

DEPARTMENT OF THE INTERIOR  
UNITED STATES GEOLOGICAL SURVEY

GEORGE OTIS SMITH, DIRECTOR

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SURFACE WATER SUPPLY  
OF  
NORTH PACIFIC COAST  
DRAINAGE, 1906

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J. C. STEVENS, ROBERT FOLLANSBEE, and E. C. LA RUE  
DISTRICT HYDROGRAPHERS

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IN OREGON DONE IN COOPERATION WITH THE STATE ENGINEER



WASHINGTON  
GOVERNMENT PRINTING OFFICE  
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Water Resources Branch,  
Geological Survey,  
Box 3106, Capitol Station  
Oklahoma City, Okla.

WASHINGTON  
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# SURFACE WATER SUPPLY OF THE NORTH PACIFIC COAST DRAINAGE, 1906.<sup>a</sup>

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J. C. STEVENS, ROBERT FOLLANSBEE, and E. C. LA RUE,

*District Hydrographers.*<sup>b</sup>

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## 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

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<sup>a</sup> The report contains information similar to that published in previous years under the title "Report of Progress of Stream Measurements."

<sup>b</sup> The data presented in this paper have been collected as follows:

Columbia River drainage in Oregon and Washington, and Puget Sound and Pacific Coast drainages north of the Oregon-California State line, by J. C. Stevens, district hydrographer, assisted by R. M. Hall, Ivan Landes, W. C. Muldrow, and H. D. McGlashan; in cooperation in Oregon with John H. Lewis, State engineer, assisted by L. R. Allen, Ivan E. Oakes, and Percy A. Cupper.

Clark Fork drainage by Robert Follansbee, district hydrographer.

Snake River drainage in Idaho and Wyoming by E. C. La Rue, district hydrographer.

The data have been prepared for publication under the direction of John C. Hoyt by R. H. Bolster, Robert Follansbee, F. F. Henshaw, J. E. Stewart, 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.

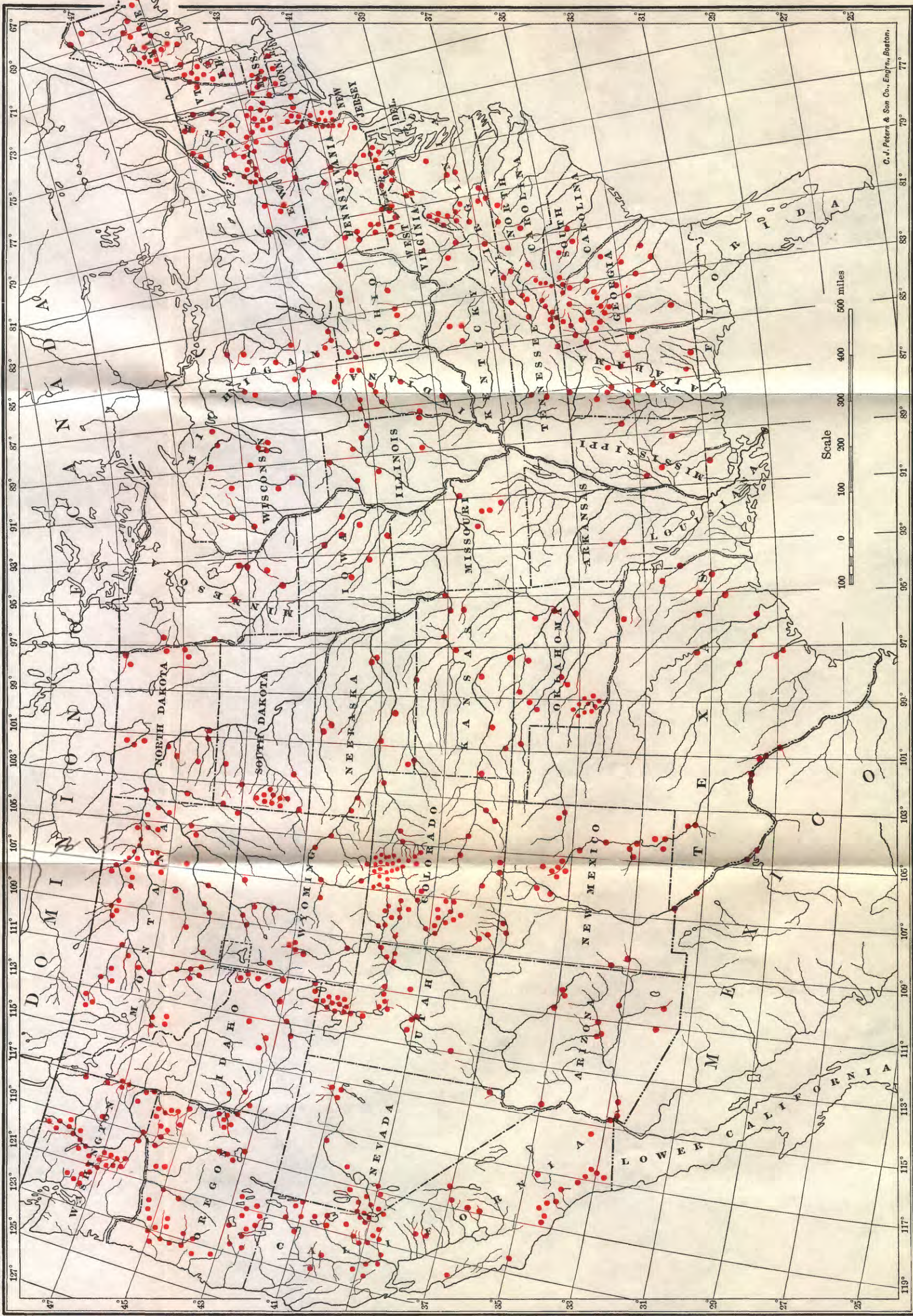
Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is, in general, impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this 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.)



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

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.<sup>a</sup>*

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

<sup>a</sup> 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.  
 1½ horsepower equal about 1 kilowatt.

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

#### 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 <sup>a</sup>); (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

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<sup>a</sup> 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.

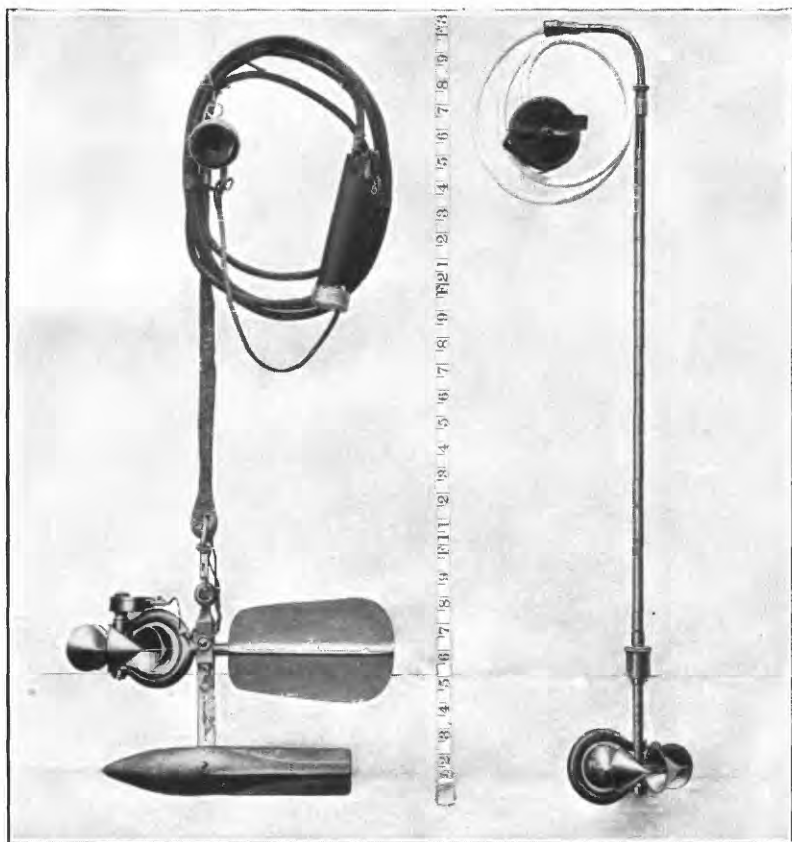
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

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, 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.

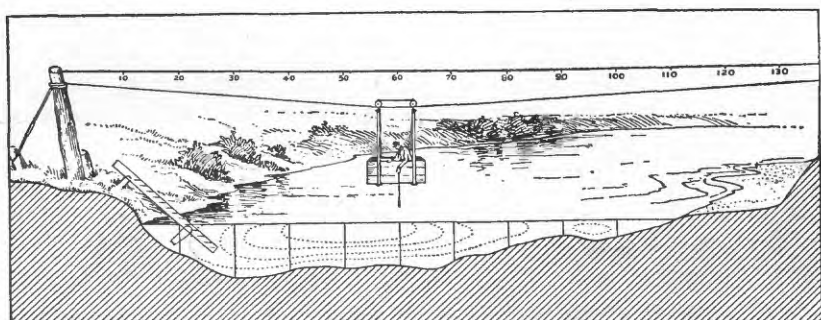


FIG. 1.—Cable station showing section of the river, car, gage, etc.

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,

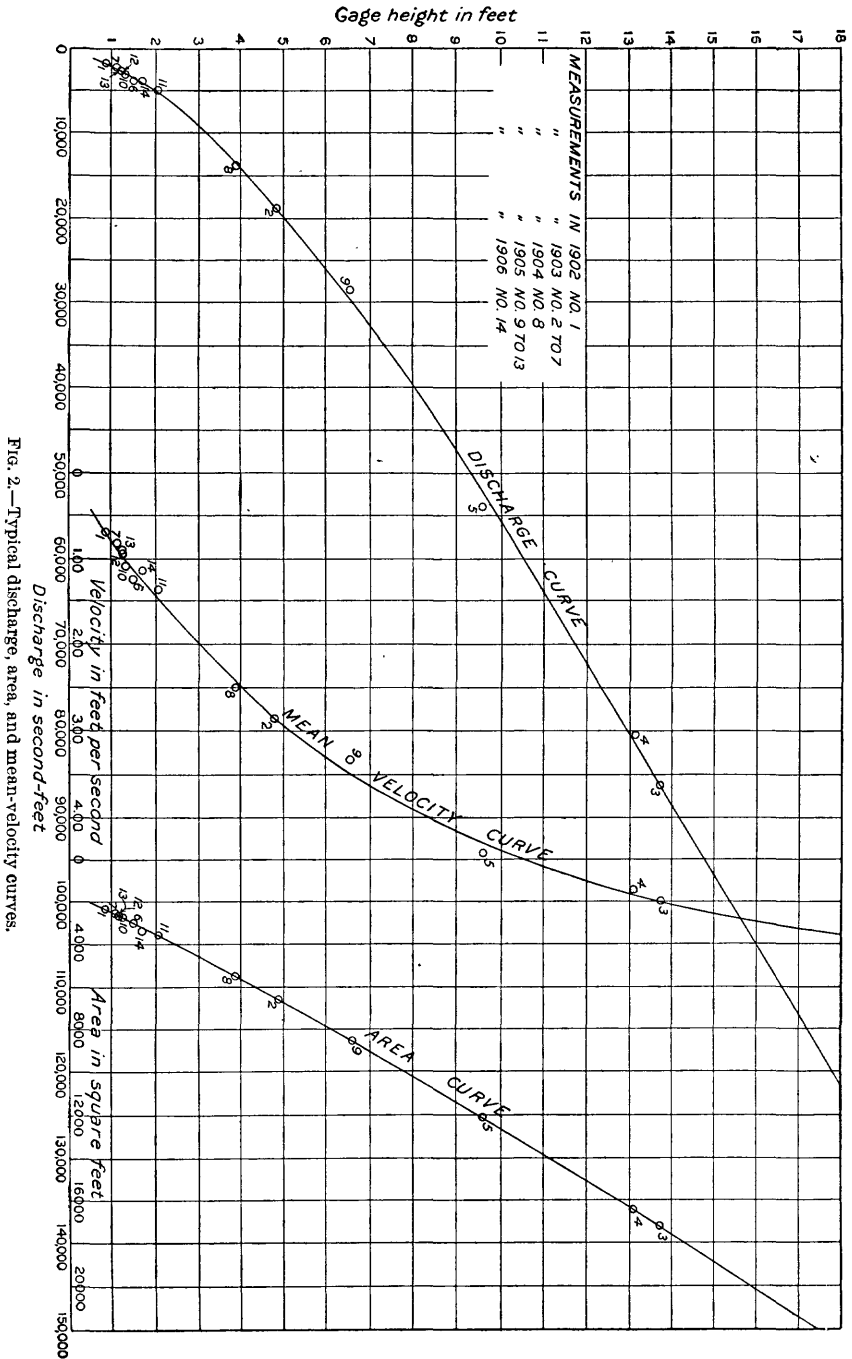


Fig. 2.—Typical discharge, area, and mean-velocity curves.

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.

Special acknowledgments are due to John H. Lewis, State engineer of Oregon, for cooperation in accordance with the provisions of section 10, chapter 228, Laws of Oregon for 1905, "Hydrographic and topographic surveys in cooperation with the United States Government," which provides \$2,500 annually for hydrographic surveys, "such appropriations, however, being contingent upon the United States Government making a like apportionment for such purposes to be expended within the State."

In 1906 the cooperative fund of \$2,500 appropriated by the State of Oregon was largely spent under the direction of the State engineer in western Oregon, the Geological Survey retaining supervision of the work and publishing the results without expense to the State; but the Federal Survey, realizing the benefits to be derived by a more extensive study of the water resources of the State than could be accomplished by merely meeting the State's appropriation,

expended on hydrographic work in Oregon the sum of \$5,533 during the calendar year 1906.

Assistance has been rendered or records furnished by the following, to whom acknowledgments are due:

The officers and employees of the United States Weather Bureau; Corps of Engineers, U. S. Army; Meteorological Service of Department of Marine and Fisheries, Canada; for climatological and hydrographic data.

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## COLUMBIA RIVER DRAINAGE.

### COLUMBIA RIVER PROPER.

#### DESCRIPTION OF BASIN.

Columbia River has its source in Columbia Lake in the east division of the Kootenai district in British Columbia; thence it flows northward to the fifty-second parallel of latitude, where it turns sharply southward and flows through a series of arrowlike lakes, crossing the international boundary line in the northeast corner of the State of Washington, where it receives the Clark Fork. After traversing the State of Washington it forms the boundary line between Washington and Oregon and empties into the Pacific Ocean at the forty-sixth parallel of latitude. The river is navigable in long stretches throughout its entire course in the United States, although, owing to rapids and falls, continuous navigation is not possible.

The Columbia and its tributaries drain a total area of 259,000 square miles, distributed as follows:

*Areas in Columbia River basin.*

	Square miles.
Oregon.....	55,370
Washington.....	48,000
Idaho.....	81,380
Montana.....	25,000
Nevada.....	5,280
Wyoming.....	5,270
British Columbia.....	38,700

The larger part of this area is arid or semiarid, the annual rainfall varying from 10 inches in portions of Oregon and Idaho to 100 inches on the Cascade Range. The area is largely mountainous, and the streams flow for the most part through deep canyons in the basaltic formations characteristic of the Pacific Northwest. The flood discharge of the Columbia at The Dalles has been estimated at 1,000,000 second-feet and the low-water flow at about 40,000 second-feet.

The tributaries of the Columbia are of great importance, affording good sites for the development of power and an abundance of water for irrigation, which latter is extensively practiced in some of the valleys, notably those of Umatilla, Yakima, and the upper portion of Snake River.

The basins of Naches, Boise, and Walla Walla rivers and other tributary streams are described in connection with gaging stations maintained on them.

On the Columbia proper but one gaging station—that at Pasco—is maintained by the Geological Survey. Others, however, are maintained by the United States Weather Bureau at Riparia, Wenatchee, Umatilla, The Dalles, and Vancouver, and by the United States Corps of Engineers at Celilo, Cascade Locks, and Fort Stevens.

COLUMBIA RIVER AT PASCO, WASH.

This station was established October 15, 1904, at the bridge of the Northern Pacific Railway, 1.2 miles from Pasco, Wash. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 13, where are given also references to publications that contain data for previous years.

*Daily gage height, in feet, of Columbia River at Pasco, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	7.7	8.0	9.3	11.4	17.8	21.0	19.7	17.5	12.9	11.6	11.0	11.8
2.....	7.7	8.1	9.2	12.2	18.1	20.9	19.7	17.4	12.8	11.5	10.8	11.7
3.....	7.6	8.2	9.2	13.0	18.5	20.8	19.7	17.4	12.8	11.4	10.8	11.6
4.....	7.6	8.2	9.2	13.0	18.8	20.8	19.7	17.2	12.8	11.3	10.8	11.4
5.....	7.6	8.3	9.1	12.8	19.2	21.0	19.7	17.0	12.7	11.2	10.7	11.3
6.....	7.6	8.3	9.0	12.6	19.3	21.0	19.7	16.8	12.7	11.1	10.6	11.2
7.....	7.5	8.2	9.0	12.6	19.2	21.1	19.7	16.5	12.7	11.0	10.6	11.1
8.....	7.5	8.1	8.9	13.0	19.1	21.1	19.8	16.1	12.6	10.9	10.6	11.1
9.....	7.5	8.1	9.0	13.4	19.0	21.0	19.9	15.9	12.6	10.9	10.7	11.1
10.....	7.5	8.0	9.1	13.9	19.0	20.9	20.1	15.6	12.5	10.8	10.9	11.1
11.....	7.4	7.9	9.1	14.4	19.3	20.8	20.3	15.4	12.5	10.7	10.7	11.0
12.....	7.4	7.9	9.2	14.4	19.7	20.8	20.4	15.3	12.8	10.6	10.8	11.0
13.....	7.4	7.9	9.2	14.3	20.1	20.9	20.5	15.1	13.2	10.6	10.9	11.0
14.....	7.5	7.9	9.0	14.1	20.3	21.1	20.6	15.0	13.5	10.5	11.4	11.0
15.....	7.5	7.9	8.9	13.8	20.3	21.1	20.6	15.0	13.7	10.5	14.0	10.9
16.....	7.5	7.8	8.8	13.8	20.2	21.0	20.6	15.0	13.7	10.5	16.6	10.8
17.....	7.4	7.8	8.7	14.0	20.2	21.0	20.5	15.0	13.5	10.5	17.5	10.6
18.....	7.4	7.8	8.4	14.3	20.1	21.1	20.4	15.0	13.3	10.5	16.3	10.6
19.....	7.4	7.8	8.3	14.6	20.0	20.9	20.2	15.0	13.1	10.6	15.3	10.5
20.....	7.4	8.0	8.3	14.9	20.0	20.7	20.0	15.0	12.8	10.6	14.0	10.4
21.....	7.4	8.8	8.3	15.1	19.9	20.5	19.9	14.9	12.6	10.6	13.3	10.6
22.....	7.4	9.0	8.3	15.3	19.9	20.1	19.7	14.7	12.4	10.6	13.1	11.4
23.....	7.3	9.2	8.3	15.9	19.9	20.0	19.4	14.6	12.2	10.6	12.9	11.4
24.....	7.4	9.3	8.3	16.6	19.9	19.8	19.2	14.4	12.0	10.5	12.8	11.3
25.....	7.4	9.3	8.4	17.2	19.9	19.5	19.0	14.3	12.0	10.5	12.6	11.3
26.....	7.6	9.3	8.7	17.6	20.0	19.5	18.8	14.0	12.0	10.4	12.4	11.4
27.....	7.8	9.3	9.4	17.6	20.2	19.3	18.6	13.8	11.9	10.3	12.2	11.7
28.....	8.0	9.3	10.2	17.5	20.8	19.3	18.4	13.6	11.8	11.2	12.0	11.7
29.....	8.0	.....	10.9	17.4	20.8	19.3	18.2	13.4	11.7	11.7	11.9	11.8
30.....	8.0	.....	11.3	17.5	20.8	19.5	18.0	13.2	11.7	11.4	11.9	11.6
31.....	8.0	.....	11.2	.....	21.0	.....	17.9	13.0	.....	11.1	.....	11.6

#### MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made on minor streams directly tributary to Columbia River during 1906:

*Miscellaneous measurements in Columbia River drainage basin in 1906.*

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Dis-charge.
			<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 10.....	Eightmile Creek.....	The Dalles, Oreg.....				<sup>a</sup> 7
April 26.....	Sandy River.....	3½ miles southeast of Troutdale, Oreg.	202	1,320		3,050
July 27.....	.....do.....	.....do.....	180	774	<sup>b</sup> 1.18	703
August 31 c.....	.....do.....	Salmon River post-office, Oreg.	88	154	1.15	397
September 1.....	.....do.....	Troutdale, Oreg.....	178	750	<sup>b</sup> 1.55	475
September 30.....	.....do.....	.....do.....	183	844	<sup>d</sup> 4.87	688
September 27.....	Still River.....	SW. ¼ sec. 13, T. 3 S., R. 7 E.	20	22		53
August 31.....	Salmon River.....	Salmon River post-office, Oreg.	71	117		120
September 27.....	Zigzag Creek.....	NE. ¼ sec. 17, T. 3 S., R. 7 E.	22	14	<sup>c</sup> 2.80	44
September 1.....	Bull Run Creek.....	Above Portland waterworks pipe intake.	74	183		93
September 1.....	.....do.....	.....do.....	74	177		110
June 30.....	Bull Run Creek pipe..	Headworks.....	14.5	52		38
September 1.....	.....do.....	.....do.....	14.5	46		38

<sup>a</sup> Estimated.

<sup>b</sup> Below top portion of lower section of bridge caisson, right bank.

<sup>c</sup> Below junction of Salmon River.

<sup>d</sup> Below top of bridge caisson, left bank, downstream side.

<sup>e</sup> Below nail in alder on south bank 20 feet upstream from footbridge.

## CLARK FORK DRAINAGE BASIN.

## DESCRIPTION OF BASIN.

Clark Fork<sup>a</sup> rises on the eastern slopes of the high mountain ranges that form the boundary between Montana and Idaho. It flows northward, northwestward, and again northward as it crosses western Montana, northern Idaho (through Lake Pend Oreille), northeastern Washington, and a few miles into British Columbia, then turns somewhat abruptly westward and southwestward and joins the Columbia near Boundary station on the Spokane Falls and Northern Railroad.

To the river thus described various names have been applied in the past and are probably still used locally. The northward-flowing section above the town of Missoula has been known as the Bitterroot, the section between the junction of Hell Gate and Big Blackfoot rivers and Lake Pend Oreille has been called the Missoula, and the stretch of the river below its exit from Lake Pend Oreille has been called Pend Oreille River. These names, as well as Silver Bow, Hell Gate, and Deer Lodge, have been superseded, a recent decision of the Board on Geographic Names applying Clark Fork to the stream continuously from the head of the Bitterroot to the mouth of the Pend Oreille.

CLARK FORK<sup>b</sup> NEAR GRANTSDALE, MONT.

This station was established April 25, 1902. It is located on the highway bridge 2 miles southwest of Grantsdale and 5 miles southwest of Hamilton, Mont. Length of chain in 1906, 23.25 feet. The bench mark is the northwest bolt in the northwest abutment of the bridge; elevation above gage datum, 19.36 feet. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 21, where are given also references to publications that contain data for previous years.

*Discharge measurements of Clark Fork near Grantsville, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 7.....	Morse and Edson.....	172	403	2.26	798
April 27.....	G. Edson.....	186	567	3.27	1,970
June 5.....	do.....	193	744	4.10	3,830
July 7.....	Morse and Richards.....	183	486	2.95	1,460
August 11 <sup>c</sup> .....	R. Richards.....	29	57	1.24	99
September 9 <sup>c</sup> .....	do.....	37	56	1.24	114

<sup>a</sup> Clark Fork; river in Idaho, Montana, and Washington. (Not Bitter Root, Bitterroot, Clarke, Clarks River, Deer Lodge, Deerlodge, Hell Gate, Hellgate, Missoula, Silver Bow, nor Silverbow.) Third Report U. S. Board on Geographic Names, Washington, 1907, p. 51.

<sup>b</sup> Station formerly known as Bitterroot River near Grantsdale, Mont.

<sup>c</sup> Measured by wading.

*Daily gage height, in feet, of Clark Fork near Grantsdale, Mont., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.8	1.5	1.6	2.35	3.3	3.6	3.0	1.4	1.3	1.4	2.1	2.15
2.....	1.8	1.5	1.6	2.25	3.2	3.5	3.0	1.5	1.3	1.4	2.0	2.15
3.....	1.8	1.5	1.6	2.15	3.4	3.5	3.1	1.4	1.3	1.4	2.0	2.1
4.....	1.8	1.7	1.6	1.95	3.8	4.0	3.1	1.3	1.2	1.4	2.0	2.1
5.....	1.8	1.7	1.6	1.95	3.6	4.0	3.0	1.3	1.2	1.5	1.9	2.1
6.....	1.8	1.6	1.6	2.25	3.5	4.1	3.0	1.6	1.2	1.5	1.9	2.5
7.....	1.8	1.6	1.6	2.35	3.5	3.9	3.0	1.5	1.2	1.5	1.9	2.4
8.....	1.8	1.5	1.6	2.35	3.7	3.7	2.9	1.4	1.2	1.5	2.95	2.35
9.....	1.9	1.8	1.7	2.45	3.8	3.5	2.8	1.3	1.2	1.5	2.7	2.35
10.....	1.9	1.8	1.7	2.45	4.0	4.0	2.8	1.3	1.2	1.5	2.5	2.3
11.....	1.9	1.8	2.5	2.35	4.2	4.3	2.6	1.2	1.2	1.5	2.4	2.3
12.....	2.3	1.8	2.5	2.35	4.2	4.4	2.6	1.3	1.3	1.5	3.0	2.25
13.....	2.3	1.7	2.5	2.25	4.3	4.1	2.5	1.2	1.4	1.5	4.1	2.2
14.....	2.3	1.7	2.5	2.25	4.1	4.0	2.4	1.2	1.5	1.5	4.6	2.1
15.....	2.3	1.6	2.5	2.55	4.0	3.9	2.3	1.2	1.5	1.5	6.02	2.05
16.....	2.3	1.6	2.5	2.55	3.8	3.7	2.2	1.2	1.5	1.6	5.0	2.15
17.....	1.8	1.6	2.5	2.65	3.7	3.6	2.1	1.2	1.5	1.75	4.05	2.15
18.....	1.7	1.5	2.3	2.65	3.6	3.5	2.2	1.2	1.5	1.7	3.55	2.1
19.....	1.8	1.5	2.2	2.65	3.4	3.4	2.1	1.2	1.5	1.7	3.25	2.1
20.....	1.8	1.6	2.0	2.75	3.3	3.3	2.0	1.1	1.6	1.7	3.0	2.1
21.....	1.8	1.6	1.8	3.05	3.5	3.2	1.9	1.1	1.6	1.65	2.7	2.2
22.....	1.7	1.6	1.8	3.45	3.4	3.1	1.9	1.3	1.6	1.6	2.6	2.25
23.....	1.7	1.6	1.8	3.85	3.4	3.0	1.9	1.4	1.6	1.65	2.5	2.25
24.....	1.7	1.6	1.7	4.15	3.5	3.0	1.8	1.4	1.5	1.65	2.35	2.2
25.....	1.6	1.6	2.1	3.85	4.0	3.1	1.7	1.5	1.5	1.7	2.3	2.2
26.....	1.6	1.6	2.0	3.45	4.3	3.2	1.7	1.5	1.5	1.9	2.3	2.25
27.....	1.6	1.6	2.0	3.25	4.4	3.3	1.5	1.5	1.5	2.9	2.25	2.3
28.....	1.6	1.6	2.0	3.2	4.3	3.8	1.5	1.4	1.4	2.7	2.25	2.3
29.....	1.6	.....	2.0	3.3	4.0	3.5	1.3	1.4	1.4	2.5	2.2	2.25
30.....	1.5	.....	2.0	3.3	3.9	3.4	1.4	1.3	1.4	2.4	2.15	2.35
31.....	1.5	.....	2.2	.....	3.8	.....	1.3	1.3	.....	2.2	.....	2.4

NOTE.—Ice conditions January 12 to 17 and February 9 to March 21.

*Rating table for Clark Fork near Grantsdale, Mont., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1.10	60	1.80	395	2.50	1,020	3.20	1,825	3.90	3,005
1.20	80	1.90	470	2.60	1,120	3.30	1,965	4.00	3,215
1.30	110	2.00	550	2.70	1,225	3.40	2,105	4.20	3,660
1.40	150	2.10	635	2.80	1,335	3.50	2,265	4.40	4,110
1.50	200	2.20	725	2.90	1,450	3.60	2,435	.....	.....
1.60	260	2.30	820	3.00	1,570	3.70	2,615	.....	.....
1.70	325	2.40	920	3.10	1,695	3.80	2,805	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on 17 discharge measurements made during 1904-1906 and is well defined.

*Monthly discharge of Clark Fork near Grantsdale, Mont., for 1906.*

[Drainage area, 1,550 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 <sup>a</sup> .....	470	200	359	22,100	0.232	0.27
February 1-8.....	325	200	246	3,900	.159	.05
March 22-31.....	725	325	522	10,400	.337	.13
April.....	3,550	510	1,370	81,500	.884	.99
May.....	4,110	1,825	2,800	172,000	1.81	2.09
June.....	4,110	1,570	2,540	151,000	1.64	1.83
July.....	1,700	110	866	53,200	.559	.64
August.....	260	60	127	7,810	.082	.09
September.....	260	80	157	9,340	.101	.11
October.....	1,450	150	386	23,700	.249	.29
November.....	8,100	470	1,650	98,200	1.06	1.18
December.....	1,020	592	750	46,100	.484	.56
The period.....	.....	.....	.....	679,000	.....	.....

<sup>a</sup> Discharge estimated January 12 to 17.

NOTE.—Values are rated as follows: January to March and August to October, good; remainder of the period, excellent.

CLARK FORK <sup>a</sup> AT MISSOULA, MONT.

This station was established July 10, 1898, at Higgins Avenue Bridge, Missoula, Mont., but was removed May 27, 1899, to the bridge of the Bitterroot Valley division of the Northern Pacific Railway, about one-half mile downstream. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 16, where are given also references to publications that contain data for previous years.

*Discharge measurements of Clark Fork at Missoula, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 6.....	Morse and Edson.....	195	833	3.43	1,750
April 6.....	do.....	195	813	3.45	1,650
April 26.....	G. Edson.....	275	1,250	4.90	4,230
June 6.....	do.....	306	1,480	6.08	7,370
July 6.....	Morse and Richards.....	172	912	4.13	2,690
August 10.....	R. Richards.....	162	715	3.08	1,070
September 8.....	do.....	137	699	2.77	1,050
September 19.....	Grover and Follansbee.....	162	733	3.07	1,050
October 15.....	Richards and Follansbee.....	162	723	2.93	972

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

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.10	3.30	2.80	4.12	4.52	5.70	4.70	3.08	3.05	2.85	3.25	3.60
2.....	3.10	3.30	2.68	4.18	4.50	5.60	4.62	3.02	3.00	2.90	3.20	3.60
3.....	3.10	3.35	2.60	3.78	4.58	5.65	4.62	3.00	3.00	2.90	3.20	3.60
4.....	3.10	3.35	2.65	3.50	4.80	5.72	4.48	3.00	3.00	2.85	3.25	3.62
5.....	3.10	3.35	2.70	3.42	4.85	5.95	4.32	3.00	2.98	2.90	3.20	3.78
6.....	3.10	3.35	2.80	3.45	4.80	6.02	4.25	3.00	2.90	2.90	3.20	3.70
7.....	3.10	3.35	2.90	3.60	4.65	6.12	4.10	3.00	2.85	2.90	3.22	3.72
8.....	3.10	3.35	2.95	3.70	4.62	5.95	4.00	3.10	2.78	2.90	3.45	3.75
9.....	3.12	3.35	2.95	3.75	4.75	5.80	3.98	3.15	2.78	2.85	3.60	3.70
10.....	3.15	3.35	2.95	3.72	4.80	5.72	3.95	3.15	2.75	2.85	3.60	3.65
11.....	3.15	3.35	2.95	3.68	5.00	5.72	3.88	2.95	2.85	2.90	3.65	3.68
12.....	3.20	3.35	2.95	3.62	5.25	5.72	3.80	2.95	2.85	2.90	3.60	3.75
13.....	3.20	3.35	2.95	3.58	5.38	5.78	3.72	3.00	2.85	2.95	3.68	3.80
14.....	3.20	3.35	2.95	3.52	5.40	5.78	3.60	3.05	2.90	2.95	4.20	3.68
15.....	3.20	3.35	2.95	3.52	5.30	5.62	3.65	3.00	3.18	2.95	5.00	3.48
16.....	3.20	3.35	2.95	3.60	5.30	5.48	3.70	3.00	3.32	2.95	5.18	3.45
17.....	3.20	3.35	3.15	3.72	5.15	5.60	3.62	2.92	3.22	3.05	5.15	3.48
18.....	3.20	3.35	3.25	3.80	5.00	5.50	3.58	2.82	3.08	3.08	4.70	3.58
19.....	3.25	3.35	3.25	3.88	4.85	5.28	3.50	2.82	3.10	3.10	4.48	3.70
20.....	3.25	3.35	3.40	3.90	4.80	5.10	3.45	2.80	3.05	3.15	4.28	3.68
21.....	3.10	3.35	3.40	4.00	4.80	5.02	3.40	2.78	3.08	3.10	4.35	3.65
22.....	3.30	2.90	3.30	4.25	4.88	4.98	3.40	2.75	3.05	3.05	4.22	3.60
23.....	3.30	2.80	3.30	4.55	4.90	4.90	3.35	3.10	3.00	3.05	4.15	3.60
24.....	3.30	2.70	3.98	4.90	4.90	4.80	3.30	3.25	2.98	3.05	4.02	3.60
25.....	3.30	2.60	3.95	5.00	4.98	4.78	3.22	3.28	2.92	3.05	4.00	3.65
26.....	3.30	2.80	4.35	4.88	4.98	4.70	3.20	3.35	2.95	3.22	3.98	3.75
27.....	3.30	2.80	4.25	4.80	5.10	4.60	3.12	3.30	2.95	3.30	3.70	3.80
28.....	3.30	2.80	3.95	4.75	5.30	4.70	3.10	3.22	2.95	3.25	3.60	3.80
29.....	3.30	.....	3.90	4.70	5.55	4.80	3.10	3.15	2.90	3.25	3.70	3.75
30.....	3.30	.....	3.85	4.62	5.78	4.78	3.10	3.10	2.90	3.25	3.60	3.70
31.....	3.30	.....	3.92	.....	5.75	.....	3.10	3.08	.....	3.25	.....	3.60

NOTE.—Ice conditions January 2 to February 19 and March 10 to 24. There was no ice during December.

<sup>a</sup> Station formerly known as Missoula River at Missoula, Mont.

*Rating table for Clark Fork at Missoula, Mont., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.50	750	3.30	1,440	4.10	2,610	4.90	4,230	5.60	5,990
2.60	810	3.40	1,560	4.20	2,790	5.00	4,460	5.70	6,270
2.70	880	3.50	1,680	4.30	2,970	5.10	4,700	5.80	6,550
2.80	950	3.60	1,830	4.40	3,160	5.20	4,950	5.90	6,840
2.90	1,030	3.70	1,970	4.50	3,360	5.30	5,200	6.00	7,130
3.00	1,120	3.80	2,120	4.60	3,570	5.40	5,460	6.20	7,740
3.10	1,220	3.90	2,280	4.70	3,780	5.50	5,720	6.40	8,370
3.20	1,330	4.00	2,440	4.80	4,000				

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1906 and is well defined between gage heights 3.5 feet and 6.0 feet. Below gage height 3.5 feet the table is only fair.

*Monthly discharge of Clark Fork at Missoula, Mont., for 1906.*

[Drainage area, 5,960 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 20-28.....	1,500	810	1,060	18,900	0.178	0.06
March <sup>a</sup> .....	3,060	810	1,480	91,000	.248	.29
April.....	4,460	1,590	2,560	152,000	.430	.48
May.....	6,490	3,360	4,510	277,000	.757	.87
June.....	7,490	3,570	5,510	328,000	.924	1.03
July.....	3,780	1,220	2,060	127,000	.346	.40
August.....	1,500	915	1,170	71,900	.196	.23
September.....	1,460	915	1,100	65,500	.185	.21
October.....	1,440	990	1,150	70,700	.193	.22
November.....	4,900	1,330	2,360	140,000	.396	.44
December.....	2,120	1,620	1,920	118,000	.322	.37
The period.....				1,460,000		

<sup>a</sup> Open channel rating applied March 10 to 24.

NOTE.—Values are rated as follows: February, March, and August to December, fair; April to July, good.

#### STILLWATER RIVER NEAR KALISPELL, MONT.

Stillwater River rises in the northern part of Flathead County and flows southeast through several lakes into Flathead River.

The gaging station was established September 25, 1906. The gage is located at the Reiter wagon bridge, 2 miles from Kalispell. The flow is controlled by dams above. The measuring section is below the mouth of Whitefish River and includes the flow of that stream. The intake for the city waterworks is between the mouth of Whitefish and the gage. Owing to the extreme sluggishness of the Stillwater above the mouth of the Whitefish, it is impossible to make measurements; hence the flow of the former is obtained by subtracting the flow at the Whitefish station from that at this station. This gives the amount available for irrigation.

Discharge measurements are made from the bridge or may be made by wading at low stage.

The gage, which is read morning and evening by W. H. Reiter, is a staff, fastened to the upstream end of the bridge pier. The bench

mark is a spike in the piling which is the upstream edge of the pier on which the right end of the right truss rests; it is 3 feet above the ground and is driven horizontally; elevation, 4.74 feet above gage datum.

*Discharge measurements of Stillwater River near Kalispell, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 25...	Follansbee and Wade .....	90	305	1.64	142
October 2 .....	Follansbee and Richards .....	98	309	1.52	125
November 22 <i>a</i> ..	R. Richards .....	67	107	2.12	322

*a* Measured by wading.

*Daily gage height, in feet, of Stillwater River near Kalispell, Mont., for 1906.*

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1 .....		1.95	1.50	2.58	12 .....		1.95	1.70	1.70	23 .....		1.85	1.75	2.10
2 .....		1.80	2.02	2.50	13 .....		1.41	1.75	1.95	24 .....		1.82	1.65	1.80
3 .....		2.10	2.20	2.50	14 .....		1.21	1.85	2.32	25 .....	1.65	1.35	2.30	1.68
4 .....		1.85	1.45	2.42	15 .....		1.71	2.05	2.28	26 .....	1.60	1.92	2.75	2.05
5 .....		1.70	2.00	2.45	16 .....		1.70	3.25	2.28	27 .....	1.72	2.22	2.70	1.55
6 .....		1.68	2.05	2.40	17 .....		1.56	3.05	2.28	28 .....	1.95	2.15	2.65	1.95
7 .....		1.56	1.70	1.98	18 .....		1.56	2.95	2.30	29 .....	2.32	1.95	2.62	1.70
8 .....		1.31	1.60	1.75	19 .....		1.60	2.32	2.25	30 .....	2.40	1.38	2.58	1.70
9 .....		1.90	1.35	1.72	20 .....		1.51	2.02	2.25	31 .....		1.98		1.58
10 .....		1.86	2.00	1.70	21 .....		1.28	2.00	2.20					
11 .....		1.60	1.90	1.70	22 .....		1.15	2.00	2.20					

NOTE.—The flow of this stream is controlled by dams.

*Rating table for Stillwater River near Kalispell, Mont., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.10	67	1.60	140	2.10	310	2.60	670	3.10	1,200
1.20	77	1.70	163	2.20	370	2.70	760	3.20	1,320
1.30	89	1.80	190	2.30	430	2.80	860	3.30	1,450
1.40	104	1.90	220	2.40	500	2.90	970		
1.50	120	2.00	260	2.50	580	3.00	1,080		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906.

*Monthly discharge of Stillwater River near Kalispell, Mont., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
September 25-30 .....	500	140	274	3,260
October .....	382	72	178	10,900
November .....	1,380	95	410	24,400
December .....	658	136	327	20,100
The period .....				58,660

NOTE.—Values are rated as follows: September, October, and December, good; November, fair.

## WHITEFISH RIVER NEAR KALISPELL, MONT.

Whitefish River rises in the central part of Flathead County and flows south into Stillwater River above the gaging station on that stream.

The gaging station was established September 24, 1906. It is located at the Tetrault wagon bridge 10 miles from Kalispell and 6 miles from Columbia Falls. There is a dam at the outlet of the lake which feeds the river, and consequently the flow is wholly controlled.

The channel is straight for 500 feet above, and 200 feet below the station. The banks are high and are not likely to overflow. The bed of the stream is composed of gravel and is permanent. There is one channel at all stages.

Discharge measurements are made from the wagon bridge or may be made by wading at low stage.

The gage, which is read daily by F. R. Miles, is a staff fastened to timber abutment 200 feet upstream from the bridge, on the left bank. The bench mark is a black paint spot on a bowlder on the right bank, near the water's edge and directly downstream from old timber abutment; it is marked "U. S. G. S. B. M."; elevation, 3.02 feet above the gage datum.

*Discharge measurements of Whitefish River near Kalispell, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 24 <sup>a</sup> .	Wade and Follansbee.....	106	99.7	2.28	126
October 22 <sup>b</sup> ...	Follansbee and Richards.....	26	19.1	1.35	14.8
November 22 <sup>b</sup> .	R. Richards.....	32	25.0	1.70	15.9

<sup>a</sup> Made at bridge.<sup>b</sup> Made by wading.*Daily gage height, in feet, of Whitefish River near Kalispell, Mont., for 1906.*

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1.....		2.95	8.....		1.6	17.....	2.0		24.....	2.5	
2.....		2.95	11.....	1.4		18.....	2.0		25.....	2.6	
3.....		2.9	12.....	1.4		19.....	2.2		26.....	2.6	
4.....		2.85	13.....	1.4		20.....	2.3		27.....	2.8	
5.....		2.8	14.....	1.4		21.....	2.4		28.....	3.0	
6.....		2.65	15.....	1.6		22.....	2.4		29.....	3.0	
7.....		1.65	16.....	1.9		23.....	2.4		30.....	3.0	

## CROW CREEK NEAR RONAN, MONT.

Crow Creek rises on the western slope of the Mission Range and flows westward across the Flathead Reservation, emptying into Clark Fork.

The gaging station was established September 21, 1906. It is located at the highway bridge on the stage road from St. Ignatius

to Ronan, 4 miles south of Ronan. The station is several miles below the canyon.

The channel curves sharply to the right immediately above the station, but is straight for 200 feet below. The banks slope back gradually from the water's edge. At all stages except extreme flood the water will all pass beneath the bridge. The current is sluggish. The bed of the stream is composed of fine gravel.

Discharge measurements are made by wading at a section either above or below the bridge. At high stages measurements may be made at the bridge.

The gage, which is read morning and evening by Mrs. Alphonsine McIntyre, is a staff fastened to the upstream end of the bridge pier. The bench mark is a spike driven horizontally 2 feet above the ground, in the northeast corner of a log building, 50 feet downstream from the gage, on the left bank; elevation, 10 feet above the datum of the gage.

*Discharge measurements of Crow Creek near Ronan, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 20 <sup>a</sup> .	Wade and Follansbee.....	33	56.5	1.00	24.9
October 18 <sup>b</sup> ...	Follansbee and Richards.....	28	28.9	1.15	35.7
November 19 <sup>b</sup> .	R. Richards.....	28	39.0	1.86	73.8

<sup>a</sup> Made at bridge.

<sup>b</sup> Made by wading.

*Daily gage height, in feet, of Crow Creek River near Ronan, Mont., for 1906.*

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1.....		0.9	1.0	1.25	12.....		1.0	1.3	1.0	22.....	1.0	1.0	1.5	1.1
2.....		.9	1.0	1.2	13.....		1.05	1.6	1.0	23.....	.95	1.0	1.45	1.05
3.....		1.2	1.0	1.15	14.....		1.0	1.8	1.05	24.....	.9	1.0	1.4	.....
4.....		1.15	1.0	1.15	15.....		1.0	2.2	1.15	25.....	.9	1.0	1.4	.....
5.....		1.0	1.0	1.15	16.....		1.1	2.95	1.05	26.....	.9	1.15	1.25	1.6
6.....		1.0	1.0	1.1	17.....		1.15	2.2	1.0	27.....	.9	1.3	1.1	1.4
7.....		1.0	1.0	1.05	18.....		1.2	2.0	1.0	28.....	1.0	1.2	1.2	1.35
8.....		1.0	1.3	1.1	19.....		1.1	1.9	1.0	29.....	.95	1.2	1.2	1.3
9.....		1.0	1.3	1.1	20.....		1.05	1.8	1.0	30.....	.9	1.1	1.2	1.3
10.....		1.0	1.3	1.0	21.....	1.0	1.0	1.6	1.0	31.....		1.1	.....	1.2
11.....		1.0	1.3	1.0										

*Rating table for Crow Creek near Ronan, Mont., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.90	22	1.40	48	1.80	71	2.20	96	2.60	126
1.00	27	1.50	53	1.90	76	2.30	103	2.70	134
1.10	32	1.60	59	2.00	82	2.40	110	2.80	143
1.20	37	1.70	65	2.10	89	2.50	118	2.90	152
1.30	42								

NOTE.—The above table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and is not well defined.

*Monthly discharge of Crow Creek near Ronan, Mont., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
September 21-30.....	27	22	23.9	474
October.....	42	22	29.9	1,840
November.....	156	27	51.5	3,060
December.....	59	27	34.2	2,100
The period.....				7,470

NOTE.—Values are only approximate on account of the small number of measurements.

## MISSION CREEK NEAR ST. IGNATIUS, MONT.

Mission Creek rises on the western slope of the Mission Range and flows across the Flathead Reservation into Clark Fork.

The station was established September 21, 1906. It is located opposite the home of A. A. Boone, 1 mile downstream from St. Ignatius. There are a few small ditches diverting water above the gage.

The channel curves both above and below the station. The right bank is low and liable to overflow; the left is high and will not overflow. The current is swift. The bed is composed of gravel and is permanent. There is one channel at all stages.

Discharge measurements are made from the footbridge to which the staff gage is attached. The gage, which is 6 or 8 miles below the canyon, is read morning and evening by Mrs. A. A. Boone. The bench mark is a large spike driven horizontally in a pine tree 27 feet back of the gage on the left bank, below a blaze in the tree and 1 foot above the ground; elevation, 7.05 feet above the gage datum.

*Discharge measurements of Mission Creek near St. Ignatius, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 21....	Wade and Follansbee.....	30	25.8	0.78	65.4
October 17.....	Follansbee and Richards.....	29	25.9	.76	56.5
November 19..	R. Richards.....	28	21.5	.66	46.5

*Daily gage height, in feet, of Mission Creek near St. Ignatius, Mont., for 1906.*

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1.....		0.7	0.7	0.5	12.....		0.7	0.65	0.55	23.....	0.75	0.65	0.65	0.55
2.....		.7	.7	.55	13.....		.7	.7	.55	24.....	.75	.65	.6	.55
3.....		.7	.7	.55	14.....		.7	.75	.55	25.....	.7	.65	.6	.6
4.....		.7	.7	.55	15.....		.7	.82	.55	26.....	.7	.68	.6	.6
5.....		.7	.7	.55	16.....		.7	.82	.55	27.....	.7	.72	.6	.6
6.....		.7	.68	.55	17.....		.72	.72	.55	28.....	.7	.75	.58	.6
7.....		.7	.75	.55	18.....		.72	.7	.55	29.....	.7	.75	.55	.6
8.....		.7	.7	.55	19.....		.72	.65	.55	30.....	.7	.7	.52	.55
9.....		.75	.7	.55	20.....		.7	.7	.55	31.....		.7		.55
10.....		.7	.65	.55	21.....	0.8	.7	.65	.55					
11.....		.7	.65	.55	22.....	.8	.7	.65	.55					

*Rating table for Mission Creek near St. Ignatius, Mont., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i> 0.50	<i>Sec.-ft.</i> 33	<i>Feet.</i> 0.60	<i>Sec.-ft.</i> 40	<i>Feet.</i> 0.70	<i>Sec.-ft.</i> 50	<i>Feet.</i> 0.80	<i>Sec.-ft.</i> 65	<i>Feet.</i> 0.90	<i>Sec.-ft.</i> 85

NOTE.—The above table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and is not well defined.

*Monthly discharge of Mission Creek near St. Ignatius, Mont., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
September 21-30.....	65	50	54.4	1,080
October.....	57	45	50.5	3,110
November.....	69	34	48.1	2,860
December.....	40	33	36.5	2,240
The period.....				9,290

NOTE.—Values are only fair on account of the small number of measurements.

#### POST CREEK NEAR ST. IGNATIUS, MONT.

Post Creek rises on the western slope of the Mission Range and flows across Flathead Reservation into Mission Creek, a tributary of Clark Fork.

The gaging station was established September 21, 1906. It is located at the upper highway bridge, near the home of Joseph Allard, 10 miles north of St. Ignatius. The station is near the canyon and only two small ditches divert above. Because of the storage possibilities of McDonald Lake, the source of Post Creek, and also because of the land which can be reached, this station is very important.

The channel is straight for 25 feet above and 100 feet below the gage. The current is very swift. Both banks are wooded and will not overflow. The bed of the stream is composed of gravel and small boulders and is permanent. There is one channel at all stages.

Discharge measurements are made from the downstream side of the highway bridge.

The gage, which is read twice each day by Mrs. Adaline Allard, is a staff fastened to the overhanging stump at the right end of the bridge. The bench mark is a headless spike, 2 feet above the ground, in a blaze in a pine tree 2 feet in diameter, 45 feet from the left bank and 18 feet from the road; elevation, 8.90 feet above the gage datum.

*Discharge measurements of Post Creek near St. Ignatius, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 21...	Grover and Follansbee.....	22	24.0	1.50	63.2
October 17.....	Follansbee and Richards.....	22	23.4	1.51	58.8
November 19...	R. Richards.....	25	29.6	1.73	70.7

*Daily gage height, in feet, of Post Creek near St. Ignatius, Mont., for 1906.*

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1.....		1.4	1.5	1.4	12.....		1.5	1.8	1.3	22.....	1.5	1.4	1.7	1.3
2.....		1.4	1.4	1.4	13.....		1.4	1.8	1.3	23.....	1.4	1.4	1.65	1.3
3.....		1.3	1.4	1.3	14.....	a	1.4	1.9	1.3	24.....	1.5	1.4	1.55	1.3
4.....		1.4	1.4	1.3	15.....	a	1.4	2.0	1.3	25.....	1.5	1.4	1.5	1.3
5.....		1.5	1.5	1.3	16.....	a	1.5	2.0	1.3	26.....	a	1.5	1.4	1.5
6.....		1.4	1.5	1.3	17.....		1.5	1.9	1.3	27.....	1.5	1.4	1.45	1.3
7.....		1.4	1.5	1.3	18.....		1.5	1.8	1.3	28.....	1.4	1.4	1.4	1.3
8.....		1.4	1.6	1.3	19.....		1.6	1.7	1.3	29.....	1.4	1.4	1.4	1.3
9.....		1.4	1.6	1.3	20.....		1.5	1.7	1.3	30.....	1.4	1.5	1.4	1.3
10.....		1.4	1.7	1.3	21.....	1.5	1.4	1.7	1.3	31.....		1.5		1.3
11.....		1.4	1.7	1.3										

*a* Interpolated.

*Rating table for Post Creek near St. Ignatius, Mont., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1.30	50	1.50	59	1.70	69	1.90	81	2.00	88
1.40	54	1.60	64	1.80	75				

NOTE.—The above table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and is not well defined.

*Monthly discharge of Post Creek near St. Ignatius, Mont., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
September 21-30.....	59	54	57.0	1,130
October.....	64	50	55.5	3,410
November.....	88	54	65.5	3,900
December.....	54	50	50.3	3,090
The period.....				11,530

NOTE.—Values are only fair on account of the small number of measurements.

### JOCKO RIVER AT RAVALLI, MONT.

Jocko River rises in the southeastern part of Flathead Reservation and flows northwest into Clark Fork.

The gaging station, which was established October 18, 1906, is located 400 feet downstream from a point opposite the railroad station at Ravalli.

The channel is straight for several hundred feet above and below the gage. Both banks are sparsely wooded and will not overflow except at very high stage. The current is swift, and small rapids occur a short distance below the gage. The bed of the stream is composed of gravel and small bowlders and is permanent. There is one channel at all stages.

Discharge measurements may be made from the highway bridge 1 mile upstream, or preferably by wading at or near the gage. In high water the bridge must be used.

The gage, which is read daily by H. F. Lynn, the station agent, is a staff fastened to an overhanging tree on the right bank. The bench mark is a nail 2 feet above the ground in a tree 25 feet northeast of the gage; elevation, 6.80 feet above the datum of the gage.

*Discharge measurements of Jocko River at Ravalli, Mont., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
October 18 <i>a</i> .....	Follansbee and Richards.....	46	80	1.69	150
November 20 <i>b</i> .....	R. Richards.....	67	120	2.14	317

*a* Measured at bridge.

*b* Measured by wading at gage.

*Daily gage height, in feet, of Jocko River at Ravalli, Mont., for 1906.*

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1.....		1.75		12.....		1.8	1.85	22.....	1.65	1.85	1.8
2.....		1.75	1.8	13.....		2.1	1.8	23.....	1.65	1.85	1.8
3.....		1.7	1.8	14.....		2.15	1.8	24.....	1.65	1.85	1.8
4.....		1.7	1.8	15.....		2.75	1.8	25.....	1.65	1.85	1.8
5.....		1.7	1.8	16.....		2.7	1.8	26.....	2.0	1.85	1.85
6.....		1.7	1.8	17.....		2.5	1.8	27.....	2.1	1.8	1.9
7.....		1.7	1.85	18.....	1.65	2.3	1.8	28.....	1.95	1.8	1.9
8.....		1.85	1.8	19.....	1.65	2.1	1.75	29.....	1.9	1.8	1.85
9.....		1.8	1.8	20.....	1.65	1.95	1.8	30.....	1.8	1.8	
10.....		1.8	1.8	21.....	1.65	1.9	1.8	31.....	1.8		
11.....		1.8	1.85								

#### MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Clark Fork drainage basin in 1906:

*Miscellaneous measurements in Clark Fork drainage basin.*

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Dis-charge.
			<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 20..	Mud Creek.....	Highway bridge near Ronan, Mont.	8	4.5	1.51	2.55
September 25..	South Fork of Flat-head River.	Columbia Falls, Mont.....	195	312	.....	649

#### SPOKANE RIVER DRAINAGE BASIN.

##### DESCRIPTION OF BASIN.

Spokane River has its source in Lake Coeur d'Alene, Idaho, flows westward through Washington for about 120 miles, and empties into Columbia River. Its drainage area consists of rough mountainous land, more or less timbered, interspersed here and there with valleys or level table-lands of tillable areas.

The rainfall in this basin is approximately 20 inches per annum, and the region is semiarid. The principal tributary streams are Hangman Creek, Little Spokane, and Chamokane rivers.

The waters of the streams are largely used for irrigation, power, and municipal water supply. The city of Spokane is furnished with an abundance of electric power from plants at Spokane, Wash., and Post Falls, Idaho. The waters of Little Spokane River are in great demand for irrigation development.

## SPOKANE RIVER AT SPOKANE, WASH.

This gaging station was originally established October 17, 1896, on the Oregon Railroad and Navigation Company's wooden bridge, about 1 mile above the falls, where discharge measurements and gage readings were taken until July 8, 1903, the gage datum being 1,880 feet above sea level by city datum and 1,865 feet by Government datum.

March 30, 1904, a cable station was established about one-half mile above the Mission Street Bridge, or 1 mile above the former station at the Oregon Railroad and Navigation Company's bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 25, where are given also references to publications that contain data for previous years.

The following measurement was made October 1, 1906:

Width, 195 feet; area, 1,630 square feet; gage height, 1.28 feet; discharge, 1,330 second-feet.

*Daily gage height, in feet, of Spokane River at Spokane, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.16	2.83	5.40	5.63	8.91	6.31	4.16	2.15	1.64	1.40	1.81	3.27
2.....	2.16	2.96	5.38	6.10	8.81	6.37	4.07	2.10	1.70	1.59	1.84	3.24
3.....	2.14	3.10	5.32	6.36	8.71	6.41	3.96	2.09	1.54	1.52	1.90	3.20
4.....	2.13	3.21	5.24	6.62	8.60	6.41	3.87	2.14	1.53	1.46	1.67	3.15
5.....	2.00	3.32	5.20	6.77	8.60	6.37	3.81	1.73	1.63	1.49	1.53	3.28
6.....	2.03	3.50	5.12	6.80	8.51	6.31	3.72	1.80	1.59	1.54	1.82	a 3.90
7.....	2.26	3.49	5.04	6.90	8.37	6.23	3.66	1.92	1.58	1.60	1.76	3.65
8.....	2.17	3.80	4.98	7.09	8.22	6.16	3.59	1.95	1.63	1.35	1.97	3.61
9.....	2.19	3.79	4.96	7.30	8.05	6.12	3.53	2.05	1.85	1.55	2.05	3.74
10.....	2.17	3.74	4.95	7.55	7.90	5.98	3.38	1.78	1.60	1.47	2.07	3.76
11.....	2.18	3.75	4.93	7.78	7.77	5.92	3.29	1.76	1.63	1.46	1.93	4.00
12.....	2.19	3.74	4.91	7.90	7.71	5.82	3.16	1.73	1.65	1.51	1.70	3.65
13.....	2.21	3.72	4.90	7.97	7.68	5.80	3.06	1.73	1.56	1.45	1.94	3.43
14.....	2.22	3.56	4.86	8.00	7.60	5.73	2.96	1.76	1.50	1.56	1.80	3.49
15.....	2.24	3.40	4.83	7.93	7.55	5.62	2.92	1.80	1.56	1.35	1.90	3.46
16.....	2.23	3.37	4.82	7.91	7.44	5.51	2.89	1.84	1.53	1.63	2.91	3.43
17.....	2.25	3.32	4.70	7.92	7.32	5.41	2.83	1.91	1.50	1.53	2.67	3.38
18.....	2.24	3.34	4.60	8.02	7.18	5.32	2.85	1.75	1.58	1.70	3.03	3.44
19.....	2.24	3.38	4.52	8.08	7.00	5.21	2.65	1.56	1.67	1.65	a 4.59	3.38
20.....	2.21	3.70	4.45	8.11	6.85	5.11	2.73	1.77	1.62	1.71	3.72	3.45
21.....	2.21	4.11	4.37	8.31	6.70	5.01	2.58	1.76	1.43	1.70	4.20	3.43
22.....	2.22	4.47	4.31	8.33	6.55	4.93	2.50	1.95	1.43	1.63	4.56	3.50
23.....	2.24	4.74	4.22	8.48	6.46	4.83	2.47	1.76	1.42	1.65	3.90	3.48
24.....	2.26	4.97	4.18	8.80	6.35	4.74	2.49	1.63	1.40	1.63	4.03	3.51
25.....	2.29	5.10	4.18	9.18	6.25	4.64	2.38	1.64	1.65	1.68	4.06	3.92
26.....	2.36	5.24	4.24	9.23	6.02	4.52	2.34	1.70	1.53	1.66	4.07	4.20
27.....	2.47	5.33	4.35	9.31	6.04	4.45	2.25	1.63	1.57	1.62	4.05	4.55
28.....	2.62	5.39	4.60	9.22	6.03	4.36	2.26	1.76	1.57	1.81	4.01	5.00
29.....	2.67	.....	4.80	9.11	5.94	4.32	2.18	1.65	1.62	1.54	3.91	5.50
30.....	2.73	.....	5.03	9.04	6.00	4.25	2.26	1.68	1.60	1.70	3.81	5.65
31.....	2.78	.....	5.30	.....	6.05	.....	2.21	1.60	.....	1.73	.....	5.70

a Backwater due to log jams.

NOTE.—The river at this point does not freeze on account of the underground flow of water which comes through the gravel above the station and into the river again.

*Rating table for Spokane River at Spokane, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.00	1,000	2.10	2,340	3.20	4,080	4.60	6,600	6.80	11,340
1.10	1,100	2.20	2,490	3.30	4,250	4.80	7,050	7.00	11,830
1.20	1,200	2.30	2,640	3.40	4,420	5.00	7,450	8.00	14,490
1.30	1,300	2.40	2,790	3.50	4,600	5.20	7,850	9.00	17,380
1.40	1,410	2.50	2,940	3.60	4,780	5.40	8,250	10.00	20,580
1.50	1,520	2.60	3,100	3.70	4,960	5.60	8,660	11.00	23,980
1.60	1,640	2.70	3,260	3.80	5,140	5.80	9,080	12.00	27,580
1.70	1,760	2.80	3,420	3.90	5,330	6.00	9,510		
1.80	1,900	2.90	3,580	4.00	5,520	6.20	9,950		
1.90	2,040	3.00	3,740	4.20	5,900	6.40	10,400		
2.00	2,190	3.10	3,910	4.40	6,280	6.60	10,860		

NOTE.—The above table is based on 22 discharge measurements made during 1904-1907 and is well defined between gage heights 1.4 feet and 12.0 feet.

*Monthly discharge of Spokane River at Spokane, Wash., for 1906.*

[Drainage area, 4,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January.....	3,390	2,190	2,600	160,000	0.650	0.75
February.....	8,230	3,470	5,320	295,000	1.33	1.38
March.....	8,250	5,860	7,050	433,000	1.76	2.03
April.....	18,400	8,720	14,200	845,000	3.55	3.96
May.....	17,100	9,380	12,800	787,000	3.20	3.69
June.....	10,400	6,000	8,440	502,000	2.11	2.35
July.....	5,820	2,460	3,790	233,000	.948	1.09
August.....	2,420	1,590	1,920	118,000	.480	.55
September.....	1,970	1,410	1,610	95,800	.402	.45
October.....	1,910	1,360	1,620	93,600	.405	.47
November.....	6,640	1,560	3,600	214,000	.900	1.00
December.....	8,870	4,000	5,210	320,000	1.30	1.50
The year.....	18,400	1,360	5,680	4,100,000	1.42	19.22

NOTE.—Values are rated as excellent.

#### MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Spokane River drainage basin in 1906:

*Spokane River.*—A measurement was made at low water October 1, 1906, at Spokane Bridge, near the Idaho-Washington State line.

Width, 163 feet; area, 778 square feet; discharge, 803 second-feet.

A measurement was made at medium stage November 12, 1906, in sec. 24, T. 27 N., R. 39 E.

Width, 154 feet; area, 760 square feet; discharge, 2,500 second-feet.

#### OKANOGAN RIVER DRAINAGE BASIN.

##### DESCRIPTION OF BASIN.

Okanogan River rises in Okanogan Lake, in British Columbia, and flows southward, entering Columbia River near Brewster, Wash. Its course in Canada lies through a series of narrow lakes. The drainage area is comparatively rough and mountainous, and is timbered except along the river. The rainfall is approximately 20 inches per annum. The principal tributaries in the United States are Sim-

ilkameen and Conconully rivers and Antwine, Bonaparte, Salmon, and Johnson creeks.

The main stream is navigable from Brewster to Riverside except during low-water periods, while the tributaries are used largely for irrigation.

SALMON CREEK NEAR MALOTT, WASH.

This station was established April 11, 1903. It is located opposite R. D. Jones's house, on the county road halfway between Malott and Conconully, Okanogan County. It is reached by way of the Great Northern Railway to Wenache, thence by way of the Columbia River steamers to Brewster, and by the Conconully stage from Brewster to Jones's ranch. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 32, where are given also references to publications that contain data for previous years.

*Daily gage height, in feet, of Salmon Creek near Malott, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	0.69	0.75	0.70	1.52	1.42	2.21	1.46	0.92	0.49	0.54	0.69	0.71
2.....	.68	.74	.69	1.33	1.38	2.02	1.40	.88	.46	.56	.69	.69
3.....	.67	.73	.68	1.25	1.44	2.00	1.33	.83	.46	.54	.71	.71
4.....	.69	.70	.66	1.29	1.33	2.29	1.29	.83	.44	.54	.83	.67
5.....	.70	.70	.68	1.40	1.25	2.00	1.25	.81	.44	.58	1.00	.67
6.....	.71	.69	.73	1.50	1.23	2.00	1.23	.81	.44	.54	.96	.67
7.....	.70	.70	.72	1.54	1.19	1.96	1.27	.79	.44	.56	.83	.69
8.....	.71	.65	.74	1.33	1.19	1.83	1.14	.75	.46	.60	.75	.67
9.....	.73	.65	.75	1.25	1.21	1.79	1.12	.75	.50	.56	.75	.71
10.....	.70	.58	.75	1.10	1.21	1.83	1.08	.75	.50	.54	.81	.73
11.....	.71	.60	.70	1.14	1.25	1.96	.98	.71	.57	.56	.79	.71
12.....	.71	.58	.68	1.11	1.25	2.12	1.00	.67	.54	.67	.79	.67
13.....	.73	.56	.70	1.12	1.29	2.02	.99	.67	.58	.67	.75	.69
14.....	.73	.58	.73	1.17	1.33	2.00	.92	.71	.60	.67	.81	.67
15.....	.70	.64	.70	1.21	1.77	1.96	.90	.67	.62	.69	1.38	.67
16.....	.69	.66	.70	1.31	1.41	1.83	.88	.66	.64	.73	1.12	.69
17.....	.67	.68	.66	1.31	1.29	1.83	.83	.58	.58	.67	.90	.69
18.....	.67	.66	.66	1.25	1.27	1.79	1.05	.56	.58	.67	.83	.71
19.....	.69	.70	.70	1.25	1.25	1.71	1.00	.54	.56	.64	.83	.71
20.....	.70	.75	.66	1.33	1.31	1.67	1.00	.52	.58	.67	.79	.73
21.....	.71	.75	.70	1.44	1.29	1.62	1.05	.54	.56	.62	.83	.71
22.....	.71	.87	.70	1.56	1.40	1.58	1.35	.58	.54	.67	.79	.73
23.....	.73	.77	.75	1.52	1.46	1.54	1.31	.66	.54	.67	.79	.73
24.....	.72	.75	.83	1.43	1.35	1.52	1.25	.58	.54	.67	.75	.67
25.....	.73	.73	.87	1.29	1.32	1.50	1.12	.56	.56	.67	.77	.67
26.....	.73	.75	.87	1.29	2.42	1.47	1.05	.56	.54	.67	.75	.54
27.....	.74	.73	.85	1.29	2.75	1.58	1.00	.54	.54	.71	.75	.46
28.....	.75	.70	.83	1.33	2.35	1.71	1.00	.54	.54	.69	.75	.50
29.....	.75	.....	.82	1.33	2.10	1.54	.96	.52	.56	.67	.75	.71
30.....	.73	.....	.86	1.35	2.08	1.46	.94	.50	.54	.67	.73	.67
31.....	.73	.....	1.42	.....	2.12	.....	.92	.50	.....	.67	.....	.67

NOTE.—The creek never freezes at the gage.

JOHNSON CREEK NEAR RIVERSIDE, WASH.

This station was established May 30, 1903. The weir was destroyed July 30, 1904, and the station discontinued, but it was replaced April 30, 1905, and the records resumed. It is located at

Sogle's ranch, on the road from Riverside to Conconully, 1 mile from Riverside and 17 miles from Conconully.

The right bank of the stream is low for 10 feet back from the water's edge and then it rises more abruptly. The left bank is steep and rocky. The bed of the creek is composed of small gravel.

The equipment consists of a sharp-crested weir with an 8-foot opening and vertical sides. Below the level of the crest the weir consists of two 2-inch pine planks, 12 inches wide, securely spiked together. Above the crest on each end are two planks 12 inches wide, which form the ends of the weir. The edges of the crest and ends are one-fourth inch wide and beveled on the downstream side to an angle of 60°. The pool above the weir is 10 feet long, 10 to 15 feet wide, and 1 foot deep below the crest. The water has a fall of about 1 foot after passing the weir and then flows rapidly away.

The depth of the water on the crest is determined by a hook gage and vernier reading to thousandths of a foot. The zero on the gage is 0.10 foot above the crest of the weir. During 1905 and 1906 the gage readings were made once each day by Mrs. S. Sogle. The bench mark is the top of the fence opposite the weir; elevation, 12.91 feet above zero of the gage and 1,241.54 feet above sea level.

A description of this station, with discharge data, is contained in Water-Supply Papers Nos. 100 and 135, United States Geological Survey.

*Daily discharge, in second-feet, of Johnson Creek at Riverside, Wash., for 1905-6.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.											*	
1.					11.7	6.3	10.8	6.2	6.1	8.3	8.0	9.5
2.					11.6	6.3	10.4	6.7	6.2	8.3	8.0	11.3
3.					11.4	9.0	9.9	6.3	6.4	7.6	8.0	11.4
4.					11.1	10.4	8.8	6.2	5.8	7.4	7.9	11.5
5.					11.0	9.1	8.1	6.1	6.1	8.1	7.9	7.9
6.					10.7	8.8	6.8	6.0	5.9	8.7	7.9	7.9
7.					10.7	8.9	6.5	5.8	5.9	9.3	7.9	8.0
8.					10.6	8.7	6.5	5.6	6.0	8.1	8.0	7.9
9.					11.1	8.1	5.6	5.4	6.4	7.5	8.0	8.4
10.					10.8	8.0	5.6	5.4	6.2	7.3	8.1	8.5
11.					10.7	9.5	4.6	6.1	6.1	7.2	8.1	8.4
12.					9.7	8.3	5.1	5.8	6.1	7.1	8.0	8.4
13.					9.5	7.6	5.0	5.8	8.3	6.9	8.1	8.4
14.					6.8	7.1	6.6	5.6	8.5	6.8	8.3	8.0
15.					6.1	6.9	6.6	5.8	6.9	7.8	8.3	8.9
16.					7.7	6.9	4.6	6.0	7.0	7.4	8.4	8.3
17.					7.7	6.8	6.8	6.2	7.6	7.4	8.4	8.3
18.					6.4	6.8	7.6	6.2	7.4	7.5	8.4	8.7
19.					5.9	6.8	6.4	6.1	7.0	7.9	12.5	9.0
20.					6.2	6.7	5.0	5.8	7.2	7.9	12.1	8.8
21.					6.7	6.6	5.3	5.6	7.3	7.9	9.7	8.7
22.					7.1	6.8	5.1	5.4	7.1	7.9	8.8	8.0
23.					9.5	6.6	5.1	5.4	6.3	8.0	8.7	7.6
24.					9.6	7.3	5.1	5.6	6.3	8.1	8.6	9.0
25.					7.1	9.0	5.1	6.5	6.3	7.9	8.7	8.4
26.					8.1	9.5	5.1	6.6	7.3	7.9	8.7	8.4
27.					7.2	13.6	5.4	6.7	12.5	7.9	8.3	8.1
28.					7.2	12.2	6.0	6.7	12.3	7.9	7.9	8.0
29.					7.1	11.5	7.0	6.4	9.1	8.0	7.9	7.9
30.					4.6	10.8	6.6	5.7	8.0	8.0	9.2	7.9
31.					6.1		6.2	6.0		8.0		8.8

Daily discharge, in second-feet, of Johnson Creek at Riverside, Wash., for 1905-6—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
1.....	4.6	10.1	9.6	12.2	3.7	6.4	3.0	1.0	3.5	4.1	4.8	6.1
2.....	8.3	9.8	9.5	9.8	3.3	5.9	3.2	1.3	3.4	4.1	4.9	6.3
3.....	8.1	9.7	9.5	9.1	2.8	4.8	2.4	1.3	3.1	4.2	5.1	6.4
4.....	7.9	9.5	9.6	8.8	2.8	6.8	2.4	1.0	3.0	4.2	6.8	6.4
5.....	7.9	9.2	9.5	8.7	1.8	6.1	4.1	1.0	2.6	4.3	8.1	6.6
6.....	7.9	8.5	9.5	8.6	2.1	5.8	3.0	1.9	2.8	4.4	5.7	7.3
7.....	6.3	8.9	9.5	8.5	2.3	5.6	3.1	1.3	2.8	4.6	5.6	7.1
8.....	8.1	8.5	9.5	8.5	1.9	5.3	3.0	1.4	3.1	4.2	5.7	6.9
9.....	8.2	8.4	9.2	8.4	2.8	5.3	1.6	1.4	3.1	4.2	6.0	6.6
10.....	7.9	8.3	9.0	8.4	2.7	4.9	1.6	1.3	3.1	4.2	6.8	6.5
11.....	14.1	8.3	8.1	8.3	3.5	5.1	1.5	1.4	3.2	4.3	6.8	6.9
12.....	8.4	8.2	7.7	8.4	3.4	5.8	1.3	1.4	3.4	4.4	5.7	6.8
13.....	8.6	8.3	8.8	8.4	3.0	5.4	1.3	1.4	4.6	4.4	5.9	6.6
14.....	8.5	8.1	8.3	8.4	2.9	5.6	1.3	1.9	4.9	4.6	8.4	6.6
15.....	8.0	8.6	7.6	8.3	5.7	5.7	1.3	1.7	4.9	4.4	7.3	5.6
16.....	8.2	8.8	9.5	8.3	4.5	6.8	1.3	1.6	4.4	4.5	7.3	5.5
17.....	8.0	10.4	8.7	8.1	4.5	6.2	1.4	1.4	4.1	4.5	6.6	6.7
18.....	8.1	12.5	8.5	8.0	3.9	5.6	3.1	1.4	4.4	4.4	6.4	8.5
19.....	33.6	17.5	8.2	8.0	3.5	5.2	3.3	1.7	4.2	4.4	6.0	7.9
20.....	10.1	13.8	8.5	8.0	3.4	5.2	2.4	1.7	4.3	4.5	6.1	7.3
21.....	7.6	15.8	8.7	8.0	1.9	5.0	2.2	1.7	4.2	4.6	6.1	7.2
22.....	7.9	13.2	8.8	7.6	2.0	4.8	2.8	2.2	4.2	4.5	6.2	7.4
23.....	9.2	11.3	8.8	7.9	3.3	4.7	2.7	2.6	4.2	4.5	6.1	7.3
24.....	10.1	10.7	9.2	7.9	3.7	4.7	2.6	2.6	4.4	4.6	6.0	7.2
25.....	10.1	12.2	9.0	8.0	3.9	4.2	2.2	2.4	4.4	4.6	6.0	7.2
26.....	10.0	10.8	8.7	7.3	3.8	3.1	1.5	3.2	4.3	4.6	6.1	7.1
27.....	9.5	11.3	8.7	7.1	9.8	4.3	1.3	3.8	4.4	4.6	5.8	7.0
28.....	9.1	10.1	8.7	6.6	8.8	4.3	1.4	2.6	4.1	4.6	6.1	7.3
29.....	9.2	.....	8.7	5.7	7.1	3.5	1.0	2.6	4.1	4.5	6.1	7.3
30.....	9.4	.....	9.0	5.6	4.9	3.2	1.0	3.0	4.1	4.8	6.0	7.1
31.....	9.6	.....	13.0	.....	6.6	.....	1.4	3.2	.....	4.7	.....	3.4

NOTE.—These discharges were obtained from the Cippoletti weir formula, using the gage heights corrected to give the head on crest of weir.

*Monthly discharge of Johnson Creek at Riverside, Wash., for 1905-6.*

[Drainage area, 66 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.						
May.....	11.7	4.6	8.64	531	0.131	0.15
June.....	13.6	6.3	8.36	497	.127	.14
July.....	10.8	4.6	6.43	395	.097	.11
August.....	6.7	5.4	5.99	368	.091	.10
September.....	12.5	5.8	7.19	428	.109	.12
October.....	9.3	6.8	7.81	480	.118	.14
November.....	12.5	7.9	8.56	509	.130	.14
December.....	11.5	7.6	8.65	532	.131	.15
The period.....				3,740		
1906.						
January.....	33.6	4.6	9.44	580	.143	.16
February.....	17.5	8.1	10.4	578	.158	.16
March.....	13.0	7.6	9.02	555	.137	.16
April.....	12.2	5.6	8.16	486	.124	.14
May.....	9.8	1.8	3.88	239	.059	.07
June.....	6.8	3.1	5.18	308	.078	.09
July.....	3.3	1.0	2.12	130	.032	.04
August.....	3.8	1.0	1.88	116	.028	.03
September.....	4.9	2.6	3.84	228	.058	.06
October.....	4.8	4.1	4.44	273	.067	.08
November.....	8.4	4.8	6.22	370	.094	.10
December.....	8.5	3.4	6.78	417	.103	.12
The year.....	33.6	1.0	5.95	4,280	.090	1.21

NOTE.—Values for 1905-6 are excellent.

## METHOW RIVER DRAINAGE BASIN.

## METHOW RIVER AT PATEROS, WASH.

Methow River heads on the eastern slope of the Cascade Range in northern Washington and flows southeast into the Columbia River. Its drainage area throughout is mountainous and heavily timbered. The rainfall varies from 40 inches at the headwaters to 20 inches near the mouth of the stream. The waters of the smaller tributaries are largely used for irrigation.

This station was originally established May 3, 1903, on a highway bridge about 1,000 feet above the mouth of the river; the first two measurements were taken from this bridge. During the summer of 1903 the bridge was washed away, and a temporary bridge 400 feet farther downstream was used in making the measurement of March 20, 1904. During the spring of 1904 this bridge also was abandoned because of its temporary nature and the poor section at this point, and a cable station was established about a mile above the mouth of the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 35, where are given also references to publications that contain data for previous years.

The following measurement was made December 29, 1906. There was a narrow strip of ice on each bank.

Width, 154 feet; area, 342 feet; gage height, 4.12 feet; discharge, 489 second-feet.

*Daily gage height, in feet, of Methow River at Pateros, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.9	3.9	3.9	4.55	7.35	8.3	6.4	4.65	4.15	4.0	4.45	4.35
2.....	3.9	3.9	3.9	4.55	7.5	8.3	6.5	4.6	4.15	4.0	4.4	4.35
3.....	3.9	3.9	3.95	4.55	7.8	8.3	6.6	4.55	4.1	4.0	4.4	4.35
4.....	<sup>a</sup> 4.1	3.9	3.95	4.65	7.6	9.5	6.7	4.55	4.1	4.0	4.45	4.35
5.....	4.1	3.9	3.95	4.8	7.2	8.5	6.75	4.55	4.05	4.0	4.45	4.35
6.....	4.1	3.9	3.95	5.2	7.0	8.2	6.85	4.55	4.05	4.0	4.45	4.35
7.....	4.1	3.8	3.95	5.7	6.95	7.8	7.0	4.45	4.05	3.95	4.4	4.35
8.....	3.95	3.8	3.95	5.8	7.0	7.5	6.6	4.45	4.05	3.95	4.45	4.35
9.....	3.95	3.8	4.0	5.65	7.1	7.0	6.4	4.45	4.05	3.95	4.4	4.35
10.....	3.95	3.8	4.0	5.5	7.2	7.3	6.25	4.45	4.1	3.95	4.45	4.35
11.....	3.95	3.9	4.0	5.4	7.75	7.3	6.15	4.4	4.1	3.95	4.65	4.35
12.....	4.0	4.0	3.9	5.3	7.8	8.3	6.0	4.4	4.1	3.95	4.65	4.35
13.....	4.15	4.0	3.9	5.2	7.8	8.0	5.95	4.4	4.1	3.95	4.65	4.35
14.....	<b>4.45</b>	3.95	3.9	5.2	7.1	7.6	5.8	4.4	4.1	3.95	4.7	4.0
15.....	4.1	3.95	3.95	5.3	7.3	7.2	5.7	4.4	4.1	4.0	5.3	4.25
16.....	4.1	<b>3.95</b>	<b>3.95</b>	5.5	7.0	7.4	5.6	4.4	4.1	4.05	5.15	4.25
17.....	4.1	<b>3.95</b>	3.95	5.5	6.9	7.1	5.5	4.35	4.1	4.05	4.9	4.25
18.....	4.1	4.0	3.95	5.6	6.7	6.8	5.4	4.3	4.1	4.05	4.8	4.2
19.....	4.1	4.0	3.95	5.7	6.65	6.75	5.35	4.25	4.1	4.05	4.7	4.15
20.....	4.1	4.05	3.95	5.7	6.6	6.7	5.25	4.25	4.1	4.05	4.65	4.15
21.....	4.1	4.0	3.95	6.1	6.6	6.7	5.2	4.2	4.05	4.0	4.6	4.2
22.....	4.1	3.95	3.95	6.8	6.6	6.65	5.15	4.25	4.05	4.0	4.55	4.2
23.....	4.2	3.95	3.95	7.0	6.65	6.6	5.05	4.25	4.05	4.0	4.5	4.2
24.....	4.25	3.95	4.0	6.8	6.75	6.55	5.0	4.25	4.05	4.0	4.5	4.2
25.....	4.15	3.95	4.05	6.5	6.75	6.75	4.95	4.25	4.05	4.0	4.5	4.2
26.....	4.15	3.95 <sup>a</sup>	4.05	6.3	10.5	7.25	4.9	4.25	4.05	3.95	4.45	4.0
27.....	4.15	3.9	4.1	6.3	10.5	7.4	4.85	4.2	4.05	4.6	4.45	4.05
28.....	4.1	3.95	4.15	6.35	9.2	7.4	4.8	4.2	4.05	4.55	4.4	4.05
29.....	4.0	.....	4.15	6.35	9.0	7.0	4.8	4.15	4.0	4.55	4.35	4.1
30.....	3.9	.....	4.25	6.95	8.7	6.6	4.75	4.15	4.0	4.5	4.45	4.15
31.....	3.9	.....	4.5	.....	8.4	.....	4.7	4.15	.....	4.5	.....	4.15

<sup>a</sup> Ice forming along banks, narrowing channel.

*Rating table for Methow River at Pateros, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.80	400	4.80	902	5.80	1,988	6.80	3,560	8.60	7,088
3.90	420	4.90	984	5.90	2,128	6.90	3,738	8.80	7,506
4.00	450	5.00	1,072	6.00	2,272	7.00	3,920	9.00	7,930
4.10	486	5.10	1,166	6.10	2,420	7.20	4,294	9.20	8,356
4.20	528	5.20	1,266	6.20	2,572	7.40	4,676	9.40	8,785
4.30	576	5.30	1,372	6.30	2,726	7.60	5,066	9.60	9,215
4.40	630	5.40	1,484	6.40	2,884	7.80	5,460	9.80	9,646
4.50	690	5.50	1,602	6.50	3,050	8.00	5,860	10.00	10,080
4.60	756	5.60	1,724	6.60	3,216	8.20	6,264		
4.70	826	5.70	1,854	6.70	3,386	8.40	6,674		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is well defined.

*Monthly discharge of Methow River at Pateros, Wash., for 1906.*

[Drainage area, 1,710 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.....	660	420	478	29,400	0.28	0.32
February.....	468	400	430	23,900	.25	.26
March.....	690	420	455	28,000	.27	.31
April.....	3,920	723	1,970	117,000	1.15	1.28
May.....	11,200	3,220	5,040	310,000	2.95	3.40
June.....	9,000	3,130	4,770	284,000	2.79	3.11
July.....	3,920	826	1,990	122,000	1.16	1.34
August.....	791	507	613	37,700	.36	.42
September.....	597	450	564	33,600	.33	.37
October.....	756	435	492	30,300	.29	.33
November.....	1,370	603	749	44,600	.44	.49
December.....	603	450	549	33,800	.32	.37
The year.....	11,200	400	1,510	1,090,000	.88	12.00

NOTE.—Values are good.

## CHELAN RIVER DRAINAGE BASIN.

Chelan River forms the outlet of Lake Chelan, a long, narrow lake fed at the upper end by Stehekin River, which drains a portion of the eastern slopes of the Cascades. The tributaries of this lake drain a rough, mountainous area, quite heavily timbered. The lower end of the lake is 380 feet above Columbia River, to which it is joined by Chelan River, about 4 miles in length. The water supply of this stream is particularly valuable for future power development.

### CHELAN RIVER AT CHELAN, WASH.

This station was established November 6, 1903, by G. H. Bliss. It is located at the highway bridge 3,000 feet below the outlet of the lake and in the town of Chelan. A dam which has been constructed at the foot of the lake by the town of Chelan holds back the flow of water to some extent during the dry season. The conditions at the station and the bench marks are described in Water-Supply Paper

No. 178, page 38, where are given also references to publications that contain data for previous years.

The following measurement was made January 2, 1907:

Width, 206 feet; area, 1,460 feet; gage height, 5.50 feet; discharge, 920 second-feet.

*Daily gage height, in feet, of Chelan River at Chelan, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.40	5.70	5.60	5.85	7.75	8.45	7.65	7.20	6.20	5.75	5.55	7.15
2.....	5.40	5.68	5.60	5.90	7.90	8.45	7.70	7.15	6.15	5.70	5.50	7.10
3.....	5.40	5.65	5.60	5.90	8.05	8.50	7.80	7.15	6.10	5.70	5.45	7.05
4.....	5.40	5.65	5.60	5.90	8.20	8.45	8.00	7.05	6.10	5.65	5.40	7.00
5.....	5.40	5.65	5.60	5.95	8.30	8.40	8.15	7.00	6.00	5.60	5.40	7.00
6.....	5.38	5.65	5.55	6.02	8.35	8.40	8.25	6.50	5.95	5.60	5.40	7.00
7.....	5.38	5.65	5.55	6.40	8.30	8.35	8.40	6.50	5.90	5.55	5.40	6.95
8.....	5.40	5.65	6.65	6.40	8.30	8.35	8.50	6.50	5.90	5.50	5.40	6.95
9.....	5.40	5.65	6.58	6.50	8.32	8.35	8.50	6.50	5.90	5.55	5.50	6.90
10.....	5.40	5.65	6.50	6.48	8.40	8.30	8.45	6.50	5.85	5.55	5.50	6.90
11.....	5.40	5.60	6.43	6.52	8.50	8.30	8.40	6.50	5.90	5.60	5.55	6.85
12.....	5.45	5.60	6.38	6.50	8.65	8.35	8.40	6.50	6.00	5.60	5.65	6.80
13.....	5.48	5.60	6.30	6.50	8.70	8.35	8.38	6.45	6.25	5.60	5.80	6.70
14.....	5.48	5.60	6.25	6.50	8.70	8.30	8.35	6.45	6.15	5.60	6.10	6.60
15.....	5.45	5.65	6.22	6.55	8.70	8.30	8.35	6.40	6.10	5.60	6.50	6.55
16.....	5.50	5.65	6.20	6.60	8.65	8.25	8.35	6.40	6.00	5.60	7.00	6.50
17.....	5.45	5.65	6.18	6.65	8.66	8.20	8.33	6.35	5.95	5.60	7.50	6.40
18.....	5.45	5.65	6.10	6.60	8.55	8.15	8.30	6.35	5.95	5.57	7.70	6.40
19.....	5.40	5.65	6.00	6.70	8.50	8.10	8.20	6.30	5.95	5.55	7.60	6.35
20.....	5.40	5.65	5.92	6.75	8.46	7.95	8.10	6.28	5.95	5.50	7.50	6.35
21.....	5.40	5.60	5.88	6.82	8.30	7.75	8.00	6.25	5.90	5.45	7.45	6.30
22.....	5.40	5.65	5.85	7.00	8.25	7.65	7.90	6.20	5.90	5.40	7.40	6.30
23.....	5.90	5.65	5.82	7.15	8.20	7.50	7.80	6.15	5.90	5.40	7.40	6.30
24.....	5.85	5.70	5.80	7.25	8.15	7.40	7.70	6.08	5.85	5.38	7.40	6.20
25.....	5.85	5.65	5.80	7.35	8.20	7.50	7.60	6.00	5.90	5.80	7.35	6.10
26.....	5.80	5.70	5.78	7.40	8.35	7.60	7.60	6.00	5.85	5.85	7.35	6.00
27.....	5.80	5.70	5.78	7.42	8.45	7.70	7.55	6.05	5.85	5.90	7.30	5.90
28.....	5.75	5.65	5.75	7.45	8.50	7.70	7.50	6.05	5.80	5.80	7.25	5.90
29.....	5.75	.....	5.72	7.50	8.50	7.68	7.50	6.10	5.78	5.65	7.20	5.85
30.....	5.70	.....	5.72	7.60	8.50	7.65	7.40	6.20	5.75	5.65	7.20	5.80
31.....	5.70	.....	5.82	.....	8.50	.....	7.30	6.20	.....	5.60	.....	5.70

*Rating table for Chelan River at Chelan, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
5.30	830	6.00	1,150	6.70	1,920	7.30	2,910	7.90	3,990
5.40	860	6.10	1,230	6.80	2,070	7.40	3,090	8.00	4,170
5.50	900	6.20	1,320	6.90	2,230	7.50	3,270	8.20	4,550
5.60	940	6.30	1,420	7.00	2,390	7.60	3,450	8.40	4,930
5.70	990	6.40	1,530	7.10	2,560	7.70	3,630	8.60	5,300
5.80	1,040	6.50	1,650	7.20	2,730	7.80	3,810	8.80	5,690
5.90	1,090	6.60	1,780	.....	.....	.....	.....	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1907, and is fairly well defined above gage height 5.5 feet.

*Monthly discharge of Chelan River at Chelan, Wash., for 1906.*

[Drainage area, 950 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.....	1,090	854	916	56,300	.964	1.11
February.....	990	940	965	53,600	1.02	1.06
March.....	1,850	920	1,170	71,900	1.23	1.42
April.....	3,450	1,050	1,990	118,000	2.09	2.33
May.....	5,500	3,720	4,890	301,000	5.15	5.94
June.....	5,110	3,090	4,330	258,000	4.56	5.09
July.....	5,110	2,910	4,210	259,000	4.43	5.11
August.....	2,730	1,150	1,620	99,600	1.71	1.97
September.....	1,370	992	1,130	67,200	1.19	1.33
October.....	1,080	812	921	56,600	.969	1.12
November.....	3,630	820	1,990	118,000	2.09	2.33
December.....	2,640	965	1,750	108,000	1.84	2.12
The year.....	5,500	812	2,160	1,570,000	2.27	30.93

NOTE.—Values are good.

## WENATCHEE RIVER DRAINAGE BASIN.

## WENATCHEE RIVER AT CASHMERE, WASH.

Wenatchee River drains a portion of the western slope of the Cascade Mountains in Washington, and flows southeast through Lake Wenatchee into the Columbia River. Its basin throughout is mountainous and quite heavily timbered. The rainfall varies from 50 inches at the crest of the Cascades to 20 inches at the mouth. The waters of the stream are principally valuable for irrigation.

This station was established July 26, 1904. It is located at the highway bridge just north of the town of Cashmere, Wash. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 40, where are given also references to publications that contain data for previous years.

The old gage was destroyed by flood November 15, 1906. A new gage was installed at the same place and datum on December 27.

*Discharge measurements of Wenatchee River at Cashmere, Wash., in 1906.*

Date.	Hydrographer	Width.	Area of section.	Gage height.	Dis- charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet. —</i>	<i>Sec.-ft.</i>
August 23.....	W. G. Steward.....	160	232	1.55	889
August 29.....	do.....	161	737	1.55	956
December 27.....	H. McGlashan.....	186	312	2.20	1,300

*Daily gage height, in feet, of Wenatchee River at Cashmere, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.3	2.4	2.0	3.6	6.0	4.6	3.6	2.2	1.8	1.5	3.2	.....
2.....	1.3	2.5	2.0	3.5	6.1	4.6	3.8	2.1	1.8	1.4	2.9	.....
3.....	1.4	2.6	2.0	3.3	6.3	4.9	4.1	2.0	1.7	1.5	2.8	.....
4.....	1.5	2.5	1.9	3.4	6.1	5.5	4.4	1.9	1.7	1.7	2.8	.....
5.....	1.7	2.5	1.9	3.6	5.9	5.3	4.5	2.0	1.6	1.7	2.9	.....
6.....	1.7	2.4	2.0	4.0	5.5	4.9	4.5	2.0	1.4	1.7	2.6	.....
7.....	1.6	2.4	2.0	4.4	5.3	4.6	4.7	2.0	1.4	1.7	2.6	.....
8.....	1.6	2.3	2.1	5.0	5.3	4.4	4.4	2.0	1.9	1.6	2.7	.....
9.....	1.5	2.2	2.2	4.6	5.4	4.2	4.1	2.0	2.4	1.5	2.7	.....
10.....	1.5	2.1	2.3	4.3	5.9	4.1	3.9	2.0	2.3	1.6	2.7	.....
11.....	1.5	2.1	2.3	4.2	6.2	4.0	3.7	2.0	2.0	1.5	3.4	.....
12.....	1.4	2.1	2.2	4.1	6.0	4.9	3.6	2.0	1.7	1.5	3.4	.....
13.....	1.4	2.0	2.1	4.0	5.8	5.0	3.6	2.0	1.6	1.7	5.7	.....
14.....	1.3	2.0	2.1	3.8	5.3	4.6	3.5	2.1	1.6	1.8	8.05	.....
15.....	1.4	2.0	2.0	3.9	5.3	4.3	3.4	2.0	1.6	2.0	.....	.....
16.....	1.4	1.9	2.0	4.2	4.9	4.3	3.3	1.9	1.6	2.4	.....	.....
17.....	1.4	1.9	2.0	4.4	4.6	4.2	3.2	1.85	1.5	2.7	.....	.....
18.....	1.4	2.0	2.0	4.3	4.4	4.0	3.1	1.8	1.5	3.0	.....	.....
19.....	1.3	2.3	2.0	4.3	4.3	3.9	3.0	1.6	1.4	2.8	.....	.....
20.....	1.3	2.5	2.0	4.4	4.2	3.8	2.9	1.6	1.4	2.7	.....	.....
21.....	1.3	2.4	2.0	4.8	4.2	3.8	2.8	1.6	1.4	2.3	.....	.....
22.....	1.4	2.3	2.0	5.85	4.1	3.8	2.7	1.6	1.4	2.2	.....	.....
23.....	1.5	2.3	2.0	5.8	4.2	3.8	2.7	1.6	1.4	2.1	.....	.....
24.....	1.8	2.2	2.0	5.6	4.2	3.9	2.6	1.5	1.4	2.0	.....	.....
25.....	2.3	2.2	2.1	5.3	4.3	4.1	2.5	1.5	1.5	1.8	.....	.....
26.....	2.4	2.1	2.2	5.0	5.4	4.4	2.5	1.6	1.8	6.5	.....	.....
27.....	2.4	2.1	2.3	4.9	5.5	4.3	2.4	1.7	1.8	6.0	.....	2.2
28.....	2.3	2.1	2.4	4.9	5.2	4.2	2.3	1.7	1.6	5.0	.....	2.2
29.....	2.3	.....	2.5	5.3	4.9	3.9	2.3	1.8	1.5	4.3	.....	2.1
30.....	2.2	.....	2.7	5.6	4.8	3.7	2.3	1.8	1.4	3.8	.....	2.1
31.....	2.3	.....	3.4	.....	4.7	.....	2.3	1.8	.....	3.5	.....	2.1

*Rating table for Wenatchee River at Cashmere, Wash., for 1905-6.*

gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.00	550	2.00	1,360	3.00	2,450	4.00	3,800	6.00	6,900
1.10	615	2.10	1,460	3.10	2,580	4.20	4,100	6.20	7,240
1.20	685	2.20	1,560	3.20	2,710	4.40	4,400	6.40	7,580
1.30	755	2.30	1,665	3.30	2,840	4.60	4,700	6.60	7,920
1.40	830	2.40	1,770	3.40	2,970	4.80	5,000	6.80	8,260
1.50	910	2.50	1,875	3.50	3,100	5.00	5,300	7.00	8,600
1.60	990	2.60	1,985	3.60	3,240	5.20	5,620	8.00	10,400
1.70	1,075	2.70	2,095	3.70	3,380	5.40	5,940	.....	.....
1.80	1,165	2.80	2,210	3.80	3,520	5.60	6,260	.....	.....
1.90	1,260	2.90	2,330	3.90	3,660	5.80	6,580	.....	.....

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 1.5 feet and 3.9 feet.

*Monthly discharge of Wenatchee River at Cashmere, Wash., for 1906.*

[Drainage area, 1,190 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.....	1,770	755	1,060	65,200	0.891	1.03
February.....	1,980	1,260	1,910	106,000	1.61	1.68
March.....	2,970	1,260	1,520	93,500	1.28	1.48
April.....	6,660	2,840	4,540	270,000	3.82	4.26
May.....	7,410	3,950	5,600	344,000	4.71	5.43
June.....	6,100	3,380	4,310	256,000	3.62	4.04
July.....	4,850	1,660	2,920	180,000	2.45	2.82
August.....	1,560	910	1,220	75,000	1.03	1.19
September.....	1,770	830	1,030	61,300	.866	.97
October.....	7,750	830	2,060	127,000	1.73	1.99
November 1-14.....	10,500	1,980	3,210	89,100	2.70	1.41
December 27-31.....	1,560	1,460	1,500	14,900	1.26	.23
The period.....				1,680,000		

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

## YAKIMA RIVER DRAINAGE BASIN.

## DESCRIPTION OF BASIN.

Yakima River rises in Lake Keechelus, near the crest of the eastern slope of the Cascade Mountains, in Washington, and flows southeast into the Columbia River at Kennewick. The headwaters of this stream are fed by numerous tributaries draining rough mountainous areas of heavy timber lands. It is fed near its source by Kachess River, which heads in Lake Kachess, and by Clealum River, which flows through Lake Clealum. Throughout the arid portion of this drainage area the country is timberless and rolling except in the immediate valleys of the streams. The annual rainfall varies from 100 inches at the crest of the Cascades to 10 inches near the mouth of the river. The entire summer flow of the Yakima and also that of its principal tributary, Naches River, is diverted for the irrigation of lands which have reached a high stage of development, rivaled only by the orange lands of southern California.

Gaging stations are maintained as follows:

Yakima River near Martin, Clealum, Umtanum, Yakima, Prosser, Kiona, and Richland, Wash.; Kachess River near Easton, Wash.; Clealum River near Roslyn; Naches River near Nile and North Yakima; Bumping River near Nile; and Tieton River near Natchez (two stations). Gages for determining fluctuations of water level are maintained in Lakes Keechelus, Kachess, and Clealum.

## YAKIMA RIVER NEAR MARTIN, WASH.

This station was established October 18, 1903. It is 1,000 feet below the outlet of Lake Keechelus, 800 feet below the dam of the Cascade Lumber Company, and 4 miles northwest of Martin, Wash. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 43, where are given also references to publications that contain data for previous years.

*Discharge measurements of Yakima River near Martin, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 18.....	J. C. Stevens.....	113	191	7.04	194
May 2.....	W. C. Muldrow.....	120	394	8.74	983
July 17.....	.....do.....	108	186	6.90	169
August 11.....	.....do.....	105	133	6.43	68
August 21 <sup>a</sup> .....	J. C. Stevens.....	48	45	6.37	66
October 30.....	W. C. Muldrow.....	119	295	8.01	582
November 25.....	.....do.....	109	208	7.18	246

<sup>a</sup> Made 500 feet below cable.

*Daily gage height, in feet, of Yakima River near Martin, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	6.86	7.40	7.26	7.45	8.79	7.91	7.39	6.52	6.32	6.52	7.56	6.55
2.	6.82	7.32	7.22	7.50	8.75	7.90	7.39	6.52	6.31	6.54	7.29	6.52
3.	6.80	7.27	7.15	7.48	8.72	7.91	7.39	6.50	6.31	6.62	7.24	6.52
4.	6.82	7.21	7.10	7.48	8.70	8.01	7.36	6.50	6.30	6.79	7.21	.....
5.	6.86	7.17	7.07	7.56	8.59	7.98	7.34	6.48	6.30	6.82	7.14	.....
6.	6.92	7.14	7.04	7.71	8.44	7.94	7.32	6.47	6.28	6.80	6.94	.....
7.	6.90	7.13	7.03	7.90	8.36	7.90	7.26	6.47	6.34	6.76	7.10	.....
8.	6.90	7.12	7.04	8.01	8.31	7.82	7.22	6.46	6.34	6.72	7.22	6.80
9.	6.92	7.10	7.10	8.05	8.38	7.76	7.16	6.45	6.36	6.69	7.31	6.90
10.	6.91	7.10	7.12	8.01	8.52	7.71	7.13	6.44	6.36	6.74	7.70	6.91
11.	6.90	7.08	7.15	7.92	8.58	7.70	7.11	6.43	6.34	6.71	8.04	7.67
12.	6.88	7.06	7.16	7.82	8.54	7.79	7.05	6.43	6.33	6.74	8.50	8.20
13.	6.88	7.04	7.14	7.73	8.40	7.74	7.02	6.42	6.32	6.72	11.28	7.91
14.	6.85	7.04	7.12	7.66	8.26	7.71	6.99	6.42	6.50	6.66	13.80	7.40
15.	6.84	7.02	7.08	7.66	8.28	7.66	6.94	6.40	6.52	6.79	13.96	7.62
16.	6.88	7.02	7.06	7.62	8.18	7.62	6.92	6.40	6.50	7.04	11.74	7.40
17.	6.88	7.04	7.06	7.78	8.13	7.59	6.89	6.40	6.48	7.61	10.04	7.75
18.	7.00	7.08	7.04	7.84	8.02	7.56	6.85	6.39	6.46	7.81	9.14	7.63
19.	7.10	7.37	7.04	7.86	7.93	7.54	6.81	6.38	6.45	7.80	8.42	7.02
20.	7.20	7.50	7.01	7.92	7.88	7.52	6.78	6.38	6.44	7.71	8.06	7.72
21.	7.42	7.53	6.98	8.34	7.82	7.51	6.76	6.37	6.42	7.58	7.71	8.25
22.	7.58	7.52	6.96	8.64	7.80	7.57	6.74	6.36	6.42	7.46	7.39	8.15
23.	7.75	7.50	6.96	8.73	7.74	7.54	6.72	6.35	6.41	7.44	7.21	7.99
24.	7.82	7.50	6.94	8.62	7.73	7.52	6.67	6.34	6.42	7.42	6.92	7.93
25.	7.85	7.46	6.92	8.56	7.82	7.50	6.64	6.34	6.48	7.52	7.18	7.85
26.	7.82	7.39	6.94	8.48	8.06	7.46	6.62	6.33	6.51	7.62	7.11	.....
27.	7.79	7.35	6.98	8.41	8.09	7.44	6.60	6.33	6.52	7.82	7.08	.....
28.	7.71	7.30	7.01	8.39	8.02	7.42	6.58	6.33	6.54	7.91	6.79	.....
29.	7.63	.....	7.04	8.44	7.94	7.42	6.56	6.32	6.52	8.01	.....	.....
30.	7.55	.....	7.11	8.60	8.00	7.40	6.55	6.32	6.52	7.78	6.56	.....
31.	7.46	.....	7.28	.....	7.97	.....	6.54	6.32	.....	7.62	.....	8.40

NOTE.—Water was entirely shut off at the lake November 29, December 4 to 7, and December 26 to 30, and for partial days at other times in December. Gage heights November 12 to 17 were computed by plotting several readings a day and taking the mean from the curve.

*Rating table for Yakima River near Martin, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
6.20	42	7.00	180	7.80	470	8.60	890	9.80	1,730
6.30	54	7.10	207	7.90	515	8.70	950	10.00	1,900
6.40	66	7.20	237	8.00	560	8.80	1,010	11.00	2,800
6.50	80	7.30	270	8.10	610	8.90	1,075	12.00	3,850
6.60	96	7.40	306	8.20	660	9.00	1,140	13.00	5,000
6.70	114	7.50	345	8.30	715	9.20	1,275	14.00	6,200
6.80	134	7.60	385	8.40	770	9.40	1,415		
6.90	156	7.70	425	8.50	830	9.60	1,570		

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 6.2 feet and 9.0 feet.

*Monthly discharge of Yakima River near Martin, Wash., for 1906.*

[Drainage area, 56 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	492	134	250	15,400	4.46	5.14
February	357	185	255	14,200	4.55	4.74
March	263	161	200	12,300	3.57	4.12
April	968	326	581	34,600	10.38	11.58
May	1,000	438	682	41,900	12.18	14.04
June	565	306	416	24,800	7.43	8.29
July	302	86	177	10,900	3.16	3.64
August	83	56	67.3	4,140	1.20	1.38
September	86	52	68.9	4,100	1.23	1.37
October	565	83	265	16,300	4.73	5.45
November	6,150	0	979	58,300	17.48	19.51
December	770	0	272	16,700	4.86	5.60
The year	6,150	0	351	254,000	6.27	84.86

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

## YAKIMA RIVER AT CLEALUM, WASH.

This station was established August 25, 1906. It is located at the highway bridge just above the town of Clealum. It is below the principal tributaries which drain the upper portion of its basin, and shows the water supply available for the Kittitas Valley.

The channel is straight for about 300 feet above and below the station. The current is swift. The right bank is low and liable to overflow; the left is high and rocky; both banks are wooded. The bed of the stream is of cobblestones and gravel and not likely to change except during high floods. There is one channel at all stages.

Measurements are made from the bridge. The initial point for soundings is the center of the downstream pier on the right bank.

A chain gage is fastened to the bridge and is read by T. J. Denny. The bench mark is a spike in a 30-inch cottonwood tree, 30 feet downstream from the right-bank pier; elevation, 8.80 feet above the datum of the gage.

*Discharge measurements of Yakima River at Clealum, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
August 24.....	J. C. Stevens.....	190	225	2.27	483
September 25....	W. C. Muldrow.....	190	226	2.20	470
October 31.....	do.....	209	546	3.92	2,320

*Daily gage height, in feet, of Yakima River at Clealum, Wash., for 1906.*

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.30	2.28	3.62	6.80	17.....		2.30	2.80		3.78
2.....		2.30	2.25	3.48	6.70	18.....		2.28	3.05		3.80
3.....		2.30	2.25	3.38	6.62	19.....		2.25	3.20		3.80
4.....		2.28	2.32	3.28	6.50	20.....		2.25	3.20		4.10
5.....		2.25	2.40	3.02	6.50	21.....		2.22	3.12		4.60
6.....		2.25	2.40	2.88	6.50	22.....		2.20	3.00		4.90
7.....		2.25	2.40	2.95	6.50	23.....		2.20	3.00		4.80
8.....		2.25	2.40	3.10	6.55	24.....	2.25	2.20	3.00		4.70
9.....		2.28	2.40	3.08	5.28	25.....	2.30	2.25	2.95		4.60
10.....		2.28	2.40	3.30	4.05	26.....	2.30	2.30	5.50		4.25
11.....		2.25	2.40	3.85	4.00	27.....	2.30	2.30	6.00		4.05
12.....		2.25	2.40	4.22	4.20	28.....	2.30	2.30	5.25	7.15	4.00
13.....		2.25	2.40	6.68	4.35	29.....	2.30	2.30	4.60	7.00	3.95
14.....		2.30	2.40		4.20	30.....	2.30	2.30	4.15	6.82	3.90
15.....		2.30	2.45		3.95	31.....	2.30		3.80		2.75
16.....		2.30	2.55		4.05						

*Rating-table for Yakima River at Clealum, Wash., from August 24 to October 25, 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.00	330	2.30	505	2.60	730	2.90	1,000	3.20	1,310
2.10	380	2.40	575	2.70	815	3.00	1,100		
2.20	440	2.50	650	2.80	905	3.10	1,200		

NOTE.—The above table is based on 3 discharge measurements made during 1906 and is not well defined.

*Monthly discharge of Yakima River at Cleahum, Wash., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
August 24-31.....	505	472	501	7,950
September.....	505	440	484	28,800
October 1-25.....	1,310	472	770	38,200
The period.....				75,000

NOTE.—Values are good.

## YAKIMA RIVER AT UMTANUM, WASH.

This station was established August 25, 1906. It is located in a canyon about 100 yards from the railroad tracks and opposite the station at Umtanum, about 6 miles above Roza, on the Northern Pacific Railroad. The station is below Kittitas Valley and above Selah and Yakima valleys.

The channel is straight for about 200 feet above and below the station. There is a riffle control about 300 feet below. The right bank is low and liable to overflow to the railroad embankment; the left is high and rocky. The right half of the bed of the stream is composed of gravel and cobblestones; the left is of solid rock. There is one channel at all stages.

Discharge measurements are made from a cable and car. There is a stay line 75 feet upstream from the cable. The initial point for soundings is the face of a small cottonwood tree 10 inches in diameter, 15 feet upstream from the gage, on the right bank, about 25 feet from the water's edge.

The gage, which was read during the season by B. F. Cummings, is a 2 by 4 inch timber fastened in a vertical position on the right bank, back of the section house. The bench mark is a mark on a boulder 100 feet west of the section house and 40 feet north of the Northern Pacific track, opposite the gage; elevation, 16.30 feet above the datum of the gage.

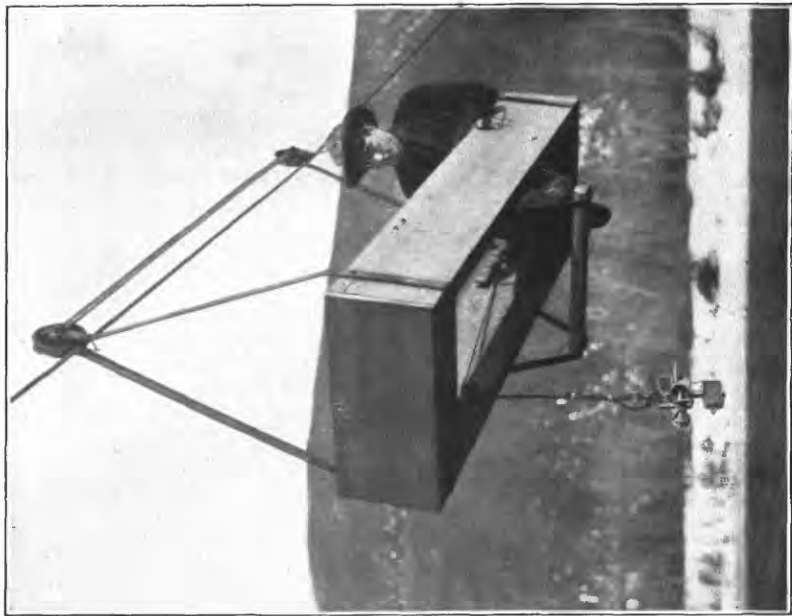
The following measurement was made August 25, 1906:

Width, 230 feet; area, 414 feet; gage height, 3.07 feet; discharge, 365 second-feet.

*Daily gage height, in feet, of Yakima River at Umtanum, Wash., for 1906.*

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.98	3.20	4.55	5.88	17.....		3.08	3.55		4.56
2.....		2.98	3.22	4.46	5.72	18.....		3.08	3.70		4.61
3.....		3.00	3.25	4.34	5.50	19.....		3.10	4.00		4.66
4.....		3.00	3.28	4.30	5.18	20.....		3.10	4.10		4.80
5.....		2.99	3.31	4.12	5.05	21.....		3.06	4.08		5.00
6.....		2.98	3.38	4.08	4.88	22.....		3.06	4.05		5.06
7.....		2.98	3.48	4.00	4.68	23.....		3.06	4.00		5.04
8.....		2.98	3.45	4.08	4.52	24.....		3.10	3.96		5.11
9.....		2.98	3.45	4.15	4.56	25.....	3.07	3.12	3.88		5.16
10.....		2.97	3.42	4.32	4.70	26.....	3.00	3.16	4.88		5.13
11.....		2.98	3.40	4.45	4.70	27.....	3.00	3.20	6.40		5.00
12.....		3.04	3.40	5.18	4.71	28.....	3.03	3.24	6.00	6.20	4.92
13.....		3.06	3.40	6.78	4.69	29.....	3.00	3.22	5.30	6.01	4.82
14.....		3.10	3.42	9.66	4.65	30.....	3.00	3.20	4.95	5.94	4.60
15.....		3.10	3.45		4.62	31.....	2.95		4.75		4.34
16.....		3.07	3.45	14.2	4.59						

NOTE.—The upper portion of the gage was washed away November 15, so that no readings could be obtained until the 28th. The gage height of November 16 is the maximum.



A. CABLE STATION, YAKIMA RIVER, NEAR UNION GAP, WASHINGTON.



B. DISCHARGE MEASUREMENT BY WADING.

## YAKIMA RIVER NEAR YAKIMA, WASH.

The station was originally established August 14, 1893, at the county bridge at Union Gap (Pl. III, A), 2 miles below Yakima, Wash. In August, 1895, a cable and new gage were installed about 1,000 feet below the bridge, and about 3 miles above the intake of the Sunnyside Canal. The station is of value, as it is the only point near the large irrigated areas above and below which is unaffected by the diversion of water. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 46, where are given also references to publications that contain data for previous years.

*Discharge measurements of Yakima River near Yakima, Wash., in 1905-1907.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 19.....	W. J. Lightfoot.....	236	1,340	6.10	3,920
September 2....	W. C. Muldrow.....	230	753	3.64	780
October 26.....	do.....	240	1,250	5.60	3,570
November 18....	Sawyer and Muldrow.....	238	560	4.32	1,600
1906.					
March 26.....	J. C. Stevens.....	240	1,190	5.29	2,900
April 30.....	W. C. Muldrow.....	340	1,800	7.62	9,790
July 9.....	do.....	241	1,100	5.14	2,840
August 3.....	do.....	232	687	3.52	748
September 29....	Stevens and Grover.....	234	723	3.60	790
October 27.....	Muldrow and McGlashan.....	249	1,620	7.29	6,770
December 29....	W. C. Muldrow.....	242	1,810	5.68	4,040
1907.					
February 20....	W. C. Muldrow.....	300	2,190	7.03	7,740
February 22....	do.....	300	2,410	7.69	9,770

*Daily gage height, in feet, of Yakima River near Yakima, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.1	5.85	5.9	7.6	8.0	6.2	5.7	3.6	3.4	3.55	5.4	5.7
2.....	4.1	5.9	5.8	7.4	8.1	6.2	5.0	3.5	3.4	3.5	5.25	5.6
3.....	4.1	5.9	5.6	7.2	8.2	6.6	5.1	3.5	3.35	3.6	5.15	5.5
4.....	4.05	6.0	5.4	7.1	8.1	6.8	5.0	3.5	3.35	3.65	5.0	5.3
5.....	4.1	6.0	5.3	7.3	8.0	6.9	5.1	3.4	3.35	3.8	4.8	5.2
6.....	4.15	5.9	5.2	7.9	8.0	6.6	5.2	3.4	3.35	3.9	5.0	5.15
7.....	4.2	5.8	5.2	8.1	7.9	6.3	5.3	3.45	3.4	3.9	5.3	5.15
8.....	4.2	5.6	5.6	8.2	7.6	6.1	5.2	3.45	3.4	3.9	5.3	5.6
9.....	4.2	5.5	5.8	8.2	7.4	6.0	5.1	3.45	3.4	3.9	5.4	5.5
10.....	4.2	5.45	5.8	7.9	7.4	6.0	5.0	3.45	3.45	3.85	5.4	5.5
11.....	4.2	5.3	5.7	7.7	7.8	5.9	5.0	3.45	3.4	3.9	6.2	5.55
12.....	4.2	5.3	5.7	7.4	7.6	5.9	4.9	3.55	3.4	3.9	6.9	5.4
13.....	4.2	5.1	5.6	7.3	7.6	6.0	4.8	3.45	3.4	3.9	10.84	5.3
14.....	4.1	5.0	5.5	7.1	7.4	6.1	4.9	3.5	3.5	3.9	13.36	5.3
15.....	4.1	5.0	5.5	7.0	7.0	6.0	4.9	3.55	3.55	3.9	15.68	5.2
16.....	4.1	5.0	5.4	7.2	6.9	6.0	4.6	3.5	3.55	4.0	14.18	5.2
17.....	4.1	5.05	5.4	7.4	6.6	5.9	4.5	3.5	3.55	4.3	11.94	5.1
18.....	4.1	5.2	5.3	7.3	6.4	5.9	4.5	3.45	3.5	4.5	10.2	5.0
19.....	4.0	5.8	5.2	7.3	6.2	5.8	4.5	3.45	3.5	4.6	8.9	5.0
20.....	4.05	6.0	5.2	7.4	6.1	5.8	4.4	3.45	3.5	4.6	8.6	6.3
21.....	4.1	6.0	5.15	7.7	6.0	5.7	4.4	3.45	3.5	4.6	8.0	6.5
22.....	4.3	6.1	5.1	7.9	6.0	5.6	4.2	3.4	3.5	4.55	7.4	6.5
23.....	4.4	6.2	5.1	8.3	5.9	5.4	4.1	3.35	3.55	4.5	7.1	6.7
24.....	4.7	6.2	5.1	8.6	5.9	5.4	4.0	3.4	3.55	4.5	6.9	6.6
25.....	5.1	6.2	5.1	8.1	5.9	5.5	4.0	3.4	3.5	4.55	6.7	6.5
26.....	5.3	6.1	5.2	7.9	6.3	5.5	3.9	3.4	3.5	4.6	6.3	6.4
27.....	5.3	6.0	5.6	7.5	7.0	5.5	3.9	3.35	3.55	7.3	6.1	6.3
28.....	5.5	6.0	5.8	7.5	6.9	5.4	3.8	3.35	3.55	7.3	6.0	6.0
29.....	5.5		6.0	7.6	6.8	5.3	3.8	3.4	3.55	6.9	5.9	5.9
30.....	5.55		6.3	7.8	6.7	5.3	3.7	3.4	3.5	6.5	5.9	5.7
31.....	5.9		6.4		6.6		3.7	3.4		6.0		5.6

NOTE.—Gage heights November 12 to 17 were found by plotting several readings a day and taking the mean from the curve.

*Rating tables for Yakima River near Yakima, Wash.*JANUARY 1, 1904, TO JUNE 4, 1905.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.80	920	4.70	1,800	5.60	3,070	6.50	5,035	7.80	9,170
3.90	1,000	4.80	1,920	5.70	3,240	6.60	5,295	8.00	9,930
4.00	1,090	4.90	2,045	5.80	3,420	6.70	5,565	8.20	10,740
4.10	1,180	5.00	2,180	5.90	3,615	6.80	5,835	8.40	11,600
4.20	1,280	5.10	2,315	6.00	3,830	6.90	6,115	8.60	12,480
4.30	1,380	5.20	2,455	6.10	4,055	7.00	6,405	8.80	13,360
4.40	1,480	5.30	2,600	6.20	4,285	7.20	7,025	9.00	14,240
4.50	1,580	5.40	2,750	6.30	4,525	7.40	7,720	9.20	15,120
4.60	1,690	5.50	2,910	6.40	4,775	7.60	8,440		

JUNE 5, 1905, TO DECEMBER 31, 1906.<sup>b</sup>

3.00	460	4.10	1,290	5.20	2,840	6.60	6,220	8.80	14,670
3.10	500	4.20	1,405	5.30	3,020	6.80	6,890	9.00	15,600
3.20	550	4.30	1,520	5.40	3,210	7.00	7,590	10.00	20,800
3.30	605	4.40	1,640	5.50	3,400	7.20	8,290	11.00	26,700
3.40	665	4.50	1,760	5.60	3,600	7.40	9,010	12.00	33,200
3.50	725	4.60	1,890	5.70	3,810	7.60	9,750	13.00	40,500
3.60	795	4.70	2,030	5.80	4,030	7.80	10,510	14.00	48,600
3.70	875	4.80	2,180	5.90	4,260	8.00	11,300	15.00	57,400
3.80	965	4.90	2,340	6.00	4,500	8.20	12,100	16.00	67,000
3.90	1,070	5.00	2,500	6.20	5,030	8.40	12,930		
4.00	1,180	5.10	2,670	6.40	5,600	8.60	13,780		

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-5 and is well defined.

<sup>b</sup> This table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1905-6 and is well defined between gage heights 3.5 feet and 7.7 feet. The extension of the table is based on a discharge for the maximum gage height of 1906 computed from a measurement at Kiona.

*Monthly discharge of Yakima River near Yakima, Wash., for 1905-6.*

[Drainage area, 3,300 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.						
January.....	2,180	1,280	1,830	113,000	0.554	0.64
February.....	3,620	920	1,750	95,900	.523	.54
March.....	9,550	3,830	7,540	463,000	2.28	2.63
April.....	9,930	3,420	4,750	283,000	1.44	1.61
May.....	7,720	3,850	4,930	303,000	1.49	1.72
June.....	14,700	5,310	8,320	495,000	2.52	2.81
July.....	5,900	1,290	2,710	167,000	.821	.95
August.....	1,290	795	922	56,700	.279	.32
September.....	1,180	795	904	53,800	.274	.31
October.....	5,750	1,290	3,200	197,000	.970	1.12
November.....	2,670	1,520	1,880	112,000	.570	.64
December.....	2,100	1,400	1,700	105,000	.515	.59
The year.....	14,700	795	3,370	2,440,000	1.02	13.88
1906.						
January.....	4,260	1,180	1,820	112,000	0.552	0.64
February.....	5,030	2,500	3,880	215,000	1.18	1.23
March.....	5,600	2,670	3,480	214,000	1.05	1.21
April.....	13,800	7,590	9,900	589,000	3.00	3.35
May.....	12,100	4,260	7,910	486,000	2.40	2.77
June.....	7,240	3,020	4,410	262,000	1.34	1.50
July.....	3,810	965	1,970	121,000	.600	.69
August.....	795	635	694	42,700	.210	.24
September.....	760	635	705	42,000	.212	.24
October.....	8,650	725	2,220	136,000	.673	.78
November.....	63,900	2,180	12,400	738,000	3.76	4.20
December.....	6,550	2,500	3,920	241,000	1.19	1.37
The year.....	63,900	635	4,440	3,200,000	1.35	18.20

NOTE.—Values are rated as follows: 1905 and January to June, 1906, excellent; July to December, 1906, fair.

## YAKIMA RIVER AT PROSSER, WASH.

This station was established February 8, 1906, to replace the old station at the highway bridge below Prosser Falls, described in Water-Supply Paper No. 178, page 48. It was abandoned October 12, 1906, as it was found unsuited for low-water measurements and as the flow was controlled by dams above. It was located  $1\frac{1}{2}$  miles below the town of Prosser, about  $1\frac{1}{4}$  miles below the county bridge across Yakima River and the power plant of the Prosser Falls Land and Power Company, and about 2,000 feet from the Northern Pacific Railroad tracks.

The channel is straight, and the current fairly swift except at low stages. The banks are of earth, intermingled with basaltic boulders; the right bank is high; the left is low and liable to overflow at extreme high water. The bed of the stream is composed of massive boulders and angular cobblestones. There is one channel at all stages.

Discharge measurements were made from a cable and car, which was removed when the station was abandoned. The initial point for soundings is a cross on a large boulder, 2 feet back of the shear legs on the left bank.

A wooden inclined gage, which was read by G. W. Booth, was located on the right bank, 80 feet upstream from the shear legs. The bench mark is the top of a copper plug in a large boulder about 40 feet downstream from the gage; elevation, 18.44 feet above the datum of the gage and 613.44 feet above sea level.

*Discharge measurements of Yakima River at Prosser, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
February 8.....	W. C. Muldrow.....	310	1,720	7.20	4,160
February 23.....	do.....	312	1,990	8.04	5,450
March 24.....	J. C. Stevens.....	303	1,610	6.84	3,200
May 17.....	W. C. Muldrow.....	316	2,060	8.25	5,900
July 12.....	do.....	291	1,160	5.48	1,470
August 18.....	J. C. Stevens.....			3.00	<sup>a</sup> 100
November 17 <sup>b</sup> .....	D. C. Henny.....	662	7,470		62,800

<sup>a</sup> Estimated.

<sup>b</sup> Measured by floats from new highway bridge above the dam.

*Daily gage height, in feet, of Yakima River at Prosser, Wash., for 1906.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1.....	7.8	7.4	9.5	9.7	7.8	5.7	3.4	2.9	2.9
2.....	7.8	7.2	9.7	10.1	7.7	5.6	3.4	3.0	3.1
3.....	7.7	7.2	9.4	10.1	7.3	5.6	3.3	2.9	3.3
4.....	7.5	7.2	9.3	10.2	7.8	5.5	3.2	2.9	3.4
5.....	7.5	7.1	9.3	10.2	8.1	5.6	3.2	2.9	3.6
6.....	7.5	7.0	9.6	9.9	8.3	5.7	3.2	2.7	3.4
7.....	7.3	7.0	10.1	9.5	7.8	5.7	3.3	2.9	3.0
8.....	7.2	7.1	10.5	9.3	7.7	5.8	3.2	2.9	3.1
9.....	7.1	7.2	10.5	9.0	7.3	5.8	2.9	3.0	3.5
10.....	7.0	7.4	10.4	9.1	7.0	5.7	3.1	3.0	3.8
11.....	7.0	7.3	10.1	9.3	6.8	5.5	2.8	2.9	3.8
12.....	6.9	7.1	9.8	9.3	7.2	5.4	3.2	2.9	3.8
13.....	6.8	7.0	9.4	9.0	7.4	5.3	2.6	3.0	.....
14.....	6.7	7.2	9.2	8.8	7.5	5.2	3.0	3.0	.....
15.....	6.6	7.4	9.2	8.6	7.4	5.2	3.0	3.0	.....
16.....	6.6	7.3	9.1	8.4	7.3	5.1	3.0	3.0	.....
17.....	6.5	7.3	9.2	8.2	7.1	5.0	3.0	3.1	.....
18.....	6.6	7.2	9.3	7.6	7.0	4.9	3.0	3.2	.....
19.....	6.8	7.1	9.3	7.0	7.0	4.8	2.6	3.2	.....
20.....	8.0	6.9	9.2	6.7	6.9	4.7	3.0	3.2	.....
21.....	8.3	6.9	9.2	7.3	6.7	4.6	2.9	3.2	.....
22.....	8.2	6.8	9.8	7.0	6.5	4.5	3.1	3.0	.....
23.....	8.0	6.8	10.5	7.0	6.3	4.4	2.9	2.9	.....
24.....	7.9	6.8	10.7	7.0	6.2	4.2	3.0	3.0	.....
25.....	7.8	6.9	10.5	7.2	6.2	4.1	2.8	3.0	.....
26.....	7.7	7.0	9.9	7.4	6.2	4.0	2.6	3.1	.....
27.....	7.7	7.2	9.6	8.4	6.1	3.9	3.0	3.2	.....
28.....	7.6	7.4	9.3	8.5	6.1	3.8	3.1	3.0	.....
29.....	.....	7.8	9.2	8.4	6.0	3.7	2.6	2.8	.....
30.....	.....	8.0	9.3	8.0	5.8	3.6	2.6	2.6	.....
31.....	.....	8.3	.....	7.8	.....	3.5	2.6	.....	.....

*Rating table for Yakima River at Prosser, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.60	40	3.80	345	5.00	1,060	6.40	2,580	8.80	7,050
2.70	50	3.90	390	5.10	1,140	6.60	2,860	9.00	7,510
2.80	65	4.00	435	5.20	1,225	6.80	3,160	9.20	7,980
2.90	80	4.10	485	5.30	1,310	7.00	3,480	9.40	8,460
3.00	100	4.20	540	5.40	1,400	7.20	3,820	9.60	8,940
3.10	120	4.30	595	5.50	1,500	7.40	4,170	9.80	9,440
3.20	145	4.40	655	5.60	1,600	7.60	4,530	10.00	9,940
3.30	170	4.50	715	5.70	1,710	7.80	4,910	11.00	12,500
3.40	200	4.60	780	5.80	1,820	8.00	5,310	.....	.....
3.50	230	4.70	845	5.90	1,940	8.20	5,730	.....	.....
3.60	265	4.80	915	6.00	2,060	8.40	6,160	.....	.....
3.70	305	4.90	985	6.20	2,310	8.60	6,600	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1906 and is well defined between gage heights 5 feet and 9 feet.

*Monthly discharge of Yakima River at Prosser, Wash., for 1906.*

[Drainage area, 5,050 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.....	5,940	2,720	4,150	230,000	0.822	0.86
March.....	5,940	3,160	3,860	237,000	.764	.88
April.....	11,700	7,740	9,130	543,000	1.81	2.02
May.....	10,400	3,010	6,580	405,000	1.30	1.50
June.....	5,940	1,820	3,600	214,000	.713	.80
July.....	1,820	230	1,080	66,400	.214	.25
August.....	200	40	106	6,520	.021	.02
September.....	145	40	98.0	5,830	.019	.02
October 1-12.....	345	80	210	5,000	.042	.02
The period.....	.....	.....	.....	1,710,000	.....	.....

NOTE.—Values are rated as follows: February to June, excellent; July, good; August to October, fair.

## YAKIMA RIVER AT KIONA, WASH.

This station was established August 20, 1895. It is located at the highway bridge on the county road about 1,800 feet northwest of the Northern Pacific Railway station at Kiona, Wash. It is about 23 miles above the mouth of the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 49, where are given also references to publications that contain data for previous years.

The staff gage, installed December 23, 1905, was read from January 1 to March 22, 1906. Subsequent to that date the wire gage was used. These gages are referred to the following bench marks: (1) A standard U. S. Geological Survey iron bench-mark post near the Northern Pacific Railway station; elevation, 61.35 feet above the datum of the gage and 514.79 feet above mean sea level. (2) A standard U. S. Geological Survey iron bench mark in northeast corner of H. A. Shandy's lot near right approach of highway bridge; elevation, 18.99 feet above gage datum. These elevations were checked during 1906.

*Discharge measurements of Yakima River at Kiona, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
February 21 <i>a</i> ..	W. C. Muldrow .....	265	1,580	7.14	5,480
March 23 .....	J. C. Stevens .....	275	1,200	5.72	2,870
May 8 .....	W. C. Muldrow .....	301	1,850	8.09	7,700
July 11 .....	do. ....	217	925	4.64	1,560
July 30 <i>b</i> .....	do. ....	67	82	2.99	309
August 18 <i>b</i> .....	Muldrow and Stevens .....	60	58	2.52	150
October 13 <i>b</i> .....	W. C. Muldrow .....	75	96	3.07	285
November 17 <i>c</i> ..	D. C. Henny .....	1,600	8,400	19.52	61,600
November 19 <i>c</i> ..	W. C. Muldrow .....		4,250	15.00	31,700
December 18 .....	do. ....	265	1,310	6.14	3,570

*a* Mean of two measurements.*b* Measured by wading.*c* Measured by floats.*Daily gage height, in feet, of Yakima River at Kiona, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1 .....	4.55	6.35	6.35	8.5	8.7	6.8	4.8	2.8	2.45	2.75	5.8	6.55
2 .....	4.55	6.45	6.25	8.8	9.2	6.7	4.8	2.8	2.4	2.8	5.7	6.55
3 .....	4.55	6.65	6.15	8.6	9.4	6.5	4.7	2.7	2.45	2.85	5.5	6.55
4 .....	4.55	6.55	6.05	8.45	9.45	6.7	4.7	2.7	2.4	2.9	5.4	6.6
5 .....	4.6	6.45	6.05	8.4	9.4	6.9	4.7	2.7	2.4	2.95	5.3	6.7
6 .....	4.6	6.35	6.0	8.8	9.3	7.2	4.7	2.7	2.45	3.0	5.2	6.7
7 .....	4.6	6.25	5.95	9.3	8.8	6.9	4.7	2.7	2.45	3.0	5.2	6.7
8 .....	4.6	6.15	5.95	9.7	8.5	6.8	4.6	2.65	2.5	3.0	5.5	6.7
9 .....	4.65	6.15	6.45	9.8	8.3	6.4	4.6	2.6	2.45	3.1	5.3	6.7
10 .....	4.65	6.05	6.55	9.75	8.3	6.3	4.6	2.6	2.4	3.2	5.7	6.7
11 .....	4.65	5.95	6.65	9.35	8.3	6.2	4.45	2.6	2.35	3.2	6.2	6.65
12 .....	4.65	5.9	6.45	9.05	8.4	6.1	4.35	2.55	2.4	3.1	6.82	6.6
13 .....	4.6	5.75	6.25	8.6	8.2	6.3	4.25	2.6	2.5	3.05	7.90	6.5
14 .....	4.6	5.6	6.05	9.4	7.9	6.3	4.2	2.6	2.55	3.05	10.4	6.4
15 .....	4.6	5.55	6.25	9.2	7.6	6.3	4.1	2.5	2.55	3.05	13.02	6.3
16 .....	4.55	5.5	6.45	8.1	7.55	6.2	4.0	2.45	2.6	3.1	17.34	6.3
17 .....	4.55	5.45	6.35	8.3	7.25	6.2	3.9	2.5	2.6	3.1	19.78	6.2
18 .....	4.55	5.45	6.25	8.4	6.95	6.1	3.8	2.45	2.55	3.3	17.55	6.15
19 .....	4.5	5.65	6.05	8.4	6.55	6.0	3.7	2.5	2.5	3.8	15.62	6.2
20 .....	4.45	6.65	5.85	8.45	6.3	5.8	3.6	2.45	2.55	4.1	12.84	6.3

*Daily gage height, in feet, of Yakima River at Kiona, Wash., for 1906—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.....	4.4	7.35	5.9	8.5	6.2	5.7	3.5	2.5	2.6	4.3	10.62	6.3
22.....	4.5	7.2	5.95	8.7	6.05	5.5	3.3	2.45	2.6	4.3	9.9	6.9
23.....	4.65	7.1	5.95	9.6	6.0	5.4	3.2	2.5	2.65	4.3	8.9	8.3
24.....	4.85	7.0	5.85	9.9	5.9	5.2	3.1	2.5	2.65	4.2	8.5	8.3
25.....	4.75	6.75	5.9	9.7	5.8	5.2	3.1	2.55	2.68	4.2	8.2	8.2
26.....	5.75	6.65	5.9	9.2	6.2	5.2	3.0	2.55	2.7	4.1	8.0	8.05
27.....	5.85	6.45	6.0	9.0	7.25	5.1	2.8	2.55	2.7	4.3	7.7	8.05
28.....	6.25	6.45	6.35	8.5	7.5	5.0	2.8	2.5	2.7	7.2	7.5	7.7
29.....	6.3	.....	6.55	8.4	7.4	4.9	2.8	2.55	2.7	7.0	7.1	7.6
30.....	6.35	.....	6.9	8.5	7.1	4.8	2.75	2.5	2.7	6.7	6.9	7.3
31.....	6.25	.....	7.3	.....	7.0	.....	2.8	2.4	.....	6.5	.....	7.3

NOTE.—The gage heights from November 15 to 21 were found by plotting several readings a day, and taking the mean from the curve.

*Rating table for Yakima River at Kiona, Wash., from October 1, 1905, to December 31, 1906.*

Gage height	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.30	90	3.60	620	4.90	1,780	6.40	3,990	9.00	9,590
2.40	120	3.70	690	5.00	1,900	6.60	4,350	10.00	12,100
2.50	150	3.80	760	5.10	2,020	6.80	4,740	11.00	14,950
2.60	180	3.90	835	5.20	2,150	7.00	5,140	12.00	18,150
2.70	210	4.00	910	5.30	2,280	7.20	5,550	13.00	21,900
2.80	245	4.10	990	5.40	2,420	7.40	5,970	14.00	26,350
2.90	280	4.20	1,070	5.50	2,560	7.60	6,390	15.00	31,700
3.00	315	4.30	1,160	5.60	2,700	7.80	6,830	16.00	37,600
3.10	355	4.40	1,250	5.70	2,850	8.00	7,270	17.00	44,000
3.20	400	4.50	1,350	5.80	3,000	8.20	7,710	18.00	50,800
3.30	450	4.60	1,450	5.90	3,160	8.40	8,170	19.00	57,800
3.40	500	4.70	1,560	6.00	3,320	8.60	8,630	20.00	65,100
3.50	555	4.80	1,670	6.20	3,650	8.80	9,110		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1897-1906 and is well defined.

*Monthly discharge of Yakima River at Kiona, Wash., for 1905-6.*

[Drainage area, 5,230 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1905.						
October <sup>a</sup> .....	4,740	690	2,470	152,000	0.473	0.56
November <sup>a</sup> .....	2,560	1,560	1,860	111,000	.356	.44
December <sup>a</sup> .....	1,900	1,450	1,710	105,000	.327	.44
1906.						
January.....	3,900	1,250	1,850	114,000	.354	.41
February.....	5,860	2,490	3,840	213,000	.734	.76
March.....	5,760	3,080	3,710	228,000	.709	.82
April.....	11,800	7,490	9,400	559,000	1.80	2.01
May.....	10,700	3,090	6,620	407,000	1.27	1.46
June.....	5,550	1,670	3,440	205,000	.658	.73
July.....	1,670	228	923	56,800	.176	.20
August.....	245	120	172	10,600	.033	.04
September.....	210	105	162	9,640	.031	.03
October.....	5,550	228	1,120	68,900	.214	.25
November.....	63,500	2,150	12,400	738,000	2.37	2.64
December.....	7,940	3,560	5,010	308,000	.958	1.10
The year.....	63,500	105	4,050	2,920,000	.776	10.45

<sup>a</sup> These values supersede those published in Water-Supply Paper No. 178, which were in error. The published gage heights for 1905 were in error as follows: October 21 to November 9, 0.7 foot too high; November 10 to 29, 0.2 foot too high; November 30 to December 19, 0.3 foot too high, and from December 19 to 23, 0.35 foot too high.

NOTE.—Values for 1905 and 1906 are rated as good.

## YAKIMA RIVER NEAR RICHLAND, WASH.

This station was established July 28, 1906, for the purpose of determining the amount of water wasted into Columbia River. It is maintained only during the irrigating season. It is located at Yakima Ferry, near the mouth of Yakima River, and below the headgate of the Amon Canal, the last diversion.

The channel is straight, the banks are high and clean. The bed of the stream is composed of gravel and bowlders.

Measurements are made by wading at any convenient place near the gage.

The gage, which was read during the season by J. E. See, is a 1 by 6 inch board bolted to a large bowlder in midstream, 500 feet below the ferry. The bench mark is a cross, marked B. M., on a large, round bowlder in the channel, at right angles to the direction of current from the old cribworks on the right bank, where an old water lift wheel was located; elevation, 5.05 feet above the datum of the gage.

*Discharge measurements of Yakima River near Richland, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
July 28.....	W. C. Muldrow.....	89	122	1.46	175
August 17.....	J. C. Stevens.....	16	12	.63	9.4
October 13.....	W. C. Muldrow.....	100	140	1.55	195

*Daily gage height, in feet, of Yakima River near Richland, Wash., for 1906.*

Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.	Day.	July.	Aug.	Sept.	Oct.
1.....		1.25	0.6	0.8	12.....		0.7	0.6	1.6	23.....		0.6	0.6	
2.....		1.15	.6	.85	13.....		.7	.6	1.55	24.....		.6	.6	
3.....		1.1	.6	1.0	14.....		.65	.6	1.52	25.....		.6	.75	
4.....		1.5	.6	1.25	15.....		.65	.6	1.6	26.....		.6	.8	
5.....		1.0	.6	1.2	16.....		.65	.6	1.7	27.....		.6	.88	
6.....		0.9	.6	1.35	17.....		.65	.6	1.75	28.....	1.5	.6	.8	
7.....		.8	.6	1.3	18.....		.6	.6	1.78	29.....	1.4	.6	.8	
8.....	.75	.6	1.38	19.....		.6	.6	1.9	30.....	1.35	.6	.8		
9.....	.7	.6	1.28	20.....		.6	.6	2.8	31.....	1.25	.6			
10.....	.75	.6	1.5	21.....		.6	.6							
11.....	.7	.6	1.55	22.....		.6	.6							

*Rating table for Yakima River near Richland, Wash., from July 28, 1906, to October 19, 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.60	8	0.90	31	1.20	87	1.50	185	1.80	340
0.70	13	1.00	46	1.30	114	1.60	235	1.90	400
0.80	21	1.10	65	1.40	145	1.70	280		

NOTE.—The above table is based on 3 discharge measurements made during 1906 and is not well defined.

*Monthly discharge of Yakima River near Richland, Wash., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
July (28-31).....	185	100	140	1,110
August.....	185	8	24.6	1,510
September.....	29	8	10.7	637
October (1-19).....	400	21	178	6,710
The period.....				9,970

NOTE.—Values are rated as fair.

## LAKE KEECHELUS NEAR MARTIN, WASH.

This station was established January 12, 1906, to obtain the fluctuations of the lake surface and the amount of stored water. It is located at the foot of the lake, 4 miles northeast of Martin, Wash., on the State road over Snoqualmie Pass.

All gage heights for 1906 refer to the level of the sill of the outlet tunnel of the dam, which is 2,457.00 feet above sea level. The bench mark is a spike in the root of a stump on the right bank of the outlet near the abutment of the dam; elevation, 16.05 feet above the datum of the gage and 2,473.05 above sea level.

*Daily gage height, in feet, of Lake Keechelus near Martin, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.72	1.48	1.73	3.17	2.47	1.73	0.82	0.40	0.44	2.22	3.12
2.....		1.62	1.41	1.86	3.57	2.40	1.73	.80	.38	.46	2.06	3.31
3.....		1.53	1.33	1.84	3.54	2.40	1.73	.78	.37	.54	2.02	3.41
4.....		1.43	1.28	1.84	3.50	2.63	1.70	.78	.36	.91	1.99	3.59
5.....		1.35	1.25	1.91	3.39	2.58	1.68	.76	.35	.93	1.94	3.85
6.....		1.32	1.20	2.10	3.16	2.51	1.64	.75	.32	.92	2.08	4.12
7.....		1.31	1.16	2.37	3.02	2.44	1.58	.75	.36	.88	2.22	4.59
8.....		1.30	1.16	2.53	2.96	2.34	1.52	.74	.36	.94	2.44	4.82
9.....		1.28	1.22	2.58	3.03	2.24	1.47	.73	.36	.99	2.64	5.01
10.....		1.26	1.30	2.53	3.25	2.19	1.44	.72	.36	1.00	3.16	5.09
11.....		1.24	1.33	2.42	3.30	2.15	1.43	.70	.33	.97	3.70	5.20
12.....	0.86	1.22	1.36	2.30	3.28	2.22	1.37	.70	.32	1.01	3.92	4.66
13.....	.85	1.20	1.34	2.16	3.09	2.17	1.34	.69	.32	1.04	5.73	4.21
14.....	.83	1.18	1.32	2.06	2.90	2.14	1.31	.64	.52	1.10	6.09	4.01
15.....	.77	1.16	1.28	2.04	2.95	2.11	1.26	.64	.54	1.32	.....	3.93
16.....	.92	1.16	1.24	2.00	2.84	2.08	1.24	.63	.52	1.67	.....	3.81
17.....	.94	1.17	1.24	2.25	2.73	2.03	1.21	.62	.50	2.22	.....	4.03
18.....	1.00	1.20	1.18	2.32	2.56	2.00	1.17	.62	.46	2.64	.....	4.01
19.....		1.70	1.18	2.34	2.43	1.96	1.13	.61	.42	2.64	.....	4.41
20.....		1.84	1.13	2.46	2.36	1.94	1.10	.60	.40	2.50	.....	4.91
21.....	1.46	1.87	1.10	2.76	2.30	1.94	1.06	.60	.37	2.27	.....	4.95
22.....	1.57	1.86	1.08	3.04	2.28	1.99	1.04	.58	.35	2.16	.....	4.75
23.....	1.77	1.84	1.08	3.07	2.21	1.96	1.02	.56	.34	2.11	.....	4.52
24.....	1.84	1.84	1.04	2.98	2.17	1.92	.97	.54	.34	2.06	.....	4.31
25.....	1.87	1.80	1.02	2.92	2.26	1.90	.94	.52	.40	2.17	.....	4.29
26.....	2.30	1.75	1.04	2.88	2.65	1.86	.92	.50	.47	2.27	.....	4.69
27.....	2.20	1.67	1.08	2.82	2.69	1.86	.90	.49	.48	2.32	.....	5.02
28.....	2.14	1.58	1.11	2.80	2.62	1.83	.88	.48	.50	2.47	.....	5.32
29.....	2.03		1.16	2.90	2.53	1.84	.86	.46	.48	2.67	.....	5.63
30.....	1.93		1.25	3.02	2.56	1.82	.85	.43	.45	2.57	3.12	5.95
31.....	1.82		1.56		2.52		.84	.41		2.37		6.22

## KACHESS LAKE NEAR EASTON, WASH.

This station was established September 20, 1905, in order to determine the amount of storage in Kachess Lake. The datum of the gage is the same as during 1905.

*Daily gage height, in feet, of Kachess Lake, near Easton, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.25	2.2	1.95	1.7	3.6	5.6	5.4	3.25	1.35	0.55	2.45	3.85
2.....	1.2	2.2	1.9	1.8	3.8	5.65	5.3	3.2	1.3	.6	2.35	3.6
3.....	1.15	2.15	1.85	1.9	3.8	5.8	5.25	3.2	1.2	.6	2.3	3.75
4.....	1.2	2.15	1.8	2.0	3.8	6.0	5.2	3.15	1.1	.65	2.2	3.2
5.....	1.15	2.15	1.8	2.0	3.75	6.05	5.1	3.15	1.1	.65	2.2	3.0
6.....	1.25	2.1	1.7	2.1	3.7	6.1	5.05	3.15	1.0	.65	2.4	2.85
7.....	1.15	2.05	1.6	2.25	3.6	6.1	5.0	3.1	1.0	.65	2.5	2.9
8.....	1.15	2.05	1.6	2.5	3.5	6.05	4.9	3.1	.95	.65	2.65	2.8
9.....	1.2	2.0	1.6	2.65	3.5	6.0	4.8	3.05	.9	.6	2.75	2.6
10.....	1.15	2.0	1.6	2.7	3.6	6.0	4.7	3.0	.85	.65	3.1	2.5
11.....	1.1	2.05	1.6	2.7	3.8	5.95	4.6	2.9	.8	.65	3.4	2.4
12.....	1.1	1.95	1.6	2.6	4.0	5.95	4.5	2.85	.75	.65	3.92	2.3
13.....	1.15	1.9	1.6	2.6	4.1	5.9	4.45	2.75	.75	.65	3.58	2.2
14.....	1.15	1.9	1.6	2.6	4.2	5.9	4.35	2.7	.8	.7	8.18	2.15
15.....	1.15	1.8	1.55	2.6	4.4	5.85	4.25	2.65	.75	.75	9.46	2.1
16.....	1.1	1.7	1.55	2.65	4.6	5.85	4.2	2.55	.7	.85	9.34	2.05
17.....	1.1	1.7	1.55	2.7	4.7	5.75	4.1	2.5	.7	1.1	8.72	1.95
18.....	1.1	1.85	1.55	2.7	4.8	5.7	4.0	2.4	.7	1.25	8.1	1.9
19.....	1.1	1.9	1.55	2.8	5.0	5.7	3.9	2.3	.65	1.3	7.6	2.0
20.....	1.1	1.95	1.5	2.8	5.15	5.7	3.8	2.2	.6	1.3	7.1	2.15
21.....	1.15	1.9	1.5	3.0	5.25	5.75	3.7	2.1	.6	1.3	6.6	2.2
22.....	1.15	2.0	1.5	3.3	5.35	5.8	3.6	2.05	.6	1.3	6.2	2.25
23.....	1.3	1.9	1.4	3.4	5.4	5.8	3.5	2.0	.6	1.25	5.8	2.2
24.....	1.35	1.85	1.4	3.5	5.45	5.8	3.5	1.9	.55	1.3	5.4	2.15
25.....	1.45	1.95	1.5	3.5	5.45	5.8	3.4	1.9	.6	1.4	5.3	2.1
26.....	1.65	2.0	1.4	3.5	5.45	5.75	3.4	1.8	.55	2.3	4.9	2.1
27.....	1.7	1.95	1.4	3.5	5.5	5.65	3.35	1.7	.6	2.7	4.5	2.1
28.....	1.9	1.95	1.4	3.5	5.5	5.6	3.3	1.7	.6	2.7	4.4	2.05
29.....	2.0		1.5	3.5	5.55	5.5	3.3	1.6	.55	2.6	4.2	2.0
30.....	2.15		1.5	3.55	5.55	5.55	3.3	1.5	.5	2.6	4.0	1.95
31.....	2.15		1.5		5.5		3.3	1.45		2.45		1.9

## KACHESS RIVER NEAR EASTON, WASH.

This station was established October 14, 1903. It is located 2 miles northwest of Easton, Wash., and one-half mile below the foot of Lake Kachess, at the outlet of which a dam has been constructed by the Cascade Canal Company. This dam controls the flow. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 78, where are given also references to publications that contain data for previous years.

*Discharge measurements of Kachess River near Easton, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 16.....	J. C. Stevens.....	70	113	3.86	215
May 1.....	W. C. Muldrow.....	76	229	5.45	732
July 16.....	do.....	69	120	4.01	256
August 11.....	do.....	68	94	3.62	156
August 23.....	do.....	68	97	3.63	149
September 24.....	do.....	64	67	3.23	74
October 29.....	Muldrow and McGlashan.....	74	164	4.60	428
November 26.....	W. C. Muldrow.....	76	230	5.50	722

*Daily gage height, in feet, of Kachess River near Easton, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.7	4.2	4.1	3.95	5.45	3.95	4.25	3.3	3.55	3.2	4.4	5.1
2.....	3.65	4.2	4.0	4.0	5.5	3.9	4.2	3.3	3.6	3.25	4.3	5.0
3.....	3.65	4.2	4.0	4.05	5.5	4.0	4.15	3.25	3.6	3.3	4.2	4.9
4.....	3.65	4.15	4.0	4.1	5.5	4.1	4.2	3.2	3.6	3.35	4.0	4.9
5.....	3.65	4.2	4.0	4.1	5.45	4.2	4.2	3.2	3.55	3.35	3.2	4.8
6.....	3.7	4.15	3.9	4.2	5.4	4.3	4.25	3.2	3.5	3.35	3.2	4.6
7.....	3.65	4.15	3.9	4.35	5.4	4.3	4.3	3.2	3.5	3.35	3.3	4.6
8.....	3.65	4.15	3.9	4.45	5.3	4.25	4.2	3.25	3.5	3.3	3.3	4.5
9.....	3.7	4.1	3.9	4.55	5.3	4.6	4.15	3.6	3.45	3.3	3.35	4.45
10.....	3.6	4.1	3.9	4.6	5.4	4.6	4.1	3.65	3.45	3.3	3.4	4.4
11.....	3.6	4.1	3.9	4.55	4.5	4.6	4.05	3.6	3.4	3.3	3.45	4.35
12.....	3.6	4.1	3.9	4.5	4.25	4.55	4.0	3.6	3.4	3.3	3.72	4.35
13.....	3.6	4.05	3.9	4.5	4.2	4.55	4.0	3.6	3.35	3.3	4.68	4.3
14.....	3.6	4.0	3.9	4.5	3.7	4.5	4.1	3.6	3.35	3.35	6.64	4.2
15.....	3.6	3.95	3.9	4.5	3.7	4.5	4.05	3.6	3.35	3.4	7.85	4.15
16.....	3.6	3.9	3.9	4.55	3.8	4.45	4.0	3.65	3.3	3.45	8.0	4.1
17.....	3.6	3.9	3.9	4.6	3.7	4.45	4.0	3.65	3.3	3.55	7.82	4.1
18.....	3.6	3.95	3.85	4.6	3.65	4.4	3.95	3.75	3.3	3.65	7.5	4.05
19.....	3.6	4.0	3.85	4.65	3.6	4.1	3.85	3.75	3.3	3.7	7.2	4.05
20.....	3.6	4.05	3.8	4.65	3.6	4.1	3.8	3.7	3.25	3.7	6.8	4.1
21.....	3.65	4.05	3.8	4.8	3.65	4.0	3.85	3.7	3.25	3.7	6.6	4.15
22.....	3.65	4.15	3.8	5.0	3.65	3.95	3.8	3.65	3.25	3.7	6.4	4.25
23.....	3.7	4.1	3.75	5.05	3.6	3.9	3.7	3.7	3.2	3.65	6.1	4.2
24.....	3.8	4.1	3.75	5.15	3.6	3.9	3.4	3.6	3.2	3.65	5.85	4.2
25.....	3.85	4.1	3.8	5.2	4.2	4.5	3.3	3.7	3.3	3.7	5.7	4.15
26.....	4.0	4.15	3.75	5.2	4.55	4.55	3.35	3.7	3.25	4.45	5.5	4.15
27.....	4.0	4.1	3.75	5.2	4.55	4.55	3.45	3.65	3.25	4.8	5.3	4.15
28.....	4.1	4.1	3.75	5.2	4.6	4.5	3.35	3.6	3.25	4.7	5.3	4.1
29.....	4.1	.....	3.8	5.3	4.6	4.5	3.3	3.7	3.2	4.6	5.2	4.1
30.....	4.1	.....	3.8	5.4	4.6	4.35	3.25	3.65	3.2	4.6	5.15	4.05
31.....	4.15	.....	3.81	.....	4.55	.....	3.3	3.6	.....	4.4	.....	4.0

NOTE.—Gage heights for November 12 to 17 were found by plotting several readings a day and taking the mean from the curve.

*Rating table for Kachess River near Easton, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.20	62	4.00	240	4.80	475	5.60	780	6.80	1,440
3.30	80	4.10	266	4.90	510	5.70	830	7.00	1,560
3.40	98	4.20	294	5.00	545	5.80	880	7.20	1,690
3.50	118	4.30	322	5.10	580	5.90	930	7.40	1,830
3.60	140	4.40	350	5.20	615	6.00	980	7.60	1,980
3.70	164	4.50	380	5.30	655	6.20	1,090	7.80	2,140
3.80	188	4.60	410	5.40	695	6.40	1,200	8.00	2,300
3.90	214	4.70	442	5.50	735	6.60	1,320		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1906 and is well defined below gage height 5.5 feet.

*Monthly discharge of Kachess River near Easton, Wash., for 1906.*

[Drainage area, 63 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.....	280	140	173	10,600	2.75	3.17
February.....	294	214	263	14,600	4.17	4.34
March.....	266	176	206	12,700	3.27	3.77
April.....	695	227	434	25,800	6.89	7.69
May.....	735	140	401	24,700	6.37	7.34
June.....	410	214	325	19,300	5.16	5.76
July.....	322	71	211	13,000	3.35	3.86
August.....	176	62	131	8,060	2.08	2.40
September.....	140	62	92.8	5,520	1.47	1.64
October.....	475	62	168	10,300	2.67	3.08
November.....	2,300	62	798	47,500	12.67	14.14
December.....	580	240	337	20,700	5.35	6.17
The year.....	2,300	62	295	213,000	4.68	63.36

NOTE.—Values are rated as follows: January to March and July to October, good; remainder of year, excellent.

## CLEALUM RIVER NEAR ROSLYN, WASH.

This station was established October 10, 1903. It is located 1,000 feet below the outlet of Lake Clealum. It is  $2\frac{1}{2}$  miles northwest of Roslyn and  $6\frac{1}{2}$  miles northwest of Clealum, Wash. On March 17, 1906, the gage was lowered to the same datum as was used prior to August 28, 1905. All gage heights of 1906 refer to this datum, 17.40 feet below the bench mark, which is a large spike driven into a root on the downstream side of the blazed tree on the left bank to which the cable is fastened. The gage was read during 1906 by Mark Barkwell, Mrs. Samuel Davis, and employees of the United States Reclamation Service. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 80, where are given also references to publications that contain data for previous years.

*Discharge measurements of Clealum River near Roslyn, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 17 <sup>a</sup> .....	J. C. Stevens.....	124	720	2.35	526
May 3.....	W. C. Muldrow.....	148	1,220	5.98	3,370
July 18 <sup>a</sup> .....	do.....	125	753	2.90	774
August 13 <sup>b</sup> .....	do.....	80	139	1.96	443
August 24 <sup>b</sup> .....	Stevens and Muldrow.....	82	114	1.58	264
October 31.....	Muldrow and McGlashan.....	128	883	3.50	1,150
November 27.....	W. C. Muldrow.....	125	786	3.01	780

<sup>a</sup> Large amount of dead water.

<sup>b</sup> Measured by wading.

*Daily gage height, in feet, of Clealum River near Roslyn, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.8	3.1	2.45	4.0	6.0	4.1	.....	.....	1.6	1.7	3.2	2.7
2.....	1.75	3.2	2.4	4.0	6.1	4.0	.....	.....	1.6	1.7	3.1	2.6
3.....	1.72	3.15	2.35	3.9	6.0	4.1	.....	.....	1.6	1.8	2.9	2.5
4.....	1.72	3.1	2.3	3.8	6.0	4.7	.....	.....	1.6	1.8	2.8	2.4
5.....	1.7	3.0	2.25	3.9	5.8	4.8	.....	2.0	1.6	1.9	2.7	2.4
6.....	1.7	2.9	2.2	4.4	5.3	4.5	.....	2.0	1.6	1.9	2.7	2.4
7.....	1.75	2.8	2.2	4.7	5.0	4.1	.....	2.0	1.6	1.9	2.8	2.4
8.....	1.72	2.7	2.2	4.9	4.9	3.9	.....	2.0	1.6	1.9	2.9	2.3
9.....	1.75	2.6	2.3	4.8	5.0	3.8	.....	2.0	1.6	1.8	2.9	2.3
10.....	1.75	2.55	2.4	4.5	5.5	.....	.....	2.0	1.7	1.8	3.2	2.3
11.....	1.75	2.5	2.5	4.3	5.7	.....	.....	2.0	1.7	1.8	4.0	2.3
12.....	1.72	2.4	2.5	4.0	5.6	.....	.....	2.0	1.7	1.9	4.2	2.3
13.....	1.72	2.4	2.58	3.8	5.1	.....	.....	2.0	1.7	1.9	6.3	2.2
14.....	1.7	2.32	2.5	3.7	4.8	.....	.....	2.0	1.7	1.9	11.1	2.2
15.....	1.7	2.3	2.5	3.7	4.7	.....	.....	2.0	1.7	2.0	14.0	2.2
16.....	1.7	2.25	2.45	3.9	4.6	.....	.....	2.0	1.7	2.2	11.6	2.2
17.....	1.7	2.2	2.4	4.2	4.2	.....	.....	2.0	1.7	2.5	8.6	2.2
18.....	1.7	2.4	2.3	4.3	4.0	.....	.....	2.0	1.7	2.7	6.6	2.2
19.....	1.7	2.5	2.28	4.3	3.9	.....	2.9	1.9	1.7	2.8	5.4	2.3
20.....	1.7	2.7	2.1	4.4	3.8	.....	.....	1.9	1.6	2.8	4.8	2.3
21.....	1.7	2.8	2.0	4.9	3.7	.....	.....	1.1	1.6	2.7	4.2	2.3
22.....	1.8	2.8	2.0	5.9	3.7	.....	2.1	1.1	1.6	2.6	3.9	2.4
23.....	1.8	2.8	2.0	6.1	3.7	.....	.....	1.1	1.6	2.5	3.6	2.5
24.....	2.0	2.7	1.8	5.7	3.8	.....	.....	1.1	1.6	2.5	3.4	2.5
25.....	2.3	2.7	1.8	5.2	3.9	.....	.....	1.1	1.7	2.5	3.3	2.5
26.....	2.7	2.7	1.9	4.9	4.5	.....	.....	1.4	1.8	6.7	3.0	2.5
27.....	2.9	2.6	2.0	4.7	4.9	.....	.....	1.5	1.8	6.6	3.0	2.5
28.....	3.0	2.52	2.05	4.7	4.8	.....	.....	1.5	1.8	5.4	2.9	2.4
29.....	3.0	.....	2.1	5.0	4.4	.....	2.0	1.5	1.9	4.5	2.8	2.4
30.....	3.0	.....	2.5	5.4	4.2	.....	.....	1.6	1.9	3.9	2.7	2.4
31.....	3.0	.....	3.4	.....	4.2	.....	.....	1.6	.....	3.5	.....	2.4

*Rating table for Clealum River near Roslyn, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.10	140	2.20	460	3.30	940	4.80	1,970	6.80	4,160
1.20	165	2.30	495	3.40	995	5.00	2,150	7.00	4,400
1.30	190	2.40	530	3.50	1,050	5.20	2,350	8.00	5,800
1.40	215	2.50	570	3.60	1,110	5.40	2,550	9.00	7,340
1.50	240	2.60	610	3.70	1,170	5.60	2,700	10.00	9,040
1.60	270	2.70	650	3.80	1,230	5.80	2,980	11.00	10,900
1.70	300	2.80	695	3.90	1,295	6.00	3,200	12.00	12,940
1.80	330	2.90	740	4.00	1,360	6.20	3,440	13.00	15,200
1.90	360	3.00	785	4.20	1,500	6.40	3,680	14.00	17,700
2.00	390	3.10	835	4.40	1,640	6.60	3,920		
2.10	425	3.20	885	4.60	1,800				

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906 and is well defined between gage heights 1.4 feet and 6.0 feet.

*Monthly discharge of Clealum River near Roslyn, Wash., for 1906.*

[Drainage area, 205 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.....	785	300	404	24,800	1.97	2.27
February.....	885	460	644	35,800	3.14	3.27
March.....	995	330	494	30,400	2.41	2.78
April.....	3,320	1,170	1,800	107,000	8.78	9.80
May.....	3,320	1,170	2,020	124,000	9.85	11.36
June 1–9.....	1,970	1,230	1,530	27,300	7.46	2.50
August 5–31.....	390	140	309	16,500	1.51	1.52
September.....	360	270	293	17,400	1.43	1.60
October.....	4,040	300	831	51,100	4.06	4.68
November.....	17,700	650	2,650	158,000	12.92	14.40
December.....	650	460	522	32,100	2.54	2.93
The period.....				622,000		

NOTE.—Values are rated as follows: April to June, excellent; remainder of period, good.

#### NACHES RIVER NEAR NILE, WASH.

This station was established June 23, 1904. It is located  $1\frac{3}{8}$  miles above the highway bridge, 23 miles northwest of North Yakima, and 8 miles southeast of Nile, Wash. The station is  $1\frac{3}{4}$  miles above the junction of Naches and Tieton rivers.

On November 15, 1906, the gage was destroyed by a flood. Gage heights after that date were taken from a temporary slanting gage, and have been reduced to the same datum as the old gage. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 82, where are given also references to publications that contain data for previous years.

*Discharge measurements of Naches River near Nile, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 27.....	J. C. Stevens.....	189	360	4.43	1,110
May 23.....	W. C. Muldrow.....	190	409	4.80	1,530
June 23.....	do.....	192	365	4.50	1,250
July 14.....	do.....	188	268	4.00	626
August 16.....	do.....	182	174	3.46	253
November 15 <sup>a</sup> .....	do.....	246	1,730	10.30	22,000
December 9.....	do.....	196	377	4.00	1,270

<sup>a</sup> Computed from slope measurement and surface floats.*Daily gage height, in feet, of Naches River near Nile, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.7	4.3	4.3	5.3	6.0	4.9	4.4	3.6	3.4	3.4	3.9	3.35
2.....	3.9	4.3	4.2	5.1	5.9	4.9	4.4	3.6	3.4	3.4	3.9	3.35
3.....	4.0	4.3	4.2	5.0	6.0	5.0	4.4	3.6	3.4	3.4	3.9	3.22
4.....	3.8	4.25	4.15	5.1	6.0	5.1	4.4	3.6	3.4	3.5	3.9	3.22
5.....	3.8	4.2	4.1	5.4	5.9	5.0	4.3	3.6	3.4	3.5	3.9	3.22
6.....	3.8	4.15	4.1	5.7	5.7	4.9	4.3	3.6	3.4	3.5	3.8	3.09
7.....	3.8	4.2	4.2	5.9	5.6	4.8	4.3	3.6	3.4	3.5	3.9	3.74
8.....	3.75	4.2	4.3	6.0	5.7	4.7	4.3	3.6	3.4	3.5	4.3	3.87
9.....	3.8	4.15	4.4	5.9	5.7	4.7	4.2	3.6	3.5	3.5	4.3	3.74
10.....	3.8	4.1	4.5	5.7	5.8	4.7	4.2	3.6	3.5	3.5	4.5	3.61
11.....	3.7	4.05	4.4	5.6	5.9	4.7	4.2	3.5	3.5	3.5	5.0	3.48
12.....	3.75	4.1	4.3	5.4	5.8	4.9	4.1	3.5	3.5	3.5	5.18	3.48
13.....	3.7	4.0	4.3	5.3	5.5	4.8	4.1	3.5	3.5	3.5	7.12	3.35
14.....	3.8	4.0	4.2	5.3	5.4	4.8	4.0	3.5	3.5	3.5	10.14	3.35
15.....	3.75	3.95	4.1	5.4	5.4	4.7	4.0	3.5	3.6	3.6	10.14	3.35
16.....	3.7	4.0	4.1	5.5	5.2	4.7	4.0	3.5	3.6	3.8	9.04	3.22
17.....	3.7	4.0	4.2	5.5	5.1	4.7	4.0	3.5	3.5	4.0	6.84	3.22
18.....	3.8	4.1	4.3	5.6	5.0	4.6	3.9	3.5	3.5	4.0	5.6	3.22
19.....	3.75	4.9	4.3	5.5	4.9	4.6	3.9	3.5	3.5	4.0	5.2	3.22
20.....	3.8	5.0	4.2	5.6	4.9	4.6	3.9	3.5	3.5	3.9	5.08	3.48
21.....	3.7	4.9	4.1	5.8	4.8	4.6	3.8	3.4	3.5	3.8	4.84	4.48
22.....	3.7	4.7	4.1	6.1	4.9	4.5	3.8	3.4	3.5	3.8	4.6	4.48
23.....	3.8	4.6	4.1	6.2	4.8	4.5	3.8	3.5	3.4	3.7	4.36	4.24
24.....	4.0	4.6	4.1	6.0	4.8	4.5	3.8	3.5	3.4	3.7	4.36	4.24
25.....	4.1	4.5	4.2	5.8	4.9	4.5	3.8	3.5	3.4	3.7	4.12	4.12
26.....	4.1	4.4	4.2	5.7	5.4	4.6	3.7	3.5	3.5	4.2	4.0	4.0
27.....	4.1	4.4	4.6	5.6	5.3	4.5	3.7	3.5	3.5	4.4	3.87	3.87
28.....	4.05	4.3	4.6	5.5	5.2	4.5	3.7	3.5	3.5	4.3	3.61	3.74
29.....	4.0	.....	4.7	5.6	5.1	4.4	3.7	3.4	3.5	4.2	3.61	3.74
30.....	4.1	.....	4.8	5.7	5.0	4.4	3.7	3.4	3.5	4.1	3.48	3.61
31.....	4.2	.....	5.2	.....	4.9	.....	3.7	3.4	.....	4.0	.....	3.48

NOTE.—Gage lengths for November 12 to 17 were found by plotting several readings a day and taking the mean from the curve.

*Rating table for Naches River near Nile, Wash., from January 1, 1905, to November 15, 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.40	235	4.30	960	5.20	2,380	6.20	4,740	8.00	10,700
3.50	280	4.40	1,090	5.30	2,580	6.40	5,300	8.20	11,520
3.60	330	4.50	1,230	5.40	2,780	6.60	5,880	8.40	12,360
3.70	390	4.60	1,380	5.50	3,000	6.80	6,480	8.60	13,240
3.80	460	4.70	1,530	5.60	3,220	7.00	7,100	8.80	14,160
3.90	540	4.80	1,690	5.70	3,460	7.20	7,740	9.00	15,100
4.00	630	4.90	1,850	5.80	3,700	7.40	8,420	10.00	20,320
4.10	730	5.00	2,020	5.90	3,960	7.60	9,140		
4.20	840	5.10	2,200	6.00	4,220	7.80	9,900		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined below gage height 5 feet.

*Monthly discharge of Naches River near Nile, Wash., for 1906.*

[Drainage area, 636 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.....	840	390	513	31,500	0.807	0.93
February.....	2,020	535	1,010	56,100	1.59	1.66
March.....	2,380	730	996	61,200	1.57	1.81
April.....	4,740	2,020	3,250	193,000	5.11	5.70
May.....	4,220	1,690	2,810	173,000	4.42	5.10
June.....	2,200	1,090	1,530	91,000	2.41	2.69
July.....	1,090	390	676	41,600	1.06	1.22
August.....	330	235	289	17,800	.454	.52
September.....	330	235	267	15,900	.420	.47
October.....	1,090	235	458	28,200	.720	.83
November 1-15.....	21,100	460	4,060	121,000	6.38	3.56
The period.....				800,000		

NOTE.—Values are rated as follows: January to May and November, good; June to October, excellent.

## NACHES RIVER NEAR NORTH YAKIMA, WASH.

The original station on Naches River was established August 14, 1893, at a point a few hundred yards above the mouth of the river, near the bridge of the Northern Pacific Railway.

On April 24, 1906, a standard chain gage was installed at the highway bridge above the cable; length of chain, 27.10 feet. After April 28, 1906, this gage was read by Mrs. A. M. Cole. The flood of November 16, 1906, swept out this gage with the bridge and changed the channel. A temporary vertical gage, installed November 22, at the same datum, was read during the remainder of the year. The bench mark is a brass plug in the top of the concrete-filled steel pier, 10 feet north of the gage; elevation, 21.74 feet above the datum of the gage and 1,093.87 feet above sea level.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 86, where are given also references to publications that contain data for previous years.

*Discharge measurements of Naches River near North Yakima, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 26.....	Stevens and Muldrow.....	130	387	<sup>a</sup> 5.35	970
April 3.....	W. C. Muldrow.....	143	576	<sup>a</sup> 6.15	2,140
April 25.....	do.....	158	644	6.45	3,790
May 28.....	do.....	142	452	5.67	2,440
June 21.....	do.....	132	307	4.48	1,280
July 10.....	do.....	127	248	4.00	961
August 20.....	J. C. Stevens.....	57	33	2.10	40
October 26.....	Muldrow and McGlashan.....	131	322	4.40	1,230
November 14 <sup>b</sup> .....	W. C. Muldrow.....	270	1,820	11.50	24,300
November 22.....	do.....	240	923	8.20	3,590

<sup>a</sup> Gage height from inclined gage; other gage heights are from chain gage.<sup>b</sup> Measured by floats.

Daily gage height, in feet, of Naches River near North Yakima, Wash., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	4.3	5.2	5.3	6.35	6.9	5.2	4.1	2.6	2.0	2.1	3.6	7.5
2.	4.3	5.2	5.2	6.3	6.9	5.1	4.0	2.5	2.0	2.4	3.5	7.5
3.	4.4	5.2	5.2	6.1	7.0	5.6	4.1	2.3	2.0	2.2	3.5	7.4
4.	4.4	5.2	5.1	6.3	7.1	5.7	4.2	2.3	2.1	2.4	3.6	7.4
5.	4.4	5.2	5.0	6.6	6.7	5.4	4.2	2.5	1.9	2.5	3.5	7.4
6.	4.4	5.2	5.0	7.0	6.0	5.1	4.2	2.3	2.0	2.5	3.4	7.5
7.	4.3	5.1	5.0	7.3	6.4	4.9	4.4	2.4	2.4	2.4	3.6	7.5
8.	4.3	5.1	5.2	.....	6.2	4.8	4.3	2.2	2.5	2.5	4.8	7.7
9.	4.3	5.0	5.5	7.3	6.4	4.8	4.1	2.3	2.5	2.5	4.4	7.7
10.	4.3	5.0	5.5	7.1	6.8	4.7	3.9	2.2	2.3	2.5	4.8	7.6
11.	4.3	4.95	5.4	6.9	6.8	4.7	4.0	2.2	2.3	2.4	5.8	7.5
12.	4.2	4.9	5.3	6.6	6.6	5.0	3.9	2.3	2.2	2.5	5.6	7.4
13.	4.2	4.9	5.3	6.5	6.2	5.0	3.8	2.3	2.0	2.5	9.1	7.3
14.	4.2	4.8	5.3	6.6	5.9	4.8	3.7	2.4	2.3	2.5	11.15	7.3
15.	4.2	4.8	5.2	.....	6.0	4.7	3.7	2.3	2.7	2.7	10.7	7.2
16.	4.2	4.8	5.2	6.7	5.8	4.8	3.8	2.4	2.5	2.7	10.7	7.3
17.	4.2	4.7	5.2	6.7	5.6	4.8	3.5	2.2	2.4	3.6	9.7	7.3
18.	4.2	5.5	5.1	6.7	5.2	4.7	3.4	2.1	2.3	3.6	(a)	7.2
19.	4.2	6.3	5.1	6.8	5.0	4.6	3.4	2.0	2.2	3.4	.....	7.2
20.	4.2	6.2	5.1	6.8	5.0	4.5	3.2	2.1	2.3	3.3	.....	7.3
21.	4.2	6.1	5.1	7.1	4.7	4.5	3.1	2.1	2.3	3.3	.....	8.5
22.	4.2	5.9	5.0	.....	4.8	4.5	3.0	2.1	2.3	3.2	.....	8.6
23.	4.4	5.8	5.0	7.6	4.9	4.4	3.1	2.1	2.3	3.0	.....	8.3
24.	4.5	5.6	5.0	7.3	5.0	4.3	3.0	1.9	2.4	3.0	.....	8.3
25.	4.7	5.55	5.0	7.1	5.1	4.4	2.8	2.1	2.4	3.0	7.9	8.1
26.	4.9	5.5	5.0	7.0	6.2	4.6	2.9	2.0	2.3	4.0	7.8	8.0
27.	4.9	5.4	5.2	6.8	6.0	4.4	2.8	2.0	2.2	4.8	7.7	7.9
28.	4.9	5.3	5.8	5.9	5.9	4.2	2.7	2.0	2.4	4.4	7.6	7.9
29.	4.9	.....	5.9	6.1	5.7	4.1	3.1	2.5	2.2	4.0	7.6	7.9
30.	4.9	.....	6.0	6.4	5.5	4.0	2.8	2.0	2.2	3.8	7.5	7.8
31.	5.1	.....	6.4	.....	5.4	.....	2.7	2.2	.....	3.6	.....	7.7

<sup>a</sup> Gage and bridge destroyed by flood.

Rating tables for Naches River near North Yakima, Wash.

JANUARY 1 TO APRIL 29, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
4.20	285	4.90	650	5.60	1,280	6.30	2,190	7.00	3,360
4.30	325	5.00	720	5.70	1,390	6.40	2,340	7.10	3,540
4.40	370	5.10	800	5.80	1,510	6.50	2,500	7.20	3,730
4.50	420	5.20	880	5.90	1,630	6.60	2,660	7.30	3,920
4.60	470	5.30	970	6.00	1,760	6.70	2,830	7.40	4,110
4.70	525	5.40	1,070	6.10	1,900	6.80	3,000	7.50	4,300
4.80	585	5.50	1,170	6.20	2,040	6.90	3,180	7.60	4,500

APRIL 28 TO NOVEMBER 14, 1906.<sup>b</sup>

1.10	5	2.10	45	3.10	365	4.20	1,055	6.20	3,350
1.20	7	2.20	60	3.20	415	4.40	1,210	6.40	3,670
1.30	9	2.30	75	3.30	470	4.60	1,380	6.60	4,000
1.40	11	2.40	95	3.40	525	4.80	1,570	6.80	4,340
1.50	14	2.50	120	3.50	585	5.00	1,780	7.00	4,700
1.60	17	2.60	150	3.60	645	5.20	2,000	8.00	6,880
1.70	21	2.70	185	3.70	710	5.40	2,240	9.00	10,100
1.80	25	2.80	225	3.80	775	5.60	2,500	10.00	14,800
1.90	30	2.90	270	3.90	840	5.80	2,770	11.00	20,900
2.00	35	3.00	315	4.00	910	6.00	3,050		

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is fairly well defined below gage height 6.2 feet.

<sup>b</sup> 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 2.0 feet and 6.5 feet.

*Monthly discharge of Naches River near North Yakima, Wash., for 1906.*

[Drainage area, 1,120 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.....	800	285	395	24,300	0.353	0.41
February.....	2,190	525	1,030	57,200	.920	.96
March.....	2,340	720	982	60,400	.877	1.01
April.....	4,500	1,900	3,120	186,000	2.79	3.11
May.....	4,890	1,470	3,040	187,000	2.71	3.12
June.....	2,630	910	1,550	92,200	1.38	1.54
July.....	1,210	185	646	39,700	.577	.67
August.....	150	30	67.6	4,160	.060	.07
September.....	185	30	74.8	4,450	.067	.07
October.....	1,570	45	386	23,700	.345	.40
November 1-14.....	21,900	525	3,300	91,600	2.95	1.54
The period.....				771,000		

NOTE.—Values are rated as follows: January to April, good; July to November, fair.

## BUMPING RIVER NEAR NILE, WASH.

This station was established June 13, 1906, for the Tieton project of the United States Reclamation Service. It is located at the outlet of Bumping Lake.

Discharge measurements are made by wading.

The gage, which was read during a part of 1906 by employees of the Reclamation Service, is a vertical staff fastened to the stump of a tree, at the point where the trail crosses the river, 2,000 feet below the lake.

*Discharge measurements of Bumping River near Nile, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis- charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
June 13.....	W. C. Muldrow.....	110	193	1.40	352
July 9.....	C. E. Hewitt.....	120	171	1.02	266
July 14.....	do.....	116	141	.76	198
July 18.....	do.....	115	126	.63	161
July 23.....	do.....	115	114	.52	136
July 28.....	do.....	115	105	.44	120
November 14 <sup>a</sup> .....	W. C. Muldrow.....	140	900	7.00	6,000
December 7.....	do.....	110	201	1.50	407

<sup>a</sup> Computed from measurements of slope.*Daily gage height, in feet, of Bumping River near Nile, Wash., for 1906.*

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1.....		1.05	12.....		.85	23.....	1.15	0.5
2.....		1.05	13.....	1.5	.8	24.....	1.1	.5
3.....		1.05	14.....	1.4	.75	25.....	1.1	.5
4.....		1.2	15.....	1.35	.75	26.....	1.1	.5
5.....		1.15	16.....	1.4	.7	27.....	1.1	.45
6.....		1.2	17.....	1.35	.65	28.....	1.05	.45
7.....		1.1	18.....	1.3	.65	29.....	1.05	.45
8.....		1.05	19.....	1.25	.6	30.....	1.05	.4
9.....		1.0	20.....	1.2	.6	31.....		.4
10.....		.9	21.....	1.2	.6			
11.....		.9	22.....	1.15	.55			

*Rating table for Bumping River near Nile, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.40	122	0.70	176	1.00	251	1.30	347
0.50	137	0.80	199	1.10	281	1.40	382
0.60	155	0.90	224	1.20	314	1.50	417

NOTE.—The above table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1906 and is well defined.

*Monthly discharge of Bumping River near Nile, Wash., for 1906.*

[Drainage area 68 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
June 13-30.....	417	266	318	11,400	4.68	3.13
July.....	314	122	195	12,000	2.87	3.31
The period.....				23,400		

NOTE.—Values are rated as excellent.

## TETON RIVER AT HEADWORKS NEAR NACHES, WASH.

This station was established March 29, 1906. It is located 1 mile below the diversion point of the proposed canal of the Tieton project of the Reclamation Service, about 15 miles from the mouth of the river.

The river flows in a narrow canyon cut in basalt. The channel is straight. The right bank is low and brush-covered, and overflows at high water; the left is fairly high and clean. The bed of the stream is of bowlders and gravel, and permanent. There is one channel at all stages. The current is swift and somewhat broken.

Measurements are made from a cable and car.

A vertical 1 by 4 inch gage is drift-bolted to a bowlder at the cable station. The bench mark is a spike in the root of a large pine, 50 feet southeast of the stump to which the cable is attached; elevation, 16.11 feet above the datum of the gage.

*Discharge measurements of Tieton River at headworks near Naches, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 12.....	W. C. Muldrow.....	75	158		416
March 29.....	J. C. Stevens.....	94	182	3.47	525
April 17.....	W. C. Muldrow.....	95	220	3.90	763
June 2.....	do.....	95	195	3.66	644
September 8....	do.....	76	142	3.12	352

*Daily gage height, in feet, of Tieton River at Headworks near Naches, Wash., for 1906.*

Day.	Apr.	May.	June.	July.	Sept.	Day.	Apr.	May.	June.	July.	Sept.
5.....		4.25				21.....	4.4	3.6		3.25	
7.....		4.2				22.....	4.6				
12.....		4.3				23.....	4.45				
13.....		4.0				24.....	4.3			3.3	
14.....		4.0				25.....	4.15				
15.....		4.0				26.....	4.0				
16.....		3.9				27.....	4.0				
17.....	3.9	3.8			2.86	28.....	3.95		2.4		
18.....	3.9	3.65				29.....	4.2				
19.....	3.9	3.6				30.....	4.3				
20.....	4.1	3.7									

#### TIETON RIVER NEAR NACHES,<sup>a</sup> WASH.

This station was established April 24, 1902, at a point immediately below the mouth of Oak Creek, in sec. 3, T. 14 N., R. 16 E. of the Willamette meridian, about 3 miles above the mouth of Tieton River and about 22 miles from North Yakima by road. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 89, where are given also references to publications that contain data for previous years. The station was moved upstream March 7, 1906, above the mouth of Oak Creek.

The channel is straight. The banks are high and do not overflow. The bed of the stream is of gravel and solid basalt and changes only during extreme floods. There is one channel at all stages. The current is very swift.

Measurements are made by means of a cable, car, and tagged wire.

The gage, which was read twice a day by Oscar M. Cobb during 1906, is a vertical staff, in two sections: The lower section is bolted to the downstream side of a large boulder; the upper section is spiked to a tree 20 feet upstream. The bench mark is the highest point of the boulder to which the gage is attached; elevation, 1,694.65 feet above sea level and 9.25 feet above the datum of the gage.

#### *Discharge measurements of Tieton River near Naches, Wash., in 1906-7.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Ser.-ft.</i>
March 7.....	W. C. Muldrow.....	69	147	<sup>b</sup> 6.10	333
March 27.....	J. C. Stevens.....	73	160	6.40	474
March 30.....	do.....	74	180	6.71	645
May 22.....	W. C. Muldrow.....	73	173	6.63	603
June 22.....	do.....	72	166	6.41	532
July 14.....	do.....	74	187	6.70	657
August 15.....	do.....	71	151	6.20	414
November 16 <sup>c</sup> .....	do.....	125	728	9.70	5,540
1907.					
February 2.....	do.....	65	212	4.80	520

<sup>a</sup> Station formerly referred to as near North Yakima, Wash.

<sup>b</sup> Old gage read 7.20 feet.

<sup>c</sup> Measured by floats.

*Daily gage height, in feet, of Tieton River near Naches, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.50	7.30	7.18	6.95	7.65	6.75	6.60	6.15	5.98	5.68	5.80	5.15
2.....	6.47	7.30	7.18	6.80	7.55	6.78	6.68	6.12	5.92	5.82	5.70	5.10
3.....	6.60	7.22	7.20	6.78	7.65	7.00	6.85	6.08	5.98	5.90	5.72	5.05
4.....	6.65	7.15	7.15	6.92	7.70	7.18	6.85	6.12	5.90	5.75	5.88	5.00
5.....	6.65	7.12	7.10	7.20	7.52	6.90	6.95	6.12	5.90	5.65	5.96	5.00
6.....	6.62	7.00	7.10	7.42	7.40	6.75	6.95	6.20	6.05	5.68	5.80	5.75
7.....	6.60	6.98	7.20	7.70	7.35	6.65	6.90	6.18	6.18	5.70	6.00	5.52
8.....	6.60	7.05	7.30	7.58	7.38	6.58	6.80	6.22	6.05	5.78	6.92	5.52
9.....	6.60	6.98	6.25	7.45	7.50	6.55	6.70	6.20	5.88	5.70	6.70	5.40
10.....	6.55	6.95	6.25	7.28	7.62	6.48	6.72	6.22	5.68	5.75	7.55	5.30
11.....	6.55	6.88	6.05	7.12	7.62	6.62	6.7	6.25	5.58	5.75	7.25	5.28
12.....	6.55	6.92	6.00	6.98	7.42	6.95	6.68	6.25	5.60	5.75	8.60	5.15
13.....	6.58	6.90	6.00	6.92	7.20	6.75	6.62	6.25	5.55	5.65	11.80	5.02
14.....	6.50	6.90	6.02	6.92	7.15	6.58	6.65	6.10	5.68	5.81	13.75	4.92
15.....	6.50	6.88	6.00	7.02	7.25	6.58	6.58	6.22	5.68	5.78	13.70	5.00
16.....	6.58	6.85	6.00	7.12	7.00	6.68	6.55	6.10	5.60	6.08	10.00	4.95
17.....	6.52	6.88	6.00	7.12	6.82	6.65	6.48	6.00	5.72	6.15	7.75	4.95
18.....	6.48	7.50	5.98	7.10	6.72	6.58	6.38	6.00	5.85	5.92	7.25	4.92
19.....	6.55	8.00	5.95	7.12	6.68	6.52	6.35	5.92	5.90	5.78	6.90	5.00
20.....	6.50	8.18	5.95	7.30	6.62	6.48	6.28	5.95	5.90	5.72	6.60	6.15
21.....	6.50	7.90	5.92	7.62	6.62	6.52	6.30	5.92	5.90	5.68	6.25	7.25
22.....	6.50	7.75	5.92	7.70	6.60	6.45	6.38	5.90	5.82	5.62	6.05	6.85
23.....	6.60	7.65	5.95	7.65	6.65	6.40	6.30	5.75	5.85	5.62	5.82	6.55
24.....	6.80	7.58	6.02	7.45	6.65	6.55	6.22	5.90	5.90	5.62	5.72	6.60
25.....	6.82	7.45	6.08	7.30	7.18	6.58	6.25	6.05	5.78	6.00	5.62	6.25
26.....	6.90	7.42	6.22	7.22	7.50	6.75	6.28	6.05	5.65	7.20	5.48	6.10
27.....	7.05	7.38	6.40	7.20	7.15	6.55	6.20	6.05	5.62	6.72	5.40	5.95
28.....	6.90	7.30	6.60	7.22	7.00	6.45	6.22	6.05	5.82	6.32	5.32	5.85
29.....	6.92		6.60	7.30	6.88	6.32	6.25	6.08	5.72	6.10	5.30	5.78
30.....	7.05		6.75	7.35	6.82	6.40	6.25	6.12	5.68	5.98	5.20	5.70
31.....	7.22		7.15		6.72		6.22	6.05		5.88		5.55

NOTE.—Gage heights prior to March 9 are for a different gage and datum from those after that date. Gage heights from November 12 to 17 were found by plotting several readings a day and taking the mean from the curve.

*Rating tables for Tieton River near Naches, Wash.*

JANUARY 1, 1905, TO MARCH 8, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
6.30	195	6.80	249	7.30	365	7.80	575	8.30	920
6.40	202	6.90	267	7.40	400	7.90	630	8.40	1,020
6.50	210	7.00	287	7.50	440	8.00	690	8.50	1,130
6.60	220	7.10	310	7.60	480	8.10	755	8.60	1,250
6.70	233	7.20	335	7.70	525	8.20	830		

MARCH 9 TO NOVEMBER 14, 1906.<sup>b</sup>

5.50	155	6.60	593	7.70	1,370	8.80	2,530	10.80	5,720
5.60	182	6.70	649	7.80	1,460	8.90	2,650	11.00	6,120
5.70	212	6.80	708	7.90	1,555	9.00	2,780	11.20	6,560
5.80	244	6.90	770	8.00	1,650	9.20	3,040	11.40	7,000
5.90	278	7.00	835	8.10	1,750	9.40	3,320	11.60	7,440
6.00	315	7.10	905	8.20	1,850	9.60	3,610	11.80	7,920
6.10	355	7.20	975	8.30	1,960	9.80	3,920	12.00	8,400
6.20	398	7.30	1,050	8.40	2,070	10.00	4,240	13.00	11,000
6.30	443	7.40	1,125	8.50	2,180	10.20	4,580	14.00	14,000
6.40	490	7.50	1,205	8.60	2,290	10.40	4,940	15.00	17,700
6.50	540	7.60	1,285	8.70	2,410	10.60	5,320		

<sup>a</sup> This 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 6.7 feet and 7.3 feet.

<sup>b</sup> 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 6 feet and 7 feet. The table has been extended beyond these limits by means of curves of area and mean velocity.

## Rating tables for Tieton River near Naches, Wash.—Continued.

NOVEMBER 15 TO DECEMBER 31, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
4.90	530	5.80	1,030	6.70	1,740	7.60	2,965	9.00	4,480
5.00	560	5.90	1,100	6.80	1,830	7.70	2,780	10.00	6,000
5.10	600	6.00	1,170	6.90	1,925	7.80	2,960	11.00	7,750
5.20	645	6.10	1,245	7.00	2,020	7.90	3,020	12.00	9,800
5.30	700	6.20	1,320	7.10	2,120	8.00	3,140	13.00	12,200
5.40	760	6.30	1,400	7.20	2,225	8.20	3,390	14.00	14,950
5.50	825	6.40	1,480	7.30	2,330	8.40	3,650		
5.60	890	6.50	1,565	7.40	2,440	8.60	3,920		
5.70	960	6.60	1,650	7.50	2,550	8.80	4,195		

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on 2 discharge measurements made during 1906-7 and the form of previous curves, and is not well defined.

## Monthly discharge of Tieton River near Naches, Wash., for 1906.

[Drainage area, 289 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.....	341	208	232	14,300	0.803	0.93
February.....	1,250	258	401	22,300	1.39	1.45
March.....	940	285	382	23,500	1.32	1.52
April.....	1,370	696	1,000	59,500	3.46	3.86
May.....	1,370	593	956	58,800	3.31	3.82
June.....	961	452	616	36,700	2.13	2.38
July.....	802	398	560	34,400	1.94	2.24
August.....	420	228	350	21,500	1.21	1.40
September.....	389	168	250	14,900	.865	.57
October.....	975	188	289	17,800	1.00	1.91
November.....	14,100	212	2,220	132,000	7.68	8.57
December.....	2,280	536	921	56,600	3.19	3.68
The year.....	14,100	168	681	492,000	2.36	31.97

NOTE.—Values are rated as follows: January to May, good; June to October, excellent; November and December, fair.

## LOW-WATER MEASUREMENTS OF TRIBUTARIES OF LAKE KACHESS.

Small streams discharging into Lake Kachess were measured during the low-water season of 1906 with the following results:

## Discharge measurements at low water of tributaries of Kachess Lake, Washington, in 1906.

Date.	Stream.	Discharge.
	East shore:	<i>Sec.-ft.</i>
August 22.....	First creek from outlet.....	1.0
August 22.....	Second creek from outlet.....	2.2
August 22.....	Third creek from outlet.....	1.6
August 22.....	Fourth creek from outlet.....	2.1
August 22.....	Fifth creek from outlet.....	1.0
August 22.....	Sixth creek from outlet.....	0.3
August 22.....	Honolulu Creek.....	0.5
	West shore:	
August 22.....	Main Creek.....	5.8
August 22.....	Tributary to Main Creek.....	0.1
August 23.....	Ninth creek from outlet.....	0.4
August 23.....	Eighth creek from outlet.....	0.1
August 23.....	Seventh creek from outlet.....	0.2
August 23.....	Box Canyon.....	14
August 23.....	Gale Creek.....	0.8
August 23.....	Fourth creek from outlet.....	0.5
August 23.....	Third creek from outlet.....	0.2
August 23.....	Second creek from outlet.....	0.7
August 23.....	First creek from outlet.....	1.5

## LOW-WATER MEASUREMENTS OF TRIBUTARIES OF LAKE KEECHELUS.

A number of tributaries of Lake Keechelus were measured during the low-water season of 1906, and the results are shown in the following table:

*Discharge measurements at low water of tributaries of Keechelus Lake in 1906.*

Date.	Stream.	Width.	Area of section.	Discharge.
	East shore:	<i>Feet.</i>	<i>Sq. ft.</i>	<i>Sec.-ft.</i>
August 21 <i>a</i> ....	First creek from outlet.....	3.5	0.8	0.8
August 21 <i>b</i> ....	Second creek from outlet.....			.2
August 21.....	Trout Creek.....			1.8
August 21.....	Fourth creek from outlet.....	5	1.25	1.8
August 21.....	Fifth creek from outlet.....			0.5
August 21.....	Sixth creek from outlet.....			6
August 21 <i>b</i> ....	Boulder Creek.....			2.5
August 21 <i>a</i> ....	Gold Creek.....	15	7.5	25
	West shore:			
August 21.....	Coal Creek.....	5	2.8	2.5
August 21.....	Roaring Creek.....	15	12	36
August 21 <i>c</i> ....	Meadow Creek.....	10	4	3.6

*a* Measured by floats one-half mile above mouth.

*b* Estimated.

*c* Measured by floats 1 mile above mouth.

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in Yakima River drainage basin during 1906:

*Atanum Creek*.—Measurements were made 2½ miles below Tampico:

April 20 (high water), width, 29 feet; area, 69 square feet; discharge, 207 second-feet.

August 28 (low water), width, 20 feet; area, 11 square feet; discharge, 7.6 second-feet.

A measurement was made at low water August 29 at The Narrows. The water surface was 3.82 feet below a spike in a tree on the right bank near the foot log:

Width, 20 feet; area, 20 square feet; discharge, 20 second-feet.

*North Fork of Atanum Creek*.—Measurements made at Tampico. The reference point is a nail in a stump on the right bank 2 feet above the second bridge; gage heights are below the reference point:

April 19, width, 30 feet; area, 52 square feet; gage height, —2.00 feet; discharge, 190 second-feet.

August 28, width, 16 feet; area, 11 square feet; gage height, —3.62 feet; discharge, 20 second-feet.

August 29, discharge, 17 second-feet; creek in four channels.

*South Fork of Atanum Creek*.—Measurements were made 1 mile above Tampico:

April 20 (high water); width, 16 feet; area, 18 square feet; discharge, 54 second-feet.

August 29 (low water); width, 11 feet; area, 10 square feet; discharge, 8.6 second-feet.

*Cabin Creek near Easton, Wash.*—The discharge of this stream at the wagon bridge on Snoqualmie Road was estimated August 21, at low water, as 7 second-feet.

*Clealum River above Lake Clealum.*—A measurement was made August 24, 1906, at low water, 2 miles above the head of the lake:

Width, 53 feet; area, 75 square feet; discharge, 189 second-feet.

*Cowiche Creek near Cowiche, Wash.*—A measurement was made June 3, 1906, just below the head of Cowiche canal:

Width, 18 feet; area, 31 square feet; discharge, 37 second-feet.

*South Fork of Cowiche Creek near Cowiche, Wash.*—Measurements were made just above the head of the canal:

April 18; width, 19 feet; area, 33 square feet; discharge, 64 second-feet.

September 1; width, 2 feet; area, 0.75 square foot; discharge, 0.71 second-foot.

*North Fork of Cowiche Creek.*—A measurement was made by floats April 18, 1906, at the corner of sections 20, 21, 28, and 29, T. 14 N., R. 17 E.:

Width, 6 feet; area, 1.8 square feet; discharge, 2.7 second-feet.

*Desolation Creek near Roslyn, Wash.*—A measurement was made at low water August 24, 1906, one-half mile above mouth:

Width, 4 feet; area, 2 square feet; discharge, 3.4 second-feet.

*Oak Creek near Naches, Wash.*—This stream is tributary to Tieton River. A measurement was made March 8, 1906, at medium stage:

Width, 7 feet; area, 8.2 square feet; discharge, 13 second-feet.

*Silver Creek near Easton, Wash.*—A measurement was made by floats at low water, April 23, 1906, at the mouth of canyon:

Width, 7 feet; area, 2.4 square feet; discharge, 3.4 second-feet.

*Taneum Creek near Thorp, Wash.*—A measurement was made at the highway bridge, 3 miles west of Thorp, March 19, 1906. The water surface was 4.17 feet below a spike in the downstream end of a 12-by-12 inch cap of bent at the left end of the bridge. The stream was at medium stage:

Width, 20 feet; area, 19 square feet; discharge, 22 second-feet.

*Yakima River at Easton, Wash.*—This station, which was discontinued November 28, 1904, is described in Water-Supply Paper No. 135, page 78. The following measurement was made March 16, 1906:

Width, 146 feet; area, 255 square feet; gage height, 5.30 feet; discharge, 585 second feet.

*Yakima River near Sunnyside, Wash.*—A measurement was made at low water August 3, 1906, below Sunnyside dam:

Width, 70 feet; area, 65 square feet; discharge, 45 second-feet.

*Yakima River near Richland.*—A measurement was made at extreme low water August 17, 1906, 500 feet below the highway bridge.

Water surface 16.15 feet below spike marked "R. P." in downstream end of cap of first pile-pin at right abutment of bridge:

Width, 54 feet; area, 23 square feet; discharge, 29 second-feet.

#### CANALS IN YAKIMA VALLEY, WASHINGTON.

Descriptions and discharge data of the canals in Yakima Valley are given in Water-Supply Paper No. 178, pages 52-78. Systematic observations of gage heights and discharge were discontinued on most of the canals during 1906.

#### SUNNYSIDE CANAL NEAR YAKIMA, WASH.

This canal heads on the left bank of Yakima River 5 miles below the town of Yakima. It is owned and operated by the United States Reclamation Service. Measurements are made from a foot-bridge 200 feet below the head gate. The gage is a vertical staff on the right bank.

*Discharge measurements of Sunnyside Canal near Yakima, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 22.....	W. C. Muldrow.....	30	17	0.70	14
April 30.....	do.....	46	189	4.63	610
June 25.....	do.....	45	193	4.80	606
August 3.....	do.....	45	166	4.15	484
September 19.....	do.....	45	150	3.80	416
September 29.....	Stevens and Grover.....	45	153	3.85	410

*Daily gage height, in feet, of Sunnyside Canal near Yakima, Wash., for 1906.*

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	0.6	4.6	4.45	4.9	4.6	3.8	17.....	3.6	4.7	4.0	5.2	4.55	4.0
2.....	.6	4.6	4.35	4.9	4.5	3.75	18.....	3.9	4.7	4.0	5.2	3.8	4.0
3.....	.6	4.6	4.35	4.9	4.15	3.6	19.....	3.9	4.7	4.0	5.2	4.2	3.9
4.....	.6	4.6	4.35	4.9	4.1	3.6	20.....	4.0	4.7	4.25	5.2	4.2	3.8
5.....	1.4	4.6	4.35	4.9	4.0	3.6	21.....	4.2	4.7	4.25	5.2	4.1	3.4
6.....	1.6	4.6	1.0	4.9	3.85	3.6	22.....	4.2	4.7	4.55	5.2	3.9	3.8
7.....	1.9	4.6	3.8	5.0	3.75	3.7	23.....	4.2	4.7	4.7	5.2	3.9	3.8
8.....	2.1	4.6	4.05	5.1	4.15	4.0	24.....	4.35	4.7	4.7	5.2	4.1	3.8
9.....	2.5	4.7	4.0	5.1	4.1	3.85	25.....	4.35	4.7	4.8	5.2	3.9	3.8
10.....	2.8	4.7	4.0	5.1	4.15	4.0	26.....	4.5	4.6	4.9	5.2	3.9	3.8
11.....	2.8	4.7	4.0	5.1	4.15	3.85	27.....	4.5	4.6	4.9	5.2	3.9	3.8
12.....	2.8	4.7	4.0	5.2	4.5	4.0	28.....	4.5	4.6	4.9	5.2	3.8	3.8
13.....	3.0	4.7	4.0	5.2	4.6	4.1	29.....	4.5	4.6	4.9	5.2	4.0	3.8
14.....	3.0	4.7	4.0	5.2	4.6	4.1	30.....	4.63	4.6	4.9	5.2	4.0	3.8
15.....	3.3	4.7	4.0	5.2	4.5	4.0	31.....		4.45		4.85	3.8	
16.....	3.6	4.7	4.0	5.2	4.6	4.0							

*Rating table for Sunnyside Canal near Yakima, Wash., for 1906.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.60	12	1.50	75	2.40	180	3.30	317	4.40	529
0.70	16	1.60	85	2.50	194	3.40	334	4.60	572
0.80	20	1.70	95	2.60	208	3.50	352	4.80	616
0.90	26	1.80	106	2.70	222	3.60	370	5.00	660
1.00	33	1.90	117	2.80	237	3.70	389	5.20	704
1.10	41	2.00	129	2.90	252	3.80	408		
1.20	49	2.10	141	3.00	268	3.90	427		
1.30	57	2.20	154	3.10	284	4.00	447		
1.40	66	2.30	167	3.20	300	4.20	487		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is fairly well defined.

*Monthly discharge of Sunnyside Canal near Yakima, Wash., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April.....	579	12	318	18,900
May.....	594	540	583	35,800
June.....	638	33	499	29,700
July.....	704	627	684	42,100
August.....	572	398	476	29,300
September.....	467	334	414	24,600
The period.....				180,000

NOTE.—Values are rated as good.

**NEW RESERVATION CANAL NEAR YAKIMA, WASH.**

This canal heads on the right bank of Yakima River a short distance below Union Gap gaging station on Yakima River. It is owned and operated by the Indian Department for the irrigation of lands in the Yakima Indian Reservation. Measurements are made at the highway bridge 2,000 feet below head-gate. The gage is a vertical staff attached to the bridge.

*Discharge measurements of New Reservation Canal near Yakima, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	Sq. ft.	Feet.	Sec.-ft.
March 22.....	J. C. Stevens.....	38	21	a 0 60	23
June 29.....	W. C. Muldrow.....	40	149	3.55	255
August 3.....	do.....	40	149	3.00	145
August 7.....	do.....	40	121	3.00	86
September 19.....	do.....	40	111	2.60	95
November 5.....	Muldrow and McGlashan.....	40	53	1.29	53

a Gage height uncertain.

*Daily gage height, in feet, New Reservation Canal near Yakima, Wash., for 1906.*

Day.	Apr.	May.	June.	Aug.	Sept.	Oct.	Day.	Apr.	May.	June.	Aug.	Sept.	Oct.
1.....		1 9	2 3		2 6	2 6	17.....	2 3	2 3	2 8	2 6	2 6	
2.....		2 1	2 3	3 7	2 6	2 6	18.....	2 3	2 3	3 45	2 6	2 6	
3.....		2 2	2 4	3 6	2 6	2 6	19.....	2 2	2 3	2 6	2 6	1 3	
4.....		2 2	2 4	3 6	2 6	2 6	20.....	2 2	0	2 6	2 6	1 3	
5.....		2 2	2 5	3 6	2 6	2 6	21.....	2 3	0	2 6	2 6	1 3	
6.....		2 3	0	3 6	2 6	2 6	22.....	1 5	2 3	2 4	2 6	2 6	1 3
7.....		0	2 3	2 9	2 6	2 6	23.....	1 7	2 4	2 7	2 6	2 6	1 3
8.....		2 4	0	2 9	2 6	2 6	24.....	1 6	2 5	2 7	2 6	2 6	1 3
9.....		2 4	2 2	2 0	2 6	2 6	25.....	1 6	2 5	2 9	2 6	2 6	1 3
10.....		2 4	2 2	1 9	2 6	2 6	26.....	1 8	2 6	3 1	2 6	2 6	1 3
11.....		2 5	0	1 9	2 6	2 6	27.....	1 6	2 5	3 4	2 6	2 6	1 3
12.....		2 5	2 2	1 9	2 6	2 6	28.....	1 8	2 3	3 5	2 6	2 6	1 3
13.....		2 4	2 1	1 9	2 6	2 6	29.....	1 8	2 3	3 6	2 6	2 6	1 3
14.....		2 4	2 1	2 8	2 6	2 6	30.....	1 9	2 3	3 6	2 6	2 6	1 3
15.....		2 5	2 3	2 8	2 6	2 6	31.....	2 3		2 6			1 3
16.....		2 5	2 3	2 8	2 6	2 6							

NOTE.—The growth of certain water plants reduces the velocity of the canal as the season progresses, therefore there is not a constant relation between gage height and discharge.

**OLD RESERVATION CANAL NEAR WAPATO, WASH.**

This canal takes water from the right bank of Yakima River, 4 miles below Wapato. It is owned and operated by the Indian Department for irrigation of lands in the Yakima Indian Reserva-

tion. Measurements are made from railroad bridge one-half mile below head-gate. The gage is a vertical staff at the railroad bridge.

*Discharge measurements of Old Reservation Canal near Wapato, Wash., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 22.....	W. C. Muldrow.....	11.5	5 6	0.45	
June 29.....	do.....	14.0	38	3.10	152
August 3.....	do.....	11.8	22	1.75	65
August 7.....	do.....	11.3	18	1.40	40
September 19.....	do.....	11.3	22	1.85	65
November 5.....	H. D. McGlashan.....	12 0	15	1.39	36

*Daily gage height, in feet, of Old Reservation Canal near Wapato, Wash., for 1906.*

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1.....		3.2	3.1	3.0		1.4	1.3
2.....			2.0	3.0		1.4	1.3
3.....			2.0	3.0	1.75	1.4	1.3
4.....		3.3	2.0	3.0	1.75	1.4	1.3
5.....			2.0	3.1	1.75	1.4	1.3
6.....			2.0	3.2	1.5	1.8	1.3
7.....		3.1	2.0	3.1	1.4	1.8	1.3
8.....			2.0	3.2	1.45	1.8	1.3
9.....			2.0	3.1	.8	1.8	1.3
10.....			2.0	3.0	.8	1.8	1.3
11.....		3.1	2.0	3.0	.8	1.8	1.3
12.....			2.0	3.0	.8	1.8	1.3
13.....			2.0	3.0	.8	1.8	1.3
14.....		3.2	2.0	3.0	1.7	1.8	1.3
15.....		3.2	2.0	3.0	1.7	1.8	1.3
16.....		3.2	2.0	3.0	1.7	1.8	1.3
17.....		3.15	2.0	3.0	1.7	1.8	1.3
18.....			2.55	2.9	1.7	1.8	1.3
19.....		3.2	3.3	2.9	1.7	1.8	1.3
20.....		3.2	3.3	2.8	1.6	1.8	1.3
21.....		3.2	3.3	2.8	1.6	1.8	1.3
22.....		3.2	3.2	2.7	1.55	1.8	1.3
23.....		3.2	3.2	2.6	1.55	1.8	1.3
24.....	3.1	3.2	3.1	2.6	1.4	1.8	1.3
25.....		3.2	3.1	2.55	1.4	1.8	1.3
26.....	3.22	3.4	3.1	2.5	1.4	1.8	1.3
27.....		3.4	3.1	2.5	1.4	1.8	1.3
28.....	3.2	3.5	3.0	2.4	1.4	1.8	1.3
29.....		3.3	3.0	2.3	1.4	1.3	1.3
30.....		3.3	3.0	2.2	1.4	1.3	1.3
31.....		3.1		2.1	1.4		1.3

*Rating table for Old Reservation Canal near Wapato, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.50	6	1.20	31	1.90	70	2.60	117	3.30	163
0.60	9	1.30	36	2.00	77	2.70	124	3.40	170
0.70	12	1.40	41	2.10	83	2.80	131	3.50	177
0.80	15	1.50	46	2.20	89	2.90	138		
0.90	18	1.60	52	2.30	96	3.00	145		
1.00	22	1.70	58	2.40	103	3.10	152		
1.10	26	1.80	64	2.50	110	3.20	159		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1906 and is well defined.

*Monthly discharge of Old Reservation Canal near Wapato, Wash., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May.....	177	152	159	9,780
June.....	163	77	112	6,660
July.....	159	83	133	8,180
August.....	75	15	45.5	2,800
September.....	64	36	58.3	3,470
October.....	36	36	36.0	2,210
The period.....				33,100

NOTE.—Values are rated as good.

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made on canals in Yakima Valley, Washington, in 1906.

*Miscellaneous measurements of canals in Yakima River drainage basin, Washington, in 1906.*

Date.	Canal.	Locality.	Width.	Area of section.	Gage height.	Dis-charge.
			<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
August 6.....	Bull.....	Head-gate, Ellensburg.....	6	8.8	1.78	20
March 19.....	Cascade.....	Upper flume, Thorp.....	8	6.4	0.80	22
April 18.....	Cowiche.....	2 miles above Cowiche.....	7	6.3		11
June 3.....	do.....	Head-gate, Cowiche.....	5	5.5		12
September 1.....	do.....	do.....	2	0.48		0.26
April 20.....	Farmers ditch.....	Highway crossing, Tampico.....	3.5	2.4		4.1
April 15.....	Fortune.....	Poster's ranch.....	5.7	2.3	0.45	1.4
April 7.....	Fowler.....	North Yakima.....	9.7	5.3		6.5
April 22.....	do.....	do.....	9.7	9.7	0.70	27
April 22.....	Granger.....	do.....	3.5	0.52		0.45
August 4 <sup>a</sup> .....	Hatch.....	Toppenish.....	6	4.2		4
April 7.....	Hubbard.....	North Yakima.....	13.1	17	1.30	12
April 22.....	do.....	do.....	15	25	1.75	31
April 22.....	Moxee.....	do.....	10	12	2.03	14
August 16.....	Old Union.....	North Yakima:				
		2,000 feet below head-gate.....	14	36	2.82	42
		At head-gate.....	12.2	20	1.44	29
		do.....	12.2	18	1.40	27
		do.....	11.5	16	1.21	17
		do.....	12.7	23	1.75	40
		2,000 feet below head-gate.....			2.65	29
August 6.....	Olsen.....	Ellensburg.....	11	25	2.50	40
May 17.....	Prosser.....	Prosser.....	6.5	12	2.12	18
May 23.....	Selah Valley.....	Natchez:				
		Wastegate No. 12.....	6.8	14		56
		Above control gates.....	8.5	26		78
		Below control gates.....	8.8	26	2.75	75
		At flume No. 8.....	8.0	20		67
		At flume No. 23.....	6.8	17		62
		At head-gate.....	18.5	42	3.58	93
April 20.....	Shaw ditch.....	1½ miles above Atanum.....	14	10		6.0
April 20.....	Stair ditch.....	2 miles above Atanum.....	4.5	2.5		4.7
March 19 <sup>b</sup> .....	Tancum.....	Thorp.....	10.5	5.9	0.57	11
May 5.....	Town.....	Ellensburg.....	14	38	2.68	115
August 6.....	do.....	do.....	14	40	2.85	125
April 3.....	do.....	North Yakima.....	5.7	6	1.00	7.5
April 3.....	do.....	do.....	5.7	6.2	1.08	8.3
April 3.....	do.....	do.....	5.7	9.5	1.71	20
April 15.....	do.....	do.....	5.7	7.5	1.26	11
March 1.....	Union.....	do.....	11.5	11	0.98	9
August 16.....	do.....	Naches avenue, North Yakima.....	6	13	2.52	33
April 26.....	Union Gap.....	North Yakima.....	3.8	1.7	0.45	1.5
August 9 <sup>c</sup> .....	Wapaton.....	do.....	2.0	54		117
April 5.....	Yakima Valley (Congdon).....	Head.....	8.5	8.6	0.48	12

<sup>a</sup> Measured by floats.<sup>b</sup> Water probably raised by ice gorge below.<sup>c</sup> Three-fourths mile below head-gate.

**SNAKE RIVER DRAINAGE BASIN.**

## DESCRIPTION OF BASIN.

Snake River, the largest tributary of the Columbia, rises among the high peaks of the Rocky Mountains in Yellowstone National Park, western Montana and eastern Wyoming, heading in the divide from which streams flow northward and eastward into the Missouri and southward and westward to the Colorado and the lakes of the Great Basin. From Shoshone, Lewis, and Hart lakes, in Yellowstone National Park, the south fork of the river flows southward, broadening into Jackson Lake (4 miles wide and 18 miles long) and passing through Jackson Valley (8 miles wide and 40 miles long), beyond which, near the Idaho-Wyoming line, it enters a long canyon. In the southern part of Fremont County, Idaho, it unites with North Fork. Below the junction of the forks it flows westward across Idaho to a point near Homedale, where it turns abruptly northward, forming for about 170 miles the boundary between Idaho and Oregon and for 30 miles more that between Idaho and Washington. At Lewiston it crosses into Washington, flows northwest, west, and southwest, and joins the Columbia at Pasco Junction.

Its upper drainage basin comprises the timbered mountainous country west and southwest of Yellowstone Lake. The east side of its valley is bounded by the Wind River Range, from the slopes of which it receives a number of tributaries, and the west side by the high Teton Mountains, from which most of the drainage flows westward through Teton River into North Fork.

Below the junction of North and South forks the Snake receives many important tributaries, among which may be mentioned Boise, Salmon, Clearwater, and Palouse rivers from the north and east and Owyhee, Malheur, Powder, and Grande Ronde rivers from the south and west.

The Owyhee, which joins the Snake at Owyhee, Oreg., drains a high, broken, timberless area, in portions of which the rainfall amounts to but 8 or 10 inches per annum. In many respects the drainage area of the Malheur is similar to that of the Owyhee, but parts of the headwater region are mountainous and rather heavily timbered. The drainage basin of the Grande Ronde, comprising the eastern slope of the Blue Mountains and the western slope of the Cornucopia Range in northeastern Oregon, is throughout mountainous and heavily timbered, and for much of its course the river occupies a deep canyon. Wallowa River, its principal tributary, closely resembles it. Grande Ronde Valley, a broadening of the Grande Ronde basin at the town of La Grande, and Wallowa Valley, a similar broadening of Wallowa River below the town of Joseph, are important agricultural areas within the Grande Ronde drainage basin. Powder and Palouse rivers and Asotin Creek drain areas similar in

character, utilized chiefly for dry farming and the production of wheat. The waters of all of these streams are valuable for irrigation, which in a number of the valleys—notably that of the Malheur—has reached a comparatively high stage of development. At Asotin a power plant is operated, and the waters used for power are also used for irrigation.

#### NORTH FORK OF SNAKE RIVER NEAR ORA, IDAHO.

This station was established August 20, 1902. It is located at the North Fork Bridge, 2 miles south of Ora and 10 miles above St. Anthony, Idaho. The bench mark is a United States Geological Survey aluminum tablet set in a large rock about 30 feet northeast from the north end of the bridge; elevation, 12.84 feet above the gage datum.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 91, where are given also references to publications that contain data for previous years.

#### *Discharge measurements of North Fork of Snake River near Ora, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 11.....	E. C. La Rue.....	178	505	2.90	2,170
May 27.....	do.....	178	470	2.70	1,900
June 17.....	do.....	178	496	2.85	2,130

#### *Daily gage height, in feet, of North Fork of Snake River near Ora, Idaho, for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....	2.0	2.0	2.0	1.9	3.3	2.9	2.5	2.1	2.1	2.0	2.1
2.....	2.0	2.0	2.0	1.9	3.3	2.9	2.5	2.1	2.1	2.0	2.1
3.....	2.0	2.0	2.0	1.9	3.3	2.8	2.5	2.1	2.1	2.0	2.1
4.....	2.0	1.9	2.0	1.9	3.3	2.9	2.4	2.1	2.0	2.0	2.1
5.....	2.0	1.9	1.9	1.9	3.1	3.0	2.4	2.1	2.0	2.0	2.1
6.....	2.0	1.9	1.9	1.9	3.1	3.2	2.4	2.1	2.0	2.0	2.1
7.....	2.0	1.9	1.9	1.9	2.9	3.2	2.4	2.1	2.0	2.0	2.1
8.....	2.0	2.0	1.9	2.0	2.9	3.1	2.4	2.1	2.0	2.1	2.1
9.....	2.0	2.0	1.9	2.0	2.9	3.0	2.4	2.1	2.1	2.1	2.1
10.....	2.0	2.0	1.9	2.0	2.8	2.9	2.4	2.0	2.1	2.1	2.1
11.....	2.0	2.0	1.9	2.1	2.8	2.9	2.4	2.0	2.1	2.1	2.1
12.....	2.0	2.0	1.9	2.1	2.8	2.8	2.3	2.0	2.1	2.1	2.1
13.....	2.0	2.0	1.9	2.1	2.8	2.8	2.3	2.0	2.1	2.1	2.1
14.....	2.0	2.0	1.9	2.1	2.9	2.8	2.3	2.0	2.2	2.1	2.1
15.....	2.0	2.0	1.9	2.1	2.9	2.8	2.3	2.0	2.2	2.1	2.1
16.....	2.0	2.0	1.9	2.1	2.9	2.7	2.3	2.0	2.2	2.1	2.1
17.....	2.0	2.0	1.9	2.2	2.8	2.8	2.3	2.0	2.2	2.1	2.1
18.....	2.0	2.0	1.9	2.2	2.8	2.8	2.3	2.1	2.2	2.1	2.0
19.....	2.0	2.0	1.9	2.2	2.7	2.7	2.3	2.1	2.1	2.1	2.0
20.....	2.0	2.0	1.9	2.2	2.7	2.7	2.3	2.1	2.1	2.1	2.0
21.....	2.0	2.0	2.0	2.2	2.7	2.6	2.3	2.1	2.1	2.1	2.0
22.....	2.0	2.0	2.0	2.5	2.6	2.6	2.2	2.2	2.1	2.1	2.0
23.....	2.0	2.0	2.0	2.5	2.6	2.6	2.2	2.2	2.1	2.1	2.0
24.....	2.0	2.0	2.0	2.8	2.6	2.6	2.2	2.2	2.1	2.1	2.0
25.....	2.0	2.0	2.0	3.0	2.7	2.5	2.2	2.2	2.1	2.1	2.0
26.....	2.0	2.0	2.0	3.0	2.7	2.5	2.2	2.2	2.1	2.1	2.0
27.....	2.0	2.0	2.0	3.1	2.7	2.5	2.2	2.2	2.1	2.1	2.0
28.....	2.0	2.0	1.9	3.2	2.7	2.5	2.2	2.1	2.1	2.1	2.0
29.....	2.0	.....	1.9	3.3	2.9	2.5	2.2	2.1	2.1	2.1	2.0
30.....	2.0	.....	1.9	3.3	3.1	2.5	2.1	2.1	2.2	2.1	2.0
31.....	2.0	.....	1.9	.....	3.0	.....	2.1	2.1	.....	2.1	(a)

<sup>a</sup> Record discontinued for the winter.

*Rating table for North Fork of Snake River near Ora, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
1.90	910	2.20	1,170	2.50	1,550	2.80	2,030	3.10	2,600
2.00	990	2.30	1,280	2.60	1,700	2.90	2,210	3.20	2,810
2.10	1,070	2.40	1,410	2.70	1,860	3.00	2,400	3.30	3,030

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905-6 and is well defined.

*Monthly discharge of North Fork of Snake River near Ora, Idaho, for 1906.*

[Drainage area, 1,040 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.....	990	990	990	60,900	0.952	1.10
February.....	990	910	979	54,400	.942	.98
March.....	990	910	938	57,700	.902	1.04
April.....	3,030	910	1,430	85,300	1.38	1.54
May.....	3,030	1,700	2,200	135,000	2.11	2.43
June.....	2,810	1,550	2,000	119,000	1.92	2.14
July.....	1,550	1,070	1,300	79,800	1.25	1.44
August.....	1,170	990	1,070	65,700	1.03	1.19
September.....	1,170	990	1,080	64,100	1.04	1.16
October.....	1,070	990	1,050	64,700	1.01	1.16
November.....	1,070	990	1,030	61,600	.995	1.11
The period.....				848,000		

NOTE.—Values are rated as excellent on the assumption that the flow was not affected by ice conditions, January to March.

## SNAKE RIVER NEAR MINIDOKA, IDAHO.

This station was originally established August 5, 1895, at Montgomery's ferry, on the stage road from Minidoka to Albion, 4 miles east of Rupert, Idaho, and 10 miles below the diversion dam for the Minidoka irrigation project. Measurements at Montgomery's ferry show the amount of water available for irrigation purposes there and for the newly constructed Twin Falls canals heading 23 miles below, and also the conditions that will exist for power purposes at Shoshone Falls, about 45 miles below, after the irrigable lands of Snake River Valley shall have been reclaimed. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 93, where are given also references to publications that contain data for previous years.

*Discharge measurements of Snake River near Minidoka, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Fect.</i>	<i>Sq. ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
April 12.....	E. C. La Rue.....	815	4,020	3.15	6,120
April 26.....	do.....	835	4,980	4.34	9,590
May 19.....	do.....	860	6,610	6.29	16,100
June 9.....	do.....	865	7,970	7.92	22,500

*Daily gage height, in feet, of Snake River near Minidoka, Idaho, in 1906.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1.		2.7	3.4	4.7	7.35	4.4	2.4	2.2	2.65
2.	(a)	2.7	3.4	4.7	7.5	4.4	2.25	2.3	2.65
3.	3.25	3.0	3.3	4.8	7.7	4.4	2.2	2.35	2.6
4.	3.2	2.9	3.15	4.95	7.8	4.4	2.05	2.35	2.7
5.	3.2	2.7	3.15	5.1	7.8	4.4	1.9	2.35	2.65
6.	3.0	2.7	3.2	5.5	7.85	4.4	1.8	2.35	2.6
7.	3.0	2.7	3.1	5.5	7.8	4.4	1.7	.6	2.6
8.	2.9	2.7	3.1	5.6	7.85	4.4	1.6	.75	2.6
9.	3.05	2.7	3.0	5.55	7.85	4.4	1.6	1.9	2.55
10.	3.3	2.7	3.0	5.5	8.0	3.85	1.55	2.1	2.4
11.	3.05	2.7	3.0	5.4	8.0	3.35	1.5	2.1	2.35
12.	2.7	2.7	3.1	5.4	7.95	3.3	1.5	2.1	2.35
13.	2.4	2.65	3.25	5.5	7.85	3.3	1.45	2.1	2.4
14.	2.2	2.6	3.25	5.55	7.7	3.2	1.45	2.1	2.4
15.	2.35	2.5	3.25	5.75	7.9	3.2	1.45	2.1	2.4
16.	2.5	2.35	3.3	5.9	8.0	3.2	1.45	2.1	2.6
17.	2.6	2.45	3.2	6.1	8.15	3.4	1.45	2.1	2.95
18.	2.6	2.9	3.2	6.25	8.2	4.8	1.45	2.15	2.9
19.	2.6	2.8	3.2	6.3	8.3	5.2	1.45	2.2	3.2
20.	2.65	2.55	3.25	6.3	8.3	5.1	1.45	2.2	3.4
21.	2.7	2.4	3.45	6.25	8.1	5.1	1.45	2.25	3.6
22.	2.7	2.35	3.6	6.2	7.8	5.0	1.5	2.25	3.5
23.	2.7	2.5	3.7	6.15	7.5	4.75	1.5	2.25	3.35
24.	2.75	2.6	4.0	6.2	7.25	4.6	1.5	2.3	3.25
25.	2.75	2.8	4.2	6.2	6.85	4.4	1.5	2.4	3.2
26.	2.75	3.05	4.3	6.2	6.6	4.15	2.1	2.7	3.2
27.	2.7	3.2	4.45	6.2	6.35	4.9	2.45	2.7	3.15
28.	2.7	3.3	4.65	6.45	6.05	3.7	2.6	2.7	3.1
29.		3.3	4.7	6.55	5.4	3.45	2.55	2.7	3.05
30.		3.4	4.7	6.8	4.75	3.1	2.2	2.65	3.0
31.		3.4		7.05		2.7	2.2		(b)

<sup>a</sup> River frozen over January 1 to February 2, 1906.

<sup>b</sup> Gates at Minidoka dam were closed during November. Records at gaging station were unreliable November 1 to December 31.

*Rating table for Snake River near Minidoka, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.60	1,640	1.70	2,670	2.70	4,930	3.70	7,630	5.40	12,950
.70	1,680	1.80	2,860	2.80	5,180	3.80	7,920	5.60	13,670
.80	1,720	1.90	3,060	2.90	5,440	3.90	8,210	5.80	14,390
.90	1,760	2.00	3,270	3.00	5,700	4.00	8,500	6.00	15,110
1.00	1,820	2.10	3,480	3.10	5,970	4.20	9,080	6.20	15,830
1.10	1,880	2.20	3,700	3.20	6,240	4.40	9,680	6.40	16,550
1.20	1,960	2.30	3,940	3.30	6,510	4.60	10,280	6.60	17,270
1.30	2,060	2.40	4,180	3.40	6,780	4.80	10,890	6.80	18,010
1.40	2,190	2.50	4,430	3.50	7,060	5.00	11,540	7.00	18,790
1.50	2,340	2.60	4,680	3.60	7,340	5.20	12,230	8.00	23,010
1.60	2,500								

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1905-6 and is well defined above 2.3 feet; below that it is uncertain.

*Monthly discharge of Snake River near Minidoka, Idaho, for 1906.*

[Drainage area, 17,900<sup>a</sup> 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 (3-28)	6,510	3,700	5,150	265,000	0.288	0.28
March	6,780	4,060	5,130	316,000	.287	.33
April	10,600	5,700	7,150	425,000	.399	.44
May	19,000	10,600	14,500	892,000	.810	.93
June	24,300	10,700	20,900	1,250,000	1.17	1.30
July	12,200	4,930	8,870	546,000	.496	.57
August	4,680	2,260	2,900	178,000	.162	.19
September	4,930	1,640	3,770	225,000	.211	.23
October	7,340	4,060	5,320	317,000	.297	.33
The period				4,410,000		

<sup>a</sup> Exclusive of drainage of Big and Little Lost rivers.

NOTE.—Values are rated as follows: February to July, and October, excellent; August and September, good.

SNAKE RIVER BETWEEN MILNER DAM AND SHOSHONE FALLS, DURING  
NOVEMBER, 1906.

The following is a brief report of investigations in regard to the source and volume of flow in Snake River between the Milner dam, Milner, Idaho, and Shoshone Falls, Idaho, dating from November 14 to 22 (inclusive), 1906, when the flow was entirely cut off at the Minidoka dam.

The flow at this time below the Milner dam was derived from leakage through the gates at the dam, waste water from the Twin Falls tract, and springs along its course. In no case did water flow over the Milner dam and the waste from the Twin Falls tract was at a minimum.

In passing down the river from Milner to Shoshone Falls, discharge measurements were made as often as suitable stations could be found. All springs of appreciable size entering between Milner and Shoshone Falls lie between Shoshone Falls and a point 6 miles above. Most of them enter on the north side. The source of these springs is not definitely known. Upon them will depend the permanent flow of Snake River over Shoshone Falls at future times if all the water is diverted above for irrigation, with no waste.

The following is a tabulation of the measurements taken:

*Measurements between Milner Dam and Shoshone Falls in 1906.*

Location.			Dis-charge.	Location.			Dis-charge.
Date.	Above Shoshone Falls.	Below Milner.		Date.	Above Shoshone Falls.	Below Milner.	
	<i>Feet.</i>	<i>Miles.</i>	<i>Sec.-ft.</i>		<i>Feet.</i>	<i>Miles.</i>	<i>Sec.-ft.</i>
November 14 .....	1,500	.....	195	November 18 .....	.....	6	20
November 15 .....	1,500	.....	165	November 18 .....	.....	7	27
November 16 .....	1,500	.....	158	November 20 .....	.....	16	60
November 17 .....	.....	2	22	November 21 .....	1,500	.....	169
November 18 .....	.....	4	17	November 22 .....	1,500	.....	200

During the investigation the minimum flow measured at Shoshone Falls was 158 second-feet. The measurements made between the Milner dam and a point 7 miles below show that about 30 second-feet come from leakage through the Milner dam and waste from the Twin Falls tract; there then remains 128 second-feet as the gain in discharge between Milner dam and Shoshone Falls. Just what part of this is spring water and what part drains from pools can not be determined. Throughout the course there are a great many pools from 200 feet to 1 mile in length. No doubt it would take considerable time for these pools to drain down to a normal stage.

There is but one conclusion to be drawn and that is that the permanent flow over Shoshone Falls during the irrigation season, when the water is all diverted above, will be reduced to approximately 130 second-feet or less.

## SNAKE RIVER AT NEELEY, IDAHO.

On March 17, 1906, a temporary station was established at Neeley, Idaho, 3 miles above the backwater from the Minidoka dam and 4 miles below American Falls. This station is to eventually take the place of the old Montgomery station below the Minidoka dam. During 1906 only gage readings were taken. The station will be rated at some future time.

*Daily gage height, in feet, of Snake River at Neeley, Idaho, for 1906.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		5.3	6.8	9.8	6.65		4.9		4.9	5.0
2.....		5.25	7.0	9.7	6.5	4.2	4.8		4.9	5.0
3.....		5.25	7.5	9.65	6.4		4.65		4.9	5.0
4.....		5.2	7.1	9.4	6.5	4.0	4.5	4.6	5.0	5.0
5.....		5.15	7.15	9.4	6.65	4.0	4.5	4.6	5.0	5.0
6.....		5.15	7.35	9.3	6.7	3.9	4.6	4.6	5.0	(a)
7.....		5.1	7.6	9.5	6.6	3.8	4.5	4.7	5.0	
8.....		5.05	7.4	9.7	6.5	3.8	6.3	4.7	5.0	
9.....		5.05	7.25	9.75	6.4	3.75	5.0	4.7	5.0	
10.....		5.1	7.15	9.5	6.4	3.7	4.3	4.7	5.0	
11.....		5.25	7.1	9.3	6.3	3.7	4.3	4.7	5.0	
12.....		5.4	7.4	9.0	6.3	3.7	4.35	4.7	5.0	
13.....		5.35	7.65	9.1	6.3	3.7	4.4	4.7	5.0	
14.....		5.3	7.85	9.5	6.3	3.7	4.5	4.7	5.0	
15.....		5.15	8.2	9.7	6.3	3.7	4.5	4.8	5.0	
16.....		5.1	8.5	10.0	6.3	3.7	4.5	4.8	5.0	
17.....	4.55	5.2	8.6	9.85	6.2	3.7	4.6	4.8	5.0	
18.....	4.55	5.3	8.7	9.75	6.1	3.7	4.7	4.8	5.0	
19.....	4.55	5.4	8.3	9.65	6.0	3.7	4.75	4.8	5.0	
20.....	4.6	5.45	8.0	9.5	6.0	3.65	4.8	4.8	5.0	
21.....	4.65	5.8	7.6	8.9	5.9	3.65	4.8	4.8	5.0	
22.....	4.7	5.95	7.75	8.0	5.8	3.65	4.8	4.8	5.0	
23.....	4.7	6.05	7.9	7.7	5.7	3.7	4.7	4.9	5.0	
24.....	4.95	6.35	7.8	7.5	5.6	3.8	4.7	4.9	5.0	
25.....	5.2	6.7	7.95	7.3	5.5	4.1	4.7	4.9	5.0	
26.....	5.35	6.9	8.1	7.0	5.4	4.6	4.7	4.9	5.0	
27.....	5.6	6.85	8.65	6.7	5.2	4.95	4.7	4.9	5.0	
28.....	5.45	6.8	9.2	6.6		4.95	4.6	4.9	5.0	
29.....	5.35	6.75	9.4	6.5		4.95	4.6	4.9	5.0	
30.....	5.35	6.65	9.5	6.7		4.95	4.6	4.9	5.0	
31.....	5.45		9.9			4.9		4.9		

<sup>a</sup> Record discontinued for the winter.

## FALL RIVER AT FREMONT, IDAHO.

This station was established January 1, 1904, about 900 feet from Fremont post-office. During 1906 the gage was read once each day by Mrs. Eva A. Loomis and C. R. Scheetz. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 97, where are given also references to publications that contain data for previous years.

*Discharge measurements of Fall River at Fremont, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 11.....	E. C. La Rue.....	147	362	3.25	1,640
May 27.....	do.....	148	369	3.32	1,690
June 17.....	do.....	149	448	3.85	2,510
August 17.....	do.....	140	184	2.02	468

Daily gage height, in feet, of Fall River at Fremont, Idaho, for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.8	3.5	3.1	1.9	1.9	1.9	1.9
2		2.1	3.6	3.2	2.0	1.9	1.9	1.9
3		2.1	3.55	3.0	2.05	1.9	1.95	1.9
4		2.1	3.4	3.0	2.05	1.9	1.95	1.9
5		2.9	3.85	3.1	2.0	1.95	1.95	1.9
6	(a)	2.1	3.95	3.3	2.0	1.8	1.95	1.9
7	1.9	2.1	3.8	3.1	2.0	1.9	1.9	1.9
8	1.9	2.1	3.65	3.0	2.0	1.9	1.9	1.9
9	1.9	3.0	3.3	3.0	2.0	1.9	1.9	1.9
10	1.9	3.0	3.0	3.1	2.0	1.9	1.9	1.9
11	1.9	3.1	3.4	3.1	2.0	1.9	1.9	1.9
12	1.9	3.2	3.3	3.0	2.0	1.9	1.9	1.9
13	1.9	3.1	3.55	2.9	2.0	1.9	1.95	1.9
14	1.9	3.3	3.65	2.8	2.05	1.95	1.95	1.9
15	1.9	3.8	3.5	2.6	2.05	2.05	1.95	1.9
16	1.9	3.4	3.3	2.6	2.0	1.95	1.95	1.9
17	2.0	2.9	3.95	2.6	2.0	1.9	1.95	1.9
18	2.05	2.85	3.55	2.5	2.0	1.9	1.95	(b)
19	2.1	2.95	3.3	2.3	2.05	1.9	1.95	
20	2.1	2.1	3.1	2.3	2.05	1.9	1.95	
21	2.15	2.1	3.0	2.5	2.0	1.9	1.9	
22	2.25	3.0	3.0	2.4	2.0	1.9	1.9	
23	2.45	3.1	3.0	2.3	2.1	1.95	1.9	
24	2.65	3.4	3.0	2.2	2.15	1.9	1.9	
25	2.6	3.65	3.0	2.3	2.05	1.9	1.9	
26	2.5	3.5	2.9	2.3	2.0	1.9	1.9	
27	2.5	3.5	3.1	2.2	2.05	1.9	1.9	
28	2.55	3.55	3.25	2.0	2.0	1.9	1.9	
29	2.7	3.6	3.0	1.9	1.9	1.9	1.9	
30	2.8	3.45	3.3	1.9	1.9	1.9	1.9	
31		3.5		2.0	1.9		1.9	

<sup>a</sup> No record on account of ice January 1 to April 6, 1906.

<sup>b</sup> Record discontinued for the winter on November 18.

Rating table for Fall River at Fremont, Idaho, for 1906.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1.40	168	2.00	485	2.60	945	3.20	1,565	3.80	2,345
1.50	210	2.10	555	2.70	1,035	3.30	1,685	3.90	2,495
1.60	255	2.20	625	2.80	1,125	3.40	1,815	4.00	2,655
1.70	305	2.30	700	2.90	1,225	3.50	1,945		
1.80	365	2.40	775	3.00	1,335	3.60	2,075		
1.90	425	2.50	860	3.10	1,445	3.70	2,205		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905-6 and is well defined.

Monthly discharge of Fall River at Fremont, Idaho, for 1906.

[Drainage area, 390 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	1,120	425	631	30,000	1.62	1.45
May	2,340	555	1,350	83,200	3.47	4.00
June	2,580	1,220	1,780	105,800	4.56	5.09
July	1,680	425	1,010	62,300	2.60	3.00
August	590	425	492	30,200	1.26	1.45
September	520	365	430	25,600	1.10	1.23
October	455	425	437	26,900	1.12	1.29
November 1-17	425	425	425	14,300	1.09	.69
The period				378,000		

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

## TETON RIVER NEAR ST. ANTHONY, IDAHO.

This station was established April 23, 1903. It is located at the bridge on the stage road from St. Anthony to Victor, Idaho. The bench mark is a United States Geological Survey aluminum tablet set in solid rock about 30 feet northeast of the north end of the bridge; elevation, 13.53 feet above the gage datum. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 99, where are given also references to publications that contain data for previous years.

*Discharge measurements of Teton River near St. Anthony, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 12.....	E. C. La Rue.....	79.5	438	3.20	1,640
May 28.....	do.....	79.5	477	3.65	2,100
June 18.....	do.....	79.5	498	3.90	2,270
August 13.....	do.....	79.5	350	1.95	646

*Daily gage height, in feet, of Teton River near St. Anthony, Idaho, for 1906.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.3	1.6	2.0	3.65	2.65	2.05	1.8	1.75	1.7	1.6
2.....		1.35	1.5	2.1	3.55	2.8	2.05	1.75	1.75	1.7	1.6
3.....		1.35	1.6	2.15	3.5	2.95	2.05	1.75	1.85	1.7	1.7
4.....		1.3	1.6	2.3	3.9	3.0	2.05	1.75	1.85	1.7	1.8
5.....		1.35	1.65	2.4	3.1	3.0	2.1	1.8	1.8	1.7	1.8
6.....		1.35	1.7	2.3	4.25	2.95	2.05	1.8	1.8	1.75	1.7
7.....		1.3	1.9	2.25	4.1	2.95	2.05	1.8	1.75	1.75	1.65
8.....		1.3	2.0	2.3	3.8	2.85	2.05	1.8	1.75	1.65	1.6
9.....		1.3	2.1	2.5	3.5	2.95	2.05	1.8	1.7	1.65	(a)
10.....		1.3	2.15	2.85	3.45	2.85	2.0	1.8	1.7	1.65	
11.....		1.1	2.2	3.0	3.9	2.8	2.0	1.8	1.7	1.65	
12.....		1.0	2.15	3.3	4.25	2.75	1.9	1.8	1.7	1.65	
13.....		1.2	2.1	3.4	4.9	2.75	1.9	1.8	1.7	1.65	
14.....		1.3	2.0	3.6	4.95	2.7	1.85	1.85	1.75	1.65	
15.....		1.4	2.1	3.85	4.35	2.65	1.85	1.95	1.75	1.6	
16.....		1.2	2.25	3.7	4.2	2.6	1.85	2.0	1.7	1.6	
17.....		1.2	2.45	3.2	4.15	2.6	1.85	2.0	1.75	1.6	
18.....		1.1	2.35	2.85	3.9	2.6	1.8	1.9	1.75	1.6	
19.....	1.3	1.1	2.15	2.6	3.45	2.55	1.85	1.9	1.75	1.65	
20.....	1.3	1.1	2.1	2.8	3.0	2.5	1.9	1.8	1.75	1.7	
21.....	1.25	1.1	2.0	3.0	2.9	2.35	1.95	1.8	1.75	1.65	
22.....	1.3	1.2	2.1	3.1	2.95	2.4	1.9	1.8	1.7	1.6	
23.....	1.3	1.25	2.2	2.95	2.9	2.4	1.95	1.8	1.7	1.65	
24.....	1.3	1.3	2.3	3.15	2.8	2.4	2.0	1.8	1.7	1.65	
25.....	1.3	1.3	2.35	4.1	2.65	2.3	2.0	1.8	1.7	1.6	
26.....	1.3	1.35	2.15	4.5	2.7	2.25	2.0	1.8	1.7	1.6	
27.....	1.35	1.35	2.0	3.95	2.7	2.2	1.95	1.75	1.7	1.6	
28.....	1.35	1.4	1.9	3.6	2.75	2.1	1.9	1.75	1.7	1.6	
29.....		1.5	1.9	3.95	2.9	2.1	1.9	1.75	1.7	1.6	
30.....		1.6	1.95	3.1	2.65	2.1	1.85	1.75	1.7	1.6	
31.....		1.65		3.8		2.1	1.8		1.7		

a Discontinued for the winter.

Rating table for Teton River near St. Anthony, Idaho, for 1906.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.00	88	1.80	548	2.60	1,100	3.40	1,755	4.40	3,045
1.10	142	1.90	610	2.70	1,177	3.50	1,850	4.60	3,385
1.20	197	2.00	674	2.80	1,255	3.60	1,950	4.80	3,740
1.30	253	2.10	740	2.90	1,335	3.70	2,060	5.00	4,115
1.40	310	2.20	808	3.00	1,417	3.80	2,175		
1.50	368	2.30	878	3.10	1,500	3.90	2,300		
1.60	427	2.40	950	3.20	1,584	4.00	2,435		
1.70	487	2.50	1,024	3.30	1,669	4.20	2,730		

NOTE.—The above table is strictly applicable only for open-channel conditions. It is based on 14 discharge measurements made during 1904-1906 and is well defined above gage height 1.5 feet.

Monthly discharge of Teton River near St. Anthony, Idaho, for 1906.

[Drainage area, 960 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 19-28.....	281	225	256	5,080	0.267	0.10
March.....	457	88	247	15,200	.257	.30
April.....	987	368	690	41,100	.719	.80
May.....	3,220	674	1,520	93,700	1.59	1.83
June.....	4,020	1,140	2,010	119,000	2.09	2.33
July.....	1,420	740	1,100	67,400	1.14	1.31
August.....	740	548	643	39,500	.670	.77
September.....	674	517	557	33,100	.580	.65
October.....	579	487	508	31,200	.529	.61
November.....	517	427	456	27,100	.475	.53
December 1-8.....	548	427	476	7,550	.496	.15
The period.....				480,000		

NOTE.—Values are rated as follows: February and March, good; April to December, excellent.

## SOUTH FORK OF SNAKE RIVER AT MORAN, WYO.

This station was established September 21, 1903. It is located directly back of the post-office at Moran, Wyo., and about three-fourths mile below the outlet of Jackson Lake. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 101, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Snake River at Moran, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
June 19.....	R. J. Newell.....	202	1,190	5.52	5,740
June 24.....	do.....	202	1,030	4.70	4,290
August 25.....	E. C. La Rue.....	198	520	1.85	962

*Daily gage height, in feet, of South Fork of Snake River at Moran, Wyo., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1.	1.0	1.2	1.25	1.2	1.7	4.7	4.4	2.7	1.7	1.25
2.	1.0	1.2	1.25	1.2	1.75	4.7	4.3	2.65	1.7	1.25
3.	1.0	1.2	1.2	1.2	1.8	4.7	4.3	2.6	1.65	1.25
4.	1.0	1.15	1.2	1.2	1.85	4.6	4.25	2.5	1.65	1.25
5.	1.0	1.15	1.2	1.2	1.9	4.4	4.25	2.5	1.65	1.2
6.	1.0	1.15	1.2	1.2	1.95	4.6	4.25	2.45	1.65	1.2
7.	1.0	1.1	1.2	1.2	2.0	4.8	4.25	2.4	1.65	1.2
8.	1.0	1.1	1.2	1.2	2.05	4.75	4.25	2.35	1.65	1.2
9.	.9	1.1	1.2	1.2	2.15	4.7	4.25	2.15	1.6	1.15
10.	.9	1.1	1.2	1.2	2.25	4.8	4.25	1.95	1.6	1.15
11.	.9	1.15	1.2	1.2	2.35	4.85	4.2	1.95	1.55	1.1
12.	.9	1.15	1.2	1.2	2.55	4.9	4.2	1.9	1.55	1.1
13.	.9	1.15	1.2	1.2	2.8	5.0	3.95	1.9	1.5	(a)
14.	.9	1.15	1.2	1.2	3.15	5.1	3.95	1.95	1.5	.....
15.	.9	1.15	1.2	1.2	3.45	5.25	3.8	1.95	1.45	.....
16.	.9	1.15	1.2	1.2	3.55	5.65	3.85	1.9	1.45	.....
17.	1.0	1.15	1.2	1.2	3.6	5.65	3.7	1.85	1.4	.....
18.	1.0	1.15	1.2	1.2	3.6	5.65	3.65	1.8	1.4	.....
19.	1.1	1.2	1.2	1.2	3.65	5.45	3.6	1.8	1.4	.....
20.	1.1	1.2	1.2	1.2	3.7	5.2	3.5	1.8	1.4	.....
21.	1.15	1.2	1.2	1.2	3.8	5.1	3.55	1.8	1.4	.....
22.	1.15	1.2	1.2	1.25	3.95	4.9	3.4	1.85	1.4	.....
23.	1.2	1.2	1.2	1.3	4.1	4.8	3.35	1.85	1.35	.....
24.	1.2	1.2	1.2	1.3	4.25	4.65	3.2	1.85	1.35	.....
25.	1.2	1.2	1.2	1.35	4.5	4.55	3.2	1.85	1.3	.....
26.	1.2	1.2	1.2	1.4	4.6	4.5	3.1	1.85	1.3	.....
27.	1.2	1.2	1.2	1.45	4.65	4.45	2.95	1.85	1.3	.....
28.	1.2	1.2	1.2	1.5	4.8	4.45	2.8	1.8	1.3	.....
29.	1.2	.....	1.2	1.6	5.0	4.4	2.8	1.8	1.3	.....
30.	1.2	.....	1.2	1.65	5.0	4.35	2.8	1.75	1.3	.....
31.	1.2	.....	1.2	.....	4.85	.....	2.75	1.75	.....	.....

<sup>a</sup> Water shut off of Jackson Lake Dam October 13 to December 24, 1906.

*Rating table for South Fork of Snake River at Moran, Wyo., for 1904-1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.80	330	1.90	1,007	3.00	1,967	4.10	3,280	5.20	5,080
0.90	374	2.00	1,084	3.10	2,070	4.20	3,420	5.30	5,265
1.00	422	2.10	1,163	3.20	2,175	4.30	3,565	5.40	5,450
1.10	474	2.20	1,244	3.30	2,285	4.40	3,715	5.50	5,640
1.20	530	2.30	1,327	3.40	2,400	4.50	3,870	5.60	5,830
1.30	590	2.40	1,412	3.50	2,515	4.60	4,030	5.70	6,025
1.40	653	2.50	1,499	3.60	2,635	4.70	4,195	5.80	6,220
1.50	719	2.60	1,588	3.70	2,760	4.80	4,365	.....	.....
1.60	788	2.70	1,679	3.80	2,885	4.90	4,540	.....	.....
1.70	859	2.80	1,772	3.90	3,015	5.00	4,720	.....	.....
1.80	932	2.90	1,868	4.00	3,145	5.10	4,900	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1903-1906 and is well defined.

*Monthly discharge of South Fork of Snake River at Moran, Wyo., for 1906.*

[Drainage area, 820 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	530	374	449	27,600	0.548	0.63
February	530	474	511	28,380	.623	.65
March	560	530	532	32,700	.649	.75
April	823	530	572	34,000	.698	.78
May	4,720	859	2,450	151,000	2.99	3.45
June	5,930	3,640	4,480	267,000	5.46	6.09
July	3,720	1,720	2,820	173,000	3.44	3.97
August	1,680	895	1,120	68,800	1.36	1.57
September	859	590	708	42,100	.863	.96
October 1-12	560	474	526	12,500	.641	.29
The period	.....	.....	.....	837,000	.....	.....

NOTE.—Values are rated as follows: January to April, September, and October, good; May to August, excellent. Flow assumed unaffected by ice conditions.

## SOUTH FORK OF SNAKE RIVER NEAR LYON, IDAHO.

This station was established April 18, 1903. It is located on the old site of Wedekind's Ferry, between Lyon and Swan Valley, at the upper end of Conant Valley. It is about 45 miles from Idaho Falls, Idaho. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 103, where are given also references to publications that contain data for previous years.

*Discharge measurements of South Fork of Snake River near Lyon, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 21.....	E. C. La Rue.....	292	2,370	5.80	15,900
June 11.....	do.....	295	2,580	6.45	19,500
June 12.....	do.....	299	2,670	6.85	20,600

*Daily gage height, in feet, of South Fork of Snake River near Lyon, Idaho, for 1906.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....		1.05	0.95	3.5	6.55	5.25	3.35	2.2	1.65	1.25
2.....		1.05	1.1	3.5	6.3	5.6	3.25	2.2	1.6	1.2
3.....		1.0	1.1	3.7	6.2	5.7	3.25	2.1	1.6	1.2
4.....		.9	.95	4.3	6.35	5.7	3.2	2.1	1.65	1.25
5.....		.8	.9	4.4	6.65	5.6	3.1	2.05	1.65	1.25
6.....		.7	.9	4.0	6.9	5.65	3.05	2.05	1.6	1.2
7.....		.7	.95	3.85	6.7	5.6	3.0	2.0	1.6	1.2
8.....		.7	1.2	4.0	6.3	5.5	2.9	2.0	1.6	1.2
9.....		.7	1.35	4.3	6.1	5.4	2.8	2.0	1.55	1.2
10.....		.7	1.45	4.65	6.1	5.35	2.7	2.0	1.55	1.2
11.....		.7	1.5	5.0	6.4	5.3	2.6	1.95	1.55	1.2
12.....		.4	1.6	5.2	7.0	5.2	2.5	1.95	1.5	1.2
13.....		.4	1.5	5.55	7.7	5.15	2.55	1.9	1.55	1.2
14.....		.6	1.5	6.15	7.9	5.2	2.55	1.95	1.5	1.5
15.....		.6	1.6	6.4	7.6	5.0	2.5	2.0	1.45	1.7
16.....		.6	1.8	6.2	7.5	4.8	2.4	1.95	1.4	1.55
17.....		.5	2.1	5.5	7.4	4.7	2.35	1.9	1.4	1.4
18.....	(a)	.5	2.4	5.15	7.1	4.7	2.35	1.9	1.3	1.2
19.....	1.7	.7	2.5	5.05	6.6	4.65	2.4	1.85	1.3	1.1
20.....	1.3	.7	2.6	5.35	6.2	4.4	2.5	1.85	1.25	.9
21.....	1.4	.8	2.85	5.8	6.0	4.3	2.6	1.8	1.2	.9
22.....	1.4	.8	3.2	5.7	6.0	4.3	2.8	1.8	1.2	.65
23.....	1.3	.8	3.6	5.7	5.95	4.3	2.9	1.75	1.3	.55
24.....	1.2	.8	3.7	6.35	5.65	4.2	2.85	1.75	1.25	.75
25.....	1.15	.9	3.55	7.2	5.5	4.05	2.7	1.75	1.3	.9
26.....	1.1	.9	3.2	7.15	5.4	3.9	2.6	1.7	1.3	.9
27.....	1.1	.9	3.0	6.9	5.5	3.8	2.5	1.7	1.25	.8
28.....	1.05	.9	3.0	7.25	5.7	3.65	2.4	1.7	1.25	.75
29.....		.9	3.2	7.55	5.55	3.5	2.3	1.65	1.25	.75
30.....		.9	3.5	7.15	5.2	3.4	2.3	1.65	1.25	.6
31.....		.95		6.9		3.3	2.2		1.25	(b)

<sup>a</sup> Frozen over, January 1 to February 18.

<sup>b</sup> December 1, record discontinued for the winter.

*Rating table for South Fork of Snake River near Lyon, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.40	1,700	1.50	3,000	2.60	5,090	3.70	7,850	5.40	14,100
0.50	1,800	1.60	3,155	2.70	5,310	3.80	8,150	5.60	15,010
0.60	1,900	1.70	3,320	2.80	5,530	3.90	8,450	5.80	15,900
0.70	2,005	1.80	3,495	2.90	5,750	4.00	8,760	6.00	16,830
0.80	2,115	1.90	3,680	3.00	5,980	4.20	9,420	6.20	17,790
0.90	2,225	2.00	3,870	3.10	6,220	4.40	10,150	6.40	18,760
1.00	2,340	2.10	4,065	3.20	6,470	4.60	10,920	6.60	19,750
1.10	2,460	2.20	4,265	3.30	6,720	4.80	11,710	6.80	20,750
1.20	2,585	2.30	4,465	3.40	7,000	5.00	12,520	7.00	21,760
1.30	2,715	2.40	4,670	3.50	7,208	5.20	13,340	8.00	27,060
1.40	2,855	2.50	4,880	3.60	7,560				

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is well defined.

*Monthly discharge of South Fork of Snake River near Lyon, Idaho, for 1906.*

[Drainage area, 5,480 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
February (19-28).....	3,320	2,400	2,690	53,300	0.491	0.18
March.....	2,400	1,700	2,050	128,000	.379	.44
April.....	7,850	2,220	4,300	256,000	.786	.88
May.....	24,600	7,280	14,900	915,000	2.72	3.14
June.....	26,500	13,300	18,900	1,120,000	3.44	3.84
July.....	15,400	6,730	11,700	718,000	2.13	2.46
August.....	6,860	4,260	5,320	327,000	.970	1.12
September.....	4,260	3,240	3,700	220,000	.675	.75
October.....	3,240	2,580	2,890	178,000	.528	.61
November.....	3,320	1,850	2,470	147,000	.450	.50
The period.....				4,070,000		

NOTE.—Values for 1906 are excellent.

#### BUFFALO RIVER NEAR ELK, WYO.

On July 31, 1906, a temporary station was established at the wagon bridge on Buffalo River, 300 feet above its junction with South Fork of Snake River.

The gage is a vertical staff nailed to the middle pier of the bridge and was read by the Government engineers during the construction of the temporary dam at Jackson Lake.

*Discharge measurements of Buffalo River near Elk, Wyo., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
August 14.....	W. G. Davies.....	74	218	4.43	352
August 25.....	E. C. La Rue.....	74.5	199	4.48	370

*Daily gage height, in feet, of Buffalo River near Elk, Wyo., in 1906.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1.....		4.8	4.15	4.0	3.9	17.....		4.3	4.1	3.9	4.0
2.....		4.75	4.15	4.0	3.9	18.....		4.25	4.1	4.0	4.0
3.....		4.75	4.1	4.0	3.9	19.....		4.35	4.1	4.0	4.0
4.....		4.8	4.1	4.0	3.9	20.....		4.45	4.1	4.0	4.0
5.....		4.7	4.1	4.0	3.9	21.....		4.5	4.1	4.0	(a)
6.....		4.6	4.1	4.0	3.9	22.....		4.55	4.1	4.0	
7.....		4.6	4.1	4.0	3.9	23.....		4.6	4.1	4.0	
8.....		4.55	4.1	4.0	3.9	24.....		4.55	4.1	4.0	
9.....		4.5	4.1	4.0	3.9	25.....		4.5	4.1	3.9	
10.....		4.4	4.05	3.9	3.9	26.....		4.4	4.0	3.9	
11.....		4.4	4.05	3.9	4.0	27.....		4.35	4.0	3.9	
12.....		4.45	4.05	3.9	4.0	28.....		4.3	4.0	3.9	
13.....		4.5	4.1	3.9	4.0	29.....		4.25	4.0	3.9	
14.....		4.5	4.1	3.9	4.0	30.....		4.2	4.0	3.9	
15.....		4.4	4.1	3.9	4.0	31.....	4.8			3.9	
16.....		4.3	4.1	3.9	4.0						

<sup>a</sup> Record discontinued for the winter.

#### PACIFIC CREEK NEAR MORAN, WYO.

On July 31, 1906, a temporary station was established at the wagon bridge on Pacific Creek, 500 feet above its junction with South Fork of Snake River.

The gage is a vertical staff nailed to the right abutment pier of the bridge. The gage readings were taken by the Government engineers during the construction of the temporary storage dam at Jackson Lake.

*Discharge measurements of Pacific Creek near Moran, Wyo., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
August 14.....	W. G. Davies.....	31	90	6.45	96
August 25.....	E. C. La Rue.....	29	77	6.60	103

*Daily gage height, in feet, of Pacific Creek near Moran, Wyo., for 1906.*

Day.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.
1.....	6.65	6.3	6.2	6.15	17.....		6.35	6.3	6.2
2.....	6.65	6.3	6.2	6.15	18.....		6.3	6.3	6.25
3.....	6.7	6.3	6.15	6.15	19.....		6.4	6.3	6.25
4.....	6.8	6.3	6.15	6.15	20.....		6.5	6.3	6.25
5.....	6.7	6.3	6.15	6.15	21.....		6.5	6.3	6.2
6.....	6.6	6.3	6.15	6.15	22.....		6.6	6.3	6.2
7.....	6.6	6.3	6.15	6.15	23.....		6.65	6.25	6.2
8.....	6.6	6.3	6.1	6.15	24.....		6.65	6.25	6.2
9.....	6.55	6.3	6.1	6.15	25.....		6.55	6.25	6.2
10.....	6.5	6.3	6.1	6.15	26.....		6.5	6.25	6.2
11.....	6.45	6.25	6.1	6.15	27.....		6.45	6.25	6.2
12.....	6.45	6.25	6.05	(a)	28.....		6.45	6.2	6.2
13.....	6.45	6.3	6.05		29.....		6.4	6.2	6.2
14.....	6.45	6.3	6.05		30.....		6.35	6.2	6.2
15.....	6.4	6.3	6.1		31.....	6.7	6.35		6.2
16.....	6.35	6.3	6.15						

<sup>a</sup> Record discontinued for the winter.

## BLACKFOOT RIVER NEAR PRESTO, IDAHO.

This station was established April 17, 1903. It is located on the ranch of James Just, 2 miles west of Presto and about 15 miles from Blackfoot, Idaho. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 106, where are given also references to publications that contain data for previous years.

*Discharge measurements of Blackfoot River near Presto, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 6.....	E. C. La Rue.....	56	293	4.06	939
May 20.....	do.....	56	288	4.04	932
June 10.....	do.....	56	254	3.40	759
August 5.....	do.....	53	111	.05	94

*Daily gage height, in feet, of Blackfoot River near Presto, Idaho, for 1906.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....		0.8	4.45	4.1	1.2	0.1	0.5	0.75	1.0
2.....		.85	4.3	4.15	1.2	.05	.45	.75	.95
3.....		.8	4.2	4.05	1.25	.05	.5	.8	1.0
4.....		.9	4.15	4.1	1.2	.05	.5	.75	1.0
5.....		.95	4.15	4.1	1.15	.05	.5	.8	1.05
6.....		.9	4.05	3.95	1.1	.05	.7	.8	1.05
7.....		.9	4.0	3.75	1.0	.0	.6	.8	.95
8.....	0.7	.85	3.9	3.6	.95	.0	.6	.8	.95
9.....	.8	.9	3.65	3.5	.9	.05	.55	.75	1.0
10.....	.6	.7	3.4	3.35	.9	.1	.55	.7	1.0
11.....	.7	.95	3.15	3.2	.9	.1	.5	.8	1.0
12.....	.7	1.0	3.0	3.0	.7	.15	.55	.8	1.1
13.....	.6	.9	2.75	2.7	.65	.4	.6	.8	1.05
14.....	.6	.95	2.9	2.5	.65	.2	.6	.9	1.0
15.....	.7	1.4	3.45	2.35	.6	.2	.55	.8	1.05
16.....	.8	1.5	3.75	2.2	.5	.2	.5	.85	1.05
17.....	.8	1.7	3.55	2.05	.55	.25	.6	.9	1.1
18.....	.9	1.95	3.7	2.0	.55	.3	.6	.85	1.15
19.....	.8	2.5	4.0	2.0	.4	.35	.7	.85	1.1
20.....	.75	2.85	4.1	1.85	.35	.3	.75	.9	1.3
21.....	.7	3.3	3.8	1.7	.3	.3	.75	.9	1.45
22.....	.7	4.1	3.55	1.8	.2	.35	.75	1.0	1.4
23.....	.9	5.1	3.3	1.75	.15	.3	.8	.95	1.5
24.....	1.7	5.5	2.9	1.7	.15	.3	.8	1.0	1.6
25.....	.85	5.5	2.95	1.55	.15	.35	.7	.9	1.6
26.....	.7	5.35	2.8	1.5	.1	.4	.65	.9	1.55
27.....	.75	5.1	2.9	1.4	.15	.45	.65	.95	1.6
28.....	.8	5.0	3.3	1.4	.1	.45	.7	.9	1.6
29.....	.8	4.7	3.55	1.25	.1	.5	.7	.9	1.9
30.....	.75	4.5	3.7	1.15	.1	.5	.7	.9	1.9
31.....	.9		3.8		.1	.5		.95	

*Rating table for Blackfoot River near Presto, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.00	59	0.90	182	1.80	345	2.70	548	4.20	995
.10	70	1.00	199	1.90	365	2.80	573	4.30	1,070
.20	82	1.10	216	2.00	386	2.90	598	4.40	1,150
.30	94	1.20	233	2.10	407	3.00	624	4.80	1,250
.40	107	1.30	251	2.20	429	3.20	679	5.00	1,350
.50	121	1.40	269	2.30	451	3.40	738	5.20	1,450
.60	135	1.50	287	2.40	474	3.60	798	5.40	1,570
.70	150	1.60	306	2.50	498	3.80	858		
.80	166	1.70	325	2.60	523	4.00	925		

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.

*Monthly discharge of Blackfoot River near Presto, Idaho, 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 8-31.....	325	135	165	7,800	0.162	0.14
April.....	1,630	150	593	35,300	.584	.65
May.....	1,090	560	801	49,200	.788	.91
June.....	977	224	551	32,800	.542	.60
July.....	242	70	139	8,550	.137	.16
August.....	121	59	87	5,350	.086	.10
September.....	166	114	138	8,210	.136	.15
October.....	199	150	174	10,700	.171	.20
November.....	365	190	240	14,300	.236	.26
The period.....				172,000		

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

## BIG LOST RIVER NEAR MACKAY, IDAHO.

This station was established November 12, 1903, and was discontinued September 1, 1906. It is located  $3\frac{1}{2}$  miles above Mackay, Idaho, above "The Narrows." The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 108, where are given also references to publications that contain data for previous years.

*Discharge measurements of Big Lost River near Mackay, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 21.....	E. C. La Rue.....	36	84	2.60	140
May 8.....	do.....	38	105	3.17	267
May 24.....	do.....	42	134	3.95	498
June 14.....	do.....	90	298	6.25	1,470
August 7.....	do.....	40	108	3.20	324

*Daily gage height, in feet, of Big Lost River near Mackay, Idaho, for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1.....	2.7	2.65	2.65	2.65	2.65	4.1	4.7	3.5
2.....	2.7	2.65	2.65	2.65	2.65	4.05	4.65	3.5
3.....	2.7	2.65	2.65	2.65	2.65	4.0	5.05	3.45
4.....	2.7	2.65	2.65	2.65	2.65	4.2	5.3	3.4
5.....	2.7	2.65	2.6	2.65	2.8	4.6	5.4	3.3
6.....	2.7	2.65	2.6	2.65	2.9	4.6	5.6	3.25
7.....	2.7	2.65	2.6	2.7	3.1	4.5	5.5	3.15
8.....	2.7	2.65	2.6	2.7	3.3	4.25	5.4	3.1
9.....	2.7	2.65	2.6	2.7	3.55	4.2	5.4	3.05
10.....	2.7	2.65	2.6	2.7	3.8	4.15	5.2	3.0
11.....	2.7	2.65	2.6	2.7	4.3	5.3	5.1	2.95
12.....	2.7	2.65	2.6	2.7	4.5	5.8	5.1	2.95
13.....	2.7	2.65	2.6	2.7	4.7	5.8	5.6	3.2
14.....	2.7	2.65	2.6	2.7	4.65	6.2	5.65	3.15
15.....	2.7	2.65	2.6	2.65	4.7	5.8	5.5	3.05
16.....	2.7	2.65	2.6	2.65	4.6	5.7	5.1	3.0
17.....	2.7	2.65	2.6	2.65	4.4	5.5	4.9	3.0
18.....	2.7	2.65	2.6	2.65	4.25	5.4	4.85	3.0
19.....	2.7	2.65	2.6	2.65	4.0	5.3	4.6	2.95
20.....	2.7	2.65	2.6	2.65	4.0	5.2	4.5	2.95
21.....	2.7	2.65	2.6	2.65	4.1	5.2	4.4	2.95
22.....	2.7	2.65	2.6	2.65	4.0	5.2	4.35	3.2
23.....	2.7	2.65	2.6	2.65	3.95	5.1	4.2	3.4
24.....	2.7	2.65	2.6	2.65	3.95	4.85	4.05	3.4
25.....	2.7	2.65	2.6	2.65	4.0	4.7	3.9	3.4
26.....	2.7	2.65	2.6	2.65	4.1	4.9	3.75	3.35
27.....	2.7	2.65	2.65	2.65	4.4	5.1	3.65	3.3
28.....	2.7	2.65	2.65	2.65	4.4	5.25	3.6	3.2
29.....	2.7	2.65	2.65	2.65	4.4	5.0	3.55	3.1
30.....	2.7	2.65	2.65	2.65	4.25	4.7	3.5	3.0
31.....	2.65	2.65	2.65	2.65	4.1	4.7	3.5	3.0

*Rating table for Big Lost River near Mackay, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.50	129	3.30	302	4.10	566	4.90	886	5.70	1,227
2.60	145	3.40	331	4.20	602	5.00	928	5.80	1,271
2.70	163	3.50	362	4.30	640	5.10	970	5.90	1,315
2.80	183	3.60	395	4.40	680	5.20	1,012	6.00	1,360
2.90	205	3.70	429	4.50	720	5.30	1,054	6.20	1,450
3.00	227	3.80	463	4.60	760	5.40	1,097		
3.10	250	3.90	497	4.70	802	5.50	1,140		
3.20	275	4.00	531	4.80	844	5.60	1,183		

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.

*Monthly discharge of Big Lost River near Mackay, Idaho, for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	163	154	163	10,000
February.....	154	154	154	8,550
March.....	154	145	148	9,100
April.....	163	154	156	9,280
May.....	802	154	507	31,200
June.....	1,450	531	914	54,400
July.....	1,200	362	814	50,000
August.....	362	216	270	16,600
The period.....				189,000

NOTE.—Values are rated as excellent. Flow assumed unaffected by ice conditions.

## BIG LOST RIVER NEAR CHILLY, IDAHO.

This station was established April 25, 1904, and was discontinued August 31, 1906. It was located at Howell's ranch, the last one on the left bank, about 25 miles upstream from Mackay, 7 miles from Chilly, and about 3 miles above Kinickinick Point.

The gage is a vertical staff on the left bank one-half mile above the cable, 300 feet from Mr. Howell's house. Until April 20, 1906, the gage was located one-quarter mile from the house. It was moved in order to place it on the main channel. During 1906 it was read once each day by Miss Maud Howell. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 110, where are given also references to publications that contain data for previous years.

*Discharge measurements of Big Lost River near Chilly, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 21.....	E. C. La Rue.....	81	149	2.50	233
April 22.....	do.....	81	163	2.67	300
May 8.....	do.....	84	216	3.35	740
May 9.....	do.....	85	239	3.60	909
May 24.....	do.....	83	213	3.28	651
June 14.....	do.....	92	308	4.30	1,790
August 7.....	do.....	81.5	166	2.68	310
August 8.....	do.....	81.5	163	2.70	318

*Daily gage height, in feet, of Big Lost River near Chilly, Idaho, for 1906.*

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1.....		2.75	3.2	3.6	2.8	17.....		3.35	4.1	3.6	2.5
2.....		2.9	3.1	3.8	2.8	18.....		3.3	3.85	3.5	2.5
3.....		3.1	3.2	3.9	2.75	19.....		3.2	3.75	3.3	2.6
4.....		3.35	3.4	4.0	2.7	20.....	(a)	3.4	3.7	3.25	2.6
5.....		3.3	3.5	3.95	2.7	21.....		2.5	3.4	3.85	3.25
6.....		3.3	3.5	3.9	2.7	22.....	2.65	3.3	3.9	3.25	2.7
7.....		3.3	3.3	4.0	2.7	23.....	2.9	3.3	3.65	3.2	2.75
8.....		3.4	3.25	3.85	2.7	24.....	2.8	3.3	3.5	3.35	2.7
9.....		3.6	3.3	3.8	2.65	25.....	2.7	3.4	3.6	3.05	2.6
10.....		3.8	3.5	3.7	2.6	26.....	2.65	3.6	3.8	3.2	2.55
11.....		3.8	3.9	3.75	2.6	27.....	2.65	3.5	3.8	2.95	2.5
12.....		3.9	4.55	3.8	2.6	28.....	2.6	3.4	3.9	2.9	2.5
13.....		3.8	4.7	4.0	2.7	29.....	2.7	3.3	3.6	2.85	2.5
14.....		3.85	4.3	3.9	2.6	30.....	2.75	3.2	3.45	2.85	2.5
15.....		3.75	4.15	3.7	2.6	31.....		3.2		2.9	2.5
16.....		3.5	4.4	3.5	2.5						

a Frozen over January 1 to April 20.

*Rating table for Big Lost River near Chilly, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.10	90	2.70	320	3.30	660	3.90	1,260	4.50	2,080
2.20	120	2.80	370	3.40	740	4.00	1,380	4.60	2,230
2.30	155	2.90	420	3.50	820	4.10	1,510	4.70	2,380
2.40	195	3.00	475	3.60	910	4.20	1,650		
2.50	235	3.10	530	3.70	1,020	4.30	1,790		
2.60	275	3.20	590	3.80	1,140	4.40	1,930		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1906 and is well defined.

*Monthly discharge of Big Lost River near Chilly, Idaho, for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 21-30.....	420	235	318	6,310
May.....	1,260	345	770	47,300
June.....	2,380	530	1,100	65,800
July.....	1,380	395	885	54,400
August.....	370	235	288	17,700
The period.....				192,000

NOTE.—Values are rated as excellent.

## BIG WOOD RIVER NEAR SHOSHONE, IDAHO.

This station was established June 5, 1905, and was discontinued December 31, 1906. It was located at A. D. Silva's ranch, 1 mile below the steel wagon bridge and 7 miles northwest of Shoshone, Idaho. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 113, where are given also references to publications that contain data for previous years.

*Discharge measurements of Big Wood River near Shoshone, Idaho, in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1905.		86	112	2.50	63
July 17.....	E. C. La Rue.....				
1906.					
April 9.....	do.....	91	297	4.76	767
April 13.....	do.....	94	469	6.50	1,810
April 25.....	do.....	92	427	6.02	1,510
May 5.....	do.....	92	350	5.25	1,060
May 18.....	do.....	89	287	4.63	699
June 8.....	do.....	89	262	4.31	552
July 6.....	do.....	88	249	4.18	502
July 13.....	do.....	88	223	3.87	404
July 26.....	do.....	86	122	2.70	91

*Daily gage height, in feet, of Big Wood River near Shoshone, Idaho, for 1906.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1.....		3.3	5.05	4.3	3.9	1.95	17.....		7.45	4.95	5.05	3.6	.....
2.....		2.5	5.1	4.15	3.8	1.75	18.....		7.1	4.7	4.85	3.4	.....
3.....		2.3	5.0	4.0	4.0	.....	19.....		6.9	4.5	4.65	3.4	.....
4.....		2.2	5.1	4.0	4.1	.....	20.....		6.0	4.3	4.55	3.2	.....
5.....		2.2	5.25	4.1	4.2	.....	21.....		5.8	4.25	4.4	3.1	.....
6.....		2.3	5.25	4.4	4.2	.....	22.....		5.8	4.15	4.3	2.9	.....
7.....		3.2	5.15	4.45	4.15	.....	23.....		6.0	4.0	4.4	2.8	.....
8.....		4.0	5.0	4.35	4.2	.....	24.....		6.2	3.9	4.2	3.0	.....
9.....		4.6	5.0	4.2	4.2	.....	25.....		6.1	3.8	4.05	2.8	.....
10.....		5.4	5.0	4.0	4.25	.....	26.....	2.2	5.9	3.75	3.75	2.75	.....
11.....		5.7	5.05	4.0	4.05	.....	27.....	2.35	5.7	4.05	4.1	2.6	.....
12.....		6.4	5.05	4.1	4.0	.....	28.....	2.35	5.4	4.3	4.2	2.4	.....
13.....		6.4	5.1	4.9	3.9	.....	29.....	3.1	5.15	4.5	4.4	2.35	.....
14.....		6.9	5.1	5.35	3.9	.....	30.....	3.4	5.1	4.5	4.15	2.2	.....
15.....		8.0	5.2	5.1	4.0	.....	31.....	3.3	.....	4.4	.....	2.0	.....
16.....		7.9	5.2	4.95	3.8	.....							

NOTE.—The river was dry January 1 to March 25 and August 2 to December 31.

*Rating table for Big Wood River near Shoshone, Idaho, for 1905-6.*

Gage height.	Dis-charge	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.90	0	2.90	124	3.90	410	4.90	845	6.00	1,870
2.00	9	3.00	145	4.00	445	5.00	900	6.80	2,010
2.10	19	3.10	170	4.10	480	5.20	1,010	7.00	2,150
2.20	29	3.20	195	4.20	515	5.40	1,130	7.20	2,300
2.30	40	3.30	220	4.30	550	5.60	1,230	7.40	2,450
2.40	51	3.40	250	4.40	590	5.80	1,370	7.60	2,610
2.50	63	3.50	280	4.50	635	6.00	1,490	7.80	2,780
2.60	76	3.60	310	4.60	685	6.20	1,610	8.00	2,950
2.70	90	3.70	340	4.70	735	6.40	1,740		
2.80	106	3.80	375	4.80	790				

NOTE.—The above table is applicable for open-channel conditions. It is based on 10 discharge measurements made during 1905-6 and is well defined.

*Monthly discharge of Big Wood River near Shoshone, Idaho, for 1905-6.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905. <sup>a</sup>				
June 5-30.....	410	115	260	13,400
July.....	115	0	58	3,570
The period.....				17,000
1906. <sup>b</sup>				
January.....			0	0
February.....			0	0
March.....	250	0	24	1,480
April.....	2,950	29	1,240	73,500
May.....	1,040	357	760	46,700
June.....	1,100	357	604	35,900
July.....	532	9	300	18,400
August.....	4	0	.13	8
September.....			0	0
October.....			0	0
November.....			0	0
December.....			0	0
The year.....				176,000

<sup>a</sup> Values for 1905 are rated as good.

<sup>b</sup> Values for 1906 are rated as follows: March and August, approximate; April to June, excellent; July, good.

NOTE.—River dry July 28 to December 31, 1905.

#### SUCCOR CREEK NEAR HOMEDALE, IDAHO.

This station was established March 19, 1903. It was originally located at a small truss bridge built to carry a flume, about one-half mile above the mouth of the river. The station was moved January 31, 1905, about one-half mile upstream to a location 1 mile west of Homedale and about 17 miles from Caldwell, the nearest railroad station. It is near the Caldwell-Jordan Valley stage road, 1 mile west of Mussel's ferry on Snake River, one-fourth mile below the head of the lowest ditch on Succor Creek, and about three-fourths mile above the mouth of the creek. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 114, where are given also references to publications that contain data for previous years.

*Discharge measurements of Succor Creek near Homedale, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 9.....	E. C. La Rue.....	35	46	3.58	126
March 10.....	.....do.....	40	58	3.90	216
April 3.....	.....do.....	45	71	4.35	370
June 7.....	.....do.....	36	47	3.50	125
July 3.....	.....do.....		.30	2.10	.2

*Daily gage height, in feet, of Succor Creek near Homedale, Idaho, for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Dec.
1.....	1.95	2.6	3.25	4.6	3.3	3.95	.....
2.....	1.95	2.55	3.05	4.6	3.3	3.9	.....
3.....	1.95	2.55	3.05	4.2	3.25	3.6	.....
4.....	1.95	2.6	3.6	3.9	3.2	3.6	.....
5.....	1.95	2.65	3.25	4.0	3.2	3.75	2.0
6.....	1.95	2.65	3.25	4.3	3.1	3.6	2.1
7.....	1.95	2.6	3.25	4.2	2.95	3.5	2.25
8.....	1.95	2.6	3.3	4.4	2.9	3.5	2.3
9.....	1.95	2.55	3.5	4.5	2.9	3.45	2.3
10.....	1.95	2.5	3.8	4.3	2.85	3.4	2.3
11.....	2.0	2.6	3.4	3.8	2.8	3.2	2.3
12.....	2.0	2.55	3.1	3.5	3.2	3.1	2.3
13.....	2.3	2.55	3.1	3.4	3.05	3.0	2.3
14.....	2.2	2.6	3.1	3.5	2.95	2.95	2.3
15.....	2.3	2.8	3.1	3.6	3.0	2.9	2.3
16.....	2.3	3.45	2.75	3.8	2.9	3.0	2.3
17.....	2.3	3.5	2.7	3.8	2.8	2.9	2.3
18.....	2.4	3.4	2.8	3.7	2.75	2.8	2.3
19.....	3.75	4.2	2.8	3.7	2.7	2.7	2.3
20.....	2.5	3.25	2.95	3.6	2.65	2.6	2.35
21.....	2.5	3.4	3.0	3.8	2.65	2.45	2.3
22.....	2.5	3.25	3.95	3.8	2.65	2.45	2.3
23.....	2.65	3.0	4.0	3.7	2.55	2.45	2.3
24.....	3.25	3.0	4.6	3.7	2.5	2.2	2.35
25.....	3.3	3.05	4.75	3.7	2.45	2.15	2.4
26.....	3.3	2.95	4.2	3.5	2.4	2.1	2.35
27.....	2.9	3.3	4.3	3.45	2.3	2.45	2.3
28.....	2.8	4.15	4.0	3.35	2.7	2.25	2.45
29.....	2.7	.....	3.9	3.3	4.75	2.1	2.5
30.....	2.6	.....	4.2	3.3	4.2	2.0	2.45
31.....	2.65	.....	4.7	.....	4.0	.....	2.5

NOTE.—Creek dry June 30 to December 4, 1906.

*Rating table for Succor Creek near Homedale, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.00	0.0	2.60	18	3.20	71	3.80	184	4.40	389
2.10	.2	2.70	24	3.30	83	3.90	214	4.50	426
2.20	3	2.80	31	3.40	97	4.00	247	4.60	464
2.30	6	2.90	40	3.50	114	4.10	281	4.70	502
2.40	9	3.00	50	3.60	134	4.20	316	4.80	542
2.50	13	3.10	60	3.70	157	4.30	352		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906, and is not well defined below 3.5 feet.

*Monthly discharge of Succor Creek near Homedale, Idaho, for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	170	0	20.7	1,270
February.....	316	13	61.9	3,440
March.....	522	24	158	9,720
April.....	464	83	210	12,500
May.....	522	6	71.2	4,380
June.....	230	0	64.3	3,830
July.....	0	0	0	0
August.....	0	0	0	0
September.....	0	0	0	0
October.....	0	0	0	0
November.....	0	0	0	0
December.....	13	0	5.8	357
The year.....				35,500

NOTE.—Values are rated as follows: January, February, May, June, and December, approximate; March and April, good. Flow assumed unaffected by ice during winter period.

## OWYHEE RIVER NEAR OWYHEE, OREG.

This station was established August 27, 1903, at the county bridge  $1\frac{1}{2}$  miles from Owyhee, Oreg. Owyhee ditch takes water from the river about 6 miles above. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 116, where are given also references to publications that contain data for previous years.

*Discharge measurements of Owyhee River near Owyhee, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Fect.</i>	<i>Sq. ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
March 8.....	R. S. Hall.....	273	556	3.58	760
March 31.....	do.....	290	1,870	8.32	9,620
April 13.....	do.....	286	1,720	7.61	7,780
April 27.....	do.....	286	1,470	6.72	5,440
June 13.....	do.....	282	940	5.02	2,290
November 29 a..	Stevens and McGlashan.....	120	192	2.80	231

a Slush ice running. Right channel entirely frozen.

*Daily gage height, in feet, of Owyhee River near Owyhee, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.97	3.42	3.42	9.00	5.90	7.12	3.97	2.02	2.02	2.37	2.32	2.75
2.....	2.97	3.37	3.42	8.97	5.87	7.10	3.87	2.04	2.02	2.37	2.32	2.75
3.....	2.97	3.32	3.42	7.78	5.82	6.52	3.72	2.00	2.02	2.37	2.32	2.75
4.....	2.97	3.37	3.42	7.24	5.79	6.42	3.62	1.97	2.02	2.37	2.32	2.75
5.....	2.97	3.37	3.42	7.04	5.77	6.27	3.67	1.92	2.02	2.37	2.32	2.75
6.....	3.02	3.37	3.42	7.02	5.72	6.02	3.47	1.92	2.02	2.37	2.32	2.75
7.....	3.02	3.37	3.42	7.14	5.67	5.87	3.32	1.92	2.02	2.42	2.34	2.75
8.....	3.02	3.37	3.57	8.12	5.57	5.74	3.22	1.92	2.02	2.37	2.37	2.75
9.....	3.02	3.37	3.90	8.87	5.47	5.52	3.22	1.92	2.02	2.37	2.40	2.75
10.....	3.02	3.37	4.02	9.00	5.37	5.67	3.42	1.92	2.02	2.37	2.42	2.75
11.....	3.02	3.27	4.10	8.60	5.27	5.57	2.97	1.92	2.02	2.30	2.45	2.75
12.....	3.22	3.32	4.12	8.22	5.37	5.47	2.97	1.92	2.02	2.30	2.47	2.75
13.....	3.22	3.27	4.12	7.72	5.27	5.37	2.92	1.92	2.04	2.30	2.52	2.75
14.....	3.22	3.22	4.12	7.32	5.22	5.27	2.92	1.92	2.04	2.30	2.57	2.75
15.....	3.22	3.22	4.12	7.32	5.17	5.07	2.90	1.92	2.02	2.30	2.60	2.75

*Daily gage height, in feet, of Owyhee River near Owyhee, Oreg., for 1906—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July	Aug.	Sept.	Oct.	Nov.	Dec.
16.....	3.22	3.22	4.17	7.42	5.12	4.92	2.87	1.92	2.02	2.30	2.64	2.75
17.....	3.22	3.17	4.07	7.57	5.07	4.77	2.87	1.92	2.07	2.30	2.70	2.75
18.....	3.22	2.92	3.87	7.42	5.02	4.57	2.82	1.97	2.14	2.30	2.72	2.75
19.....	3.60	3.00	3.70	7.32	4.97	4.47	2.82	1.97	2.14	2.30	2.72	2.75
20.....	3.90	3.07	3.57	7.27	4.92	4.47	2.82	1.97	2.14	2.32	2.72	2.75
21.....	3.42	3.06	3.47	6.87	4.82	4.39	2.80	1.97	2.14	2.32	2.72	2.75
22.....	3.42	3.17	3.47	6.82	4.67	4.32	2.72	1.97	2.14	2.32	2.72	2.75
23.....	3.42	3.32	5.70	6.72	4.57	4.17	2.62	1.97	2.14	2.32	2.72	2.75
24.....	3.42	3.37	5.44	6.52	4.42	4.11	2.57	1.97	2.14	2.32	2.72	2.76
25.....	3.47	3.52	6.61	6.02	4.27	4.02	2.47	2.02	2.14	2.32	2.72	2.75
26.....	3.47	3.42	7.62	6.52	4.22	3.97	2.32	2.02	2.14	2.32	2.72	2.75
27.....	3.47	3.37	8.04	6.47	4.14	3.92	2.27	2.02	2.37	2.32	2.67	2.75
28.....	3.47	3.37	7.94	6.42	4.12	3.87	2.22	2.02	2.37	2.32	2.67	2.80
29.....	3.47	.....	8.02	6.32	4.62	3.90	2.17	2.02	2.37	2.32	2.75	2.85
30.....	3.47	.....	7.87	6.12	6.62	3.97	2.12	2.02	2.37	2.32	2.75	2.85
31.....	3.47	.....	8.52	.....	7.07	.....	2.07	2.02	.....	2.32	.....	2.90

NOTE.—There was probably some obstruction from ice during the latter part of November and December. No correction has been made in discharge.

*Rating table for Owyhee River near Owyhee, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.90	15	2.90	295	3.90	995	4.90	2,100	6.80	5,080
2.00	25	3.00	350	4.00	1,080	5.00	2,240	7.00	6,160
2.10	35	3.10	410	4.10	1,170	5.20	2,540	7.20	6,660
2.20	50	3.20	475	4.20	1,270	5.40	2,860	7.40	7,180
2.30	70	3.30	540	4.30	1,370	5.60	3,210	7.60	7,700
2.40	95	3.40	610	4.40	1,480	5.80	3,580	7.80	8,240
2.50	125	3.50	680	4.50	1,590	6.00	3,960	8.00	8,780
2.60	160	3.60	755	4.60	1,710	6.20	4,360	9.00	11,570
2.70	200	3.70	830	4.70	1,830	6.40	4,780		
2.80	245	3.80	910	4.80	1,960	6.60	5,220		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined.

*Monthly discharge of Owyhee River near Owyhee, Oreg., for 1906.*

[Drainage area, 9,880 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.....	995	333	519	31,900	0.052	0.06
February.....	695	306	533	29,600	.054	.06
March.....	10,200	624	2,700	166,000	.272	.31
April.....	11,600	4,200	7,250	432,000	.733	.82
May.....	6,340	1,190	2,700	166,000	.270	.31
June.....	6,460	970	2,640	157,000	.267	.30
July.....	1,060	32	367	22,600	.037	.04
August.....	29	17	21.5	1,320	.0022	.002
September.....	88	27	39.6	2,360	.0040	.004
October.....	102	70	78.2	4,810	.0079	.01
November.....	222	75	152	9,040	.015	.02
December.....	295	222	228	14,000	.023	.03
The year.....	11,600	17	1,210	1,040,000	.122	1.97

NOTE.—Values are rated as good.

## BOISE RIVER NEAR HIGHLAND, IDAHO.

This station was established on July 27, 1905, to replace the Boise station. It is located 2 miles below the mouth of Moores Creek, 3 miles southwest of Highland post-office, about 8 miles above the old Boise station, and 15 miles east of Boise, the nearest railroad point. The conditions and the bench marks are described in Water-Supply Paper No. 178, page 121.

*Discharge measurements of Boise River near Highland, Idaho, in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 3.....	E. C. La Rue.....	180	309	3.85	1,130
April 4.....	do.....	220	831	6.38	3,150
April 15.....	do.....	233	1,260	8.20	5,630
May 16.....	do.....	235	1,520	9.40	7,260
June 6.....	do.....	230	1,340	8.80	6,590
June 29.....	do.....	226	1,160	7.90	5,040
July 11.....	do.....	220	844	6.55	3,090
July 16.....	do.....	216	669	5.75	2,350
July 20.....	do.....	202	550	5.10	1,750
July 24.....	do.....	193	442	4.60	1,480
July 27.....	do.....	188	368	4.20	1,310

*Daily gage height, in feet, of Boise River near Highland, Idaho, for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....	3.3	3.5	4.0	7.55	9.1	8.35	7.25	3.9	3.4	3.15	3.4
2.....	3.3	3.45	3.85	6.9	9.2	8.2	7.35	3.85	3.4	3.1	3.4
3.....	3.25	3.45	3.85	6.55	9.5	8.3	7.5	3.8	3.45	3.15	3.4
4.....	3.3	3.5	3.85	6.4	9.9	8.6	7.55	3.8	3.35	3.25	3.4
5.....	3.4	3.4	3.85	6.25	9.5	8.65	7.4	3.7	3.3	3.35	3.45
6.....	3.6	3.45	3.8	6.8	9.35	8.85	7.3	3.65	3.3	3.35	3.45
7.....	3.4	3.45	3.8	7.4	9.25	8.35	7.2	3.65	3.25	3.3	3.5
8.....	3.4	3.5	4.0	7.95	9.45	8.35	7.05	3.6	3.25	3.2	3.5
9.....	3.4	3.5	4.4	8.05	9.55	8.2	6.9	3.55	3.25	3.2	3.55
10.....	3.5	3.5	4.6	8.3	9.95	8.25	6.7	3.5	3.25	3.15	3.6
11.....	3.6	3.5	4.5	7.75	10.05	8.5	6.55	3.45	3.25	3.15	3.6
12.....	3.6	3.6	4.4	7.6	10.3	9.5	6.5	3.4	3.25	3.2	3.5
13.....	3.5	3.65	4.3	7.7	10.3	9.85	6.3	3.5	3.45	3.3	3.8
14.....	3.5	3.7	4.1	7.75	10.15	9.15	6.15	3.55	3.5	3.25	5.75
15.....	3.5	3.75	3.9	8.2	10.1	9.05	5.9	3.5	3.4	3.15	6.0
16.....	3.5	3.9	3.6	8.6	9.5	8.95	5.75	3.4	3.35	3.25	8.05
17.....	3.5	4.0	3.4	8.75	8.85	8.95	5.6	3.4	3.3	3.3	5.5
18.....	3.8	4.1	3.5	8.8	8.5	8.55	5.45	3.35	3.3	3.35	4.6
19.....	3.7	4.25	3.6	8.85	8.35	8.3	5.3	3.25	3.25	3.3	3.95
20.....	3.6	4.2	3.8	8.9	8.35	8.15	5.1	3.3	3.25	3.3	3.9
21.....	3.5	4.1	3.9	9.5	8.35	8.1	4.95	3.3	3.2	3.3	4.0
22.....	3.7	4.2	4.0	9.9	8.25	8.0	4.85	3.4	3.15	3.3	4.0
23.....	3.6	4.1	4.3	10.2	8.1	7.9	4.95	3.55	3.15	3.3	3.8
24.....	3.5	3.95	4.65	9.75	8.15	7.7	4.6	3.65	3.15	3.3	3.7
25.....	3.5	3.9	5.65	9.5	8.2	7.7	4.45	3.6	3.15	3.3	3.7
26.....	3.7	3.9	6.2	8.9	9.25	7.8	4.35	3.45	3.15	3.3	3.65
27.....	3.6	3.85	6.5	8.75	9.05	7.9	4.2	3.45	3.15	3.3	3.65
28.....	3.5	4.15	6.5	8.7	8.9	8.5	4.15	3.55	3.15	3.35	3.65
29.....	3.5		6.65	8.9	8.85	7.9	4.05	3.45	3.15	3.35	3.55
30.....	3.4		6.75	8.95	8.6	7.5	4.0	3.45	3.15	3.35	3.5
31.....	3.4		7.25		8.5		3.95	3.4		3.35	

NOTE.—Record discontinued for the winter on December 1.

*Rating table for Boise River near Highland, Idaho, for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.00	560	4.00	1,240	5.00	1,700	6.00	2,620	8.00	5,180
3.10	600	4.10	1,280	5.10	1,780	6.20	2,840	8.20	5,470
3.20	650	4.20	1,310	5.20	1,860	6.40	3,060	8.40	5,770
3.30	700	4.30	1,350	5.30	1,940	6.60	3,300	8.60	6,070
3.40	750	4.40	1,390	5.40	2,020	6.80	3,540	8.80	6,370
3.50	810	4.50	1,430	5.50	2,110	7.00	3,800	9.00	6,670
3.60	880	4.60	1,470	5.60	2,200	7.20	4,060	10.00	8,240
3.70	960	4.70	1,510	5.70	2,300	7.40	4,340		
3.80	1,060	4.80	1,560	5.80	2,400	7.60	4,620		
3.90	1,160	4.90	1,620	5.90	2,510	7.80	4,900		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 15 discharge measurements made during 1905-6, and is well defined between gage heights 3 feet and 9 feet.

*Monthly discharge of Boise River near Highland, Idaho, 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.....	1,060	675	820	50,400	0.314	0.36
February.....	1,330	750	1,020	56,800	.391	.41
March.....	4,130	750	1,630	100,000	.624	.72
April.....	8,560	2,900	5,630	335,000	2.15	2.40
May.....	8,720	5,320	6,900	425,000	2.64	3.04
June.....	8,000	4,480	8,780	344,000	2.21	2.47
July.....	4,550	1,200	2,630	162,000	1.00	1.15
August.....	1,160	675	839	51,600	.321	.37
September.....	810	625	685	40,800	.262	.29
October.....	725	600	683	42,000	.261	.30
November.....	5,250	750	1,220	72,800	.468	.52
The period.....				1,680,000		

NOTE.—Values are rated as excellent. Flow assumed unaffected by ice conditions during the winter months

#### SEEPAGE INVESTIGATIONS ON BOISE RIVER.

The following is a detailed report of the investigation made by E. C. La Rue during October, 1906, in order to determine the amount of seepage water returning to Boise River between the mouth of its canyon, 8 miles above Boise, and Caldwell Canyon,  $2\frac{1}{2}$  miles above Caldwell, Idaho.

The distance by river between the points is 34 miles. This distance was covered on foot and by following the river bank, and the discharge of every diversion and tributary was carefully noted.

The gage reading at the Highland station on Boise River, about 8 miles above the mouth of Boise Canyon, was 3.20 on October 9, 1906, which corresponds to a discharge of 650 second-feet. From here to Boise Canyon the river flows through a narrow rocky canyon and receives no tributaries. Consequently 650 second-feet is the discharge at the mouth of the canyon, just above the New York canal heading. On October 12, 1906, the day the investigation was finished, the gage at the Highland station still read 3.20. Therefore during this period

of investigation the uniform available supply of the river above all irrigation was 650 second-feet.

The net seepage will be the difference between the discharge of the river at the upper point, plus all tributaries between the two points of measurement, and the discharge of the river at the lower point, plus all diverted water between the two points in question.

The results are expressed in the following table:

*Discharge of Boise River at upper point, plus tributaries.*

Date.	Stream.	Locality of heading or place of measurement.	Discharge in second-feet.
1906.			
October 9.....	Boise River.....	At mouth of canyon, above New York canal heading.	650
October 9.....	Waste from sloughs.....	Between Ninth and Broadway Bridge.....	.5
October 9.....	Waste from canals and sloughs.....	Between Broadway Bridge and Ridenbaugh canal heading.	2.8
October 10.....	Waste from Rossi canal.....	$\frac{1}{2}$ mile below Broadway Bridge.....	17.8
October 10.....	do.....	Just above Oregon Short Line Railway bridge.	38.1
October 10.....	do.....	Just below Oregon Short Line Railway bridge.	98.6
October 10.....	Waste.....	Below Mill slough ditch heading.....	13.0
October 10.....	do.....	From Lower Mill slough ditch.....	3.0
October 10.....	do.....	Just above Phyllis canal heading.....	1.0
October 10.....	do.....	From Eureka canal.....	3.0
October 11.....	do.....	3 miles below Star Bridge.....	4.0
October 11.....	Willow Creek waste.....	$\frac{1}{2}$ mile below Middleton.....	21.1
October 12.....	Waste Middleton Mill slough.....	At Middleton.....	4.0
October 12.....	Waste.....	Just below Farmers' Union canal heading.....	2.0
October 12.....	do.....	Boise City sewer discharge.....	10.0
Total.....			868.9

*Discharge of Boise River at lower point, plus all diversions.*

Date.	Stream.	Locality of heading or place of measurement.	Discharge in second-feet.
1906.			
October 9.....	New York canal.....	Below all waste.....	95.5
October 9.....	Ridenbaugh canal.....	Just below wasteway.....	209.4
October 9.....	Rossi canal.....	Just above wasteway.....	205.9
October 9.....	Small diversion.....	$\frac{1}{2}$ mile above Rossi heading.....	1.0
October 9.....	Payne ditch.....	At heading.....	1.0
October 10.....	Davis or Mill slough ditch.....	Below wasteway.....	20.1
October 10.....	Joplin ditch.....	At heading.....	4.0
October 10.....	Eureka canal.....	Below wasteway.....	9.3
October 10.....	Phyllis canal.....	do.....	58.6
October 11.....	Boise River.....	At lower point of measurement, $2\frac{1}{2}$ miles above Caldwell.....	95.1
October 11.....	Caldwell Highline canal.....	Below all waste.....	26.7
October 12.....	Canyon County canal.....	Below wasteway.....	9.2
October 12.....	Small diversion.....	3 miles above Star.....	1.0
October 12.....	Middleton Mill ditch.....	Below wasteway.....	35.0
October 12.....	Middleton Mill slough ditch.....	do.....	8.9
October 12.....	Pioneer or Stewart ditch.....	do.....	0.0
October 12.....	Ballantyne ditch.....	Below all waste.....	1.0
October 12.....	Dry Creek ditch.....	Below wasteway.....	10.8
October 12.....	Farmers' Union and Valley ditch.....	do.....	61.6
October 12.....	Boise City ditch.....	do.....	9.5
October 12.....	Perrault ditch.....	At penitentiary.....	9.4
Total.....			873.0

Investigations similar to the foregoing were made during 1898, 1901, 1902, 1903, and 1905. The results of these investigations, including the summary for 1906, are given below:

*Seepage gains in Boise River.*

	Sec.-ft.	Sec.-ft.
1898, August 24 to September 2:		
Amount taken out by canals.....		1, 160. 0
Amount in river above canals.....	734	
Amount of measured return water.....	197	
Total.....	931	
Amount in river at Caldwell station.....	31	
Difference.....		900. 0
Gain by seepage in 34 miles.....		260. 0
1901, August 13 to 17:		
Discharge Boise River above New York canal heading.....		821. 0
Discharge Boise River at Caldwell Canyon.....	73. 3	
Amount of measured return water.....		131. 0
Amount taken out by canals.....	1, 140. 1	
Gain by seepage in 34 miles.....		261. 4
	1, 213. 4	1, 213. 4
1902, August 11 to 15:		
Discharge Boise River at upper point.....		924. 5
Discharge Boise River at lower point.....	1. 5	
Amount of measured return waters.....		174. 4
Amount taken out by canals.....	1, 309. 0	
Gain by seepage in 34 miles.....		211. 6
	1, 310. 5	1, 310. 5
1903, October 24 to 29:		
Discharge of Boise River at upper point.....		771. 6
Discharge of Boise River at lower point.....	619. 4	
Amount of measured return waters.....		362. 6
Amount taken out by canals.....	654. 4	
Gain by seepage in 34 miles.....		<sup>a</sup> 139. 6
	1, 273. 8	1, 273. 8
1905, October 2 to 7:		
Discharge Boise River at upper point.....		602. 0
Discharge Boise River at lower point.....	106. 6	
Amount of measured return waters.....		82. 7
Amount taken out by canals.....	601. 5	
Gain by seepage in 34 miles.....		23. 4
	708. 1	708. 1

<sup>a</sup> Mistakes were found in calculation. The result of 255.3 second-feet gain, as published in Water-Supply Paper No. 100, should read 139.6 second-feet.

1906, October 9 to 12:

Sec.-ft. Sec.-ft.

Discharge Boise River at upper point..... 650.0

Discharge Boise River at lower point..... 95.1

Amount of measured return water..... 218.9

Amount taken out by canals..... 777.9

Gain by seepage in 34 miles..... 4.1

873.0 873.0

## PAYETTE RIVER NEAR HORSESHOE BEND, IDAHO.

This station was established February 13, 1906. It is located at a point known as Jerusalem, 5 miles above Horseshoe Bend post-office, Idaho, and about 32 miles from Boise, the most convenient railway point.

The channel is straight for 1,000 feet above and below the station. The water is comparatively swift during all stages. Both banks are firm, rather steep, and not liable to overflow. The bed of the stream is strewn with small smooth bowlders, and is permanent.

Discharge measurements are made by means of a cable and car. The initial point for soundings is the inner face of the pine tree which acts as the right cable support.

The gage, which was read once each day by E. R. Sherard, is inclined and is located on the right bank directly under the cable. The bench mark is a United States Geological Survey aluminum tablet set in the base of the pine tree which is used as the cable support on the right bank; elevation, 12.53 feet above the datum of the gage.

*Discharge measurements of Payette River near Horseshoe Bend, Idaho, by E. C. La Rue, in 1906.*

Date.	Width.	Area of section.	Gage height.	Discharge.
	<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 24.....	253	476	4.21	1,250
April 6.....	265	811	5.46	3,100
April 16.....	273	1,060	6.40	5,030
May 3.....	275	1,200	6.97	6,600
May 15.....	281	1,530	8.15	9,620
June 27.....	270	1,110	6.60	5,510
July 10.....	269	878	5.75	3,630
July 19.....	260	656	4.95	2,150
August 2.....	252	498	4.30	1,330

*Daily gage height, in feet, of Payette River near Horseshoe Bend, Idaho, in 1906.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....		4.1	5.65	6.8	7.1	6.5	4.35	3.9	3.8	3.95
2.....		4.0	5.55	6.8	6.75	6.35	4.3	3.85	3.8	3.95
3.....		4.0	5.4	7.0	6.6	6.3	4.3	3.85	3.8	3.95
4.....		4.05	5.45	7.15	6.8	6.25	4.25	3.85	3.75	3.95
5.....		4.0	5.35	7.15	7.15	6.2	4.25	3.8	3.75	3.95
6.....		4.0	5.5	7.1	7.1	6.15	4.2	3.8	3.75	3.95
7.....		4.0	5.8	7.1	6.9	6.05	4.2	3.8	3.75	4.0
8.....		4.1	6.0	7.05	6.9	6.0	4.15	3.8	3.75	4.1
9.....		4.2	6.1	7.15	6.8	5.95	4.15	3.75	3.75	4.2
10.....		4.3	6.5	7.4	6.7	5.85	4.1	3.75	3.75	4.25

Daily gage height, in feet, of Payette River, near Horseshoe Bend, Idaho, in 1906—Cont'd.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11.....		4.35	6.2	7.65	6.65	5.7	4.1	3.75	3.75	4.5
12.....		4.2	6.1	8.0	7.2	5.6	4.15	3.8	3.75	5.0
13.....	3.9	4.2	6.05	8.1	7.25	5.45	4.15	3.8	3.75	6.0
14.....	3.9	4.15	6.0	8.1	7.4	5.35	4.2	3.9	3.8	6.4
15.....	4.0	4.1	6.1	8.1	7.6	5.3	4.15	4.0	3.8	6.4
16.....	4.05	4.0	6.4	8.0	7.5	5.25	4.1	4.0	3.8	6.0
17.....	4.05	4.0	6.4	7.6	7.6	5.1	4.0	4.0	3.8	5.5
18.....	4.05	4.0	6.5	7.25	7.4	5.0	4.0	3.95	3.8	6.0
19.....	4.1	4.0	6.5	7.05	7.2	4.95	4.05	3.95	3.85	5.5
20.....	4.15	4.0	6.55	6.9	7.25	4.85	4.05	3.9	3.85	5.2
21.....	4.15	4.1	6.8	6.9	7.1	4.8	4.0	3.9	3.85	5.0
22.....	4.2	4.05	7.1	6.8	6.95	4.75	4.0	3.85	3.85	4.9
23.....	4.2	4.1	7.35	6.85	6.95	4.7	4.0	3.85	3.85	4.8
24.....	4.1	4.15	7.35	6.85	6.8	4.7	4.0	3.85	3.85	4.7
25.....	4.05	4.55	7.35	6.85	6.65	4.65	4.0	3.8	3.85	4.7
26.....	4.0	4.75	7.05	6.95	6.5	4.55	4.0	3.8	3.85	4.65
27.....	4.0	4.9	6.8	7.05	6.5	4.5	4.0	3.8	3.85	4.65
28.....	4.1	5.0	6.65	7.5	7.0	4.45	3.95	3.8	3.9	4.6
29.....		5.05	6.65	7.5	6.9	4.45	3.95	3.8	3.9	4.6
30.....		5.15	6.75	7.2	6.85	4.4	3.9	3.8	3.9	4.6
31.....		5.25		7.25		4.35	3.9		3.9	(a)

a Record discontinued for the winter.

Rating table for Payette River near Horseshoe Bend, Idaho, for 1906.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
3.70	760	4.70	1,800	5.70	3,530	6.70	5,760	7.70	8,430
3.80	850	4.80	1,940	5.80	3,720	6.80	6,020	7.80	8,710
3.90	940	4.90	2,090	5.90	3,920	6.90	6,280	7.90	8,990
4.00	1,030	5.00	2,250	6.00	4,120	7.00	6,540	8.00	9,270
4.10	1,130	5.10	2,420	6.10	4,330	7.10	6,800	8.10	9,550
4.20	1,230	5.20	2,590	6.20	4,550	7.20	7,070	8.20	9,830
4.30	1,330	5.30	2,770	6.30	4,780	7.30	7,340		
4.40	1,440	5.40	2,960	6.40	5,020	7.40	7,610		
4.50	1,550	5.50	3,150	6.50	5,260	7.50	7,880		
4.60	1,670	5.60	3,340	6.60	5,510	7.60	8,150		

NOTE.—The above table is applicable only to open-channel conditions. It is based on 9 discharge measurements made during 1906 and is well defined.

Monthly discharge of Payette River near Horseshoe Bend, Idaho, for 1906.

[Drainage area, 2,240 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 13-28.....	1,230	940	1,090	34,700	0.488	0.29
March.....	2,080	1,030	1,930	118,000	.859	.99
April.....	7,480	2,860	4,960	295,000	2.21	2.47
May.....	9,550	6,020	7,260	446,000	3.24	3.74
June.....	8,150	5,260	6,560	390,000	2.92	3.26
July.....	5,260	1,380	2,900	178,000	1.30	1.50
August.....	1,380	940	1,120	69,200	.502	.58
September.....	1,030	805	894	53,200	.399	.44
October.....	940	805	859	52,800	.383	.44
November.....	5,020	985	2,130	127,000	.952	1.06
The period.....				1,760,000		

NOTE.—Values are rated as follows: February to August and November, excellent; September and October, good.

## MALHEUR RIVER AT M'LAUGHLIN'S BRIDGE, NEAR VALE, OREG.

This station was established December 10, 1904, and was discontinued December 20, 1906. It is located at the new county bridge, known as McLaughlin's bridge, 10 miles above Vale, Oreg. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 129, where are given also references to publications that contain data for previous years.

*Discharge measurements of Malheur River at McLaughlin's bridge, near Vale, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 3.....	R. S. Hall.....	81	131	3.18	328
April 26.....	do.....	153	568	5.11	2,680
November 28 <sup>a</sup> ..	Stevens and McGlashan.....	45	120	1.71	107

<sup>a</sup> Channel frozen over above and below bridge.

*Daily gage height, in feet, of Malheur River at McLaughlin Bridge, near Vale, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.60	3.62	3.55	10.06	4.25	4.00	2.40	1.35	1.25	1.65	1.90	2.35
2.....	3.60	3.62	3.25	8.28	4.15	3.62	2.30	1.35	1.30	1.65	1.90	2.35
3.....	3.60	3.62	3.20	7.85	4.10	3.65	2.30	1.30	1.30	1.70	1.95	2.35
4.....	3.60	3.62	3.15	7.25	4.05	3.60	2.25	1.25	1.40	1.70	1.95	2.35
5.....	3.60	3.62	3.20	7.80	4.00	3.60	2.25	1.20	1.35	1.70	1.95	2.35
6.....	3.60	3.62	3.20	7.40	3.95	3.75	2.25	1.20	1.40	1.70	1.95	2.4
7.....	3.60	3.62	3.30	7.70	3.95	3.70	2.15	1.15	1.40	1.70	1.95	2.4
8.....	3.60	3.62	3.80	7.92	3.85	3.60	2.15	1.15	1.45	1.70	1.95	2.4
9.....	3.60	3.62	3.90	8.08	3.75	3.58	2.15	1.15	1.45	1.70	1.95	2.4
10.....	3.60	3.62	4.20	7.98	3.65	3.55	1.90	1.15	1.45	1.70	1.95	2.3
11.....	3.60	3.70	4.10	7.40	3.60	3.55	1.90	1.00	1.45	1.70	1.95	2.2
12.....	3.60	3.70	3.63	6.85	3.60	3.30	1.90	1.00	1.50	1.70	1.95	2.2
13.....	3.60	3.70	3.50	6.10	3.65	3.30	1.80	1.00	1.50	1.70	2.00	2.2
14.....	3.60	3.70	3.35	5.90	3.60	3.25	1.75	1.00	1.55	1.65	2.00	2.2
15.....	3.60	3.70	3.25	5.95	3.55	3.20	1.75	1.00	1.55	1.65	2.00	2.15
16.....	3.60	3.70	3.25	6.00	3.52	3.20	1.65	1.00	1.55	1.65	2.00	2.15
17.....	3.60	3.70	3.20	6.15	3.50	3.15	1.65	1.00	1.60	1.70	2.00	2.15
18.....	3.60	3.70	3.15	6.15	3.45	3.00	1.60	1.00	1.60	1.70	2.00	2.15
19.....	3.60	3.75	3.15	5.80	3.30	2.90	1.55	1.05	1.60	1.75	2.05	2.15
20.....	3.60	4.24	3.15	5.38	3.15	2.85	1.52	1.05	1.65	1.75	2.10	.....
21.....	3.60	4.66	3.15	5.44	3.00	2.80	1.52	1.10	1.65	1.75	2.10	.....
22.....	3.60	4.80	3.25	5.44	3.00	2.75	1.42	1.10	1.62	1.80	2.10	.....
23.....	3.60	5.32	3.85	5.38	2.90	2.50	1.50	1.15	1.60	1.80	2.10	.....
24.....	3.60	4.82	5.15	5.30	2.90	2.50	1.42	1.15	1.60	1.80	2.10	.....
25.....	3.60	4.22	7.25	5.22	2.90	2.50	1.50	1.15	1.60	1.80	2.15	.....
26.....	3.60	3.40	7.38	5.09	2.85	2.50	1.42	1.15	1.60	1.80	2.15	.....
27.....	3.60	3.40	7.40	5.04	2.85	2.50	1.42	1.20	1.65	1.80	2.20	.....
28.....	3.60	3.38	7.40	4.72	3.90	2.50	1.42	1.20	1.65	1.80	2.20	.....
29.....	3.60	.....	7.30	4.50	4.10	2.50	1.40	1.25	1.65	1.80	2.20	.....
30.....	3.60	.....	8.04	4.25	4.70	2.50	1.40	1.25	1.65	1.85	2.30	.....
31.....	3.60	.....	9.88	.....	4.65	.....	1.40	1.25	.....	1.90	.....	.....

NOTE.—The following ice conditions prevailed during 1906: River frozen over January 1 to February 22; gage heights are to the top of ice. On February 22 an ice jam formed at the bridge; this went out February 25. November 13 to 18, slush ice was running in the morning; the gage heights were taken in the afternoon, and were probably not affected. November 19 there was ice along edges and anchor ice in the bottom; this ice went out December 11. December 14 to 19 ice formed at night, but went out in the daytime, and probably did not affect gage heights.

*Rating tables for Malheur River at McLaughlin's Bridge, near Vale, Oreg.*JANUARY 1 TO MARCH 31, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.00	270	3.80	755	4.60	1,380	5.40	2,125	6.40	3,610
3.10	320	3.90	825	4.70	1,465	5.50	2,245	6.60	3,970
3.20	375	4.00	900	4.80	1,550	5.60	2,370	6.80	4,350
3.30	430	4.10	975	4.90	1,635	5.70	2,500	7.00	4,750
3.40	490	4.20	1,055	5.00	1,720	5.80	2,640	8.00	7,200
3.50	550	4.30	1,135	5.10	1,810	5.90	2,790	9.00	10,200
3.60	615	4.40	1,215	5.20	1,910	6.00	2,950	10.00	13,250
3.70	685	4.50	1,295	5.30	2,015	6.20	3,270		

APRIL 1 TO DECEMBER 20, 1906.<sup>b</sup>

1.00	5	1.90	215	2.80	630	3.70	1,245	5.20	2,810
1.10	20	2.00	250	2.90	690	3.80	1,325	5.40	3,090
1.20	37	2.10	290	3.00	750	3.90	1,410	5.60	3,380
1.30	56	2.20	330	3.10	815	4.00	1,500	5.80	3,680
1.40	77	2.30	375	3.20	880	4.20	1,690	6.00	4,000
1.50	100	2.40	420	3.30	950	4.40	1,890	7.00	5,900
1.60	125	2.50	470	3.40	1,020	4.60	2,090	8.20	8,150
1.70	155	2.60	520	3.50	1,090	4.80	2,310	9.30	10,650
1.80	185	2.70	575	3.60	1,165	5.00	2,550	10.40	13,250

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6, and is well defined below gage heights 5 feet. The table has been extended by subtracting the discharge of Bully Creek for April 1 from the discharge at Vale.

<sup>b</sup> This table is applicable only for open-channel conditions. It is based on 1 discharge measurement made during 1906 and on the form of the previous curve, and is not well defined.

*Monthly discharge of Malheur River at McLaughlin Bridge, near Vale, Oreg., for 1906.*

[Drainage area, 4,150 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.....	12,900	348	2,000	123,000	0.482	0.56
April.....	13,400	1,740	5,100	303,000	1.23	1.37
May.....	2,200	660	1,220	75,000	.294	.34
June.....	1,500	470	851	50,600	.205	.23
July.....	420	77	190	11,700	.046	.05
August.....	66	5	27.4	1,680	.0066	.01
September.....	140	46	106	6,310	.026	.03
October.....	215	140	165	10,100	.040	.05
November 1-18.....	250	215	236	8,430	.057	.04
December 11-19.....	330	310	319	5,690	.077	.03
The period.....				611,000		

NOTE.—Values are rated as follows: March to June, fair; July to December, approximate.

## MALHEUR RIVER AT VALE, OREG.

This station was established May 20, 1903, at the steel highway bridge one-eighth mile southeast of Vale, Oreg., where a station has been maintained at intervals since 1890. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 126, where are given also references to publications that contain data for previous years.

*Discharge measurements of Malheur River at Vale, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
January 29.....	R. S. Hall.....	102	175	4.45	212
February 15.....	do.....	103	174	4.42	197
February 16.....	do.....	104	185	4.49	228
March 2.....	do.....	122	230	4.93	432
March 24.....	do.....	149	599	6.83	1,990
March 25.....	do.....	165	986	9.30	5,300
March 29.....	do.....	162	1,010	9.54	5,310
April 9.....	do.....	165	1,220	10.82	7,190
April 24.....	do.....	146	792	7.58	2,840
April 26.....	do.....	144	746	7.40	2,670
May 4.....	do.....	127	474	6.12	1,250
June 14.....	do.....	117	292	5.14	591

*Daily gage height, in feet, of Malheur River at Vale, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.39	4.37	5.23	14.34	6.36	6.36	4.30	3.44	3.40	3.68	3.90	4.01
2.....	4.16	4.35	4.95	11.55	6.26	5.88	4.26	3.40	3.40	3.68	3.92	4.01
3.....	4.14	4.31	4.78	9.82	6.20	5.61	4.18	3.40	3.41	3.71	3.93	3.98
4.....	4.40	4.30	4.75	9.52	6.12	5.50	4.14	3.36	3.42	3.72	3.94	3.96
5.....	4.48	4.31	4.74	9.50	6.02	5.58	4.12	3.33	3.44	3.73	3.98	3.97
6.....	4.34	4.66	4.84	9.88	5.95	5.88	4.10	3.32	3.51	3.72	3.99	3.98
7.....	4.49	4.50	4.87	10.51	5.89	5.76	4.03	3.29	3.48	3.74	4.02	4.02
8.....	4.24	4.32	5.36	10.62	5.76	5.85	3.96	3.29	3.50	3.74	4.02	4.12
9.....	4.16	4.43	5.80	10.86	5.64	5.75	3.94	3.28	3.51	3.73	4.04	4.22
10.....	4.18	4.27	6.10	10.54	5.56	5.57	3.90	3.26	3.49	3.72	4.08	4.21
11.....	4.19	4.27	6.35	9.86	5.51	5.46	3.82	3.26	3.50	3.73	4.04	4.22
12.....	4.20	4.28	6.07	8.93	5.61	5.38	3.76	3.30	3.51	3.74	4.04	4.21
13.....	4.20	4.31	5.56	8.52	5.62	5.24	3.72	3.25	3.50	3.74	4.03	4.23
14.....	4.22	4.36	5.18	8.30	5.52	5.18	3.66	3.24	3.50	3.70	4.03	4.22
15.....	4.28	4.41	5.34	8.44	5.40	5.10	3.62	3.25	3.54	3.72	4.05	4.24
16.....	4.20	4.49	5.27	8.49	5.38	5.04	3.55	3.25	3.58	3.73	4.06	4.20
17.....	4.38	4.52	4.68	8.62	5.32	4.98	3.50	3.25	3.58	3.74	4.06	4.15
18.....	4.24	4.52	4.55	8.54	5.26	4.87	3.50	3.24	3.59	3.74	4.05	4.17
19.....	4.25	4.54	4.55	8.23	5.16	4.87	3.51	3.21	3.64	3.75	4.04	4.22
20.....	4.38	4.80	4.76	7.90	5.04	4.75	3.49	3.20	3.63	3.77	4.11	4.20
21.....	4.54	5.28	4.76	7.82	4.98	4.68	3.48	3.20	3.64	3.77	4.12	4.17
22.....	4.36	5.23	4.80	7.79	4.90	4.60	3.34	3.20	3.66	3.81	4.07	4.24
23.....	4.36	5.51	5.09	7.75	4.83	4.53	3.37	3.18	3.64	3.88	4.00	4.21
24.....	4.34	5.21	6.98	7.58	4.78	4.44	3.20	3.20	3.64	3.90	3.92	4.22
25.....	4.33	5.22	9.36	7.47	4.72	4.38	3.38	3.22	3.64	3.92	3.88	4.22
26.....	4.65	4.90	9.48	7.38	4.68	4.38	3.34	3.28	3.63	3.94	3.92	4.22
27.....	4.42	4.82	9.53	7.22	4.64	4.31	3.39	3.30	3.66	3.91	4.00	4.26
28.....	4.46	4.90	9.82	6.96	4.80	4.27	3.50	3.31	3.65	3.90	4.16	4.48
29.....	4.47	.....	9.45	6.60	5.16	4.22	3.50	3.34	3.64	3.90	4.12	4.69
30.....	4.42	.....	10.28	6.44	6.80	4.32	3.50	3.31	3.65	3.89	4.03	4.58
31.....	4.38	.....	12.75	.....	6.93	.....	3.50	3.39	.....	3.90	.....	4.50

NOTE.—River frozen two-thirds across November 22. Ice conditions until December 20. Ice attained a maximum thickness of 10 inches.

*Rating table for Malheur River at Vale, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.20	5	4.40	195	5.50	810	6.70	1,840	8.80	4,330
3.30	9	4.50	235	5.60	880	6.80	1,940	9.00	4,600
3.40	14	4.60	280	5.70	955	6.90	2,045	9.20	4,870
3.50	21	4.70	325	5.80	1,030	7.00	2,150	9.40	5,150
3.60	29	4.80	375	5.90	1,110	7.20	2,370	9.60	5,430
3.70	39	4.90	430	6.00	1,190	7.40	2,595	9.80	5,710
3.80	52	5.00	490	6.10	1,275	7.60	2,825	10.00	6,000
3.90	67	5.10	550	6.20	1,360	7.80	3,060	11.00	7,470
4.00	85	5.20	610	6.30	1,450	8.00	3,300	12.00	8,970
4.10	105			6.40	1,545	8.20	3,550	13.00	10,570
4.20	130	5.30	675	6.50	1,640	8.40	3,810	14.00	12,220
4.30	160	5.40	740	6.60	1,740	8.60	4,070		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1906 and is well defined between gage heights 4.4 feet and 11.0 feet.

*Monthly discharge of Malheur River at Vale, Oreg., for 1906.*

[Drainage area, 4,860 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.....	302	115	174	10,700	0.036	0.04
February.....	817	151	311	17,300	.064	.07
March.....	10,200	258	1,920	118,000	.395	.46
April.....	12,800	1,580	4,550	271,000	.936	1.04
May.....	2,080	298	862	53,000	.177	.20
June.....	1,510	136	589	35,000	.121	.14
July.....	160	5	49.7	3,050	.010	.01
August.....	17	4	8.6	529	.0018	.002
September.....	35	14	25.7	1,530	.0053	.01
October.....	74	37	50.5	3,110	.010	.01
November.....	120	64	89.3	5,310	.018	.02
December.....	320	78	138	8,480	.028	.03
The year.....	12,800	4	731	527,000	.150	2.03

NOTE.—Values are rated as follows: January, November, and December, good; February to June, excellent; July, September, and October, fair; August, approximate.

#### MIDDLE FORK OF MALHEUR RIVER AT RIVERSIDE, OREG.

This station was established January 24, 1906, and was discontinued December 31, 1906, on account of the expense of maintenance. It was located one-half mile above Riverside post-office, and 200 feet above the mouth of South Fork.

The channel is straight; the banks are high and steep. The bed is of gravel and liable to change. There is one channel at all stages.

Discharge measurements were made from a cable.

A chain gage, which was read by J. C. Bloylock, was installed May 8, 1906; length of chain, 15.12 feet. Gage heights previous to this were reduced to the same datum. The bench mark is the highest point of a rock on the left bank near the cable supports, marked B. M.; elevation, 19.41 feet above the gage datum.

The following measurement was made May 9, 1906:

Width, 86 feet; area, 156 feet; gage height, 2.18 feet; discharge, 495 second-feet.

*Daily gage height, in feet, of Middle Fork of Malheur River at Riverside, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		1.9		6.75	2.2	2.2	1.4	0.6	0.6	0.9	0.9	1.2
2.		1.9			2.2	2.1	1.4	.6	.6	.9	1.1	1.2
3.	1.9	1.6			2.2	2.1	1.4	.6	.6	.9	1.1	1.3
4.	1.9	1.6		6.35	2.2	2.2	1.3	.5	.6	.9	1.1	1.2
5.	1.9	1.7			2.2	2.3	1.2	.5	.6	.9	1.1	1.3
6.	1.9	1.8			2.2	2.2	1.2	.5	.6	.9	1.1	1.2
7.	1.9	1.8			2.2	2.2	1.1	.5	.6	.9	1.1	1.2
8.	1.9	1.7		6.35	2.1	2.1	1.1	.5	.6	.9	1.1	1.2
9.	1.9	1.7		6.35	2.2	2.1	1.1	.5	.6	.9	1.1	1.2
10.	1.9	1.8	2.0	6.35	2.2	2.1	1.1	.5	.6	1.0	1.1	1.2
11.	2.0	1.8	1.9	6.35	2.2	2.1	1.0	.5	.6	1.0	1.1	1.2
12.	2.1	1.9	1.8		2.1	2.0	1.0	.5	.6	1.0	1.1	1.2
13.	2.1	1.9	1.7		2.2	2.0	1.0	.5	.6	1.2	1.1	1.2
14.	2.1	1.8	1.6		2.1	1.9	1.0	.5	.7	1.2	1.1	1.1
15.	2.1	1.85			2.1	1.9	.9	.5	.8	.9	1.1	1.2
16.	2.1	1.9			2.1	1.9	.9	.55	.7	.9	1.1	1.2
17.	2.1	1.7			2.0	1.8	1.0	.5	.7	1.0	1.2	1.2
18.	2.2	1.7			2.0	1.8	1.0	.5	.7	1.0	1.2	1.2
19.	2.3	1.7			1.9	1.7	.9	.5	.7	1.0	1.2	1.2
20.	2.3	1.6		3.3	1.8	1.7	.9	.5	.7	1.0	1.2	1.2
21.	2.4	1.7		3.5	1.8	1.6	.9	.5	.7	1.0	1.1	1.2
22.	2.0	1.6	1.8	3.4	1.7	1.6	.9	.5	.8	1.0	1.1	1.2
23.		1.3	2.1	3.4	1.7	1.6	.9	.5	.8	1.0	1.4	1.2
24.	2.0	1.1	3.75	3.0	1.7	1.5	.9	.5	.8	1.0	1.5	1.2
25.	2.0	1.1	4.1	2.9	1.7	1.4	.8	.5	.8	1.0	1.4	1.3
26.	2.0		3.8	2.9	1.6	1.4	.8	.5	.8	1.0	1.4	1.7
27.	2.1		4.15	2.7	1.8	1.6	.8	.5	.8	1.0	1.3	1.8
28.	2.1		4.2	2.6	2.1	1.5	.8	.5	.9	1.0	1.2	1.6
29.	2.0		4.2	2.4	2.5	1.4	.7	.6	.9	1.0	1.2	1.5
30.	2.0		6.75	2.2	2.8	1.5	.7	.6	.9	1.0	1.2	1.5
31.	1.9				2.5		.7	.6		.9		1.3

#### BULLY CREEK ABOVE VALE, OREG.

This station was established January 27, 1905. It is near the location of the original station on Bully Creek, one-fourth mile below Warm Springs stage station, 15 miles above Vale, Oreg. To replace the former bench mark, which had been destroyed, a new one was established May 6, 1906, as follows: A small shoulder cut in rock on upper side of road 6.2 feet upstream from gage; elevation, 6.82 feet above gage datum. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 137, where are given also references to publications that contain data for previous years.

*Discharge measurements of Bully Creek above Vale, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	Sq. ft.	Feet.	Sec.-ft.
January 28.	R. S. Hall.	13	6.7	2.03	7.8
March 26.	do	77	128	3.98	579
March 27.	do	78	176	4.60	1,100
March 28.	do	79	151	4.19	826
March 29.	do	79	172	4.58	1,010
April 10.	do	78	123	3.88	704
April 11.	do	68	115	3.70	567
May 5.	do	39	43	2.00	52
June 15.	do	33	35	1.70	20

*Daily gage height, in feet, of Bully Creek above Vale, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.18	2.18	2.14	5.00	2.50	2.18	1.46	1.30	1.30	1.30	1.30	1.50
2.....	2.18	2.20	2.14	4.20	2.40	2.12	1.50	1.30	1.30	1.30	1.30	1.50
3.....	2.16	2.24	2.16	4.00	2.30	2.12	1.50	1.30	1.30	1.30	1.30	1.50
4.....	2.15	2.26	2.18	3.70	2.20	2.14	1.50	1.30	1.30	1.30	1.30	1.50
5.....	2.12	2.28	2.20	4.20	2.00	2.18	1.50	1.30	1.30	1.30	1.30	1.52
6.....	2.12	2.30	2.20	4.50	2.00	2.18	1.50	1.30	1.30	1.30	1.30	1.52
7.....	2.12	2.26	2.30	4.30	1.96	2.18	2.00	1.30	1.30	1.30	1.32	1.52
8.....	2.14	2.20	2.36	4.00	1.90	2.10	1.80	1.30	1.30	1.30	1.32	1.54
9.....	2.14	2.10	2.65	4.30	1.80	2.00	1.70	1.30	1.30	1.30	1.34	1.54
10.....	2.16	2.08	2.80	3.80	1.76	1.90	1.60	1.30	1.30	1.30	1.34	1.56
11.....	2.16	2.00	2.60	3.60	2.10	1.86	1.52	1.30	1.30	1.30	1.36	1.56
12.....	2.16	2.00	2.60	3.50	2.18	1.84	1.50	1.30	1.30	1.30	1.40	1.56
13.....	2.16	2.00	2.60	3.30	2.18	1.80	1.44	1.30	1.30	1.30	1.44	1.54
14.....	2.16	2.08	2.58	3.30	2.10	1.70	1.40	1.30	1.30	1.30	1.46	1.54
15.....	2.14	2.10	2.54	3.20	2.00	1.60	1.40	1.30	1.30	1.30	1.46	1.54
16.....	2.14	2.10	2.40	3.20	2.00	1.64	1.40	1.20	1.30	1.30	1.48	1.52
17.....	2.12	2.10	2.40	3.10	1.90	1.70	1.40	1.30	1.30	1.30	1.48	1.52
18.....	2.12	2.10	2.40	3.10	1.90	1.70	1.40	1.30	1.30	1.30	1.48	1.54
19.....	2.10	2.10	2.50	3.00	1.80	1.70	1.40	1.30	1.30	1.30	1.50	1.54
20.....	2.08	2.10	2.50	3.00	1.80	1.68	1.40	1.30	1.30	1.30	1.50	1.54
21.....	2.06	2.10	2.54	3.00	1.80	1.68	1.40	1.30	1.30	1.30	1.50	1.56
22.....	2.08	2.10	2.80	3.00	1.78	1.66	1.40	1.30	1.30	1.30	1.50	1.56
23.....	2.08	2.10	3.00	2.80	1.78	1.64	1.40	1.30	1.30	1.30	1.50	1.56
24.....	2.10	2.10	4.30	2.80	1.74	1.64	1.38	1.30	1.30	1.30	1.50	1.56
25.....	2.10	2.10	4.10	2.80	1.74	1.60	1.36	1.30	1.30	1.30	1.50	1.56
26.....	2.10	2.10	4.10	2.60	1.72	1.60	1.34	1.30	1.30	1.30	1.50	1.56
27.....	2.10	2.12	4.50	2.60	1.72	1.58	1.30	1.30	1.30	1.30	1.50	1.56
28.....	2.12	2.10	4.30	2.60	1.72	1.58	1.30	1.30	1.30	1.30	1.50	1.56
29.....	2.12	.....	4.30	2.60	1.80	1.56	1.30	1.30	1.30	1.30	1.50	1.56
30.....	2.14	.....	4.90	2.50	2.20	1.50	1.30	1.30	1.30	1.30	1.50	1.54
31.....	2.16	.....	6.10	.....	2.20	.....	1.30	.....	1.30	.....	.....	1.52

NOTE.—Creek was frozen December 12 to 31; discharges not corrected.

*Rating tables for Bully Creek above Vale, Oreg.*

JANUARY 1 TO MARCH 31, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.60	0.0	2.40	42	3.20	238	4.00	620	4.80	1,195
1.70	.3	2.50	56	3.30	274	4.10	680	4.90	1,275
1.80	2	2.60	74	3.40	313	4.20	745	5.00	1,360
1.90	6	2.70	96	3.50	355	4.30	815	5.20	1,540
2.00	11	2.80	120	3.60	400	4.40	885	5.40	1,750
2.10	17	2.90	146	3.70	450	4.50	960	5.60	1,980
2.20	24	3.00	174	3.80	505	4.60	1,035	5.80	2,230
2.30	32	3.10	205	3.90	560	4.70	1,115	6.00	2,500

APRIL 1 TO DECEMBER 31, 1906.<sup>b</sup>

1.30	3	2.00	50	2.70	190	3.40	425	4.20	845
1.40	4	2.10	65	2.80	215	3.50	470	4.40	975
1.50	7	2.20	80	2.90	245	3.60	515	4.60	1,110
1.60	12	2.30	100	3.00	275	3.70	565	4.80	1,250
1.70	19	2.40	120	3.10	310	3.80	615	5.00	1,400
1.80	28	2.50	140	3.20	345	3.90	670		
1.90	38	2.60	165	3.30	385	4.00	725		

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is not well defined.

<sup>b</sup> This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is fairly well defined.

*Monthly discharge of Bully Creek above Vale, Oreg., for 1906.*

[Drainage area, 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.
January.....	23	15	18.9	1,160	0.029	0.03
February.....	32	11	19.2	1,070	.030	.03
March.....	2,640	20	324	19,900	.498	.57
April.....	1,400	140	173.0	23,100	.728	.81
May.....	140	21	50.6	3,110	.078	.09
June.....	77	7	33.7	2,010	.052	.06
July.....	50	3	7.61	468	.012	.01
August.....	3	3	3.0	184	.0046	.01
September.....	3	3	3.0	179	.0046	.01
October.....	3	3	3.0	184	.0046	.01
November.....	7	3	5.23	311	.0080	.01
December.....	10	7	8.94	550	.014	.02
The year.....	2,640	3	79.2	57,200	.122	1.66

NOTE.—Values are rated as follows: January to March and July to December, approximate; April to June, good.

**BULLY CREEK AT VALE, OREG.**

This station was discontinued as a permanent gaging station on December 31, 1905. The conditions and the bench marks are described in Water-Supply Paper No. 178, page 140, where are given also references to publications that contain data for previous years.

A number of measurements were made during 1906, as follows:

*Discharge measurements of Bully Creek at Vale, Oreg., in 1906.*

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
January 29.....	15	6.7	3.22	8.5	March 24.....	45	97	5.52	435
February 15.....	14	8.3	3.30	11	November 28 <sup>a</sup> ..	.....	.....	.....	3
March 3.....	14	10	3.36	16					

<sup>a</sup> Estimated at low water; frozen.

**WILLOW CREEK NEAR MALHEUR, OREG.**

This station was established November 4, 1904, and was discontinued August 15, 1906. It is located at Beer's ranch, about 5 miles from Malheur, on the road to Huntington, Oreg. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 141, where are given also references to publications that contain data for previous years.

The following measurement was made April 5, 1906:

Width, 36 feet; area, 79 square feet; gage height, 4.75 feet; discharge, 355 second-feet.

*Daily gage height, in feet, of Willow Creek near Malheur, Oreg., for 1906.*

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1.....		5.0	1.9	1.9	1.0	0.2	17.....		2.9	0.8	1.5		
2.....		4.0	1.9	1.8	1.0		18.....		2.9	.8	1.25		
3.....		3.9	1.8	1.8	1.0		19.....		2.7	.8	1.0		
4.....		5.0	1.5	1.7		.2	20.....		2.8	1.3	.9	0.4	
5.....		5.1	1.3	1.7	.7	.2	21.....		2.7	1.4	.95	.4	
6.....		5.1	1.3	1.8	.7	.2	22.....		2.6	1.4	.5	.4	
7.....		5.1	1.2	1.9	.7	.2	23.....	1.3	2.6	1.8	.6	.4	
8.....		4.7	1.2	1.9	.7	.2	24.....	3.8	2.5	1.8	.5		
9.....		4.3	1.2	1.9	.7	.2	25.....	2.5	2.5	1.9	.5		
10.....		4.0	1.2	1.3	.7	.2	26.....	2.5	2.5	1.9	.8		
11.....		3.7	1.0	1.4	.65		27.....	3.0	2.5	1.9	.9	.4	
12.....		3.3	1.0		.65		28.....	3.0	2.4	1.9	.9	.3	
13.....		3.0	1.0		.65	.2	29.....	3.5	2.3	1.9	.8	.3	
14.....		2.9	.9	1.3	.8	.2	30.....	4.1	2.1	1.9	1.0		
15.....		2.9	.9	1.3	.7		31.....	4.7		1.9			
16.....		2.9	.9	1.3	.55								

*Rating table for Willow Creek near Malheur, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.20	0	1.10	16	2.00	64	2.90	137	3.80	235
.30	.5	1.20	20	2.10	71	3.00	147	3.90	247
.40	1.2	1.30	24	2.20	78	3.10	157	4.00	259
.50	2.2	1.40	29	2.30	86	3.20	167	4.20	283
.60	3.5	1.50	34	2.40	94	3.30	178	4.40	309
.70	5.0	1.60	39	2.50	102	3.40	189	4.60	335
.80	7.0	1.70	45	2.60	110	3.50	200	4.80	361
.90	9.5	1.80	51	2.70	119	3.60	211	5.00	388
1.00	12.5	1.90	57	2.80	128	3.70	223		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is fairly well defined below gage height 2 feet.

*Monthly discharge of Willow Creek near Malheur, Oreg., for 1906.*

[Drainage area, 259 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.....	348	24	175	3,120	0.676	0.23
April.....	402	71	196	11,700	.757	.84
May.....	57	7	32.2	1,980	.124	.14
June.....	57	2.2	26.5	1,580	.102	.11
July.....	12.5	0	3.90	240	.015	.02
August 1-14.....	0	0	0	0	0	0
The period.....				18,600		

NOTE.—Values are rated as good.

#### WILLOW CREEK NEAR DELL, OREG.

This station was established May 12, 1904, and was discontinued July 16, 1906, on account of unfavorable conditions. It is located at a bridge at Cole's ranch near Dell, Oreg., 28 miles above Vale. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 143, where are given also references to publications that contain data for previous years.

*Discharge measurements of Willow Creek near Dell, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 5 <sup>a</sup> .....	R. S. Hall.....	8.7	6.1	2.09	10
March 27.....	do.....	63	173	5.80	371
March 27.....	do.....	62	132	5.00	261
March 28.....	do.....	54	91	4.53	175
April 25.....	do.....	45	57	4.17	108
June 15.....	do.....	46	24	3.11	36

<sup>a</sup> Measured by wading.*Daily gage height, in feet, of Willow Creek near Dell, Oreg., for 1906.*

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Feb.	Mar.	Apr.	May.	June.	July.
1.....		2.2	6.75	3.4	3.4	2.7	17.....		3.0	4.5	3.0	3.1	2.5
2.....		2.2	6.5	3.4	3.6	2.7	18.....		3.1	4.4	2.6	3.0	2.5
3.....		2.3	5.75	3.2	4.0	2.75	19.....		2.9	4.4	2.75	3.0	
4.....		2.2	5.9	3.3	4.0	2.5	20.....		3.1	4.4	2.6	3.0	
5.....		2.1	6.4	3.1	3.7	2.6	21.....	2.1	3.0	4.5	2.9	2.9	
6.....		2.1	6.1	3.0	3.7	2.6	22.....	2.15	2.6	4.6	3.0	2.9	
7.....		2.2	6.0	2.9	3.6	2.6	23.....	2.2	3.1	4.4	3.6	2.8	
8.....		2.6	6.1	3.1	3.5	2.5	24.....	2.2	5.8	4.5	3.7	2.6	
9.....		2.8	6.0	3.0	3.6	2.6	25.....	2.2	5.6	4.5	4.0	2.5	
10.....		2.7	5.9	3.2	3.6	2.5	26.....	2.1	5.2	4.0	4.1	3.1	
11.....		2.5	5.6	4.0	3.7	2.6	27.....	2.2	6.15	4.2	4.0	2.8	
12.....		2.6	5.4	4.2	3.5	2.6	28.....	2.1	5.6	4.0	4.1	2.8	
13.....		2.4	5.5	4.2	3.4	2.6	29.....		6.0	3.6	4.0	2.75	
14.....		2.1	5.4	4.2	3.3	2.5	30.....		5.5	3.5	3.4	2.8	
15.....		2.4	5.1	3.0	3.2	2.6	31.....		6.8		3.7		
16.....		3.0	4.6	3.0	3.15	2.5							

*Rating table for Willow Creek near Dell, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.10	7	2.90	32	3.70	79	4.50	156	5.60	345
2.20	9	3.00	37	3.80	87	4.60	168	5.80	395
2.30	11	3.10	42	3.90	95	4.70	181	6.00	445
2.40	14	3.20	47	4.00	104	4.80	195	6.20	500
2.50	17	3.30	53	4.10	113	4.90	210	6.40	560
2.60	20	3.40	59	4.20	123	5.00	225	6.60	620
2.70	24	3.50	65	4.30	133	5.20	260	6.80	680
2.80	28	3.60	72	4.40	144	5.40	300		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1906, and is fairly well defined.

*Monthly discharge of Willow Creek near Dell, Oreg., for 1906.*

[Drainage area, 455 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 21-28.....	9	7	8.12	129	0.018	0.01
March.....	680	7	122	7,500	.238	.31
April.....	665	65	279	16,600	.613	.68
May.....	123	20	64.5	3,970	.142	.16
June.....	104	17	52.0	3,090	.114	.13
July 1-18.....	26	17	19.6	700	.033	.03
The period.....				32,000		

NOTE.—Values are rated as fair.

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POWDER RIVER AT SALISBURY, OREG.<sup>a</sup>

This station was established December 20, 1903. It is located 10 miles above Baker City, Oreg., and one-fourth mile below Salisbury, a station on the Sumpter Valley Railway. The station is above all important diversions and above the point where the river enters the valley which surrounds Baker City. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 148, where are given also references to publications that contain data for previous years.

*Discharge measurements of Powder River at Salisbury, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 9 <sup>a</sup> .....	R. S. Hall.....	27	24	2.25	45
March 9 <sup>a</sup> .....	do.....	24	23	2.28	48
April 14.....	do.....	40	88	3.80	368
April 23.....	do.....	43	119	4.55	655
May 14.....	do.....	40	79	3.60	321
June 12.....	do.....	41	74	3.42	297
November 30 <sup>b</sup> .....	Stevens and McGlashan.....	35	32	2.38	25

<sup>a</sup> Slush ice running.

<sup>b</sup> Ice measurement; 15 feet of open channel.

*Daily gage height, in feet, of Powder River at Salisbury, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.1	2.05	2.15	4.05	4.15	3.35	2.65	2.0	1.8	1.8	1.95	2.5
2.....	2.1	2.05	2.15	4.2	4.05	3.25	2.55	2.05	1.75	1.75	2.0	2.35
3.....	2.05	2.1	2.15	3.55	4.15	3.3	2.6	1.85	1.75	1.7	2.1	2.35
4.....	2.05	2.1	2.15	3.65	4.25	3.4	2.45	1.85	1.75	1.75	2.15	2.45
5.....	2.05	2.1	2.15	4.3	4.15	3.5	2.4	1.8	1.75	1.8	2.25	2.45
6.....	2.05	2.15	2.15	4.95	3.75	3.5	2.35	1.9	1.7	1.75	2.25	2.45
7.....	2.05	2.15	2.15	5.0	4.05	3.4	2.35	1.85	1.75	1.8	2.2	2.5
8.....	2.05	2.15	2.2	4.5	4.05	3.4	2.35	1.9	1.75	1.8	2.3	2.5
9.....	2.1	2.2	2.2	4.25	4.05	3.3	2.3	1.85	1.8	1.7	2.25	2.45
10.....	2.1	2.2	2.25	4.1	3.85	3.4	2.25	1.8	1.7	1.75	2.2	2.45
11.....	2.1	2.2	2.15	4.2	3.7	3.35	2.25	1.85	1.8	1.75	2.25	2.55
12.....	2.1	2.2	2.1	3.95	3.7	3.45	2.25	1.85	1.85	1.75	2.35	2.45
13.....	2.1	2.2	2.1	3.9	3.65	3.4	2.3	1.75	1.75	1.8	2.35	2.45
14.....	2.05	2.25	2.2	4.05	3.55	3.35	2.25	1.7	1.8	1.75	2.25	2.55
15.....	2.05	2.25	2.25	4.15	3.35	3.25	2.3	1.75	1.75	1.75	2.15	2.5
16.....	2.05	2.3	2.25	4.25	3.4	3.35	2.25	1.7	1.75	1.85	2.05	2.65
17.....	2.0	2.35	2.2	4.05	3.15	3.35	2.2	1.65	1.75	1.85	2.05	2.65
18.....	2.0	2.35	2.25	4.15	3.05	3.25	2.1	1.65	1.75	1.8	2.05	2.65
19.....	2.1	2.35	2.35	3.95	3.05	3.25	2.1	1.65	1.75	1.7	1.95	2.45
20.....	2.15	2.4	2.45	4.05	3.15	3.05	2.05	1.75	1.75	1.8	2.10	2.3
21.....	2.15	2.45	2.4	4.05	3.15	3.15	2.1	1.8	1.7	1.8	2.15	2.35
22.....	2.15	2.45	2.45	4.7	3.15	3.1	2.05	1.75	1.75	1.8	2.25	2.45
23.....	2.1	2.45	2.45	4.55	3.15	3.05	2.1	1.85	1.75	1.8	2.3	2.45
24.....	2.1	2.4	2.65	4.45	3.05	2.95	2.05	1.85	1.75	1.9	2.4	2.5
25.....	2.1	2.25	3.0	4.25	3.05	3.1	2.0	1.75	1.7	1.95	2.3	2.6
26.....	2.1	2.2	3.15	4.1	3.15	3.15	2.05	1.75	1.75	1.95	2.3	2.65
27.....	2.1	2.1	3.5	3.6	3.1	3.05	2.05	1.7	1.75	1.95	2.3	2.65
28.....	2.15	2.15	3.5	3.55	3.25	2.95	2.05	1.8	1.8	1.9	2.25	2.55
29.....	2.15	.....	3.6	3.45	3.15	2.85	2.0	1.75	1.8	1.9	2.3	2.45
30.....	2.1	.....	4.2	3.95	3.15	2.7	1.9	1.75	1.7	1.85	2.4	2.45
31.....	2.1	.....	4.55	.....	3.25	.....	1.9	1.75	.....	1.85	.....	2.4

NOTE.—The river was frozen January 1 to about February 24 and November 19 to December 31. The gage heights of this stream vary somewhat during the day on account of placer mining upstream.

<sup>a</sup> Formerly known as Powder River near Baker City.

*Rating tables for Powder River at Salisbury, Oreg.*OPEN-CHANNEL CONDITIONS, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.60	4	2.20	38	2.80	120	3.40	267	4.00	469
1.70	7	2.30	48	2.90	140	3.50	299	4.20	537
1.80	11	2.40	60	3.00	161	3.60	333	4.40	605
1.90	16	2.50	72	3.10	184	3.70	367	4.60	673
2.00	22	2.60	86	3.20	209	3.80	401	4.80	741
2.10	30	2.70	102	3.30	237	3.90	435	5.00	810

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906, and is well defined between gage heights 1.7 feet and 4.6 feet.

ICE CONDITIONS, 1906.<sup>b</sup>

1.95	9	2.10	15	2.30	23	2.50	32	2.70	42
2.00	11	2.20	19	2.40	27	2.60	37		

<sup>b</sup> This table is applicable only for ice conditions. It is based on 3 discharge measurements made at times of ice obstruction during 1904-1906, and is not well defined.

*Monthly discharge of Powder River at Salisbury, Oreg., for 1906.*

[Drainage area, 275 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.....	17	11	14.5	892	0.053	0.06
February.....	43	13	23.1	1,280	.084	.09
March.....	656	30	114	7,010	.415	.48
April.....	810	283	513	30,500	1.87	2.09
May.....	554	172	312	19,200	1.13	1.30
June.....	299	102	222	13,200	.807	.90
July.....	94	16	41.8	2,570	.152	.18
August.....	26	5	11.1	682	.040	.05
September.....	13	7	9.2	547	.033	.04
October.....	19	7	11.6	713	.042	.05
November.....	54	9	30.5	1,810	.111	.12
December.....	40	23	31.7	1,950	.115	.13
The year.....	810	5	111	80,400	.404	5.49

NOTE.—Values are rated as follows: January, February, November, and December, fair; March to October, good.

## GRANDE RONDE RIVER AT HILGARD, OREG.

This station was established November 6, 1903. It is located at the county highway bridge one-half mile below the Oregon Railroad and Navigation Company station at Hilgard, Oreg. It is just below the mouth of Five Points Creek, which is the first important tributary above Grande Ronde Valley. There are two dams about 20 miles upstream, used to flood the river during the log-driving season. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 150, where are given also references to publications that contain data for previous years.

Gage heights observed during 1906 are of no value as an index of discharge, on account of obstruction and backwater from log jams.

*Discharge measurements of Grande Ronde River at Hilgard, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 10.....	R. S. Hall.....	108.5	371	5.18	745
April 3.....	do.....	102	378	4.88	1,140
May 16 <sup>a</sup> .....	do.....	70	370	6.74	657
June 22.....	do.....	70	242	3.74	238
December 4 <sup>b</sup> ..	Stevens and McGlashan.....	70	181	3.02	66

<sup>a</sup> Backwater from log jam. <sup>b</sup> Ice measurements.

## GRANDE RONDE RIVER AT ELGIN, OREG.

This station was established November 20, 1903. It is located at the lower end of the Grande Ronde Valley at the county bridge on the road from Elgin to Wallowa, Oreg., and is one-fourth mile east of the railroad station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 153, where are given also references to publications that contain data for previous years.

*Discharge measurements of Grande Ronde River at Elgin, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 18.....	R. S. Hall.....	95	367	3.34	1,030
June 29.....	do.....	94	334	2.93	666
December 10 <sup>a</sup> ..	Stevens and McGlashan.....	90	310	2.20	290

<sup>a</sup> Narrow strip of ice on each bank.*Daily gage height, in feet, of Grande Ronde River at Elgin, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.9	2.0	2.55	5.45	4.2	5.75	3.0	1.55	1.5	1.7	.....	2.05
2.....	1.85	1.9	2.5	5.4	4.2	5.75	2.6	1.55	1.5	1.7	1.85	2.05
3.....	1.9	1.95	2.45	5.2	4.2	5.8	2.6	1.5	1.5	1.7	1.85	2.0
4.....	1.95	1.95	2.45	5.0	4.15	5.75	2.6	1.55	1.5	1.7	1.9	2.0
5.....	1.85	1.9	2.45	4.8	4.0	5.7	2.5	1.55	1.5	1.7	2.0	2.0
6.....	1.9	1.95	2.4	4.7	3.95	5.5	2.5	1.55	1.5	1.7	2.0	2.05
7.....	1.9	2.0	2.45	4.75	3.95	5.5	2.45	1.55	.....	1.7	2.0	2.1
8.....	1.9	1.95	2.9	4.9	3.8	5.45	2.35	1.55	1.5	1.7	2.05	2.2
9.....	1.85	1.9	3.1	5.0	3.75	5.3	2.5	1.5	1.5	1.7	2.05	2.2
10.....	1.9	1.9	3.45	5.1	3.7	5.1	2.35	1.5	1.5	1.7	2.05	2.25
11.....	1.9	.....	3.5	5.0	3.75	4.9	.....	1.5	1.5	1.7	.....	2.3
12.....	2.0	1.9	3.25	4.85	3.7	4.3	2.1	1.55	1.55	1.7	.....	.....
13.....	1.9	1.9	2.9	4.7	3.7	4.5	2.0	1.5	1.6	1.75	2.05	2.3
14.....	1.95	1.95	2.65	4.5	3.6	4.3	2.0	1.5	1.65	1.75	2.2	2.25
15.....	1.95	2.0	2.5	4.7	3.6	4.2	1.9	1.5	1.7	.....	2.5	2.1
16.....	2.0	2.05	2.6	4.5	3.6	4.2	1.9	1.5	1.7	1.75	2.6	2.1
17.....	2.0	2.2	2.5	4.5	3.6	4.2	1.85	1.5	1.75	1.8	2.6	.....
18.....	2.0	2.65	2.45	4.5	3.45	4.05	1.85	1.5	1.8	1.8	2.5	2.15
19.....	1.95	2.6	2.45	4.5	3.2	3.85	1.8	1.5	1.8	1.8	2.35	2.25
20.....	1.95	2.85	2.45	4.5	3.15	3.75	.....	1.5	1.8	1.75	2.3	2.7
21.....	1.9	2.8	2.4	4.5	3.0	3.6	1.7	1.5	1.8	1.8	2.1	3.1
22.....	1.95	2.8	2.5	4.7	3.0	3.5	1.65	1.5	1.75	1.8	2.0	3.1
23.....	1.95	2.75	2.8	4.9	3.0	3.3	1.65	1.5	1.75	1.8	2.2	3.3
24.....	2.0	2.65	3.8	4.8	3.0	3.25	1.65	1.5	1.7	1.8	2.1	3.45
25.....	2.1	2.65	4.2	4.75	3.0	3.2	1.65	1.5	1.7	1.8	2.1	3.9
26.....	.....	2.6	4.5	4.6	3.0	3.1	.....	1.5	1.7	1.8	2.1	4.3
27.....	2.2	2.7	4.8	4.5	2.9	3.0	1.65	1.5	1.7	.....	2.1	4.4
28.....	2.1	2.65	4.9	.....	2.9	3.1	1.65	1.5	1.7	1.8	2.1	4.85
29.....	2.0	.....	.....	4.35	3.3	3.0	1.6	1.5	1.75	1.8	1.95	4.0
30.....	2.0	.....	5.1	4.1	4.45	2.9	1.6	1.5	1.75	1.8	2.0	3.85
31.....	1.95	.....	5.45	.....	4.7	.....	1.6	1.5	.....	1.8	.....	3.7

NOTE.—There was some ice obstruction during November and December.

*Rating table for Grande Ronde River at Elgin, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.50	45	2.20	260	2.90	640	3.60	1,340	4.60	3,020
1.60	67	2.30	305	3.00	710	3.70	1,480	4.80	3,380
1.70	92	2.40	350	3.10	790	3.80	1,630	5.00	3,740
1.80	120	2.50	400	3.20	880	3.90	1,790	5.20	4,100
1.90	150	2.60	455	3.30	980	4.00	1,960	5.40	4,460
2.00	185	2.70	515	3.40	1,090	4.20	2,300	5.60	4,820
2.10	220	2.80	575	3.50	1,210	4.40	2,660	5.80	5,200

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 below gage height 3.5 feet.

*Monthly discharge of Grande Ronde River at Elgin, Oreg., for 1906.*

[Drainage area, 1,350 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January.....	260	135	172	10,600	0.127	0.15
February.....	608	150	293	16,300	.217	.23
March.....	4,550	350	1,230	75,600	.911	1.05
April.....	4,550	2,130	3,270	195,000	2.42	2.70
May.....	3,200	640	1,440	88,500	1.07	1.23
June.....	5,200	640	2,670	159,000	1.98	2.21
July.....	710	67	220	13,500	.163	.19
August.....	56	45	47.8	2,940	.035	.04
September.....	120	45	78.4	4,670	.058	.06
October.....	120	92	107	6,580	.079	.09
November.....	455	128	235	14,000	.174	.19
December.....	2,660	185	756	46,500	.560	.65
The year.....	5,200	45	877	603,000	.650	8.79

NOTE.—Discharges have been interpolated for days when the gage was not read. November and December have been applied as for open channel. Values are rated as follows: January, February, July, and October to December, fair; March to June, good; August and September, approximate.

## GRANDE RONDE RIVER AT ZINDEL, WASH.

This station was established June 30, 1904. It is located at Zindel Ferry, 2 miles above the mouth of the river and  $1\frac{1}{2}$  miles below Joseph Creek. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 155, where are given also references to publications that contain data for previous years.

The following measurement was made by floats December 22, 1906:

Width, 224 feet; area, 1,310 square feet; gage height, 5.60 feet; discharge, 8,400 second-feet.

*Daily gage height, in feet, of Grande Ronde River at Zindel, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.2	2.45	3.5	6.4	5.1	6.0	3.9	2.2	2.1	2.1	2.35	3.0
2.....	2.2	2.3	3.3	6.0	5.1	5.8	3.9	2.2	2.1	2.1	2.35	3.0
3.....	2.2	2.25	3.3	5.8	5.0	5.7	3.8	2.2	2.1	2.1	2.3	3.0
4.....	2.3	2.3	3.3	5.5	5.1	5.9	3.8	2.2	2.2	2.2	2.3	3.0
5.....	2.3	2.35	3.5	5.5	5.0	5.8	3.8	2.2	2.2	2.2	2.3	3.0
6.....	2.3	2.35	3.5	5.7	4.8	5.8	3.8	2.2	2.2	2.2	2.3	2.9
7.....	2.3	2.35	3.5	5.9	4.7	5.8	3.8	2.2	2.2	2.2	2.6	2.9
8.....	2.3	2.3	3.5	5.9	4.7	5.7	3.75	2.2	2.2	2.2	3.35	3.0
9.....	2.3	2.3	3.9	6.0	4.7	5.7	3.6	2.2	2.2	2.2	3.3	3.1
10.....	2.3	2.25	4.2	5.9	4.9	5.5	3.6	2.2	2.2	2.2	3.1	3.2
11.....	2.3	2.25	4.1	5.8	5.1	5.5	3.6	2.2	2.1	2.2	3.0	3.2
12.....	2.3	2.3	3.9	5.2	5.0	5.7	3.55	2.2	2.1	2.2	3.1	3.4
13.....	2.35	2.3	3.7	5.2	4.8	5.7	3.5	2.4	2.2	2.2	3.4	3.4
14.....	2.35	2.3	3.2	5.1	4.7	5.2	3.25	2.2	2.2	2.2	6.85	3.1
15.....	2.2	2.3	3.2	5.2	4.5	4.9	3.0	2.2	2.2	2.2	6.85	3.1
16.....	2.2	2.5	3.2	5.3	4.2	5.2	3.0	2.2	2.2	2.25	5.8	3.1
17.....	2.25	2.5	2.8	5.0	4.2	5.0	3.0	2.2	2.1	2.25	5.1	3.0
18.....	2.25	2.8	3.0	5.3	4.0	4.8	2.9	2.2	2.1	2.25	4.5	3.0
19.....	2.3	3.9	2.9	5.3	4.0	4.6	2.8	2.2	2.15	2.25	4.1	3.1
20.....	2.3	3.9	2.9	5.3	4.0	4.4	2.7	2.2	2.15	2.25	3.9	3.3
21.....	2.3	3.55	2.9	5.5	4.0	4.3	2.7	2.05	2.15	2.25	3.9	5.65
22.....	2.3	3.7	3.1	6.0	4.0	4.2	2.6	2.0	2.15	2.25	3.6	5.6
23.....	2.4	3.8	3.1	6.0	3.9	4.1	2.55	2.0	2.15	2.25	3.5	5.1
24.....	2.4	3.8	3.4	6.0	3.9	4.0	2.55	2.2	2.15	2.25	3.3	5.1
25.....	2.5	3.6	4.9	5.6	3.9	3.9	2.4	2.2	2.1	2.25	3.3	4.9
26.....	2.6	3.45	5.2	5.6	3.8	3.9	2.4	2.2	2.1	2.25	3.1	5.8
27.....	2.55	3.7	5.6	5.6	3.8	3.8	2.4	2.2	2.1	2.3	3.1	5.9
28.....	2.4	3.5	5.7	5.4	3.8	3.8	2.3	2.2	2.1	2.45	3.0	5.7
29.....	2.4	.....	5.8	5.0	4.1	3.8	2.3	2.1	2.1	2.45	3.0	5.4
30.....	2.4	.....	5.8	5.1	4.8	3.8	2.3	2.1	2.1	2.4	3.0	5.3
31.....	2.4	.....	6.1	.....	5.6	.....	2.2	2.1	.....	2.4	.....	5.0

#### CATHERINE CREEK NEAR UNION, OREG.

This station was established May 15, 1906. It is located in the canyon at the head of a fertile valley 6 miles above Union.

Discharge measurements are made from a highway bridge just below Robbins's sawmill, where there is a dam that affects the flow somewhat.

The gage is read by H. D. Drake, who is paid by the citizens of Union. It is a vertical staff attached to the downstream side of the bridge. The bench mark is the head of a spike driven into the top of the downstream end of log-tying at the end of the bridge; elevation, 7.67 feet above the datum of the gage.

*Discharge measurements of Catherine Creek near Union, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
April 29.....	R. S. Hall.....	Feet. 38	Sq. ft. 68	Feet. 3.20	Sec.-ft. 335
May 15.....	do.....	38	68	3.30	378
June 24.....	do.....	37.5	61	3.10	276
December 14...	Stevens and McGlashan.....	39	51	2.80	54

<sup>a</sup> Channel obstructed by anchor ice.

*Daily gage height, in feet, of Catherine Creek near Union, Oreg., for 1906.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		3.5	2.9	2.1	2.1	2.0	2.0	2.5
2.....		3.7	2.8	2.1	2.1	2.0	2.0	2.6
3.....		3.8	2.8	2.1	2.1	2.1	2.1	2.6
4.....		4.0	2.8	2.1	2.0	2.1	2.1	2.8
5.....		3.9	2.8	2.1	2.0	2.1	2.2	2.5
6.....		3.8	2.7	2.1	2.0	2.0	2.1	2.3
7.....		3.7	2.7	2.1	2.0	2.0	2.2	2.3
8.....		3.5	2.7	2.1	2.0	2.0	2.2	2.2
9.....		3.5	2.6	2.1	2.0	2.0	2.2	2.2
10.....		3.5	2.6	2.1	2.0	2.0	2.2	2.2
11.....		3.6	2.6	2.1	2.0	2.0	2.2	2.3
12.....		3.6	2.5	2.1	2.0	2.1	2.2	2.3
13.....		3.5	2.5	2.1	2.1	2.0	3.1	2.2
14.....		3.4	2.5	2.1	2.1	2.0	3.6	2.2
15.....	3.3	3.3	2.4	2.1	2.1	2.0	3.0	2.2
16.....	3.2	3.3	2.4	2.1	2.1	2.0	2.7	2.2
17.....	3.1	3.3	2.4	2.1	2.1	2.0	2.6	2.2
18.....	3.0	3.3	2.4	2.1	2.1	2.0	2.5	2.2
19.....	3.0	3.2	2.4	2.1	2.0	2.0	2.7	2.2
20.....	3.0	3.1	2.3	2.1	2.0	2.0	2.5	2.3
21.....	3.0	3.1	2.3	2.1	2.0	2.0	2.5	2.3
22.....	3.0	3.1	2.3	2.1	2.0	2.0	2.4	2.4
23.....	3.0	3.0	2.3	2.1	2.0	2.0	2.3	2.5
24.....	3.0	3.0	2.3	2.1	2.0	2.0	2.2	2.6
25.....	3.0	3.0	2.3	2.1	2.0	2.0	2.3	2.7
26.....	3.1	3.0	2.3	2.1	2.0	2.1	2.5	3.0
27.....	3.1	3.1	2.2	2.1	2.0	2.1	2.5	3.0
28.....	3.0	3.0	2.2	2.1	2.0	2.0	2.4	2.8
29.....	3.2	2.9	2.2	2.1	2.0	2.1	2.4	2.7
30.....	3.3	2.8	2.2	2.1	2.0	2.0	2.4	2.7
31.....	3.4		2.2	2.1		2.0		2.6

NOTE.—Anchor ice formed in the bed of the stream about December 10 and remained until the end of the year.

#### WALLOWA RIVER AT JOSEPH, OREG.

This station was established November 12, 1903. It is located 500 feet below the outlet of Wallowa Lake, about  $1\frac{1}{4}$  miles above Joseph, Oreg. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 156, where are given also references to publications that contain data for previous years.

*Discharge measurements of Wallowa River at Joseph, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 23.....	R. S. Hall.....	37.5	64	2.65	247
June 27.....	do.....	37.5	75	2.80	336
December 7....	Stevens and McGlashan.....	33	42	2.20	128

*Daily gage height, in feet, of Wallowa River at Joseph, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.9	1.9	2.1	2.0	2.4	2.6	2.8	2.9	2.05	1.8	1.95	2.3
2.....	1.9	1.9	2.1	2.0	2.4	2.6	2.85	2.9	2.0	1.9	.....	2.3
3.....	1.9	1.9	2.05	1.95	2.4	2.65	2.9	2.95	2.0	1.9	2.0	2.3
4.....	1.95	1.9	2.0	1.95	2.45	2.6	3.0	2.9	2.0	1.9	2.1	2.3
5.....	1.95	1.9	2.0	1.95	2.5	2.6	3.0	2.85	2.0	1.85	2.05	2.25
6.....	1.95	1.9	2.0	1.95	2.2	2.6	3.0	2.8	2.0	1.9	2.05	2.2
7.....	1.95	1.9	1.95	1.95	2.3	2.6	3.0	2.8	2.0	1.9	2.1	2.2
8.....	1.95	1.9	2.0	1.95	2.35	2.6	3.0	2.75	2.0	1.9	2.1	2.2
9.....	1.95	1.9	2.0	2.0	2.4	2.6	3.1	2.7	2.0	1.9	2.1	2.2
10.....	1.9	1.9	2.0	2.0	2.45	2.7	3.15	2.6	2.0	1.9	2.1	2.2
11.....	1.9	1.9	2.0	2.0	2.5	2.65	3.15	2.5	2.0	1.9	.....	2.2
12.....	1.9	1.9	.....	2.0	2.5	2.6	3.0	2.5	2.5	1.9	2.15	2.2
13.....	1.9	1.9	2.0	2.0	2.4	2.65	3.0	2.5	2.5	1.9	2.2	2.2
14.....	1.9	1.9	2.0	2.0	2.35	2.7	3.0	2.5	2.1	1.9	2.3	2.2
15.....	1.9	1.9	2.0	2.0	2.3	2.7	3.0	2.45	2.1	1.9	2.5	2.2
16.....	2.0	1.9	1.95	2.0	2.3	2.65	3.05	2.4	2.0	1.9	2.6	2.2
17.....	1.95	1.9	1.95	2.0	2.4	2.55	2.95	2.4	2.0	1.95	2.6	2.2
18.....	1.95	1.9	1.95	2.0	2.4	2.6	2.8	2.35	2.0	1.95	2.7	2.15
19.....	1.95	1.95	1.9	2.0	2.4	2.5	2.8	.....	2.0	1.95	2.7	2.1
20.....	1.95	1.9	1.9	2.1	2.4	2.5	2.85	2.3	2.0	1.95	2.65	2.1
21.....	1.95	1.95	1.95	2.15	2.4	2.6	2.85	2.3	2.0	1.95	2.65	2.2
22.....	1.9	1.95	.....	2.2	2.4	2.6	2.8	2.25	2.0	1.95	2.6	2.2
23.....	1.95	1.95	1.95	2.3	2.6	2.7	2.75	2.2	2.0	1.95	2.6	2.2
24.....	1.95	1.95	1.95	2.4	2.7	2.7	2.8	2.25	.....	1.95	2.55	2.2
25.....	1.95	1.95	1.95	2.3	2.5	2.7	2.8	2.2	2.0	1.95	2.55	2.15
26.....	1.95	1.95	1.95	2.35	2.7	.....	2.85	2.15	1.9	1.9	2.5	2.1
27.....	1.95	2.1	1.95	2.35	2.8	2.8	2.9	2.1	1.8	1.9	2.45	2.1
28.....	1.95	2.1	1.95	2.4	2.65	2.85	3.0	2.1	1.85	1.95	2.4	2.15
29.....	1.9	.....	1.95	2.4	2.7	2.85	2.95	2.1	1.85	1.95	2.4	2.2
30.....	1.9	.....	1.95	2.4	2.7	2.85	2.9	2.1	1.8	1.9	2.35	2.15
31.....	1.9	.....	2.0	.....	2.6	.....	2.9	2.1	.....	1.95	.....	2.15

NOTE.—The river was not frozen at any time during the year.

*Rating table for Wallowa River at Joseph, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.80	26	2.10	77	2.40	170	2.70	299	3.00	464
1.90	35	2.20	104	2.50	209	2.80	350	3.10	527
2.00	54	2.30	135	2.60	252	2.90	405	3.20	597

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined between gage heights 2.0 feet and 2.75 feet.

*Monthly discharge of Wallowa River at Joseph, Oreg., for 1906.*

[Drainage area, 47 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.....	54	35	40.5	2,490	0.862	0.99
February.....	77	35	40.2	2,230	.855	.89
March.....	77	35	50.1	3,080	1.07	1.23
April.....	170	44	81.9	4,870	1.74	1.94
May.....	350	104	201	12,400	4.28	4.93
June.....	377	209	279	16,600	5.94	6.63
July.....	561	324	426	26,200	9.06	10.44
August.....	434	77	208	12,800	4.43	5.11
September.....	209	26	62.1	3,700	1.32	1.47
October.....	44	26	38.0	2,340	0.809	.93
November.....	299	44	159	9,460	3.38	3.77
December.....	135	77	103	6,330	2.19	2.52
The year.....	561	26	141	102,000	2.99	40.84

NOTE.—Values are rated as follows: January to March, September, and October, fair; remainder of year, good.

## WALLOWA RIVER NEAR WALLOWA, OREG.

This station was established November 14, 1903. It is located at the county bridge,  $1\frac{1}{2}$  miles below Wallowa, Oreg., and one-fourth mile below the mouth of Bear Creek. A small irrigation ditch takes water from the river about 300 feet above the bridge on the right bank. During 1906 the gage was read by L. S. Johnson and C. C. Roop. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 159, where are given also references to publications that contain data for previous years.

*Discharge measurements of Wallowa River near Wallowa, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Fect.</i>	<i>Sq. ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
May 22.....	R. S. Hall.....	85	165	2.78	794
June 26.....	do.....	85.5	198	3.11	1,120
December 8....	Stevens and McGlashan.....	84	140	2.22	528

*Daily gage height, in feet, of Wallowa River near Wallowa, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.7	1.75	1.9	2.7	2.8	3.0	3.0	1.9	1.9	1.7	2.0	2.2
2.....	1.8	1.7	1.8	2.5	2.9	3.1	3.1	1.9	1.9	1.7	1.9	2.2
3.....	1.8	1.7	1.9	2.5	3.0	3.1	3.2	1.9	1.9	1.7	2.0	2.1
4.....	1.75	1.65	1.9	2.4	3.3	3.3	3.2	1.9	1.9	1.7	2.0	2.1
5.....	1.75	1.7	1.9	2.4	3.0	3.2	3.3	1.8	1.8	1.7	2.1	2.1
6.....	1.8	1.6	1.9	2.5	3.0	3.1	3.2	1.8	1.8	1.7	2.1	2.1
7.....	1.7	1.8	1.9	2.6	2.9	3.0	3.2	1.8	1.8	1.7	2.1	2.1
8.....	1.7	2.0	1.95	2.6	2.9	2.9	3.2	1.8	1.8	1.7	2.6	2.2
9.....	1.8	2.2	2.0	2.7	3.0	2.9	3.1	1.8	1.9	1.8	2.6	2.2
10.....	1.8	2.0	2.1	2.7	3.2	3.0	3.0	1.7	1.9	1.8	2.6	2.1
11.....	1.75	2.1	2.0	2.5	3.4	3.3	2.8	1.7	1.9	1.8	2.7	2.2
12.....	1.75	1.8	1.9	2.5	3.5	3.8	2.7	1.8	1.9	1.8	2.6	2.2
13.....	1.8	1.9	1.8	2.4	3.1	3.7	2.7	1.9	1.8	1.8	3.5	2.2
14.....	1.8	1.8	1.9	2.4	3.1	3.4	2.7	1.9	2.0	1.8	4.8	2.1
15.....	1.7	1.8	1.9	2.4	3.0	3.4	2.6	1.9	2.0	1.9	4.7	2.0
16.....	1.75	1.8	1.7	2.6	2.8	3.8	2.6	1.8	1.9	1.9	3.8	2.0
17.....	1.8	1.8	1.7	2.7	2.7	3.5	2.5	1.8	1.9	2.0	3.3	2.0
18.....	1.8	1.8	1.8	2.7	2.6	3.2	2.4	1.8	1.9	1.9	3.1	2.0
19.....	1.8	2.0	1.9	2.6	2.5	3.2	2.4	1.8	1.9	1.9	2.9	2.1
20.....	1.8	1.9	1.8	2.7	2.6	3.2	2.4	1.8	1.9	1.9	2.9	2.3
21.....	1.8	2.0	1.9	2.9	2.6	3.2	2.4	1.8	1.8	1.9	2.8	2.3
22.....	1.8	2.0	1.9	3.1	2.8	3.1	2.1	1.8	1.8	1.9	2.7	2.3
23.....	1.8	2.0	2.0	3.2	2.7	3.2	2.1	1.8	1.8	1.9	2.6	2.3
24.....	1.8	1.9	2.2	3.0	2.7	3.1	2.0	1.8	1.8	1.9	2.5	2.3
25.....	1.8	1.9	2.4	2.9	2.7	3.1	2.0	1.9	1.8	1.9	2.5	2.4
26.....	1.8	1.9	2.4	2.7	2.9	3.2	1.9	1.8	1.8	1.9	2.4	2.6
27.....	1.7	1.9	2.6	2.8	2.9	3.4	1.9	1.8	1.8	1.9	2.3	2.5
28.....	1.75	1.9	2.6	2.8	2.9	3.3	1.9	1.8	1.8	2.1	2.3	2.5
29.....	1.75	.....	2.5	2.8	2.9	3.0	1.9	1.8	1.8	2.1	2.3	2.5
30.....	1.75	.....	2.7	2.8	3.0	2.9	1.9	1.9	.....	2.0	2.3	2.4
31.....	1.75	.....	2.7	.....	3.0	.....	1.9	1.9	.....	2.0	.....	2.3

*Rating tables for Wallowa River near Wallowa, Oreg.*JANUARY 1 TO NOVEMBER 14, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.50	140	2.10	375	2.70	710	3.30	1,290	3.90	1,950
1.60	170	2.20	425	2.80	790	3.40	1,400	4.00	2,070
1.70	205	2.30	475	2.90	880	3.50	1,510	4.20	2,310
1.80	245	2.40	525	3.00	980	3.60	1,620	4.40	2,570
1.90	285	2.50	580	3.10	1,080	3.70	1,730	4.60	2,830
2.00	330	2.60	640	3.20	1,180	3.80	1,840	4.80	3,100

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6, and is well defined between gage heights 1.7 feet and 3.1 feet.

NOVEMBER 15 TO DECEMBER 31, 1906.<sup>b</sup>

1.50	210	2.10	460	2.70	830	3.30	1,330	3.90	1,950
1.60	245	2.20	515	2.80	900	3.40	1,420	4.00	2,070
1.70	285	2.30	570	2.90	980	3.50	1,520	4.20	2,310
1.80	325	2.40	630	3.00	1,060	3.60	1,620	4.40	2,570
1.90	365	2.50	690	3.10	1,150	3.70	1,730	4.60	2,830
2.00	410	2.60	760	3.20	1,240	3.80	1,840		

<sup>b</sup> 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 and is not well defined.

*Monthly discharge of Wallowa River near Wallowa, Oreg., for 1906.*

[Drainage area, 510 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.....	245	205	233	14,300	0.457	0.53
February.....	425	170	275	15,300	.539	.56
March.....	710	205	363	22,300	.712	.82
April.....	1,180	525	707	42,100	1.39	1.55
May.....	1,510	580	912	56,100	1.79	2.06
June.....	1,840	880	1,210	72,000	2.37	2.64
July.....	1,290	285	687	42,200	1.35	1.56
August.....	285	205	255	15,700	.500	0.58
September.....	330	225	267	15,900	.524	0.58
October.....	375	205	267	16,400	.524	0.60
November.....	3,100	285	877	52,200	1.72	1.92
December.....	760	410	530	32,600	1.04	1.20
The year.....	3,100	170	549	397,000	1.08	14.60

NOTE.—Values are rated as good.

## WALLOWA RIVER NEAR ELGIN, OREG.

This station was established November 18, 1903. It is located at the county highway bridge just below the mouth of Minam River, 12 miles from Elgin, Oreg. The station is in Wallowa Canyon about 9 miles below the lower end of Wallowa Valley. The gage was read during 1906 by Tillie Ransom. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 161, where are given also references to publications that contain data for previous years.

*Discharge measurements of Wallowa River near Elgin, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 21.....	R. S. Hall.....	194	457	3.60	1,580
June 28.....	do.....	199	570	4.14	2,480
December 9....	Stevens and McGlashan.....	135	264	2.90	777

*Daily gage height, in feet, of Wallowa River near Elgin, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.25	2.25	2.6	2.8	.....	4.0	3.9	2.5	2.3	2.25	2.45	2.7
2.....	2.3	2.3	2.5	2.6	.....	4.0	4.0	2.5	2.3	2.25	2.4	2.65
3.....	2.3	2.3	2.5	3.8	.....	4.15	4.0	2.45	2.3	.....	2.4	2.65
4.....	2.25	2.3	2.5	3.8	.....	4.5	4.1	2.45	2.3	.....	2.45	2.6
5.....	2.2	2.25	2.5	3.3	.....	4.3	4.1	2.45	2.3	.....	2.5	2.6
6.....	2.2	2.25	2.5	3.3	.....	4.1	4.0	2.45	2.3	2.25	2.45	2.6
7.....	2.2	2.25	2.55	3.6	.....	4.0	4.0	2.4	2.3	2.25	2.55	2.85
8.....	2.2	2.2	2.65	3.5	.....	3.9	4.0	2.35	2.3	2.25	3.3	2.85
9.....	2.3	2.2	2.8	3.4	.....	3.9	3.8	2.35	2.3	2.25	3.1	2.9
10.....	2.3	2.25	2.9	3.3	.....	4.0	3.7	2.35	2.3	2.25	3.1	2.9
11.....	2.3	2.3	2.8	3.3	.....	4.38	3.6	2.35	2.3	2.25	3.2	2.95
12.....	2.35	2.3	2.65	3.3	.....	4.75	3.6	2.35	2.3	2.3	3.1	3.0
13.....	2.25	2.3	2.45	3.3	.....	4.6	3.4	2.35	2.4	2.3	4.5	3.0
14.....	2.2	2.4	2.5	3.3	.....	4.4	3.3	2.35	2.4	2.3	5.52	2.95
15.....	2.2	2.4	2.55	3.3	.....	4.4	3.3	2.35	2.4	2.3	5.45	2.95
16.....	2.2	2.35	2.65	3.3	.....	4.8	3.2	2.35	2.35	2.35	4.4	2.95
17.....	2.2	2.35	2.6	3.4	.....	4.7	3.1	2.35	2.35	2.4	4.1	2.9
18.....	2.2	2.4	2.3	3.4	.....	4.4	3.1	2.35	2.35	2.4	3.7	2.95
19.....	2.2	2.7	2.45	3.5	.....	4.2	3.0	2.3	2.35	2.35	3.5	2.95
20.....	2.3	2.7	2.45	3.6	3.6	4.15	2.95	2.3	2.35	2.35	3.45	3.4
21.....	2.2	2.8	2.5	3.8	3.6	4.25	2.9	2.3	2.3	2.35	3.45	3.7
22.....	2.2	2.8	2.6	3.8	3.75	4.1	2.85	2.3	2.3	2.3	3.35	3.4
23.....	2.2	2.7	2.6	3.8	3.65	3.9	2.8	2.3	2.3	2.3	3.3	3.35
24.....	2.3	2.7	2.9	4.2	3.6	3.9	.....	2.4	2.3	2.3	3.25	3.3
25.....	2.3	2.7	3.4	4.2	3.65	4.0	2.7	2.35	2.3	2.3	3.2	3.3
26.....	2.3	2.7	3.4	4.0	3.95	4.1	2.6	2.35	2.3	2.3	3.2	3.9
27.....	2.25	2.7	3.7	3.8	3.9	4.4	2.55	2.3	2.3	2.7	3.1	3.6
28.....	2.3	2.8	3.4	3.6	3.8	4.4	2.55	2.3	2.3	2.55	3.1	3.55
29.....	2.3	.....	3.5	.....	3.85	3.9	2.55	2.3	2.3	2.5	3.0	3.5
30.....	2.3	.....	3.65	.....	4.0	3.8	2.55	2.3	2.25	2.5	2.9	3.4
31.....	2.25	.....	3.75	.....	4.05	.....	2.5	2.3	.....	2.45	.....	3.3

*Rating table for Wallowa River near Elgin, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.00	215	2.70	615	3.40	1,330	4.10	2,385	4.80	3,700
2.10	255	2.80	695	3.50	1,470	4.20	2,555	4.90	3,920
2.20	300	2.90	780	3.60	1,610	4.30	2,730	5.00	4,140
2.30	350	3.00	870	3.70	1,755	4.40	2,910	5.20	4,600
2.40	405	3.10	970	3.80	1,905	4.50	3,100	5.40	5,090
2.50	470	3.20	1,080	3.90	2,060	4.60	3,300		
2.60	540	3.30	1,200	4.00	2,220	4.70	3,500		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is well defined below gage height 4.2 feet.

*Monthly discharge of Wallowa River near Elgin, Oreg., for 1906.*

[Drainage area, 870 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.....	378	300	326	20,000	0.375	0.43
February.....	695	300	453	25,200	.521	.54
March.....	1,830	350	759	46,700	.872	1.01
April 1-28.....	2,560	540	1,520	84,400	1.75	1.82
May 20-31.....	2,300	1,610	1,880	44,700	2.16	.96
June.....	3,700	1,900	2,600	15,500	2.99	3.34
July.....	2,380	470	1,280	78,700	1.47	1.70
August.....	470	350	384	23,600	.441	.51
September.....	405	325	359	21,400	.413	.46
October.....	615	325	372	22,900	.428	.49
November.....	5,420	405	1,420	84,500	1.63	1.82
December.....	2,060	540	1,010	62,100	1.16	1.34
The period.....				530,000		

NOTE.—Values are rated as excellent.

## ASOTIN CREEK NEAR ASOTIN, WASH.

This station was established March 25, 1904. It is located at Shellman's ranch, about 8 miles above Asotin, Wash. Gage height observations were discontinued during 1906, as no observer was available. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 167, where are given also references to publications that contain data for previous years.

*Discharge measurements of Asotin Creek near Asotin, Wash., in 1904 and 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 25.....	W. W. Schlecht.....	35	31	2.03	113
April 22.....	W. G. Steward.....	40	70	3.15	458
July 1.....	do.....	30	31	1.79	92
August 12.....	Hulburt and Moore.....	26	17	1.52	40
1906.					
December 24....	H. McGlashan.....	36	50	2.30	215

*Daily gage height, in feet, of Asotin Creek near Asotin, Wash., for 1906.*

Day.	Jan.	Feb.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....	1.45	1.55	.....	2.0	1.6	1.4	1.4	1.4	1.5
2.....	1.45	1.55	.....	2.0	1.6	1.4	1.4	1.4	1.5
3.....	1.45	1.55	.....	2.0	1.6	1.4	1.4	1.5	1.5
4.....	1.58	1.55	.....	2.1	1.6	1.4	1.4	1.5	1.5
5.....	1.55	1.55	.....	2.1	1.5	1.4	1.4	1.5	1.5
6.....	1.98	1.55	.....	2.1	1.5	1.4	1.4	1.5	1.5
7.....	1.52	1.55	.....	2.0	1.5	1.4	1.4	1.5	1.5
8.....	1.45	1.55	.....	1.9	1.5	1.4	1.4	1.5	1.8
9.....	1.45	1.55	.....	1.9	1.5	1.4	1.4	1.5	1.7
10.....	1.5	1.55	.....	1.8	1.5	1.4	1.4	1.5	1.6
11.....	1.5	1.55	.....	1.8	1.5	1.4	1.4	1.5	1.6
12.....	1.5	1.55	.....	1.8	1.5	1.4	1.4	1.5	1.6
13.....	1.5	1.55	.....	1.8	1.5	1.4	1.4	1.5	1.8
14.....	1.5	1.55	.....	1.8	1.5	1.5	1.4	1.5	2.2
15.....	1.52	1.55	.....	1.8	1.5	1.5	1.4	1.5	2.3
16.....	1.5	1.55	.....	1.8	1.5	1.5	1.4	1.5	2.4
17.....	1.5	1.62	1.8	1.8	1.5	1.5	1.4	1.5	2.2
18.....	1.5	.....	1.8	1.7	1.5	1.5	1.4	1.5	2.0
19.....	1.5	.....	1.7	1.7	1.5	1.5	1.4	1.5	1.9
20.....	1.5	.....	1.7	1.7	1.5	1.5	1.4	1.5	1.9
21.....	1.5	.....	1.7	1.7	1.5	1.5	1.4	1.5	1.8
22.....	1.5	.....	1.7	1.7	1.5	1.5	1.4	1.5	1.8
23.....	1.7	.....	1.7	1.7	1.5	1.5	1.4	1.5	1.7
24.....	1.6	.....	1.7	1.7	1.5	1.5	1.4	1.5	1.7
25.....	1.55	.....	1.7	1.6	1.5	1.5	1.4	1.5	1.7
26.....	1.55	.....	1.7	1.6	1.5	1.5	1.4	1.5	1.7
27.....	1.55	.....	1.7	1.6	1.5	1.5	1.4	1.5	1.7
28.....	1.55	.....	1.7	1.6	1.5	1.5	1.4	1.5	1.6
29.....	1.55	.....	1.9	1.6	1.5	1.5	1.4	1.5	1.6
30.....	1.55	.....	2.1	1.6	1.5	1.5	1.4	1.5	1.6
31.....	1.55	.....	2.1	.....	1.5	1.4	.....	1.5	.....

*Rating table for Asotin Creek near Asotin, Wash., for 1904-1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.40	29	2.00	126	2.60	277	3.20	502	3.80	829
1.50	40	2.10	147	2.70	309	3.30	549	3.90	894
1.60	54	2.20	169	2.80	343	3.40	599	4.00	962
1.70	70	2.30	193	2.90	379	3.50	652	4.10	1,032
1.80	87	2.40	219	3.00	417	3.60	708	4.20	1,104
1.90	106	2.50	247	3.10	458	3.70	767	4.30	1,179

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1904-1906 and is not well defined.

*Monthly discharge of Asotin Creek near Asotin, Wash., for 1904-1906.*

[Drainage area, 171 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1904.						
March 21-31 .....	193	116	156	3,400	0.912	0.37
April .....	1,180	198	469	27,900	2.74	3.06
May .....	417	219	276	17,000	1.61	1.86
June .....	277	78	159	9,460	.930	1.04
July .....	116	50	70.8	4,350	.414	.48
August .....	54	44	47.0	2,890	.275	.32
September .....	64	44	47.3	2,810	.277	.31
October .....	85	47	50.5	3,100	.295	.34
November 1-19 .....	47	47	47.0	1,770	.275	.19
The period .....				72,700		
1905.						
April .....	96	62	80.3	4,780	0.470	0.52
May .....	106	78	91.8	5,640	.537	.62
June .....	283	54	189	11,200	1.11	1.24
July .....	70	34	43.1	2,650	.252	.29
August .....	34	34	34.0	2,090	.199	.23
September .....	62	34	36.2	2,150	.212	.24
October .....	47	40	40.7	2,500	.238	.28
November .....	40	34	39.1	2,330	.229	.26
December .....	47	34	38.9	2,390	.228	.26
The period .....				35,700		
1906.						
January .....	122	34	45.5	2,800	0.266	0.31
February 1-17 .....	57	47	47.6	1,600	.278	.18
May 17-31 .....	147	70	85.0	2,530	.497	.28
June .....	147	54	89.0	5,300	.520	.58
July .....	54	40	41.8	2,570	.244	.28
August .....	40	29	35.0	2,150	.205	.24
September .....	29	29	29.0	1,730	.170	.19
October .....	40	29	39.3	2,420	.230	.27
November .....	219	40	82.5	4,910	.482	.54
The period .....				26,000		

NOTE.—Values are rated as fair.

#### PALOUSE RIVER AT HOOPER, WASH.

The gaging station at Hooper, Wash., was originally established April 1, 1897, by the land department of the Northern Pacific Railway. The United States Geological Survey assumed charge September 9, 1897, and moved the station about 1 mile downstream.

The measurements are of value in showing the amount of water available for use on lands of Washtucna Valley and in the section

north of Pasco. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 171, where are given also references to publications that contain data for previous years.

*Daily gage height, in feet, of Palouse River at Hooper, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.5	3.6	4.75	5.3	3.2	3.7	1.65	0.9	0.8	0.8	0.9	1.6
2.....	1.6	3.5	4.7	5.75	3.0	3.5	1.6	.9	.8	.8	.9	1.6
3.....	1.55	3.6	4.4	6.0	2.4	2.45	1.6	.85	.8	.8	.95	1.6
4.....	1.5	4.05	4.1	5.85	2.3	2.7	1.6	.8	.8	.8	1.0	1.55
5.....	1.6	3.5	3.6	5.7	2.15	3.5	1.6	.8	.8	.8	1.0	1.5
6.....	1.65	3.5	3.9	5.6	2.5	3.05	1.5	.8	.8	.8	1.0	1.65
7.....	1.7	3.05	3.6	4.4	2.4	2.45	1.4	.8	.8	.8	1.05	1.8
8.....	1.8	2.9	3.6	4.4	2.2	2.55	1.35	.8	.8	.8	1.15	2.05
9.....	2.0	2.9	3.6	4.3	2.2	2.6	1.5	.75	.8	.8	1.2	3.05
10.....	1.95	2.8	3.8	4.9	2.2	2.4	1.4	.75	.8	.8	1.35	2.7
11.....	1.95	2.8	5.15	4.8	2.15	2.55	1.35	.75	.8	.8	1.6	2.7
12.....	1.85	2.85	4.9	4.75	2.1	2.4	1.3	.75	.8	.8	1.8	2.9
13.....	1.85	2.8	3.4	4.6	2.0	2.3	1.25	.75	.8	.85	2.1	3.05
14.....	2.0	2.7	4.9	3.6	2.0	2.3	1.2	.8	.8	.9	2.4	3.4
15.....	2.35	2.75	4.0	3.4	2.0	2.25	1.7	.8	.8	.9	3.3	2.8
16.....	2.3	2.7	3.6	3.9	2.1	2.2	1.4	.8	.8	.9	3.8	2.7
17.....	2.35	3.1	3.5	3.5	2.1	2.2	1.3	.75	.8	.9	4.1	2.7
18.....	2.3	3.2	3.5	3.4	2.05	2.1	1.2	.75	.8	.9	4.4	2.6
19.....	2.2	3.3	3.3	3.4	2.05	2.1	1.15	.7	.8	.9	3.05	2.6
20.....	1.95	5.05	3.6	3.4	2.05	2.05	1.15	.7	.8	.9	2.6	3.7
21.....	1.85	6.1	3.5	3.25	2.05	2.0	1.1	.7	.8	.9	2.5	6.1
22.....	2.0	6.35	2.95	3.1	2.0	2.0	1.05	.7	.8	.9	2.3	8.7
23.....	2.35	5.7	3.2	3.05	2.0	2.0	1.05	.7	.8	.9	2.2	9.8
24.....	3.15	5.65	3.25	3.0	1.9	1.95	1.05	.7	.8	.9	2.1	8.2
25.....	3.3	5.15	3.4	2.9	1.85	1.85	1.05	.7	.8	.9	2.0	7.1
26.....	3.7	5.0	3.6	3.4	1.8	1.6	1.05	.7	.8	.9	1.85	6.8
27.....	4.2	4.8	4.9	3.1	1.75	1.7	1.0	.7	.8	.95	1.6	7.0
28.....	4.05	4.75	5.4	3.0	1.7	1.6	1.0	.7	.8	.95	1.5	7.4
29.....	4.0	.....	6.1	2.9	2.2	1.65	.95	.7	.8	.95	1.5	6.8
30.....	3.9	.....	6.4	3.0	3.8	1.75	.95	.7	.8	.95	1.6	7.1
31.....	3.6	.....	5.8	.....	2.7	.....	.95	.75	.....	.9	.....	7.6

*Rating table for Palouse River at Hooper, Wash., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.60	10	1.70	110	2.80	351	3.90	670	6.00	1,915
0.70	13	1.80	125	2.90	355	4.00	715	6.20	2,120
0.80	17	1.90	141	3.00	380	4.20	805	6.40	2,280
0.90	22	2.00	158	3.10	405	4.40	900	6.60	2,440
1.00	28	2.10	176	3.20	430	4.60	1,015	6.80	2,620
1.10	36	2.20	195	3.30	457	4.80	1,135	7.00	2,800
1.20	46	2.30	215	3.40	486	5.00	1,265	8.00	3,780
1.30	57	2.40	236	3.50	517	5.20	1,400	9.00	4,900
1.40	69	2.50	259	3.60	551	5.40	1,540	10.00	6,200
1.50	82	2.60	283	3.70	588	5.60	1,680		
1.60	96	2.70	307	3.80	628	5.80	1,820		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is well defined between gage heights 0.8 feet and 10.0 feet.

*Monthly discharge of Palouse River at Hooper, Wash., for 1906.*

[Drainage area, 2,210 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.....	805	82	269	16,500	0.122	0.14
February.....	2,240	307	784	43,500	.355	.37
March.....	2,280	367	857	52,700	.388	.45
April.....	1,960	355	842	50,100	.381	.43
May.....	628	110	208	12,800	.094	.11
June.....	588	96	231	13,700	.105	.12
July.....	110	25	56.8	3,490	.026	.03
August.....	22	13	15.3	941	.0069	.01
September.....	17	17	17.0	1,010	.0077	.01
October.....	25	17	20.4	1,250	.0092	.01
November.....	900	22	196	11,700	.089	.10
December.....	5,920	82	1,360	83,600	.615	.71
The year.....	5,920	13	405	291,000	.183	2.49

NOTE.—Values are rated as good.

#### MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Snake River drainage basin in 1906:

*Asotin Creek at Asotin, Wash.*—This station, which was discontinued December 31, 1905, is described in Water-Supply Paper No. 178, page 167. A measurement was made December 21, 1906.

Width, 52 feet; area, 68 square feet; gage height, 3.97 feet; discharge, 290 second-feet.

*Bear Creek near Wallowa, Oreg.*—The reference point is on top of the lower end of the left floor beam; gage heights are distances below reference point.

May 22, width 35 feet; area, 55 square feet; gage height, —7.66 feet; discharge, 226 second-feet.

June 26, width, 37 feet; area, 62 square feet; gage height, —7.45 feet; discharge, 259 second-feet.

*Five point Creek near Hilgard, Oreg.*—A measurement was made just above the mouth March 10, 1906. The water surface was 6.34 feet below the top of the highway bridge floor, upstream side, at a point 23 feet from the right end of the floor.

Width, 25 feet; area, 45 square feet; discharge, 157 second-feet.

A measurement was made at low water December 4, 1906. The water surface was 7.15 feet below a bent spike in the downstream side of the top log of the right abutment of the highway bridge.

Width, 20 feet; area, 21 square feet; discharge, 7.4 second-feet.

*Minam Creek near Lovely, Oreg.*—The discharge of this stream was found December 9, 1906, by taking the difference of the discharges of Wallowa River above and below its mouth. Discharge, 228 second-feet.

*Wallowa River near Lovely, Oreg.*—A measurement was made at medium stage, December 9, 1906, at the footbridge just below Canyon stage stations and above the mouth of Minam Creek. The water surface was 1.08 feet below a small ledge of projecting rock on the right bank, 9.0 feet vertically underneath a point on the top of the downstream log of the footbridge, 7.5 feet from the right end of the log.

Width, 85 feet; area, 186 square feet; discharge, 549 second-feet.

*Miscellaneous measurements in Snake River drainage basin in 1906.*

Date.	Stream.	Locality.	Width.	Area of section.	Dis-charge.
			<i>Feet.</i>	<i>Sq. ft.</i>	<i>Sec.-ft.</i>
January 9.....	Boise River.....	Below Barber dam and 7 miles above Boise, Idaho.	144	261	562
April 4.....	Burnt River.....	Huntington, Oreg.....	78	156	696
August 6.....	Cedar Creek.....	In canyon, 8 miles above Mackay, Idaho.	10	6.2	12.5
July 19.....	North Fork Buffalo River..	At most northerly meadows, Wyoming.	62	75	165
September 8....	John Day River.....	Junction with South Fork Snake River, Wyoming.	42	104	592

## WALLA WALLA RIVER DRAINAGE BASIN.

### DESCRIPTION OF BASIN.

Walla Walla River heads on the northwestern slope of the Blue Mountains in northeastern Oregon and southeastern Washington, flows westward, and unites with the Columbia at Wallula, Wash. The Blue Mountains have an elevation of approximately 2,000 feet above the surrounding country; their northwestern slope is drained by the numerous tributaries of the Walla Walla and their southeastern slope by those of Grande Ronde River, a tributary of the Snake. The drainage basin is a broad, triangular-shaped area, aggregating 1,050 square miles. Except on the mountain slopes the area is timberless, being composed of rolling table-lands devoted largely to the production of wheat. The valleys are level tracts in which irrigation has reached a high stage of development. The rainfall at Walla Walla, Wash., is about 18 inches per annum. The principal tributaries of the stream are Little Walla Walla River, Mill Creek, on which the city of Walla Walla is situated, Garrison Creek, Yellowhawk Creek, Cottonwood Creek, and South Fork of Walla Walla River.

The main stream and its tributaries are used extensively for irrigation and power. The power plant of the Northwestern Gas and Electric Company, from which the cities of Pendleton, Walla Walla, Weston, and neighboring towns are connected by an electric line, is located on South Fork of Walla Walla River, about 12 miles above Milton.

## WALLA WALLA RIVER NEAR MILTON, OREG.

This station was established August 12, 1905, to replace the station at Milton, Oreg., one-half mile below. It was located near the old city reservoir,  $1\frac{1}{2}$  miles above Milton, but the gage, cable, and bench mark were destroyed by flood May 30, 1906, and on August 16, 1906, the station was reestablished at West's highway bridge, 3 miles above Milton. A small ditch heads just above the bridge.

The channel is straight above the station and curved below. The water is shallow and the current swift. The banks are low and liable to overflow. The bed of the stream is composed of clean sand and gravel and liable to shift. There is one channel at all stages.

Measurements are made from the bridge. The initial point is the face of the right abutment.

The gage, which is read by Maud Osborn, is a 2 by 6 inch timber spiked vertically to the right abutment. The bench mark is a 20-penny spike in pole 1170 of a transmission line at the southwest corner of the bridge; elevation, 9.03 feet above the datum of the gage.

The conditions at the old station and the bench marks are described in Water-Supply Paper No. 178, page 178, where are given also references to publications that contain data for previous years.

*Discharge measurements of Walla Walla River near Milton, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Fect.</i>	<i>Sq.ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
February 19 . . .	R. S. Hall . . . . .	60	91	<sup>a</sup> 4.62	413
March 23 . . . . .	Copper and Buchanan . . . . .	47	60	<sup>a</sup> 4.11	181
May 22 . . . . .	P. A. Copper . . . . .	45	66	<sup>a</sup> 4.13	187
June 28 <sup>b</sup> . . . . .	do . . . . .	45	59		186
July 21 <sup>b</sup> . . . . .	do . . . . .	44	56		112
August 4 <sup>b</sup> . . . . .	do . . . . .	43	50		99
August 29 . . . . .	do . . . . .	43	52	<sup>c</sup> 1.63	97
December 11 . . . . .	H. McGlashan . . . . .	63	72	<sup>c</sup> 2.20	300

<sup>a</sup> Gage near city reservoir.

<sup>b</sup> Measured by wading at mouth of Couse Creek.

<sup>c</sup> Gage at West's bridge.

*Daily gage height, in feet, of Walla Walla River near Milton, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Sept.	Oct.	Nov.	Dec.
1 . . . . .	4.02	4.28	4.38	4.70	4.45	<sup>a</sup> 1.35	1.65	1.75	1.95
2 . . . . .	4.00	4.28	4.32	4.60	4.45	1.55	1.75	1.75	1.95
3 . . . . .	4.00	4.20	4.28	4.60	4.48	1.45	1.75	1.65	1.85
4 . . . . .	4.02	4.20	4.28	4.60	4.45	1.65	1.65	1.70	1.85
5 . . . . .	4.10	4.18	4.22	4.60	4.35	1.65	1.85	1.75	1.90
6 . . . . .	4.22	4.15	4.22	4.62	4.35	1.55	1.75	1.75	1.95
7 . . . . .	4.32	4.10	4.25	4.62	4.30	1.35	1.75	1.85	2.05
8 . . . . .	4.30	4.10	4.30	4.65	4.30	1.65	1.65	1.85	2.05
9 . . . . .	4.22	4.08	4.38	4.70	4.30	1.55	1.75	1.90	2.15
10 . . . . .	4.20	4.08	4.38	4.60	4.30	1.65	1.75	1.95	2.05
11 . . . . .	4.20	4.08	4.35	4.55	4.30	1.55	1.75	2.65	2.05
12 . . . . .	4.18	4.05	4.32	4.45	4.30	1.55	1.65	2.85	2.35
13 . . . . .	4.22	4.02	4.25	4.42	4.25	1.65	1.75	2.75	2.30
14 . . . . .	4.22	4.02	4.22	4.48	4.25	1.75	1.75	2.95	2.20
15 . . . . .	4.20	4.05	4.22	4.50	4.28	1.75	1.75	3.25	2.15

*Daily gage height, in feet, of Walla Walla River near Milton, Oreg., in 1906—Con.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Sept.	Oct.	Nov.	Dec.
16.....	4.28	4.05	4.20	4.58	4.22	1.75	1.85	3.65	2.20
17.....	4.22	4.05	4.15	4.55	4.15	1.75	1.75	2.95	2.20
18.....	4.20	4.20	4.12	4.52	4.25	1.75	1.75	2.75	2.25
19.....	4.18	4.60	4.10	4.52	4.25	1.65	1.75	2.65	2.35
20.....	4.12	4.60	4.10	4.52	4.12	1.75	1.75	2.55	2.15
21.....	4.10	4.60	4.10	4.62	4.13	1.75	1.65	2.35	4.00
22.....	4.12	4.55	4.10	4.70	4.12	1.75	1.75	2.15	3.40
23.....	4.18	4.45	4.10	4.65	4.13	1.85	1.75	2.05	3.00
24.....	4.40	4.42	4.25	4.60	4.12	1.85	1.70	1.95	2.95
25.....	4.50	4.38	4.30	4.52	4.10	1.75	1.75	1.95	2.95
26.....	4.45	4.35	4.32	4.48	4.12	1.75	1.75	1.95	2.90
27.....	4.40	4.40	4.62	4.45	4.13	1.75	1.65	1.90	2.85
28.....	4.32	4.40	4.62	4.45	4.12	1.85	1.75	1.85	2.85
29.....	4.30	.....	4.58	4.45	5.90	1.75	1.70	1.80	2.80
30.....	4.28	.....	4.60	4.45	(b)	1.65	1.75	1.85	2.75
31.....	4.25	.....	4.72	.....	.....	.....	1.75	.....	2.75

<sup>a</sup> On gage at West's bridge.

<sup>b</sup> Gage and cable washed away by flood.

*Rating table for Walla Walla River near Milton, Oreg., from January 1 to May 29, 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
3.80	94	4.10	175	4.30	251	4.50	349	4.70	469
3.90	117	4.20	210	4.40	297	4.60	406	4.80	534
4.00	144								

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined below gage height 4.2 feet.

*Monthly discharge of Walla Walla River near Milton, Oreg., for 1906.*

[Drainage area, 130 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.....	349	144	221	13,600	1.70	1.96
February.....	406	150	239	13,300	1.84	1.92
March.....	482	175	260	16,000	2.00	2.31
April.....	469	307	384	22,800	2.95	3.29
May 1-29.....	1,370	175	274	15,800	2.11	2.28
The period.....				81,500		

NOTE.—Values are rated as excellent.

#### SOUTH FORK OF WALLA WALLA RIVER NEAR MILTON, OREG.

This station was originally established February 15, 1903, 6 miles above the mouth of the river and 12 miles from Milton, Oreg. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 176, where are given also references to publications that contain data for previous years.

The flood of May 30, 1906, entirely changed the channel. On August 10, 1906, a new station was established one-fourth mile above the headgate of the Northwestern Gas and Electric Company's pipe line. This point is above all diversions.

The channel is straight for 200 feet above and below the station. The banks are low and liable to overflow. There is one channel at all stages. The bed of the stream is of gravel and will change during high floods. The current is swift at all stages.

Measurements are made by wading 17 feet below the gage. The initial point for soundings is a blaze on a cottonwood tree on the left bank.

Gage heights are furnished by the Northwestern Gas and Electric Company, through Mr. Paul Young. The gage is a 2 by 6 inch timber, spiked in a vertical position to a tree on the left bank. The bench mark is a spike in the roots of a large cottonwood tree on the left bank, 10 feet from the gage; elevation, 7.74 feet above the datum of the gage.

*Discharge measurements of South Fork of Walla Walla River near Milton, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
February 20.....	R. S. Hall.....	48	71	<i>a</i> 2.10	390
March 23.....	P. A. Cupper.....	45	41	<i>a</i> 1.50	159
May 24.....	do.....	45	48	<i>a</i> 1.66	171
August 10.....	J. C. Stevens.....	45	49	<i>b</i> 2.50	120
December 13.....	H. McGlashan.....	42	56	<i>b</i> 3.73	183

*a* Gage at bridge.

*b* Gage at headgate.

*Daily gage height, in feet, of South Fork of Walla Walla River near Milton, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Aug.	Sept.
1.....		1.7	1.7	2.0	2.0	1.2		2.5
2.....	1.55	1.7	1.65	2.0	2.0			2.5
3.....	1.55		1.65	2.0		1.0		2.5
4.....		1.65	1.65	2.0				2.5
5.....	1.6	1.6	1.6	2.0	1.95			2.5
6.....	1.7	1.6	1.6	2.0	1.9			2.5
7.....		1.6	1.6	2.1	1.85			2.5
8.....	1.65	1.6	1.7	2.1	1.8			2.5
9.....	1.65	1.6		2.1	1.85			2.52
10.....	1.7		1.7	2.0			2.5	2.52
11.....	1.65	1.55			1.9		2.5	2.51
12.....		1.55		1.8	1.9		2.53	2.5
13.....	1.65	1.55		1.8	1.85		2.55	2.55
14.....	1.65	1.55		1.8	1.85		2.52	2.56
15.....	1.65	1.55	1.5	1.9	1.8		2.52	2.55
16.....	1.7	1.55		1.9			2.51	
17.....	1.7			1.9	1.75		2.51	
18.....	1.7		1.5	1.9	1.7		2.52	
19.....	1.7	2.2	1.5	1.9	1.7		2.5	
20.....		2.0	1.5	1.95	1.7		2.5	
21.....	1.65	2.1	1.5	2.0			2.5	
22.....	1.65	2.0		2.2	1.7		2.57	
23.....	1.8	1.9	1.5	2.2	1.7		2.55	
24.....	1.8	1.8	1.6	2.1			2.53	
25.....	1.95	1.8	1.7	2.05			2.52	
26.....	1.9	1.8	2.0	2.0	1.7		2.52	
27.....	1.8	1.75	2.0	1.95	1.7		2.52	
28.....	1.75	1.75	2.0	1.9	1.7		2.5	
29.....	1.7		2.0	1.95	2.86		2.5	
30.....	1.7		1.95	2.0			2.5	
31.....	1.7		2.15				2.5	

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Walla Walla River drainage basin during 1906:

*Couse Creek near Milton, Oreg.*—March 23, discharge, 10 second-feet; August 10, dry.

*Dry Creek near Milton, Oreg.*—A measurement was made 500 feet below the crossing of Finis Irrigation Company's flume. The water surface was 0.5 foot below the bench mark on a rock 50 feet above the section.

Width, 18 feet; area, 10 square feet; discharge, 13 second-feet.

*Walla Walla River at Milton, Oreg.*—The following discharges were computed from slope measurements for the spring and fall floods:

May 30, width, 316 feet; area, 924 square feet; discharge, 8,130 second-feet.

November 14, width, 281 feet; area, 632 square feet; discharge, 4,550 second-feet.

*North Fork of Walla Walla River near Milton, Oreg.*—Measurements were made near the junction with South Fork.

March 23, width, 17 feet; area, 12 square feet; discharge, 28 second-feet.

March 24, width, 16 feet; area, 8 square feet; discharge, 21 second-feet.

August 29, width, 12 feet; area, 12 square feet; discharge, 7 second-feet.

## UMATILLA RIVER DRAINAGE BASIN.

## DESCRIPTION OF BASIN.

Umatilla River rises in the western slopes of the Blue Mountains in northeastern Oregon, flows westward, and joins Columbia River at the town of Umatilla. Its drainage area is timberless except on the mountain slopes, and is composed of rolling table-lands devoted largely to the production of wheat. The rainfall on the drainage area varies from 24 inches on the headwaters to 10 inches at the mouth.

The waters of this stream are used for both power and irrigation purposes, and it is one of the most important rivers in the State.

## UMATILLA RIVER AT GIBBON, OREG.

This station was established July 22, 1896. It is located about 1 mile west of Bingham Springs Railroad station (Gibbon post-office), Oreg. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 181, where are given also references to publications that contain data for previous years.

The gage at this station was read during a portion of 1906 by J. C. Hilliard. The gage was washed out May 30, 1906, and on December 3 a new one was installed about 50 feet upstream from the cable on the left bank. It consists of a 2 by 6 inch timbers, in two sections, spiked to cottonwood trees. The bench mark is a spike in the root of a 16-inch yellow pine, 415 feet from the initial point for soundings, 160 feet from the railroad track, and 20 feet upstream from the line of the cable extended; elevation, 9.03 feet above the datum of the gage.

*Discharge measurements of Umatilla River at Gibbon, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
February 1.....	R. S. Hall.....	53	67	a1.80	351
March 14.....	do.....	55	80	a1.85	415
April 2.....	do.....	117	260	a3.28	1,680
April 21.....	J. C. Stevens.....	112	203	a2.80	1,310
May 26.....	R. S. Hall.....	44	44	a1.40	203
June 6.....	do.....	112	307	.....	1,390
July 9.....	do.....	86	80	.....	102
December 3.....	Stevens and McGilshan.....	102	132	b1.50	183

*a* Old gage.*b* New gage.*Daily gage height, in feet, of Umatilla River at Gibbon, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	Dec.	Day.	Jan.	Feb.	Mar.	Apr.	May.	Dec.
1.....	1.45	.....	1.9	3.7	2.2	.....	17.....	1.6	.....	1.7	2.4	1.5	1.9
2.....	1.4	1.8	1.9	3.25	.....	.....	18.....	1.6	1.7	1.7	2.4	1.45	1.9
3.....	1.4	1.8	1.8	2.9	2.0	a1.5	19.....	1.55	2.4	.....	2.4	1.4	1.9
4.....	1.5	1.8	1.8	2.9	2.0	1.5	20.....	1.55	2.3	1.5	2.7	1.4	5.2
5.....	1.5	1.8	1.8	2.8	2.0	1.5	21.....	1.5	2.4	1.5	2.8	1.4	5.8
6.....	.....	1.7	1.8	2.9	1.95	1.6	22.....	1.5	2.3	1.5	2.9	1.4	4.5
7.....	1.8	1.6	1.8	3.3	1.9	2.1	23.....	.....	2.2	1.5	.....	1.4	3.8
8.....	1.7	1.6	2.05	.....	1.8	2.5	24.....	2.0	2.0	2.0	2.5	1.4	3.6
9.....	1.65	1.6	2.3	.....	1.8	2.4	25.....	2.25	2.0	2.7	2.5	1.4	3.7
10.....	1.65	1.55	2.4	2.9	1.75	2.2	26.....	2.1	2.0	2.75	2.5	1.4	4.1
11.....	1.6	1.5	.....	2.8	1.75	2.2	27.....	2.0	.....	3.4	2.4	1.4	3.7
12.....	1.7	1.5	2.0	2.5	1.7	2.2	28.....	1.95	.....	3.3	2.4	1.7	3.6
13.....	1.65	1.5	1.9	2.5	1.7	2.1	29.....	1.9	.....	3.0	2.4	.....	3.4
14.....	1.6	1.5	.....	2.4	1.7	2.0	30.....	1.9	.....	3.5	2.3	(b)	3.1
15.....	1.6	1.5	.....	2.5	1.6	2.0	31.....	1.85	.....	4.1	.....	.....	3.0
16.....	1.6	1.5	1.7	2.4	1.5	1.9							

*a* New gage installed December 3. No relation determined for the two gages.*b* Gage destroyed by flood.*Rating table for Umatilla River at Gibbon, Oreg., from January 1 to May 29, 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.40	190	2.00	555	2.60	1,075	3.20	1,660	3.80	2,305
1.50	233	2.10	635	2.70	1,170	3.30	1,765	3.90	2,415
1.60	284	2.20	720	2.80	1,265	3.40	1,870	4.00	2,530
1.70	343	2.30	805	2.90	1,360	3.50	1,975	4.10	2,645
1.80	408	2.40	895	3.00	1,460	3.60	2,085		
1.90	479	2.50	985	3.10	1,560	3.70	2,195		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined below gage heights 3.0 feet.

*Monthly discharge of Umatilla River at Gibbon, Oreg., for 1906.*

[Drainage area, 353 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.....	762	190	352	21,600	1.00	1.15
February.....	895	233	441	24,500	1.25	1.30
March.....	2,640	233	734	45,100	2.08	2.40
April.....	2,200	805	1,190	70,800	3.37	3.76
May 1-28.....	720	190	344	19,100	.975	1.02
The period.....				181,000		

NOTE.—Values January to May are rated as good.

## UMATILLA RIVER AT YOAKUM, OREG.

This station was established May 5, 1903. It is located one-half mile east of Yoakum, a station of the Oregon Railroad and Navigation Company, at what is known as the Yoakum wagon bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 185, where are given also references to publications that contain data for previous years.

*Discharge measurements of Umatilla River at Yoakum, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 19.....	R. S. Hall.....	75	224	4.45	516
April 20.....	J. C. Stevens.....	76	352	5.98	1,570
June 2.....	R. S. Hall.....		531	8.30	4,780
July 11.....	do.....	74	154	3.20	93
November 26 <sup>a</sup> ..	H. McGlashan.....	76	229	4.05	284

<sup>a</sup> Some slack water and eddies.

*Daily gage height, in feet, of Umatilla River at Yoakum, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.3	5.3	5.3	8.05	5.0	9.5	3.7	2.7	2.8	2.9	3.2	3.9
2.....	4.3	5.1	5.3	7.25	5.0	8.0	3.6	2.7	2.8	2.9	3.2	3.9
3.....	4.1	5.0	5.2	7.0	4.9	7.4	3.5	2.7	2.8	3.0	3.2	3.9
4.....	4.1	4.8	5.2	7.1	4.9	7.4	3.5	2.7	2.8	3.0	3.1	3.9
5.....	4.1	4.6	5.1	7.2	4.7	7.3	3.4	2.7	2.8	3.0	3.2	3.9
6.....	4.2	4.5	5.0	7.2	4.7	7.2	3.3	2.7	2.8	3.0	3.2	4.0
7.....	4.6	4.5	4.9	7.2	4.5	6.9	3.3	2.7	2.8	3.0	3.2	4.3
8.....	4.6	4.4	5.1	7.2	4.4	6.7	3.2	2.7	2.8	3.0	3.3	4.6
9.....	4.04	4.4	5.5	7.3	4.4	6.5	3.1	2.7	2.8	3.0	3.5	4.8
10.....	4.2	4.3	5.7	6.8	4.3	6.2	3.1	2.7	2.8	3.0	3.5	4.8
11.....	4.3	4.3	5.8	6.5	4.3	5.7	3.1	2.7	2.8	3.0	3.5	4.8
12.....	4.3	4.2	5.5	6.1	4.2	5.4	3.1	2.8	2.8	3.0	3.5	4.7
13.....	4.3	4.1	5.5	6.0	4.2	5.0	3.1	3.0	3.0	3.0	3.5	4.6
14.....	4.3	4.1	5.2	6.0	4.2	4.9	3.1	3.0	3.1	3.0	5.2	4.5
15.....	4.2	4.0	5.1	6.1	4.2	4.8	3.0	3.0	3.1	3.0	5.9	4.5
16.....	4.2	4.0	5.0	6.4	4.2	4.8	3.0	3.0	3.1	3.5	5.7	4.5
17.....	4.3	4.0	4.9	6.3	4.0	4.6	3.0	3.0	3.0	3.5	5.0	4.4
18.....	4.3	4.0	4.5	6.1	4.0	4.5	3.0	2.9	3.0	3.5	4.9	4.4
19.....	4.3	5.0	4.6	6.0	3.9	4.5	3.0	2.9	3.0	3.5	4.5	4.5
20.....	4.3	5.8	4.6	6.0	3.9	4.4	2.9	2.8	3.0	3.5	4.5	6.8
21.....	4.2	5.7	4.6	6.2	3.9	4.3	2.9	2.8	3.0	3.5	4.5	9.0
22.....	4.2	5.7	4.7	6.4	3.9	4.3	2.9	2.8	3.0	3.5	4.4	7.8
23.....	4.3	5.6	4.7	6.3	3.9	4.2	2.8	2.8	2.9	3.6	4.3	7.0
24.....	4.8	5.6	5.9	5.9	3.9	4.2	2.8	2.8	2.9	3.6	4.3	6.5
25.....	5.3	5.5	6.1	5.7	3.9	4.1	2.8	3.0	2.9	3.6	4.2	6.5
26.....	5.8	5.4	6.7	5.45	3.9	4.0	2.7	2.9	2.9	3.6	4.0	7.0
27.....	5.7	5.3	7.2	5.3	3.8	4.0	2.7	2.9	2.9	3.6	4.0	7.1
28.....	5.6	5.3	7.4	5.3	4.0	4.1	2.7	2.8	2.9	3.5	4.0	6.5
29.....	5.4	.....	7.0	5.2	6.65	3.9	2.7	2.8	2.9	3.4	4.0	6.4
30.....	5.4	.....	7.2	5.2	15.0	3.8	2.7	2.8	2.9	3.3	4.0	6.4
31.....	5.3	.....	7.75	.....	13.0	.....	2.7	2.8	.....	3.3	.....	6.4

<sup>a</sup> Estimated; water overflowed bottom lands.

*Rating table for Umatilla River at Yoakum, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.70	28	3.80	225	4.90	755	6.00	1,645	8.20	4,590
2.80	37	3.90	253	5.00	820	6.20	1,840	8.40	4,940
2.90	47	4.00	284	5.10	890	6.40	2,040	8.60	5,300
3.00	59	4.10	320	5.20	965	6.60	2,260	8.80	5,680
3.10	73	4.20	360	5.30	1,040	6.80	2,500	9.00	6,060
3.20	89	4.30	410	5.40	1,120	7.00	2,750	10.00	8,190
3.30	107	4.40	460	5.50	1,200	7.20	3,020	11.00	10,750
3.40	127	4.50	515	5.60	1,285	7.40	3,310	12.00	13,730
3.50	149	4.60	570	5.70	1,370	7.60	3,610	13.00	17,000
3.60	173	4.70	630	5.80	1,460	7.80	3,930	14.00	20,400
3.70	199	4.80	690	5.90	1,550	8.00	4,250	15.00	23,900

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is well defined below gage height 9.7 feet.

*Monthly discharge of Umatilla River at Yoakum, Oreg., for 1906.*

[Drainage area, 1,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January.....	1,460	298	587	36,100	0.489	0.56
February.....	1,460	284	697	38,700	.581	.60
March.....	3,850	515	1,370	84,200	1.14	1.31
April.....	4,340	965	2,090	124,000	1.74	1.94
May.....	23,900	225	1,770	109,000	1.47	1.70
June.....	7,080	225	1,460	86,900	1.22	1.36
July.....	199	28	72.7	4,470	.061	.07
August.....	59	28	39.4	2,420	.033	.04
September.....	73	37	48.4	2,880	.040	.04
October.....	173	47	105	6,460	.088	.10
November.....	1,550	73	384	22,800	.320	0.36
December.....	6,060	253	1,360	83,600	1.13	1.30
The year.....	23,900	28	832	602,000	.693	9.38

NOTE.—Values are rated as follows: January, February, and July to November, good; March to June and December, excellent.

## UMATILLA RIVER AT UMATILLA, OREG.

This station was established October 21, 1903. It is located about 1 mile above Umatilla, Oreg., and about one-fourth mile below the diversion dam of the Oregon Land and Water Company. To obtain the total discharge of the river, the discharge of the irrigation ditch must be added to that of the river at the gage. The gage was read during 1906 by N. E. Newton. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 188, where are given also references to publications that contain data for previous years.

*Discharge measurements of Umatilla River at Umatilla, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		<i>Fect.</i>	<i>Sq. ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
December 20....	R. S. Hall.....	167	165	3.08	363
1906.					
February 22....	R. S. Hall.....	177	328	4.00	1,330
March 17.....	do.....	174	219	3.40	652
April 19.....	J. C. Stevens.....	176	328	4.05	1,440
May 28.....	R. S. Hall.....	154	105	2.70	169
May 31 <sup>a</sup> .....	Stevens and Lewis.....		1,620	11.00	17,500
June 11.....	R. S. Hall.....	176	330	4.05	1,360
June 23.....	do.....	165	178	3.02	414
August 11 <sup>b</sup> ...	J. C. Stevens.....			1.10	0.3
November 25....	H. McGlashan.....	165	163	3.00	348

<sup>a</sup> Measured by floats.<sup>b</sup> Stream bed dry except at left edge.*Daily gage height, in feet, of Umatilla River at Umatilla, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.9			5.4	3.5	8.0	2.65	1.0	1.2	1.8	2.3	2.8
2.....		3.4	3.8			6.3				2.1	2.3	
3.....	2.8			4.9	3.4	5.5	2.5	1.0	1.2	2.15	2.25	2.75
4.....		3.35	3.6							2.1	2.3	
5.....	2.8			4.7	3.3	5.4	2.25	1.0	1.2	2.0	2.3	2.7
6.....		3.3	3.5							2.0	2.35	
7.....	3.0			4.7	3.15	5.0	2.0	1.0	1.2	2.1	2.4	2.7
8.....		3.25	3.4							2.1	2.4	
9.....	3.25			4.8	3.05	4.5	1.75	1.0	1.2	2.1	2.4	3.1
10.....		3.2	3.7							2.1	2.6	
11.....	3.2			4.6	2.9	4.1	1.7	1.1	1.2	2.1	2.6	3.2
12.....		3.0	3.7							2.1	2.6	
13.....	3.1			4.2	2.85	3.8	1.6	1.1	1.25	2.1	2.6	3.3
14.....		2.95	3.9							2.2	2.6	
15.....	3.1			4.0	2.9	3.5	1.3	1.1	1.3	2.2	3.9	3.3
16.....		2.9	3.6			3.7				2.15	3.8	
17.....	3.1			4.2	2.85	3.6	1.2	1.1	1.8	2.2	3.7	3.2
18.....		3.0	3.3							2.2	3.6	3.15
19.....	3.0			4.1	2.7	3.3	1.1	1.1	1.9	2.2	3.4	3.1
20.....		3.5	3.2							2.3	3.3	3.0
21.....	3.0			4.0	2.65	3.15	1.1	1.1	1.85	2.3	3.2	5.2
22.....		4.1	3.2							2.25	3.1	6.1
23.....	3.0			4.1	2.7	3.0	1.1	1.1	1.85	2.25	3.1	5.2
24.....		3.9	3.2							2.3	3.0	4.7
25.....	3.6			3.9	2.6	2.9	1.0	1.2	1.85	2.3	3.0	4.5
26.....		3.8	4.2							2.3	2.95	4.6
27.....	3.85			3.7	2.6	2.7	1.1	1.2	1.8	2.3	2.9	4.9
28.....		3.7	4.8		2.7					2.3	2.9	4.65
29.....	3.6			3.6	2.8	2.8	1.1	1.2	1.8	2.35	2.9	4.45
30.....			4.7		6.85					2.4	2.85	4.3
31.....	3.5				10.2		1.1	1.2		2.35		4.3

*Rating table for Umatilla River at Umatilla, Oreg., for 1906.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
1.10	0.1	2.10	21	3.10	400	4.20	1,670	6.20	5,220
1.20	.2	2.20	32	3.20	485	4.40	1,975	6.40	5,620
1.30	.3	2.30	45	3.30	575	4.60	2,290	6.60	6,030
1.40	.4	2.40	60	3.40	675	4.80	2,620	6.80	6,450
1.50	.5	2.50	80	3.50	775	5.00	2,960	7.00	6,880
1.60	.7	2.60	108	3.60	885	5.20	3,310	8.00	9,200
1.70	1.5	2.70	146	3.70	1,000	5.40	3,675	9.00	11,800
1.80	3.5	2.80	194	3.80	1,125	5.60	4,050	10.00	14,580
1.90	7.5	2.90	252	3.90	1,250	5.80	4,435	11.00	17,500
2.00	13	3.00	320	4.00	1,385	6.00	4,825		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906 and is well defined between gage heights 2 feet and 7 feet.

*Monthly discharge of Umatilla River at Umatilla, Oreg., for 1906.*

[Drainage area, 2,130 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.....	1,190	194	492	30,300	0.231	0.27
February.....	1,520	252	691	38,400	.324	.34
March.....	3,070	485	1,130	69,500	.531	.61
April.....	3,680	830	1,860	111,000	.873	.97
May.....	15,200	108	983	60,400	.462	.53
June.....	9,200	146	1,690	101,000	.793	.88
July.....	127	0	15.0	922	.007	.01
August.....	0.2	0	.094	5.8	.000044	.00005
September.....	7.5	0.2	2.46	146	.0012	.001
October.....	60	3.5	31.9	1,960	.015	.02
November.....	1,250	38.5	323	19,200	.152	.17
December.....	5,020	146	1,180	72,600	.554	.64
The year.....	15,200	0	700	505,000	.329	4.45

NOTE.—Values are rated as follows: January to June, November and December, excellent; July and October, fair; August and September, approximate. Discharges interpolated for days on which gage heights were not observed.

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Umatilla River drainage basin during 1906:

*Meacham Creek at Gibbon, Oreg.*—A measurement was made from the highway bridge one-half mile east of the Bingham Springs railroad station February 1, 1906. The water surface was 8.72 feet below the lower end of the floor plank, 5.3 feet from the left end of the truss.

Width, 45 feet; area, 130 square feet; discharge, 189 second-feet.

*Minnehaha Spring near Hermiston, Oreg.*—The following measurement was made May 7, 1906:

Width, 6 feet; area, 2.7 feet; discharge, 2.6 second-feet.

*Wild Horse Creek near Pendleton, Oreg.*—A measurement was made February 26, 1906. The water surface was 7.42 feet below a tack in the upstream side of the bridge.

Width, 16 feet; area, 13 square feet; discharge, 22 second-feet.

*Discharge measurements of Umatilla River near Fosters,<sup>a</sup> Oreg., in 1905-6.*

Date.	Width.	Area of section.	Gage height.	Discharge.
1905.	<i>Fect.</i>	<i>Sq. ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
November 11.....	66	55	1.08	40
December 4.....	82	106	1.78	227
December 22.....	115	159	2.10	413
December 28.....	102	124	1.84	291
1906.				
January 5.....	100	115	1.80	219
January 13.....	116	157	2.18	420
January 17.....	116	166	2.18	429
January 29.....	138	267	2.90	1,090
February 9.....	117	161	2.12	423
February 17.....	105	129	1.85	284
March 2.....	138	272	2.95	1,140

<sup>a</sup> At highway bridge, 4 miles below Echo, Oreg.

*Discharge measurements of Umatilla River at Pendleton, Oreg., in 1906.*

Date.	Width.	Area of section.	Gage height.	Dis-charge.
	<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
January 31 <sup>a</sup> .....	89	297		582
February 3 <sup>b</sup> .....	104	144	4.48	540
February 14 <sup>a</sup> .....	82	246	4.20	253
February 26 <sup>b</sup> .....	115	196	4.78	903
March 21 <sup>a</sup> .....	85	254	4.28	317

<sup>a</sup> From Oregon Railroad and Navigation Company's railway bridge.<sup>b</sup> From highway bridge.

## CANALS IN UMATILLA RIVER VALLEY, OREGON.

The points of diversion of these canals and the points of measurement are described in Water-Supply Paper No. 178, pages 190 to 201, where are also given the data collected during 1905.

*Discharge measurements of canals in Umatilla River Valley, Oregon, in 1906.*

## HORSESHOE IRRIGATION COMPANY'S CANAL, YOAKUM.

Date.	Width.	Area of section.	Gage height.	Dis-charge.
	<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
March 3.....	4	2		2.5
May 4.....	3.4	1.4		.87

## SLUSHER AND GOULD CANAL, NOLIN.

January 6.....	4.2	3.5	0.77	2.0
March 3.....	4.1	1.6	.42	.9

## CHARLES LISLE CANAL, ECHO.

January 6.....	7.6	6.9	0.99	1.9
January 17.....	7.7	7.0	.94	1.8
February 8.....	7.3	5.8	.82	1.8
February 17.....	9.8	9.2	1.24	.94
May 4.....	8.2	6.9	.98	3.85

## MILL CANAL, ECHO.

January 6.....	9.4	7.1	1.58	5.2
January 13.....	9.7	7.9	1.67	6.6
January 17.....	9.8	8.0	1.58	7.0
February 8.....	5.9	1.7	.89	.56
February 17.....	7.3	4.6	1.40	4.0
March 3.....	8.0	7.2	1.82	7.8
May 4.....	5.5	1.9	.99	1.3

## MILL CANAL WASTEWAY, ECHO.

1905.				
December 28.....	7.0	5.2	1.10	3.8
1906.				
January 6.....	7.0	5.8	1.13	4.3
January 17.....	7.2	7.0	1.20	5.0
February 8.....	4.8	1.4	.34	0.18
February 17.....	6.7	5.02	.92	4.86
March 2.....	7.2	7.4	1.20	7.5

Discharge measurements of canals in Umatilla River Valley, Oregon, in 1906—Cont'd.

## WILSON &amp; CO.'S CANAL, ECHO.

Date.	Width.	Area of section.	Gage height.	Discharge.
	<i>Fect.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
February 8.....	7.6	4.6	2.72	4.2
May 4.....	7.1	3.2	1.58	2.6

## ALLEN CANAL, ECHO.

1905.				
December 28.....	10.2	16	1.24	14
1906.				
January 5.....	10.2	16	1.25	13
January 17.....	10.3	16	1.25	12
March 2.....	9.7	6.9	.....	2.8
May 5.....	10.7	17	1.15	29

## ALLEN CANAL WASTEWAY, ECHO.

January 5.....	5.2	4.7	0.75	7.3
January 17 <sup>a</sup> .....	5.5	6.0	.....	10
February 9.....	5.2	3.7	.52	3.14
February 17.....	3.6	2.2	.30	.47
March 2.....	3.5	2.4	.28	.44
May 5.....	3.6	2.5	.29	.7

## HINKLE CANAL, ECHO.

January 5.....	14	14	1.70	14
January 13.....	13.8	14	1.70	15
January 17.....	14.4	14	1.71	15
February 8.....	15	16	1.91	20
February 17.....	12	11	1.50	9.3
March 2.....	12.7	13	1.73	14
May 5.....	16	25	2.43	42

## PIONEER CANAL, ECHO.

January 5.....	8.2	3.4	0.80	2.2
January 17.....	9.7	5.1	.98	4.33
May 5.....	12.4	23	1.58	54

## HERMISTON CANAL, HERMISTON.

1905.				
December 28.....	15.3	14	.....	11
1906.				
January 15 <sup>b</sup> .....	15.4	15	.....	11
February 16 <sup>c</sup> .....	16.0	17	0.62	17
May 7.....	19.0	29	1.34	39

## BEITLE CANAL, HERMISTON.

May 7.....	3.7	1.8	0.92	1.4

## OREGON LAND AND WATER COMPANYS CANAL, UMATILLA.

May 7.....	13.5	19	.....	44
November 25.....	4.8	4.1	.....	13

<sup>a</sup> Measured above wasteway.<sup>b</sup> At headgate.<sup>c</sup> Below headgate.

*Discharge measurements of canals in Umatilla River Valley, Oregon, in 1906.—Cont'd.*

BROWNELL CANAL, HERMISTON.

Date.	Width.	Area of section.	Gage height.	Dis-charge.
	<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
December 29..... 1905.	5	2.8	0.98	0.97
January 15..... 1906.	5	4.3	1.72	4.0
May 7.....	5	6.4	1.58	10

MAXWELL CANAL, ECHO.

January 5.....	5.2	1.6	0.31	0.79
January 15.....	5.4	2.0	.30	1.0
May 3.....	10.4	8.4		15

WILLOW CREEK DRAINAGE BASIN.

DESCRIPTION OF BASIN.

This stream rises in the timbered foothills of the Blue Mountains and flows northwestward into Columbia River near Arlington. Its drainage area throughout is timberless, and is composed of high, rolling table-lands used for the production of wheat and as range for cattle and sheep. The creek is small but is subject to excessive and sudden floods. In 1903 this stream was the scene of the disaster at Heppner, where over one hundred lives were lost from a sudden flood lasting scarcely more than an hour. The waters of this stream are used to some extent for irrigation in the immediate valley.

WILLOW CREEK NEAR ARLINGTON, OREG.

This station was established December 17, 1904, and was abandoned July 21, 1906, on account of poor conditions. It is located at the wagon bridge at Rhea siding, 9 miles from Arlington, Oreg. The station was maintained as a flood station and miscellaneous measurements only are made during the summer season.

During 1906 the gage was read by G. R. Huff. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 202.

*Discharge measurements of Willow Creek near Arlington, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
February 7.....	F. C. Dillard.....	24	85	(a)	33
February 28.....	R. S. Hall.....	23.5	51	1.50	55
March 31.....	F. C. Dillard.....	26	107	(a)	207
April 19.....	J. C. Stevens.....	23.5	41	1.12	32
June 9.....	R. S. Hall.....	24.5	89	3.15	296
June 9.....	do.....	24	94	3.40	363

*a* Gage not read.

*Daily gage height, in feet, of Willow Creek near Arlington, Oreg., for 1906.*

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1.....	1.52	2.8	0.85	4.4	1.15	17.....	1.35	1.25	0.45	2.4	0.8
2.....	1.52	2.7	.8	3.9	1.1	18.....	1.6	1.2	.45	2.2	.8
3.....	1.5	2.5	.75	3.65	1.0	19.....	1.5	1.15	.45	2.0	.8
4.....	1.52	2.4	.65	3.9	.95	20.....	1.45	1.1	.45	1.9	.8
5.....	1.55	2.3	.6	4.05	.95	21.....	1.4	1.1	.45	1.8	.8
6.....	1.5	2.2	.6	3.75	.95	22.....	1.98	1.1	.45	1.6	.....
7.....	1.52	2.1	.6	3.5	.95	23.....	2.45	1.1	.45	1.5	.....
8.....	1.62	2.0	.6	3.2	.9	24.....	2.3	1.1	.45	1.4	.....
9.....	1.75	1.9	.55	3.0	.85	25.....	2.4	1.1	.5	1.35	.....
10.....	1.8	1.8	.5	3.1	.85	26.....	4.15	1.1	.5	1.25	.....
11.....	1.8	1.7	.5	2.8	.9	27.....	3.0	1.0	.6	1.2	.....
12.....	1.75	1.6	.45	2.6	.9	28.....	3.1	1.0	.55	1.2	.....
13.....	1.8	1.5	.45	2.6	.9	29.....	2.7	.9	.5	1.2	.....
14.....	1.8	1.4	.45	2.45	.85	30.....	2.4	.9	6.7	1.15	.....
15.....	1.75	1.35	.4	2.3	.8	31.....	2.4	.....	6.0	.....	.....
16.....	1.35	1.3	.45	3.1	.8						

NOTE.—Some ice March 12 and 13; discharge not corrected.

*Rating table for Willow Creek near Arlington, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.40	10	1.20	35	2.00	100	2.80	224	3.60	421
0.50	12	1.30	41	2.10	112	2.90	244	3.70	454
0.60	14	1.40	48	2.20	125	3.00	265	3.80	489
0.70	16	1.50	55	2.30	139	3.10	286	3.90	526
0.80	19	1.60	63	2.40	154	3.20	309	4.00	565
0.90	22	1.70	72	2.50	170	3.30	334	5.00	965
1.00	25	1.80	81	2.60	187	3.40	361	6.00	1,365
1.10	30	1.90	90	2.70	205	3.50	390	7.00	1,765

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is not well defined.

*Monthly discharge of Willow Creek near Arlington, Oreg., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March.....	625	44	115	7,070
April.....	224	22	71.1	4,230
May.....	1,640	10	109	6,700
June.....	725	32	221	13,200
July 1-21.....	32	19	22.1	920
The period.....				32,100

NOTE.—Values are rated as follows: May, approximate; remainder of period, fair.

## JOHN DAY RIVER DRAINAGE BASIN.

### JOHN DAY RIVER AT M'DONALD, OREG.

John Day River rises in the Blue Mountains in northeastern Oregon, at an elevation of about 5,000 feet, and flows northward into Columbia River. The lower 90 miles of the stream flows in a comparatively deep canyon from which it is impracticable to take water for irrigation. The surrounding country is rolling, timberless land, partly cultivated and partly desert. The upper portions of the stream are more broken and mountainous, and large areas are well timbered. The river is fed by innumerable tributaries draining timbered mountain slopes. The main stream is formed by the junction of three

important streams called North, Middle, and South forks of John Day River. The rainfall in the drainage area varies from 25 inches on the headwaters to 9 inches at the mouth of the river.

The waters of the numerous mountain tributaries are used extensively for irrigating small valleys, for mining, and for power purposes. Irrigation is not practiced in the lower portion of the stream to any considerable extent.

This station was established November 14, 1901. It is located at the ferry at McDonald, 16 miles above the mouth of the river and 18 miles southwest of Arlington, Oreg. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 203, where are given also references to publications that contain data for previous years.

*Discharge measurements of John Day River at McDonald, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
February 6.....	F. C. Dillard.....	263	728	2.35	866
February 23.....	R. S. Hall.....	282	1,140	3.88	2,990
March 15.....	do.....	273	910	3.10	1,710
April 2.....	F. C. Dillard.....	319	2,050	6.70	10,500
April 17.....	J. C. Stevens.....	314	1,640	5.50	6,840
May 2.....	R. S. Hall.....	309	1,430	4.70	4,760
June 8.....	do.....	322	1,860	6.16	8,670
July 6.....	do.....	278	797	2.69	1,240
November 23.....	H. McGlashan.....	268	624	1.97	495

*Daily gage height, in feet, of John Day River at McDonald, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.80	2.40	3.80	7.50	4.70	6.98	3.22	1.55	1.45	1.55	1.75	1.70
2.....	1.90	2.52	3.55	6.72	4.68	6.48	3.08	1.55	1.45	1.55	1.75	1.80
3.....	1.85	2.58	3.25	6.05	4.62	6.20	2.98	1.55	1.40	1.55	1.75	1.80
4.....	1.78	2.42	3.15	5.45	4.58	6.10	2.88	1.50	1.40	1.55	1.75	1.85
5.....	1.80	2.42	3.10	5.35	4.52	6.78	2.78	1.50	1.40	1.55	1.75	1.85
6.....	1.85	2.35	3.10	5.45	4.55	6.82	2.68	1.50	1.40	1.55	1.75	1.92
7.....	1.88	2.35	3.05	5.60	4.35	6.55	2.60	1.50	1.40	1.55	1.72	1.95
8.....	1.90	2.30	3.15	6.00	4.15	6.15	2.50	1.50	1.40	1.55	1.82	2.00
9.....	1.85	2.20	3.75	5.92	4.05	5.80	2.48	1.45	1.40	1.60	1.85	2.00
10.....	1.90	2.15	4.15	5.90	3.98	5.70	2.42	1.45	1.35	1.60	1.85	2.10
11.....	1.90	2.20	4.50	5.85	3.92	5.45	2.42	1.45	1.35	1.60	1.85	2.20
12.....	1.90	2.18	4.25	5.55	3.98	5.25	2.32	1.45	1.40	1.60	1.92	2.20
13.....	1.88	2.12	4.75	5.25	3.98	5.05	2.28	1.45	1.40	1.60	2.00	2.15
14.....	1.90	2.12	3.40	5.05	4.00	4.95	2.20	1.40	1.45	1.60	1.95	2.18
15.....	1.90	2.20	3.15	5.00	3.80	4.72	2.12	1.82	1.45	1.60	2.00	2.28
16.....	2.00	2.20	3.10	5.12	3.70	4.55	2.05	1.88	1.45	1.60	1.95	2.20
17.....	2.00	2.20	3.00	5.35	3.80	4.60	2.00	1.70	1.52	1.60	2.00	2.15
18.....	2.10	2.28	2.90	5.60	3.65	4.72	2.00	1.65	1.65	1.60	2.40	2.10
19.....	2.30	2.30	2.95	5.35	3.50	4.60	1.92	1.60	1.75	1.65	2.30	2.00
20.....	2.18	3.35	3.00	5.12	3.40	4.15	1.90	1.60	1.75	1.65	2.22	2.10
21.....	2.10	3.88	3.00	5.10	3.28	4.00	1.90	1.50	1.70	1.70	2.20	2.10
22.....	2.05	3.70	3.00	5.25	3.25	3.88	1.85	1.50	1.70	1.70	2.10	2.20
23.....	2.00	3.85	3.35	5.60	3.30	3.78	1.80	1.50	1.70	1.70	2.00	2.25
24.....	2.25	3.50	4.55	5.60	3.40	3.60	1.80	1.45	1.65	1.70	2.00	2.55
25.....	2.60	3.25	5.05	5.50	3.40	3.50	1.75	1.45	1.60	1.75	2.10	2.68
26.....	2.95	3.20	6.55	5.35	3.30	3.40	1.70	1.45	1.60	1.75	2.00	2.75
27.....	2.92	3.10	6.40	5.22	3.40	3.45	1.70	1.45	1.60	1.75	1.95	3.60
28.....	2.80	3.10	6.55	5.00	3.40	3.30	1.65	1.48	1.60	1.75	1.90	4.10
29.....	2.58	.....	6.30	4.85	3.50	3.35	1.60	1.50	1.60	1.75	1.95	3.75
30.....	2.50	.....	6.10	4.72	3.50	3.40	1.60	1.50	1.60	1.75	1.90	3.45
31.....	2.42	.....	6.50	.....	7.85	.....	1.60	1.50	.....	1.75	.....	3.25

Rating table for John Day River at McDonald, Oreg., for 1906.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.00	60	2.00	540	3.00	1,615	3.90	3,050	5.60	7,050
1.10	85	2.10	625	3.10	1,750	4.00	3,240	5.80	7,590
1.20	115	2.20	715	3.20	1,890	4.20	3,650	6.00	8,150
1.30	145	2.30	810	3.30	2,035	4.40	4,090	6.20	8,710
1.40	180	2.40	910	3.40	2,185	4.60	4,550	6.40	9,290
1.50	220	2.50	1,015	3.50	2,345	4.80	5,020	6.60	9,880
1.60	265	2.60	1,125	3.60	2,515	5.00	5,500	6.80	10,480
1.70	320	2.70	1,240	3.70	2,690	5.20	6,000	7.00	11,100
1.80	385	2.80	1,360	3.80	2,870	5.40	6,520	8.00	14,310
1.90	460	2.90	1,485						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined below gage height 6.0 feet.

Monthly discharge of John Day River at McDonald, Oreg., for 1906.

[Drainage area, 7,800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January.....	1,550	372	672	41,300	0.086	0.10
February.....	3,010	643	1,280	71,100	.164	.17
March.....	9,730	1,480	3,820	235,000	.490	.56
April.....	12,700	4,830	6,860	408,000	.879	.98
May.....	13,800	1,960	3,390	208,000	.435	.50
June.....	11,000	2,040	5,560	331,000	.713	.80
July.....	1,920	265	760	46,700	.097	.11
August.....	445	180	236	14,500	.030	.03
September.....	352	162	234	13,900	.030	.03
October.....	352	242	288	17,700	.037	.04
November.....	910	352	506	30,100	.065	.07
December.....	3,440	320	969	59,600	.124	.14
The year.....	13,800	162	2,050	1,480,000	.262	3.53

NOTE.—Values are rated as excellent.

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in John Day River drainage basin in 1906:

*Canyon Creek at Canyon City, Oreg.*—The reference point is a cross cut in the top of a cap of a bent on the right bank downstream side of the highway bridge.

July 2, width, 27 feet; area, 22 square feet; gage height, —8.00 feet; discharge, 50 second-feet.

*Rock Creek at Rockcreek, Oreg.*—Rockcreek is a station on the Oregon Railroad and Navigation Company's Condon branch, 6 miles above the mouth of the creek. Measurements are made at a highway bridge near the railway station. The reference point is on top of the first projecting beam from the left bank on upstream side of the bridge; elevation, 15 feet above the datum of the assumed gage.

February 6, width, 24 feet; area, 33 square feet; gage height, 5.67 feet; discharge, 35 second-feet.

February 23, width, 40 feet; area, 62 square feet; gage height, 6.48 feet; discharge, 122 second-feet.

March 16, width, 30 feet; area, 53 square feet; gage height, 6.07 feet; discharge, 87 second-feet.

## DESCHUTES RIVER DRAINAGE BASIN.

## DESCRIPTION OF BASIN.

Deschutes River and its tributaries drain the eastern slope of the Cascade Mountains in Oregon. The main stream flows northward parallel to this range and empties into Columbia River 15 miles above The Dalles. Its drainage area may be divided into two parts: The tributaries from the west drain the timbered slopes of the Cascade Range; those from the east drain the timberless areas of high table-lands which are devoted largely to the production of wheat and to ranges for sheep and cattle. The soil throughout is composed of disintegrated lava rock, interlaid with porous lava and basalt, a fact which no doubt accounts for the remarkable constancy in the flow of this river and its tributaries from the west. The maximum discharge is only about four times the minimum. The stream is therefore the most valuable in the State. Its power possibilities are phenomenal, and its upper portions furnish an abundance of water for the irrigation of the fertile table-lands. Its principal tributaries are West Fork, Tumalo Creek, Squaw Creek, Crooked River, Metolius River, Warm Springs, and White River, all of which are used for irrigation, power, and logging purposes.

## DESCHUTES RIVER NEAR LAVA, OREG.

This station was established February 17, 1905, about 1 mile north of Lava, Oreg. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 212.

*Discharge measurements of Deschutes River near Lava, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 14.....	I. Landes.....	56.5	181	6.21	317
May 1.....	do.....	66.5	231	6.96	422
May 12.....	do.....	67.0	248	7.15	485
June 12.....	do.....	56.0	215	6.94	413
June 21.....	J. C. Stevens.....	61.0	210	6.67	368

*Daily gage height, in feet, of Deschutes River near Lava, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	5.4	5.7	5.3	5.6	7.0	6.65	6.45	5.5	5.2	5.15	5.1	5.45
2.....	5.35	5.7	5.2	5.6	6.9	6.6	6.4	5.5	5.15	5.15	5.1	5.35
3.....	5.35	5.7	5.25	5.65	6.9	6.7	6.3	5.5	5.15	5.15	5.1	5.4
4.....	5.35	5.5	5.2	5.6	6.9	6.65	6.3	5.5	5.15	5.15	5.1	5.45
5.....	5.45	5.45	5.25	5.7	6.95	6.6	6.35	5.5	5.15	5.15	5.2	5.45
6.....	5.5	5.4	5.2	5.85	7.0	6.85	6.35	5.45	5.15	5.15	5.3	5.4
7.....	5.5	5.4	5.2	6.0	7.05	7.0	6.35	5.45	5.15	5.15	5.3	5.4
8.....	5.5	5.45	5.3	6.1	7.1	7.0	6.35	5.45	5.15	5.15	5.35	5.45
9.....	5.5	5.4	5.25	6.15	7.15	7.05	6.35	5.4	5.2	5.1	5.55	5.45
10.....	5.5	5.35	5.2	6.2	7.15	7.1	6.3	5.4	5.2	5.1	5.65	5.4

Daily gage height, in feet, of Deschutes River near Lava, Oreg., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11.....	5.6	5.3	5.35	6.25	7.15	7.15	6.2	5.4	5.25	5.1	5.6	5.4
12.....	5.6	5.25	5.65	6.25	7.15	7.0	6.2	5.5	5.25	5.15	5.55	5.7
13.....	5.6	5.15	5.75	6.2	7.2	6.95	6.2	5.45	5.3	5.15	5.0	5.4
14.....	5.6	5.1	5.5	6.25	7.25	6.85	6.2	5.4	5.3	5.2	5.55	5.3
15.....	5.6	5.15	5.5	6.35	7.35	6.85	6.15	5.4	5.35	5.2	5.55	5.45
16.....	5.75	5.15	5.3	6.5	7.35	6.85	6.15	5.4	5.3	5.2	5.65	5.4
17.....	5.75	5.1	5.35	6.65	7.35	6.85	6.1	5.35	5.3	5.3	5.9	5.35
18.....	5.8	5.15	5.3	6.82	7.4	6.85	6.1	5.3	5.3	5.3	5.9	5.4
19.....	5.7	5.65	5.5	6.9	7.35	6.8	6.1	5.3	5.3	5.3	5.9	5.45
20.....	5.85	5.4	5.3	6.9	7.1	6.75	5.95	5.3	5.25	5.25	5.85	5.5
21.....	5.9	5.3	5.5	6.95	6.95	6.7	5.95	5.3	5.2	5.2	5.85	5.65
22.....	5.95	5.35	5.55	7.05	6.8	6.6	5.85	5.3	5.2	5.2	5.8	5.7
23.....	5.95	5.4	5.7	7.18	6.75	6.55	5.8	5.35	5.2	5.15	5.7	5.65
24.....	5.95	5.45	5.6	7.28	6.65	6.5	5.75	5.3	5.2	5.15	5.45	5.75
25.....	6.1	5.4	5.75	7.35	6.65	6.45	5.75	5.3	5.2	5.15	5.45	5.85
26.....	6.1	5.3	5.7	7.35	6.6	6.5	5.7	5.3	5.2	5.1	5.45	5.85
27.....	6.1	5.3	5.6	7.35	6.6	6.5	5.65	5.25	5.2	5.1	5.45	5.9
28.....	6.1	5.4	5.7	7.25	6.8	6.45	5.65	5.25	5.2	5.1	5.45	6.0
29.....	6.1	.....	5.7	7.2	6.85	6.45	5.65	5.2	5.2	5.1	5.45	5.9
30.....	5.9	.....	5.8	7.1	7.0	6.45	5.6	5.2	5.2	5.1	5.45	5.8
31.....	5.9	.....	5.85	.....	7.05	.....	5.55	5.2	.....	5.1	.....	5.8

NOTE.—From January 1 to March 22 there was some obstruction from ice, which formed and then went out again, sometimes reaching a thickness of 0.6 foot. There was also some ice November 23 to December 8. Discharges have been applied as for open channel.

Rating table for Deschutes River near Lava, Oreg., for 1905-6.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
4.80	76	5.40	125	6.00	205	6.60	329	7.20	498
4.90	82	5.50	135	6.10	223	6.70	355	7.30	528
5.00	89	5.60	147	6.20	242	6.80	382	7.40	559
5.10	97	5.70	160	6.30	262	6.90	410		
5.20	106	5.80	173	6.40	283	7.00	439		
5.30	115	5.90	188	6.50	305	7.10	468		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1905-6 and is well defined between gage heights 6.0 feet and 7.5 feet. Below gage height 6 feet the measurements are inconsistent.

Monthly discharge of Deschutes River near Lava, Oreg., for 1906.

[Drainage area, 880 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.....	223	120	166	10,200	0.189	0.22
February.....	160	97	123	6,830	.140	.15
March.....	180	106	136	8,360	.155	.18
April.....	544	147	332	19,800	.377	.42
May.....	559	329	445	27,400	.506	.58
June.....	483	294	369	22,000	.419	.47
July.....	294	141	220	13,500	.250	.29
August.....	135	106	122	7,500	.139	.16
September.....	120	102	108	6,430	.123	.14
October.....	115	97	103	6,330	.117	.13
November.....	188	89	137	8,150	.156	.17
December.....	205	115	144	8,850	.164	.19
The year.....	559	89	200	145,000	.228	3.10

NOTE.—Values are rated as fair.

## DESCHUTES RIVER AT WEST'S RANCH, NEAR LAVA, OREG.

This station was established June 20, 1906. It is located at a private bridge on B. F. West's ranch, 16 miles above Bend. It is below the mouth of West Fork and of Spring River and above all important diversions.

The channel is straight for 200 feet above and 100 feet below the station. The right bank is low, sparsely wooded, and liable to overflow at rare intervals; the left is high and rocky and will not overflow. The bed of the stream is partly of rock and partly of gravel, and will change only during floods.

Measurements are made from a private highway bridge constructed of logs. The initial point is a mark on the guardlog of the bridge, nearly over the gage.

The gage, which is read by B. F. West, is a 2 by 4 inch timber spiked to the approach on the right bank. The bench mark is a spike in the north side of the base of a lone yellow pine, 75 feet upstream from the bridge on the left bank; elevation, 17.44 feet above the datum of the gage.

*Discharge measurements of Deschutes River at West's ranch, near Lava, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 13.....	I. Landes.....	107	588	9.08	1,500
May 20.....	do.....	110	652	9.42	1,920
June 12.....	do.....	110	649	9.39	1,910
June 20.....	Stevens and Landes.....	110	626	9.30	1,780
August 23.....	C. W. Allen.....	105	576	8.85	1,400

*Daily gage height, in feet, of Deschutes River at West's ranch, near Lava, Oreg., for 1906.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		8.9	8.8	8.8	8.7	8.75	17.....		8.85	8.85	8.75	8.95	8.8
2.....		8.9	8.8	8.8	8.7	8.75	18.....		8.85	8.85	8.75	9.0	8.8
3.....		8.9	8.8	8.8	8.7	8.75	19.....		8.85	8.85	8.75	8.95	8.85
4.....		8.9	8.8	8.8	8.7	8.75	20.....		8.85	8.8	8.75	8.9	8.85
5.....		8.9	8.8	8.75	8.75	8.75	21.....	9.0	8.85	8.8	8.75	8.9	8.85
6.....		8.9	8.8	8.75	8.75	8.75	22.....	9.0	8.85	8.8	8.75	8.9	8.9
7.....		8.9	8.8	8.75	8.8	8.8	23.....	8.98	8.85	8.8	8.7	8.8	8.9
8.....		8.9	8.8	8.75	8.8	8.8	24.....	8.95	8.85	8.8	8.7	8.8	8.9
9.....		8.9	8.8	8.75	8.8	8.8	25.....	8.95	8.85	8.8	8.7	8.82	8.9
10.....		8.9	8.8	8.75	8.88	8.8	26.....	8.95	8.85	8.8	8.7	8.75	8.98
11.....		8.9	8.8	8.75	8.85	8.8	27.....	8.95	8.85	8.8	8.7	8.7	9.0
12.....		8.9	8.8	8.78	8.85	8.75	28.....	8.95	8.85	8.8	8.7	8.72	9.0
13.....		8.9	8.82	8.75	8.8	8.75	29.....	8.95	8.8	8.8	8.7	8.72	8.95
14.....		8.9	8.85	8.75	8.8	8.8	30.....	8.92	8.8	8.8	8.7	8.75	8.95
15.....		8.85	8.85	8.75	8.85	8.8	31.....	8.90	8.8		8.7		8.9
16.....		8.85	8.85	8.75	8.9	8.78							

*Rating table for Deschutes River at West's ranch, near Lava, Oreg., for 1906.*

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
8.70	1,290	8.90	1,430	9.10	1,590	9.30	1,780	9.40	1,900
8.80	1,360	9.00	1,510	9.20	1,680				

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and is well defined.

*Monthly discharge of Deschutes River at West's ranch, near Lava, Oreg., for 1906.*

[Drainage area, 1,240 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
July 21-31.....	1,510	1,430	1,470	32,100	1.19	0.49
August.....	1,430	1,360	1,410	86,700	1.14	1.31
September.....	1,400	1,360	1,370	81,500	1.10	1.23
October.....	1,360	1,290	1,320	81,200	1.06	1.22
November.....	1,510	1,290	1,370	81,500	1.10	1.23
December.....	1,510	1,320	1,390	85,500	1.12	1.29
The period.....				448,000		

NOTE.—Values are rated as excellent.

#### DESCHUTES RIVER AT BEND, OREG.

This station was established December 22, 1904. It is located at the wagon bridge known as Sizemore's bridge, 1½ miles south of Bend, Oreg.

On account of backwater from logs and other disturbing influences the gage heights at this station are no index of the discharge, which is practically the same as at West's ranch. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 208, where are given also references to publications that contain data for previous years.

*Discharge measurements of Deschutes River at Bend, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		<i>Fect.</i>	<i>Sq. ft.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
April 19.....	I. Landes.....	370.5	747	1.78	1,680
June 19.....	J. C. Stevens.....	376	883	2.11	1,880

#### DESCHUTES RIVER NEAR BIGGS, OREG.

This station was established July 7, 1906. It is located at Taylor's ranch, 1½ miles above the junction of the river with the Columbia, about the same distance above the Oregon Railroad and Navigation Company's bridge, and 1 mile above Moody's toll bridge.

The channel is straight; the banks are overgrown with alder and not liable to overflow. The bed of the stream is of rock and gravel, free from vegetation, and liable to shift slightly. There is but one channel at all stages. There is a good even current at the gaging section; a little lower down it is considerably broken by falls and riffles.

Measurements are made from a car and cable of 490 feet span. The initial point for soundings is 8 feet from the inside of the shear leg on the left bank. There is a tagged wire overhead and a stay-line 100 feet upstream.

The gage, which is read by Wilbur Taylor, is 150 yards below the point of measurement, on the right bank. It is in two sections and

is bolted to alder trees. The bench mark is the top of three 20-penny nails driven into the trunk of the alder tree to which the lower part of the gage is anchored; elevation, 5.46 feet above the datum of the gage.

*Discharge measurements of Deschutes River near Biggs, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
July 7.....	L. R. Allen.....	452	1,610	2.63	6,010
August 30.....	do.....	449	1,550	2.34	5,140
September 29.....	I. B. Oakes.....	435	1,530	2.30	5,000
October 18.....	Stevens and Oakes.....	450	1,530	2.35	5,320
December 17.....	H. D. McGlashan.....	449	1,650	2.64	5,710

*Daily gage height, in feet, of Deschutes River near Biggs, Oreg., for 1906.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.4	2.3	2.3	2.35	2.56	17.....		2.4	2.3	2.3	3.6	2.63
2.....		2.4	2.3	2.3	2.35		18.....		2.4	2.3	2.35	3.46	
3.....		2.4	2.3	2.3	2.35	2.55	19.....		2.4	2.3	2.35		2.65
4.....		2.4	2.3	2.3	2.35		20.....		2.4	2.3	2.35	3.1	
5.....		2.4	2.3	2.3	2.35	2.55	21.....		2.4	2.3	2.35	2.85	3.5
6.....		2.4	2.3	2.3	2.35	2.55	22.....	2.4	2.4	2.3	2.35	2.75	3.25
7.....		2.4	2.3	2.3	2.45		23.....	2.4	2.4	2.3	2.35		
8.....		2.4	2.3	2.3	3.25	2.66	24.....	2.4	2.4	2.3	2.35	2.7	3.18
9.....		2.4	2.3	2.3			25.....	2.4	2.4	2.3	2.35		3.1
10.....		2.4	2.3	2.3	2.9	2.62	26.....	2.4	2.4	2.3	2.35	2.65	
11.....		2.4	2.3	2.3	3.0	2.6	27.....	2.4	2.4	2.3	2.56		3.08
12.....		2.4	2.3	2.3			28.....	2.4	2.4	2.3	2.4	2.6	
13.....		2.4	2.3	2.3	3.8	2.58	29.....	2.4	2.4	2.3	2.39		3.03
14.....		2.4	2.3	2.3	3.65		30.....	2.4	2.4	2.3	2.36	2.58	3.0
15.....		2.4	2.3	2.3	4.1	2.55	31.....	2.4	2.4		2.35		2.98
16.....		2.4	2.3	2.3	3.9								

*Rating table for Deschutes River near Biggs, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.30	5,140	2.70	6,060	3.10	7,020	3.50	8,000	3.90	9,000
2.40	5,370	2.80	6,300	3.20	7,260	3.60	8,250	4.00	9,250
2.50	5,600	2.90	6,540	3.30	7,500	3.70	8,500	4.10	9,500
2.60	5,830	3.00	6,780	3.40	7,750	3.80	8,750		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and is fairly well defined below gage height 2.7 feet.

*Monthly discharge of Deschutes River near Biggs, Oreg., for 1906.*

[Drainage area, 9,180 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
July 22-31.....	5,370	5,370	5,370	106,000	0.585	0.22
August.....	5,370	5,370	5,370	330,000	.585	.67
September.....	5,140	5,140	5,140	306,000	.560	.62
October.....	5,740	5,140	5,220	321,000	.569	.66
November.....	9,500	5,260	6,640	395,000	.723	.81
December.....	8,000	5,720	6,360	391,000	.693	.80
The period.....				1,850,000		

NOTE.—Values are rated as fair.

## EAST FORK OF DESCHUTES RIVER AT ODELL, OREG.

This station was established December 25, 1904, at Odell post-office. The conditions and the bench marks are described in Water-Supply Paper No. 178, page 210, where are given also references to publications that contain data for previous years.

*Discharge measurements of East Fork of Deschutes River at Odell, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 11.....	I. Landes.....	24	34	2.70	43
May 21.....	do.....	25	43	3.15	101
June 14.....	do.....	25.5	47	a 3.40	118
June 21.....	Stevens and Landes.....	25.5	44	3.15	109

<sup>a</sup> Gage height uncertain.

*Daily gage height, in feet, of East Fork of Deschutes River at Odell, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.1	3.2	3.1	2.6	3.25	3.1	3.0	2.4	2.2	2.2	2.2	2.75
2.....	3.1	3.2	2.7	2.6	3.25	3.1	3.0	2.4	2.2	2.2	2.2	2.65
3.....	3.0	3.2	3.05	2.92	3.3	3.1	2.9	2.4	2.2	2.2	2.2	2.7
4.....	3.0	2.8	3.1	2.6	3.35	3.2	3.0	2.3	2.2	2.2	2.3	2.75
5.....	3.0	2.8	3.0	2.55	3.4	3.3	3.1	2.3	2.2	2.2	2.3	2.5
6.....	3.0	3.1	2.9	2.75	3.5	3.4	3.1	2.3	2.5	2.2	2.4	2.5
7.....	3.0	2.9	2.9	2.5	3.5	3.3	3.0	2.2	2.5	2.2	2.6	2.5
8.....	3.0	2.9	3.0	2.8	3.45	3.3	2.9	2.2	2.5	2.2	2.4	2.5
9.....	3.0	2.8	2.9	2.85	3.5	3.3	2.8	2.2	2.5	2.2	2.4	2.5
10.....	2.8	2.9	2.85	2.85	3.55	3.2	2.8	2.2	2.5	2.2	2.4	2.5
11.....	2.8	3.0	2.9	2.7	3.55	3.2	2.75	2.2	2.5	2.2	2.65	2.7
12.....	2.8	3.1	2.8	2.7	3.6	3.3	2.75	2.3	2.5	2.2	2.65	2.6
13.....	2.9	3.1	2.5	2.75	3.6	3.3	2.7	2.3	2.3	2.2	2.65	2.5
14.....	2.9	3.1	3.0	2.8	3.7	3.4	2.7	2.3	2.4	2.2	2.65	2.5
15.....	3.1	3.0	2.9	2.9	3.7	3.4	2.7	2.3	2.4	2.2	2.4	2.4
16.....	3.1	3.0	2.8	3.0	3.6	3.5	2.7	2.3	2.3	2.2	2.7	2.5
17.....	2.4	3.1	2.7	3.0	3.4	3.5	2.7	2.3	2.3	2.65	2.6	2.5
18.....	2.2	3.2	2.7	3.0	3.3	3.4	2.7	2.3	2.3	2.3	2.65	2.5
19.....	2.2	3.2	2.8	3.0	3.1	3.2	2.6	2.3	2.3	2.3	2.4	2.6
20.....	2.18	3.35	2.8	3.0	3.0	3.1	2.6	2.3	2.2	2.3	2.6	2.5
21.....	3.5	3.5	2.8	3.3	3.1	3.1	2.65	2.3	2.2	2.65	2.6	2.5
22.....	3.0	3.3	2.85	3.4	3.1	3.1	2.5	2.3	2.2	2.65	2.55	2.45
23.....	3.4	3.3	3.2	3.4	2.9	3.1	2.5	2.3	2.2	2.65	2.5	2.4
24.....	3.4	3.0	3.1	3.4	2.9	3.0	2.5	2.5	2.2	2.65	2.68	2.45
25.....	3.4	2.85	3.1	3.45	2.9	3.0	2.5	2.5	2.2	2.2	2.65	2.5
26.....	3.4	2.85	3.0	3.3	3.0	3.0	2.45	2.5	2.2	2.2	2.85	2.7
27.....	2.9	2.8	3.0	3.25	3.0	3.0	2.45	2.5	2.2	2.2	2.85	2.6
28.....	3.2	3.25	2.75	3.25	3.3	3.0	2.45	2.5	2.2	2.2	2.65	2.5
29.....	3.2	.....	2.65	3.2	3.2	3.0	2.45	2.2	2.2	2.2	2.7	2.5
30.....	3.2	.....	2.7	3.25	3.2	3.0	2.4	2.2	2.2	2.2	2.65	2.5
31.....	3.2	.....	3.1	.....	3.1	.....	2.4	2.2	.....	2.2	.....	2.4

*Rating table for East Fork of Deschutes River at Odell, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.10	24	2.50	49	2.90	81	3.30	121	3.70	174
2.20	30	2.60	56	3.00	90	3.40	133		
2.30	36	2.70	64	3.10	100	3.50	146		
2.40	42	2.80	72	3.20	110	3.60	160		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and the form of previous curves and is fairly well defined.

*Monthly discharge of East Fork of Deschutes River at Odell, Oreg., for 1906.*

[Drainage area, 196 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.....	146	29	88.8	5,460	0.454	0.52
February.....	146	72	97.6	5,420	.498	.52
March.....	110	60	80.8	4,970	.413	.48
April.....	140	49	89.7	5,340	.458	.51
May.....	174	81	124	7,620	.633	.73
June.....	146	90	110	6,540	.562	.63
July.....	100	42	65.2	4,010	.333	.38
August.....	49	30	37.8	2,320	.196	.23
September.....	49	30	36.2	2,150	.185	.21
October.....	60	30	35.4	2,180	.182	.21
November.....	77	30	52.0	3,090	.265	.30
December.....	68	42	52.0	3,200	.265	.31
The year.....	174	29	73.0	52,300	.522	5.03

NOTE.—Values are rated as fair.

## WEST FORK OF DESCHUTES RIVER NEAR LAVA, OREG.

This station was established February 20, 1905, about  $11\frac{1}{2}$  miles west of Lava, Oreg. The conditions and the bench marks are described in Water-Supply Paper No. 178, page 214, where are given also references to publications that contain data for previous years.

*Discharge measurements of West Fork of Deschutes River near Lava, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis- charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 13.....	I. Landes.....	99	453	7.91	910
May 2.....	do.....	100	468	8.10	880
May 13.....	do.....	100	485	8.30	942
June 11.....	do.....	101	485	8.39	955
June 21.....	Stevens and Landes.....	101	484	8.26	914

*Daily gage height, in feet, of West Fork of Deschutes River near Lava, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		7.52						8.05				
2.....	8.01	7.50								8.10	7.90	
3.....		7.50	7.50									
4.....	7.70	7.50					8.15					
5.....	7.62	7.50			8.50	8.35		8.10		8.00		
6.....	7.62	7.50										
7.....	7.65	7.50		7.80				8.01				
8.....	7.60	7.50			8.15							8.10
9.....	7.60	7.50								8.00	8.00	
10.....	7.60	7.50	7.60									
11.....	7.60	7.50					8.15				8.00	
12.....	7.60	7.50				8.40		8.15		8.10	7.90	
13.....	7.70	7.50			8.30							
14.....	7.65	7.50		8.00					8.20			
15.....	7.65	7.50										7.90
16.....	7.85	7.50								8.10	8.10	
17.....	7.62	7.55	7.40		8.40							
18.....	7.70	7.62					8.15					
19.....	7.66	7.70						8.10		8.00		
20.....	7.60	7.65			8.30							

*Daily gage height, in feet, of West Fork of Deschutes River near Lava, Oreg., in 1906—*  
Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.....	7.55	7.60				8.26			8.01			
22.....	7.60	7.60										7.70
23.....	7.65	7.60										
24.....	7.66	7.60	7.50			8.20	8.10				7.95	
25.....	7.60	7.60										
26.....	7.60					8.25		8.15		7.95		
27.....	7.58											
28.....	7.55	7.50		8.20					8.01			
29.....	7.55											8.00
30.....	7.55										7.90	
31.....	7.55		7.75					8.15				

NOTE.—There was some floating ice during January.

*Rating tables for West Fork of Deschutes River near Lava, Oreg.*

JANUARY 1, 1905, TO APRIL 30, 1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
7.40	837	7.60	867	7.80	902	8.00	942	8.20	984
7.50	852	7.70	883	7.90	922	8.10	963		

MAY 1 TO DECEMBER 31, 1906.<sup>b</sup>

7.50	727	7.80	802	8.10	879	8.40	958	8.50	985
7.60	752	7.90	827	8.20	905				
7.70	777	8.00	853	8.30	931				

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined above gage height, 7.7 feet.

<sup>b</sup> This table is applicable only for open-channel conditions. It is based on 4 discharges measurements made during 1906 and is well defined above gage height 8.1 feet. The table has been extended beyond these limits.

*Monthly discharge of West Fork of Deschutes River near Lava, Oreg., for 1906.*

[Drainage area, 360 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.....	944	860	874	53,700	2.43	2.80
February.....	883	852	858	47,700	2.38	2.48
March.....	802	837	860	52,900	2.39	2.76
April.....	984	902	943	56,100	2.62	2.92
May.....	985	892	939	57,700	2.61	3.01
June.....	958	905	929	55,300	2.58	2.88
July.....	892	879	889	54,700	2.47	2.85
August.....	892	866	883	54,300	2.45	2.82
September.....	905	856	868	51,600	2.41	2.69
October.....	879	840	862	53,000	2.39	2.76
November.....	879	827	844	50,200	2.34	2.61
December.....	879	777	834	51,300	2.32	2.68
The year.....	985	777	882	638,000	2.45	33.26

NOTE.—Owing to the steady flow of the river the mean discharge for the days of each month when the gage was read has been taken as the mean for the month. Values are good.

## CENTRAL OREGON AND PILOT BUTTE CANALS, NEAR BEND, OREG.

These canals have a common head-gate and are operated by the Deschutes Irrigation and Power Company, under the provisions of the Carey Act. They divert water from Deschutes River about 3 miles above Bend. Measurements are made 2,000 feet below dividing point. The conditions at these stations are described in Water-Supply Paper No. 178, pages 216-217.

*Discharge measurements of Central Oregon canal near Bend, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet</i>	<i>Sec.-ft.</i>
April 18.....	I. Landes.....	13.3	11	0.80	35
May 18.....	do.....	13.3	17	1.25	66
June 10.....	do.....	13.3	19	1.45	86
June 19.....	J. C. Stevens.....	13.4	19	1.44	92
June 19.....	I. Landes.....	13.4	19	1.44	90
June 19.....	L. R. Allen.....	13.4	19	1.44	87
August 22.....	C. W. Allen.....	13.3	25	1.87	134

*Daily gage height, in feet, of Central Oregon canal near Bend, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.35	1.25	1.25	.80	1.25	1.58	1.80	1.87	1.84	1.68	1.09
2.....		1.25	.90	1.25		1.25	1.58	1.80	1.88	1.84	1.65	.98
3.....	.38	1.60	1.15	1.25	1.12	1.25	1.58	1.80	1.87	1.82	1.59	.98
4.....	.90	1.60	1.30	1.25	1.30	1.25	1.58	1.80	1.87	1.84	1.08	.98
5.....	.90	1.20	1.20	1.25	1.20	1.25	1.61	1.80	1.87	1.84	1.09	1.09
6.....	.90	.95	.60	1.25	1.20	1.25	1.61	1.80	1.87	1.84	1.6	1.19
7.....	1.00	.65	.60	1.25	.60	1.25	1.64	1.80	1.87	1.84	1.48	1.20
8.....	.55	.65	.60	1.12	.60	1.35	1.65	1.80	1.86	1.84	1.10	1.20
9.....		.65	.90	.90	1.20	1.45	1.65	1.80	1.87	1.84	1.02	1.20
10.....		.65	.90	.82	1.22	1.45	1.67	1.80	1.87	1.84	0.51	1.20
11.....		.32		.85	1.20	1.45	1.69	1.80	1.87	1.83		1.20
12.....	.62	.33	.35	1.20	1.20	1.45	1.85	1.80	1.87	1.83		1.20
13.....	.43	.32	.45	1.25	1.20	1.45	1.84	1.80	1.85	1.84		1.20
14.....	1.42	.65		1.25	1.20	1.45	1.85	1.80	1.84	1.84	1.00	1.38
15.....	1.50	1.10		1.25	1.20	1.45	1.85	1.80	1.84	1.84	1.40	1.54
16.....	1.20	.65		.62	1.20	1.45	1.77	1.87	1.84	1.82	1.60	1.55
17.....				.40	1.20	1.45	1.70	1.87	1.84	1.80	1.58	1.55
18.....				.78	1.20	1.45	1.70	1.87	1.84	1.77		1.55
19.....				.90	1.20	1.45	1.70	1.87	1.84	1.77	.20	1.55
20.....				.85	1.10	1.45	1.70	1.87	1.84	1.77	.62	1.55
21.....				.75	1.10	1.45	1.70	1.87	1.84	1.76	.98	1.55
22.....				.75	1.10	1.48	1.70	1.87	1.84	1.77	.38	1.55
23.....				.78	1.10	1.53	1.70	1.87	1.82	1.77	.40	1.55
24.....				.75	1.10	1.53	1.70	1.87	1.84	1.77	.60	1.38
25.....	1.50		.55	.80	1.10	1.53	1.70	1.77	1.84	1.76	.77	1.20
26.....	1.40		1.05	.82	1.10	1.53	1.80	1.77	1.84	1.76	.90	1.20
27.....	1.25	.50	1.05	.85	1.25	1.53	1.80	1.82	1.84	1.77	1.00	1.20
28.....	1.50	.50	1.12	.92	1.25	1.53	1.88	1.87	1.84	1.77	1.10	1.20
29.....	1.40		1.20	1.20	1.25	1.53	1.81	1.88	1.84	1.77	1.20	1.20
30.....	1.40		1.25	1.20	1.25	1.53	1.80	1.87	1.82	1.77	1.20	1.20
31.....	1.52		1.25		1.25		1.79	1.87		1.72		

NOTE.—The canal was dry on days when the gage height was not recorded.

*Rating table for Central Oregon canal near Bend, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.00	0	0.40	12	0.80	34	1.20	65	1.60	105
0.10	2	0.50	17	0.90	41	1.30	74	1.70	116
0.20	5	0.60	22	1.00	48	1.40	84	1.80	128
0.30	8	0.70	28	1.10	56	1.50	94	1.90	140

NOTE.—The above table is based on 12 discharge measurements made during 1905-6 and is well defined.

*Monthly discharge of Central Oregon canal near Bend, Oreg., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	96	0	35.2	2,160
February.....	105	0	26.2	1,460
March.....	74	0	28.0	1,720
April.....	70	12	49.6	2,950
May.....	74	0	58.0	3,570
June.....	97	70	86.5	5,150
July.....	138	103	118	7,260
August.....	138	124	131	8,060
September.....	138	130	134	7,970
October.....	133	118	128	7,870
November.....	114	0	48.5	2,890
December.....	100	47	73.8	4,540
The year.....	138	0	70.4	55,600

NOTE.—Values are rated as good.

*Discharge measurements of Pilot Butte canal near Bend, Oreg., in 1906.*

Date.	Hydrographer.	Width.		Area of section.	Gage height.	Dis-charge.
		Fcet.	Sq. ft.	Fcet.	Sec.-ft.	
April 18.....	I. Landes.....	31.5	33	1.85	37	
May 18.....	do.....	33	42	2.10	62	
June 10.....	do.....	33	51	2.30	95	
June 18.....	L. R. Allen.....	44	58	2.30	99	
June 19.....	J. C. Stevens.....	34	52	2.30	90	

*Daily gage height, in feet, of Pilot Butte canal near Bend, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		1.95		1.85	2.05	2.15	2.44	2.00	2.28	2.46	1.52	1.40
2.....		1.95	1.85	1.50	2.05	2.15	2.44	2.62	2.45	2.45		1.36
3.....	.88		1.95	1.50	2.05	2.15	2.44	2.00	2.46	2.43	1.37	1.40
4.....	1.85		1.90	1.62	2.10	2.10	2.44	2.00	2.46	2.44	1.34	1.59
5.....	.98		1.85	1.50	2.15	2.30	2.44	2.00	2.46	2.46	1.38	1.79
6.....	1.95		1.85	1.50	2.15	2.30	2.44	2.00	2.46	2.46	1.38	1.60
7.....	1.95		1.85	1.62	2.15	2.30	2.51	2.00	2.46	2.46	1.80	1.75
8.....		1.95	1.82	1.62	2.15	2.30	2.56	2.00	2.46	2.46	2.26	1.90
9.....		1.95	1.73	1.84	2.15	2.30	2.60	2.00	2.46	2.46		1.90
10.....	1.90	1.95	1.82	2.18	2.22	2.30	2.60	2.00	2.46	2.46		1.64
11.....	1.80	1.95		2.30	2.35	2.30	2.60	2.60	2.46	2.45	1.10	1.40
12.....	.95	1.95		2.30	2.35	2.30	2.60	2.60	2.46	2.44	1.36	1.40
13.....		1.85		2.05	2.40	2.30	2.60	2.60	2.46	2.44	1.14	1.40
14.....		1.85		2.05	2.40	2.30	2.60	2.60	2.46	2.46	1.06	1.39
15.....		1.85		2.05	2.40	2.30	2.60	2.60	2.46	2.46	1.02	1.42
16.....		1.85		2.00	2.40	2.30	2.60	2.60	2.46	2.44	1.48	1.74
17.....		1.85		2.45	2.40	2.30	2.60	2.60	2.46	2.46	1.38	1.90
18.....		1.85		2.45	2.05	2.30	2.60	2.60	2.46	2.46	1.42	1.90
19.....		1.85		1.95	2.05	2.30	2.60	2.60	2.46	2.46	1.42	1.92
20.....		1.85		1.95	2.05	2.30	2.59	2.59	2.46	2.46	1.51	1.92
21.....		1.85		1.95	2.10	2.30	2.60	2.60	2.46	2.46	1.74	1.92
22.....		1.85		1.95	2.15	2.30	2.60	2.60	2.46	2.46	1.59	1.92
23.....		1.85		1.78	2.15	2.30	2.59	2.60	2.43	1.73	1.64	1.92
24.....		1.85	1.78	2.05	2.15	2.37	2.60	2.60	2.46	1.62	2.10	1.92
25.....		1.85	1.95	2.05	2.15	2.42	2.60	2.60	2.46	2.29	2.10	1.92
26.....	1.50	1.90	1.90	2.05	2.15	2.44	2.60		2.46	2.30	2.10	1.92
27.....	1.75	.97	1.95	2.05	2.20	2.44	2.60	2.60	2.46	2.30	1.75	1.92
28.....	.90	.98		2.05	2.20	2.44	2.59	2.58	2.46	2.30	1.40	1.92
29.....	.95		.85	2.05	2.35	2.44	2.60		2.46	2.30	1.38	1.92
30.....	1.80			2.05	2.40	2.44	2.58	2.18	2.44	2.30	1.40	1.92
31.....	1.70				1.78		2.35	1.91		2.30		1.66

NOTE.—The canal was dry on days when the gage height was not recorded.

*Rating table for Pilot Butte canal near Bend, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.90	2	1.30	7	1.70	25	2.10	61	2.50	145
1.00	2	1.40	10	1.80	33	2.20	77	2.60	175
1.10	3	1.50	13	1.90	41	2.30	97		
1.20	5	1.60	18	2.00	49	2.40	120		

NOTE.—The above table is based on discharge measurements made during 1905-6, and is well defined between gage heights 1.7 feet and 2.3 feet.

*Monthly discharge of Pilot Butte canal near Bend, Oreg., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January.....	45	0	10.0	615
February.....	45	0	30.0	1,670
March.....	45	0	16.0	984
April.....	132	13	50.8	3,020
May.....	120	31	79.1	4,800
June.....	130	69	100	5,950
July.....	175	108	162	9,960
August.....	181	0	156	9,590
September.....	135	93	133	7,910
October.....	135	19	118	7,260
November.....	77	2	19.3	1,150
December.....	43	9	29.9	1,840
The year.....	181	0	75.3	54,800

NOTE.—Values are rated as fair.

#### TUMALO CREEK NEAR LAIDLAW, OREG.

This station was established May 15, 1906. It is located about one-half mile above the head-gate of the Columbia Southern Canal, in sec. 2, T. 18 S., R. 10 E.

The channel is straight; neither bank is liable to overflow, and there is one channel at all stages.

Measurements are made from a footlog. The initial point is a notch cut in the left end of the log.

The gage, which is read voluntarily by G. W. Updike, the ditch tender, is a 1 by 4 inch pine board, graduated with brass tacks, driven in the left bank at the water's edge on the upstream side of the footlog. The bench mark is on top of a fir stump 5 feet from the left bank; elevation, 6.67 feet above the datum of the gage.

*Discharge measurements of Tumalo Creek near Laidlaw, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 15.....	I. Landes.....	39	59	2.19	218
June 9.....	do.....	37	46	1.85	144
June 16.....	L. R. Allen.....	36	61	2.23	236
June 18.....	Stevens and Landes.....	37	55	2.08	202

*Daily gage height, in feet, of Tumalo Creek near Laidlaw, Oreg., for 1906.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1.....		1.85	2.50	1.55	1.50	1.50	17.....	2.20	2.30	1.65	1.50	1.50	1.55
2.....		2.10	2.65	1.55	1.50	1.65	18.....	2.40	2.35	1.55	1.50	1.50	1.55
3.....		2.25	2.60	1.50	1.50	1.60	19.....	2.50	2.40	1.65	1.50	1.50	1.52
4.....		2.15	2.70	1.50	1.50	1.60	20.....	2.00	2.45	1.70	1.50	1.50	1.52
5.....		1.95	2.60	1.50	1.50	1.55	21.....	1.95	2.25	1.70	1.50	1.50	1.50
6.....		1.90	2.45	1.50	1.50	1.52	22.....	1.90	2.20	1.65	1.50	1.50	1.50
7.....		1.80	2.45	1.50	1.50	1.52	23.....	1.92	2.20	1.65	1.50	1.50	1.50
8.....		1.85	2.40	1.55	1.50	1.52	24.....	2.00	2.18	1.60	1.50	1.50	1.50
9.....		1.85	2.20	1.55	1.50	1.50	25.....	2.50	2.60	1.60	1.50	1.50	1.55
10.....		1.80	2.15	1.55	1.50	1.65	26.....	1.95	2.40	1.60	1.50	1.50	2.15
11.....		2.10	2.15	1.55	1.50	1.85	27.....	1.90	2.10	1.60	1.50	1.50	1.65
12.....		2.15	2.10	1.55	1.50	1.70	28.....	1.95	1.90	1.60	1.50	1.50	1.60
13.....		2.10	2.10	1.55	1.62	1.70	29.....	1.85	2.05	1.60	1.50	1.50	1.55
14.....		2.00	1.95	1.55	1.58	1.67	30.....	1.80	2.20	1.60	1.50	1.50	1.55
15.....	2.19	2.55	1.85	1.55	1.50	1.80	31.....	1.80		1.60	1.50		1.55
16.....	2.90	2.45	1.75	1.50	1.50	1.65							

*Rating table for Tumalo Creek near Laidlaw, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.50	80	1.90	155	2.20	230	2.50	315	2.80	415
1.60	95	2.00	180	2.30	255	2.60	345	2.90	450
1.70	115	2.10	205	2.40	285	2.70	380	3.00	490
1.80	135								

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is well defined between gage heights 1.7 feet and 2.5 feet.

*Monthly discharge of Tumalo Creek near Laidlaw, Oreg., for 1906.*

[Drainage area, 90 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 15-31.....	450	135	210	7,080	2.34	1.48
June.....	345	135	219	13,000	2.44	2.72
July.....	380	88	182	11,200	2.01	2.32
August.....	88	80	82.6	5,080	.918	1.06
September.....	99	80	81.0	4,820	.900	1.00
October.....	218	80	98.5	6,060	1.09	1.26
The period.....				47,200		

NOTE.—To give the natural flow at this station, the discharge of Wymer canal should be added. Values are rated as good.

#### TUMALO CREEK NEAR BEND, OREG.

This station was established October 6, 1906, to take the place of the station on Tumalo Creek near Laidlaw during the winter months when no gage reader is available at the latter place. It is located at the highway bridge on the Bend-Sisters road, about 5 miles from Bend, Oreg.

The channel is straight for 175 feet above and 300 feet below the station. The right bank is high; the left, low. There is a single channel.

The gage, which is read by W. P. Downing, is a pine board attached to the river face of the abutment at the southeast corner of the bridge.

*Discharge measurements of Tumalo Creek near Bend, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
January 13.....	Ivan Landes.....	24	31	1.23	53
April 19.....	do.....	26	35	1.52	80
October 6.....	C. L. Swain.....			.40	a 8

a Estimated.

*Daily gage height, in feet, of Tumalo Creek near Bend, Oreg., for 1906.*

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1.....		1.4	1.6	12.....	0.80	1.8	1.45	23.....	0.35	1.4	1.65
2.....		1.35	1.6	13.....	.52	2.9	1.5	24.....	.65	1.5	1.65
3.....		1.4	1.5	14.....	.60	3.8	1.5	25.....	.75	1.55	1.6
4.....		1.4	1.4	15.....	.50	2.2	1.5	26.....	2.00	1.6	1.6
5.....		1.4	1.45	16.....	.78	1.9	1.45	27.....	.95	1.7	1.5
6.....	0.40	1.45	1.4	17.....	.32	1.75	1.4	28.....	.80	1.75	1.5
7.....	.40	2.2	1.3	18.....	.32	1.8	1.4	29.....	.75	2.0	1.5
8.....	.42	2.45	1.3	19.....	.31	2.1	1.35	30.....	.75	1.9	1.45
9.....	.40	1.5	1.35	20.....	.30	1.5	1.35	31.....	.80		1.6
10.....	.40	3.1	1.4	21.....	.32	1.5	1.5				
11.....	.38	1.85	1.4	22.....	.35	1.4	1.6				

WYMER CANAL NEAR LAIDLAW, OREG.

Wymer canal takes water from Tumalo Creek just above the gaging station on the latter. A gaging station was established on the canal June 16, 1906, in order to determine the total water supply of the creek. It is located just below the headgates.

The bed and banks are of loam and gravel.

Measurements are made from two logs. The gage is a vertical staff and is read by G. W. Updike. The bench mark is on a bench on a fir tree, about 16 inches in diameter, 25 feet below the headgate, and 3 feet from the right bank; elevation, 4.12 feet above the datum of the gage.

*Discharge measurements of Wymer canal near Laidlaw, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
May 15.....	I. Landes.....	5.5	9		12
June 9.....	do.....	4	3.2		8.5
June 16.....	L. R. Allen.....	16	22	1.90	41
June 18.....	Stevens and Landes.....	15.5	20	1.85	43

*Daily gage height, in feet, of Wymer canal near Laidlaw, Oreg., for 1906.*

Day.	June.	July.	Aug.	Sept.	Oct.	Day.	June.	July.	Aug.	Sept.	Oct.
1.		2.05	1.00	0.88	1.00	17.	1.95	1.45	0.88	0.88	1.10
2.		2.10	1.00	.88	1.30	18.	1.95	1.45	.88	.88	1.10
3.		2.05	.95	.88	1.20	19.	2.00	1.45	.88	.88	1.10
4.		2.15	.95	.88	1.10	20.	2.00	1.50	.88	.88	1.10
5.		2.05	.95	.88	1.10	21.	1.95	1.45	.88	.88	1.05
6.		2.05	.95	.88	1.06	22.	1.90	1.40	.88	.88	1.05
7.		2.05	.95	.88	1.06	23.	1.90	1.40	.88	.88	1.10
8.		2.00	.95	.88	1.04	24.	1.90	1.15	.88	.88	1.15
9.		1.95	.95	.88	1.02	25.	2.10	1.05	.88	.88	1.20
10.		1.90	.95	.88		26.	2.05	1.05	.88	.88	2.20
11.		1.90	.95	.88		27.	1.95	1.05	.88	.88	1.25
12.		1.90	.95	1.28		28.	1.85	1.05	.88	.88	1.20
13.		1.90	.95	1.08		29.	1.90	1.05	.88	.88	1.20
14.		1.75	.95	.95		30.	1.95	1.05	.88	.88	1.15
15.		1.65	.88	.88		31.		1.05	.88		1.15
16.	1.98	1.55	.88	.88	1.62						

NOTE.—Water turned out October 10 to 15.

COLUMBIA SOUTHERN CANAL NEAR LAIDLAW, OREG.

Columbia Southern canal, which is operated by the Columbia Southern Irrigation Company under provisions of the Carey Act, takes water from Tumalo Creek, 15 miles above its mouth. Measurements are made in the flume 1,000 feet below the head-gate. The gage is set with its zero at the bottom of the flume. It is read by G. W. Updike.

*Discharge measurements of Columbia Southern canal near Laidlaw, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 19 <sup>a</sup> .	I. Landes	20	14		35
May 15.	do.	19.7	31.5	1.60	52
June 9.	do.	19.7	35	1.78	72
June 16.	L. R. Allen	19.6	22	1.15	22
June 16.	do.	19.6	31	1.62	57
June 18.	Stevens and Landes.	19.7	33	1.65	63

<sup>a</sup> Measured 9 miles below the head of the canal.

*Daily gage height, in feet, of Columbia Southern canal near Laidlaw, Oreg., for 1906.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1.		1.70	1.87	1.75	1.68	1.70	17.	1.70	1.65	2.00	1.70	1.68	1.65
2.		1.75	1.87	1.75	1.68	1.70	18.	1.75	1.65	1.95	1.70	1.68	1.65
3.		1.75	1.95	1.75	1.68	1.65	19.	1.75	1.65	1.95	1.70	1.68	1.65
4.		1.75	1.95	1.75	1.68	1.65	20.	1.75	1.65	1.95	1.70	1.68	1.65
5.		1.75	1.95	1.75	1.68	1.65	21.	1.75	1.70	1.90	1.70	1.68	1.60
6.		1.70	2.05	1.75	1.68	1.70	22.	1.75	1.70	1.90	1.70	1.68	1.60
7.		1.70	2.05	1.75	1.68	1.70	23.	1.75	1.70	1.90	1.70	1.68	1.60
8.		1.70	2.05	1.75	1.68	1.70	24.	1.75	1.70	1.80	1.70	1.68	1.65
9.		1.70	2.05	1.75	1.68	1.70	25.	1.75	1.80	1.80	1.70	1.70	1.65
10.		1.70	2.10	1.75	1.68	1.72	26.	1.75	1.85	1.80	1.70	1.70	1.60
11.		1.70	2.10	1.75	1.68	1.72	27.	1.75	1.80	1.80	1.70	1.70	1.70
12.		1.70	2.10	1.75	1.68	1.70	28.	1.75	1.80	1.80	1.70	1.70	1.65
13.		1.70	2.10	1.75	1.68	1.70	29.	1.70	1.87	1.80	1.70	1.70	1.65
14.		1.70	2.10	1.75	1.68	1.70	30.	1.70	1.87	1.80	1.70	1.70	1.65
15.	1.70	1.65	2.00	1.70	1.68	1.70	31.	1.70		1.80	1.70		1.65
16.	1.70	1.65	1.88	1.70	1.68	1.70							

*Rating table for Columbia Southern canal near Laidlaw, Oreg., for 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.60	55	1.80	74	1.90	86	2.00	99	2.10	114
1.70	64								

NOTE.—The above table is based on 5 discharge measurements made during 1906 and is fairly well defined.

*Monthly discharge of Columbia Southern canal near Laidlaw, Oreg., for 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 15-31.....	69	64	67.2	2,260
June.....	82	60	66.6	3,960
July.....	114	74	91.7	5,640
August.....	69	64	66.3	4,080
September.....	64	62	62.4	3,710
October.....	66	55	61.3	3,770
The period.....				23,400

NOTE.—Values are rated as good.

#### SQUAW CREEK NEAR SISTERS, OREG.

The station was established June 15, 1906. It is located 4 miles south of Sisters and above all present diversions. McAllister ditch, under construction, has its intake 200 feet above the station.

The channel is straight for 200 feet above and 100 feet below the station. The right bank is high and rocky; the left is low and liable to overflow at extreme high water. The bed of the stream is of firm gravel and is permanent. Changes in a dam 250 feet below will change the rating.

Measurements are made from a foot log.

Gage heights are furnished jointly by the Squaw Creek Irrigation Company and citizens of Sisters. The gage is vertical, and nailed to an alder tree on the right bank, about 3 feet above the foot log. The bench mark is the highest point of the sawed part of a pine stump 30 feet to the left and 10 feet upstream from the point of measurement; elevation, 10.27 feet above the datum of the gage.

*Discharge measurements of Squaw Creek near Sisters, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 17.....	I. Landes.....	31	48	3.65	106
June 8.....	L. R. Allen.....	31	46	3.53	105
June 8.....	I. Landes.....	31	49	3.60	114
June 15.....	J. H. Lewis and L. R. Allen.....	32	65	4.09	205
September 22.....	C. W. Allen.....	31	38	3.55	110

*Daily gage height, in feet, of Squaw Creek near Sisters, Oreg., for 1906.*

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.3	3.75	3.6	3.6	3.1	3.0	17.....	4.1	3.65	3.25	3.35	2.1	1.7
2.....	4.2	3.7	3.6	3.65	3.1	1.8	18.....	4.0	3.65	3.35	3.3	2.0	1.65
3.....	4.4	3.72	3.5	3.65	3.1	1.6	19.....	2.25	3.6	3.4	3.3	1.95	1.6
4.....	4.95	3.7	3.55	3.65	3.1	1.6	20.....	4.05	3.6	3.45	3.3	1.9	2.3
5.....	4.6	3.8	3.55	3.3	3.1	1.6	21.....	4.1	3.5	3.45	3.3	1.8	2.05
6.....	4.6	4.0	3.75	3.35	3.15	1.6	22.....	4.2	3.5	3.55	3.3	1.8	2.0
7.....	4.55	4.0	3.8	3.3	5.25	3.0	23.....	4.2	3.55	3.4	3.35	1.8	1.9
8.....	4.5	3.85	4.1	3.35	4.1	1.7	24.....	3.8	3.55	3.35	3.35	1.8	1.95
9.....	4.3	3.8	3.6	3.3	3.05	1.75	25.....	3.85	3.55	3.35	3.35	1.7	2.1
10.....	4.5	4.0	3.5	3.45	5.7	1.7	26.....	3.75	3.55	3.3	4.0	1.7	2.0
11.....	4.55	3.9	3.45	3.4	3.4	1.7	27.....	4.0	3.6	3.3	3.55	1.7	1.9
12.....	4.9	4.0	3.45	3.35	3.2	1.75	28.....	4.2	3.6	3.3	3.35	3.5	1.9
13.....	4.52	3.95	3.4	3.3	4.2	2.9	29.....	3.95	3.5	3.4	3.3	3.0	1.8
14.....	4.4	3.8	3.3	3.3	4.5	1.7	30.....	3.9	3.6	3.4	3.2	2.05	1.8
15.....	4.35	3.9	3.3	3.3	3.0	1.7	31.....	3.85	3.5		3.2		1.75
16.....	4.1	3.75	3.25	3.3	2.4	1.75							

NOTE.—Conditions were changed early in November by washing out of dam below; this was replaced November 28, and washed out again December 3. Ice jam December 1 and 13.

*Rating table for Squaw Creek near Sisters, Oreg., from July 1 to October 31, 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
3.20	67	3.60	113	4.00	185	4.40	282	4.80	405
3.30	77	3.70	128	4.10	207	4.50	310	4.90	440
3.40	88	3.80	145	4.20	231	4.60	340	5.00	475
3.50	100	3.90	164	4.30	256	4.70	372		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and it is not well defined.

*Monthly discharge of Squaw Creek near Sisters, Oreg., for 1906.*

[Drainage area, 90 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
July .....	458	136	251	15,400	2.79	3.22
August.....	185	100	133	8,180	1.48	1.71
September.....	207	72	97.9	5,830	1.09	1.22
October.....	185	67	88.3	5,400	.981	1.13
The period.....				34,800		

NOTE.—Values, July to October, are rated as fair.

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Deschutes River drainage basin in 1906:

*Miscellaneous measurements in Deschutes River drainage basin, Oregon, in 1906.*

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Discharge.
			<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
January 9.....	Crooked River.....	Forest.....	50	78	<i>a</i> 27.43	75
April 16.....	do.....	do.....	135	967	<i>a</i> 18.71	3,940
May 16.....	do.....	do.....	84	189	<i>a</i> 25.44	326
June 17.....	do.....	do.....	100	395	<i>a</i> 23.94	773
October 14.....	do.....	do.....	22	65	<i>a</i> 24.62	84
April 18 <sup>b</sup> .....	Deschutes Irrigation and Power Company's flume.	Near Bend.....	14.9	15		83
January 10.....	Deschutes River.....	Sec. 36, T. 14 S. R. 12 E.....	145	481		1,350
October 13 <sup>c</sup> .....	do.....	do.....	138	458		1,230
September 2 <sup>d</sup> .....	do.....	Moro.....	260	1,120	1.35	5,040
October 17 <sup>d</sup> .....	do.....	do.....	260	1,130	1.40	5,520
October 18.....	do.....	Warm Springs Ferry.....	170	1,690	<i>e</i> 5.40	4,780
June 8.....	McAllister ditch.....	Sisters.....	7	5		6.9
June 15.....	do.....	do.....	7	5.2		6.6
October 17.....	Metolius River.....	Near mouth.....				/2,800
January 6.....	Ochoco Creek.....	Prineville.....	9	4.4	<i>g</i> 5.88	4.6
April 16.....	do.....	do.....	71	97	<i>g</i> 4.55	286
May 17.....	do.....	do.....	14	10	<i>g</i> 5.76	35
June 7.....	do.....	do.....	44	68	<i>g</i> 4.87	148
June 13.....	Pole Creek.....	Sisters.....	8	4.2		6.2
October 15.....	Shitike.....	Warm Springs Agency.....	26	29	( <i>h</i> )	61
June 10.....	Swalley canal.....	Bend, intake flume.....	7	6		13
June 20.....	do.....	Bend, below intake flume.....	13	10		12
June 20.....	do.....	Bend, 5 miles below head.....	8	5		6.5
October 19.....	Warm Springs.....	Warm Springs Agency.....	92	433	( <i>h</i> )	260
October 20.....	White River.....	Tygh Valley.....	56	56	( <i>h</i> )	165

<sup>a</sup> Below nail in top of floor sill on downstream side of east end of bridge.

<sup>b</sup> Just below headgate; contains discharge of Pilot Butte and Central Oregon canals.

<sup>c</sup> At Tetherow bridge; water surface 4.35 feet below cross cut in northeast corner of bridge on top of abutment.

<sup>d</sup> At Free Bridge gaging station, discontinued December 31, 1899; see Water-Supply Paper No. 38, p. 377, 378.

<sup>e</sup> Below point on alder stump on west bank.

<sup>f</sup> Estimated.

<sup>g</sup> Below reference point on bridge.

<sup>h</sup> Low water.

## HOOD RIVER DRAINAGE BASIN.

## HOOD RIVER AT WINANS, OREG.

Hood River has its source in the glaciers on the northern slope of Mount Hood, flows north, and unites with Columbia River at the town of Hood River. Its drainage area is wholly mountainous and timbered except where the timber has been removed. A large percentage of its forested area has been burned. The waters of this stream and its tributaries are used for irrigation and power development. The table-lands bordering the river have been cleared of timber and are irrigated by high-line canals. The agricultural products of the district are fruit and berries.

This station was established November 17, 1905. It is located 300 feet below the junction of the main forks of the river at Winans, 10½ miles above Hood River post-office, Oreg. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 219, where are given also references to publications that contain data for previous years.

*Discharge measurements of Hood River at Winans, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1905.					
November 17...	L. R. Allen.....	90	147	0.57	493
December 23.....	do.....	90	180	1.03	767
1906.					
March 9.....	P. A. Cupper.....	99	298	1.90	1,360
May 22 a.....	L. R. Allen.....	93	188	1.31	702
July 8.....	do.....	97	259	1.52	1,160
August 29.....	do.....	91	191	.77	571
October 20.....	J. C. Stevens.....	95	224	1.17	899
December 15.....	H. McGlashan.....	94	253	1.20	864

a Not reliable, as débris was lodged against gage.

*Daily gage height, in feet, of Hood River at Winans, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	0.9	1.6	1.8	1.9	2.0	1.3	1.5	1.0	0.7	0.7	1.3	1.1
2.....	1.0	1.6	1.7	1.8	2.0	1.3	1.5	1.0	.7	.7	1.0	1.2
3.....	1.0	1.5	1.6	1.7	1.9	1.4	1.6	1.0	.7	.7	.9	1.3
4.....	1.0	1.5	1.6	1.6	1.9	1.4	1.6	1.0	.7	.7	.9	1.3
5.....	1.1	1.4	1.5	1.9	1.9	1.4	1.7	1.0	.7	.7	.9	1.4
6.....	1.2	1.4	1.6	2.0	1.9	1.5	1.7	1.0	.7	.7	.8	1.4
7.....	1.3	1.3	1.7	2.4	1.9	1.5	1.7	1.0	.7	.7	.8	1.5
8.....	1.3	1.2	1.9	2.4	1.8	1.6	1.6	1.0	.7	.7	.8	1.5
9.....	1.4	1.1	1.9	2.2	1.8	1.6	1.5	1.0	.7	.7	.8	1.5
10.....	1.5	1.1	1.8	2.1	1.8	1.6	1.4	1.0	.7	.7	.9	1.4
11.....	1.1	1.0	1.6	2.0	1.7	1.6	1.3	1.0	.7	2.0	2.5	1.4
12.....	1.1	1.0	1.6	1.9	1.7	1.6	1.3	1.0	.7	2.2	4.5	1.3
13.....	1.1	1.0	1.6	1.9	1.7	1.7	1.3	1.0	.7	2.0	6.4	1.2
14.....	1.0	1.0	1.6	1.8	1.7	1.8	1.3	1.0	1.2	2.0	6.5	1.2
15.....	1.0	1.0	1.5	1.8	1.7	1.8	1.3	1.0	1.3	1.9	6.4	1.2
16.....	1.1	1.0	1.5	1.8	1.6	2.0	1.3	0.9	1.0	1.8	3.7	1.2
17.....	1.2	1.3	1.5	1.9	1.6	1.9	1.3	.9	.7	1.7	3.4	1.3
18.....	1.3	3.0	1.6	1.9	1.5	1.7	1.3	.9	.6	1.5	2.7	1.4
19.....	1.0	3.0	1.6	2.0	1.5	1.7	1.3	.8	.7	1.4	2.4	1.6
20.....	.9	3.0	1.5	2.1	1.5	1.7	1.3	.8	.7	1.4	2.2	6.6
21.....	.9	2.9	1.5	2.2	1.5	1.6	1.3	.8	.7	1.4	2.0	4.6
22.....	1.2	2.8	1.5	2.2	1.4	1.6	1.2	.7	.7	1.4	2.0	3.6
23.....	1.4	2.4	1.5	2.1	1.4	1.6	1.2	.7	.7	2.0	1.8	3.6
24.....	2.9	2.3	1.5	2.0	1.4	1.6	1.1	.7	.7	2.0	1.7	3.4
25.....	2.0	2.2	1.5	2.0	1.5	1.6	1.1	.7	.7	1.9	1.5	3.3
26.....	1.8	2.2	1.5	2.0	1.5	1.6	1.0	.7	.7	1.8	1.5	3.0
27.....	1.8	2.0	1.5	2.0	1.5	1.6	.9	.7	.7	1.8	1.4	2.4
28.....	1.6	1.9	1.5	2.0	1.5	1.6	.9	.7	.7	1.7	1.4	2.2
29.....	1.7		1.6	2.0	1.4	1.6	1.0	.7	.7	1.6	1.2	2.2
30.....	1.7		2.0	2.0	1.4	1.6	1.0	.7	.7	1.5	1.2	2.2
31.....	1.7		2.5		1.4		1.0	.7		1.4		2.2

NOTE.—From March to June there was more or less backwater, caused by débris. The flow is influenced by logging dams on the east fork, about 2 miles above the station. These gage heights represent only approximately the daily means.

*Rating table for Hood River at Winans, Oreg., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.50	430	1.10	835	1.70	1,325	2.30	1,875	2.90	2,460
0.60	490	1.20	910	1.80	1,415	2.40	1,970	3.00	2,560
0.70	555	1.30	990	1.90	1,505	2.50	2,065	4.00	3,560
0.80	620	1.40	1,070	2.00	1,595	2.60	2,160	5.00	4,660
0.90	690	1.50	1,155	2.10	1,685	2.70	2,260	6.00	5,860
1.00	760	1.60	1,240	2.20	1,780	2.80	2,360		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1905-6 and is well defined between gage heights 0.5 foot and 1.5 feet. Above gage height 2.0 feet it becomes uncertain, and for the highest stages is only approximate.

*Monthly discharge of Hood River at Winans, Oreg., for 1905-6.*

[Drainage area, 370 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.						
November 19-30.....	1, 160	555	709	16, 900	1. 92	.857
December.....	1, 420	555	804	49, 400	2. 17	2. 50
The period.....				66, 300		
1906.						
January.....	2, 460	690	1, 030	63, 300	2. 78	3. 20
February.....	2, 560	760	1, 400	77, 800	3. 78	3. 94
March.....	2, 060	1, 150	1, 280	78, 700	3. 46	3. 99
April.....	1, 970	1, 240	1, 590	94, 600	4. 30	4. 80
May.....	1, 600	1, 070	1, 280	78, 700	3. 46	3. 99
June.....	1, 600	990	1, 240	73, 800	3. 35	3. 74
July.....	1, 320	690	1, 000	61, 500	2. 70	3. 11
August.....	760	555	674	41, 400	1. 82	2. 10
September.....	990	490	586	34, 900	1. 58	1. 76
October.....	1, 780	555	1, 100	67, 600	2. 97	3. 42
November.....	6, 460	620	1, 800	112, 000	5. 11	5. 70
December.....	6, 580	835	1, 740	107, 000	4. 70	5. 42
The year.....	6, 580	490	1, 230	891, 000	3. 33	45. 17

NOTE.—Values are rated as follows: March to June, 1906, approximate; remainder of 1905 and 1906, good. Débris caused backwater to a greater or less extent.

**WILLAMETTE RIVER DRAINAGE BASIN.****DESCRIPTION OF BASIN.**

Willamette River is formed by the junction of Middle and Coast forks near Eugene, Oreg., from which point it flows in a general northerly direction to its point of junction with the Columbia, about 10 miles north of Portland. Coast Fork rises in the eastern slope of the Coast Range and Middle Fork on the western slope of the Cascade Mountains. The tributaries of this stream flow both east and west, draining heavily timbered mountain areas. Many of them afford extensive power possibilities. At present the development in this line is in the primitive state. The natural resources of the Willamette Valley would make it an unrivaled manufacturing center. There is unlimited water power, an abundance of raw material, and adequate transportation facilities. The principal tributaries of this stream are the McKenzie, Santiam, Luckiamute, Molalla, Yamhill, and Clackamas rivers.

**WILLAMETTE RIVER AT ALBANY, OREG.**

This station was established July 21, 1905. It is located at the Corvallis and Eastern Railroad bridge at Albany, Oreg., just above the mouth of Calipooia Creek and 7 miles above the mouth of Santiam River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 223.

*Discharge measurements of Willamette River at Albany, Oreg., in 1905-1907.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
July 20.....	L. R. Allen.....		3,720	3.29	3,430
1906.					
January 6.....	L. R. Allen.....	438	5,160	6.56	13,400
February 8.....	do.....	439	4,860	5.84	11,700
March 28.....	do.....	438	4,900	6.12	13,300
May 9.....	do.....	433	4,380	5.10	9,380
July 25.....	do.....	428	3,610	2.92	4,360
September 5.....	I. E. Oakes.....	425	3,580	2.20	2,960
1907.					
February 5.....	I. E. Oakes.....	2,960	38,500	27.55	146,000

*Daily gage height, in feet, of Willamette River at Albany, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	9.3	7.5	12.7	7.9	6.05	7.8	4.45	2.8	2.4	2.35	3.1	5.05
2.....	8.8	7.45	10.5	8.3	5.85	6.9	4.25	2.75	2.35	2.3	2.95	4.8
3.....	7.4	7.15	9.4	7.55	5.75	6.5	4.2	2.7	2.3	2.3	2.9	4.65
4.....	6.8	7.05	8.7	6.98	5.55	6.3	4.1	2.7	2.3	2.35	2.95	4.4
5.....	6.75	6.75	8.25	6.68	5.5	6.8	3.95	2.7	2.2	2.4	3.15	4.5
6.....	6.55	6.55	7.75	6.48	5.4	6.55	3.8	2.6	2.2	2.4	3.35	4.5
7.....	6.5	6.2	7.6	6.28	5.25	6.7	3.75	2.6	2.2	2.4	3.9	4.7
8.....	6.4	5.8	7.5	6.18	5.05	7.1	3.7	2.6	2.2	2.4	6.9	5.6
9.....	6.75	5.75	7.5	6.08	5.1	6.9	3.7	2.6	2.2	2.3	9.3	6.6
10.....	8.3	5.6	7.45	6.3	5.0	7.3	3.55	2.6	2.2	2.3	7.6	7.1
11.....	8.1	5.5	7.4	6.05	5.1	7.2	3.3	2.6	2.1	2.35	7.2	7.5
12.....	8.3	5.35	7.25	5.8	5.1	6.9	3.3	2.6	2.15	2.4	7.1	7.55
13.....	9.0	5.2	6.7	5.55	5.0	6.65	3.3	2.55	2.2	2.45	6.9	6.8
14.....	10.25	5.1	6.4	5.35	4.9	6.5	3.25	2.5	2.3	2.65	8.4	6.45
15.....	10.2	4.85	6.15	5.25	5.0	6.3	3.2	2.5	2.3	2.7	10.95	6.2
16.....	10.3	5.05	5.75	5.25	5.7	6.6	3.2	2.5	2.5	2.9	12.35	6.65
17.....	13.0	5.15	5.55	5.3	5.75	7.4	3.1	2.5	2.8	3.45	13.1	8.15
18.....	15.0	5.75	5.38	5.2	5.4	7.05	3.1	2.5	2.9	4.6	12.9	7.35
19.....	13.0	7.05	5.32	5.08	5.2	6.6	3.1	2.5	2.75	4.65	13.05	7.3
20.....	11.8	9.85	5.42	4.92	5.1	6.5	3.1	2.5	2.65	4.3	10.7	8.8
21.....	9.8	11.6	5.72	5.42	5.1	5.8	3.1	2.6	2.6	4.05	9.35	11.4
22.....	8.85	13.25	6.2	5.25	5.35	5.55	3.0	2.6	2.4	3.7	9.25	10.95
23.....	8.15	12.55	6.32	5.4	5.8	5.3	3.0	2.6	2.4	3.4	8.9	9.8
24.....	9.6	12.85	6.25	5.22	5.9	5.1	3.0	2.65	2.5	3.25	8.0	9.85
25.....	10.6	14.8	6.18	5.5	5.7	4.9	2.9	2.8	2.5	3.2	7.1	9.45
26.....	10.25	15.1	6.08	5.68	5.6	4.6	2.9	2.95	2.6	3.1	6.55	10.65
27.....	9.4	13.9	6.1	5.95	5.6	4.5	2.85	2.75	2.55	2.9	6.2	11.45
28.....	8.55	13.5	6.22	5.9	5.55	4.5	2.8	2.6	2.5	3.3	5.85	10.5
29.....	8.1	.....	6.42	6.4	7.2	4.55	2.8	2.5	2.5	3.25	5.55	9.4
30.....	7.65	.....	5.8	6.25	9.95	4.55	2.8	2.5	2.4	3.15	5.25	8.5
31.....	7.5	.....	6.1	.....	8.9	.....	2.8	2.4	.....	3.1	.....	8.4

*Rating tables for Willamette River at Albany, Oreg.*

1905.<sup>a</sup>

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.00	1,755	2.90	2,835	3.80	4,320	4.70	6,260	6.20	10,300
2.10	1,855	3.00	2,980	3.90	4,510	4.80	6,500	6.40	10,910
2.20	1,960	3.10	3,130	4.00	4,710	4.90	6,750	6.60	11,530
2.30	2,070	3.20	3,385	4.10	4,910	5.00	7,000	6.80	12,160
2.40	2,185	3.30	3,445	4.20	5,120	5.20	7,500	7.00	12,800
2.50	2,305	3.40	3,610	4.30	5,340	5.40	8,020	8.00	16,000
2.60	2,430	3.50	3,780	4.40	5,560	5.60	8,560	9.00	19,400
2.70	2,560	3.60	3,955	4.50	5,790	5.80	9,120		
2.80	2,695	3.70	4,135	4.60	6,020	6.00	9,700		

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on one discharge measurement made during 1905 and the form of the 1906 curve and is not well defined.

*Rating tables for Willamette River at Albany, Oreg.—Continued.*1906.<sup>a</sup>

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.00	2,670	3.10	4,730	4.20	7,240	5.60	11,010	7.80	18,060
2.10	2,810	3.20	4,950	4.30	7,480	5.80	11,600	8.00	18,800
2.20	2,960	3.30	5,170	4.40	7,730	6.00	12,200	8.00	22,700
2.30	3,120	3.40	5,390	4.50	7,980	6.20	12,800	10.00	27,000
2.40	3,290	3.50	5,610	4.60	8,230	6.40	13,410	11.00	31,600
2.50	3,470	3.60	5,840	4.70	8,490	6.60	14,030	12.00	36,400
2.60	3,660	3.70	6,070	4.80	8,760	6.80	14,660	13.00	41,300
2.70	3,860	3.80	6,300	4.90	9,030	7.00	15,300	14.00	46,700
2.80	4,070	3.90	6,530	5.00	9,300	7.20	15,960	15.00	52,200
2.90	4,290	4.00	6,760	5.20	9,860	7.40	16,640		
3.00	4,510	4.10	7,000	5.40	10,430	7.60	17,340		

<sup>a</sup> This table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1906 and 1 during 1907 and is well defined between gage heights 2.2 feet and 6.5 feet.

*Monthly discharge of Willamette River at Albany, Oreg., for 1905-6.*

(Drainage area, 4,860 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.						
September.....	2,560	1,800	2,020	120,000	0.416	0.46
October <sup>a</sup> .....	6,750	2,700	3,750	231,000	.772	.89
November <sup>a</sup> .....	5,900	2,430	3,450	205,000	.710	.79
December.....	18,700	4,910	9,650	593,000	1.99	2.29
The period.....				1,150,000		
1906.						
January.....	52,200	13,400	23,600	1,450,000	4.86	5.60
February.....	52,800	8,900	21,900	1,220,000	4.51	4.70
March.....	39,800	10,200	15,700	965,000	3.23	3.72
April.....	19,900	9,080	12,200	726,000	2.51	2.80
May.....	26,800	9,030	11,500	707,000	2.37	2.73
June.....	18,100	7,980	12,900	768,000	2.65	2.96
July.....	7,860	4,070	5,260	323,000	1.08	1.24
August.....	4,400	3,290	3,680	226,000	.757	.87
September.....	4,290	2,810	3,320	198,000	.683	.76
October.....	8,360	3,120	4,530	279,000	.932	1.07
November.....	41,800	4,290	18,200	1,080,000	3.74	4.17
December.....	33,800	7,730	18,200	1,120,000	3.74	4.31
The year.....	52,800	2,810	12,600	9,060,000	2.59	34.93

<sup>a</sup> Gage heights published in Water-Supply Paper No. 178 as 2.11 feet should be 2.9 feet, 3.11 should be 3.9, and 2.1 should be 2.8.

NOTE.—Values are rated as follows: September, 1905, to February, 1906, fair; March to December, 1906, good.

## MIDDLE FORK OF WILLAMETTE RIVER AT JASPER, OREG.

This station was established September 16, 1905. It is located at Jasper Ferry, Jasper post-office, Oreg., 2 miles above Natron and 3 miles below the mouth of Fall Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 220.

*Discharge measurements of Middle Fork of Willamette River at Jasper, Oreg., in 1905-1907.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1905.					
September 16.....	L. R. Allen.....	322	652	1.25	758
December 29.....	do.....	354	1,370	3.27	3,920
1906.					
February 3.....	L. R. Allen.....	368	1,590	3.87	5,530
March 23.....	do.....	357	1,400	<sup>a</sup> 3.38	3,890
May 5.....	do.....	356	1,420	<sup>a</sup> 3.52	5,280
August 17.....	do.....	325	726	1.48	953
September 17.....	I. D. Oakes.....	327	807	1.70	1,130
1907.					
January 30.....	do.....	396	2,730	7.10	21,100

<sup>a</sup> Affected by log jam.

*Daily gage height, in feet, of Middle Fork of Willamette River at Jasper, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.6	3.8	4.4	4.6	3.6	4.0	2.6	1.7	1.4	1.4	1.6	2.5
2.....	3.1	3.8	4.1	4.2	3.5	3.9	2.6	1.7	1.4	1.4	1.6	2.5
3.....	3.1	3.9	4.0	4.1	3.5	3.8	2.5	1.6	1.4	1.5	1.6	2.4
4.....	3.1	3.7	3.9	3.8	3.4	4.1	2.5	1.6	1.4	1.9	1.6	2.3
5.....	3.0	3.6	3.7	3.7	3.4	4.0	2.5	1.7	1.4	1.5	2.0	2.4
6.....	3.2	3.6	3.7	3.6	3.3	4.1	2.4	1.6	1.4	1.5	2.0	2.7
7.....	3.2	3.4	3.8	3.6	3.3	4.4	2.3	2.0	1.4	1.5	3.3	2.7
8.....	3.3	3.3	3.9	3.5	3.2	4.3	2.2	1.8	1.4	1.4	4.6	3.6
9.....	4.6	3.2	4.0	3.7	3.2	4.4	2.1	2.0	1.5	1.4	3.7	3.6
10.....	4.3	3.1	4.1	3.6	3.4	4.5	2.1	2.2	1.5	1.4	3.2	3.6
11.....	4.0	3.0	3.9	3.4	3.5	4.2	2.0	2.2	1.4	1.4	3.7	3.7
12.....	4.2	2.9	3.7	3.2	3.3	4.1	2.0	2.3	1.5	1.5	3.2	3.5
13.....	4.5	2.8	3.5	3.2	3.2	4.0	2.0	2.0	2.2	1.7	4.1	3.2
14.....	4.2	2.8	3.3	3.1	3.1	3.8	1.9	2.2	1.9	1.6	4.9	3.1
15.....	4.1	2.8	3.2	3.0	3.6	3.7	1.9	1.5	2.4	1.6	5.6	3.0
16.....	6.3	2.9	3.0	3.0	3.4	4.4	1.9	1.5	2.0	2.2	6.1	4.4
17.....	5.9	3.1	2.9	3.1	3.2	4.2	2.0	1.5	1.7	2.9	5.9	4.0
18.....	4.9	3.4	2.8	3.0	3.0	3.9	1.8	1.5	1.6	2.7	6.0	3.7
19.....	4.2	5.1	2.8	2.9	2.9	3.6	1.8	1.5	1.5	2.6	4.8	4.4
20.....	4.0	5.05	2.8	2.9	2.9	3.5	1.8	1.5	1.5	2.2	4.2	5.7
21.....	3.5	5.4	3.0	2.9	3.2	3.3	1.7	1.4	1.5	2.1	4.5	5.3
22.....	3.4	5.1	3.2	3.0	3.4	3.7	1.6	1.4	1.4	1.9	4.3	4.6
23.....	4.0	4.8	3.2	3.1	3.6	3.1	1.7	1.4	1.5	1.8	4.0	4.3
24.....	5.2	5.5	3.3	3.4	3.4	3.1	1.7	1.4	1.5	1.7	3.6	4.2
25.....	5.0	5.5	3.4	3.4	3.4	2.8	1.7	1.4	1.6	1.7	3.3	4.5
26.....	4.8	4.9	3.5	3.6	3.3	2.8	1.8	1.4	1.6	1.6	3.2	5.3
27.....	4.7	5.0	3.4	3.4	3.3	2.8	1.7	1.3	1.5	2.1	3.0	4.8
28.....	4.2	4.7	3.3	3.8	4.2	2.9	1.7	1.4	1.5	1.9	2.8	4.3
29.....	4.0	.....	3.3	3.7	5.7	2.8	1.6	1.4	1.4	1.7	2.8	4.0
30.....	3.9	.....	3.3	3.6	5.1	2.7	1.6	1.4	1.4	1.7	2.6	4.0
31.....	3.8	.....	4.1	.....	4.6	.....	1.6	1.4	.....	1.6	.....	4.0

NOTE.—From June to August the discharge showed considerable daily fluctuation, caused by storage at logging dams. There was also some backwater from log jams during the same period, especially August 7 to 14.

*Rating table for Middle Fork of Willamette River at Jasper, Oreg., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.20	730	2.20	1,790	3.20	3,750	4.20	6,690	5.40	11,670
1.30	800	2.30	1,940	3.30	3,990	4.30	7,050	5.60	12,650
1.40	880	2.40	2,110	3.40	4,240	4.40	7,420	5.80	13,680
1.50	960	2.50	2,290	3.50	4,500	4.50	7,800	6.00	14,750
1.60	1,050	2.60	2,480	3.60	4,780	4.60	8,190	6.20	15,860
1.70	1,150	2.70	2,670	3.70	5,070	4.70	8,590	6.40	16,990
1.80	1,260	2.80	2,870	3.80	5,370	4.80	9,000	6.60	18,150
1.90	1,380	2.90	3,080	3.90	5,680	4.90	9,420	6.80	19,320
2.00	1,510	3.00	3,300	4.00	6,000	5.00	9,850	7.00	20,500
2.10	1,650	3.10	3,520	4.10	6,340	5.20	10,740		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1905-1907 and is fairly well defined.

*Monthly discharge of Middle Fork of Willamette River at Jasper, Oreg., for 1905-6.*

[Drainage area, 1,450 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.						
September 16-30.....	1,380	730	868	25,800	0.599	0.33
October.....	3,520	880	1,580	97,200	1.09	1.26
November.....	3,520	880	1,430	85,100	.986	1.10
December.....	6,340	1,790	3,360	207,000	2.32	2.68
The period.....	6,340	1,790		415,000		
1906.						
January.....	16,400	3,300	6,720	413,000	4.63	5.34
February.....	12,200	2,870	6,290	349,000	4.34	4.52
March.....	7,420	2,870	4,610	283,000	3.18	3.67
April.....	8,190	3,080	4,430	264,000	3.06	3.41
May.....	13,200	3,080	4,760	293,000	3.28	3.78
June.....	7,800	2,670	5,240	312,000	3.61	4.03
July.....	2,480	1,050	1,530	94,100	1.06	1.22
August <sup>a</sup> .....	1,150	800	969	59,600	.668	.77
September.....	2,110	880	1,040	61,900	.717	.80
October.....	3,080	880	1,310	80,600	.903	1.04
November.....	15,300	1,050	5,710	340,000	3.94	4.40
December.....	13,200	1,940	5,670	349,000	3.91	4.51
The year.....	16,400	800	4,020	2,900,000	2.77	37.49

<sup>a</sup> August 7 to 14, discharge estimated at 1,000 second-feet.

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

## COAST FORK OF WILLAMETTE RIVER NEAR GOSHEN, OREG.

This station was established August 23, 1905. It is located at the highway bridge 3 miles east of Goshen, Oreg., 9 miles southeast of Eugene, and about 4 miles above the junction of Coast and Middle forks of Willamette River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 221.

*Discharge measurements of Coast Fork of Willamette River near Goshen, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis- charge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
August 23.....	L. R. Allen.....	80	47	0.30	67.6
November 7.....	do.....	165	204	.67	182
December 29.....	do.....	241	677	2.78	1,910
1906.					
February 2.....	L. R. Allen.....	242	570	2.38	1,620
March 22.....	do.....	243	697	2.87	2,260
May 3.....	do.....	234	402	1.70	917
July 16.....	do.....	160	226	.82	252
August 17.....	do.....	145	158	.58	132
September 19.....	I. E. Oakes.....	134	168	.65	145
1907.					
January 31.....	I. E. Oakes.....	256	1,870	7.75	10,700

Daily gage height, in feet, of Coast Fork of Willamette River near Goshen, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.7	2.5	4.3	4.7	2.0	3.4	1.3	0.6	0.3	0.7	0.8	1.4
2.....	3.0	2.5	3.7	3.7	1.8	2.9	1.3	.6	.3	.7	.8	1.4
3.....	2.8	2.0	3.3	3.2	1.7	2.8	1.2	.6	.3	.6	.8	1.5
4.....	2.8	2.0	3.2	3.0	1.5	3.0	1.2	.6	.3	.5	1.0	1.5
5.....	3.1	2.0	3.0	2.7	1.5	2.7	1.3	.6	.3	.7	1.5	1.7
6.....	3.0	1.8	3.0	2.6	1.5	2.6	1.1	.6	.3	.7	1.6	1.8
7.....	2.7	1.8	2.9	2.5	1.5	2.7	1.1	.5	.3	.5	1.9	2.3
8.....	2.5	1.7	2.9	2.2	1.4	2.9	1.1	.5	.3	.5	2.0	2.9
9.....	5.0	1.6	2.8	2.3	1.4	3.5	1.1	.5	.3	.5	2.5	3.0
10.....	4.0	1.6	2.7	2.2	1.4	3.0	1.0	.5	.3	.6	2.0	3.4
11.....	3.6	1.6	2.5	2.0	1.4	2.7	1.0	.5	.3	.6	2.0	3.0
12.....	3.5	1.5	2.3	1.9	1.3	2.5	1.0	.5	.5	.8	2.0	2.7
13.....	5.4	1.3	2.1	1.7	1.3	2.5	1.0	.5	.5	1.0	2.0	2.3
14.....	4.5	1.3	2.0	1.7	1.4	2.3	.9	.4	.8	1.0	3.0	2.3
15.....	4.3	1.7	1.9	1.6	2.2	2.3	.9	.4	1.0	1.0	3.4	2.1
16.....	5.7	1.4	1.8	1.5	2.5	2.3	.8	.4	1.0	1.2	5.2	4.0
17.....	7.5	1.6	1.6	1.5	2.2	2.9	.8	.5	.8	1.5	4.3	3.7
18.....	5.4	2.0	1.7	1.5	2.0	2.6	.8	.5	.8	1.9	5.0	3.0
19.....	4.5	4.5	1.7	1.4	2.0	2.3	.8	.5	.7	1.8	4.7	3.2
20.....	3.7	3.7	1.9	1.4	2.0	2.0	.8	.5	.5	1.7	3.0	4.4
21.....	3.3	6.2	2.7	1.4	1.9	2.0	.8	.5	.5	1.5	3.6	4.0
22.....	3.0	5.6	2.9	1.5	2.1	1.8	.8	.5	.5	1.4	3.0	3.0
23.....	3.5	5.2	2.6	1.6	2.9	1.5	.8	.5	.6	1.4	3.0	3.0
24.....	5.1	7.0	2.5	1.6	2.5	1.6	.8	.5	.7	1.0	2.6	3.4
25.....	4.4	7.0	2.4	1.7	2.3	1.6	.8	.4	1.0	1.0	2.3	4.0
26.....	3.7	5.3	2.2	2.0	2.3	1.5	.7	.3	.8	1.0	2.0	5.0
27.....	3.5	6.0	2.2	1.9	2.1	1.5	.7	.3	/	1.0	2.0	4.2
28.....	3.5	5.0	2.1	2.7	2.5	1.5	.7	.3	.6	.9	2.0	3.3
29.....	2.7	.....	2.0	2.7	9.5	1.5	.7	.3	.6	.9	1.7	2.6
30.....	2.7	.....	2.0	2.2	5.7	1.4	.7	.3	.....	.9	1.5	2.6
31.....	2.6	.....	3.0	.....	4.4	.....	.7	.3	.....	.8	.....	2.3

Rating table for Coast Fork of Willamette River near Goshen, Oreg., for 1905-6.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
0.20	52	1.40	635	2.60	1,880	3.80	3,610	6.00	7,670
0.30	68	1.50	720	2.70	2,005	3.90	3,775	6.20	8,070
0.40	89	1.60	810	2.80	2,135	4.00	3,940	6.40	8,470
0.50	115	1.70	905	2.90	2,270	4.20	4,280	6.60	8,870
0.60	147	1.80	1,005	3.00	2,410	4.40	4,625	6.80	9,270
0.70	186	1.90	1,105	3.10	2,550	4.60	4,980	7.00	9,670
0.80	232	2.00	1,210	3.20	2,695	4.80	5,350	8.00	11,750
0.90	285	2.10	1,315	3.30	2,840	5.00	5,720	9.00	13,850
1.00	345	2.20	1,420	3.40	2,990	5.20	6,100	10.00	16,050
1.10	410	2.30	1,530	3.50	3,140	5.40	6,485		
1.20	480	2.40	1,645	3.60	3,295	5.60	6,875		
1.30	555	2.50	1,760	3.70	3,450	5.80	7,270		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1905-1907 and is well defined between gage heights 0.3 foot and 3.0 feet.

*Monthly discharge of Coast Fork of Willamette River near Goshen, Oreg., for 1905-6.*

[Drainage area, 690 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. <sup>a</sup>						
August 23-31.....	68	58	64.7	1,150	0.094	0.031
September 1-20.....	58	52	56.5	2,240	.082	.061
October 4-31.....	1,530	115	492	27,300	.713	.742
November.....	2,410	68	483	28,700	.701	.782
December.....	5,720	555	1,870	115,000	2.71	3.12
The period.....				174,000		
1906. <sup>b</sup>						
January.....	10,700	1,760	3,820	235,000	5.54	6.39
February.....	9,670	555	3,080	171,000	4.46	4.64
March.....	4,450	810	1,790	110,000	2.59	2.99
April.....	5,160	635	1,460	86,900	2.12	2.36
May.....	15,000	555	1,870	115,000	2.71	3.12
June.....	3,140	635	1,620	96,400	2.35	2.62
July.....	555	186	311	19,100	.451	.520
August.....	147	68	109	6,700	.158	.182
September.....	345	68	147	8,750	.213	.238
October.....	1,100	115	373	22,900	.541	.62
November.....	6,100	232	1,920	114,000	2.78	3.10
December.....	5,720	635	2,410	148,000	3.49	4.02
The year.....				1,130,000	2.28	30.80

<sup>a</sup> Values for 1905 are rated as follows: August to November, good; December, fair.

<sup>b</sup> Values for 1906 are rated as excellent.

#### MCKENZIE RIVER NEAR SPRINGFIELD, OREG.

This station was established September 12, 1905, by L. R. Allen. It is located at Hendricks Ferry, 11 miles above Springfield, about 3 miles above the mouth of Camp Creek. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 222.

*Discharge measurements of McKenzie River near Springfield, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis- charge.
<b>1905.</b>		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
September 12....	L. R. Allen.....	395	928	1.30	1,570
November 10....	.....do.....	398	880	1.12	1,810
December 30....	.....do.....	404	1,370	2.65	4,900
<b>1906.</b>					
February 5....	L. R. Allen.....	372	1,400	2.66	5,280
March 24....	.....do.....	342	1,190	2.14	3,690
May 4....	.....do.....	384	1,400	2.71	5,040
June 7....	.....do.....	379	1,430	<sup>a</sup> 2.77	5,160
July 26....	.....do.....	327	1,100	<sup>a</sup> 1.40	2,250
August 15....	.....do.....	328	1,110	<sup>a</sup> 1.40	1,960
September 18....	I. E. Oakes.....	315	924	1.05	1,860

<sup>a</sup> Affected by log jam.

*Daily gage height, in feet, of McKenzie River near Springfield, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.4	3.1	3.3	3.55	2.75	2.85	1.9	1.4	1.4	1.0	1.3	2.1
2.....	2.2	3.0	3.1	2.85	2.65	2.75	1.85	1.4	1.4	1.15	1.3	2.0
3.....	2.1	2.9	3.0	2.7	2.65	2.7	1.8	1.4	1.4	1.15	1.3	1.9
4.....	2.2	2.75	2.85	2.65	2.7	2.7	1.8	1.4	1.4	1.1	1.4	1.95
5.....	2.3	2.55	2.8	2.5	2.6	2.8	1.75	1.4	1.4	1.1	1.5	2.0
6.....	2.45	2.5	2.9	2.75	2.6	3.0	1.75	1.4	1.4	1.1	1.55	2.05
7.....	2.5	2.4	3.0	2.8	2.5	3.25	1.7	1.4	1.4	1.05	1.35	3.1
8.....	2.5	2.3	3.3	2.9	2.5	3.15	1.7	1.4	1.4	1.05	4.6	2.95
9.....	3.2	2.2	3.2	3.0	2.5	3.4	1.65	1.4	1.4	1.0	3.2	2.75
10.....	2.8	2.1	3.15	2.85	2.5	3.2	1.7	1.4	1.4	1.0	3.7	2.7
11.....	3.0	2.1	2.85	2.7	2.45	3.05	1.8	1.4	1.4	1.0	4.4	2.6
12.....	3.1	2.05	2.7	2.6	2.35	2.8	1.85	1.4	1.6	1.3	3.0	3.1
13.....	3.3	2.0	2.6	2.55	2.25	2.7	1.95	1.4	1.8	1.15	5.6	3.2
14.....	3.05	2.0	2.4	2.55	2.7	3.1	2.05	1.45	2.15	1.25	6.5	3.2
15.....	2.85	2.1	2.3	2.7	2.6	3.45	2.0	1.4	2.25	1.3	6.5	2.95
16.....	4.25	2.15	2.2	2.75	2.55	3.4	2.05	1.4	1.8	1.95	6.2	2.9
17.....	3.7	2.4	2.15	2.8	2.45	3.1	1.5	1.4	1.2	2.6	5.35	2.9
18.....	3.5	3.0	2.1	2.75	2.4	2.95	1.4	1.4	1.1	2.3	4.3	2.8
19.....	3.2	3.95	2.0	2.7	2.35	2.8	1.4	1.4	1.05	2.2	4.1	2.75
20.....	2.95	4.6	2.0	2.35	2.35	2.45	1.45	1.4	1.25	1.9	4.0	4.0
21.....	2.5	4.2	2.1	2.5	2.55	2.3	1.45	1.4	1.2	1.6	3.9	6.0
22.....	2.95	4.05	2.1	2.55	2.6	2.2	1.5	1.4	1.15	1.45	3.6	4.9
23.....	4.9	4.1	2.0	2.85	2.55	2.15	1.45	1.4	1.1	1.4	3.3	4.85
24.....	4.45	4.3	2.15	3.0	2.5	2.1	1.45	1.4	1.1	1.4	3.2	4.65
25.....	4.2	4.05	2.24	3.15	2.5	2.05	1.45	1.4	1.1	1.35	2.9	4.4
26.....	3.6	3.9	2.5	2.9	2.55	2.0	1.45	1.4	1.05	1.7	2.6	4.15
27.....	3.35	3.6	2.55	2.85	2.45	2.0	1.45	1.4	1.05	2.0	2.55	3.9
28.....	3.2	3.45	2.5	2.9	3.7	2.05	1.4	1.4	1.05	1.7	2.45	3.65
29.....	3.0	.....	2.5	2.8	3.65	2.0	1.4	1.4	1.0	1.8	2.3	3.45
30.....	3.15	.....	2.8	2.75	3.45	1.95	1.4	1.4	1.0	1.6	2.2	3.2
31.....	3.3	.....	3.5	.....	3.0	.....	1.4	1.4	.....	1.8	.....	2.95

*Rating table for McKenzie River near Springfield, Oreg., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.00	1,630	1.80	3,000	2.60	4,760	3.40	6,920	4.40	10,090
1.10	1,780	1.90	3,200	2.70	5,010	3.50	7,210	4.60	10,770
1.20	1,930	2.00	3,410	2.80	5,270	3.60	7,510	4.80	11,450
1.30	2,090	2.10	3,620	2.90	5,530	3.70	7,820	5.00	12,150
1.40	2,260	2.20	3,840	3.00	5,800	3.80	8,130	6.00	15,650
1.50	2,440	2.30	4,060	3.10	6,070	3.90	8,450	7.00	19,250
1.60	2,620	2.40	4,290	3.20	6,350	4.00	8,770		
1.70	2,810	2.50	4,520	3.30	6,630	4.20	9,420		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1905-6 and is fairly well defined between gage heights 1 foot and 3 feet.

*Monthly discharge of McKenzie River near Springfield, Oreg., for 1905-6.*

[Drainage area, 960 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. <sup>a</sup>						
September 12-30.....	2,810	2,090	2,230	84,000	2.32	1.64
October.....	5,270	2,090	2,770	170,000	2.89	3.33
November.....	4,060	1,780	2,260	134,000	2.35	2.62
December.....	6,920	2,810	4,010	247,000	4.18	4.82
The period.....				635,000		
1906. <sup>b</sup>						
January.....	11,800	3,620	6,200	381,000	6.46	7.45
February.....	10,800	3,410	5,980	332,000	6.23	6.49
March.....	7,210	3,410	4,850	298,000	5.05	5.82
April.....	7,360	4,170	5,220	311,000	5.44	6.07
May.....	7,820	3,950	4,900	301,000	5.10	5.88
June.....	7,060	3,300	5,040	300,000	5.25	5.86
July.....	3,510	2,260	2,710	167,000	2.82	3.25
August.....	2,350	2,260	2,260	139,000	2.35	2.71
September.....	3,950	1,630	2,200	131,000	2.29	2.56
October.....	4,760	1,630	2,440	150,000	2.54	2.93
November.....	17,400	2,090	7,300	434,000	7.60	8.48
December.....	15,600	3,200	6,650	409,000	6.93	7.99
The period.....	17,400	1,630	4,650	3,350,000	4.84	65.49

<sup>a</sup>Values for 1905 are rated as follows: November and December, excellent; October, fair; September, approximate.

<sup>b</sup>Values are rated as follows: January to July, good; August to December, fair.

<sup>c</sup>During the morning of September 17, 1906, there was a drop of 0.5 foot in the water due to the removal of a log jam lodged on a bar 200 yards below the gage. The daily discharge September 12 to 17 was applied as if open-channel conditions existed. It is impossible to judge accurately the extent of the backwater effect from this log jam owing to a natural rise from rains about the middle of September, but the monthly mean for this month is believed to be not more than 2 or 3 per cent too high from this cause. Estimates for this station are affected by log drives which cause changes in the channel and modify the flow generally.

## NORTH FORK OF SANTIAM RIVER AT MEHAMA, OREG.

This station was established July 11, 1905. It is located just below the highway bridge at Mehama, Oreg., about 1½ miles north of Lyons, the nearest railroad station, which is about 12 miles below the junction of Little North Fork and North Fork. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 224.

*Discharge measurements of North Fork of Santiam River at Mehama, Oreg., in 1905-1907.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis- charge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
July 11.....	L. R. Allen.....	160	756	2.90	1,050
October 18 <sup>a</sup> .....	do.....	202	1,010	4.44	3,560
November 16.....	J. H. Lewis.....	155	756	2.90	973
December 12.....	L. R. Allen.....	250	927	4.24	2,880
1906.					
January 4.....	L. R. Allen.....	249	926	4.20	2,230
February 7.....	do.....	251	1,000	4.51	3,320
March 26.....	do.....	250	927	4.20	2,740
May 7.....	do.....	250	947	4.28	2,800
May 15 <sup>b</sup> .....	do.....	253	1,030	4.65	3,060
July 17.....	do.....	242	632	3.04	1,080
August 21.....	do.....	237	550	2.64	756
September 27.....	I. E. Oakes.....	242	585	2.83	905
1907.					
February 6.....	I. E. Oakes.....	305	2,710	11.00	29,100

<sup>a</sup>Measurement unreliable. <sup>b</sup>Backwater from log jam.

Daily gage height, in feet, of North Fork of Santiam River at Mehama, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.35	5.8	5.5	5.45	5.0	4.3	3.8	2.8	2.6	2.7	3.3	3.75
2.....	4.2	5.9	5.3	5.0	4.6	4.1	3.8	2.8	2.55	2.8	3.25	3.7
3.....	4.1	5.5	5.2	4.7	4.6	4.2	3.7	2.8	2.55	3.55	3.2	3.7
4.....	4.2	5.2	5.15	4.55	4.6	4.8	3.65	2.75	2.55	3.6	3.45	3.5
5.....	4.4	5.0	5.0	4.55	4.6	4.5	3.6	2.75	2.55	3.3	3.8	3.75
6.....	4.5	4.75	5.25	4.8	4.3	5.0	3.5	2.75	2.55	3.1	3.7	4.0
7.....	4.5	4.6	5.4	5.0	4.3	5.4	3.4	2.75	2.55	2.95	9.65	6.2
8.....	4.6	4.4	5.6	5.0	4.3	5.1	3.35	2.75	2.55	2.9	10.0	5.5
9.....	5.1	4.25	5.5	5.3	4.5	5.1	3.3	2.75	2.65	2.8	6.9	5.2
10.....	4.85	4.15	5.65	5.0	4.6	5.1	3.25	2.7	2.65	2.8	8.5	4.8
11.....	5.5	4.05	5.2	5.0	5.0	4.7	3.25	2.7	2.6	2.8	6.5	4.85
12.....	5.0	4.0	4.9	5.0	4.45	4.8	3.2	2.7	2.7	3.25	6.75	4.6
13.....	5.3	3.9	4.7	4.85	4.25	4.7	3.2	2.7	3.15	3.3	11.25	4.5
14.....	5.0	3.9	4.4	4.8	4.4	4.4	3.2	2.7	4.1	3.0	12.35	4.2
15.....	4.7	4.2	4.2	4.5	5.0	4.5	3.15	2.7	4.2	3.3	11.7	4.5
16.....	5.3	4.3	4.1	4.6	4.2	5.4	3.1	2.7	3.1	5.1	8.8	7.3
17.....	5.3	4.9	3.9	4.6	4.05	5.0	3.1	2.7	3.05	5.3	9.1	5.4
18.....	5.15	6.2	3.95	4.3	4.05	4.75	3.0	2.7	2.9	5.2	8.65	5.0
19.....	4.8	7.7	3.9	4.3	4.25	4.5	3.0	2.65	2.9	4.75	6.6	5.4
20.....	4.5	8.1	3.8	4.3	4.2	4.35	3.0	2.65	2.8	4.35	5.9	10.6
21.....	4.35	7.85	3.8	4.9	4.5	4.2	2.95	2.65	2.75	3.9	6.05	9.6
22.....	4.5	7.05	3.8	4.7	4.5	4.2	2.95	2.65	2.7	3.7	5.5	7.2
23.....	6.3	6.85	3.7	4.6	4.5	3.9	2.95	2.6	2.7	3.5	5.1	6.4
24.....	8.55	6.4	3.95	4.5	4.3	3.9	2.9	2.6	2.95	3.4	4.9	6.4
25.....	6.8	6.05	3.05	5.2	4.2	3.8	2.9	2.6	3.15	3.4	4.6	6.6
26.....	6.25	6.4	4.2	5.2	4.3	3.75	2.85	2.6	2.9	4.2	4.4	6.6
27.....	5.85	6.6	4.3	4.95	4.2	3.65	2.85	2.6	2.8	4.3	4.3	6.3
28.....	5.5	5.95	4.25	5.2	4.1	3.65	2.85	2.6	2.8	3.85	4.0	5.45
29.....	5.4	.....	4.25	4.95	4.35	3.65	2.8	2.6	2.75	3.8	4.0	5.2
30.....	5.4	.....	4.65	4.9	4.6	3.85	2.8	2.6	.....	3.5	3.8	5.2
31.....	6.1	.....	6.1	.....	4.35	.....	2.8	2.6	.....	3.4	.....	5.0

NOTE.—Gage heights for May and June were affected by log jams.

Rating table for North Fork of Santiam River at Mehama, Oreg., for 1905-6.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
2.40	590	3.40	1,570	4.40	3,100	5.80	6,410	7.80	13,750
2.50	660	3.50	1,700	4.50	3,280	6.00	7,000	8.00	14,600
2.60	740	3.60	1,840	4.60	3,470	6.20	7,630	9.00	19,200
2.70	820	3.70	1,980	4.70	3,670	6.40	8,300	10.00	24,100
2.80	910	3.80	2,130	4.80	3,880	6.60	9,000	11.00	29,100
2.90	1,000	3.90	2,280	4.90	4,100	6.80	9,730	12.00	34,300
3.00	1,100	4.00	2,430	5.00	4,330	7.00	10,500	13.00	39,800
3.10	1,210	4.10	2,590	5.20	4,810	7.20	11,290	.....	.....
3.20	1,320	4.20	2,750	5.40	5,320	7.40	12,090	.....	.....
3.30	1,440	4.30	2,920	5.60	5,850	7.60	12,910	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1905-1907 and is well defined between gage heights 2.5 feet and 4.5 feet.

*Monthly discharge of North Fork of Santiam River at Mehama, Oreg., for 1905-6.*

[Drainage area, 740 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.						
July 11-31.....	1,000	780	876	36,500	1.18	0.92
August.....	780	660	727	44,700	.982	1.13
September.....	3,010	625	952	56,600	1.29	1.44
October.....	9,730	1,500	3,460	213,000	4.68	5.40
November.....	3,880	1,000	1,830	109,000	2.47	2.76
December.....	6,700	2,430	4,010	247,000	5.42	6.25
The period.....				707,000		
1906.						
January.....	17,100	2,590	5,050	311,000	6.82	7.86
February.....	15,000	2,280	6,180	343,000	8.35	8.70
March.....	7,310	1,150	3,680	226,000	4.97	5.73
April.....	5,450	2,920	3,970	236,000	5.36	5.98
May.....	4,330	2,510	3,170	195,000	4.28	4.93
June.....	5,320	1,910	3,280	195,000	4.43	4.94
July.....	2,130	910	1,310	80,600	1.77	2.04
August.....	910	740	809	49,700	1.09	1.26
September.....	2,750	700	1,030	61,300	1.39	1.55
October.....	5,060	820	1,990	122,000	2.69	3.10
November.....	36,200	1,320	10,300	613,000	13.92	15.53
December.....	27,100	1,700	6,450	397,000	8.72	10.05
The year .....	36,200	700	3,930	2,830,000	5.31	71.67

NOTE.—Values are rated as follows: 1905, January, April, and July to December, 1906, excellent; May and June, 1906, fair; affected by log jams.

## SOUTH FORK OF SANTIAM RIVER AT WATERLOO, OREG.

This station was established July 28, 1905. It is located about one-half mile below the highway bridge at Waterloo, Oreg. The station is about 4 miles above the mouth of Hamilton Creek, and about 3 miles above a dam which diverts water into a canal for the use of the town of Albany. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 225.

*Discharge measurements of South Fork of Santiam River at Waterloo, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
July 28.....	L. R. Allen.....	150	246	1.06	375
1906.					
January 5.....	L. R. Allen.....	315	831	3.49	3,550
February 6.....	do.....	315	802	3.36	3,410
March 27.....	do.....	304	616	2.85	2,390
May 8.....	do.....	233	460	2.30	1,560
May 14.....	do.....	243	481	2.28	1,550
August 20.....	do.....	142	199	.93	263
September 26.....	I. E. Oakes.....	155	273	1.40	555

*Daily gage height, in feet, of South Fork of Santiam River at Waterloo, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.7	4.6	4.6	4.4	3.1	3.2	2.2	1.2	0.7	1.2	2.9	2.5
2.....	3.2	4.4	4.2	3.7	2.4	3.0	2.1	1.2	.7	1.1	2.9	2.5
3.....	3.3	4.3	3.9	3.5	2.7	2.9	2.0	1.2	.7	1.5	2.9	2.4
4.....	3.2	3.9	3.9	3.3	2.7	3.5	1.8	1.1	.7	2.0	2.5	2.4
5.....	3.4	3.6	3.9	3.2	2.5	3.2	1.7	1.1	.7	1.6	2.3	2.5
6.....	3.5	3.4	4.0	3.1	2.4	3.6	1.8	1.1	.7	1.5	2.3	2.6
7.....	3.7	3.1	4.6	3.2	2.4	3.8	1.8	1.1	.7	1.3	7.4	3.5
8.....	3.6	3.1	4.4	3.1	2.3	4.3	1.7	1.1	.7	1.2	11.2	4.0
9.....	4.2	3.0	4.5	3.5	2.3	4.0	1.7	1.0	.7	1.1	6.6	3.7
10.....	4.0	2.9	4.2	3.2	2.3	3.4	1.6	1.0	.7	1.1	5.3	3.6
11.....	4.1	2.7	3.8	3.0	2.2	3.9	1.6	1.0	.7	1.0	5.6	3.6
12.....	4.3	2.6	3.5	2.8	2.2	3.3	1.6	1.0	.7	1.3	7.5	3.5
13.....	5.0	2.6	3.3	2.7	2.1	3.3	1.6	1.0	.7	1.5	10.0	3.7
14.....	4.4	2.6	3.2	2.6	2.3	3.1	1.5	1.0	1.8	1.3	13.5	3.3
15.....	4.3	3.0	2.9	2.6	2.6	3.1	1.5	1.0	1.9	1.4	10.0	4.1
16.....	4.6	3.0	2.7	2.7	2.8	3.7	1.5	1.0	1.7	1.5	8.5	4.0
17.....	5.4	3.4	2.7	2.6	2.6	3.7	1.5	1.0	1.7	4.4	8.5	3.6
18.....	5.0	3.8	2.6	2.5	2.6	3.2	1.5	1.0	1.7	4.0	8.2	4.5
19.....	4.4	5.9	2.6	2.5	2.8	3.0	1.4	1.0	1.4	4.7	8.1	7.7
20.....	3.9	7.0	2.5	2.5	2.7	2.7	1.4	.9	1.3	4.8	5.2	7.8
21.....	3.5	6.9	2.6	2.7	3.2	2.7	1.3	.8	1.2	2.3	5.1	6.5
22.....	3.4	5.9	2.6	2.6	3.4	2.6	1.3	.8	1.2	2.3	4.8	5.0
23.....	4.8	5.9	2.5	2.6	3.2	2.5	1.3	.8	1.2	2.1	4.2	4.85
24.....	7.1	5.9	2.6	2.6	3.0	2.4	1.3	.8	1.3	2.1	4.8	4.8
25.....	6.1	5.6	2.6	2.8	2.9	2.2	1.3	.8	1.3	2.3	3.5	5.6
26.....	5.5	5.3	2.8	3.8	2.4	2.2	1.2	.7	1.3	2.4	3.3	5.9
27.....	4.9	6.2	2.9	3.5	3.0	2.3	1.2	.7	1.0	2.9	3.4	4.8
28.....	4.5	5.1	2.8	3.7	2.9	2.3	1.2	.7	1.0	2.5	3.0	4.4
29.....	4.3	.....	2.9	3.5	3.7	2.4	1.2	.7	1.1	2.2	2.7	4.0
30.....	4.5	.....	2.8	3.2	3.8	2.4	1.2	.7	1.1	2.1	2.7	3.1
31.....	4.8	.....	4.5	.....	3.6	.....	1.2	.7	.....	2.3	.....	3.8

*Rating table for South Fork of Santiam River at Waterloo, Oreg., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.50	128	1.70	850	2.90	2,510	4.20	5,260	6.60	12,380
0.60	158	1.80	960	3.00	2,680	4.40	5,780	6.80	13,040
0.70	192	1.90	1,070	3.10	2,860	4.60	6,310	7.00	13,700
0.80	230	2.00	1,190	3.20	3,050	4.80	6,850	8.00	17,000
0.90	273	2.10	1,320	3.30	3,240	5.00	7,400	9.00	20,400
1.00	320	2.20	1,450	3.40	3,440	5.20	7,980	10.00	23,900
1.10	370	2.30	1,590	3.50	3,640	5.40	8,580	11.00	27,500
1.20	430	2.40	1,730	3.60	3,850	5.60	9,190	12.00	31,200
1.30	500	2.50	1,870	3.70	4,070	5.80	9,810	13.00	35,000
1.40	580	2.60	2,020	3.80	4,290	6.00	10,450	14.00	38,800
1.50	660	2.70	2,180	3.90	4,520	6.20	11,090	.....	.....
1.60	750	2.80	2,340	4.00	4,760	6.40	11,730	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905-6 and is well defined between gage heights 0.9 foot and 4 feet.

*Monthly discharge of South Fork of Santiam River at Waterloo, Oreg., for 1905-6.*

[Drainage area, 640 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. <sup>a</sup>						
August.....	345	230	297	18,300	.464	0.54
September.....	1,070	158	314	18,700	.491	.55
October.....	6,040	660	2,340	144,000	3.66	4.22
November.....	3,440	580	1,270	75,600	1.98	2.21
December.....	7,120	2,180	4,140	255,000	6.47	7.46
The period.....				512,000		
1906. <sup>b</sup>						
January.....	14,000	3,050	5,790	356,000	9.05	10.43
February.....	13,700	2,020	5,910	328,000	9.23	9.61
March.....	6,310	1,870	3,490	215,000	5.45	6.28
April.....	5,780	1,870	2,850	170,000	4.45	4.96
May.....	4,290	1,320	2,310	142,000	3.61	4.16
June.....	5,520	1,450	2,900	173,000	4.53	5.05
July.....	1,450	430	707	43,500	1.10	1.27
August.....	430	192	298	18,300	.466	.54
September.....	1,070	192	411	24,500	.642	.72
October.....	6,850	320	1,640	101,000	2.56	2.95
November.....	36,900	1,590	10,300	613,000	16.09	17.95
December.....	16,300	1,730	5,470	336,000	8.55	9.86
The period.....	36,900	192	3,510	2,520,000	5.48	73.78

<sup>a</sup> Values for 1905 are rated as follows: October to December, excellent; August and September, good.<sup>b</sup> Values for 1906 are rated as follows: March to July, September, and October, excellent; remainder of the year, good.

## LUCKIAMUTE RIVER NEAR SUVER, OREG.

This station was established August 18, 1905. It is located just below Helmick bridge on the public highway, 4 miles northwest of Suver, Oreg., 2 miles west of Parkers Station, and about 3 miles below the junction of the main forks of the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 226.

*Discharge measurements of Luckiamute River near Suver, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
August 18.....	L. R. Allen.....	45	121	1.47	73
October 7.....	..do.....	79	571	8.57	1,180
1906.					
January 10.....	P. A. Cupper.....	78	508	7.60	928
April 5.....	L. R. Allen.....	62	322	5.01	495
May 16.....	..do.....	62	356	5.59	592
June 30.....	..do.....	61	290	4.28	396

*Daily gage height, in feet, of Luckiamute River near Suver, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	15.6	8.35	15.8	6.8	3.95	4.0	3.8	2.0	1.25	1.5	3.5	6.9
2.	12.3	7.5	13.6	5.9	3.85	3.6	3.75	1.85	.85	1.55	2.6	6.1
3.	11.25	7.3	12.05	5.3	3.65	4.0	3.5	1.8	.95	2.45	3.0	7.3
4.	9.5	7.4	10.8	5.1	4.35	4.4	3.5	1.2	1.25	2.85	4.0	5.9
5.	7.75	6.5	9.95	5.0	4.6	4.8	3.25	1.85	1.2	1.95	8.2	5.5
6.	8.2	6.2	9.3	5.1	5.25	4.25	3.1	1.85	1.2	1.6	7.1	5.7
7.	8.5	5.7	8.55	4.9	5.0	4.9	3.05	1.75	1.2	1.45	10.9	13.0
8.	7.8	5.45	8.1	4.8	3.1	5.1	3.05	1.85	1.15	1.8	23.1	12.5
9.	9.0	5.3	7.6	5.0	3.2	4.8	2.9	1.8	.95	1.9	23.6	11.1
10.	8.3	5.2	7.4	5.8	3.05	4.35	2.85	2.15	1.25	1.7	17.6	12.8
11.	9.0	5.1	7.2	5.25	3.0	4.2	2.8	1.8	1.2	1.7	18.8	12.9
12.	10.8	4.9	6.75	4.35	2.9	5.1	2.7	1.75	1.35	2.5	13.0	10.9
13.	17.15	4.6	6.35	4.75	3.0	5.4	2.65	1.7	2.5	3.9	15.4	10.8
14.	17.15	4.5	6.1	4.3	3.2	5.6	2.6	1.75	2.3	3.2	18.7	10.3
15.	16.15	4.7	6.85	3.9	3.9	5.3	2.65	1.7	2.55	3.3	22.1	12.6
16.	17.6	4.9	5.4	3.83	5.6	8.7	2.25	1.75	2.5	7.5	25.9	13.0
17.	20.8	6.4	5.4	3.85	6.7	7.5	2.3	1.65	1.9	8.35	23.1	12.2
18.	21.6	12.3	5.3	3.75	4.2	7.2	2.5	1.6	1.75	6.5	18.9	11.5
19.	18.6	18.5	5.7	3.8	4.1	6.0	2.35	1.65	1.65	5.6	15.4	13.1
20.	16.55	15.5	5.95	3.8	4.25	5.6	2.5	1.45	1.55	4.8	13.0	18.0
21.	15.5	23.2	6.5	3.7	4.3	5.1	2.3	1.5	1.45	3.45	12.8	22.0
22.	13.2	22.0	6.6	3.6	4.4	4.6	2.2	1.55	1.3	3.6	12.6	24.5
23.	16.6	21.5	7.1	3.5	3.4	4.3	2.15	1.5	1.5	3.4	11.0	18.0
24.	21.6	22.5	7.3	3.5	3.8	4.25	2.15	1.4	1.65	3.1	10.0	14.0
25.	18.0	23.9	7.6	4.2	4.7	4.0	2.0	1.45	2.5	2.7	9.5	13.6
26.	14.8	22.9	7.45	4.1	4.9	3.95	2.5	1.45	1.8	3.2	8.3	16.0
27.	13.2	22.1	7.1	4.25	5.0	3.8	2.0	1.25	1.4	5.4	7.2	13.0
28.	13.5	18.9	6.5	5.25	4.85	3.65	2.3	1.3	1.3	4.5	7.3	11.9
29.	10.7	-----	6.8	5.35	4.6	3.9	2.25	1.2	1.7	4.2	6.4	10.2
30.	10.4	-----	6.1	4.2	4.45	4.3	2.5	1.15	1.95	4.1	6.5	10.5
31.	9.0	-----	7.5	-----	4.6	-----	2.35	1.3	-----	4.05	-----	11.4

*Rating table for Luckiamute River near Suver, Oreg., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
0.90	39	2.30	143	3.70	306	6.20	701	17.00	3,770
1.00	44	2.40	153	3.80	319	6.40	737	18.00	4,148
1.10	50	2.50	163	3.90	333	6.60	774	19.00	4,540
1.20	56	2.60	173	4.00	347	6.80	812	20.00	4,944
1.30	62	2.70	184	4.20	375	7.00	850	21.00	5,360
1.40	69	2.80	195	4.40	405	8.00	1,058	22.00	5,780
1.50	76	2.90	206	4.60	435	9.00	1,290	23.00	6,200
1.60	83	3.00	218	4.80	466	10.00	1,543	24.00	6,630
1.70	91	3.10	230	5.00	498	11.00	1,810	25.00	7,060
1.80	99	3.20	242	5.20	530	12.00	2,095	26.00	7,490
1.90	107	3.30	254	5.40	563	13.00	2,400		
2.00	115	3.40	267	5.60	597	14.00	2,716		
2.10	124	3.50	280	5.80	631	15.00	3,050		
2.20	133	3.60	293	6.00	665	16.00	3,404		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1905-6 and is well defined between gage heights 1.5 feet and 9.0 feet.

*Monthly discharge of Luckiamute River near Suver, Oreg., for 1905-6.*

Month.	Discharge in second-feet.			Total in Acre-feet.
	Maximum.	Minimum.	Mean.	
1905. <sup>a</sup>				
August 26-31.....	76	41	55.4	1,320
September.....	280	39	76.6	4,560
October.....	1,290	133	396	24,300
November.....	1,000	115	247	14,700
December.....	4,400	375	1,450	89,200
The period.....				134,000
1906. <sup>b</sup>				
January.....	5,610	1,000	2,720	167,000
February.....	6,590	420	2,410	134,000
March.....	3,330	546	1,060	65,200
April.....	812	280	436	25,900
May.....	793	206	381	23,400
June.....	1,220	293	492	29,300
July.....	319	115	192	11,800
August.....	115	53	85	5,230
September.....	168	37	84.5	5,030
October.....	1,140	72	314	19,300
November.....	7,450	173	2,640	157,000
December.....	6,840	580	2,290	141,000
The year.....	7,450	37	1,090	784,000

<sup>a</sup> Values for 1905 are rated as follows: October, excellent; November and December, good; August and September, fair.

<sup>b</sup> Values for 1906 are rated as follows: April to June and October, excellent; March and July, good; remainder of the year, fair.

## MOLALLA RIVER NEAR MOLALLA, OREG.

This station was established November 1, 1905. It is located at Dickey Prairie, 3 miles below the junction of the forks of the river  $3\frac{1}{2}$  miles southeast of Molalla, Oreg. The conditions at the station and the bench marks are described in Water-Supply Paper No. 178, page 227.

*Discharge measurements of Molalla River near Molalla, Oreg., in 1905-6.*

Date.		Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
			Feet.	Sq. ft.	Feet.	Sec.-ft.
1905.						
November 2....	L. R. Allen.....		106	226	1.83	376
1906.						
January 9 <sup>a</sup> ....	L. R. Allen.....		130	437	3.63	1,510
January 13....	P. A. Cupper.....		130	422	3.55	1,610
April 3.....	L. R. Allen.....		118	334	2.80	924
May 24.....	do.....		117	323	2.66	822
July 11.....	do.....		104	174	1.33	186
September 4....	I. E. Oakes.....		102	118	.75	60

<sup>a</sup> Measurement unreliable.

*Daily gage height, in feet, of Molalla River near Molalla, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	2.7	3.75	3.75	3.4	2.7	2.25	1.9	1.0	0.75	1.0	1.85	2.25
2.....	2.7	3.5	3.45	3.0	2.5	2.15	1.85	.95	.75	1.05	1.8	2.15
3.....	2.75	3.4	3.7	2.8	2.4	2.25	1.8	.95	.75	1.6	1.75	2.1
4.....	2.8	3.3	3.65	2.7	2.3	2.5	1.75	.95	.75	1.55	2.5	2.05
5.....	3.15	2.8	3.45	2.7	2.2	2.5	1.65	.9	.75	1.4	2.6	2.4
6.....	3.1	2.7	3.55	2.7	2.15	2.75	1.5	.9	.75	1.35	2.5	2.5
7.....	3.05	2.6	3.6	2.8	2.1	2.95	1.45	.9	.75	1.3	6.8	3.3
8.....	3.3	2.5	3.7	2.7	2.0	2.85	1.45	.9	.75	1.1	6.5	3.65
9.....	3.7	2.35	3.8	2.8	2.0	2.85	1.4	.9	.75	1.05	4.9	3.4
10.....	3.45	2.3	3.5	2.7	1.9	2.75	1.4	.9	.75	1.0	5.3	3.0
11.....	3.5	2.2	3.3	2.7	1.85	2.65	1.35	.9	.75	1.05	4.4	3.2
12.....	3.5	2.15	3.0	2.7	1.8	2.55	1.3	.85	.85	1.65	4.0	3.4
13.....	3.55	2.1	2.7	2.5	1.75	2.55	1.3	.85	1.3	2.2	7.45	2.8
14.....	3.5	2.05	2.65	2.45	2.15	2.5	1.25	.9	2.8	2.65	8.1	2.7
15.....	3.7	2.5	2.45	2.35	2.4	3.0	1.2	.9	2.5	2.2	8.85	3.4
16.....	3.9	2.5	2.3	2.35	2.35	4.0	1.2	.85	1.8	3.6	6.2	3.9
17.....	3.9	3.9	2.25	2.3	3.3	3.4	1.2	.85	1.45	3.9	6.0	3.2
18.....	3.95	5.0	2.2	2.25	2.3	3.0	1.2	.85	1.3	3.3	5.3	3.2
19.....	3.45	4.7	2.15	2.15	2.6	2.8	1.2	.85	1.2	3.1	4.4	3.5
20.....	3.1	5.9	2.1	2.1	2.7	2.6	1.15	.8	1.15	2.75	4.0	7.5
21.....	2.9	5.4	2.1	2.25	2.75	2.4	1.15	.8	1.15	2.5	3.8	6.0
22.....	2.95	4.5	2.05	2.25	2.8	2.3	1.15	.8	1.1	2.35	3.6	4.6
23.....	4.85	4.35	2.0	2.25	2.85	2.2	1.15	.8	1.2	2.1	3.4	4.2
24.....	5.2	4.5	2.2	2.2	2.65	2.1	1.1	.8	1.3	1.95	3.1	3.6
25.....	4.5	4.4	2.1	3.4	2.5	1.95	1.1	.8	1.2	1.9	2.9	4.2
26.....	4.0	4.6	2.35	3.0	2.65	1.85	1.1	.8	1.1	1.95	2.75	4.5
27.....	3.75	4.9	2.45	2.7	2.6	1.9	1.1	.75	1.05	1.95	2.6	3.9
28.....	3.5	4.35	2.4	3.1	2.5	1.95	1.1	.75	1.0	1.95	2.5	3.5
29.....	3.5	.....	2.5	3.05	2.45	2.05	1.05	.75	.95	1.9	2.35	3.4
30.....	3.7	.....	2.7	2.85	2.4	2.0	1.05	.75	.95	1.85	2.3	3.3
31.....	4.0	.....	3.7	.....	2.35	.....	1.0	.75	.....	1.85	.....	3.2

*Rating table for Molalla River near Molalla, Oreg., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.70	52	1.70	320	2.70	855	3.70	1,595	5.40	3,225
0.80	68	1.80	364	2.80	920	3.80	1,680	5.60	3,435
0.90	86	1.90	411	2.90	985	3.90	1,770	5.80	3,645
1.00	106	2.00	460	3.00	1,055	4.00	1,860	6.00	3,855
1.10	127	2.10	510	3.10	1,125	4.20	2,040	7.00	4,955
1.20	151	2.20	565	3.20	1,200	4.40	2,225	8.00	6,105
1.30	178	2.30	620	3.30	1,275	4.60	2,415	9.00	7,305
1.40	208	2.40	675	3.40	1,350	4.80	2,610		
1.50	242	2.50	735	3.50	1,430	5.00	2,810		
1.60	279	2.60	795	3.60	1,510	5.20	3,015		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined between gage heights 0.75 foot and 4.0 feet.

*Monthly discharge of Molalla River near Molalla, Oreg., for 1905-6.*

[Drainage area, 220 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. <sup>a</sup>						
November.....	1,600	164	464	27,600	2.11	2.35
December.....	2,320	592	1,190	73,200	5.41	6.24
The period.....				101,000		
1906. <sup>b</sup>						
January.....	3,020	855	1,490	91,600	6.77	7.80
February.....	3,750	485	1,580	87,800	7.18	7.48
March.....	1,680	460	986	60,600	4.48	5.16
April.....	1,350	510	830	49,400	3.77	4.21
May.....	952	342	657	40,400	2.99	3.45
June.....	1,860	387	787	46,800	3.58	3.99
July.....	411	106	191	11,700	.868	1.00
August.....	106	60	77.6	4,770	.353	.407
September.....	920	60	164	9,760	.745	.831
October.....	1,770	106	512	31,500	2.33	2.69
November.....	7,120	242	2,170	129,000	9.86	11.00
December.....	5,530	485	1,510	92,800	6.86	7.91
The year.....	7,120	60	.913	656,000	4.15	55.93

<sup>a</sup> Values for 1905 are rated as follows: November, excellent; December good.<sup>b</sup> Values for 1906 are rated as follows: March to June, November and December, excellent; remainder of the year, good.

## SOUTH FORK OF YAMHILL RIVER AT SHERIDAN, OREG.

This station was established April 25, 1906. It is located in Sheridan, Oreg., about 2 miles below the mouth of Mill Creek.

The channel is straight for 250 feet above and 500 feet below the station, and the current is uniform. Both banks are high and well covered with undergrowth; the right is liable to overflow at extreme high water. The bed of the stream is of sand and fine clean gravel and is liable to shift during high water. There is one channel at all stages.

Discharge measurements are made from the public highway bridge in Sheridan. The initial point for soundings is two nails driven in the wall, about 1 foot to the left of the corner of the first building on the right bank.

The gage, which is read daily by G. Schoppert, is a 2 by 8 inch timber in two sections, the lower section being vertical, 3.8 feet long, and nailed to a cross timber on the lower side of the right bridge pier. The upper portion is inclined at a small angle and nailed to an upright timber of the pier, being 24.3 feet in length. The bench mark is the top of three 30-penny nails driven in an ash tree about 5 feet below the bridge and 25 feet from the initial point; elevation, 21.70 feet above the datum of the gage.

*Discharge measurements of South Fork of Yamhill River at Sheridan, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1905.		122	428		583
December 14.....	L. R. Allen.....				
1906.					
April 25.....	L. R. Allen.....	124	494	2.70	813
May 18.....	do.....	123	453	2.34	625
July 1.....	do.....	116	374	1.81	436
September 7.....	I. E. Oakes.....	106	211	1.30	48
October 30.....	do.....	117	309	1.80	423

*Daily gage height, in feet, of South Fork of Yamhill River at Sheridan, Oreg., for 1906.*

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		2.0	1.9	1.9	.8	.3		2.0	2.5
2.....		2.0	1.8	1.65	.7	.3		2.0	2.5
3.....		1.9	1.8	1.5	.7	.3		2.0	2.4
4.....		2.3	2.9	1.5	.7	.2		2.0	2.3
5.....		2.3	2.9	1.45	.6	.3		4.0	2.3
6.....		2.2	2.9	1.45	.6	.3		4.3	2.3
7.....		2.1	3.1	1.4	.6	.3		7.9	8.5
8.....		2.9	2.8	1.4	.6	.4		12.0	6.0
9.....		2.8	2.75	1.3	.6	.4		8.1	6.0
10.....		2.7	2.4	1.3	.5	.4		9.0	5.5
11.....		2.6	2.5	1.3	.5	.5		8.0	5.5
12.....		2.5	3.0	1.35	.5	.6		7.8	5.3
13.....		1.7	3.9	1.2	.5	1.4		7.5	5.2
14.....		1.7	4.0	1.1	.6	1.6		8.5	4.0
15.....		2.3	3.8	1.1	.5	1.7		14.5	4.5
16.....		2.3	5.0	1.0	.5	1.7		8.5	5.5
17.....		2.5	4.0	1.0	.5	1.6		9.5	5.5
18.....		2.4	3.6	1.0	.5	1.0		8.5	4.4
19.....		2.3	3.4	1.0	.5	.9		7.0	4.6
20.....		2.2	3.0	1.0	.4	.7		7.0	11.4
21.....		2.1	2.8	.9	.4	.7		5.5	11.6
22.....		2.0	2.6	.9	.4	.6		5.3	7.3
23.....		1.9	2.4	.9	.4	.7		5.0	7.0
24.....		2.0	2.2	.9	.4	.9		4.6	5.9
25.....	2.6	2.5	2.0	.9	.4	1.3		4.0	6.8
26.....	2.3	2.5	1.9	.8	.4	1.0		4.0	5.8
27.....	2.4	2.9	1.9	.8	.4	.9		3.5	5.8
28.....	2.5	2.3	1.95	.8	.3	.8		3.0	5.3
29.....	2.3	2.2	1.8	.8	.3	.8		2.8	4.5
30.....	2.2	2.1	2.1	.9	.3		1.8	2.5	4.8
31.....		2.1		.8	.3		1.9		4.5

*Rating table for South Fork of Yamhill River at Sheridan, Oreg., from April 25 to September 30, 1906.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.20	38	1.10	208	2.00	500	2.90	895	3.80	1,395
0.30	51	1.20	235	2.10	540	3.00	945	3.90	1,455
0.40	65	1.30	264	2.20	580	3.10	995	4.00	1,515
0.50	80	1.40	294	2.30	620	3.20	1,050	4.20	1,645
0.60	97	1.50	326	2.40	665	3.30	1,105	4.40	1,775
0.70	116	1.60	359	2.50	710	3.40	1,160	4.60	1,915
0.80	137	1.70	393	2.60	755	3.50	1,215	4.80	2,055
0.90	159	1.80	428	2.70	800	3.60	1,275	5.00	2,200
1.00	183	1.90	464	2.80	845	3.70	1,335		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is not well defined.

*Monthly discharge of South Fork of Yamhill River at Sheridan, Oreg., for 1906.*

[Drainage area, 290 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 25-30.....	755	580	658	7,830	2.27	.51
May.....	895	393	614	37,800	2.12	2.44
June.....	2,200	428	873	51,900	3.01	3.36
July.....	464	137	225	13,800	.776	.90
August.....	137	51	81.0	4,980	.279	.32
September.....	393	38	149	8,870	.514	.57
The period.....				125,000		

NOTE.—The above estimates are provisional and subject to revision when more data are available. Values are rated as follows: April to June, good; July to September, fair.

## CLACKAMAS RIVER NEAR BARTON, OREG.

This station was established October 2, 1905. It is located 2½ miles below Barton, Oreg., 1½ miles below the mouth of Deep Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 228.

*Discharge measurements of Clackamas River near Barton, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis- charge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
October 2.....	L. R. Allen.....	310	704	3.30	1,600
1906.					
January 8.....	L. R. Allen.....	310	1,070	4.52	3,310
January 13.....	do.....	325	1,160	4.84	4,020
April 2.....	do.....	324	1,290	5.18	4,950
May 23.....	do.....	304	1,010	4.30	3,250
July 10.....	do.....	276	640	3.01	1,270
September 3....	Ivan Oakes.....	265	497	2.51	817

*Daily gage height, in feet, of Clackamas River near Barton, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.4	5.6	5.6	5.9	4.9	3.8	3.4	2.7	2.52	2.6	3.2	4.5
2.....	4.3	5.4	5.3	5.3	4.7	3.8	3.4	2.7	2.52	2.7	3.1	4.5
3.....	4.1	5.2	5.3	4.9	4.5	3.8	3.3	2.7	2.52	2.8	3.1	4.5
4.....	4.1	4.9	5.1	4.7	4.5	4.1	3.2	2.7	2.52	3.0	3.2	4.4
5.....	4.36	4.7	5.0	4.7	4.4	4.0	3.2	2.7	2.52	2.9	3.7	4.4
6.....	4.45	4.5	5.0	4.8	4.3	4.2	3.1	2.65	2.51	2.8	3.5	4.6
7.....	4.52	4.4	5.0	5.0	4.2	4.5	3.1	2.65	2.51	2.7	7.15	6.0
8.....	4.5	4.2	5.1	5.1	4.2	4.3	3.1	2.65	2.51	2.7	10.0	6.5
9.....	4.9	4.1	5.3	5.5	4.2	4.5	3.0	2.6	2.51	2.7	7.0	6.0
10.....	4.9	4.0	5.4	5.3	4.2	4.2	3.0	2.6	2.51	2.6	6.3	5.7
11.....	4.9	3.9	5.2	5.0	4.1	4.2	3.0	2.6	2.51	2.6	6.6	5.6
12.....	4.9	3.8	4.8	4.7	4.1	4.1	3.0	2.6	2.54	2.7	5.7	5.3
13.....	4.9	3.8	4.6	4.6	3.9	4.1	3.0	2.6	2.8	2.8	10.1	5.1
14.....	4.7	3.7	4.5	4.6	3.8	4.0	3.0	2.6	3.3	3.1	10.6	5.0
15.....	4.6	3.8	4.4	4.6	4.3	4.0	3.0	2.6	4.1	3.1	11.9	4.9
16.....	4.6	3.9	4.1	4.7	4.2	5.3	3.0	2.6	3.3	4.3	10.7	6.6
17.....	4.9	4.0	4.1	4.7	4.0	5.0	3.0	2.6	3.0	4.6	10.5	6.1
18.....	5.1	5.8	4.0	4.5	4.0	4.7	3.0	2.6	2.8	4.7	8.6	5.7
19.....	4.75	8.2	3.9	4.5	3.9	4.5	3.0	2.6	2.75	4.4	7.0	5.9
20.....	4.5	7.1	3.9	4.5	4.0	4.2	3.0	2.55	2.7	4.0	6.5	11.0

Daily gage height, in feet, of Clackamas River, near Barton, Oreg., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.....	4.3	8.0	3.9	4.9	4.2	3.9	3.0	2.55	2.65	3.7	6.5	11.0
22.....	4.2	7.0	3.8	4.8	4.3	3.9	3.0	2.55	2.65	3.5	6.2	9.0
23.....	4.7	6.4	3.8	4.8	4.3	3.7	3.0	2.55	2.65	3.4	6.0	7.0
24.....	7.2	6.1	3.9	4.7	4.2	3.6	2.9	2.55	2.65	3.3	5.8	6.5
25.....	6.7	6.4	3.9	4.9	4.2	3.5	2.8	2.55	2.65	3.2	5.3	7.0
26.....	6.0	6.1	4.2	5.3	4.3	3.5	2.8	2.55	2.64	3.3	5.1	7.5
27.....	5.6	6.8	4.2	4.9	4.3	3.4	2.7	2.55	2.63	3.4	4.9	7.5
28.....	5.3	6.1	4.2	5.1	4.2	3.5	2.7	2.55	2.62	3.5	4.8	6.8
29.....	5.2	.....	4.2	5.1	4.0	3.5	2.7	2.54	2.61	3.4	4.7	6.2
30.....	5.3	.....	4.4	5.0	4.0	3.6	2.7	2.53	2.6	3.2	4.6	6.1
31.....	5.6	.....	5.7	.....	3.9	.....	2.7	2.53	.....	3.2	.....	5.9

Rating table for Clackamas River near Barton, Oreg., for 1905-6.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
2.50	810	3.50	1,860	4.50	3,480	5.50	5,560	7.00	9,460
2.60	890	3.60	2,000	4.60	3,670	5.60	5,790	7.20	10,040
2.70	970	3.70	2,140	4.70	3,860	5.70	6,030	7.40	10,620
2.80	1,060	3.80	2,290	4.80	4,050	5.80	6,270	7.60	11,220
2.90	1,160	3.90	2,450	4.90	4,250	5.90	6,510	7.80	11,820
3.00	1,260	4.00	2,610	5.00	4,460	6.00	6,760	8.00	12,430
3.10	1,370	4.10	2,780	5.10	4,670	6.20	7,270	9.00	15,530
3.20	1,480	4.20	2,950	5.20	4,890	6.40	7,790	10.00	18,730
3.30	1,600	4.30	3,120	5.30	5,110	6.60	8,330	11.00	22,030
3.40	1,730	4.40	3,300	5.40	5,330	6.80	8,890	12.00	25,430

NOTE.—The above table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1905-6 and is well defined below gage height 5.5 feet.

Monthly discharge of Clackamas River near Barton, Oreg., for 1905-6.

[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.
1905. <sup>a</sup>						
November 11-30.....	3,860	1,160	2,060	81,700	2.58	1.92
December.....	5,490	2,290	3,800	234,000	4.75	5.48
The period.....				316,000		
1906. <sup>b</sup>						
January.....	10,000	2,780	4,400	271,000	5.50	6.34
February.....	13,000	2,140	5,430	302,000	6.79	7.07
March.....	6,030	2,290	3,700	228,000	4.62	5.33
April.....	6,510	3,480	4,280	255,000	5.35	5.97
May.....	4,250	2,290	2,960	182,000	3.70	4.27
June.....	5,110	1,730	2,730	162,000	3.41	3.80
July.....	1,730	970	1,260	77,500	1.58	1.82
August.....	970	834	890	54,700	1.11	1.28
September.....	2,780	818	1,010	60,100	1.26	1.41
October.....	3,860	890	1,650	101,000	2.06	2.38
November.....	25,100	1,370	8,720	519,000	10.90	12.16
December.....	22,000	3,300	7,690	473,000	9.61	11.08
The year.....	25,100	818	3,730	2,690,000	4.66	62.91

<sup>a</sup> Values for 1905 are rated as excellent.

<sup>b</sup> Values for 1906 are rated as follows: January to October, excellent; November and December, good.

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Willamette River drainage basin in 1906:

*Boulder Creek near Detroit, Oreg.*—The flow of this stream was estimated September 5, 1906, at 5 second-feet.

*Breitenbush Creek near Detroit, Oreg.*—A measurement was made at low water, September 4, 1906, just above the mouth of the creek.

Width, 59 feet; area, 100 square feet; discharge, 184 second-feet.

*Calapooia Creek.*—A measurement was made 300 yards below Kendall's bridge in sec. 19, T. 12 S., R. 3 W., at low water, August 23, 1906.

Width, 50 feet; area, 38 square feet; discharge, 64 second-feet.

*Crabtree Creek near Thomas, Oreg.*—A measurement was made 100 yards below the bridge in sec. 27, T. 10 S., R. 2 W., at low water August 24, 1906.

Width, 51 feet; area, 59 square feet; discharge, 55 second-feet.

*Long Tom Creek near Junction City, Oreg.*—A measurement was made 75 feet above the highway bridge, in sec. 10, T. 16 S., R. 5 W., at low water August 18, 1906.

Width, 42 feet; area, 29 square feet; discharge, 22 second-feet.

*Marys Creek near Philamath, Oreg.*—A measurement was made at the bridge in sec. 11, T. 12 S., R. 6 W., at low water August 25, 1906.

Width, 50 feet; area, 31 square feet; discharge, 18 second-feet.

*Minto Creek.*—The two channels of this stream were measured in sec. 10, T. 11 S., R. 7 E., at low water September 6, 1906.

The surface of the right channel was 3.22 feet below a spike in a large cedar just upstream from the trail crossing.

Width, 10 feet; area, 3.7 square feet; discharge, 3.7 second-feet.

The water surface of the left channel was 3.35 feet below a nail in a 10-inch cedar on the right bank just above the trail crossing.

Width, 7 feet; area, 3.3 square feet; discharge, 6.7 second-feet.

*Mohawk River near Mohawk, Oreg.*—A measurement was made by wading, August 16, 1906, 50 feet above the highway bridge in sec. 9, T. 17 S., R. 2 W.

Width, 62 feet; area, 64 square feet; discharge, 37 second-feet.

*Permelia Creek.*—A measurement was made in sec. 33, T. 10 S., R. 7 E., at low water, September 6, 1906. The water surface was 5.20 feet below a nail in a 6-inch alder 30 feet upstream from the Minto trail crossing.

Width, 39 feet; area, 32 square feet; discharge, 80 second-feet.

*Roaring Creek.*—This stream is very rocky and rough and has an enormous fall. A measurement was made in T. 11 S., R. 7 E., at low water, September 7, 1906. The water surface was 3.84 feet below a spike in an 18-inch alder on the right bank near the Minto trail crossing.

Width, 19 feet; area, 26 square feet; discharge, 65 second-feet.

*Santiam River at Jefferson, Oreg.*—This station is described in Water-Supply Paper 178, page 224. Gage readings were discontinued during 1906, as the flow was obstructed by logs. The following measurements were made during 1906:

January 3, width, 314 feet; area, 3,060 square feet; gage height, 4.76 feet; discharge, 5,790 second-feet.

March 30, width, 311 feet; area, 2,950 square feet; gage height, 5.50 feet; discharge, 6,170 second-feet.

*Marion Fork of Santiam River.*—A measurement was made in sec. 15, T. 11 S., R. 7 E., at low water, September 6, 1906. The water surface was 4.76 feet below a spike in a yew tree on the right bank, 30 feet upstream from the foot log.

Width, 52 feet; area, 91 square feet; discharge, 157 second-feet.

A measurement was made September 7, 1906, 200 feet below the outlet of Lake Marion. The water surface was 4.45 feet below a spike in a small alder, on the right bank 30 feet downstream from water-right notice.

Width, 31 feet; area, 51 square feet; discharge, 77 second-feet.

*Middle Fork of Santiam River.*—The following measurement was made near Foster, Oreg., at low water, September 3, 1906.

Width, 96 feet; area, 183 square feet; discharge, 66 second-feet.

The following measurement was made at Withcombe Place, Oreg., at low water, September 4, 1906.

Width, 60 feet; area, 144 square feet; discharge, 82 second-feet.

*North Fork of North Fork of Santiam River near Mehama, Oreg.*—A measurement was made in sec. 18, T. 9 S., R. 2 E., at old fort one-half mile above Mehama, at low water, August 21, 1906.

Width, 59 feet; area, 40 square feet; discharge, 54 second-feet.

*North Fork of Santiam River in sec. 12, T. 10 S., R. 5 E.*—A measurement was made at low water, August 22, 1906, opposite the mill above Detroit, Oreg.

Width, 58 feet; area, 387 square feet; discharge, 469 second-feet.

A measurement was made September 4, 1906, below the mouth of Breitenbush Creek. The water surface was 3.68 feet below a spike in the upstream face of the foot log near the right bank.

Width, 110 feet; area, 282 square feet; discharge, 564 second-feet.

A measurement was made September 5, 1906, above the mouth of Breitenbush Creek. The water surface was 5.95 feet below a shelf cut into rock on the right bank for a brace to the footbridge.

Width, 60 feet; area, 456 square feet; discharge, 433 second-feet.

*North Fork of Santiam River T. 11 S., R. 7 E.*—A measurement was made above the mouth of Marion Fork, September 6, 1906, at low water.

East channel, width, 30 feet; area, 45 square feet; discharge, 43 second-feet. West channel, width, 36 feet; area, 44 square feet; discharge, 53 second-feet.

*South Fork of Santiam River.*—A measurement was made 150 yards below Sanderson bridge in sec. 4, T. 11 S., R. 2 W., on August 24, 1906.

Width, 76 feet; area, 50 square feet; discharge, 51 second-feet.

A measurement was made at Foster, September 3, 1906.

Width, 87 feet; area, 163 square feet; discharge, 131 second-feet.

A measurement was made at Withcombe Place, September 3, 1906.

Width, 60 feet; area, 144 square feet; discharge, 82 second-feet.

*Thomas Fork of Santiam River at Scio, Oreg.*—A measurement was made above the bridge in sec. 18, T. 10 S., R. 1 W., August 24, 1906.

Width, 34 feet; area, 28 square feet; discharge, 28 second-feet.

*Whitewater Creek in SW.  $\frac{1}{4}$  sec. 21, T. 10 S., R. 7 E.*—A measurement was made one-fourth mile above the mouth September 6, 1906. The water surface was 4.49 feet below the reference point on a cedar tree 100 feet upstream from a log cabin near the Minto trail.

Width, 32 feet; area, 28 square feet; discharge, 65 second-feet.

## PUGET SOUND DRAINAGE BASIN.

### DESCRIPTION OF BASIN.

The streams flowing into Puget Sound drain the western slope of the Cascade Mountains in Washington. Their areas are heavily timbered and mountainous. The precipitation is high, varying from 40 to 100 inches per annum. The streams draining this area are principally valuable for power and logging purposes. Little or no irrigation is practiced.

## SNOHOMISH RIVER DRAINAGE BASIN.

### SNOQUALMIE RIVER NEAR SNOQUALMIE FALLS, WASH.

Snoqualmie and Skykomish rivers unite to form Snohomish River, which flows into Puget Sound about 10 miles beyond the junction, near Everett, Wash. The following gage heights were furnished by the Seattle-Tacoma Power Company, of Seattle, Wash. The gage is referred to mean sea datum and is not the one referred to in Water-Supply and Irrigation Paper No. 178, page 233.

*Daily gage height, in feet, of Snoqualmie River near Snoqualmie Falls, Wash., for 1906.*

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1.....	561.8	561.2	12.....	565.9	561.9	23.....	561.9	563.6
2.....	561.3	561.6	13.....	566.6	561.9	24.....	561.7	562.9
3.....	561.1	561.3	14.....	570.0	561.3	25.....	561.5	562.8
4.....	561.6	561.5	15.....	570.2	561.5	26.....	561.5	562.0
5.....	561.7	562.0	16.....	570.0	562.0	27.....	561.6	561.8
6.....	561.9	562.4	17.....	564.2	562.8	28.....	561.6	561.7
7.....	562.8	563.0	18.....	563.4	562.5	29.....	561.6	561.7
8.....	562.6	562.4	19.....	562.9	563.0	30.....	561.6	561.7
9.....	563.0	562.4	20.....	562.4	564.6	31.....		561.7
10.....	564.5	561.9	21.....	562.3	564.5			
11.....	563.0	561.9	22.....	562.2	563.9			

### WHITE RIVER DRAINAGE BASIN.

White River rises near Mount Rainier and flows into Puget Sound near Seattle. Cedar River is a branch of White River.

#### CEDAR RIVER NEAR RAVENSDALE, WASH.

This station was established September 27, 1902. It is located at the intake of the Seattle waterworks pipe line and is 15 miles below Cedar Lake, 4 miles from the Northern Pacific Railway at Ravensdale, and 6 miles from the Columbia and Puget Sound Railway at Maple Valley. The discharge of the pipe line is practically constant at 34 second-feet. The conditions at this station and the bench marks are described in Water-Supply Paper No. 178, page 230, where are given also references to publications that contain data for previous years.

The following measurement was made October 21, 1906:

Width, 128 feet; area, 1,060 square feet; gage height, 1.40 feet; discharge, 864 second-feet.

*Daily gage height, in feet, of Cedar River near Ravensdale, Wash., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	1.30	2.18	1.56	1.39	1.30	1.13	1.09	0.62	0.55	0.58	1.38	1.17
2.....	1.26	2.14	1.47	1.41	1.31	1.15	1.07	.63	.57	.60	1.32	1.88
3.....	1.21	2.07	1.39	1.36	1.27	1.07	1.04	.62	.57	.62	1.20	1.08
4.....	1.31	1.96	1.31	1.29	1.26	1.18	1.01	.63	.56	.66	1.18	1.07
5.....	1.48	1.92	1.28	1.26	1.21	1.12	.97	.35	.57	.62	1.12	1.09
6.....	1.83	1.77	1.26	1.27	1.16	1.14	.93	.65	.57	1.20	1.08	1.25
7.....	1.76	1.64	1.27	1.33	1.13	1.15	.90	.63	.50	1.14	1.21	1.64
8.....	1.76	1.56	1.30	1.37	1.10	1.12	.89	.62	.60	1.00	1.40	1.70
9.....	1.71	1.47	1.35	1.48	1.10	1.11	.87	.61	.59	1.06	1.50	1.64
10.....	1.64	1.42	1.41	1.42	1.13	1.10	.86	.61	.58	1.14	1.71	1.57
11.....	1.51	1.36	1.40	1.36	1.10	1.12	.82	.60	.58	1.25	2.00	1.44
12.....	1.47	1.31	1.37	1.33	1.08	1.13	.82	.60	.61	1.32	2.20	1.36
13.....	1.45	1.29	1.30	1.26	1.09	1.12	.82	.60	.64	1.35	3.64	1.27
14.....	1.37	1.26	1.25	1.22	1.08	1.11	.77	.61	.72	1.42	6.77	1.26
15.....	1.31	1.20	1.20	1.19	1.04	1.13	.75	.60	.64	1.43	8.65	1.27
16.....	1.28	1.18	1.19	1.18	1.13	1.21	.74	.59	.60	1.55	6.35	1.64
17.....	1.29	1.20	1.16	1.21	1.11	1.16	.72	.60	.58	1.60	4.10	1.65
18.....	1.25	1.31	1.14	1.21	1.06	1.12	.72	.53	.59	1.54	3.11	1.62
19.....	1.21	1.92	1.10	1.20	1.07	1.15	.69	.60	.57	1.41	2.55	1.72
20.....	1.17	1.99	1.07	1.19	1.05	1.09	.68	.60	.57	1.40	2.22	2.73

*Daily gage height, in feet, of Cedar River near Ravensdale, Wash., for 1906—Continued.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21.....	1.15	2.06	1.05	1.27	1.04	1.12	.67	.59	.56	1.29	2.10	3.02
22.....	1.23	1.95	1.05	1.37	1.04	1.14	.66	.58	.55	1.20	1.91	2.85
23.....	1.68	1.85	1.04	1.44	1.08	1.12	.65	.57	.57	1.15	1.71	2.52
24.....	2.25	1.84	1.02	1.38	1.07	1.06	.65	.59	.60	1.06	1.58	2.20
25.....	2.67	1.76	1.01	1.35	1.02	1.05	.63	.58	.59	1.25	1.52	2.02
26.....	2.47	1.78	1.01	1.31	1.06	1.04	.63	.58	.58	2.11	1.47	1.83
27.....	2.25	1.71	1.07	1.28	1.04	1.01	.66	.56	.58	2.24	1.39	1.77
28.....	2.10	1.67	1.04	1.26	1.06	1.01	.65	.58	.57	1.94	1.24	1.64
29.....	2.01	.....	1.03	1.25	1.03	1.13	.63	.57	.57	1.73	1.18	1.60
30.....	2.00	.....	1.04	1.27	1.02	1.11	.64	.57	.57	1.59	1.77	1.50
31.....	2.10	.....	1.29	.....	1.14	.....	.63	.57	.....	1.47	.....	1.45

NOTE.—These gage heights were read with a hook gage and give the height above the crest of the diversion dam of the Seattle water-system pipe line

*Rating table for Cedar River near Ravensdale, Wash., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.50	180	1.60	910	2.70	1,940	3.70	3,100	5.40	5,450
0.60	230	1.70	990	2.80	2,050	3.80	3,220	5.60	5,750
0.70	285	1.80	1,075	2.90	2,160	3.90	3,350	5.80	6,050
0.80	340	1.90	1,160	3.00	2,270	4.00	3,480	6.00	6,370
0.90	400	2.00	1,250	3.10	2,380	4.20	3,740	6.20	6,690
1.00	465	2.10	1,340	3.20	2,500	4.40	4,000	6.40	7,010
1.10	530	2.20	1,430	3.30	2,620	4.60	4,280	6.60	7,330
1.20	600	2.30	1,530	3.40	2,740	4.80	4,560	6.80	7,660
1.30	675	2.40	1,630	3.50	2,860	5.00	4,850	7.00	8,000
1.40	750	2.50	1,730	3.60	2,980	5.20	5,150	8.00	9,700
1.50	830	2.60	1,830	.....	.....	.....	.....	.....	.....

NOTE.—The above table is computed for discharges over a steel-shod triangular weir 120 feet long, which approximates in shape type O in Hazen and Whipple's discussion of irregular weirs. It includes the discharge of the Seattle water-supply pipe line.

*Monthly discharge of Cedar River near Ravensdale, Wash., for 1905-6.*

[Drainage area, 170 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.						
January.....	1,010	376	623	38,300	3.66	4.22
February.....	1,010	280	535	29,700	3.15	3.28
March.....	1,070	420	742	45,600	4.36	5.03
April.....	870	485	618	36,800	3.64	4.06
May.....	1,980	406	807	49,600	4.75	5.48
June.....	1,190	394	656	39,000	3.86	4.31
July.....	472	274	336	20,700	1.98	2.28
August.....	268	180	236	14,500	1.39	1.60
September.....	246	195	215	12,800	1.26	1.41
October.....	1,230	180	710	43,700	4.18	4.82
November.....	950	290	478	28,400	2.81	3.14
December.....	1,070	524	728	44,800	4.28	4.93
The year.....	1,980	180	557	404,000	3.28	44.56
1906.						
January.....	1,910	565	950	58,400	5.59	6.44
February.....	1,410	586	976	54,200	5.74	5.98
March.....	878	472	610	37,500	3.59	4.14
April.....	814	586	678	40,300	3.99	4.45
May.....	682	478	538	33,100	3.16	3.64
June.....	608	472	540	32,100	3.18	3.55
July.....	524	246	334	20,500	1.96	2.26
August.....	258	210	231	14,200	1.36	1.57
September.....	296	205	224	13,300	1.32	1.47
October.....	1,470	220	688	42,300	4.05	4.67
November.....	10,800	517	1,870	111,000	11.00	12.27
December.....	2,290	510	1,010	62,100	5.95	6.86
The year.....	10,800	205	721	519,000	4.24	57.30

NOTE.—Values for 1905-6 are rated as good. Discharge includes 34 second-feet diverted by the Seattle water supply pipe line.

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in Puget Sound drainage basin during 1906:

*Baker River near Baker, Wash.*—A measurement was made November 5, 1906, at the highway bridge between Baker and Concrete. The water surface was 24.25 feet below the top of the first floor beam from the left downstream pier. The stage was about 3 feet above low water, and 15 feet below high water.

Width, 150 feet; area, 737 square feet; discharge, 3,180 second-feet.

*Creeks near Baker, Wash.*—The discharge of the first creek below the head-gate of the Washington Portland Cement Company's power flume was estimated November 5, 1906, as 8 second-feet. This stream is a series of cascades. The discharge of the second from the head-gate was estimated as 6 second-feet.

*Carbon River.*—This stream rises in Mount Rainier and flows into Puyallup River. It is a glacial stream and is always white with suspended matter. A measurement was made near the mouth of Canada Creek, September 26, 1906, which was not low water for the season.

Width, 31 feet; area, 54 square feet; discharge, 145 second-feet.

A measurement was made September 27, 1906, at the railroad bridge at Fairfax, Wash. The water surface was 8.55 feet below the top of the retaining wall forming the right abutment downstream side.

Width, 54 feet; area, 103 square feet; discharge, 455 second-feet.

*Canada Creek.*—This stream is a tributary of Carbon River. A measurement was made near the mouth September 26, 1906. The water surface was 3.52 feet below a nail in a small cedar near the mouth.

Width, 7 feet; area, 3.2 square feet; discharge, 5.5 second-feet.

*Chenewis Creek.*—A measurement was made near the junction with Carbon River, September 27, 1906.

Width, 14 feet; area, 14 square feet; discharge, 15 second-feet.

## NORTHERN PACIFIC OCEAN DRAINAGE.

## DESCRIPTION OF BASIN.

The streams draining the western slope of the Coast Range in Oregon are comparatively short, but, owing to the heavy precipitation on their catchment basins, carry large quantities of water. The area throughout this region is mountainous and heavily timbered. A considerable portion of the timbered area has been burned over. The principal streams in this basin are the Siletz, Alseya, Suislaw, Smiths, Umpqua, Coquille, Illinois, and Rogue rivers.

## SILETZ RIVER BASIN.

## SILETZ RIVER AT SILETZ, OREG.

This station was established November 25, 1905. It is located at Siletz, Oreg., about 1 mile above the ferry on the Siletz and Toledo stage road, 6 miles below the mouth of Rock Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 177, page 252.

*Discharge measurements of Siletz River at Siletz, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1905.					
November 26....	L. R. Allen.....	157	394	2.15	1,170
1906.					
February 9.....	L. R. Allen.....	156	338	1.77	810
March 29.....	do.....	157	370	2.03	1,030
May 10.....	do.....	157	303	1.50	492
July 23.....	do.....	151	231	1.23	309
September 24....	I. E. Oakes.....	155	289	1.60	592

<sup>a</sup> Possible backwater effect from small dam 75 feet below.

*Daily gage height, in feet, of Siletz River at Siletz, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	4.5	2.5	3.6	2.3	1.9	1.9	2.1	1.15	0.85	1.4	2.0	2.0
2.....	3.8	2.4	3.0	2.2	1.85	1.85	2.0	1.1	.85	1.5	2.0	2.0
3.....	3.3	2.3	2.7	2.1	1.8	1.9	1.85	1.1	.85	1.8	2.2	2.0
4.....	3.0	2.2	2.9	2.0	1.75	2.3	1.8	1.1	.85	1.7	3.0	2.7
5.....	2.9	2.1	2.9	1.95	1.7	2.6	1.75	1.1	.85	1.6	3.4	2.9
6.....	2.8	2.0	2.9	1.9	1.65	2.7	1.65	1.1	.85	1.6	3.7	6.2
7.....	2.7	1.9	2.7	1.8	1.6	2.65	1.6	1.05	.85	1.5	10.74	4.2
8.....	2.9	1.8	2.6	1.75	1.6	2.6	1.55	1.05	.95	1.5	12.5	4.0
9.....	2.9	1.8	2.5	2.2	1.55	2.55	1.5	1.05	.95	1.45	7.1	3.7
10.....	2.8	1.7	2.4	2.0	1.55	2.6	1.5	1.05	.9	1.6	9.1	3.5
11.....	3.0	1.7	2.3	1.9	1.5	2.6	1.45	1.0	.9	2.0	6.3	3.5
12.....	3.6	1.6	2.1	1.85	1.5	2.7	1.4	1.0	.95	1.9	7.0	3.1
13.....	5.8	1.6	2.1	1.8	1.5	3.35	1.4	1.0	1.6	1.85	8.4	3.0
14.....	4.8	1.5	2.0	1.75	2.0	3.1	1.4	1.0	2.0	1.85	13.5	2.8
15.....	4.2	1.5	1.9	1.7	2.4	3.05	1.35	1.0	1.95	2.65	16.6	3.0
16.....	5.0	1.8	1.8	1.7	2.65	4.1	1.35	1.0	1.5	4.0	9.9	4.0
17.....	5.8	2.8	1.8	1.65	2.4	3.55	1.3	.95	1.35	3.9	9.7	3.7
18.....	5.6	6.6	1.8	1.6	2.3	3.1	1.3	.95	1.25	3.6	7.6	3.5
19.....	4.8	6.05	1.8	1.6	2.2	2.8	1.3	.95	1.15	3.1	5.5	4.1
20.....	4.0	7.6	1.9	1.55	2.2	2.6	1.3	.95	1.15	2.7	4.4	11.5
21.....	3.5	7.9	2.1	1.5	2.3	2.4	1.25	.95	1.1	2.6	4.1	12.9
22.....	3.8	6.9	2.1	1.5	2.2	2.25	1.25	.95	1.1	2.4	3.7	7.0
23.....	6.2	5.8	2.3	1.5	2.1	2.1	1.25	.9	1.4	2.25	3.5	5.1
24.....	8.1	6.4	2.4	2.35	2.0	2.0	1.25	.9	1.6	2.1	3.2	4.0
25.....	5.7	6.7	2.3	2.15	2.05	1.95	1.2	.9	1.6	2.5	2.9	3.8
26.....	4.4	6.4	2.2	2.2	2.3	1.9	1.2	.9	1.5	3.3	2.7	3.6
27.....	3.7	6.4	2.2	2.2	2.25	1.8	1.2	.9	1.5	3.0	2.5	3.45
28.....	3.2	4.7	2.1	2.2	2.2	1.8	1.2	.9	1.4	2.7	2.4	3.15
29.....	2.9	.....	2.0	2.1	2.1	2.2	1.2	.9	1.4	2.55	2.3	3.0
30.....	2.6	.....	2.1	2.0	2.05	2.4	1.15	.9	1.4	2.4	2.1	3.0
31.....	2.6	.....	2.3	.....	2.0	.....	1.15	.85	.....	2.2	.....	2.9

Rating table for Siletz River at Siletz, Oreg., for 1906.

Gage height.	Dis-charge	Gage height.	Dis-charge	Gage height.	Dis-charge	Gage height.	Dis-charge	Gage height.	Dis-charge
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
0.85	130	1.40	425	2.00	990	2.60	1,790	3.40	3,070
0.90	150	1.50	500	2.10	1,110	2.70	1,940	3.60	3,410
1.00	195	1.60	580	2.20	1,230	2.80	2,090	3.80	3,770
1.10	245	1.70	670	2.30	1,360	2.90	2,250	4.00	4,130
1.20	300	1.80	770	2.40	1,500	3.00	2,410		
1.30	360	1.90	880	2.50	1,640	3.20	2,730		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1905-6 and is well defined between gage heights 1.2 feet and 2.2 feet.

Monthly discharge of Siletz River at Siletz, Oreg., for 1906.

[Drainage area, 220 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.....	3,410	770	1,430	87,900	6.50	7.49
April.....	1,430	500	899	53,500	4.09	4.56
May.....	1,860	500	990	60,900	4.50	5.19
June.....	4,310	770	1,700	101,000	7.73	8.62
July.....	1,110	272	467	28,700	2.12	2.44
August.....	272	130	191	11,700	.868	1.00
September.....	990	130	345	20,500	1.57	1.75
October.....	4,130	425	1,480	91,000	6.73	7.76
November 1-7.....	3,590	990	1,750	24,300	7.95	2.07
The period.....				480,000		

NOTE.—The above estimates are provisional and subject to revision when more data are available. Values are rated as follows: April, May, and July, excellent; March, June, and August to November, good.

## UMPQUA RIVER DRAINAGE BASIN.

## UMPQUA RIVER AT ELKTON, OREG.

This station was established October 18, 1905, by J. G. Kelley, of Portland, Oreg., by whom it is maintained and the results furnished to the Geological Survey. It is located at Smiths Ferry, 4 miles above Elkton.

The gage is 100 feet above the ferry, on the left bank. It is an inclined staff fastened to bed rock. The gage datum is low water.

The following measurement was made August 11, 1906:

Width, 365 feet; area, 1,560 square feet; gage height, 0.07 foot; discharge, 1,340 second-feet.

Daily gage height, in feet, of Umpqua River near Elkton, Oreg., for 1905-6.

1905.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1.....		0.08	2.88	12.....		0.00	1.67	23.....	.08	.62	2.54
2.....		.00	2.38	13.....		.00	1.38	24.....	.08	.42	2.12
3.....		.00	2.00	14.....		.00	1.21	25.....	.17	.29	1.42
4.....		.00	2.33	15.....		.00	1.12	26.....	.17	.25	1.75
5.....		.00	2.42	16.....		.00	1.05	27.....	.67	.25	6.00
6.....		.00	2.67	17.....		.00	.08	28.....	.71	1.42	5.71
7.....		.00	3.12	18.....	0.08	.00	1.21	29.....	.58	1.29	4.46
8.....		.00	3.08	19.....	.75	.00	1.42	30.....	.58	1.88	4.08
9.....		.00	2.88	20.....	.50	.50	2.33	31.....	.38		8.29
10.....		.00	2.38	21.....	.42	1.62	4.29				
11.....		.00	1.96	22.....	0.25	1.21	3.29				

Daily gage height, in feet, of Umpqua River near Elkton, Oreg., for 1905-6—Continued.

1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	6.08	5.50	7.50	7.33	3.58	6.29	1.75	0.25	0.00	0.00	0.00	1.38
2.....	6.08	5.00	6.17	6.58	3.29	5.46	1.75	.25	.00	.00	.00	1.29
3.....	3.38	4.42	6.05	5.71	3.12	4.88	1.67	.17	.00	.00	.00	1.12
4.....	3.46	4.50	5.75	5.29	3.00	4.88	1.50	.17	.00	.00	.00	1.00
5.....	3.46	4.12	5.75	5.29	3.00	4.83	1.38	.17	.00	.00	.25	1.00
6.....	3.38	3.79	5.05	4.62	3.05	4.58	1.33	.17	.00	.00	.12	1.05
7.....	3.50	3.54	5.25	4.33	2.96	4.79	1.17	.17	.00	.00	1.50	1.42
8.....	3.50	3.29	5.25	4.17	2.75	4.88	1.00	.17	.00	.00	3.75	3.08
9.....	4.29	3.17	5.21	4.05	2.75	4.83	1.00	.17	.00	.00	3.75	5.21
10.....	6.88	3.05	5.12	4.17	2.58	4.83	.88	.17	.00	.00	3.12	5.58
11.....	5.62	2.96	5.00	3.88	2.75	5.38	.75	.17	.00	.00	2.25	5.75
12.....	5.29	2.79	5.00	3.54	2.71	4.75	.75	.17	.00	.08	2.21	5.21
13.....	9.88	2.62	5.00	3.21	2.58	4.50	.75	.17	.00	.12	1.96	4.62
14.....	8.88	2.50	5.00	3.12	2.16	4.08	.75	.08	.29	.08	2.33	3.88
15.....	8.17	2.62	4.17	3.00	2.54	4.25	.75	.08	1.17	.12	2.92	3.54
16.....	13.79	3.08	3.12	3.00	4.12	4.42	.62	.08	1.00	.21	6.33	5.62
17.....	18.33	3.25	3.00	3.00	3.56	4.50	.54	.08	.75	.29	5.50	6.33
18.....	10.42	3.67	3.00	2.16	3.58	3.96	.50	.00	.54	1.21	7.17	4.75
19.....	8.46	6.88	3.00	2.67	3.38	3.62	.50	.00	.46	1.12	5.83	4.67
20.....	6.79	9.05	3.00	2.67	3.08	3.29	.50	.00	.42	1.00	4.50	6.05
21.....	5.88	15.38	3.50	2.75	2.96	3.00	.46	.00	.33	.67	4.00	6.67
22.....	5.21	13.08	4.17	2.88	3.46	2.92	.42	.00	.25	.38	4.58	5.42
23.....	5.05	11.62	4.50	3.08	4.46	2.67	.42	.00	.12	.29	4.58	4.79
24.....	8.62	11.33	4.29	3.08	4.21	2.42	.33	.00	.08	.00	3.50	4.42
25.....	8.29	11.38	4.17	3.08	3.46	2.25	.25	.00	.17	.00	3.05	5.21
26.....	7.58	9.75	4.29	3.17	3.75	2.17	.25	.00	.17	.00	2.67	8.21
27.....	6.62	10.88	4.46	3.33	3.88	2.00	.25	.00	.05	.00	2.29	8.21
28.....	5.83	8.62	4.12	3.75	4.58	2.00	.25	.00	.00	.00	2.00	6.75
29.....	5.38	.....	3.66	4.00	13.21	2.00	.25	.00	.00	.00	1.88	5.33
30.....	4.54	.....	3.75	3.88	10.25	1.96	.25	.00	.00	.00	9.67	4.79
31.....	5.42	.....	3.75	.....	8.50	.....	.25	.00	.....	.00	.....	5.62

#### NORTH FORK OF UMPQUA RIVER NEAR OAKCREEK, OREG.

This station was established September 6, 1905. It is located 3 miles west of Oakcreek, Oreg.,  $1\frac{1}{4}$  miles above J. R. Dixon's farmhouse, about 10 miles below the mouth of East Fork of North Fork of Umpqua River. The conditions at the station and the bench marks are described in Water-Supply Paper No. 177, page 251.

Discharge measurements of North Fork of Umpqua River near Oakcreek, Oreg., in 1905-6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
1905.		Feet.	Sq. ft.	Feet.	Sec.-ft.
September 6....	L. R. Allen.....	215	457	1.35	886
October 19.....	.....do.....	222	580	2.10	1,420
December 27....	.....do.....	279	1,450	5.35	7,110
1906.					
January 31....	L. R. Allen.....	280	1,480	5.56	7,370
March 20.....	.....do.....	249	847	3.23	2,780
May 1.....	.....do.....	268	1,090	4.06	4,340
May 30.....	.....do.....	284	1,800	6.74	10,200
July 14.....	.....do.....	213	611	2.23	1,600
August 10.....	.....do.....	190	508	1.73	1,120
September 13..	.....do.....	208	604	2.30	1,610

Daily gage height, in feet, of North Fork of Umpqua River near Oakcreek, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....	3.6	5.2	5.3	5.5	4.05	5.0	2.9	1.8	1.5	1.5	1.5	2.4
2.....	3.2	5.0	4.75	5.5	3.9	4.7	2.8	1.8	1.5	1.5	1.55	2.35
3.....	3.1	4.7	4.6	5.1	3.9	4.5	2.8	1.8	1.5	1.55	1.6	2.3
4.....	3.4	4.3	4.4	4.6	3.95	4.45	2.6	1.8	1.5	1.6	1.8	2.3
5.....	3.7	4.15	4.3	4.4	3.8	4.3	2.6	1.8	1.5	1.55	2.8	2.45
6.....	3.7	4.1	4.2	4.2	3.7	4.5	2.6	1.8	1.5	1.5	2.25	2.5
7.....	3.7	4.1	4.9	4.0	3.65	4.95	2.5	1.75	1.5	1.5	6.25	4.5
8.....	3.8	4.1	5.0	3.8	3.6	5.2	2.45	1.75	1.6	1.45	4.35	4.55
9.....	7.3	3.7	5.0	4.4	3.65	5.5	2.4	1.7	1.7	1.45	3.75	4.7
10.....	5.2	3.6	4.75	4.4	3.75	5.05	2.35	1.7	1.6	1.45	3.3	4.4
11.....	5.4	3.5	4.3	3.85	3.7	5.5	2.35	1.7	1.5	1.5	3.3	4.2
12.....	5.55	3.4	4.15	3.65	3.55	4.5	2.3	1.7	1.65	1.8	2.8	4.2
13.....	6.2	3.3	3.7	3.55	3.5	4.5	2.25	1.7	2.4	1.7	3.8	3.7
14.....	6.1	3.3	3.5	3.55	3.5	4.3	2.2	1.65	2.3	1.75	4.1	3.55
15.....	5.4	3.7	3.25	3.65	4.1	4.4	2.2	1.65	2.5	1.65	7.75	4.35
16.....	12.5	3.6	3.25	3.7	4.0	4.3	2.25	1.65	1.95	2.1	5.75	6.15
17.....	7.0	3.85	3.0	3.6	3.8	4.5	2.15	1.65	1.75	3.0	7.1	5.0
18.....	6.7	4.6	3.15	3.5	3.6	4.1	2.1	1.6	1.65	2.9	6.1	4.4
19.....	6.3	6.75	3.1	3.5	3.55	3.95	2.1	1.6	1.5	2.9	4.6	4.4
20.....	4.3	7.3	4.8	3.75	3.95	3.8	2.05	1.6	1.55	2.9	4.1	6.15
21.....	4.0	7.5	4.4	3.9	4.5	3.6	1.9	1.6	1.55	1.85	4.9	6.9
22.....	8.95	6.95	4.15	3.95	4.9	3.3	2.0	1.6	1.55	1.85	4.4	5.7
23.....	5.6	6.55	3.8	3.95	4.6	3.0	1.95	1.6	1.6	1.85	3.95	4.95
24.....	7.4	6.95	4.3	3.7	4.8	3.3	1.95	1.55	1.8	1.7	3.6	5.2
25.....	6.7	6.4	4.2	3.85	4.0	3.2	1.95	1.55	1.6	1.65	3.3	6.85
26.....	6.06	6.4	4.2	4.05	4.0	3.1	1.9	1.55	1.6	1.6	3.0	7.4
27.....	5.4	7.25	4.1	4.2	5.8	3.1	1.9	1.5	1.55	1.75	2.8	5.9
28.....	5.1	7.0	3.9	4.45	7.5	3.05	1.9	1.5	1.55	1.65	2.7	5.0
29.....	4.7	.....	3.7	4.3	7.9	3.0	1.9	1.5	1.5	1.6	2.6	4.9
30.....	5.2	.....	3.9	4.2	6.75	2.9	1.9	1.5	1.5	1.65	2.5	4.8
31.....	5.2	.....	5.9	.....	5.6	.....	1.85	1.5	.....	1.6	.....	4.8

Rating table for North Fork of Umpqua River near Oakcreek, Oreg., for 1905-6.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
1.30	860	2.50	1,860	3.70	3,580	4.90	5,930	7.20	11,340
1.40	920	2.60	1,980	3.80	3,760	5.00	6,150	7.40	11,860
1.50	985	2.70	2,100	3.90	3,940	5.20	6,590	7.60	12,390
1.60	1,055	2.80	2,230	4.00	4,130	5.40	7,040	7.80	12,930
1.70	1,130	2.90	2,360	4.10	4,320	5.60	7,500	8.00	13,470
1.80	1,205	3.00	2,500	4.20	4,510	5.80	7,960	9.00	16,300
1.90	1,285	3.10	2,640	4.30	4,700	6.00	8,420	10.00	19,300
2.00	1,370	3.20	2,780	4.40	4,900	6.20	8,900	11.00	22,300
2.10	1,460	3.30	2,930	4.50	5,100	6.40	9,380	12.00	25,300
2.20	1,550	3.40	3,080	4.60	5,300	6.60	9,860		
2.30	1,650	3.50	3,240	4.70	5,510	6.80	10,340		
2.40	1,750	3.60	3,410	4.80	5,720	7.00	10,830		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1905-6 and is well defined between gage heights 1.3 feet and 7.0 feet.

*Monthly discharge of North Fork of Umpqua River near Oakcreek, Oreg., for 1905-6.*

[Drainage area, 1,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1905.						
September 6-30.....	1,090	860	902	44,700	0.902	0.839
October.....	2,300	920	1,270	78,100	1.27	1.46
November.....	2,230	890	1,190	70,800	1.19	1.33
December.....	9,020	1,650	3,020	186,000	3.02	3.48
The period.....				380,000		
1906.						
January.....	26,800	2,640	7,600	467,000	7.60	8.76
February.....	12,100	2,930	6,490	360,000	6.49	6.76
March.....	8,190	2,500	4,570	281,000	4.57	5.27
April.....	7,270	3,240	4,340	258,000	4.34	4.84
May.....	13,200	3,240	5,000	307,000	5.00	5.76
June.....	7,270	2,360	4,470	266,000	4.47	4.99
July.....	2,360	1,240	1,600	98,400	1.60	1.84
August.....	1,200	985	1,090	67,000	1.09	1.26
September.....	1,860	985	1,120	66,600	1.12	1.25
October.....	2,500	952	1,260	77,500	1.26	1.45
November.....	12,800	985	4,120	245,000	4.12	4.60
December.....	11,900	1,650	5,500	338,000	5.50	6.34
The year.....	26,800	952	3,930	2,830,000	3.93	53.12

NOTE.—Values for 1905 and 1906 are excellent.

#### SOUTH FORK OF UMPQUA RIVER NEAR BROCKWAY, OREG.

This station was established December 6, 1905, by L. R. Allen. It is located just below Winston's highway bridge, 3 miles east of Brockway, Oreg., and 3 miles below the mouth of Lookingglass Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 177, page 250.

*Discharge measurements of South Fork of Umpqua River near Brockway, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
December 28 ...	L. R. Allen.....	302	1,620	4.16	3,000
1906.					
February 1.....	L. R. Allen.....	303	1,650	4.32	3,490
March 21.....	do.....	299	1,440	3.60	2,390
May 2.....	do.....	295	1,200	2.82	1,500
May 29.....	do.....	320	3,130	8.77	14,800
May 29.....	do.....	318	2,920	8.40	13,800
July 13.....	do.....	283	688	.95	442
August 9.....	do.....	276	481	.22	205
September 14...	I. E. Oakes.....	284	642	.78	414

Daily gage height, in feet, of South Fork of Umpqua River near Brockway, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	4.4	4.35	6.25	5.9	3.0	5.1	1.65	0.4	0.05	0.25	0.3	1.25
2.	3.6	4.1	5.55	3.35	2.8	4.4	1.55	.35	.05	.25	.3	1.15
3.	3.25	4.0	5.05	4.9	2.75	4.1	1.55	.35	.05	.25	.35	1.35
4.	3.0	3.75	5.0	4.7	2.65	4.1	1.4	.35	.05	.25	.4	1.2
5.	3.15	3.5	4.75	4.45	2.6	3.9	1.3	.35	.05	.25	2.0	1.2
6.	3.2	3.35	4.7	4.2	2.5	3.25	1.3	.35	.05	.25	2.1	1.25
7.	3.15	3.2	4.6	4.0	2.45	3.25	1.2	.3	.05	.2	2.8	1.6
8.	3.1	3.05	4.6	3.75	2.3	3.4	1.2	.25	.05	.2	3.1	4.0
9.	4.7	2.95	4.5	3.7	2.25	3.95	1.1	.25	.05	.15	2.8	4.1
10.	5.25	2.85	4.35	3.7	2.25	4.1	1.05	.25	.1	.15	2.6	4.4
11.	4.5	2.75	4.2	3.45	2.25	4.1	1.05	.2	.15	.15	1.9	5.8
12.	6.45	2.6	4.0	3.25	2.2	4.0	1.0	.2	.25	.2	1.65	5.0
13.	8.2	2.55	3.75	3.1	2.1	3.8	.95	.2	.45	.3	1.45	4.1
14.	6.75	2.5	3.55	2.9	2.1	3.55	.95	.2	.6	.35	1.35	3.5
15.	6.6	3.0	3.35	2.9	2.7	3.3	.85	.15	.8	.35	1.1	3.5
16.	18.1	3.0	3.2	2.9	3.6	3.3	.8	.15	.9	.35	4.35	5.25
17.	9.9	3.05	3.05	2.8	3.4	3.3	.8	.15	.9	.45	3.95	4.65
18.	7.4	3.65	2.9	2.7	3.15	3.1	.8	.1	.85	1.05	5.3	4.05
19.	6.0	6.2	3.0	2.6	2.95	2.85	.75	.1	.75	1.00	4.2	4.0
20.	5.35	9.05	3.1	2.55	2.7	2.65	.7	.05	.6	.95	3.6	4.4
21.	4.4	10.7	3.5	2.55	2.55	2.5	.65	.05	.4	.75	3.1	4.4
22.	4.45	10.3	3.95	2.65	2.75	2.4	.65	.05	.3	.75	3.95	3.9
23.	4.65	8.3	4.15	2.75	3.4	2.25	.6	.05	.35	.65	3.6	3.5
24.	6.65	8.0	4.0	2.8	3.2	2.15	.6	.05	.4	.65	3.1	3.35
25.	6.3	7.3	4.0	2.8	3.0	2.05	.55	.05	.45	.5	2.75	3.6
26.	5.8	7.25	4.05	2.8	3.0	1.9	.55	.05	.45	.45	2.3	6.55
27.	5.1	8.5	4.05	2.75	3.4	1.9	.5	.05	.3	.45	2.05	5.8
28.	4.75	7.3	3.8	3.2	3.7	1.9	.5	.05	.25	.4	1.75	4.85
29.	4.4	.....	3.6	3.3	9.1	1.85	.45	.05	.25	.4	1.65	4.3
30.	4.15	.....	3.45	3.15	7.4	1.75	.45	.05	.25	.35	1.4	3.95
31.	4.4	.....	4.25	.....	6.0	.....	.4	.05	.....	.35	.....	4.9

Rating table for South Fork of Umpqua River near Brockway, Oreg., for 1905-6.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.	Feet.	Sec.-ft.
0.00	160	1.20	544	2.40	1,210	4.20	3,210	9.00	15,600
0.10	182	1.30	585	2.50	1,280	4.40	3,540	10.00	18,760
0.20	206	1.40	627	2.60	1,360	4.60	3,890	11.00	21,980
0.30	232	1.50	670	2.70	1,440	4.80	4,260	12.00	25,280
0.40	260	1.60	715	2.80	1,520	5.00	4,650	13.00	28,600
0.50	290	1.70	765	2.90	1,610	5.20	5,060	14.00	32,000
0.60	321	1.80	820	3.00	1,700	5.40	5,500	15.00	35,400
0.70	354	1.90	880	3.20	1,900	5.60	5,960	16.00	38,900
0.80	389	2.00	940	3.40	2,110	5.80	6,440	17.00	42,400
0.90	426	2.10	1,005	3.60	2,340	6.00	6,940	18.00	46,000
1.00	465	2.20	1,070	3.80	2,610	7.00	9,610		
1.10	504	2.30	1,140	4.00	2,900	8.00	12,530		

NOTE.—The above table is applicable only to open-channel conditions. It is based on 9 discharge measurements made during 1905-6 and is well defined below gage height 9 feet.

*Monthly discharge of South Fork of Umpqua River near Brockway, Oreg., for 1905-6.*

[Drainage area, 1,800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft per sq. mile.	Depth in inches.
1905.						
December 6-31.....	7,190	484	1,480	76,300	0.822	0.795
1906.						
January.....	46,400	1,700	6,760	416,000	3.76	4.34
February.....	21,000	1,280	6,120	340,000	3.40	3.54
March.....	7,580	1,610	3,160	194,000	1.76	2.03
April.....	6,690	1,320	2,340	139,000	1.30	1.45
May.....	15,900	1,000	2,480	152,000	1.38	1.59
June.....	4,850	792	2,020	120,000	1.12	1.25
July.....	740	260	434	26,700	2.41	.28
August.....	260	171	200	12,300	.111	.13
September.....	426	171	250	14,900	.139	.16
October.....	484	194	272	16,700	.151	.17
November.....	5,280	232	1,470	87,500	.817	.91
December.....	8,380	524	3,010	185,000	1.67	1.92
The year.....	46,400	171	2,380	1,700,000	1.50	17.77

NOTE.—Values for 1905 and 1906 are rated as excellent.

## ILLINOIS RIVER DRAINAGE BASIN.

### ROGUE RIVER NEAR TOLO, OREG.<sup>a</sup>

This station was established August 30, 1905. It is located at Gold Ray, Oreg.,  $1\frac{1}{2}$  miles below Tolo post-office, just below the Concor Water and Power Company's dam and bridge, and a short distance below the mouth of Stewart Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 177, page 249.

*Discharge measurements of Rogue River near Tolo, Oreg., in 1905-6.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
1905.		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
August 30.....	L. R. Allen.....	180	1,010	1.10	1,310
October 17.....	do.....	180	1,020	1.20	1,210
December 26.....	do.....	184	1,100	1.57	1,510
1906.					
January 29.....	L. R. Allen.....	188	1,270	2.51	2,920
March 19.....	do.....	190	1,230	2.33	2,670
April 30.....	do.....	192	1,470	3.24	4,570
May 31.....	do.....	200	1,500	3.72	5,360
July 12.....	do.....	184	1,100	1.64	1,800
September 12....	I. E. Oakes.....	178	981	1.06	1,350

<sup>a</sup> Referred to in 1905 report as "Gold Ray."

*Daily gage height, in feet, of Rogue River near Tolo, Oreg., for 1906.*

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.	1.5	2.65	3.6	3.7	3.1	3.8	2.1	1.6	1.05	1.1	1.2	1.45
2.	1.38	2.6	3.15	3.7	3.2	3.7	2.5	1.6	1.05	1.1	1.2	1.5
3.	1.4	2.55	2.9	3.5	3.1	3.6	2.5	1.5	1.05	1.1	1.3	1.4
4.	1.48	2.4	2.85	3.3	3.2	3.6	2.5	1.5	1.1	1.1	1.55	1.4
5.	1.45	2.35	2.75	3.3	3.3	3.4	2.6	1.3	1.1	1.1	1.7	1.4
6.	1.4	2.3	2.75	3.4	3.2	3.3	2.5	1.3	1.1	1.1	1.75	1.55
7.	1.4	2.25	2.9	3.4	3.2	3.3	2.4	1.3	1.1	1.1	2.0	1.7
8.	1.5	2.2	2.95	3.3	3.1	3.2	2.4	1.3	1.1	1.1	1.95	2.75
9.	1.7	2.18	3.0	3.4	3.2	3.7	2.4	1.2	1.1	1.1	1.8	2.15
10.	2.05	2.1	3.0	3.2	3.4	3.5	2.3	1.3	1.1	1.1	1.65	2.1
11.	1.9	2.1	3.1	3.0	3.3	3.3	2.4	1.2	1.1	1.1	1.35	2.05
12.	2.25	2.05	3.15	3.0	3.1	3.3	2.3	1.2	1.1	1.1	1.3	2.1
13.	3.2	2.0	3.0	2.9	2.9	3.2	2.2	1.25	1.2	1.1	1.35	2.2
14.	2.78	1.95	3.0	3.0	3.0	3.1	2.2	1.3	1.4	1.1	1.4	2.0
15.	2.65	2.3	2.8	2.9	3.2	2.9	2.3	1.2	1.5	1.2	1.45	2.2
16.	11.4	2.25	2.7	3.1	2.9	3.0	2.3	1.25	1.45	1.35	2.1	2.7
17.	4.4	2.25	2.6	2.9	3.0	2.9	2.2	1.2	1.25	1.5	2.15	2.25
18.	4.0	2.82	2.5	2.9	2.8	2.8	2.2	1.2	1.2	1.5	2.05	2.15
19.	3.5	4.5	2.4	3.0	2.7	2.8	2.1	1.2	1.2	1.35	1.7	2.2
20.	2.8	4.4	2.5	3.2	.....	2.75	2.1	1.2	1.2	1.2	1.5	2.45
21.	2.4	4.7	2.8	3.4	2.7	2.7	2.2	1.2	1.2	1.2	1.65	2.4
22.	2.25	4.5	3.1	.....	3.0	2.6	2.1	1.2	1.15	1.2	1.7	2.2
23.	3.75	4.4	2.8	3.5	2.9	2.5	2.0	1.2	1.1	1.2	1.55	2.25
24.	3.85	4.0	2.7	3.3	2.7	2.4	2.0	1.2	1.1	1.25	1.4	2.4
25.	3.7	3.7	3.0	3.4	2.6	2.3	2.0	1.2	1.1	1.3	1.4	3.5
26.	3.25	3.8	3.5	3.0	2.7	2.35	1.9	1.2	1.1	1.35	1.35	4.75
27.	2.95	4.6	3.1	3.2	.....	2.4	1.9	1.2	1.1	1.3	1.4	3.4
28.	2.75	3.9	3.0	3.3	3.8	2.3	1.7	1.2	1.1	1.2	1.35	2.95
29.	2.55	.....	2.8	3.2	4.7	2.3	1.8	1.2	1.1	1.2	1.35	2.95
30.	2.5	.....	2.9	3.1	4.4	2.2	1.7	1.05	1.1	1.2	1.35	3.15
31.	2.7	.....	5.1	.....	3.9	.....	1.7	1.1	.....	1.2	.....	2.9

*Rating table for Rogue River near Tolo, Oreg., for 1905-6.*

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
1.00	1,200	2.00	2,160	3.00	3,850	4.00	6,000	6.00	11,320
1.10	1,270	2.10	2,320	3.10	4,030	4.20	6,480	6.20	11,900
1.20	1,340	2.20	2,450	3.20	4,250	4.40	6,980	6.40	12,480
1.30	1,420	2.30	2,600	3.30	4,440	4.60	7,490	6.60	13,060
1.40	1,500	2.40	2,760	3.40	4,650	4.80	8,010	6.80	13,660
1.50	1,590	2.50	2,930	3.50	4,870	5.00	8,540	7.00	14,260
1.60	1,690	2.60	3,100	3.60	5,090	5.20	9,080	8.00	17,280
1.70	1,800	2.70	3,280	3.70	5,310	5.40	9,620	9.00	20,500
1.80	1,910	2.80	3,460	3.80	5,540	5.60	10,180	10.00	23,850
1.90	2,030	2.90	3,640	3.90	5,770	5.80	10,740	11.00	27,300

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905-6 and is fairly well defined below gage height 4 feet.

*Monthly discharge of Rogue River near Tolo, Oreg., for 1905-1906.*

[Drainage area, 2,020 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1905.						
September.....	1,690	1,240	1,300	77,400	0.644	0.718
October.....	1,690	1,300	1,390	85,500	.688	.793
November.....	1,590	1,340	1,370	81,500	.678	.756
December.....	1,930	1,320	1,490	91,600	.738	.851
The period.....				336,000		
1906.						
January.....	27,800	1,480	4,000	246,000	1.98	2.28
February.....	7,750	2,090	4,040	224,000	2.00	2.08
March.....	8,810	2,760	3,840	236,000	1.90	2.19
April.....	7,060	3,640	4,370	260,000	2.16	2.41
May.....	7,750	3,100	4,220	259,000	2.09	2.41
June.....	5,540	2,450	3,840	228,000	1.90	2.12
July.....	3,100	1,800	2,440	150,000	1.21	1.40
August.....	1,690	1,230	1,390	85,500	.688	.79
September.....	1,590	1,230	1,310	78,000	.648	.72
October.....	1,590	1,270	1,340	82,400	.663	.76
November.....	2,380	1,340	1,680	100,000	.832	.93
December.....	7,880	1,500	2,820	173,000	1.40	1.61
The year.....	27,800	1,230	2,940	2,120,000	1.46	19.70

NOTE.--Discharges have been interpolated for days when gage was not read. Values for 1905-1906 are rated good.

## ROGUE RIVER NEAR GALICE, OREG.

This station was established May 29, 1906. It is located at the ferry on the Mertin-Galice road in sec., 9, T. 35 S., R. 7 W. The gage is an inclined staff on the left bank.

Gage heights, discharge measurements, and monthly discharges have been furnished by Charles Gilman Hyde, University of California, Berkeley, Cal.

*Discharge measurements of Rogue River near Galice, Oreg., in 1906.*

Date.	Hydrographer.	Gage height.	Dis- charge.
May 16.....	C. G. Hyde.....	<i>Fect.</i> 6.5	<i>Sec.-ft.</i> 4,170
August 6.....	do.....	4.5	1,400

*Daily gage height of Rogue River at Galice, Oregon, for 1906.*

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.		7.5	5.6	4.5	4.35	4.4	4.35	4.6
2.		7.4	5.5	4.5	4.35	4.4	4.4	4.6
3.		7.3	5.5	4.5	4.35	4.4	4.5	4.5
4.		7.6	5.4	4.5	4.35	4.1	4.6	4.5
5.		7.4	5.4	4.5	4.35	4.4	4.85	4.6
6.		7.1	5.3	4.5	4.35	4.35	4.75	5.3
7.		7.2	5.3	4.5	4.3	4.35	4.65	5.8
8.		7.1	5.2	4.5	4.25	4.35	5.8	6.3
9.		7.7	5.15	4.5	4.4	4.3	5.0	6.1
10.		7.5	5.05	4.4	4.5	4.35	4.8	6.0
11.		7.3	5.0	4.4	4.4	4.35	4.8	5.8
12.		7.5	5.0	4.4	4.35	4.35	4.8	5.6
13.		7.2	4.9	4.4	4.5	4.35	4.75	5.5
14.		7.0	4.9	4.4	4.7	4.35	4.75	5.4
15.		6.8	4.9	4.4	4.6	4.4	5.0	5.8
16.		7.2	4.9	4.4	4.5	4.4	5.85	6.8
17.		6.9	4.8	4.4	4.5	4.5	5.85	6.2
18.		6.7	4.8	4.4	4.5	4.5	5.8	5.7
19.		6.5	4.8	4.4	4.4	4.5	5.5	5.5
20.		6.4	4.7	4.4	4.4	4.5	5.0	5.7
21.		6.3	4.7	4.4	4.5	4.5	5.0	6.0
22.		6.2	4.7	4.4	4.5	4.5	5.2	5.7
23.		6.1	4.7	4.4	4.4	4.45	5.0	5.6
24.		6.1	4.7	4.4	4.4	4.45	5.0	5.6
25.		6.0	4.6	4.4	4.4	4.45	4.9	6.7
26.		5.9	4.6	4.4	4.4	4.4	4.9	9.8
27.		5.9	4.6	4.4	4.4	4.4	4.8	8.1
28.		5.8	4.5	4.4	4.4	4.4	4.7	7.0
29.		9.0	5.7	4.4	4.3	4.35	4.7	6.8
30.		8.6	5.6	4.4	4.3	4.35	4.6	7.5
31.		8.5	4.5	4.4		4.35		7.0

*Monthly discharge of Rogue River near Galice, Oreg., in 1906.*

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum	Minimum.	Mean.	
June.	6,250	2,700	4,700	280,000
July.	2,700	1,400	1,800	111,000
August.	1,400	1,350	1,360	83,600
September.	1,600	1,225	1,350	80,300
October.	1,400	1,300	1,350	83,000
November.	3,125	1,300	1,850	110,000
December.	9,950	1,400	3,350	206,000
The period.				954,000

## NEHALEM RIVER DRAINAGE BASIN.

### NEHALEM RIVER AT FISHHAWK, OREG.

This station is located at Fishhawk post-office, below the mouth of Fishhawk Creek. The bed of the stream is of clean sand, liable to shift. Measurements are made from a cable and car. The gage rod is a 2 by 8 inch timber in four sections. The bench mark is the top of three spikes driven in the upper side of a cedar stump about 50 feet above the cable on the left bank; elevation, 23.69 feet above the datum of the gage. No gage heights were observed during 1906.

*Discharge measurements of Nehalem River at Fishhawk, Oreg., in 1906.*

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sq. ft.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>
April 18.....	L. R. Allen.....	59	316	1.02	386
April 19.....	do.....	59	203	.93	364
May 21.....	do.....	59	284	.52	310
August 1.....	do.....	55	179	.24	102

## MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in North Pacific Ocean drainage in 1906:

*Miscellaneous measurements in North Pacific Ocean drainage in 1906.*

Date.	Stream.	Locality.	Width.	Area of section.	Dis-charge.
			<i>Feet.</i>	<i>Sq. ft.</i>	<i>Sec.-ft.</i>
August 5.....	Antelope Creek.....	Eagle Point.....			0
August 8.....	Applegate Creek.....	Ruch.....	41	88	110
August 5.....	Big Butte Creek.....	Sec. 14, T. 34 S., R. 1 E.....	102	291	184
August 6.....	Condor Water and Power Co.'s canal.	Prospect, 200 feet below dam.	14	36	74
August 7.....	Elk Creek.....	Sec. 31, T. 33 S., R. 1 W.....	25	20	9.1
August 5.....	Little Butte Creek.....	Eagle Point.....	36	42	48
August 6.....	Rogue River.....	Prospect, below dam.	53	289	445
August 13.....	Siuslaw River.....	Below Walton Creek, sec. 16, T. 18 S., R. 8 W.	107	127	131
August 7.....	Trail Creek.....	Mouth.....			0

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# CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 214.]

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1888. Tenth Annual Report, Part II\*.

1889. Eleventh Annual Report, Part II\*.

1890. Twelfth Annual Report, Part II\*.

1891. Thirteenth Annual Report, Part III\*.

1892. Fourteenth Annual Report, Part II\*.

1893. Bulletin No. 131\*.

1894. Bulletin No. 131\*; Sixteenth Annual Report, Part II\*.

1895. Bulletin No. 140\*.

1896. Water-Supply Paper No. 11\*, Eighteenth Annual Report, Part IV\*.

1897. Water-Supply Papers Nos. 15\* and 16\*, Nineteenth Annual Report, Part IV\*.

1898. Water-Supply Papers Nos. 27\* and 28\*, Twentieth Annual Report, Part IV\*.

1899. Water-Supply Papers Nos. 35\*, 36\*, 37\*, 38\*, and 39\*, Twenty-first Annual Report, Part IV\*.

1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.

1901. East of Mississippi River, Water-Supply Papers Nos. 65\* and 75\*.

West of Mississippi River, Water-Supply Papers Nos. 66 and 75\*.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.  
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.  
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.  
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165\*, 166\*, 167, 168\*, 169, 170, and 171.  
West of Mississippi River, Water-Supply Papers Nos. 171, 172\*, 173\*, 174, 175\*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.  
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

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