30	1.55	2.15	2.00	1.50	1.82	1.35	2.08	1.78
25	.90	.92	1.45	1.60	2.15	1.90	1.50	1.90	1.15	2.20	1.80
26	.90	1.00	1.30	1.70	2.65	1.65	1.58	2.02	1.35	2.18	1.70
27	1.10	1.00	1.38	1.78	2.80	1.50	1.60	1.90	1.85	2.28	1.62
28	1.00	.70	1.10	1.90	2.55	1.40	1.60	1.92	2.02	2.35	1.60
29	1.00	.....	.95	2.00	2.40	1.55	1.45	1.78	2.20	2.40	1.58
30	1.02	.....	.85	2.05	2.28	1.58	1.40	1.75	2.15	2.45	1.52
31	1.00	.....	.95	.....	2.10	.....	1.35	1.65	.....	2.45	.....

Daily discharge, in second-feet, of South Platte River at Denver, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	56	97	56	120	935	385	245	265	340	445	905
2	56	82	55	177	790	365	285	255	350	415	925
3	56	90	56	220	834	350	340	230	340	385	905
4	56	97	56	320	834	340	400	275	340	350	890
5	58	75	100	195	935	350	365	298	350	355	840
6	56	53	90	127	950	350	365	250	300	395	850
7	56	57	118	127	935	342	408	240	285	400	740
8	56	58	107	190	985	342	450	230	228	395	715
9	56	58	100	178	830	320	475	265	180	370	715
10	54	56	97	204	705	350	408	230	118	340	710
11	63	56	97	200	650	360	360	240	228	325	670
12	58	82	80	200	555	390	300	250	250	360	670
13	63	100	63	175	490	400	222	300	310	370	660
14	63	63	82	175	440	395	485	310	340	395	625
15	68	69	73	140	450	400	630	295	330	375	565
16	72	82	56	87	415	370	450	255	310	285	520
17	75	82	73	80	375	440	255	300	195	330	505
18	75	75	73	76	375	415	210	285	425	365	460
19	75	82	73	106	350	295	195	285	460	350	452
20	82	84	71	166	370	205	283	285	390	370	420
21	75	90	101	188	350	218	288	250	310	395	460
22	75	97	123	175	432	248	283	250	275	475	460
23	75	110	162	200	585	490	283	330	255	525	460
24	79	94	162	245	515	440	250	390	225	570	452
25	82	84	200	262	515	395	250	425	170	645	460
26	82	97	162	300	860	295	285	485	225	630	420
27	115	97	182	324	1,020	240	290	425	415	700	380
28	97	56	120	378	770	215	290	435	500	750	370
29	97	.....	95	423	660	260	240	375	595	795	365
30	100	.....	90	444	570	275	225	360	565	840	345
31	97	.....	97	.....	477	.....	210	320	.....	840	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of South Platte River at Denver, Colo., for 1906.

[Drainage area 3,840 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	115	54	71.9	4,420	0.019	0.02
February	110	53	79.4	4,410	.021	.02
March	200	55	99.0	6,080	.026	.03
April	444	76	207	12,300	.054	.06
May	1,020	350	644	39,600	.168	.19
June	490	205	341	20,300	.089	.10
July	630	195	323	19,900	.084	.10
August	485	230	302	18,600	.079	.09
September	595	118	320	19,000	.083	.09
October	840	285	469	28,800	.122	.14
November	925	345	597	35,500	.155	.17
The period				209,000		

NOTE.—Values for 1906 are good.

SOUTH PLATTE RIVER NEAR KERSEY, COLO.

This station was established April 7, 1901. It is located at a bridge about 1½ miles north of the railroad station at Kersey, which is on the Union Pacific Railroad about 6 miles east of Greeley, in T. 5 N., R. 64 W., and was intended to take the place of the station previously maintained at Orchard, Colo. The station was discontinued in the fall of 1903, but was reestablished March 5, 1905, to satisfy the demand for hydrographic data pertaining to the storage of flood waters. The station is below all the important tributaries of the South Platte which derive their supply from the mountain region and is at about the point where water could be used to best advantage for storage in reservoirs along the South Platte in northeastern Colorado. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 227, where are given also references to publications that contain data for previous years.

Discharge measurements of South Platte River near Kersey, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 23	M. C. Hinderlider	154	200	2.61	454
March 22	do	161	229	2.85	540
March 27	do	187	320	3.30	840
May 3	do	242	609	4.35	1,850
June 22	do	102	102	1.92	184
October 15	R. I. Meeker	225	358	3.08	740
November 5	do	257	644	4.40	1,840

Daily gage height, in feet, of South Platte River near Kersey, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.7	2.7	2.6	3.0	3.8	3.1	2.0	1.7	1.8	3.2	4.25
2	2.7	2.7	2.6	2.95	3.95	3.05	2.05	1.75	1.8	3.4	4.25
3	2.7	2.7	2.6	2.9	4.35	2.9	1.8	1.75	1.8	3.2	4.3
4	2.7	2.7	2.65	2.8	4.35	2.6	1.8	1.8	1.8	3.1	4.35
5	2.7	2.7	2.65	2.8	4.4	2.5	1.7	1.8	1.85	3.05	4.4

Daily gage height, in feet, of South Platte River near Kersey, Colo., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
6	2.7	2.7	2.7	2.8	4.4	2.4	2.0	1.75	1.95	3.0	4.4
7	2.7	2.7	2.7	2.8	4.55	2.1	2.0	1.7	2.0	3.1	4.3
8	2.7	2.7	2.7	3.0	4.4	1.7	2.0	1.7	2.2	3.2	4.28
9	2.7	2.65	2.7	3.2	4.2	1.7	2.0	1.7	2.2	3.2	4.28
10	2.7	2.65	2.75	3.6	4.2	1.7	2.35	1.7	2.2	3.3	4.22
11	2.7	2.6	2.75	3.5	4.05	1.7	2.8	1.7	2.2	3.2	4.12
12	2.7	2.6	2.75	3.3	4.0	1.7	2.3	1.7	2.2	3.1	3.98
13	2.7	2.6	2.75	3.25	4.2	1.7	2.0	1.75	2.4	3.0	3.98
14	2.7	2.65	2.75	3.1	4.0	1.6	1.95	1.75	2.4	3.0	3.98
15	2.7	2.65	2.75	3.0	4.0	3.0	2.1	1.75	2.4	3.0	3.98
16	2.7	2.65	2.7	2.95	3.9	2.8	3.3	1.75	2.55	3.0	3.75
17	2.7	2.65	2.7	2.85	3.5	2.5	3.7	1.7	2.65	2.95	3.75
18	2.7	2.65	2.65	2.8	3.5	2.7	3.6	1.7	2.7	2.95	3.75
19	2.7	2.65	2.6	2.85	3.4	2.6	3.6	1.7	2.8	2.9	3.75
20	2.7	2.65	2.7	2.9	2.7	2.3	3.3	1.7	2.8	2.9	3.75
21	2.7	2.65	2.8	2.95	2.3	2.0	2.8	1.7	3.1	3.0	3.75
22	2.7	2.65	2.85	3.1	2.3	1.95	2.3	1.75	3.4	3.8	3.7
23	2.75	2.6	3.0	3.1	2.3	1.95	2.2	1.75	3.35	3.9	3.7
24	2.75	2.6	3.2	3.1	2.3	2.3	2.0	1.75	3.3	3.95	3.7
25	2.75	2.6	3.25	3.1	2.7	2.3	2.0	1.75	3.25	4.0	3.7
26	2.75	2.6	3.3	3.2	3.5	3.3	1.8	1.8	3.25	4.0	3.7
27	2.75	2.6	3.3	3.5	3.8	2.8	1.7	1.8	3.2	4.0	3.7
28	2.75	2.6	3.25	4.0	3.6	2.55	1.7	1.8	3.2	4.1	3.7
29	2.75	.....	3.2	4.3	3.2	2.3	1.7	1.8	3.1	4.1	3.65
30	2.75	.....	3.2	4.1	3.2	2.05	1.7	1.8	3.1	4.5	3.6
31	2.7	.....	3.1	.....	3.2	.....	1.7	1.8	.....	4.25	.....

NOTE.—Floating ice January 1 to February 15.

Rating table for South Platte River near Kersey, Colo., from January 1 to December 31, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	110	2.40	345	3.20	805	3.90	1,380
1.70	130	2.50	390	3.30	875	4.00	1,470
1.80	155	2.60	440	3.40	950	4.10	1,565
1.90	180	2.70	495	3.50	1,030	4.20	1,660
2.00	210	2.80	550	3.60	1,115	4.30	1,760
2.10	240	2.90	610	3.70	1,200	4.40	1,865
2.20	270	3.00	670	3.80	1,290	4.50	1,970
2.30	305	3.10	735				

NOTE.—The above table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1906 and is well defined between gage heights 1.9 feet and 4.5 feet.

Monthly discharge of South Platte River near Kersey, Colo., for 1906.

[Drainage area, 9,470 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	522	495	502	30,900	0.053	0.06
February	495	440	467	25,900	.049	.05
March	875	440	585	36,000	.062	.07
April	1,760	550	801	47,700	.085	.09
May	2,020	305	1,200	73,800	.127	.15
June	875	110	359	21,400	.038	.04
July	1,200	130	357	22,000	.038	.04
August	155	130	141	8,670	.015	.02
September	950	155	476	28,300	.050	.06
October	1,970	610	986	60,600	.104	.12
November	1,860	1,160	1,440	85,700	.152	.17
The period	.....	.....	.....	441,000	.....	.....

NOTE.—The plotting of the 1906 measurements appears to indicate that the conditions of flow for any given gage height remained constant, although it is known that radical changes in the channel at this station occurred about the middle of the year. Radical changes in the conditions of flow have taken place in previous years. Values are rated as follows: August, good; remainder of the year, excellent.

SOUTH PLATTE RIVER NEAR JULESBURG, COLO.

This station was established April 2, 1902. It is located at the wagon bridge crossing the South Platte about 1 mile southeast of Julesburg, Colo., a station at the junction of the main line and the Denver branch of the Union Pacific Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 229, where are given also references to publications that contain data for previous years.

As this is the last station on the South Platte in Colorado, and as it is also below all irrigation ditches taking water from the South Platte in Colorado with the exception of one, it is of considerable importance for obtaining data relative to the flow of return waters as well as to the natural flow of the main channel.

Discharge measurements of South Platte River near Julesburg, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 24	M. C. Hinderlider	618	427	1.90	918
March 30	do	823	530	2.20	1,200
June 23 [a]	do	[a] 139	[a] 52	1.48	71
November 6	R. I. Meeker	898	924	2.78	1,940

[a] Wading section.

Daily gage height, in feet, of South Platte River near Julesburg, Colo., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.9		2.2	1.6	1.5	1.4				2.6
2	1.9		2.25	1.6	1.4		1.2	1.3	1.45	
3	1.9	1.9	2.2	1.6	1.45	1.4				
4	1.85	1.9	1.95	1.6	1.45		1.2	1.3	1.35	2.6
5	1.85	1.9	2.0	1.7	1.4	1.4				
6		1.9	1.95	1.75	1.4		1.2	1.1	1.45	2.6
7		2.2	1.95	2.0	1.35	1.35	1.45			
8	1.9	2.75	1.85	2.2	1.35			1.15	1.95	2.6
9	1.9	2.85	1.9	2.05	1.3	1.3	1.45			
10	1.9		1.9	2.05	1.35			1.15	1.95	2.6
11	1.9	2.7	1.9	2.05	1.3	1.4	1.25			2.5
12	2.2		1.9	2.05	1.4			1.4	1.95	2.75
13	2.75		2.5	2.0	1.35	1.35	1.25			
14			1.95	1.9	1.5			1.35	1.95	2.75
15			1.9	1.8	1.3	1.45	1.3			
16			1.8	1.75	1.3			1.35	1.95	2.75
17			1.9	1.6	1.3	1.35	1.3			
18			1.9	1.55	1.3			1.35	1.85	
19			1.95	1.5	1.3	1.35	1.2	1.35		
20			1.9	1.4	1.25			1.35	1.95	
21			1.85	1.35	1.2	1.35	1.15			
22			1.8	1.35	1.3			1.35	1.95	
23			1.8	1.5	1.45	1.3	1.15			
24	1.9		1.8	1.55	1.4			1.4	2.5	
25	1.9		1.8	1.7	1.4	1.3	1.15			
26	1.9		1.8	1.9	1.4			1.35	2.8	
27	1.85	2.25	1.8	1.9	1.4	1.35	1.15			
28	1.85	2.45	1.6	1.85	1.4			1.35	2.8	
29		2.25	1.6	1.7	1.4	1.3	1.15			
30		2.25	1.6	1.6	1.4			1.35	2.8	
31		2.25		1.55		1.3	1.2			

Rating table for South Platte River near Julesburg, Colo., for 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	7	1.70	165	2.30	825	2.90	2,330
1.20	14	1.80	230	2.40	1,000	3.00	2,700
1.30	28	1.90	310	2.50	1,200	3.10	3,090
1.40	48	2.00	410	2.60	1,430		
1.50	77	2.10	530	2.70	1,700		
1.60	115	2.20	670	2.80	2,000		

[a] The table was applied indirectly from February 1 to May 31.

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6, and is not well defined.

Monthly discharge of South Platte River near Julesburg, Colo., for 1906.

[Drainage area, 20,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
February (1–13; 24–28)	2,800	870	1,030	36,800	0.050	0.03
March (13 days)	3,120	920	1,580	40,700	.077	.04
April	1,800	210	636	37,800	.031	.03
May	880	50	302	18,600	.015	.02
June	77	14	42.6	2,530	.0021	.002
July	62	28	38.9	2,390	.0019	.002
August	62	10	21.1	1,300	.0010	.001
September	48	7	30.5	1,810	.0015	.002
October	2,000	38	679	41,800	.033	.04
November	1,850	1,200	1,550	49,200	.075	.04
The period				233,000		

NOTE.—The discharge was interpolated for missing gage heights. Values can not safely be considered as better than approximate, owing to shifting channel conditions and insufficient data.

CLEAR CREEK AT FORKSCREEK, COLO.

This station was established May 29, 1899. It is located at the United States Geological Survey bridge, just below the Colorado and Southern Railway bridge at the railroad station, in T. 33 S., R. 72 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 231, where are given also references to publications that contain data for previous years. The station is important because of its location above all diversions and also because of contemplated power development.

Discharge measurements of Clear Creek at Forkscreek, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	M. C. Hinderlider	28	19	2.20	49
May 7	T. E. Brick	35	52	3.22	227
May 26	M. C. Hinderlider	36	94	3.80	636
June 7	T. E. Brick	36	106	4.10	838
June 13	do	36	145	5.20	1,600
June 28	M. C. Hinderlider	36	111	4.10	712
August 18	R. I. Meeker	34	68	3.15	237
October 5	do	35	77	3.45	322
October 24	do	31	59	3.00	199

Daily gage height, in feet, of Clear Creek at Forkscreek, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.28	2.82	4.10	4.28	3.42	2.95	3.50	2.92
2	2.35	2.85	4.10	4.28	3.40	3.32	3.45	2.90
3	2.32	2.90	4.02	4.12	3.40	3.28	3.45	2.80
4	2.30	3.05	4.02	4.02	3.38	3.12	3.45	2.80
5	2.28	3.12	4.15	3.95	3.32	2.98	3.42	2.80
6	2.35	3.18	4.35	3.95	3.30	3.00	3.42	2.80
7	2.52	3.28	4.12	3.98	3.38	2.98	3.40	2.80
8	2.42	3.35	3.98	4.00	3.28	2.95	3.38	2.80
9	2.40	3.48	4.08	3.98	3.22	3.00	3.35	2.80
10	2.48	3.52	4.20	4.00	3.20	2.98	3.35	2.75
11	2.52	3.58	4.42	4.05	3.28	3.05	3.30	2.75
12	2.58	3.55	4.98	4.10	3.20	3.00	3.25	2.70
13	2.32	3.55	5.22	4.10	3.20	2.95	3.20	2.75
14	2.40	3.45	5.10	4.18	3.25	2.90	3.20	2.78
15	2.42	3.45	5.18	4.05	3.22	2.90	3.18	2.70
16	2.52	3.68	5.12	3.92	3.25	3.18	3.18	2.58
17	2.58	3.78	5.00	3.88	3.20	3.12	3.10	2.50
18	2.70	3.80	4.62	3.88	3.12	3.12	3.00	.....
19	2.65	3.88	4.50	3.90	3.05	3.10	3.00	.....
20	2.60	4.05	4.45	3.88	3.08	3.10	2.98	.....
21	2.70	4.02	4.42	3.82	3.25	3.10	2.95	.....
22	2.85	4.10	4.42	3.82	3.25	3.02	2.90	.....
23	2.98	4.20	4.42	3.80	3.35	3.10	2.90	.....
24	2.98	4.18	4.28	3.92	3.40	3.20	2.95	.....
25	2.90	4.08	4.08	3.72	3.25	3.25	3.00	.....
26	2.92	3.92	4.15	3.65	3.15	3.68	3.00	.....
27	2.92	3.92	4.15	3.60	3.12	3.60	2.98	.....
28	2.68	4.18	4.18	3.52	3.02	3.55	2.98	.....
29	2.72	4.22	4.12	3.55	3.00	3.48	3.00	.....
30	2.80	4.10	4.15	3.52	2.98	3.58	2.90	.....
31	.....	4.02	.....	3.48	2.98	.....	2.92	.....

Rating table for Clear Creek at Forkscreek, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	49	3.00	183	3.80	545	4.60	1,370
2.30	59	3.10	213	3.90	620	4.70	1,505
2.40	71	3.20	245	4.00	705	4.80	1,645
2.50	85	3.30	280	4.10	795	4.90	1,785
2.60	100	3.40	320	4.20	895	5.00	1,930
2.70	117	3.50	365	4.30	1,000	5.10	2,080
2.80	135	3.60	415	4.40	1,115	5.20	2,230
2.90	157	3.70	475	4.50	1,240		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is fairly well defined.

Monthly discharge of Clear Creek at Forkscreek, Colo., for 1906.

[Drainage area, 345 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	178	57	102	6,070	0.296	0.33
May	916	139	510	31,400	1.48	1.71
June	2,260	688	1,170	69,600	3.39	3.78
July	979	356	638	39,200	1.85	2.13
August	329	178	256	15,700	.742	.86
September	463	157	238	14,200	.690	.77
October	365	157	240	14,800	.696	.80
November (1-17)	162	85	129	4,350	.374	.24
The period	.....	.....	.....	195,000	.....	.....

NOTE.—Values for 1906 are good.

PLATTE RIVER.

DESCRIPTION OF BASIN.

From the point of junction of North and South Platte rivers the main stream winds eastward across Nebraska, uniting with the Missouri at Plattsmouth, about 10 miles south of Omaha. Its course lies in the main through broad, level bottom lands, rather sandy in places, but for the most part fertile, bordered by bluffs varying in height from 50 to 300 or 400 feet. From its source to a point near Ashland, Saunders County, it is a broad, shallow stream, flowing in many places as a network of interlacing channels among numerous islands and sand bars, but father east it is confined between heavily wooded limestone bluffs.

The average annual precipitation is about 23 inches, of which 69 per cent falls during the five months of the growing season, from April to August; about half of the remainder is snowfall. The stream is subject to periodic floods, caused by the melting of snows in the headwaters regions of North and South Platte rivers; these floods reach a maximum in June and July and often do considerable damage to property on the lower portions of the stream. In the western part of the drainage area the waters of the river are extensively used for irrigation.

The Loup and its branches, which form the most important tributaries of the Platte, drain an area 13,540 square miles in extent, lying in the heart of Nebraska. The Loup proper is formed by the junction of North and Middle Loup rivers, which unite near the city of St. Paul, the Middle Loup in turn receiving the South Loup in the southwestern part of Howard County. The principal tributaries are Beaver, Cedar, Calamus, and Dismal creeks. A comparatively small amount of water is diverted for irrigation, the ditches generally being small and covering limited areas. A number of power plants are in operation and others of considerable extent have been proposed, particularly one near Columbus, by which it is believed that about 20,000 continuous horsepower may be developed.

PLATTE RIVER NEAR LEXINGTON, NEBR.

This station was established April 2, 1902. It is located at a highway bridge 3 miles south of Lexington, Nebr., in sec. 20, T. 9 N., R. 21 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 235, where are given also references to publications that contain data for previous years.

Discharge measurements of Platte River near Lexington, Nebr., in 1905-6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 1	G. W. Bates	3,720	1,420	3.50	2,470
May 16	do	3,790	5,050	4.25	13,800
June 12	H. C. Gardner	3,720	8,220	4.93	25,800
July 10	do	3,800	4,700	3.93	11,000
July 18	do	2,900	1,680	3.38	2,880
August 2	do	3,140	1,760	3.48	2,880
August 23	H. O. Smith				0
September 6	H. C. Gardner	1,480	637	3.25	990
September 20	F. S. Dobson	1,540	502	3.10	760
1906.					
April 10	F. S. Dobson	3,800	2,910	3.83	6,570
May 10	do		3,240	3.93	6,560
July 8	Arthur Dobson	3,770	2,550	3.83	4,910
July 31	do	3,620	1,180	3.52	2,040
September 8	A. R. Wilson		577	3.38	780
October 19	Arthur Dobson		923	3.40	1,540
November 10	do		2,490	3.78	4,920

Daily gage height, in feet, of Platte River near Lexington, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.97	4.27	3.85	3.45	3.30	3.37	3.81
2		3.97	4.42	3.72	3.40	3.35	3.35	3.92
3		4.00	4.44	3.80	3.45	3.35	3.35	3.92
4		4.00	4.47	3.81	3.57	3.40	3.45	3.94
5	3.82	3.95	4.47	3.82	3.61	3.40	3.40	3.95
6	3.82	3.98	4.50	3.87	3.65	3.40	3.42	3.90
7	3.77	4.02	4.50	3.80	3.60	3.35	3.44	3.77
8	3.80	3.97	4.42	3.83	3.50	3.37	3.45	3.80
9	3.82	3.92	4.17	3.72	3.47	3.33	3.45	3.80
10	3.87	3.95	4.11	3.67	3.40	3.30	3.42	3.81
11	3.95	3.95	4.05	3.57	3.40	3.25	3.42	3.86
12	3.87	3.85	3.97	3.60	3.34	3.42	3.42	3.90
13	3.80	3.82	3.95	3.60	3.27	3.45	3.45	3.85
14	3.82	3.80	4.00	3.55	3.22	3.52	3.46	3.80
15	3.87	3.82	4.05	3.56	3.20	3.50	3.47	3.80
16	3.92	3.85	4.02	3.57	3.17	3.44	3.37	3.66
17	3.85	3.75	3.97	3.55	3.20	3.37	3.50	3.80
18	3.80	3.77	3.92	3.55	3.20	3.37	3.45	3.75
19	3.80	3.72	3.87	3.55	3.15	3.40	3.50	3.70
20	3.80	3.80	3.90	3.60	3.10	3.42	3.52	3.60
21	3.85	3.87	3.85	3.62	3.07	3.45	3.52	3.60
22	3.84	4.00	4.05	3.60	3.02	3.47	3.52	3.48
23	3.82	4.00	4.07	3.57	3.00	3.46	3.57	3.32
24	3.75	4.02	4.10	3.55	3.10	3.45	3.55	3.32
25	3.72	4.07	4.12	3.55	3.25	3.40	3.52	3.46
26	3.70	4.20	4.15	3.65	3.30	3.42	3.55	3.60
27	3.80	4.16	4.10	3.60	3.35	3.40	3.55	3.65
28	3.87	4.12	4.07	3.55	3.42	3.42	3.75	3.60
29	3.95	4.55	4.02	3.52	3.27	3.40	3.95	3.42
30	3.96	4.15	3.97	3.50	3.27	3.38	3.77	3.25
31		4.20		3.52	3.25		3.90	

NOTE.—Sunday and holiday gage heights interpolated. Gage heights are the mean of the two gages.

Daily discharge, in second-feet, of Platte River near Lexington, Nebr., for 1905–6.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1905.							
1	.....	2,150	12,500	27,600	11,500	3,900	0
2	.....	2,600	12,500	27,600	15,600	2,900	300
3	.....	3,100	14,200	26,400	21,600	3,800	300
4	.....	3,400	14,700	25,200	17,800	3,400	300
5	.....	3,400	15,100	24,000	14,200	2,900	1,200
6	.....	3,400	15,100	20,300	11,600	2,200	990
7	.....	3,600	16,000	17,700	16,700	1,900	800
8	.....	3,250	17,000	16,500	14,000	1,900	800
9	.....	2,700	15,800	16,500	12,300	2,200	800
10	.....	2,100	16,100	21,400	11,000	2,500	600
11	.....	2,500	18,000	23,200	11,000	900	400
12	.....	2,300	20,300	25,200	9,600	700	500
13	.....	3,000	20,300	22,600	8,000	700	700
14	.....	2,850	18,400	20,700	7,200	800	500
15	.....	2,850	16,200	27,700	6,000	1,100	700
16	.....	2,850	13,800	30,000	5,500	600	1,600
17	.....	3,400	14,600	29,000	4,300	800	2,000
18	.....	3,650	13,800	28,000	3,200	100	2,300
19	.....	3,400	13,300	25,500	3,000	100	2,100
20	.....	3,400	14,000	24,300	3,200	100	1,900
21	.....	5,200	14,000	22,000	3,000	100	1,900
22	.....	6,300	14,000	19,400	4,700	100	2,000
23	.....	6,600	12,000	26,100	4,100	0	2,000
24	2,900	7,000	11,100	25,000	3,600	0	1,700
25	1,900	9,300	10,500	21,100	3,000	0	1,300
26	2,000	10,400	13,000	17,900	2,800	0	1,300
27	2,150	10,900	13,000	15,600	2,650	0	1,200
28	1,650	11,500	18,200	12,900	2,100	0	1,000
29	1,900	11,000	23,700	11,800	2,300	0	800
30	2,470	11,700	23,100	12,600	2,600	0	900
31	2,470	.....	24,500	.....	2,800	0	.....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1906.								
1	.....	8,100	12,500	5,100	1,400	200	1,000	5,600
2	.....	8,100	15,500	3,600	1,000	600	900	7,100
3	.....	8,500	15,800	4,500	1,400	600	900	7,000
4	.....	8,500	16,400	4,600	2,400	900	1,600	7,200
5	6,500	7,700	16,400	4,700	2,800	900	1,200	7,400
6	6,500	8,200	17,000	5,400	3,000	900	1,600	6,700
7	5,800	8,800	17,000	4,500	2,700	600	1,700	5,000
8	6,100	7,500	15,400	4,900	1,800	700	1,800	5,200
9	6,500	6,800	10,500	3,600	1,600	500	1,800	5,200
10	7,200	7,200	9,400	3,100	1,000	250	1,600	5,300
11	8,500	7,200	8,400	2,100	1,000	100	1,600	6,000
12	7,100	5,800	7,100	2,600	600	1,100	1,600	6,500
13	6,200	5,400	6,800	2,600	100	1,300	1,800	5,800
14	6,400	5,200	7,500	2,100	0	1,900	1,900	5,200
15	6,800	5,400	8,400	2,200	0	1,800	2,000	5,200
16	7,600	5,800	7,900	2,300	0	1,400	1,300	3,600
17	6,600	4,500	7,000	2,100	0	900	2,400	5,200
18	6,000	4,800	6,300	2,200	0	900	2,000	4,600
19	6,000	4,000	5,500	2,200	0	1,100	2,400	4,000
20	6,000	4,900	6,000	2,600	0	1,300	2,700	2,900
21	6,600	5,900	5,300	2,800	0	1,500	2,700	2,900
22	6,500	7,700	8,100	2,600	0	1,700	2,700	1,800
23	6,100	7,700	8,500	2,400	0	1,600	2,900	600
24	5,000	8,000	9,000	2,200	0	1,500	2,700	600
25	4,600	8,900	9,300	2,200	100	1,100	2,400	1,700
26	4,400	11,100	9,900	3,200	200	1,400	2,700	3,000
27	5,600	10,400	9,000	2,700	600	1,200	2,700	3,400
28	6,600	9,700	8,500	2,300	1,100	1,400	4,800	3,000
29	7,700	18,000	7,800	2,000	100	1,200	7,600	1,300
30	8,000	10,200	7,000	1,900	100	1,100	5,000	200
31	.....	11,000	.....	2,000	100	.....	6,800	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of Platte River near Lexington, Nebr., for 1905–6.

[Drainage area, 53,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1905.						
March (24–31)	2,900	1,650	2,180	34,600	0.041	0.01
April	11,700	2,100	4,990	297,000	.094	.10
May	24,500	10,500	15,800	972,000	.296	.34
June	30,000	11,800	22,100	1,320,000	.415	.46
July	21,600	2,100	7,770	478,000	.146	.17
August	3,900	0	1,090	67,000	.020	.02
September	2,300	0	1,100	65,500	.021	.02
The period				3,230,000		
1906.						
April (5–30)	8,500	4,400	6,420	331,000	.120	.12
May	18,000	4,000	7,770	478,000	.146	.17
June	17,000	5,300	9,970	593,000	.187	.21
July	5,400	1,900	3,010	185,000	.056	.06
August	3,000	0	745	45,800	.014	.02
September	1,900	100	1,060	63,100	.020	.02
October	7,600	900	2,480	152,000	.047	.05
November	7,400	200	4,210	251,000	.079	.09
The period				2,100,000		

NOTE.—Values are rated as follows: March, April, August, September, 1905, August and September, 1906, approximate; May to July, 1905, April to July, October and November, 1906, fair.

PLATTE RIVER NEAR COLUMBUS, NEBR.

This station was established June 4, 1895. It is located at the Meridian Bridge, about 3 miles south of Columbus, Nebr., in sec. 31, T. 17, R. 1 E. The bridge lies on the sixth principal meridian. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 237, where are given also references to publications that contain data for previous years.

Discharge measurements of Platte River near Columbus, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 30	Geo. W. Bates	1,660	4,400	4.51	16,800
May 3	do	2,250	5,380	5.12	19,800
June 8	Arthur Dobson	2,300	4,570	4.52	13,800
July 13	do	2,007	1,550	2.90	2,880
August 28	do		40	1.24	51
September 29	do		386	1.88	534
October 27	do		1,540	2.98	3,100
November 24	do		960	2.65	2,150

Daily gage height, in feet, of Platte River near Columbus, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.1	3.9	4.15	2.75	0.85	1.9	2.7
2	.....	5.1	4.1	3.75	2.7	1.45	1.9	3.45
3	.....	5.15	4.1	3.7	2.65	1.55	1.85	3.45
4	.....	4.7	4.55	3.55	3.2	1.35	1.7	3.4
5	.....	4.4	4.55	3.45	3.0	1.35	1.65	3.55
6	.....	4.3	4.5	3.3	2.75	1.35	1.7	3.55
7	.....	4.1	4.45	3.2	3.25	1.35	1.7	3.6
8	3.75	3.8	4.65	3.15	3.05	1.4	1.65	3.6
9	3.65	3.8	4.45	3.05	3.0	1.65	1.65	3.5
10	3.6	3.75	4.4	2.95	3.15	1.7	1.75	3.5
11	3.6	3.7	4.1	2.9	2.95	1.6	1.9	3.3
12	3.65	3.65	3.9	2.8	3.0	1.65	1.9	3.3
13	3.8	3.55	3.75	2.9	2.8	1.65	1.85	3.45
14	4.2	3.5	3.6	2.85	2.6	2.05	1.9	3.3
15	3.95	3.35	3.55	2.75	2.6	2.75	1.95	3.3
16	3.65	3.35	3.5	2.7	2.25	2.35	2.1	3.3
17	3.7	3.25	3.65	2.65	2.5	2.6	2.25	3.15
18	3.6	3.2	4.0	3.2	1.95	2.7	2.4	3.1
19	3.45	3.2	3.75	2.8	1.65	2.75	2.45	3.1
20	3.35	3.2	3.85	2.8	1.35	2.5	2.45	3.0
21	3.0	3.15	3.55	2.65	1.35	2.4	2.4	.....
22	3.25	3.15	3.35	2.6	1.35	2.2	2.95	.....
23	3.4	3.05	3.3	2.6	1.35	2.2	3.4	.....
24	3.5	3.55	3.35	2.85	1.2	2.15	3.2	2.9
25	3.3	4.1	4.0	2.8	1.15	2.05	3.35	2.95
26	3.3	3.7	.....	2.75	1.35	2.05	3.35	2.95
27	3.45	3.8	4.5	2.15	1.25	2.15	3.0	2.9
28	3.8	3.1	4.15	2.95	1.05	2.05	3.0	2.9
29	4.5	3.05	3.95	3.05	1.05	1.9	2.7	2.9
30	4.3	3.85	4.0	3.0	1.0	1.9	2.55	3.2
31	.....	3.95	.....	3.0	0.9	.....	2.8	.....

Rating table for Platte River near Columbus, Nebr., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	5	1.80	500	2.80	2,580	3.80	7,370
0.90	10	1.90	630	2.90	2,900	3.90	8,090
1.00	15	2.00	770	3.00	3,240	4.00	8,860
1.10	25	2.10	930	3.10	3,620	4.20	10,580
1.20	40	2.20	1,110	3.20	4,040	4.40	12,540
1.30	70	2.30	1,310	3.30	4,490	4.60	14,800
1.40	120	2.40	1,530	3.40	4,970	4.80	17,490
1.50	190	2.50	1,770	3.50	5,500	5.00	20,600
1.60	280	2.60	2,020	3.60	6,080	5.20	24,100
1.70	380	2.70	2,290	3.70	6,700		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is well defined.

Monthly discharge of Platte River near Columbus, Nebr., for 1906.

[Drainage area, 56,900 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (8-30)	13,600	3,240	6,530	298,000	0.115	0.10
May	23,200	3,430	8,180	503,000	.144	.17
June	15,400	4,490	9,220	549,000	.162	.18
July	10,100	1,020	3,480	214,000	.061	.07
August	4,260	10	1,580	97,200	.028	.03
September	2,440	8	846	50,300	.015	.02
October	4,970	330	1,640	101,000	.029	.03
November	6,080	2,290	4,080	243,000	.072	.08
The period	.....	.....	.....	2,060,000	.....	.....

NOTE.—Conditions of flow remained fairly constant during 1906. Values are rated as follows: April and May, fair; June to November, excellent.

LOUP RIVER AT COLUMBUS, NEBR.

This station was established October 13, 1894. It is located about 75 yards above the Union Pacific Railroad bridge and 6 miles above the mouth of the river, in sec. 23, T. 17 N., R. 1 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 240, where are given also references to publications that contain data for previous years.

Discharge measurements of Loup River at Columbus, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 23	F. S. Dobson	.....	2,760	5.95	11,300
March 30	Geo. W. Bates	360	1,200	5.60	7,620
May 3	do	490	1,950	5.84	9,320
June 8	Arthur Dobson	530	1,110	4.39	2,760
July 13	do	527	897	4.25	2,250
August 28	do	.....	977	4.65	2,810
September 29	do	.....	1,090	4.49	2,690
October 27	do	210	764	4.63	3,760
November 24	do	.....	847	4.70	2,750

Daily gage height, in feet, of Loup River at Columbus, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8.4	4.6	5.4	4.8	4.25	4.4	4.6
2	.....	6.55	4.4	4.75	4.7	4.3	4.35	4.65
3	.....	5.75	4.5	4.65	4.5	4.45	4.35	4.8
4	.....	5.75	4.5	4.35	4.85	4.4	4.4	4.9
5	.....	5.5	4.45	4.3	5.0	4.4	4.3	4.95
6	.....	5.0	4.5	4.25	4.9	4.4	4.3	4.95
7	.....	5.0	4.5	4.2	6.1	4.35	4.3	4.9
8	4.75	4.9	4.4	4.2	5.7	4.35	4.25	4.7
9	4.9	4.7	4.4	4.2	5.35	4.3	4.25	4.65
10	4.8	4.3	4.35	4.15	5.3	4.1	4.25	4.75
11	4.65	4.3	4.25	4.15	4.7	4.2	4.35	4.55
12	4.55	4.2	4.2	4.1	4.55	4.3	4.35	4.35
13	4.8	4.35	4.2	4.2	4.6	4.55	4.35	4.5
14	5.4	4.3	4.25	4.4	4.6	5.5	4.4	4.45
15	5.75	4.3	4.35	4.2	4.4	4.95	4.3	4.5
16	4.9	4.3	4.35	4.25	4.35	4.75	4.5	4.5
17	5.0	4.2	4.3	4.2	4.3	5.15	4.4	4.45
18	4.95	4.2	4.35	4.25	4.25	4.8	4.5	4.55
19	5.5	4.2	4.4	4.65	4.2	4.65	4.5	4.5
20	5.5	4.2	4.3	4.45	4.15	4.4	4.6	4.5
21	4.9	4.2	4.25	4.65	4.15	4.5	4.65	.....
22	4.85	4.3	4.25	4.4	4.05	4.45	5.05	.....
23	4.8	4.5	4.15	4.45	4.05	4.45	5.05	.....
24	4.8	4.55	4.25	4.45	4.05	4.5	5.3	4.7
25	4.75	5.1	4.4	4.35	4.1	4.5	5.0	4.7
26	4.8	4.75	.....	4.25	4.4	4.5	4.75	4.75
27	5.65	4.85	4.85	4.65	4.65	4.45	4.6	4.8
28	6.1	4.9	4.8	4.25	4.65	4.4	4.95	4.8
29	5.75	4.65	4.85	4.55	4.35	4.4	4.55	4.8
30	6.85	5.3	4.6	4.6	4.3	4.45	4.85	4.75
31	.....	4.8	.....	4.55	4.3	.....	4.75	.....

Daily discharge, in second-feet, of Loup River at Columbus, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	25,000	3.400	7,900	4,000	1,400	2,300	3,300
2	.....	14,100	2,800	4,400	3,600	1,700	2.100	3,500
3	.....	8,700	3,000	3,900	2,700	2,200	2,200	4,100
4	.....	8,700	3,200	2,600	4,200	2,000	2,400	4,600
5	.....	7,200	3,000	2,400	5,000	2,000	2,100	4,900
6	.....	4,500	3,200	2.200	4,400	2,000	2,100	4,900
7	.....	4,500	3,200	2,100	11,600	1,800	2,100	4,600
8	3,650	4,300	2,800	2,100	9,000	1,800	1,900	3,400
9	3,950	3,400	2,800	2,100	6.600	1,700	1,900	3,200
10	3,500	1,900	2,600	1,900	6,200	1,100	2,000	3,600
11	2,900	1,900	2,200	1,900	3,300	1,400	2,400	2,700
12	2,500	1,500	2,000	1,700	2.700	1,700	2,400	2,000
13	3,600	2,000	2,000	2,100	2,900	2,700	2,400	2,500
14	6,600	1,800	2,200	2,800	2,900	7,400	2,500	2,400
15	8,700	1,800	2,600	2,100	2,100	4,400	2,200	2,200
16	4,000	1,800	2,600	2,200	1,900	3,500	2,900	2,200
17	4,500	1,600	2,400	2,100	1,800	5,400	2,500	2,000
18	4,200	1,600	2,600	2,200	1,600	3,700	3,100	2,400
19	7,200	1,600	2,800	3.600	1,400	3,400	3,100	2,200
20	7,200	1,600	2,400	2,800	1,300	2,200	3,500	2,200
21	4,000	1,600	2,200	3,600	1,300	2,600	3,700	.....
22	3,800	2,000	2.200	2,600	1,000	2,400	5,700	.....
23	3.600	2,700	1,900	2,800	1,000	2,400	5,700	.....
24	3,600	2,900	2,200	2,800	1,000	2,600	7,100	2,750
25	3,400	5,400	2,800	2,400	1,100	2,600	5,600	2,750
26	3,600	4,100	3,800	2,000	1,900	2,600	4,300	2,900
27	8,100	4,500	4,800	3,600	2.800	2,500	3,600	3,100
28	11,000	4,800	4,600	2,000	2,800	2,300	5,300	3,100
29	8,700	3,600	4.800	3,200	1,700	2,300	3,400	3,100
30	16,100	6,900	3,700	3,100	1,500	2,300	4,800	2,900
31	.....	4,300	.....	2,900	1,500	.....	4,300	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting conditions of flow.

Monthly discharge of Loup River at Columbus, Nebr., for 1906.

[Drainage area, 13,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (8-30)	16,100	2,500	5,580	255,000	0.413	0.35
May	25,000	1,500	4,590	282,000	.340	.39
June	4,800	1,900	2,890	172,000	.214	.24
July	7,900	1,700	2,780	171,000	.206	.24
August	11,600	1,000	3,120	192,000	.231	.27
September	7,400	1,100	2,600	155,000	.193	.22
October	7,100	1,900	3,280	202,000	.243	.28
November (27 days)	4,900	2,000	3,090	165,000	.229	.23
The period	.....	.....	.....	1,590,000	.....	.....

NOTE.—Considerable changes in the conditions of flow took place at this station during 1906. Values are rated as follows: April to July, fair; August to Novembe,r approximate.

KANSAS RIVER DRAINAGE BASIN.

GENERAL FEATURES.

The drainage basin of Kansas River lies between the basins of the Platte and the Arkansas, entirely within the region of the Great Plains, and extends through the arid, semiarid, and humid regions. It extends from eastern Colorado to Missouri River, a distance of 485 miles.

The principal tributaries are Smoky Hill and Republican rivers, whose union forms Kansas River, and Blue River.

REPUBLICAN RIVER.

DESCRIPTION OF BASIN.

Republican River rises in the arid plains of eastern Colorado, flows northeastward into southwestern Nebraska, then eastward through the southern tier of counties to Superior, where it turns to the southeast, enters Kansas, and about 2 miles northeast of Junction unites with Smoky Hill River to form Kansas River. The length of the basin east and west is approximately 360 miles, its greatest width is 120 miles, and the total area drained is 25,840 square miles. The river is wide and rather shallow, with a rapid descent, and the bed is largely shifting quicksand of the most unstable character.

In the upper portion of its course the Republican receives many tributaries, chiefly from the south. Nearly all of these flow through a region where the rainfall is less than 22 inches; but as this part of the basin is covered with buffalo grass, which sheds rain like a roof, the per cent of rainfall reaching the streams is great. Near the mouth the drainage area is very narrow, and the tributaries are small and unimportant; but here the rainfall is 28 to 38 inches.

The Republican is subject to sudden rises and falls, and occasionally overflows its banks . The most notable flood since 1895, when the gaging station at Junction was established, occurred in May and June, 1903. This covered all the low bottom lands and washed away fences, houses, crops, railway tracks, bridges, stock, and everything movable.

Information in regard to the basin is contained in the following Annual Reports of the United States Geological Survey: Eighteenth, Part IV, page 194; Twenty-first, Part IV, page 219.

REPUBLICAN RIVER NEAR BOSTWICK, NEBR.

This station was established June 6, 1904. It is located at a highway bridge 1 mile south of Bostwick, Nebr., in sec. 23, T. 1 N., R. 8 W., and replaces a station established at Superior, Nebr., in 1895. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 244, where are given also references to publications that contain data for previous years.

Discharge measurements of Republican River near Bostwick, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	F. S. Dobson	417	614	2.00	590
May 19	do		427	1.66	832
June 13	Arthur Dobson	196	237	1.05	391
July 19	do	415	150	.75	276
August 30	do	417	182	.84	267
October 13	do		107	.68	187

Daily gage height, in feet, of Republican River near Bostwick, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.9	1.55	.....	1.15	0.8	0.65	1.4
2	.....	4.95	1.5	.....	1.1	.8	.65	1.4
3	.....	4.15	1.5	.....	1.3	.75	.6	1.35
4	.....	3.85	1.5	.....	1.65	.75	.6	1.35
5	.....	2.75	1.45	.....	1.45	.7	.6	1.4
6	.....	2.55	1.45	.....	1.35	.65	.7	1.4
7	2.0	2.45	1.35	.....	1.25	.6	.75	1.4
8	2.15	2.65	1.3	1.15	1.15	.55	.8	1.4
9	2.05	2.55	1.25	1.05	1.15	.65	.75	1.4
10	1.95	2.45	1.25	1.0	2.1	.65	.7	1.4
11	1.95	2.3	1.15	.9	2.45	.9	.65	1.4
12	1.9	2.2	1.1	1.6	2.15	1.1	.65	1.4
13	2.15	2.1	1.05	.95	1.65	.75	.7	1.4
14	2.5	2.05	1.05	.9	1.5	.95	.7	1.4
15	2.35	2.0	1.0	.9	1.4	1.15	.75	1.4
16	2.15	1.95	1.0	.8	1.35	.85	.75	1.35
17	2.05	1.9	1.0	.75	1.2	.85	.8	1.35
18	2.0	1.85	.95	.7	1.15	.8	.8	1.4
19	1.95	1.8	.9	.7	1.05	.8	.85	1.4
20	1.95	1.65	.9	.8	1.0	.85	.9	1.35
21	1.95	1.6	.85	1.25	.9	.8	1.0	1.35
22	1.9	3.8	.85	2.95	.9	.8	1.35	1.3
23	1.9	2.6	.8	2.95	.9	.8	1.45	1.3
24	1.9	2.15	.8	2.6	1.1	.8	1.4	1.25
25	1.85	1.8	.8	2.25	1.1	.75	1.35	1.3
26	1.85	1.75	.85	2.15	.95	.75	1.45	1.35
27	2.0	1.55	.95	2.1	.9	.75	1.6	1.35
28	2.25	1.55	1.35	1.85	.85	.7	1.5	1.4
29	2.35	1.65	1.55	1.4	.85	.7	1.5	1.4
30	3.15	1.6	1.15	1.3	.85	.....	1.45	1.4
31	.....	1.55	.....	1.25	.8	.....	1.45	.....

Rating tables for Republican River near Bostwick, Nebr.

APRIL 7 TO 30, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	445	2.20	745	2.60	1,105	3.00	1,520
1.90	515	2.30	830	2.70	1,200	3.10	1,630
2.00	590	2.40	920	2.80	1,300	3.20	1,750
2.10	665	2.50	1,010	2.90	1,410		

MAY 1 TO NOVEMBER 30, 1906.[b]

0.60	170	1.60	790	2.60	1,750	3.60	2,970
.70	210	1.70	870	2.70	1,860	3.70	3,110
.80	260	1.80	960	2.80	1,970	3.80	3,250
.90	310	1.90	1,050	2.90	2,080	3.90	3,390
1.00	370	2.00	1,140	3.00	2,200	4.00	3,540
1.10	430	2.10	1,240	3.10	2,320	4.20	3,850
1.20	490	2.20	1,340	3.20	2,440	4.40	4,170
1.30	560	2.30	1,440	3.30	2,570	4.60	4,510
1.40	630	2.40	1,540	3.40	2,700	4.80	4,860
1.50	710	2.50	1,640	3.50	2,830	5.00	5,220

[a] This table is applicable only for open-channel conditions. It is based on one discharge measurement made during 1906 and the form of previous curves. It was assumed that a change in section occurred about May 1.

[b] This table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906 and the form of previous curves.

Monthly discharge of Republican River near Bostwick, Nebr., for 1906.

[Drainage area, 23,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (7-30)	1,690	480	673	32,000	0.029	0.03
May	5,130	750	1,610	99,000	.069	.08
June	750	260	466	27,700	.020	.02
July (8-31)	2,140	210	736	35,000	.032	.03
August	1.590	260	553	34,000	.024	.03
September	460	150	253	15,100	.011	.01
October	790	170	371	22,100	.016	.02
November	630	525	610	36,300	.026	.03
The period				301,000		

NOTE.—Conditions of flow during April are very uncertain; during the remainder of the year they were probably constant. Values are rated as follows: April, approximate, or worse; May to November, probably good.

REPUBLICAN RIVER AT BENKELMAN, NEBR.

This station was established November 1, 1894, discontinued September 7, 1895, and reestablished May 20, 1903, some distance below the original location. It is located about one-half mile east of Benkelman, Nebr., on the line between secs. 17 and 20, T. 1 N., R. 37 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 247, where are given also references to publications that contain data for previous years.

Discharge measurements of Republican River at Benkelman, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	F. S. Dobson		53	1.15	114
June 19	Arthur Dobson	143	34	1.00	40
August 25	do	153	44	1.12	64
September 22	do	154	54	1.15	74
November 30	do	94	158	1.10	122

Daily gage height, in feet, of Republican River at Benkelman, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.15	1.2	1.1	0.8	0.9	0.85	1.05	1.2
2	1.1	1.1	1.05	.85	.9	.9	1.05	1.3
3	1.1	1.1	1.05	.85	.9	.9	1.05	1.3
4	1.1	1.05	1.05	.....	.9	1.0	1.05	1.25
5	1.1	1.2	1.0	.8	1.0	.95	1.0	.....
6	1.05	1.2	.95	.8	1.1	.9	1.0	1.25
7	1.1	1.1	.9	.95	1.0	.9	1.05	1.2
8	1.1	1.25	.85	1.05	1.0	.85	1.05	1.2
9	1.1	1.25	.8	1.05	1.0	.85	1.05	.....
10	1.1	1.15	.8	1.05	1.0	.85	1.05	1.2
11	.....	1.15	.8	1.0	1.0	.....	1.1	1.2
12	.....	1.1	.8	1.0	1.0	.9	1.1	1.2
13	1.1	1.1	.8	.....	1.0	.9	.....	.....
14	1.15	1.1	.85	.8	.9	.....	.....	1.25
15	1.15	1.05	1.7	.8	.9	.....	1.05	1.25
16	1.15	1.05	.....	.8	.9	.9	1.15	1.25
17	.....	1.0	1.05	.8	.9	.95	1.2	1.3
18	1.2	1.0	1.0	.75	.8	1.0	1.05	1.2
19	1.2	.....	1.0	.7	.8	1.0	1.1	.....
20	1.2	.....	.85	.7	.8	1.1	1.1	.....
21	1.2	1.05	.8	.6	.8	1.1	.....	.....
22	1.2	1.05	.....	.5	.7	1.1	.....	.....
23	1.15	.....	1.0	.5	.....	1.1	.....	1.3
24	1.2	1.7	1.0	.7	1.1	1.1	.....	1.3
25	1.15	1.3	1.1	.5	1.1	1.25	1.2	1.3
26	1.1	1.1	.....	.....	.....	1.1	.....	1.1
27	1.9	1.1	.....	1.35	.95	1.05	1.2	1.2
28	1.6	1.0	.....	1.05	.85	1.0	1.15	.....
29	1.6	1.05	.85	.....	.85	1.0	1.15	1.1
30	.....	1.1	.8	.....	.....	1.0	1.15	1.1
31	.....	1.1	.....	.9	.9	.....	1.2	.....

NOTE.—Ice conditions November 17-30.

Daily discharge, in second-feet, of Republican River at Benkelman, Nebr., for 1905-6.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1905.								
1	.....	242	145	117	74	98	8	72
2	.....	262	130	95	102	72	8	72
3	.....	205	138	68	65	98	8	72
4	.....	154	138	58	42	85	22	72
5	.....	175	138	68	27	62	30	72
6	.....	160	138	58	40	98	45	72
7	.....	160	138	42	40	72	55	72
8	.....	175	160	27	57	60	45	60
9	.....	175	160	42	77	60	105	50
10	.....	192	160	74	77	60	105	72
11	.....	175	127	102	77	83	78	72
12	.....	167	127	87	50	110	55	72
13	.....	167	120	90	50	83	78	72
14	.....	167	103	55	40	60	77	72
15	.....	167	103	55	35	57	53	103
16	.....	167	103	65	35	57	77	72
17	.....	150	103	118	54	47	53	72
18	.....	150	108	90	47	47	77	72
19	237	142	138	65	32	37	103	72
20	217	157	108	55	58	37	103	72
21	165	175	122	55	72	37	77	85
22	105	157	108	103	86	35	72	103
23	130	270	97	55	72	10	72	85
24	130	328	142	55	72	10	50	85
25	115	230	142	42	67	10	72	85
26	148	178	127	55	67	15	72	85
27	165	145	127	55	67	35	72	103
28	165	162	117	42	136	10	72	112
29	122	178	182	42	136	10	50	142
30	93	162	148	42	310	6	50	176
31	170	.....	117	.....	125	3	.....	195

Daily discharge, in second-feet, of Republican River at Benkelman, Nebr., for 1905–6—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1906.								
1	115	130	78	10	24	17	57	122
2	102	102	67	17	24	24	57	150
3	102	102	67	17	24	24	57	150
4	102	88	67	13	24	42	57	150
5	102	130	56	10	42	32	47	150
6	88	130	42	10	62	24	47	150
7	102	102	36	32	42	24	67	135
8	102	145	24	51	42	17	67	135
9	102	145	17	51	42	17	67	135
10	102	115	17	51	42	17	67	135
11	102	115	14	42	42	20	78	135
12	102	100	14	42	42	24	78	135
13	102	100	14	26	42	24	74	142
14	115	100	20	10	24	24	70	150
15	115	113	263	10	24	24	67	150
16	115	113	160	10	24	24	93	150
17	122	67	57	10	24	32	105	167
18	130	67	47	4	10	42	67	147
19	130	74	47	2	10	42	78	163
20	130	74	17	2	10	62	78	163
21	130	80	10	1	10	62	100	163
22	130	75	26	0	2	62	100	163
23	115	185	42	0	32	70	100	180
24	130	295	42	2	62	70	100	180
25	115	145	62	0	66	108	122	180
26	102	87	40	64	48	70	122	117
27	398	82	40	128	32	57	122	147
28	275	59	40	51	17	47	105	132
29	275	70	17	38	17	47	105	117
30	200	82	10	37	20	47	105	117
31	.....	82	.....	24	24	.....	122	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of Republican River at Benkelman, Nebr., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March (19–31)	237	93	151	3,890
April	328	142	183	10,900
May	182	97	129	7,930
June	118	27	65.9	3,920
July	310	27	73.8	4,540
August	110	3	50.5	3,110
September	105	8	61.5	3,660
October	195	50	86.9	5,340
The period	.....	.....	.....	43,300
1906.				
April	398	88	135	8,030
May	295	59	108	6,640
June	263	10	48.4	2,880
July	128	0	24.7	1,520
August	62	2	30.6	1,880
September	108	17	39.9	2,370
October	122	47	83.3	5,120
November	180	117	147	8,750
The period	.....	.....	.....	37,200

NOTE.—Owing to frequent radical changes in the conditions of flow at this station the above values can not safely be considered as better than approximate and in some instances may be even worse.

SOUTH FORK OF REPUBLICAN RIVER AT BENKELMAN, NEBR.

This station was established November 1, 1894, discontinued September 5, 1895, and reestablished May 20, 1903. It is located at the highway bridge about three-fourths of a mile east of Benkelman, on the line between secs. 17 and 20, T. 1 N., R. 37 W., and is about one-fourth mile above the mouth of the South Fork. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 248, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Republican River at Benkelman, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	F. S. Dobson		49	1.50	75
June 19	Arthur Dobson	18	1.8	1.00	(a)
August 25	do				(b)
November 30	do	85	33	1.48	45

a Less than 1 second-foot. b Dry.

Daily gage height, in feet, of South Fork of Republican River at Benkelman, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.75	2.0	1.4	0.95	1.0	0.9	1.0	1.45
2	1.7	1.95	1.4	.95	1.0	.9	1.0	1.5
3	1.7	1.95	1.35	.95	1.0	.9	1.0	1.5
4	1.7	1.95	1.3		1.0	.9	1.0	1.5
5	1.6	1.9	1.25	.95	1.0	.9	1.0	
6	1.6	1.8	1.2	.95	1.0	.9	1.0	1.5
7	1.65	1.7	1.15	.95	1.0	.95	.95	1.45
8	1.6	1.7	1.1	.95	1.0	.95	1.0	1.45
9	1.6	1.7	1.05	.95	1.0	.95	.95	
10	1.55	1.6	1.05	.95	1.0	.95	1.0	1.5
11		1.5	1.0	.95	1.0	.95	1.0	1.5
12		1.5	1.0	.95	.9	.9	1.0	1.4
13	1.6	1.5	1.0		.9	.9		
14	1.6	1.5	1.0	.95	.9			1.45
15	1.6	1.5	1.0	.95	.9		1.0	1.45
16	1.5	1.5		.95	.9	.95	1.2	1.45
17		1.45	1.0	.95	.9	.95	1.2	1.5
18	1.6	1.4	1.0	.9	.9	1.0	1.2	1.5
19	1.6		1.0	.9	.9	1.0	1.25	
20	1.7		1.0	.9	1.0	1.0	1.25	
21	1.7	1.5	.95	.9	.9	.95		
22	1.7	1.45		.9	.9	1.0		
23	1.65		1.0	.9		.95	1.6	1.6
24	1.65	1.6	1.0	.9	1.0	1.0	1.5	1.5
25	1.7	1.6	1.0	.9		1.0	1.6	1.5
26	1.6	1.5				1.0		1.55
27	2.3	1.5		1.9	.95	1.0	1.6	1.55
28	2.3	1.5		1.2	.95	1.0	1.55	
29	2.2	1.45	1.0		.9	1.0	1.55	1.55
30		1.4	.95		.9	.95	1.55	1.5
31		1.4		1.1	.95		1.5	

Daily discharge, in second-feet, of South Fork of Republican River at Benkelman, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	137	215	52	0	0	0	0	42
2	123	199	52	0	.....	.....	.....	48
3	123	199	43	0	.....	.....	.....	48
4	123	199	35	0	.....	.....	.....	48
5	96	183	28	0	0	0	0	48
6	96	152	21	0	.....	.....	.....	48
7	109	123	15	0	.....	.....	.....	42
8	96	123	10	0	.....	.....	.....	42
9	96	123	5	0	.....	.....	.....	48
10	84	96	5	0	0	0	0	48
11	88	73	0.5	0	.....	.....	.....	48
12	92	73	.5	0	.....	.....	.....	36
13	96	73	.5	0	.....	.....	.....	39
14	96	73	.5	0	.....	.....	.....	42
15	96	73	.5	0	0	0	0	42
16	73	73	.5	0	.....	.....	17	42
17	84	62	.5	0	.....	.....	17	48
18	96	52	.5	0	.....	.....	17	48
19	96	62	.5	0	.....	.....	21	50
20	123	62	.5	0	0	0	21	53
21	123	73	0	0	.....	.....	34	53
22	123	62	0	0	.....	.....	47	58
23	109	79	0	0	.....	.....	61	61
24	109	96	0	0			48	48
25	123	96	0	0	0	0	61	48
26	96	73	0	92	.....	.....	61	54
27	317	73	0	183	.....	.....	61	54
28	317	73	0	21	.....	.....	54	54
29	283	62	0	18	.....	.....	54	54
30	249	52	0	14	.....	0	54	48
31	.....	52	.....	10	0	.....	48	.....

NOTE.—A rating table was used April 1 to July 31. After that date the discharge was obtained by the indirect method for shifting conditions of flow.

Monthly discharge of South Fork of Republican River at Benkelman, Nebr., for 1906.

[Drainage area, 5,910 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	317	73	129	7,680	0.022	0.02
May	215	52	99.3	6,110	.017	.02
June	52	0	90.3	5,370	.015	.02
July	183	0	10.9	670	.0018	.00
August	0	0	0	0.0	.000	.00
September	0	0	0	0.0	.000	.00
October	61	0	21.8	1,340	.0037	.00
November	61	36	48.0	2,860	.0081	.01
The period	.....	.....	.....	24,000	.....	.....

NOTE.—Owing to frequent changes in the conditions of flow at this station and on account of insufficient number of discharge measurements the above values can not safely be considered as better than approximate and in many instances are probably worse.

KANSAS RIVER.

DESCRIPTION OF BASIN.

Kansas River as such is a comparatively short stream, being formed by the union of Smoky Hill and Republican rivers in Geary County, Kans., whence it flows eastward, entering the Missouri at Kansas City, Mo.

The most important feeder of the Kansas below the junction of Smoky Hill and Republican rivers is the Blue, which rises in southeastern Nebraska, flows to the southeast and south into Kansas, and joins Kansas River at Manhattan. The principal tributary of the Blue is the Little Blue, which rises in southern Nebraska, flows southeastward, and unites with the main stream near Blue Rapids.

Both the Kansas and the Blue have periods of high water nearly every year, but disastrous floods are rare. The most notable flood on record is that which occurred in May and June, 1903, when the water covered all the low bottom lands, destroying many lives and millions of dollars worth of property.

KANSAS RIVER AT LECOMPTON, KANS.

This station was established April 16, 1899. It is located at the new wagon bridge at Lecompton, Kans. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 259, where are given also references to publications that contain data for previous years.

Discharge measurements of Kansas River at Lecompton, Kans., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	E. C. Murphy	751	3,090	4.01	4,930
June 28	W. G. Russell	736	2,590	3.00	6,020

Daily gage height, in feet, of Kansas River at Lecompton, Kans., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	4.7	4.2	4.5	3.1	17	5.3	4.1	3.35	3.65
2	4.65	4.5	4.3	5.5	18	5.05	4.0	3.2	3.6
3	4.5	4.6	4.1	5.45	19	5.0	4.0	3.2	3.5
4	4.2	4.65	4.0	5.35	20	4.7	3.95	3.2	3.4
5	4.2	4.7	3.9	5.25	21	4.5	3.9	3.1	3.3
6	4.1	4.8	3.8	5.05	22	4.3	3.9	3.1	3.2
7	4.1	5.1	3.8	4.7	23	4.1	3.8	3.65	3.2
8	4.1	6.1	3.7	4.45	24	4.05	3.8	5.15	3.15
9	7.4	5.55	3.6	4.35	25	4.0	4.0	4.95	3.1
10	6.55	5.15	3.95	4.3	26	4.0	4.0	4.1	3.0
11	5.85	5.0	3.75	4.2	27	3.95	3.95	3.45	3.0
12	5.15	4.8	3.7	4.05	28	3.9	4.75	3.0	3.55
13	7.15	4.7	3.6	4.0	29	4.0	4.8	2.95	3.95
14	7.6	4.5	3.55	3.9	30	4.0	4.65	2.9	4.0
15	6.6	4.2	3.5	3.8	31	.....	4.6	.....	4.0
16	6.2	4.1	3.45	3.75					

GASCONADE RIVER DRAINAGE BASIN.

GASCONADE RIVER AT ARLINGTON, MO.

This station was established April 11, 1903, and was discontinued July 21, 1906. It was at first located about 2 miles below Arlington, on the right bank of the river, but owing to the impossibility of maintaining a cable across the river during high water the station was moved July 27, 1904, to the St. Louis and San Francisco railroad bridge, 1¼ miles upstream from the cable and one-fourth mile west of Arlington, Mo. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 266, where are given also references to publications that contain data for previous years.

Discharge measurements of Gasconade River at Arlington, Mo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 6	M. S. Brennan	366	1,630	5.17	3,730
May 11	do	351	1,140	3.92	1,780

Daily gage height, in feet, of Gasconade River at Arlington, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.85	5.1	6.1	7.9	3.25	4.5	11.5
2	3.75	4.95	5.8	7.55	4.2	7.1	7.5
3	5.6	4.4	5.7	6.9	4.35	6.2	4.6
4	9.5	3.65	5.4	6.4	4.4	5.95	4.35
5	12.0	3.4	5.0	5.95	4.45	5.6	3.95
6	11.5	3.25	5.2	5.5	4.4	5.15	4.0
7	9.8	3.1	5.1	5.2	4.2	4.85	3.7
8	6.0	3.0	4.8	5.5	4.15	5.0	3.45
9	4.9	3.05	4.5	5.8	3.95	4.3	3.5
10	4.35	2.95	4.3	5.65	3.9	4.5	3.45
11	4.5	4.0	4.1	5.4	3.9	4.35	3.15
12	4.35	3.9	4.4	4.95	3.85	4.3	2.9
13	4.1	4.0	4.35	5.55	3.8	4.1	2.85
14	3.9	4.6	4.0	7.5	3.75	4.0	3.0
15	3.7	5.2	4.05	8.5	3.2	3.85	3.15
16	3.6	5.8	4.2	7.5	3.0	3.75	3.95
17	3.45	5.95	3.95	6.55	3.05	3.7	3.7
18	3.5	5.7	4.0	6.1	3.0	3.4	4.1
19	3.4	5.3	4.3	5.2	2.85	3.45	3.85
20	3.35	5.1	4.35	4.85	2.95	3.55	4.0
21	3.6	5.15	4.4	4.35	3.0	3.6	8.4
22	4.5	5.0	4.7	4.15	3.25	3.55	.....
23	8.4	5.15	5.0	4.2	3.3	3.3	.....
24	8.2	8.0	7.1	4.15	3.2	3.85	.....
25	6.5	9.2	11.55	3.85	3.3	4.6	.....
26	5.3	9.8	12.9	3.45	3.25	4.35	.....
27	4.85	7.3	11.8	3.3	3.15	4.0	.....
28	4.95	6.5	15.1	3.2	3.0	5.0	.....
29	5.6	.....	14.5	3.15	3.3	4.5	.....
30	5.8	.....	8.75	3.0	3.1	6.1	.....
31	5.4	.....	7.5	.....	3.4	.....	.....

Rating table for Gasconade River at Arlington, Mo., from July 26, 1904, to July 21, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	630	4.20	2,340	5.60	5,130	8.00	10,400
2.90	700	4.30	2,520	5.70	5,340	8.20	10,860
3.00	780	4.40	2,710	5.80	5,560	8.40	11,320
3.10	870	4.50	2,900	5.90	5,780	8.60	11,780
3.20	965	4.60	3,100	6.00	6,000	8.80	12,240
3.30	1,060	4.70	3,300	6.20	6,440	9.00	12,700
3.40	1,160	4.80	3,500	6.40	6,880	10.00	15,050
3.50	1,270	4.90	3,700	6.60	7,320	11.00	17,500
3.60	1,390	5.00	3,900	6.80	7,760	12.00	20,100
3.70	1,520	5.10	4,100	7.00	8,200	13.00	22,800
3.80	1,660	5.20	4,300	7.20	8,640	14.00	25,600
3.90	1,820	5.30	4,500	7.40	9,080	15.00	28,400
4.00	1,990	5.40	4,710	7.60	9,520		
4.10	2,160	5.50	4,920	7.80	9,960		

NOTE.—The above table is applicable only for open-channel conditions. It is based on fourteen discharge measurements made during 1904-6, and is fairly well defined.

Monthly discharge of Gasconade River at Arlington, Mo., for 1906.

[Drainage area, 2,720 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	20,100	1,110	5,360	330,000	1.97	2.27
February	14,600	740	4,380	243,000	1.61	1.68
March	28,700	1,700	7,170	441,000	2.64	3.04
April	11,600	780	4,840	288,000	1.78	1.99
May	2,800	665	1,440	88,500	.529	.61
June	8,420	1,060	2,800	167,000	1.03	1.15
July 1-21	18,800	665	3,220	134,000	1.18	.92
The period				1,690,000		

NOTE.—Values for 1906 are good.

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1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
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Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
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