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SURFACE WATER SUPPLY OF THE UNITED STATES

1917

PART XII. NORTH PACIFIC SLOPE DRAINAGE BASINS

C. LOWER COLUMBIA RIVER BASIN AND PACIFIC
SLOPE DRAINAGE BASINS IN OREGON

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SURFACE WATER SUPPLY OF LOWER COLUMBIA RIVER AND PACIFIC SLOPE DRAINAGE BASINS IN OREGON, 1917.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting records of measurements of flow made on streams in the United States during the year ending September 30, 1917.

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

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

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

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

Annual appropriations for the fiscal years ending June 30, 1895-1918.

1895	\$12,500
1896	20,000
1897 to 1900, inclusive	50,000
1901 to 1902, inclusive	100,000
1903 to 1906, inclusive	200,000
1907	150,000
1908 to 1910, inclusive	100,000
1911 to 1917, inclusive	150,000
1918	175,000

In the execution of the work many private and State organizations have cooperated either by furnishing data or by assisting in collecting data. Acknowledgments for cooperation of the first kind are made in connection with the description of each station affected; cooperation of the second kind is acknowledged on page 11.

Measurements of stream flow have been made at about 4,240 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1917, 1,180 gaging stations were being maintained by the Survey and the cooperating organizations.

Many miscellaneous discharge measurements are made at other points. In connection with this work data were also collected in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country and will be made available in water-supply papers from time to time. Information in regard to publications relating to water resources is presented in the appendix to this report.

DEFINITION OF TERMS.

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

“Second-feet” is an abbreviation for “cubic feet per second.” A second-foot is the rate of discharge of water flowing in a channel of rectangular cross-section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

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

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

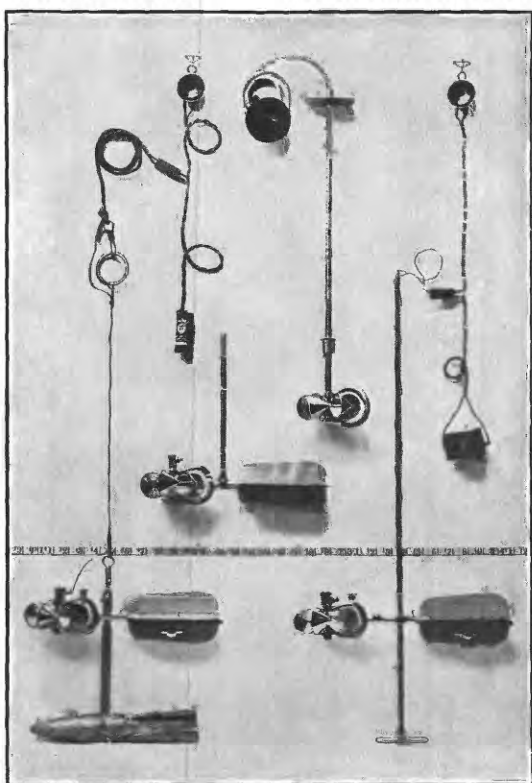
An “acre-foot,” equivalent to 43,560 cubic feet, is the quantity required to cover an acre to the depth of 1 foot. The term is commonly used in connection with storage for irrigation.

The following terms not in common use are here defined:

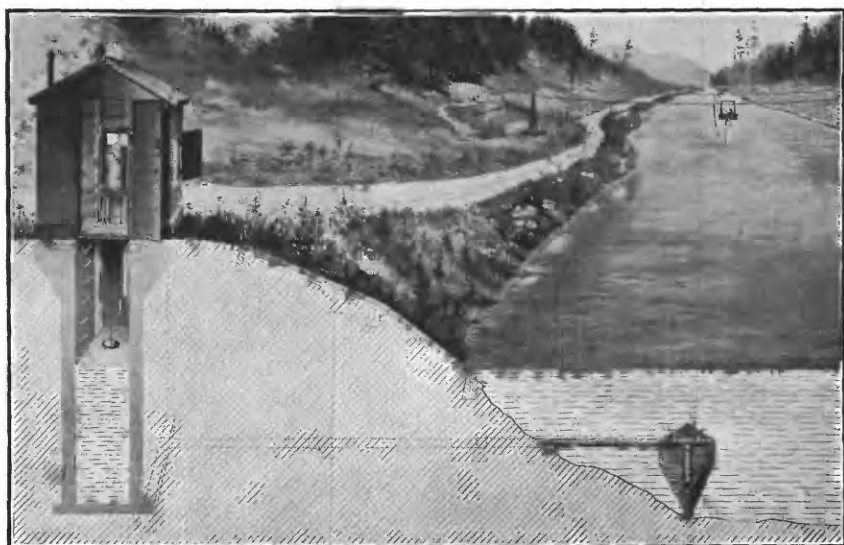
“Stage-discharge relation,” an abbreviation for the term “relation of gage height to discharge.”

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

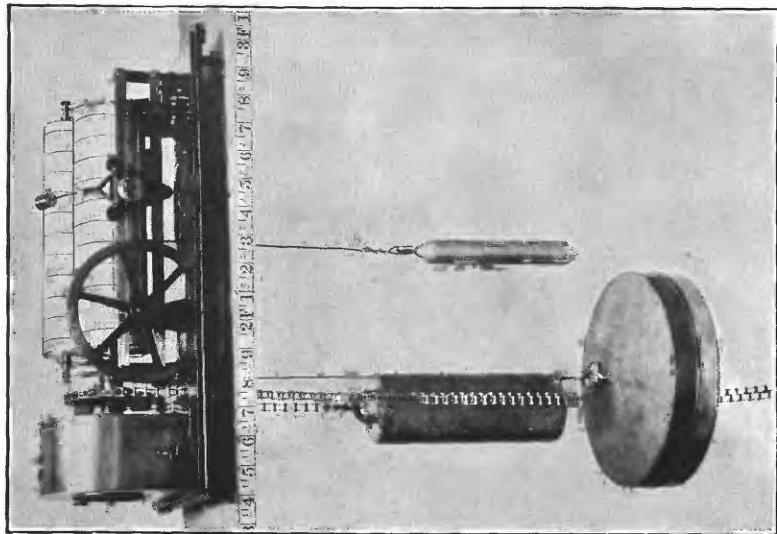
The “point of zero flow” for a gaging station is that point on the gage—the gage height—to which the surface of the river would fall if there were no flow.



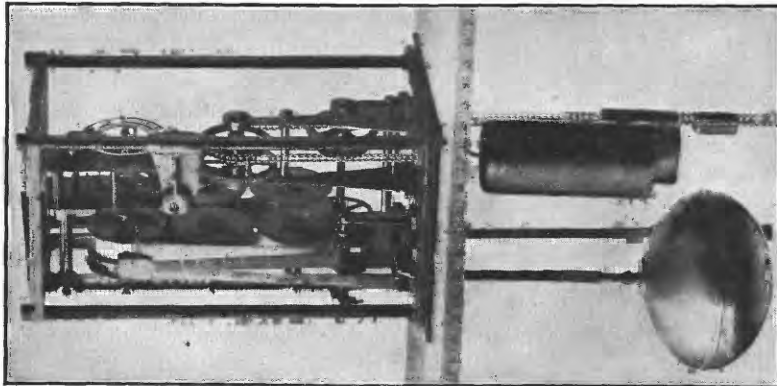
A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.

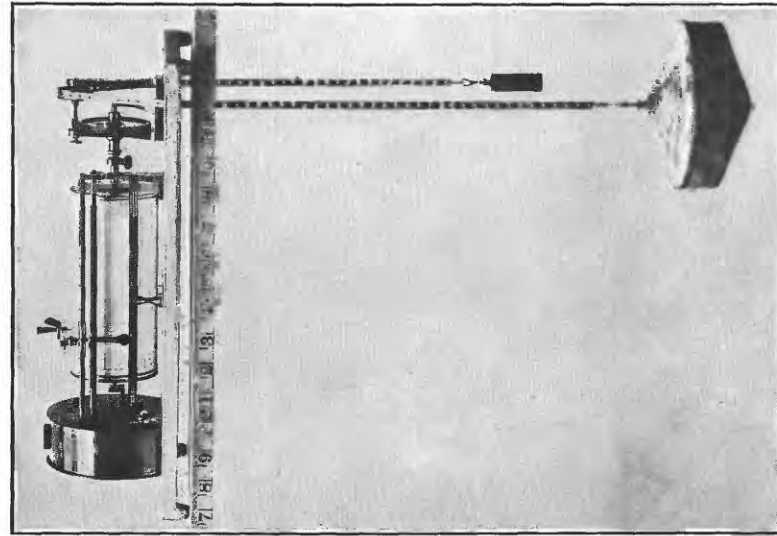


A STEVENS CONTINUOUS.



B. GURLEY PRINTING.

WATER-STAGE RECORDERS.



C. FRIEZ.

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1916, and ending September 30, 1917. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

The base data collected at gaging stations consist of records of stage, measurements of discharge, and general information used to supplement the gage heights and discharge measurements in determining the daily flow. The records of stage are obtained either from direct readings on a staff gage or from a water-stage recorder that gives a continuous record of the fluctuations. Measurements of discharge are made with a current meter by the general methods outlined in standard textbooks on the measurement of river discharge. (See Pls. I, II.)

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

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

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

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

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the

day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by use of the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet per second during the month. On this average flow are based computations recorded in the remaining columns, which are defined on page 8.

ACCURACY OF FIELD DATA AND COMPUTED RECORDS.

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

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

For the rating tables "well defined" indicates, in general, that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined," within 15 to 25 per cent. These notes are very general and are based on the plotting of the individual measurements with reference to the mean rating curve.

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

than 20 inches. All figures representing "second-feet per square mile" and "run-off (depth in inches)" previously published by the Survey should be used with caution because of possible inherent sources of error not known to the Survey.

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

COOPERATION.

The work in Oregon and Washington was carried on under cooperative agreements between the United States Geological Survey and the respective States.

Cooperation with the States is effected under contracts which are made between the Director of the United States Geological Survey and the State engineers or other officials and are authorized by legislative acts appropriating moneys.

Acknowledgments are due to John H. Lewis, State engineer of Oregon, and to Henry Landes, State geologist of Washington, for the efficient manner in which they represented their States in the cooperative investigations.

Acknowledgements are also due to the United States Reclamation Service, the United States Forest Service, and the United States Office of Indian Affairs for assistance, suggestions, and the freest use of data gathered exclusively for them and paid for by them; to the Corps of Engineers, United States Army; and to the United States Weather Bureau for hydrographic and climatic data.

Special acknowledgments are due for financial assistance rendered by municipalities, corporations, and individuals, as follows: Water masters for Umatilla, Crook, and Deschutes Counties, Water Bureau of the city of Portland, Tumalo Project of the State of Oregon, Teel Irrigation District, Ochoco Irrigation District, Suttle Lake Irrigation District, East Fork Irrigation District, Talent Irrigation District, Horse Heaven Irrigation District, Furnish Ditch Co., Prairie Power Co., Pacific Power & Light Co., Central Oregon Irrigation Co., Arnold Irrigation Co., Northwestern Electric Co., Portland Railway, Light & Power Co., Waldo Lake Irrigation & Power Co., O'Neil Bros. & Callaghan, North Coast Power Co., Crown-Willamette Paper Co., California-Oregon Power Co., Rogue River Valley Canal Co., M. A. Moody, Carl Bieberstedt, and J. G. Kelley.

Acknowledgment is made in descriptions of gaging stations for records furnished.

DIVISION OF WORK.

The data for stations in Oregon and Washington, except those in Walla Walla River and Cowlitz River basins in Washington, were collected and prepared for publication under the direction of F. F. Henshaw, district engineer, assisted by C. L. Batchelder, J. E. Stewart, W. E. Dickinson, and R. C. Briggs.

Data for stations in Walla Walla River and Cowlitz River basins in Washington were collected and prepared for publication under the direction of G. L. Parker, district engineer, assisted by Lasley Lee, C. O. Brown, C. G. Paulsen, J. E. Stewart, J. T. Hartson, John McCombs, and L. D. Carson.

The records were reviewed and the manuscript assembled by W. E. Dickinson.

GAGING-STATION RECORDS.

COLUMBIA RIVER AT THE DALLES, OREG.

LOCATION.—In sec. 34, T. 2 N., R. 13 E., 2,000 feet below ferry at The Dalles, about 18 miles below Deschutes River, and above Hood and Klickitat rivers.

DRAINAGE AREA.—237,000 square miles.

RECORDS AVAILABLE.—June 1, 1878, to September 30, 1917. Maximum stages 1858 to 1877.

GAGE.—Two gages at The Dalles: The Government or Brooks gage, used by the United States Geological Survey made up of several sections attached to the piling of viaduct connecting Regulator Dock with the warehouse; the United States Army engineers' gage, similar in form but with a datum of 8.9 feet lower than the Brooks gage. Gage at Cascade Locks, 20 miles below The Dalles, which was used in computing early records, has been situated at various points but is at present attached to side of wooden fender of upper locks chamber between upper guard and lock gates. Elevation of datum of Brooks gage, 46.36 feet (adjustment of primary level net, 1912).

DISCHARGE MEASUREMENTS.—In 1903, made by United States Army engineers with rod floats and meter from a steamer; in 1907, by United States Geological Survey engineers with meter from a launch; in 1908, float measurements by United States Geological Survey engineers 2,000 feet below gage at The Dalles; in 1910 and 1913, measurements by United States Geological Survey engineers on Columbia River above Snake River and on Snake River referred to The Dalles gage, allowance being made for intervening tributaries.

CHANNEL AND CONTROL.—Rocky and permanent at the rapids at Cascade Locks, the control for all three gages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 40.4 feet, June 20 (discharge, 727,000 second-feet); minimum stage recorded, —1.0 foot January 19 to 21 (discharge, 56,800 second-feet).

1857–1917: Maximum stage recorded, 59.6 feet June 6, 1894 (discharge, 1,170,000 second-feet); minimum stage recorded, —3.9 feet on gage at Cascade Locks January 7, 1890 (discharge, 41,900 second-feet).

ICE.—Stage-discharge relation possibly affected by ice for short periods in December and January.

DIVERSIONS.—Quantity of water diverted for irrigation is large in the aggregate but constitutes only a small proportion of the total flow; the low-water flow, which comes in the winter, is little affected.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; ice jams in river December 30 and 31, and January 17 to 22 but open water rating assumed applicable. Rating curve well defined between 80,000 and 900,000 second-feet. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records excellent, except July to September, which are shown by comparison with records at Cascade Locks to be somewhat uncertain.

COOPERATION.—Gage readings furnished by United States Weather Bureau.

No discharge measurements during year.

Daily discharge, in second-feet, of Columbia River at The Dalles, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	120,000	91,000	79,400	63,400	62,000	69,000	93,000	264,000	688,000	644,000	297,000	159,000
2.....	118,000	91,000	78,600	64,800	62,000	72,200	97,000	257,000	673,000	627,000	289,000	156,000
3.....	116,000	90,100	79,400	69,800	62,000	74,600	100,000	246,000	662,000	611,000	281,000	155,000
4.....	113,000	92,000	79,400	70,600	66,200	76,200	99,000	240,000	655,000	602,000	273,000	152,000
5.....	112,000	92,000	78,600	71,400	67,600	74,600	100,000	233,000	640,000	596,000	264,000	150,000
6.....	111,000	91,000	81,100	74,600	66,200	72,200	100,000	234,000	624,000	596,000	255,000	146,000
7.....	107,000	92,000	81,100	73,800	66,200	69,800	111,000	240,000	607,000	587,000	245,000	142,000
8.....	105,000	93,000	80,200	73,800	68,300	67,600	137,000	243,000	594,000	576,000	232,000	135,000
9.....	103,000	95,000	79,400	73,000	69,000	66,900	156,000	255,000	586,000	572,000	225,000	134,000
10.....	102,000	93,000	77,800	72,200	69,000	66,900	170,000	278,000	611,000	564,000	218,000	131,000
11.....	102,000	90,100	77,800	71,400	69,800	66,200	176,000	302,000	653,000	553,000	212,000	129,000
12.....	102,000	86,500	76,200	70,600	70,600	66,200	176,000	322,000	664,000	543,000	204,000	126,000
13.....	102,000	85,600	75,400	68,300	69,000	65,500	177,000	349,000	646,000	526,000	199,000	124,000
14.....	102,000	85,600	73,800	66,900	69,000	66,900	199,000	379,000	622,000	503,000	195,000	121,000
15.....	103,000	83,800	74,600	65,500	69,000	66,200	201,000	403,000	605,000	487,000	187,000	118,000
16.....	104,000	81,100	76,200	63,400	73,000	65,500	202,000	435,000	600,000	477,000	184,000	115,000
17.....	105,000	79,400	74,600	59,900	70,600	64,800	195,000	483,000	620,000	467,000	183,000	112,000
18.....	103,000	78,600	73,800	57,400	70,600	65,500	188,000	475,000	668,000	451,000	178,000	111,000
19.....	101,000	77,800	74,600	56,800	69,800	65,500	176,000	449,000	716,000	439,000	176,000	110,000
20.....	97,000	77,000	74,600	56,800	69,000	66,200	168,000	433,000	727,000	428,000	173,000	108,000
21.....	96,000	77,800	73,000	56,800	71,400	66,900	168,000	426,000	718,000	416,000	170,000	107,000
22.....	102,000	78,600	72,200	58,000	70,600	66,200	172,000	428,000	709,000	407,000	168,000	107,000
23.....	89,200	79,400	73,800	59,200	69,800	66,900	181,000	432,000	700,000	395,000	168,000	107,000
24.....	89,200	78,600	71,400	61,300	69,000	67,600	199,000	441,000	697,000	385,000	168,000	106,000
25.....	91,000	77,800	69,800	66,200	68,300	70,600	226,000	457,000	682,000	374,000	168,000	105,000
26.....	92,000	79,400	69,800	68,300	67,600	69,000	254,000	493,000	677,000	359,000	170,000	103,000
27.....	92,000	79,400	64,800	68,300	68,300	70,600	264,000	500,000	668,000	349,000	169,000	105,000
28.....	92,000	82,000	66,900	69,800	68,300	73,800	278,000	551,000	664,000	340,000	169,000	107,000
29.....	90,100	79,400	64,800	70,600	.....	77,000	286,000	583,000	660,000	332,000	168,000	110,000
30.....	90,100	80,200	63,400	71,400	.....	80,200	276,000	611,000	651,000	322,000	166,000	110,000
31.....	92,000	.....	63,400	66,200	.....	90,100	.....	657,000	.....	308,000	163,000	.....

Monthly discharge of Columbia River at The Dalles, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 237,000 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	120,000	89,200	101,000	0.426	0.49	6,210,000
November.....	95,000	77,000	84,600	.357	.40	5,030,000
December.....	91,000	63,400	74,200	.313	.36	4,560,000
January.....	74,600	56,800	66,500	.281	.32	4,090,000
February.....	73,000	62,000	68,300	.288	.30	3,790,000
March.....	90,100	64,800	69,900	.295	.34	4,300,000
April.....	286,000	93,000	178,000	.751	.84	10,600,000
May.....	657,000	233,000	391,000	1.65	1.90	24,000,000
June.....	727,000	594,000	657,000	2.77	3.09	39,100,000
July.....	644,000	308,000	478,000	2.02	2.33	29,400,000
August.....	297,000	163,000	204,000	.861	.99	12,500,000
September.....	159,000	103,000	123,000	.519	.58	7,320,000
The year.....	727,000	56,800	210,000	.886	11.94	151,000,000

TRIBUTARIES OF COLUMBIA RIVER BELOW MOUTH OF SNAKE RIVER.

WALLA WALLA RIVER BASIN.

SOUTH FORK OF WALLA WALLA RIVER NEAR MILTON, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 9, T. 4 N., R. 37 E., a quarter of a mile above head gate of pipe line of Pacific Power & Light Co., and about 12 miles above Milton, Umatilla County.

DRAINAGE AREA.—72 square miles.

RECORDS AVAILABLE.—August 10 to September 15, 1906; January 1, 1907, to March 14, 1908; October 14, 1908, to November 24, 1917, when station was discontinued.

For station at point 6 miles below present site, February 16, 1903, to May 29, 1906.

GAGE.—Vertical staff; read by R. Chapman. Datum of gage is 0.07 foot above that used up to September 30, 1914.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Gravel and small boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.25 feet May-13 (discharge not determined); minimum stage recorded, 2.09 feet August to November (discharge, 108 second-feet).

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

DIVERSIONS.—Station is above all diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during flood of May, 1917. Rating curve for low water of 1917 defined by one measurement and form of previous curve. Gage read once a day to quarter-tenths. Daily discharge July to November ascertained by applying daily gage reading to rating table. Records fair. Discharge October to June, not determined.

The following discharge measurement was made by Reineman and Roeder, water masters:

October 8, 1917: Gage height, 2.09 feet; discharge, 108 second-feet.

Daily gage height, in feet, of South Fork of Walla Walla River near Milton, Oreg., for the period October, 1916, to June, 1917.

Day.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1.	2.40	.....	2.45	2.50	2.45	2.66	3.18	.....
2.	2.40	.....	2.46	2.48	2.45	2.70	3.11	.....
3.	2.40	.....	2.48	2.49	2.45	2.70	3.15	.....
4.	2.40	.....	2.49	2.58	2.45	2.80	3.12	.....
5.	2.40	.....	2.55	2.68	2.45	3.28	3.19	.....
6.	2.40	.....	2.62	2.71	2.45	3.40	3.28	.....
7.	2.40	.....	2.65	2.70	2.45	3.66	3.40	.....
8.	2.40	.....	2.65	2.70	2.45	4.02	3.75	.....
9.	2.40	.....	2.65	2.70	2.46	3.45	3.99	.....
10.	2.40	.....	2.62	2.70	2.48	3.29	4.08	3.49
11.	2.40	.....	2.62	2.69	2.48	3.52	4.12	3.27
12.	2.40	.....	2.58	2.70	2.48	3.22	4.26	3.17
13.	2.40	3.20	2.55	2.66	2.48	3.10	4.30	3.17
14.	2.40	2.78	2.52	2.62	2.48	3.10	.....	3.32
15.	2.40	2.66	2.50	2.60	2.48	3.01	.....	3.67
16.	2.40	2.64	2.48	2.72	2.45	2.90	.....	3.75
17.	2.40	2.59	2.48	2.80	2.45	2.81	.....	3.62
18.	2.40	2.55	2.45	2.76	2.46	2.78	.....	3.47
19.	2.40	2.58	2.45	2.71	2.50	2.75	.....	3.37
20.	2.40	2.60	2.45	2.68	2.50	2.82	.....	3.27
21.	2.40	2.64	2.45	2.64	2.50	3.28	.....	3.19
22.	2.40	2.59	2.45	2.58	2.50	3.34	.....	3.12
23.	2.40	2.55	2.45	2.55	2.50	4.00	.....	3.09
24.	2.40	2.52	2.45	2.51	2.54	3.75	.....	3.09
25.	2.40	2.50	2.48	2.48	2.54	3.92	.....	2.99
26.	2.40	2.50	2.48	2.48	2.50	4.25	.....	2.96
27.	2.44	2.48	2.58	2.48	2.51	3.70	.....	2.93
28.	2.41	2.48	2.66	2.48	2.59	3.50	.....	2.92
29.	.....	2.45	2.61	.....	3.04	3.44	.....	2.91
30.	.....	2.45	2.55	.....	2.88	3.30	.....	2.89
31.	.....	2.45	2.52	.....	2.76	.....	.....	.....

Daily discharge, in second-feet, of South Fork of Walla Walla River near Milton, Oreg., for the period July 1 to Nov. 24, 1917.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1.....	299	124	108	108	108	16.....	163	117	108	108	112
2.....	275	122	108	108	108	17.....	158	117	108	108	112
3.....	257	120	108	108	112	18.....	152	117	108	108	112
4.....	245	120	108	108	112	19.....	152	114	108	108	108
5.....	239	120	108	108	108	20.....	145	112	108	108	108
6.....	230	120	108	108	108	21.....	140	112	108	108	108
7.....	221	120	108	108	112	22.....	140	112	108	108	108
8.....	215	120	108	108	112	23.....	136	112	111	108	108
9.....	202	117	108	108	112	24.....	136	112	111	108	108
10.....	193	117	108	108	112	25.....	130	112	112	108	.....
11.....	188	117	108	108	112	26.....	130	111	112	108	.....
12.....	188	117	108	108	112	27.....	128	108	112	108	.....
13.....	183	117	108	108	112	28.....	124	108	112	108	.....
14.....	176	117	108	108	112	29.....	124	108	111	108	.....
15.....	168	117	108	108	112	30.....	124	108	108	108	.....
						31.....	124	108	.....	108	.....

Monthly discharge of South Fork of Walla Walla River near Milton, Oreg., for the period July 1 to Nov. 24, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
July.....	299	124	177	10,900
August.....	124	108	115	7,070
September.....	112	108	109	6,490
October.....	108	108	108	6,640
November 1-24.....	112	108	110	5,240
The period.....				36,300

MILL CREEK NEAR WALLA WALLA, WASH.

LOCATION.—In sec. 12, T. 6 N., R. 37 E., below diversion dam of Walla Walla water works and 12 miles east of Walla Walla, in Walla Walla County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 27, 1913, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff spiked to cottonwood tree on left bank 500 feet below diversion dam; read by Otto Zimmerman.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Control consists of long gravel bar and boulder riffle; shifting at high stages. Banks high and not subject to overflow. Stage of zero flow, according to measurements made August 17 and November 2, 1916, gage height 1.1 feet \pm 0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.09 feet at 7 a. m. May 13 (discharge, 1,120 second-feet); minimum stage recorded, 1.75 feet October 22 and 23 and 2.32 feet August 29-31, September 1-6, 19-21, and 26-30 (discharge, 28 second-feet). Discharge October 1-21, 24-26, and 28 at gage height 1.76 feet, also 28 second-feet.

1913-1917: Maximum stage recorded May 13, 1917; minimum stage recorded, 0.69 foot August 29 to September 1, 1915 (discharge, 21 second-feet).

ICE.—Stage-discharge relation seriously affected by ice during severe winters; flow estimated from observer's notes and weather records.

DIVERSIONS.—The city of Walla Walla diverts from 21 to 32 second-feet of water above the station for public water supply. The quantity diverted was ascertained by deducting the flow measured at the station from that obtained by miscellaneous measurements (p. 142) above the intake.

REGULATION.—Gates at intake of water-supply conduit are closed occasionally when settling basins are cleaned.

ACCURACY.—Stage-discharge relation changed at high water on May 13; affected by ice December 30 and part of each day from January 16 to 18. Rating curve used prior to change well defined; curve used after the change fairly well defined up to 300 second-feet. Shifting-control method used May 14 to 18. Gage read twice daily to hundredths. Daily discharge ascertained by applying mean daily gage height to rating table. Records prior to high water in May excellent, after high water good.

COOPERATION.—Gage-height record furnished by city of Walla Walla.

Discharge measurements of Mill Creek near Walla Walla, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Nov. 2	J. E. Stewart.....	1.79	28.6	June 30	John McCombs.....	2.72	103
Mar. 9	C. G. Paulsen.....	2.01	61	Sept. 15	C. G. Paulsen.....	2.35	32.1
Apr. 10	John McCombs.....	2.90	372				

Daily discharge, in second-feet, of Mill Creek near Walla Walla, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	28	30	46	40	53	44	117	422	269	101	34	28
2.....	28	31	50	59	62	43	112	397	247	98	34	28
3.....	28	34	73	85	70	43	105	372	247	93	34	28
4.....	28	33	100	100	98	48	152	397	230	91	33	28
5.....	28	36	73	223	175	56	450	422	222	88	33	28
6.....	28	38	66	223	240	54	450	477	239	88	33	28
7.....	28	36	54	143	210	54	450	532	264	106	33	30
8.....	28	33	52	117	182	56	810	652	301	103	33	30
9.....	28	39	50	110	149	61	477	744	346	88	33	30
10.....	28	37	44	117	125	59	422	777	296	70	33	30
11.....	28	33	44	117	117	56	450	912	234	68	32	40
12.....	28	30	94	98	117	56	372	1,020	195	64	32	34
13.....	28	30	257	88	112	56	308	1,090	199	62	32	38
14.....	28	30	128	73	94	56	280	982	256	58	32	31
15.....	28	30	94	63	198	53	231	912	264	54	32	32
16.....	28	29	73	58	215	53	182	562	311	52	31	31
17.....	28	29	66	48	160	54	140	397	273	49	31	31
18.....	28	30	79	46	140	63	131	322	230	48	31	31
19.....	28	30	108	46	125	66	122	264	207	46	31	28
20.....	28	30	98	44	108	66	134	273	199	44	30	28
21.....	28	29	83	43	88	59	397	264	188	43	30	28
22.....	28	30	73	42	70	56	397	260	156	41	30	30
23.....	28	30	66	40	66	50	912	247	163	40	30	51
24.....	28	30	59	39	66	59	622	247	144	40	30	33
25.....	28	47	56	47	63	59	532	230	131	37	30	31
26.....	28	63	50	44	56	56	1,060	239	125	38	30	28
27.....	32	98	47	81	50	66	947	282	125	37	30	28
28.....	28	79	44	83	47	94	712	371	125	37	30	28
29.....	37	54	43	73	.....	262	622	548	120	36	28	28
30.....	31	53	40	68	.....	210	504	426	106	36	28	28
31.....	39	.....	40	61	.....	146	.....	320	.....	36	28	.....

NOTE.—Stage-discharge relation affected by ice Dec. 30 (discharge estimated) and part of each day Jan. 16-18 (discharge ascertained from afternoon readings which were not affected by backwater from ice).

Monthly discharge of Mill Creek near Walla Walla, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	39	28	28.9	1,780
November.....	98	29	38.7	2,300
December.....	257	40	72.6	4,460
January.....	223	39	81.3	5,000
February.....	240	47	116	6,440
March.....	262	43	71.4	4,390
April.....	1,060	105	420	25,000
May.....	1,090	230	495	30,400
June.....	346	106	213	12,700
July.....	106	36	61.0	3,750
August.....	34	28	31.3	1,920
September.....	51	28	30.8	1,830
The year.....	1,090	28	138	100,000

UMATILLA RIVER BASIN.

UMATILLA RIVER ABOVE FURNISH RESERVOIR, NEAR YOAKUM, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 17, T. 2 N., R. 31 E., at Oregon-Washington Railroad & Navigation Co.'s bridge a quarter of a mile above Campbell flag station, 5 miles by river above Yoakum and old gaging station, and 10 miles west of Pendleton, Umatilla County; just above backwater from Furnish reservoir.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 18 to August 28, 1915; July 5, 1916, to September 30, 1917.

GAGE.—Stevens 8-day water-stage recorder on right side of main channel at downstream end of bridge pier; installed in July, 1916. Temporary gage near same site used in 1915. Observer, O. L. Dusschee.

DISCHARGE MEASUREMENTS.—Made from cable 20 feet above gage. Low-water measurements made by wading or from a log across river 200 feet above cable.

CHANNEL AND CONTROL.—Channel straight at bridge; current even; left bank high and rocky; right bank low with some cottonwood and brush; overflow channel extends under west span of bridge. Control is at almost right-angle turn to right, about 250 feet below gage and below deep pool, and is composed of gravel and free from vegetation; may shift slightly.

EXTREMES OF DISCHARGE.—1916-17: Maximum stage recorded during year, 9.03 feet at 2 p. m. May 13, 1917 (discharge, 7,940 second-feet); minimum stage recorded, 0.40 foot at 6 p. m. July 27, 1917 (discharge, 27 second-feet).

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

DIVERSIONS.—720 acres irrigated from Umatilla River above station and some from tributaries.

REGULATION.—At low stages water is ponded in the power canals of two flouring mills at Pendleton and released at intervals to obtain sufficient power for operating the mills. This causes a rapidly fluctuating stage at the station. There is practically no effect at medium and high stages. Backwater from the Furnish reservoir extends to within a few hundred yards of the control.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 30 and 500 second-feet and fairly well defined above 500 second-feet. Operation of water-stage recorder satisfactory January 22 to June 7; unsatisfactory for certain periods during rest of year. (See footnote to table of daily discharge.) Daily discharge ascertained as follows: October 3 to 23, by use of discharge integrator; December 12, January 25, March 28, 29, and April 5, by averaging the values obtained by applying to rating table the gage heights for various subdivisions of the day; for all other days, except those given in footnote to table of daily discharge, by applying to rating table the mean daily gage height. Records good.

COOPERATION.—Station installed and records obtained under direction of L. A. Reineman, water master for Umatilla County.

Discharge measurements of Umatilla River above Furnish reservoir, near Yoakum, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Apr. 10	L. A. Reineman.....	6.73	4,570	July 23	L. A. Reineman.....	1.11	100
June 19	do.....	3.84	1,290	25	H. R. Wessel.....	1.02	79
July 2	Reineman and Wessel..	2.23	356	27	do.....	.92	69
11	H. R. Wessel.....	1.56	191	Aug. 1	do.....	.83	60
12	do.....	1.49	168	3	L. A. Reineman.....	.78	54
13	do.....	1.44	154	7	H. R. Wessel.....	.65	43
14	Reineman and Wessel..	1.41	163	28	L. A. Reineman.....	.46	30.9
16	H. R. Wessel.....	1.38	148				

Daily discharge, in second-feet, of Umatilla River above Furnish reservoir, near Yoakum, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	41	56	92	243	225	228	1,040	4,260	3,590	a 403	63	30
2.....	41	57	90	202	215	228	970	3,720	3,200	368	60	32
3.....	41	59	a 104	273	202	225	940	3,850	2,840	332	57	32
4.....	44	59	117	322	270	218	1,080	3,850	2,490	a 316	52	33
5.....	45	66	125	754	374	264	2,910	3,980	2,320	a 300	51	34
6.....	43	70	129	910	640	285	4,680	4,400	2,320	a 285	48	34
7.....	44	74	125	a 755	736	306	4,820	5,520	2,440	a 270	45	34
8.....	44	72	119	600	790	303	6,090	5,800	a2,340	a 255	44	34
9.....	46	71	119	506	748	315	5,800	6,390	a2,250	240	43	a 35
10.....	47	66	115	483	655	315	4,540	6,990	a2,150	218	42	a 36
11.....	47	69	117	466	565	309	4,960	6,990	2,060	190	41	a 37
12.....	47	69	353	a 415	650	300	4,540	6,990	a1,900	173	38	a 38
13.....	47	72	1,250	a 365	715	297	3,590	7,740	a1,740	163	36	39
14.....	45	a 70	590	315	625	303	3,330	6,990	1,580	157	35	40
15.....	46	a 67	438	a 270	535	297	2,960	6,840	a1,540	148	35	39
16.....	43	a 65	a 406	225	692	285	2,540	5,380	a1,500	139	35	38
17.....	46	62	a 373	a 212	1,000	291	2,220	4,400	a1,450	125	35	37
18.....	46	66	340	a 200	850	318	2,060	3,980	1,410	121	34	37
19.....	47	62	413	a 189	665	350	1,910	3,850	1,290	121	35	36
20.....	49	63	469	a 178	530	350	1,960	3,850	a1,190	111	33	35
21.....	50	62	469	a 166	448	343	2,960	3,590	a1,090	103	32	a 42
22.....	50	62	466	155	399	322	3,720	3,590	a 985	92	32	a 49
23.....	50	62	385	155	357	303	5,660	3,460	a 885	89	32	a 56
24.....	50	60	326	149	329	303	6,690	3,330	a 785	84	32	62
25.....	50	74	309	396	309	374	5,800	3,590	685	81	30	54
26.....	49	88	a 287	264	282	368	7,290	3,590	a 631	75	30	50
27.....	50	103	a 265	246	261	364	7,290	3,720	a 578	72	28	47
28.....	55	107	243	a 245	246	728	6,240	4,120	a 525	71	a 28	45
29.....	56	109	a 243	243	.....	1,780	5,380	4,680	472	67	a 29	45
30.....	56	99	a 243	a 241	.....	1,910	4,820	4,820	a 438	64	a 29	44
31.....	56	.....	a 243	240	.....	1,370	.....	4,120	.....	64	a 30	.....

a Interpolated because of unsatisfactory gage-height record.

Monthly discharge of Umatilla River above Furnish reservoir, near Yoakum, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	56	41	47.5	2,920
November.....	109	56	71.4	4,250
December.....	1,250	90	302	18,600
January.....	910	149	335	20,600
February.....	1,000	202	511	28,400
March.....	1,910	218	450	27,700
April.....	7,290	940	3,960	236,000
May.....	7,740	3,390	4,790	295,000
June.....	3,590	438	1,620	96,400
July.....	403	64	171	10,500
August.....	63	28	38.5	2,370
September.....	62	30	40.1	2,390
The year.....	7,740	28	1,030	745,000

UMATILLA RIVER NEAR UMATILLA, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 21, T. 5 N., R. 28 E., near main line of Oregon-Washington Railroad & Navigation Co., about a mile below diversion point of Oregon Land & Water Co.'s canal, and $1\frac{1}{2}$ miles above Umatilla, Umatilla County, and mouth of river.

DRAINAGE AREA.—2,130 square miles.

RECORDS AVAILABLE.—October 21, 1903, to September 30, 1917.

GAGE.—Inclined staff in two sections; lower section 1.2 to 3.5 feet, upper 3.5 to 10.8 feet. Gage reader, T. J. George.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Solid rock without gravel or sand. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8 feet at 2 p. m. April 27 and at 8 a. m. May 14 (discharge, 10,200 second-feet); minimum stage recorded, 2.45 feet June 29 (discharge, 68 second-feet).

1903-1917: Maximum stage recorded, 11 feet May 31, 1906 (discharge, 19,600 second-feet); minimum stage recorded, 1 foot July 25 and August 1 to 9, 1906 (channel dry).

ICE.—Occasionally shore and floating ice, but stage-discharge relation not materially affected.

DIVERIONS.—Large part of total flow of river diverted for irrigation above station. The Umatilla project feed canal also diverts water during the winter for storage in the Cold Springs reservoir. The low-water flow is return water from the Hermiston project and other irrigated tracts.

REGULATION.—Practically none.

ACCURACY.—Stage-discharge relation practically permanent for stages above 3.5 feet (discharge, 770 second-feet); below this a change in relation occurred in 1917. Rating curve well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except for November and March, for which months they are derived from records of the station above Furnish reservoir.

COOPERATION.—Gage-height record furnished by a United States Reclamation Service.

No discharge measurements made during year.

Daily discharge, in second-feet, of Umatilla River near Umatilla, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.	108	-----	-----	415	305	240	1,520	4,680	3,680	105	79	81
2.	108	-----	-----	455	284	210	1,310	3,860	3,140	99	79	83
3.	108	-----	-----	495	270	185	1,310	3,310	2,450	93	79	86
4.	90	-----	216	538	210	-----	1,240	3,680	2,130	90	77	86
5.	102	-----	216	580	210	-----	2,290	3,680	1,820	90	77	86
6.	102	-----	-----	625	340	-----	4,460	3,860	1,660	90	77	86
7.	96	-----	-----	670	720	-----	4,460	1,660	1,660	90	77	86
8.	96	-----	-----	720	770	-----	5,370	6,060	1,820	83	79	86
9.	96	-----	-----	770	880	-----	7,570	6,060	1,820	86	79	86
10.	99	-----	-----	720	938	-----	5,370	6,540	1,890	86	81	86
11.	102	-----	-----	670	880	-----	4,680	7,040	1,820	83	83	86
12.	105	-----	-----	625	825	-----	5,830	7,570	1,520	83	83	88
13.	108	-----	1,380	580	770	-----	4,260	8,140	1,120	83	83	88
14.	111	-----	1,820	538	770	-----	3,490	9,590	995	83	81	86
15.	108	-----	1,380	455	825	-----	3,490	7,850	880	83	81	86
16.	111	-----	1,120	355	880	-----	3,310	7,300	995	83	79	86
17.	114	-----	995	355	995	-----	4,680	995	995	81	81	86
18.	120	-----	998	355	1,120	-----	2,290	3,680	998	81	83	83
19.	128	-----	998	355	1,180	-----	2,130	3,310	825	81	83	79
20.	128	-----	880	355	1,240	-----	1,970	3,140	495	79	83	75
21.	132	-----	825	355	1,120	-----	2,130	2,960	495	79	83	72
22.	120	-----	770	340	880	-----	3,490	2,790	415	79	83	81
23.	120	-----	770	340	770	-----	4,260	2,620	415	81	83	81
24.	120	-----	720	340	495	-----	7,300	2,620	270	83	83	81
25.	120	-----	580	340	455	-----	6,790	2,790	185	88	83	81
26.	124	-----	538	305	355	-----	6,790	2,960	140	90	83	81
27.	124	200	880	270	312	-----	9,880	2,960	117	93	83	81
28.	124	-----	415	305	298	-----	8,430	3,140	79	93	83	81
29.	128	-----	385	340	-----	-----	6,540	3,490	68	86	83	81
30.	128	-----	355	355	-----	-----	5,600	4,910	90	83	83	81
31.	128	-----	385	415	-----	-----	5,140	-----	-----	79	81	-----

NOTE.—Discharge estimated at 130 second-feet Nov. 1-20; 170 second-feet, Nov. 21-26; 190 second-feet, Nov. 28-30; 200 second-feet Dec. 1-3; 210 second-feet Dec. 6-12; 250 second-feet Mar. 4-28; 1,400 second-feet Mar. 29-31.

Monthly discharge of Umatilla River near Umatilla, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).		
	Maximum.	Minimum.	Mean.	River.	Canals.	Total.
October.	132	96	113	6,950	-----	6,950
November.	-----	-----	146	8,690	-----	8,690
December.	1,820	-----	599	36,800	-----	36,800
January.	770	270	462	28,400	-----	28,400
February.	1,240	210	682	37,900	-----	37,900
March.	-----	-----	558	22,000	337	22,300
April.	9,880	1,240	4,340	258,000	2,040	260,000
May.	9,590	2,620	4,670	287,000	2,160	289,000
June.	3,680	68	1,160	69,000	2,470	71,500
July.	105	79	86.0	5,290	3,590	8,880
August.	83	77	81.1	4,990	3,680	8,670
September.	88	72	83.2	4,950	3,380	8,330
The year.	9,880	68	1,060	770,000	17,700	787,000

NOTE.—Run-off given for canals is sum of run-off of West Umatilla and irrigation canals which divert around the station. Record of total run-off furnished by United States Reclamation Service.

JOHN DAY RIVER BASIN.

JOHN DAY RIVER NEAR PRAIRIE CITY, OREG.

LOCATION.—In SW. $\frac{1}{4}$ NE. $\frac{1}{4}$ sec. 10, T. 13 S., R. 33 E., one-eighth mile below Prairie Power Co.'s plant and about a mile from center of Prairie City, Grant County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 30, 1916, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff on left bank; read by E. T. Schroeder.

DISCHARGE MEASUREMENTS.—Made by wading. No equipment for making high-water measurements.

CHANNEL AND CONTROL.—Gravel; shifts in extreme floods.

EXTREMES OF STAGE.—Maximum stage recorded during period, 3.90 feet at 6.30 p. m.

April 8. Minimum stage recorded, 0.16 foot at 7.30 a. m. January 12, 13, and 14.

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

DIVERSIONS.—A considerable part of the summer flow is diverted above the station for irrigation.

REGULATION.—Practically none. Power canal diverts a constant amount and spills into river near plant when not using all the water through the wheels.

ACCURACY.—Stage-discharge relation not permanent. Sufficient measurements to develop rating curve not obtained. Gage read twice daily to hundredths. Daily discharge not determined.

Discharge measurements of John Day River near Prairie City, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 30	C. L. Batchelder.....	0.50	85
July 28	R. C. Briggs.....	.96	98

Daily gage height, in feet, of John Day River near Prairie City, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.		0.50	0.54	0.49	0.22	0.24	0.77	1.89	2.53	1.74	0.94	.....
2.		.53	.53	.62	.46	.26	.85	1.77	2.42	1.66	.92	0.48
3.		.48	.55	.54	.55	.54	.83	1.78	2.38	1.56	.92	.50
4.		.48	.52	.55	.43	.55	1.35	1.89	2.20	1.54	.91	.52
5.		.54	.52	.55	.46	.49	2.04	1.94	2.10	1.60	.89	.53
6.		.53	.51	.51	.41	.50	2.33	2.07	1.98	1.46	.87	.56
7.		.57	.48	.50	.40	.44	3.03	2.40	2.07	1.35	.84	.59
8.		.51	.47	.47	.40	.49	3.49	2.49	2.21	1.36	.81	.55
9.		.51	.53	.50	.38	.47	2.74	2.63	2.58	1.31	.79	.57
10.		.51	.52	.45	.39	.49	2.75	2.66	2.67	1.24	.81	.57
11.		.38	.46	.49	.42	.48	3.50	2.78	2.58	1.14	.80	.61
12.		.30	.56	.24	.45	.49	2.43	2.93	2.27	1.08	.75	.61
13.		.21	.58	.23	.46	.47	2.09	3.11	2.06	.96	.75	.69
14.		.41	.47	.18	.41	.45	1.99	3.21	1.90	.94	.73	.73
15.		.51	.46	.20	.39	.46	1.65	3.27	1.98	.92	.69	.75
16.		.49	.56	.19	.48	.46	1.65	2.90	2.27	.87	.67	.73
17.		.51	.54	.22	.48	.39	1.58	2.65	2.64	.87	.72	.73
18.		.53	.52	.27	.48	.44	1.74	2.37	2.71	.84	.63	.73
19.		.54	.52	.43	.46	.46	1.57	2.23	2.56	.86	.52	.71
20.		.48	.47	.50	.47	.47	1.58	2.19	2.45	.87	.55	.71
21.		.47	.49	.48	.44	.47	1.95	2.11	2.41	.86	.43	.71
22.		.49	.45	.45	.42	.46	1.98	2.04	2.28	.81	.49	.71
23.		.52	.49	.46	.45	.48	2.36	1.98	2.19	.83	.54	.96
24.		.49	.47	.51	.47	.52	2.30	2.30	2.12	.83	.40	1.01
25.		.54	.43	.48	.61	.50	2.76	2.30	2.05	.84	.40	.89
26.		.60	.43	.44	.53	.47	3.01	2.30	1.96	.92	.....	.90
27.		.52	.25	.48	.50	.54	2.63	2.30	1.91	.96	.....	.87
28.		.56	.42	.46	.49	.68	2.29	2.43	1.90	.95	.....	.89
29.		.51	.56	.44	.....	.98	2.04	2.74	1.87	.94	.....	.86
30.	0.50	.54	.30	.39	.....	.78	1.92	2.82	1.83	.94	.....	.84
31.	.50	.....	.46	.35	.....	.76	.....	2.67	.....	.95	.48	.....

JOHN DAY RIVER AT McDONALD, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 11, T. 1 N., R. 19 E., at ferry at McDonald post office, Sherman County, half a mile below mouth of Rock Creek, 16 miles above junction with Columbia River, and 18 miles southwest of Arlington.

DRAINAGE AREA.—7,800 square miles.

RECORDS AVAILABLE.—December 16, 1904, to September 30, 1917.

GAGE.—Inclined staff in two sections on left bank, 183 feet above ferry cable; read by William G. McDonald.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Clean gravel and sand; shifts slightly. Banks high. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.6 feet at 1 p. m., April 27 (discharge, 22,600 second-feet); minimum stage recorded, 1.35 feet September 4 to 10 and 12 to 15 (discharge 150 second-feet).

1905-1917: Maximum stage recorded, 10.38 feet February 6, 1907 (discharge, 22,800 second-feet). A flood about 20 years ago is said to have reached a height of 12.8 feet (discharge estimated from extension of rating curve as 33,000 second-feet). Minimum stage recorded, 1.02 feet September 8 to 11, 1915 (discharge, 63 second-feet).

ICE.—Stage-discharge relation affected by ice for short periods.

DIVERSIONS.—Large part of natural low-water flow of stream diverted in the upper John Day Valley for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water of April 27. Rating curve, used October 1 to April 26, well defined between 80 and 6,000 second-feet. That used April 27 to September 30, well defined between 250 and 10,000 second-feet. Both curves fairly well defined outside of these limits. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Gage heights uncertain July 13 to 19 and discharge interpolated. Records good.

Discharge measurements of John Day River at McDonald, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
May 24	C. L. Batchelder.....	6.11	9,020
Aug. 6	R. C. Briggs.....	1.76	371

Daily discharge, in second-feet, of John Day River at McDonald, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	310	461	648	431	780	970	3,160	11,900	13,000	3,420	468	166
2.....	310	477	605	735	648	970	2,630	10,900	11,600	3,200	438	182
3.....	310	485	605	565	605	870	2,800	10,200	10,500	3,000	438	182
4.....	310	509	605	690	648	780	2,630	9,880	9,560	2,810	400	150
5.....	310	485	648	735	780	870	2,980	10,500	7,360	2,810	372	150
6.....	310	493	565	690	780	920	7,260	10,900	7,060	2,460	365	150
7.....	336	509	565	735	870	1,070	10,000	11,900	7,360	2,460	344	150
8.....	375	509	605	735	780	1,020	11,300	15,400	7,660	2,300	330	150
9.....	375	525	525	735	735	970	16,800	15,800	8,600	2,140	330	150
10.....	389	605	485	690	690	870	14,400	16,400	10,200	1,990	318	150
11.....	375	565	477	648	780	970	12,000	17,200	9,880	1,840	306	162
12.....	389	565	517	565	825	970	14,000	18,400	8,600	1,640	300	150
13.....	389	605	493	461	870	920	13,000	19,200	7,360	1,550	282	150
14.....	389	605	485	410	870	870	10,000	20,800	6,180	1,460	270	150
15.....	389	485	461	362	920	870	9,380	20,400	5,620	1,370	270	150
16.....	389	431	690	389	870	870	8,440	20,000	6,180	1,270	259	162
17.....	382	342	525	262	970	870	6,980	16,100	7,360	1,180	259	162
18.....	375	461	477	648	920	870	6,420	13,300	8,280	1,090	248	162
19.....	375	461	509	735	870	870	5,860	12,600	8,280	1,000	242	170
20.....	375	565	605	690	920	870	6,420	10,500	7,360	910	226	192
21.....	375	565	605	605	920	920	6,700	10,200	6,760	820	226	206
22.....	375	509	605	509	870	970	10,300	9,880	6,180	820	226	206
23.....	375	485	648	525	870	1,020	12,700	9,240	5,900	730	226	206
24.....	389	525	605	605	870	1,070	16,100	8,920	5,360	640	220	206
25.....	389	565	565	605	870	1,120	16,800	9,880	5,100	640	242	215
26.....	389	525	525	605	780	1,270	16,800	10,500	4,840	598	210	226
27.....	403	565	525	648	1,380	1,670	20,800	10,200	4,580	555	192	259
28.....	410	605	525	690	1,220	2,630	20,000	9,880	4,100	547	188	555
29.....	417	605	461	648	.....	3,160	16,400	10,900	3,860	523	179	415
30.....	445	690	445	690	.....	6,980	13,600	12,600	3,640	507	174	400
31.....	453	.....	410	780	.....	3,160	.....	14,000	.....	475	170	.....

NOTE.—Stage-discharge relation somewhat affected by ice Dec. 27 to Jan. 3 and Jan. 14-19; in determining discharge for these periods a slight correction was made to gage heights before entering rating table.

Monthly discharge of John Day River at McDonald, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	453	310	374	23,000
November.....	690	342	526	31,300
December.....	690	410	549	33,800
January.....	780	262	607	37,300
February.....	1,380	605	854	47,400
March.....	6,980	780	1,360	83,600
April.....	20,800	2,630	10,600	631,000
May.....	20,800	8,920	13,200	812,000
June.....	13,000	3,640	7,280	433,000
July.....	3,420	475	1,510	92,800
August.....	468	170	281	17,300
September.....	555	150	201	12,000
The year.....	20,800	150	3,110	2,250,000

STRAWBERRY CREEK NEAR PRAIRIE CITY, OREG.

LOCATION.—In sec. 5, T. 14 S., R. 34 E., at Nelson's ranch, about 6 miles south of Prairie City, Grant County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 5, 1916, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff on downstream side of wagon bridge. Gage reader, Wm. G. Nelson.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Gravel and boulders; practically permanent.

EXTREMES OF STAGE.—Maximum stage recorded during period, 5.62 feet June 17, 1917. Minimum stage, 4.20 feet most of time, February 5 to April 3.

ICE.—Stream freezes almost solid during severe winter weather.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Not sufficient measurements to develop rating curve. Gage read once daily to hundredths, November to June, and twice a week, July to September. Daily discharge not determined.

Discharge measurements of Strawberry Creek near Prairie City, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by-	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 31	C. L. Batchelder.....	4.30	6.6
July 29	R. C. Briggs.....	4.67	20.5

Daily gage height, in feet, of Strawberry Creek near Prairie City, Oreg., for the year ending Sept. 30, 1917.

Day.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....		4.30	4.28	4.22	4.20	4.20	4.48	5.20			4.45
2.....		4.30	4.60	4.22	4.20	4.20	4.48	5.22			4.45
3.....		4.30	4.25	4.22	4.20	4.20	4.42	5.22			
4.....		4.30	4.25	4.22	4.20	4.22	4.40	5.20			4.45
5.....	4.30	4.30	4.28	4.20	4.20	4.28	4.46	5.22		4.55	4.45
6.....	4.30	4.30	4.25	4.20	4.20	4.30	4.60	5.22			
7.....	4.30	4.28	4.25	4.20	4.20	4.35	4.80	5.28			4.45
8.....	4.30	4.28	4.28	4.20	4.20	4.38	4.90	5.35			
9.....	4.30	4.30	4.25	4.20	4.20	4.35	4.98	5.38			
10.....	4.30	4.30	4.25	4.20	4.20	4.38	5.00	5.30			4.45
11.....	4.30	4.30	4.25	4.20	4.20	4.38	5.10	5.28			
12.....	4.30	4.28	4.25	4.20	4.20	4.40	5.10	5.42		4.50	
13.....		4.25	4.50	4.20	4.20	4.35	5.15	5.40			4.45
14.....		4.28	4.25	4.20	4.20	4.35	5.00	5.45			
15.....		4.30		4.20	4.20	4.32	4.98	5.45			
16.....		4.30		4.20	4.20	4.35	4.92	5.60		4.48	4.45
17.....		4.30		4.20	4.20	4.40	4.95	5.62			
18.....	4.28	4.28		4.20	4.20	4.38	4.90	5.55			
19.....	4.28	4.28		4.20	4.20	4.40	4.90	5.58		4.48	
20.....	4.28	4.25	4.22	4.20	4.20	4.45	4.88	5.50			4.42
21.....	4.30	4.25	4.22	4.20	4.20	4.50	4.80	5.45	4.88		
22.....	4.30	4.28	4.22	4.20	4.20	4.55	4.75	5.48		4.48	
23.....	4.30	4.28	4.25	4.20	4.20	4.50	4.85	5.45			4.42
24.....	4.30	4.30	4.25	4.25	4.20	4.60	4.85	5.48			4.45
25.....	4.30	4.28	4.22	4.25	4.20	4.62	4.90	5.45			
26.....	4.30	4.28	4.22	4.20	4.20	4.55	4.92	5.45		4.48	4.42
27.....	4.30	4.28	4.22	4.20	4.20	4.48	5.02	5.40			
28.....	4.30	4.30	4.22	4.20	4.25	4.45	5.10	5.38		4.48	
29.....	4.30	4.30	4.22		4.20	4.45	5.12	5.35		4.48	
30.....	4.30	4.30	4.22		4.20	4.50	5.22	5.35	4.68		4.40
31.....		4.30	4.22		4.20		5.25				

DESOLATION CREEK NEAR DALE, OREG.

LOCATION.—In sec. 1, T. 7 S., R. 31 E., at Dale ranger station, in Grant County, one-fourth mile above junction with North Fork of John Day River, 1 mile from Dale, and about 12 miles south of Ukiah.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 21, 1915, to September 2, 1917, when station was discontinued.

GAGE.—Vertical staff on left bank. Gage reader, Chas. F. Groom, ranger, U. S. Forest Service.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gravel and boulders; practically permanent.

EXTREMES OF STAGE.—Maximum stage recorded during year, 4.0 feet or slightly more during night of May 13; minimum stage recorded, 0.40 foot October 18, 19, 21 to 24, and August 25.

1915-1917: Maximum stage is that of 1917; minimum stage, 0.35 foot August 22, 23, September 1 to 4, and September 11, 1915.

ICE.—Stage-discharge relation affected during severely cold weather; record suspended during this period.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Measurements insufficient to develop rating curve. Gage read to quarter-tenths once daily when observer is at home. Daily discharge not determined.

Discharge measurements of Desolation Creek near Dale, Oreg., from July 21, 1915, to Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
July 21, 1915	H. M. Nelson.....	0.60	26.2
Nov. 1, 1916	C. L. Batchelder.....	.48	12.5
Aug. 2, 1917	R. C. Briggs.....	.70	27.3

Daily gage height, in feet, of Desolation Creek near Dale, Oreg., for the years ending Sept. 30, 1915 to 1917.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1915.				1915.				1915.			
1.....			0.35	11.....			0.35	21.....	0.60	0.40	.....
2.....		0.52	.35	12.....			.40	22.....		.35	.....
3.....		.50	.35	13.....				23.....		.35	.....
4.....		.50	.35	14.....				24.....			.....
5.....		.50		15.....				25.....			.....
6.....				16.....		0.45		26.....			.....
7.....				17.....				27.....			.....
8.....				18.....				28.....			.....
9.....				19.....				29.....			.....
10.....				20.....				30.....			.....
								31.....			.....

Daily gage height, in feet, of Desolation Creek near Dale, Oreg., for the years ending Sept. 30, 1915 to 1917—Continued.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915-16.											
1.....					0.78	1.50		1.90	1.45	0.70	0.50
2.....			0.50			1.50		1.85	1.60	.68	.50
3.....			.55					2.00		.65	.48
4.....		0.65	.60			1.50		2.10		.62	.48
5.....			.60			1.45		2.20		.60	.45
6.....		.42				1.45	2.50			.60	.45
7.....					.85	1.50	2.30		1.45	.58	.42
8.....					.90	1.65	2.20		1.45		.45
9.....					1.00	1.75	2.10		1.45		
10.....					1.15	2.00	1.90		1.30		
11.....					1.30	2.20	1.75		1.25		
12.....			.60			1.85			1.20		.50
13.....			.60			1.75			1.20	.55	
14.....	0.40		.55		1.20	1.80			1.15	.55	
15.....	.40					1.85			1.10	.52	.48
16.....	.45					1.92			1.07	.55	.45
17.....	.45					1.95			1.07	.58	
18.....				0.98		1.80	1.85	2.30	1.05	.60	
19.....				.95		1.68	2.35	2.20	1.05	.58	
20.....		.60		.95		1.60	2.25	1.85	1.00	.55	
21.....		.60		.95		1.65	2.15	1.70	.95		
22.....	.40	.55		.95			2.10	1.70	.92		
23.....				.90		1.50	1.95	1.65	.90		
24.....				.90		1.80		1.58	.88		
25.....		.52		.85		2.05		1.60	.85		.48
26.....	.40	.52		.80	1.30	2.30		1.70	.80		.45
27.....		.50		.80	1.35	2.45			.80		.45
28.....				.80	1.30	2.50			.78		.45
29.....	.40	.60		.78	1.25	2.10			.75		.45
30.....	.40	.60			1.01			1.50	.72		.42
31.....					1.15		1.85		.70		

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1916-17.								
1.....	0.42	0.50		1.30	2.45	1.80	0.50	0.50
2.....	.45	.48		1.28	2.40	1.85		.50
3.....	.47	.48		1.30				
4.....	.47	.50		1.42				
5.....	.47	.50		1.42				
6.....	.47	.50	1.00			1.60		
7.....	.45	.50	1.10	2.10		1.55		
8.....	.45	.50	1.25	2.30		1.50		
9.....	.45	.50	1.12	2.45		1.45		
10.....	.45	.50	1.05	2.52			.55	
11.....	.45		1.20	2.60			.60	
12.....	.45		1.10	2.70			.55	
13.....	.45		1.08	3.30	2.30		.60	
14.....	.45		1.10	3.50	2.50		.60	
15.....	.45			2.90	2.70			
16.....	.42		.90	2.60	2.90			
17.....	.42		.80	2.40	3.00			
18.....	.40		.80	2.30				
19.....	.40		.70		2.60			
20.....	.42		.75		2.50			
21.....	.40		1.01		2.50			
22.....	.40		1.30		2.40		.45	
23.....	.40		1.40		2.35			.45
24.....	.40		1.50		2.25		.45	
25.....	.42		1.75	2.30	2.20	.85	.40	
26.....	.45		1.80		2.20	.80	.45	
27.....	.45		1.70		2.15	.75	.50	
28.....	.45		1.45	2.90	2.15	.70	.50	
29.....	.45		1.50	3.10	2.15	.60	.55	
30.....			1.30	2.70	2.15	.57	.50	
31.....	.45			2.50		.55	.50	

CAMAS CREEK ABOVE CABLE CREEK, NEAR UKIAH, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 4, T. 5 S., R. 32 E., at highway bridge 200 feet above mouth of Cable Creek and 6 miles east of Ukiah, Umatilla County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1914, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff on abutment of highway bridge; read by S. M. Ledgerwood.

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

CHANNEL AND CONTROL.—Rock and gravel; slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.5 feet May 13 and 14 (discharge not determined); minimum stage recorded, 0.75 foot during October. Minimum discharge probably occurred during winter and was very small.

1914-1917: Maximum stage recorded was that of 1917. Minimum stage recorded, 0.50 foot August 29 to 31, 1914 (discharge, 3 second-feet). Discharge estimated to have become as low as 2 second-feet in December, 1914.

ICE.—Stream freezes almost solid during severe winter weather.

DIVERSIONS.—Practically none.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during year. Rating curve not developed. Gage read to quarter-tenths once daily except during floods, when two readings daily were made. Daily discharge not determined.

Discharge measurements of Camas Creek above Cable Creek, near Ukiah, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
Nov. 1	C. L. Batchelder.....	<i>Feet.</i> 0.80	<i>Sec.-ft.</i> 5.4
Aug. 3	R. C. Briggs.....	.94	4.5

Daily gage height, in feet, of Camas Creek above Cable Creek, near Ukiah, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	0.75	0.82	1.40	1.80	2.10	2.60	1.0	3.0	3.0	1.3	1.0	0.98
2.....	.75	.80	1.40	2.05	2.10	2.60	1.5	2.9	2.9	1.5	.95	.96
3.....	.75	.82	1.40	2.10	1.80	2.70	1.5	3.2	2.8	1.5	.95	.96
4.....	.75	.80	1.40	2.50	1.70	3.50	1.4	3.4	2.8	1.4	.96	.96
5.....	.75	.88	1.30	2.10	1.40	3.60	1.9	3.3	2.6	1.4	.94	.96
6.....	.78	.88	1.10	2.05	2.40	3.20	2.2	3.65	2.6	1.3	.94	.96
7.....	.75	.88	1.20	2.02	2.30	2.80	2.45	4.0	2.8	1.3	.94	.96
8.....	.78	.85	.80	1.80	2.00	2.80	3.1	3.9	2.9	1.3	.94	.90
9.....	.75	.85	1.70	1.80	2.50	3.00	2.8	4.0	3.1	1.3	.96	.90
10.....	.75	.82	1.50	1.40	2.80	2.90	2.5	4.05	2.9	1.3	.92	.98
11.....	.75	.90	1.60	1.30	2.80	2.60	3.0	4.02	2.6	1.3	.92	.98
12.....	.75	.80	1.70	1.90	2.75	2.60	2.8	4.05	2.4	1.2	.90	.90
13.....	.75	.90	1.90	2.00	2.75	2.60	2.5	4.35	2.3	1.2	.90	.90
14.....	.75	1.00	1.30	2.20	1.80	2.00	2.55	4.40	2.3	1.15	.90	.90
15.....	.78	.90	1.80	1.70	2.50	2.50	2.2	3.90	2.8	1.1	.90	.94
16.....	.78	1.10	1.90	2.40	3.00	1.60	2.0	3.50	2.8	1.1	.90	.94
17.....	.75	1.10	1.75	.....	3.00	1.60	2.0	3.2	2.7	1.1	.90	.94
18.....	.75	1.20	1.72	.....	1.90	2.30	1.95	3.2	2.5	1.1	1.0	.90
19.....	.75	1.20	1.80	.....	3.10	3.35	1.9	3.2	2.3	1.1	.98	.90
20.....	.75	1.30	1.80	.....	3.00	2.50	2.2	2.9	2.3	1.1	.98	.90
21.....	.78	1.20	1.80	.....	3.00	2.50	2.8	2.9	2.3	1.1	.96	.98
22.....	.78	1.30	1.65	.....	2.90	2.40	3.4	2.9	2.0	1.0	.90	.90
23.....	.78	1.30	1.75	.....	2.90	2.45	3.85	2.9	2.0	1.0	.95	.98
24.....	.80	1.40	1.50	.....	2.65	2.40	3.7	3.1	1.95	1.0	.90	1.20
25.....	.78	1.35	1.90	.....	3.20	2.50	3.85	3.2	1.90	1.0	.90	1.96
26.....	.78	1.40	1.75	.....	3.00	1.50	4.0	3.2	1.85	1.0	.98	1.10
27.....	.75	1.40	1.70	.....	3.00	2.50	3.85	3.1	1.30	1.0	.98	1.0
28.....	.80	1.45	2.00	2.40	3.20	2.40	3.6	3.2	1.30	1.0	.98	.98
29.....	.80	1.45	1.70	2.40	.....	3.20	3.3	3.35	1.30	1.0	.98	.96
30.....	.82	1.40	1.50	2.40	.....	3.20	3.2	3.4	1.30	1.0	.98	.96
31.....	.82	.....	2.02	2.10	.....	3.00	.....	3.2	.....	1.0	.98	.....

NOTE.—Stage-discharge relation affected by ice Nov. 12 to Mar. 30.

CABLE CREEK NEAR UKIAH, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 9, T. 5 S., R. 32 E., at highway bridge about 1,000 feet above mouth of creek, about 6 miles east of Ukiah, Umatilla County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1914, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff on abutment of bridge; read by S. M. Ledgerwood.

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

CHANNEL AND CONTROL.—Gravel and rock; uneven; slightly shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.7 feet at 8 a. m.

May 15 (discharge not determined); minimum discharge probably occurred during winter when the flow was probably zero.

1914-1917: Maximum and minimum stages are those of 1917.

ICE.—Stream freezes and may go almost dry in extremely cold weather.

DIVERSIONS.—Probably none.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during year. Rating curve not developed. Gage read to quarter-tenths once daily. Daily discharge not determined

Discharge measurements of Cable Creek near Ukiah, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
Nov. 1	C. L. Batchelder.....	Feet.	Sec.-ft.
Aug. 3	R. C. Briggs.....	0.20	1.6
		.07	3.0

Daily gage height, in feet, of Cable Creek near Ukiah, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	0.18	0.22	0.40	0.22	0.20	1.40	2.00	1.10	1.90	0.45	0.12	0.00
2.....	.18	.20	.40	.25	.20	1.80	1.50	1.20	1.80	.40	.09	.00
3.....	.18	.20	.40	.25	.30	2.00	.50	1.20	1.60	.30	.07	.00
4.....	.18	.20	.40	.25	.30	1.30	.40	1.30	1.50	.30	.08	.00
5.....	.18	.28	.35	.25	.30	1.05	1.20	1.30	1.45	.40	.08	.00
6.....	.20	.22	.20	.30	.30	.60	1.40	1.50	1.50	.30	.10	.00
7.....	.18	.22	.20	.35	.30	.40	1.50	1.70	1.60	.30	.08	.00
8.....	.18	.18	.30	.30	.20	.30	1.80	1.75	1.62	.35	.08	.00
9.....	.18	.20	.20	.30	.20	.30	1.35	1.90	1.80	.40	.08	.00
10.....	.18	.25	.25	.20	.20	.40	1.10	2.02	1.60	.30	.06	.00
11.....	.15	.20	.20	.30	.30	.32	1.50	2.12	1.50	.30	.06	.02
12.....	.15	.20	.20	.30	.30	.35	1.10	2.25	1.30	.28	.06	.04
13.....	.15	.30	.45	.50	.30	.40	1.00	2.52	1.30	.28	.04	.04
14.....	.15	.30	.30	.50	.30	.38	1.00	2.62	1.30	.25	.04	.04
15.....	.18	.10	.30	.10	.30	.30	.90	2.60	1.30	.25	.04	.04
16.....	.12	.10	.30	.....	.30	.30	1.00	2.20	1.30	.25	.04	.04
17.....	.15	.10	.30	.....	.30	.30	.75	1.90	1.20	.25	.04	.04
18.....	.15	.30	.25	1.0	.30	.30	.70	1.70	1.10	.20	.10	.04
19.....	.15	.50	.25	.....	.30	.30	.70	1.60	1.00	.20	.06	.02
20.....	.15	.70	.25	.....	.40	.35	.90	1.60	1.00	.20	.04	.02
21.....	.18	.50	.30	.....	.40	.40	1.30	1.60	.90	.20	.04	.02
22.....	.15	.50	.25	.....	.30	.30	1.70	1.55	.80	.30	.04	.00
23.....	.15	.50	.25	.....	.30	.35	1.80	1.55	.80	.25	.04	.18
24.....	.18	.50	.25	.....	.30	.38	1.60	1.70	.80	.25	.02	.26
25.....	.18	.50	.20	.....	.30	.40	1.82	1.72	.70	.25	.02	.26
26.....	.18	.60	.20	.....	.40	.30	1.70	1.68	.55	.22	.00	.10
27.....	.15	.60	.20	.....	.40	.35	1.65	1.70	.40	.22	.00	.04
28.....	.18	.70	.20	.30	.50	.45	1.40	1.90	.50	.20	.00	.06
29.....	.20	.65	.20	.40	.....	1.20	1.35	2.25	.50	.20	.00	.06
30.....	.22	.50	.20	.40	.....	1.60	1.20	2.20	.40	.18	.00	.06
31.....	.20	.....	.20	.30	.....	2.70	.....	2.00	.....	.15	.00	.....

NOTE.—Stage-discharge relation affected by ice from Nov. 12 to Mar. 31.

DESCHUTES RIVER BASIN.

DESCHUTES RIVER AT CRANE PRAIRIE, NEAR LAPINE, OREG.

LOCATION.—In sec. 17, T. 21 S., R. 8 E., at outlet of Crane Prairie, above proposed dam site and below mouth of Cultus River; about 28 miles by road west of Lapine, Deschutes County.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—January 1, 1914, to June 30, 1917, when station was discontinued; fragmentary gage readings 1907 to 1913.

GAGE.—Vertical staff on left bank at outlet of marsh; read by George E. Graft.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Bed composed of sand and gravel; somewhat shifting. Control some distance below station; rocky and fairly permanent. Stage-discharge relation slightly affected by growth of aquatic plants.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.8 feet, June 26 (discharge, 505 second-feet). Minimum stage recorded, 1.12 feet, March 31 (discharge 130 second-feet).

1907–1917: Maximum stage from fragmentary records, 2.75 feet July 31, 1913 (determined from high-water marks on Sept. 15); discharge, 531 second-feet. Minimum stage recorded in 1917.

ICE.—Ice jams may affect the stage-discharge relation during extremely cold weather.

DIVERSION.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by snow and ice December to January 20. Deschutes River at Crane Prairie near Lapine, Oreg. Rating curve fairly well defined. Gage read to quarter-tenths once weekly. Discharge ascertained by applying gage heights to rating table. Records fair.

Discharge measurements of Deschutes River at Crane Prairie, near Lapine, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 16	Batchelder and Reineking.....	2.41	422
June 3	Briggs and Batchelder.....	2.33	370
Aug. 20	R. C. Briggs.....	2.36	431

Daily discharge, in second-feet, of Deschutes River at Crane Prairie, near Lapine, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1									
2			330						
3					210	160			380
4		405							
5									
6									
7								355	
8									
9	430		300						455
10					190	160	200		
11		355							
12									
13									
14		355							
15								330	
16	405		310						455
17					180	142			
18		330					230		
19									
20				278					480
21									
22								290	
23									
24	405	310			170	145	265		
25									
26				240					505
27									
28									
29									
30							242	555	
31	380		310			130			

Monthly discharge of Deschutes River at Crane Prairie, near Lapine, Oreg., for the year ending Sept. 30, 1917.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October	405	24,900	March	147	9,040
November	351	20,900	April	234	13,900
December	312	19,200	May	332	20,400
January	276	17,000	June	455	27,100
February	188	10,400			
			The period		163,000

NOTE.—Monthly mean discharge is average of discharge determined for days on which gage was read.

DESCHUTES RIVER NEAR LAPINE, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 26, T. 20 S., R. 10 E., at Forest Service bridge at Big River ranger station, 7 miles by river above mouth of East Fork, 11 miles north of Lapine, Deschutes County.

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—September 22 to December 21, 1910; February 18 to December 31, 1912; April 7 to October 27, 1913, occasional readings; October 1, 1914, to May 14, 1917, when station was discontinued.

GAGE.—Vertical staff on bent of bridge; read by Burton Oney.

DISCHARGE MEASUREMENTS.—Made from upstream side of wagon bridge. Conditions excellent.

CHANNEL AND CONTROL.—Stream bed composed of gravel and sand; no defined control. Channel crooked, apparently permanent; gradient low.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.12 feet October 1 to 5 (discharge, 1,200 second-feet); minimum stage recorded, 0.78 foot March 31 to April 14 (discharge, 865 second-feet).

1905-1917: [Extremes from record on Deschutes River near Lava, Oreg.] Maximum stage recorded, 11.50 feet November 26, 1909 (discharge, 1,700 second-feet); minimum stage recorded, 7.18 feet at time of measurement, November 8, 1911 (discharge, 739 second-feet).

ICE.—Stage-discharge relation materially affected by ice jams for short periods of extremely cold weather.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice for short periods during the winter. Rating curve well defined. Gage read to hundredths once daily when ranger is at station. Daily discharge ascertained by applying daily gage height to rating table. Records excellent for days when gage was read.

COOPERATION.—Gage readings furnished by United States Forest Service, W. G. Hastings, supervisor.

Discharge measurements of Deschutes River near Lapine, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 14	Batchelder and Reineking.....	2.00	1,190
June 4	Briggs and Batchelder.....	1.80	1,110

Daily discharge, in second-feet, of Deschutes River near Lapine, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.
1.....	1,190	1,160	1,090	1,040	915	915	865	965
2.....	1,190	1,160	1,090	1,040	915	915	865	965
3.....	1,190	1,160	1,090	1,040	915	915	865	965
4.....	1,190	1,160	1,090	1,040	915	915	865	990
5.....	1,190	1,160	1,060	1,040	915	915	865	1,040
6.....	1,190	1,160	1,060	1,040	915	915	865	1,040
7.....	1,180	1,160	1,060	1,040	915	915	865	1,060
8.....	1,180	1,160	1,060	1,040	915	915	865	1,060
9.....	1,180	1,160	1,060	1,040	915	915	865	1,060
10.....	1,170	1,160	1,040	1,040	915	915	865	1,090
11.....	1,170	1,160	1,040	1,040	915	915	865	1,120
12.....	1,170	1,160	1,040	1,040	915	890	865	1,140
13.....	1,160	1,160	1,040	1,040	915	890	865	1,140
14.....	1,160	1,160	1,040	1,030	915	890	865	1,160
15.....	1,160	1,160	1,040	1,030	915	890	865	.....
16.....	1,160	1,160	1,040	1,030	915	890	865	.....
17.....	1,160	1,160	1,040	1,020	915	890	865	.....
18.....	1,160	1,160	1,040	1,020	915	890	865	.....
19.....	1,160	1,160	1,040	1,020	915	890	865	.....
20.....	1,160	1,160	1,040	1,020	915	890	865	.....
21.....	1,160	1,160	1,040	1,020	915	865	865	.....
22.....	1,160	1,150	1,040	1,010	915	865	865	.....
23.....	1,160	1,140	1,040	1,010	915	865	890	.....
24.....	1,160	1,130	1,040	990	915	865	890	.....
25.....	1,160	1,120	1,040	965	915	865	915	.....
26.....	1,160	1,120	1,040	965	915	865	940	.....
27.....	1,160	1,120	1,040	940	915	865	965	.....
28.....	1,160	1,120	1,040	915	915	865	965	.....
29.....	1,160	1,120	1,040	915	.....	865	965	.....
30.....	1,160	1,120	1,040	915	.....	865	965	.....
31.....	1,160	.....	1,040	915	.....	865	.....	.....

NOTE.—Stage-discharge relation affected by ice and discharge interpolated Jan. 16-22 and Feb. 1-7. No gage-height record Oct. 6-13, 15-17, 29-31; Nov. 1, 10, 11, 14-18, 22-25; Jan. 12-15, and Apr. 7-9 (discharge interpolated).

Monthly discharge of Deschutes River near Lapine, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	1,190	1,160	1,170	71,900
November.....	1,160	1,120	1,150	68,400
December.....	1,090	1,040	1,050	64,600
January.....	1,040	915	1,010	62,100
February.....	915	915	915	50,800
March.....	915	865	890	54,700
April.....	965	865	884	52,600
May 1-14.....	1,160	965	1,060	29,400
The period.....				454,000

DESCHUTES RIVER BELOW BEND, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 20, T. 17 S., R. 12 E., half a mile below North canal dam and 2 miles north of Bend, Deschutes County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 27, 1914, to September 30, 1917.

GAGE.—Stevens 8 day water-stage recorder on right bank; Gage readers, Mrs. Chas. Orewiler, Mrs. Gertrude Hogue, and John Thompson.

DISCHARGE MEASUREMENTS.—Made from cable about 50 feet upstream from gage.

CHANNEL AND CONTROL.—Rocky; shifting. Logs, drift, and aquatic plants on the wide shallow control affect stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.55 feet at 8 a. m. May 21 (discharge, 2,050 second-feet); minimum stage recorded, 1.03 feet at 1 p. m. August 16 (discharge, 420 second-feet).

1915-1917: Maximum stage recorded was that of 1917. Minimum stage recorded, 0.51 foot at 2 a. m. July 28, 1915 (discharge, 163 second-feet).

1905-1917: Maximum stage recorded, 3.45 feet at pumping plant at Bend at 7.45 a. m. November 27, 1909 (discharge, 4,820 second-feet; no diversions).

ICE.—Stage-discharge relation seldom almost affected by ice.

DIVERSIONS.—Station is below the intakes of the five large canals (Arnold, Central Oregon, Pilot Butte, North, and Swalley canals) which divert water from Deschutes River near Bend; only small diversions below station. Tables showing combined discharge of river and canals are published herewith.

REGULATION.—Flow regulated by hydroelectric plants at North canal dam and at Bend.

ACCURACY.—Stage-discharge relation not permanent; not affected by ice. Two fairly well-defined rating curves used, one applicable October 1 to April 25, the other June 7 to September 28. Operation of water-stage recorder unsatisfactory; many breaks in gage-height record for various periods. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph; shifting-control method used April 26 to June 6 and September 29-30. Discharge for days of no gage-height record ascertained by interpolation based on figures obtained by first including the diversions in the five canals near Bend and then subtracting from the interpolated figures the total discharge of the canals for those days. Records fair.

Discharge measurements of Deschutes River below Bend, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 20	Batchelder and Reineking.	1.70	876	May 1	F. F. Henshaw.....	1.95	1,200
Apr. 11	C. L. Batchelder.....	2.35	1,720	29	C. L. Batchelder.....	2.02	1,300
12	.....do.....	2.18	1,450	June 13	R. C. Briggs.....	1.94	1,300
				Aug. 14	.....do.....	1.39	705

Daily discharge, in second-feet, of Deschutes River below Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	780	1,090	1,240	1,320	1,090	893	1,150	1,210	1,150	1,210	670	670
2.....	828	1,150	1,330	1,300	980	910	1,150	1,210	1,150	1,200	670	670
3.....	828	1,150	1,400	1,280	1,090	928	1,150	1,210	1,210	1,170	630	670
4.....	828	1,150	1,400	1,160	1,090	980	1,150	1,280	1,280	1,150	630	670
5.....	828	1,210	1,400	1,090	980	980	1,210	1,340	1,280	1,120	630	670
6.....	828	1,400	1,400	1,000	980	980	1,280	1,340	1,340	1,100	670	710
7.....	828	1,470	1,400	1,140	980	1,040	1,340	1,340	1,250	1,080	630	758
8.....	875	1,470	1,400	1,260	980	1,040	1,340	1,400	1,250	1,130	630	710
9.....	980	1,400	1,400	1,250	980	1,040	1,400	1,470	1,250	1,080	630	710
10.....	875	1,400	1,400	1,240	980	1,040	1,400	1,470	1,250	1,020	630	710
11.....	875	1,220	1,400	1,230	928	1,040	1,470	1,470	1,250	1,020	630	758
12.....	875	1,310	1,400	1,220	980	1,040	1,400	1,470	1,320	1,020	592	805
13.....	875	1,410	1,400	1,220	980	1,040	1,470	1,550	1,250	1,020	630	858
14.....	875	1,390	1,400	1,210	980	1,040	1,280	1,600	1,510	970	630	858
15.....	875	1,340	1,400	1,200	980	1,040	1,090	1,600	1,650	910	630	858
16.....	875	1,300	1,400	1,190	980	1,090	1,040	1,640	1,440	910	630	858
17.....	875	1,220	1,340	1,190	875	1,090	1,340	1,320	1,380	910	670	910
18.....	875	1,210	1,090	1,180	780	1,040	1,280	1,710	1,320	910	670	910
19.....	875	1,210	1,040	1,150	840	1,040	1,210	1,750	1,250	858	670	910
20.....	875	1,210	1,210	1,090	1,020	828	1,210	1,680	1,250	858	710	910
21.....	928	1,210	1,400	1,210	990	875	1,280	1,900	1,190	858	710	858
22.....	1,090	1,310	1,400	1,280	970	1,040	1,340	1,320	1,190	858	710	805
23.....	1,090	1,150	1,400	1,210	950	1,040	1,400	1,610	1,190	858	710	805
24.....	1,090	980	1,390	1,210	928	1,090	1,400	1,530	1,190	805	710	858
25.....	1,090	980	1,380	980	928	1,090	1,470	1,470	1,190	805	710	858
26.....	1,090	960	1,370	828	928	1,090	1,610	1,400	1,250	758	710	858
27.....	1,090	1,020	1,360	1,090	928	1,040	1,680	1,340	1,320	758	758	910
28.....	1,090	1,120	1,350	1,090	875	980	1,680	1,340	1,320	710	710	910
29.....	1,090	1,140	1,350	1,150	-----	1,040	1,680	1,280	1,250	710	710	910
30.....	1,090	1,150	1,340	1,090	-----	1,150	1,400	1,210	1,230	710	710	910
31.....	1,090	-----	1,330	1,150	-----	1,150	-----	1,150	-----	670	710	-----

NOTE.—No gage-height record Nov. 11-17, Nov. 26 to Dec. 2, Dec. 24 to Jan. 18, Feb. 19-23, Mar. 1-2, May 13-18, June 30 to July 6.

Daily discharge, in second-feet, of Deschutes River, including canals, near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	1,450	1,400	1,370	1,330	1,100	920	1,170	1,550	1,850	2,080	1,630	1,580
2.....	1,500	1,470	1,390	1,320	990	930	1,170	1,560	1,850	2,070	1,630	1,570
3.....	1,500	1,450	1,410	1,310	1,100	950	1,170	1,560	1,850	2,050	1,590	1,580
4.....	1,470	1,450	1,410	1,300	1,100	1,000	1,180	1,620	1,930	2,030	1,590	1,590
5.....	1,500	1,510	1,410	1,300	990	1,000	1,240	1,620	1,950	2,020	1,580	1,580
6.....	1,490	1,510	1,410	1,290	990	1,020	1,310	1,710	1,970	2,000	1,630	1,580
7.....	1,480	1,580	1,410	1,280	990	1,180	1,370	1,720	2,000	1,980	1,590	1,620
8.....	1,450	1,580	1,410	1,270	990	1,060	1,360	1,780	2,010	1,980	1,590	1,570
9.....	1,500	1,510	1,410	1,260	990	1,060	1,420	1,850	2,030	1,990	1,570	1,570
10.....	1,480	1,560	1,410	1,250	990	1,060	1,420	1,900	2,030	1,950	1,590	1,560
11.....	1,450	1,520	1,410	1,240	1,000	1,050	1,530	1,930	2,040	1,930	1,590	1,570
12.....	1,450	1,470	1,410	1,230	1,000	1,050	1,460	1,930	2,120	1,930	1,550	1,590
13.....	1,450	1,430	1,410	1,230	1,000	1,050	1,530	1,970	2,060	1,940	1,590	1,640
14.....	1,440	1,390	1,410	1,220	1,000	1,050	1,500	2,010	2,130	1,890	1,590	1,640
15.....	1,430	1,340	1,410	1,210	1,000	1,050	1,410	2,040	2,170	1,830	1,590	1,600
16.....	1,430	1,300	1,410	1,200	1,000	1,100	1,360	2,080	2,200	1,830	1,590	1,590
17.....	1,430	1,250	1,400	1,200	1,000	1,100	1,300	2,110	2,200	1,830	1,610	1,630
18.....	1,440	1,210	1,350	1,190	1,080	1,050	1,300	2,150	2,090	1,850	1,540	1,610
19.....	1,450	1,250	1,350	1,180	1,060	1,080	1,230	2,190	2,110	1,780	1,530	1,600
20.....	1,450	1,240	1,440	1,120	1,040	1,070	1,230	2,120	2,110	1,790	1,550	1,620
21.....	1,440	1,240	1,410	1,220	1,010	1,060	1,300	2,100	2,060	1,790	1,550	1,550
22.....	1,430	1,250	1,410	1,290	990	1,050	1,360	2,140	2,070	1,790	1,540	1,550
23.....	1,430	1,190	1,410	1,220	970	1,050	1,440	2,030	2,060	1,790	1,550	1,550
24.....	1,420	1,190	1,400	1,320	950	1,100	1,440	1,960	2,060	1,720	1,560	1,600
25.....	1,420	1,260	1,390	1,190	950	1,110	1,500	1,910	2,080	1,720	1,570	1,570
26.....	1,400	1,280	1,380	1,040	950	1,110	1,640	1,900	2,130	1,680	1,570	1,540
27.....	1,400	1,300	1,370	1,170	950	1,160	1,710	1,840	2,170	1,680	1,620	1,600
28.....	1,420	1,320	1,360	1,100	900	1,160	1,710	1,880	2,180	1,670	1,580	1,590
29.....	1,420	1,340	1,360	1,160	-----	1,140	1,730	1,840	2,100	1,660	1,590	1,560
30.....	1,420	1,350	1,350	1,100	-----	1,170	1,610	1,810	2,100	1,660	1,610	1,550
31.....	1,420	-----	1,340	1,160	-----	1,170	-----	1,830	-----	1,720	1,620	-----

NOTE.—Discharge in this table interpolated for periods indicated in footnote to preceding table.

Monthly discharge of Deschutes River below Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	1,090	780	937	57,600
November.....	1,470	960	1,220	72,600
December.....	1,490	1,040	1,350	83,000
January.....	1,320	828	1,170	71,900
February.....	1,090	780	963	53,500
March.....	1,150	828	1,020	62,700
April.....	1,680	1,040	1,340	79,700
May.....	1,900	1,150	1,470	90,400
June.....	1,650	1,150	1,280	76,200
July.....	1,210	670	940	57,800
August.....	758	592	669	41,100
September.....	910	670	809	48,100
The year.....	1,900	592	1,100	795,000

Monthly discharge of Deschutes River, including canals, near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	1,500	1,400	1,450	89,200
November.....	1,580	1,190	1,370	81,500
December.....	1,440	1,340	1,390	85,500
January.....	1,330	1,040	1,220	75,000
February.....	1,100	900	1,000	55,500
March.....	1,180	920	1,070	65,800
April.....	1,730	1,170	1,400	83,300
May.....	2,190	1,550	1,890	116,000
June.....	2,200	1,850	2,060	123,000
July.....	2,080	1,660	1,860	114,000
August.....	1,630	1,530	1,580	97,200
September.....	1,640	1,540	1,580	94,000
The year.....	2,200	900	1,490	1,080,000

DESCHUTES RIVER AT MECCA, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 20, T. 9 S., R. 13 E., at bridge at Mecca station on Oregon Trunk Railway, Jefferson County, $1\frac{1}{2}$ miles below mouth of Shitike Creek and 12 miles above mouth of Warm Springs River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 7, 1911, to September 30, 1917.

GAGE.—Vertical staff fastened to tree on right bank 75 feet above bridge. Gage reader, William H. See.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Rock and gravel; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.7 feet April 27 (discharge, 11,600 second-feet); minimum discharge, 4,070 second-feet for several days in October, January, February, and March.

1911-1917: Maximum stage recorded, 5.75 feet March 21, 1916 (discharge, 11,700 second-feet); minimum stage recorded 1.95 feet in August and September, 1915 (discharge, 3,410 second-feet).

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

DIVERSIONS.—Flow affected by same diversions from upper Deschutes River at Bend, Laidlaw, and Cline Falls stations. Summer flow of Crooked River above head of Lower canyon near Terrebonne practically all diverted.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water April 27. Rating curves well defined between 4,000 and 6,500 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

Discharge measurements of Deschutes River at Mecca, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Apr. 13	C. L. Batchelder.....	4.52	8,570	Aug. 9	R. C. Briggs.....	2.50	4,390
May 27	.....do.....	3.70	6,600	Sept. 16	F. F. Henshaw.....	2.54	4,290
Aug. 8	R. C. Briggs.....	2.50	4,400				

Daily discharge, in second-feet, of Deschutes River at Mecca, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	4,250	4,450	4,900	4,900	4,070	4,450	5,370	7,800	6,840	5,300	4,400	4,100
2.....	4,070	4,450	4,900	4,900	4,450	4,450	5,370	7,320	6,360	5,500	4,400	4,100
3.....	4,070	4,450	4,900	4,900	4,670	4,450	4,900	7,080	6,360	5,500	4,400	4,100
4.....	4,250	4,670	4,900	4,900	4,450	4,450	4,900	7,320	6,140	5,500	4,400	4,100
5.....	4,450	4,450	4,900	4,450	4,670	4,670	5,130	7,320	6,140	5,500	4,400	4,100
6.....	4,450	4,670	4,900	4,450	4,450	4,450	5,370	7,560	5,920	5,500	4,400	4,250
7.....	4,450	4,900	4,900	4,450	4,450	4,450	6,850	7,800	5,920	5,500	4,400	4,250
8.....	4,450	4,900	4,900	4,450	4,450	4,450	7,850	8,780	6,140	5,300	4,400	4,100
9.....	4,450	4,900	4,900	4,670	4,450	4,670	8,100	9,040	6,360	5,300	4,250	4,100
10.....	4,450	4,900	4,900	4,670	4,450	4,670	8,350	9,040	6,140	5,100	4,100	4,100
11.....	4,450	4,900	4,900	4,450	4,450	4,450	7,850	9,040	5,700	5,100	4,100	4,250
12.....	4,450	4,900	4,900	4,450	4,450	4,450	8,600	9,300	5,500	5,100	4,100	4,250
13.....	4,450	4,450	4,900	4,450	4,450	4,450	8,850	9,560	5,500	5,100	4,100	4,250
14.....	4,450	4,450	4,900	4,450	4,450	4,450	7,850	9,300	5,500	5,100	4,100	4,400
15.....	4,450	4,450	4,900	4,450	4,450	4,450	7,350	9,040	5,920	5,100	4,250	4,400
16.....	4,250	4,670	4,900	4,250	4,450	4,450	6,850	8,780	6,360	5,300	4,250	4,400
17.....	4,250	4,670	4,900	4,070	4,670	4,450	6,600	8,280	6,140	5,500	4,250	4,400
18.....	4,250	4,900	4,670	4,250	4,450	4,450	6,350	7,800	5,920	5,300	4,250	4,400
19.....	4,250	4,900	4,450	4,450	4,250	4,450	6,100	7,320	5,920	5,300	4,250	4,400
20.....	4,250	4,900	4,450	4,450	4,450	4,250	5,850	7,320	5,920	5,100	4,400	4,400
21.....	4,250	4,900	4,450	4,450	4,450	4,070	6,350	7,320	5,920	5,100	4,400	4,400
22.....	4,450	4,900	4,900	4,900	4,450	4,450	7,600	7,320	5,700	5,100	4,400	4,400
23.....	4,450	4,900	4,900	4,900	4,450	4,450	7,850	6,840	5,500	4,920	4,400	4,400
24.....	4,450	4,900	4,670	4,670	4,900	4,670	9,100	6,600	5,300	4,740	4,250	4,400
25.....	4,450	4,670	4,670	4,450	4,450	4,670	10,800	6,360	5,100	4,560	4,250	4,400
26.....	4,450	4,900	4,670	4,450	4,450	4,900	10,800	6,360	5,500	4,740	4,100	4,400
27.....	4,450	4,900	4,450	4,450	4,450	5,130	11,600	6,600	5,500	4,740	4,100	4,400
28.....	4,450	4,900	4,450	4,450	4,450	5,130	10,600	6,600	5,500	4,740	4,100	4,400
29.....	4,450	4,900	4,450	4,670	-----	6,600	9,560	6,840	5,500	4,740	4,100	4,400
30.....	4,450	4,900	4,450	4,670	-----	7,100	8,780	6,840	5,300	4,560	4,100	4,400
31.....	4,450	-----	4,450	4,450	-----	5,850	-----	6,840	-----	4,400	4,100	-----

Monthly discharge of Deschutes River at Mecca, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	4,450	4,070	4,370	269,000
November.....	4,900	4,450	4,740	282,000
December.....	4,900	4,450	4,750	292,000
January.....	4,900	4,070	4,550	280,000
February.....	4,900	4,070	4,470	248,000
March.....	7,100	4,070	4,730	291,000
April.....	11,600	4,900	7,580	451,000
May.....	9,560	6,360	7,720	475,000
June.....	6,840	5,100	5,850	348,000
July.....	5,500	4,400	5,110	314,000
August.....	4,400	4,100	4,250	261,000
September.....	4,400	4,100	4,300	256,000
The year.....	11,600	4,070	5,200	3,770,000

DESCHUTES RIVER AT MOODY, NEAR BIGGS, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 26, T. 2 N., R. 15 E., opposite Moody railroad station, $1\frac{1}{2}$ miles above bridge of Oregon-Washington Railroad & Navigation Co., $1\frac{1}{2}$ miles above mouth of river, and about 5 miles southwest of Biggs, Sherman County.

DRAINAGE AREA.—About 9,180 square miles.

RECORDS AVAILABLE.—July 7, 1906, to September 30, 1917; October 19, 1897, to December 31, 1899, for a station near Moro, 10 miles above mouth of river in the NE. $\frac{1}{4}$ sec. 5, T. 1 S., R. 16 E. Records for 1908 and 1910 somewhat fragmentary.

GAGE.—Staff in two sections, the lowest inclined, the upper vertical. Gage reader, W. Ryan. At the Moro station gage was an inclined staff.

DISCHARGE MEASUREMENTS.—Made from cable about 450 feet above gage. At Moro station made from the "free bridge" 3 miles below gage.

CHANNEL AND CONTROL.—Rock and gravel; shifting only in floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.8 feet April 30 (discharge, 14,500 second-feet); minimum stage recorded, 2.25 feet September 2 to 4 (discharge, 4,350 second-feet).

1906-1917: Maximum stage recorded, 7.50 feet February 6, 1907 (discharge, 30,600 second-feet); minimum stage recorded, 1.9 feet August 18 to September 16, 1915 (discharge, 3,600 second-feet).

ICE.—Stage-discharge relation never affected by ice.

DIVERSIONS.—Summer discharge at this station has been progressively reduced since about 1904 or 1905 by diversions from the upper river. Some of this water returns but the net reduction during midsummer is now probably 15 to 20 per cent.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during flood at end of April. Rating curve used October 1 to April 29 well defined between 3,600 and 15,000 second-feet; curve used April 30 to September 30 well defined between 4,200 and 12,000 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating tables. Records excellent.

Discharge measurements of Deschutes River at Moody, near Biggs, Oreg., during the year ending Sept. 30, 1917.

[Made by C. L. Batchelder.]

Date.	Gage height.	Discharge.
May 23.....	<i>Feet.</i> 3.60	<i>Sec.-ft.</i> 8,740
Aug. 23.....	2.30	4,590

Daily discharge, in second-feet, of Deschutes River at Moody, near Biggs, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	5,000	5,600	5,600	5,600	5,300	5,300	8,200	13,500	9,250	6,600	4,600	4,600
2.....	5,000	5,600	5,600	5,600	5,600	5,300	7,500	12,500	9,250	6,600	4,600	4,350
3.....	5,000	5,600	5,600	5,600	5,600	5,300	6,800	10,600	8,800	6,600	4,600	4,350
4.....	5,000	5,600	5,600	5,300	5,600	5,300	6,500	10,200	8,800	6,600	4,600	4,350
5.....	5,000	5,600	5,600	5,300	5,900	5,300	6,800	9,700	8,400	6,600	4,600	4,600
6.....	5,000	5,600	5,600	5,300	5,600	5,600	7,500	9,250	8,400	6,600	4,600	4,600
7.....	5,000	5,600	5,600	5,300	5,600	5,600	7,800	9,700	8,000	6,600	4,600	4,600
8.....	5,000	5,600	5,600	5,300	5,600	5,900	8,200	10,200	8,000	6,300	4,600	4,600
9.....	5,000	5,600	5,600	5,300	5,300	5,300	9,300	10,600	8,400	6,300	4,600	4,600
10.....	5,000	5,600	5,600	5,300	5,300	5,300	10,100	11,500	8,400	6,300	4,600	4,600
11.....	5,000	5,600	5,600	5,300	5,300	5,300	10,100	12,500	8,400	6,300	4,350	4,600
12.....	5,000	5,600	5,600	5,300	5,300	5,300	10,500	12,000	8,400	6,300	4,350	4,600
13.....	5,000	5,300	5,600	5,300	5,300	5,300	10,100	12,500	8,000	6,010	4,350	4,600
14.....	5,000	5,300	5,600	5,300	5,300	5,300	9,700	13,000	8,000	6,010	4,350	4,600
15.....	5,000	5,300	5,600	5,300	5,300	5,300	8,900	12,500	8,000	6,010	4,350	4,870
16.....	5,000	5,300	5,600	5,300	5,300	5,300	8,200	12,000	7,600	6,010	4,600	4,870
17.....	5,000	5,300	5,600	5,300	5,300	5,300	7,850	12,000	7,600	5,720	4,600	4,870
18.....	5,000	5,300	5,600	5,300	5,300	5,300	7,850	11,500	7,600	5,720	4,600	4,870
19.....	5,000	5,300	5,300	5,300	5,300	5,300	7,500	10,600	7,600	5,720	4,600	4,870
20.....	5,000	5,300	5,300	5,300	5,300	5,300	7,500	10,200	7,600	5,720	4,600	4,870
21.....	5,000	5,300	5,300	5,300	5,300	5,300	7,500	9,700	7,600	5,720	4,600	4,600
22.....	5,000	5,300	5,300	5,300	5,300	5,600	7,850	9,250	7,600	5,430	4,350	4,600
23.....	5,000	5,300	5,300	5,300	5,300	5,900	8,200	8,800	7,600	5,430	4,600	4,600
24.....	5,000	5,300	5,300	5,300	5,300	6,200	8,550	8,800	7,250	5,430	4,600	4,600
25.....	5,000	5,300	5,300	5,300	5,300	6,200	8,900	8,800	7,250	5,150	4,600	4,600
26.....	5,000	5,300	5,300	5,300	5,300	6,200	9,300	8,400	6,900	5,150	4,600	4,600
27.....	5,300	5,600	5,300	5,300	5,300	6,500	10,500	8,400	6,900	4,870	4,600	4,600
28.....	5,300	5,600	5,300	5,300	5,300	6,800	11,400	8,800	6,600	4,870	4,600	4,600
29.....	5,300	5,300	5,300	5,300	-----	7,500	13,200	8,800	6,600	4,870	4,600	4,600
30.....	5,600	5,600	5,600	5,300	-----	8,200	14,500	9,250	6,600	4,600	4,600	4,600
31.....	5,600	-----	5,300	5,300	-----	8,550	-----	9,250	-----	4,600	4,600	-----

Monthly discharge of Deschutes River at Moody, near Biggs, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	5,600	5,000	5,070	312,000
November.....	5,600	5,300	5,450	324,000
December.....	5,600	5,300	5,480	337,000
January.....	5,600	5,300	5,330	328,000
February.....	5,900	5,300	5,390	299,000
March.....	8,550	5,300	5,810	357,000
April.....	14,500	6,500	8,860	527,000
May.....	13,500	8,400	10,500	646,000
June.....	9,250	6,600	7,850	407,000
July.....	6,600	4,600	5,830	358,000
August.....	4,600	4,350	4,550	280,000
September.....	4,870	4,350	4,630	276,000
The year.....	14,500	4,350	6,230	4,510,000

EAST FORK AT MORSON INTAKE, NEAR LAPINE, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 34, T. 23 S., R. 9 E., at private road bridge about half a mile from river road to Crescent, and 12 miles southwest of Lapine, Deschutes County. Up to July 27, 1915, and since May 19, 1917, in SE. $\frac{1}{4}$ sec. 33, T. 23 S., R. 9 E., about 500 feet below mouth of Crescent Creek, just above proposed intake for Deschutes Land Co., Carey Act segregation.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 26, 1914, to September 14, 1917, except winter periods. Station discontinued.

GAGE.—Vertical staff nailed to bent of bridge; vertical staff nailed to a tree root at upstream site. Friez water-stage recorder used August 12 to November 21, 1914. Gage reader, George M. Mayfield.

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

CHANNEL AND CONTROL.—Bed composed of gravel and sand, with steep banks of silt, overgrown with brush; may shift. in floods. Channel divided by an island just below bridge.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.73 feet at upper gage, June 12 (discharge, 835 second-feet), minimum stage recorded, 1.12 feet at lower (bridge) gage, October 25 and 28 (discharge, 100 second-feet).

1914-1917: Maximum stage is that of 1917; flood of November 25, 1909, may have reached 1,800 second-feet (estimated from records at Allen's ranch). Minimum stage recorded, 0.40 foot September 3 to 11, 1915 (discharge, 40 second-feet).

ICE.—Stream is frozen two or three months; no winter records have been obtained.

DIVERSIONS.—A few small ditches divert water above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent at bridge gage while record was obtained there. At gage above Morson intake stage-discharge relation changed during spring high water. Rating curve for bridge gage fairly well defined between 100 and 500 second-feet. For gage above Morson intake curve fairly well defined throughout. Gage read once on days for which discharge record is given. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of East Fork at Morson intake, near Lapine, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.		Discharge.		
		Upper gage.	Bridge gage.	River at bridge gage.	Morson canal.	Total river above Morson canal.
		<i>Feet.</i>	<i>Feet.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>	<i>Sec.-ft.</i>
Oct. 13	C. L. Batchelder.....	.....	1.15	104	0	104
May 13	F. F. Henshaw.....	.....	4.45	722	0	722
June 2	Briggs and Batchelder.....	.....	2.75	350	230	580
Aug. 14	R. C. Briggs.....	6.45	2.90	391	326	717
Aug. 19	.....do.....	4.42	0.51	41	116	157

Daily discharge, in second-feet, of East Fork at Morson intake, near Lapine, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	May.	June.	July.	Aug.	Sept.
1	110	108	161					
2					580	480		
3	110	112	161				238	152
4								
5	110	135	156			480	192	
6								
7	108	132	156					
8								143
9	108	135	152			450		
10							172	134
11	104	132				435		
12					835		168	
13	104	128		722				
14					732	420		125
15	104	135						
16						420		
17	104	135					162	
18						405		
19	104	135		698	766		156	
20								
21	104	132				390		
22					732			
23	104	135				390		
24							156	
25	100	135			616			
26								
27		156						
28	100				540	349		
29		164						
30	104					286		
31								

Monthly discharge of East Fork River at Morson intake, near Lapine, Oreg., for the year ending Sept. 30, 1917.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October	105	6,460	July	410	25,200
November	134	7,970	August	178	10,900
December 1-9	157	2,800	September 1-14	138	3,830
June	686	40,800			

NOTE.—Monthly mean discharge is average of discharge determined for days when gage was read.

ARNOLD CANAL NEAR BEND, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 23, T. 18 S., R. 11 E., about a mile below intake of canal and 9 miles south of Bend, Deschutes County.

RECORDS AVAILABLE.—April 10, 1914, to September 30, 1917; information sufficient for a rough estimate October, 1912, to March, 1914.

GAGE.—Vertical staff on right side of flume 400 feet below a spillway, installed May 12, 1917; staff on left side just below spillway used May 1, 1915, to December 2, 1916. A gage one-half mile above, in the NE. $\frac{1}{4}$ sec. 27, was used up to April 30, 1915. Gage readers, Joe Stenkamp and B. Tekampe.

DISCHARGE MEASUREMENTS.—Made from collar of flume near gage.

CHANNEL AND CONTROL.—Flume 12 to 14 feet wide; fairly steep gradient.

EXTREMES OF DISCHARGE.—1914-1917: Maximum stage recorded, 2.18 feet June 23 and 27, 1917 (discharge, 114 second-feet); canal dry at various times during year.

ACCURACY.—Stage-discharge relation not permanent. Rating curves applicable as follows: Curve well defined below 100 second-feet, October 1 to December 2; fairly well defined curve applicable directly, May 2 to June 2, and by shifting-control method, June 4 to 19; curve well defined between 30 and 110 second-feet, June 21 to September 30. Gage read to hundredths once each day when water was flowing, October to December; and on alternate days, May to September. Daily discharge ascertained by applying daily gage height to rating table, interpolating for days when gage was not read. Records good except for May and June, for which they are fair.

Arnold canal diverts water from the right bank of Deschutes River at the head of Lava Island, in the SW. $\frac{1}{4}$ sec. 27, T. 18 S., R. 11 E., and irrigates land south and east of Bend lying above the Central Oregon Irrigation Co.'s Carey Act segregation.

Discharge measurements of Arnold canal near Bend, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.		Dis-charge.
		Old gage.	New Gage. ^a	
		<i>Fect.</i>	<i>Fect.</i>	<i>Sec.-ft.</i>
Oct. 20	Batchelder and Reineking.....	1.55		67
May 12	F. F. Henshaw.....	.80	1.06	27.1
29	C. L. Batchelder.....	.95	1.22	33.4
June 4	Briggs and Batchelder.....	1.20	1.45	50
Aug. 15	R. C. Briggs.....	1.71	2.10	106
22	do.....	1.28	1.63	70

^a Installed May 12, 1917.

Daily discharge, in second-feet of Arnold canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	May.	June.	July.	Aug.	Sept.
1.....	72	49	41		34	108	101	106
2.....	72	52	41	4	45	106	106	106
3.....	72	52		8	48	106	110	106
4.....	72	52		8	50	104	110	104
5.....	72	52		8	53	102	108	102
6.....	68	46		8	56	104	106	102
7.....	68	46			62	106	106	104
8.....	72	46			67	106	106	106
9.....	72	46			78	106	106	106
10.....	72	46		26	78	106	106	106
11.....	72	46		26	78	106	110	106
12.....	72	23		26	77	106	108	106
13.....	72			27	86	106	106	102
14.....	68			28	89	106	106	98
15.....	68			28	92	106	106	74
16.....	68			28	95	106	106	74
17.....	68			28	98	106	106	74
18.....	68			29	107	106	106	74
19.....	68	31		24	110	106	88	74
20.....	68	19		19	110	106	70	76
21.....	68	19		14	110	98	70	78
22.....	65	27			112	98	70	78
23.....	65	36			114	98	80	76
24.....	62	36		17	112	96	90	74
25.....	62	36		24	110	94	106	76
26.....	62	36		34	112	96	106	78
27.....	62	41		34	114	99	106	78
28.....	62	41		34	112	102	106	78
29.....	62	41		34	110	100	106	78
30.....	62	41		34	110	98	106	78
31.....	62			34		100	106	

NOTE.—Canal dry Nov. 13-18, Dec. 3 to May 1, May 7-9, and May 22-23. Gage heights May 2-6 and 10-11 estimated by observer on May 12.

Monthly discharge of Arnold canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	72	62	67.7	4,180
November (24 days).....	52	19	40.0	1,900
December (2 days).....	41	41	41.0	163
May (25 days).....	34	4	23.4	1,160
June.....	114	34	87.6	5,210
July.....	108	94	103	6,330
August.....	110	70	101	6,210
September.....	106	74	89.3	5,310
The year.....				30,400

CENTRAL OREGON CANAL NEAR BEND, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 7, T. 18 S., R. 12 E., at a flume section about half a mile below point where waters in main diversion canal are divided between this canal and Pilot Butte canal, about 2 miles south of Bend, Deschutes County.

RECORDS AVAILABLE.—May 11, 1905, to September 30, 1917.

GAGE.—Vertical enameled staff nailed to inside of flume on right side. Gage reader, J. A. Watson.

DISCHARGE MEASUREMENTS.—Made from yoke of flume at gage section.

CHANNEL AND CONTROL.—A plank flume of rectangular cross section with battened seams. Flume rather unstable but the rating appears not to change.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year and during period 1905-1917, 3.78 feet at 5 p. m. August 14 (discharge 385 second-feet). Canal dry at various times during year.

ICE.—Canal operated in winter but only during periods of moderately cold weather, for furnishing water for domestic use. The velocity of the water passing the gage is sufficient to maintain open channel at all times.

Central Oregon canal diverts water from the right bank of Deschutes River in the NE. $\frac{1}{4}$ sec. 13, T. 18 S., R. 12 E., and irrigates land lying to the east of Bend and in the vicinity of Powell Buttes.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good for irrigating season; fair for period November to March.

COOPERATION.—Gage record height furnished by Central Oregon Irrigation Co.

Discharge measurements of Central Oregon canal near Bend, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis- charge.
May 31	Briggs and Batchelder.....	<i>Feet.</i> 3.20	<i>Sec.-ft.</i> 317
Aug. 14	R. C. Briggs.....	3.78	391

Daily discharge, in second-feet, of Central Oregon canal near Bend, Oreg., for the year ending Sept. 30 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.	272		74					170	299	355	385	355
2.	272		13					182	299	355	385	355
3.	272							182	299	355	385	355
4.	246			47				170	299	355	385	370
5.	272			134				170	299	370	385	370
6.	272			127				182	261	370	385	370
7.	259							182	327	370	385	270
8.	207							182	327	299	385	370
9.	170							182	327	370	370	370
10.	246	57						194	313	370	385	370
11.	220	182						220	327	370	385	355
12.	220	106						220	327	370	385	341
13.	220							194	327	370	385	341
14.	220						120	182	327	370	385	341
15.	220						170	220	341	370	385	341
16.	220						170	220	341	370	385	341
17.	220		54		97		57	220	341	370	385	341
18.	220		140		152			220	341	385	355	341
19.	207		170		82		24	220	355	370	355	327
20.	207		64			112		220	355	370	355	327
21.	155					50		9	355	385	355	327
22.								128	355	385	355	327
23.								220	355	385	355	327
24.		20						220	355	370	355	327
25.		57		84				220	370	370	355	299
26.		92		92				246	355	370	355	272
27.		123		24		97		246	355	370	355	272
28.		123				158		259	355	385	355	272
29.		123				86	18	272	355	385	355	246
30.		123					97	285	355	385	355	246
31.								299		385	355	.....

NOTE.—Canal dry during periods for which no discharge is given.

Monthly discharge of Central Oregon canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October (21 days).....	272	155	229	9,540
November (10 days).....	182	20	101	2,000
December (6 days).....	170	13	85.8	1,020
January (6 days).....	134	24	84.7	1,010
February (3 days).....	152	82	110	655
March (6 days).....	158	24	87.8	1,040
April (6 days).....	170	18	105	1,250
May.....	299	9	204	12,500
June.....	370	261	333	19,800
July.....	385	299	370	22,800
August.....	385	355	371	22,800
September.....	370	246	332	19,800
The year.....				114,000

PILOT BUTTE CANAL NEAR BEND, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 7, T. 18 S., R. 12 E., at a point in canal directly opposite gaging station on Central Oregon canal half a mile below point where waters are divided between this canal and Central Oregon canal and about 2 miles south of Bend, Deschutes County.

RECORDS AVAILABLE.—March 6, 1905, to September 30, 1917.

GAGE.—Vertical staff on right bank. Gage reader, J. A. Watson.

DISCHARGE MEASUREMENTS.—Made by wading at the gage.

CHANNEL AND CONTROL.—Bed composed of gravel and sand. Control partly solid rock; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 1.80 feet, October 1 to 8 (discharge 42 second-feet). Canal dry at various times.

1905-1917: Maximum stage recorded 3.10 feet, June 8, 11 to 16, July 19 to 21, 1913 (discharge 244 second-feet). Canal dry at various times.

ICE.—Canal operated intermittently during winter to provide water for stock and domestic use. Stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation changed during year. Rating curve used October 1 to 8 well defined between 15 and 60 second-feet. Curve used from October 16 to September 30 fairly well defined between 15 and 44 second-feet. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Pilot Butte canal diverts water from the right bank of Deschutes River in the NE. $\frac{1}{4}$ sec. 13, T. 18 S., R. 12 E., in a flume common to it and the Central Oregon canal for irrigating lands lying mostly north of Bend and extending nearly to Crooked River. North canal also diverts water into the Pilot Butte.

Discharge measurements of Pilot Butte canal near Bend, Oreg., during the year ending Sept. 30 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 20	Batchelder and Reineking	1.45	17.7	Aug. 15	R. C. Briggs	1.71	39.4
May 31	Batchelder and Briggs	1.46	17.1	21	.....do.....	1.72	36.8

Daily discharge, in second-feet, of Pilot Butte canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	42	.....	10	.....	.....	.....	.....	20	18	24	35	35
2.....	42	.....	.....	.....	.....	.....	.....	20	18	29	35	35
3.....	42	.....	.....	.....	.....	.....	.....	20	18	35	35	35
4.....	42	.....	.....	15	.....	.....	.....	20	18	35	35	35
5.....	42	.....	.....	35	.....	.....	.....	20	18	35	35	35
6.....	42	.....	.....	26	.....	.....	.....	20	19	35	35	35
7.....	42	.....	.....	.....	.....	.....	.....	20	20	26	35	35
8.....	17	.....	.....	.....	.....	.....	.....	20	24	35	35	35
9.....	.....	.....	.....	.....	.....	.....	.....	20	20	35	35	35
10.....	.....	.....	.....	.....	.....	.....	.....	20	20	35	35	35
11.....	.....	12	.....	.....	.....	.....	.....	20	19	18	35	35
12.....	.....	31	.....	.....	.....	.....	.....	20	24	35	35	35
13.....	.....	20	.....	.....	.....	.....	.....	24	24	35	35	35
14.....	.....	.....	.....	.....	.....	.....	11	20	24	35	35	35
15.....	.....	.....	.....	.....	.....	.....	20	20	24	35	35	35
16.....	.....	.....	.....	.....	.....	.....	20	20	24	35	35	35
17.....	.....	.....	.....	.....	12	.....	7	20	24	35	35	35
18.....	4	.....	.....	.....	15	.....	.....	20	24	35	35	35
19.....	15	.....	.....	.....	8	4	.....	20	24	35	35	35
20.....	15	.....	.....	.....	.....	15	.....	20	24	35	35	35
21.....	11	.....	.....	.....	.....	6	.....	1	24	35	35	35
22.....	.....	.....	.....	.....	.....	.....	.....	11	27	35	35	35
23.....	.....	.....	.....	.....	.....	.....	.....	20	20	35	35	35
24.....	.....	6	.....	.....	.....	.....	.....	20	24	35	35	35
25.....	.....	20	.....	12	.....	.....	.....	20	24	35	35	27
26.....	.....	27	.....	8	.....	.....	.....	20	24	35	35	24
27.....	.....	27	.....	.....	.....	.....	.....	20	24	35	35	27
28.....	.....	27	.....	.....	.....	.....	.....	20	24	35	35	27
29.....	.....	27	.....	.....	.....	.....	3	20	24	35	35	29
30.....	.....	27	.....	.....	.....	.....	15	20	24	35	35	24
31.....	.....	.....	.....	.....	.....	.....	.....	19	.....	35	35	.....

NOTE.—Canal dry during periods for which no discharge is given.

Monthly discharge of Pilot Butte canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October (12 days).....	42	4	29.7	707
November (30 days).....	31	6	22.4	444
December (1 day).....	10	10	10.0	20
January (5 days).....	35	8	19.2	190
February (3 days).....	15	8	11.7	70
March (3 days).....	15	4	8.3	49
April (6 days).....	20	3	12.7	151
May.....	24	1	19.2	1,180
June.....	27	18	22.2	1,320
July.....	35	18	33.6	2,070
August.....	35	35	35.0	2,150
September.....	35	24	33.3	1,980
The year.....				10,300

NORTH CANAL NEAR BEND, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 29, T. 17 S., R. 13 E., about 500 feet below bridge on road to Tumalo, a quarter of a mile below intake, and about a mile north of Bend, Deschutes County.

RECORDS AVAILABLE.—June 14, 1913, to September 30, 1917.

GAGE.—Painted on left side of concrete lining of flume. Gage reader, C. Orewiler.

DISCHARGE MEASUREMENTS.—Made from plank across canal.

CHANNEL AND CONTROL.—Concrete-lined section extends about 1,000 feet below gage; below this point the canal is unlined and sides and bottom are very rough. Changes in unlined section affect stage-discharge relation.

EXTREMES OF DISCHARGE.—1913–1917: Maximum stage recorded 5.57 feet during parts of July, August, and September, 1917 (discharge, 340 second-feet). Canal dry at various times.

ICE.—Only a small quantity of water diverted in winter for stock; stage-discharge relation not affected by ice.

ACCURACY.—Stage-discharge relation changed by repairs to canal while water was out during latter part of March. Two well-defined rating curves used, one applicable before, the other after April 1. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Record excellent except for November and April; only fair for these months because of uncertainty as to length of time water was running during days when it was turned in or out.

North canal diverts water from the right bank of Deschutes River at a concrete dam about 60 feet high, in the NE. $\frac{1}{4}$ sec. 29, T. 17 S., R. 13 E., and extends eastward for about a mile, where it discharges the water into Pilot Butte canal.

DESCHUTES RIVER BASIN.

45

Discharge measurements of North canal near Bend, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Apr. 12..	C. L. Batchelder	<i>Feet.</i> 1.20	<i>Sec.-ft.</i> 32.9	June 13..	R. C. Briggs.....	<i>Feet.</i> 5.19	<i>Sec.-ft.</i> 301
May 29..	do.....	3.85	195	Aug. 14	do.....	5.54	339
May 31..	Briggs and Batchelder	4.55	245				

Daily discharge, in second-feet, of North canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.
1.....	217	203						106	277	312	340	340
2.....	217	203		9				100	277	312	340	340
3.....	217	182		26				100	277	312	340	340
4.....	217	182		65				100	281	312	340	340
5.....	217	182		130				100	294	321	340	330
6.....	217			130		27		119	294	321	340	294
7.....	217			130		118		133	294	321	340	285
8.....	217							133	303	321	340	285
9.....	217							133	303	321	340	285
10.....	217							147	303	321	340	269
11.....	217				51		33	154	303	330	340	245
12.....	217						33	147	303	321	340	237
13.....	217						33	133	306	321	340	237
14.....	217						64	133	117	321	340	237
15.....	203						106	133		321	340	221
16.....	203						106	133	238	321	340	213
17.....	203	32						133	303	321	340	197
18.....	203		107		107			133	232	330	303	182
19.....	217		136	20	130			133	303	330	303	189
20.....	217		161	20		97		133	303	330	303	205
21.....	217					112		133	312	330	303	221
22.....	217							133	312	330	303	237
23.....	217						17	133	312	330	303	245
24.....	203	136		102			17	133	312	330	303	245
25.....	203	161		102			8	133	312	330	303	245
26.....	189	161		102				161	312	330	303	245
27.....	189	80		51				161	285	340	303	245
28.....	203							182	294	340	312	237
29.....	203							196	294	340	321	229
30.....	203						60	228	312	340	330	229
31.....	203							258		340	340	.....

NOTE.—No flow during periods for which discharge is not given.

Monthly discharge of North canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	217	189	211	13,000
November (10 days).....	203	32	152	3,020
December (3 days).....	161	107	135	803
January (12 days).....	130	9	73.9	1,760
February (3 days).....	130	51	96.0	571
March (4 days).....	118	27	88.5	702
April (10 days).....	106	8	47.7	946
May.....	258	100	141	8,670
June (29 days).....	312	117	289	16,600
July.....	340	312	326	20,000
August.....	340	303	326	20,000
September.....	340	182	255	15,200
The year.....				101,000

SWALLEY CANAL NEAR BEND, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 29, T. 17 S., R. 12 E., about 100 yards above road crossing, a quarter of a mile below intake of canal at North canal dam and about $1\frac{1}{2}$ miles north of Bend, Deschutes County.

RECORDS AVAILABLE.—June 1, 1913, to September 30, 1917.

GAGE.—Vertical staff on right bank at lower end of intake flume. Gage readers, Charles Orewiler and Arch Hogue.

DISCHARGE MEASUREMENTS.—Made from plank laid across flume.

CHANNEL AND CONTROL.—Earth canal of regular cross section and practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 2.30 feet at 5 p. m. July 10 (discharge, 102 second-feet). Canal dry at various times.

1913–1917: Maximum and minimum stages were those of 1917.

ICE.—Stage-discharge relation unaffected; no water carried during extremely cold weather.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Revision of curve above 60 second-feet necessitated by measurements at higher stage. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent for irrigating season and good for the rest of the year.

Swalley canal diverts water from the right bank of Deschutes River at the North canal dam in the NE. $\frac{1}{4}$ sec. 29 and irrigates the Carey Act segregation of the Deschutes Reclamation & Irrigation Co., north of Bend and west of the Pilot Butte tract.

Discharge measurements of Swalley canal near Bend, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 20	Batchelder and Reineking.....	1.81	65	May 31	Briggs and Batchelder..	1.78	63
Apr. 11	C. L. Batchelder.....	1.04	25.4	June 13	R. C. Briggs.....	1.78	65
May 29	.....do.....	^a 1.28	32.5	Aug. 14	.....do.....	2.21	96

^a Stage-discharge relation may have been temporarily affected by obstruction in the canal.

Daily discharge in second-feet of Swalley canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1.....	65	62	7.5	7.5	7.5	23	18	43	72	68	94	72
2.....	65	62	4.0	7.5	7.5	23	18	43	62	72	90	68
3.....	65	62	7.5	7.5	7.5	23	23	43	.....	72	94	72
4.....	65	62	7.5	7.5	7.5	18	26	43	.....	76	90	72
5.....	65	62	7.5	7.5	7.5	18	26	43	9.5	72	86	72
6.....	65	62	7.5	7.5	7.5	18	26	43	.....	72	94	68
7.....	65	62	7.5	7.5	7.5	18	26	43	43	76	94	68
8.....	65	62	7.5	7.5	7.5	18	23	43	43	86	94	68
9.....	65	62	7.5	7.5	7.5	18	23	43	56	82	90	68
10.....	65	62	7.5	7.5	7.5	18	23	43	65	94	90	68
11.....	65	62	7.5	7.5	23	14	23	43	65	86	90	72
12.....	65	.....	7.5	7.5	23	14	23	43	65	82	94	68
13.....	65	.....	7.5	7.5	23	14	23	43	65	86	94	68
14.....	65	.....	7.5	7.5	23	12	23	43	62	82	90	68
15.....	65	.....	7.5	7.5	23	12	23	43	62	86	94	68
16.....	65	.....	7.5	7.5	23	12	23	43	62	86	94	68
17.....	65	.....	7.5	7.5	23	12	23	43	53	86	76	72
18.....	65	.....	7.5	7.5	23	14	23	43	65	82	76	72
19.....	65	7.5	7.5	7.5	23	14	23	43	65	79	76	68
20.....	65	7.5	7.5	7.5	23	14	23	43	65	86	79	65
21.....	65	7.5	7.5	7.5	23	14	23	43	65	86	76	65
22.....	62	7.5	7.5	7.5	23	14	23	43	72	86	65	65
23.....	62	7.5	7.5	7.5	23	14	23	43	68	86	65	62
24.....	62	7.5	7.5	7.5	23	14	26	43	68	86	65	65
25.....	62	7.5	7.5	7.5	23	18	26	43	72	86	65	65
26.....	62	7.5	7.5	7.5	23	18	26	43	79	86	65	62
27.....	62	7.5	7.5	7.5	23	18	26	43	72	94	65	65
28.....	62	7.5	7.5	7.5	23	18	28	43	72	94	65	65
29.....	62	7.5	7.5	7.5	.....	18	28	38	72	94	65	65
30.....	62	7.5	7.5	7.5	.....	18	36	36	72	94	72	65
31.....	62	.....	7.5	7.5	.....	18	.....	65	.....	94	72	.....

NOTE.—No flow during periods for which no discharge is given.

Monthly discharge of Swalley canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	65	62	64.0	3,940
November (23 days).....	62	7.5	33.6	1,530
December.....	7.5	4	7.39	454
January.....	7.5	7.5	7.50	461
February.....	23	7.5	17.4	966
March.....	23	12	16.4	1,010
April.....	36	18	24.2	1,440
May.....	65	36	43.3	2,660
June (27 days).....	79	9.5	62.6	3,350
July.....	94	68	83.8	5,150
August.....	94	65	81.3	5,000
September.....	72	62	67.6	4,020
The year.....	.....	.....	.....	30,000

TUMALO CREEK NEAR BEND, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 23, T. 17 S., R. 11 E., a quarter of a mile above diversion dam of feed canal of Tumalo project, half a mile below highway bridge on Bend-Sisters road. 4 miles above mouth, and 4 miles northwest of Bend, Deschutes County.

DRAINAGE AREA.—57 square miles.

RECORDS AVAILABLE.—October 6, 1906, to September 30, 1917. Until May, 1914, this station was maintained only in winter.

GAGE.—Since April 27, 1915, Stevens' continuous water-stage recorder referred to vertical staff nailed to overhanging stump. Staff gage read November, 1910, to April 26, 1915. Observers, T. G. Becker and F. H. Dayton. Previous records at different site.

DISCHARGE MEASUREMENTS.—At ordinary stages, made by wading near the gage; at flood stages, from a large tree fallen across stream about 200 yards below gage.

CHANNEL AND CONTROL.—Rocks and gravel; not likely to shift greatly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.58 feet at 10 p. m. June 16 (discharge, 417 second-feet); minimum stage recorded 0.98 foot at 7 a. m. March 20 (discharge, 31 second-feet).

1906-1917: Maximum stage recorded, 3.8 feet at old gage, November 14, 1906 (discharge, estimated from extension of rating curve, 820 second-feet). The peak of the flood of November, 1909, was probably considerably greater. Minimum stage recorded was that of 1917.

ICE.—Stage-discharge relation considerably affected by ice during extremely cold weather.

DIVERSIONS.—Columbia southern canal and Anderson ditch divert water, above the station. Water was diverted into Columbia southern canal continuously beginning October 24, to supply water for sawmill of Pine Tree Lumber Co. Meter measurements were made as follows:

	Second-feet.
At former gaging station near intake: June 1.....	33.6
At mill:	
June 1.....	21.6
Aug. 21.....	5.6

From these measurements and information furnished by Fred N. Wallace, project manager, and by the observer on Tumalo Creek, monthly diversion has been estimated for the purpose of determining the total flow of Tumalo Creek. From August 13 to September 30 water was diverted into the head of Tumalo Creek from Crater Creek, a tributary of Deschutes River. Discharge measured at an 8-foot Cippoletti weir at the divide where the waters pass into the Tumalo Creek drainage basin is given in a following table.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice for various periods, November to March. Rating curve well defined between 45 and 250 second-feet. Curve used is a revision of that used for 1916. Operation of water-stage recorder satisfactory from June 1 to September 30; previous to June 1 intake to well was stopped up and two readings a day on outside staff gage were made. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting gage-height graph or by averaging the two daily gage readings. Records good, except for periods when stage-discharge relation was affected by ice as shown in footnote to table of daily discharge.

Discharge measurements of Tumalo Creek near Bend, Oreg. during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 17	Batchelder and Reinking.	1.38	a 63	June 1	Batchelder and Briggs..	1.86	178
Apr. 11	C. L. Batchelder.....	1.17	44.9	Aug. 16	R. C. Briggs.....	1.45	100
May 1	F. F. Henshaw.....	1.35	a 64.5		.....do.....	1.45	a 89.3

a Measured in feed canal.

Daily discharge, in second-feet, of Tumalo Creek near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	70	60	60	60	60	57	38	60	194	208	98	70
2.....	70	70	60	60	60	58	40	62	181	252	98	77
3.....	67	77	63	60	60	59	37	65	168	282	98	74
4.....	67	74	62	60	60	60	38	67	163	282	92	68
5.....	67	60	63	60	60	60	44	70	181	282	85	67
6.....	67	60	62	62	60	58	40	85	208	267	81	70
7.....	67	60	62	60	58	56	45	90	252	252	81	67
8.....	67	60	62	60	56	40	44	88	252	252	74	63
9.....	67	60	61	60	54	42	42	107	298	267	77	63
10.....	67	60	61	60	54	42	42	120	237	252	81	67
11.....	67	60	61	60	54	41	46	139	194	267	65	65
12.....	67	59	61	60	53	41	45	151	194	267	65	63
13.....	67	59	60	60	51	41	51	144	194	237	72	65
14.....	65	58	62	60	49	41	53	146	222	208	88	63
15.....	65	57	60	60	49	40	53	149	267	252	83	63
16.....	68	57	58	60	49	40	51	130	315	252	83	65
17.....	68	56	59	60	44	40	49	122	332	252	88	67
18.....	68	55	60	60	49	40	49	111	315	237	85	67
19.....	68	54	60	60	47	39	49	102	332	222	77	62
20.....	68	54	54	60	48	31	51	100	315	194	77	60
21.....	68	53	60	60	49	36	49	96	332	168	85	58
22.....	67	52	60	60	50	39	52	94	298	168	79	56
23.....	67	52	60	60	51	38	60	102	267	194	75	57
24.....	46	51	60	60	52	38	62	105	252	161	79	51
25.....	48	67	60	60	53	38	72	100	237	139	77	50
26.....	54	62	60	60	54	38	81	107	237	149	77	52
27.....	56	70	60	60	55	45	77	116	237	144	67	56
28.....	56	67	60	60	56	45	70	139	252	125	63	58
29.....	58	60	60	60	.....	42	68	181	237	111	63	58
30.....	58	60	60	60	.....	39	63	181	208	100	70	59
31.....	60	.....	60	60	.....	38	.....	181	.....	100	70	.....

NOTE.—Stage-discharge relation affected by ice Nov. 12-23; Dec. 6-12, 15, 24-31; Jan. 1-4, 12-27, 30, 31; Feb. 1-3, 20-28; Mar. 1-3, 6, 11-17, and 31; discharge estimated. Discharge interpolated Oct. 20-22.

Monthly discharge of Tumalo Creek near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	70	46	64.0	3,940
November.....	77	51	60.1	3,580
December.....	63	54	60.4	3,710
January.....	62	60	60.1	3,700
February.....	60	44	53.4	2,870
March.....	60	31	43.9	2,700
April.....	81	37	52.0	3,090
May.....	181	60	113	6,950
June.....	332	163	246	14,600
July.....	282	100	211	13,000
August.....	98	63	79.1	4,860
September.....	77	50	62.7	3,730
The year.....	332	31	92.3	66,800

Daily discharge, in second-feet, of Crater Creek near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1.....		20.0	11.....		8.5	21.....	24.3	8.5
2.....		17.3	12.....		8.5	22.....	21.8	8.5
3.....		14.4	13.....	24.9	8.5	23.....	22.5	8.5
4.....		14.4	14.....	24.7	8.5	24.....	21.1	8.5
5.....		14.1	15.....	22.5	8.5	25.....	17.6	8.5
6.....		13.7	16.....	21.9	8.5	26.....	15.6	8.5
7.....		9.9	17.....	22.4	8.5	27.....	15.6	8.5
8.....		10.6	18.....	20.6	8.5	28.....	17.3	8.5
9.....		11.3	19.....	19.7	8.5	29.....	17.3	8.5
10.....		8.5	20.....	22.6	8.5	30.....	17.4	8.5
						31.....	20.2	

NOTE.—Discharge estimated for the period Sept. 11 to Sept. 30.

Monthly discharge of Tumalo Creek and Columbia Southern canal less Crater Creek near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.					Run-off (total in acre-feet).
	Tumalo Creek.	Canal.	Total.	Crater Creek.	Difference.	
October.....	64.0	3.9	67.9	0	67.9	4,180
November.....	60.1	11.6	71.7	0	71.7	4,270
December.....	60.4	0	60.4	0	60.4	3,710
January.....	60.1	0	60.1	0	60.1	3,700
February.....	53.4	8.6	62.0	0	62.0	3,440
March.....	43.9	15.0	58.9	0	58.9	3,620
April.....	52.0	15.0	67.0	0	67.0	3,990
May.....	113	20.0	133	0	133	8,180
June.....	246	47.0	293	0	293	17,400
July.....	211	55.0	266	0	266	16,400
August.....	79.1	15.0	94.1	12.6	81.5	5,010
September.....	62.7	15.0	77.7	10.1	67.6	4,020
The year.....	92.3	17.2	109	.....	107	77,960

TUMALO FEED CANAL NEAR BEND, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 23, T. 17 S., R. 11 E., in concrete-lined section, about 300 feet below diversion dam, half a mile below bridge across Tumalo Creek on road from Bend to Sisters, and 4 miles from Bend, Deschutes County.

RECORDS AVAILABLE.—May 21, 1914, when water was first diverted, to September 30, 1917.

GAGE.—Painted on sloping concrete lining. Gage readers, T. G. Becker and F. H. Dayton.

DISCHARGE MEASUREMENTS.—Made from a footbridge at gage.

CHANNEL AND CONTROL.—Trapezoidal concrete section; the control is the sand trap just above the intake to a steel flume.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.30 feet June 2 to July 20 (discharge, 148 second-feet). Canal dry at various times.

1914-1917: Maximum stage recorded, 3.80 feet May 4, 5, and 6, 1916 (discharge, 219 second-feet).

ICE.—Water has to be turned out in extremely cold weather.

ACCURACY.—Stage-discharge relation changed in March by work on canal below station; affected by ice at times during December (see footnote to table of daily discharge). Rating curve used October 1 to March 15 fairly well defined; curve used March 16 to September 30 well defined between 40 and 150 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good October to March; excellent for the rest of year.

Tumalo feed canal diverts water from Tumalo Creek in the SE. $\frac{1}{4}$ sec. 23, T. 17 S., R. 11 E., into the Tumalo project reservoir. Some land is also watered directly from the canal.

Discharge measurements of Tumalo feed canal near Bend, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Oct. 17	Batchelder and Reineking.....	<i>Feet.</i> 2.51	<i>Sec.-ft.</i> 63	June 1	Briggs and Batchelder.....	<i>Feet.</i> 3.10	<i>Sec.-ft.</i> 132
May 1	F. F. Henshaw.....	2.40	64	Aug. 16	R. C. Briggs.....	2.74	89

Daily discharge, in second-feet, of Tumalo feed canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	74	56	59	-----	-----	-----	30	64	136	148	96	72
2.....	70	66	59	13	-----	-----	30	64	148	148	96	76
3.....	70	70	62	19	5	-----	28	68	148	148	96	72
4.....	66	66	59	19	15	17	28	72	148	148	92	68
5.....	70	59	62	19	17	17	37	72	148	148	88	68
6.....	66	59	60	23	21	6	34	88	148	148	80	72
7.....	66	59	60	12	28	17	41	88	148	148	80	68
8.....	66	59	60	8	52	17	37	84	148	148	76	64
9.....	66	59	60	19	52	4	34	106	148	148	76	64
10.....	66	59	60	34	52	-----	16	111	148	148	72	68
11.....	66	59	60	59	52	-----	-----	131	148	148	72	64
12.....	66	52	60	42	52	-----	-----	136	148	148	72	64
13.....	66	24	59	-----	49	-----	16	131	148	148	72	64
14.....	66	-----	56	-----	46	-----	47	131	148	148	88	60
15.....	66	-----	46	-----	46	-----	47	111	148	148	88	64
16.....	66	35	56	-----	46	15	44	80	148	148	88	64
17.....	66	17	58	-----	35	15	44	80	148	148	92	64
18.....	66	17	59	-----	46	15	44	80	148	148	92	64
19.....	66	17	59	-----	40	17	44	80	148	148	84	64
20.....	66	17	52	-----	46	12	47	80	148	148	84	64
21.....	66	17	59	-----	38	19	44	80	148	142	88	64
22.....	66	20	59	19	35	28	50	80	148	136	88	56
23.....	66	21	59	21	38	23	64	80	148	148	80	56
24.....	40	23	59	21	40	26	64	80	148	136	80	53
25.....	43	26	59	21	23	27	76	101	148	126	80	53
26.....	52	59	59	21	-----	27	84	106	148	131	80	56
27.....	49	66	59	21	-----	38	80	116	148	131	72	56
28.....	52	62	42	23	-----	38	72	136	148	121	64	60
29.....	56	59	-----	23	-----	34	72	136	148	106	68	60
30.....	56	59	-----	6	-----	32	68	136	148	96	72	60
31.....	56	-----	-----	-----	-----	41	-----	136	-----	96	68	-----

NOTE.—Stage-discharge relation affected by ice and daily discharge estimated Dec. 6-12, 15, and 24-28. No gage readings Jan. 2, 3, 22-26, Mar. 4-9, 16, and 17; discharge estimated from observer's notes. Discharge interpolated Oct. 20-22 and Aug. 4. Canal dry on days for which no discharge is given.

Monthly discharge of Tumalo feed canal near Bend, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	74	40	62.6	3,850
November (28 days).....	70	17	45.1	2,500
December (28 days).....	62	42	58.2	3,230
January (20 days).....	59	6	22.2	881
February (23 days).....	52	5	38.0	1,730
March (22 days).....	41	4	22.0	960
April (28 days).....	84	16	47.2	2,620
May.....	136	64	98.2	6,040
June.....	148	136	148	8,810
July.....	148	96	140	8,610
August.....	96	64	81.4	5,010
September.....	76	53	63.4	3,770
The year.....	-----	-----	-----	48,000

SQUAW CREEK NEAR SISTERS, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 32, T. 15 S., R. 10 E., immediately above intake of McCallister ditch and about 5 miles by road above Sisters, Deschutes County.

DRAINAGE AREA.—63 square miles.

RECORDS AVAILABLE.—May 30, 1913, to September 30, 1917; no winter records.

From July 1, 1906, to May 23, 1913, in sec. 29, at station below the intake of McCallister ditch, about 700 feet farther downstream.

GAGE.—Stevens eight-day water-stage recorder on right bank; inspected by A. E. Perry, deputy water master. Vertical staff read prior to 1916.

DISCHARGE MEASUREMENTS.—Made from a cable about 100 yards above gage, or by wading.

CHANNEL AND CONTROL.—Gravel and boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.47 feet at 10 p. m., July 18 (discharge, 518 second-feet); minimum stage recorded, 1.77 feet at 12 midnight, April 6 (discharge, 38 second-feet).

1906-1917: Maximum stage recorded, 7.5 feet at old station, November 22, 1909 (discharge estimated from extension of rating curve as 1,940 second-feet); minimum stage recorded, 2.65 feet at old station, March 19, 1912 (discharge, 32 second-feet).

DIVERSIONS.—Pole Creek, a tributary of Squaw Creek from the west, has been diverted for irrigation. The diversion canal has been eroded until it carries the entire flow of this creek. Low-water flow entirely diverted below the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water in July. Rating curve used October 1 to July 16 well defined between 70 and 400 second-feet; curve used July 20 to September 30 fairly well defined between 50 and 450 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting recorder graph. Shifting-control method used July 17-19. Records good.

Discharge measurements of Squaw Creek near Sisters, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 18	Batchelder and Reineking.....	2.05	72	Aug. 9	Perry and Cox ^b	2.66	204
July 10	Perry ^a and Brewster ^b	3.10	394	18	Briggs and Cox.....	2.58	172
31	A. E. Perry.....	2.71	211	Sept. 2	Perry and Cox.....	2.56	181
				30	.....do.....	2.30	108

^a Water master.

^b Manager Squaw Creek Irrigation Co.

Daily discharge, in second-feet, of Squaw Creek near Sisters, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	90	-----	-----	68	161	268	240	158
2.....	77	-----	-----	68	144	302	240	172
3.....	71	-----	-----	71	133	302	240	183
4.....	71	-----	-----	72	133	339	240	158
5.....	70	-----	41	77	147	339	210	142
6.....	68	-----	39	77	164	358	198	138
7.....	66	57	48	88	188	358	192	138
8.....	65	51	49	88	218	377	186	130
9.....	64	-----	44	98	250	415	195	121
10.....	62	-----	43	115	218	396	180	119
11.....	61	-----	49	141	185	396	170	108
12.....	-----	-----	46	150	173	396	175	108
13.....	-----	-----	44	147	170	396	183	104
14.....	-----	-----	43	150	188	358	186	100
15.....	-----	-----	42	138	218	415	180	108
16.....	-----	-----	41	122	268	472	183	115
17.....	-----	-----	41	115	285	470	192	119
18.....	72	-----	40	100	285	460	186	115
19.....	70	-----	43	95	302	450	178	112
20.....	68	-----	44	88	302	410	178	110
21.....	68	-----	45	90	302	350	195	96
22.....	64	-----	60	85	302	330	172	84
23.....	62	-----	66	92	285	310	165	83
24.....	62	-----	72	100	285	292	170	77
25.....	-----	-----	90	95	268	275	175	94
26.....	-----	-----	85	98	285	292	160	102
27.....	-----	-----	80	115	285	275	155	102
28.....	-----	-----	76	136	302	258	142	108
29.....	-----	-----	72	152	285	240	148	115
30.....	-----	-----	70	155	268	225	152	112
31.....	-----	-----	-----	158	-----	225	148	-----

Monthly discharge of Squaw Creek near Sisters, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 5-30.....	90	39	54.3	2,800
May.....	158	68	108	6,640
June.....	302	133	233	13,900
July.....	472	225	347	21,300
August.....	240	142	184	11,300
September.....	183	77	118	7,020
The period.....	-----	-----	-----	63,000

SQUAW CREEK CANAL NEAR SISTERS, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 28, T. 15 S., R. 10 E., about half a mile below intake and about 4 miles by road south of Sisters, Deschutes County.

RECORDS AVAILABLE.—April 26 to September 11, 1916; April 30 to September 30, 1917.

GAGE.—Stevens 8-day water-stage recorder on right side of canal, a short distance below a wasteway; inspected by A. E. Perry.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Channel is excavated in a gravelly soil; not likely to shift; a timber placed across canal just below gage forms a control for low water but has little effect at ordinary stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during 1916-1917, 2.22 feet at 5 p. m. July 10, 1917 (discharge, 182 second-feet); canal dry during winter.

ACCURACY.—Stage-discharge relation changed during winter. Rating curve used April 30 to September 30 well defined between 60 and 180 second-feet and fairly well defined below 60 second-feet. Water-stage recorder operated satisfactorily. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting the gage-height graph. Records excellent for June, July, and August; good for May and September.

Squaw Creek canal diverts water from Squaw Creek in the SE. $\frac{1}{4}$ sec. 29, T. 15 S., R. 10 E., and irrigates land east and north of Sisters; 8,328 acres have been adjudicated a water right under it, but only about 4,900 acres were irrigated in 1916.

Discharge measurements of Squaw Creek canal near Sisters, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
July 10	Perry ^a and Brewster ^b .	<i>Feet.</i> 2.15	<i>Sec.-ft.</i> 169	Aug. 14	Perry and Cox ^b	<i>Feet.</i> 1.59	<i>Sec.-ft.</i> 77
Aug. 10	Perry and Cox ^b	1.70	94	18	R. C. Briggs.....	1.60	80

^a Water master.

^b Manager Squaw Creek Irrigation Co.

Daily discharge, in second-feet, of Squaw Creek canal near Sisters, Oreg., for the year ending Sept. 30, 1917.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1.....	26	55	126	121	64	16.....	48	141	146	88	48
2.....	34	51	145	126	66	17.....	44	128	150	86	50
3.....	36	50	83	131	64	18.....	38	116	160	80	49
4.....	36	55	97	124	55	19.....	38	115	157	80	51
5.....	36	69	116	115	53	20.....	37	134	146	84	56
6.....	39	86	133	113	49	21.....	37	145	155	94	49
7.....	27	94	148	116	48	22.....	37	121	143	90	40
8.....	20	99	143	113	44	23.....	36	99	138	91	36
9.....	22	96	155	113	46	24.....	37	97	124	97	32
10.....	36	80	169	104	45	25.....	38	97	115	102	37
11.....	48	73	169	94	45	26.....	41	104	134	80	40
12.....	50	79	157	97	43	27.....	43	107	100	90	41
13.....	49	88	150	100	43	28.....	43	118	128	62	42
14.....	49	97	152	102	43	29.....	55	126	116	64	44
15.....	50	120	157	91	45	30.....	51	123	116	65	43
						31.....	56	.....	120	65	.....

Monthly discharge of Squaw Creek canal near Sisters, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May.....	56	20	40.1	2,470
June.....	145	50	98.8	5,880
July.....	169	83	137	8,420
August.....	131	62	96.1	5,910
September.....	66	32	47.0	2,800
The period.....				25,500

OCHOCO CREEK AT ELLIOTT RANCH, NEAR PRINEVILLE, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 5, T. 15 S., R. 17 E., at dam site of proposed reservoir for Ochoco project, below all tributaries, $6\frac{1}{2}$ miles east of Prineville, Crook County, on road to Mitchell.

DRAINAGE AREA.—300 square miles.

RECORDS AVAILABLE.—November 1, 1908, to April 30, 1910; November 23, 1914, to June 30, 1915; January 21, 1916, to September 30, 1917.

GAGE.—Stevens 8-day water-stage recorder on left bank since April 21, 1916; inspected by Harry G. Kennard, water master. Vertical staff up to that time.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading.

CHANNEL AND CONTROL.—Gravel and boulders; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.12 feet at 10 a. m. April 26 (discharge, 930 second-feet); minimum stage recorded 0.58 foot September 13 and 21 (discharge, 1.4 second-feet).

1908-1910, and 1915-1917: Maximum stage recorded, 4.50 feet at 4 p. m. November 23, 1909 (discharge, 1,160 second-feet). Creek dry at various times on account of diversions above.

ICE.—Stage-discharge relation slightly affected during cold weather.

DIVERSIONS.—Considerable land irrigated along Ochoco Creek and tributaries above the station. Tableland and Elliott ditches divert water around the station. (See pp. 57-58.)

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed slightly. Rating curve fairly well defined between 4 and 400 second-feet. Operation of water-stage recorder satisfactory except for breaks in record indicated in footnote to table of daily discharge. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting the gage-height graph, except for March 27-29, for which days the discharge given is the average of discharge determined for shorter intervals. Records good March to May; fair October, November, February, and June; poor for the remainder of year.

Discharge measurements of Ochoco Creek at Elliott ranch, near Prineville, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Mar. 29	H. G. Kennard ^a	<i>Feet.</i> 1.72	<i>Sec.-ft.</i> 116	June 6	Briggs and Kennard...	<i>Feet.</i> 1.84	<i>Sec.-ft.</i> 150
Apr. 19	.....do.....	1.96	166	Aug. 13	.....do.....	.65	2.1

^a Water master.

Daily discharge, in second-feet, of Ochoco Creek at Elliott ranch, near Prineville, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.	4.6	6.7			11	69	424	236			2.2
2.	4.6	6.7			11	76	382	215			2.2
3.	4.6	6.4			15	60	430	195			2.0
4.	4.6	7.3			14	96	424	180			1.8
5.	4.6	8.2			18	162	441	162			1.6
6.	4.6	8.5			13	180	483	145			1.5
7.	5.2	8.5			14	289	567				1.5
8.	5.5	8.8			15	466	546				1.4
9.	5.5	9.4			15	354	581				1.4
10.	5.5	9.7			14	302	630				1.4
11.	5.2	10			12	385	658		9.1		1.5
12.	5.2	9.1		16	11	382	730		8.8		1.5
13.	4.9	10		14	13	317	726	84	8.5	2.8	1.4
14.	4.9	7.9	9.4	12	14	311	654	75	8.2	2.8	1.4
15.	4.9	8.2	9.7	17	12	260	595	54	7.9	2.8	1.4
16.	4.9	7.9	10	26	11	236	500		7.6	2.8	1.4
17.	4.9		11	19	11	202	462		7.3	3.8	1.4
18.	4.9		11	17	12	182	434		7.0	3.0	1.4
19.	4.9		10	18	15	171	385			2.8	1.4
20.	4.9		11	18	15	192	368	30		2.8	1.4
21.	4.9		11	16	15	242	350			2.8	1.4
22.				15	16	293	320			3.8	1.5
23.				16	17	458	228			2.8	2.5
24.				15	35	609	215			2.8	2.8
25.				15	45	710	208			2.8	2.5
26.	7.0			12	33	826	198			2.8	2.5
27.	7.0			12	173	702	212			2.8	2.2
28.	6.7			14	175	626	230			2.8	2.2
29.	6.7				141	553	263			2.8	2.2
30.	6.7				78	483	263		4.6	2.8	2.2
31.	6.7				60		257		4.0	2.5	.....

NOTE.—Daily discharge estimated as follows: Oct. 22-25, 6 second-feet; Nov. 17-30, 8 second-feet; Dec. 1-13, 9 second-feet; Dec. 22-31, 10 second-feet; Feb. 1-11, 12 second-feet; May 20-22, as given in table; June 7-12, 100 second-feet; June 16-19, 40 second-feet; June 21-30, 18 second-feet; July 1-10, 12 second-feet; July 19-29, 6 second-feet; Aug. 1-12, 3 second-feet. Discharge interpolated Mar. 21, 22, June 5, July 12-17, Aug. 21-26, Sept. 5, 14-20 and 28-30.

Monthly discharge of Ochoco Creek at Elliott ranch, near Prineville, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....		4.6	5.44	334
November.....	10	6.4	8.18	487
December.....			9.88	595
January.....			a 10.0	615
February.....	26		14.4	799
March.....	175	11	34.0	2,060
April.....	826	60	339	20,200
May.....	730	198	425	26,100
June.....	236		77.2	4,590
July.....		4.0	8.35	513
August.....		2.5	2.91	179
September.....	2.8	1.4	1.77	105
The year.....	826	1.4	78.2	56,600

a Estimated.

Combined monthly discharge of Ochoco Creek at Elliott ranch, Tableland and Elliott ditches near Prineville, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	—	4.6	5.44	334
November.....	10	6.4	8.18	487
December.....	—	—	9.68	595
January.....	—	—	^a 10.0	615
February.....	27	—	15.0	833
March.....	181	12	35.6	2,190
April.....	847	69	356	21,200
May.....	752	215	445	27,400
June.....	254	—	97.2	5,780
July.....	—	6.0	10.4	640
August.....	—	2.5	2.91	179
September.....	2.8	1.4	1.77	105
The year.....	—	—	—	60,400

^a Estimated.

TABLELAND DITCH NEAR PRINEVILLE, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 5, T. 15 S., R. 16 E., at Elliott's ranch, about $1\frac{1}{2}$ miles below intake, quarter of a mile upstream from station on Ochoco Creek, and about $6\frac{1}{2}$ miles east of Prineville, Crook County.

RECORDS AVAILABLE.—Irrigating seasons 1915 to 1917.

GAGE.—Vertical staff on right bank just below a wasteway from which the surplus flow is returned to the creek. Datum 3.0 feet lower than that used in 1915. Gage reader, S. B. Anderson.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Ditch is well made in solid material and shifts only slightly; no defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.33 feet May 23 (discharge, 19.1 second-feet); ditch dry at times.

1915–1917: Maximum stage recorded, 5.4 feet February 26 to March 1, 1915, and March 20 and 26–30, 1916 (discharge, 20 second-feet).

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good. Some uncertainty as to date at which water was turned in.

Tableland ditch diverts water from the right bank of Ochoco Creek in the NW. $\frac{1}{4}$ sec. 4, T. 15 S., R. 16 E., and extends northwestward for about 8 miles, irrigating about 1,400 acres of bench land lying north of Ochoco Creek and Crooked River.

Discharge measurements of Tableland ditch near Prineville, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis- charge.
		<i>Fect.</i>	<i>Sec.-ft.</i>
May 23	H. G. Kennard ^a	5.33	18.7
June 5	Briggs and Kennard.....	5.11	14.8

^a Water master.

Daily discharge, in second-feet, of Tableland ditch near Prineville, Oreg., for the year ending Sept. 30, 1917.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1.....			18	14	16.....		16	18	18
2.....		3.4	18	14	17.....		10	18	18
3.....		11	18	14	18.....		12	18	18
4.....		12	18	14	19.....		12	18	18
5.....		1.3	18	14	20.....		16	18	18
6.....		12	18	14	21.....		16	18	18
7.....		14	18	14	22.....		16	18	18
8.....		14	18	16	23.....		18	18	18
9.....		14	18	18	24.....		18	18	18
10.....		14	18	18	25.....		18	14	18
11.....		16	18	18	26.....		18	14	18
12.....		16	18	18	27.....		18	14	11
13.....		16	18	18	28.....	6.0	18	14	.....
14.....		16	18	18	29.....	9.0	18	14	.....
15.....		16	18	18	30.....	9.0	18	16	.....
					31.....	9.0	.....	14	.....

Monthly discharge of Tableland ditch near Prineville, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March (4 days).....	9.0	6.0	8.25	65
April (29 days).....	18	1.3	14.4	828
May.....	18	14	17.2	1,060
June (27 days).....	18	11	16.6	889
The year.....				2,840

ELLIOTT DITCH NEAR PRINEVILLE, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 5, T. 15 S., R. 17 E., about 200 yards below intake, opposite gage on Ochoco Creek, and $6\frac{1}{2}$ miles east of Prineville, Crook County.

RECORDS AVAILABLE.—November 1, 1908, to April 30, 1910, and October 26, 1914, to June 29, 1917, with some gaps.

GAGE.—Vertical staff driven in the right bank of canal; different gage was used 1908 to 1910. Gage reader, H. G. Kennard.

DISCHARGE MEASUREMENTS.—Made by wading or from a foot plank near the gage.

CHANNEL AND CONTROL.—Ditch flat and badly silted; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year and during 1908–1910, and 1915–1917, 2.2 feet on June 25 (discharge, 13 second-feet). Canal dry at various times.

ICE.—Stage-discharge relation affected by ice at times.

ACCURACY.—Stage-discharge relation changed during winter. Rating curve poorly defined. Gage read to half-tenths on days for which discharge is given. Discharge ascertained by applying gage height to rating tables except March 13 for which it has been estimated on account of ice. Records poor but are of value in determining the total flow of Ochoco Creek.

Elliott ditch diverts from the left bank of Ochoco Creek and irrigates 160 acres of land, mostly in alfalfa. Probably a considerable part of the water returns to the stream a short distance below.

Discharge measurements of Elliott ditch near Prineville, Oreg., during the year ending Sept. 30, 1917.

[Made by H. G. Kennard, water master.]

Date.	Gage height.	Dis-charge.
	<i>Feet.</i>	<i>Sec.-ft.</i>
May 22	1.12	1.9
June 25	2.05	10.7
25	1.55	4.9

Discharge, in second-feet, of Elliott ditch near Prineville, Oreg., for the year ending Sept. 30, 1917.

Date.	Dis-charge.	Date.	Dis-charge.	Date.	Dis-charge.
Feb. 19	1.1	Mar. 29	0.0	June 4	2.6
26	1.3	Apr. 27	3.4	5	2.0
Mar. 6 .....	.8	May 12	3.7	25	8.3
13 .....	.8	22	1.9	26	4.5
22 .....	.5	29	5.0	28	3.6
				29	3.4

Monthly discharge of Elliott ditch near Prineville, Oreg., for the year ending Sept. 30, 1917.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
February (14 days)	1.2	33	June	5.0	298
March (25 days) .....	.7	35	July	2.0	123
April (25 days)	3.0	149			
May	3.5	215	The period		853

NOTE.—Mean discharge estimated from fragmentary gage height record and notes by water master.

METOLIUS RIVER AT ALLINGHAM RANGER STATION, NEAR SISTERS, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 3, T. 13 S., R. 9 E., at Allingham ranger station, in Jefferson County, $1\frac{1}{2}$ miles below mouth of Lake Creek, 3 miles below head of river, and about 17 miles northwest of Sisters.

DRAINAGE AREA.—50 square miles.

RECORDS AVAILABLE.—September 15, 1910, to October 31, 1913; June 21 to September 30, 1915; May 16 to September 16, 1916; July 1 to September 14, 1917, when station was discontinued.

GAGE.—Vertical staff on left bank 100 yards below bridge at ranger station. Gage reader, L. W. Zumwalt.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 0.91 foot May 30 (discharge, 460 second-feet); minimum stage recorded, 0.52 foot, January 12 (discharge, 304 second-feet).

1910-1913 and 1915-1917: Maximum stage recorded, 0.97 foot, February 16, 1912 (discharge, 566 second-feet); minimum stage recorded, 0.40 foot, September 28, 1915 (discharge, 264 second-feet).

ICE.—Stage-discharge relation unaffected by ice, as water comes from springs.

DIVERSIONS.—Practically none.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to hundredths occasionally between July 1 and September 14. Daily discharge ascertained by applying daily gage height to rating table. Records excellent for days on which gage was read.

Discharge measurements of Metolius River at Allingham ranger station, near Sisters, Oreg., Oct. 17, 1916, to Oct. 16, 1917.

Date.	Made by—	Gage height.	Dis-charge.
		<i>Fect.</i>	<i>Sec.-ft.</i>
Oct. 17	Batchelder and Reineking.....	0.52	305
May 30	Perry and Batchelder.....	.91	449
Oct. 16	Batchelder and Briggs.....	.60	333

Daily discharge, in second-feet, of Metolius River at Allingham ranger station, near Sisters, Oreg., for the year ending Sept. 30, 1917.

Day.	Jan.	May.	July.	Aug.	Sept.	Day.	Jan.	May	July.	Aug.	Sept.
1.....			419	362		16.....				330	
2.....						17.....			378		
3.....			410			18.....				330	
4.....				362	338	19.....					
5.....						20.....					
6.....			406			21.....			370		
7.....				350		22.....					
8.....			410			23.....			366		
9.....						24.....					
10.....			390	330	338	25.....			366		
11.....						26.....					
12.....	304		382		350	27.....					
13.....				330		28.....			362		
14.....			382		350	29.....					
15.....						30.....		460	362		
						31.....					

LAKE CREEK NEAR SISTERS, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 24, T. 13 S., R. 8 E., in Jefferson County, a quarter of a mile below outlet of Suttle Lake, 6 miles from mouth of creek, and about 15 miles northwest of Sisters.

DRAINAGE AREA.—20.5 square miles.

RECORDS AVAILABLE.—May to November, 1911; March to September, 1912; May to October, 1913, occasional readings; April 7, 1915, to September 30, 1917.

GAGE.—Vertical staff on left bank; gage about 20 feet above a 15-foot weir read April 7, 1915, to April 30, 1916. Gage in natural channel, near site of weir, used 1911 to 1913. Gage readers, Harry Heising and Wm. Heathman.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Heavy gravel and boulders; practically permanent.

EXTREMES OF DISCHARGE.—1911-1913 and 1915-1917: Maximum stage recorded, 1.60 feet May 27, 1917 (discharge, 146 second-feet). Minimum stage recorded, 0.31 foot October 18, 1916 (discharge, 20 second-feet).

ICE.—Stage-discharge relation unaffected.

DIVERSIONS.—None above station; one small ditch takes out of Lake Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 20 and 150 second-feet. Gage read to quarter-tenths about once a week October to June 17; to hundredths daily thereafter. Daily discharge ascertained by applying daily gage height to rating table. No readings in April. Records fair, October to February and June; poor. March to May; good, July to September.

Discharge measurements of Lake Creek near Sisters, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 18	Batchelder and Reineking	0.31	18.9
May 30	Perry ^a and Batchelder	1.46	125
June 25	A. E. Perry	1.50	129

^a Water master.

Daily discharge, in second-feet of Lake Creek near Sisters, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	May.	June.	July.	Aug.	Sept.
1					46	70			110	45	39
2									106	45	38
3				36					99	44	38
4					49		100		94	44	38
5			36						91	43	38
6				37					87	43	38
7		35			51				85	43	38
8	25			42					85	43	38
9								141	83	43	38
10					51				80	43	38
11				42			106		77	43	38
12			37				95		73	43	38
13					59				71	43	38
14				44					68	42	38
15	25	36							66	42	38
16					57				65	42	37
17				44				110	63	41	37
18	20							111	62	41	37
19								116	60	41	37
20			37	44			112	124	59	41	37
21	29	35			57			125	59	41	37
22							138	143	56	41	37
23				46	59			143	55	41	37
24						65		143	53	41	37
25						75		130	51	41	37
26				46	75			128	50	40	37
27			38					125	48	40	37
28		36				70		146	48	40	37
29	35			46				122	47	40	37
30								122	46	39	37
31						75		124	46	39	37

Monthly discharge of Lake Creek near Sisters, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October			26.8	1,650
November			35.5	2,110
December			37.0	2,280
January			42.7	2,630
February			56.0	3,110
March			^a 56.2	3,460
April			^a 85.0	5,060
May			117	7,190
June			^a 128	7,620
July	110	46	69.1	4,250
August	45	39	41.9	2,580
September	39	37	37.5	2,230
The year			61.1	44,200

^a Estimated.

NOTE.—Monthly mean discharge, October to February and May is average of discharge for days on which gage was read.

FIRST CREEK NEAR SISTERS, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 12, T. 13 S., R. 8 E., in Jefferson County, just above a trail crossing $1\frac{1}{2}$ miles from road leading to Suttle Lake, about 15 miles northwest of Sisters.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 7, 1915, to March 31, 1917, when station was discontinued.

GAGE.—Vertical staff on left bank about 5 feet above weir. Old gage read prior to April 2, 1916, was at a datum 5.08 feet higher. Gage reader, Harry Heising.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Control is a trapezoidal weir 14.8 feet long; crest rounded; considerable velocity of approach; not permanent on account of leakage under weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.4 feet December 27 (discharge, 10 second-feet). Minimum stage was recorded during period when stage-discharge relation was affected by ice (discharge estimated 0.1 second-foot).

1915-1917: Maximum stage recorded, 6.3 feet June 18 and 20, 1916 (discharge, 71 second-feet). Minimum stage recorded that of 1917.

ICE.—Stage-discharge relation occasionally affected.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not entirely permanent on account of leakage under the weir. Rating curve fairly well defined. Gage read to half-tenths about once a week. Discharge ascertained by applying daily gage heights to rating table. Records fair for October and November; poor for remainder of period.

The following discharge measurement was made by Batchelder and Reineking: October 18, 1916: Gage height, 5.21 feet; discharge 1.87 second-feet.

Daily discharge, in second-feet, of First Creek near Sisters, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1.....					0.2	0.2	16.....					5.0	
2.....							17.....				0.2		
3.....				5.0			18.....	1.8					
4.....					.2		19.....						
5.....			1.5				20.....			5.0	.2	.2	
6.....				5.0			21.....	1.5	1.5				
7.....		1.5			.4		22.....						
8.....	1.5			5.0			23.....				.2	.2	
9.....							24.....						0.2
10.....					.4		25.....						
11.....				5.0			26.....				.2	1.0	
12.....			5.0				27.....			10.0			
13.....					.2		28.....		1.5				
14.....				0.5			29.....	1.5			.2		
15.....	1.5	1.5					30.....						
							31.....						

NOTE.—Mean discharge estimated as 0.1 second-foot March 2 to 23; 5 second-feet March 25 to 31.

Monthly discharge of First Creek near Sisters, Oreg., for the year ending Sept. 30, 1917.

Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month.	Mean discharge in second-feet.	Run-off (total in acre-feet).
October.....	1.6	98	February.....	0.9	50
November.....	1.5	89	March.....	1.2	74
December.....	5.4	332			
January.....	2.2	135	The period.....		778

NOTE.—Monthly mean discharge is average of discharge for days on which gage was read, except that or March, which was estimated.

TROUT CREEK NEAR ANTELOPE, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 2, T. 9 S., R. 15 E., at J. H. Priday's ranch, about 2 miles above mouth of Antelope Creek, 15 miles east of Gateway, Jefferson County, and 16 miles southwest of Antelope, Wasco County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 24 to September 18, 1915; February 15, 1916, to July 14, 1917, when station was discontinued.

GAGE.—Vertical staff on right bank about 60 feet below a flume crossing and about 600 feet from Priday ranch house. Gage reader, Mrs. J. H. Priday.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Stream bed of gravel and silt; one channel at all stages; no defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.0 feet at 9 p. m. March 27 (discharge, 790 second-feet); minimum stage recorded, -0.10 foot August 7 (discharge, 0.5 second-foot, estimated).

1915-1917: Maximum stage about 5.0 feet February 8, 1916 (discharge approximately 900 second-feet); minimum stage recorded, 0.55 foot August 6 to September 18, 1915 (discharge, 0.2 second-foot).

ICE.—Stage-discharge relation affected by ice.

DIVERSIONS.—Several canals divert water for irrigation above station, mostly in the vicinity of Ashwood.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during flood of March 27. Rating curve used previous to that date fairly well defined; curve used March 27 to September 30 poorly defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Trout Creek near Antelope, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
May 26	C. L. Batchelder.....	1.90	92
Aug. 7	R. C. Briggs.....	— .10	a 0.5

a Estimated.

Daily discharge, in second-feet, of Trout Creek near Antelope, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1.....		2.0	2.0	2.0	3.0	4.0	64	130	69	12
2.....		2.0	2.0	3.0	3.0	4.0	56	130	69	10
3.....		2.0	2.0	5.0	3.0	5.6	74	114	69	9.2
4.....		2.0	2.0	4.0	3.0	6.6	41	114	69	8.8
5.....		2.0	2.0	3.6	3.0	9.6	99	114	69	8.8
6.....		2.0	2.0	5.0	3.0	11	86	114	60	8.0
7.....		2.0	2.0	5.0	31	15	181	130	60	8.0
8.....		2.0	2.0	7.5	25	15	210	146	60	6.0
9.....		2.0	2.0	6.0	20	15	122	130	51	4.0
10.....		1.5	2.0	3.0	20	15	114	154	51	2.0
11.....		1.5	2.0	3.0	16	15	138	230	44	1.8
12.....		1.5	2.0	1.5	16	12	130	190	44	1.6
13.....		1.5	2.0	1.5	16	12	99	172	38	1.4
14.....		1.5	2.0	1.5	16	11	130	172	32	1.0
15.....		1.5	2.0	.8	16	11	86	154	32	.....
16.....		1.5	2.0	1.5	25	13	64	154	27	.....
17.....		1.0	2.0	3.0	25	15	86	154	23	.....
18.....		1.0	2.0	3.0	18	15	74	172	23	.....
19.....		1.0	2.0	3.0	17	16	122	172	21	.....
20.....		1.0	2.0	5.0	12	17	130	172	19	.....
21.....	1.0	1.5	2.0	.....	12	19	138	172	19	.....
22.....	1.0	1.5	2.0	.....	6.0	21	190	154	18	.....
23.....	1.0	2.0	2.0	.....	6.0	25	370	122	17	.....
24.....	1.0	2.0	2.0	.....	6.0	25	250	92	17	.....
25.....	1.0	2.0	2.0	.....	5.6	60	290	92	17	.....
26.....	1.0	2.0	2.0	.....	6.6	31	250	92	17	.....
27.....	1.5	1.5	2.0	.....	4.0	390	290	80	16	.....
28.....	2.0	1.5	2.0	.....	3.6	92	270	80	16	.....
29.....	2.0	2.0	2.0	.....	.....	138	240	80	14	.....
30.....	2.0	2.0	2.0	.....	.....	69	146	80	13	.....
31.....	2.0	.....	2.0	.....	.....	60	.....	80	.....	.....

NOTE.—Mean discharge estimated Jan. 21 to Feb. 3, 3 second-feet.

Monthly discharge of Trout Creek near Antelope, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 21-31.....	2.0	1.0	1.41	31
November.....	2.0	1.0	1.68	100
December.....	2.0	2.0	2.00	123
January.....	7.5	.8	3.25	200
February.....	31	3.0	12.2	2,378
March.....	390	4.0	37.7	2,520
April.....	370	41	151	8,980
May.....	230	80	134	8,240
June.....	69	13	36.5	2,170
July 1-14.....	12	1.0	5.90	164
The period.....				23,000

WARM SPRINGS RIVER NEAR WARM SPRING, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 19, T. 8 S., R. 13 E., in Wasco County, at bridge on road between Warm Spring and Simnasho, 9 miles from Warm Spring.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 29, 1911, to September 30, 1917 (fragmentary prior to 1914).

GAGE.—Stevens water-stage recorder since July 1, 1914; fastened to downstream side of right abutment. Observers, Jerry Brunoe and Willie Palmer. Vertical staff spiked to upstream side of right abutment of old bridge, July 29, 1911, to July 1, 1914.

DISCHARGE MEASUREMENTS.—Made from upstream side of bridge or by wading.

CHANNEL AND CONTROL.—Control is of gravel and small boulders about 100 yards below bridge; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.56 feet at noon May 12 (discharge, 1,540 second-feet); minimum stage recorded, 0.90 foot January 27 (discharge, 262 second-feet).

1911-1917: Maximum stage recorded, 4.0 feet at 10 p. m., March 9, 1916 (discharge, 2,930 second-feet); minimum stage recorded, 0.73 foot January 15, 1915 (discharge, 192 second-feet).

ICE.—River probably never freezes, as there are hot springs just above bridge.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Water-stage recorder operated satisfactorily April 12 to July 28 only.

Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the recorder graph. Records good for October and for period April to July; fair for remainder of year.

Discharge measurements of Warm Springs River near Warm Spring, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
Apr. 13	C. L. Batchelder.....	<i>Feet.</i> 1.80	<i>Sec.-ft.</i> 782
May 28	.....do.....	2.06	982
Aug. 9	R. C. Briggs.....	1.03	309

Daily discharge, in second-feet, of Warm Springs River near Warm Spring, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	305	328						882	1,090	564		
2.....	305	314	350					834	1,050	540		
3.....	305	318						826	957	534		
4.....	305	328			332			802	882	534		
5.....	305	332			350			794	842	528		
6.....	305	323		350	370		700	778	834	522		
7.....	305	328			355			966	874	504		
8.....	305	318			346			1,030	930	486		
9.....	305	318			338			1,120	1,000	462	314	
10.....	305	323			346			1,240	1,020	445	314	
11.....	305	328			350			1,340	939	430	310	
12.....	305				355			1,430	850	415	305	
13.....	305				390		770	1,380	763	415	305	
14.....	305				390		749	1,340	756	415	310	
15.....	305				390		707	1,240	756	415	314	
16.....	305			284	425		658	1,170	794	400	310	
17.....	305				435		618	1,090	834	405	305	
18.....	305		305		415		588	1,030	834	400	305	
19.....	305	314			405		558	984	818	405		
20.....	305	314			400		552	922	818	390		
21.....	305	314			390		582	898	810	390		
22.....	305	314			385		588	882	810	385		
23.....	305	314			370	400	637	874	763	390		
24.....	305	314			350		763	866	721	375		
25.....	305	314			328		858	842	686	365		
26.....	305						1,000	826	658	360		305
27.....	305			262			1,100	874	624	355		
28.....	305						1,090	975	606	350		
29.....	305						1,020	1,090	600			
30.....	328					630	957	1,160	582			
31.....	328							1,130				

NOTE.—Mean discharge estimated as follows: Nov. 12-18 and 26-30, 320 second-feet; Feb. 1-3, 300 second-feet; Feb. 26-28, 310 second-feet; Apr. 1-5, 660 second-feet; Apr. 7-12, 770 second-feet; July 29-31, 340 second-feet; Aug. 1-8, 320 second-feet; Aug. 19-31, 300 second-feet. Discharge interpolated Nov. 20-23.

Monthly discharge of Warm Springs River near Warm Spring, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	328	305	306	18,800
November.....		314	320	19,000
December.....			α 320	19,700
January.....			α 300	18,400
February.....			359	19,900
March.....			α 370	22,800
April.....	1,100	552	747	44,400
May.....	1,430	778	1,020	62,700
June.....	1,090	582	817	48,600
July.....	564		426	26,200
August.....			308	18,900
September.....			α 300	17,900
The year.....	1,430		466	337,000

α Estimated.

WHITE RIVER NEAR TYGH VALLEY, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 10, T. 4 S., R. 13 E., 1 mile south of Tygh Valley, Wasco County, 1 mile above mouth of Tygh Creek, and 4 miles above Tygh Valley plant of Pacific Power & Light Co. at fall of White River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 18, 1911, to September 30, 1917.

GAGE.—Vertical staff on lower corner of left pier of highway bridge. Gage reader, Mrs. Bessie Nickerson.

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

CHANNEL AND CONTROL.—Gravel and sand; slightly shifting. White River carries a heavy load of glacial sediment at times.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.95 feet June 9 (discharge 1,530 second-feet); minimum stage recorded, 0.50 foot December 29 to 31 (discharge, 131 second-feet).

1911-1917: Maximum stage recorded, 5.3 feet January 9, 1912 (probably ice affected); maximum open-water stage 3.5 feet January 13, 1912 (discharge, 2,050 second-feet). Minimum stage recorded 0.25 foot October 18 and 19, 1915 (discharge, 75 second-feet).

ICE.—Stage-discharge relation affected by ice for short periods; ice jams occasionally form during extremely cold weather.

DIVERSIONS.—The Wapinitia Irrigation Co. began diverting a small quantity of water in the spring of 1917 from Clear Creek, a tributary of White River. This water will be used to irrigate land lying south of White River known as Juniper Flats.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water of May 11-13.

Rating curve used October 1 to May 13 well defined between 100 and 1,200 second-feet; curve used May 14 to September 30 well defined between 100 and 300 second-feet and fairly well defined above 300 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of White River near Tygh Valley, Oreg., during the year 1917.

[Made by C. L. Batchelder.]

Date.	Gage height.	Dis-charge.	Date.	Gage height.	Dis-charge.
	<i>Feet.</i>	<i>Sec.-ft.</i>		<i>Feet.</i>	<i>Sec.-ft.</i>
Apr. 14.....	1.31	452	Aug. 23.....	0.79	176
May 21.....	2.30	a 876	Oct. 18.....	.60	115
23.....	2.25	975			

a Measuring section poor on account of eddies; next measurement considered better.

b Measurement made by wading; conditions good.

Daily discharge, in second-feet, of White River near Tygh Valley, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	164	173	188	158	158	188	380	680	1,300	740	255	162
2.....	161	158	182	173	144	188	358	680	1,230	740	255	162
3.....	158	188	182	182	238	220	335	680	1,160	740	235	162
4.....	158	204	204	182	255	194	295	680	1,090	810	235	162
5.....	158	188	204	238	238	255	380	710	1,090	810	215	156
6.....	158	188	188	238	220	214	405	780	1,090	810	215	156
7.....	158	188	173	220	220	220	430	920	1,230	710	215	156
8.....	158	173	158	204	220	220	535	1,060	1,370	680	215	156
9.....	158	188	188	204	220	220	508	1,280	1,530	650	215	156
10.....	153	295	158	188	220	220	480	1,440	1,300	620	208	162
11.....	153	214	158	188	220	204	480	1,520	1,160	620	208	156
12.....	153	188	173	188	238	234	480	1,520	1,020	620	208	145
13.....	153	204	220	173	238	220	480	1,520	950	560	198	145
14.....	153	204	188	173	220	188	480	1,370	1,020	532	198	145
15.....	153	188	173	158	220	188	455	1,370	1,230	505	198	180
16.....	158	164	158	220	295	194	430	1,160	1,370	505	198	162
17.....	158	153	173	204	335	188	380	1,090	1,370	505	198	156
18.....	158	158	173	158	335	194	380	1,020	1,230	505	187	145
19.....	153	158	188	158	295	204	380	1,020	1,230	450	187	145
20.....	153	158	158	158	255	220	380	950	1,230	422	180	145
21.....	158	153	188	144	255	220	430	950	1,160	395	180	145
22.....	158	153	188	158	238	188	430	1,020	1,090	345	180	145
23.....	153	158	188	158	238	214	480	950	950	345	180	145
24.....	153	158	173	158	238	335	535	1,020	950	322	180	152
25.....	153	158	173	188	220	255	710	950	950	300	180	145
26.....	158	220	173	188	220	255	990	950	880	300	173	156
27.....	158	255	158	188	220	295	920	1,020	810	300	173	145
28.....	158	220	144	188	204	380	920	1,160	880	291	162	139
29.....	153	214	131	173	.....	430	920	1,370	880	255	162	145
30.....	173	220	131	188	.....	380	780	1,370	740	255	162	139
31.....	191	.....	131	158	.....	335	.....	1,370	.....	255	162	.....

Monthly discharge of White River near Tygh Valley, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	191	153	158	9,720
November.....	295	153	188	11,200
December.....	220	131	173	10,600
January.....	238	144	182	11,200
February.....	335	144	236	13,100
March.....	430	188	240	14,800
April.....	990	295	518	30,800
May.....	1,520	680	1,080	66,400
June.....	1,530	740	1,120	66,600
July.....	810	255	513	31,500
August.....	255	162	197	12,100
September.....	180	139	152	9,040
The year.....	1,530	131	397	287,000

KLIKITAT RIVER BASIN.

KLIKITAT RIVER NEAR GLENWOOD, WASH.

LOCATION.—In NE. $\frac{1}{4}$ sec. 14, T. 7 N., R. 12 E., just below Dairy Creek, $2\frac{1}{2}$ miles below southern boundary of Yakima Indian Reservation, 3 miles below Big Muddy Creek, and about 6 miles north of Glenwood, Klickitat County.

DRAINAGE AREA.—356 square miles.

RECORDS AVAILABLE.—December 16, 1910, to September 30, 1917, at present site; October 9, 1909, to December 15, 1910, at a point a mile above, in section 11.

GAGE.—Stevens continuous water-stage recorder referred to vertical staff on left bank. Observer, A. G. Hanson. Prior to July 19, 1910, several vertical staffs were used.

DISCHARGE MEASUREMENTS.—Made from cable just below gage.

CHANNEL AND CONTROL.—Heavy gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 2.90 feet at 7 a. m. June 9 (discharge, 3,300 second-feet); minimum stage, from water-stage recorder, 0.19 foot at 12 p. m. January 15 (discharge, 325 second-feet).
1909–1917: Maximum stage recorded, 5.20 feet on original gage November 24, 1909 (discharge, estimated by extension of rating curve, 6,250 second-feet); minimum discharge recorded, 285 second-feet November 13, 1915.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent; changed slightly in November and again (above 850 second-feet) during May. Three well-defined rating curves used, one applicable October 1 to November 26, one December 10 to May 16, and one May 26 to September 30 (except July 30 to Aug. 18). Operation of water-stage recorder fairly satisfactory; paper did not run straight and considerable correction was necessary for period May to July. Daily discharge ascertained by applying to rating table the mean daily gage height ascertained by inspecting recorder graph; shifting-control method used May 17–25 and July 30 to August 18. Records good.

Discharge measurements of Klickitat River near Glenwood, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 18	A. G. Hanson.....	0.57	567	May 30	A. G. Hanson.....	2.63	2,860
Nov. 3	.....do.....	.62	579	June 22	.....do.....	2.27	2,300
Feb. 8	.....do.....	.38	419	.....do.....	.....do.....	1.94	1,890
Mar. 12	.....do.....	.30	384	July 27	.....do.....	1.16	968
Apr. 2	W. E. Dickinson.....	.35	415	Aug. 18	.....do.....	.83	822
.....9	.....do.....	.57	531	Sept. 13	.....do.....	.56	539
May 13	A. G. Hanson.....	2.02	2,150				

Daily discharge, in second-feet, of Klickitat River near Glenwood, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	628	570		500	416	380	410	.....	2,820	1,850	913	.....
2.....	628	586		488	416	355	404	.....	2,520	1,910	940	.....
3.....	622	604		476	416		398	.....	2,300	2,020	931	.....
4.....	616	676		470	422		404	.....	2,160	2,090	895	.....
5.....	610	622		458	428		416	.....	2,160	2,090	868	.....
6.....	604	622		458	428		440	.....	2,300	1,950	859	.....
7.....	598	604		446	428	365	494	.....	2,670	1,810	826	.....
8.....	592	598		452	428	365	542	.....	2,980	1,720	818	.....
9.....	592	664		440	440	375	542	.....	3,140	1,770	826	.....
10.....	592	664	446	434	446	380	542	.....	2,820	1,770	810	.....
11.....	586	622	446	428	440	386	578	.....	2,440	1,680	818	.....
12.....	580	586	464	404	446	380	572	.....	2,230	1,620	834	.....
13.....	580	565	488	375	440	380	566	2,180	2,230	1,570	834	536
14.....	580	565	488	355	440	370	560	2,240	2,370	1,510	826	560
15.....	575	565	476	330	440	375	548	2,200	2,740	1,520	826	572
16.....	570	565	464	.....	452	365	530	2,000	3,140	1,550	818	590
17.....	570	565	476	.....	464	370	512	1,820	2,980	1,550	818	596
18.....	565	565	482	.....	464	370	506	1,690	2,900	1,470	818	590
19.....	555	565	488	.....	464	375	500	1,690	2,820	1,420	.....	590
20.....	555	560	482	345	458	370	518	1,730	2,670	1,310	.....	560
21.....	550	555	488	355	458	375	530	1,790	2,520	1,190	.....	530
22.....	545	555	488	360	452	375	530	1,820	2,370	1,120	.....	536
23.....	540	545	494	370	452	370	536	1,890	2,160	1,050	.....	530
24.....	545	545	476	380	446	375	596	1,950	2,230	994	.....	506
25.....	540	540	446	392	440	380	722	1,880	2,160	976	.....	494
26.....	540	540	404	392	428	370	794	1,910	2,090	1,000	.....	512
27.....	545	.....	410	404	392	370	834	2,230	2,160	1,010	.....	524
28.....	545	.....	422	416	386	380	.....	2,670	2,090	976	.....	536
29.....	550	.....	458	428	.....	506	.....	2,900	1,950	922	.....	518
30.....	565	.....	524	428	.....	446	.....	2,900	1,880	922	.....	512
31.....	592	.....	512	422	.....	410	.....	2,740	.....	904	.....	.....

NOTE.—No gage-height record. Discharge estimated: Nov. 27-30, 550 sec.-ft.; Dec. 1-5, 500 sec.-ft., Dec. 6-9, 450 sec.-ft.; Jan. 16-19, 330 sec.-ft.; Mar. 3-6, 340 sec.-ft.; Apr. 28 to May 5, 850 sec.-ft.; May 6-12, 1,500 sec.-ft.; Aug. 19-31, 750 sec.-ft.; Sept. 1-12, 630 sec.-ft.

Monthly discharge of Klickitat River near Glenwood, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 356 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	628	540	576	1.62	1.87	35,400
November.....	676	540	580	1.63	1.82	34,500
December.....	524	404	472	1.33	1.53	29,000
January.....	500	330	404	1.13	1.30	24,800
February.....	464	386	437	1.23	1.28	24,300
March.....	506	.....	377	1.06	1.22	23,200
April.....	.....	398	569	1.60	1.78	33,900
May.....	2,900	.....	1,770	4.97	5.73	109,000
June.....	3,140	1,880	2,470	6.94	7.74	147,000
July.....	2,090	904	1,460	4.10	4.73	89,800
August.....	940	.....	807	2.27	2.62	49,600
September.....	.....	494	578	1.62	1.81	34,400
The year.....	3,140	330	877	2.46	33.43	635,000

BIG MUDDY CREEK NEAR GLENWOOD, WASH.

LOCATION.—In NE. $\frac{1}{4}$ sec. 3, T. 7 N., R. 12 E., a few hundred feet above mouth of Cougar Creek and about 9 miles north of Glenwood, Klickitat County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—November 12, 1916, to September 30, 1917; almost directly comparable with record obtained about 3 miles above mouth August 28 to November 12, 1916.

GAGE.—Stevens continuous water-stage recorder on right bank, inspected by A. G. Hanson.

DISCHARGE MEASUREMENTS.—Made from foot log just above gage.

CHANNEL AND CONTROL.—Heavy boulders; shifting. Velocities very high; bottom rough.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, 3.05 feet July 19, 7 to 9 p. m. (discharge, 362 second-feet); minimum discharge recorded 35 second-feet at 12 p. m. April 3 (gage height 1.21 feet).

1916–1917: Maximum discharge from recorder, 390 second-feet at 6 p. m. September 1, 1916 (gage height 2.13 feet at former station); minimum discharge recorded, 35 second-feet on April 3, 1917.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Fairly well-defined rating curves applicable November 24 to March 16, April 7 to June 15, and July 18 to September 18; shifting-control method November 12 to 23, April 1 to 6, June 16 to July 17, and September 19 to 30. Operation of water-stage recorder satisfactory November 12 to 29 and April 1 to September 30; during the winter it ran only a few days at a time. Daily discharge ascertained by applying to rating table the mean gage height obtained by inspecting recorder graph. Records good for November, April to June, August, and September; poor for July on account of bad shifts in control; fair December to March, on account of steady flow, although gage-height record is fragmentary.

Discharge measurements of Big Muddy Creek near Glenwood, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Nov. 17	A. G. Hanson.....	1.37	96	May 15	A. G. Hanson.....	1.83	124
26	....do.....	1.32	65	June 6	....do.....	1.98	158
Jan. 7	....do.....	1.26	61	24	....do.....	2.20	224
Feb. 7	....do.....	1.21	47.2	30	....do.....	2.04	213
Mar. 13	....do.....	1.20	46.5	July 22	....do.....	2.65	264
Apr. 1	W. E. Dickinson.....	1.23	38.8	Aug. 12	....do.....	2.60	246
9	....do.....	1.28	38.9	Sept. 12	....do.....	2.21	161

Daily discharge, in second-feet, of Big Muddy Creek near Glenwood, Wash., for the year ending Sept. 30, 1917.

Day.	Nov.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.					39	59	172	220	250	225
2.					39	63	150	220	262	225
3.					37	61	139	256	250	225
4.					39	64	137	280	250	225
5.					39	66	150	280	238	225
6.					38	77	161	268	250	225
7.			57	48	45	86	172	256	250	212
8.			57		41	104	184	256	250	200
9.			59		38	115	196	256	250	189
10.			57		40	129	172	268	225	189
11.					44	137	150	256	250	178
12.	85				41	131	139	256	250	158
13.	111			46	40	133	139	244	250	170
14.	105			48	40	139	161	256	238	180
15.	96			48	39	129	196	280	250	190
16.	94			48	38	113	232	306	250	200
17.	98				37	111	256	306	250	212
18.	94				37	106	268	288	262	200
19.	87				38	106	268	300	262	212
20.	83				41	108	244	275	262	212
21.	83				40	115	232	275	250	212
22.	77				40	117	208	262	238	200
23.	75				43	127	196	250	238	189
24.	71				48	131	232	238	238	178
25.	77				64	135	208	238	238	168
26.	69				63	161	208	250	225	168
27.	87				61	161	220	250	225	158
28.	77				61	172	232	250	225	168
29.	73				63	184	220	225	225	168
30.	70				60	172	220	225	238	168
1.						172		238	225	

Monthly discharge of Big Muddy Creek near Glenwood, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	150	103	121	7,440
November.....	120	69	92.4	5,500
December.....			a 65	4,000
January.....			a 55	3,380
February.....			a 50	2,780
March.....			a 45	2,770
April.....	64	37	44.4	2,640
May.....	184	59	119	7,320
June.....	268	137	195	11,600
July.....	306	220	259	15,900
August.....	262	225	244	15,000
September.....	225	158	194	11,500
The year.....	306	37	124	89,800

a Estimated.

NOTE.—Record for Oct. 1 to Nov. 11 from station temporarily maintained 3 miles upstream.

HOOD RIVER BASIN.

HOOD RIVER AT DEE, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 7, T. 1 N., R. 10 E., just above backwater of mill dam at Dee, Hood River County, and half a mile below junction of East and Middle forks.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 21, 1913, to December 31, 1914; February 1, 1915, to January 15, 1916; May 9 to December 15, 1917, when station was discontinued.

GAGE.—Stevens 8-day water-stage recorder at wooden crib on left bank just above railroad trestle; installed May 18, 1917; inspected by C. E. Stricklin and James Shepler. Vertical staff at same site, February 1, 1915, to May 17, 1917. Gage 400 feet below dam was used 1913 to December 31, 1914.

DISCHARGE MEASUREMENTS.—Made from cable about 25 feet above gage.

CHANNEL AND CONTROL.—Control of boulders, stumps, and gravel; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage during period May 9 to December 15, about 4 feet during night of November 29–30 (observed from high-water mark the next morning); discharge, estimated from extension of rating curve 2,400 second-feet. Minimum stage recorded, 0.04 foot at 7 p. m. November 23; discharge, 207 second-feet.

1913–1917: Maximum discharge recorded is that of 1917, but was considerably exceeded in December, 1917 (no record); minimum discharge, 134 second-feet, September 7, 10, and 11, 1915 (gage height, 0.58 foot). The minimum of 60 second-feet at the station below dam in 1914 was caused by holding backwater at dam and is not the minimum natural flow.

ICE.—Stage discharge relation unaffected by ice.

DIVERSIONS.—Several small ditches divert water for irrigation above station. The East Fork Irrigation District canal diverts water through a divide to lands outside the drainage area.

REGULATION.—None. The flow at former station is quite irregular, especially during low water, owing to changes in load in power plant at mill of Oregon Lumber Co., just above gage.

ACCURACY.—Stage-discharge relation changed by filling May 28. Rating curve used after May 28 fairly well defined; this curve applicable May 9 to 28 adding 0.1 foot to gage heights. Operations of water-stage recorder satisfactory except from 10 p. m. November 29 to 3 p. m. December 2, when it was removed on account of flood. Daily discharge ascertained by applying to the rating table mean daily gage heights determined by inspecting gage-height graph. Results good.

Discharge measurements of Hood River at Dee, Oreg., during the period, Oct. 1, 1916, to Dec. 15, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
1916.		<i>Feet.</i>	<i>Sec.-ft.</i>	1917.		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 26	Rhea Luper a.....	0.22	261	July 7	C. E. Stricklin.....	1.42	770
				21	.....do.....	1.22	712
				24	.....do.....	.90	589
May 9	C. E. Stricklin a.....	1.65	940	Aug. 3	.....do.....	.72	459
17	C. L. Batchelder.....	1.40	828	10	.....do.....	.46	326
June 1	C. E. Stricklin.....	1.76	956	13	.....do.....	.50	358
8	.....do.....	1.68	924	30	.....do.....	.24	279
15	.....do.....	1.64	871	Nov. 24	R. C. Briggs.....	.05	213
19	.....do.....	1.71	935				

a Assistant to State engineer.

Daily discharge, in second-feet, of Hood River at Dee, Oreg., for the period May 9 to Dec. 15, 1917.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1.....		980	780	450	278	330	260	780
2.....		880	830	450	278	330	260	370
3.....		830	880	472	278	330	350	350
4.....		780	930	472	278	330	260	370
5.....		780	930	430	278	330	225	350
6.....		780	880	430	278	330	260	350
7.....		880	830	410	260	312	295	312
8.....		960	780	370	295	312	260	312
9.....	980	1,080	830	370	330	330	225	295
10.....	980	930	830	370	330	330	210	295
11.....	1,180	830	830	370	350	312	225	278
12.....	1,080	780	830	390	350	312	278	410
13.....	1,080	780	780	390	330	295	210	1,080
14.....	1,030	830	730	390	370	295	210	1,230
15.....	1,030	930	780	370	410	295	210	830
16.....	950	1,030	830	410	410	295	210	.....
17.....	860	1,080	880	430	430	278	210	.....
18.....	780	980	880	390	410	278	210	.....
19.....	780	980	880	370	410	278	210	.....
20.....	780	980	780	370	410	260	210	.....
21.....	780	980	730	370	370	278	210	.....
22.....	780	930	680	330	350	278	210	.....
23.....	780	830	585	330	350	278	210	.....
24.....	780	880	540	350	312	278	210	.....
25.....	780	830	518	350	350	278	210	.....
26.....	780	830	562	312	370	278	210	.....
27.....	880	780	585	295	370	278	225	.....
28.....	980	830	540	295	390	260	295	.....
29.....	980	830	472	278	370	260	600	.....
30.....	980	780	450	295	350	260	1,350	.....
31.....	980	.....	472	278	.....	260	.....	.....

NOTE.—Daily discharge interpolated May 16 and 17; obtained by applying table to gage heights of 6-hour periods Nov. 29 and from one daily reading and high-water mark Nov. 30.

Monthly discharge of Hood River at Dee, Oreg., for period May 9 to Dec. 15, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 9-31.....	1,180	780	913	41,700
June.....	1,080	780	887	52,800
July.....	930	450	737	45,300
August.....	472	278	374	23,000
September.....	430	260	345	20,500
October.....	330	260	295	18,100
November.....	1,350	210	274	16,300
December 1-15.....	1,230	278	504	15,000
The period.....				233,000

HOOD RIVER AT TUCKER BRIDGE, NEAR HOOD RIVER, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 15, T. 2 N., R. 10 E., at Tucker Bridge, 5 miles south of Hood River, Hood River County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 20, 1897, to December 31, 1899; August 27, 1913, to September 30, 1914; July 24, 1915, to September 3, 1917, when station was discontinued.

GAGE.—Chain gage attached to highway bridge; read by F. J. Knoblock. Wire gage attached to an earlier bridge, used 1897 to 1899; Stevens water-stage recorder on right bank one-third mile above intake of power flume and three-fourths mile above bridge, July 24 to December 21, 1915, when it was washed out by a flood.

DISCHARGE MEASUREMENTS.—Made from highway bridge; flow of flume included in that of river. Measuring conditions only fair.

CHANNEL AND CONTROL.—Rocks and boulders; practically permanent at both locations.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.56 feet at 8 a. m. June 8 (discharge, 3,870 second-feet). Minimum stage recorded, 1.35 feet at 8 a. m. October 10 and 6.30 p. m. September 3 (discharge, 428 second-feet).

1897–1899 and 1913–1916: Maximum stage recorded, 6.8 feet (determined by leveling to high-water marks) at water-stage recorder about 1 a. m. December 22, 1915 (discharge approximately 14,600 second-feet). Minimum stage recorded, 0.62 foot at 1 a. m. September 16, 1915 (discharge, 136 second-feet). This minimum was caused by holding water back at dam at Dee and is not representative of natural low-water flow.

ICE.—Stage-discharge relation unaffected.

DIVERSIONS.—Several large diversions for irrigation above station. Power flume diverts water a few hundred feet above the bridge and discharges directly below it; diversion included in records.

REGULATION.—Water stored at sawmill at Dee. During low water of 1914 and 1915 the pond was filled and emptied as many as six times daily, causing fluctuations of as much as 0.8 foot at Tucker Bridge. During 1916 and 1917 steam was used to supplement water power at Dee and the stage fluctuated through only a small range.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve poorly defined for current year. Chain gage read to quarter-tenths twice daily when observer was at home. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

Discharge measurements of Hood River at Tucker Bridge, near Hood River, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Nov. 10	C. L. Batchelder.....	2.35	898	May 31	C. E. Stricklin a.....	3.80	2,150
May 8	C. E. Stricklin a.....	4.20	1,860	July 25	.....do.....	2.35	807
12	.....do.....	4.60	2,400				

a Assistant to State engineer

Daily discharge, in second-feet, of Hood River at Tucker Bridge, near Hood River, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	445	600	1,070	^a 640	750	650	1,190	1,680	1,900	1,520	750	445
2.....	445	700	950	700	800	650	1,250	1,520	1,800	1,680	750	.....
3.....	445	750	1,070	900	1,130	600	1,190	1,600	1,700	1,760	750	428
4.....	445	1,130	1,190	1,100	1,130	700	1,250	1,520	1,600	1,840	700	.....
5.....	428	700	1,190	2,480	1,130	950	1,840	1,380	1,600	1,680	700	.....
6.....	445	750	950	1,900	1,190	850	1,600	1,600	1,760	1,680	700	.....
7.....	445	750	900	1,400	1,070	800	2,380	2,200	2,020	1,520	650	.....
8.....	445	750	850	1,190	1,070	800	2,300	2,200	2,290	^a 1,560	600	.....
9.....	428	1,010	^a 800	1,130	1,010	^a 785	1,930	2,580	2,790	1,600	580	.....
10.....	428	900	750	1,070	^a 1,070	^a 770	1,600	2,480	2,100	1,520	600	.....
11.....	445	800	700	1,010	1,130	^a 750	1,760	2,580	1,950	1,450	580	.....
12.....	428	650	^a 800	950	1,070	^a 730	1,680	2,580	1,600	1,450	600	.....
13.....	445	600	900	950	950	^a 715	1,450	2,480	1,600	1,310	600	.....
14.....	480	580	800	^a 850	950	700	^a 1,380	2,200	1,800	1,310	580	.....
15.....	480	600	800	800	950	700	1,310	2,110	2,200	1,380	560	.....
16.....	480	580	800	750	1,130	650	1,250	1,930	2,490	1,450	580	.....
17.....	500	580	700	750	^a 1,040	650	1,190	1,680	2,290	1,520	600	.....
18.....	500	580	750	700	950	650	1,130	1,520	2,200	1,450	580	.....
19.....	480	540	800	700	900	700	1,130	1,680	2,200	1,450	580	.....
20.....	462	520	900	^a 700	900	750	1,190	^a 1,640	2,020	1,380	560	.....
21.....	462	540	950	^a 700	850	750	1,190	1,600	2,200	1,190	580	.....
22.....	445	520	900	700	850	750	1,190	1,600	2,020	1,070	560	.....
23.....	445	520	900	^a 675	750	850	1,600	1,520	1,700	1,010	560	.....
24.....	445	540	850	650	^a 725	1,250	1,600	1,520	1,950	950	560	.....
25.....	445	1,010	^b 800	650	700	1,010	2,110	1,520	1,950	900	520	.....
26.....	445	1,070	750	650	700	900	2,290	1,520	1,800	900	^a 491	.....
27.....	500	2,110	700	1,520	700	1,010	2,100	1,600	1,680	900	462	.....
28.....	462	1,520	700	1,010	700	1,310	1,930	1,760	1,800	900	462	.....
29.....	650	1,160	650	900	.....	1,840	1,760	1,680	1,700	850	462	.....
30.....	650	1,190	600	900	.....	1,310	1,680	^a 1,760	1,600	750	462	.....
31.....	900	.....	580	800	.....	1,190	.....	1,840	.....	750	445	.....

^a Discharge interpolated.

NOTE.—Discharge estimated from flow at Powderdale, Jan. 3, 4, 6, 7; Mar. 4, Apr. 8; May 26, 27; June 1-4, 10-16, 23-26, and 28-30.

Monthly discharge of Hood River at Tucker Bridge, near Hood River, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean	
October.....	900	428	482	29,600
November.....	2,110	520	808	48,100
December.....	1,190	580	840	51,600
January.....	2,480	640	960	59,000
February.....	1,190	700	839	52,100
March.....	1,840	600	862	53,000
April.....	2,380	1,130	1,580	94,000
May.....	2,580	1,380	1,840	112,000
June.....	2,790	1,600	1,940	115,000
July.....	1,840	750	1,310	80,600
August.....	750	445	586	36,000
The period.....	.....	.....	.....	732,000

HOOD RIVER AT POWERDALE, NEAR HOOD RIVER, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 36, T. 3 N., R. 10 E., at Powerdale, about three-quarters of a mile south of town of Hood River, Hood River County, above discharge of tail-race of Powerdale plant of Pacific Power & Light Co., and $1\frac{1}{2}$ miles above mouth of stream.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 31, 1913 to September 30, 1917.

GAGE.—Vertical staff on right bank opposite power plant, about one-half mile above railroad bridge, in the SE. $\frac{1}{4}$ sec. 36; used March 31, 1913, to September 30, 1914, and after December 21, 1915. Vertical staff on left bank just below bridge of Mount Hood Railway, October 1, 1914, to July 26, 1915. Water-stage recorder at same site July 27 to December 21, 1915. Gage reader, A. Rogers.

DISCHARGE MEASUREMENTS.—Made from cable 100 feet above gage at power plant.

CHANNEL AND CONTROL.—Rock and boulders; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.0 feet at noon November 27 (discharge, 4,500 second-feet); minimum stage recorded, 1.50 feet at 3 p. m. October 4 (discharge, 290 second-feet).

1913-1917: Maximum stage recorded, 7.5 feet, on gage opposite power plant, at 1 a. m. December 22, 1915 (discharge approximately 12,200 second-feet); minimum stage recorded, 1.33 feet September 4, 1915 (discharge, estimated from extension of rating curve, 176 second-feet).

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

DIVERSIONS.—Large diversions for irrigation above station; water for power plant is diverted around upper gage, but is returned above the bridge gage. A record of this diversion has been kept (p. 83).

REGULATION.—Water stored at sawmill at Dee causes sudden fluctuations at low water, but this has been much less noticeable since 1916 than in 1914 or 1915.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 290 and 5,000 second-feet. Gage read to quarter tenths four times daily. Daily discharge ascertained by applying mean daily gage height to rating table. Record October to July, excellent; August, good; September, fair.

Discharge measurements of Hood River at Powerdale, near Hood River, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Nov. 9	C. L. Batchelder.....	2.65	1,080	July 23	C. E. Stricklin ^a	2.45	1,020
June 12	C. E. Stricklin ^a	3.21	1,520	Aug. 8	.....do.....	2.15	670
20	.....do.....	3.60	2,080				

^a Assistant to State engineer.

Daily discharge, in second-feet, of Hood River at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	600	565	1,060	600	705	670	1,240	1,710	2,070	1,610	860	558
2.....	467	635	980	780	705	670	1,510	1,610	1,940	1,710	900	544
3.....	436	635	1,420	900	1,060	635	1,330	1,610	1,820	1,710	940	530
4.....	400	1,020	1,240	1,150	1,240	705	1,240	1,510	1,610	1,710	900	502
5.....	418	740	1,240	2,340	1,240	1,060	1,820	1,510	1,610	1,820	820	558
6.....	412	705	1,060	1,940	1,330	900	1,710	1,610	1,820	1,610	820	551
7.....	406	705	860	1,420	1,150	900	2,340	2,200	1,940	1,510	780	600
8.....	412	705	820	1,240	1,060	820	2,340	2,200	2,200	1,610	705	600
9.....	400	980	780	1,150	1,060	820	2,070	2,490	2,490	1,610	780	740
10.....	400	940	780	1,060	1,060	780	1,820	2,490	2,070	1,420	740	705
11.....	400	780	705	980	1,060	780	1,940	2,490	1,940	1,420	740	705
12.....	400	586	780	900	1,150	780	1,820	2,490	1,610	1,420	740	740
13.....	412	530	900	980	1,060	740	1,710	2,340	1,610	1,420	780	705
14.....	412	530	860	940	1,060	820	1,610	2,200	1,820	1,330	780	670
15.....	412	516	860	780	980	780	1,510	2,070	2,200	1,420	820	820
16.....	430	516	820	670	1,150	740	1,420	1,820	2,490	1,420	780	820
17.....	454	502	820	670	980	740	1,330	1,710	2,340	1,420	820	780
18.....	412	530	820	635	1,060	740	1,240	1,710	2,070	1,420	820	740
19.....	406	495	900	600	980	740	1,240	1,710	2,200	1,420	740	740
20.....	436	474	940	635	940	780	1,240	1,610	2,070	1,330	740	740
21.....	424	460	1,060	670	900	740	1,420	1,610	2,070	1,240	820	670
22.....	412	474	940	586	860	740	1,420	1,610	1,940	1,060	705	635
23.....	400	481	900	572	820	860	1,710	1,610	1,710	980	705	670
24.....	400	488	820	572	940	1,420	1,710	1,610	1,940	900	705	586
25.....	400	1,060	820	635	900	1,240	2,070	1,610	1,940	820	670	579
26.....	406	1,060	780	572	860	1,060	2,340	1,610	1,820	860	484	635
27.....	460	2,970	740	1,330	740	1,240	2,070	1,610	1,710	1,060	516	635
28.....	412	1,610	670	1,060	705	1,330	1,940	2,070	1,820	980	530	600
29.....	600	1,240	600	900	-----	1,820	1,820	2,340	1,710	860	544	635
30.....	586	1,240	516	820	-----	1,820	1,820	2,200	1,610	820	572	600
31.....	860	-----	635	670	-----	1,330	-----	2,070	-----	820	572	-----

Monthly discharge of Hood River at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	860	400	448	27,500
November.....	2,970	460	806	48,000
December.....	1,420	516	875	53,800
January.....	2,340	572	928	57,100
February.....	1,330	705	991	55,000
March.....	1,820	635	942	57,900
April.....	2,340	1,240	1,690	101,000
May.....	2,490	1,510	1,900	117,000
June.....	2,490	1,610	1,940	115,000
July.....	1,820	820	1,310	80,600
August.....	940	484	736	45,300
September.....	820	502	653	38,900
The year.....	2,970	400	1,100	797,000

Combined daily discharge, in second-feet, of Hood River and Pacific Power & Light Co.'s tailrace at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	680	638	1,060	670	802	733	1,280	1,750	2,160	1,620	860	558
2.....	549	708	980	850	802	750	1,510	1,650	2,030	1,770	900	544
3.....	518	708	1,420	994	1,160	711	1,420	1,650	1,830	1,780	940	530
4.....	483	1,090	1,240	1,240	1,280	755	1,320	1,550	1,610	1,720	900	502
5.....	498	810	1,280	2,430	1,330	1,130	1,900	1,580	1,610	1,890	820	558
6.....	494	775	1,060	2,040	1,430	955	1,790	1,620	1,830	1,680	820	551
7.....	486	772	954	1,480	1,250	958	2,420	2,280	1,950	1,580	780	600
8.....	459	778	914	1,340	1,150	903	2,380	2,260	2,210	1,620	705	600
9.....	485	1,050	874	1,250	1,150	906	2,150	2,560	2,530	1,610	780	740
10.....	483	1,010	794	1,150	1,110	870	1,900	2,560	2,150	1,520	740	705
11.....	483	780	791	1,070	1,100	866	2,020	2,560	2,010	1,490	740	705
12.....	483	672	866	894	1,170	870	1,900	2,560	1,680	1,490	740	740
13.....	495	616	986	1,060	1,060	837	1,790	2,350	1,680	1,490	780	705
14.....	495	616	907	954	1,060	820	1,690	2,200	1,890	1,390	780	670
15.....	492	602	874	874	1,020	780	1,550	2,130	2,270	1,440	820	820
16.....	513	602	826	764	1,230	820	1,460	1,880	2,560	1,490	780	820
17.....	537	588	823	760	1,060	780	1,410	1,720	2,340	1,480	820	798
18.....	495	616	823	732	1,100	813	1,320	1,720	2,140	1,490	820	758
19.....	489	575	903	697	1,060	816	1,320	1,720	2,260	1,490	740	740
20.....	516	550	943	729	1,010	820	1,320	1,620	2,140	1,430	740	740
21.....	500	536	1,060	710	980	780	1,500	1,620	2,140	1,330	820	720
22.....	495	550	1,010	680	936	830	1,490	1,620	2,010	1,150	705	667
23.....	476	554	914	666	872	946	1,780	1,620	1,780	1,070	705	702
24.....	480	561	896	666	998	1,480	1,780	1,620	2,010	993	705	662
25.....	476	1,130	834	732	958	1,280	2,140	1,620	2,010	910	670	627
26.....	489	1,120	794	669	930	1,140	2,410	1,620	1,890	950	484	684
27.....	543	3,000	754	1,430	816	1,320	2,140	1,710	1,720	1,060	516	686
28.....	495	1,610	746	1,130	781	1,410	2,020	2,150	1,860	980	530	648
29.....	683	1,240	676	997	-----	1,900	1,830	2,420	1,780	860	544	687
30.....	669	1,240	592	884	-----	1,900	1,860	2,280	1,680	820	572	649
31.....	943	-----	649	767	-----	1,410	-----	2,160	-----	820	572	-----

Combined monthly discharge of Hood River and Pacific Power & Light Co.'s tailrace at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	943	459	528	32,500
November.....	3,000	536	870	51,800
December.....	1,420	592	911	56,000
January.....	2,430	666	1,020	62,700
February.....	1,430	781	1,060	58,900
March.....	1,900	710	1,010	62,100
April.....	2,420	1,280	1,760	105,000
May.....	2,560	1,550	1,950	120,000
June.....	2,560	1,610	1,990	118,000
July.....	1,890	820	1,370	84,200
August.....	940	484	736	45,300
September.....	820	502	671	39,900
The year.....	3,000	459	1,150	836,000

EAST FORK OF HOOD RIVER NEAR MOUNT HOOD, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 4, T. 1 S., R. 10 E., 1,000 feet above intake of East Fork Irrigation District canal, three-quarters of a mile above toll bridge and former gage, and 2 miles south of Mount Hood post office, Hood River County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 22, 1915, to September 30, 1917.

GAGE.—Stevens eight-day water-stage recorder on left bank. Observer, C. H. Shaw.

DISCHARGE MEASUREMENTS.—Made from cable at gage, or by wading.

CHANNEL AND CONTROL.—Heavy boulders; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 3.20 feet at 1 a. m. June 9 (discharge, 700 second-feet); minimum stage recorded, 1.23 feet at 10 a. m. March 15 (discharge, 126 second-feet).

1915-1917: Maximum stage from water-stage recorder, 4.33 feet at 11 p. m. December 21, 1915 (discharge, 1,280 second-feet); minimum stage recorded, 1.20 feet November 11, 1915 (discharge, 108 second-feet).

ICE.—Stage-discharge relation unaffected by ice, but float is sometimes frozen in.

DIVERSIONS.—The Glacier ditch and other small ditches divert water for irrigation above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during year. Transition rating curve used October 1 to 25; fairly well defined. Curve used October 26 to September 30 well defined between 122 and 600 second-feet. Operation of water-stage recorder satisfactory, except June 17 to 22 and 24-29, for which periods discharge has been interpolated. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting gage-height graph. Records excellent.

Discharge measurements of East Fork of Hood River near Mount Hood, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 25	Luper and Donnelly.	1.44	158	July 28	C. E. Stricklin.....	2.17	330
May 16	Batchelder and Stricklin.	2.53	458	Aug. 4	.....do.....	1.99	282
June 10	Stricklin and Donnelly.	2.87	563	11	.....do.....	1.81	242
July 8	C. E. Stricklin.....	2.72	499	Sept. 2	.....do.....	1.59	180

a Assistants to State engineer.

Daily discharge, in second-feet, of East Fork of Hood River near Mount Hood, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	188	174	174	150	148	143	180	294	540	505	302	199
2.....	183	184	176	168	158	149	178	297	505	560	300	203
3.....	181	186	192	170	174	137	170	300	470	580	313	199
4.....	177	210	182	174	170	152	182	297	452	600	292	194
5.....	175	180	178	203	168	158	223	302	452	580	282	194
6.....	175	178	170	172	166	143	223	358	488	560	277	190
7.....	174	172	168	164	164	143	274	421	540	540	267	184
8.....	168	172	170	160	162	142	274	452	620	540	260	188
9.....	166	196	162	158	160	140	253	522	660	560	265	188
10.....	168	184	160	156	158	137	246	540	580	540	258	196
11.....	172	164	160	154	158	137	255	580	505	560	270	190
12.....	174	148	166	152	160	136	241	560	488	560	270	184
13.....	175	148	164	150	158	136	232	540	488	522	274	176
14.....	179	152	156	146	156	132	227	540	540	505	272	172
15.....	181	156	152	143	160	132	221	505	620	540	262	196
16.....	188	158	162	136	196	131	212	452	660	560	260	216
17.....	190	168	154	136	172	132	203	432	643	560	253	214
18.....	184	164	158	138	170	136	199	407	626	560	260	214
19.....	181	158	160	144	166	137	201	400	608	540	253	210
20.....	181	154	158	144	162	138	216	397	591	505	253	210
21.....	179	156	160	144	158	138	221	400	574	452	265	203
22.....	174	160	154	140	156	138	223	404	557	414	262	188
23.....	168	158	154	138	154	146	333	418	540	376	241	166
24.....	168	156	152	138	152	154	270	421	555	346	241	170
25.....	168	194	150	140	149	146	349	404	530	334	250	160
26.....	168	178	148	140	149	143	382	432	525	361	234	176
27.....	172	265	144	160	146	172	367	470	520	361	229	180
28.....	162	201	144	150	144	199	346	522	515	334	210	178
29.....	176	182	144	146	.....	232	331	560	510	302	210	188
30.....	180	178	143	144	.....	196	310	560	505	292	212	180
31.....	201	.....	144	146	.....	180	.....	540	.....	294	210	.....

Monthly discharge of East Fork of Hood River near Mount Hood, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	201	162	177	10,900
November.....	265	148	174	10,400
December.....	192	143	160	9,840
January.....	203	136	152	9,350
February.....	196	144	160	8,890
March.....	232	131	150	9,220
April.....	382	170	252	15,000
May.....	580	294	443	27,200
June.....	660	452	546	32,500
July.....	600	292	479	29,500
August.....	313	210	258	15,900
September.....	216	160	190	11,300
The year.....	660	131	262	190,000

EAST FORK OF HOOD RIVER NEAR DEE, OREG.

LOCATION.—Near center of sec. 18, T. 1 N., R. 10 E., about one-eighth mile below Trout Creek, one-fourth mile above junction with Middle Fork, and 1½ miles above Dee, Hood River County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 26 to August 24, 1917, when station was discontinued.

GAGE.—Stevens 8-day water-stage recorder on right bank.

DISCHARGE MEASUREMENTS.—Made from cable one-eighth mile above gage.

CHANNEL AND CONTROL.—Boulders and gravel; permanent during medium and low stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded June 26 to August 24, 2.05 feet at 10 p. m. July 4 (discharge, 560 second-feet); minimum stage recorded, 1.07 feet at 5 p. m. August 22 and 23 (discharge, 119 second-feet).

ICE.—None.

DIVERSIONS.—Several hundred acres irrigated above the station from the Glacier, Mount Hood, and other ditches. East Fork Irrigation District canal diverts water outside the drainage basin.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the recorder graph. Records excellent.

Discharge measurements of East Fork of Hood River near Dee, Oreg., during the year ending Sept. 30, 1917.

[Made by C. E. Stricklin, assistant to State engineer.]

Date.	Gage height.	Dis-charge.	Date.	Gage height.	Dis-charge.	Date.	Gage height.	Dis-charge.
June 30.....	<i>Feet.</i> 1.82	<i>Sec.-ft.</i> 437	July 24.....	<i>Feet.</i> 1.44	<i>Sec.-ft.</i> 242	Sept. 3.....	<i>Feet.</i> 1.03	<i>Sec.-ft.</i> 108
July 19.....	1.77	392	Aug. 3.....	1.31	188			
22.....	1.56	288	10.....	1.17	146			

Daily discharge, in second-feet, of East Fork of Hood River near Dee, Oreg., for the period June 26 to Aug. 24, 1917.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1.....		446	201	11.....		458	146	21.....		390	146
2.....		482	197	12.....		452	151	22.....		325	132
3.....		506	204	13.....		428	148	23.....		288	126
4.....		512	197	14.....		405	143	24.....		248	134
5.....		506	183	15.....		428	143	25.....		227	.....
6.....		482	180	16.....		440	146	26.....	422	252	.....
7.....		458	170	17.....		440	148	27.....	458	261	.....
8.....		452	137	18.....		434	140	28.....	482	236	.....
9.....		482	137	19.....		428	146	29.....	476	212	.....
10.....		452	143	20.....		400	148	30.....	446	197	.....
								31.....		197	.....

Monthly discharge of East Fork of Hood River near Dee, Oreg., for the period June 26 to Aug. 24, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June 26-30.....	482	422	457	4,530
July.....	512	197	384	23,600
August 1-24.....	201	126	156	7,430

EAST FORK IRRIGATION DISTRICT CANAL, NEAR MOUNT HOOD, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 33, T. 1 N., R. 10 E., 1 mile below intake, about $1\frac{1}{2}$ miles south of Mount Hood post office, and 2 miles east of Parkdale station on Mount Hood Railroad.

RECORDS AVAILABLE.—June 17, 1913, to October 26, 1914; July 21, 1915, to September 30, 1917.

GAGE.—Stevens eight-day water-stage recorder on left side of canal just above road crossing. Observers, F. A. McDonald and C. H. Shaw. Vertical staff on side of flume, 1,000 feet downstream, in the SW. $\frac{1}{4}$ sec. 34, used up to October, 1914.

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

CHANNEL AND CONTROL.—Smooth earth section. Head of flume probably acts as control; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year and during 1915 to 1917, 3.35 feet at 2 a. m. July 17 (discharge, 143 second-feet). Canal dry at various times.

ICE.—No water carried in cold weather.

ACCURACY.—Stage-discharge relation practically permanent during irrigation season. Rating curve used October 1 to 29 well defined; curve used April 16 to September 30, well defined between 20 and 140 second-feet. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting gage-height graph. Records excellent.

The East Fork Irrigation District canal diverts water in the SW. $\frac{1}{4}$ sec. 4, T. 1 S., R. 10 E., and irrigates lands lying east of Hood River. Most of the return water reaches Odell and Neal creeks and the lower part of Hood River.

Discharge measurements of East Fork Irrigation District canal near Mount Hood, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 25	Luper ^a and Donnelly ^a .	1.46	21.8	June 21	C. E. Stricklin.....	2.88	100
May 15	C. E. Stricklin ^a	1.62	24.3	July 10	.....do.....	3.03	113
June 10	Stricklin and Donnelly.	2.55	79	July 22	.....do.....	3.18	131

^a Assistant to State engineer.

Daily discharge, in second-feet, of East Fork Irrigation District canal near Mount Hood, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	54	.....	13	30	120	129	116
2.....	54	.....	12	31	120	129	110
3.....	53	.....	16	32	120	129	110
4.....	42	.....	16	32	120	120	105
5.....	30	.....	16	40	120	120	102
6.....	30 [*]	16	48	116	120	102
7.....	30	.....	17	67	116	116	98
8.....	30	.....	17	82	120	120	97
9.....	30	.....	17	83	120	124	98
10.....	30	.....	16	77	116	120	78
11.....	30	.....	17	78	120	120	64
12.....	31	.....	20	82	120	120	53
13.....	31	.....	19	85	120	124	49
14.....	31	.....	22	92	124	124	50
15.....	0	.....	26	98	129	124	47
16.....	0	9	26	104	138	129	43
17.....	0	9	26	105	143	129	38
18.....	12	9	26	103	138	124	36
19.....	12	11	26	104	134	124	36
20.....	13	10	24	102	134	124	36
21.....	15	11	25	104	129	129	36
22.....	15	12	26	84	129	124	34
23.....	19	12	27	97	129	124	34
24.....	21	12	27	107	129	124	34
25.....	21	13	27	116	129	120	35
26.....	22	13	27	116	134	120	34
27.....	22	13	.....	116	134	116	34
28.....	21	13	7	120	129	120	34
29.....	8	13	22	120	124	120	34
30.....	.....	13	25	116	120	120	55
31.....	.....	.....	28	.....	116	120	.....

NOTE.—No discharge Oct. 30 to Apr. 15, inclusive.

Monthly discharge of East Fork Irrigation District canal near Mount Hood, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October (27 days).....	54	8	26.6	1,420
April (15 days).....	13	9	11.5	342
May (30 days).....	28	7	21.0	1,250
June.....	120	30	85.7	5,100
July.....	143	116	125	7,690
August.....	129	116	123	7,560
September.....	116	34	61.1	3,640
The year.....	.....	.....	.....	27,000

PACIFIC POWER & LIGHT CO.'S TAILRACE NEAR HOOD RIVER, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 36, T. 3 N., R. 10 E., just below power house, opposite upper gage on Hood River, three-quarters of a mile south of Hood River, Hood River County.

RECORDS AVAILABLE.—October 1, 1913, to September 30, 1914; January 1, 1916, to September 30, 1917.

GAGE.—Vertical staff on right bank of tailrace, at different datum from that of gage used 1913 to 1914. Gage reader, A. Rogers.

DISCHARGE MEASUREMENTS.—Made from footbridge just below gage.

CHANNEL AND CONTROL.—Flume 11 feet wide extends a few feet down from gage; below this the canal is excavated in gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.0 feet several times during year (discharge, 97 second-feet). Canal dry at various times.

1913-14 and 1916-17: Maximum discharge, 110 second-feet (determined from electric output February 20, 1914). Canal practically dry at times.

ICE.—Never any ice here.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table except when there was a great difference in the two readings for the day. For such days discharge is average of values obtained by applying both gage heights to rating table. Records good.

The Pacific Power & Light Co.'s canal diverts water from Hood River at a dam in the NE. $\frac{1}{4}$ sec. 1, T. 2 N., R. 10 E., to a power plant in the SE. $\frac{1}{4}$ sec. 36, T. 3 N., and the tailrace discharges back into the river in the NE. $\frac{1}{4}$ sec. 36, below gage on Hood River at Powderdale and above gage at bridge.

The following discharge measurement was made by C. E. Stricklin, assistant to State engineer:

June 12, 1917: Gage height, 1.70 feet; discharge, 76 second-feet.

Daily discharge, in second-feet, of Pacific Power & Light Co.'s tailrace near Hood River Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Sept.
1.....	80	73	-----	70	97	73	40	40	90	14	-----
2.....	82	73	-----	70	97	80	-----	40	86	64	-----
3.....	82	73	-----	94	97	76	90	40	14	73	-----
4.....	83	70	-----	94	40	50	83	40	-----	10	-----
5.....	80	70	35	94	90	67	80	70	-----	70	-----
6.....	82	70	-----	97	97	55	76	14	10	67	-----
7.....	80	67	94	64	97	58	80	80	10	70	-----
8.....	47	73	94	97	94	83	40	64	10	14	-----
9.....	85	73	94	97	90	86	76	70	40	-----	-----
10.....	83	67	14	90	52	90	80	70	83	97	-----
11.....	83	-----	86	94	40	86	80	67	70	70	-----
12.....	83	86	86	94	20	90	80	67	70	73	-----
13.....	83	86	86	83	-----	97	83	14	67	73	-----
14.....	83	86	47	14	-----	-----	80	-----	70	64	-----
15.....	80	86	14	94	38	-----	40	64	70	18	-----
16.....	83	86	6	94	80	80	40	64	67	67	-----
17.....	83	86	3	90	76	40	83	6	3	64	18
18.....	83	86	3	97	40	73	80	6	70	70	18
19.....	83	80	3	97	83	76	83	6	64	70	-----
20.....	80	76	3	94	73	40	76	6	70	97	-----
21.....	76	76	3	40	80	40	80	6	70	90	50
22.....	83	76	70	94	76	90	70	6	70	86	32
23.....	76	73	14	94	52	86	73	6	70	90	32
24.....	80	73	76	94	58	61	73	6	67	93	76
25.....	76	67	14	97	58	40	70	6	67	90	48
26.....	83	64	14	97	70	83	73	6	70	90	49
27.....	83	34	14	97	76	80	73	97	14	51	-----
28.....	83	-----	76	73	76	80	70	83	42	48	-----
29.....	83	-----	76	97	-----	83	14	83	67	52	-----
30.....	83	-----	76	64	-----	83	40	83	67	49	-----
31.....	83	-----	14	97	-----	76	-----	90	-----	-----	-----

NOTE.—No flow on days for which discharge is not given.

Monthly discharge of Pacific Power & Light Co.'s tailrace near Hood River, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	85	47	80.5	4,950
November (26 days).....	86	34	74.2	3,830
December (26 days).....	94	3	42.9	2,210
January.....	97	14	85.9	5,280
February (26 days).....	97	20	71.0	3,660
March (29 days).....	97	40	72.5	4,170
April (29 days).....	90	14	69.2	3,980
May (30 days).....	97	6	43.3	2,580
June (28 days).....	90	3	56.0	3,110
July (25 days).....	97	10	67.4	3,340
September (12 days).....	76	18	43.6	1,040
The year.....				37,800

WHITE SALMON RIVER BASIN.

WHITE SALMON RIVER AT SPLASH DAM NEAR TROUT LAKE, WASH.

LOCATION.—In NE. $\frac{1}{4}$ sec. 6, T. 5 N., R. 11 E., at splash dam formerly used by Wind River Lumber Co., $2\frac{1}{2}$ miles south of Trout Lake, Klickitat County, 4 miles below mouth of Trout Creek, and about 10 miles north of Husum.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 1, 1912, to September 30, 1917.

GAGE.—Vertical staffs in the pond above the dam, except June 1 to September 30, 1912, and May 23 to June 28, 1913, during which periods gage readings were made on vertical staff on right bank just below dam, Gage reader, H. G. Williams, sr.

DISCHARGE MEASUREMENTS.—Made from a cable 800 feet below the dam.

CHANNEL AND CONTROL.—For the gage above the dam the control is formed by two sharp-crested weirs and an overflow opening; below the dam, rocks and gravel; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.15 feet at 7 a. m. May 30 (discharge, 1,370 second-feet); minimum stage recorded, 1.82 feet December 29 (discharge, 117 second-feet).

1912-1917: Maximum stage recorded, 7.65 feet at 7 a. m. April 3, 1915 (discharge, 2,160 second-feet); minimum stage recorded, 1.05 feet August 1, 4, 5, and 6, 1915 (discharge, 52 second-feet).

ICE.—Stage-discharge relation unaffected by ice, but it is occasionally impossible to read gage when it is covered with ice and snow.

DIVERSIONS.—A considerable quantity of water is diverted for irrigation above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed by log hitting weir April 28. Rating curve used October 1 to April 27 fairly well defined between 125 and 700 second-feet. Curve used April 28 to September 30 fairly well defined. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good October to March, August, and September; fair April and July.

Discharge measurements of White Salmon River at splash dam near Trout Lake, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 27	W. E. Dickinson.....	2.15	151	Aug. 24	C. L. Batchelder.....	1.09	155
May 19	C. L. Batchelder.....	4.74	910	Oct. 20	.....do.....	1.00	149

Daily discharge, in second-feet, of White Salmon River at splash dam near Trout Lake, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	160	186	191	135	135	135	186	600	1,260	750	202	178
2.....	154	186	200	147	147	141	191	600	1,170	750	202	168
3.....	160	215	215	147	154	141	173	600	1,020	780	202	168
4.....	154	365	200	147	180	147	180	575	960	810	190	168
5.....	154	265	186	200	173	160	215	600	900	780	178	168
6.....	154	215	180	208	173	154	230	625	930	750	178	158
7.....	160	200	173	186	160	147	345	725	1,050	700	178	158
8.....	154	186	166	173	160	141	440	810	1,110	650	168	168
9.....	147	230	160	180	160	141	415	930	1,200	650	178	168
10.....	147	245	154	186	154	135	390	1,080	1,110	625	190	168
11.....	154	200	154	173	160	135	440	1,230	960	600	178	168
12.....	154	160	160	160	173	135	415	1,200	840	575	178	168
13.....	154	173	166	160	173	135	390	1,170	810	550	168	168
14.....	147	166	160	166	166	130	390	1,140	900	502	158	168
15.....	154	160	147	130	166	130	365	1,110	990	526	168	168
16.....	154	180	147	130	186	125	365	1,020	1,050	526	178	168
17.....	154	173	147	130	186	125	345	960	1,050	526	190	168
18.....	135	186	147	135	173	135	345	900	1,020	526	168	168
19.....	154	173	147	135	180	135	325	900	1,020	458	168	178
20.....	160	166	147	154	173	135	345	930	990	414	168	178
21.....	160	160	154	147	166	135	390	960	960	374	168	178
22.....	147	173	147	147	160	135	365	960	900	338	168	168
23.....	147	173	141	141	154	141	390	960	810	306	168	168
24.....	147	166	135	141	160	154	440	990	900	290	158	158
25.....	147	191	141	147	147	135	520	960	900	258	168	168
26.....	154	208	135	154	154	135	640	930	840	242	158	168
27.....	154	265	130	160	160	147	700	1,050	810	258	168	168
28.....	147	265	125	147	147	186	700	1,200	840	242	168	178
29.....	154	215	117	147	.....	265	700	1,340	810	202	168	168
30.....	166	200	135	125	.....	230	650	1,340	810	202	168	168
31.....	230	.....	147	123	.....	200	.....	1,260	.....	202	168	.....

Monthly discharge of White Salmon River at splash dam near Trout Lake, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	230	135	155	9,530
November.....	365	160	202	12,000
December.....	215	117	157	9,650
January.....	208	123	154	9,470
February.....	186	135	164	9,110
March.....	265	125	149	9,160
April.....	700	173	400	23,800
May.....	1,340	575	957	58,800
June.....	1,260	810	964	57,400
July.....	810	202	496	30,500
August.....	202	158	175	10,800
September.....	178	158	169	10,100
The year.....	1,340	117	345	250,000

WHITE SALMON RIVER AT HUSUM, WASH.

LOCATION.—In SE. $\frac{1}{4}$ sec. 25, T. 4 N., R. 10 E., 1,000 feet above falls and power house at Husum, Klickitat County, and three-quarters of a mile above Rattlesnake Creek.

DRAINAGE AREA.—300 square miles.

RECORDS AVAILABLE.—September 23, 1909, to September 30, 1917.

GAGE.—Vertical staff on right bank; read by John Wassell. Fuller water-stage recorder used October, 1912, to February, 1915.

DISCHARGE MEASUREMENTS.—Made from cable 100 feet below gage.

CHANNEL AND CONTROL.—Gravel and lava boulders; practically permanent. Control is crest of falls, which is sometimes obstructed by logs, causing backwater.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.55 feet, May 29 (discharge, 2,220 second-feet); minimum stage recorded, 2.98 feet, January 15 (discharge, 537 second-feet).

1909-1917: Maximum stage recorded, 7.65 feet at 7 a. m., November 24, 1909 (discharge, 4,340 second-feet); minimum stage recorded, 2.66 feet at 2 p. m., September 30, 1915 (discharge, 432 second-feet).

ICE.—Stage-discharge relation practically unaffected by ice.

DIVERSIONS.—Several ditches divert water for irrigation in Trout Lake Valley.

REGULATION.—None. Flow formerly affected at times by operation of splash dam 10 miles upstream; no logging on stream at present.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating table, except for April 2, for which discharge has been interpolated. Records good.

Discharge measurements of White Salmon River at Husum, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 27	W. E. Dickinson.....	3.35	698
May 19	C. L. Batchelder.....	4.62	1,460
Aug. 24	.....do.....	3.60	825

Daily discharge, in second-feet, of White Salmon River at Husum, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	820	720	675	585	565	545	820	1,170	2,060	1,580	990	820
2.....	820	720	720	585	565	565	750	1,110	1,900	1,580	990	820
3.....	770	720	720	585	585	545	720	1,170	1,740	1,660	990	820
4.....	770	990	720	608	608	585	720	1,110	1,660	1,740	930	820
5.....	770	720	675	630	608	585	720	1,110	1,580	1,660	930	820
6.....	770	770	675	675	608	585	770	1,170	1,370	1,580	930	820
7.....	770	720	630	630	608	585	930	1,300	1,580	1,510	930	820
8.....	770	720	630	630	608	630	1,110	1,370	1,900	1,510	870	820
9.....	770	720	630	630	608	630	1,050	1,580	1,900	1,510	870	770
10.....	770	770	630	630	585	608	1,050	1,740	1,900	1,440	930	770
11.....	770	720	630	630	608	608	1,110	1,900	1,740	1,440	930	770
12.....	720	720	630	630	630	585	1,050	1,900	1,510	1,370	930	770
13.....	720	675	630	585	608	565	1,050	1,820	1,440	1,370	930	770
14.....	720	630	675	565	608	565	990	1,740	1,740	1,300	870	770
15.....	720	630	630	545	608	565	930	1,660	1,900	1,300	870	770
16.....	720	630	630	545	630	545	930	1,580	1,980	1,300	870	770
17.....	720	675	608	565	630	545	930	1,510	1,900	1,300	870	720
18.....	720	675	608	565	630	565	930	1,440	1,900	1,300	870	720
19.....	720	675	630	565	630	565	930	1,440	1,900	1,230	930	770
20.....	720	630	630	585	630	565	870	1,510	1,900	1,170	870	770
21.....	720	630	630	585	585	545	870	1,510	1,740	1,170	870	720
22.....	675	675	630	585	608	565	930	1,510	1,660	1,110	870	720
23.....	675	630	630	585	608	585	930	1,580	1,580	1,110	870	720
24.....	675	630	608	585	608	630	990	1,580	1,740	1,050	870	630
25.....	675	675	585	565	608	630	1,110	1,580	1,740	1,050	820	675
26.....	675	770	585	565	630	630	1,230	1,510	1,580	1,050	820	675
27.....	675	720	585	630	630	630	1,300	1,580	1,660	1,050	820	675
28.....	675	720	565	585	565	675	1,300	1,900	1,660	1,050	820	675
29.....	675	720	565	565	.....	930	1,230	2,220	1,660	1,050	820	675
30.....	720	720	565	545	.....	870	1,230	2,060	1,580	1,050	820	675
31.....	770	.....	585	565	.....	770	.....	2,060	.....	990	820	.....

Monthly discharge of White Salmon River at Husum, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	820	675	731	44,900
November.....	990	630	704	41,900
December.....	720	565	630	38,700
January.....	675	545	591	36,300
February.....	630	565	607	33,700
March.....	930	545	613	37,700
April.....	1,300	720	983	58,500
May.....	2,220	1,110	1,560	95,900
June.....	2,060	1,440	1,740	104,000
July.....	1,740	990	1,310	80,600
August.....	990	820	888	54,600
September.....	820	630	751	44,700
The year.....	2,220	545	927	672,000

WHITE SALMON RIVER NEAR UNDERWOOD, WASH.

LOTATION.—In NW. $\frac{1}{4}$ sec. 14, T. 3 N., R. 10 E., in Klickitat County, about 200 yards below Northwestern Electric Co.'s power plant, $2\frac{1}{2}$ miles north of Underwood.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 11, 1915 to September 30, 1917; also October 18, 1912, to February 26, 1913, at dam about a mile above.

GAGE.—Friez water-stage recorder on left bank since January 30, 1916; Fuller recorder prior to that date; inspected by D. J. Shore, foreman of power plant, and by other employees.

DISCHARGE MEASUREMENTS.—Made from cable at gage; measuring conditions good.

CHANNEL AND CONTROL.—Rock and gravel; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 30 feet at 6.0 a. m. June 9 (discharge, 2,130 second-feet); minimum discharge not determined; occurs when power plant is shut down.

1915-1917: Maximum stage recorded, 5.0 feet at 3 a. m. March 21, 1916 (discharge, 4,100 second-feet); minimum discharge not determined; occurs when power plant is shut down.

ICE.—Stage-discharge relation not affected.

DIVERSIONS.—Several ditches divert water for irrigation in Trout Lake Valley.

REGULATION.—At low and medium stages practically all the water is used through the wheels of the power plant. The pond above the dam covers about 83 acres and is drawn down 6 or 8 feet at times.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 600 and 3,000 second-feet; fairly well defined between 300 and 600 second-feet. Operation of water-stage recorder unsatisfactory. Daily discharge ascertained by use of discharge integrator or by averaging discharge for two-hour intervals. Discharge for periods for which gage-height record is missing or impossible of interpretation has been determined from record of electrical output of power plant. Curve of relation of output to discharge is fairly well defined. Records good except for periods estimated. (See footnote to table of daily discharge.)

Discharge measurements of White Salmon River near Underwood, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 28	W. E. Dickinson.....	1.10	726
Nov. 3	C. L. Batchelder.....	1.36	936
May 19	do.....	2.32	1,550

Daily discharge, in second-feet, of White Salmon River near Underwood, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	871	a710	b800	760	a660	a710	1,140	1,400	1,950	1,630	1,070	a910
2.....	865	a740	b730	b770	a700	a620	1,190	1,430	b1,900	1,690	1,070	860
3.....	865	a730	853	b780	a740	a770	1,120	1,410	b1,840	1,680	b1,060	860
4.....	869	1,010	861	800	923	b400	1,140	1,370	1,790	1,750	b1,050	1,040
5.....	843	b800	826	860	900	a760	1,230	1,410	1,800	1,620	b1,040	a950
6.....	842	a650	772	960	860	a810	1,260	1,550	1,810	1,600	b1,020	a870
7.....	835	a690	b750	900	a850	a840	1,590	1,670	1,910	1,430	a1,010	a790
8.....	b670	a700	b730	860	a860	a840	1,630	1,830	1,990	1,470	a1,010	a720
9.....	a760	a710	710	800	a750	a720	1,560	1,890	2,130	.....	a1,040	a650
10.....	a770	a720	617	810	a690	a720	1,550	2,010	b1,960	.....	a990	a730
11.....	a760	a680	720	780	a720	a620	1,520	1,970	b1,800	.....	b990	a890
12.....	a740	a600	a720	830	a650	a590	1,450	.....	1,630	.....	b990	a840
13.....	a750	a600	a720	720	a740	a820	1,370	.....	1,660	.....	b980	a820
14.....	a740	a610	a700	a570	a800	a840	1,370	.....	1,750	.....	a980	a890
15.....	b620	b630	a700	a650	a770	b630	1,320	.....	1,880	1,420	a940	a930
16.....	a710	a640	a710	a660	a810	a780	b1,290	.....	1,950	1,380	b920	a550
17.....	a780	a660	620	a640	a790	a600	b1,250	.....	.....	1,340	a910	a710
18.....	a770	a670	a720	a640	a550	b500	1,220	.....	.....	1,280	a910	a850
19.....	a780	b550	a740	a680	800	a760	1,160	.....	.....	1,270	b800	a780
20.....	a760	a620	a730	a700	a810	a780	1,230	1,660	.....	1,230	1,030	a830
21.....	a760	a690	a720	778	a820	a820	b1,300	1,700	.....	b1,200	960	a810
22.....	b630	a730	a740	755	a780	a570	b1,300	1,680	.....	b1,180	918	a870
23.....	a710	a730	a710	747	a730	a800	b1,400	1,690	.....	b1,150	932	a450
24.....	a750	a700	700	737	a640	1,030	b1,400	1,730	1,790	1,130	895	a740
25.....	a740	760	770	723	a640	973	1,490	1,720	1,690	1,090	a890	a710
26.....	a770	833	700	701	a710	928	1,540	1,710	1,580	1,100	810	a760
27.....	a770	945	a670	607	a780	1,150	1,620	1,920	1,580	1,000	980	a770
28.....	a750	873	a630	670	a650	1,400	1,560	2,000	1,580	b1,090	a920	a750
29.....	b610	795	a610	703	.....	1,280	1,520	2,020	1,570	b,080	a920	a810
30.....	a730	b780	a600	740	.....	1,210	1,490	2,030	1,560	1,070	a930	a470
31.....	a720	.....	620	a780	.....	b1,000	.....	2,020	.....	1,071	a930	.....

a Computed from electric output of power plant.

b Estimated.

NOTE.—Mean discharge estimated: May 12-19, 1,700 second-feet; June 17-23, 1,870 second-feet; July 9-14, 1,440 second-feet.

Monthly discharge of White Salmon River near Underwood, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	871	610	759	46,700
November.....	1,010	550	719	42,800
December.....	861	600	716	44,000
January.....	960	570	746	45,900
February.....	923	550	754	41,900
March.....	1,400	400	815	50,100
April.....	1,630	1,120	1,370	81,500
May.....	2,030	1,370	1,720	106,000
June.....	2,130	1,560	1,840	109,000
July.....	1,750	1,070	1,340	82,400
August.....	1,070	800	964	59,300
September.....	1,040	450	780	46,400
The year.....	2,130	400	1,050	756,000

SANDY RIVER BASIN.

SANDY RIVER BELOW DAM NEAR MARMOT, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 13, T. 2 S., R. 5 E., a quarter of a mile below diversion dam for Bull Run plant of Portland Railway, Light & Power Co., about a mile southwest of Marmot, Clackamas County, and 9 miles east of Bull Run.

DRAINAGE AREA.—267 square miles at cable (measured on Mount Hood topographic map and on map of Oregon National Forest).

RECORDS AVAILABLE.—December 22, 1915, to September 30, 1917. When discharge of Sandy River canal is added the records are directly comparable with those at station above dam near Marmot, August 15, 1911, to December 21, 1915.

GAGE.—Vertical staff installed in gage well on right bank October 16, 1916; Stevens 8-day water-stage recorder installed December 9, 1916. Observer, O. G. Olson. Gage above crest of dam used December 22, 1915, to October 15, 1916.

DISCHARGE MEASUREMENTS.—Made from cable near upper end of backwater of dam (discharge of Sandy River canal deducted) or by wading near gage.

CHANNEL AND CONTROL.—Gravel and boulders; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 9.0 feet at 1.30 p. m. November 27 (discharge, 7,700 second-feet); minimum stage recorded, 0.37 foot October 26 (discharge, 9 second-feet).

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

DIVERSIONS.—Sandy River canal of Portland Railway, Light & Power Co. takes out at dam. Its flow is included with that of river to give total run-off.

REGULATION.—The storage back of dam serves to lessen diurnal fluctuation caused by melting glaciers but has no effect for period of a day or over.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage read once a day to hundredths October 16 to November 4; twice a day to hundredths November 5 to December 9. Operation of water-stage recorder satisfactory after December 9, except April 25 to 27 and July 8 to 13. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the gage-height graph, or for days when there was considerable fluctuation, by averaging discharge obtained by applying to rating table the mean gage heights for various subdivisions of the day. Records excellent.

Discharge measurements of Sandy River below dam near Marmot, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 16	F. F. Henshaw.....	0.39	<i>a</i> 12.9	May 10	C. L. Batchelder.....	7.00	<i>b</i> 3,650
Dec. 12	C. L. Batchelder.....	4.08	<i>b</i> 1,040	Aug. 7	F. F. Henshaw.....	2.04	<i>a</i> 251
Jan. 28	Batchelder and Briggs..	4.88	<i>b</i> 1,590				

a Measurement made by wading near gage.

b Measurement made above dam and canal deducted.

Daily discharge, in second-feet, of Sandy River below dam near Marmot, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....		345	1,340	458	702	422	2,050	2,320	4,120	1,970	389	78
2.....		302	1,250	1,280	795	405	1,540	2,230	3,410	1,970	345	230
3.....		515	1,400	1,810	1,220	422	1,370	2,230	3,410	1,970	305	190
4.....		1,370	1,510	1,920	1,370	682	1,480	2,140	2,930	1,890	290	70
5.....		795	1,340	3,960	1,480	1,310	3,040	2,050	2,930	1,730	272	60
6.....		770	1,310	2,710	1,540	920	2,710	2,920	3,280	1,620	255	40
7.....		820	870	2,140	1,540	795	3,820	5,200	3,960	1,480	242	18
8.....		770	895	1,620	1,440	702	3,820	4,440	4,280	1,350	228	33
9.....		1,480	870	1,340	1,280	652	2,930	4,620	5,000	1,300	230	37
10.....		1,970	748	1,190	1,190	615	2,510	3,960	4,120	1,240	210	38
11.....		1,250	680	1,100	1,340	575	2,820	3,820	3,540	1,420	215	202
12.....		820	990	970	1,810	555	2,410	3,960	2,930	1,130	235	52
13.....		680	1,890	845	1,650	535	1,970	3,680	3,160	1,080	218	43
14.....		535	1,480	748	1,370	495	1,970	3,410	4,120	1,020	398	64
15.....		444	1,160	652	1,250	458	1,730	2,950	4,620	1,040	595	92
16.....	10	345	995	595	2,020	466	1,510	2,410	4,800	1,070	615	55
17.....	10	312	895	555	1,730	475	1,320	2,230	4,280	1,020	635	146
18.....	10	345	870	515	1,400	535	1,220	2,320	3,680	970	595	84
19.....	10	290	1,160	495	1,190	555	1,280	2,510	3,540	920	575	77
20.....	10	238	1,480	495	1,040	575	1,650	2,710	3,280	845	555	72
21.....	10	225	1,580	515	945	555	1,970	3,160	3,410	770	575	93
22.....	10	210	1,280	458	845	555	1,810	2,820	2,960	702	535	30
23.....	10	235	1,020	495	748	732	2,610	2,610	2,510	635	447	44
24.....	10	205	870	458	702	1,540	2,820	2,580	2,710	595	242	38
25.....	9	1,250	748	732	635	1,100	4,440	2,540	2,510	575	240	45
26.....	9	2,050	652	870	555	920	5,000	2,510	2,410	615	134	59
27.....	10	3,960	595	1,830	595	1,710	4,200	2,820	2,320	635	82	161
28.....	12	2,710	535	1,620	458	2,320	3,410	3,410	2,410	575	72	93
29.....	10	1,890	495	1,190		3,040	2,930	4,120	2,230	515	75	58
30.....	225	1,730	458	920	32,840	2,050	2,410	3,820	1,970	405	70	37
31.....	555		440	770		1,480		3,960		458	67	

NOTE.—Mean discharge, Oct. 1-15, estimated 12 second-feet.

Monthly discharge of Sandy River below dam near Marmot, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	555	9	35.5	2,180
November.....	3,960	205	962	57,200
December.....	1,890	440	1,030	63,300
January.....	3,960	458	1,140	70,100
February.....	2,020	458	1,170	65,000
March.....	3,040	405	908	55,800
April.....	5,000	1,220	2,490	148,000
May.....	5,200	2,050	3,110	191,000
June.....	5,000	1,970	3,360	200,000
July.....	1,970	405	1,080	66,400
August.....	635	67	321	19,700
September.....	230	18	78.0	4,640
The year.....	5,200	9	1,300	943,000

Combined daily discharge, in second-feet, of Sandy River and canal near Marmot, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	400	589	1,500	726	938	738	2,290	2,500	4,130	2,150	759	450
2.....	392	546	1,400	1,560	1,030	721	1,780	2,410	3,420	2,190	745	424
3.....	376	759	1,620	2,110	1,460	738	1,610	2,400	3,420	2,190	737	463
4.....	376	1,610	1,720	2,220	1,620	998	1,720	2,310	2,940	2,110	722	484
5.....	368	1,000	1,550	4,280	1,730	1,630	3,250	2,300	2,940	1,950	695	474
6.....	368	971	1,520	3,020	1,790	1,240	2,880	3,170	3,290	1,840	678	472
7.....	360	1,020	1,110	2,450	1,790	1,110	3,990	5,250	3,970	1,760	665	450
8.....	360	964	1,160	1,920	1,680	1,030	3,990	4,530	4,300	1,700	651	501
9.....	352	1,630	1,150	1,640	1,520	976	2,940	4,720	5,050	1,650	653	487
10.....	344	2,080	1,030	1,480	1,430	939	2,530	4,060	4,160	1,590	633	488
11.....	344	1,400	964	1,390	1,580	899	2,860	3,920	3,580	1,540	638	652
12.....	352	1,030	1,270	1,250	2,060	879	2,450	4,060	2,970	1,480	658	484
13.....	352	888	2,190	1,130	1,890	859	2,050	3,780	3,250	1,430	686	475
14.....	352	779	1,780	1,030	1,610	811	1,990	3,510	4,290	1,370	650	514
15.....	360	728	1,450	936	1,490	774	1,940	3,050	4,790	1,390	596	533
16.....	366	629	1,130	879	2,270	782	1,660	2,590	4,970	1,420	616	487
17.....	366	596	1,180	831	1,970	791	1,490	2,510	4,450	1,360	636	484
18.....	358	645	1,150	791	1,640	851	1,400	2,600	3,850	1,310	596	480
19.....	342	606	1,440	771	1,430	879	1,460	2,790	3,710	1,250	576	473
20.....	342	554	1,770	771	1,280	899	1,530	2,990	3,450	1,180	556	468
21.....	342	533	1,870	791	1,180	879	2,150	3,280	3,580	1,100	576	465
22.....	334	518	1,570	734	1,080	879	1,990	2,830	3,130	1,030	536	462
23.....	334	551	1,310	771	984	1,060	2,000	2,620	2,680	967	578	476
24.....	326	513	1,150	734	946	1,840	3,010	2,590	2,880	919	590	470
25.....	325	1,490	1,030	1,020	887	1,410	4,660	2,550	2,640	899	588	468
26.....	325	2,220	936	1,160	847	1,100	5,120	2,520	2,510	939	566	491
27.....	366	4,050	871	2,060	787	1,950	4,310	2,830	2,420	959	496	494
28.....	376	2,740	811	1,790	774	2,560	3,540	3,420	2,460	899	486	516
29.....	390	1,910	771	1,360	-----	3,300	3,080	4,130	2,360	831	489	481
30.....	549	1,900	726	1,120	-----	2,290	2,570	3,830	2,120	777	484	460
31.....	847	-----	708	1,010	-----	1,720	-----	3,970	-----	768	499	-----

Combined monthly discharge of Sandy River and canal near Marmot, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 267 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	847	325	379	1.42	1.64	23,300
November.....	4,060	513	1,180	4.42	4.93	70,200
December.....	2,190	708	1,280	4.80	5.53	78,700
January.....	4,280	726	1,410	5.28	6.09	86,700
February.....	2,270	774	1,420	5.32	5.54	78,900
March.....	3,300	721	1,210	4.53	5.22	74,400
April.....	5,120	1,400	2,640	9.89	11.03	157,000
May.....	5,250	2,300	3,230	12.1	13.95	199,000
June.....	5,050	2,120	3,460	13.0	14.50	206,000
July.....	2,190	768	1,390	5.21	6.01	85,500
August.....	759	484	614	2.30	2.65	37,800
September.....	652	424	484	1.81	2.02	28,800
The year.....	5,250	325	1,550	5.81	79.11	1,130,000

LOST CREEK NEAR BRIGHTWOOD, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 25, T. 2 S., R. 7 E., about 100 yards above mouth, 1 mile southeast of Truman's ranch, and 8 miles east of Brightwood, Clackamas County.

DRAINAGE AREA.—11.2 square miles (measured on topographic map).

RECORDS AVAILABLE.—September 17, 1913, to September 30, 1917.

GAGE.—Stevens continuous water-stage recorder referred to a vertical staff on left bank. Observer, Carl Raithel.

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

CHANNEL AND CONTROL.—Gravel and boulders; may shift in floods.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder 2.48 feet at 9.40 a. m. November 27 (discharge, 485 second-feet); minimum stage recorded 0.40 foot September 30 (discharge, 19 second-feet).

1913-1917: Maximum stage recorded, 3.75 feet December 22, 1915 (discharge, 1,330 second-feet); minimum stage recorded, 0.38 foot September 25, 1915 (discharge, 15 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation practically permanent. However, a new rating curve, fairly well defined, has been drawn up averaging all late measurements. Operation of water-stage recorder somewhat unsatisfactory, as water in river has not had free access to well at times. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging discharge for bi-hourly periods. Records good.

Discharge measurements of Lost Creek near Brightwood, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
May 9	C. L. Batchelder.....	<i>Fect.</i> 2.06	<i>Sec.ft.</i> 290
Aug. 6	F. F. Henshaw.....	.67	30.2

Daily discharge, in second-feet, of Lost Creek near Brightwood, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	25	32	85	35	52	34	58	130	220	132	34	21
2.....	25	41	80	76	63	33	61	130	162	140	33	21
3.....	25	46	105	74	77	32	54	130	142	140	33	20
4.....	25	91	98	112	70	49	67	120	132	130	31	20
5.....	25	64	83	190	74	71	144	134	144	118	30	20
6.....	25	61	67	136	74	46	120	250	193	110	30	19
7.....	25	60	58	114	70	43	236	340	235	102	30	19
8.....	24	59	54	87	66	40	205	300	265	100	29	21
9.....	24	140	51	76	61	38	142	300	265	96	30	22
10.....	23	140	47	66	59	36	128	250	178	90	28	22
11.....	23	88	45	59	74	36	144	265	146	85	28	25
12.....	23	67	63	52	100	35	116	282	128	80	28	23
13.....	23	54	98	49	90	35	102	235	162	79	28	23
14.....	23	50	76	45	74	35	93	205	205	74	28	25
15.....	23	46	63	42	70	34	82	170	235	79	27	24
16.....	23	43	56	40	112	35	71	142	220	74	27	^a 22
17.....	22	40	52	39	93	35	64	134	220	70	27	19
18.....	22	40	54	37	77	36	60	136	205	66	26	^a 19
19.....	22	37	61	36	66	36	60	144	196	61	26	19
20.....	22	36	73	36	59	36	85	140	187	54	^a 26	19
21.....	21	36	54	36	58	36	110	144	202	50	^a 26	^a 20
22.....	21	35	46	34	49	36	108	134	168	46	26	^a 20
23.....	21	35	42	34	45	37	170	126	144	45	25	23
24.....	21	34	38	34	43	50	172	130	175	42	24	^a 22
25.....	21	104	37	46	40	41	300	132	150	40	23	22
26.....	21	124	35	47	39	38	300	132	148	43	23	^a 22
27.....	24	269	36	67	36	84	220	162	144	40	23	^a 21
28.....	22	150	35	77	35	108	196	220	142	38	22	^a 20
29.....	28	107	35	63	.....	140	168	235	130	36	22	20
30.....	29	102	34	58	.....	88	142	220	124	34	22	19
31.....	43	.....	34	58	.....	66	.....	235	.....	36	21	.....

^a Discharge interpolated.

NOTE.—Discharge estimated from comparison with record of Little Sandy River Jan. 28 to Feb. 4 and June 14-18.

Monthly discharge of Lost Creek near Brightwood, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 11.2 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	43	21	24.0	2.14	2.47	1,480
November.....	269	32	74.4	6.64	7.41	4,430
December.....	105	34	57.9	5.17	5.96	3,560
January.....	190	34	63.1	5.63	6.49	3,880
February.....	112	35	65.2	5.82	6.06	3,620
March.....	140	32	48.4	4.32	4.98	2,980
April.....	300	54	133	11.9	13.28	7,910
May.....	340	120	187	16.7	19.25	11,500
June.....	265	124	179	16.0	17.85	10,700
July.....	140	34	75.2	6.71	7.74	4,620
August.....	34	21	27.0	2.41	2.78	1,660
September.....	25	19	21.1	1.88	2.10	1,260
The year.....	340	19	79.4	7.09	96.37	57,600

SANDY RIVER CANAL NEAR MARMOT, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 13, T. 2 S., R. 5 E., about 500 feet below head gate, 1 mile southwest of Marmot, and 9 miles east of Bull Run, Clackamas County.

RECORDS AVAILABLE.—December 22, 1915, to September 30, 1917.

GAGE.—Vertical staff in stilling well; datum even with bottom of canal. Curley simplex gage used July 24 to November 7, 1916. Observer, O. G. Olson.

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

CHANNEL AND CONTROL.—Concrete-lined canal, 13 feet wide on bottom, side slopes 1 to 1. Control is at intake of first tunnel about 200 yards below gage, where there is a drop in grade.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year and during period 1916-17, 4.40 feet at 4.30 p. m. August 13 and 7.30 a. m. August 14 (discharge, 504 second-feet); minimum stage recorded, 0.10 foot September 11 to 15, 1916, and August 15 to 22, 1917 (discharge, 1 second-foot—leakage through gates).

ICE.—Stage-discharge relation never affected by ice.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage read to half-tenths twice daily. Operation of recorder satisfactory. Daily discharge ascertained by applying to the rating table the mean daily gage height obtained by inspecting the recorder graphs up to November 7, and the mean of two daily readings thereafter, except for days when there was a considerable change in stage, for which the discharge given is the result of averaging the applied gage heights. Records excellent.

Sandy River canal diverts water from Sandy River in the NE. $\frac{1}{4}$ sec. 13, T. 2 S., R. 5 E., into a reservoir near Bull Run post office, from which it is drawn for the Bull Run hydroelectric plant of the Portland Railway Light & Power Co. The tail-race of the power plant discharges into Bull Run River in the NE. $\frac{1}{4}$ sec. 6, T. 2 S., R. 5 E.

Discharge measurements of Sandy River canal near Marmot, Oreg., during the year ending Sept. 30 1917.

[Made by F. F. Henshaw.]

	Date.	Gage height.	Discharge.
		Feet.	Sec.-ft.
Oct. 16	3.52	351
Aug. 7	3.90	411

Daily discharge, in second-feet, of Sandy River canal near Marmot, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	388	244	155	268	236	316	236	177	13	180	370	372
2.....	380	244	152	284	236	316	236	177	12	222	400	194
3.....	364	244	215	300	244	316	236	174	12	222	432	273
4.....	364	236	215	300	252	316	236	174	11	222	432	414
5.....	356	208	208	316	252	316	208	252	11	222	423	414
6.....	356	201	208	308	252	316	166	252	12	222	423	432
7.....	348	201	244	308	252	316	172	47	12	284	423	432
8.....	348	194	260	300	244	324	172	94	25	348	423	468
9.....	340	150	284	300	244	324	15	96	52	348	423	450
10.....	332	114	284	292	236	324	16	97	43	348	423	450
11.....	332	152	284	292	244	324	40	104	42	122	423	450
12.....	340	208	284	284	252	324	37	102	41	348	423	432
13.....	340	208	300	284	244	324	80	99	89	438	468	432
14.....	340	244	300	284	244	316	18	99	166	348	252	450
15.....	348	284	292	284	244	316	105	97	166	348	1	441
16.....	356	284	135	284	252	316	145	177	166	348	1	432
17.....	356	284	284	276	244	316	166	284	166	340	1	338
18.....	348	300	284	276	244	316	179	284	166	340	1	396
19.....	332	316	284	276	244	324	177	284	166	332	1	396
20.....	332	316	292	276	244	324	180	284	166	332	1	396
21.....	332	308	292	276	236	324	180	115	166	332	1	372
22.....	324	308	292	276	236	324	179	13	166	332	1	432
23.....	324	316	292	276	236	324	187	13	166	332	131	432
24.....	316	308	284	276	244	300	194	10	166	324	348	432
25.....	316	244	284	284	252	308	215	10	134	324	348	423
26.....	316	174	284	292	292	177	116	10	104	324	432	432
27.....	356	91	276	229	192	236	112	10	104	324	414	333
28.....	364	28	276	172	316	244	128	11	48	324	414	423
29.....	380	24	276	170	.....	260	146	13	128	316	414	423
30.....	324	165	268	201	.....	244	160	13	152	372	414	423
31.....	292	.....	268	236	.....	236	.....	13	.....	310	432	.....

Monthly discharge of Sandy River canal near Marmot, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	388	292	343	21,100
November.....	316	24	220	13,100
December.....	300	135	260	16,000
January.....	316	170	274	16,800
February.....	316	192	247	13,700
March.....	324	177	302	18,600
April.....	236	15	148	8,810
May.....	284	10	116	7,130
June.....	166	11	95.7	5,690
July.....	348	122	304	18,700
August.....	468	1	293	18,000
September.....	468	194	406	24,200
The year.....	468	1	251	182,000

BULL RUN RIVER NEAR BULL RUN, OREG.

LOCATION.—In sec. 25, T. 1 S., R. 5 E., $1\frac{1}{4}$ miles above intake of Portland water-supply pipe line and 5 miles east of Bull Run, Clackamas County.

DRAINAGE AREA.—102 square miles.

RECORDS AVAILABLE.—August 20, 1907, to September 30, 1917; also readings on a gage belonging to city water department, January 5, 1895, to November 13, 1906.

GAGE.—Friez water-stage recorder referred to vertical staff on left bank. Gage datum raised 2 feet July 26, 1916. Prior to July 28, 1909, an inclined staff at headworks $1\frac{1}{4}$ miles below present gage. Observer, W. B. Wilson.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading near gage.

CHANNEL AND CONTROL.—Rocks and gravel; shifting in extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.40 feet at 11 a. m., November 27 (discharge, 7,970 second-feet); minimum stage recorded, 0.67 foot October 25 and 26 (discharge, 87 second-feet).

1895-1917: Maximum stage recorded, 10.6 feet on gage at headworks November 13, 1906 (discharge, 15,400 second-feet); minimum stage recorded, 2.54 feet August 29 to September 4, 1914 (discharge, 72 second-feet), and 2.60 feet September 3-4, 1910 (discharge, 72 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None above station. The two water-supply pipes divert practically all the low-water flow $1\frac{1}{2}$ miles below the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed November 4, when flood carried away a large log on control. Rating curve used October 1 to November 3 well defined between 100 and 4,000 second-feet; curve used November 4 to September 30 well defined. Operation of water-stage recorder satisfactory except for short periods. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging results obtained by applying to rating table the mean gage heights for bi-hourly periods. Records excellent.

Discharge measurements of Bull Run River near Bull Run, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
Jan. 27	Batchelder and Briggs.....	Feet.	Sec.-ft.
Aug. 7	F. F. Henshaw.....	3.82	2,360
		.96	175

Daily discharge, in second-feet, of Bull Run River near Bull Run, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	132	280	1,140	320	476	261	916	1,140	1,580	964	192	114
2.....	129	342	1,010	1,500	665	250	1,020	1,050	1,480	980	189	114
3.....	126	600	1,390	1,530	1,320	246	886	948	1,340	924	186	114
4.....	122	1,580	1,260	2,960	1,260	474	1,100	886	1,180	837	183	114
5.....	119	879	1,140	4,400	1,220	924	2,290	872	1,140	774	174	111
6.....	116	1,100	865	2,750	1,140	642	1,740	1,720	1,300	732	169	111
7.....	113	1,180	672	2,310	1,000	576	2,680	2,550	1,480	666	166	118
8.....	111	996	642	1,420	924	521	2,680	1,910	1,630	624	161	142
9.....	108	2,290	648	1,220	844	471	1,790	1,910	2,160	600	161	125
10.....	106	1,850	559	1,060	767	440	1,480	1,530	1,850	554	155	130
11.....	106	940	498	900	1,090	410	1,850	1,440	1,790	526	155	172
12.....	106	850	865	760	1,530	386	1,440	1,580	1,480	504	153	132
13.....	106	761	1,480	660	1,150	382	1,180	1,440	1,580	476	150	128
14.....	104	672	1,060	582	900	350	1,100	1,300	1,850	471	148	158
15.....	103	583	830	498	774	329	940	1,140	2,030	466	142	155
16.....	102	494	690	440	1,100	312	816	1,020	2,030	440	142	130
17.....	100	405	594	396	932	304	718	1,000	1,740	410	140	118
18.....	98	316	636	372	774	308	654	1,100	1,530	377	140	114
19.....	96	288	886	354	672	346	711	1,140	1,480	350	140	109
20.....	95	250	1,340	337	582	363	1,180	1,140	1,340	324	138	109
21.....	94	232	1,480	333	515	354	1,480	1,100	1,390	308	135	107
22.....	92	238	1,140	350	460	350	1,180	980	1,180	288	130	116
23.....	92	272	851	396	410	456	1,740	908	1,040	269	125	135
24.....	90	235	672	405	386	951	1,630	948	1,390	253	125	128
25.....	87	1,800	559	830	354	725	2,420	1,060	1,220	235	125	148
26.....	87	2,100	476	816	333	588	2,160	1,060	1,100	224	125	135
27.....	103	4,720	410	1,650	391	1,440	1,630	1,140	1,040	218	123	140
28.....	118	2,400	363	1,240	284	1,790	1,440	1,390	1,050	238	120	158
29.....	145	1,440	320	851	.....	2,290	1,260	1,530	1,100	221	120	145
30.....	242	1,440	320	654	.....	1,390	1,180	1,440	980	207	118	131
31.....	542	.....	308	548	.....	1,050	.....	1,480	.....	201	116	.....

NOTE.—Discharge interpolated because of defective gage-height record, Oct. 2-6, 15-20, 27, Nov. 12-27, estimated Nov. 10-11.

Monthly discharge of Bull Run River near Bull Run, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 102 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	542	87	125	1.23	1.42	7,690
November.....	4,720	232	1,050	10.3	11.49	62,500
December.....	1,480	308	810	7.94	9.15	49,800
January.....	4,400	320	1,060	10.4	11.99	65,200
February.....	1,530	284	795	7.79	8.11	44,200
March.....	2,290	246	635	6.23	7.18	39,000
April.....	2,680	654	1,440	14.1	15.73	85,700
May.....	2,550	872	1,290	12.6	14.53	79,300
June.....	2,160	980	1,450	14.2	15.84	86,300
July.....	980	201	473	4.64	5.35	29,100
August.....	192	116	147	1.44	1.66	8,040
September.....	172	107	129	1.26	1.41	7,680
The year.....	4,720	87	781	7.66	103.86	566,000

LITTLE SANDY RIVER NEAR MARMOT, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 6, T. 2 S., R. 6 E., at trail bridge at Little Sandy ranger station, $1\frac{1}{2}$ miles north of Marmot, Clackamas County.

DRAINAGE AREA.—17.2 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 14, 1913, to September 30, 1917.

GAGE.—Stevens water-stage recorder referred to vertical staff on left bank just below bridge; inspected by Carl Aschoff.

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

CHANNEL AND CONTROL.—Gravel and boulders; may shift somewhat.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.60 feet at 11 a. m.

November 27 (discharge, 1,030 second-feet); minimum stage recorded, 0.25 foot October 25 and 26 (discharge, 14 second-feet).

1913-1917: Maximum stage recorded, 4.55 feet at 4 p. m., November 17, 1915 (discharge, 1,510 second-feet); minimum stage recorded, 0.21 foot August 28, 1914 (discharge, 12 second-feet).

ICE.—Stage-discharge relation never affected by ice.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined below 800 second-feet. Operation of water-stage recorder somewhat unsatisfactory on account of clock stopping occasionally and stoppage of inlet to well during period of low water. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting recorder graph or, for days of considerable fluctuation, by averaging results obtained by applying to rating table the mean gage heights for bihourly periods. Records good.

Discharge measurements of Little Sandy River near Marmot, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.
Dec. 12	C. L. Batchelder.....	Feet. 1.65	Sec.-ft. 178
Aug. 6	F. F. Henshaw.....	.44	24.9
14	do.....	.36	18.4

Daily discharge, in second-feet, of Little Sandy River near Marmot, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	22	40	189	60	101	52	178	212	300	208	24	16
2.....	22	89	178	307	120	52	189	200	265	194	24	15
3.....	21	88	200	318	212	51	178	189	265	181	23	15
4.....	20	265	178	350	200	98	200	178	224	168	23	15
5.....	20	189	167	540	200	167	390	178	224	155	22	15
6.....	19	189	135	410	200	125	335	333	265	142	22	15
7.....	19	212	112	370	189	112	450	540	300	129	21	17
8.....	18	145	104	237	178	102	430	370	335	116	21	23
9.....	18	450	105	200	167	93	318	352	430	108	20	19
10.....	17	265	96	189	200	84	282	282	352	100	20	20
11.....	17	125	82	156	237	79	318	282	318	92	19	28
12.....	17	107	230	135	212	72	265	318	265	84	19	21
13.....	17	91	450	120	189	71	224	265	318	77	18	22
14.....	17	67	450	101	178	66	200	251	370	69	18	30
15.....	17	58	200	86	156	61	189	224	390	61	18	30
16.....	16	49	156	78	262	55	167	200	390	53	18	21
17.....	16	46	135	72	200	54	145	200	352	47	18	19
18.....	16	54	138	68	167	54	135	224	318	45	18	18
19.....	16	50	200	64	145	56	145	251	300	43	18	18
20.....	15	42	251	61	125	58	212	251	282	41	17	18
21.....	15	40	265	61	107	55	282	237	300	39	17	17
22.....	15	40	224	67	96	56	237	224	251	37	17	18
23.....	15	54	178	73	84	73	300	200	224	35	17	27
24.....	15	44	145	76	78	112	300	212	300	33	16	24
25.....	14	319	116	218	72	107	410	224	287	31	16	34
26.....	14	370	97	212	68	101	390	224	274	29	16	28
27.....	20	651	86	251	61	209	300	237	261	27	16	31
28.....	21	335	76	237	56	335	251	265	248	28	16	37
29.....	32	237	68	178	.....	390	224	300	235	29	16	28
30.....	41	237	63	135	.....	265	212	282	222	26	15	24
31.....	92	.....	58	111	.....	200	.....	282	.....	24	16	.....

NOTE.—Discharge estimated from hydrographic comparison with station on Bull Run River Nov. 4-14 and with station on Lost Creek Feb. 8-13. Discharge interpolated June 25 to July 7, July 9-15, 18-26, and Aug. 2-13.

Monthly discharge of Little Sandy River near Marmot, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 17.2 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	92	14	21.0	1.22	1.41	1,290
November.....	651	40	165	9.59	10.70	9,820
December.....	450	58	166	9.65	11.12	10,200
January.....	540	60	179	10.4	11.99	11,000
February.....	262	56	152	8.84	9.20	8,440
March.....	390	51	112	6.51	7.50	6,890
April.....	450	135	262	15.2	16.96	15,000
May.....	540	178	258	15.0	17.29	15,900
June.....	430	222	296	17.2	19.19	17,000
July.....	208	24	79.1	4.60	5.30	4,860
August.....	24	15	18.7	1.09	1.26	1,150
September.....	37	15	22.1	1.28	1.43	1,320
The year.....	651	14	144	8.37	113.35	104,000

WILLAMETTE RIVER BASIN.

MIDDLE FORK OF WILLAMETTE RIVER AT JASPER, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 23, T. 18 S., R. 2 W., just below Jasper post office, Lane County, 2 miles above Natron and 3 miles below Fall Creek.

DRAINAGE AREA.—1,450 square miles.

RECORDS AVAILABLE.—September 16, 1905, to February 6, 1912; July 26, 1913, to March 31, 1917, when station was discontinued.

GAGE.—Vertical staff on right bank; read by B. F. Sylvester.

DISCHARGE MEASUREMENTS.—Made from new highway bridge a short distance above the gage.

CHANNEL AND CONTROL.—Gravel and small boulders; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.45 feet at 7 a. m., March 28 (discharge, 15,600 second-feet); minimum stage recorded, 3.25 feet, October 19 to 27 (discharge, 850 second-feet).

1905-1912 and 1913-1917: Maximum stage recorded, 16.6 feet at 9 a. m., November 23, 1909 (discharge, estimated from extension of rating curve, 122,000 second-feet); minimum authentic discharge, 610 second-feet in September and October, 1915; a minimum of 530 second-feet September to November, 1907, is uncertain.

DIVERSIONS.—None.

REGULATION.—Some storage developed on Waldo Lake, but no storage operations since 1909.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 700 and 10,000 second-feet. Gage read daily to quarter-tenths. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

The following discharge measurement was made by C. L. Batchelder:

June 12, 1917: Gage height, 5.79 feet; discharge, 6,550 second-feet.

Daily discharge, in second-feet, of Middle Fork of Willamette River at Jasper, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1.....	950	1,280	3,860	2,280	3,320	2,860	16.....	900	1,220	2,660	2,460	4,760	2,860
2.....	950	1,060	3,320	3,860	2,860	2,860	17.....	900	1,220	2,660	2,460	6,200	2,860
3.....	1,000	1,940	2,860	9,550	6,600	2,860	18.....	900	1,220	1,750	2,370	5,460	2,860
4.....	1,000	1,860	5,820	6,600	5,820	2,860	19.....	850	1,480	4,440	2,280	4,760	2,860
5.....	1,000	1,940	5,820	9,550	5,820	7,500	20.....	850	1,410	7,500	2,190	4,440	3,320
6.....	950	2,020	5,820	14,100	6,200	7,050	21.....	850	1,340	8,500	2,280	3,860	4,140
7.....	950	4,440	4,440	10,100	6,200	5,820	22.....	850	1,280	7,500	2,190	3,860	3,860
8.....	950	1,780	3,860	7,500	5,820	5,820	23.....	850	1,280	5,820	2,280	3,320	3,860
9.....	900	2,020	4,440	5,820	5,100	5,100	24.....	850	1,220	4,760	2,280	3,320	9,000
10.....	900	2,020	4,440	5,100	5,100	4,440	25.....	850	1,410	3,860	2,190	3,860	15,300
11.....	900	1,860	3,580	4,440	5,820	3,860	26.....	850	10,100	3,320	2,190	3,580	9,000
12.....	900	1,620	3,080	4,140	7,500	3,580	27.....	850	6,200	2,860	2,280	3,320	10,100
13.....	900	1,410	2,860	3,860	6,600	3,580	28.....	900	12,900	2,660	5,820	3,080	15,300
14.....	900	1,340	2,860	3,320	5,820	3,320	29.....	900	7,500	2,460	3,860	.....	15,300
15.....	900	1,280	2,860	2,860	4,760	3,080	30.....	1,280	5,100	1,480	4,440	.....	12,300
							31.....	1,110	.....	3,320	3,580	.....	9,000

Monthly discharge of Middle Fork of Willamette River at Jasper, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	1,280	850	922	56,700
November.....	12,900	1,060	2,760	164,000
December.....	8,500	1,480	4,050	249,000
January.....	14,100	2,190	4,460	274,000
February.....	7,500	2,860	4,900	272,000
March.....	15,300	2,860	6,020	370,000
The period.....				1,390,000

WILLAMETTE RIVER AT ALBANY, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 6, T. 11 S., R. 3 W., at the end of Broadalbin Street, Albany, Linn County, about half a mile above Southern Pacific Railroad bridge (formerly Corvallis & Eastern) just below mouth of Calapooya Creek, and about 9 miles by river above Santiam River.

DRAINAGE AREA.—4,860 square miles.

RECORDS AVAILABLE.—November 24, 1878, to April 30, 1882; January 21, 1892, to September 30, 1917; some fragmentary records 1883 to 1888.

GAGE.—Vertical staff in two sections on right bank.

DISCHARGE MEASUREMENTS.—Made from Southern Pacific bridge, or from highway bridge immediately upstream from gage.

CHANNEL AND CONTROL.—Sand and fine gravel; control practically permanent. Above gage height 17 feet some water flows through a slough several hundred feet to the left of the main channel.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.4 feet at 8 a. m. April 9 (discharge, 45,600 second-feet); minimum stage recorded, 0.9 foot October 26–28 (discharge, 3,220 second-feet).

1878–1882 and 1892–1917: Maximum stage recorded, 32.8 feet January 14, 1881 (discharge, 245,000 second-feet); minimum stage recorded, 0.2 foot September 21 to 27, 1879 (discharge, 1,870 second-feet), but this is somewhat uncertain. Lowest stages recorded in recent years are 0.4 foot October 30 to November 10, 1895 (discharge, 2,220 second-feet), and 0.5 foot August 26 to September 25, 1905, September 5 to 14, and October 13–15, 20–22, 1915 (discharge, 2,400 second-feet). The maximum stage ever known was 36.0 feet December 4, 1861 (discharge, 302,000 second-feet).

ICE.—Stage discharge relation unaffected by ice.

DIVERSIONS.—The Albany power canal has diverted water from South Santiam River near Lebanon and discharged into Willamette River above the gage and measuring section since the early nineties. The following measurements have been made of the quantity diverted:

	Second-feet.
Nov. 9, 1911, at Albany.....	210
Sept. 21, 1912, at intake.....	262
Sept. 21, 1912, at Albany.....	242
July 15, 1913, at intake.....	247
Aug. 23, 1917, at Albany.....	195

Determinations of run-off per square mile and depth in inches published in Water-Supply Papers 370, 312, 332, 362, and 394 are in error.

REGULATION.—Practically none.

ACCURACY.—Stage-discharge relation for medium and low stages appears to have changed slightly some time during recent years. A new rating curve well defined, has been drawn for stages below 8 feet; this curve applied since October 1, 1916. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

COOPERATION.—Gage-height record furnished by the Weather Bureau.

Discharge measurements of Willamette River at Albany, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	Sec.-ft.
Oct. 14	W. E. Dickinson.....	1.02	3,480
Aug. 27	F. F. Henshaw.....	1.20	3,740

Daily discharge, in second-feet, of Willamette River at Albany, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	3,830	4,500	20,500	10,500	16,900	15,700	30,900	21,100	18,100	13,300	5,710	3,620
2.....	3,830	4,730	18,100	11,000	14,500	14,200	27,800	21,800	18,400	12,700	5,460	3,620
3.....	3,620	4,500	15,700	16,000	13,900	13,300	32,600	20,800	18,100	13,300	5,210	3,620
4.....	3,620	5,710	16,300	24,200	16,900	12,700	32,200	19,600	16,900	13,900	5,210	3,620
5.....	3,620	7,520	22,400	22,400	18,700	14,500	27,100	18,100	15,400	13,900	4,970	3,420
6.....	3,620	9,930	26,700	28,600	18,700	23,500	29,000	17,500	14,800	13,300	4,970	3,420
7.....	3,620	9,110	28,200	36,000	18,700	24,200	33,000	19,600	15,700	13,000	4,970	3,420
8.....	3,620	13,300	23,800	29,700	18,400	22,100	23,000	25,300	16,900	12,700	4,730	3,420
9.....	3,620	10,200	20,500	23,800	17,500	21,800	45,600	25,600	17,800	12,200	4,730	3,420
10.....	3,620	8,570	21,100	20,200	16,300	20,500	43,200	26,000	20,800	11,900	4,730	3,620
11.....	3,620	8,040	19,600	18,100	15,700	18,700	36,000	27,100	21,100	11,600	4,730	3,620
12.....	3,620	7,520	16,900	16,900	17,500	16,900	37,300	25,300	19,000	11,000	4,500	3,620
13.....	3,620	7,000	15,400	16,000	20,200	16,000	42,300	24,900	16,900	10,800	4,500	3,620
14.....	3,620	6,220	14,200	14,200	19,000	15,700	36,000	25,300	15,400	10,200	4,500	3,620
15.....	3,420	5,710	13,300	13,000	16,900	15,100	31,300	24,200	15,700	9,930	4,270	3,620
16.....	3,420	5,210	12,700	11,900	15,700	14,200	27,800	22,400	17,800	9,380	4,270	3,620
17.....	3,420	5,210	12,200	11,000	15,700	16,000	24,500	21,500	17,800	9,380	4,270	3,620
18.....	3,420	4,970	11,600	10,200	17,200	14,500	22,100	21,100	20,500	9,110	4,270	3,620
19.....	3,420	5,210	11,000	9,650	16,000	12,400	19,900	22,400	19,300	8,840	4,270	3,620
20.....	3,420	5,710	14,500	9,110	16,000	12,400	19,000	21,100	19,300	8,570	4,050	3,620
21.....	3,420	5,460	19,300	9,110	17,800	12,200	20,200	21,100	18,700	8,570	4,050	3,620
22.....	3,420	5,210	22,400	9,380	18,400	16,000	25,600	20,500	18,100	8,040	4,050	3,420
23.....	3,420	5,210	23,100	9,380	19,000	16,900	24,900	19,600	17,500	7,520	4,050	3,420
24.....	3,420	5,210	21,500	9,380	17,800	20,800	25,300	18,400	16,000	7,260	4,050	3,420
25.....	3,420	5,460	19,900	9,110	16,600	33,900	26,700	17,200	15,100	6,740	4,050	3,420
26.....	3,220	7,520	17,500	8,840	16,900	45,100	27,800	16,900	14,500	6,480	4,050	3,420
27.....	3,220	21,800	15,400	9,110	17,200	36,000	30,900	16,000	14,200	6,480	4,050	3,420
28.....	3,220	20,500	13,900	11,600	16,600	33,400	28,200	15,400	14,200	6,220	4,050	3,420
29.....	3,420	29,700	12,700	21,100	.....	40,000	24,900	16,900	14,500	5,960	3,830	3,420
30.....	3,620	23,800	11,900	21,500	.....	41,400	22,800	18,700	13,900	5,960	3,830	3,420
31.....	4,270	.....	11,000	19,300	.....	38,700	.....	18,700	.....	5,960	3,620	.....

Monthly discharge of Willamette River at Albany, Oreg., for the year ending Sept. 30, 1917

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	4,270	3,220	3,540	218,000
November.....	29,700	4,500	8,960	533,000
December.....	28,200	11,000	17,500	1,080,000
January.....	36,000	8,840	15,800	972,000
February.....	20,200	13,900	17,200	555,000
March.....	45,100	12,200	21,600	1,330,000
April.....	45,600	19,000	29,600	1,760,000
May.....	27,100	15,400	21,000	1,290,000
June.....	21,100	13,900	17,100	1,020,000
July.....	13,900	5,960	9,810	603,000
August.....	5,710	3,620	4,450	274,000
September.....	3,620	3,420	3,530	210,000
The year.....	45,600	3,220	14,100	10,200,000

SALMON CREEK NEAR OAKRIDGE, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 13, T. 21 S., R. 3 E., about a mile above Southern Pacific Railroad bridge and 3 miles above Oakridge, Lane County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 6, 1913, to March 7, 1916, and October 1, 1916, to September 30, 1917.

GAGE.—Stevens continuous water-stage recorder on right bank about a mile above railroad bridge; used since October 1, 1914. Vertical staff on right bank 500 feet above railroad bridge used February 6 to November 21, 1913. Inclined staff on right bank 200 feet above railroad bridge used November 22, 1913, to September 30, 1914. Observers, Flora Warner and Mrs. J. W. Michael.

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

CHANNEL AND CONTROL.—Gravel and small boulders; may shift during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.49 feet some time between December 25 and April 11, while clock was stopped (discharge, 1,740 second-feet); minimum stage recorded, 0.65 feet (staff gage reading) October 16 (discharge, 132 second-feet).

1913-1917: Maximum stage recorded, 2.92 feet at 3 p. m. November 25, 1915 (discharge, 2,610 second-feet); minimum stage recorded, 0.23 foot at 8 p. m. October 30, 1915 (discharge, 98 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; lower part of last rating curve slightly revised on basis of latest measurements. New rating curve used from October 1 well defined between 150 and 1,600 second-feet. Operation of water-stage recorder fairly satisfactory; staff gage read on days for which discharge is given October 1 to November 3. Daily discharge ascertained by applying to the rating table the mean daily gage height determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging results obtained by applying the mean gage heights for short intervals to the rating table. Records good.

Discharge measurements of Salmon Creek near Oakridge, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.
May 13	J. C. Kuhns ^a	<i>Feet.</i> 62.38	<i>Sec.-ft.</i> 1,530
June 13	C. L. Batchelder	1.88	858
Sept. 5	do.	.79	167

^aForest ranger.

^bGage height taken from recorder sheet.

Daily discharge, in second-feet, of Salmon Creek near Oakridge, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1	210		404		980	1,040	830	322	189
2			440		930	1,040	930	315	189
3		222	470		880	930	980	308	186
4			470		830	830	930	300	186
5	200		440		830	830	930	292	186
6			392		1,050	930	880	284	182
7			368		1,400	1,040	880	277	178
8	196		356		1,320	1,240	830	270	175
9			330		1,400	1,560	830	263	175
10			305		1,400	1,400	780	256	175
11			290	1,170	1,400	1,100	780	249	172
12	200		285	1,170	1,480	930	740	242	172
13			285	980	1,560	880	740	246	175
14			285	930	1,400	1,180	690	242	175
15			280	830	1,240	1,480	690	242	175
16	160		275	780	1,100	1,400	650	238	169
17			300	690	1,040	1,330	650	238	163
18			470	650	1,040	1,260	610	230	160
19			650	610	980	1,190	580	222	154
20	132		610	650	930	1,140	540	218	154
21		175	540	780	930	1,070	470	210	151
22		175	470	780	930	1,000	440	206	154
23	142	172	410	980	880	930	440	200	172
24		304	368	1,100	830	930	410	200	169
25		500	335	1,400	780	930	386	200	169
26	140	690		1,560	780	930	368	196	166
27		780		1,320	780	930	368	196	163
28		610		1,170	880	930	350	192	160
29		500		1,040	1,040	880	343	192	571
30		440		980	1,040	830	336	192	571
31	175				1,040		329	189	

NOTE.—Discharge interpolated June 14, 17-22, 24-27, and July 29 to Aug. 11.

Monthly discharge of Salmon Creek near Oakridge, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
November 21-30.....	780	172	435	8,630
December 1-25.....	650	275	393	19,500
April 11-30.....	1,560	610	978	38,800
May.....	1,560	780	1,070	65,800
June.....	1,560	830	1,070	63,700
July.....	980	329	636	39,100
August.....	322	189	240	14,800
September.....	189	151	170	10,100

MCKENZIE RIVER AT MCKENZIE BRIDGE, OREG.

LOCATION.—In sec. 14, T. 16 S., R. 6 E., at highway bridge at McKenzie Bridge, Lane County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 8, 1910, to September 30, 1916; April 1 to September 30, 1917.

GAGE.—Vertical staff attached to right abutment of the highway bridge at McKenzie Bridge. Gage reader, S. L. Taylor. Another gage, which was formerly read, is located at Hayes ranch, one-half mile above McKenzie Bridge; and a third is on left bank at Paradise ranger station about 2 miles above the bridge.

DISCHARGE MEASUREMENTS.—Made from cable three-eighths mile above the ranger station.

CHANNEL AND CONTROL.—Rocky; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.2 feet June 16 and 19 (discharge, 3,450 second-feet); minimum stage recorded, 2.4 feet September 25 and 26 (discharge, 1,420 second-feet).

1910-1917: Maximum stage recorded, 5 feet on gage at highway bridge, January 13, 1912 (discharge, 7,400 second-feet); minimum stage recorded, 1.42 feet November 7, 1915 (discharge, 924 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Daily discharge ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Gage-height records furnished by U. S. Forest Service, C. R. Seitz, supervisor.

No discharge measurements made during year.

Daily discharge, in second-feet, of McKenzie River at McKenzie Bridge, Oreg., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	1,670	2,160	2,620	2,620	1,850	1,580	16.....	1,940	2,500	3,450	2,380	1,670	a1,500
2.....	1,670	2,050	2,620	2,750	1,760	a1,580	17.....	1,850	2,620	a3,380	a2,320	1,670	1,500
3.....	1,670	2,050	2,500	2,750	1,760	a1,580	18.....	1,760	2,500	3,300	2,270	a1,620	a1,500
4.....	1,670	a2,050	2,380	2,750	a1,760	1,580	19.....	1,760	2,380	3,450	a2,220	1,580	a1,500
5.....	1,850	2,050	2,380	a2,750	a1,760	a1,580	20.....	1,760	a2,320	3,300	2,160	1,580	1,500
6.....	1,940	a2,280	2,500	2,750	1,760	1,580	21.....	1,940	2,270	3,150	2,160	1,580	a1,480
7.....	2,880	2,500	2,750	2,620	1,760	1,580	22.....	a2,000	a2,240	3,150	2,160	a1,580	a1,470
8.....	2,750	2,620	2,750	2,620	1,670	1,580	23.....	2,050	a2,200	a3,060	2,160	1,580	a1,450
9.....	2,380	2,880	3,300	2,620	a1,670	1,580	24.....	2,160	2,160	a2,970	2,050	1,580	a1,440
10.....	2,160	2,750	3,150	2,500	1,670	1,580	25.....	2,620	2,160	2,880	2,050	1,580	1,420
11.....	2,160	2,880	2,750	2,380	a1,670	a1,500	26.....	2,880	2,160	2,750	a2,020	a1,580	1,420
12.....	2,270	2,750	2,620	a2,380	1,670	1,500	27.....	2,380	a2,270	2,750	a2,000	a1,580	.....
13.....	2,160	a2,820	2,500	a2,380	1,670	a1,500	28.....	a2,270	2,380	2,880	a1,970	1,580	.....
14.....	2,050	2,880	2,620	2,380	1,670	1,500	29.....	a2,270	2,500	2,750	1,940	1,580	.....
15.....	a2,000	2,750	3,010	a2,380	1,670	a1,500	30.....	2,270	2,500	2,620	1,940	1,670	.....
							31.....	.....	2,620	.....	a1,900	1,580	.....

a Interpolated.

NOTE.—Discharge estimated 1,400 second-feet Sept. 27-30.

Monthly discharge of McKenzie River at McKenzie Bridge, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April.....	2,880	1,670	2,110	126,000
May.....	2,880	2,050	2,430	149,000
June.....	3,450	2,380	2,880	171,000
July.....	2,750	1,900	2,330	143,000
August.....	1,850	1,580	1,660	102,000
September.....	1,580	.....	1,500	89,300
The period.....	.....	.....	.....	780,000

NORTH SANTIAM RIVER AT NIAGARA, OREG.

LOCATION.—In SE. $\frac{1}{4}$ sec. 29, T. 9 S., R. 4 E., just below Badbanks Creek, half a mile below Niagara, Marion County, and about 15 miles below Breitenbush Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 21, 1908, to November 17, 1910; June 7, 1911, to September 30, 1917.

GAGE.—Vertical staff in two sections on right bank, about 200 feet below the mouth of Badbanks Creek. Gage reader, H. D. Bondy.

DISCHARGE MEASUREMENTS.—Made from cable 75 feet above gage. Prior to 1913 made from a boat.

CHANNEL AND CONTROL.—Gravel and boulders. Control is about 50 feet below gage and is composed of huge boulders; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.3 feet at 4 p. m. May 7 (discharge, 8,300 second-feet); minimum stage recorded, 1.6 feet October 25 to 28 (discharge, 650 second-feet).

1908-1917: Maximum stage (determined from high-water mark), 16.4 feet about 1 p. m. November 22, 1909 (discharge, 63,200 second-feet); minimum stage, 1.25 feet, September 23 to 25, 1915 (discharge, 430 second-feet).

ICE.—Stage-discharge relation never affected by ice.

DIVERSIONS.—None above station. The Salem power canal diverts water near Stayton.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 400 and 2,000 second-feet and fairly well defined above 2,000 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of North Santiam River at Niagara, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
Oct. 12	W. E. Dickinson.....	Feet. 1.72	Sec.-ft. 779
Sept. 28	C. L. Batchelder.....	1.74	747

Daily discharge, in second-feet, of North Santiam River at Niagara, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	800	970	3,360	1,450	1,450	1,350	2,880	4,240	6,240	5,400	1,350	720
2.....	800	1,350	3,200	1,800	1,560	1,350	2,600	4,240	5,800	5,400	1,250	720
3.....	800	1,250	5,000	2,320	2,320	1,350	2,460	4,240	5,800	5,200	1,250	760
4.....	760	3,200	4,060	3,700	2,040	1,450	2,320	4,240	5,400	4,600	1,200	840
5.....	720	2,320	3,520	6,240	2,040	1,920	2,740	4,240	5,400	4,420	1,200	880
6.....	720	2,180	2,880	5,000	2,180	1,800	3,880	6,240	5,400	4,060	1,150	1,680
7.....	685	1,920	2,460	3,360	2,180	1,680	7,120	8,060	5,800	3,880	1,150	1,800
8.....	720	1,800	2,320	2,880	2,040	1,560	6,630	8,060	6,460	3,700	1,100	1,800
9.....	685	2,040	2,180	2,460	2,180	1,450	5,400	8,060	8,060	3,520	1,100	1,800
10.....	685	1,920	2,040	2,320	2,180	1,350	5,800	7,580	7,580	3,200	1,060	1,800
11.....	720	1,800	1,920	2,180	2,600	1,350	5,200	7,120	7,340	2,880	1,060	1,800
12.....	720	1,560	1,800	2,040	3,200	1,350	5,000	6,900	7,580	2,740	1,060	1,800
13.....	720	1,350	2,040	1,920	3,040	1,350	4,240	6,680	7,580	2,600	1,060	2,040
14.....	720	1,350	2,040	1,800	2,600	1,350	3,880	6,240	7,580	2,600	1,060	1,920
15.....	720	1,200	1,920	1,680	2,460	1,250	3,520	6,020	7,580	2,600	1,060	1,920
16.....	720	1,150	1,800	1,560	3,880	1,250	3,200	5,400	7,580	2,460	1,020	1,920
17.....	685	1,150	1,800	1,450	3,200	1,200	2,740	5,000	7,580	2,460	1,020	1,680
18.....	685	1,250	1,800	1,450	2,880	1,150	2,600	4,600	7,580	2,320	1,020	1,560
19.....	685	1,150	2,320	1,350	2,600	1,560	2,600	4,600	7,340	2,320	970	1,350
20.....	685	1,150	2,460	1,450	2,320	1,350	3,040	4,420	7,120	2,320	970	1,100
21.....	685	1,150	2,320	1,350	2,180	1,250	3,360	4,420	6,900	2,180	925	925
22.....	685	1,100	2,180	1,350	2,040	1,350	3,360	4,420	7,120	2,180	880	840
23.....	685	1,250	2,040	1,350	1,920	1,800	3,200	4,630	7,120	2,040	840	880
24.....	685	1,250	2,040	1,350	1,800	2,180	3,520	4,630	7,120	1,920	840	970
25.....	650	4,800	2,040	1,250	1,680	1,920	4,060	4,600	7,120	1,800	800	970
26.....	650	4,600	1,680	1,350	1,800	2,460	4,600	4,600	6,680	1,680	800	925
27.....	650	6,680	1,560	1,350	1,680	2,740	5,000	4,600	6,460	1,560	800	925
28.....	650	5,400	1,450	1,350	1,450	3,200	5,400	4,800	6,240	1,450	800	760
29.....	760	3,520	1,350	1,350	.....	5,000	5,000	5,000	5,800	1,350	760	720
30.....	1,060	3,700	1,350	1,350	.....	4,240	4,600	5,400	5,600	1,350	760	720
31.....	970	.....	1,250	1,450	.....	2,880	.....	6,240	.....	1,350	760	.....

Monthly discharge of North Santiam River at Niagara, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	1,060	650	728	44,800
November.....	6,680	970	2,180	130,000
December.....	5,000	1,250	2,260	139,000
January.....	6,240	1,250	2,040	125,000
February.....	3,880	1,450	2,270	126,000
March.....	5,000	1,150	1,850	114,000
April.....	7,120	2,320	4,000	238,000
May.....	8,060	4,240	5,470	336,000
June.....	8,060	5,400	6,770	403,000
July.....	5,400	1,350	2,820	173,000
August.....	1,350	760	1,000	61,500
September.....	2,040	720	1,280	76,200
The year.....	8,060	650	2,720	1,970,000

CLACKAMAS RIVER NEAR CAZADERO, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 11, T. 4 S., R. 4 E., a short distance above backwater from Cazadero dam of Portland Railway, Light & Power Co. and 3 miles southeast of Cazadero, Clackamas County.

DRAINAGE AREA.—685 square miles.

RECORDS AVAILABLE.—January 1, 1909, to September 30, 1917.

GAGE.—Friez water-stage recorder referred to a vertical staff on right bank; inspected by employee of Portland Railway, Light & Power Co.

DISCHARGE MEASUREMENTS.—Made from a cable 50 feet below gage.

CHANNEL AND CONTROL.—Rocks and gravel; shifting in extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 31.77 feet at 6 a. m. June 9 (discharge, 8,170 second-feet); minimum discharge occurred October 22 to 26 and is estimated at 950 second-feet; water-stage recorder not working satisfactorily.

1909-1917: Maximum stage recorded, 43.7 feet at 1 p. m. November 22, 1909 (discharge, 46,800 second-feet); minimum stage recorded, 25.7 feet September 21 to 23 and October 8 to 10, 1915 (discharge, 705 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water of June 9. Curve used October 1 to June 8 well defined; that used June 9 to September 30 fairly well defined. Operation of water-stage recorder satisfactory, except for several short periods. Daily discharge ascertained by applying to rating table the mean daily gage height determined from recorder graph by inspection. Records good except for periods of defective gage-height record, for which they are fair.

No discharge measurements made during year.

Daily discharge, in second-feet, of Clackamas River near Cazadero, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	1,000	1,450	3,310	1,600	1,850	1,650	3,120	4,350	6,470	4,480	1,550	1,090
2.....	1,000	1,270	3,120	2,130	1,900	1,600	3,310	4,090	6,190	4,740	1,520	1,090
3.....	1,000	2,070	3,960	2,920	2,370	1,550	3,050	4,090	5,650	4,740	1,480	1,090
4.....	1,000	3,570	4,350	2,860	2,670	1,800	2,980	3,830	5,280	4,610	1,450	1,090
5.....	1,000	2,550	3,830	5,390	2,790	2,550	4,220	3,830	5,280	4,350	1,420	1,090
6.....	1,000	2,390	3,180	5,000	2,920	2,190	4,350	6,000	5,520	4,090	1,400	1,090
7.....	1,000	2,230	2,610	3,960	2,920	1,960	5,390	8,000	6,190	3,830	1,380	1,090
8.....	985	2,070	2,490	3,310	2,860	1,960	6,470	8,000	6,750	3,570	1,360	1,110
9.....	990	2,500	2,430	2,980	2,730	1,960	5,390	8,000	8,060	3,570	1,340	1,130
10.....	985	2,300	2,250	2,790	2,670	1,850	4,610	7,500	7,450	3,440	1,320	1,130
11.....	980	2,100	2,070	2,610	2,920	1,790	5,260	7,000	6,750	3,310	1,300	1,240
12.....	975	1,900	2,430	2,400	3,440	1,730	4,870	6,750	5,910	3,180	1,290	1,130
13.....	970	1,700	3,310	2,190	3,440	1,670	4,350	6,470	5,650	2,990	1,290	1,180
14.....	964	1,550	2,980	2,070	3,050	1,620	4,090	6,330	6,330	2,320	1,290	1,180
15.....	964	1,450	2,610	1,950	2,790	1,570	3,700	6,050	7,310	2,810	1,240	1,170
16.....	960	1,400	2,370	1,850	3,700	1,510	3,570	5,390	7,750	2,700	1,240	1,090
17.....	960	1,360	2,190	1,800	3,830	1,450	3,240	5,130	7,450	2,590	1,240	1,070
18.....	960	1,360	2,250	1,750	3,310	1,500	2,680	5,000	6,890	2,480	1,200	1,050
19.....	960	1,360	2,670	1,750	2,980	1,500	2,560	4,870	6,750	2,320	1,200	1,050
20.....	960	1,360	3,120	1,700	2,790	1,500	3,180	5,000	6,470	2,200	1,200	1,040
21.....	955	1,360	3,310	1,700	2,550	1,500	3,960	5,130	6,470	2,100	1,190	1,030
22.....	950	1,360	3,050	1,600	2,370	1,500	3,330	5,000	6,050	2,040	1,180	1,040
23.....	950	1,320	2,610	1,600	2,130	1,650	4,350	4,870	5,390	1,940	1,160	1,090
24.....	950	1,320	2,310	1,600	2,070	3,050	5,000	4,610	5,390	1,840	1,160	1,090
25.....	950	2,980	2,020	1,700	2,020	2,670	5,780	4,610	5,130	1,790	1,130	1,110
26.....	950	4,350	1,960	1,850	1,900	2,190	6,330	4,350	5,000	1,740	1,130	1,090
27.....	1,020	5,650	1,850	2,860	1,800	3,050	5,910	4,740	5,000	1,700	1,120	1,080
28.....	1,090	5,520	1,750	3,310	1,700	4,090	5,520	5,650	5,130	1,650	1,110	1,090
29.....	1,000	3,960	1,650	2,550	.....	5,780	5,130	6,330	4,870	1,650	1,110	1,050
30.....	1,650	3,830	1,600	2,130	.....	4,480	4,610	6,190	4,610	1,620	1,110	1,030
31.....	2,020	.....	1,600	1,960	.....	3,570	.....	6,190	.....	1,590	1,090	.....

NOTE.—No gage-height record, discharge estimated by comparison with records on Bull Run and North Santiam rivers Oct. 22-27, Nov. 9-11, Mar. 18-22, and May 6-11; interpolated Oct. 2-6, 8-13, 16-20, Nov. 6-7, Jan. 12, Mar. 11-16, July 30 to Aug. 4, and Aug. 6-11.

Monthly discharge of Clackamas River near Cazadero, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 685 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	2,020	950	1,040	1.52	1.75	64,000
November.....	5,650	1,270	2,320	3.39	3.78	138,000
December.....	4,350	1,600	2,620	3.82	4.40	161,000
January.....	5,390	1,600	2,450	3.58	4.13	151,000
February.....	3,830	1,700	2,660	3.88	4.04	148,000
March.....	5,780	1,450	2,210	3.23	3.72	136,000
April.....	6,470	2,860	4,380	6.39	7.13	261,000
May.....	8,000	3,830	5,590	8.16	9.41	344,000
June.....	8,060	4,610	6,100	8.91	9.94	364,000
July.....	4,740	1,590	2,840	4.15	4.78	175,000
August.....	1,550	1,090	1,260	1.84	2.12	77,500
September.....	1,240	1,030	1,100	1.61	1.80	65,500
The year.....	8,060	950	2,880	4.20	57.00	2,080,000

OAK GROVE FORK OF CLACKAMAS RIVER AT INTAKE NEAR CAZADERO, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 4, T. 6 S., R. 7 E., 2,000 feet above proposed intake of Oak Grove power development of Portland Railway, Light & Power Co., about 35 miles above Cazadero, Clackamas County.

DRAINAGE AREA.—131 square miles (measured by Portland Railway, Light & Power Co.).

RECORDS AVAILABLE.—May 21, 1909, to August 4, 1917.

GAGE.—Stevens water-gage recorder on left bank, used since December, 1916; Watson recording gage used March, 1912, to September, 1913; Friez recorder October, 1913, to October, 1916.

DISCHARGE MEASUREMENTS.—Made from cable.

CHANNEL AND CONTROL.—Gravel; fairly permanent. Velocities high. Channel straight.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 2.55 feet June 15 (discharge, 1,650 second-feet); minimum stage for year probably occurred September 30 and was approximately the same as that recorded at time of measurement, 0.80 foot October 5, 1917 (discharge, 395 second-feet).

1909–1917: Maximum stage recorded, 3.40 feet November 24, 1909 (discharge, 2,670 second-feet); minimum discharge, 320 second-feet (gage height, 0.60 foot) October 17 to November 3, 1911.

ICE.—Never any ice, as stream is largely spring-fed.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent during year. Rating curve well defined. Operation of water-stage recorder satisfactory December 15 to April 29, June 3 to July 17, and for short periods at other times. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the recorder graph. Records good except those for periods for which they are estimated, which are fair.

COOPERATION.—Field data furnished by Portland Railway, Light & Power Co.

The following discharge measurement was made by Frank Ewing:

April 5, 1917: Gage height, 1.00 foot; discharge, 472 second-feet.

Daily discharge, in second-feet, of Oak Grove Fork of Clackamas River at intake near Cazadero, Oreg., for the year ending Sept. 30, 1917.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	^a June.	July.	Aug.
1.		462	453	458	540	1,200	1,020	476
2.		480	462	453	520	1,200	940	480
3.		490	480	453	500	1,230	900	471
4.		500	476	458	490	1,280	900	458
5.		580	476	458	530	1,280	865	-----
6.		555	476	466	545	1,360	830	-----
7.		535	480	471	610	1,410	795	-----
8.		520	480	466	640	1,550	748	-----
9.		515	480	466	622	1,550	736	-----
10.		505	480	458	622	1,410	712	-----
11.		495	480	453	640	1,320	700	-----
12.		490	490	453	622	1,360	688	-----
13.		490	490	448	610	1,410	670	-----
14.		480	490	444	610	1,500	622	-----
15.	505	471	490	435	586	1,600	610	-----
16.	500	471	570	435	575	1,550	598	-----
17.	495	471	560	435	560	1,500	580	-----
18.	495	471	550	435	555	1,460	573	-----
19.	505	466	540	431	550	1,410	566	-----
20.	520	466	530	435	586	1,410	559	-----
21.	520	466	525	431	610	1,360	552	-----
22.	505	462	510	435	610	1,320	544	-----
23.	500	458	500	448	676	1,270	536	-----
24.	495	453	500	444	712	1,230	528	-----
25.	480	476	490	431	795	1,180	521	-----
26.	476	476	480	466	830	1,160	514	-----
27.	476	525	466	500	830	1,140	507	-----
28.	471	495	462	540	830	1,100	500	-----
29.	462	485	-----	580	795	1,060	495	-----
30.	462	471	-----	560	795	1,060	490	-----
31.	458	453	-----	550	-----	-----	480	-----

NOTE.—Discharge estimated Mar. 28 to Apr. 3, Apr. 30, and June 1-3 from the points of maximum and minimum stage indicated on the recorder graph. Discharge interpolated June 22, 23, 26, and July 18-27.

Monthly discharge of Oak Grove Fork of Clackamas River at intake near Cazadero, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum	Mean.	
December 15-31	520	458	490	16,500
January	580	453	488	30,000
February	570	453	495	27,500
March	580	431	464	28,500
April	830	490	633	37,700
May	-----	-----	^a 1,000	61,500
June	1,600	1,060	1,330	79,100
July	1,020	480	654	40,200

^a Estimated.

LEWIS RIVER BASIN.

LEWIS RIVER NEAR AMBOY, WASH.

LOCATION.—In sec. 36, T. 6 N., R. 3 E., at Cresap's ferry crossing, on county road from Amboy to Cougar, $1\frac{1}{2}$ miles below Canyon Creek, 2 miles above Speilei Creek, and about 5 miles northeast of Amboy, Clarke County.

DRAINAGE AREA.—665 square miles (measured on map in Water-Supply Paper 253, p. 74, and checked on Forest Service map).

RECORDS AVAILABLE.—January 20, 1911, to September 30, 1917.

GAGE.—Inclined staff on left bank, replacing vertical staff at same location and datum; read once daily. Gage reader, James Hanley.

DISCHARGE MEASUREMENTS.—Made from cable at gage.

CHANNEL AND CONTROL.—Gravel and small boulders; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.3 feet November 29 (discharge, 11,100 second-feet); minimum stage recorded, 0.30 foot, October 19 to 24 (discharge, 840 second-feet).

1911-1917: Maximum stage recorded, 12 feet at 12' p. m. December 21, 1915 (discharge, 37,700 second-feet); minimum stage recorded, 0.08 foot, September 30, 1915 (discharge, 686 second-feet).

ICE.—Stage-discharge relation never affected by ice.

DIVERSION.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 900 and 14,000 second-feet. Gage read to hundredths twice daily; oftener during high water. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

No discharge measurements made during year.

Daily discharge, in second-feet, of Lewis River near Amboy, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	1,070	1,450	4,200	1,910	2,040	2,180	4,000	8,300	9,530	6,620	1,670	1,030
2.....	1,160	2,470	4,880	2,180	2,320	2,040	4,420	7,710	8,910	6,360	1,670	1,030
3.....	1,070	2,320	6,360	2,780	2,620	1,910	3,810	6,620	8,000	6,890	1,670	990
4.....	990	6,620	7,710	4,200	3,280	2,040	4,200	5,600	8,000	6,620	1,670	950
5.....	990	5,600	5,600	10,200	4,420	2,320	5,360	5,600	7,160	6,360	1,560	950
6.....	990	4,200	4,420	9,530	3,810	2,620	7,160	8,000	7,430	5,850	1,560	950
7.....	990	3,280	4,000	5,600	3,450	2,470	8,910	8,000	8,000	5,360	1,450	910
8.....	990	3,110	3,810	5,120	3,450	2,320	10,500	8,300	7,710	5,120	1,450	910
9.....	950	5,600	4,420	4,420	3,450	2,180	8,910	10,200	9,530	5,360	1,450	1,160
10.....	950	4,880	4,200	4,200	3,280	2,180	6,620	9,220	8,600	5,120	1,350	1,200
11.....	910	3,450	3,630	4,000	4,880	2,040	6,360	9,220	7,430	4,650	1,350	1,200
12.....	910	3,110	3,110	3,810	5,120	2,040	7,710	9,530	6,100	4,420	1,250	1,030
13.....	910	2,940	3,110	3,450	4,420	1,910	6,620	9,530	6,620	4,420	1,250	1,250
14.....	950	2,780	2,780	3,280	4,200	1,910	6,620	8,910	8,600	4,200	1,250	1,250
15.....	910	2,180	2,780	3,110	4,000	1,910	5,850	8,000	9,530	4,200	1,250	1,200
16.....	910	1,910	2,620	2,620	3,630	1,790	4,650	7,710	10,200	4,000	1,200	1,160
17.....	910	1,910	2,470	2,470	3,630	1,790	4,420	6,890	9,840	3,630	1,200	1,160
18.....	875	2,040	2,470	2,470	3,450	1,790	4,200	6,360	9,530	3,450	1,250	1,160
19.....	840	1,910	2,470	2,320	3,450	1,910	4,650	6,100	8,600	3,280	1,250	1,160
20.....	840	1,790	2,780	2,180	3,450	2,040	6,100	6,100	8,300	3,110	1,350	1,070
21.....	840	1,790	3,450	2,180	3,450	1,910	6,620	5,850	8,000	2,940	1,250	1,030
22.....	840	1,910	3,110	2,180	3,110	1,910	6,890	5,850	7,710	2,940	1,250	990
23.....	840	1,910	2,780	2,040	2,780	2,180	7,710	5,600	6,620	2,780	1,250	990
24.....	840	1,790	2,620	1,910	2,620	2,620	8,000	5,850	6,620	2,470	1,250	1,070
25.....	910	4,200	2,470	4,200	2,470	2,470	8,300	5,600	6,100	2,320	1,200	1,200
26.....	990	5,360	2,320	3,810	2,470	2,620	8,300	5,600	6,890	2,180	1,160	1,200
27.....	990	7,160	2,180	3,630	2,320	4,200	8,000	6,100	7,430	2,040	1,120	1,160
28.....	990	8,300	2,040	3,450	2,180	5,120	7,710	7,710	6,890	1,910	1,120	1,160
29.....	1,160	11,100	1,910	2,780	.....	8,910	8,000	8,300	6,890	1,910	1,120	1,120
30.....	1,160	8,000	1,910	2,470	.....	6,360	8,600	8,600	6,100	1,790	1,070	1,120
31.....	1,350	.....	1,790	2,180	.....	4,200	.....	9,220	.....	1,790	1,070	.....

Monthly discharge of Lewis River near Amboy, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 665 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	1,350	840	969	1.46	1.68	59,600
November.....	11,100	1,450	3,840	5.77	6.44	228,000
December.....	7,710	1,790	3,370	5.07	5.84	207,000
January.....	10,200	1,910	3,570	5.37	6.19	220,000
February.....	5,120	2,040	3,350	5.04	5.25	185,000
March.....	8,910	1,790	2,710	4.08	4.70	167,000
April.....	10,500	3,810	6,640	9.98	11.14	395,000
May.....	10,200	5,600	7,430	11.2	12.91	457,000
June.....	10,200	6,100	7,900	11.9	13.28	470,000
July.....	6,890	1,790	4,000	6.02	6.94	245,000
August.....	1,670	1,070	1,320	1.98	2.28	81,200
September.....	1,250	910	1,060	1.59	1.77	63,100
The year.....	11,100	840	3,840	5.77	78.42	2,780,000

KALAMA RIVER BASIN.

KALAMA RIVER NEAR KALAMA, WASH.

LOCATION.—In sec. 7, T. 6 N., R. 1 E., 150 feet below power house of North Coast Power Co., about 10 miles east of Kalama, Cowlitz County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—July 6, 1911, to January 11, 1912; December 1, 1912, to September 30, 1913; August 19, 1916, to September 30, 1917.

GAGE.—Vertical staff bolted to rock ledge on left bank; lower section up to 8 feet on left bank; upper section, reading 8 to 12 feet, in a cove on right bank opposite lower section. Gage reader, L. A. Van Fleet. Gage at same site but with datum 2 feet lower, used 1911 to January, 1912, and one with datum 3 feet lower used December, 1912, to September, 1913.

DISCHARGE MEASUREMENTS.—Made from a cable about one-half mile below gage.

CHANNEL AND CONTROL.—Control is a rock reef and bar of heavy gravel about 100 feet below gage; gravel may shift in extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.02 feet at noon January 5, observer noted crest of rise (discharge, 4,430 second-feet); minimum stage recorded, 0.88 foot October 23 to 26 and 28 (discharge, 246 second-feet).

1911-1913 and 1916-1917: Water over gage (top of gage 7.0 feet present datum) January 1 and 3, 1913 (discharge estimated 6,000 second-feet); minimum stage recorded, 0.85 foot (referred to 1916 datum) August 27 to September 1, 1911 (discharge, 232 second-feet).

ICE.—Stage-discharge relation never affected by ice.

DIVERSIONS.—None.

REGULATION.—Operation of power plant causes some fluctuation but gage is read only at times when load is steady.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined above 300 second-feet. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Record excellent for discharge above 300 second-feet; good for discharge below 300 second-feet.

Discharge measurements of Kalama River near Kalama, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 25	J. L. Stannard ^a	0.88	243	Mar. 29	C. L. Batchelder.....	4.95	3,120
25	.....do.....	0.88	252	30	.....do.....	4.40	2,500
Mar. 29	C. L. Batchelder.....	5.05	3,180				

^a Hydraulic engineer for North Coast Power Co.

Daily discharge, in second-feet, of Kalama River near Kalama, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	276	360	1,250	700	870	645	1,780	2,040	1,620	1,110	435	292
2.....	276	645	1,860	1,460	1,050	645	1,950	1,780	1,620	1,050	435	292
3.....	276	672	2,930	2,040	1,320	595	1,780	1,780	1,460	1,110	435	292
4.....	276	1,780	3,040	1,860	1,620	930	1,780	1,460	1,320	1,050	415	292
5.....	276	1,180	2,040	4,400	1,780	1,180	2,410	1,320	1,320	1,050	415	292
6.....	261	990	1,620	3,390	1,780	990	2,310	1,620	1,320	1,050	415	276
7.....	261	930	1,320	2,610	1,620	930	3,630	1,950	1,320	1,050	396	276
8.....	261	870	1,180	2,130	1,780	930	4,140	1,950	1,460	990	396	292
9.....	261	1,390	1,050	1,860	1,620	810	3,150	2,310	1,620	870	378	292
10.....	261	1,180	1,050	1,780	1,620	930	2,610	2,040	1,700	700	378	308
11.....	261	930	1,050	1,620	1,950	870	2,710	1,950	1,390	700	360	342
12.....	261	755	1,050	1,320	1,950	755	2,610	2,040	1,110	700	360	342
13.....	261	700	1,180	1,250	1,950	810	2,220	2,040	1,110	700	360	308
14.....	261	700	1,180	1,110	1,460	755	2,310	1,780	1,460	700	360	342
15.....	261	522	1,050	1,050	1,320	700	2,040	1,700	1,780	700	342	325
16.....	246	415	1,050	930	1,460	700	1,780	1,320	1,700	672	342	308
17.....	246	415	930	870	1,320	645	1,540	1,320	1,460	645	342	292
18.....	246	545	930	870	1,320	672	1,460	1,320	1,320	620	342	276
19.....	246	435	1,050	810	1,180	810	1,860	1,250	1,320	595	342	276
20.....	246	415	1,180	700	1,050	930	2,410	1,250	1,250	570	342	276
21.....	246	415	1,390	700	1,050	870	2,610	1,320	1,250	570	342	261
22.....	246	415	1,780	755	930	990	2,130	1,250	1,250	545	325	276
23.....	246	595	1,460	700	810	1,780	1,950	1,250	1,050	522	255	276
24.....	246	570	1,320	700	810	2,410	1,780	1,250	1,460	500	308	276
25.....	246	1,390	1,050	930	810	1,950	1,950	1,320	1,250	500	308	308
26.....	246	810	990	930	810	1,700	2,130	1,320	1,110	455	308	292
27.....	246	2,930	870	2,130	810	1,950	2,040	1,320	1,110	455	308	292
28.....	246	2,310	810	1,390	645	1,950	1,950	1,700	1,320	455	308	292
29.....	396	1,620	700	1,250	.....	3,270	1,950	1,780	1,620	455	308	276
30.....	342	1,320	700	930	.....	2,510	2,130	1,860	1,250	455	308	261
31.....	595	.....	700	930	.....	2,040	.....	1,620	.....	455	292	.....

Monthly discharge of Kalama River near Kalama, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	595	246	275	16,900
November.....	2,930	360	940	55,900
December.....	3,040	700	1,280	78,700
January.....	4,400	700	1,420	87,300
February.....	1,950	645	1,310	72,800
March.....	3,270	595	1,210	74,400
April.....	4,140	1,460	2,240	133,000
May.....	2,310	1,250	1,620	99,600
June.....	1,780	1,050	1,380	82,100
July.....	1,110	455	710	43,700
August.....	435	292	356	21,900
September.....	342	261	293	17,400
The year.....	4,400	246	1,080	784,000

COWLITZ RIVER BASIN.

OHANAPECOSH RIVER NEAR LEWIS, WASH.

LOCATION.—In sec. 29, T. 14 N., R. 10 E., 900 feet above Clear Fork and 7 miles northeast of Lewis, in Lewis County.

DRAINAGE AREA.—116 square miles (measured on Plate I, Water-Supply Paper 313).

RECORDS AVAILABLE.—August 19, 1907, to January 12, 1913; April 14, 1913, to September 30, 1917, when station was discontinued.

GAGE.—Inclined staff on left bank, 900 feet above Clear Fork, since May 4, 1915; prior to January 5, 1914, vertical staff 8 feet upstream from site of present gage and at datum 0.06 foot lower; January 13, 1914, to May 1, 1915, vertical staff at site of previous gage and at datum of present gage. Gage read by J. A. Combs.

DISCHARGE MEASUREMENTS.—Made from cable 30 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders; apparently permanent. Lodging and washing away of drift below gage at high stages changes stage-discharge relation. One channel at all stages. Banks not subject to overflow. Stage of zero flow, mean of several measurements; gage height 0.5 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.30 feet June 16 (discharge, 3,060 second-feet); minimum stage recorded, 0.28 foot October 28 (discharge, 70 second-feet).

1907-1917: Maximum stage recorded, above top of gage (8 feet) November 23, 1909 (mean discharge for day estimated at 7,500 second-feet); minimum stage recorded, 0.20 foot September 28, 1915 (discharge, 56 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed about July 1, 1917. Rating curve used prior to the change well defined above and fairly well defined below 70 second-feet. Rating curve used after the change well defined above and fairly well defined below 150 second-feet. Gage read to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

COOPERATION.—Gage-height record furnished by Portland Railway, Light & Power Co.

Discharge measurements of Ohanapecosh River near Lewis, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 4	C. O. Brown.....	0.42	96
May 27	John McCombs.....	3.14	1,340
Sept. 19	L. D. Carson.....	.65	166

Daily discharge, in second-feet, of Ohanapecosh River near Lewis, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	May.	June.	July.	Aug.	Sept.
1.....			188			1,820			207
2.....				108	522				
3.....	104							635	
4.....					522		2,540		180
5.....									
6.....			192	252		930			
7.....	94	158							
8.....								545	175
9.....			161			2,300			
10.....	88			322				460	
11.....		235			1,520		2,380		
12.....			204						168
13.....	92			235		1,240			
14.....								420	
15.....		149			1,240		2,460		155
16.....			173			3,060			
17.....	115			158					
18.....		113					2,620	380	
19.....			167		930				168
20.....	92			137		2,300			
21.....							1,310		
22.....		132						270	155
23.....			158		930	1,660			
24.....	73			132					
25.....		115					1,170	270	
26.....					990				139
27.....			129	252		1,820			
28.....	70						820		
29.....		176						225	
30.....			115		2,140	2,460			
31.....	115						680		

COWLITZ RIVER AT LEWIS, WASH.

LOCATION.—In sec. 15, T. 13 N., R. 9 E., at suspension bridge about a mile northeast of Lewis and $1\frac{1}{2}$ miles below Lake Creek, in Lewis County.

DRAINAGE AREA.—275 square miles (measured on Plate I, Water-Supply Paper 313).

RECORDS AVAILABLE.—July 1, 1911, to September 30, 1917.

GAGE.—Vertical staff bolted to solid rock on left bank 40 feet above suspension bridge, installed May 3, 1915; read by William Sethe and J. A. Combs. Original gage was installed August 15, 1907, by Valley Development Co., on left bank 150 feet below site of present gage and at a different datum; this gage was washed out November 20, 1911, and November 3, 1914, but was replaced each time at same site and datum. Datum of published gage heights for year ending September 30, 1913, is 0.07 foot lower than correct datum of old gage, as corrections to gage heights were not applied for that year.

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

CHANNEL AND CONTROL.—Bed of stream composed of gravel and sand; shifts at high water. Right bank subject to overflow at extremely high stages. Control is gravel and boulder riffle 300 feet below gage. Stage of zero flow, according to measurement made October 5, 1916, gage height -0.45 ± 0.1 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.02 feet at 8.30 p. m. June 16 (discharge, 8,970 second-feet); minimum stage recorded, 0.80 foot October 26 (discharge, 323 second-feet).

1911-1917: Maximum stage recorded, 7.35 feet November 19, 1911 (discharge not determined); stage probably higher on following day, when gage was washed out; minimum stage recorded, 0.95 foot October 30 to November 3, 1911 (discharge, 285 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed May 12, May 29, and June 18. Rating curve used October 1 to May 12 and May 29 to June 18 fairly well defined; curve used May 13 to 28 and June 19 to September 30 also fairly well defined. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Gage-height record furnished by United States Forest Service and Portland Railway, Light & Power Co.

Discharge measurements of Cowlitz River at Lewis, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Oct. 5	C. O. Brown.....	<i>Feet.</i> 0.96	<i>Sec.-ft.</i> 394	May 29	John McCombs.....	<i>Feet.</i> 4.52	<i>Sec.-ft.</i> 5,400
May 25	John McCombs.....	2.78	2,310	Sept. 18	L. D. Carson.....	1.40	781

Daily discharge, in second-feet, of Cowlitz River at Lewis, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	490	366	575	413	490	518	575	1,330	5,210	5,700	1,769	929
2.....	463	635	575	438	518	490	575	1,330	4,330	6,620	2,190	929
3.....	438	546	700	413	668	463	546	1,330	3,500	7,100	2,040	929
4.....	390	810	668	490	930	518	546	1,220	2,930	7,340	1,900	853
5.....	390	692	635	770	1,120	518	1,020	1,330	2,580	6,390	1,900	781
6.....	413	575	575	770	1,120	490	1,020	1,650	2,930	6,390	1,700	781
7.....	413	490	546	700	1,020	463	1,450	1,970	3,910	5,930	1,510	748
8.....	390	546	546	700	1,020	463	1,570	2,580	4,670	5,930	1,510	781
9.....	390	1,570	518	1,020	975	463	1,330	3,500	5,430	6,620	1,460	748
10.....	390	1,120	490	975	975	463	1,220	3,700	4,330	6,160	1,460	715
11.....	390	810	463	890	1,150	438	1,330	3,910	3,300	6,160	1,460	817
12.....	390	635	635	770	1,330	413	1,170	4,120	2,580	5,700	1,400	781
13.....	366	575	930	735	1,220	413	1,070	3,960	3,300	5,930	1,510	748
14.....	413	518	832	635	1,120	413	1,020	3,760	4,550	5,470	1,480	748
15.....	438	518	735	575	1,020	413	930	3,370	6,570	6,390	1,400	748
16.....	518	490	700	546	1,280	390	890	2,660	8,200	6,390	1,460	782
17.....	463	463	635	518	1,220	402	810	2,340	7,260	5,700	1,400	817
18.....	390	163	668	518	1,110	413	770	2,420	8,440	5,930	1,300	781
19.....	366	438	635	490	1,000	413	770	2,500	7,180	5,930	1,300	781
20.....	366	413	635	490	890	413	850	2,190	5,930	4,380	1,240	781
21.....	366	413	635	463	810	413	930	2,190	6,160	3,960	1,200	685
22.....	355	438	605	463	770	413	930	2,340	5,250	3,370	1,100	655
23.....	344	438	546	438	700	490	1,020	2,500	4,170	3,000	1,060	655
24.....	344	413	518	463	635	490	1,120	2,500	6,390	2,500	1,100	547
25.....	323	575	490	700	605	463	1,970	2,500	5,470	2,500	1,060	623
26.....	323	672	463	668	575	438	2,260	2,500	5,250	2,660	1,010	700
27.....	366	770	463	700	546	546	2,260	3,760	5,700	2,660	1,010	776
28.....	344	735	438	635	518	623	1,830	5,030	6,860	2,660	970	853
29.....	413	668	413	575	.....	700	1,670	5,430	5,930	2,040	970	715
30.....	390	635	413	546	.....	635	1,510	5,210	5,250	1,900	1,010	627
31.....	463	.....	413	518	.....	605	.....	4,990	.....	1,760	1,010	.....

NOTE.—Gage not read Oct. 22, Nov. 5, 26, Dec. 14, 25, Feb. 11, 18, 19, Mar. 17, 28, Apr. 29, May 6, 10, 18, 22, 30, June 8, 19, July 27, 30, Aug. 6, Sept. 16, 19, and 25-27, discharge interpolated.

Monthly discharge of Cowlitz River at Lewis, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 275 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	518	323	397	1.44	1.66	24,400
November.....	1,570	366	614	2.23	2.49	36,500
December.....	930	413	584	2.12	2.44	35,900
January.....	1,020	413	614	2.23	2.57	37,800
February.....	1,330	490	905	3.29	3.43	50,300
March.....	700	390	477	1.73	1.99	29,300
April.....	2,260	546	1,170	4.25	4.74	69,600
May.....	5,430	1,220	2,910	10.60	12.22	179,000
June.....	8,440	2,580	5,120	18.60	20.75	305,000
July.....	7,340	1,760	4,820	17.50	20.18	296,000
August.....	2,190	970	1,380	5.02	5.79	84,800
September.....	929	547	760	2.76	3.08	45,200
The year.....	8,440	323	1,650	6.00	81.34	1,190,000

COWLITZ RIVER AT MOSSY ROCK, WASH.

LOCATION.—In sec. 1, T. 12 N., R. 2 E., at county highway bridge 1 mile north of Mossy Rock, in Lewis County, and $2\frac{1}{2}$ miles above mouth of Tilton River.

DRAINAGE AREA.—1,170 square miles (measured on Pl. I, Water Supply Paper 313).

RECORDS AVAILABLE.—January 1, 1912, to September 30, 1917 (fragmentary), when station was discontinued.

GAGE.—Vertical staff in three sections on left bank 100 feet above bridge; read by G. W. Jerrells. Chain gage on bridge, at different datum, was used prior to September 18, 1913.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Channel above and below gage is deep canyon whose walls are almost vertical. Control is a broad riffle, 450 feet below gage, composed of sand, gravel, and boulders; shifting at high stages. Stage of zero flow, about gage height —0.9 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.0 feet on June 19 (discharge, 17,400 second-feet); minimum stage recorded, 2.00 feet October 19–28 (discharge, 975 second-feet).

1912–1917: Maximum stage recorded, 18.0 feet January 7–8, 1914 (discharge, 30,300 second-feet); flood of November, 1906, as determined by leveling from high-water marks pointed out by residents, reached a stage corresponding to about 29.4 feet on present staff gage (discharge about 51,000 second-feet); minimum stage recorded, 1.40 feet October 10–13, 1915 (discharge, 825 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed at highwater May 30. Rating curve used prior to change well defined below 10,000 second-feet; curve used after change well defined below 15,000 second-feet. Gage read once daily to half tenths. Gage-height record fairly reliable. Daily discharge ascertained by applying daily gage height to rating table. Records good.

Discharge measurements of Cowlitz River at Mossy Rock, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 7	C. O. Brown.....	2.34	1,300	July 29	John McCombs.....	5.59	5,490
May 31	John McCombs.....	10.70	15,000	Sept. 22	L. D. Carson.....	2.99	1,510

Daily discharge, in second-feet, of Cowlitz River at Mossy Rock, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	1,520	1,420	4,300	2,090	3,010	2,870	4,130	7,560	15,400	15,200	4,790	2,150
2.....	1,520	1,420	2,870	2,210	2,870	3,010	3,960	7,000	15,200	14,100	4,620	2,150
3.....	1,520	1,420	3,310	2,330	3,010	3,160	3,790	6,820	11,800	15,400	4,620	2,150
4.....	1,420	1,740	3,310	2,460	3,310	3,310	3,470	6,630	10,700	14,800	4,620	2,010
5.....	1,320	1,970	3,310	3,310	4,300	3,470	4,300	6,440	9,940	14,600	4,280	2,010
6.....	1,320	2,460	3,160	4,130	4,640	3,470	5,720	6,820	9,760	13,700	3,610	2,010
7.....	1,220	2,330	3,010	3,960	5,000	3,160	6,080	7,560	11,800	13,000	3,450	2,010
8.....	1,140	2,460	2,730	3,790	5,360	2,870	6,820	8,660	12,000	11,800	3,290	1,880
9.....	1,140	2,590	2,590	3,960	5,000	2,730	8,300	11,300	14,400	12,000	3,140	1,750
10.....	1,140	3,010	2,460	4,470	4,640	2,590	7,740	12,600	14,800	12,600	2,990	1,750
11.....	1,140	3,310	2,330	4,300	5,720	2,460	7,560	13,800	12,600	12,200	2,850	1,880
12.....	1,050	3,010	2,730	4,130	6,260	2,460	7,000	14,200	9,940	11,800	2,850	1,880
13.....	1,050	2,460	3,310	.....	6,440	2,330	6,630	14,000	9,760	11,500	2,850	2,010
14.....	1,050	2,210	4,300	.....	6,630	2,330	6,260	13,100	12,600	10,900	2,850	2,010
15.....	1,050	2,090	4,300	.....	6,080	2,210	5,900	12,400	14,400	11,100	2,850	1,880
16.....	1,050	1,970	3,960	.....	5,900	2,210	5,540	10,500	14,800	11,600	2,850	1,880
17.....	975	1,970	3,470	.....	5,900	2,210	5,000	9,040	15,400	11,800	2,710	1,750
18.....	975	1,970	3,470	.....	5,900	2,210	5,000	8,480	16,500	11,300	2,710	1,750
19.....	975	1,860	3,310	.....	5,720	2,330	5,000	8,300	17,400	10,700	2,710	1,750
20.....	975	1,740	3,310	.....	5,540	2,460	5,000	7,920	16,300	9,570	2,710	1,750
21.....	975	1,630	3,310	.....	5,000	2,460	5,180	7,920	15,200	8,830	2,710	1,630
22.....	975	1,630	3,310	.....	4,640	2,460	5,360	7,920	14,600	7,900	2,570	1,520
23.....	975	1,740	3,310	.....	3,960	2,460	5,540	7,920	13,000	6,980	2,570	1,520
24.....	975	1,740	3,310	.....	3,470	2,590	5,900	7,920	14,800	6,240	2,430	1,520
25.....	975	1,970	3,470	.....	3,310	2,730	6,260	8,110	14,400	5,870	2,430	1,520
26.....	975	3,630	2,870	.....	3,310	2,870	6,820	7,920	13,700	5,690	2,290	1,520
27.....	975	4,130	2,730	3,960	3,160	3,010	9,400	8,300	13,700	5,870	2,290	1,520
28.....	975	5,000	2,460	3,630	2,870	3,310	9,040	12,200	14,100	5,690	2,290	1,520
29.....	1,050	5,720	2,210	3,310	.....	3,630	8,660	14,400	15,000	5,510	2,290	1,520
30.....	1,220	5,000	2,170	3,160	.....	3,790	8,110	15,900	15,200	4,790	2,290	1,520
31.....	1,420	.....	2,130	3,010	.....	4,130	.....	15,200	.....	4,450	2,150	.....

NOTE.—No gage-height record available Jan. 13-26; mean discharge estimated as 2,900 second-feet by hydrographic comparison with flow of Cowlitz River at Lewis.

Monthly discharge of Cowlitz River at Mossy Rock, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 1,170 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	1,520	975	1,130	0.966	1.11	69,500
November.....	5,720	1,420	2,520	2.15	2.40	150,000
December.....	4,300	2,130	3,120	2.67	3.08	192,000
January.....	4,470	2,090	3,190	2.73	3.15	196,000
February.....	6,630	2,870	4,680	4.00	4.16	260,000
March.....	4,130	2,210	2,820	2.41	2.78	173,000
April.....	9,400	3,470	6,120	5.23	5.84	364,000
May.....	15,900	6,440	9,900	8.46	9.75	609,000
June.....	17,400	9,760	13,600	11.6	12.94	809,000
July.....	15,400	4,450	10,200	8.72	10.05	627,000
August.....	4,790	2,150	3,020	2.58	2.97	186,000
September.....	2,150	1,520	1,790	1.53	1.71	107,000
The year.....	17,400	975	5,170	4.42	59.94	3,740,000

CLEAR FORK NEAR LEWIS, WASH.

LOCATION.—In sec. 29, T. 14 N., R. 10 E., above Yakima trail bridge, 1,000 feet above mouth, and about 7 miles northeast of Lewis, in Lewis County.

DRAINAGE AREA.—48 square miles (measured on Plate I, Water-Supply Paper 313).

RECORDS AVAILABLE.—August 30, 1907, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff on right bank 350 feet above bridge; read by J. A. Combs.

Gage was washed out several times prior to 1912, but was replaced at same site and approximately same datum. Relation of present datum to that maintained before 1912 somewhat uncertain.

DISCHARGE MEASUREMENTS.—Made from cable at gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and boulders; shifts during extremely high water. One channel at all stages. Stage of zero flow, according to measurements October 4, 1916, gage height -0.13 ± 0.05 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.60 feet June 16 (discharge, 1,330 second-feet); minimum stage recorded, 1.50 feet October 24 and 28 (discharge, 75 second-feet).

1907-1917: Maximum stage recorded, 7.3 feet November 23, 1909 (discharge, 2,530 second-feet); minimum stage recorded, 1.16 feet September 28, 1915 (discharge, 43 second-feet).

ICE.—Record discontinued during winter.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined.

Gage read to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Records good.

COOPERATION.—Gage-height record furnished by Portland Railway Light & Power Co.

Discharge measurements of Clear Fork near Lewis, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.
		<i>Fet.</i>	<i>Sec.-ft.</i>
Oct. 4	C. O. Brown.....	1.67	96
May 26	John McCombs.....	2.98	417
Sept. 19	L. D. Carson.....	1.70	93

Daily discharge, in second-feet, of Clear Fork near Lewis, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	May.	June.	July.	Aug.	Sept.
1									124
2			108			700			
3	100			82	230				
4	94							319	
5					219		950		115
6			108	150					
7	94	115				700			
8								266	108
9			94			1,100			
10	87			168				254	
11		168			648		600		
12			141						115
13	87			132		535			
14								230	
15		108			535		816		115
16			132			1,330			
17	81			108					
18		81					880	198	
19			132		366				100
20	77			94		950			
21							756		
22		100						168	94
23			100		366	756			
24	75			94					
25		87					436	150	
26					383				87
27			87	150		700			
28	75						350		
29		132						141	
30			87		880	950			
31	108						334		

LAKE CREEK AT OUTLET OF PACKWOOD LAKE, NEAR LEWIS, WASH.

LOCATION.—In sec. 21, T. 13 N., R. 10 E., 500 feet below outlet of Packwood Lake, 5 miles east of Lewis, in Lewis County.

DRAINAGE AREA.—About 18 square miles (measured on Pl. I, Water-Supply Paper 313).

RECORDS AVAILABLE.—September 2, 1911, to September 30, 1917.

GAGE.—Vertical staff spiked to cedar tree on right bank, 32 feet upstream from weir and 500 feet below outlet; read by J. A. Combs. Zero of gage at elevation of crest of weir.

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

CHANNEL AND CONTROL.—A rectangular weir 19.94 feet long, with crest 1 inch wide, forms control. Overflow occurs at gage height 4.4 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.62 feet, afternoon reading, June 17 (discharge, 506 second-feet); minimum stage recorded, 0.53 foot, afternoon reading, October 26 (discharge, 33 second-feet). Discharge October 24–26, at gage height 0.54 foot, also 33 second-feet.

1911–1917: Maximum stage recorded, 4.00 feet, morning reading, June 18, 1916 (discharge, 582 second-feet); minimum stage recorded, 0.48 foot, February 26 to March 3, 1915, and 0.53 foot, October 26, 1916 (discharge, 33 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined except for extremely low water. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent except for extremely low water.

COOPERATION.—Gage-height record furnished by Portland Railway, Light & Power Co.

Discharge measurements of Lake Creek at outlet of Packwood Lake, near Lewis, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
Oct. 5	C. O. Brown.....	<i>Feet.</i> 0.70	<i>Sec.-ft.</i> 44	Sept. 20	L. D. Carson.....	<i>Feet.</i> 1.00	<i>Sec.-ft.</i> 75
May 29	John McCombs.....	1.78	176	21	.....do.....	.95	72

Daily discharge, in second-feet, of Lake Creek at outlet of Packwood Lake, near Lewis, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	57	47	52	42	46	52	38	64	244	314	159	88
2.....	56	47	52	41	49	51	38	64	260	350	152	82
3.....	52	49	52	42	54	50	38	66	244	386	152	77
4.....	51	55	54	47	58	51	39	68	212	404	159	76
5.....	47	55	55	52	54	49	40	68	204	404	152	74
6.....	46	54	55	60	54	49	42	70	212	422	152	73
7.....	42	61	54	62	53	49	45	70	228	368	152	72
8.....	42	73	54	62	54	47	47	69	228	350	145	72
9.....	40	75	53	61	53	47	50	73	244	350	131	77
10.....	38	74	54	58	53	46	50	88	244	368	131	77
11.....	38	70	63	52	54	45	51	112	244	350	131	88
12.....	38	64	66	50	54	43	51	138	244	350	131	85
13.....	38	58	63	43	53	43	51	152	228	350	131	82
14.....	37	56	60	42	52	42	50	159	228	350	131	82
15.....	36	52	60	41	53	41	49	159	278	350	131	82
16.....	37	51	57	41	56	39	47	152	350	386	124	82
17.....	36	50	56	40	58	38	47	152	482	422	124	82
18.....	36	47	57	39	59	38	48	145	422	386	124	82
19.....	36	49	57	39	58	37	50	138	386	368	124	82
20.....	35	45	56	38	58	37	51	131	386	350	118	77
21.....	34	43	54	38	58	36	50	118	386	314	118	73
22.....	35	41	54	37	56	36	49	118	386	278	112	68
23.....	34	42	52	36	56	36	48	112	332	244	106	67
24.....	33	42	52	36	57	40	47	196	350	212	106	66
25.....	33	42	51	41	56	38	49	112	332	212	100	65
26.....	33	51	49	42	55	38	52	112	314	204	100	66
27.....	35	59	47	46	54	39	58	124	314	196	94	70
28.....	36	57	44	48	54	40	61	152	332	204	94	74
29.....	40	56	44	48	.....	40	66	173	332	196	94	75
30.....	43	54	42	47	.....	38	66	188	332	180	88	75
31.....	45	.....	42	47	.....	38	.....	228	.....	173	88	.....

NOTE.—Gage not read on 6 to 12 days per month from November to May, inclusive; discharge based on observer's estimate of stage when he was absent. Gage not read Sept. 5, 12, 23, 30; discharge interpolated.

Monthly discharge of Lake Creek at outlet of Packwood Lake, near Lewis, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	57	33	40.0	2,400
November.....	75	41	54.0	3,210
December.....	66	42	53.6	3,300
January.....	62	36	45.7	2,810
February.....	52	46	54.6	3,030
March.....	52	36	42.4	2,610
April.....	66	38	48.9	2,910
May.....	228	64	119	7,320
June.....	422	204	299	17,800
July.....	422	173	316	19,400
August.....	159	88	124	7,620
September.....	88	65	76.4	4,550
The year.....	482	33	106	77,000

YOUNGS RIVER BASIN.

YOUNGS RIVER NEAR ASTORIA, OREG.

LOCATION.—In NE. $\frac{1}{4}$ sec. 2, T. 6 N., R. 9 W., at MacGregor-Malone logging camp, about 4 miles above Youngs River falls, and 13 miles south of Astoria, Clatsop County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 7, 1916, to September 30, 1917.

GAGE.—Vertical staff on right bank opposite cook house; read by J. H. Morgan.

DISCHARGE MEASUREMENTS.—Made by wading at low stages; no equipment for flood measurements.

CHANNEL AND CONTROL.—Control is of rock and compact clay; channel is a succession of pools and riffles at low stages; velocities high in flood.

EXTREMES OF STAGE.—Maximum stage recorded during year, 7.4 feet at 4 p. m. March 23; minimum stage, 2.20 feet in October, August, and September.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Gage read once daily to hundredths. Not enough discharge measurements have been made to define a rating curve.

The following discharge measurement was made by C. L. Batchelder:

August 14, 1917: Gage height, 2.26 feet; discharge, 10.3 second-feet. -

Daily gage height, in feet, of Youngs River near Astoria, Oreg., for the year ending Sept. 30, 1917.

[J. H. Morgan, observer.]

Day.	Oct.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	2.30	-----	3.30	3.75	3.00	4.65	3.45	2.95	3.00	2.40	2.20
2.....	2.30	-----	3.80	4.25	3.00	4.95	3.30	3.15	3.00	2.40	2.20
3.....	2.30	-----	3.70	4.35	3.00	4.60	3.15	3.20	3.00	2.40	2.20
4.....	2.30	-----	4.20	4.25	4.15	4.95	3.00	3.10	3.00	2.40	2.20
5.....	2.30	-----	5.55	4.20	5.40	4.85	3.05	2.90	2.90	2.40	2.20
6.....	2.30	-----	4.50	3.95	4.65	4.45	3.20	2.90	2.90	2.35	2.20
7.....	2.30	-----	4.10	3.80	4.30	5.50	3.55	2.90	2.90	2.30	2.30
8.....	2.20	-----	3.90	3.70	4.35	4.80	3.50	3.05	2.80	2.30	2.30
9.....	2.20	-----	3.50	3.50	4.00	4.45	3.45	3.25	2.75	2.30	2.40
10.....	2.20	-----	3.40	3.50	3.90	4.60	3.30	3.30	2.70	2.30	2.45
11.....	2.20	-----	3.40	3.50	3.75	4.50	3.30	3.35	2.70	2.30	2.50
12.....	2.20	-----	3.40	3.40	3.70	4.35	3.15	3.25	2.70	2.30	2.50
13.....	2.20	-----	3.35	3.30	3.75	4.25	3.00	3.10	2.65	2.30	2.50
14.....	2.20	-----	3.20	3.20	3.65	4.00	3.00	3.00	2.60	2.25	2.52
15.....	2.20	-----	3.20	3.00	3.60	3.95	3.00	3.00	2.60	2.25	2.58
16.....	2.20	-----	3.00	3.50	3.50	3.80	3.05	2.90	2.60	2.25	2.45
17.....	2.20	-----	3.00	3.35	3.40	3.75	3.15	2.80	2.60	2.25	2.40
18.....	2.20	-----	2.80	3.20	3.45	3.70	3.05	2.80	2.55	2.25	2.35
19.....	2.20	-----	2.90	3.35	3.55	3.75	3.15	2.75	2.50	2.25	2.30
20.....	2.20	-----	3.10	3.40	3.90	4.35	3.10	2.75	2.50	2.25	2.25
21.....	2.20	-----	3.40	3.40	4.15	4.40	3.10	2.85	2.50	2.25	2.20
22.....	2.20	-----	3.40	3.40	5.30	4.05	3.05	2.85	2.50	2.25	2.25
23.....	2.20	-----	3.40	3.30	6.20	3.95	2.95	2.90	2.50	2.20	2.25
24.....	2.20	-----	3.30	3.20	5.75	3.80	2.90	3.80	2.50	2.20	2.30
25.....	2.20	-----	3.60	3.00	4.80	3.75	2.90	3.50	2.45	2.20	2.38
26.....	2.20	-----	3.60	3.00	4.35	3.55	2.90	3.05	2.40	2.20	2.48
27.....	2.20	-----	5.25	3.00	4.60	3.50	2.90	3.00	2.50	2.20	2.55
28.....	2.20	-----	4.75	3.00	4.50	3.50	2.80	3.20	2.50	2.20	2.50
29.....	2.70	-----	4.10	-----	5.20	3.60	2.80	3.35	2.50	2.20	2.42
30.....	3.20	2.30	3.70	-----	4.50	3.60	2.80	3.20	2.50	2.20	2.32
31.....	-----	3.20	3.45	-----	4.20	-----	2.80	-----	2.40	2.20	-----

STREAMS BETWEEN COLUMBIA RIVER AND KLAMATH RIVER.**ROGUE RIVER BASIN.****ROGUE RIVER BELOW PROSPECT, OREG.**

LOCATION.—In sec. 6, T. 33 S., R. 3 E., at Prospect power plant of California-Oregon Power Co., 2 miles below Prospect, Jackson County, about 47 miles northeast of Medford, 1 mile below mouth of Mill Creek, and 2 miles above Middle Fork.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 3, 1913, to September 30, 1917.

GAGE.—Vertical staff on right bank about 100 feet above power house. Gage reader, O. L. Irwin.

DISCHARGE MEASUREMENTS.—Made from cable about 500 feet above gage.

CHANNEL AND CONTROL.—Control formed by large boulders; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.4 feet, June 9 (discharge, 3,540 second-feet; total, including discharge of flume, 3,680 second-feet); minimum stage recorded, 2.4 feet at 4 p. m. November 12 (discharge, 430 second-feet; total, including flume, 587 second-feet).

1913-1917: Maximum stage recorded is that of 1917; minimum stage recorded, 2.3 feet September 30 to October 3, October 10, and November 7, 1915 (discharge, 400 second-feet; total, including flume, 544 second-feet).

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

DIVERSIONS.—The California-Oregon Power Co.'s flume diverts around this station; a record is kept of this diversion. (See p. 124.)

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read twice a day to quarter-tenths. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Rogue River below Prospect, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 4	Batchelder and Reineking.....	2.65	518
June 19	C. L. Batchelder.....	5.02	3,010
Sept. 7	F. F. Henshaw.....	2.72	574

Daily discharge, in second-feet, of Rogue River below Prospect, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	532	505	505	485	485	560	780	1,800	2,740	2,250	780	595
2.....	505	505	505	485	485	560	820	1,800	2,610	2,250	780	595
3.....	532	505	560	485	505	595	780	1,800	2,490	2,250	780	595
4.....	532	630	630	505	505	595	780	1,800	2,370	2,250	780	595
5.....	532	595	630	505	505	595	860	1,800	2,490	2,250	780	560
6.....	532	595	560	595	505	560	1,250	2,610	2,740	2,130	700	560
7.....	560	560	485	560	560	560	1,250	2,740	2,870	2,020	700	560
8.....	505	505	505	505	560	560	1,800	2,740	3,130	1,910	700	560
9.....	505	505	485	505	595	560	1,580	2,870	3,540	1,800	700	560
10.....	505	505	485	505	630	560	1,360	2,740	3,130	1,800	700	560
11.....	505	505	485	505	630	532	2,020	3,000	2,740	1,690	700	560
12.....	505	448	485	505	665	505	1,800	3,000	2,370	1,690	700	560
13.....	505	465	485	505	665	505	1,640	3,000	2,370	1,690	700	560
14.....	505	505	485	485	700	505	1,470	3,000	2,610	1,520	665	560
15.....	505	505	485	465	665	505	1,360	2,740	2,870	1,470	665	560
16.....	505	505	505	465	700	505	1,250	2,490	3,130	1,420	630	560
17.....	505	485	485	465	700	505	1,150	2,490	3,130	1,360	630	560
18.....	485	485	485	465	700	505	1,100	2,370	3,130	1,250	630	560
19.....	485	505	505	465	630	505	1,050	2,250	3,130	1,250	630	560
20.....	505	485	630	505	630	505	1,060	2,370	3,090	1,150	630	560
21.....	485	485	560	505	630	505	1,360	2,250	2,870	1,100	630	560
22.....	485	485	505	532	630	505	1,470	2,250	2,740	1,050	630	560
23.....	485	485	505	532	630	505	1,800	2,250	2,490	1,050	630	560
24.....	485	485	505	505	630	505	2,130	2,250	2,490	950	630	560
25.....	485	560	485	505	780	560	2,490	2,130	2,490	950	630	560
26.....	485	740	485	505	665	532	2,610	2,020	2,370	950	595	560
27.....	485	665	465	505	630	905	2,490	2,130	2,370	860	595	560
28.....	485	780	485	505	630	1,250	2,250	2,490	2,370	860	630	560
29.....	485	560	485	505	-----	1,200	2,250	2,740	2,250	860	595	560
30.....	505	505	485	505	-----	1,150	2,020	2,740	2,250	820	595	560
31.....	560	-----	485	485	-----	950	-----	2,740	-----	780	595	-----

Monthly discharge of Rogue River at Prospect, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	560	485	506	31,100
November.....	780	448	535	31,800
December.....	630	465	51.	31,400
January.....	630	465	506	31,100
February.....	780	485	616	34,200
March.....	1,250	505	624	38,400
April.....	2,610	780	1,530	91,000
May.....	3,000	1,800	2,430	149,000
June.....	3,540	2,250	2,710	161,000
July.....	2,250	780	1,470	90,400
August.....	780	595	669	41,100
September.....	595	560	565	33,600
The year.....	3,540	448	1,060	764,000

Combined monthly discharge of Rogue River and California-Oregon Power Co. flume near Prospect, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	730	642	670	41,200
November.....	964	605	704	41,900
December.....	828	573	686	42,200
January.....	800	597	669	41,100
February.....	950	642	786	43,600
March.....	1,420	675	796	49,000
April.....	2,780	944	1,700	101,000
May.....	3,170	1,970	2,600	160,000
June.....	3,680	2,420	2,880	171,000
July.....	2,420	964	1,640	101,000
August.....	964	765	841	51,700
September.....	765	730	715	43,700
The year.....	3,680	573	1,230	887,000

ROGUE RIVER NEAR TOLO, OREG.

LOCATION.—In sec. 18, T. 36 S., R. 2 W., at Ray Gold, just below dam and power house of California-Oregon Power Co., $1\frac{1}{4}$ miles below Tolo, Jackson County, 7 miles above Gold Hill, half a mile below mouth of Bear Creek.

DRAINAGE AREA.—2,020 square miles.

RECORDS AVAILABLE.—August 30, 1905, to September 30, 1917.

GAGE.—Friez water-stage recorder referred to vertical staff bolted to concrete pier of bridge near right bank. Observers, E. W. Howells and E. B. Price.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet below gage.

CHANNEL AND CONTROL.—Rock and boulders; practically permanent. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 6.68 feet at 3 a. m. February 25 (discharge, 12,300 second-feet); minimum discharge less than 670 second-feet every night at 10 p. m. August 23 to September 30 (water surface below intake to recorder well).

1905-1917: Maximum stage recorded, 20.0 feet at 7.30 a. m. November 23, 1909 (discharge estimated by extension of rating curve as 60,000 second-feet); minimum stage estimated at -0.2 foot at 8 p. m. October 6 to 9 and 11 to 13, 1915 (discharge about 460 second-feet); water below intake to recorder well.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—A large area of land is irrigated from Rogue River and its tributaries.

REGULATION.—Discharge is influenced by changes of load on power plant just above station.

ACCURACY.—Stage-discharge relation practically permanent. On the basis of measurements made in 1917 and 1918 the rating curve has been revised; new curve applicable October 1, 1916, well defined between 800 and 30,000 second-feet. Operation of water-stage recorder unsatisfactory greater part of time prior to March 21. No record November 21 to December 31. Daily discharge ascertained by use of discharge integrator whenever record was satisfactory; for other periods, except those indicated in footnote to table of daily discharge, by applying to rating table the gage reading made at 6 a. m., which gives nearly the mean for the day. Records excellent, April to September; good for rest of year.

Discharge measurements of Rogue River near Tolo, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 2	Batchelder and Reineking.....	1.15	1,340	June 15	C. L. Batchelder.....	4.02	5,680
Mar. 22	Henshaw and Briggs...	2.40	2,940	Sept. 3	F. F. Henshaw.....	1.26	1,530

Daily discharge, in second-feet, of Rogue River near Tolo, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	1,180	1,220	1,360	1,540	3,290	4,800	5,860	6,640	3,840	1,690	1,290
2.....	1,180	1,190	1,460	1,560	2,970	6,090	5,230	6,460	3,890	1,690	1,300
3.....	1,180	1,180	2,660	1,720	2,960	5,120	5,220	5,940	4,100	1,680	1,380
4.....	1,180	1,260	2,430	2,100	3,010	4,780	5,180	5,490	3,950	1,640	1,360
5.....	1,180	1,420	3,780	2,340	5,580	5,850	5,360	6,080	3,780	1,580	1,370
6.....	1,270	1,380	3,870	2,380	4,700	6,740	6,200	6,550	3,690	1,650	1,360
7.....	1,270	1,380	2,870	2,460	4,190	6,670	7,750	6,670	3,480	1,560	1,360
8.....	1,270	1,330	2,530	2,460	4,470	8,590	7,560	7,060	3,400	1,540	1,360
9.....	1,270	1,310	2,140	2,440	4,760	7,220	7,590	8,190	3,300	1,550	1,360
10.....	1,270	1,290	1,970	2,420	5,040	6,310	7,410	7,260	3,150	1,530	1,380
11.....	1,340	1,260	1,900	2,970	3,540	8,980	7,760	6,110	2,960	1,490	1,400
12.....	1,300	1,240	1,830	3,380	2,940	8,850	8,120	5,310	2,940	1,490	1,400
13.....	1,290	1,220	1,680	3,210	2,800	7,100	9,020	5,120	2,800	1,520	1,420
14.....	1,240	1,220	1,520	2,870	2,840	6,130	7,600	5,140	2,710	1,490	1,420
15.....	1,230	1,180	1,460	2,560	2,620	5,920	8,380	5,450	2,680	1,520	1,330
16.....	1,250	1,180	1,220	2,630	2,660	5,190	7,820	6,180	2,610	1,490	1,310
17.....	1,270	1,270	1,010	2,970	2,800	4,790	8,110	6,530	2,530	1,490	1,420
18.....	1,270	1,270	1,140	2,600	2,940	4,140	7,930	6,360	2,410	1,490	1,300
19.....	1,250	1,270	1,320	2,660	2,940	3,930	6,960	6,520	2,320	1,380	1,320
20.....	1,250	1,360	1,420	2,530	2,870	4,270	6,760	6,310	2,190	1,400	1,340
21.....	1,230	.....	1,470	2,530	3,270	5,240	6,630	6,100	2,140	1,390	1,310
22.....	1,220	.....	1,450	2,530	2,730	6,050	6,440	5,660	2,090	1,350	1,300
23.....	1,200	.....	1,430	2,530	2,650	6,700	6,080	5,210	2,060	1,360	1,260
24.....	1,210	.....	1,380	3,630	3,170	7,630	5,720	4,630	1,990	1,340	1,410
25.....	1,200	.....	1,380	8,720	4,410	8,660	5,420	4,500	1,940	1,380	1,330
26.....	1,220	.....	1,400	5,040	3,900	9,100	5,020	4,360	1,900	1,380	1,360
27.....	1,220	.....	1,410	5,400	8,940	8,230	5,230	4,360	1,840	1,370	1,230
28.....	1,220	.....	2,800	3,440	8,920	7,170	5,890	4,300	1,810	1,350	1,280
29.....	1,180	.....	2,450	.....	8,980	7,110	6,540	4,090	1,760	1,340	1,300
30.....	1,210	.....	2,250	.....	7,320	6,110	6,440	3,900	1,740	1,330	1,280
31.....	1,220	.....	1,880	.....	5,450	.....	6,540	.....	1,730	1,330	.....

NOTE.—Mean discharge estimated Nov. 21–31, 1,440 second-feet; Dec. 1–31, 1,350 second-feet. Discharge interpolated Oct. 16, 21–22, Nov. 9–12, Jan. 22, and Mar. 8–9.

Monthly discharge of Rogue River near Tolo, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	1,340	1,180	1,230	75,600
November.....	1,180	.....	1,330	79,100
December.....	.....	.....	1,350	83,000
January.....	3,870	1,010	1,900	117,000
February.....	8,720	1,540	2,990	166,000
March.....	8,980	2,620	4,180	257,000
April.....	9,100	3,930	6,450	384,000
May.....	9,020	5,020	6,700	412,000
June.....	8,190	3,900	5,750	342,000
July.....	4,100	1,730	2,700	166,000
August.....	1,690	1,330	1,480	91,000
September.....	1,420	1,230	1,340	79,700
The year.....	9,100	1,010	3,110	2,250,000

CALIFORNIA-OREGON POWER CO.'S FLUME NEAR PROSPECT, OREG.

LOCATION.—In sec. 6, T. 33 S., R. 3 E., at lower end of power flume, just above forebay, and about 2 miles below Prospect, Jackson County.

RECORDS AVAILABLE.—August 1, 1913, to September 30, 1917.

GAGE.—Vertical staff in stilling box on right side of flume, about 500 feet above forebay, used after August 17, 1915. Gage one mile above forebay used August 1, 1913, to August 16, 1915. Gage reader, Geo. Walker.

DISCHARGE MEASUREMENTS.—Made from collar of flume.

CHANNEL AND CONTROL.—Wooden flume at the end of which there is a free fall into the forebay.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.6 feet December 7-9 and 17-23 (discharge, 198 second-feet); minimum stage recorded, 1.9 feet, December 27 (discharge, 108 second-feet).

1916-1917: Maximum stage recorded, 3.7 feet April 25, 26, 30, May 1 and 2, 1916 (discharge, 212 second-feet); minimum stage was that of 1917.

ICE.—Stage-discharge relation never affected by ice.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read once daily to half-tenths. Daily discharge ascertained by applying daily gage height to rating table. Records good.

The California-Oregon Power Co.'s flume diverts water from Rogue River in the SE. $\frac{1}{4}$ sec. 30, T. 32 S., R. 3 E., and delivers it to the power plant in the NW. $\frac{1}{4}$ sec. 6, T. 33 S., R. 3 E., where a head of about 500 feet is utilized.

~ The following discharge measurement was made by Batchelder and Reineking:

October 4, 1916: Gage height, 2.30 feet; discharge, 162 second-feet.

Daily discharge, in second-feet, of California-Oregon Power Co.'s flume near Prospect, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	157	170	184	184	157	177	164	170	170	170	184	170
2.....	164	170	184	184	170	170	157	170	170	170	184	170
3.....	170	170	184	184	170	170	170	170	170	170	184	170
4.....	164	170	184	170	170	170	170	170	170	170	184	170
5.....	170	157	191	170	170	170	184	170	157	170	170	170
6.....	170	157	191	170	170	170	184	170	157	170	170	170
7.....	157	157	198	184	170	170	157	170	144	170	170	170
8.....	157	144	198	184	170	170	157	170	144	177	170	170
9.....	157	170	198	170	170	170	170	170	144	184	170	170
10.....	157	144	144	170	170	170	170	170	170	184	170	170
11.....	157	144	157	170	164	170	170	170	170	170	170	170
12.....	157	157	157	144	164	170	170	170	157	170	170	170
13.....	157	157	132	144	170	170	184	170	157	170	170	170
14.....	157	170	132	144	170	177	184	170	144	170	170	170
15.....	157	170	144	144	170	177	184	170	170	170	170	170
16.....	164	170	144	132	184	170	184	170	170	170	170	170
17.....	164	170	198	132	184	170	184	170	170	170	170	170
18.....	157	170	198	144	170	170	177	170	170	170	170	170
19.....	170	170	198	144	170	170	177	170	170	170	170	170
20.....	170	170	198	144	170	170	184	170	170	170	170	170
21.....	164	170	198	157	170	170	184	170	170	170	170	170
22.....	157	184	198	157	170	170	170	170	170	170	170	170
23.....	157	184	198	170	170	170	170	170	170	177	170	170
24.....	170	184	184	170	170	170	157	170	170	184	170	170
25.....	170	184	144	170	170	184	157	170	170	184	170	170
26.....	170	184	132	170	170	184	170	170	170	184	170	170
27.....	170	184	108	170	170	184	157	157	170	184	170	170
28.....	170	184	184	170	177	170	157	157	170	184	170	170
29.....	170	184	184	170	.....	170	170	157	170	177	170	170
30.....	170	184	184	170	.....	170	170	170	170	177	170	170
31.....	170	.....	184	157	.....	170	.....	170	.....	184	170	.....

Monthly discharge of California-Oregon Power Co.'s flume near Prospect, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	170	157	164	10, 100
November.....	184	144	169	10, 100
December.....	198	108	175	10, 800
January.....	184	132	163	10, 000
February.....	184	157	170	9, 440
March.....	184	170	172	10, 600
April.....	184	157	171	10, 200
May.....	170	157	169	10, 400
June.....	170	144	165	9, 820
July.....	184	170	175	10, 800
August.....	184	170	172	10, 600
September.....	170	170	170	10, 100
The year.....	198	108	169	123, 000

SOUTH FORK OF LITTLE BUTTE CREEK NEAR DEADWOOD, OREG.

LOCATION.—In sec. 9, T. 38 S., R. 4 E., about 1½ miles east of Deadwood, 4 miles east of Lilyglen, and 21 miles east of Ashland, Jackson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April to July, 1917.

GAGE.—Barrett & Lawrence water-stage recorder on left bank.

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

CHANNEL AND CONTROL.—Gravel and boulders; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 2.08 feet at 2 a. m. June 19 (discharge, 60 second-feet); probably no flow on January 19, 1917.

DIVERSIONS.—None at present. Water can be diverted above station and stored in the proposed Beaver Creek reservoir.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve poorly defined. Operation of water-stage recorder satisfactory May 4 to July 24. Discharge estimated April 1 to May 3 and July 25-31. Determinations of daily discharge not sufficiently accurate to warrant publication. Records of monthly discharge fair for May and June, poor for April and July.

Discharge measurements of South Fork of Little Butte Creek near Deadwood, Oreg., during the year ending Sept. 30, 1917.

[Made by F. C. Dillard.^a]

Date.	Gage height.	Discharge.
June 7.....	<i>Feet.</i> 1.90	<i>Sec.-ft.</i> 48.8
July 24.....	.78	4.5

^a Engineer, Talent irrigation district.

Monthly discharge of South Fork of Little Butte Creek near Deadwood, Oreg., for the year ending Sept. 30, 1917.

Month—	Mean discharge in second-feet.	Run-off (total in acre-feet).	Month—	Mean discharge in second-feet.	Run-off (total in acre-feet).
April.....	7.7	458	July.....	11.3	695
May.....	33.5	2,060			
June.....	48.4	2,880	The period.....		6,090

LITTLE BUTTE CREEK ABOVE EAGLE POINT, OREG.

LOCATION.—In sec. 31, T. 35 S., R. 1 E., at Bieberstedt's ranch, a quarter of a mile above intake of Eagle Point ditch, about 3 miles east of Eagle Point, Jackson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 24, 1916, to September 30, 1917.

GAGE.—Vertical staff; low-water section nailed to stump on right bank; high-water section on left bank directly opposite. Gage reader, Carl Bieberstedt.

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

CHANNEL AND CONTROL.—Channel of smooth gravel; fairly deep and narrow. Control is diversion dam of Eagle Point ditch which may be changed occasionally.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.25 feet at 11.30 a. m., May 17 (discharge, 1,430 second-feet); minimum stage recorded, 1.98 feet at 7.40 a. m. November 21, at 8.10 a. m. December 17, at 8.10 a. m. December 29, and at 8.30 a. m. January 16 (discharge, 30 second-feet).

1916-1917: Maximum stage was recorded in 1917. Minimum stage recorded, 1.70 feet August 2, 1916 (discharge, 20 second-feet). The flood of 1884 is said to have reached a stage of about 15 feet.

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

DIVERSIONS.—The Rogue River Valley canal diverts water above the station (see p. 130) and the municipal water supply (about 7.5 second-feet) for Medford is taken out above. Several hundred acres are irrigated along the creek above the station. The Eagle Point ditch diverts about 8 second-feet just below this station but above former station at Tronson's ranch.

REGULATION.—Water was being stored in Fish Lake reservoir November 10 to June 4 and was released October 2 to 15, June 4 to 12, and during September. Not much change at other times.

ACCURACY.—Stage-discharge relation changed in January; not affected by ice. Rating curves well defined between 30 and 600 second-feet; applicable October 1 to January 28 and January 29 to September 30, respectively. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent below 600 second-feet.

Discharge measurements of Little Butte Creek above Eagle Point, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 5	Batchelder and Reinck- ing.	3.02	171	June 17	Batchelder and Cow- gill. ^a	4.25	547
Mar. 22	Henshaw and Briggs...	3.32	241	Aug. 1	R. P. Cowgill.....	2.20	53
				Sept. 6	F. F. Henshaw.....	2.35	66

^a Chief engineer, Rogue River Valley Canal Co.

Daily discharge, in second-feet, of Little Butte Creek above Eagle Point, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	68	75	33	59	112	292	490	600	600	188	50	57
2.....	70	75	33	278	92	264	680	560	560	166	49	60
3.....	80	73	37	292	137	251	490	560	525	156	51	60
4.....	146	78	39	188	238	320	455	525	525	146	53	62
5.....	177	84	39	525	200	920	640	525	1,150	146	49	62
6.....	177	89	38	306	188	455	640	600	1,050	128	48	64
7.....	177	89	35	200	188	438	640	720	920	128	46	69
8.....	177	83	35	146	166	320	920	680	840	128	46	69
9.....	166	80	35	112	156	385	680	720	800	112	48	72
10.....	177	76	37	96	166	385	560	680	760	112	47	73
11.....	188	49	37	84	251	306	1,000	720	680	92	45	78
12.....	166	70	44	75	292	238	760	800	600	78	44	78
13.....	137	48	44	76	225	355	600	960	455	85	46	85
14.....	104	41	48	80	177	292	640	920	368	85	49	78
15.....	83	31	43	65	146	238	560	1,000	385	71	47	78
16.....	73	31	47	48	200	212	525	920	438	68	48	73
17.....	73	31	43	59	188	264	402	1,200	525	68	49	73
18.....	73	31	41	70	156	251	350	880	525	73	48	73
19.....	73	33	54	69	146	225	320	800	490	71	47	73
20.....	73	31	112	60	188	251	368	760	438	71	47	73
21.....	70	30	80	68	188	385	490	720	385	71	44	73
22.....	70	31	69	69	212	238	680	680	368	71	38	73
23.....	70	31	64	58	238	238	720	640	320	71	40	78
24.....	70	31	71	53	525	455	760	600	320	71	43	85
25.....	70	35	65	53	760	455	880	560	292	68	48	78
26.....	70	64	60	53	490	455	880	525	264	61	50	78
27.....	70	47	58	53	420	1,150	840	525	251	57	48	78
28.....	73	48	54	640	402	760	800	560	238	54	46	73
29.....	73	38	44	200	.....	1,100	680	600	225	54	47	73
30.....	76	34	57	212	.....	760	640	600	212	54	46	69
31.....	76	.....	69	137	.....	525	.....	600	.....	52	47	.....

Monthly discharge of Little Butte Creek above Eagle Point, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....	188	68	105	6,460
November.....	89	30	52.9	3,150
December.....	112	33	50.5	3,110
January.....	640	48	145	8,920
February.....	760	92	245	13,600
March.....	1,150	212	426	26,200
April.....	1,000	320	636	37,800
May.....	1,200	525	701	43,100
June.....	1,150	212	517	30,800
July.....	188	52	92.1	5,660
August.....	53	38	46.9	2,880
September.....	85	57	72.3	4,300
The year.....	1,200	30	257	186,000

DEAD INDIAN CREEK NEAR LILYGLEN, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 22, T. 38 S., R. 3 E., at Neill's ranch, about a-mile west of Lilyglen, a former post office, and about 17 miles east of Ashland, Jackson County.

DRAINAGE AREA.—Not measured; no adequate maps available.

RECORDS AVAILABLE.—February 16, 1916, to June 30, 1917.

GAGE.—Stevens' 8-day water-stage recorder installed in October, 1916. Vertical staff on left bank, one-eighth mile upstream used up to May, 1916. Observer, William Lindsay.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Closely packed clay; practically permanent.

EXTREMES OF DISCHARGE.—1916-17: Maximum stage recorded, 3.12 feet at 4 p. m. March 29, 1917; probably caused by backwater from ice jams; discharge uncertain. Minimum stage recorded, 0.15 foot November 20, 1917 (discharge estimated, 0.1 second-foot).

ICE.—Stage-discharge relation affected by ice from November 12 to March 29. Discharge estimated from observer's notes and temperature records.

DIVERSIONS.—None at present. Water can be diverted from a point about 1,500 feet above the gage into the proposed Beaver Creek reservoir.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined between 0.5 and 100 second-feet. Water-stage recorder worked satisfactorily except during winter when float was frozen in well. Daily discharge ascertained by applying to the rating table the mean daily gage height determined by inspecting recorder graph. Records October to March, poor because no discharge measurements were made; April to June, good.

Discharge measurements of Dead Indian Creek near Lilyglen, Oreg., during the year ending Sept. 30, 1917.

[Made by F. C. Dillard.^a]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	<i>Feet.</i>	<i>Sec.-ft.</i>		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 19	0.20	0.4	Apr. 23	0.92	49.3
Apr. 12 .....	.60	15.7	May 10	1.03	57

^a Engineer, Talent irrigation district.

Daily discharge, in second-feet, of Dead Indian Creek near Lilyglen, Oreg., for the year ending Sept. 30, 1917.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May	June
1.		116	28	52	16.		9	51	16
2.		25	28	52	17.		9	49	16
3.		4	33	47	18.		8	42	14
4.		4	37	47	19.		8	40	14
5.		8	35	36	20.		11	40	14
6.		11	47	33	21.		15	37	11
7.		13	51	34	22.		16	36	11
8.		15	50	36	23.		37	36	9
9.		12	54	36	24.	2	45	36	9
10.		13	54	34	25.		45	36	7
11.		18	61	29	26.		51	38	7
12.		15	77	26	27.		51	42	7
13.		14	90	21	28.		48	48	7
14.		12	78	16	29.		35	49	5
15.		11	67	16	30.	206	30	52	5
					31.	170		52	

NOTE.—Discharge estimated 2 second-feet, Feb. 1-12; 5 second-feet, Feb. 13-18; 10 second-feet, Feb. 19-28; 5 second-feet, Mar. 1-5; 2 second-feet, Mar. 6-9; 0.5 second-foot, Mar. 10-23; 50 second-feet, Mar. 25-26; 100 second-feet, Mar. 27-29.

Monthly discharge of Dead Indian Creek near Lilyglen, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October.....			α 0.5	31
November.....			α .5	30
December.....			α 1.0	61
January.....			α .5	31
February.....			5.5	305
March.....	206		26.4	1,620
April.....	116	4	23.6	1,400
May.....	90	28	47.5	2,920
June.....	52	5	22.2	1,320
The period.....				7,720

α Estimated.

NORTH FORK OF LITTLE BUTTE CREEK NEAR LAKE CREEK, OREG.

LOCATION.—In sec. 21, T. 36 S., R. 2 E., about one-eighth mile above intake of Rogue River Valley canal, 1 mile above Lake Creek post office, Jackson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 20 to October 13, 1916; May 7 to September 30, 1917.

At station above city intake, about 3 miles above present station, September 10, 1911, to March 31, 1913 (gives discharge slightly greater than present station gives).

GAGE.—Vertical staff on right bank. Gage reader, Will Mann.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Boulders and gravel; fairly permanent except in extreme floods.

EXTREMES OF DISCHARGE.—Maximum discharge during period May 7 to September 30, 1917, about 700 second-feet on June 5 (estimated from records on Little Butte Creek above Eagle Point). Minimum stage recorded, 2.1 feet August 21 to 31 (discharge, 60 second-feet).

1916-1917: Maximum stage is that of 1917. Minimum stage, 1.8 feet August 24 to September 1, 1916 (discharge, 38 second-feet).

ICE.—Stage-discharge relation practically never affected by ice.

DIVERSIONS.—Pipe line for water supply of city of Medford, capacity about 7.5 second-feet, carries water past the gage. Several hundred acres irrigated above the station.

REGULATION.—Water was stored in Fish Lake reservoir, about 15 miles above the station, November 10 to June 4, and was released October 2 to 15, June 4 to 12, and during September; little change at other times.

ACCURACY.—Stage-discharge relation changed during flood of June 5 to 7. Two rating curves used; well-defined below 250 second-feet. Gage read every other day to tenths. Daily discharge ascertained by applying the gage reading to rating table. Records only fair on account of inaccurate gage readings.

Discharge measurements of North Fork of Little Butte Creek near Lake Creek, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis- charge.
		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 5	Batchelder and Reineking.....	2.65	190
June 17	Batchelder and Cowgill.....	2.68	192
Sept. 5	F. F. Heashaw.....	2.23	83

Daily discharge, in second-feet, of North Fork of Little Butte Creek near Lake Creek, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	May.	June.	July.	Aug.	Sept.	Day.	Oct.	May.	June.	July.	Aug.	Sept.
1.....	75	.....	a110	.....	78	.....	16.....	.....	.....	144	78	.....	98
2.....	.....	.....	110	98	.....	78	17.....	.....	176	192	.....	78	.....
3.....	75	.....	a110	.....	78	.....	18.....	.....	.....	198	78	.....	88
4.....	.....	.....	110	98	.....	78	19.....	.....	176	a184	.....	78	.....
5.....	176	.....	700	.....	78	84	20.....	.....	.....	170	98	.....	88
6.....	.....	.....	600	98	.....	88	21.....	.....	152	a157	.....	60	.....
7.....	176	130	500	.....	78	.....	22.....	.....	.....	144	78	.....	88
8.....	.....	.....	460	98	.....	88	23.....	.....	130	a144	.....	60	.....
9.....	176	130	a395	.....	78	.....	24.....	.....	.....	144	78	.....	88
10.....	.....	.....	330	98	.....	98	25.....	.....	130	a132	.....	60	.....
11.....	176	130	a312	.....	120	.....	26.....	.....	.....	120	78	.....	98
12.....	.....	.....	295	78	.....	98	27.....	.....	110	a120	.....	60	.....
13.....	130	130	a196	.....	78	.....	28.....	.....	.....	120	78	.....	98
14.....	.....	.....	98	78	.....	98	29.....	.....	110	a120	.....	60	.....
15.....	.....	176	a121	.....	78	.....	30.....	.....	.....	120	78	.....	.....
							31.....	.....	110	.....	.....	60	.....

a Interpolated.

NOTE.—Daily discharge June 5-7 estimated from records on Little Butte Creek above Eagle Point. The increase in discharge was due to release of water at Fish Lake. No record Oct. 14 to May 6.

Monthly discharge of North Fork of Little Butte Creek near Lake Creek, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 7-31.....	176	110	138	6,840
June.....	700	98	222	13,200
July.....	.....	78	86.0	5,290
August.....	120	60	73.9	4,540
September.....	.....	.....	90.9	5,410
The period.....	.....	.....	.....	35,300

NOTE.—Monthly mean discharge is average of discharge given in daily discharge table.

ROGUE RIVER VALLEY CANAL NEAR BROWNSBORO, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 8, T. 36 S., R. 1 E., at head of Bradshaw drop, about 2 miles southwest of Brownsboro, 8 miles below intake, and 16 miles from Medford, Jackson County.

RECORDS AVAILABLE.—Irrigation seasons of 1913 and 1915 to 1917.

GAGE.—Vertical staff just at head of drop, installed June 5, 1916. Former gages were a few feet upstream. Gage reader, Wills Mann.

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

CHANNEL AND CONTROL.—Solid rock at head of drop; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during season, 2.0 feet June 19 to August 20 (discharge, 41 second-feet). Canal dry during winter.

1913 and 1915-1917: Maximum discharge, 41 second-feet in 1916 and 1917.

Canal dry at times.

ACCURACY.—Stage-discharge relation practically permanent during season. Rating curve fairly well defined. Gage read every other day to tenths. Discharge ascertained by applying gage height to rating table. Records fair.

The Rogue River Valley canal diverts water from North Fork of Little Butte Creek in the SE. $\frac{1}{4}$ sec. 22, T. 36 S., R. 2 E., to irrigate land lying in the basin of Bear Creek. Any seepage or return water from irrigation of about 300 acres above this point reaches Little Butte Creek above the station above Eagle Point.

Discharge measurements of Rogue River Valley canal near Brownsboro, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.
June 17	Batchelder and Cowgill.....	<i>Feet.</i> 1.90	<i>Sec.-ft.</i> 37.7
Sept. 5	F. F. Henshaw.....	1.83	30.9

Daily discharge, in second-feet, of Rogue River Valley canal near Brownsboro, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	May.	June.	July.	Aug.	Sept.	Day.	Oct.	May.	June.	July.	Aug.	Sept.
1.....			21	41		30	16.....		17		41	41	
2.....	24				41		17.....			35	41		21
3.....			21	41		30	18.....		14			41	
4.....					41		19.....			41	41		21
5.....			17	41		30	20.....		14			41	
6.....					41		21.....			41	41		21
7.....	7		21	41		25	22.....		11			35	
8.....		14			41		23.....			41	41		21
9.....			25	41		25	24.....		11			35	
10.....		14			41		25.....			41	41		17
11.....			30	41		25	26.....		11			35	
12.....		14			41		27.....			41	41		17
13.....			30	41		21	28.....		11			35	
14.....		14			41		29.....			41	41		14
15.....			41	41		21	30.....		11			30	
							31.....				41		

Monthly discharge of Rogue River Valley canal near Brownsboro, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October (13 days).....			a 11.0	283
May 8-31.....	17	11	13.0	619
June.....	41	17	32.5	1,930
July.....	41	41	41.0	2,520
August.....	41	30	38.7	2,390
September.....	30	14	22.6	1,340

a Estimated from unpublished records at intake.

NOTE.—Monthly mean discharge is mean of discharge for days on which gage was read.

BEAR CREEK AT MEDFORD, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 30, T. 37 S., R. 1 W., just above Main Street Bridge in Medford, Jackson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 13, 1915, to July 11, 1917; fragmentary.

GAGE.—Vertical staff at southeast corner of Page theater building, on left bank.

Gage reader, R. P. Cowgill.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading; conditions favorable.

CHANNEL AND CONTROL.—Channel of loose gravel; a concrete sewer passing under creek forms a partial control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.50 feet at 8 a. m. and 6 p. m. March 27 (discharge, 580 second-feet). Minimum discharge for year probably close to that of September 3; estimated 1.2 second-feet (water below gage).

1915-1917: Maximum stage recorded, 4.75 feet at 8 a. m. February 10, 1919 (discharge, 1,240 second-feet); minimum stage recorded, 1.25 feet August 20, 1915 (discharge, 0.2 second-foot or less).

ICE.—Stage-discharge relation unaffected.

DIVERSIONS.—A large area above the station is irrigated from the flood waters of Bear Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed some time between June 2 and 14.

Rating curves fairly well defined between 50 and 350 second-feet. Gage read to hundredths daily on days for which discharge is published. Daily discharge ascertained by applying daily gage height to rating table. Records good, February to May; poor, November to January; and fair, June and July.

Discharge measurements of Bear Creek at Medford, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
Mar. 22	Henshaw and Briggs.....	<i>Feet.</i> 2.29	<i>Sec.-ft.</i> 136
June 16	C. L. Batchelder.....	1.90	73

Daily discharge, in second-feet, of Bear Creek at Medford, Oreg., for the year ending Sept. 30, 1917.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1.....			20	111	272	175	160	31
2.....				102	350	160	160	27
3.....				102	270	160	145	23
4.....	35			370	250	160	135	19
5.....		54	54	290	350	160	125	15
6.....		68		220	370	200	118	12
7.....			60	160	370	220	110	10
8.....			60	160	430	220	110	8
9.....			60	160	330	220	105	6
10.....			60	174	272	220	105	4
11.....			78	174	418	220	105	2
12.....				160	430	300	100	
13.....			98	160	320	330	95	
14.....			78	147	250	300	90	
15.....				134	220	290	84	
16.....				122	220	370	78	
17.....			116	134	204	430	77	
18.....	20				189	490	77	
19.....			68		189	338	76	
20.....					189	390	72	
21.....					255	340	69	
22.....				142	330	290	66	
23.....			68	118	370	240	61	
24.....		23		160	450	210	56	
25.....			512	189	450	175	50	
26.....			255	204	450	140	45	
27.....			204	580	410	140	42	
28.....			166	490	350	150	40	
29.....				526	270	150	38	
30.....		41		490	200	160	35	
31.....	20					160		

NOTE.—Discharge Nov. 27, 1916, 35 second-feet. Discharge estimated by hydrographic comparison with Little Butte and Beaver Creeks on the following dates: April 2-5, 9, 13, 14, 29, 30, May 1, 3-10, 12-14, 21-31, June 3-10, 12, 13, 15, 17-18, 20-21, 23-25, 27-29, and July 1-11.

Monthly discharge of Bear Creek at Medford, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March.....	580	102	215	13,200
April.....	450	189	314	18,700
May.....	490	140	226	13,900
June.....	160	35	87.6	5,210
July 1-11.....	31	2	14.3	312
The period.....				51,800

PHOENIX DITCH AT TALENT, OREG.

LOCATION.—In NW. $\frac{1}{4}$ sec. 23, T. 38 S., R. 1 W., about a quarter of a mile below an old bridge across Bear Creek and half a mile north of Talent, Jackson County.

RECORDS AVAILABLE.—April 19, 1916, to September 30, 1917.

GAGE.—Vertical staff on left of flume about 80 feet below intake. Gage reader, V. D. Brophy, ditch rider.

DISCHARGE MEASUREMENTS.—Made from collar of flume.

CHANNEL AND CONTROL.—Flume extends only a few feet below gage; no defined control.

EXTREMES OF DISCHARGE.—Maximum discharge recorded during period of record, 28 second-feet June 22, 23, and 25, 1917 (gage height, 2.2 feet). Canal dry in winter.

ACCURACY.—Stage-discharge relation practically permanent except from about June 28 to July 8, when there was probably a temporary obstruction which caused backwater at the station. Rating curve well defined. Gage read to hundredths about every other day. Daily discharge ascertained by applying daily gage height directly to rating table except for June 28 to July 8, for which period shifting control method was used. Records fair.

Discharge measurements of Phoenix ditch at Talent, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		Feet.	Sec.-ft.			Feet.	Sec.-ft.
June 16	Batchelder and Cowgill ^a	1.85	19.1	July 23	R. P. Cowgill.....	1.25	5.8
				27	.....do.....	1.05	3.4
July 5	R. P. Cowgill.....	2.45	26.1	31	.....do.....	.73	1.2
12	.....do.....	1.68	14.9				

^a Chief engineer, Rogue River Valley Canal Co.

Daily discharge, in second-feet, of Phoenix ditch at Talent, Oreg., for the year ending Sept. 30, 1917.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1.....		5.2	25.0	1.2	16.....	3.0	19.2	16.0	.....
2.....		4.5	26.0	1.2	17.....	.0	19.2	18.0	.....
3.....		3.7	26.0	1.2	18.....	1.0	19.6	15.5	.....
4.....		3.0	26.0	.0	19.....	1.0	20.1	13.8	.....
5.....		7.0	26.1	.....	20.....	.0	20.5	12.0	.....
6.....		5.0	24.0	.....	21.....	.0	21.8	10.0	.....
7.....		3.0	22.0	.....	22.....	5.2	28.0	8.0	.....
8.....		11.0	20.0	.....	23.....	3.9	28.0	6.1	.....
9.....		12.0	18.0	.....	24.....	2.6	16.4	5.5	.....
10.....	1.5	13.0	16.8	.....	25.....	3.0	28.0	4.8	.....
11.....	1.4	11.5	15.9	.....	26.....	2.7	24.9	4.0	.....
12.....	1.4	10.0	15.0	.....	27.....	2.5	21.8	3.5	.....
13.....	1.3	12.0	13.5	.....	28.....	2.2	23.0	2.9	.....
14.....	1.2	15.5	12.0	.....	19.....	3.1	24.0	2.4	.....
15.....	2.1	20.5	14.0	.....	30.....	4.0	24.0	1.8	.....
					31.....	2.6	.....	1.2	.....

NOTE.—Ditch dry except during irrigation season.

Monthly discharge of Phoenix ditch at Talent, Oreg., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 10-31.....	5.2	0	2.08	91
June.....	28	3.0	15.8	940
July.....	26.1	1.2	13.7	842
August 1-4.....	1.2	0	.12	7
The period.....				1,880

COQUILLE RIVER BASIN.

SOUTH FORK OF COQUILLE RIVER AT POWERS, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 13, T. 31 S., R. 12 W., a quarter of a mile due west of Powers post office, Coos County, at present terminus of Willamette Pacific Railroad, 200 feet above Bingham Creek and 1,000 feet below Salmon Creek.

DRAINAGE AREA.—168 square miles (measured on topographic map and on Douglas County Abstract Co.'s map).

RECORDS AVAILABLE.—September 4, 1916, to September 30, 1917.

GAGE.—Inclined staff in three sections on left bank under footbridge. Gage reader, B. F. Segur.

DISCHARGE MEASUREMENTS.—Made by wading or from footbridge.

CHANNEL AND CONTROL.—Gravel and solid rock; shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage during period covered by record, 8.0 feet at 8 a. m. March 29 and April 11 (discharge, 5,300 second-feet). Minimum discharge, 23 second-feet October 26 (gage height, 2.58 feet).

ICE.—Stage-discharge relation never affected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water of April. Two rating curves used; both fairly well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good for September and October, 1916, and from July to September, 1917; fair, November to June.

Discharge measurements of South Fork of Coquille River at Powers, Oreg., during the period Sept. 4, 1916, to Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		<i>Feet.</i>	<i>Sec.-ft.</i>			<i>Feet.</i>	<i>Sec.-ft.</i>
Sept. 4	W. E. Dickinson.....	3.00	64	Jan. 9	M. S. Kelley.....	5.15	1,130
4	.....do.....	2.98	65	10	.....do.....	5.05	1,060
4	.....do.....	2.98	62	July 6	.....do.....	2.98	90
Oct. 21	M. S. Kelley.....	2.60	24.9	6	.....do.....	2.98	88
Jan. 8	.....do.....	5.50	1,500	Aug. 22	.....do.....	2.55	36
9	.....do.....	5.20	1,200				

Daily discharge, in second-feet, of South Fork of Coquille River at Powers, Oreg., from Sept. 4, 1916, to Sept. 30, 1917.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	
1.		31	81	585	470	865	650	1,610	1,100	408	116	50	32	
2.		35	54	1,610	1,400	940	585	1,610	950	376	116	50	32	
3.		32	181	4,760	1,830	1,200	585	2,070	915	343	114	50	32	
4.	66	31	1,500	3,380	1,400	1,300	650	1,720	845	323	104	48	32	
5.	54	31	790	3,220	4,220	1,400	1,830	2,770	810	303	93	47	32	
6.		49	30	2,340	2,620	3,380	1,300	1,300	2,480	1,020	284	93	46	32
7.		44	29	1,500	1,830	2,070	1,200	1,100	3,220	1,020	266	84	45	32
8.		44	28	790	1,830	1,500	1,100	1,200	3,540	950	266	84	44	34
9.		46	28	498	1,830	1,150	940	1,200	2,770	1,020	266	84	43	38
10.		45	27	398	1,300	1,100	865	1,100	2,070	950	232	75	42	38
11.		41	27	314	1,060	1,060	942	1,100	5,300	950	232	75	42	40
12.		40	27	224	828	940	1,020	940	3,870	880	216	75	41	40
13.		38	27	224	720	790	902	865	2,920	810	200	71	40	44
14.		38	27	192	650	685	755	865	2,920	690	185	68	40	44
15.		37	27	168	555	585	650	720	2,480	630	185	68	40	42
16.		37	27	148	525	498	650	720	1,610	605	185	68	39	42
17.		35	26	126	498	445	585	720	1,400	1,020	170	68	39	42
18.		35	25	121	445	420	555	790	1,200	880	163	61	39	42
19.		34	26	126	445	375	790	790	1,020	750	156	61	38	42
20.		34	25	121	790	354	720	790	1,830	750	142	61	38	40
21.		33	25	116	1,500	445	650	1,200	1,500	750	142	61	37	40
22.		33	25	113	1,950	445	790	1,020	2,070	690	142	58	36	40
23.		32	24	118	2,070	445	790	1,200	2,200	605	137	56	36	37
24.		31	24	116	1,500	420	865	3,870	2,340	605	129	55	35	38
25.		31	23	3,220	1,100	420	1,200	3,380	2,030	592	126	54	35	37
26.		31	23	3,070	790	420	1,100	2,480	1,720	580	124	52	34	34
27.		31	25	2,340	755	498	1,100	2,770	1,500	580	116	52	34	33
28.		31	26	1,950	828	3,220	790	3,220	1,400	555	116	52	34	33
29.		31	25	1,150	685	2,770	.....	5,300	1,300	530	109	52	34	32
30.		31	35	790	585	1,830	.....	2,770	1,200	480	109	52	34	31
31.		57	.....	525	1,150	.....	.....	2,070	.....	430	.....	51	33	.....

*Monthly discharge of South Fork of Coquille River at Powers, Oreg., for the period Sept. 4, 1916, to Sept. 30, 1917.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1916.						
September 4-30.....	66	31	38.2	0.227	0.28	2,050
1916-17.						
October.....	57	23	28.3	0.168	.19	1,740
November.....	3,220	54	763	4.54	5.06	45,400
December.....	4,760	445	1,350	8.04	9.27	83,000
January.....	4,220	354	1,180	7.02	8.09	73,600
February.....	1,400	555	927	5.52	5.75	51,500
March.....	5,300	585	1,540	9.17	10.57	94,700
April.....	5,300	1,020	2,190	13.00	14.50	130,000
May.....	1,100	430	772	4.60	5.30	47,500
June.....	408	109	205	1.22	1.36	12,200
July.....	116	51	72.1	.429	.49	4,430
August.....	50	33	40.1	.239	.28	2,470
September.....	44	31	36.9	.220	.25	2,200
The year.....	5,300	23	757	4.51	61.11	548,000

UMPQUA RIVER BASIN.

UMPQUA RIVER NEAR ELKTON, OREG.

LOCATION.—In sec. 8, T. 23 S., R. 7 W., at falls, 4 miles south (by road) from Elkton, Douglas County, and 8 miles (by river) above Elk Creek.

DRAINAGE AREA.—3,680 square miles.

RECORDS AVAILABLE.—October 18, 1905, to December 31, 1906; May 12, 1907, to September 30, 1917.

GAGE.—Staff in five sections. Low-water section inclined, the others vertical. Datum lowered 0.52 foot September 2, 1910. Gage reader, D. C. Higginbotham.

DISCHARGE MEASUREMENTS.—Made from ferry 100 feet below gage.

CHANNEL AND CONTROL.—Channel of gravel; somewhat shifting. Control of rock; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 13.8 feet at 6 p. m. March 25 (discharge, 40,300 second-feet); minimum stage recorded, 0.30 foot October 1 to 30 and September 8 and 9 (discharge 1,140 second-feet).

1905-1917: Maximum stage recorded, 38.5 feet (present datum) at 7 a. m. November 23, 1909 (discharge, estimated from extension of rating curve, 163,000 second-feet); minimum stage recorded, 0.10 foot September 17 to October 24, 1915 (discharge, 950 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—Practically none.

REGULATION.—Practically none.

ACCURACY.—Stage-discharge relation practically permanent during year. Rating curve well defined. Gage read twice a day to tenths. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Umpqua River near Elkton, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.	Date.	Made by—	Gage height.	Dis-charge.
		<i>Feet.</i>	<i>Sec. Ft.</i>			<i>Feet.</i>	<i>Sec.-Ft.</i>
Feb. 3	M. S. Kelley ¹	4.30	7,280	Feb. 26	M. S. Kelley ¹	8.75	22,000
4	.....do.....	5.25	10,000	27	.....do.....	7.80	18,000
5	.....do.....	6.14	12,400	Mar. 6	.....do.....	10.25	25,900
13	.....do.....	7.00	14,800	Aug. 30 and 31	F. F. Henshaw.....	0.56	1,370

¹ Employee of J. G. Kelley, consulting engineer, Portland, Oreg.

UMPQUA RIVER BASIN.

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Daily discharge, in second-feet, of Umpqua River near Elkton, Oreg., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	1,140	1,450	12,600	9,100	9,600	12,600	20,600	13,200	11,400	7,220	1,560	1,240
2.....	1,140	1,290	10,200	11,700	8,120	11,700	20,200	16,000	10,800	6,800	1,670	1,240
3.....	1,140	1,240	7,660	14,700	7,660	10,500	24,400	13,800	10,200	7,220	1,560	1,240
4.....	1,140	1,560	6,800	21,000	9,900	9,600	19,600	12,000	9,350	6,800	1,560	1,240
5.....	1,140	1,670	8,600	15,000	12,600	15,700	17,100	10,800	8,120	6,400	1,670	1,240
6.....	1,140	1,560	10,800	25,800	12,000	25,800	22,000	11,700	8,120	6,010	1,560	1,240
7.....	1,140	1,780	12,000	24,800	12,600	19,900	21,600	18,500	9,100	5,630	1,450	1,190
8.....	1,140	3,910	10,800	18,200	12,000	16,400	36,300	18,500	10,800	5,080	1,450	1,140
9.....	1,140	4,900	9,350	16,000	11,100	16,400	27,600	17,400	11,400	4,900	1,450	1,140
10.....	1,140	3,140	8,600	14,100	10,200	13,800	23,000	16,400	10,800	5,260	1,450	1,240
11.....	1,140	2,690	8,120	12,000	10,800	13,200	23,000	15,700	10,200	4,900	1,450	1,340
12.....	1,140	2,280	7,660	10,200	15,700	11,400	33,100	15,000	9,600	4,560	1,450	1,340
13.....	1,140	1,900	6,800	6,800	15,700	10,800	26,600	15,000	8,850	4,230	1,340	1,340
14.....	1,140	1,670	6,400	7,220	13,500	10,800	21,300	14,400	9,120	3,910	1,290	1,240
15.....	1,140	1,450	6,400	7,890	10,200	9,600	19,200	13,800	10,800	3,590	1,240	1,340
16.....	1,140	1,450	6,400	7,660	9,600	8,600	17,100	12,600	10,200	2,990	1,190	1,340
17.....	1,140	1,450	6,600	7,220	10,800	8,120	15,000	13,800	9,600	2,690	1,190	1,290
18.....	1,140	1,670	8,600	6,400	9,900	8,120	13,800	17,800	9,100	2,410	1,190	1,240
19.....	1,140	1,670	10,800	6,010	9,100	8,600	12,000	17,100	8,600	2,410	1,240	1,240
20.....	1,140	1,560	13,500	5,630	11,400	9,100	11,400	15,000	9,350	2,690	1,340	1,240
21.....	1,140	1,560	15,000	5,260	10,800	9,350	14,400	13,800	9,200	2,410	1,240	1,240
22.....	1,140	1,560	14,400	4,900	10,800	10,800	18,200	12,300	9,100	2,280	1,240	1,240
23.....	1,140	1,670	15,000	4,560	11,100	11,100	17,400	17,400	8,600	2,150	1,240	1,240
24.....	1,140	1,670	13,800	4,230	10,200	20,200	18,500	10,800	8,120	1,900	1,290	1,240
25.....	1,140	1,670	12,300	3,910	15,700	38,700	20,200	10,200	7,660	2,150	1,450	1,240
26.....	1,140	6,800	10,800	3,750	20,600	26,200	19,900	9,350	7,220	1,900	1,450	1,240
27.....	1,140	13,200	9,100	3,750	17,800	24,400	18,200	8,600	6,800	1,900	1,450	1,240
28.....	1,140	12,000	8,120	4,560	14,400	37,900	16,400	10,200	7,220	1,900	1,340	1,240
29.....	1,140	12,600	7,660	14,400	.....	33,900	15,000	13,500	7,890	1,670	1,450	1,240
30.....	1,140	15,400	7,010	15,000	.....	31,100	12,600	13,200	7,660	1,670	1,450	1,240
31.....	1,290	.....	7,440	12,000	.....	26,200	.....	12,000	.....	1,670	1,290	.....

Monthly discharge of Umpqua River near Elkton, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 3,680 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	1,290	1,140	1,140	.310	.36	70,100
November.....	15,400	1,240	3,610	.981	1.09	215,000
December.....	15,000	6,400	9,660	2.62	3.02	594,000
January.....	25,800	3,750	10,400	2.83	3.26	640,000
February.....	20,600	7,660	12,100	3.29	3.43	672,000
March.....	38,700	8,120	16,800	4.57	5.27	1,030,000
April.....	36,300	11,400	19,900	5.41	6.04	1,180,000
May.....	18,500	8,600	13,700	3.72	4.29	842,000
June.....	11,400	6,800	9,180	2.49	2.78	546,000
July.....	7,220	1,670	3,780	1.03	1.19	232,000
August.....	1,670	1,190	1,390	.378	.44	85,500
September.....	1,340	1,140	1,250	.340	.38	74,400
The year.....	38,700	1,140	8,550	2.32	31.55	6,180,000

NORTH UMPQUA RIVER AT TOKETEE FALLS, OREG.

LOCATION.—In T. 26 S., R. 5 E. (unsurveyed), one-eighth mile below mouth of Clearwater River, half a mile above Toketee Falls, 52 miles by trail east of Hoaglin post office, and 76 miles east of Roseburg, Douglas County.

DRAINAGE AREA.—337 square miles (measured on topographic map).

RECORDS AVAILABLE.—February 26, 1903, to July 20, 1909; December 19, 1914, to November 19, 1917, with missing periods. Station discontinued.

GAGE.—Stevens continuous water-stage recorder on left bank. Readings for 1908 and 1909 were made on staff gage at same datum.

DISCHARGE MEASUREMENTS.—Made from cable about 75 feet below gage; good measuring section.

CHANNEL AND CONTROL.—Boulders, rock, and heavy gravel; fairly smooth; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage during year from water-stage recorder, 4.18 feet sometime between January 13 and August 21; minimum stage from water-stage recorder, 1.65 feet October 8 and 9 (discharge 705 second-feet).

1908-9 and 1915-1917: Maximum stage recorded, 4.33 feet January 21, 1909; minimum stage recorded, 1.38 feet October 8 to 12, and 27 to 30, 1915 (discharge 582 second-feet).

ICE.—Stage-discharge relation unaffected, as much of the water comes from springs

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation considered practically permanent. Rating curve fairly well defined below 1,200 second-feet; not defined above this. Operation of recorder fairly satisfactory; gage heights somewhat uncertain at times owing to the infrequent inspection of gage. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the recorder graph. Low-water records good.

The following discharge measurement was made by R. C. Briggs:

August 29, 1917: Gage height, 1.90 feet; discharge, 851 second-feet.

Daily discharge, in second-feet, of North Umpqua River at Toketee Falls, Oreg., for the years ending Sept. 30, 1915-1917.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	Aug.	Sept.
1914-15.								
1.....		705	820	790	945	880	.....	590
2.....		705	820	790	1,020	880	.....	590
3.....		705	820	790	1,080	880	.....	590
4.....		705	820	790	1,050	850	.....	590
5.....		705	790	790	1,020	850	.....	590
6.....		705	790	790	980	820	.....	590
7.....		730	790	790	1,020	820	.....	612
8.....		760	760	790	980	820	.....	590
9.....		730	760	760	945	850	.....	590
10.....		730	760	760	945	880	.....	590
11.....		730	760	760	980	880	.....	612
12.....		730	790	790	1,020	880	.....	612
13.....		790	790	820	1,050	910	635	612
14.....		790	790	880	1,020	945	635	612
15.....		760	790	880	980	910	635	612
16.....		760	790	880	980	880	612	612
17.....		760	790	910	1,020	910	612	612
18.....	680	760	790	910	1,020	1,020	612	612
19.....	680	730	790	910	1,050	1,050	612	590
20.....		730	790	910	1,050	1,020	612	590
21.....	680	730	790	945	1,050	1,020	612	590
22.....	680	730	790	980	1,020	1,020	612	590
23.....	680	730	790	1,020	980	980	612	590
24.....	680	730	.....	1,020	945	1,120	612	590
25.....	680	730	.....	980	910	1,050	612	590
26.....	705	880	.....	945	910	1,080	612	590
27.....	680	910	.....	910	910	1,080	612	590
28.....	680	910	.....	910	910	1,120	612	590
29.....	680	880	.....	910	945	1,080	612	590
30.....	680	850	.....	910	910	1,050	590	590
31.....	705	820	.....	910	.....	1,020	590	.....

Daily discharge, in second-feet, of North Umpqua River at Toketee Falls, Oreg., for the years ending Sept. 30, 1915-1917—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	July.	Aug.	Sept.
1915-16.							
1.....	590	590	.....	880	.....	910	790
2.....	590	590	.....	.....	.....	910	790
3.....	590	590	.....	.....	.....	910	820
4.....	590	590	.....	820	.....	880	790
5.....	586	590	.....	760	.....	880	790
6.....	586	590	.....	760	.....	850	790
7.....	586	590	.....	.....	.....	850	790
8.....	582	612	.....	760	.....	850	790
9.....	582	590	.....	760	.....	850	790
10.....	582	590	.....	760	.....	850	790
11.....	582	612	980	.....	.....	850	790
12.....	582	612	910	730	.....	850	790
13.....	590	590	910	730	.....	850	760
14.....	590	612	.....	730	.....	850	760
15.....	590	658	.....	730	.....	850	760
16.....	590	658	.....	730	.....	850	760
17.....	586	705	820	.....	.....	850	760
18.....	586	760	820	705	.....	850	760
19.....	582	680	790	705	.....	820	760
20.....	586	760	850	705	.....	820	760
21.....	582	760	1,020	705	1,120	820	760
22.....	582	.....	.....	.....	1,080	820	760
23.....	635	.....	.....	820	1,020	820	760
24.....	590	.....	.....	850	980	820	760
25.....	590	.....	.....	820	945	820	760
26.....	590	.....	.....	.....	910	820	760
27.....	582	.....	.....	.....	910	820	760
28.....	582	.....	.....	760	910	820	760
29.....	582	.....	.....	730	910	820	760
30.....	582	.....	980	.....	910	790	760
31.....	586	.....	945	.....	910	790	.....

Day.	Oct.	Nov.	Dec.	Jan.	Aug.	Sept.	Day.	Oct.	Nov.	Dec.	Jan.	Aug.	Sept.
1916-17.							1916-17.						
1.....	730	730	760	730	.....	850	16.....	730	730	730	.....	.....	820
2.....	730	730	760	730	.....	850	17.....	730	730	730	.....	.....	790
3.....	730	730	730	730	.....	820	18.....	730	730	730	.....	.....	790
4.....	730	760	730	790	.....	820	19.....	730	730	730	.....	.....	820
5.....	730	730	730	880	.....	820	20.....	730	730	760	.....	.....	790
6.....	705	760	730	850	.....	820	21.....	730	730	760	.....	850	790
7.....	705	760	730	820	.....	820	22.....	730	730	730	.....	850	790
8.....	705	760	730	820	.....	820	23.....	730	730	730	.....	850	790
9.....	705	760	730	820	.....	820	24.....	730	760	730	.....	850	790
10.....	705	730	730	820	.....	820	25.....	730	750	730	.....	850	790
11.....	705	730	730	790	.....	820	26.....	730	790	730	.....	850	790
12.....	730	730	730	790	.....	820	27.....	730	910	730	.....	850	790
13.....	730	730	730	760	.....	820	28.....	730	790	730	.....	850	790
14.....	730	730	730	.....	.....	820	29.....	730	760	730	.....	850	790
15.....	730	730	730	.....	.....	820	30.....	730	760	730	.....	850	790
							31.....	730	.....	730	.....	850	.....

NOTE.—No record June 1 to Aug. 12, Nov. 22-24, Nov. 26 to Dec. 10, Dec. 14-16 and 22-29, 1915; Jan. 2, 3, 7, 11, 17, 22, 26, 27, and Jan. 30 to Mar. 22 and June 14 to July 20, 1916; Jan. 14 to Aug. 20, 1917. Discharge exceeded 1,200 second-feet Nov. 25, 1915, March 23 to June 13, 1916, and probably for considerable periods not covered by records. Discharge Oct. 1, 1917, 790 second-feet; Oct. 8, 1917, 760 second-feet; Oct. 30, 1917, 705 second-feet; Nov. 6, 1917, 760 second-feet; and Nov. 19, 1917, 730 second-feet.

Monthly discharge of North Umpqua River at Toketee Falls, Oreg., for 1914-1917.

Month.	Discharge in second-feet.			Run-off (in acre-feet).
	Maximum.	Minimum.	Mean.	
1914.				
December 19-31.....	705	680	684	17,600
1915.				
January.....	910	705	762	46,900
February.....	820	760	790	43,900
March.....	1,020	760	869	53,400
April.....	1,080	910	988	58,800
May.....	1,120	820	953	58,600
August 13-31.....	635	590	613	23,100
September.....	612	590	597	35,500
October.....	635	582	587	36,100
November 1-21.....	760	590	635	26,400
1916.				
July 21-31.....	1,120	910	964	21,000
August.....	910	790	843	51,800
September.....	820	760	773	46,000
October.....	730	705	725	44,600
November.....	910	730	752	44,700
December.....	760	730	734	45,100
1917.				
January 1-13.....	880	730	795	20,500
August 21-31.....	850	850	850	18,500
September.....	850	790	809	48,100

NORTH UMPQUA RIVER NEAR GLIDE, OREG.

LOCATION.—In SW. $\frac{1}{4}$ sec. 13, T. 26 S., R. 4 W. at Hughes ferry, about 2 miles below Glide, Douglas County, just off main road to Roseburg.

DRAINAGE AREA.—1,210 square miles (measured on topographic and Forest Service maps).

RECORDS AVAILABLE.—September 1, 1915, to September 30, 1917.

GAGE.—Vertical staff on left bank just below ferry landing. Gage reader, J. H. Hayes.

DISCHARGE MEASUREMENTS.—Made from ferry up to a stage of about 6 feet; excellent section. Flood measurements have been made from the bridge at Winchester, about 20 miles downstream, and the inflow, estimated from measurements of Oak Creek, deducted.

CHANNEL AND CONTROL.—Practically permanent; control is of solid rock.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.4 feet at 6 p. m. April 11 (discharge, 18,100 second-feet); minimum stage recorded, 0.22 foot October 19 to 21 (discharge, 866 second-feet).

1915-1917: Maximum stage recorded, 12.8 feet at 3 p. m., November 25, 1915, (discharge, 42 000 second-feet); minimum stage recorded 0.05 foot October 1, 2, 7, to 13, and 18 to 22, 1915 (discharge, 750 second-feet).

Maximum stage in many years occurred during night of November 22, 1909; gage height 22 feet as determined by leveling to well-defined high-water marks on September 1, 1917 (discharge, estimated from extension of rating curve, 90 000 second-feet).

ICE.—Never any ice here.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation, practically permanent. Rating curve, well defined below 10,000 second-feet and fairly well defined above. Gage read to quarter tenths once or twice daily except for days given in footnote to table of daily discharge. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of North Umpqua River near Glide, Oreg., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Dis-charge.
June 15	C. L. Batchelder.....	Feet. 3.45	Sec.-ft. 6,110
Sept. 1	F. F. Henshaw.....	.50	1,120

Daily discharge, in second-feet, of North Umpqua River near Glide, Oreg., for the year ending Sept. 30 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1.....	930	1,070	2,300	2,000	2,620	3,270	5,700	.....	6,350	3,610	1,450	1,120
2.....	930	1,020	3,610	5,300	2,620	3,100	8,850	.....	5,900	3,610	1,450	1,120
3.....	930	1,120	3,780	7,100	3,960	2,940	7,350	.....	5,300	3,610	1,390	1,070
4.....	980	1,580	4,140	4,900	5,500	3,100	6,100	.....	4,700	3,610	1,390	1,070
5.....	930	1,580	4,110	12,500	5,300	7,350	9,400	.....	4,700	3,610	1,390	1,070
6.....	930	2,150	3,960	9,400	5,700	6,350	10,600	9,400	5,300	3,440	1,330	1,078
7.....	930	2,300	2,940	6,600	5,900	4,900	13,900	10,600	5,900	3,270	1,330	1,070
8.....	930	1,720	2,460	5,100	5,300	4,510	16,700	10,300	8,850	3,100	1,330	1,120
9.....	930	1,450	2,940	4,320	4,900	4,320	11,800	10,300	7,850	2,940	1,280	1,070
10.....	930	1,450	2,620	3,960	4,700	3,780	6,850	9,700	6,850	2,940	1,280	1,120
11.....	930	1,450	2,300	3,960	6,100	3,440	17,400	9,400	5,500	2,780	1,280	1,120
12.....	930	1,220	2,150	3,780	8,100	3,100	15,300	8,850	4,900	2,620	1,280	1,170
13.....	930	1,120	2,000	3,270	6,350	3,100	10,000	8,350	4,900	2,460	1,280	1,170
14.....	930	1,070	2,000	2,940	5,100	2,940	8,350	8,600	5,100	2,460	1,280	1,170
15.....	930	1,070	2,000	2,620	5,100	2,780	7,100	7,600	5,900	2,460	1,280	1,070
16.....	930	1,020	2,150	2,300	4,510	2,780	5,900	7,350	6,600	2,300	1,220	1,070
17.....	930	1,020	2,150	2,150	5,500	2,780	5,300	8,850	6,350	2,300	1,220	1,070
18.....	930	1,120	2,300	2,150	4,510	2,940	4,700	8,600	6,100	2,150	1,220	1,070
19.....	890	1,330	4,510	2,150	3,960	3,100	4,700	7,350	5,900	2,000	1,220	1,070
20.....	930	1,220	8,350	2,000	3,610	3,100	4,510	7,100	5,500	2,000	1,220	1,070
21.....	890	1,120	6,600	2,000	3,270	4,510	8,850	6,850	5,100	1,860	1,170	1,070
22.....	930	1,120	5,500	2,000	3,100	3,780	7,850	6,350	5,100	1,790	1,170	1,070
23.....	890	1,120	3,960	2,000	2,940	3,780	7,850	5,700	4,510	1,720	1,170	1,070
24.....	890	1,120	3,270	1,860	2,940	10,300	10,900	5,300	4,320	1,650	1,170	1,120
25.....	890	1,720	2,780	1,860	5,900	11,200	12,500	5,100	4,140	1,650	1,170	1,070
26.....	890	7,850	2,460	2,000	4,700	6,600	12,200	4,700	4,140	1,580	1,170	1,070
27.....	890	5,300	2,300	2,150	3,960	11,800	11,800	4,700	4,140	1,580	1,170	1,070
28.....	930	6,350	2,150	8,100	3,610	14,200	10,300	5,900	3,960	1,520	1,170	1,070
29.....	930	3,780	2,000	5,100	.....	14,200	.....	6,850	3,610	1,520	1,170	1,070
30.....	1,020	2,780	1,860	3,960	.....	9,100	.....	6,350	3,610	1,520	1,170	1,020
31.....	1,020	.....	1,860	3,100	.....	6,850	.....	6,350	.....	1,450	1,120	.....

NOTE.—Discharge estimated April 29 and 30, 9,000 and 7,500 second-feet, respectively. Mean discharge estimated May 1-5, 8,000 second-feet.

Monthly discharge of North Umpqua River near Glide, Oreg., for the year ending Sept. 30, 1917.

[Drainage area, 1,210 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	1,020	890	927	0.766	0.88	57,000
November.....	7,850	1,020	1,980	1.64	1.83	118,000
December.....	8,350	1,860	3,150	2.60	3.00	194,000
January.....	12,500	1,860	3,960	3.27	3.77	243,000
February.....	8,100	2,620	4,630	3.83	3.99	257,000
March.....	14,200	2,780	5,480	4.53	5.22	337,000
April.....	17,400	4,510	9,310	7.69	8.58	554,000
May.....	10,600	4,700	7,630	6.31	7.28	469,000
June.....	7,850	3,610	5,300	4.38	4.89	315,000
July.....	3,610	1,450	2,420	2.00	2.31	149,000
August.....	1,450	1,120	1,260	1.04	1.20	77,500
September.....	1,170	1,020	1,090	.901	1.01	64,900
The year.....	17,400	890	3,920	3.24	43.96	2,840,000

MILL CREEK NEAR ASH, OREG.

LOCATION.—In sec. 2, T. 23 S., R. 10 W., three-quarters of a mile below outlet of Loon Lake, 5 miles northwest of Ash post office, and about 12 miles south of Scottsburg, Douglas County.

DRAINAGE AREA.—90 square miles (measured on maps prepared by J. G. Kelley).

RECORDS AVAILABLE.—May 29, 1907, to September 30, 1912; April 20, 1915, to November 12, 1917, when station was discontinued.

GAGE.—Stevens water-stage recorder on right bank; inspected by Richard Peterson.

Vertical staff on lake was read 1907 to 1912, and for comparison in 1915 and 1916.

DISCHARGE MEASUREMENTS.—Made from cable at gage or at low stages by wading.

CHANNEL AND CONTROL.—Channel, gravel; control of boulders and clay about 85 feet downstream from gage. Rock channel at lake outlet forms control for lake gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, about 6.60 feet at 5 a. m. March 25 (discharge, 3,180 second-feet); minimum stage uncertain as water-stage recorder was not working (discharge, 3.7 second-feet or less).

1907-1912 and 1915-1917: Maximum stage recorded on lake gage, 21.4 feet November 23, 1909 (discharge, 10,000 second-feet); minimum stage recorded, 2.1 feet September 13 to 20 and September 25 to October 2, 1910 (discharge, 1.5 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—Some fluctuation at low water due to effect of wind on lake.

ACCURACY.—Stage-discharge relation assumed to be practically permanent, although no discharge measurements were made after the 1917 high water. Rating curve well defined. Operation of water-stage recorder satisfactory January to June; unsatisfactory for rest of year. Gage heights taken from Loon Lake gage for December, except 8 to 14 and 29 to 31. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting gage-height graph or, for days of considerable fluctuation, by averaging discharge obtained by applying to rating table the mean gage heights for bihourly periods. Records good, January to June; fair for rest of period.

COOPERATION.—Gage-height and discharge-measurement records furnished by J. G. Kelley, consulting engineer, Portland, Oreg.

Discharge measurements of Mill Creek near Ash, Oreg., during the period Oct. 1, 1916, to Nov. 12, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1916.		<i>Feet.</i>	<i>Sec.-ft.</i>	1916.		<i>Feet.</i>	<i>Sec.-ft.</i>
Oct. 15	H. V. Eva.....	0.33	4.1	Nov. 6	Kelley and Eva.....	1.48	155
28	.....do.....	.31	4.0	17	H. V. Eva.....	.85	39.8
Nov. 2	.....do.....	.50	11.4				

Daily discharge, in second-feet, of Mill Creek near Ash, Oreg., for the period Oct. 1, 1916, to Nov. 12, 1917.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1.....		8.4	350	330	700	382	900	210	90	.....	5.0	4.0	.....	2.2
2.....		11	310	455	605	348	900	198	85	.....	4.7	4.0	.....	2.2
3.....		14	310	960	700	315	1,080	185	80	.....	4.7	4.0	.....	2.2
4.....		31	480	1,020	800	330	900	172	76	.....	5.0	4.0	.....	2.3
5.....		α 96	750	1,020	700	700	750	160	74	.....	4.7	4.0	.....	2.3
6.....		160	900	1,260	628	1,020	650	185	70	.....	4.4	4.0	.....	2.6
7.....		285	820	1,200	538	960	α 605	210	68	.....	4.4	4.0	.....	2.8
8.....		240	750	900	475	800	560	225	65	.....	4.0	4.7	.....	3.4
9.....		172	900	700	400	800	560	210	63	.....	4.7	4.7	.....	3.7
10.....		127	960	538	365	750	515	198	62	.....	4.4	4.4	.....	4.0
11.....		104	800	435	348	700	560	185	59	15	.....	4.7	.....	4.7
12.....		85	605	365	382	582	650	172	56	15	.....	4.7	.....	7.5
13.....		α 73	475	315	365	560	700	160	59	15	4.....	4.4	2.5	.....
14.....		α 62	382	270	330	560	700	155	46	14	.....	4.0	2.5	.....
15.....	5.0	50	326	240	300	538	700	150	39	13	.....	4.0	2.5	.....
16.....	5.0	46	270	225	270	475	628	155	35	13	.....	4.0	2.3	.....
17.....	4.7	42	235	198	255	435	560	153	34	12	.....	4.0	2.2	.....
18.....	4.7	39	200	185	225	418	475	198	31	11	.....	4.0	2.2	.....
19.....	4.0	36	223	172	240	435	435	240	28	11	.....	.....	2.1	.....
20.....	3.7	34	247	172	300	455	400	225	24	9.8	.....	.....	2.2	.....
21.....	3.7	32	270	185	348	605	538	210	22	9.3	.....	.....	2.2	.....
22.....	3.7	30	620	198	400	800	582	185	22	8.8	.....	.....	2.2	.....
23.....	3.7	29	588	198	435	1,020	495	172	22	7.5	.....	.....	2.1	.....
24.....	α 3.8	29	556	198	418	1,810	435	153	20	7.5	.....	.....	2.1	.....
25.....	α 4.0	57	525	198	382	2,860	348	143	20	7.5	.....	.....	2.3	.....
26.....	α 4.1	210	494	198	382	1,880	285	134	18	6.8	.....	.....	2.3	.....
27.....	α 4.3	400	462	225	400	1,320	240	125	18	6.8	.....	.....	2.3	.....
28.....	4.4	628	430	582	418	1,200	210	116	17	6.8	.....	.....	2.1	.....
29.....	5.4	560	435	900	.....	1,200	198	110	18	6.8	4.0	.....	2.1	.....
30.....	5.8	348	400	1,020	.....	1,260	210	104	18	6.8	4.0	.....	2.1	.....
31.....	7.2	.....	365	900	.....	1,080	.....	96	.....	5.8	4.0	.....	2.2	.....

α Discharge interpolated.

NOTE.—Discharge estimated as follows: Oct. 1-14, 6 second-feet; July 1-10, 16 second-feet; Aug. 9-28, 4 second-feet; Sept. 19-30, 3.5 second-feet; Oct. 1-12, 3.0 second-feet. Loon Lake gage read Dec. 1-7, 16, 18, 21, 22, and 28; discharge Dec. 1-7 and 15-28 based on these readings.

Monthly discharge of Mill Creek near Ash, Oreg., for the period Oct. 1, 1916, to Nov. 12, 1917.

[Drainage area, 90 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
October.....	7.2	3.7	5.20	0.058	0.07	320
November.....	628	8.4	135	1.50	1.67	8,030
December.....	960	200	498	5.53	6.38	30,600
January.....	1,260	172	508	5.64	6.50	31,200
February.....	800	225	432	4.80	5.00	24,000
March.....	2,860	315	858	9.53	11.00	52,800
April.....	1,080	198	559	6.21	6.93	33,300
May.....	240	96	171	1.90	2.19	10,500
June.....	90	17	44.4	.493	.55	2,640
July.....	.....	5.8	11.9	.132	.15	732
August.....	5.0	.....	4.16	.046	.05	256
September.....	4.7	.....	3.92	.044	.05	233
October.....	.....	2.1	2.53	.281	.32	156
November 1-12.....	7.5	2.2	3.32	.369	.16	79
The year.....	2,860	.....	269	2.99	40.54	195,000

MISCELLANEOUS DISCHARGE MEASUREMENTS.

Records of measurements of the flow of streams at points other than those at which gaging stations were maintained are presented in the following tables:

Miscellaneous discharge measurements in lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1917.

Walla Walla River basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	Sec.-ft.
Nov. 2	Mill Creek.....	Walla Walla River..	Above city of Walla Walla diversion dam, 12 miles east of Walla Walla, Wash.	.....	49.9
Mar. 9	.....do.....	.....do.....	.....do.....	.....	83.5
Apr. 10	.....do.....	.....do.....	.....do.....	.....	398
June 30	.....do.....	.....do.....	.....do.....	.....	134
Sept. 15	.....do.....	.....do.....	.....do.....	.....	57.6

Umatilla River basin.

May 3	Umatilla.....	Columbia River.....	Pendleton, Oreg.....	4.65	1,620
June 29	.....do.....	.....do.....	Below Furnish reservoir, Oreg..	1.71	417
July 3	.....do.....	.....do.....	.....do.....	1.50	328
14	.....do.....	.....do.....	.....do.....	1.21	220
27	.....do.....	.....do.....	.....do.....	.97	145
Aug. 6	.....do.....	.....do.....	.....do.....	.81	102
9	.....do.....	.....do.....	.....do.....	.74	85

John Day River basin.

Oct. 31	Prairie Power Co.'s flume.	Diverts from John Day River.	Prairie City, Oreg.....	.....	44.3
31	Strawberry Creek.....	John Day River.....	100 yards below source of creek, in sec. 30, T. 14 S., R. 34 E.	.....	3.2
Nov. 1	North Fork of John Day River.	.....do.....	Highway bridge, 1 mile from Dale, Oreg.	.....	71

Deschutes River basin.

Oct. 14	Deschutes River....	Columbia River....	Pringle Falls, SW. $\frac{1}{4}$ sec. 23, T. 21 S., R. 9 E., Oreg.	1.28	1,070
June 3	.....do.....	.....do.....	.....do.....	1.28	1,040
Aug 20	.....do.....	.....do.....	.....do.....	1.32	987
June 5	Marks Creek.....	Ochoco Creek.....	Sear's ranch, near mouth.....	3.73	40.0
	Mill Creek.....	.....do.....	Sec. 25, T. 13 S., R. 17 E., about 200 feet above 1916 gage.	2.10	66
Mar. 28	McKay Creek.....	.....do.....	Sec. 4, T. 14 S., R. 16 E.	.70	27.8
June 6	.....do.....	.....do.....	.....do.....	.40	23.0
Aug. 13	.....do.....	.....do.....	.....do.....	.....	.8
1916.					
Oct. 17	Jack Creek.....	Metolius River.....	SE. $\frac{1}{4}$ sec. 28, T. 12 S., R. 9 E....	1.09	75
May 30	.....do.....	.....do.....	.....do.....	.73	47.1
Aug 1	.....do.....	.....do.....	.....do.....	.85	a 58
11	.....do.....	.....do.....	.....do.....	.80	a 54
18	.....do.....	.....do.....	.....do.....	.80	a 54
Oct. 16	.....do.....	.....do.....	.....do.....	.96	69
1916.					
Oct. 17	Canyon Creek.....	.....do.....	NW. $\frac{1}{4}$ sec. 27, T. 12 S., R. 9 E..	1.93	67
1917.					
May 30	.....do.....	.....do.....	.....do.....	2.32	132
Aug 1	.....do.....	.....do.....	.....do.....	2.1	a 95
11	.....do.....	.....do.....	.....do.....	2.0	a 80
18	.....do.....	.....do.....	.....do.....	1.98	a 77
Oct. 16	.....do.....	.....do.....	.....do.....	1.90	68.6
May 22	Clear Creek.....	White River.....	SW. $\frac{1}{4}$ sec. 8, T. 5 S., R. 10 E....	1.73	172

a Discharge computed from gage readings.

Miscellaneous discharge measurements in lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1917—Continued.

Klickitat River basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Dis-charge.
Oct. 24	Klickitat River.....	Columbia River.....	Caldwell Prairie, sec. 29, T. 9 N., R. 13 E., Wash.	<i>Feet.</i> 0.72	<i>Sec.-ft.</i> 24.1
25	Diamond Fork.....	Klickitat River.....	Mouth, sec. 3, T. 10 N., R. 13 E.	.08	37.5
Apr. 5	Little Muddy Creek.....	West Fork.....	Elevation 4,650 feet.....		2.6
5	Crawford Creek.....	Little Muddy Creek.....	Elevation about 4,700 feet.....		.23
6	Trapper Creek.....	.....do.....	Elevation about 4,700 feet, below forks, $\frac{1}{2}$ mile above Yakima Indian Reservation boundary.		.81
6	Unnamed creek north of Little Muddy Creek.....	Trapper Creek.....	Elevation 4,650 feet.....		.23
7	Cunningham Creek.....	Klickitat River.....	.....do.....		Dry
7	Big Muddy Creek.....	.....do.....	1,000 feet above Hellroaring Creek.		35.1
7	Hellroaring Creek.....	Big Muddy Creek.....	400 feet above mouth.....		8.8
3	Cougar Creek.....	.....do.....	Mouth.....		a. 5
Mar. 31	Dairy Creek.....	Klickitat River.....	Road crossing, sec. 10, T. 7 N., R. 12 E.		a 1.0

^a Estimated.

Gorton Creek basin.

Aug. 25	Gorton Creek.....	Columbia River.....	Above Oregon-Washington Railroad & Navigation Co.'s intake near Wyeth, Oreg., sec. 1, T. 2 N., R. 8 E.	0.95	2.6
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Willamette River basin.

June 13	North Fork of Middle Fork of Willamette River.	Middle Fork of Willamette River.	Former gaging station near Oakridge, Oreg., SE. $\frac{1}{4}$ sec. 7, T. 21 S., R. 3 E.	3.65	1,500
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Youngs River basin.

Aug. 14	Youngs River.....	Columbia River.....	Below falls near Astoria, Oreg....	13.8
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Rogue River basin.

Oct. 3	Mill Creek.....	Rogue River.....	Former gaging station near Prospect, Oreg.	2.95	49.6
3	Red Blanket Creek.....	Middle Fork of Rogue River.	Old road crossing near Prospect, Oreg.	.....	75
June 17	North Fork of Little Butte Creek.	Little Butte Creek.....	Former gaging station above city intake near Lake Creek, Oreg., in sec. 25, R. 2 E., T. 36 S.	2.15	209
July 10	.....do.....	.....do.....	.....do.....	1.85	113
Sept. 4	.....do.....	.....do.....	.....do.....	1.81	85.3
Sept. 5	Paley ditch.....	Diverts from North Fork Little Butte Creek.	Sec. 22, T. 36 S., R. 2 E. at intake of Rogue River Valley canal.	.....	3.0
Apr. 17	Emigrant Creek.....	Bear Creek.....	Sec. 34, T. 39 S., R. 2 E., at Klamath Falls road crossing.	.....	62.2
June 9	.....do.....	.....do.....	.....do.....	.....	24.3
Apr. 20	Walker Creek.....	Emigrant Creek.....	Bridge just above mouth in sec. 12, T. 39 S., R. 1 E.	.....	49.3
June 9	.....do.....	.....do.....	.....do.....	.....	17.7
May 3	McDonald Creek.....	Little Applegate River.	1 mile above mouth in sec. 40, T. 40 S., R. 1 W.	.....	13.6
31	.....do.....	.....do.....	.....do.....	1.50	29.9
June 22	.....do.....	.....do.....	.....do.....	1.55	34.6
July 13	.....do.....	.....do.....	.....do.....	0.82	10.4
June 13	Sterling ditch.....	From Glade Creek.	Sec. 30, T. 39 S., R. 1 W.	.....	33.0
July 14	.....do.....	.....do.....	.....do.....	.....	29.5
Apr. 20	.....do.....	.....do.....	.....do.....	2.0	15.1
May 30	Neil Creek.....	Bear Creek.....	Sec. 12 T. 39 S., R. 1 E., at Dead Indian road crossing.	2.2	32.0

Miscellaneous discharge measurements in lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1917—Continued.

Umpqua River basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Dis-charge.
				<i>Feet.</i>	<i>Sec.-ft.</i>
Aug. 27	Lake Creek.....	North Umpqua River.	SW. 1/4 sec. 30, T. 27 S., R. 6 E., at outlet of Diamond Lake.	.....	31.8
27	Thielsens Creek.....	Lake Creek.....	Trail crossing at elevation about 4,700 feet.	.....	4.5
28	Clearwater River....	North Umpqua River.	Elevation 3,700 feet.....	.....	172
29	.....do.....	.....do.....	Elevation about 2,400 feet near mouth.	.....	175
28	Watson Creek.....	Clearwater River....	Trail crossing at elevation 3,400 feet.	.....	5.9

Siuslaw River basin.

Oct. 23	Siuslaw River.....	Pacific Ocean.....	Railroad bridge at Austa station.	59.3
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STREAM-GAGING STATIONS
AND
PUBLICATIONS RELATING TO WATER RESOURCES

PART XII.—NORTH PACIFIC SLOPE BASINS



STREAM-GAGING STATIONS AND PUBLICATIONS RELATING TO WATER RESOURCES.

INTRODUCTION.

Investigation of water resources by the United States Geological Survey has consisted in large part of measurements of the volume of flow of streams and studies of the conditions affecting that flow, but it has comprised also investigation of such closely allied subjects as irrigation, water storage, water powers, underground waters, and quality of waters. Most of the results of these investigations have been published in the series of water-supply papers, but some have appeared in the bulletins, monographs, professional papers, and annual reports.

The result of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage as indicated below:

Part I. North Atlantic slope basins.

II. South Atlantic slope and eastern Gulf of Mexico basins.

III. Ohio River basin.

IV. St. Lawrence River basin.

V. Upper Mississippi River and Hudson Bay basins.

VI. Missouri River basin.

VII. Lower Mississippi River basin.

VIII. Western Gulf of Mexico basins.

IX. Colorado River basin.

X. Great Basin.

XI. Pacific slope basins in California.

XII. North Pacific slope basins, in three volumes:

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

B, Snake River basin.

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

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
 Albany, N. Y., 704 Journal Building.
 Atlanta, Ga., Post Office Building.
 Nashville, Tenn., 306 Customhouse.
 Madison, Wis., care of Railroad Commission of Wisconsin.
 Topeka, Kans., 23 Federal Building.
 Helena, Mont., Montana National Bank Building.
 Denver, Colo., 403 New Post Office Building.
 Salt Lake City, Utah, 313 Federal Building.
 Boise, Idaho, 615 Idaho Building.
 Portland, Oreg., 606 Post Office Building.
 Tacoma, Wash., 406 Federal Building.
 San Francisco, Calif., 328 Customhouse.
 Los Angeles, Calif., 619 Federal Building.
 Austin, Tex., Capitol Building.
 Honolulu, Hawaii, 25 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,200 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2.....	Descriptive information only.....	1884 to September, 1890.
11th A, pt. 2.....	Monthly discharge and descriptive information.....	1884 to June 30, 1891.
12th A, pt. 2.....	.....do.....	1884 to Dec. 31, 1892.
13th A, pt. 3.....	Mean discharge in second-feet.....	1888 to Dec. 31, 1893.
14th A, pt. 2.....	Monthly discharge (long-time records, 1871 to 1893).....	1893 and 1894.
B 131.....	Descriptions, measurements, gage heights, and ratings.....	1895.
16th A, pt. 2.....	Descriptive information only.....	1896.
B 140.....	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895 and 1896.
W 11.....	Gage heights (also gage heights for earlier years).....	1897.
18th A, pt. 4.....	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1897.
W 15.....	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16.....	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 2.....	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1898.
W 27.....	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28.....	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th A, pt. 4.....	Monthly discharge (also for many earlier years).....	1899.
W 35 to 39.....	Descriptions, measurements, gage heights, and ratings.....	1899.

Stream-flow data in reports of the United States Geological Survey—Continued.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
21st A, pt. 4.....	Monthly discharge.....	1899.
W 47 to 52.....	Descriptions, measurements, gage heights, and ratings.....	1900.
22d A, pt. 4.....	Monthly discharge.....	1900.
W 65, 66.....	Descriptions, measurements, gage heights, and ratings.....	1901.
W 75.....	Monthly discharge.....	1901.
W 82 to 85.....	Complete data.....	1902.
W 97 to 100.....	do.....	1903.
W 124 to 135.....	do.....	1904.
W 165 to 178.....	do.....	1905.
W 201 to 214.....	do.....	1906.
W 241 to 252.....	do.....	1907-8.
W 261 to 272.....	do.....	1909.
W 281 to 292.....	do.....	1910.
W 301 to 312.....	do.....	1911.
W 321 to 332.....	do.....	1912.
W 351 to 362.....	do.....	1913.
W 381 to 394.....	do.....	1914.
W 401 to 414.....	do.....	1915.
W 431 to 444.....	do.....	1916.
W 451 to 464.....	do.....	1917.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The table following gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1917. The data for any particular station will, as a rule, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1917, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, 431, and 451, which contain records for the New England streams from 1903 to 1917. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

In exception to this rule the records for Mississippi River are given in four parts, as indicated on page III, and the records for large lakes are presented in order of the streams around the rim of the lake.

Numbers of water-supply papers containing results of stream measurements, 1899-1917.

Year.	I North Atlantic slope basins (St. John River to York River).	II South Atlantic slope and eastern Mexico basins (James River to the Missis- sippi).	III Ohio River basin.	IV St. Lawrence River basin.	V Hudson Bay and upper Missis- sippi River basins.	VI Missouri River basin.	VII Lower Missis- sippi River basin.	VIII Western Gulf of Mexico basins.	IX Colorado River basin.	X Great Basin.	XI Pacific slope basins in Cali- fornia.	XII North Pacific slope basins.		
												Pacific slope basins in Washing- ton and upper Columbia River.	Snake River basin.	Lower Columbia River and Pacific slope basins in Oregon.
1899 ^a	35	b 35, 36	36	36	36	c 38, 37	37	37	d 37, 38	38, e 39	38, f 39	38	38	38
1900 ^g	47, h 48	48, i 49	49	49	49	49, j 50	50	50	50	51	51	51	51	51
1901.....	65, 75	65, 75	65, 75	65, 75	k 65, 66, 75	66, 75	k 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902.....	82	b 82, 83	83	83	k 83, 85	84	k 83, 85	84	85	85	85	85	85	85
1903.....	97	b 97, 98	98	98	k 98, 99, m 100	99	k 98, 99	99	100	100	100	100	100	100
1904.....	n 124, o 125, p 126	p 126, 127	128	128	k 128, 130	130, q 131	k 128, 131	132	133	133, r 134	134	135	135	135
1905.....	n 165, o 166, p 167	p 167, 168	169	170	171	172	k 169, 173	174	175, s 177	176, r 177	177	178	178	t 177, 178
1906.....	n 201, o 202, p 203	p 203, 204	205	206	207	208	k 205, 209	210	211	212, r 213	213	214	214	214
1907-8.....	241	242	243	244	245	246	247	248	249	250, r 251	251	252	252	252
1909.....	261	262	263	264	265	266	267	268	269	270, r 271	271	272	272	272
1910.....	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911.....	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912.....	321	322	323	324	325	326	327	328	329	330	331	332-A	332-B	332-C
1913.....	351	352	353	354	355	356	357	358	359	360	361	362-A	362-B	362-C
1914.....	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915.....	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916.....	431	432	433	434	435	436	437	438	439	440	441	442	443	444
1917.....	451	452	453	454	455	456	457	458	459	460	461	462	463	464

^a Rating tables and index to Water-Supply Papers 35-39 contained in Water-Supply Paper 39. Tables for monthly discharge for 1899 in Twenty-first Annual Report, Part IV.

^b James River only.

^c Gallatin River.

^d Green and Gunnison rivers and Grand River above junction with Gunnison.

^e Mohave River only.

^f Kings and Kern rivers and south Pacific slope basins.

^g Rating tables and index to Water-Supply Papers 47-52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables for monthly discharge for 1900 in Twenty-second Annual Report, Part IV.

^h Wissahickon and Schuylkill rivers to James River.

ⁱ Soloto River.

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

^k Tributaries of Mississippi from east.

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

^m Hudson Bay only.

ⁿ New England Rivers only.

^o Hudson River to Delaware River, inclusive.

^p Susquehanna River to Yackin River, inclusive.

^q Pacific and Kansas Rivers.

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

^s Below junction with Gila.

^t Rogue, Umpqua, and Siletz rivers only.

NORTH PACIFIC SLOPE DRAINAGE BASINS.

PRINCIPAL STREAMS.

The largest rivers discharging into the Pacific Ocean in Oregon and Washington are Rogue, Umpqua, and Columbia rivers and streams that reach the ocean through Puget Sound. The principal tributaries of the Columbia are Kootenai, Clark Fork, Spokane, Wenatchee, Yakima, Snake, Walla Walla, Umatilla, John Day, Deschutes, Klickitat, Willamette, and Lewis rivers. Nisqually, Puyallup, White, Snohomish, and Skagit rivers flow into Puget Sound. The streams of this division drain wholly or in part the States of Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming.

In addition to the list of gaging stations and the annotated list of publications relating specifically to the section, these pages contain a similar list of reports that are of general interest in many sections and cover a wide range of hydrologic subjects, and also brief references to reports published by State and other organizations (p. xxxii).

GAGING STATIONS.

NOTE.—Dash after date indicates that station was being maintained September 30, 1917. Period after a date indicates discontinuance.

BETWEEN COLUMBIA RIVER AND PUGET SOUND.

- Chehalis River at Centralia, Wash., 1910-11.
- Quinault River at Quinault Lake, Wash., 1911-
- Soleduck River near Quillayute, Wash., 1897-1901.
- Kalawa River near Forks, Wash., 1897-1901.
- Elwha River at McDonald, Wash., 1897-1901.
- Elwha River near Port Angeles, Wash., 1911-12.
- Dungeness River at Sequim, Wash., 1897-98.
- Dungeness River at Dungeness, Wash., 1898-1901.

PUGET SOUND DRAINAGE BASINS.

- Dosewallips River at Brinnon, Wash., 1910-11.
- Duckabush River near Duckabush, Wash., 1910-11.
- Skokomish River, North Fork (head of Skokomish River), near Hoodspport, Wash., 1910-11; 1913-
- Nisqually River near Ashford, Wash., 1910-1914.
- Nisqually River near La Grande, Wash., 1906-1911.
- Puyallup River near Electron, Wash., 1909-
- Puyallup River at Alderton, Wash., 1914-
- Puyallup River at Puyallup, Wash., 1914-
- Carbon River at Fairfax, Wash., 1910-1912.
- White River below Forks, near Enumclaw, Wash., 1911-12.
- White River at Buckley, Wash., 1899-1903; 1910-11; 1913-
- Greenwater River at mouth, near Enumclaw, Wash., 1911-12.
- White River flume at Buckley, Wash., 1913-
- Green River at Kanaskat, Wash., 1911.
- Duwamish River:
 - Cedar River at Vaughn Bridge, near Cedar Lake, Wash., 1898-99.
 - Cedar River at Cedar Lake, near North Bend, Wash., 1902-3.

Duwamish River—Continued

Cedar River at Cedar Falls, Wash., 1914—

Cedar River near Landsberg, Wash., 1914—

Cedar River near Ravensdale, Wash., 1901–1912.

Cedar River at Clifford Bridge, near Ravensdale, Wash., 1895–1898.

Cedar River at Renton, Wash., 1901–1907. (Published in Water-Supply Paper 313.)

Skykomish River, South Fork (head of Snohomish River), near Berlin, Wash., 1910–11.

Skykomish River, South Fork, near Index, Wash., 1902–1905; 1911–12, 1913—

Skykomish River at Sultan, Wash., 1910–11.

Foss River near Skykomish, Wash., 1911.

East Fork of Foss River near Skykomish, Wash., 1911.

Miller Creek near Miller River (Berlin), Wash., 1911—

West Fork of Miller Creek near Miller River (Berlin), Wash., 1911.

North Fork of Skykomish River at Index, Wash., 1910—

Sultan River near Sultan, Wash., 1911—

Snoqualmie River, Middle Fork (head of Snoqualmie River), near North Bend, Wash., 1907— (Records for this station and other stations in Snoqualmie River basin published in Water-Supply Paper 412.)

Snoqualmie River near Snoqualmie, Wash., 1898–99; 1900; 1902–1904. (Revised records published in Water-Supply Paper 412.)

North Fork of Snoqualmie River at cable bridge, near North Bend, Wash., 1913–1915.

North Fork of Snoqualmie River near North Bend, Wash., 1907—

South Fork of Snoqualmie River near Garcia, Wash., 1910–1915.

South Fork of Snoqualmie River at North Bend, Wash., 1907—

Tokul Creek near Snoqualmie, Wash., 1907–1914.

Pilchuck Creek near Granite Falls, Wash., 1911.

Stilaguamish River, South Fork (head of Stilaguamish River), near Silverton, Wash., 1910–1917.

Stilaguamish River, South Fork, near Robe, Wash., 1902–3.

Stilaguamish River, South Fork at Granite Falls, Wash., 1911; 1913–1915.

Canyon Creek near Granite Falls, Wash., 1911–1913.

Skagit River at Reflector Bar, near Marblemount, Wash., 1913—

Skagit River near Marblemount, Wash., 1908–1914.

Skagit River near Sedro Woolley, Wash., 1908—

Stetattle Creek near Marblemount, Wash., 1913–1915.

Cascade River near Marblemount, Wash., 1909–1913.

Sauk River above Whitechuck River, near Darrington, Wash., 1910.

Sauk River above Clear Creek, near Darrington, Wash., 1910–1913.

Sauk River at Darrington, Wash., 1914—

Sauk River near Suiattle Crossing, near Sauk, Wash., 1910–1912.

Whitechuck River near Darrington, Wash., 1910.

Clear Creek near Darrington, Wash., 1910–11.

Baker Lake (on Baker River) near Concrete, Wash., 1910–1915.

Baker River below Anderson Creek, near Concrete, Wash., 1910—

Baker River at Concrete, Wash., 1910–1915.

Whatcom Lake near Bellingham, Wash., 1913–14.

Whatcom Creek near Bellingham, Wash., 1910–1914.

Nooksack River,¹ North Fork (head of Nooksack River), near Glacier, Wash., 1910–11.

Nooksack River near Deming, Wash., 1910–11.

Middle Fork of Nooksack River at ranger station near Deming, Wash. 1910.

Middle Fork of Nooksack River near Deming, Wash., 1910–11.

¹ Revised decision of United States Geographic Board rendered Oct. 3, 1917.

COLUMBIA RIVER BASIN.

- Columbia River at Trail, British Columbia, 1913-
- Columbia River at Wenatchee, Wash., 1910; 1913-1916.
- Columbia River at Vernita, Wash., 1917-
- Columbia River near Julia, Wash., 1905.
- Columbia River at Hanford, Wash., 1910.
- Columbia River at Pasco, Wash., 1904-1910.
- Columbia River at Cascade Locks and The Dalles, Oreg., 1878-
- Kootenai River at Libby Mont., 1910-
- Kootenai River at Crossport, Idaho, 1904.
- Kootenai River near Bonners Ferry, Idaho, 1904.
- Kootenai River near Porthill, Idaho, 1904.
- Callahan Creek at Troy, Mont., 1911-1916.
- Yaak River near Troy, Mont., 1910-1916.
- Moyie River at Snyder, Idaho, 1911-1916.
- Clark Fork at Missoula, Mont., 1898-1907.
- Clark Fork at St. Regis, Mont., 1910-
- Clark Fork near Plains, Mont., 1910-
- Pend Oreille Lake at Sandpoint, Idaho, 1914-
- Clark Fork at Priest River, Idaho, 1903-1905.
- Clark Fork at Newport, Wash., 1904-1910.
- Clark Fork at Metaline Falls, Wash., 1908-1910; 1912-
- Racetrack Creek near Anaconda, Mont., 1911-12; 1914-
- Little Blackfoot River and ditch near Elliston, Mont., 1910-1915.
- Rock Creek near Quigley, Mont., 1910-1912.
- Big Blackfoot River at Bonner, Mont., 1898-1905.
- Rattlesnake Creek at Missoula, Mont., 1899-1900.
- Bitterroot River, West Fork (head of Bitterroot River), near Darby, Mont., 1910-
- Bitterroot River near Grantsdale, Mont., 1902-1907.
- Bitterroot River near Missoula, Mont., 1898-1901; 1903-4.
- East Fork of Bitterroot River near Darby, Mont., 1910-1916.
- Lolo Creek near Lolo, Mont., 1910-1916.
- St. Regis River near St. Regis, Mont., 1910-
- Flathead River near Columbia Falls, Mont., 1910-
- Flathead River at Demersville, near Kalispell, Mont., 1909-1912.
- Flathead River at Damon's ranch near Kalispell, Mont., 1909-1912.
- Flathead River at Keller's ranch, near Holt, Mont., 1909-1912.
- Flathead Lake (on Flathead River) near Holt, Mont., 1900.
- Flathead Lake at Polson, Mont., 1908-
- Flathead River near Polson, Mont., 1907-
- Middle Fork of Flathead River at Belton, Mont., 1910-
- Lake McDonald outlet at Lake McDonald, Mont., 1912-1914.
- South Fork of Flathead River near Columbia Falls, Mont., 1910-1916.
- Stillwater River near Kalispell, Mont., 1906-7.
- Whitefish River near Kalispell, Mont., 1906.
- Ashley Creek, Kila, Mont., 1916.
- Swan River near Big Fork, Mont., 1910-11
- Big Creek, near Polson, Mont., 1917-
- Little Bitterroot River near Marion, Mont., 1910-1916.
- Little Bitterroot River near Hubbard, Mont., 1909-1916.
- Little Bitterroot River near Niarada (Dayton), Mont., 1908-9; 1916.
- Crow Creek near Ronan, Mont., 1906-

Columbia River tributaries—Continued.

Clark Fork tributaries—Continued.

Flathead River tributaries—Continued.

Crow Creek at Lozeau's ranch, near Ronan, Mont., 1911-1916.

Mud Creek near Ronan, Mont., 1908-1910.

Mission Creek near St. Ignatius, Mont., 1906.

Dry Creek near St. Ignatius, Mont., 1908-1916.

Post Creek at Fitzpatrick's ranch, near Ronan, Mont., 1906-1911.

Post Creek at Deschamp's ranch near Ronan, Mont., 1911.

Post Creek near St. Ignatius, Mont., 1911-

Jocko River, South Fork (head of Jocko River), near Jocko, Mont., 1912-1916.

Jocko River near Jocko, Mont., 1908-1916.

Jocko River at Ravalli, Mont., 1906-1911.

Middle Fork of Jocko River near Jocko, Mont., 1912-1916.

North Fork of Jocko River near Jocko, Mont., 1912-1916.

Falls Creek near Jocko, Mont., 1912-1916.

Big Knife Creek near Jocko, Mont., 1908-1916.

Agency Creek near Jocko, Mont., 1908-1916.

Blodgett Creek near Jocko, Mont., 1909-10.

Finley Creek near Jocko, Mont., 1908-1916.

East Finley Creek near Jocko, Mont., 1908-1916.

Indian ditch near Jocko, Mont., 1908-1911; 1912-1916.

Valley Creek near Ravalli, Mont., 1908-1911.

Revais Creek near Dixon, Mont., 1911-1916.

Thompson River near Thompson Falls, Mont., 1911-1916.

Prospect Creek near Thompson Falls, Mont., 1911-1916.

Priest River at outlet of Priest Lake, at Coolin, Idaho, 1911-1917.

Priest River at Falk's ranch, near Priest River, Idaho, 1911-12.

Priest River near Priest River, Idaho, 1903-1905; 1910-11.

Sullivan Lake near Metaline Falls, Wash., 1912-

Sullivan Creek near Metaline Falls, Wash., 1912-

Kettle River at Curlew, Wash., 1911-12.

Kettle River at Boyds, Wash., 1913-1915.

Curlew Creek near Curlew, Wash., 1917-

Hall Creek at Inchelium, Wash., 1912-

Stranger Creek at Meteor, Wash., 1916-

Stranger Creek at Inchelium, Wash., 1914-1917.

North Fork of Cœur d'Alene River (head of Cœur d'Alene River and through Cœur d'Alene Lake of Spokane River) at Pritchard, Idaho, 1911-1914.

North Fork of Cœur d'Alene River at Enaville, Idaho, 1911-1913.

Cœur d'Alene River near Cataldo, Idaho, 1911-12.

Cœur d'Alene Lake at Cœur d'Alene, Idaho, 1903-

Spokane River at Post Falls, Idaho, 1913-1917.

Spokane River at Trent, Wash., 1911-1913.

Spokane River at Washington Water Power Co.'s dam, at Spokane, Wash., 1891-1896.

Spokane River at Spokane, Wash., 1896-

Spokane River, below Little Falls, near Long Lake, Wash., 1912-

Little North Fork of Cœur d'Alene River near Enaville, Idaho, 1911-12.

St. Joe River at Avery, Idaho, 1911-1917.

St. Joe River near Colder, Idaho, 1911-12.

St. Maries River at Lotus, Idaho, 1911-12.

Spokane Valley Land & Water Co.'s canal near Post Falls, Idaho, 1911-1917.

Columbia River tributaries—Continued.

Spokane River tributaries—Continued.

Latah (Hangman) Creek at and near Tekoa, Wash., 1904-5.

North Fork of Latah Creek near Tekoa, Wash., 1904-5.

Little Spokane River near Spokane, Wash., 1903-1905; 1911-1913.

Sanpoil River at Keller, Wash., 1911-1917.

Nespelem River at Nespelem, Wash., 1911-

Okanogan River at Okanogan, Wash., 1911-

Similkameen River near Oroville, Wash., 1911-

Sinlahekin Creek near Loomis, Wash., 1903-1905.

Johnson Creek near Riverside, Wash., 1903-1907.

Salmon Creek near Conconully, Wash., 1910-

Salmon Creek near Okanogan, Wash., 1903-1912.

Methow River at Winthrop, Wash., 1912.

Methow River at Pateros, Wash., 1903-

Chewack Creek at Winthrop, Wash., 1912-13.

Twisp River at Twisp, Wash., 1911-1913.

Stehekin River (head of Chelan River) at Stehekin, Wash., 1910-1915.

Chelan Lake at Lakeside, Wash., 1897-1899.

Chelan Lake at Chelan, Wash., 1905; 1910-

Chelan River at Chelan, Wash., 1903-

Railroad Creek at Lucerne, Wash., 1910-1913.

Entiat River at Entiat, Wash., 1910-

Wenatchee River near Leavenworth, Wash., 1910-

Wenatchee River at Dryden (Cashmere), Wash., 1904-1917.

Wenatchee River near Wenatchee, Wash., 1897.

White River near Chiwaukum, Wash., 1911-12; 1914.

Nason Creek near Nason, Wash., 1911.

Chiwawa River near Leavenworth, Wash., 1911-12; 1913-14.

Chiwaukum Creek near Chiwaukum, Wash., 1911.

Icicle Creek near Leavenworth, Wash., 1911-1914.

Peshastin Creek at Blewett, Wash., 1911-12.

Peshastin Creek near Leavenworth, Wash., 1911-12.

Wenatchee Valley canal at Dryden, Wash. (irrigation seasons only), 1912-1917

Crab Creek at Wilson Creek, Wash., 1904.

Crab Creek at Adrian, Wash., 1910; 1911; 1912.

Crab Creek near Ephrata, Wash., 1909.

Moses Lake at Neppel (Moses Lake), Wash., 1909-1914.

Crab Creek near Warden, Wash., 1909-1912.

Rocky Ford Creek near Ephrata, Wash., 1909-1911.

Keechelus Lake (on Yakima River) near Martin, Wash., 1906-

Yakima River near Martin, Wash., 1903-

Yakima River at Easton, Wash., 1904; 1910-1915.

Yakima River at Cle Elum, Wash., 1906-

Yakima River at Umtanum, Wash., 1906-

Yakima River at Selah Gap, near North Yakima, Wash., 1897; 1904-5; 1911; 1912.

Yakima River at Union Gap, near Yakima City, Wash., 1894-1909; 1911-1914.

Yakima River near Parker (Wapato), Wash., 1908-

Yakima River at Mabton, Wash., 1904-1906; 1911-12.

Yakima River near Prosser, Wash., 1904-1906; 1913-

Yakima River at Kiona, Wash., 1895-1915.

Yakima River near Richland, Wash., 1906-1911.

Cabin Creek near Easton, Wash., 1909-1911.

Kachess Lake (on Kachess River) near Easton, Wash., 1905-

Columbia River tributaries—Continued.

Yakima River tributaries—Continued.

- Kachess River near Easton, Wash., 1903–
- Big Creek near Cle Elum, Wash., 1909.
- Cle Elum River, North Fork (head of Cle Elum River), at Galena, Wash., 1907; 1911.
- Cle Elum Lake near Roslyn, Wash., 1906–
- Cle Elum River near Roslyn, Wash., 1903–
- Teanaway River below Forks, near Cle Elum, Wash., 1911–12.
- Teanaway River near Cle Elum, Wash., 1909–1911; 1912–1914.
- Swauk Creek near Cle Elum, Wash., 1909–1912.
- Cascade canal near Ellensburg (Thorp), Wash., 1905–6; 1909–1911.
- West Kittitas canal near Thorp, Wash., 1904–1906; 1909–1911.
- Ellensburg Water Co.'s canal near Ellensburg, Wash., 1904–5; 1909–1911.
- Taneum Creek near Thorp, Wash., 1909–1912.
- Manastash Creek near Ellensburg, Wash., 1909–1914.
- Wilson Creek near Thrall, Wash., 1911.
- Selah Moxee canal near Selah, Wash., 1904–5; 1909–1911.
- Wenas Creek near Selah, Wash., 1909–1912.
- Naches River at Anderson's ranch, near Nile, Wash., 1909–1914.
- Naches River at Oak Flat, near Nile, Wash., 1904–1917.
- Naches River below Tieton River, near Naches, Wash., 1905; 1909–1912; 1915–
- Naches River near North Yakima, Wash., 1893–1897; 1898–1912.
- Bumping Lake (on Bumping River) near Nile, Wash., 1909; 1910–
- Bumping River at Bumping Lake, near Nile, Wash., 1906; 1909–
- American River near Nile, Wash., 1909; 1910; 1911; 1913; 1914; 1915.
- Selah Valley canal near Naches, Wash., 1904–1906; 1909–1912.
- Tieton River, North Fork, below Clear Creek, near Naches, Wash., 1914–15.
- Tieton River at McAllister Meadows, near Naches, Wash., 1908–1914.
- Tieton River at headworks of Tieton canal, near Naches, Wash., 1906–
- Tieton River at Cobb's ranch, near Naches, Wash., 1902–1913.
- Tieton canal near Naches, Wash., 1910–
- Wapatox canal near Naches, Wash., 1904–5; 1909–1911.
- Naches Canal Co.'s (Gleed) canal near Naches, Wash., 1904–1906; 1909–1911.
- Yakima Valley (Congdon) canal near Naches, Wash., 1904–1906; 1909–1911.
- Naches-Cowiche canal near Naches, Wash., 1904–5; 1909–1911.
- North Yakima power canal near North Yakima, Wash., 1904–1906; 1909–10.
- Schanno canal near North Yakima, Wash., 1904–5; 1909–1911.
- North Yakima power waste at North Yakima, Wash., 1909–1912.
- North Yakima mill waste at North Yakima, Wash., 1909–1912.
- Naches Avenue Union canal at North Yakima, Wash., 1904–1906; 1909–1911.
- Old Union canal near North Yakima, Wash., 1904–1906; 1909–1911.
- Moxee Co.'s canal near North Yakima, Wash., 1904–1906; 1909–1911.
- Fowler canal near North Yakima, Wash., 1904–1906; 1909–1911.
- Ahtanum Creek, North Fork (head of Ahtanum Creek), near Tampico, Wash., 1907–
- Ahtanum Creek at The Narrows, near Tampico, Wash., 1908–1913.
- Ahtanum Creek near Yakima, Wash., 1904; 1907–1912.
- South Fork of Ahtanum Creek at Conrad ranch, near Tampico, Wash., 1915–
- South Fork of Ahtanum Creek near Tampico, Wash., 1907–1914.

Columbia River tributaries—Continued.

Yakima River tributaries—Continued.

New Reservation canal at Parker (Yakima City), Wash., 1904—
 Old Reservation canal at Parker (Wapato), Wash., 1904—
 Sunnyside canal near Parker (Wapato), Wash., 1904—
 Toppenish Creek near Fort Simcoe, Wash., 1909—
 Toppenish Creek near White Swan (Wapato), Wash., 1909–1912.
 Toppenish Creek at railway bridge, near Toppenish, Wash., 1894–1896.
 Toppenish Creek near Toppenish, Wash., 1908–9.
 Toppenish Creek at Alfalfa, Wash., 1909–1912.

Simcoe Creek near Fort Simcoe, Wash., 1909—
 Reservation drain at Alfalfa, Wash., 1912—
 Satus Creek near Toppenish, Wash., 1908–1913.
 Satus Creek below Dry Creek, near Toppenish, Wash., 1913—
 Satus Creek near Alfalfa, Wash., 1905.
 Satus Creek near Satus, Wash., 1894–1896.
 Kiona canal near Kiona, Wash., 1904–1906; 1908–1911.
 Kennewick canal near Richland (Kennewick), Wash., 1904–5; 1910–11.
 Lower Yakima canal near Kiona, Wash., 1905; 1910–11.

Snake River at south boundary of Yellowstone National Park, Wyo., 1913—
 Jackson Lake (Snake River) at Moran, Wyo., 1909–10 (fragmentary); 1911—
 Snake River ¹ near Moran, Wyo., 1903—
 Snake River ¹ at Grovont, Wyo., 1899.
 Snake River at Alpine, Idaho, 1916—
 Snake River ¹ near Lyon, Idaho, 1903–1911.
 Snake River ¹ near Heise, Idaho, 1910—
 Snake River at Idaho Falls, Idaho, 1889–90; 1892–1894.
 Snake River near Shelley, Idaho, 1915—
 Snake River near Firth, Idaho, 1915—
 Snake River at Porterville Bridge near Blackfoot, Idaho, 1916—
 Snake River near Blackfoot, Idaho, 1910—
 Snake River at Neeley, Idaho, 1906—
 Lake Walcott (on Snake River) near Minidoka, Idaho, 1909—
 Snake River at Howells Ferry, near Minidoka, Idaho, 1910—
 Snake River at Montgomery Ferry, near Minidoka, Idaho, 1895–1899; 1901–1910.
 Lake Milner (on Snake River) at Milner, Idaho, 1911—
 Snake River at Milner, Idaho, 1909—
 Snake River near Twin Falls, Idaho, 1911–1917.
 Snake River near Hagerman, Idaho, 1912–1917.
 Snake River at King Hill, Idaho, 1909—
 Snake River near Murphy, Idaho, 1912; 1913—
 Snake River at Weiser, Idaho, 1910—
 Snake River at Lewiston, Idaho, 1910.
 Snake River at Riparia, Wash., 1916—
 Snake River near Burbank, Wash., 1907–1917.
 Pacific Creek near Moran, Wyo., 1906; 1917.
 Buffalo Fork near Elk (Moran), Wyo., 1906; 1917.
 Spread Creek near Elk, Wyo., 1917.
 Cottonwood Creek near Teton, Wyo., 1917.
 Spring Creek near Teton, Wyo., 1917.
 Spring Creek near Zenith, Wyo., 1917.
 Gros Ventre River at Zenith, Wyo., 1917.

¹ Decision of United States Geographic Board; formerly called South Fork of Snake River.

Columbia River tributaries—Continued.

Snake River tributaries—Continued.

- Spring Creek at Zenith, Wyo., 1917.
- Fish Creek near Wilson, Wyo., 1917.
- Mosquito Creek near Wilson, Wyo., 1917.
- Flat Creek near Cheney, Wyo., 1917.
- Horse Creek near Cheney, Wyo., 1917.
- Hoback River near Cheney, Wyo., 1917.
- Fall Creek near Cheney, Wyo., 1917.
- Dog Creek near Cheney, Wyo., 1917.
- Cabin Creek near Cheney, Wyo., 1917.
- Bailey Creek near Alpine, Idaho, 1917.
- Wolf Creek near Alpine, Idaho, 1917.
- Greys River near Alpine, Idaho, 1917.
- Salt River near Alpine, Idaho, 1917.
- McCoy Creek near Alpine, Idaho, 1917.
- Indian Creek near Blowout, Idaho, 1917.
- Big Elk Creek near Blowout, Idaho, 1917.
- Little Elk Creek near Blowout, Idaho, 1917.
- Bear Creek near Irwin, Idaho, 1917.
- Palisade Creek near Irwin, Idaho, 1917.
- Fall Creek near Swan Valley, Idaho, 1917.
- Rainy Creek at Swan Valley, Idaho, 1917.
- Pine Creek near Swan Valley, Idaho, 1917.
- Burns Creek near Heise, Idaho, 1917.
- Henrys Fork¹ at Warm River, Idaho, 1910-1915.
- Henrys Fork near Ora, Idaho, 1902-1909.
- Henrys Fork in canyon above Fall River, Idaho, 1890-91.
- Henrys Fork near Rexburg, Idaho, 1909-
 Warm River at Warm River, Idaho, 1912-1915.
- Robinson Creek at Warm River, Idaho, 1912-1915.
- Fall River near Marysville, Idaho, 1902-3.
- Fall River at Fremont, Idaho, 1904-1909 (replace Marysville station).
- Fall River at Canyon, Idaho, 1890-1901.
- Teton River near St. Anthony, Idaho, 1903-1909.
- Teton River at Chase's ranch, Idaho, 1890-1893.
- Idaho (Government) canal near Shelley, Idaho, 1912-
- Willow Creek near Prospect, Idaho, 1903-4.
- Willow Creek near Ririe, Idaho, 1916-
- Willow Creek near Ionia, Idaho, 1916-
 Grays Lake outlet near Herman, Idaho, 1916-
- Sand Creek near Firth, Idaho, 1916-
- Blackfoot River above reservoir, near Henry, Idaho, 1914-
- Blackfoot-Marsh reservoir near Henry, Idaho, 1912-
- Blackfoot River below reservoir, near Henry [near Rossfork], Idaho, 1908-
- Blackfoot River near Shelley, Idaho, 1909-
- Blackfoot River near Presto, Idaho, 1903-1909.
- Blackfoot River near Blackfoot, Idaho, (fragmentary), 1913; 1914; 1915-
 Little Blackfoot River at Henry, Idaho, 1914-
- Meadow Creek near Henry, Idaho, 1914-
- Idaho (Government) canal near Firth, Idaho, 1914-
- Fort Hall upper canal near Blackfoot, Idaho, 1912-
- Fort Hall lower canal near Blackfoot, Idaho, 1912-

¹ Decision of United States Geographic Board; formerly called North Fork of Snake River.

Columbia River tributaries—Continued.

Snake River tributaries—Continued.

- Big Lost River near Chilly, Idaho, 1904-1906; 1907-1915.
- Big Lost River near Mackay, Idaho, 1903-1906; 1912-1915.
 - Thousand Springs Creek near Chilly, Idaho, 1912-13; 1914.
 - Sharp ditch near Mackay, Idaho, 1912-1914.
 - Streeter ditch near Mackay, Idaho, 1913-14.
 - Cedar Creek above forks; near Mackay, Idaho, 1911-1913.
 - Cedar Creek below forks, near Mackay, Idaho, 1911-1913.
 - Antelope Creek near Darlington, Idaho, 1913-1916.
 - Little Lost River near Clyde, Idaho, 1910-1913.
 - Birch Creek near Kaufman, Idaho, 1910-1912.
 - Camas Creek near Hamer, Idaho, 1912-13.
- Portneuf River above reservoir, near Chesterfield, Idaho, 1912-1914.
- Portneuf diversion channel near Chesterfield, Idaho, 1914.
- Portneuf River below reservoir, near Chesterfield, Idaho, 1912-1915.
- Portneuf River near Pebble, Idaho, 1910-1913.
- Portneuf River at Topaz, 1913-1915.
- Portneuf River near McCammon, Idaho, 1896.
- Portneuf River at Pocatello, Idaho, 1897-1899; 1911-
 - Topons Creek near Chesterfield, Idaho, 1912-1914.
 - Pebble Creek near Pebble, Idaho, 1911-1914.
 - Birch Creek near Downey, Idaho, 1911-1914.
- Raft River near Bridge, Idaho, 1909-1915.
 - Clear Creek near Naf, Idaho, 1910-11; 1912.
 - Cassia Creek near Conant, Idaho, 1909-1912.
- North Side Minidoka canal near Minidoka, Idaho, 1909-
- South Side Minidoka canal near Minidoka, Idaho, 1909-
- Goose Creek above Trapper Creek, near Oakley, Idaho, 1911-1916.
- Goose Creek near Oakley, Idaho, 1909-1911.
 - Trapper Creek near Oakley, Idaho, 1911-1916.
 - Birch Creek near Oakley, Idaho, 1912-13; 1914-1916.
- North Side Twin Falls canal at Milner, Idaho, 1909-
- South Side Twin Falls canal at Milner, Idaho, 1909-
- Big Cottonwood Creek near Oakley, Idaho, 1909-1915.
- Dry Creek near Artesian City, Idaho, 1912.
- Rock Creek near Rock Creek, Idaho, 1909-1913.
 - McMullen Creek near Rock Creek, Idaho, 1910; 1912.
- Salmon Falls Creek above upper Vineyard ditch, near Contact, Nev., 1914.
- Salmon Falls Creek below upper Vineyard ditch, near Contact, Nev., 1914.
- Salmon Falls Creek below High Lane canal, near San Jacinto Nev., 1914.
- Salmon Falls Creek near San Jacinto, Nev., 1909-1916.
- Salmon Falls Creek near Twin Falls, Idaho, 1909-10.
 - Upper Vineyard ditch near Contact, Nev., 1914.
 - Lower Vineyard ditch near Contact, Nev., 1914.
 - Jakes Creek above Hubbard ranch, near Contact, Nev., 1914.
 - Jakes Creek below Hubbard ranch, near Contact Nev., 1914.
 - Willow Creek near Contact, Nev., 1914.
 - Bird's Nest ditch near Contact, Nev., 1914.
 - Harrell ditch near Contact, Nev., 1914.
 - High Line ditch near San Jacinto, Nev., 1914.
 - San Jacinto ditch near San Jacinto, Nev., 1914.
 - Island ditch near San Jacinto, Nev., 1914.
 - West Boar's Nest ditch near San Jacinto, Nev., 1914.

Columbia River tributaries—Continued.

Snake River tributaries—Continued.

Salmon Falls Creek tributaries—Continued.

Trout Creek near San Jacinto, Nev., 1914.

East Boar's Nest ditch near San Jacinto, Nev., 1914.

Shoshone Creek near San Jacinto, Nev., 1914-15.

North Side ditch near San Jacinto, Nev., 1914.

Cedar Creek near Roseworth, Idaho, 1909-1914; 1916.

Devil Creek near Three Creek, Idaho, 1912-1914; 1916.

Big Wood River near Gimlet, Idaho, 1904-5.

Big Wood River at Hailey, Idaho, 1889; 1915-16.

Big Wood Slough at Hailey, Idaho, 1915-16.

Big Wood River near Bellevue, Idaho, 1911-1916.

Big Wood River below Magic dam, near Richfield, Idaho, 1911-1916.

Big Wood River below North Gooding canal, near Shoshone, Idaho, 1911-1916.

Big Wood River near Gooding, Idaho, 1916-

Big Wood River near Shoshone, Idaho, 1905-6; 1908-1913.

Big Wood River at Toponis, Idaho, 1896-1899.

Big Wood River near Bliss, Idaho, 1899.

Camas Creek near Blaine, Idaho, 1912-1916.

Little Wood River near Carey, Idaho, 1904-5.

Little Wood River near Richfield, Idaho, 1911-1916.

Little Wood River at Toponis [Gooding], Idaho, 1896-1899.

Dry Creek near Blanche, Idaho, 1911-1914.

King Hill Creek near King Hill, Idaho, 1913.

Little Canyon Creek at Glenss Ferry, Idaho, 1909-1913.

Alkali Creek near Glenss Ferry, Idaho, 1909-1913.

Cold Springs Creek near Hammett, Idaho, 1909-1913.

Bennett Creek near Hammett, Idaho, 1909-1913.

Rattlesnake Creek near Mountain Home, Idaho, 1917.

Canyon Creek near Mountain Home, Idaho, 1917.

Long Tom Creek below reservoir near Bennett, Idaho, 1917.

Willowdale Creek near Bennett, Idaho, 1917.

Syrup Creek near Mountain Home, Idaho, 1917.

Bruneau River near Rowland, Nev., 1913-

Bruneau River near Tindall, Idaho, 1910-1912.

Bruneau River near Hot Spring, Idaho, 1909-1915.

Bruneau River near Grandview, Idaho, 1895-1903; 1909-1916.

Sheep Creek near Tindall, Idaho, 1910-1913.

Marys Creek near Owyhee, Nev., 1913-1915.

Marys Creek at Tindall, Idaho, 1910-1913.

Louse Creek near Wickahoney, Idaho, 1911.

East Fork of Bruneau River near Three Creek, Idaho, 1912-1914; 1916.

East Fork of Bruneau River near Hot Spring, Idaho, 1910-1915.

Three Creek near Three Creek, Idaho, 1912-1914; 1916.

Cherry Creek near Three Creek, Idaho, 1912-1914; 1916.

Deadwood Creek near Three Creek, Idaho, 1912-1914; 1916.

Buckaroo ditch at Hot Spring, Idaho, 1912-1914.

Grandview canal near Grandview, Idaho, 1912-1915.

Castle Creek near Castle Creek, Idaho, 1910-11.

Sucker Creek near Homedale, Idaho, 1903-1910.

Owyhee River near Gold Creek, Nev., 1916-

Owyhee River at Mountain City, Nev., 1913.

Columbia River tributaries—Continued.

Snake River tributaries—Continued.

Owyhee River near Owyhee, Nev., 1913—

Owyhee River at Owyhee, Oreg., 1890-1896; 1903-1916.

South Fork of Owyhee River near Tuscarora, Nev., 1913.

Jack Creek near Tuscarora, Nev., 1913—

Jordan Creek near Jordan Valley, Oreg., 1911—

Cow Creek at Narrows, near Jordan Valley, Oreg., 1914.

Cow Creek at mouth, near Jordan Valley, Oreg., 1914.

Owyhee canal near Owyhee, Oreg., 1904-5; 1911-1916.

Boise River near Twin Springs, Idaho, 1911—

Boise River at Dowling's ranch, near Arrowrock, Idaho, 1911—

Boise River below Moore Creek, near Arrowrock, Idaho, 1915-16.

Boise River near Highland, Idaho (replaces the Boise station), 1905-1915.

Boise River near Boise, Idaho, 1894-1904.

Boise River at Caldwell, Idaho, 1895-96.

Cottonwood Creek near Arrowrock, Idaho, 1914-1917.

South Fork of Boise River near Lenox, Idaho, 1911—

Little Camas Creek below reservoir near Bennett, Idaho, 1917.

Little Camas canal at heading near Bennett, Idaho, 1917.

Little Camas canal above tunnel No. 9, near Bennett, Idaho, 1917.

Smith Creek near Lenox, Idaho, 1916-17.

Long Gulch Creek near Lenox, Idaho, 1916.

Rattlesnake Creek near Lenox, Idaho, 1916-17.

Willow Creek near Lenox, Idaho, 1916-17.

Little Camas Creek near Little Camas Store, Idaho, 1896.

Moore Creek near Arrowrock, Idaho, 1915—

Grimes Creek near Centerille, Idaho, 1910.

Dry Creek:

Spring Creek near Boise, Idaho, 1911-12.

Wilson ditch near Ontario, Oreg., 1904-5.

Malheur River near Drewsey, Oreg., 1914.

Malheur River at Warm Springs reservoir site, near Riverside, Oreg., 1914-1917.

Malheur River above South Fork, at Riverside, Oreg., 1906-7; 1908-1910.

Malheur River at Riverside, Oreg., 1909-1915.

Malheur River near Namorf, Oreg., 1913-1917.

Malheur River near Harper ranch, near Westfall, Oreg., 1903-1905.

Malheur River near Little Valley, Oreg., 1914.

Malheur River at McLaughlin bridge, near Vale, Oreg., 1904-1906.

Malheur River at Vale, Oreg., 1890-91; 1895-96; 1903-1914.

Malheur River at Halliday bridge, near Ontario, Oreg., 1904-5.

Malheur River near Ontario, Oreg., 1903-4.

South Fork of Malheur River at Riverside, Oreg., 1910-1913; 1913-1915.

North Fork of Malheur River at Scotts ranch, near Beulah, Oreg., 1914.

North Fork of Malheur River at Foley's ranch, near Beulah, Oreg., 1909-1912; 1913-14.

Vines ditch near Little Valley, Oreg., 1904-5; 1914.

Malheur Farmers' canal above Vale, Oreg., 1904-5.

McLaughlin ditch above Vale, Oreg., 1904-5.

"J. H." ditch above Vale, Oreg., 1904-5.

Gellerman & Frohman ditch above Vale, Oreg., 1904-5.

Sand Hollow ditch above Vale, Oreg., 1904-5.

Bully Creek near Westfall, Oreg., 1911; 1912-13.

Columbia River tributaries—Continued.

Snake River tributaries—Continued.

Malheur River tributaries—Continued.

Bully Creek at Warm Springs, near Vale, Oreg., 1903-4; 1905-1907; 1911-1917.

Bully Creek at Vale, Oreg., 1904-5.

Hope Mill ditch at Vale, Oreg., 1904-5.

Willow Creek near Malheur, Oreg., 1904-1906; 1910-11; 1912-1915.

Willow Creek near Brogan, Oreg., 1912-1914.

Willow Creek at Dell, Oreg., 1904-1906; 1910-11.

Cow Creek near Brogan, Oreg., 1912-1914.

Pole Creek near Brogan, Oreg., 1912-13.

Nevada ditch below Vale, Oreg., 1904-5.

Payette River near Horseshoe Bend, Idaho, 1906-1916.

Payette River at Payette, Idaho, 1895-1897.

North Fork of Payette River at Lardo, Idaho, 1908-1917.

North Fork of Payette River at Van Wyck, Idaho, 1912-1916.

Lake Fork of Payette River near McCall, Idaho, 1909-1914.

Shafer Creek near Horseshoe Bend, Idaho, 1911-12.

Harris Creek near Horseshoe Bend, Idaho, 1911-12.

Weiser River near Weiser, Idaho; 1890-91; 1894-1904; 1910-1915.

Weiser River, West Fork, near Fruitvale, Idaho, 1910-1913.

Lost Creek near Tamarack, Idaho, 1910-1914.

Middle Fork of Weiser River at Middle Fork, Idaho, 1910-1913.

Sage Creek near Midvale, Idaho, 1913.

Sommercamp Creek near Midvale, Idaho, 1913.

Miller Creek near Midvale, Idaho, 1913.

Crane Creek near Midvale, Idaho, 1910-1916.

Mann Creek near Weiser, Idaho, 1911-1913.

Monroe Creek (upper station) near Weiser, Idaho, 1911-12.

Monroe Creek (lower station) near Weiser, Idaho, 1911-1913.

Burnt River, North Fork (head of Burnt River) near Audrey, Oreg., 1915-16.

Burnt River near Hereford, Oreg., 1915-16.

Burnt River near Bridgeport, Oreg., 1915-16.

Middle Fork of Burnt River near Audrey, Oreg., 1915-16.

South Fork of Burnt River near Unity, Oreg., 1915-16.

South Fork of Burnt River at Hardman ranch near Unity, Oreg., 1916-

Sawmill Creek near Unity, Oreg., 1915.

Camp Creek near Hereford, Oreg., 1915.

Powder River at Salisbury, Oreg., 1903-1914.

Powder River at Baker, Oreg., 1913; 1914.

Powder River near North Powder, Oreg., 1909-1912; 1913-1916.

Baldock Slough at Baker, Oreg., 1913; 1914.

Old Settlers Slough at Baker, Oreg., 1913; 1914.

Pine Creek near Baker, Oreg., 1913; 1914.

Goodrich Creek near Baker, Oreg., 1913.

Mill Creek near Baker, Oreg., 1913; 1914.

Lee-Polly ditch near Baker, Oreg., 1914.

Marble Creek near Baker, Oreg., 1913; 1914.

Salmon Creek near Baker, Oreg., 1913; 1914.

Willow Creek near Haines, Oreg., 1913.

North Powder River at Gardner's ranch, near North Powder, Oreg., 1912.

North Powder River at North Powder, Oreg., 1912; 1913; 1914.

Anthony Creek near North Powder, Oreg., 1912.

Columbia River tributaries—Continued.

Snake River tributaries—Continued.

Powder River tributaries—Continued.

Wolf Creek near North Powder, Oreg., 1913; 1914.

Big Creek near Medical Springs, Oreg., 1913; 1914.

Goose Creek near Keating, Oreg., 1913; 1914.

Eagle Creek above West Fork, near Baker, Oreg., 1911.

Eagle Creek near Baker, Oreg., 1909-10.

Eagle Creek near New Bridge, Oreg., 1910-11; 1914.

West Fork of Eagle Creek near Baker, Oreg., 1911.

Daly Creek, near Richland, Oreg., 1913.

Salmon River near Pierson, Idaho, 1911-1913.

Salmon River at Salmon, Idaho, 1912-1916.

Salmon River at Whitebird, Idaho, 1910-1917.

Lake Creek near Stanley, Idaho, 1910-1913.

Valley Creek near Stanley, Idaho, 1910-1913.

Pahsimeroi River near Goldburg, Idaho, 1910-1913.

Pahsimeroi River below the sinks, near Goldburg, Idaho, 1913.

Goldburg Creek near Goldburg, Idaho, 1910-1913.

Big Creek near Patterson, Idaho, 1910-1913.

Lemhi River:

Timber Creek near Leadore, Idaho, 1912.

West Fork of Timber Creek near Leadore, Idaho, 1912.

Eightmile Creek near Leadore, Idaho, 1912.

North Fork of Salmon River near North Fork, Idaho, 1912.

Grande Ronde River at Hilgard, Oreg., 1903-1915.

Grande Ronde River at Elgin, Oreg., 1903-1912.

Grande Ronde River at Zindel, Wash., 1904-1912.

Catherine Creek near Union, Oreg., 1906-7; 1911-12; 1915.

Little Creek near Union, Oreg., 1915.

Mill Creek near Summerville, Oreg., 1914-15.

Wallowa Lake (on Wallowa River) near Joseph, Oreg., 1905-6; 1912-1914; 1915.

Wallowa River at Joseph, Oreg., 1903-1914; 1915.

Wallowa River near Wallowa, Oreg., 1903-1907.

Wallowa River at Minam (near Elgin), Oreg., 1903-1914.

Silver Lake ditch near Joseph, Oreg., 1905; 1915.

Farmers and Citizens' ditch near Joseph, Oreg., 1905; 1915.

Granger ditch at Joseph, Oreg., 1905; 1915.

Big Bend ditch at Joseph, Oreg., 1905; 1915.

Hurricane Creek near Joseph, Oreg., 1915.

Lostine River near Lostine, Oreg., 1912-1914; 1915.

Company ditch near Wallowa, Oreg., 1905.

Bear Creek near Wallowa, Oreg., 1915.

Minam River at Minam, Oreg., 1912-1914.

Asotin Creek near Shelmans ranch, near Asotin, Wash., 1904-1906.

Asotin Creek near Asotin, Wash., 1904-5; 1910; 1911.

Selway River (head of Clearwater River), near Lowell, Idaho, 1911-12.

Clearwater River at Kamiah, Idaho, 1910-1916.

Clearwater River at Lewiston, Idaho, 1910-1913.

Lochsa River near Lowell, Idaho, 1910-1912.

South Fork of Clearwater River near Geangeville, Idaho, 1910-1916.

South Fork of Clearwater River at Kooskia, Idaho, 1910-1912.

Lolo Creek near Greer, Idaho, 1911-12.

Columbia River tributaries—Continued.

- Tucannon River near Pomeroy, Wash., 1913-1915.
- Tucannon River near Starbuck, Wash., 1914-1917.
- Palouse River near Potlatch, Idaho, 1914-
- Palouse River at Elberton, Wash., 1904-5.
- Palouse River near Winona, Wash., 1915-1917.
- Palouse River at Hooper, Wash., 1897-1916.
 - Rock Creek near Ewan (St. John), Wash., 1903-1905; 1914-1917.
 - Cow Creek near Keystone, Wash., 1904-5.
 - Cow Creek near Hooper, Wash., 1904.
- Walla Walla River near Milton, Oreg., 1903-1908.
- Walla Walla River at Whitman, Wash., 1897-1899.
 - South Fork of Walla Walla River near Milton, Oreg., 1906; 1907-1917.
 - South Fork of Walla Walla River near Milton, Oreg. (lower station), 1903-1906.
 - Mill Creek near Walla Walla, Wash., 1913-1917.
- Umatilla River at Gibbon, Oreg., 1896-1911.
- Umatilla River at Pendleton, Oreg., 1891-92; 1903-1905.
- Umatilla River above Furnish reservoir, near Yoakum, Oreg., 1915-
- Umatilla River at Yoakum, Oreg., 1903-1916.
- Umatilla River near Umatilla, Oreg., 1903-
 - North Fork of Umatilla River near Gibbon, Oreg., 1912-1915.
 - McKay Creek near Pendleton, Oreg., 1903-4.
 - Farmers' mill ditch at Pendleton, Oreg., 1905.
 - Slusher & Gould ditch near Nolin, Oreg., 1905-6.
 - Lisle & Crane ditch near Echo, Oreg., 1905.
 - Charles Lisle ditch at Echo, Oreg., 1905-6.
 - Henrietta mill ditch at Echo, Oreg., 1905-6.
 - Wilson & Co.'s ditch at Echo, Oreg., 1905-6.
 - Allen ditch at Echo, Oreg., 1905-6.
 - Western Land & Irrigation Co.'s (Hinkle) ditch at Echo, Oreg., 1905-6.
 - Pioneer ditch at Echo, Oreg., 1905-6.
 - Maxwell ditch at Echo, Oreg., 1905-6.
 - Maxwell Land & Irrigation Co.'s (Hermiston) ditch near Hermiston, Oreg., 1905-6.
 - Beitle ditch near Hermiston, Oreg., 1905-6.
 - Oregon Land & Water Co.'s ditch at Umatilla, Oreg., 1905-6.
 - Brownell ditch at Umatilla, Oreg., 1905-6.
- Willow Creek near Arlington, Oreg., 1905-6.
- Rock Creek near Goldendale, Wash., 1911-1913.
 - Squaw Creek near Goldendale, Wash., 1911-1913.
- John Day River near Prairie City, Oreg., 1916-17.
- John Day River near Dayville, Oreg., 1908-1914.
- John Day River at Clarno, Oreg., 1914-15.
- John Day River at McDonald, Oreg., 1904-
 - Strawberry Creek near Prairie City, Oreg., 1916-17.
 - South Fork of John Day River at Dayville, Oreg., 1908-1914.
 - Dayville ditch at Dayville, Oreg., 1910-1914.
- North Fork of John Day River:
 - Desolation Creek near Dale, Oreg., 1915-1917.
 - Camas Creek above Cable Creek, near Ukiah, Oreg., 1914-1917.
 - Camas Creek below Cable Creek, near Ukiah, Oreg., 1914.
 - Cable Creek near Ukiah, Oreg., 1914-1917.
- Rock Creek at Rockcreek, Oreg., 1905; 1911.

Columbia River tributaries—Continued.

- Deschutes River at Crane Prairie, near Lapine, Oreg., 1907-1913; 1914-1917.
 Deschutes River at Forest Service bridge, near Lapine, Oreg., 1910; 1912; 1913; 1914-1917.
 Deschutes River near Lava, Oreg., 1905-1907; 1909-1911; 1912; 1913-1915.
 Deschutes River at West's ranch, near Lava, Oreg., 1906-1909; 1914.
 Deschutes River at Benham Falls, Oreg., 1909-1914.
 Deschutes River at Lava Island, Oreg., 1915-16.
 Deschutes River at Bend, Oreg., 1904-1914.
 Deschutes River below Bend, Oreg., 1914-
 Deschutes River at Tumalo [Laidlaw], Oreg., 1909-1912; 1914-15.
 Deschutes River near Cline Falls, Oreg., 1910-11; 1912-13.
 Deschutes River at Mecca, Oreg., 1911-
 Deschutes River at Sherar, Oreg., 1912-1914.
 Deschutes River at Moro, Oreg., 1897-1899.
 Deschutes River at Moody (Biggs), Oreg., 1906-
 Odell Creek near Crescent, Oreg., 1911; 1912; 1913; 1914.
 Fall River near Lapine, Oreg., 1912.
 East Fork at Crescent, Oreg., 1904-1908; 1910-1914.
 East Fork at Morson intake, near Lapine, Oreg., 1914-1917.
 East Fork near Lapine, Oreg., 1910-1913.
 East Fork at Allen's ranch, near Lava, Oreg., 1905-1912; 1913-1915.
 Crescent Creek at outlet of Crescent Lake, near Crescent, Oreg., 1911; 1912-1915.
 Crescent Creek below Cold Creek, near Crescent, Oreg., 1912-13.
 Crescent Creek near Crescent, Oreg., 1912-13; 1914.
 Big Marsh Creek near Crescent, Oreg., 1912-1914.
 Arnold Canal near Bend, Oreg., 1914-
 Central Oregon canal near Bend, Oreg., 1905-
 Pilot Butte canal near Bend, Oreg., 1905-
 North canal near Bend, Oreg., 1913-
 Swalley canal near Bend, Oreg., 1913-
 Tumalo Creek near Tumalo [Laidlaw], Oreg., 1906-1914.
 Tumalo Creek near Bend, Oreg., 1906-
 Lewis Creek near Tumalo [Laidlaw], Oreg., 1908-9.
 Wimer canal near Tumalo [Laidlaw], Oreg., 1906-1914; 1916-17.
 Columbia Southern canal near Tumalo [Laidlaw], Oreg., 1906-1914; 1916.
 Tumalo feed canal near Bend, Oreg., 1914-
 Squaw Creek near Sisters, Oreg., 1906-
 Squaw Creek canal near Sisters, Oreg., 1916-
 McAllister's ditch near Sisters, Oreg., 1909-1913.
 Crooked River near Post, Oreg., 1908-1911.
 Crooked River at Hoffman's ranch, near Prineville, Oreg., 1913-14.
 Crooked River near Prineville, Oreg., 1908-1912.
 Crooked River at Prineville, Oreg., 1914.
 Prineville flour mill tailrace at Prineville, Oreg., 1914.
 Ochoco Creek near Howard, Oreg., 1910-11.
 Ochoco Creek at Elliot's ranch, near Prineville, Oreg., 1908-1910; 1914-
 Ochoco Creek at Prineville, Oreg., 1912; 1913-1915.
 Marks Creek near Prineville, Oreg., 1916.
 Mill Creek near Prineville, Oreg., 1916.
 Tableland ditch near Prineville, Oreg., 1915-1917.
 Elliot ditch near Prineville, Oreg., 1908-1910; 1914-1917.
 McKay Creek near Prineville, Oreg., 1915-16.

Columbia River tributaries—Continued.

Deschutes River tributaries—Continued.

Metolius River at Alligham ranger station, near Sisters, Oreg., 1910-1913; 1915-1917.

Metolius River at Hubbard's ranch, near Grandview, Oreg., 1910-1913.

Metolius River at Riggs ranch, near Sisters, Oreg., 1908-1912.

Lake Creek near Sisters, Oreg., 1911-1913; 1915-

First Creek near Sisters, Oreg., 1915-1917.

Jack Creek near Sisters, Oreg., 1915-16.

Canyon Creek near Sisters, Oreg., 1915-16.

Whitewater River near Grandview, Oreg., 1911-1913.

Shitike Creek at Warmspring, Oreg., 1911-1916.

Trout Creek near Antelope, Oreg., 1915; 1916-17.

Trout Creek near Gateway, Oreg., 1915; 1916.

Hay Creek near Hay Creek, Oreg., 1915; 1916.

Warm Springs River near Warmspring, Oreg., 1911-

Mill Creek near Warmspring, Oreg., 1915.

White River near Tygh Valley, Oreg., 1911-

Tygh Creek at Tygh Valley, Oreg., 1911-1913.

Klickitat River above Pearl Creek, near Glenwood, Wash., 1910; 1916.

Klickitat River above Big Muddy Creek, Wash., 1905.

Klickitat River below Big Muddy Creek, Wash., 1905; 1907-8.

Klickitat River at Camp Klickitat, Wash., 1907-8.

Klickitat River near Glenwood, Wash., 1909-

Klickitat River below Glenwood, Wash., 1914.

Klickitat River at Hanson's cable, near Klickitat, Wash., 1908-9.

Klickitat River at Klickitat (Wright), Wash., 1909-1912.

Klickitat River at Wols Ferry, near Lyle, Wash., 1907-1910.

Klickitat River near Lyle, Wash., 1912.

Pearl Creek near Glenwood, Wash., 1916.

Swamp Creek near Glenwood, Wash., 1916.

West Fork of Klickitat River near Glenwood, Wash., 1910; 1916.

Surveyors Creek near Glenwood, Wash., 1916.

Cunningham Creek near Glenwood, Wash., 1916.

Big Muddy Creek near Glenwood, Wash., 1916-

Big Muddy River above mouth of Cougar Creek, near Wright, Wash., 1905; 1908.

Cougar Creek near Glenwood, Wash., 1916.

Little Klickitat River near Goldendale, Wash., 1910-1912.

Hood River at Dee, Oreg., 1913-1917.

Hood River at Winans, Oreg., 1905-1907; 1910-1912; 1913.

Hood River at Tucker Bridge, Oreg., 1897-1899; 1913-1917.

Hood River at Powerdale, near Hood River, Oreg., 1913-

East Fork of Hood River near Mount Hood, Oreg., 1913.

East Fork Hood River near Dee, Oreg., 1917.

East Fork Irrigation District canal near Mount Hood, Oreg., 1913-

West Fork of Hood River near Dee, Oreg., 1913-1916.

Pacific Light & Power Co.'s tailrace near Hood River, Oreg., 1914; 1916-

White Salmon River at splash dam near Trout Lake, Wash., 1912-1917.

White Salmon River at Husum, Wash., 1909-

White Salmon River at Condit dam, near Underwood, Wash., 1912-13.

White Salmon River near Underwood, Wash., 1915-

Trout Creek at Guler, Wash., 1909-1911.

Columbia River tributaries—Continued.

- Little White Salmon River below Lava Creek, near Cook, Wash., 1903-1906.¹
- Little White Salmon River near Cook, Wash., 1909.
- Latourell Creek at Latourell, Oreg., 1912-13.
- Sandy River above Salmon River, at Brightwood, Oreg., 1910-1914.
- Sandy River below Salmon River, near Brightwood, Oreg., 1907-1911.
- Sandy River near Marmot, Oreg., 1911-1915.
- Sandy River at and below dam near Marmot, Oreg., 1915-
- Sandy River above Bull Run River, near Bull Run, Oreg., 1910-1912.
- Sandy River below Bull Run River, near Bull Run, Oreg., 1910-1914.
- Clear Fork of Sandy River near Welches, Oreg., 1913; 1914-15.
- Lost Creek near Brightwood, Oreg., 1913-
- Sandy River canal near Marmot, Oreg., 1916-
- Still Creek near Rowe, Oreg., 1910-1912.
- Salmon River near Rowe, Oreg., 1910-1912.
- Salmon River at Welches, Oreg., 1913-14.
- Salmon River at Fish Hatchery, near Brightwood, Oreg., 1912-13.
- Bull Run River near Bull Run, Oreg., 1895-
- Little Sandy River near Marmot, Oreg., 1913-
- Little Sandy River near Bull Run, Oreg., 1911-1913.
- Little Sandy flume near Bull Run, Oreg., 1912-13.
- Willamette River, Middle Fork (head of Willamette River), above Salt Creek, near Oakridge, Oreg., 1913-14.
- Willamette River, Middle Fork, below North Fork, near Oakridge, Oreg., 1911-12.
- Willamette River, Middle Fork, at Jasper, Oreg., 1905-1912; 1913-1917.
- Willamette River at Springfield, Oreg., 1911-1913.
- Willamette River at Albany, Oreg., 1878-1880; 1892-
- Willamette River at Salem, Oreg., 1909-1916.
- Willamette River at Oregon City, Oreg., 1909-1912.
- Salt Creek near Oakridge, Oreg., 1913-14.
- Salmon Creek near Oakridge, Oreg., 1913-
- North Fork of Middle Fork of Willamette River near Oakridge (Hazeldell), Oreg., 1909-1912; 1913-1916.
- Fall Creek near Fall Creek, Oreg., 1911.
- Coast Fork of Willamette River near Goshen, Oreg., 1905-1912.
- Row River near Disston, Oreg., 1910-1913.
- McKenzie River at Clear Lake, Oreg., 1912-1915.
- McKenzie River at McKenzie Bridge, Oreg., 1910-
- McKenzie River at Martins Rapids, Oreg., 1910-11.
- McKenzie River near Springfield, Oreg., 1905-1915.
- Eugene power canal near Walterville, Oreg., 1912-1915.
- North Santiam River near Hoover, Oreg., 1910-1913.
- North Santiam River at Detroit, Oreg., 1907-1909.
- North Santiam River at Niagara, Oreg., 1908-
- North Santiam River at Mehama, Oreg., 1905-1907; 1910-1914.
- Santiam River at Jefferson, Oreg., 1905-6; 1908-1916.
- Marion Fork of Santiam River at Marion Lake, near Hoover, Oreg., 1907; 1909-1912.
- Puzzle Creek near Detroit (Hoover), Oreg., 1907; 1909.
- North Fork of Puzzle Creek near Hoover, Oreg., 1909-1912.
- South Fork of Puzzle Creek near Hoover, Oreg., 1909-1912.
- Pamelia Creek near Detroit, Oreg., 1907; 1909; 1913.

¹ Records published in U. S. Geol. Survey Water-Supply Paper 272, pp. 428-429.

Columbia River tributaries—Continued.

Willamette River tributaries—Continued.

Santiam River tributaries—Continued.

Whitewater Creek near Detroit, Oreg., 1907; 1913.

Breitenbush Creek near Detroit, Oreg., 1910-1913.

South Santiam River near Cascadia, Oreg., 1910-1913.

South Santiam River near Foster, Oreg., 1911.

South Santiam River at Waterloo, Oreg., 1905-1907; 1910-11.

Middle Santiam River near Foster, Oreg., 1911.

Luckiamute River near Suver, Oreg., 1905-1911.

Yamhill River, South Fork (head of Yamhill River), at Sheridan, Oreg., 1906-1911.

Yamhill River at La Fayette, Oreg., 1908-1914.

Molalla River near Molalla, Oreg., 1905-1909.

Clackamas River near Cazadero, Oreg., 1909-

Clackamas River at Estacada, Oreg., 1908-1911.

Clackamas River near Barton, Oreg. (replaced by Estacada station), 1905-1908.

Clackamas River at Park Place, Oreg., 1911-12.

Oak Grove Fork of Clackamas River at Timothy Meadows, near Cazadero, Oreg., 1913-1916.

Oak Grove Fork of Clackamas River at intake, near Cazadero, Oreg., 1909-

Lewis River above Muddy River near Cougar, Wash., 1909.

Lewis River near Cougar, Wash., 1909-1912.

Lewis River near Amboy, Wash., 1911-

Lewis River at Ariel, Wash., 1909.

Muddy River at mouth, near Cougar, Wash., 1909.

Pine Creek at mouth, near Cougar, Wash., 1909.

Swift Creek at mouth, near Cougar, Wash., 1909.

Kalama River near Kalama, Wash., 1911-1913; 1916-

Ohanapecosh River near Lewis, Wash., 1907-1917.

Cowlitz River at Lewis, Wash., 1911-

Cowlitz River at Randle, Wash., 1910-1912.

Cowlitz River at Mossy Rock, Wash., 1912-1917.

Cowlitz River at Mayfield, Wash., 1910-11.

Clear Fork near Lewis, Wash., 1907-1917.

Coal Creek near Lewis, Wash., 1910-1915.

Lake Creek at outlet of Packwood Lake, near Lewis, Wash., 1911-

Lake Creek at mouth, near Lewis, Wash., 1907-1915.

Hagar Creek near Lewis, Wash., 1911-12; 1913-14.

North Fork of Hagar Creek near Lewis, Wash., 1911-12; 1913-14.

Johnson Creek below West Fork, near Lewis, Wash., 1911-1914.

Johnson Creek at mouth, near Lewis, Wash., 1907-1914.

Glacier Creek near Lewis, Wash., 1911-1914.

Cispus River near Randle, Wash., 1910-1912.

Toutle River at St. Helens, Wash., 1909.

Toutle River near Castle Rock, Wash., 1909-1912.

Youngs River near Astoria, Oreg., 1916-

STREAMS BETWEEN COLUMBIA RIVER AND KLAMATH RIVER.

Rogue River near Prospect, Oreg., 1907-1912.

Rogue River below Prospect, Oreg., 1913-

Rogue River near Trail, Oreg., 1910-1913.

- Rogue River near Tolo, Oreg., 1905-
Rogue River near Galice, Oreg., 1906.
California-Oregon Power Co.'s flume near Prospect, Oreg., 1913-
Mill Creek near Prospect, Oreg., 1910.
Big Butte Creek, South Fork (head of Big Butte Creek), at Butte Falls, Oreg., 1910-11; 1915.
Little Butte Creek, South Fork (head of Little Butte Creek), near Deadwood, Oreg., 1917.
Little Butte Creek, South Fork, near Lake Creek, Oreg., 1910-1913.
Little Butte Creek above Eagle Point, Oreg., 1916-
Little Butte Creek near Eagle Point, Oreg., 1907-1916.
Dead Indian Creek near Lilyglen, Oreg., 1916-
North Fork of Little Butte Creek, near Lake Creek, Oreg., 1911-1913; 1916-
Rogue River Valley canal at intake, near Lake Creek, Oreg., 1914; 1915; 1916.
Rogue River Valley canal near Brownsboro, Oreg., 1913; 1915-
Bear Creek at Talent, Oreg., 1907-1914.
Bear Creek at Medford, Oreg., 1915-
Neil Creek near Ashland, Oreg., 1913.
George Dunn ditch near Ashland, Oreg., 1913.
Ashland Creek at Ashland, Oreg., 1913.
Wagner Creek near Talent, Oreg., 1913.
Phoenix ditch near Talent, Oreg., 1916-
Evans Creek at Wimer, Oreg., 1913.
Applegate River near Buncom, Oreg., 1911-1914.
Applegate River at Murphy, Oreg., 1907-1910.
Cameron ditch near Buncom, Oreg., 1911-1914.
East Fork of Little Applegate River near Buncom, Oreg., 1913.
Little Applegate River near Ruch, Oreg., 1913.
West Fork of Little Applegate River near Buncom, Oreg., 1913.
Spicer ditch near Buncom, Oreg., 1913.
Thompson Creek near Applegate, Oreg., 1913.
Slate Creek at Wonder, Oreg., 1913.
Grave Creek near Placer, Oreg., 1913.
Coquille River, South Fork, at Powers, Oreg., 1916-
South Umpqua River (head of Umpqua River) near Tiller, Oreg., 1910-11.
South Umpqua River near Brockway, Oreg., 1905-1912.
Umpqua River near Elkton, Oreg., 1905-
Cow Creek at Riddle, Oreg., 1911-12.
North Umpqua River at Tokeetee Falls near Hoaglin, Oreg., 1908-9; 1914-1917.
North Umpqua River near Hoaglin, Oreg., 1910-1912; 1914-1916.
North Umpqua River near Glide, Oreg., 1915-
North Umpqua River near Oakcreek, Oreg., 1905-1908; 1913-1915.
North Umpqua River at Winchester, Oreg., 1908-1913.
Calapooya Creek near Sutherlin, Oreg., 1912-13.
Luse canal near Sutherlin, Oreg., 1912-13.
Mill Creek near Ash, Oreg., 1907-1912; 1915-1917.
Siletz River at Siletz, Oreg., 1905-1912.
Wilson River near Tillamook, Oreg., 1914-1916.
North Fork of Wilson River near Tillamook, Oreg., 1913-1915; 1916.
Nehalem River at Salmonberry, near Balm, Oreg., 1913-14.

REPORTS ON WATER RESOURCES OF THE NORTH PACIFIC SLOPE DRAINAGE BASINS.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, Washington, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

- *4. A reconnaissance in Southeastern Washington, by I. C. Russell, 1897. 96 pp., 7 pls. 15c.

Describes an area "bordered on the south by Oregon, on the east by Idaho, on the north by Snake River, and on the west by the Columbia," and "briefly designated as lying south of Snake River," discusses climate, vegetation, topography and drainage, geologic formations—including the river terraces and soils—irrigation, and the artesian water supply, and gives an outline of the geological history of the region.

- *44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp. 11 pls. 15c.

Gives elevations and distances along Columbia, Willamette, Flathead, and Snake rivers.

- *53. Geology and water resources of Nez Perce County, Idaho, Part I, by I. C. Russell. 1901. 85 pp., 10 pls. 10c.

- *54. Geology and water resources of Nez Perce County, Idaho, Part II, by I. C. Russell. 1901. 55 pp. (87-141).

Nos. 53 and 54 relate to an area "in western Idaho, bordered on the west by portions of Washington and Oregon," drained through Snake River to the Columbia; they describe the topography, geology, and soils of the region, discuss the relation of the surface features—plateaus, canyons, streams, etc.—to the geology and the climate, the source and quantity of the water supply, including springs and artesian wells, and refer briefly to the occurrence of building stones, lignite, gold, silver, and copper. They include also a short bibliography of artesian waters and two appendixes—one giving list of elevations, and the other notes concerning Portland cement.

55. Geology and water resources of a portion of Yakima County, Wash., by G. O. Smith. 1901. 68 pp., 7 pls. 10c.

Describes topography, climate, soil, agriculture, geology, and surface and ground waters of an area comprising about 50 square miles in the vicinity of North Yakima; discusses in some detail the artesian basins and wells.

- *57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. 5c.

- *61. Preliminary list of deep borings in the United States, Part II, (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second, revised, edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

- *78. Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon, by I. C. Russell. 1903. 53 pp., 2 pls. 5c.

Discusses briefly the rocks and geologic structure of a part of the Snake River Plains in Canyon and Owyhee counties, Idaho, and Malheur and Harney counties, Oreg.; describes briefly the conditions on which artesian flow depends, and in some detail the springs and drilled wells in the Lewis, Otis, Harney, and Whitehorse artesian basins; also describes artesian wells in alluvial deposits and discusses the size of drill holes, casings, etc., the preservation of well records, and the importance of laws to control the use of artesian waters; gives list of publications bearing on artesian waters.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer, 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:
 Investigations in Idaho, by D. W. Ross. Describes the irrigable lands in the area drained by Snake River.
 Investigations in Oregon, by J. T. Whistler. Mentions the Umatilla, Malheur, and Harney projects.
 Work in Washington, by T. A. Noble. Describes the plains of Columbia River.
96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.
 Gives an account of a flood (commonly spoken of as the "Heppner disaster") on Willow Creek, a tributary of Columbia River, in Morrow County, Oreg.
- *103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. [Superseded by No. 152, q. v.]
 Cites statutory restrictions of water pollution in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.
111. Preliminary report on the underground waters of Washington, by Henry Landes. 1905. 85 pp., 1 pl. 10c.
 Describes, by counties, the municipal water supplies, deep wells, and springs in the State, giving also for each county a brief account of the climate, rainfall, topography, drainage, and geology.
118. Geology and water resources of a portion of east-central Washington, by F. C. Calkins. 1905. 96 pp., 4 pls. 5c.
 Describes briefly the topography, geology, climate, vegetation, grazing, and agriculture on the Columbia Plains and in Kittitas Valley; discusses the streams, springs, and shallow and deep wells.
- *122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.
 Cites legislative acts relating to ground waters in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.
- *149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.
 Gives, by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.
- *152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.
 Cites statutory restrictions of water pollution in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.
- *162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.
 Gives estimates (p. 85) of flood discharge and frequency for Boise River at Boise and Weiser River at Weiser, Idaho.
- *231. Geology and water resources of the Harney Basin region, Oregon, by G. A. Waring. 1909. 93 pp., 5 pls. 25c.
 The greater part of the area covered by this report is in the Great Basin, but a small tract in the northeastern corner is drained by a number of small streams that are tributary to Malheur River.
253. Water powers of the Cascade Range, Part I, Southern Washington, by J. C. Stevens. 1910. 94 pp., 21 pls. 40c.
 Discusses conditions governing hydraulic development, water laws of Washington, and variations in streams; describes the drainage basins of Klickitat, White Salmon, Little White Salmon, Lewis, and Toutle rivers; gives results of observations at gaging stations, and estimates of average minimum discharge and of the available horsepower at the power sites.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Boise, Malheur, Payette, and Palouse rivers, and Salmon Creek.

313. Water powers of the Cascade Range, Part II, Cowlitz, Nisqually, Puyallup, White, Green, and Cedar drainage basins, by F. F. Henshaw and G. L. Parker. 1913. 170 pp., 16 pls. 55c.

Describes the geological features and history of the drainage basins, topography and drainage, soils and vegetation, and precipitation; gives stream-flow records and discusses water powers, storage, and power sites; discusses also natural resources and harbors of the Pacific coast, central electric stations, and power utilization, and gives commercial and residential rates. See also 253.

316. Geology and water resources of a portion of south-central Washington, by G. A. Waring. 1913. 46 pp., 1 pl. 5c.

Describes settlements, climate and vegetation, agriculture, grazing, geographic provinces, relation of surface features and structure, and geology; discusses shallow and artesian waters and irrigation enterprises in Sunnyside and Reservation valleys, Horse Heaven Plateau, and the Columbia River Plains, and irrigation along lower Yakima River; gives tabulated data concerning wells and springs.

- *339. Quality of the surface waters of Washington, by Walton Van Winkle. 1914. 105 pp., 2 pls. 15c.

Discusses briefly the natural and economic features of the State, the constituents and uses of the natural waters, purification of water, methods of analysis, and industrial and geochemical interpretation of the results of analysis; describes the general features of the principal drainage basins and gives the results of an investigation of the character of the river waters; treats briefly of the average chemical composition of river water, the economic value of the rivers, denudation, and the influence of natural features on the character of the waters.

344. Deschutes River, Oregon, and its utilization, by F. F. Henshaw, John H. Lewis, and E. J. McCaustland. 1914. 200 pp., 28 pls. 50c.

A report, prepared in cooperation with the State of Oregon, containing the results of measurements of stream flow, a discussion of the economic distribution of the water, and chapters on the quality of the water supply, the availability of the water supply, the developed water powers, undeveloped power sites, water rights and appropriations, the relation of the Federal Government to the development of water power, and Government permits for power and reservoir sites.

346. Profile surveys in the basin of Clark Fork of Columbia River, Montana-Idaho-Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 6 pp., 3 pls. (22 sheets). 50c.

- *347. Profile surveys in Snake River basin, Idaho, prepared under the direction of R. B. Marshall, chief geographer. 1914. 12 pp., 3 pls. (37 sheets). 55c.

348. Profile surveys in Hood and Sandy River basins, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 2 pls. (6 sheets). 30c.

349. Profile surveys in Willamette River basin, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 3 pls. (16 sheets). 30c.

363. Quality of the surface waters of Oregon, by W. Van Winkle. 1914. 137 pp., 2 pls. 20c.

Describes the topography, drainage, rocks and soils, climate, population, and industries of the State, the constituents of natural waters, water for domestic and industrial uses, and purification of water, methods of analysis, and interpretation of results of analysis; describes the general features of the river basins and the character of the river waters, discusses the conditions influencing the quality of the surface waters, average chemical composition, geochemical character, denudation, industrial value, and value for irrigation.

- *364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.
Contains analyses of Soap and Omak lakes, Wash., and of mine waters from Butte, Mont.
366. Profile surveys of Snoqualmie, Sultan, and Skykomish rivers, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 7 pp., 3 pls. (12 sheets). 20c.
368. Profile surveys in Wenatchee River basin, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 7 pp., 1 pl. (8 sheets). 20c.
369. Water powers of the Cascade Range. Part III, Yakima River basin, by G. L. Parker and F. B. Storey, 1916. 169 pp., 20 pls. 45c.
Describes the geography of the basin, the geologic history, physiography and river history, climate, settlement, and development, population, and transportation; gives stream-flow records and discusses natural conditions affecting stream flow; storage reservoirs, developed and undeveloped power sites; treats also of the industrial development of the region, discussing irrigation by gravity systems and by pumping, the production of coal and other minerals, and manufacturing; presents a scheme of development and utilization of stored water. The report was prepared under the direction of the Washington State Board of Geological Survey, and is based on data consisting of "stream-flow records, river plans and profiles, reservoir surveys, and field reconnaissance of the rivers and their various tributaries," obtained by the United States Geological Survey and the United States Reclamation Service, supplemented by a large amount of information furnished by private parties.
370. Surface water supply of Oregon, 1878-1910, by F. F. Henshaw and H. J. Dean. 1915. 829 pp., 1 pl. 45c.
Describes briefly the natural features of Oregon and in greater detail the general features of the river basins; consists principally of records of stream flow that have been carefully studied and recomputed when necessary to insure their best possible interpretation.
- *376. Profile surveys in Chelan and Methow River basins, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1915. 8 pp., 5 pls. 15c.
377. Profile surveys in Spokane River basin, Washington, and John Day River basin, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1915. 7 pp., 10 pls. 15c.
378. Profile surveys in 1914 on Middle Fork of Willamette River and White River, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1915. 8 pp., 6 pls. 15c.
379. Profile surveys in 1914 in Umpqua River basin, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1915. 7 pp., 13 pls. 20c.
- *400. Contributions to the hydrology of the United States, 1916, Nathan C. Grover, chief hydraulic engineer, 1917. 108 pp., 7 pls. 15c. Contains:
(b) Artesian water for irrigation in Little Bitterroot Valley, Mont., by O. E. Meinzer.
419. Profile surveys in 1915 in Skagit River basin, Washington, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 8 pp., 12 pls. 15c.
420. Profile surveys along Henrys Fork, Idaho, and Logan River and Blacksmith Fork, Utah, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 8 pp., 10 pls. 10c.
- *425. Contributions to the hydrology of the United States, 1917, N. C. Grover, chief hydraulic engineer, 1918. Contains:
(c) Ground water in Quincy Valley, Wash., by A. T. Schwennesen and O. E. Meinzer.

BULLETINS.

An asterisk (*) indicates that the Geological Survey's stock of the paper is exhausted. Many of the papers so marked may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C. Bulletins are of octavo size.

- *199. Geology and water resources of the Snake River Plains of Idaho, by I. C. Russell. 1902. 192 pp., 25 pls. 25c.

Describes the topography, geology, climate, vegetation, fauna, and soils of an area extending entirely across the southern part of Idaho; discusses streams, springs, water powers, irrigation and agriculture, industries, and routes of transportation and highways; treats of the origin of surface and subsurface waters, the requisite conditions for artesian wells and the quantity of water available.

- *252. Preliminary report on the geology and water resources of central Oregon, by I. C. Russell. 1905. 138 pp., 24 pls. 15c.

Describes a portion of the extreme northern part of the Great Basin and a part of the drainage area of Deschutes River and its principal tributary, Crooked River; gives an account of the topography, drainage, rainfall and temperature, winds, and forests; describes the volcanic sedimentary rock formations, and discusses by counties the geology and topography, the surface and ground waters; treats of artesian conditions in the Deschutes basin and makes suggestions concerning artesian well records.

- *264. Record of deep-well drilling for 1904, by M. L. Fuller, E. F. Lines, and A. C. Veatch. 1905. 106 pp. 10c.

- *298. Record of deep-well drilling for 1905, by M. L. Fuller and Samuel Sanford. 1906. 299 pp. 25c.

Bulletins 264 and 298 give an account of progress in the collection of well records and samples, and contain tabulated records of wells in Idaho, Montana, Nevada, Oregon, Washington, and Wyoming. No. 298 gives detailed records of wells in Flathead County, Mont., and Benton, Jefferson, and Walla Walla counties, Wash. The wells of which detailed sections are given were selected because they afford valuable stratigraphic information.

ANNUAL REPORTS.

Each of the papers contained in the annual reports was also issued in separate form.

Annual reports are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers so marked, however, may be purchased from the SUPERINTENDENT OF DOCUMENTS, WASHINGTON, D. C.

- *Tenth Annual Report of the Director of the United States Geological Survey, 1888-89, J. W. Powell, Director. 1890. 2 parts. *Pt. II. Irrigation, viii, 123 pp. 35c.

Makes a preliminary report on the organization and prosecution of the survey of the arid lands for purposes of irrigation; includes an account of the methods of topographic and hydraulic work, the segregation work on reservoir sites and irrigable lands, field and office methods, and brief descriptions of the topography of some of the river basins.

- Eleventh Annual Report of the United States Geological Survey, 1889-90, J. W. Powell, Director. 1891. 2 parts. Pt. II. Irrigation, xiv, 395 pp. 30 pls. and maps. \$1.25. Contains:

*Hydrography, pp. 1-110. Discusses scope of work, methods of stream measurement, rainfall and evaporation, and describes the more important streams.

*Engineering, pp. 111-200. Defines the scope of the work and gives an account of the survey in the Sun River basin and in the Arkansas, Rio Grande, California, Lahontan, Utah, and Snake River divisions.

*Topography, pp. 291-343. Comprises reports of the topographic surveys in California, Nevada, Colorado, Idaho, Montana, and New Mexico, and a report on reservoir sites.

*Irrigation literature, pp. 345-388. Gives a list of books and pamphlets on irrigation and allied subjects, mainly contained in the library of the United States Geological Survey.

- *Twelfth Annual Report of the Director of the United States Geological Survey, 1890-91, J. W. Powell, Director. 1891. 2 parts. Pt. II, Irrigation, xviii, 576 pp. 93 pls. \$2. Contains:

*Hydrography of the arid regions, by F. H. Newell, pp. 213-361, Pls. 58-106. Discusses the available water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River basin.

Thirteenth Annual Report of the United States Geological Survey, 1891-92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. \$1.85. Contains:

*Engineering results of irrigation survey, by H. M. Wilson, pp. 351-427, Pls. 147-182. Describes structures on the Pocatello canal, Idaho.

Sixteenth Annual Report of the United States Geological Survey, 1894-95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 43 pls. \$1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457-533, Pls. 35-39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant land; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Nineteenth Annual Report of the United States Geological Survey, 1897-98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xvii, 400 pp., 110 pls. \$1.25. 16 maps in separate case, 75c. Contains:

*Priest River Forest Reserve, by J. B. Leiber, pp. 217-252, Pls. 48-61.

*Bitterroot Forest Reserve, by J. B. Leiber, pp. 253-282, Pls. 62-73.

*Washington Forest Reserve, by H. B. Ayres, pp. 283-313, Pls. 76-100.

*Eastern part of Washington Forest Reserve, by M. W. Gorman, pp. 315-350, Pl. 101.

*Forest conditions of northern Idaho, by J. B. Leiber, pp. 373-386, Pls. 109-110.

These reports describe the topography and the streams of the forest reserves.

Twentieth Annual Report of the United States Geological Survey, 1898-99, Charles D. Walcott, Director. 1899. (Pts. II, III, IV, V, and VII, 1900.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xix, 498 pp., 159 pls., 8 maps in separate case. \$2.80. Contains:

*The Flathead Forest Reserve, by H. B. Ayres, pp. 245-316, Pls. 77-113.

*Bitterroot Forest Reserve, by J. B. Leiber, pp. 317-409, Pls. 115-142. Contains brief descriptions of the streams and lakes in the reserves.

Twenty-first Annual Report of the United States Geological Survey, 1899-1900, Charles D. Walcott, Director. 1900. (Pts. III, IV, VI, VI continued, and VII, 1901.) 7 parts in 8 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, 711 pp., 143 pls., 39 maps in separate case. \$3.85. Contains:

*Mount Rainier Forest Reserve, Washington, by F. G. Plummer, pp. 81-143, Pls. 33-50.

*Olympic Forest Reserve, Washington, from field notes by Arthur Dodwell and T. F. Rixon, pp. 145-208, Pls. 51-70.

*Cascade Range Forest Reserve, Oregon, from T. 28 S. to T. 37 S., inclusive, together with the Ashland Forest Reserve and adjacent forest regions from T. 28 S. to T. 41 S., inclusive, and from R. 2 W. to R. 14 E., Willamette meridian, inclusive, by J. B. Leiber, pp. 209-498, Pls. 71-84. Contains descriptions of many of the streams flowing through the forest reserves.

GEOLOGIC FOLIOS.

Under the plan adopted for the preparation of a geologic map of the United States the entire area is divided into small quadrangles, bounded by certain meridians and parallels, and these quadrangles, which number several thousand, are separately surveyed and mapped.¹ The unit of survey is also the unit of publication, and the maps and description of each quadrangle are issued in the form of a folio. When all the folios are completed they will constitute the Geologic Atlas of the United States.

A folio is designated by the name of the principal town or of a prominent natural feature within the quadrangle. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped and several pages of descriptive text. The text explains the maps and describes the topographic

¹ Index maps showing areas in the North Pacific slope basins covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but the folios are usable and are sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy except folio 193, which sells for 75 cents a copy. If 34 folios selling at 25 cents each (or their equivalent in higher-priced folios) are ordered at one time a discount of 40 per cent is allowed; \$5.10 is the minimum amount accepted at this rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*45. Boise, Idaho.

86. Ellensburg, Wash. 5c.

*103. Nampa, Idaho-Oregon.

Describes the relief, drainage, climate, and vegetation of the area; discusses the geologic history and geologic formations, and, under "Economic geology," the surface waters available for irrigation, the springs and shallow wells, and the artesian wells; indicates areas of possible artesian flow.

104. Silver City, Idaho. 5c.

106. Mount Stuart, Wash. 5c.

*139. Snoqualmie, Wash.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the northern Pacific coast drainage basins are the reports of the commissioner of conservation of the State of Montana; the State land commission; the State engineer of Idaho; the Bureau of Industry, Agriculture, and Irrigation of Nevada; the State engineers of Nevada, Oregon, Utah, and Washington; the annual reports of the United States Reclamation Service; and the reports of the Chief of Engineers, U. S. Army. The following reports deserve special mention:

The Oregon system of water titles, by John H. Lewis: Oregon State Engineer Bull. 2, 1912.

State and National water laws, with a detailed statement of the Oregon system of water titles, by John H. Lewis, with a discussion by Clarence T. Johnston and L. J. Le Conte: Am. Soc. Civil Eng. Trans., vol. 76, pp. 637-758, 1913.

Report of the commission on conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests: Helena, 1911; also report of the governor of the State of Montana on the same subject.

How to appropriate the public waters of the State of Nevada, compiled by W. M. Kearney, State engineer, 1911.

Requirements and regulations, including suggestions and instructions in relation to the appropriation, use, and measurement of water in the State of Nevada: State engineer of Nevada, 1912.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bur. of Industry, Agr., and Irr. Bull. 8, 1913.

The water resources of Washington: Potable and mineral water, by H. G. Byers; artesian water, by C. A. Ruddy; water power, by R. E. Heine: Washington Geol. Survey Ann. Rept. for 1901, vol. 1, pt. 5, 1902.

Preliminary report on the Quincy Valley irrigation project, by Henry Landes and others: Washington Geol. Survey Bull. 14, 1912.

Biennial Report of the State Commissioner of Arid Lands [Washington], 1895-96 and 1897-98.

The irrigated lands of the State of Washington, by George M. Allen, deputy commissioner: State Bureau of Statistics and Immigration, 1910.

Irrigation laws of the State of Wyoming, prepared for publication in the office of the State engineer, 1909.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

- *1. Pumping water for irrigation, by H. M. Wilson. 1896. 56 pp., 9 pls.
Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.
- *3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. See Water-Supply Paper 22.) 10c.
Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.
- *8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.
Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kans; describes instruments and methods and draws conclusions.
- *14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl.
Discusses efficiency of pumps and water lifts of various types.
- *20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.
Includes tables and descriptions of wind wheels, compares wheels of several types, and discusses results.
- *22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.
Gives résumé of Water-Supply Paper 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.
- *41. The windmill, its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 5c.
- *42. The windmill, its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp. (73-147), 2 pls. (15-16). 10c.
Nos. 41 and 42 give details of results of experimental tests with windmills of various types.
- *43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.
- *56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.
Describes the methods used by the Survey in 1901-2. See also Nos. 64, 94, and 95.
- *64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.
Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.
- *67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.
Discusses origin, depth, and amount of ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.
Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.
- *80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.
Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effects of forests on rainfall and run-off.
87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.
First edition was published in Part II of the Twelfth Annual Report.
93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Requests for this paper should be addressed to the U. S. Reclamation Service.]
Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geological Survey and the reports of the conference, the following papers of more or less general interest:
Limits of an irrigation project, by D. W. Ross.
Relation of Federal and State laws to irrigation, by Morris Bien.
Electrical transmission of power for pumping, by H. A. Storrs.
Correct design and stability of high masonry dams, by Geo. Y. Wisner.
Irrigation surveys and the use of the plane table, by J. B. Lippincott.
The use of alkaline waters for irrigation, by Thomas H. Means.
- *94. Hydrographic manual of the United States Geological Survey, prepared by E. C. Murphy, J. C. Hoyt, and G. B. Hollister. 1904. 76 pp., 3 pls. 10c.
Gives instruction for field and office work relating to measurements of stream flow by current meters. See also No. 95.
- *95. Accuracy of stream measurements (second, enlarged edition), by E. C. Murphy. 1904. 169 pp., 6 pls.
Describes methods of measuring and computing stream flow and compares results derived from different instruments and methods. See also No. 94.
- *103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. (See No. 152.)
Explains the legal principles under which antipollution statutes become operative, quotes court decisions to show authority for various deductions, and classifies according to scope the statutes enacted in the different States.
110. Contributions to the hydrology of eastern United States, 1904; M. L. Fuller, geologist in charge. 1905. 211 pp., 5 pls. 10c.
Contains the following reports of general interest. The scope of each paper is indicated by its title.
Description of underflow meter used in measuring the velocity and direction of underground water, by Charles S. Slichter.
The California or "stovepipe" method of well construction, by Charles S. Slichter.
Approximate methods of measuring the yield of flowing wells, by Charles S. Slichter.
Corrections necessary in accurate determinations of flow from vertical well casings, from notes furnished by A. N. Talbot.
Experiments relating to problems of well contamination at Quitman, Ga., by S. W. McCallie.
113. The disposal of strawboard and oil-well wastes, by R. L. Sackett and Isaiah Bowman. 1905. 52 pp., 4 pls. 5c.
The first paper discusses the pollution of streams by sewage and by trade wastes, describes the manufacture of strawboard, and gives results of various experiments in disposing of the waste. The second paper describes briefly the topography, drainage, and geology of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.
- *114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.
Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting ground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.
120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879-1904, by M. L. Fuller. 1905. 128 pp. 10c.
- *122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.
Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.
140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.
Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Calif., and on Long Island, N. Y., gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.
143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls. 5c.
Scope indicated by title.
145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.
Contains brief reports of general interest as follows:
Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.
Construction of so-called fountain and geyser springs, by Myron L. Fuller.
A convenient gage for determining low artesian heads, by Myron L. Fuller.
146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the U. S. Reclamation Service.]
Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:
Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable-gaging station, by E. C. Murphy.
Siltng of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.
147. Destructive floods in the United States in 1904, by E. C. Murphy and others. 1905. 206 pp., 18 pls. 15c.
Contains a brief account of "A method of computing cross-section area of waterways," including formulas for maximum discharge and area of cross section.
- *150. Weir experiments, coefficients, and formulas, by R. E. Horton. 1906. 189 pp. 38 pls. (See Water-Supply Paper 200.) 15c.
Scope indicated by title.

151. Field assay of water, by M. O. Leighton. 1905. 77 pp., 4 pls.
Discusses methods, instruments, and reagents used in determining turbidity, color, iron, chlorides, and hardness in connection with the studies of the quality of water in various parts of the United States.
- *152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.
Scope indicated by title.
- *155. Fluctuations of the water level in wells, with special reference to Long Island, N. Y., by A. C. Veatch. 1906. 83 pp., 9 pls. 25c.
Includes general discussion of fluctuation changes due to rainfall and evaporation, barometric changes, temperature changes, changes in rivers, changes in lake level, tidal changes, effects of settlement, irrigation, dams, underground-water developments, and to indeterminate causes.
- *160. Underground-water papers, 1906; M. L. Fuller, geologist in charge. 1906. 104 pp., 1 pl.
Gives account of work in 1905; lists publications relating to ground waters, and contains the following brief reports of general interest:
Significance of the term "artesian," by Myron L. Fuller.
Representation of wells and springs on maps, by Myron L. Fuller.
Total amount of free water in the earth's crust, by Myron L. Fuller.
Use of fluorescein in the study of underground waters, by R. B. Dole.
Problems of water contamination, by Isaiah Bowman.
Instances of improvement of water in well, by Myron L. Fuller.
- *162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.
- *163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.
Scope indicated by title.
- *179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.
Describes grain distillation; treatment of slop; sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.
- *180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.
Scope indicated by title.
- *185. Investigations on the purification of Boston sewage, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.
Discusses composition, disposal, purification, and treatment of sewages and tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filtration and coarse material; gives bibliography.
- *186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.
Gives history of pollution by acid-iron wastes at Shelby, Ohio, and the resulting litigation; discusses effect of acid-iron liquors on sewage-purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.
- *187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c.
Scope indicated by title.

- *189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amount and character of water used, raw material and finished product, and mechanical filtration.

- *194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls.

Scope indicated by amplification of title.

- *200. Weir experiments, coefficients, and formulas (revision of paper No. 150), by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

- *226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

- *229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

- *234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

- *235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States, Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvements of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

- *255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

- *257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall; water-bearing rocks; amount of ground water; artesian conditions; oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties, contamination of well waters and methods of prevention, tests of capacity and measurement of depth, and costs of sinking wells.

- *258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:

Drainage by wells, by M. L. Fuller.

Freezing of wells and related phenomena, by M. L. Fuller.

Pollution of underground waters in limestone, by G. C. Matson.

Protection of shallow wells in sandy deposits, by M. L. Fuller.

Magnetic wells, by M. L. Fuller.

- *315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of water-works systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water and municipal water softening.

334. The Ohio Valley flood of March-April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

- *337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

- *345. Contributions to the hydrology of the United States, 1914; N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

(e) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53-65.

- *364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells shelters, and structures for making discharge measurements and artificial controls.

- *375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c. Contains:

(c) The relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77-84.

(e) A method of correcting river discharge for a changing stage, by B. E. Jones, pp. 117-130.

(f) Conditions requiring the use of automatic gages in obtaining records of stream flow, by C. H. Pierce, pp. 131-139.

Three papers presented at the conference of engineers of the water-resources branch in December, 1914.

- *400. Contributions to the hydrology of the United States, 1916; N. C. Grover, chief hydraulic engineer. 108 pp., 7 pls. Contains:

(a) The people's interest in water-power resources, by G. O. Smith, pp. 1-8.

(c) The measurement of silt-laden streams, by R. C. Pierce, pp. 39-51.

(d) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53-59.

416. The divining rod, a history of water witching, with a bibliography, by Arthur J. Ellis. 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquiries that are continually being received from all parts of the country" as to the efficacy of the divining rod for locating underground water

- *425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

* (c) Hydraulic conversion tables and convenient equivalents, pp. 71-94. 1917.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

Includes publications prepared, in whole or in part, by the Geological Survey that treat any phase of the subject of ground water or any subject directly applicable to ground water. Illustrated by map showing reports that cover specific areas more or less thoroughly.

ANNUAL REPORTS.

- *Fifth Annual Report of the United States Geological Survey, 1883-84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. \$2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125-173, pl. 21. Scope indicated by title.

- *Twelfth Annual Report of the United States Geological Survey, 1890-91, J. W. Powell, Director. 1891. 2 parts. *Pt. II, Irrigation, xviii, 576 pp., 93 pls. \$2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 363-561, pls. 107 to 146. See Water-Supply Paper 87

- Thirteenth Annual Report of the United States Geological Survey, 1891-92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. \$1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101-349, pls. 11 to 146. Discusses the economical aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho, California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping, and subirrigation.

- Fourteenth Annual Report of the United States Geological Survey, 1892-93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. \$2.10. Contains:

*The potable waters of eastern United States, by W. J. McGee, pp. 1-47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49-88, pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral-spring resorts; contains also some analyses.

- Nineteenth Annual Report of the United States Geological Survey, 1897-98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) - 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. \$2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59-294, pls. 6 to 16. Discusses the amount of waters stored in sandstone, in soil, and in other rocks, and the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium, and through sand, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295-384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

- *72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate, and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee River basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Calif., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 59c.

Presents the results of an investigation undertaken by the United States Geological Survey in response to a memorial from the California Miners' Association asking that a particular study be made of portions of the Sacramento and San Joaquin valleys affected by detritus from torrential streams. The report deals largely with geologic and physiographic aspects of the subject, traces the physical effects, past and future, of the hydraulic mining of earlier decades, the similar effects which certain other industries induce through stimulation of the erosion of the soil, and the influence of the restriction of the area of inundation by the construction of levees. Suggests cooperation by several interests for the control of the streams now carrying heavy loads of débris.

BULLETINS.

- *32. Lists and analyses of the mineral springs of the United States (a preliminary study), by A. C. Peale. 1886. 235 pp.

Defines mineral waters, lists the springs by States, and gives tables of analyses so far as available.

- *319. Summary of the controlling factors of artesian flows, by Myron L. Fuller. 1908. 44 pp., 7 pls. 10c.

Describes underground reservoirs, the sources of ground waters, the confining agents, the primary and modifying factors of artesian circulation, the essential and modifying factors of artesian flow, and typical artesian systems.

- *479. The geochemical interpretation of water analyses, by Chase Palmer. 1911. 31 pp. 5c.

Discusses the expression of chemical analyses, the chemical character of water and the properties of natural waters; gives a classification of waters based on property values and reacting values, and discusses the character of the waters of certain rivers as interpreted directly from the results of analyses; discusses also the relation of water properties to geologic formations, silica in river water, and the character of the water of the Mississippi and the Great Lakes and St. Lawrence River as indicated by chemical analyses.

695. The data of geochemistry (fourth edition), by F. W. Clarke. 1920. 832 pp. 45c.

Earlier editions were published as Bulletins 330, 491, and 616. Contains a discussion of the statement and interpretation of water analyses and a chapter on "Mineral wells and springs" (pp. 175-211). Discusses the definition and classification of mineral waters, changes in the composition of water, deposits of calcareous, ocherous, and siliceous materials made by water, vadose and juvenile waters, and thermal springs in relation to volcanism. Describes the different kinds of ground water and gives typical analyses. Includes a brief bibliography of papers containing water analyses.

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G F=Geologic folio.]

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¹ Many of the reports contain brief subject bibliographies. *See abstracts.*

² Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

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