DEPARTMENT OF THE INTERIOR
FRANKLIN K. LANE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 444

SURFACE WATER SUPPLY OF THE UNITED STATES

1916

PART XII. NORTH PACIFIC SLOPE DRAINAGE BASINS

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

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Prepared in cooperation with the States of
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SURFACE WATER SUPPLY OF LOWER COLUMBIA RIVER BASIN AND PACIFIC SLOPE DRAINAGE BASINS IN OREGON, 1916.

AUTHORIZATION AND SCOPE OF WORK.

This volume is one of a series of 14 reports presenting results of measurements of flow made on streams in the United States during the year ending September 30, 1916.

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

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

The work was begun in 1888 in connection with special studies relating to irrigation in the arid West. Since the fiscal year ending June 30, 1895, successive sundry bills passed by Congress have carried the following items 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, 1895–1917.

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

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 14.

Measurements of stream flow have been made at about 4,100 points in the United States and also at many points in Alaska and the Hawaiian Islands. In July, 1916, 1,290 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, and acre-feet. They may be defined as follows:

"Second-feet" is an abbreviation for "cubic feet per second." A second-foot is the rate of discharge of water flowing in a channel of rectangular cross section 1 foot wide and 1 foot deep at an average velocity of 1 foot per second. It is generally used as a fundamental unit from which others are computed by the use of the factors given in the tables of convenient equivalents (p. 9).

"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.

CONVENIENT EQUIVALENTS.

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

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

Discharge (second-feet per square mile).	Run-off (depth in inches.)				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.03719	1.041	1.079	1.116	1.153
2	.07438	2.083	2.157	2.231	2.306
3	.11157	3.124	3.236	3,347	3.459
4	.14876	4.165	4.314	4.463	4.612
5	.18595	5.207	5.393	5.578	5.764
6	.22314	6.248	6.471	6.694	6.917
7	.26033	7.289	7.550	7.810	8.070
8	.29752	8.331	8.628	8.926	9.223
9	.33471	9.372	9.707	10.041	10.376

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

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

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

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

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

Discharge (second-feet).	Run-off (millions of cubic feet).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.0864	2.419	2.506	2.592	2.678
2	.1728	4.838	5.012	5.184	5.356
3	.2592	7.257	7.518	7.776	8.034
4	.3456	9.676	10.02	10.37	10.71
5	.4320	12.10	12.53	12.96	13.39
6	.5184	14.51	15.04	15.55	16.07
7	.6048	16.93	17.54	18.14	18.75
8	.6912	19.35	20.05	20.74	21.42
9	.7776	21.77	22.55	23.33	24.10

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

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

Discharge (second-feet).	Run-off (millions of gallons).				
	1 day.	28 days.	29 days.	30 days.	31 days.
1	0.6463	18.10	18.74	19.39	20.04
2	1.293	36.20	37.48	38.78	40.08
3	1.939	54.30	56.22	58.17	60.12
4	2.585	72.40	74.96	77.56	80.16
5	3.232	90.50	93.70	96.95	100.2
6	3.878	108.6	112.4	116.3	120.2
7	4.524	126.7	131.2	135.7	140.3
8	5.170	144.8	149.9	155.1	160.3
9	5.817	162.9	168.7	174.5	180.4

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

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

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

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

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

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

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

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

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

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

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

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

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

1 second-foot equals about 1 acre-inch per hour.

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

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

EXPLANATION OF DATA.

The data presented in this report cover the year beginning October 1, 1915, and ending September 30, 1916. At the beginning of January in most parts of the United States much of the precipitation in the preceding three months is stored as ground water, in the form of snow or ice, or in ponds, lakes, and swamps, and this stored water passes off in the streams during the spring break-up. At the end of September, on the other hand, the only stored water available for run-off is possibly a small quantity in the ground; therefore the run-off for the year beginning October 1 is practically all derived from precipitation within that year.

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

From the discharge measurements rating tables are prepared that give the discharge for any stage, 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.

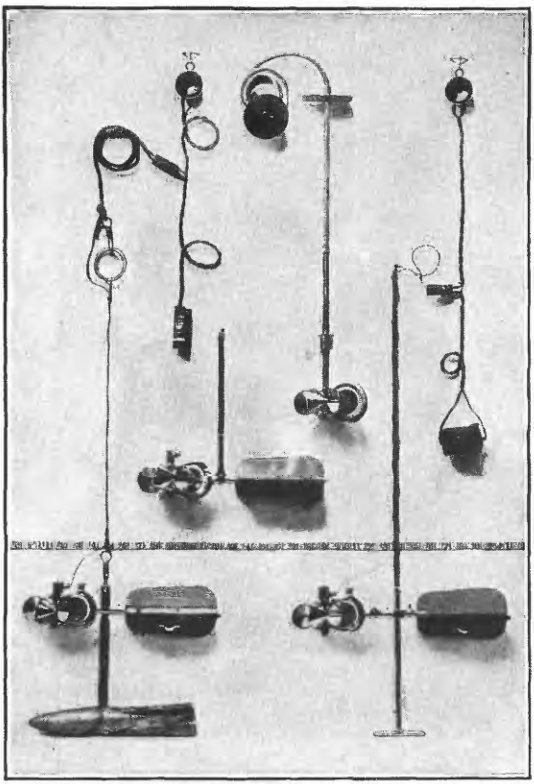
The data presented for each gaging station in the area covered by this report comprise a description of the station, a table giving results of discharge measurements, a table showing the daily discharge of the stream, and a table of monthly and yearly discharge and run-off.

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

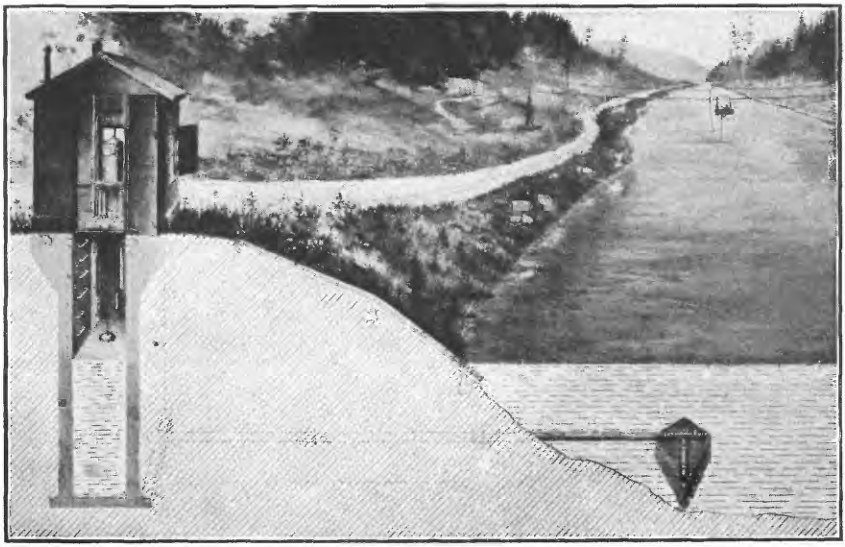
The description of the station gives, in addition to statements regarding location and equipment, information in regard to any conditions that may affect the permanence of the stage-discharge relation, covering such subjects as the occurrence of ice, the use of the stream for log driving, shifting of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

The table of daily discharge gives, in general, the discharge in second-feet corresponding to the mean of the gage heights read each day. At stations on streams subject to sudden or rapid diurnal fluctuations the discharge obtained from the rating table and the mean daily gage height may not be the true mean discharge for the day. If such stations are equipped with water-stage recorders the mean daily discharge may be obtained by averaging discharge at regular intervals during the day or by using the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

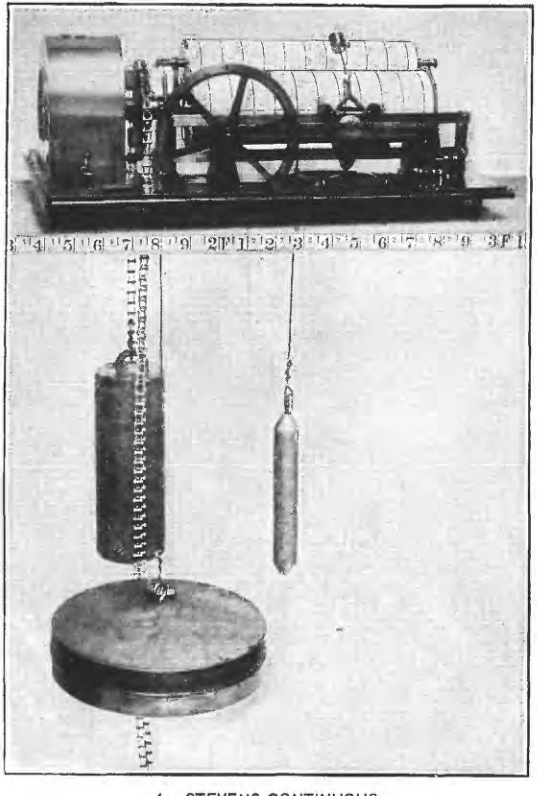
In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day it does not indicate correctly the stage when the water surface was at crest height and the corresponding discharge was consequently larger than given in the maximum column. Likewise, in the column headed "Minimum" the quantity given is the mean flow for the day when



A. PRICE CURRENT METERS.



B. TYPICAL GAGING STATION.



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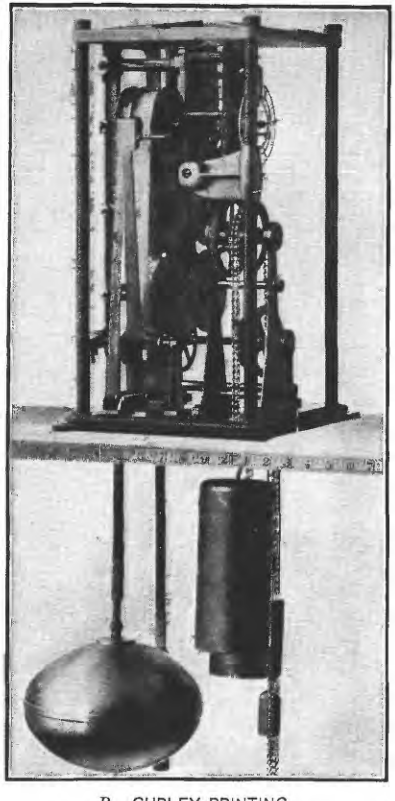
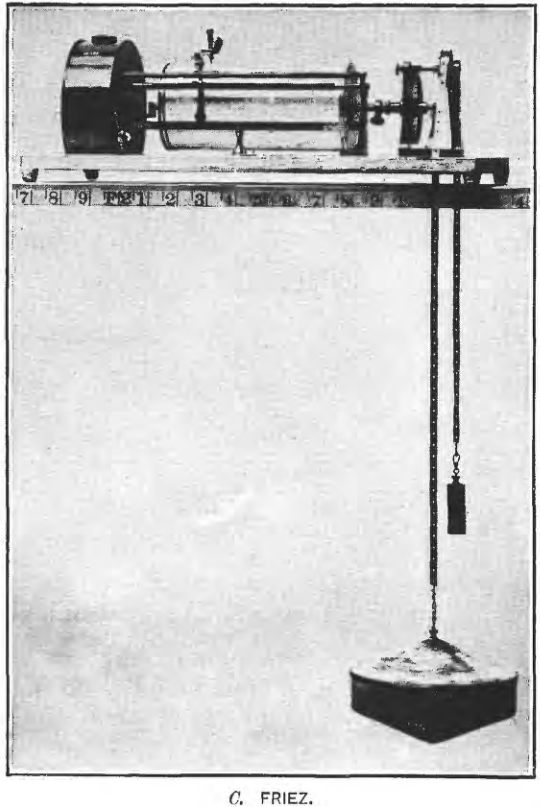


B. GURLEY PRINTING.



C. FRIEZ.

WATER-STAGE RECORDERS.

the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this average flow are based computations recorded in the remaining columns, which are defined on page 8.

ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

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

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

The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and 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.

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

COOPERATION.

During the year ending September 30, 1916 the work in Oregon and Washington has been done 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 Federal Survey and the State engineers or other officials and are authorized by legislative acts appropriating moneys. The State contracts are essentially of the same order, the principal provisions being substantially as follows:

1. The United States Geological Survey retains direct supervision of the field work and the preparation of the data for publication.

2. The Federal Survey retains possession of all material collected—field notes, maps, etc.—but this material is open at all times to inspection by the State officials, and if not satisfactory the agreements can be terminated at any time.

3. The salaries of gage observers and the salaries and traveling and field expenses of the engineers are divided between the two parties in some manner agreed upon, the accounts being rendered monthly in accordance with the regulations of the Federal Survey.

4. The streams and localities in which investigations shall be made are determined by conference between the State officials and the representatives of the United States Geological Survey.

5. The cost of publication is borne entirely by the Federal Survey.

In general, the cooperative agreements specify that the United States Geological Survey shall allot from its appropriation a sum equal to that appropriated from the State funds.

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

Acknowledgments are also due to the engineers and employees of the United States Reclamation Service, the United States Forest Service, the United States Office of Indian Affairs, and the State Water Board of Oregon for assistance, suggestions, and the freest use of data gathered exclusively for them and for which they have paid, and to the Corps of Engineers, United States Army, and the officers of the United States Weather Bureau for hydrographic and climatologic data.

Special acknowledgments are due for financial assistance rendered by municipalities, corporations, and individuals, as follows: Water bureau of the city of Portland, Tumalo project of the State of Oregon, Teel Irrigation District, Suttles Lake Irrigation District, East Fork Irrigation District, Pacific Power & Light Co., Arnold Irrigation Co.,

Central Oregon Irrigation Co., Oregon Lumber Co., Northwestern Electric Co., Portland Railway, Light & Power Co., Waldo Lake Irrigation & Power Co., California-Oregon Power Co., Rogue River Valley Canal Co., M. A. Moody, W. E. Herring, and J. G. Kelley.

DIVISION OF WORK.

The data for stations in Oregon and Washington, with the exception of those noted below, were collected and prepared for publication under the direction of F. F. Henshaw, district engineer, assisted by James E. Stewart, C. L. Batchelder, C. G. Paulsen, and P. V. Hodges, junior engineers.

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

The records were reviewed and assembled for publication by W. E. Dickinson and G. C. Stevens.

GAGING-STATION RECORDS.

COLUMBIA RIVER AT THE DALLES, OREG.

LOCATION.—In sec. 34, T. 2 N., R. 13 E., 2,000 feet below the 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, 1916. 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 the viaduct connecting Regulator Dock with the warehouse, and the United States Army Engineers' gage, similar in form but with a datum 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 the side of wooden fender of upper locks chamber between upper guard and lock gates. Elevation of datum of Brooks gage, 46.36 feet. (1912 adjustment of primary level net.)

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 July 1 (discharge, 727,000 second-feet); minimum discharge, January 17, 57,000 second-feet (stage-discharge relation affected by ice).

1857–1916: 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 seldom seriously affected by ice, but was materially affected January 17 to 21, 1916.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice January 17 to 21 and discharge estimated from gage records at upper end of Celilo canal and temperature records. 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 heights to rating table. Records excellent except those for January 17 to 21, which are fair.

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

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Columbia River at The Dalles, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	82,000	75,400	79,400	74,600	77,800	124,000	230,000	334,000	390,000	727,000	385,000	172,000
2	85,600	77,000	76,200	74,600	80,200	125,000	226,000	328,000	390,000	720,000	372,000	168,000
3	82,000	77,800	76,200	66,900	76,200	121,000	227,000	327,000	388,000	706,000	354,000	173,000
4	80,200	78,600	77,000	66,200	74,600	118,000	236,000	332,000	388,000	704,000	342,000	170,000
5	78,600	79,400	79,400	66,200	79,400	117,000	245,000	349,000	390,000	709,000	332,000	170,000
6	77,800	81,100	82,000	66,200	85,600	115,000	248,000	385,000	405,000	709,000	322,000	170,000
7	77,000	80,200	82,900	62,200	84,700	116,000	251,000	416,000	428,000	695,000	310,000	169,000
8	78,600	80,200	84,700	65,500	87,400	118,000	249,000	443,000	439,000	688,000	307,000	173,000
9	80,200	81,100	85,600	66,900	100,000	125,000	248,000	463,000	441,000	679,000	294,000	174,000
10	81,100	82,000	85,600	69,800	113,000	134,000	248,000	461,000	453,000	673,000	287,000	173,000
11	82,000	82,900	83,800	66,900	223,000	155,000	257,000	455,000	465,000	673,000	278,000	168,000
12	81,100	82,900	82,900	63,400	215,000	195,000	264,000	433,000	477,000	668,000	272,000	173,000
13	80,200	82,900	82,000	59,900	209,000	218,000	276,000	418,000	479,000	657,000	266,000	170,000
14	78,600	82,000	82,000	59,900	192,000	223,000	289,000	403,000	477,000	642,000	261,000	165,000
15	75,400	82,000	82,900	59,900	180,000	230,000	289,000	390,000	475,000	631,000	255,000	165,000
16	74,600	81,100	79,400	59,900	168,000	223,000	284,000	383,000	489,000	618,000	249,000	164,000
17	73,800	82,000	79,400	57,000	164,000	215,000	286,000	376,000	520,000	605,000	242,000	163,000
18	76,200	82,900	79,400	58,000	159,000	206,000	291,000	367,000	555,000	596,000	236,000	159,000
19	77,000	84,700	77,000	59,000	152,000	202,000	291,000	367,000	602,000	585,000	230,000	156,000
20	77,000	84,700	77,000	61,000	147,000	209,000	291,000	376,000	638,000	574,000	223,000	147,000
21	76,200	83,800	77,000	67,000	146,000	226,000	286,000	385,000	651,000	562,000	223,000	143,000
22	74,600	81,100	104,000	72,200	141,000	267,000	278,000	401,000	675,000	547,000	220,000	142,000
23	73,800	92,000	95,000	81,100	137,000	283,000	276,000	403,000	664,000	539,000	216,000	141,000
24	73,000	90,100	99,000	100,000	132,000	286,000	263,000	403,000	646,000	532,000	209,000	137,000
25	73,000	91,000	101,000	100,000	128,000	276,000	260,000	397,000	635,000	501,000	205,000	135,000
26	73,000	93,000	99,000	87,400	126,000	270,000	260,000	388,000	644,000	485,000	201,000	132,000
27	73,800	94,000	100,000	82,900	126,000	260,000	266,000	385,000	655,000	467,000	195,000	128,000
28	73,800	95,000	104,000	82,900	126,000	260,000	289,000	379,000	679,000	449,000	191,000	123,000
29	73,000	94,000	100,000	78,600	125,000	255,000	318,000	381,000	695,000	428,000	187,000	121,000
30	74,600	93,000	82,000	78,600	.....	245,000	332,000	385,000	716,000	411,000	181,000	121,000
31	74,600	.....	72,000	78,600	.....	236,000	.....	390,000	.....	394,000	176,000	.....

Monthly discharge of Columbia River at The Dalles, Oreg., for the year ending Sept. 30, 1916.

[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	85,600	73,000	77,200	0.326	0.38	4,750,000
November	95,000	75,400	84,300	.356	.40	5,020,000
December	104,000	76,200	85,600	.361	.42	5,260,000
January	100,000	57,000	70,700	.298	.34	4,350,000
February	223,000	74,600	133,000	.661	.71	7,650,000
March	286,000	115,000	198,000	.835	.96	12,200,000
April	332,000	226,000	268,000	1.13	1.26	15,900,000
May	463,000	327,000	390,000	1.65	1.90	24,000,000
June	716,000	388,000	532,000	2.24	2.50	31,700,000
July	727,000	394,000	599,000	2.53	2.92	36,800,000
August	385,000	176,000	259,000	1.09	1.26	15,900,000
September	174,000	121,000	156,000	.658	.73	9,280,000
The year	727,000	57,000	238,000	1.00	13.78	173,000,000

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. ¼ sec. 9, T. 4 N., R. 37 E., a quarter of a mile above head gate of pipe line of Pacific Light & Power 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 September 30, 1916. 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, 4.1 feet at 9 a. m. March 10; minimum stage recorded, 2.40 feet August 29 to September 8 and September 13–30.

1906–1915: Maximum stage recorded, 4.5 feet March 2 and March 20, 1910, and January 24, 1912 (discharge, 760 second-feet). A discharge of 1,650 second-feet was recorded at old station, 6 miles below, April 14, 1904, and a still greater discharge occurred during the flood of May 30, 1906.

1903–1916: Minimum stage recorded, 2.40 feet August 28 to September 10 and September 19 to October 1, 1915, and during August and September, 1916.

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

DIVERSIONS.—Station is above all diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation probably changed during high water of March. Rating curve for 1915 used until February 29; fairly well defined for period used. Discharge not computed for period March to September. Gage read to quarter-tenths twice a day. Results, October to February, good.

No discharge measurements were made during the year.

Daily gage height, in feet, of South Fork of Walla Walla River near Milton, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.40	2.45	2.58	2.65	2.52	2.78	3.10	3.15	3.10	2.79	2.45	2.40
2	2.48	2.45	2.59	2.62	2.52	2.76	3.10	3.30	3.10	2.78	2.45	2.40
3	2.72	2.45	2 65	2.62	2.52	2.75	3.10	3.50	3.10	2.90	2.45	2.40
4	2.49	2.45	2.88	2.61	2.52	2.71	3.10	3.60	3.10	2.79	2.45	2.40
5	2.45	2.45	2.84	2.59	2.50	2.75	3.00	3.55	3.10	2.76	2.45	2.40
6	2.45	2.45	2.85	2.55	2.50	2.75	2.98	3.65	3.10	2.72	2.45	2.40
7	2.45	2.45	2.85	2.55	3.10	2.72	3.00	3.50	3.10	2.70	2.45	2.40
8	2.42	2.45	2.85	2.56	3.20	3.00	3.10	3.25	3.10	2.70	2.45	2.40
9	2.42	2.48	2.94	2.58	3.10	3.95	3.15	3.20	3.10	2.68	2.45	2.42
10	2.45	2.45	2.84	2.55	3.70	4.10	3.20	3.00	3.10	2.65	2.44	2.44
11	2.44	2.45	2.79	2.55	3.45	4.00	3.35	2.98	3.10	2.62	2.42	2.42
12	2.42	2.45	2.74	2.52	3.15	3.90	3.25	2.95	3.10	2.60	2.42	2.41
13	2.45	2.45	2.70	2.50	3.10	3 50	3.15	2.95	3.10	2.60	2.42	2.40
14	2.50	2.45	2.70	2.50	3.05	3.15	3.20	2.92	3.05	2.59	2.42	2.40
15	2.49	2.50	2.65	2.50	3.35	3.05	3.30	2.95	3.05	2.56	2.42	2.40
16	2.45	2.61	2.62	2.50	3.45	3.05	3.20	3.10	3.05	2.56	2.42	2.40
17	2.45	2.64	2.62	2.50	3.35	3.05	3.20	3.10	3.05	2.59	2.45	2.40
18	2.45	2.72	2.61	2.50	3.20	3.10	3.10	3.15	3.05	2.61	2.46	2.40
19	2.45	2.88	2.60	2.50	3.20	3.20	3.10	3.30	3.05	2.56	2.45	2.40
20	2.45	2.85	2.60	2.50	3.15	3.65	3.10	3.30	3.05	2.54	2,45	2.40
21	2.44	2.79	2.78	2.50	3.10	3.55	3.00	3.20	2.95	2.51	2.44	2.40
22	2.42	2.80	3.70	2.50	2.99	3.50	2.95	3.15	2.85	2.50	2.42	2.40
23	2.44	2.90	3.20	3.00	2.95	3.35	2.95	3.10	2.82	2.50	2.42	2.40
24	2.45	2.86	2.99	2.98	2.91	3.20	3.05	3.10	2.80	2.50	2.42	2.40
25	2.45	2.85	2.90	2.82	2.88	3.10	3.30	3.10	2.80	2.50	2.42	2.40
26	2.45	2.79	2.82	2.76	2.85	3.20	3.40	3.10	2.85	2.50	2.42	2.40
27	2.45	2.71	2.74	2.66	2.85	3.60	3.55	3.10	2.82	2.50	2.42	2.40
28	2.45	2.66	2.72	2.62	2.80	3.40	3.35	3.10	2.82	2.49	2.41	2.40
29	2.44	2.65	2.71	2.60	2.80	3.15	3.20	3.10	2.85	2.48	2.40	2.40
30	2.42	2.65	2.68	2.58	.....	3.00	3.10	3.10	2.82	2.46	2.40	2.40
31	2.42	.....	2.65	2.55	.....	3.00	.....	3.10	.....	2.45	2.40	2.40

Daily discharge, in second-feet, of South Fork of Walla Walla River near Milton, Oreg., for the period Oct. 1, 1915, to Feb. 29, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.
1	90	98	117	130	108	16	98	122	124	105	358
2	102	98	118	124	108	17	98	128	124	105	322
3	145	98	130	124	108	18	98	145	122	105	275
4	104	98	183	122	108	19	98	183	120	105	275
5	98	98	173	118	105	20	98	176	120	105	260
6	98	98	176	112	105	21	96	161	158	105	245
7	98	98	176	112	245	22	93	163	455	105	212
8	93	98	176	114	275	23	96	188	275	215	202
9	93	102	199	117	245	24	98	178	212	210	191
10	98	98	173	112	455	25	98	176	188	168	183
11	96	98	161	112	358	26	98	161	168	154	176
12	93	98	149	108	260	27	98	142	149	132	176
13	98	98	140	105	245	28	98	132	145	124	163
14	105	98	140	105	230	29	96	130	142	120	163
15	104	105	130	105	322	30	93	130	136	117	.....
						31	93	.....	130	112	.....

Monthly discharge of South Fork of Walla Walla River near Milton, Oreg., for the period Oct. 1, 1915, to Feb. 29, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	145	90	98.8	6,080
November	188	98	127	7,560
December	455	117	165	10,100
January	215	105	123	7,560
February	455	105	223	12,800
The period				44,100

MILL CREEK NEAR WALLA WALLA, WASH.

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

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 27, 1913, to September 30, 1916.

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 ± 0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.40 feet at 4.45 p. m. March 10 (discharge, 778 second-feet); minimum stage recorded, 0.72 foot October 1 (discharge, 23 second-feet).

1913–1916: Maximum stage recorded March 10, 1916; minimum stage recorded, 0.69 foot August 29 to September 1, 1915 (discharge, 21 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; 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. 183) above the intake.

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

ACCURACY.—Stage-discharge relation changed March 10; affected by ice January 12–19, 29, 31, and February 2–4. Rating curves well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean gage height to rating table. Open-water records excellent; others fair.

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, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 18	C. O. Brown	2.60	242
13	C. G. Paulsen	2.31	118
Aug. 17	....do	1.80	32.7

Daily discharge, in second-feet, of Mill Creek near Walla Walla, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	23	27	52	61	54	121	219	146	117	72	31	27
2	34	27	54	56	52	119	223	163	117	70	31	26
3	52	27	69	56	50	105	210	182	117	103	31	42
4	34	27	102	52	48	102	198	206	122	85	31	33
5	29	28	87	50	46	102	175	206	122	77	31	32
6	27	29	109	49	49	102	152	223	117	70	30	30
7	27	28	109	48	182	92	152	190	112	66	31	28
8	26	28	104	48	238	170	167	152	115	63	32	30
9	26	31	146	47	238	560	175	146	117	58	32	30
10	27	29	124	48	440	732	206	134	108	56	32	30
11	26	30	102	43	368	592	266	128	98	53	37	28
12	26	32	80	.....	269	562	244	125	94	50	34	28
13	27	29	76	.....	224	397	215	128	94	48	34	28
14	32	29	71	.....	238	280	215	122	96	47	34	28
15	28	34	66	.....	334	227	215	117	98	46	30	28
16	27	52	61	.....	368	210	198	117	98	47	28	28
17	27	94	59	.....	368	215	223	117	103	47	33	28
18	27	102	51	.....	301	231	206	134	105	44	34	28
19	27	224	51	.....	269	271	190	182	98	44	32	28
20	27	157	50	39	238	477	179	182	85	40	30	28
21	27	126	196	38	224	477	190	186	81	39	31	28
22	27	121	602	41	196	504	175	206	81	39	31	28
23	27	182	334	224	170	422	167	231	90	38	30	28
24	28	146	209	209	170	303	171	240	79	37	30	28
25	28	130	157	134	157	266	206	223	66	36	28	32
26	27	117	117	102	146	372	227	206	90	36	28	30
27	27	91	94	84	146	592	231	198	83	36	28	28
28	27	69	98	74	134	422	210	182	85	34	27	28
29	27	63	77	68	126	298	171	160	90	32	27	28
30	27	55	74	61	.....	231	146	140	77	32	27	28
31	28	.....	66	58	.....	215	.....	128	.....	32	27	.....

NOTE.—Discharge estimated or interpolated, on account of ice, Jan. 12–19, 40 second-feet; Jan. 29, 31, and Feb. 2–4, as in table.

Monthly discharge of Mill Creek near Walla Walla, Wash., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet.)
	Maximum.	Minimum.	Mean.	
October	52	23	28.4	1,750
November	224	27	72.1	4,290
December	602	50	118	7,260
January	224	.....	64.8	3,980
February	440	46	201	11,600
March	732	92	315	19,400
April	266	146	197	11,700
May	240	117	168	10,300
June	122	66	98.5	5,860
July	103	32	50.9	3,130
August	37	27	30.7	1,890
September	42	26	29.1	1,730
The year	732	23	114	82,900

UMATILLA RIVER BASIN.

UMATILLA RIVER ABOVE FURNISH RESERVOIR, NEAR YOAKUM, OREG.

LOCATION.—In NW. ¼ 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 to September 30, 1916.

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.

DISCHARGE MEASUREMENT.—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.—Maximum stage for year not covered by records. Minimum stage from water-stage recorder, 0.43 foot at 12 m. September 18 (discharge, 30 second-feet).

ICE.—No winter records.

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 within a few hundred yards of the control.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined for range covered in 1916. Operation of water-stage recorder very satisfactory. Daily discharge July 5 to 11 ascertained by applying to rating table the mean of two readings daily; July 11 to 26, by applying the mean bi-hourly gage heights taken from the gage-height graph; July 27 to August 21 and September 12 to 18, by averaging results obtained by applying to the rating table the gage record every two hours. Records excellent except those for September, for which the estimate is 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, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
June 14	L. A. Reineman	1.96	392	July 16	C. A. Jordan	1.20	117
July 6	do	1.55	215	24	L. A. Reineman	1.07	89
10	Reineman and Jordan	1.40	160	31	do	.92	65

Daily discharge, in second-feet, of Umatilla River above Furnish reservoir, near Yoakum, Oreg., for the year ending Sept. 30, 1916.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	64	.....	11	141	46	41	21	95	44	.....
2	.....	61	.....	12	137	46	43	22	93	.....	.....
3	.....	61	.....	13	129	41	41	23	89	.....	.....
4	.....	59	.....	14	123	45	39	24	87	.....	.....
5	198	57	.....	15	117	41	40	25	76	.....	.....
6	192	55	.....	16	111	41	40	26	78	.....	.....
7	182	57	.....	17	119	42	40	27	79	.....	.....
8	172	54	.....	18	115	45	38	28	77	.....	.....
9	162	54	.....	19	111	44	.....	29	75	.....	.....
10	155	47	.....	20	103	42	.....	30	69	.....	.....
								31	68	.....	.....

NOTE.—Discharge estimated at 42 second-feet Aug. 22-31, and 40 second-feet Sept. 1-10 and 19-30.

Monthly discharge of Umatilla above Furnish reservoir, near Yoakum, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
July 5-31	198	68	117	6,270
August	64	.....	47.3	2,900
September	.....	.....	40.1	2,390

UMATILLA RIVER AT YOAKUM, OREG.

LOCATION.—In SW. ¼ sec. 2, T. 2 N., R. 30 E., at Yoakum wagon bridge, half a mile east of Yoakum station of Oregon-Washington Railroad & Navigation Co., and 18 miles below Pendleton, Umatilla County.

DRAINAGE AREA.—1,200 square miles.

RECORDS AVAILABLE.—May 5, 1903, to August 15, 1916, when station was discontinued.

GAGE.—Vertical staff spiked to right abutment of highway bridge; read by Robert Bond. Temporary gage in sec. 12, below Furnish reservoir, used August 1 to 15.

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

CHANNEL AND CONTROL.—Rock and gravel; shifts in extreme floods, when left bank is overflowed. One channel at all stages. Control composed of lava boulders.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.05 feet at midnight February 10-11 (discharge, 8,200 second-feet); minimum stage recorded, 2.88 feet at 7 a. m. October 13 (discharge, 43 second-feet).

1903-1916: Maximum stage, from high water marks, about 15.0 feet May 31, 1906 (discharge estimated at 23,900 second-feet); minimum stage, 2.45 feet August 10-12, 1908 (discharge, 12 second-feet).

ICE.—River occasionally freezes over for short periods.

DIVERSIONS.—Small tracts, aggregating 720 acres, are irrigated from Umatilla River above the station, in addition to tracts irrigated from the tributaries.

REGULATION.—Water is stored during the winter in Furnish reservoir about 3 miles upstream and is released during low water. Capacity of reservoir about 5,000 acre-feet.

ACCURACY.—Stage-discharge relation changed during spring flood. Rating curves applicable as follows: October 1 to February 10, well defined; after February 10, well defined between 100 and 3,000 second-feet. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records good.

Discharge measurements of Umatilla River at Yoakum, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 5	Henshaw and Hinkle.	4.14	366	May 3	Henshaw and Reineman [a]	6.34	1,800
Do	do	4.18	351	June 17	L. A. Reineman	4.08	305

[a] Watermaster for Umatilla County.

Discharge measurements of Umatilla River below Furnish reservoir, near Yoakum, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.			Date.	Made by—	Gage height.		
		Below reservoir.	At Yoakum station. [a]	Discharge.			Below reservoir.	At Yoakum station. [a]	Discharge.
		Feet.	*Feet.*	*Sec.-ft.*			*Feet.*	*Feet.*	*Sec.-ft.*
June 24	Arthur Jordan	1.48	4.00	249	July 28	L. A. Reineman	1.07	3.59	134
July 10	Jordan and Reineman.	1.41	3.91	240	Aug. 7	do	.96	.....	104
16	Arthur Jordan	1.21	3.70	180	14	do	.86	.....	79

[a] Observers' reading for day.

Daily discharge, in second-feet, of Umatilla River at Yoakum, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	57	82	550	550	492	1,100	2,000	1,520	1,340	234	121
2	57	88	492	465	465	1,030	2,580	1,700	1,100	305	121
3	57	92	438	465	465	890	3,120	1,800	960	258	121
4	58	82	465	438	465	890	2,710	1,900	960	244	115
5	74	90	492	318	410	890	2,580	2,000	890	227	110
6	87	94	580	310	410	890	2,840	1,900	770	230	105
7	108	84	610	298	1,030	890	2,980	1,800	590	224	90
8	102	90	760	277	5,790	1,260	2,710	1,700	560	237	90
9	110	114	820	277	4,730	4,030	2,710	1,520	620	273	90
10	110	106	960	270	7,350	6,160	2,710	1,260	560	234	80
11	94	126	1,030	235	6,380	6,600	2,980	1,180	530	218	80
12	74	82	960	222	4,030	6,160	3,120	1,100	480	194	80
13	57	87	960	208	3,120	4,860	2,580	960	412	185	80
14	63	94	890	208	2,980	3,870	2,460	890	368	176	80
15	75	94	820	208	4,030	2,980	2,340	830	368	173	65
16	66	94	580	205	4,520	2,580	2,460	770	368	170	50
17	81	106	520	202	4,190	2,580	2,340	770	345	165	42
18	81	148	492	215	3,560	2,580	2,340	1,030	345	160	45
19	76	410	410	208	2,980	2,980	2,000	1,030	345	160	44
20	88	580	363	225	2,710	4,860	1,900	1,900	305	148	42
21	88	520	386	239	2,460	4,860	1,700	1,800	285	145	44
22	75	438	520	363	2,110	4,350	1,800	1,800	265	145	.....
23	78	410	2,540	2,660	1,900	3,710	1,700	1,700	265	150	.....
24	106	465	2,180	1,650	1,900	2,980	1,800	1,520	265	142	.....
25	100	520	1,450	1,100	1,800	2,580	2,000	3,410	258	140	.....
26	88	580	1,180	820	1,800	2,980	2,340	4,190	458	145	.....
27	90	640	960	730	1,700	3,120	2,840	3,410	435	140	.....
28	98	640	820	670	1,430	3,260	2,710	2,840	265	142	.....
29	74	640	760	580	1,260	2,710	2,220	2,340	285	135	.....
30	74	580	640	550	.....	2,220	1,800	1,800	244	135	.....
31	72	.....	550	520	.....	2,000	.....	1,520	.....	108	.....

NOTE.—Daily discharge for Aug. 1 to 15, obtained at station below Furnish reservoir by water master, Aug. 16 estimated, Aug. 16–21 from record above Furnish Reservoir; Aug. 22–31, estimated at 42 second-feet.

Monthly discharge of Umatilla River at Yoakum, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	110	57	81.2	4,990
November	640	82	273	16,200
December	2,540	363	812	49,900
January	2,660	202	506	31,100
February	7,350	410	2,640	152,000
March	6,600	890	3,000	184,000
April	3,120	1,700	2,410	143,000
May	4,190	770	1,740	107,000
June	1,340	244	508	30,200
July	305	108	185	11,400
August	121	.....	68.2	4,190
September	.....	.....	a40.0	2,380
The year	7,350	.....	1,010	736,000

a Estimated from station above Furnish reservoir.

UMATILLA RIVER NEAR UMATILLA, OREG.

LOCATION.—In NW. ¼ 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 1½ miles above Umatilla, Umatilla County, and mouth of river.

DRAINAGE AREA.—2,130 square miles.

RECORDS AVAILABLE.—October 21, 1903, to September 30, 1916.

GAGE.—Inclined staff in two sections; read by C. A. Holder and W. A. Walpole.

DISCHARGE MEASUREMENTS.—Made from cable.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.1 feet February 11 (discharge, 10,500 second-feet); minimum stage recorded, 2.2 feet November 11 (discharge, 34 second-feet).

1903–1916: Maximum stage recorded, 11.0 feet May 31, 1906 (discharge, 19,600 second-feet); minimum stage recorded, 1.0 foot July 25 and August 1–9, 1906 (channel dry).

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

DIVERSIONS.—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. Rating curve well defined. Gage read to hundredths once daily during October and for period June to September; from two to six times a week during rest of year. Gage could not be read during part of January on account of shore ice. Daily discharge ascertained by applying daily gage heights to rating table. In computing monthly mean, discharge interpolated for days when gage was not read. Records for October and period June to September, excellent; for March, good; for other months, poor.

COOPERATION.—Field data furnished by United States Reclamation Service; records computed by United States Geological Survey.

No discharge measurements made during year.

Daily discharge, in second-feet, of Umatilla River near Umatilla, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	88	34	140	378	495	.....	.....	.....	1,180	170	108	86
2	88	.....	.....	340	.....	1,120	.....	1,120	938	730	102	86
3	88	.....	.....	.....	.....	825	.....	.....	770	455	96	90
4	88	42	105	.....	.....	770	2,290	.....	690	378	86	90
5	86	.....	.....	.....	.....	.....	.....	.....	580	234	81	90
6	86	42	.....	.....	.....	880	.....	.....	538	210	86	90
7	86	.....	305	.....	415	.....	1,820	.....	455	170	86	90
8	86	.....	.....	.....	.....	880	.....	1,310	1,120	132	90	90
9	88	.....	.....	.....	3,680	1,820	.....	.....	495	96	88	90
10	88	120	.....	378	.....	4,680	2,290	.....	284	96	88	90
11	88	.....	625	340	9,300	6,300	.....	995	228	86	90	90
12	86	.....	.....	340	.....	.....	.....	.....	170	72	90	90
13	88	58	.....	258	.....	5,600	.....	.....	136	77	90	90
14	88	.....	.....	240	.....	4,050	.....	.....	96	81	90	90
15	90	.....	.....	230	4,260	3,140	.....	670	49	90	90	90
16	90	.....	.....	220	4,460	2,620	2,290	.....	53	86	90	90
17	90	90	.....	210	4,460	2,620	.....	.....	57	86	90	90
18	90	.....	240	200	.....	2,620	.....	720	136	96	90	90
19	90	.....	.....	200	.....	.....	1,890	.....	136	96	222	96
20	90	210	.....	200	.....	3,310	.....	.....	120	96	99	96
21	90	.....	120	340	2,620	4,460	.....	.....	102	90	102	96
22	90	.....	90	400	2,290	4,260	1,520	.....	90	86	105	90
23	90	.....	185	2,000	1,970	3,860	.....	1,120	79	86	105	99
24	90	270	1,660	4,460	1,970	3,140	.....	.....	72	86	90	102
25	105	.....	.....	1,120	1,820	2,620	1,660	.....	64	86	86	102
26	90	.....	.....	825	.....	.....	.....	2,960	58	81	86	108
27	90	240	.....	670	.....	2,620	.....	4,260	160	90	86	105
28	90	.....	625	770	1,450	3,140	2,290	.....	415	86	86	108
29	90	.....	.....	632	1,310	2,620	.....	2,290	222	90	86	108
30	90	.....	.....	495	.....	2,290	.....	.....	185	114	83	108
31	90	.....	.....	495	.....	.....	.....	.....	.....	114	79	.....

NOTE.—Discharge estimated Jan. 15 to 20, 22, 23, 31, and Feb. 1.

Monthly discharge of Umatilla River near Umatilla, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	105	86	89.3	5,490
November	.....	34	132	7,860
December	.....	.....	452	27,800
January	4,460	.....	589	36,200
February	9,300	.....	2,950	170,000
March	6,300	770	2,800	172,000
April	.....	.....	2,030	121,000
May	4,260	.....	1,410	86,700
June	1,180	49	323	19,200
July	730	72	147	9,040
August	222	79	95.0	5,840
September	108	86	94.3	5,610
The year	9,300	34	918	667,000

JOHN DAY RIVER BASIN.

JOHN DAY RIVER AT McDONALD, OREG.

LOCATION.—In NW. ¼ 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, 1916.

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

DISCHARGE MEASUREMENTS.—Made from cable.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.2 feet at 1 a. m. Feb. 11 (discharge, 18,900 second-feet); minimum stage recorded, 1.30 feet October 1 (discharge, 155 second-feet).

1905–1916: 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, 65 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 practically permanent; affected by ice January 5 to 16, 26 and 27. Rating curve well defined between 80 and 6,000 second-feet. Gage read to quarter-tenths twice daily; oftener during high water. Daily discharge ascertained by applying gage height to rating table. Records October to December and June to August, excellent; February to May, and September, good; January, fair.

Discharge measurements of John Day River at McDonald, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 7	P. V. Hodges	4.63	4,490
Aug. 5	F. F. Henshaw	1.92	540

Daily discharge, in second-feet, of John Day River at McDonald, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	155	280	780	920	648	4,400	5,600	7,540	5,860	3,350	690	274
2	164	280	690	870	605	3,960	6,140	6,980	5,600	3,540	648	262
3	164	298	690	690	525	3,540	8,440	6,980	5,340	3,960	605	280
4	164	310	690	445	605	3,350	8,140	7,540	5,100	3,740	565	262
5	173	310	690	.....	648	3,160	8,140	8,140	4,860	3,540	541	262
6	178	310	870	.....	690	3,740	7,540	9,380	5,100	3,160	493	262
7	178	304	1,170	.....	780	4,400	7,260	9,700	5,340	2,980	485	262
8	178	310	1,020	.....	11,000	3,740	7,260	9,700	5,100	2,800	517	256
9	182	323	1,020	.....	12,300	4,180	7,540	8,140	4,860	2,630	525	250
10	182	342	1,020	.....	15,800	6,700	8,740	6,980	5,100	2,460	517	250
11	200	342	970	.....	16,800	10,300	9,060	6,420	5,100	2,300	485	262
12	205	342	970	.....	14,000	12,000	11,600	5,600	4,860	2,150	485	262
13	210	362	920	.....	8,440	13,300	11,000	5,100	4,620	1,930	477	280
14	210	375	870	.....	8,740	13,000	9,380	4,620	4,400	1,730	525	304
15	210	375	825	.....	8,740	10,000	8,740	4,400	4,400	1,610	445	342
16	225	375	780	.....	9,380	9,060	8,740	3,960	4,180	1,610	431	342
17	230	362	780	445	9,380	8,740	8,740	3,960	4,180	1,610	410	342
18	256	342	780	485	9,060	9,380	8,740	3,740	4,860	1,490	410	316
19	280	362	690	565	8,440	9,700	8,140	3,960	5,100	1,550	382	310
20	310	445	735	648	8,140	10,700	7,540	5,100	5,340	1,490	375	310
21	310	477	690	690	8,140	15,000	6,980	7,260	4,620	1,380	410	310
22	304	509	573	735	7,540	14,400	6,420	6,980	4,400	1,070	493	286
23	280	573	690	970	7,260	12,000	6,420	6,420	3,960	1,070	509	280
24	280	589	1,380	1,670	6,980	10,700	6,140	5,860	3,540	970	477	280
25	298	605	2,220	1,550	6,980	8,740	6,140	5,600	3,160	870	445	280
26	280	647	1,550	1,530	6,420	7,540	7,540	6,420	3,160	825	403	280
27	280	690	1,270	1,510	6,420	7,540	8,740	9,060	3,960	825	375	280
28	298	780	1,270	1,490	5,600	7,840	10,000	8,140	3,960	825	342	280
29	298	870	1,170	1,270	4,860	7,540	10,000	7,540	3,960	780	342	298
30	298	780	1,070	1,170	.....	6,420	8,740	6,980	3,540	735	310	298
31	298	.....	920	825	.....	5,860	.....	6,420	.....	690	280	.....

NOTE.—Discharge Jan. 4 to 16 estimated at 500 second-feet; discharge Jan. 26 and 27 interpolated.

Monthly discharge of John Day River at McDonald, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	310	155	235	14,400
November	870	280	442	26,300
December	2,220	573	960	59,000
January	1,670	.....	790	48,600
February	16,800	525	7,070	407,000
March	15,000	3,160	8,090	497,000
April	11,600	5,600	8,120	483,000
May	9,700	3,740	6,600	406,000
June	5,860	3,160	4,590	273,000
July	3,960	690	1,930	119,000
August	690	280	464	28,500
September	342	250	285	17,000
The year	16,800	155	3,280	2,380,000

CAMAS CREEK ABOVE CABLE CREEK, NEAR UKIAH, OREG.

LOCATION.—In SE. ¼ 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, 1916.

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; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.5 feet March 19 (discharge, 980 second-feet); minimum stage recorded, 0.70 foot August 29 to September 2 and September 18 to 25 (discharge, 4 second-feet).

1914–1916: Maximum stage recorded was that of 1916. 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 practically permanent; affected by ice February 7 to 14 and at other times when gage was not being read. Rating curve well defined above 10 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records good except for February, for which month they are poor on account of the ice-affected period.

Discharge measurements of Camas Creek above Cable Creek, near Ukiah, Oreg., during the year ending Sept. 30, 1916.

[Made by W. B. Hinkle.[a]]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 27	2.80	517
28	2.60	442
May 5	2.59	431

[a] Chief engineer, Teel irrigation district.

Daily discharge, in second-feet, of Camas Creek above Cable Creek, near Ukiah, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	5.5	9.0	19	.....	133	520	330	216	58	7.2	4.0
2	5.5	9.0	30	.....	112	580	330	186	52	6.0	4.0
3	6.4	9.0	16	.....	94	520	370	186	64	6.0	4.4
4	7.0	9.0	26	.....	94	520	420	216	52	6.0	5.0
5	7.0	9.0	26	.....	158	470	420	216	52	6.0	5.0
6	7.0	9.0	40	.....	133	420	445	216	52	6.0	5.0
7	7.0	9.0	46	186	116	470	370	180	40	6.0	5.0
8	7.0	9.0	46	330	122	550	330	158	40	6.0	5.0
9	7.0	11	52	370	568	580	250	172	40	6.0	5.6
10	7.0	10	52	420	714	610	233	158	40	6.0	5.6
11	7.0	11	52	520	735	700	186	133	30	6.0	5.6
12	5.5	11	30	420	744	580	186	112	30	5.6	5.0
13	6.4	14	30	370	752	470	186	94	22	5.0	5.0
14	9.0	22	30	420	761	470	158	94	22	5.0	5.0
15	9.0	16	30	216	770	520	158	94	22	5.0	4.4
16	9.0	14	30	216	779	470	158	98	22	5.0	4.4
17	7.8	11	.....	216	788	470	158	94	22	5.0	4.4
18	7.8	14	.....	158	797	420	158	94	30	5.0	4.0
19	7.8	16	.....	186	805	370	420	78	30	5.0	4.0
20	7.8	11	.....	250	910	330	445	78	20	5.0	4.0
21	7.0	16	.....	216	840	330	370	78	20	5.0	4.0
22	7.0	22	.....	201	670	330	330	64	20	5.0	4.0
23	7.0	26	.....	201	520	330	290	58	12	5.0	4.0
24	9.0	30	.....	250	370	370	216	52	12	5.0	4.0
25	9.0	26	.....	216	330	420	470	52	12	5.0	4.0
26	9.0	30	.....	216	370	520	520	64	12	5.0	4.4
27	9.0	30	.....	186	520	580	470	64	9	4.4	4.4
28	9.0	64	.....	133	420	520	395	64	12	4.4	4.4
29	9.0	78	.....	133	330	420	370	64	12	4.0	4.4
30	9.0	22	.....	.....	250	330	250	52	9	4.0	5.0
31	7.8	.....	.....	.....	250	.....	250	.....	9	4.0	.....

NOTE.—Discharge Feb. 7 to 14 estimated on account of ice; Mar. 12 to 18, interpolated. No record Dec. 17 to Feb. 6.

Monthly discharge of Camas Creek above Cable Creek, near Ukiah, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	9.0	5.5	7.59	467
November	78	9.0	19.2	1,140
December 1–16	52	16	34.7	1,100
February 7–29	520	133	262	12,000
March	910	94	482	29,600
April	700	330	473	28,100
May	520	158	311	19,100
June	216	52	116	6,900
July	64	9.0	28.4	1,750
August	7.2	4.0	5.28	325
September	5.6	4.0	4.57	272

CABLE CREEK NEAR UKIAH, OREG.

LOCATION.—In NE. ¼ sec. 9, T. 5 S., R. 32 E., at highway bridge about 1,000 feet above mouth of creek and 6 miles east of Ukiah, Umatilla County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 1, 1914, to September 30, 1916.

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, but practically permanent.

EXTREMES OF DISCHARGE.—1914–1916: Maximum stage recorded during year, 1.9 feet at 6 p. m. April 27, 1916 (discharge, 310 second-feet); minimum stage recorded, 0.10 foot August 29 to September 2, 1916 (discharge, 1.0 second-foot).

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

DIVERSIONS.—Probably none.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; affected by ice December 15 to February 18. Rating curve well defined between 5 and 300 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent April to July; good for November and December; fair for March and poor for October, February, August, and September.

Discharge measurements of Cable Creek near Ukiah, Oreg., during the year ending Sept. 30, 1916.

[Made by W. B. Hinkle.[a]]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Mar. 27	1.15	112
Mar. 28	1.10	98
May 5	1.65	222

[a] Chief engineer, Teel irrigation district.

Daily discharge, in second-feet, of Cable Creek near Ukiah, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.0	3.0	13	.....	37	88	168	137	20	2.8	1.0
2	2.0	2.4	13	.....	37	110	168	121	20	2.0	1.0
3	2.4	2.4	8	.....	37	110	180	110	20	2.0	1.5
4	3.0	2.4	9	.....	28	110	210	121	24	2.0	1.5
5	3.0	2.4	14	.....	52	110	225	88	20	2.0	1.5
6	3.0	3.0	16	.....	37	110	225	70	20	2.0	1.5
7	2.0	3.0	19	70	28	110	195	70	20	2.0	1.5
8	2.0	3.0	19	292	28	121	156	70	20	2.0	1.5
9	2.0	3.0	19	180	144	149	132	57	16	2.0	1.8
10	2.0	3.0	20	180	121	156	132	57	16	2.0	2.0
11	2.0	4.0	20	180	156	180	110	46	12	2.0	2.0
12	2.0	3.6	13	132	153	180	88	46	12	2.0	1.8
13	2.0	4.0	10	156	151	156	88	46	12	2.0	1.8
14	3.0	6.0	8	132	149	156	88	39	9.0	2.0	1.8
15	3.0	4.0	8	88	147	180	70	37	6.0	2.0	1.5
16	3.0	4.8	8	88	144	180	70	37	9.0	2.0	1.5
17	3.0	4.0	.....	70	142	180	79	32	9.0	2.0	1.5
18	3.0	6.0	.....	57	140	156	88	28	12	2.8	1.5
19	2.4	8.0	.....	57	137	156	210	28	11	2.8	1.5
20	2.4	7.2	.....	57	156	132	275	37	7.0	2.0	1.5
21	2.4	4.8	.....	57	156	132	210	37	6.0	2.0	1.5
22	2.0	8.0	.....	46	156	110	180	30	6.0	2.0	1.5
23	2.4	8.0	.....	46	110	110	156	28	6.0	2.0	1.5
24	3.0	9.0	.....	46	88	110	144	28	6.0	2.0	1.5
25	3.6	7.2	.....	52	88	180	168	24	5.2	2.0	1.5
26	3.0	13	.....	52	79	240	195	28	5.2	1.8	1.5
27	3.0	16	.....	46	110	292	210	28	2.0	1.8	1.5
28	3.0	13	.....	46	88	275	225	28	2.0	1.8	1.5
29	2.4	14	.....	37	70	210	210	28	2.8	1.0	1.5
30	2.4	10	.....	.....	70	180	132	26	4.0	1.0	1.8
31	2.4	.....	.....	.....	70	.....	156	.....	2.8	1.0	.....

NOTE.—Discharge estimated Dec. 15 and 16 and Feb. 7 to 18, on account of ice. Mar. 12–18 interpolated no record Dec. 17 to Feb. 6.

Monthly discharge of Cable Creek near Ukiah, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3.6	2.0	2.54	156
November	16	2.4	6.07	361
December 1–16	20	8.0	13.6	430
February 7–29	292	37	94.2	4,300
March	156	28	100	6,150
April	292	88	156	9,280
May	275	70	159	9,780
June	137	24	52.1	3,100
July	24	2.0	11.1	682
August	2.8	1.0	1.96	121
September	2.0	1.0	1.55	92

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, 1916; some fragmentary readings 1907 to 1913.

GAGE.—Vertical staff on bent of former footbridge; read by George E. Graft.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

CHANNEL AND CONTROL.—Bed composed of sand and gravel, somewhat shifting. Control some distance below station, rocky and fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.0 feet August 27 (discharge uncertain on account of backwater; probably about 490 second-feet); minimum stage recorded, 1.18 feet October 9, November 13, and December 26 (discharge, 142 second-feet).

1907–1916: Maximum stage from fragmentary records, 2.75 feet July 31, 1913 (determined from high-water marks on September 15); discharge, 531 second-feet. Minimum stage, 1.18 feet October to December, 1915; discharge, 142 second-feet.

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by ice jams below gage January 5 to February 7; above gage height 2.2, by tree sagging in water below gage; also slightly affected by growth of aquatic plants. Rating curve fairly well defined. Gage read to half-tenths weekly. Daily discharge ascertained by applying gage heights to rating table. Results good except for January (estimated on account of ice), and May and June, for which an arbitrary correction has been made for effect of log obstruction.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Deschutes River at Crane Prairie near Lapine, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.
1								
2								
3						252		
4					160			
5								368
6		145						
7			152				330	
8						310		
9	142							
10			160			342		
11					170			380
12				170				
13		142						
14								
15							342	
16	145					290		
17		180						
18		152	145		220			418
19				160				
20								
21		160				310	355	
22								
23	145							
24								
25					200			430
26			142	160				
27		160						
28							368	
29	145			160				
30						310		
31					200			

Monthly discharge of Deschutes River at Crane Prairie, near Lapine, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
October	144	8,850	April	302	18,000
November	156	9,280	May	349	21,500
December	150	9,220	June	399	23,700
January	140	8,610			
February	162	9,320	The period		120,000
March	190	11,700			

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

DESCHUTES RIVER NEAR LAPINE, OREG.

LOCATION.—In NW. ¼ 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.[1]

DRAINAGE AREA.—Indeterminate.

RECORDS AVAILABLE.—September 22 to December 21, 1910; February 18 to December 31, 1912; April 7 to October 27, 1913, occassional readings; October 1, 1914, to September 30, 1916.

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, 2.20 feet September 1 to 3 (discharge, 1,220 second-feet); minimum stage recorded, 0.40 foot February 1 and 2 (discharge, 780 second-feet).

1905–1916, 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 affected by ice jams for short periods of extremely cold weather.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to hundredths once daily when ranger is at station. Daily discharge ascertained by applying daily gage heights 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, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 18	P. V. Hodges	0.42	790
Aug. 12	F. F. Henshaw	1.87	1,110

[1] Formerly part of Crook County.

Daily discharge, in second-feet, of Deschutes River near Lapine, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	800	780	780	.....	780	800	820	915	1,020	1,140	.....	1,220
2	800	.....	780	.....	780	.....	.....	915	1,020	1,160	.....	1,220
3	.....	780	800	.....	.....	.....	.....	1,020	.....	1,160	.....	1,220
4	.....	780	800	.....	.....	.....	.....	.....	.....	1,140	.....	1,220
5	.....	780	800	.....	.....	.....	.....	.....	.....	1,140	.....	1,220
6	.....	780	800	.....	.....	.....	.....	.....	1,020	1,140	.....	1,220
7	.....	.....	800	.....	.....	.....	820	.....	1,020	.....	.....	1,220
8	.....	800	800	.....	.....	800	820	.....	.....	1,140	.....	1,220
9	.....	800	800	800	.....	.....	.....	.....	.....	1,120	.....	1,220
10	.....	780	800	800	.....	.....	.....	.....	1,020	1,140	.....	1,220
11	800	780	800	800	.....	.....	.....	.....	1,020	.....	.....	.....
12	800	780	800	800	.....	.....	.....	.....	1,020	.....	1,130	.....
13	800	780	800	800	.....	.....	.....	.....	1,020	.....	.....	.....
14	.....	.....	.....	.....	.....	800	840	1,020	.....	.....	.....	1,220
15	.....	780	.....	.....	.....	800	.....	1,020	1,020	.....	.....	1,220
16	.....	780	.....	.....	.....	.....	.....	1,020	1,020	.....	.....	1,220
17	.....	.....	.....	.....	.....	820	890	1,020	1,020	.....	.....	1,220
18	.....	800	.....	.....	780	.....	890	1,020	1,020	1,120	.....	1,220
19	.....	.....	.....	.....	.....	.....	890	.....	.....	1,120	.....	.....
20	.....	800	.....	.....	.....	.....	890	.....	.....	1,120	.....	.....
21	780	800	.....	.....	.....	820	890	.....	.....	1,120	.....	.....
22	780	800	.....	780	.....	820	.....	.....	.....	1,120	.....	.....
23	800	800	.....	780	.....	.....	.....	.....	.....	1,120	.....	.....
24	.....	820	.....	780	.....	.....	915	.....	.....	.....	.....	.....
25	780	820	.....	780	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	840	.....	780	.....	820	.....	.....	1,120	.....	.....	.....
27	.....	840	.....	780	.....	.....	.....	.....	1,120	1,120	.....	1,190
28	.....	820	.....	780	.....	.....	915	.....	1,120	1,120	.....	1,190
29	.....	820	.....	.....	.....	.....	.....	.....	1,120	1,120	.....	1,190
30	.....	800	.....	.....	.....	820	915	.....	1,120	1,120	.....	1,190
31	780	.....	.....	.....	.....	820	.....	1,020	.....	.....	.....	.....

NOTE.—Daily discharge determined only for days on which gage was read.

Monthly discharge of Deschutes River near Lapine, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	800	780	792	48,700
November	840	780	796	47,400
December	800	780	799	49,100
January	800	780	791	48,600
February	.....	780	784	45,100
March	820	800	810	49,800
April	915	820	865	51,500
May	1,020	915	1,010	62,100
June	1,120	1,020	1,050	62,500
July	1,160	1,120	1,130	69,500
August	.....	.....	1,130	69,500
September	1,220	1,190	1,210	72,000
The year	1,220	780	931	676,000

NOTE.—Discharge interpolated for days on which gage was not read in order to compute monthly mean, except that for August, which was estimated.

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DESCHUTES RIVER AT LAVA ISLAND, NEAR BEND, OREG.

LOCATION.—In SE. ¼ sec. 27, T. 18 S., R. 11 E., at remains of old log bridge half a mile above upper end of Lava Island and intake of Arnold canal and about 10 miles south of Bend, Deschutes County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 30, 1915, to December 1, 1916, when station was discontinued. Discharge is the same as at the Benham Falls and West's ranch stations January 1, 1905, to January 29, 1915.

GAGE.—Vertical staff nailed to a clump of willows on right bank about 600 feet above the intake of Arnold canal; read by Joe Stenkamp.

DISCHARGE MEASUREMENTS.—Made from logs of old bridge about three-eighths mile above gage; section relatively deep and narrow; conditions fairly good.

CHANNEL AND CONTROL.—Stream bed rocky; practically permanent; control is a riffle just above head of Lava Island falls; stage-discharge relation may be affected by changes in a wing dam used to divert water into Arnold canal.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period October 1, 1915, to December 1, 1916, 2.76 feet May 13 and 15 (discharge, 2,090 second-feet); minimum stage recorded, 1.68 feet October 1, 2, 6, and 8, 1915 (discharge, 1,070 second-feet).

1905–1916: 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). Minimum stage, 3.2 feet at Benham Falls station January 4, 1912 (discharge, 1,000 second-feet).

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

DIVERSIONS.—Quantity of water diverted for irrigation above station negligible; first diversion of importance, Arnold canal, just below gage. Lost Creek, a defluent of the river, diverts water between the gage and measuring section into the lava beds east of the river. Its flow was not measured during 1916. The water may return to the river near the lower end of Lava Island Falls, but this is not certain.

REGULATION.—None.

ACCURACY.—Stage-discharge relation not permanent. Three fairly well-defined rating curves applicable October 1 to January 31, May 13 to July 20, and September 4 to December 1, respectively. Discharge February 1 to May 12 and July 22 to September 3, computed by shifting-control method. Gage read to quarter-tenths every other day. Daily discharge ascertained by applying daily-gage height to rating table or, by shifting-control method. Records for October, November, February, March, and April, good; for other months, fair.

Discharge measurements of Deschutes River at Lava Island, near Bend, Oreg., during the period Oct. 1, 1915, to Dec. 1, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec-ft.*			*Feet.*	*Sec-ft.*
Oct. 1	Henshaw and Batchelder.	1.68	1,070	June 19	F. F. Henshaw	2.52	1,780
				Aug. 11	do	2.28	1,620
Feb. 19	P. V. Hodges	2.22	1,340	Oct. 20	Batchelder and Reineking	2.29	1,530
Apr. 4	do	2.29	1,460				

Daily discharge, in second-feet, of Deschutes River at Lava Island, near Bend, Oreg., for the period Oct. 1, 1915, to Nov. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1,070	1,110	.....	.....	.....	1,250	.....	1,690	.....	.....	1,660	.....	.....	.....
2	1,070	.....	1,280	.....	1,340	.....	1,350	.....	1,700	2,000	.....	1,620	1,580	1,560
3	.....	1,110	.....	1,210	.....	1,180	1,420	1,740	.....	.....	1,640	.....	.....	.....
4	1,080	.....	1,280	.....	1,270	.....	1,440	.....	1,680	2,000	.....	1,630	1,580	1,560
5	.....	1,110	.....	1,280	.....	1,230	1,470	1,740	.....	2,000	1,610	.....	1,580	.....
6	1,070	.....	1,360	.....	1,330	.....	1,510	.....	1,640	2,000	.....	1,630	.....	1,600
7	.....	.....	.....	1,270	.....	1,160	.....	1,880	.....	.....	1,610	.....	1,580	.....
8	1,070	1,140	1,340	.....	1,270	.....	1,510	.....	1,680	1,960	.....	1,630	.....	1,630
9	.....	.....	.....	.....	.....	1,270	.....	1,930	.....	.....	1,610	1,630	1,580	.....
10	1,080	1,140	1,300	1,210	1,300	.....	1,610	.....	1,700	1,830	.....	.....	.....	1,600
11	.....	.....	1,300	.....	.....	1,270	1,700	2,040	.....	.....	1,580	1,630	1,580	.....
12	1,080	1,140	.....	1,210	1,300	.....	.....	.....	1,700	1,810	.....	.....	.....	.....
13	.....	.....	1,240	.....	.....	1,340	1,660	2,090	.....	.....	1,660	1,630	1,560	1,380
14	1,090	1,140	.....	1,180	1,300	.....	1,700	.....	1,700	1,780	.....	.....	.....	.....
15	.....	.....	1,220	.....	.....	1,300	.....	2,090	.....	.....	1,720	1,600	1,530	1,500
16	1,090	1,180	.....	1,190	1,320	.....	1,700	.....	1,720	1,810	.....	1,600	.....	.....
17	1,090	.....	1,200	.....	.....	1,300	1,720	1,980	.....	.....	1,660	.....	1,530	1,530
18	1,090	1,200	1,140	1,200	1,340	.....	1,720	.....	1,760	1,830	.....	1,580	.....	.....
19	.....	.....	.....	.....	1,380	.....	.....	1,830	.....	1,780	1,660	.....	1,530	1,530
20	1,090	1,220	.....	1,210	1,380	1,360	1,740	.....	1,820	1,810	.....	1,600	1,530	.....
21	.....	.....	1,210	.....	.....	.....	1,740	1,810	.....	.....	1,660	.....	1,560	1,490
22	1,110	1,220	1,240	1,340	1,400	1,480	1,740	.....	1,880	1,740	.....	1,580	.....	.....
23	.....	.....	1,280	.....	.....	.....	.....	1,810	.....	.....	1,660	.....	1,530	1,490
24	1,110	1,240	.....	1,360	1,380	1,450	1,700	.....	1,940	1,710	.....	1,580	.....	.....
25	.....	.....	.....	.....	.....	1,430	.....	1,830	.....	.....	1,660	.....	1,530	1,490
26	1,110	1,360	.....	1,300	1,320	.....	1,700	.....	2,010	1,740	.....	1,580	.....	.....
27	.....	.....	1,210	.....	.....	1,390	.....	1,830	.....	.....	1,640	.....	1,530	1,560
28	1,110	1,320	.....	1,080	1,290	1,410	1,660	.....	1,940	1,740	.....	1,580	.....	.....
29	.....	.....	1,180	1,110	.....	1,430	1,720	1,770	.....	.....	1,640	.....	1,530	1,580
30	1,110	1,280	1,240	.....	.....	.....	.....	.....	1,940	1,690	1,640	1,580	.....	.....
31	.....	.....	1,270	1,210	.....	1,360	.....	1,740	.....	.....	1,640	.....	1,560	.....

NOTE.—Discharge for Dec. 1, 1916, 1,580 second-feet.

Monthly discharge of Deschutes River at Lava Island, near Bend, Oreg., for the period Oct. 1, 1915, to Nov. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915–16.				
October	1,110	1,070	1,090	67,000
November	1,360	1,110	1,190	70,800
December	1,360	1,180	1,250	76,900
January	1,360	1,080	1,220	75,000
February	1,400	1,270	1,330	76,500
March	1,480	1,160	1,330	81,800
April	1,740	1,350	1,630	97,000
May	2,090	1,690	1,860	114,000
June	2,010	1,640	1,790	107,000
July	2,000	1,690	1,840	113,000
August	1,720	1,580	1,640	101,000
September	1,630	1,580	1,600	95,200
The year	2,090	1,070	1,480	1,080,000
1916.				
October	1,580	1,530	1,550	95,300
November	1,630	1,380	1,540	91,600

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

DESCHUTES RIVER BELOW BEND, OREG.

LOCATION.—In SE. ¼ 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, 1916.

GAGE.—Stevens eight-day water-stage recorder on right bank; installed April 1, 1916, to replace Lietz recorder. Recorder inspected by Charles Orewiler.

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

CHANNEL AND CONTROL.—Rocky and probably permanent. Some logs and drift lodged on the wide shallow control may affect stage-discharge relation slightly.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 2.22 feet at 11 p. m. December 31 (discharge, 1,570 second-feet). Minimum stage, from water-stage recorder, 0.85 foot at 7 a. m. October 3 (discharge, 285 second-feet).

1915–16: Maximum stage recorded was that of 1916. Minimum stage recorded, 0.51 foot at 2 a. m. July 28, 1915 (discharge, 163 second-feet). For maximum for period 1905 to 1916 see description of Deschutes River at Lava Island (p. 34).

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

DIVERSIONS.—Station is below the intake of the five large canals (Arnold, Central Oregon, Pilot Butte, North, and Swalley canals) which divert water from Deschutes River near Bend. Tables showing combined discharge of river and canals follow tables for the station on the river. Only small diversions below station.

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

ACCURACY.—Stage-discharge relation changed during September, probably owing to growth of aquatic plants or to drift on control. Rating curves used as follows: October 1 to August 31, fairly well defined; September 16 to 30, fairly well defined. Operation of Lietz water-stage recorder unsatisfactory; that of Stevens water-stage recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting gage-height graph; shifting-control method used September 16–30. Records for October and April to June excellent; November, December, Frbruary, March, and July to September, good; January, fair.

Discharge measurements of Deschutes River below Bend, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 20	P. V. Hodges	1.90	1,230
May 28	F. F. Henshaw	1.72	962
Aug. 9	....do	1.30	611

Daily discharge, in second-feet, of Deschutes River below Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	365	770	1,160	1,230	1,220	1,150	1,360	1,130	930	1,170	741	628
2	360	780	1,170	1,280	1,240	1,130	1,220	1,110	930	1,360	732	660
3	316	810	1,200	1,250	1,260	1,120	1,050	1,110	930	1,300	705	696
4	332	810	1,230	1,100	1,280	1,060	994	1,110	900	1,300	678	705
5	384	830	1,170	1,180	1,300	920	1,190	1,250	880	1,170	644	696
6	354	870	1,020	1,160	1,230	850	1,360	1,300	840	1,260	628	714
7	348	780	1,020	1,140	1,170	880	1,430	1,230	830	1,280	628	741
8	360	732	1,060	1,120	1,030	920	1,500	1,170	830	1,240	628	790
9	378	714	1,040	1,140	950	1,040	1,500	1,110	820	1,210	612	810
10	391	696	1,030	1,140	974	1,050	1,570	1,160	790	1,180	588	820
11	404	850	1,040	1,140	964	1,180	1,570	1,170	780	1,120	588	810
12	410	994	1,050	1,040	1,060	1,210	1,570	1,220	790	1,020	612	810
13	404	994	1,140	1,130	1,170	1,210	1,570	1,240	780	960	614	810
14	398	1,000	1,140	1,120	1,170	1,180	1,570	1,250	780	910	616	820
15	472	1,030	1,140	1,120	1,150	1,190	1,570	1,240	770	870	619	820
16	580	1,040	1,100	1,110	1,160	1,170	1,430	1,190	770	930	621	810
17	696	1,060	1,080	1,110	1,220	1,180	1,360	1,130	750	950	624	800
18	696	1,070	1,070	1,100	1,260	1,240	1,360	1,130	750	950	626	800
19	696	1,100	1,130	1,100	1,240	1,430	1,360	1,050	760	950	628	800
20	705	1,080	1,050	1,000	1,240	1,500	1,360	1,000	780	940	612	810
21	714	1,080	1,000	1,050	1,240	1,500	1,360	983	820	950	644	810
22	723	1,100	1,020	1,110	1,230	1,430	1,360	983	930	940	652	800
23	696	994	1,060	1,120	1,210	1,360	1,360	983	930	1,020	644	810
24	628	972	1,230	1,070	1,180	1,360	1,300	1,000	910	1,080	612	830
25	687	1,110	1,260	1,110	1,160	1,360	1,300	1,030	930	870	604	820
26	714	1,110	1,260	1,070	1,120	1,290	1,300	1,050	994	830	628	800
27	705	1,130	1,200	1,080	1,160	1,360	1,230	1,060	1,070	780	644	810
28	705	1,160	1,190	1,120	1,190	1,360	1,110	1,000	1,100	760	644	800
29	741	1,180	1,200	1,120	1,170	1,360	1,120	994	1,140	732	660	810
30	760	1,160	1,240	1,180	.....	1,400	1,120	972	1,160	732	628	810
31	750	.....	1,100	1,160	.....	1,410	.....	961	.....	732	636	.....

NOTE.—Discharge interpolated, taking into account variation in diversions, for the following periods: Dec. 22-24, Jan. 9-14, 16-19, 21-22, 24-28, Jan. 31 to Feb. 1, Feb. 3-4, 6-8, 10-11, 13-16, 18, 23-25, Mar. 1-3, 12-17, 26-28, 30-31, June 11-17, July 9-16, Aug. 13-18.

Monthly discharge of Deschutes Creek below Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	760	316	544	33,400
November	1,180	696	967	57,500
December	1,260	1,000	1,120	68,900
January	1,280	1,000	1,130	69,500
February	1,300	950	1,170	67,300
March	1,500	850	1,220	75,000
April	1,570	994	1,350	80,300
May	1,300	961	1,110	68,200
June	1,160	750	879	52,300
July	1,360	732	1,020	62,700
August	741	588	637	39,200
September	830	628	782	46,500
The year	1,570	316	992	721,000

Combined daily discharge, in second-feet, of Deschutes River and Arnold, Central Oregon, Pilot Butte, North, and Swalley canals, near Bend, Oreg., for the year ending Sept. 30, 1916.

Day	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,040	1,080	1,220	1,260	1,220	1,180	1,460	1,670	1,580	1,780	1,610	1,480
2	1,040	1,050	1,230	1,310	1,240	1,180	1,530	1,690	1,570	1,950	1,590	1,520
3	1,020	1,050	1,260	1,280	1,260	1,170	1,390	1,720	1,580	1,880	1,550	1,520
4	1,010	1,050	1,290	1,230	1,280	1,160	1,340	1,740	1,610	1,880	1,550	1,530
5	1,060	1,040	1,280	1,210	1,300	1,170	1,360	1,780	1,590	1,750	1,520	1,500
6	1,030	1,100	1,220	1,190	1,240	1,150	1,410	1,750	1,550	1,850	1,530	1,520
7	1,030	1,120	1,290	1,170	1,180	1,120	1,480	1,820	1,560	1,870	1,530	1,510
8	1,040	1,100	1,320	1,150	1,120	1,060	1,550	1,820	1,590	1,880	1,530	1,520
9	1,040	1,100	1,300	1,140	1,050	1,070	1,550	1,770	1,580	1,860	1,520	1,540
10	1,050	1,100	1,260	1,140	1,120	1,080	1,620	1,830	1,560	1,840	1,490	1,550
11	1,040	1,060	1,220	1,140	1,180	1,220	1,680	1,820	1,560	1,800	1,490	1,530
12	1,040	1,080	1,160	1,130	1,240	1,240	1,660	1,870	1,570	1,790	1,520	1,530
13	1,040	1,080	1,190	1,130	1,250	1,260	1,650	1,890	1,580	1,760	1,530	1,530
14	1,030	1,090	1,190	1,120	1,270	1,290	1,640	1,880	1,590	1,740	1,530	1,520
15	1,090	1,120	1,170	1,120	1,290	1,310	1,690	1,880	1,600	1,710	1,490	1,500
16	1,010	1,130	1,160	1,110	1,310	1,340	1,700	1,860	1,610	1,690	1,490	1,490
17	1,040	1,150	1,130	1,110	1,320	1,360	1,670	1,840	1,620	1,670	1,460	1,470
18	1,040	1,160	1,100	1,110	1,300	1,380	1,670	1,840	1,630	1,680	1,450	1,470
19	1,040	1,190	1,150	1,100	1,280	1,490	1,670	1,780	1,640	1,660	1,450	1,460
20	1,050	1,170	1,130	1,090	1,290	1,510	1,670	1,730	1,650	1,660	1,430	1,460
21	1,060	1,220	1,160	1,100	1,290	1,510	1,670	1,710	1,670	1,660	1,450	1,470
22	1,070	1,250	1,190	1,110	1,280	1,440	1,670	1,690	1,720	1,650	1,440	1,460
23	1,040	1,210	1,220	1,120	1,260	1,370	1,690	1,670	1,750	1,590	1,450	1,480
24	971	1,190	1,250	1,120	1,230	1,370	1,670	1,670	1,730	1,630	1,440	1,490
25	1,030	1,200	1,280	1,120	1,210	1,390	1,690	1,680	1,710	1,640	1,430	1,500
26	1,060	1,190	1,290	1,120	1,180	1,390	1,740	1,690	1,730	1,610	1,460	1,480
27	1,040	1,210	1,230	1,120	1,210	1,390	1,690	1,700	1,780	1,580	1,480	1,480
28	1,030	1,240	1,220	1,120	1,210	1,390	1,660	1,640	1,780	1,560	1,490	1,480
29	1,060	1,260	1,230	1,120	1,190	1,390	1,650	1,640	1,780	1,560	1,520	1,480
30	1,080	1,240	1,270	1,180	.....	1,420	1,650	1,620	1,800	1,570	1,490	1,480
31	1,070	.....	1,130	1,200	.....	1,440	.....	1,610	.....	1,570	1,500	.....

Combined monthly discharge of Deschutes River and Arnold, Central Oregon, Pilot Butte, North, and Swalley canals near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,090	971	1,040	64,000
November	1,260	1,040	1,140	67,800
December	1,320	1,100	1,220	75,000
January	1,310	1,090	1,150	70,700
February	1,320	1,050	1,230	70,800
March	1,510	1,060	1,300	79,900
April	1,740	1,340	1,610	95,800
May	1,890	1,610	1,750	108,000
June	1,800	1,550	1,640	97,600
July	1,950	1,560	1,720	106,000
August	1,610	1,430	1,500	92,200
September	1,550	1,460	1,500	89,300
The year	1,950	971	1,400	1,020,000

DESCHUTES RIVER AT MECCA, OREG.

LOCATION.—In SW. ¼ sec. 20, T. 9 S., R. 13 E., at bridge at the Mecca station on Oregon Trunk Railway, Jefferson County, 1½ 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, 1916.

GAGE.—Vertical staff fastened to tree on right bank, 100 yards above bridge; read by E. Chaloupka.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Rock and gravel, shifts slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.75 feet March 21 (discharge, 11,700 second-feet); minimum stage recorded, 2.15 feet October 1, 2, 9, and 10 (discharge, 3,680 second-feet).

1911–1916: Maximum stage was recorded during 1916; 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 as 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 of February or March. Discharge measurements made during 1916 and 1917 indicate the previous form of curve to have been incorrect. The new rating curve, which is well defined, has been applied from February 7, 1916. In Water-Supply Paper 414 are published revised estimates of accuracy for April, 1913, March and April, 1914. Rating curve used prior to February 7 was well defined below and fairly well defined above 6,000 second-feet. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent.

Discharge measurements of Deschutes River at Mecca, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 29	P. V. Hodges	3.55	6,090	June 28	C. L. Batchelder	3.35	5,820
May 11	C. L. Batchelder	3.45	5,960	Aug. 22	F. F. Henshaw	2.77	4,330
23	F. F. Henshaw	3.02	4,960				

Daily discharge, in second-feet, of Deschutes River at Mecca, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,680	4,050	4,740	4,740	4,560	6,100	7,350	6,350	5,370	5,850	4,670	4,450
2	3,680	4,050	4,740	4,740	4,560	5,850	7,350	6,100	5,370	6,350	4,450	4,450
3	3,750	4,050	4,740	4,560	4,560	5,850	7,600	6,100	5,370	6,350	4,450	4,450
4	3,750	4,050	4,740	4,560	4,740	5,850	7,850	6,350	5,370	6,600	4,450	4,450
5	3,750	4,050	4,740	4,740	4,920	5,610	7,850	6,350	5,370	6,350	4,450	4,450
6	3,750	4,050	4,740	4,740	5,290	5,370	7,850	6,600	5,370	6,350	4,450	4,450
7	3,750	4,050	4,740	4,740	6,850	5,370	7,600	6,850	5,370	6,350	4,250	4,250
8	3,750	4,050	4,740	4,740	9,600	5,370	7,850	6,850	5,130	6,100	4,250	4,450
9	3,680	4,050	4,740	4,740	8,850	5,850	7,600	6,350	5,130	5,850	4,450	4,450
10	3,680	4,050	4,740	4,740	9,350	6,600	8,100	6,350	4,900	5,850	4,450	4,450
11	3,750	4,050	4,740	4,740	10,400	7,600	8,850	5,850	4,900	5,850	4,250	4,450
12	3,750	4,210	4,740	4,560	9,350	8,850	9,350	5,850	4,900	5,850	4,250	4,450
13	3,750	4,210	4,740	4,560	7,850	9,100	8,350	5,850	4,670	5,850	4,450	4,450
14	3,750	4,210	4,740	4,380	7,350	8,850	8,350	5,610	4,670	5,850	4,250	4,450
15	3,750	4,380	4,740	4,380	7,850	8,600	7,850	5,370	4,670	5,370	4,250	4,450
16	3,750	4,380	4,740	4,380	7,850	7,850	7,850	5,370	4,900	5,850	4,450	4,450
17	3,750	4,380	4,740	4,380	8,100	7,850	7,850	5,370	5,370	6,350	4,450	4,450
18	3,900	4,920	4,740	4,380	7,850	8,350	7,600	5,130	5,610	5,850	4,450	4,450
19	3,900	4,920	4,740	4,380	8,100	8,600	7,100	4,900	5,610	5,370	4,450	4,450
20	4,050	4,740	4,740	4,380	8,100	10,400	6,850	5,130	5,370	5,370	4,450	4,450
21	3,900	4,740	5,290	4,380	8,350	11,700	6,850	5,130	5,370	5,370	4,450	4,450
22	3,900	4,740	5,480	4,740	7,350	10,800	6,600	4,900	5,130	5,370	4,450	4,450
23	4,050	4,740	5,100	4,740	7,100	9,850	6,350	4,900	4,900	5,370	4,450	4,450
24	4,050	4,920	5,100	4,740	7,100	8,850	6,350	4,900	4,900	5,610	4,450	4,450
25	4,050	5,860	4,920	4,740	7,100	8,100	6,350	5,370	4,900	5,130	4,450	4,450
26	4,050	5,480	4,920	4,740	6,850	7,850	6,850	5,370	5,610	4,900	4,250	4,250
27	4,050	5,100	4,920	4,740	6,850	7,850	6,850	5,850	5,370	4,670	4,450	4,250
28	4,050	4,920	4,740	4,560	6,850	7,850	6,850	5,850	5,370	4,450	4,450	4,250
29	4,050	4,740	4,740	4,380	6,350	7,600	6,850	5,850	5,850	4,450	4,450	4,250
30	4,050	4,740	4,740	4,380	.....	7,350	6,850	5,610	5,850	4,450	4,450	4,250
31	4,050	.....	4,740	4,380	.....	7,350	.....	5,370	.....	4,450	4,450	.....

Monthly discharge of Deschutes River at Mecca, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4,050	3,680	3,860	237,000
November	5,860	4,050	4,500	268,000
December	5,480	4,740	4,820	296,000
January	4,740	4,380	4,580	282,000
February	10,400	4,560	7,240	416,000
March	11,700	5,370	7,710	474,000
April	9,350	6,350	7,460	444,000
May	6,850	4,900	5,730	352,000
June	5,850	4,670	5,220	311,000
July	6,600	4,450	5,610	345,000
August	4,670	4,250	4,410	271,000
September	4,450	4,250	4,410	262,000
The year	11,700	3,680	5,450	3,960,000

DESCHUTES RIVER AT MOODY, NEAR BIGGS, OREG.

LOCATION.—In SE. ¼ sec. 26, T. 2 N., R. 15 E., opposite Moody railroad station, 1¼ miles above bridge of Oregon-Washington Railroad & Navigation Co., 1½ 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, 1916; October 19, 1897, to December 31, 1899, for a station near Moro, 10 miles above mouth of river in the NE. ¼ sec. 5, T. 1 S., R. 16 E. Records for 1908 and 1910 somewhat fragmentary.

GAGE.—Staff in two sections, the lower inclined, the upper vertical; read by A. C. Osborn. At the Moro station gage was an inclined staff.

DISCHARGE MEASUREMENTS.—Made from a 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, 7.4 feet, night of February 10 (discharge, 27,000 second-feet); minimum stage recorded, 2.0 feet October 1 to 18 (discharge, 3,920 second-feet).

1906–1916: 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 practically permanent; rating curve well defined. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

Discharge measurements of Deschutes River at Moody, near Biggs, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Mar. 9	P. V. Hodges	4.20	11,600
May 12	C. L. Batchelder	3.30	7,540
Aug. 4	F. F. Henshaw	2.50	5,300

Daily discharge, in second-feet, of Deschutes River at Moody, near Biggs, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3,920	4,180	5,600	5,600	5,300	8,550	8,900	8,550	7,150	7,500	5,600	5,150
2	3,920	4,440	5,300	5,300	5,300	8,200	9,200	8,900	7,150	7,500	5,300	5,150
3	3,920	4,440	5,300	5,300	5,300	8,200	9,500	9,300	7,150	7,500	5,300	5,150
4	3,920	4,440	5,300	5,300	5,300	8,200	9,900	9,300	7,150	7,500	5,300	5,150
5	3,920	4,440	5,300	5,300	5,300	8,200	10,200	9,700	7,150	7,500	5,300	5,150
6	3,920	4,440	5,600	5,300	5,300	8,200	10,500	9,700	7,150	7,500	5,300	5,000
7	3,920	4,440	5,600	5,300	5,900	8,900	10,500	9,700	7,150	7,500	5,150	5,000
8	3,920	4,440	5,600	5,300	11,000	10,100	10,500	9,700	6,800	7,150	5,150	5,000
9	3,920	4,440	5,600	5,300	14,100	12,300	10,500	9,300	6,800	7,150	5,150	5,000
10	3,920	4,440	5,600	5,300	20,500	12,300	11,000	8,550	6,800	7,150	5,150	5,000
11	3,920	4,440	5,600	5,300	22,500	12,300	11,400	8,200	6,800	7,150	5,000	5,000
12	3,920	4,440	5,600	5,300	18,000	12,300	12,300	7,850	6,800	7,150	5,000	5,000
13	3,920	4,440	5,600	5,300	15,000	13,600	11,800	7,850	6,800	7,150	5,300	5,000
14	3,920	4,440	5,600	5,300	13,600	14,100	11,400	7,850	6,800	6,800	5,300	5,000
15	3,920	4,440	5,600	5,300	14,100	13,600	11,000	7,500	6,800	6,800	5,300	5,000
16	3,920	4,440	5,600	5,300	14,600	13,200	10,500	7,500	6,800	6,800	5,300	5,000
17	3,920	4,440	5,600	5,000	14,100	12,800	10,100	7,500	6,800	6,500	5,300	5,000
18	3,920	4,720	5,600	5,000	13,600	12,300	9,700	7,150	8,200	6,500	5,300	5,000
19	4,180	5,600	5,600	5,000	12,800	11,000	9,700	7,150	8,200	6,200	5,300	5,000
20	4,180	5,600	5,600	5,000	11,800	12,800	9,300	7,150	7,850	6,200	5,300	5,000
21	4,180	5,600	5,600	5,300	11,400	17,500	8,900	7,150	7,850	6,200	5,300	5,000
22	4,180	5,600	9,300	5,900	11,000	17,500	8,550	7,150	7,850	6,200	5,300	5,000
23	4,180	5,600	8,550	6,200	11,000	15,000	8,550	7,150	7,850	5,900	5,300	5,000
24	4,180	5,600	7,850	8,200	10,500	14,100	8,550	7,150	7,500	5,900	5,300	5,000
25	4,180	5,600	6,800	8,200	10,500	11,800	8,550	7,150	7,500	5,900	5,300	5,000
26	4,180	7,850	6,500	6,800	10,100	11,400	8,550	7,150	7,500	5,900	5,300	5,000
27	4,180	6,200	6,200	6,500	9,700	11,000	8,900	7,150	7,500	5,600	5,150	5,000
28	4,180	6,200	6,200	6,200	9,300	10,500	8,900	7,150	7,500	5,600	5,150	5,000
29	4,180	6,200	5,600	5,900	8,900	10,100	8,900	7,150	7,500	5,600	5,000	5,000
30	4,180	5,900	5,600	5,600	.....	9,700	8,550	7,150	7,500	5,600	5,150	5,000
31	4,180	.....	5,600	5,300	.....	9,300	.....	7,150	.....	5,600	5,150	.....

Monthly discharge of Deschutes River at Moody, near Biggs, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	4,180	3,920	4,030	248,000
November	7,850	4,180	5,050	300,000
December	9,300	5,300	5,950	366,000
January	8,200	5,000	5,650	347,000
February	23,500	5,300	11,300	650,000
March	17,500	8,200	11,600	713,000
April	12,300	8,550	9,830	585,000
May	9,700	7,150	7,970	490,000
June	8,200	7,150	7,280	433,000
July	7,500	5,600	6,620	407,000
August	5,600	5,000	5,240	322,000
September	5,150	5,000	5,020	299,000
The year	23,500	3,920	7,110	5,160,000

EAST FORK AT MORSON INTAKE, NEAR LAPINE, OREG.

LOCATION.—In NE. ¼ 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, in the SE. ¼ sec. 33, T. 23 S., R. 9 E., about 500 feet below mouth of Crescent Creek, just below proposed intake for Deschutes Land Co., Carey Act segregation.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 26 to November 21, 1914; March 15, 1915, to September 30, 1916.

GAGE.—Vertical staff nailed to bent of bridge since July 27, 1915; at old site, vertical staff nailed to a tree root. Gage reader, Geo. M. Mayfield.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—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 period April 1 to September 30, 1916, 4.4 feet May 7 (discharge, 772 second-feet); minimum stage recorded, 0.40 foot October 8 to 20 (discharge, 40 second-feet).

1914–1916: Maximum stage recorded was that of 1916; 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 changed during spring high water; change assumed to have occurred while records were suspended. Rating curves used as follows: October 1 to December 18, well defined between 40 and 80 second-feet; April 1 to September 30, well defined between 100 and 500 second-feet. Gage read to quarter-tenths every other day, October 1 to December 18, and April 1 to September 30. Daily discharge ascertained by applying gage height to rating table. Records good except for April and May, for which they are fair.

Discharge measurements of East Fork at Morson intake, near Lapine, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 2	Henshaw and Batchelder	[a] 0.41	40.8
June 17	P. V. Hodges	3.20	485
Aug. 14	F. F. Henshaw	1.85	203

[a] Old gage read 3.57 feet.

Daily discharge, in second-feet, of East Fork at Morson intake, near Lapine, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1		50	190	290		350	551	230	
2	42			290	580			226	149
3		48	190	294		340	544		
4	42			300	585			216	149
5		48	190	310	616	310	537		
6	42					286		212	
7		50	187	350	772		508		142
8	40			438		254		209	
9		50	182	496	772		503		138
10	40		137	556		230		204	
11		50			676		489		135
12	40		130	496		460		234	
13		56			580		460	212	132
14	40		141	537		438		199	
15		58			508		438		128
16	40		137	544		472		193	
17		68			472	484	438		125
18	40		137	544				183	
19		114			465	544	394		122
20	40			556	460			177	
21		158				580	368		120
22	44			508	460			167	
23		206				544	334	167	116
24	50			532	438		326		
25		193				551		164	112
26	50			556	416		280		
27		187				544		161	111
28	50			580	394		260		
29		187		580		551		156	110
30	50			575	372		240		
31								152	

Monthly discharge of East Fork at Morson intake, near Lapine, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	50	40	43.3	2,660
November	206	48	102	6,070
December 1–18	190	130	162	5,780
April	580	290	467	27,800
May	772	372	535	32,900
June	580	230	434	25,800
July	551	240	417	25,600
August	234	152	192	11,800
September	149	110	128	7,620

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

ARNOLD CANAL NEAR BEND, OREG.

LOCATION.—In SW. ¼ 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, 1916; information sufficient for a rough estimate, October, 1912, to March, 1914.

GAGE.—Vertical staff on side of flume. A gage one-half mile above, in the NE. ¼ sec. 27, was used up to April 30, 1915. Gage readers, O. E. Bowman and Joe Stenkamp.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.00 feet August 1, 29–31 (discharge, 107 second-feet). Canal dry at various times during year.

1914–1916: Maximum stage recorded, 2.20 feet August 11 to 14, 1915 (discharge, 112 second-feet).

ACCURACY.—Stage-discharge relation not permanent, probably on account of variable effect of a cross gate at wasteway a few feet above gage; changes in rating assumed to have occurred in latter part of February and June 22, when repairs were made to flume and canal. Rating curves, fairly well defined, used October 1 to February 29, March 1 to June 22, and June 23 to September 30, respectively. Gage read to half-tenths one daily. Daily discharge ascertained by applying mean daily gage height to rating tables. Records good.

Arnold canal diverts water from the right bank of Deschutes River at the head of Lava Island, in the SW. ¼ 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, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 21	P. V. Hodges	1.10	37.8	June 19	F. F. Henshaw	1.78	97
21	do	.58	15.0	Aug. 11	do	1.90	97

Daily discharge, in second-feet, of Arnold canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	88	60	33	.....	6	33	58	62	49	107	102
2	88	60	33	.....	33	33	58	62	49	97	102
3	88	60	33	.....	33	33	67	62	49	97	102
4	88	60	33	.....	33	33	67	62	49	97	102
5	88	57	33	.....	33	33	72	62	49	79	97
6	88	54	28	.....	33	33	72	62	56	97	97
7	88	54	28	.....	33	33	72	72	56	97	97
8	88	51	14	.....	33	33	72	72	60	97	97
9	88	40	33	.....	16	33	72	77	60	97	92
10	88	38	33	.....	16	33	72	77	56	97	92
11	66	38	33	.....	16	33	56	77	56	97	88
12	66	38	33	.....	16	33	50	77	79	97	88
13	66	38	28	.....	16	33	58	82	79	102	88
14	66	38	28	.....	6	33	38	92	88	97	84
15	66	38	14	28	6	33	38	92	92	97	84
16	66	38	33	28	12	33	38	104	79	92	84
17	66	38	33	28	12	36	67	104	56	92	84
18	66	38	16	28	12	38	67	98	60	92	84
19	66	38	.....	28	12	38	67	98	60	92	79
20	66	38	.....	33	12	38	67	98	63	97	71
21	66	38	16	33	12	38	67	98	67	97	75
22	66	38	16	33	12	38	67	49	67	97	79
23	66	38	8	33	12	38	67	79	67	97	88
24	66	38	.....	33	12	38	67	75	71	97	79
25	66	38	.....	33	20	38	58	56	71	97	79
26	66	33	.....	.....	33	50	58	43	71	97	79
27	60	33	.....	.....	33	50	58	43	79	97	79
28	60	33	.....	.....	33	50	58	49	79	102	79
29	60	33	.....	.....	33	58	58	49	79	107	79
30	60	33	.....	.....	16	58	58	49	84	107	79
31	60	.....	.....	.....	33	.....	58	.....	84	107	.....

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

Monthly discharge of Arnold canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	88	60	72.1	4,430
November	60	33	42.3	2,520
December (21 days)	33	8	26.6	1,110
February (11 days)	33	28	30.7	670
March	33	6	20.6	1,270
April	58	33	37.8	2,250
May	72	38	61.4	3,780
June	104	43	72.7	4,330
July	92	49	66.6	4,100
August	107	79	97.4	5,990
September	102	71	87.0	5,180
The year				35,600

NOTE.—See footnote to daily discharge table.

CENTRAL OREGON CANAL NEAR BEND, OREG.

LOCATION.—In NE. ¼ 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, 1916.

GAGE.—Vertical enameled staff nailed to inside of flume on right side; read by John 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.—1905–1916: Maximum stage recorded, 3.6 feet at 6 p. m. June 19, 1916 (discharge, 355 second-feet). Canal dry at times.

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.

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 excellent for irrigating season; fair for period November to March.

Central Oregon canal diverts water from the right bank of Deschutes River in the NE. ¼ sec. 13, T. 18 S., R. 12 E., and irrigates land lying to the east of Bend and in the vicinity of Powell Buttes.

The following discharge measurement was made by F. F. Henshaw:

June 17, 1916: Gage height, 3.45 feet; discharge, 328 second-feet.

Daily discharge, in second-feet, of Central Oregon canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	272	.....	.....	.....	.....	.....	16	220	272	246	341	341
2	272	.....	.....	.....	.....	.....	123	259	259	246	341	341
3	272	.....	.....	.....	.....	.....	140	259	259	246	355	327
4	272	.....	.....	.....	.....	.....	140	272	299	246	355	327
5	272	.....	.....	.....	.....	74	44	272	299	246	355	327
6	272	18	120	.....	.....	102	.....	259	299	246	355	327
7	272	112	170	.....	.....	102	.....	246	313	246	355	313
8	272	134	182	.....	.....	72	.....	285	327	272	355	299
9	246	158	170	.....	.....	.....	.....	285	327	272	355	299
10	246	182	134	.....	12	.....	.....	285	327	272	355	299
11	246	62	102	.....	57	.....	.....	285	327	285	355	299
12	246	.....	47	.....	74	.....	.....	285	327	327	355	299
13	246	.....	.....	.....	45	15	.....	285	327	327	355	299
14	246	.....	.....	.....	65	90	.....	285	327	341	355	285
15	233	.....	.....	.....	74	92	32	285	327	341	327	272
16	73	.....	.....	.....	88	112	74	299	327	299	327	272
17	.....	.....	.....	.....	52	123	123	299	327	299	327	272
18	.....	.....	.....	.....	.....	123	128	299	341	313	327	272
19	.....	.....	.....	.....	.....	46	128	299	355	327	327	272
20	.....	.....	.....	.....	.....	.....	128	299	341	327	327	259
21	.....	.....	.....	.....	.....	.....	128	299	341	313	327	259
22	.....	.....	.....	.....	.....	.....	128	299	341	313	313	259
23	.....	.....	.....	.....	.....	.....	128	285	341	170	313	259
24	.....	.....	.....	.....	.....	.....	128	272	341	144	327	259
25	.....	.....	.....	10	.....	.....	146	272	327	327	327	272
26	.....	.....	.....	53	.....	.....	146	259	313	327	327	272
27	.....	.....	.....	45	.....	.....	158	259	299	341	327	272
28	.....	.....	.....	.....	.....	.....	207	259	285	341	327	272
29	.....	.....	.....	.....	.....	.....	207	272	246	341	341	272
30	.....	.....	.....	.....	.....	.....	207	272	246	341	341	272
31	.....	.....	.....	.....	.....	.....	.....	272	.....	341	341	.....

NOTE.—No water in canal on days for which discharge is not given.

Monthly discharge of Central Oregon canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October (16 days)	272	73	247	7,840
November (6 days)	182	18	111	1,320
December (7 days)	182	47	132	1,830
January (3 days)	53	10	36.0	214
February (8 days)	88	12	58.4	926
March (11 days)	123	15	86.5	1,890
April (21 days)	207	16	127	5,290
May	299	220	277	17,000
June	355	246	313	18,600
July	341	144	291	17,900
August	355	313	339	20,800
September	341	259	289	17,200
The year	.....	.....	.....	111,000

NOTE.—See footnote to table of daily discharge.

PILOT BUTTE CANAL NEAR BEND, OREG.

LOCATION.—In NE. ¼ 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, 1916.

GAGE.—Vertical staff on right bank; read by John A. Watson.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge half a mile below the gage.

CHANNEL AND CONTROL.—Channel, gravel and sand; control partly solid rock; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.25 feet, August 5 to 23 (discharge, 90 second-feet). Canal dry at various times.

1905–1916: Maximum stage recorded, 3.10 feet, June 8, 11 to 16, July 19 to 21, 1913 (discharge, 244 second-feet).

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 practically permanent. Rating curve well defined. Gage read to half-tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

The following measurement was made by F. F. Henshaw: June 17, gage height, 2.08 feet; discharge, 71 second-feet.

Pilot Butte canal diverts water from the right bank of Deschutes River, in the NE. ¼ 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.

Daily discharge, in second-feet, of Pilot Butte canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	.....	.....	4	.....	42	30	73	84
2	10	.....	.....	.....	.....	21	.....	42	30	73	84
3	34	.....	.....	.....	.....	27	.....	42	30	73	62
4	34	.....	.....	.....	.....	27	.....	42	30	73	62
5	34	.....	.....	.....	9	8	17	42	30	90	62
6	34	4	28	.....	17	.....	27	42	30	90	62
7	42	16	40	.....	18	.....	34	42	36	90	53
8	42	24	34	.....	13	.....	27	42	42	90	51
9	40	27	34	.....	.....	.....	27	42	42	90	51
10	38	30	30	3	.....	.....	27	42	42	90	51
11	38	11	21	16	.....	.....	27	42	49	90	51
12	38	.....	10	27	.....	.....	27	42	62	90	51
13	38	.....	.....	27	.....	.....	27	42	68	90	51
14	38	.....	.....	27	.....	.....	27	42	73	90	46
15	36	.....	.....	27	.....	17	27	62	73	90	42
16	11	.....	.....	30	.....	26	42	62	60	90	42
17	.....	.....	.....	16	.....	27	42	73	46	90	42
18	.....	.....	.....	.....	.....	27	42	73	46	90	42
19	.....	.....	.....	.....	.....	27	42	73	46	90	42
20	.....	.....	.....	.....	.....	27	42	73	46	90	42
21	.....	.....	.....	.....	.....	27	42	53	46	90	42
22	.....	.....	.....	.....	.....	27	42	46	46	90	42
23	.....	.....	.....	.....	.....	27	42	46	38	90	42
24	.....	.....	.....	.....	.....	27	42	46	44	86	42
25	.....	.....	.....	.....	.....	27	42	40	68	84	42
26	.....	.....	.....	.....	.....	27	42	34	73	84	42
27	.....	.....	.....	.....	.....	27	42	34	73	84	42
28	.....	.....	.....	.....	.....	23	42	30	73	84	42
29	.....	.....	.....	.....	.....	.....	42	30	73	84	42
30	.....	.....	.....	.....	.....	.....	42	30	73	84	42
31	.....	.....	.....	.....	.....	.....	42	.....	73	84	.....

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

Monthly discharge of Pilot Butte canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October (15 days)	42	10	33.8	1,010
November (6 days)	30	4	18.7	222
December (7 days)	40	10	28.1	390
February (8 days)	30	3	21.6	343
March (4 days)	18	9	14.2	113
April (19 days)	27	4	23.7	893
May (27 days)	42	17	35.8	1,920
June	73	30	46.4	2,760
July	73	30	51.3	3,150
August	90	73	86.3	5,310
September	84	42	49.8	2,960
The year				19,100

NOTE.—See footnote to table of daily discharge.

NORTH CANAL NEAR BEND, OREG.

LOCATION.—In NE. ¼ 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, 1916.

GAGE.—Painted on left side of concrete lining of flume; read by 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 may affect stage-discharge relation.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.7 feet June 13–25 and August 5–14 (discharge, 280 second-feet). Canal dry at various times.

1913–1916: Maximum stage recorded, 5.85 feet August 7–18, 1914 (discharge 304 second-feet).

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent for irrigating season; fair December to March when water is carried only at irregular intervals.

North canal diverts water from the right bank of Deschutes River, in the NE. ¼ sec. 29, T. 17 S., R. 13 E., at a concrete dam about 60 feet high, and extends eastward about a mile, where it discharges the water into Pilot Butte canal.

Discharge measurements of North canal near Bend, Oreg., during the year ending Sept. 30, 1916.

[Made by F. F. Henshaw.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 28	4.93	220
June 17	5.62	276

Daily discharge, in second-feet, of North canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	245	203	.....	.....	.....	.....	51	210	231	231	273	259
2	245	161	.....	.....	.....	.....	130	210	231	210	273	259
3	245	130	.....	.....	.....	.....	130	238	238	203	273	259
4	217	130	.....	102	.....	51	130	238	252	203	273	259
5	217	107	51	.....	.....	112	65	119	252	203	280	252
6	217	107	.....	.....	.....	130	.....	32	252	203	280	245
7	217	107	.....	.....	.....	65	.....	189	252	203	280	238
8	217	107	.....	.....	82	.....	.....	210	266	217	280	217
9	217	107	.....	.....	97	.....	.....	224	266	224	280	217
10	217	107	.....	.....	124	.....	.....	231	266	224	280	217
11	217	54	.....	.....	136	.....	60	231	266	224	280	217
12	217	.....	.....	92	68	.....	44	231	266	231	280	217
13	217	.....	.....	.....	.....	.....	32	231	280	245	280	217
14	217	.....	.....	.....	.....	.....	22	231	280	252	280	217
15	217	.....	62	.....	.....	.....	22	238	280	259	266	217
16	217	.....	124	.....	.....	28	118	238	280	245	266	217
17	217	.....	136	.....	.....	28	102	245	280	238	238	203
18	217	.....	136	.....	.....	.....	102	252	280	231	238	203
19	217	.....	.....	.....	.....	.....	102	252	280	217	231	203
20	217	.....	.....	92	.....	.....	102	252	280	203	224	217
21	217	51	.....	51	.....	.....	102	252	280	203	217	217
22	217	65	.....	.....	.....	.....	102	252	280	210	217	217
23	217	130	.....	.....	.....	.....	102	245	280	217	231	217
24	217	130	.....	51	.....	.....	124	245	280	224	245	217
25	217	.....	.....	.....	.....	.....	124	231	280	231	245	217
26	217	.....	.....	.....	32	56	161	231	273	238	245	217
27	210	.....	.....	.....	32	.....	175	231	259	238	252	217
28	203	.....	.....	.....	.....	.....	217	231	252	238	259	217
29	203	.....	.....	.....	.....	.....	210	231	245	259	259	217
30	203	.....	.....	.....	.....	.....	210	231	245	259	259	217
31	203	.....	.....	41	.....	.....	.....	231	.....	259	259	.....

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

Monthly discharge of North canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	245	203	218	13,400
November (15 days)	203	51	113	3,360
December (5 days)	136	51	102	1,010
January (6 days)	102	41	71.5	851
February (7 days)	136	32	81.6	1,130
March (7 days)	130	28	67.1	932
April (25 days)	217	22	110	5,460
May	252	32	223	13,700
June	280	231	265	15,800
July	259	203	227	14,000
August	280	217	259	15,900
September	259	203	224	13,300
The year	.....	.....	.....	98,800

NOTE.—See footnote to table of daily discharge.

SWALLEY CANAL NEAR BEND, OREG.

LOCATION.—In NE. ¼ 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 1½ miles north of Bend, Deschutes County.

RECORDS AVAILABLE.—June 1, 1913, to September 30, 1916.

GAGE.—Vertical staff on right bank at lower end of intake flume; read by Chas. Orewiler.

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, 2.2 feet July 29 and 30, August 12–16 (discharge, 91 second-feet). This is probably the maximum ever diverted. Canal dry at various times during the year.

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

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Revision above 1.5 feet made to average measurements of 1916; used after March 31. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent during irrigating season; good December to March.

Swalley canal diverts water from the right bank of Deschutes River at the North canal dam, in the NE. ¼ 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, 1916.

[Made by F. F. Henshaw.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 28	1.66	57
Aug. 9	2.00	78

Daily discharge, in second-feet, of Swalley canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	66	48	28	28	.....	20	.....	53	48	53	77	71
2	66	48	28	28	.....	20	.....	53	48	53	77	71
3	66	48	28	28	.....	20	9	53	48	53	77	71
4	66	48	28	28	.....	20	18	53	53	53	77	71
5	66	48	28	28	.....	18	18	53	53	53	77	71
6	66	48	28	28	7.5	18	18	53	53	53	77	71
7	66	48	28	28	7.5	18	18	53	53	53	77	71
8	66	48	28	28	7.5	18	18	53	53	53	77	71
9	66	48	28	.....	7.5	18	18	53	53	53	77	71
10	66	48	28	.....	7.5	18	18	53	53	71	77	71
11	66	48	28	.....	7.5	19	18	53	71	71	77	65
12	66	48	18	.....	7.5	18	18	53	71	71	91	65
13	66	48	18	.....	7.5	18	18	53	71	77	91	65
14	66	48	18	.....	7.5	18	18	53	71	77	91	65
15	66	48	18	.....	7.5	18	18	53	71	77	91	65
16	66	48	18	.....	7.5	18	18	53	71	77	91	65
17	63	48	18	.....	7.5	18	18	53	84	77	84	65
18	60	48	18	.....	7.5	9	18	53	84	77	84	65
19	60	48	18	.....	13	.....	18	68	77	77	84	65
20	60	48	18	.....	20	.....	18	68	77	77	80	65
21	60	48	18	.....	20	.....	18	68	77	77	77	65
22	60	48	18	.....	20	.....	18	48	77	77	77	65
23	60	48	18	.....	20	.....	36	48	77	77	77	65
24	60	48	18	.....	20	.....	53	48	77	71	77	65
25	60	48	18	.....	20	9	53	48	77	71	77	65
26	60	48	28	.....	20	9	53	48	71	71	77	65
27	60	48	28	.....	20	.....	53	48	71	71	71	65
28	60	48	28	.....	20	.....	53	48	71	71	71	65
29	60	48	28	.....	20	.....	53	48	71	80	71	65
30	60	48	28	.....	.....	.....	53	48	71	84	71	65
31	60	.....	28	.....	.....	.....	.....	48	.....	77	71	.....

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

Monthly discharge of Swalley canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	66	60	63.2	3,890
November	48	48	48.0	2,860
December	28	18	23.5	1,440
January (8 days)	28	28	28.0	444
February (24 days)	20	7.5	12.9	614
March (20 days)	20	9	17.1	678
April (28 days)	53	9	27.1	1,510
May	68	48	52.8	3,250
June	84	48	66.8	3,970
July	84	53	68.8	4,230
August	91	71	79.1	4,860
September	71	65	67.0	3,990
The year				31,700

NOTE.—See footnote to table of daily discharge.

TUMALO CREEK NEAR BEND, OREG.

LOCATION.—In SE. ¼ 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, 1916 (fragmentary). 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. J. C. Stiles and T. G. Becker, gage readers. 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, 2.70 feet at 9 p. m. July 16 (discharge, 570 second-feet; total including diversions, 694 second-feet). Minimum stage recorded, 1.19 feet at various times October 6 to 12 (discharge, 43 second-feet; total including diversions, 45 or 46 second-feet).

1906–1916: 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, 1.17 feet at 6 p. m. September 18, 1915 (discharge, 41 second-feet; total including diversions, 44 second-feet).

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

DIVERSIONS.—Wimer and Columbia Southern canals and Anderson ditch divert water above the station.

ACCURACY.—Stage-discharge relation changed at end of ice period. Rating curves applicable as follows: October 1 to February 9, well defined; February 10 to September 30, fairly well defined between 40 and 300 second-feet. Operation of water-stage recorder unsatisfactory during the spring; two readings a day by the ditch rider, used March 1 to June 18. Daily discharge ascertained by applying to the rating table the mean daily gage height determined by inspecting gage-height graph or averaging the two daily readings. Records excellent for October and November, good for December and March to September, fair for January and February.

Discharge measurements of Tumalo Creek near Bend, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 16	P. V. Hodges	1.36	66	Juy 7	John Dubuis [a]	1.94	211
June 30	John Dubuis [a]	1.60	128	Aug. 10	F. F. Henshaw	1.65	127

[a] Inspector, Desert Land Board.

Daily discharge, in second-feet, of Tumalo Creek near Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	45	62	60	.....	73	62	72	140	155	170	194	98
2	45	55	62	.....	51	60	72	170	126	170	194	96
3	48	55	66	.....	44	56	70	185	170	140	194	120
4	45	55	64	.....	44	56	74	215	215	170	181	96
5	44	54	64	.....	44	56	72	230	230	185	168	88
6	44	52	64	.....	73	53	74	215	200	215	156	85
7	44	52	64	.....	110	56	76	185	200	248	144	81
8	44	52	62	.....	91	56	90	155	215	282	156	81
9	44	52	62	.....	82	52	90	140	230	320	156	81
10	44	54	62	.....	74	50	102	113	200	282	144	79
11	44	54	64	.....	60	52	102	90	170	282	144	75
12	44	52	64	.....	53	53	102	90	185	340	144	74
13	47	72	64	.....	53	53	102	86	200	360	144	74
14	51	64	64	.....	62	53	113	68	230	265	144	74
15	48	60	63	.....	62	55	113	63	265	282	156	74
16	48	57	63	.....	63	56	113	70	340	448	144	74
17	48	55	63	.....	63	56	113	86	340	267	132	74
18	48	58	63	.....	63	65	113	90	380	194	109	74
19	50	91	63	.....	63	70	102	90	320	168	98	74
20	50	82	62	.....	63	90	102	90	215	181	94	74
21	50	78	62	.....	62	88	102	102	140	194	94	74
22	50	68	66	.....	60	90	90	86	113	181	96	74
23	54	77	61	.....	58	86	90	80	140	181	98	74
24	52	67	66	.....	56	78	102	68	170	181	98	72
25	52	73	64	.....	56	78	113	65	200	168	109	72
26	52	71	62	.....	56	76	140	82	300	132	98	72
27	52	68	61	.....	56	74	155	140	230	109	96	72
28	52	64	58	.....	56	70	140	155	185	144	94	70
29	51	64	58	.....	56	68	140	155	140	168	109	70
30	51	58	58	.....	.....	67	126	140	113	181	116	70
31	58	.....	58	.....	.....	68	.....	140	.....	194	98	.....

NOTE.—Discharge estimated because of ice Dec. 15–19, 26–31, Jan. 1–31, and Feb. 1–9.

Monthly discharge of Tumalo Creek near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	58	44	48.4	2,980
November	91	52	62.5	3,720
December	66	58	62.5	3,840
January	.....	.....	[a] 50.0	3,070
February	110	44	62.3	3,580
March	90	50	64.6	3,970
April	155	70	102	6,070
May	230	63	122	7,500
June	380	113	211	12,600
July	448	109	219	13,500
August	194	94	132	8,120
September	120	70	78.9	4,690
The year	448	44	102	73,600

[a] Estimated.

Combined monthly discharge of Tumalo Creek, Wimer canal, Columbia, Southern canal, and Anderson ditch near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	58	44	48.4	2,980
November	91	52	62.5	3,720
December	66	58	62.5	3,840
January	.....	.....	a 50.0	3,070
February	110	44	62.3	3,580
March	90	50	64.6	3,970
April	155	70	102	6,070
May	.....	144	180	11,100
June	525	126	316	18,800
July	572	172	323	19,900
August	197	97	135	8,300
September	123	73	81.9	4,870
The year	572	44	124	90,200

a Estimated.

NOTE.—Anderson ditch estimated as follows: May, 4 second-feet; June, 5 second-feet; July, 4 second-feet; August and September, 3 second-feet. Probably a little water diverted in October.

WIMER CANAL NEAR TUMALO, OREG.

LOCATION.—In NE. ¼ sec. 2, T. 18 S., R. 10 E., half a mile below intake and below controlling spillway, about 15 miles southwest of Tumalo, Deschutes County.

RECORDS AVAILABLE.—1906–1916, irrigation seasons only. Those for 1906–7 were obtained just below intake and above controlling spillway.

GAGE.—Vertical staff; no change in datum since April 1, 1908.

DISCHARGE MEASUREMENTS.—Made by wading or from yoke of flume.

CHANNEL AND CONTROL.—Flume; fairly stable.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.35 feet June 10 (discharge, 17 second-feet). Canal dry at various times of year.

ICE.—Canal not operated during winter.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records fair.

The following discharge measurement was made by John Dubuis, inspector, Desert Land Board.

July 27, 1916: Gage height, 1.10 feet; discharge, 13.3 second-feet.

Wimer canal diverts water from Tumalo Creek in the SW. ¼ sec. 2, and formerly irrigated land lying above the Tumalo project reservoir. It was used in 1916 only when the Tumalo feed canal was out of commission.

Daily discharge in second-feet of Wimer canal near Tumalo, Oreg., for the year ending Sept. 30, 1916.

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1	.....	8.8	11	.....	12	21	9.5	12
2	.....	8.8	12	.....	12	22	8.0	11
3	.....	8.0	13	.....	8.0	23	8.0	11
4	.....	11	14	.....	11	24	8.0	11
5	.....	11	15	.....	11	25	11	12
6	.....	11	16	.....	12	26	12	12
7	.....	12	17	.....	11	27	10	12
8	.....	11	18	14	11	28	8.0	6
9	.....	11	19	12	11	29	8.0	.....
10	17	11	20	11	14	30	8.0	.....
						31	.....	.....

NOTE.—Mean discharge for June 6 to 9 estimated 16 second-feet; for June 11 to 17, 12 second-feet; July 23 to 26 interpolated. No flow in canal before June 6 nor after July 28.

Monthly discharge of Wimer canal near Tumalo, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
June (25 days)	17	8	11.7	582
July (28 days)	14	6	10.8	600
The year				1,180

COLUMBIA SOUTHERN CANAL NEAR TUMALO, OREG.

LOCATION.—In sec. 2, T. 18 S., R. 10 E., a quarter of a mile below head gates and about 15 miles southwest of Tumalo, Deschutes County.

RECORDS AVAILABLE.—May 15, 1906, to May 23, 1914; May 5 to July 28, 1916.

GAGE.—Vertical staff on upstream side of wasteway.

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

CHANNEL AND CONTROL.—Flume for about 30 feet and then earth section; no well-defined control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.30 feet June 17 and 18 (discharge, 125 second-feet); canal dry most of year.

1906–1916: Maximum discharge, 126 second-feet (gage height, 2.2 feet) July and August, 1907.

ICE.—Canal not operated during winter.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve not defined for 1916, but probably applicable. Gage read to half-tenths once daily; daily discharge ascertained by applying daily gage heights to rating table. Records fair; estimated discharge May 5 to June 17 roughly approximate.

No discharge measurements made during 1916.

Columbia Southern canal diverts water from Tumalo Creek, in the SE. ¼ sec. 2, and formerly irrigated the lands now embraced in the Tumalo project. Water was diverted in May, 1916, when the Tumalo feed canal was out of commission, and in June and July, when the discharge of the creek far exceeded the capacity of the feed canal.

Daily discharge, in second-feet, of Columbia Southern canal near Tumalo, Oreg., for the year ending Sept. 30, 1916.

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1		114	11		108	21	98	103
2		114	12		108	22	92	92
3		108	13		108	23	103	
4		108	14		103	24	103	
5		114	15		103	25	108	
6		114	16		108	26	114	
7		114	17	125	103	27	98	
8		103	18	125	92	28	98	
9		103	19	120	92	29	103	
10		103	20	108	103	30	108	
						31		

NOTE.—Mean discharge estimated, as follows, for periods when water was in canal, but no record secured: Noon May 5 to noon May 26, 80 second-feet; June 6 to 16, 110 second-feet; July 23 to noon July 28, 90 second-feet. No flow before May 5 or after July 28.

Monthly discharge of Columbia Southern canal near Tumalo, Oreg., for 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May (21 days)			80	3,330
June (25 days)	125	92	109	5,400
July (28 days)	114	45	100	5,550
The period				14,300

NOTE.—See footnote to table of daily discharge.

TUMALO FEED CANAL NEAR BEND, OREG.

LOCATION.—In SE. ¼ 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, 1916.

GAGE.—Painted on sloping concrete lining; read by J. C. Stiles and T. G. Becker.

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 period 1914 to 1916, 3.80 feet May 4, 5, and 6, 1916 (discharge, 219 second-feet). Canal dry at times.

ICE.—Water turned out in extremely cold weather.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records for December, February, and September good; for other months excellent.

Tumalo feed canal diverts water from Tumalo Creek in the SE. ¼ 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, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 16	P. V. Hodges	2.43	64	July 7	John Dubuis	3.45	166
June 30	John Dubuis [a]	3.15	128	Aug. 10	F. F. Henshaw	3.12	127

[a] Inspector, desert land board.

Daily discharge, in second-feet, of Tumalo feed canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	46	53	52	.....	60	70	128	134	159	165	92
2	46	47	56	.....	60	66	146	122	159	172	92
3	47	47	63	.....	59	66	172	146	146	165	101
4	47	47	56	.....	60	70	219	146	152	159	92
5	46	47	59	.....	59	70	219	146	159	152	87
6	46	47	58	.....	57	70	110	146	159	146	83
7	46	47	58	43	58	74	.....	146	159	146	83
8	46	48	56	101	58	87	.....	146	159	146	83
9	47	48	56	66	56	92	.....	146	152	146	78
10	46	48	56	63	55	101	.....	146	159	134	78
11	46	48	59	60	28	101	.....	140	159	134	74
12	47	47	56	35	55	92	.....	146	159	146	74
13	48	20	56	53	55	92	.....	140	159	134	74
14	50	52	59	66	55	106	.....	140	159	146	74
15	49	56	59	60	55	106	.....	140	159	140	70
16	49	50	59	60	58	106	.....	140	159	134	74
17	48	48	59	60	62	101	.....	73	159	122	74
18	47	101	59	60	67	101	.....	159	159	101	74
19	48	83	59	61	69	92	.....	159	146	92	74
20	47	74	59	62	92	92	.....	159	146	87	74
21	47	78	59	60	83	101	48	146	152	92	74
22	49	31	59	61	87	92	83	122	146	92	74
23	51	.....	59	59	78	92	78	146	146	92	74
24	48	.....	66	60	78	96	74	152	146	101	74
25	47	35	60	63	78	111	66	159	146	101	70
26	47	59	60	63	78	128	70	159	122	96	66
27	47	59	63	63	74	152	122	159	101	92	74
28	47	56	59	62	70	134	24	159	122	92	74
29	47	60	59	61	70	.....	140	140	152	101	74
30	47	59	26	.....	66	.....	134	122	159	116	74
31	53	.....	.....	.....	70	.....	134	.....	159	101	.....

NOTE.—Discharge estimated, on account of ice, Dec. 15 to 21, 25, 26, and 29. No flow during January or on days for which discharge is not given.

Monthly discharge of Tumalo feed canal near Bend, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	53	46	47.5	2,920
November (28 days)	101	20	53.4	2,970
December (30 days)	66	26	57.5	3,420
February (23 days)	101	35	61.0	2,780
March	92	28	64.8	3,980
April (28 days)	152	66	95.0	5,280
May (17 days)	219	48	116	3,910
June	159	73	143	8,510
July	159	101	151	9,280
August	172	87	124	7,620
September	101	66	77.8	4,630
The year	.....	.....	.....	55,300

NOTE.—See footnote to table of daily discharge.

SQUAW CREEK NEAR SISTERS, OREG.

LOCATION.—In NW. ¼ 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, 1916; no winter records. From July 1, 1906, to May 29, 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 installed March 24, 1916; inspected by Harry G. Kennard, watermaster. Vertical staff used prior to 1916.

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

CHANNEL.—Gravel and rock; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded after March 23, 1916, 3.56 feet at 7 p. m. July 16 (discharge, 574 second-feet); minimum stage recorded, 2.05 feet at 7 a. m. March 30 (discharge, 72 second-feet).

1906–1916: 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 between September, 1915, and March, 1916. Rating curve well defined between 70 and 400 second-feet. Operation of the water-stage recorder satisfactory. Daily discharge ascertained by applying to the rating table the mean daily gage height determined by inspecting gage-height graph. Records excellent.

Discharge measurements of Squaw Creek near Sisters, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 26	F. F. Henshaw	2.13	79	June 9	A. E. Perry [a]	2.59	218
27	Luper and Kennard [a]	2.18	99	17	....do	2.94	335
June 7	A. E. Perry [a]	2.47	175	July 12	....do	3.04	377

[a] Watermaster.

Daily discharge, in second-feet, of Squaw Creek near Sisters, Oreg., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	76	100	110	278	268	206
2	.....	76	120	110	260	268	197
3	.....	76	144	136	237	260	197
4	.....	76	170	170	254	254	170
5	.....	76	197	176	271	240	158
6	.....	76	176	179	285	237	150
7	.....	77	147	194	288	237	147
8	.....	82	138	218	299	240	147
9	.....	88	125	231	331	234	133
10	.....	98	112	203	350	224	115
11	.....	98	105	203	350	224	105
12	.....	95	100	200	400	231	108
13	.....	90	95	212	388	231	110
14	.....	102	90	254	347	218	105
15	.....	105	92	292	392	228	108
16	.....	100	100	324	514	234	115
17	.....	98	108	358	426	209	122
18	.....	95	112	404	354	173	115
19	.....	90	112	350	306	155	120
20	.....	85	118	271	302	150	115
21	.....	92	120	215	306	147	118
22	.....	80	112	182	302	147	110
23	.....	78	90	191	299	161	98
24	78	82	95	224	299	173	85
25	80	98	92	274	285	173	78
26	82	110	92	358	264	176	98
27	77	112	105	328	237	179	105
28	77	100	112	292	231	185	100
29	76	92	110	250	228	200	105
30	76	95	102	254	237	206	105
31	76	.....	105	.....	250	215	.....

Monthly discharge of Squaw Creek near Sisters, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 24-31	82	76	77.8	1,230
April	112	76	89.9	5,350
May	197	90	116	7,130
June	404	110	239	14,200
July	514	228	309	19,000
August	268	147	209	12,900
September	206	78	125	7,440
The period				67,200

SQUAW CREEK CANAL NEAR SISTERS, OREG.

LOCATION.—In SW. ¼ sec. 28, T. 15 S., R. 10 E., about half a mile below intake and 4 miles by road south of Sisters, Deschutes County.

RECORDS AVAILABLE.—April 26 to September 11, 1916.

GAGE.—Stevens eight-day water-stage recorder on right side of canal, a short distance below a wasteway.

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 during irrigating season from water-stage recorder, 2.04 feet at 8 p. m. July 12 (discharge, 168 second-feet). Canal dry at times.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 100 second-feet. Operation of recorder satisfactory. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting gage-height graph. Records excellent.

Squaw Creek canal diverts water from Squaw Creek in the SE. ¼ sec. 29, T. 15 S., R. 10 E., and irrigates land east and north of Sisters. Under it 8,328 acres have been adjudicated, 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, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 19	A. E. Perry [a]	1.18	23.8	May 27	Kennard [a] and Luper [b]	1.46	49.6
19	....do	1.01	12.1	30	Brewster and Perry	1.53	66
19	....do	1.36	40.0	31	....do	1.70	87
19	....do	1.43	45.6	31	....do	1.70	88
26	Perry and Brewster	1.31	35.3				

[a] Watermaster. [b] Employee, State water board.

Daily discharge, in second-feet, of Squaw Creek canal, near Sisters, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	39	63	49	108	50	16	.....	52	106	86	98	.....
2	.....	39	62	45	94	54	17	.....	60	96	52	83	.....
3	.....	42	69	43	102	67	18	.....	59	84	67	63	.....
4	.....	46	76	38	113	66	19	.....	60	81	96	62	.....
5	.....	62	80	32	124	60	20	.....	59	80	96	59	.....
6	.....	43	84	38	136	59	21	.....	60	75	90	70	.....
7	.....	39	98	48	138	59	22	.....	59	67	80	84	.....
8	.....	32	133	49	146	59	23	.....	57	75	75	92	.....
9	.....	37	136	48	144	46	24	.....	57	81	75	98	.....
10	.....	42	115	60	136	39	25	.....	55	92	75	98	.....
11	.....	42	110	119	133	38	26	35	52	83	83	84	.....
12	.....	41	110	131	128	.....	27	42	52	67	92	73	.....
13	.....	41	110	78	113	.....	28	50	57	56	96	72	.....
14	.....	41	115	119	102	.....	29	40	59	49	98	73	.....
15	.....	42	108	131	100	.....	30	39	62	49	104	70	.....
							31	.....	66	.....	115	55	.....

Monthly discharge of Squaw Creek canal, near Sisters, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 26–30	50	35	41.2	409
May	66	32	50.1	3,080
June	136	49	87.0	5,180
July	131	32	77.7	4,780
August	146	55	98.4	6,050
September 1–11	67	38	54.3	1,180
The period	.....	.....	.....	20,700

OCHOCO CREEK AT ELLIOTT RANCH, NEAR PRINEVILLE, OREG.

LOCATION.—In NE. ¼ sec. 5, T. 15 S., R. 17 E., at dam site of proposed reservoir for Ochoco project, below all tributaries, 6½ 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 to September 30, 1916.

GAGE.—Stevens eight-day water-stage recorder on left bank installed April 21, 1916; vertical staff up to that time; read by Harry G. Kennard, water master.

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, 3.5 feet at noon March 20 (discharge, 660 second-feet); minimum stage recorded, 0.70 foot September 17 to 20 (discharge, 4.0 second-feet).

1908–1910, 1915, and 1916: 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. 63–65.)

REGULATION.—None.

ACCURACY.—Stage-discharge relation slightly varying. Rating curve well defined. Gage read to tenths once daily until April 21; gage readings somewhat questionable. Operation of recorder after that date satisfactory except July 28 to August 6. Daily discharge ascertained by applying to the rating table the daily gage readings or the mean daily gage height determined by inspecting the gage-height graph. Records for May and June excellent; for March, April, and July, good; for January, February, August, and September, fair.

Discharge measurements of Ochoco Creek at Elliott ranch, near Prineville, during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 24	P. V. Hodges	2.62	338
Apr. 5	do	2.40	292
Aug. 8	Henshaw and Kennard	.79	6.6

Daily discharge, in second-feet, of Ochoco Creek at Elliott ranch, near Prineville, Oreg., for the year ending Sept. 30, 1916.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	23	200	280	195	170	140	9.0	5.5
2	.....	33	175	310	190	160	208	1.0	5.3
3	.....	33	175	310	192	130	205	8.0	5.1
4	.....	33	150	310	195	120	175	7.0	5.0
5	.....	33	175	280	220	115	148	6.0	5.0
6	.....	45	130	280	274	104	126	5.0	4.8
7	.....	130	130	280	262	102	109	8.0	4.6
8	.....	200	130	310	222	98	93	6.7	4.4
9	.....	250	130	310	202	86	84	7.0	4.2
10	.....	405	200	340	182	83	70	7.6	4.0
11	.....	340	310	475	162	74	51	7.0	7.0
12	.....	250	475	405	144	66	56	7.0	6.4
13	.....	200	475	340	130	60	38	6.7	5.8
14	.....	250	405	340	119	43	20	5.2	5.2
15	.....	340	280	340	106	26	16	5.5	4.6
16	.....	405	370	310	91	21	39	5.8	4.3
17	.....	440	405	340	83	43	42	6.7	4.0
18	.....	370	475	280	88	60	45	7.0	4.0
19	.....	405	510	250	90	57	48	7.6	4.0
20	.....	405	660	250	84	60	43	8.5	4.0
21	45	405	620	238	81	58	20	8.5	4.3
22	60	440	545	218	83	54	18	8.5	4.3
23	93	370	475	208	102	48	17	7.9	4.9
24	76	340	370	215	98	46	17	7.3	4.9
25	45	340	340	225	152	50	17	7.0	4.9
26	33	340	340	250	240	81	16	6.1	4.9
27	33	310	310	274	245	128	16	6.1	4.9
28	33	250	280	259	225	175	15	5.2	4.6
29	33	405	250	230	210	160	14	4.3	4.9
30	76	.....	250	205	195	142	13	4.9	4.9
31	45	.....	250	.....	180	.....	12	5.5	.....

Monthly discharge of Ochoco Creek at Elliott ranch, near Prineville, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January 21-31	93	33	52.0	1,130
February	440	23	269	15,500
March	660	130	322	19,800
April	475	205	289	17,200
May	274	81	163	10,000
June	175	21	87.3	5,190
July	208	12	62.3	3,830
August	10	4.3	6.86	422
September	7.0	4.0	4.82	287
The period				73,400

Combined monthly discharge of Ochoco Creek at Elliott ranch, Tableland and Elliott Creek ditches near Prineville, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January 21-31	93	33	52.0	1,130
February	440	23	269	15,500
March	680	133	335	20,600
April	495	227	307	18,300
May	297	104	182	11,200
June	191	37	104	6,190
July	223	27	76.5	4,700
August	27	8	11.7	719
September	8.8	4.0	5.76	343
The period				78,700

MARKS CREEK NEAR PRINEVILLE, OREG.

LOCATION.—Near mouth, at Sears ranch, about 15 miles east of Prineville, Crook County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 14 to August 31, 1916.

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

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gravel; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 5.0 feet at 7.30 a. m. March 20 (discharge, 320 second-feet); minimum stage recorded, 3.0 feet August 6 to 9 and 13 to 31 (discharge, 2 second-feet).

DIVERSIONS.—A considerable area is irrigated above this station.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve fairly well defined; gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table.

COOPERATION.—Records furnished by Ochoco irrigation district.

Discharge measurements of Marks Creek near Prineville, Oreg., during the year ending Sept. 30, 1916.

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

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 18	4.60	221	May 15	3.60	25.7
30	4.10	123	Aug. 9	3.00	1.8

Daily discharge, in second-feet, of Marks Creek near Prineville, Oreg., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	.....	125	77	60	68	7	16	200	156	25	8.5	14	2
2	.....	156	60	52	77	4	17	222	156	25	10	30	2
3	.....	156	60	45	60	4	18	245	135	25	14	20	2
4	.....	156	60	45	45	4	19	295	125	25	25	17	2
5	.....	135	60	30	45	4	20	320	105	30	14	14	2
6	.....	156	77	30	45	2	21	222	95	30	14	14	2
7	.....	146	60	25	30	2	22	222	86	25	14	14	2
8	.....	146	60	25	20	2	23	178	95	30	14	14	2
9	.....	156	60	20	20	2	24	178	105	38	14	12	2
10	.....	178	60	20	17	7	25	156	95	60	17	12	2
11	.....	200	52	20	14	7	26	167	95	95	30	10	2
12	.....	189	45	20	20	4	27	156	95	86	45	10	2
13	.....	156	38	14	14	2	28	135	77	86	60	8.5	2
14	178	135	30	7	10	2	29	125	77	77	60	8.5	2
15	178	156	30	7	12	2	30	115	77	68	68	7	2
							31	125	.....	60	.....	7	2

Monthly discharge of Marks Creek near Prineville, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 14–31	320	115	190	6,780
April	200	77	131	7,800
May	95	25	52.1	3,200
June	68	7.0	27.6	1,640
July	77	7.0	22.9	1,410
August	7.0	2.0	2.8	172
The period	.....	.....	.....	21,000

MILL CREEK NEAR PRINEVILLE, OREG.

LOCATION.—In sec. 25, T. 13 S., R. 17 E., at Fuller ranch, about 2 miles above mouth and 10 miles east of Prineville, Crook County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 14 to September 5, 1916.

GAGE.—Vertical staff; read by Irene Fuller.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Gravel; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.0 feet at 7 a. m. March 20 (discharge, 184 second-feet); minimum stage recorded, 1.0 foot August 30 to September 5 (discharge, 0.5 second-foot).

DIVERSIONS.—Considerable land irrigated above station.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Gage read to tenths or half-tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records good except for March, for which on account of diurnal fluctuation, they are only fair.

COOPERATION.—Records furnished by Ochoco irrigation district.

Discharge measurements of Mill Creek near Prineville, Oreg., during the year ending Sept. 30, 1916.

[Made by H. G. Kennard, watermaster.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Mar. 14	2.50	118	June 12	1.72	39.2
30	2.12	74	Aug. 9	1.20	4.8

Daily discharge, in second-feet, of Mill Creek near Prineville, Oreg., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	84	106	63	73	4.5	0.5
2	.....	84	118	63	84	4.5	.5
3	.....	90	130	54	73	4.5	.5
4	.....	84	143	54	63	4.5	.5
5	.....	84	118	54	63	4.5	.5
6	.....	84	130	54	54	4.5	.....
7	.....	84	118	54	54	4.5	.....
8	.....	95	106	45	54	7.2	.....
9	.....	112	84	45	45	4.5	.....
10	.....	118	84	45	45	4.5	.....
11	.....	156	84	45	37	4.5	.....
12	.....	130	73	37	37	3.2	.....
13	.....	118	63	37	37	3.2	.....
14	118	118	63	37	29	3.2	.....
15	118	118	63	29	29	3.2	.....
16	106	130	54	29	29	2.0	.....
17	118	130	54	29	29	2.0	.....
18	130	118	63	37	37	2.0	.....
19	143	106	73	37	29	3.2	.....
20	184	95	63	37	22	3.2	.....
21	170	106	54	29	16	3.2	.....
22	143	95	54	29	16	3.2	.....
23	130	95	54	29	16	3.2	.....
24	106	95	54	37	13	3.2	.....
25	106	118	63	45	13	3.2	.....
26	106	118	73	45	10	3.2	.....
27	106	143	84	54	10	2.0	.....
28	95	130	73	63	10	2.0	.....
29	84	118	73	63	10	2.0	.....
30	73	106	73	73	7.2	.5	.....
31	73	.....	63	.....	4.5	.5	.....

Monthly discharge of Mill Creek near Prineville, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March 14–31	184	73	117	4,180
April	156	84	109	6,490
May	143	54	80.9	4,970
June	73	29	45.1	2,680
July	84	4.5	33.8	2,080
August	7.2	.5	3.34	205
September 1–5	.5	.5	.50	5
The period	.....	.....	.....	20,610

TABLELAND DITCH NEAR PRINEVILLE, OREG.

LOCATION.—In NW ¼ sec. 5, T. 15 S., R. 16 E., at Elliott's ranch, about 1½ miles below intake, a quarter of a mile upstream from station on Ochoco Creek, and about 6½ miles east of Prineville, Crook County.

RECORDS AVAILABLE.—February 24 to June 9, 1915; March 1 to August 2, 1916; irrigation seasons.

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 read by ditch walker.

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, 5.4 feet February 26 to March 1, 1915, and March 20 and 26–30, 1916 (discharge, 20 second-feet). Ditch dry most of year.

ICE.—Water turned out during winter.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to tenths daily, in March; to quarter tenths daily April to July. Daily discharge ascertained by applying daily gage height to rating table. Records fair for March; good for rest of season.

Tableland ditch diverts water from the right bank of Ochoco Creek in the NW. ¼ 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, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 5	P. V. Hodges	4.55	5.1
5	....do	4.89	11.9
27	H. G. Kennard [a]	5.18	14.9

[a] Watermaster.

Daily discharge, in second feet, of Tableland ditch near Prineville, Oreg., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Day.	Mar.	Apr.	May.	June.	July.	Aug.
1	.....	.....	16	.....	16	12	16	16	16	16	16	13	.....
2	2.3	.....	16	5.2	15	6	17	18	16	16	16	.....	.....
3	2.3	.....	16	11	15	.....	18	16	16	16	16	7	.....
4	2.3	.....	16	14	14	.....	19	18	16	16	16	14	.....
5	3.2	5.2	16	15	16	.....	20	20	16	16	16	14	.....
6	3.2	11	16	16	16	.....	21	18	16	16	16	14	.....
7	3.2	12	16	16	16	.....	22	18	16	16	16	14	.....
8	4.5	14	16	16	15	.....	23	18	16	16	16	14	.....
9	7.5	14	16	16	15	.....	24	16	16	16	16	14	.....
10	12	14	16	16	15	.....	25	18	16	16	16	13	.....
11	12	15	16	16	14	.....	26	20	16	.....	16	11	.....
12	16	15	16	16	14	.....	27	20	16	.....	16	12	.....
13	16	15	16	16	14	.....	28	20	16	.....	16	14	.....
14	16	15	16	16	13	.....	29	20	16	.....	16	12	.....
15	16	16	16	16	13	.....	30	20	16	.....	16	12	.....
							31	18	.....	.....	.....	11	.....

NOTE.—No flow during October to February or September or on days for which discharge is not given.

Monthly discharge of Tableland ditch near Prineville, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
March (30 days)	20	2.3	13.7	815
April (26 days)	16	5.2	14.9	768
May (25 days)	16	10	16.0	793
June (29 days)	16	5.2	15.4	886
July (30 days)	16	7	13.7	815
August (2 days)	12	6	9.0	37
The period	.....	.....	.....	4,110

NOTE.—See footnote to table of daily discharge.

ELLIOTT DITCH NEAR PRINEVILLE, OREG.

LOCATION.—In NE. ¼ sec. 5, T. 15 S., R. 17 E., about 200 yards below intake, opposite gage on Ochoco Creek, and 6½ miles east of Prineville, Crook County.

RECORDS AVAILABLE.—November 1, 1908, to April 30, 1910, October 26, 1914, to June 30, 1915, and April 1 to September 30, 1916.

GAGE.—Vertical staff driven in right bank of canal; read by David Elliott. Different gage was used 1908–1910.

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, 1.6 feet during May and June (discharge, 6.9 second-feet).

1908–1910 and 1915–1916: Maximum stage recorded, 1.6 feet April 26–30, 1909 (discharge, 8.5 second-feet). Ditch dry at times.

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

ACCURACY.—Stage-discharge relation probably permanent. Rating curve fairly well defined. Gage read to tenths about once a week. Daily discharge ascertained by applying daily gage height to rating table. Records fair for April, May, August, and September; poor for June and July.

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, 1916.

[Made by Henshaw and Kennard.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Aug. 7	1.48	6.0
7	1.13	3.6

Daily discharge, in second-feet, of Elliott ditch near Prineville, Oreg., for the year ending Sept. 30, 1916.

Apr. 1..... 5.4	Aug. 5..... 6.1	Aug. 25..... 3.4
Apr. 13..... 5.4	Aug. 6–7..... 6.0	Aug. 30..... 4.2
Apr. 30..... 6.1	Aug. 8–9..... 4.7	Sept. 2..... 2.8
May 8, 18, 20, 30, June 3..... 6.9	Aug. 12..... 4.3	Sept. 6..... 2.3
July 27..... 6.0	Aug. 15..... 2.8	Sept. 10..... 3.4
	Aug. 20..... 4.0	

NOTE.—No flow prior to about Apr. 1, from June 10 to July 26, and after Sept. 10.

Monthly discharge of Elliott ditch near Prineville, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
April	5.6	333	August	4.21	259
May	6.9	424	September (10 days)	2.83	56
June (9 days)	6.9	123			
July (5 days)	6.0	60	The year		1,260

NOTE.—See footnote to table of daily discharge. Mean discharge April, May, and August taken as average of discharge on days gage was read.

McKAY CREEK NEAR PRINEVILLE, OREG.

LOCATION.—In sec. 4, T. 14 S., R. 16 E., on main road to Shaniko, 6 miles north of Prineville, Crook County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 25 to May 31, 1915; February 21 to June 21, 1916.

GAGE.—Vertical staff on spillway of diversion dam; gage on bridge abutment on line between secs. 7 and 8, T. 14 S., R. 16 E., used in 1915.

DISCHARGE MEASUREMENTS.—Made by wading above dam.

CHANNEL AND CONTROL.—Broad-crested weir, 38.9 feet long.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.5 feet March 20 (discharge, 202 second-feet). Minimum stage recorded, 0.25 foot June 17 and 18 (discharge, 9 second-feet).

1915–1916: Maximum stage recorded was that of 1916. In 1915, stream dry up to February 24, and practically dry after June 1.

ICE.—Practically none.

DIVERSIONS.—Considerable land irrigated above the station. Spillway was closed by flashboards and all water turned into canal on June 22. Practically no other water diverted around gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair for June and good for other months.

Discharge measurements of McKay Creek near Prineville, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Feb. 25	P. V. Hodges	1.74	116
Mar. 21	Hodges and Kennard [a]	1.30	74
May 9	H. G. Kennard	.76	38.2

[a] Watermaster.

Daily discharge, in second-feet, of McKay Creek near Prineville, Oreg., for the year ending Sept. 30, 1916.

Day.	Feb.	Mar.	Apr.	May.	June.	Day.	Feb.	Mar.	Apr.	May.	June.
1	.....	67	84	42	29	16	.....	123	88	32	11
2	.....	59	84	42	29	17	.....	128	84	32	9
3	.....	59	93	38	29	18	.....	144	84	32	9
4	.....	52	88	38	26	19	.....	166	67	29	13
5	.....	52	80	35	26	20	.....	202	67	29	15
6	.....	56	84	38	23	21	133	178	63	29	13
7	.....	56	93	45	23	22	138	172	52	26	.....
8	.....	45	93	45	20	23	138	166	48	26	.....
9	.....	45	88	48	20	24	133	113	45	26	.....
10	.....	88	113	45	18	25	133	113	45	56	.....
11	.....	138	128	38	15	26	118	113	45	63	.....
12	.....	172	103	35	15	27	113	108	45	52	.....
13	.....	155	103	35	15	28	84	98	45	48	.....
14	.....	133	98	35	13	29	75	88	42	42	.....
15	.....	118	93	32	13	30	.....	84	42	42	.....
						31	.....	80	.....	38	.....

Monthly discharge of McKay Creek near Prineville, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
February 21-29	138	75	118	2,110
March	202	45	109	6,700
April	128	42	76.2	4,530
May	63	26	38.5	2,370
June 1-21	29	9	18.3	762
The period				16,500

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

LOCATION.—In NE. ¼ sec. 3, T. 13 S., R. 9 E., at Allingham ranger station, Jefferson County, 1½ 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, and May 16 to September 16, 1916.

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

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Gravel.

EXTREMES OF DISCHARGE.—Maximum stage recorded May 16, to September 16, 0.92 foot June 19 (discharge, 465 second-feet). Minimum stage recorded, 0.55 foot September 6 to 16 (discharge, 314 second-feet).

1910–1913 and 1915–16: 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 quarter-tenths about every other day. Daily discharge ascertained by applying gage height to rating table. Records good.

Discharge measurements of Metolius River at Allingham ranger station, near Sisters, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 25	F. F. Henshaw	0.80	388
June 30	C. L. Batchelder	.81	416

Daily discharge, in second-feet, of Metolius River at Allingham ranger station, near Sisters, Oreg., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1		410				16	410			314	314
2			419	324	327	17		446	410		
3		402				18	402				
4			419		327	19		465	370	324	
5		410		324		20	402				
6					314	21				324	
7				350		22	410		350		
8			410			23				327	
9		419		350	314	24	419	419	350		
10			410			25					
11		446			314	26		419	338		
12			390	362		27				314	
13		432			314	28		410			
14				314		29			338	314	
15		446	390			30	414	419			
						31			330		

Monthly discharge of Metolius River at Allingham ranger station, near Sisters, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
May 16–31	419	402	410	13,000
June	465	402	426	25,300
July	419	330	379	23,300
August	362	314	328	20,200
September 1–16	327	314	318	10,100
The period				91,900

NOTE.—Mean discharge is average of discharge for days on which gage was read.

LAKE CREEK NEAR SISTERS, OREG.

LOCATION.—In SE. ¼ sec. 24, T. 13 S., R. 8 E., 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, 1916.

GAGE.—Vertical staff, installed April 1, 1916, on left bank, about 1,000 feet below a 15-foot weir. April 7, 1915, to April 30, 1916, vertical staff about 20 feet above weir. Gage in natural channel, near site of weir, used 1911 to 1913. Gage reader, Harry Heising.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Heavy gravel and boulders; permanent. Prior to April 1, trapezoidal weir 15 feet long, crest not quite level and somewhat rounded; some velocity of approach; rather unstable.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.70 feet June 20 and 25 (discharge, 138 second-feet); minimum stage recorded, 0.50 foot above weir, October 19 (discharge, 21 second-feet).

1911–1913 and 1915–1916: Maximum discharge, 145 second-feet for a stage of 1.22 feet on old gage, May 29, 1913. Minimum stage recorded was that of 1916.

ICE.—Stage-discharge relation unaffected.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed April 1, when new gage was installed. Rating curve for weir gage fairly well defined between 60 and 100 second-feet. Rating curve for lower gage well defined. Gage read to hundredths about three times a week until July 30 and once a week thereafter. Daily discharge ascertained by applying gage heights to rating table. Records fair.

Discharge measurements of Lake Creek near Sisters, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.		Discharge.
		Weir gage.	Lower gage.	
		Feet.	*Feet.*	*Sec.-ft.*
Apr. 1	Hodges and Young	1.42	1.19	92
May 25	F. F. Henshaw	1.87	1.30	98
July 1	C. L. Batchelder	1.54	1.30	99

Daily discharge, in second-feet, of Lake Creek near Sisters, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	35			61			85	99	99	99		
2	28	23		69	65					99		
3							75	99				42
4	28		49				75		99	99		
5		26		69	69			99				
6	26						75		114	99	49	
7		28			69			99				
8	32		55	61		65						
9		28					80	99		99		
10	28			61	75	69						38
11			61					92	130	86		
12	28	28			75		86					
13	26					69			130	75	42	
14			61	65			92	92				
15					81	72			130			
16		35					86	92		75		
17	26		55		89	75						35
18		38		69	89		99	92	130			
19	21				89					75		
20		38				75	99		164		42	
21		40		69				96		75		
22	23	40			89	89	99					
23			55					106		75		42
24	32	43		69	85	92	106					
25								106	164	75		
26	23				81		99					
27			55	69		89			114		42	
28	23	49					106	99		57		
29						89						
30		55					106	99	99	57		38
31	32			65								

Monthly discharge of Lake Creek near Sisters, Oreg., for year ending Sept. 30, 1916.

Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).	Month.	Discharge in second-feet (mean).	Run-off (total in acre-feet).
October	27.4	1,680	May	97.8	6,010
November	36.2	2,150	June	125.	7,440
December	55.9	3,440	July	81.8	5,030
January	66.1	4,060	August	43.8	2,690
February	79.7	4,580	September	39.0	2,320
March	78.4	4,820			
April	91.2	5,430	The year	68.5	49.600

NOTE.—Monthly means found by averaging daily discharge for days when gage was read.

FIRST CREEK NEAR SISTERS, OREG.

LOCATION.—In SW. ¼ sec. 12, T. 13 S., R. 8 E., Jefferson County, just above a trail crossing, 1½ miles from road leading to Suttle Lake, about 15 miles northwest of Sisters.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 7, 1915, to September 30, 1916.

GAGE.—Vertical staff on left bank about 5 feet above wier. Beginning with April 2 new gage with datum 5.08 feet lower. 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.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.3 feet June 18 and 20 (discharge, 71 second-feet); minimum stage recorded, 0.15 foot on old gage October 20 and 22 (discharge, 0.9 second-foot). 1915-1916: Extremes are those of 1916.

ICE.—Stage-discharge relation apparently unaffected.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed gradually during high water of 1916, as weir began to leak. Gage read to quarter-tenths about three times a week up to July 31; weekly thereafter. Two rating curves used; well defined for old gage up to April 1; fairly well defined for new gage after April 2. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of First Creek near Sisters, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
April 2	Hodges and Young	5.79	34.9
July 1	C. L. Batchelder	5.99	48.3

Daily discharge, in second-feet, of First Creek near Sisters, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.5			37			37	42	42	49		
2	1.5	1.5		37	40		34			49		
3								42				5.0
4	1.5		14						42	49		
5		1.5		37	37			42				
6	3.0						35		42	42	16	
7		1.5			37			42				
8	1.5		19	34		40	35					
9		1.5						42		42		
10	1.5			34	40	40						5.0
11			25					42	56	35		
12	1.5	1.5			40		35					
13	1.5					40			63	35	10	
14			25	37			35	42				
15					43	37			63			
16		1.5					38	42		35		
17			22		43	31						1.5
18	1.5	1.5		37	43		35	42	71			
19					43					35		
20	.9	1.5				25	35		71		10	
21		1.5		37				42		35		
22	.9	3.0			43	31	35					
23			25					42		35		1.5
24	1.5	4.8		37	40	34	38					
25								42	63	35		
26	1.5				40		38					
27			27	37		43			56		10	
28	1.5	14.					46	42		22		
29						43						
30		14.					46	42		22		1.5
31	1.5			40								

Monthly discharge of First Creek near Sisters, Oreg., during the year ending Sept. 30, 1916.

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	1.52	93	May	42.0	2,500
November	3.79	225	June	56.9	3,380
December	22.4	1,380	July	37.1	2,280
January	36.7	2,260	August	11.5	707
February	40.8	2,350	September	2.90	173
March	36.4	2,240			
April	37.3	2,220	The year	27.4	19,900

NOTE.—Monthly means found by averaging daily discharge for days when gage was read.

JACK CREEK NEAR SISTERS, OREG.

LOCATION.—In SE. ¼ sec. 28, T. 12 S., R. 9 E., Jefferson County, at road crossing about half a mile north of Heising's ranch and 19 miles northwest of Sisters.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 21 to September 27, 1915; May 24 to September 16, 1916. Miscellaneous measurements during 1911 to 1913.

GAGE.—Vertical staff on right bank just above bridge; read by L. W. Zumwalt.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Loose gravel; shifting.

EXTREMES OF DISCHARGE.—1915–1916: Maximum stage recorded, 1.10 feet September 16, 1916 (discharge, 76 second-feet); minimum stage recorded, 0.60 foot September 25, 1915 (discharge, 34 second-feet).

ICE.—Stage-discharge relation probably unaffected.

DIVERSIONS.—Heising's ditch diverts 1 second-foot or less above station for irrigation.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during period of records; rating curve well defined. Gage read to quarter-tenths about once a week. Records excellent for days on which gage was read.

COOPERATION.—Gage-height record furnished by U. S. Forest Service, W. G. Hastings, supervisor.

Discharge measurements of Jack Creek near Sisters, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 25	F. F. Henshaw	0.82	59
June 30	C. L. Batchelder	.77	55

Daily discharge, in second-feet, of Jack Creek near Sisters, Oreg., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1			54			16					76
2					72	17		57			
3		56				18					
4						19				69	
5				60		20					
6						21					
7						22			57		
8			53			23					
9					72	24	60	56			
10						25	59				
11						26					
12		56		68		27					
13						28					
14						29			58		
15			57			30		55			
						31					

CANYON CREEK NEAR SISTERS, OREG.

LOCATION.—In NW. ¼ sec. 27, T. 12 S., R. 9 E., Jefferson County, about three-quarters of a mile above mouth, 1 mile north of Heising's ranch, and 20 miles northwest of Sisters.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 21 to September 27, 1915. May 24 to September 16, 1916. Miscellaneous measurements during 1911 to 1913.

GAGE.—Vertical staff nailed to tree on right bank about 100 feet below new bridge; read by L. W. Zumwalt.

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

EXTREMES OF DISCHARGE.—Maximum stage during period covered by records, 2.40 feet June 17, 1916 (discharge, 150 second-feet); minimum stage recorded during 1916, 2.0 feet September 9 (discharge, 80 second-feet); minimum stage in 1915, 1.80 feet, September 4 (discharge, 56 second-feet).

ICE.—Stage-discharge relation unaffected by ice, as most of water is from springs.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; rating curve well defined. Gage read to quarter-tenths, about once a week. Records excellent for days on which gage was read.

COOPERATION.—Gage-height records furnished by United States Forest Service, W. G. Hastings, supervisor.

Discharge measurements of Canyon Creek near Sisters, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 24	F. F. Henshaw	2.11	98
June 30	C. L. Batchelder	2.19	112

Daily discharge, in second feet, of Canyon Creek near Sisters, Oreg., for the year ending Sept. 30, 1916.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1			112			16					88
2					88	17		150			
3		97				18					
4						19				109	
5				95		20					
6						21					
7						22			116		
8			95			23					
9					80	24		95	112		
10						25					
11						26					
12		92		98		27					
13						28					
14						29			95		
15			134			30		112			
						31					

SHITIKE CREEK AT WARM SPRING, OREG.

LOCATION.—In NE. ¼ sec. 26, T. 9 S., R. 12 E., at Warm Spring, Jefferson County, about 2 miles above mouth of creek and below all tributaries.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 11, 1911, to October 31, 1916, when station was discontinued.

GAGE.—Vertical staff on left bank opposite store; read by Will H. See.

DISCHARGE MEASUREMENTS.—Made by wading or from temporary footbridge near gage.

CHANNEL AND CONTROL.—Gravel and sand; likely to shift somewhat.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.90 feet February 9 (discharge, 720 second-feet); minimum stage recorded, 0.85 foot October 1–30, 1915 (discharge, 41 second-feet).

1911–1916: Maximum stage recorded, during 1916; minimum stage recorded 0.81 foot September 4, 1915 (discharge, 36 second-feet).

ICE.—Stage-discharge relation somewhat affected by ice during short periods of cold weather.

DIVERSIONS.—Probably none above station.

REGULATION.—Practically none. There is a small power plant just above the station.

ACCURACY.—Stage-discharge relation changed March 21, 1916. Rating curve used prior to March 21 well defined up to 200 second-feet; rating curve used from March 21 well defined between 90 and 200 second-feet. Gage read to half-tenths, or quarter-tenths at low water, once a day. Daily discharge ascertained by applying daily gage height to rating table. Records excellent October to December, 1915, and March to August, 1916; good, January, February, September, and October, 1916.

Discharge measurements of Shitike Creek at Warm Spring, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*St.ec.-f*			*Feet.*	*Sec.-ft.*
Oct. 13	F. F. Henshaw	0.83	36	May 23	F. F. Henshaw	1.48	150
Mar. 1	P. V. Hodges	1.52	180	June 29	C. L. Batchelder	1.60	183
May 11	C. L. Batchelder	1.56	178	Aug. 22	F. F. Henshaw	1.30	98

Daily discharge, in second-feet, of Shitike Creek at Warm Spring, Oreg., for the period Oct. 1, 1915, to Oct. 31, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	41	64	147	100	111	175	220	187	155	155	155	77	77
2	41	62	143	100	111	175	220	187	155	255	125	77	68
3	41	62	134	100	111	175	220	187	155	255	125	120	68
4	41	62	134	90	111	161	220	220	187	255	125	120	68
5	41	62	122	100	111	161	204	292	220	255	125	112	68
6	41	62	122	100	122	175	204	330	187	220	125	103	68
7	41	62	122	100	288	190	204	292	220	220	125	98	68
8	41	66	134	111	398	175	204	292	220	255	125	98	68
9	41	64	134	111	720	190	204	238	255	255	125	112	68
10	41	62	134	111	625	205	187	187	220	255	125	98	68
11	41	62	134	111	495	205	204	171	187	255	125	93	68
12	41	62	147	111	342	190	204	171	187	255	125	88	68
13	41	62	147	111	271	175	187	155	220	255	98	88	63
14	41	80	161	111	205	175	204	140	220	220	98	88	63
15	37	100	147	111	205	161	220	140	255	220	125	81	63
16	41	342	134	111	271	161	220	155	292	292	125	81	60
17	41	306	134	111	306	147	220	155	330	255	98	81	60
18	41	288	134	111	495	147	220	155	370	220	98	77	60
19	41	237	122	111	342	161	187	155	330	187	98	77	60
20	41	205	122	111	288	175	171	155	255	187	98	77	60
21	41	271	111	122	271	450	187	155	220	187	98	77	60
22	41	271	111	134	271	330	187	155	187	187	98	77	60
23	41	237	111	122	254	292	187	155	155	187	98	77	60
24	41	205	111	122	237	274	171	155	187	187	88	57	60
25	41	205	122	111	221	255	171	155	220	187	88	57	60
26	41	205	111	111	205	255	187	155	292	155	77	77	60
27	41	147	111	111	205	238	187	155	255	155	77	77	60
28	41	147	111	111	190	238	204	155	220	155	77	57	60
29	41	147	100	100	175	220	204	187	187	155	77	57	60
30	41	147	100	100	.....	220	187	155	155	155	77	57	68
31	62	.....	100	111	.....	220	.....	155	.....	155	77	.....	77

NOTE.—Daily discharge interpolated on account of ice, Jan. 9 to 16.

Monthly discharge of Shitike Creek at Warm Spring, Oreg., for the period Oct. 1, 1915, to Oct. 31, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	62	37	41.5	2,550
November	342	62	145	8,630
December	161	100	126	7,750
January	134	90	109	6,700
February	720	111	274	15,800
March	450	147	209	12,900
April	220	171	200	11,900
May	330	140	184	11,300
June	370	155	223	13,300
July	292	155	213	13,100
August	155	77	106	6,520
September	120	57	83.9	4,990
The year	720	37	159	115,000
October	77	60	64.5	3,970

TROUT CREEK NEAR ANTELOPE, OREG.

LOCATION.—In NE. ¼ 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 August 31, 1915; February 15 to September 9, 1916.

GAGE.—Vertical staff on right bank about 60 feet below a flume crossing and about 600 feet from Priday ranch house; read by 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 during period March, 1915, to September, 1916, was about 5.0 feet February 8, 1916 (discharge about 900 second-feet). Minimum discharge recorded, 0.2 second-foot (gage height, 0.55 foot) August 6 to September 18, 1915.

ICE.—No record secured during winter.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent between floods; changed early in February, 1916. Rating curve for 1916 fairly well defined. Gage read to tenths twice a day. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

COOPERATION.—Part of field data secured by assistants to the State Engineer of Oregon.

Discharge measurements of Trout Creek near Antelope, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 28	P. V. Hodges	1.70	92	May 30	Rhea Luper	1.60	71
Mar. 29	do	2.00	128	Aug. 7	F. F. Henshaw	.52	6.8
May 12	C. L. Batchelder	1.60	69				

Daily discharge, in second-feet, of Trout Creek near Antelope, Oreg., for the year ending Sept. 30, 1916.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	66	105	83	71	90	9	.....
2	.....	56	113	71	60	83	9	1
3	.....	56	105	71	60	77	9	.....
4	.....	60	90	71	51	77	8	.....
5	.....	56	83	71	51	66	8	1
6	.....	60	77	71	51	60	7	.....
7	.....	60	66	83	44	60	7	.....
8	.....	66	77	97	44	56	7	.....
9	.....	105	83	97	37	44	7	1
10	.....	168	83	97	37	40	8	.....
11	.....	178	168	71	37	31	9	.....
12	.....	221	130	71	44	25	10	.....
13	.....	199	113	60	44	25	11	.....
14	.....	158	97	60	37	25	12	.....
15	221	139	97	51	37	25	12	.....
16	244	122	97	51	31	40	10	.....
17	256	122	97	51	31	51	9	.....
18	232	130	83	60	31	40	8	.....
19	168	158	83	51	34	34	6	.....
20	130	199	83	51	34	31	4	.....
21	105	221	83	51	40	25	4	.....
22	90	199	83	44	37	25	2	.....
23	83	178	71	44	31	25	2	.....
24	83	158	71	44	34	25	2	.....
25	83	139	71	44	31	20	1	.....
26	83	139	71	83	37	16	1	.....
27	71	178	71	71	60	10	1	.....
28	71	158	83	60	122	9	1	.....
29	66	122	83	71	105	9	1	.....
30	.....	105	83	77	90	9	1	.....
31	.....	90	.....	71	.....	9	1	.....

Monthly discharge of Trout Creek near Antelope, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
February 15-29	256	66	132	3,930
March	221	56	131	8,060
April	168	66	90.0	5,360
May	97	44	66.1	4,060
June	122	31	48.4	2,880
July	90	9	37.5	2,310
August	12	1	6.0	369
September	.....	.....	[a] 1.0	60
The period	.....	.....	.....	27,000

[a] Estimated.

TROUT CREEK NEAR GATEWAY, OREG.

LOCATION.—In SE. ¼ sec. 18, T. 9 S., R. 15 E., at Cram's lower ranch, just above mouth of Hay Creek, about 10 miles east of Gateway, Jefferson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 25 to August 7, 1915; February 27 to July 10, 1916; incomplete.

GAGE.—Inclined staff on right bank; read by Mrs. F. A. Moore. The datum used during 1916 was about 1 foot lower than that used during 1915.

DISCHARGE MEASUREMENTS.—Made by wading at gage.

CHANNEL AND CONTROL.—Gravel; shifting during floods.

EXTREMES OF DISCHARGE.—Maximum stage during period of records: 4.7 feet at 5.30 p. m. March 8, 1916 (discharge from extension of rating curve, 408 second-feet); the flood of February, 1916, was about 3 feet higher. Stream bed practically dry in April and August, 1915.

ICE.—No record during period when stream was frozen.

DIVERSIONS.—Large area irrigated above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent between floods; changed during February, 1916. Rating curve fairly well defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good for days on which gage was read except those above 25 second-feet, which are fair.

Discharge measurements of Trout Creek near Gateway, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 27	P. V. Hodges	3.45	138	May 11	C. L. Batchelder	3.10	74
Mar. 29	do	3.68	168	Aug. 7	F. F. Henshaw	2.50	3.5

Daily discharge, in second-feet, of Trout Creek near Gateway, Oreg., during the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	90	140	.....	.....	178	16	178	98	.....	4	.....
2	68	131	.....	.....	262	17	178	98	.....	4	.....
3	90	131	.....	.....	158	18	178	106	.....	4	.....
4	75	122	.....	.....	122	19	218	90	.....	4	.....
5	82	106	.....	.....	106	20	262	75	.....	9	.....
6	90	98	.....	.....	90	21	251	.....	.....	14	.....
7	106	98	.....	.....	75	22	240	.....	.....	14	.....
8	408	106	.....	.....	61	23	218	.....	.....	14	.....
9	284	106	.....	.....	61	24	198	.....	.....	25	.....
10	284	131	.....	36	48	25	198	.....	.....	75	.....
11	273	178	75	36	.....	26	188	.....	.....	75	.....
12	284	158	.....	14	.....	27	188	.....	.....	140	.....
13	240	140	.....	4	.....	28	178	.....	.....	140	.....
14	208	106	.....	4	.....	29	158	.....	.....	122	.....
15	178	106	.....	4	.....	30	140	.....	.....	140	.....
						31	140	.....	.....	.....	.....

NOTE.—Mean discharge Mar. 1–31, 189 second-feet (11,600 acre-feet); Apr. 1–20, 116 second-feet (4,600 acre-feet); June 10–30, 42 second-feet (1,750 acre-feet); July 1–10, 116 second-feet (3,200 acre-feet).

HAY CREEK NEAR HAY CREEK, OREG.

LOCATION.—In N. ½ sec. 5, T. 11 S., R. 15 E., at McCue's ranch, 5 miles above mouth, 1½ miles north of Hay Creek post office, Jefferson County.

RECORDS AVAILABLE.—March 26 to September 30, 1915; February 20 to July 31, 1916, when station was discontinued.

GAGE.—Inclined staff on right bank; read by Mrs. C. E. McCue.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Rocky and permanent. Control about 18 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded February 20 to July 31, 1916, 5.4 feet June 28 and July 1 (discharge, 18.5 second-feet); minimum stage recorded, 4.5 feet May 8 (discharge, 0.7 second-foot).

Maximum stage during period of available records is that of 1916; minimum stage recorded, 4.4 feet July 17–24, 1915 (discharge, 0.4 second-foot).

ICE.—No records during winter.

DIVERSIONS.—Considerable water diverted for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent. Rating curve poorly defined. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records poor.

Discharge measurements of Hay Creek near Hay Creek, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 26	P. V. Hodges	4.58	1.1	May 11	C. L. Batchelder	4.69	1.4
Mar. 29	do	5.20	13.3	Aug. 7	F. F. Henshaw	4.64	1.9

Daily discharge, in second-feet, of Hay Creek near Hay Creek, Oreg., during the year ending Sept. 30, 1916.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Feb.	Mar.	Apr.	May.	June.	July.
1		1.0	13.3	2.2	2.2	18.5	16		8.5	8.5	1.2	6.2	15.8
2		1.2	13.3	1.2	4.0	15.8	17		8.5	7.4	1.0	4.0	10.8
3		1.2	13.3	1.2	4.0	15.8	18		8.5	6.4	2.2	4.0	10.8
4		1.2	13.3	1.2	3.1	15.8	19		8.5	5.4	2.2	3.1	10.8
5		1.2	13.3	1.2	3.1	15.8	20	2.2	8.5	4.4	1.7	4.0	8.5
6		1.2	12.0	1.2	3.1	13.3	21	1.2	8.5	3.2	1.7	4.0	8.5
7		2.2	10.8	1.2	3.1	10.8	22	1.2	9.6	2.2	1.7	4.0	6.2
8		2.2	10.8	.7	3.1	8.5	23	1.2	10.8	6.2	1.7	4.0	6.2
9		2.2	8.5	1.7	6.2	10.8	24	1.2	13.3	8.5	1.7	6.2	8.5
10		4.0	13.3	2.2	6.2	10.8	25	1.2	13.3	8.5	1.7	6.2	6.2
11		6.2	13.3	2.2	5.1	8.5	26	1.1	13.3	8.5	6.2	10.8	2.2
12		8.5	10.8	2.2	5.1	8.5	27	1.0	15.8	6.2	4.0	13.3	2.2
13		8.5	10.8	2.2	5.1	8.5	28	1.0	15.8	6.2	3.1	18.5	2.2
14		8.5	8.5	1.2	6.2	6.2	29	1.0	13.3	4.0	4.0	13.3	2.2
15		8.5	8.5	1.2	6.2	10.8	30		15.8	4.0	4.0	13.3	2.2
							31		15.8		4.0		2.2

NOTE.—Gage heights Apr. 17–21 apparently erroneous; discharged interpolated.

Monthly discharge of Hay Creek near Hay Creek, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
February 20–29	2.2	1.0	1.23	24
March	15.8	1.0	7.92	487
April	13.3	2.2	8.78	522
May	6.2	.7	2.10	129
June	18.5	2.2	6.02	358
July	18.5	2.2	9.16	563
The period				2,080

WARM SPRINGS RIVER NEAR WARM SPRING, OREG.

LOCATION.—In NE. ¼ sec. 19, T. 8 S., R. 13 E., 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, 1916 (fragmentary prior to 1914).

GAGE.—Stevens water-stage recorder since July 1, 1914; fastened to downstream side of right abutment. Gage reader, Jerry Brunoe. 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 during year from water-stage recorder 4.0 feet at 10 p. m. March 9 (discharge, 2,930 second-feet); minimum stage from water-stage recorder, 0.77 foot January 15 (discharge, 210 second-feet).

1911–1916: Maximum stage recorded is that of March 9, 1916; 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 permanent since winter of 1914–15. Rating curve well defined below 450 second-feet and fairly well defined from 450 to 1,500 second-feet. Operation of water-stage recorder fairly satisfactory except January 1 to 15, July 20 to August 17, and September 10 to 30. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting the recorder graph. Records good except for March and for periods when gage was not operating, for which they are fair.

Discharge measurements of Warm Springs River near Warm Spring, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 2	P. V. Hodges	1.69	665	June 28	C. L. Batchelder	1.75	663
May 9	C. L. Batchelder	2.17	1,130	Aug. 23	F. F. Henshaw	1.04	335
23	F. F. Henshaw	1.86	861	Sept. 3	C. L. Batchelder	1.08	327

Daily discharge, in second-feet, of Warm Springs River near Warm Spring, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	254	210	375	.....	375	810	1,290	890	850	693	.....	318
2	254	213	375	.....	375	770	1,290	930	810	707	.....	318
3	254	220	375	.....	375	930	1,290	1,020	810	749	.....	341
4	249	220	375	.....	375	810	1,290	1,110	770	700	.....	350
5	249	220	375	.....	375	810	1,290	1,290	810	637	.....	341
6	249	220	570	.....	375	850	1,200	1,290	810	612	.....	336
7	258	220	600	.....	480	930	1,200	1,200	810	588	.....	332
8	258	224	510	350	735	1,580	1,200	1,110	890	564	.....	328
9	262	224	480	.....	930	2,080	1,290	1,110	850	558	.....	328
10	262	224	480	.....	1,480	2,080	1,380	1,020	850	552	.....	.....
11	245	233	480	.....	1,880	1,780	1,380	890	850	540	.....	.....
12	245	233	425	.....	1,680	1,880	1,290	850	850	534	.....	.....
13	245	245	425	.....	1,480	1,780	1,200	810	850	534	.....	.....
14	245	249	400	.....	1,580	1,580	1,200	770	810	534	.....	.....
15	241	262	375	.....	1,680	1,480	1,290	735	770	516	.....	.....
16	241	292	350	350	1,680	1,450	1,200	735	735	552	.....	305
17	237	305	350	350	1,680	1,410	1,200	735	735	558	.....	.....
18	233	400	350	375	1,680	1,380	1,110	770	735	528	350	.....
19	237	350	328	375	1,680	1,580	1,020	810	735	498	341	.....
20	241	328	305	328	1,580	2,180	930	810	770	474	323	.....
21	241	305	305	328	1,380	2,080	1,020	850	810	450	318	.....
22	241	328	350	350	1,290	1,980	930	850	850	.....	314	.....
23	237	400	1,020	450	1,480	1,680	850	810	850	.....	323	.....
24	241	425	1,290	600	1,480	1,480	850	810	825	.....	328	.....
25	237	425	930	510	1,290	1,480	890	810	805	.....	328	305
26	228	630	735	480	1,110	1,680	930	810	780	.....	328	.....
27	220	450	700	450	930	1,680	1,020	810	760	.....	332	.....
28	220	375	600	425	930	1,580	1,020	810	735	450	323	.....
29	216	350	540	400	890	1,380	930	810	665	.....	318	.....
30	210	425	540	400	.....	1,290	890	810	665	.....	318	305
31	210	.....	480	375	.....	1,290	.....	850	.....	.....	318	.....

NOTE.—Daily discharge interpolated Mar. 16–17, May 24–25, June 24–27, and Aug. 31 to Sept. 1. Mean discharge estimated for periods when recorder was not operating as follows: Jan. 1–7, 415 second-feet; Jan. 9–15, 350 second-feet; July 22–27, 450 second-feet; July 29–30, 440 second-feet; Aug. 1–17, 390 second-feet; Sept. 10–15, 315 second-feet; Sept. 17–24, 305 second-feet; Sept. 26–29, 305 second-feet.

Monthly discharge of Warm Springs River near Warm Spring Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	262	210	241	14,800
November	630	210	307	18,300
December	1,290	305	509	31,300
January	600	328	395	24,300
February	1,880	375	1,150	66,200
March	2,180	770	1,480	91,000
April	1,380	850	1,130	67,200
May	1,290	735	900	55,300
June	890	665	795	47,300
July	749	.....	534	32,800
August	.....	314	361	22,200
September	350	305	315	18,700
The year	2,180	210	674	489,000

WHITE RIVER NEAR TYGH VALLEY, OREG.

LOCATION.—In SW. ¼ 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 falls of White River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—June 18, 1911, to September 30, 1916.

GAGE.—Vertical staff on lower corner of left pier of highway bridge; read by Gertrude Brown and 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, 3.4 feet at 8 a. m. December 22 (discharge, 1,960 second-feet); minimum stage recorded, 0.25 foot October 18 and 19 (discharge, 75 second-feet).

1911–1916: Maximum stage recorded, 5.3 feet January 9, 1912 (probably ice-affected); maximum when channel was clear, 3.5 feet January 13, 1912 (discharge, 2,050 second-feet). Minimum occurred in 1916.

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

DIVERSIONS.—Probably no diversion from White River above station, although diversion of water for irrigation of lands south of lower White River is probably feasible.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent during year; affected by ice January 9–22 and 27–31. A new rating curve, averaging measurements made 1916, has been used after October 18 and is well defined between 100 and 1,200 second-feet; rating curve used October 1 to 9 fairly well defined. Gage read to quarter-tenths once daily, oftener during high water. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of White River near Tygh Valley, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 18	C. L. Batchelder	[a] 0.85	187	May 9	C. L. Batchelder	2.36	1,100
Mar. 3	P. V. Hodges	1.90	785	Sept. 3	.....do	.81	220
4	.....do	1.62	614				

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of White River near Tygh Valley, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	96	136	295	590	255	562	850	1,060	990	710	315	244
2	110	119	255	562	220	508	850	1,200	990	710	295	244
3	110	119	295	562	173	780	920	1,360	990	780	295	244
4	110	107	315	535	188	562	990	1,600	1,060	780	295	244
5	96	107	295	535	173	480	920	1,690	990	710	287	220
6	82	107	315	508	188	650	990	1,600	990	650	275	220
7	77	107	380	480	295	1,200	990	1,520	1,060	650	275	204
8	82	119	455	430	430	1,600	1,060	1,360	1,060	650	255	204
9	82	112	430	405	535	1,440	1,130	1,200	1,200	650	275	210
10	82	107	405	358	590	1,200	1,130	1,060	1,060	620	275	198
11	81	107	405	335	990	1,130	1,200	990	990	590	255	198
12	80	107	405	335	780	1,060	1,130	920	990	590	255	173
13	79	107	380	295	780	990	1,060	850	990	590	255	173
14	78	107	335	295	590	850	1,130	850	990	562	255	167
15	76	112	295	238	650	850	1,130	780	1,130	535	275	167
16	75	164	315	204	780	815	1,130	850	1,200	535	315	173
17	75	131	335	188	920	780	1,130	920	1,280	590	295	173
18	75	358	315	173	920	850	1,130	990	1,440	535	255	173
19	75	405	315	173	920	990	1,060	990	1,200	480	255	173
20	85	295	335	188	850	1,280	990	990	1,060	480	255	173
21	89	263	650	173	780	1,360	990	990	920	455	255	170
22	89	275	1,690	204	710	1,280	920	990	780	430	255	164
23	112	650	1,060	255	710	1,200	850	920	780	430	255	161
24	119	620	850	430	745	990	850	850	745	380	275	158
25	131	535	815	335	745	920	920	850	920	380	275	158
26	119	455	780	295	680	990	1,060	920	990	380	275	158
27	112	380	815	255	562	1,060	1,130	920	920	358	255	161
28	107	335	990	255	620	990	1,200	920	780	335	255	164
29	107	295	850	275	535	920	1,130	920	780	335	244	164
30	96	315	590	255	.....	920	1,130	850	710	335	244	164
31	103	.....	620	255	.....	850	.....	850	.....	315	244	.....

NOTE.—Discharge Jan. 9–22 and 27–31 estimated on basis of measurement made Jan. 18.

Monthly discharge of White River near Tygh Valley, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	131	75	93.2	5,730
November	650	107	239	14,200
December	1,690	255	535	32,900
January	590	173	335	20,600
February	990	173	597	34,300
March	1,600	480	970	59,600
April	1,200	850	1,030	61,300
May	1,690	780	1,060	65,200
June	1,440	710	1,000	59,500
July	780	315	533	32,800
August	315	244	269	16,500
September	244	158	187	11,100
The year	1,690	75	570	414,000

KLICKITAT RIVER BASIN.

KLICKITAT RIVER ABOVE PEARL CREEK, NEAR GLENWOOD, WASH.

LOCATION.—In SE. ¼ sec. 25, T. 10 N., R. 12 E., Yakima County, a quarter of a mile above Pearl Creek and about 26 miles north of Glenwood.

DRAINAGE AREA.—126 square miles.

RECORDS AVAILABLE.—May 31 to December 2, 1910; August 23 to November 9, 1916.

GAGE.—Stevens eight-day water-stage recorder until September 15; readings on vertical staff on right bank, by B. E. Hanson, thereafter. Vertical staff in 1910.

CHANNEL AND CONTROL.—Rocky; may shift during floods.

DISCHARGE MEASUREMENTS.—Made from a pole bridge; channel straight and fairly smooth.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, 2.02 feet at noon, August 23 and 24 (discharge, 231 second-feet); minimum stage, 1.52 feet October 23 and 24 (discharge, 110 second-feet).

ICE.—No winter records.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of recorder satisfactory until September 18, when it was removed; gage read to hundredths once a day thereafter. Daily discharge ascertained by applying to rating table the daily-gage reading or the mean daily-gage height determined by inspecting the gage-height graph. Records excellent.

COOPERATION.—Field data furnished by Horse Heaven irrigation district, through O. Laurgaard, consulting engineer.

Discharge measurements of Klickitat River above Pearl Creek, near Glenwood, Wash., during 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug. 24	Hanson and Kingsley..	2.02	231	Oct. 19	A. G. Hanson.....	1.54	114
Sept. 5	A. G. Hanson.....	1.85	178	25	J. O. Kingsley.....	1.52	107
21	.....do.....	1.68	138	31	.....do.....	1.53	111
29	.....do.....	1.64	133	Nov. 4	A. G. Hanson.....	1.89	189

Daily discharge, in second-feet, of Klickitat River above Pearl Creek, near Glenwood, Wash., for the period Aug. 23 to Nov. 9, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	178	127	123	16	.....	143	115	.....
2	.....	178	131	133	17	.....	141	115	.....
3	.....	175	135	137	18	.....	139	115	.....
4	.....	175	131	192	19	.....	139	113	.....
5	.....	173	133	143	20	.....	139	113	.....
6	.....	170	133	137	21	.....	137	112	.....
7	.....	167	129	121	22	.....	131	112	.....
8	.....	165	127	120	23	216	131	110	.....
9	.....	162	123	123	24	219	131	110	.....
10	.....	160	120	.....	25	216	129	113	.....
11	.....	155	121	.....	26	213	139	113	.....
12	.....	148	120	.....	27	204	135	115	.....
13	.....	145	118	.....	28	189	131	112	.....
14	.....	148	118	.....	29	173	129	115	.....
15	.....	145	115	.....	30	184	125	120	.....
					31	181	.....	148	.....

Monthly discharge of Klickitat River above Pearl Creek, near Glenwood, Wash., for period Aug. 23 to Nov. 9, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August 23–31	219	173	199	3,550
September	178	125	149	8,870
October	148	110	120	7,380
November 1–9	192	120	137	2,450
The period				22,200

KLICKITAT RIVER NEAR GLENWOOD, WASH.

LOCATION.—In NE. ¼ sec. 14, T. 7 N., R. 12 E., just below Dairy Creek, 2½ 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, 1916, for station at present site; October 9, 1909, to December 15, 1910, for station at a point a mile above, in sec. 11.

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

DISCHARGE MEASUREMENTS.—Made from cable, just below gage, erected to replace cable bridge that was broken down by snow.

CHANNEL AND CONTROL.—Heavy gravel; may shift during high water.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 3.47 feet at 2.30 a. m. June 18 (discharge, 4,620 second-feet); minimum stage, from water-stage recorder, 0.63 foot at 1 p. m. November 13 (discharge, 285 second-feet).

1909–1916: 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 changed during flood of May and June. Rating curves applicable as follows: October 1 to May 3, well defined between 375 and 1,000 second-feet; June 18 to September 30, well defined between 500 and 4,000 second-feet. Discharge May 4 to June 17 computed by shifting control method on the assumption that most of shift occurred in high water of May 4 to 6 and June 15 to 17. Operation of water-stage recorder satisfactory except January 12 to February 17, when float was frozen in well, and August 16 to 29. Daily discharge ascertained by applying to rating table the mean daily gage height determined by inspecting gage-height graph. Records excellent, except as follows: January, February, and May, fair; June and August, good.

Discharge measurements of Klickitat River near Glenwood, Wash., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 27	A. G. Hanson	0.85	398	Aug. 12	A. G. Hanson	1.37	1,190
Nov. 28	do	.85	404	30	do	1.06	980
June 26	Hanson and Batchelder	2.56	3,000	Sept. 20	do	.77	666
July 23	A. G. Hanson	1.82	1,840	28	do	.72	636

Daily discharge, in second-feet, of Klickitat River near Glenwood, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	413	436	397	425	.....	582	1,160	2,390	2,280	2,730	1,400	904
2	391	408	403	425	.....	563	1,220	2,620	2,360	3,670	1,340	868
3	386	419	460	425	.....	554	1,340	3,030	2,610	3,500	1,270	778
4	370	408	557	425	.....	554	1,400	3,300	3,030	2,990	1,270	770
5	364	397	496	425	.....	532	1,340	3,400	2,860	2,820	1,230	749
6	358	391	466	419	.....	508	1,340	3,380	2,780	2,570	1,220	728
7	364	380	466	413	.....	508	1,470	2,940	2,860	2,490	1,170	728
8	370	375	478	408	.....	657	1,540	2,600	3,030	2,650	1,200	721
9	370	364	514	413	.....	784	1,670	2,360	3,290	2,820	1,210	714
10	364	348	454	403	.....	920	1,820	2,050	2,950	2,650	1,190	714
11	364	348	460	380	.....	1,010	1,820	1,820	2,690	2,650	1,190	714
12	364	336	442	.....	.....	1,160	1,750	1,680	2,690	2,650	1,200	714
13	391	315	430	.....	.....	1,220	1,750	1,530	2,860	2,730	1,220	707
14	391	364	386	.....	.....	1,110	1,960	1,460	3,200	2,490	1,210	707
15	391	370	358	.....	.....	1,010	2,030	1,460	3,480	2,410	1,210	700
16	375	375	397	.....	.....	965	1,960	1,600	4,000	2,730	1,190	700
17	375	430	386	.....	.....	1,010	1,960	1,750	4,300	2,490	1,170	700
18	375	454	386	.....	630	1,200	1,820	1,900	4,490	2,250	1,150	700
19	370	532	403	.....	636	1,380	1,680	2,200	3,940	2,100	1,130	694
20	375	472	413	.....	643	1,560	1,610	2,280	3,240	2,030	1,110	707
21	375	466	380	.....	643	1,750	1,540	2,280	2,730	2,030	1,090	735
22	370	478	1,010	.....	643	1,680	1,470	2,120	2,570	1,950	1,070	735
23	490	526	745	.....	636	1,610	1,400	1,980	2,820	1,880	1,050	707
24	419	472	657	.....	630	1,540	1,400	1,820	2,900	1,810	1,030	688
25	430	466	635	.....	609	1,480	1,610	1,900	2,900	1,670	1,010	676
26	425	460	563	.....	609	1,410	1,960	2,050	2,990	1,530	986	700
27	403	397	550	.....	595	1,340	2,240	2,360	3,070	1,470	965	688
28	397	403	530	.....	595	1,280	2,170	2,520	2,730	1,400	945	652
29	391	419	478	.....	589	1,160	2,100	2,360	2,490	1,340	924	640
30	380	408	430	.....	.....	1,110	2,170	2,200	2,490	1,340	904	640
31	425	.....	430	.....	.....	1,110	.....	2,280	.....	1,400	913	.....

NOTE.—Discharge interpolated Dec. 31 to Jan. 5, Mar. 18–20, 22–25, and Aug. 16–29. Mean discharge estimated Jan. 12–31, 390 second-feet; Feb. 1–8, 380 second-feet; Feb. 9–17, 500 second-feet.

Monthly discharge of Klickitat River near Glenwood, Wash., for the year ending Sept. 30, 1916.

[Discharge 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	490	358	388	1.09	1.26	23,900
November	532	315	414	1.16	1.29	24,600
December	1,010	358	505	1.42	1.64	31.100
January	.....	.....	399	1.12	1.29	24,500
February	.....	.....	517	1.45	1.56	29,700
March	1,750	508	1,070	3.01	3.47	65,800
April	2,240	1,160	1,690	4.75	5.30	101,000
May	3,400	1,460	2,250	6.32	7.29	138,000
June	4,490	2,280	3,020	8.48	9.46	180,000
July	3,670	1,340	2,300	6.46	7.45	141,000
August	1,400	904	1,130	3.18	3.67	69,500
September	904	640	719	2.02	2.25	42,800
The year	4,490	315	1,200	3.37	45.93	872,000

PEARL CREEK NEAR GLENWOOD, WASH.

LOCATION.—In SE. ¼ sec. 25, T. 9 N., R. 12 E., Yakima County, a quarter of a mile above mouth and 26 miles north of Glenwood.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 24 to November 9, 1916.

GAGE.—Vertical staff on left bank; read by B. E. Hanson.

DISCHARGE MEASUREMENTS.—Made from pole bridge 10 feet above gage.

CHANNEL AND CONTROL.—Rocky; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded August 24 to November 9, 0.80 foot August 24 (discharge, 3.4 second-feet); minimum stage recorded, 0.57 foot October 24, 26, and 28 (discharge, 0.9 second-foot).

ACCURACY.—Stage-discharge relation permanent; rating curve well defined. Gage read to hundredths practically every day. Daily discharge ascertained by applying daily gage heights to rating table. Records good.

COOPERATION.—Field data furnished by Horse Heaven Irrigation District, through O. Laurgaard, consulting engineer.

Daily discharge, in second-feet, of Pearl Creek near Glenwood, Wash., for the period Aug. 24 to Nov. 9, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	2.5	1.6	1.2	16	.....	2.3	1.2	.....
2	.....	2.5	1.7	1.4	17	.....	2.0	1.1	.....
3	.....	2.5	1.7	1.2	18	.....	2.0	1.1	.....
4	.....	2.5	1.5	1.5	19	.....	2.2	1.2	.....
5	.....	2.5	1.6	1.4	20	.....	1.9	1.1	.....
6	.....	2.5	1.4	1.3	21	.....	1.9	1.1	.....
7	.....	2.5	1.5	1.2	22	.....	1.9	1.0	.....
8	.....	2.5	1.4	1.2	23	.....	1.9	1.0	.....
9	.....	2.4	1.3	1.2	24	3.4	2.0	.9	.....
10	.....	2.4	1.2	.....	25	3.3	2.0	1.0	.....
11	.....	2.4	1.3	.....	26	3.0	2.2	.9	.....
12	.....	2.4	1.2	.....	27	2.9	1.8	1.1	.....
13	.....	2.3	1.2	.....	28	2.7	1.8	.9	.....
14	.....	2.3	1.2	.....	29	2.6	1.6	1.1	.....
15	.....	2.3	1.2	.....	30	2.5	1.6	1.2	.....
					21	2.5	.....	1.2	.....

Monthly discharge of Pearl Creek near Glenwood, Wash., for the period Aug. 24 to Nov. 9, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August 24–31	3.4	2.5	2.86	45
September	2.5	1.6	2.19	130
October	1.7	.9	1.23	76
November 1–9	1.5	1.2	1.29	23
The period	.....	.....	.....	274

SWAMP CREEK NEAR GLENWOOD, WASH.

LOCATION.—In NE. ¼ sec. 19, T. 9 N., R. 13 E., Yakima County, a quarter of a mile above mouth and about 21 miles north of Glenwood.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 31 to November 9, 1916.

GAGE.—Vertical staff on left bank; read by A. G. Hanson.

DISCHARGE MEASUREMENTS.—Made from pole bridge 2 feet above gage.

CHANNEL AND CONTROL.—Rocky; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded for period August 31 to November 9, 2.77 feet November 4 (discharge, 10.5 second-feet). Minimum stage recorded, 2.64 feet, October 19–24 (discharge, 6.1 second-feet).

ACCURACY.—Stage-discharge relation probably permanent. Rating curve poorly defined on account of poor measuring conditions. Gage read to hundredths nearly every day. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

COOPERATION.—Field data furnished by Horse Heaven Irrigation District, through O. Laurgaard, consulting engineer.

Discharge measurements of Swamp Creek near Glenwood, Wash., for period Aug. 31 to Nov. 9, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug. 31	Hanson and Kingsley..	2.70	8.8	Oct. 19	A. G. Hanson.....	2.64	6.1
Sept. 5	A. G. Hanson.....	2.71	8.4	28	Hanson and Kingsley..	2.66	7.6
21	.....do.....	2.67	5.7	Nov. 4	A. G. Hanson.....	2.77	10

Daily discharge, in second-feet, of Swamp Creek near Glenwood, Wash., for the period Aug. 31 to Nov. 9, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	8.1	7.4	8.8	16	.....	7.4	7.4	.....
2	.....	8.1	7.8	9.1	17	.....	7.4	6.7	.....
3	.....	8.4	8.1	9.1	18	.....	7.4	6.4	.....
4	.....	8.4	7.4	10.5	19	.....	7.1	6.1	.....
5	.....	8.4	8.1	9.8	20	.....	6.7	6.1	.....
6	.....	8.1	7.4	8.8	21	.....	7.1	6.1	.....
7	.....	8.1	7.8	8.4	22	.....	7.1	6.1	.....
8	.....	8.1	7.8	8.1	23	.....	7.4	6.1	.....
9	.....	8.1	7.4	8.1	24	.....	7.4	6.1	.....
10	.....	8.1	7.1	.....	25	.....	7.4	6.7	.....
11	.....	8.1	7.4	.....	26	.....	7.8	6.7	.....
12	.....	8.1	7.1	.....	27	.....	7.8	7.1	.....
13	.....	8.1	7.4	.....	28	.....	7.4	6.7	.....
14	.....	6.7	7.1	.....	29	.....	7.1	6.7	.....
15	.....	7.1	7.1	.....	30	.....	7.1	8.1	.....
					31	8.1	.....	10.1	.....

Monthly discharge of Swamp Creek near Glenwood, Wash., for the period Sept. 1 to Nov. 9, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
September	8.4	6.7	7.65	455
October	10.1	6.1	7.15	440
November 1–9	10.5	8.1	8.97	160
The period	.....	.....	.....	1,060

WEST FORK OF KLICKITAT RIVER NEAR GLENWOOD, WASH.

LOCATION.—In SE. ¼ sec. 24, T. 9 N., R. 12 E., Yakima County, at sheep bridge about 1 mile above mouth, 20 miles north of Glenwood.

DRAINAGE AREA.—72 square miles.

RECORDS AVAILABLE.—June 17 to November 30, 1910; August 25 to November 9, 1916.

GAGE.—Stevens 8-day water-stage recorder, September 15 to November 9; vertical staff, read by A. G. Hanson, August 25 to September 14. Gage read in 1910 by employees of Klickitat Irrigation & Power Co. was just below junction of Little Muddy Creek and Fish Lake stream in sec. 10.

DISCHARGE MEASUREMENTS.—Made from sheep bridge 100 feet upstream from gage.

CHANNEL AND CONTROL.—Rocky; somewhat shifting on account of high velocities.

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder for period August 25 to November 9, 1.20 feet at 3 a. m. November 4 (discharge, 317 second-feet). Minimum stage from water-stage recorder, 0.58 foot October 23 to 25 (discharge, 255 second-feet).

June 17 to November 30, 1910: Maximum discharge, 752 second-feet November 10.

ACCURACY.—Stage-discharge relation not permanent. Fairly well defined rating curves were used August 25 to October 28 and October 30 to November 9. Gage read nearly every day to September 14; operation of recorder satisfactory thereafter. Daily discharge ascertained by applying to the rating table the daily gage reading or the mean gage height determined by inspecting the gage-height graph; estimated for October 29. Records good except those for November, which are fair.

COOPERATION.—Field data furnished by Horse Heaven Irrigation District, through O. Laurgaard, consulting engineer.

Discharge measurements of West Fork of Klickitat River near Glenwood, Wash., for period Aug. 25 to Nov. 9, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug. 25	Hanson and Kingsley	1.05	328	Oct. 19	A. G. Hanson	0.62	259
Sept. 3	A. G. Hanson	.98	321	25	J. O. Kingsley	.61	260
21	do	.74	298	30	do	.65	251
29	do	.75	282	Nov. 4	A. G. Hanson	1.00	291

Daily discharge, in second-feet, of West Fork of Klickitat River near Glenwood, Wash., for the period Aug. 25 to Nov. 9, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1		317	279	260	16		288	264	
2		317	279	272	17		288	261	
3		319	279	280	18		287	258	
4		314	276	299	19		284	260	
5		308	277	282	20		282	260	
6		306	276	276	21		280	258	
7		306	274	266	22		279	256	
8		308	269	266	23		279	255	
9		303	268	288	24		277	255	
10		303	266		25	330	279	255	
11		303	266		26	327	287	256	
12		298	266		27	325	282	258	
13		290	266		28	324	282	256	
14		288	266		29	322	282	258	
15		288	264		30	322	279	256	
					31	319		272	

Monthly discharge of West Fork of Klickitat River near Glenwood, Wash., for the period Aug. 25 to Nov. 9, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August 25–31	330	319	324	4,500
September	319	277	293	17,400
October	279	255	265	16,300
November 1–9	299	260	277	4,940
The period				43,100

CUNNINGHAM CREEK NEAR GLENWOOD, WASH.

LOCATION.—In SW. ¼ sec. 15, T. 8 N., R. 12 E., Yakima County, 200 feet above trail crossing, 1 mile above mouth, and about 14 miles north of Glenwood.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 28 to November 9, 1916.

GAGE.—Vertical staff on right bank; read by B. E. Hanson.

DISCHARGE MEASUREMENTS.—Made from pole bridge about 5 feet below gage.

CHANNEL AND CONTROL.—Rocky; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded August 28 to November 9, 0.50 foot August 28 to 30 (discharge, 28 second-feet); minimum stage recorded, 0.37 foot November 6 and 7 (discharge, 19 second-feet).

ACCURACY.—Stage-discharge relation apparently permanent; rating curve fairly well defined; gage read to hundredths nearly every day. Daily discharge ascertained by applying daily gage reading to rating table. Records good.

COOPERATION.—Field data furnished by Horse Heaven Irrigation District, through O. Laurgaard, consulting engineer.

Discharge measurements of Cunningham Creek near Glenwood, Wash., for period Aug. 28 to Nov. 9, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug 29	Hanson and Kingsley	0.50	27.8	Oct. 31	J. O. Kingsley	.39	21.7
Sept. 20	A. G. Hanson	.43	20.9	Nov. 5	A. G. Hanson	.38	19.5
Oct. 20	do	.40	19.9				

Daily discharge, in second-feet, of Cunningham Creek near Glenwood, Wash., for the period Aug. 28 to Nov. 9, 1916.

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

Monthly discharge of Cunningham Creek near Glenwood, Wash., for the period Aug. 28 to Nov. 9, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August 28–31	28	27	27.8	221
September	27	22	24.2	1,440
October	26	19	21.2	1,300
November 1–9	22	19	19.9	355
The period				3,320

BIG MUDDY CREEK NEAR GLENWOOD, WASH.

LOCATION.—In SW. ¼ sec. 21, T. 8 N., R. 12 E., half a mile below mouth of Hell Roaring Creek, about 3 miles above mouth of stream, and 12 miles north of Glenwood, Klickitat County.

DRAINAGE AREA.—23 square miles (Water-Supply Paper 253, p. 46).

RECORDS AVAILABLE.—August 28 to November 12, 1916; occasional measurements in 1905 and 1908.

GAGE.—Stevens eight-day water-stage recorder installed temporarily; inspected by A. G. Hanson.

DISCHARGE MEASUREMENTS.—Made from a tree felled across stream; conditions poor; current very turbulent.

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

EXTREMES OF DISCHARGE.—Maximum stage from water-stage recorder, August 28 to November 12, 2.13 feet at 6 p. m. September 1 (discharge, 390 second-feet); minimum stage recorded, 1.21 feet at end of record, 9.30 a. m. November 12 (discharge, 90 second-feet).

ICE.—No winter records.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed frequently. Two well-defined rating curves were used, one applicable September 4–25, the other September 28 to November 12. 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 August 28 to September 3 and September 26–27. Records fair.

COOPERATION.—Field data furnished by Horse Heaven Irrigation District, through O. Laurgaard, consulting engineer.

Discharge measurements of Big Muddy Creek near Glenwood, Wash., for the period Aug. 28 to Nov. 12, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet	*Sec.-ft.*			*Feet*	*Sec.-ft.*
Aug. 28	Hanson and Kingsley	2.00	288	Oct. 18	A. G. Hanson	1.41	126
Sept. 4	A. G. Hanson	1.80	232	31	J. O. Kingsley	1.30	103
22	do	1.60	143	Nov. 3	A. G. Hanson	1.33	120
28	do	1.57	181				

Daily discharge, in second-feet, of Big Muddy Creek near Glenwood, Wash., for the period Aug. 28 to Nov. 12, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	352	150	103	16	.....	144	147	.....
2	.....	346	141	107	17	.....	144	138	.....
3	.....	289	138	116	18	.....	144	122	.....
4	.....	241	136	120	19	.....	152	116	.....
5	.....	230	124	105	20	.....	152	116	.....
6	.....	212	122	103	21	.....	152	114	.....
7	.....	202	118	102	22	.....	152	109	.....
8	.....	198	114	102	23	.....	130	116	.....
9	.....	168	114	105	24	.....	120	114	.....
10	.....	152	118	100	25	.....	120	116	.....
11	.....	156	120	97	26	.....	172	118	.....
12	.....	156	120	91	27	.....	200	116	.....
13	.....	156	120	.....	28	289	178	109	.....
14	.....	152	120	.....	29	225	178	103	.....
15	.....	148	138	.....	30	216	161	107	.....
					31	312	.....	105	.....

Monthly discharge of Big Muddy Creek near Glenwood, Wash., for the period Aug. 28 to Nov. 12, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August 28–31	312	216	260	2,060
September	352	120	182	10,800
October	150	103	121	7,440
November 1–12	120	91	104	2,480
The period	.....	.....	.....	22,800

COUGAR CREEK NEAR GLENWOOD, WASH.

LOCATION.—In NW. ¼ sec. 33, T. 8 N., R. 12 E., Yakima County, 50 feet above trail crossing, about 1½ miles above mouth, and 10 miles north of Glenwood.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 27 to November 9, 1916.

GAGE.—Vertical staff on left bank; read by B. E. Hanson.

DISCHARGE MEASUREMENTS.—Made from pole bridge about 10 feet above gage; conditions poor.

CHANNEL AND CONTROL.—Boulders; somewhat shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period August 27 to November 9, 0.90 foot August 28 (discharge, 4.8 second-feet); minimum stage recorded, 0.75 foot October 21 to 26, and 28 (discharge, 1.5 second-feet).

ACCURACY.—Stage-discharge relation not permanent. Two fairly well defined rating curves applicable August 27 to October 29 and October 30 to November 9. Gage read to hundredths nearly every day. Daily discharge ascertained by applying daily gage heights to rating table. Records fair.

COOPERATION.—Field data furnished by Horse Heaven Irrigation District through O. Laurgaard, consulting engineer.

Discharge measurements of Cougar Creek near Glenwood, Wash., for period Aug. 27 to Nov. 9, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Aug. 27	Hanson and Kingsley..	0.89	4.2	Oct. 18	A. G. Hanson.....	0.76	1.5
Sept 20	A. G. Hanson.....	.82	1.8	Nov. 3	.....do.....	.88	2.2

Daily discharge, in second-feet, of Cougar Creek near Glenwood, Wash., for the period Aug. 27 to Nov. 9, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1	.....	3.6	1.8	2.2	16	.....	1.8	1.5	.....
2	.....	3.6	1.8	2.0	17	.....	2.0	1.5	.....
3	.....	4.1	2.0	2.2	18	.....	2.5	1.5	.....
4	.....	4.1	1.7	2.4	19	.....	2.0	1.5	.....
5	.....	3.6	1.7	2.2	20	.....	1.8	1.5	.....
6	.....	3.2	1.7	1.9	21	.....	2.0	1.5	.....
7	.....	2.8	1.7	1.7	22	.....	2.0	1.5	.....
8	.....	2.8	1.6	1.8	23	.....	2.0	1.5	.....
9	.....	2.8	1.6	1.7	24	.....	1.8	1.5	.....
10	.....	2.5	1.6	.....	25	.....	1.8	1.5	.....
11	.....	2.5	1.6	.....	26	.....	2.0	1.5	.....
12	.....	2.5	1.6	.....	27	4.1	1.8	1.5	.....
13	.....	2.0	1.5	.....	28	4.8	1.8	1.5	.....
14	.....	2.0	1.5	.....	29	4.1	1.8	2.0	.....
15	.....	1.8	1.5	.....	30	4.1	2.0	2.2	.....
					31	3.6	.....	2.2	.....

Monthly discharge of Cougar Creek near Glenwood, Wash., for the period Aug. 27 to Nov. 9, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
August 27–31	4.8	3.6	4.14	41
September	4.1	1.8	2.43	145
October	2.2	1.5	1.63	100
November 1–9	2.4	1.7	2.01	36
The period	.....	.....	.....	322

HOOD RIVER BASIN.

HOOD RIVER AT DEE, OREG.

LOCATION.—In SW. ¼ 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.

GAGE.—Vertical staff attached to wooden crib on left bank just above railroad trestle; read by J. W. West. 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; fairly permanent between floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded October 1 to January 15, 1916, 3.3 feet at 2. p. m. December 21 and 10 a. m. December 22 (peak of flood occurred between these readings; discharge cannot be computed); minimum stage prior to December 22, 0.68 foot October 10 to 12 (discharge, 172 second feet).

1913–1916: Maximum stage was recorded during 1916; minimum stage recorded, 0.58 foot September 7, 10, and 11, 1915 (discharge, 134 second-feet).

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 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 December 21. Rating curve used prior to that date well defined between 180 and 335 second-feet and curve used after that fairly well defined between 300 and 1,100 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Discharge measurements of Hood River at Dee, Oreg., during the year ending Sept. 30, 1916.

[Made by P. V. Hodges.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Jan. 8	0.70	370
Mar. 15	1.60	823

Daily discharge, in second-feet, of Hood River at Dee, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1	.....	305	625	510	16	189	323	545	.....
2	.....	323	545	485	17	180	.....	508	.....
3	250	305	625	460	18	180	.....	485	.....
4	225	265	585	437	19	180	.....	470	.....
5	202	250	.....	415	20	189	705	470	.....
6	180	225	.....	392	21	180	.....	.....	.....
7	180	216	.....	392	22	180	665	.....	.....
8	180	235	.....	392	23	265	.....	1,100	.....
9	180	225	.....	379	24	368	.....	875	.....
10	172	216	.....	370	25	323	.....	875	.....
11	172	275	.....	338	26	287	.....	710	.....
12	172	225	705	310	27	235	.....	660	.....
13	250	216	625	330	28	225	705	660	.....
14	225	216	585	330	29	216	.....	610	.....
15	189	485	585	310	30	202	665	560	.....
					31	545	.....	535	.....

NOTE.—Unrecorded discharge for days between Oct. 3 and Dec. 20 exceeded 705 second-feet; that between Dec. 20 and 23 exceeded 1,100 second-feet.

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

LOCATION.—In SE. ¼ 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 30, 1916.

GAGE.—Chain gage attached to highway bridge; 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, used July 24 to December 21, 1915, when it was washed out by a flood.

DISCHARGE MEASUREMENTS.—Made from highway bridge; flow of flume included with 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, 6.8 feet (determined by leveling to high-water marks) at the recorder, about 1 a. m. December 22 (discharge, 14,600 second-feet, from extension of rating curve). Minimum stage, 0.65 foot at 2 a. m. October 13 (discharge, 145 second-feet).

1897–1899 and 1913–1916: Maximum stage recorded is that of December 22, 1915; minimum stage, 0.62 foot at 1 a. m. September 16, 1915 (discharge, 136 second-feet).

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 steam was used to supplement water power, and the stage fluctuated through only a small range.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve for water-stage recorder well defined between 150 and 5,000 second-feet. Rating curve for chain gage well defined between 400 and 5,000 second-feet. Chain gage read to quarter-tenths twice daily. Daily discharge ascertained as follows: October 1 to December 15, by use of discharge integrator; after January 1, by applying to rating table the mean daily stage obtained from chain gage. Records excellent for October and November; fair for December, June and July; good for rest of year.

Discharge measurements of Hood River at Tucker Bridge, near Hood River, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.		Discharge.	Date.	Made by—	Gage height.		Discharge.
		Recorder.	Chain gage.				Recorder.	Chain gage.	
		Feet.	*Feet.*	*Sec.-ft.*			*Feet.*	*Feet.*	*Sec.-ft.*
Nov. 16	C. L. Batchelder	2.14	2.61	978	Mar. 15	P. V. Hodges....	2.86	4.00	2,120
17	.....do.....	2.00	2.35	942	May 6	C. L. Batchelder.	.....	5.00	3,000
17	.....do.....	3.90	6.15	4,770	13	.....do.....	.....	3.58	1,680
17	.....do.....	3.86	6.10	4,690	Aug. 3	F. F. Henshaw..	.....	2.32	818
Jan. 5	P. V. Hodges....	1.96	2.45	910					

Daily discharge, in second-feet, of Hood River at Tucker Bridge, near Hood River, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	346	672	1,100	1,180	560	1,140	2,480	2,150	1,600	.....	860	630
2	404	540	1,040	1,120	620	1,160	2,540	2,430	1,680	.....	825	720
3	411	592	1,010	1,050	800	1,180	2,430	2,790	1,720	.....	915	810
4	340	532	1,030	1,000	760	1,130	.....	3,050	1,950	.....	850	615
5	325	510	2,350	960	730	1,090	.....	3,250	1,880	.....	800	596
6	318	500	2,240	880	680	1,420	.....	3,210	.....	.....	800	528
7	310	456	2,080	860	2,040	1,480	.....	2,740	.....	.....	785	520
8	298	464	1,890	830	2,180	2,020	.....	2,680	.....	.....	780	528
9	296	443	2,230	810	2,090	2,900	.....	2,290	.....	.....	770	605
10	305	443	1,710	800	2,630	3,210	.....	2,110	.....	.....	780	562
11	313	443	1,490	750	2,890	3,210	.....	1,880	.....	.....	780	520
12	314	450	1,300	710	2,200	3,200	.....	1,680	.....	.....	750	512
13	315	415	1,180	690	1,760	3,110	.....	1,560	.....	.....	740	504
14	495	393	1,070	690	1,880	2,400	.....	1,680	.....	.....	735	473
15	329	840	975	690	2,000	2,040	.....	1,580	.....	.....	745	512
16	309	1,280	900	690	2,250	1,880	2,440	1,600	.....	.....	720	516
17	295	2,540	830	650	2,020	1,950	2,530	1,820	.....	1,660	735	516
18	310	3,110	790	690	2,200	2,030	2,380	1,930	.....	1,450	713	524
19	322	3,420	790	690	2,060	2,090	2,180	1,930	.....	1,260	691	524
20	314	1,860	770	630	1,780	3,690	2,060	1,760	.....	1,310	668	512
21	308	1,730	5,100	720	1,640	3,440	2,480	1,780	.....	1,250	644	512
22	310	1,900	11,300	890	1,480	3,640	2,200	1,840	.....	1,220	622	512
23	403	3,960	4,100	1,820	1,390	2,900	1,980	1,760	.....	1,180	600	504
24	410	2,120	2,600	1,480	1,320	2,500	2,020	1,660	.....	1,140	630	480
25	521	3,630	2,300	1,200	1,230	5,560	2,060	1,780	.....	1,070	630	476
26	425	2,800	2,050	1,100	1,170	7,040	2,160	1,720	.....	1,000	640	473
27	368	1,700	1,700	1,020	1,160	5,220	2,480	1,720	.....	920	670	488
28	306	1,400	1,800	910	1,160	3,840	2,430	1,720	.....	880	610	473
29	293	1,550	1,450	850	1,160	2,700	2,290	1,760	.....	850	592	473
30	312	1,350	1,250	800	.....	2,430	2,200	1,720	.....	870	576	470
31	610	.....	1,150	800	.....	2,400	.....	1,660	.....	890	536	.....

NOTE.—Daily discharge estimated, on account of lack of gage readings, from record at Powerdale as follows: Nov. 27 to Dec. 1, Dec. 16–31, Jan. 11–20, Jan. 30 to Feb. 6, and Aug. 18–22. Gage could not be read on account of ice under the weight on the following days: Jan. 11–20 and Jan. 30 to Feb. 6. Mean discharge estimated on account of lack of gage records as follows: 2,450 second-feet Apr. 4–15; 2,000 second-feet, June 6–30; 1,800 second-feet, July 1–16.

Monthly discharge of Hood River at Tucker Bridge, near Hood River, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	610	293	353	21,700
November	3,960	393	1,400	83,300
December	11,300	770	1,910	117,000
January	1,820	630	902	55,500
February	2,890	560	1,580	90,900
March	7,040	1,090	2,710	167,000
April	.....	1,980	2,360	140,000
May	3,250	1,560	2,040	125,000
June	.....	.....	1,960	117,000
July	.....	850	1,480	91,000
August	915	536	716	44,000
September	810	470	536	31,900
The year	11,300	293	1,490	1,080,000

HOOD RIVER AT POWERDALE, NEAR HOOD RIVER, OREG.

LOCATION.—In NE. ¼ 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 tailrace of plant of Pacific Power & Light Co., and 1½ miles above mouth of stream.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—March 31, 1913, to September 30, 1916.

GAGE.—Vertical staff on right bank opposite power plant, about one-half mile above railroad bridge, in the SE. ¼ 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 location 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, 7.5 feet on gage opposite power plant at 1 a. m. December 22 (discharge about 12,200 second feet); minimum stage from water-stage recorder, 1.60 feet at 1 a. m. October 11 (discharge, 235 second-feet).

1913–1916: Maximum stage recorded was that of 1916. Minimum stage recorded, 1.33 feet September 4, 1915 (discharge, 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. 101).

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

ACCURACY.—Stage-discharge relation permanent for gage at bridge; rating curve well defined. Stage-discharge relation for upper gage changed March 26; two rating curves, well defined between 700 and 5,000 second-feet, applicable December 22 to March 26 and March 27 to September 30. From October 1 to November 17 operation of water-stage recorder not satisfactory. Staff gage used after December 21 read to hundredths four times daily. Daily discharge ascertained as follows: October 1 to November 17, by applying to the rating table mean daily gage height determined by inspecting gage-height graph; November 18 to December 21, by use of discharge integrator; December 22 to September 30, by applying mean daily gage height to rating table. Records good.

Discharge measurements of Hood River at Powerdale, near Hood River, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.		Discharge.	Date.	Made by—	Gage height.		Discharge.
		Bridge gage.	Gage opposite power house.				Bridge gage.	Gage opposite power house.	
		Feet.	*Feet.*	*Sec.-ft.*			*Feet.*	*Feet.*	*Sec.-ft.*
Nov. 17	C. L. Batchelder..	5.70	5.00	[a] 4,970	May 5	C. L. Batchelder..	.....	4.36	3,040
Jan. 6	P. V. Hodges.....	.....	2.40	816	21	F. F. Henshaw...	.....	3.48	1,900
Mar. 16	....do.....	.....	3.55	2,050	Aug. 1	.....do.....	.....	2.43	918

[a] Measured at Tucker Bridge; inflow, estimated as 200 second-feet, has been added.

Daily discharge, in second-feet, of Hood River at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1916.

[Gage opposite power plant.]

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	1,080	530	1,280	2,490	2,200	1,710	2,340	940	740
2	.....	.....	.....	1,080	600	1,180	2,490	2,640	1,710	2,340	900	740
3	.....	.....	.....	1,040	820	1,380	2,490	2,800	1,710	2,070	900	820
4	.....	.....	.....	900	740	1,280	2,490	2,970	2,070	1,940	900	670
5	.....	.....	.....	820	705	1,230	2,340	3,140	1,940	1,710	900	600
6	.....	.....	.....	804	670	1,820	2,200	3,140	1,820	1,610	860	600
7	.....	.....	.....	780	2,070	1,590	2,200	2,640	1,820	1,610	820	600
8	.....	.....	.....	780	2,070	2,340	2,340	2,640	1,940	1,710	900	600
9	.....	.....	.....	780	2,200	3,140	2,490	2,340	2,070	1,710	940	600
10	.....	.....	.....	740	2,490	3,320	2,640	2,200	1,710	1,610	820	600
11	.....	.....	.....	670	3,140	3,500	2,800	1,940	1,710	1,610	820	600
12	.....	.....	.....	635	2,490	3,500	2,490	1,820	1,710	1,610	860	565
13	.....	.....	.....	600	1,820	3,320	2,340	1,710	1,710	1,610	900	565
14	.....	.....	.....	600	1,940	2,490	2,490	1,710	1,820	1,610	820	530
15	.....	.....	.....	600	1,940	2,200	2,490	1,710	2,200	1,420	820	530
16	.....	.....	.....	600	2,200	2,070	2,490	1,710	2,490	1,820	820	530
17	.....	.....	.....	565	2,640	2,070	2,490	1,820	2,640	1,710	740	530
18	.....	.....	.....	600	2,640	2,070	2,340	1,940	2,970	1,610	700	530
19	.....	.....	.....	600	2,340	2,200	2,070	1,820	2,490	1,420	670	530
20	.....	.....	.....	530	2,070	3,500	2,070	1,820	2,070	1,420	670	530
21	.....	.....	.....	670	1,820	3,700	2,490	1,940	1,820	1,330	495	495
22	.....	.....	.....	900	1,700	3,700	2,200	2,070	1,710	1,330	565	495
23	.....	.....	.....	1,820	1,700	2,800	2,070	1,820	1,710	1,380	705	460
24	.....	.....	.....	1,590	1,590	2,490	1,940	1,710	1,820	1,200	635	460
25	.....	.....	.....	1,280	1,480	5,500	1,940	1,820	1,940	1,100	635	430
26	.....	.....	.....	1,080	1,380	6,800	2,200	1,820	2,200	1,060	670	430
27	.....	.....	.....	990	1,330	5,250	2,490	1,820	1,940	980	705	460
28	.....	.....	.....	900	1,380	3,500	2,340	1,940	1,940	940	670	460
29	.....	.....	.....	820	1,380	2,970	2,340	1,820	1,710	900	740	460
30	.....	.....	.....	820	.....	2,640	2,200	1,820	1,610	980	705	460
31	.....	.....	.....	780	.....	2,640	.....	1,710	.....	980	780	.....

Monthly discharge of Hood River at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1916.

[Gage opposite power plant.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	1,820	530	853	52,400
February	3,140	530	1,720	98,900
March	6,800	1,180	2,820	173,000
April	2,800	1,940	2,350	140,000
May	3,140	1,710	2,100	129,000
June	2,970	1,610	1,960	117,000
July	2,340	900	1,510	92,800
August	940	495	774	47,600
September	820	430	554	33,000
The period	.....	.....	.....	884,000

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, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	360	690	1,160	1,100	615	1,370	2,560	2,250	1,720	2,430	1,030	824
2	495	560	1,020	1,100	672	1,260	2,540	2,720	1,720	2,350	989	798
3	380	560	970	1,060	860	1,460	2,560	2,880	1,720	2,160	983	830
4	340	495	970	990	813	1,360	2,550	3,040	2,080	1,950	984	759
5	340	495	2,160	916	777	1,240	2,410	3,210	1,950	1,800	987	686
6	340	435	2,040	900	728	1,840	2,260	3,140	1,900	1,700	874	686
7	340	465	2,910	864	2,160	1,690	2,260	2,640	1,900	1,700	909	687
8	340	495	1,730	855	2,160	2,420	2,400	2,640	2,020	1,800	990	689
9	340	435	2,070	855	2,290	3,240	2,540	2,340	2,150	1,770	1,020	688
10	325	465	1,660	835	2,580	3,410	2,700	2,200	1,720	1,690	910	632
11	310	495	1,460	754	3,220	3,590	2,860	1,940	1,760	1,700	902	684
12	310	435	1,300	716	2,580	3,570	2,560	1,820	1,790	1,700	946	652
13	340	435	1,200	691	1,890	3,380	2,410	1,710	1,790	1,700	930	651
14	435	400	1,080	694	2,030	2,590	2,560	1,710	1,900	1,700	906	601
15	380	850	970	700	2,030	2,300	2,560	1,710	2,280	1,510	906	619
16	340	1,280	900	697	2,290	2,150	2,550	1,710	2,570	1,830	906	613
17	325	2,600	830	649	2,730	2,150	2,560	1,820	2,720	1,800	826	610
18	340	2,540	795	699	2,730	2,130	2,410	1,940	2,980	1,700	786	613
19	340	2,890	795	691	2,420	2,260	2,150	1,820	2,570	1,510	756	610
20	340	1,560	774	622	2,140	3,560	2,140	1,820	2,150	1,510	682	606
21	340	1,530	5,180	763	1,900	3,760	2,550	1,940	1,900	1,420	579	575
22	340	1,990	8,900	972	1,770	3,760	2,270	2,070	1,790	1,420	654	581
23	435	3,410	4,100	1,910	1,780	2,860	2,120	1,820	1,790	1,390	789	543
24	495	1,910	2,640	1,680	1,670	2,550	2,000	1,710	1,910	1,290	722	540
25	625	3,670	2,340	1,360	1,560	5,570	2,000	1,820	1,950	1,190	724	516
26	528	2,550	2,070	1,160	1,460	6,870	2,260	1,820	2,290	1,150	757	517
27	495	1,730	1,700	1,070	1,410	5,310	2,550	1,830	2,030	1,070	763	564
28	435	1,450	1,820	973	1,400	3,610	2,420	1,950	2,030	1,030	757	536
29	380	1,560	1,480	910	1,400	3,030	2,410	1,830	1,800	990	824	542
30	380	1,380	1,280	863	.....	2,700	2,240	1,830	1,700	992	781	543
31	830	.....	1,180	865	.....	2,670	.....	1,770	.....	1,060	866	.....

NOTE.—Discharge October to December obtained from records at bridge gage and represents total flow. Discharge January to September obtained by adding the flow of Pacific Power & Light Co.'s tailrace to the discharge of the river as given in preceding table.

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, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	830	310	398	24,500
November	3,670	400	1,330	79,100
December	8,900	774	1,890	116,000
January	1,910	622	931	57,200
February	3,220	615	1,790	103,000
March	6,870	1,240	2,890	178,000
April	2,860	2,000	2,410	143,000
May	3,210	1,710	2,120	130,000
June	2,980	1,700	2,020	120,000
July	2,430	990	1,590	97,800
August	1,030	579	852	52,400
September	830	516	633	37,700
The year	8,900	310	1,570	1,140,000

NOTE.—Discharge for October to December from gage at bridge.

EAST FORK OF HOOD RIVER ABOVE INTAKE NEAR MOUNT HOOD, OREG.

LOCATION.—In SW. ¼ 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, 1916.

GAGE.—Stevens eight-day water-stage recorder on left bank. Gage readers, J. R. Higgins and F. A. McDonald.

DISCHARGE MEASUREMENTS.—Made from cable at gage.

CHANNEL AND CONTROL.—Heavy boulders; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded July 22, 1915, to September 30, 1916, 4.33 feet at 11 p. m. December 21, 1915 (discharge, 1,280 second-feet); minimum stage recorded, 1.20 feet at 5 a. m. November 11, 1915 (discharge, 108 second-feet).

ICE.—Ice forms in gage well but stage-discharge relation is unaffected by ice.

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

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed slightly during high water, change affecting only lower part of curve. Rating curve used before July 30 well defined up to 700 second-feet; curve used after July 30 fairly well defined. Operation of water-stage recorder unsatisfactory January 1 to February 6 owing to formation of ice in well, and from June to September on account of clock stopping. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging the bihourly periods. Records good except for January and August, for which months they are fair.

Discharge measurements of East Fork of Hood River above intake near Mount Hood, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16	C. L. Batchelder	1.37	140	May 6	C. L. Batchelder	3.15	666
18	do	2.26	390	20	F. F. Henshaw	2.54	426
18	do	2.32	371	July 30	do	2.31	349
Mar. 13	P. V. Hodges	2.50	414				

Daily discharge, in second-feet, of East Fork of Hood River above intake near Mount Hood, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	143	145	205	220	158	230	436	457	440	583	371	247
2	151	136	207	216	159	221	436	497	443	557	359	246
3	135	142	207	210	161	218	440	557	471	553	352	241
4	121	158	320	204	163	212	440	629	533	558	344	247
5	119	136	317	198	164	207	422	663	529	563	336	235
6	119	122	314	192	165	209	412	668	541	567	329	234
7	122	119	317	186	335	205	418	597	577	571	327	230
8	125	124	292	180	326	280	443	549	613	576	345	227
9	125	125	268	174	317	368	460	505	593	581	342	223
10	124	125	243	174	307	429	485	457	561	565	332	219
11	119	121	219	174	297	446	478	422	549	577	337	219
12	118	114	194	174	287	457	440	408	557	629	334	223
13	130	118	192	174	275	432	432	387	581	613	329	223
14	133	122	184	174	311	380	468	374	629	553	319	219
15	122	149	176	174	353	353	471	377	704	606	309	221
16	119	143	178	174	418	341	460	387	810	658	299	221
17	119	306	172	174	443	350	464	404	905	565	289	219
18	118	317	169	174	418	362	443	422	950	501	279	219
19	119	350	167	176	384	415	418	426	840	478	269	217
20	120	296	169	178	350	573	408	440	672	474	259	215
21	121	242	611	176	329	565	412	457	573	469	258	215
22	121	235	808	252	308	525	390	436	537	464	257	215
23	122	323	460	240	293	457	384	415	553	460	256	208
24	130	218	380	228	280	418	401	415	557	443	255	202
25	154	299	322	216	272	533	432	432	621	432	254	198
26	133	233	265	204	262	605	457	432	717	420	253	202
27	124	210	255	192	252	557	482	454	690	408	252	210
28	121	186	258	180	240	493	457	460	663	397	251	200
29	119	205	235	168	235	450	436	440	637	385	250	200
30	118	207	230	156	.....	426	422	422	610	374	249	200
31	172	.....	225	157	.....	422	.....	426	.....	380	248	.....

NOTE.—Daily discharge estimated Oct. 20–23 and Feb. 7–12; interpolated Dec. 30 to Jan. 1, Jan. 3–8, 10–15, 24–29, Jan. 31 to Feb. 5, Feb. 7–12, June 27 to July 1, July 4–8, 20–22, 25–29, Aug. 3–5, 14–19, Aug. 21 to Sept. 2, Sept. 4–9.

Monthly discharge of East Fork of Hood River above intake near Mount Hood, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	172	118	127	7,810
November	350	114	191	11,400
December	808	167	276	17,000
January	252	156	189	11,600
February	443	158	285	16,400
March	605	205	392	24,100
April	485	384	438	26,100
May	668	374	465	28,600
June	950	440	622	37,000
July	658	374	515	31,700
August	371	248	298	18,300
September	247	200	220	13,100
The year	950	114	335	243,000

EAST FORK IRRIGATION DISTRICT CANAL NEAR MOUNT HOOD, OREG.

LOCATION.—In SE. ¼ sec. 33, T. 1 N., R. 10 E., 1 mile below intake, 1½ 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, 1916.

GAGE.—Stevens eight-day water-stage recorder on left side of canal just above road crossing. Gage reader, F. A. McDonald. Vertical staff on side of flume, 1,000 feet downstream, in the SW. ¼ sec. 34, used 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 during period July 21, 1915, to September 30, 1916, from water-stage recorder, 3.15 feet at 9 p. m. July 30 (discharge, 116 second-feet). Canal dry throughout winter and at various other times.

ICE.—No water carried in cold weather.

ACCURACY.—Stage-discharge relation changed during May. Two well-defined rating curves used October 1 to November 21 and June 11 to September 30, respectively. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to the rating table mean daily gage height, determined by inspecting gage-height graph. Records excellent for period when water-stage recorder was operating.

The East Fork Irrigation District canal diverts water in the SW. ¼ sec. 4, T. 1 S., R. 10 E., and Irrigates lands lying east of Hood River. Most of the return water reaches Neal Creek 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, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 20	F. F. Henshaw	1.88	23
July 30	....do	3.08	112
Sept. 16	Rhea Luper [a]	2.25	57

[a] Employee of State water board.

Daily discharge, in second-feet, of East Fork Irrigation District canal near Mount Hood, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	36	31	.....	.....	56	108	112
2	36	31	.....	.....	45	109	104
3	36	31	.....	.....	37	111	98
4	36	30	.....	.....	38	109	92
5	35	30	.....	.....	43	108	90
6	35	30	.....	.....	42	112	87
7	34	30	.....	.....	43	112	86
8	34	30	.....	.....	50	115	87
9	34	30	.....	.....	54	111	82
10	34	30	.....	.....	53	108	79
11	34	30	.....	73	65	108	78
12	34	30	.....	75	68	108	77
13	34	31	.....	77	76	106	73
14	34	31	.....	77	80	109	62
15	34	32	.....	78	79	111	58
16	34	32	.....	79	64	109	58
17	33	32	.....	86	74	106	58
18	33	32	.....	93	77	100	58
19	33	32	.....	88	76	99	58
20	33	32	23	82	84	104	59
21	33	32	.....	60	91	104	59
22	33	.....	.....	22	93	107	59
23	32	.....	.....	86	86	109	58
24	32	.....	.....	82	60	112	57
25	33	.....	.....	78	94	112	56
26	32	.....	.....	66	97	112	55
27	32	.....	.....	63	105	109	56
28	32	.....	.....	58	112	111	55
29	32	.....	.....	57	113	112	55
30	32	.....	.....	57	115	111	55
31	31	.....	.....	.....	114	112	.....

NOTE.—No flow Nov. 22 to Apr. 30. Some water carried in May and June before recorder was started. Discharge May 1 to 14, estimated, 10 second-feet; May 15 to 19, 20 second-feet; May 21 to June 10, 23 second-feet.

Monthly discharge of East Fork Irrigation District canal near Mount Hood, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	36	31	33.5	2,060
November (21 days)	32	30	30.9	1,290
May	.....	.....	16.6	1,010
June	93	.....	55.6	3,310
July	115	37	73.7	4,530
August	115	99	109	6,700
September	112	55	70.7	4,210
The year	.....	.....	.....	23,100

NOTE.—See footnote to table of daily discharge.

WEST FORK OF HOOD RIVER NEAR DEE, OREG.

LOCATION.—In SW. ¼ sec. 1, T. 1 N., R. 9 E., about 500 feet below an old bridge, 1 mile from mouth, and 2 miles by road west of Dee, Hood River County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 26, 1913, to September 30, 1914; January 1, 1915, to February 12, 1916, when station was discontinued.

GAGE.—Vertical staff on right bank attached to stump; read by Fred Pilling.

DISCHARGE MEASUREMENTS.—Made by wading at low water. No equipment for high-water measurement.

CHANNEL AND CONTROL.—Rocky; probably permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year and during period 1913–1916, 5.60 feet at 7 a. m. December 22 (discharge not determined); minimum stage recorded, 1.00 foot September 29 to October 1, 1915 (discharge, 100 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—Some water is diverted for irrigation near Dee, and some from Greenpoint Creek for fluming logs.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined between 100 and 350 second-feet; not determined above 530 second-feet. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records good except for low water.

No discharge measurements made during 1916.

Daily gage height, in feet, of West Fork of Hood River near Dee, Oreg., for the period Oct. 1, 1915, to Feb. 12, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.
1	1.00	1.75	1.85	.....	.....	16	1.15	2.00	1.70	1.62	.....
2	1.28	1.50	1.82	.....	.....	17	1.15	1.80	1.65	1.62	.....
3	1.20	1.55	1.75	.....	.....	18	1.15	3.80	1.60	1.62	.....
4	1.10	1.52	1.75	.....	.....	19	1.20	3.50	1.60	1.62	.....
5	1.08	1.50	2.50	.....	.....	20	1.15	2.40	1.55	1.62	.....
6	1.08	1.45	2.60	.....	2.70	21	1.10	2.10	3.55	.....	.....
7	1.08	1.40	2.50	1.82	3.00	22	1.10	2.10	5.60	.....	.....
8	1.08	1.38	2.30	.....	3.10	23	1.22	3.00	4.80	.....	.....
9	1.08	1.35	2.20	1.78	3.25	24	1.28	2.60	3.00	.....	.....
10	1.08	1.35	2.10	1.75	3.25	25	1.48	3.55	2.80	.....	.....
11	1.08	1.35	2.00	1.72	3.70	26	1.30	2.90	.....	.....	.....
12	1.08	1.40	1.90	1.70	3.70	27	1.40	2.40	.....	.....	.....
13	1.10	1.35	1.82	1.68	.....	28	1.30	2.00	.....	.....	.....
14	1.48	1.35	1.80	1.65	.....	29	1.22	2.10	.....	.....	.....
15	1.20	1.40	1.75	1.62	.....	30	1.25	2.00	.....	.....	.....
						31	1.48	.....	.....	.....	.....

NOTE.—Gage washed out Dec. 22; replaced at same location and datum on Jan. 7. Gage heights Dec. 22–25 were estimated by observer.

Daily discharge, in second-feet, of West Fork of Hood River near Dee, Oreg., October to December, 1915.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	100	.....	.....	11	124	250	.....	21	130	.....	.....
2	210	350	.....	12	124	280	.....	22	130	.....	.....
3	170	390	.....	13	130	250	.....	23	180	.....	.....
4	130	366	.....	14	336	250	.....	24	210	.....	.....
5	124	350	.....	15	170	280	.....	25	336	.....	.....
6	124	315	.....	16	150	.....	530	26	220	.....	.....
7	124	280	.....	17	150	.....	480	27	280	.....	.....
8	124	268	.....	18	150	.....	430	28	220	.....	.....
9	124	250	.....	19	170	.....	430	29	180	.....	.....
10	124	250	.....	20	150	.....	390	30	195	.....	.....
								31	336	.....	.....

NOTE.—Where no discharge is given, for period Oct. to Dec. 21, it exceeded 530 second-feet.

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

LOCATION.—In SE. ¼ sec. 36, T. 3 N., R. 10 E., just below power house at Powerdale, three-quarters of a mile south of Hood River, Hood River County.

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

GAGE.—Vertical staff on right bank of tailrace, installed March 16, at different datum from that of gage used 1913 to 1914. Read by A. Rogers.

DISCHARGE MEASUREMENTS.—Made from foot bridge just below gage.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.90 feet in July and August (discharge, 90 second-feet); discharge January 15, 100 second-feet determined from electric output of power plant). Minimum stage recorded, 0.20 foot May 6 to 25 (discharge, 3 second-feet).

1913–14 and 1916: 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 a day. Daily discharge March 16 to September 30 ascertained by applying the mean daily gage height to rating table. Records good. Daily discharge January 1 to March 15 ascertained from daily electric output of power plant, the relation of which to discharge has been determined by current-meter measurements. Records for this period fair.

The Pacific Power & Light Co.'s pipe line diverts water from Hood River at a dam in the NE. ¼ sec. 1, T. 2 N., R. 10 E., to a power plant in the SE. ¼ sec. 36, T. 3 N., and the tailrace discharges back into the river in the NE. ¼ sec. 36, below gage on Hood River at Powerdale and above gage at bridge. (See p. 94.)

Discharge measurements of Pacific Power & Light Co.'s tailrace at Powerdale, near Hood River, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 6	P. V. Hodges	.....	92	May 20	F. F. Henshaw	.20	[a] 3
Mar. 16	.....do	1.80	84	Aug. 1	.....do	1.84	85
May 5	C. C. Batchelder	1.62	71				

[a] Estimated.

Daily discharge, in second-feet, of Pacific Power & Light Co.'s tailrace at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1916.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	15	85	86	70	50	8	90	86	84
2	15	72	83	52	76	10	12	89	58
3	15	40	76	70	76	10	86	83	10
4	90	73	85	64	70	10	14	84	89
5	96	72	15	67	71	10	86	87	86
6	96	58	15	64	3	80	90	14	86
7	84	85	98	64	3	83	90	89	87
8	75	87	86	58	3	83	86	90	89
9	75	86	96	52	3	83	64	83	88
10	75	85	92	64	3	10	83	90	32
11	84	85	92	64	3	47	90	82	84
12	81	86	69	65	3	83	90	86	87
13	91	70	62	70	3	83	90	30	86
14	94	86	96	70	3	83	90	86	89
15	100	87	96	70	3	83	90	86	71
16	97	86	83	64	3	83	14	86	83
17	84	86	83	70	3	83	90	86	80
18	99	86	63	70	3	14	89	86	83
19	91	82	64	76	3	80	90	86	80
20	92	66	64	70	3	83	90	12	76
21	93	84	63	64	3	83	90	84	80
22	72	72	59	70	3	83	90	89	86
23	88	81	58	52	3	83	14	84	83
24	85	83	64	64	3	86	90	87	80
25	78	83	70	65	3	14	90	89	86
26	78	82	70	64	4	86	90	87	87
27	76	83	64	64	8	86	90	58	86
28	73	15	58	76	8	86	90	87	76
29	90	15	64	70	8	86	90	84	82
30	43	.....	64	42	8	86	12	76	83
31	85	.....	26	.....	58	.....	83	86	.....

Monthly discharge of Pacific Power & Light Co.'s tailrace at Powerdale, near Hood River, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Mnimum.	Mean.	
January	100	15	77.7	4,780
February	87	15	74.5	4,290
March	98	15	69.8	4,290
April	76	42	64.8	3,860
May	76	3	16.0	984
June	86	8	62.9	3,740
July	90	12	75.9	4,670
August	90	12	78.5	4,830
September	89	10	78.6	4,680
The period	.....	.....	.....	36,100

WHITE SALMON RIVER BASIN.

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

LOCATION.—In NE. ¼ sec. 6, T. 5 N., R. 11 E., at splash dam formerly used by Wind River Lumber Co., 2½ 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, 1916.

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 read by 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, 8.42 feet at 4 p. m. June 18 (discharge, 1,890 second-feet); minimum stage recorded, 1.45 feet at 4 p. m. October 10 (discharge, 63 second-feet).

1912–1916: Maximum stage recorded, 7.65 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 August 3, when observer commenced clearing drift from weir. Observer could not read gage January 4–22 and January 25 to February 13, on account of ice and snow. Fairly well defined rating curves used October 1 to August 2 and August 6 to September 30. Discharge August 3 to 5 interpolated. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except as follows: January, poor; February, fair.

COOPERATION.—Gage-height record furnished by Northwestern Electric Co.

Discharge measurements of White Salmon River at splash dam near Trout Lake, Wash., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 1	P. V. Hodges	1.51	66	June 25	C. L. Batchelder	6.72	1,210
19	do	1.60	77	Aug. 2	F. F. Henshaw	4.00	377

Daily discharge, in second-feet, of White Salmon River at splash dam near Trout Lake, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	71	172	172	320	.....	420	1,020	1,240	1,130	1,240	443	190
2	93	141	172	289	.....	420	1,020	1,360	1,130	1,600	377	190
3	93	151	183	274	.....	398	1,020	1,480	1,200	1,640	346	202
4	75	141	232	.....	.....	398	1,060	1,640	1,360	1,440	316	228
5	75	126	246	.....	.....	377	1,020	1,640	1,320	1,320	286	202
6	71	121	219	.....	.....	357	1,020	1,560	1,280	1,160	256	190
7	71	111	260	.....	.....	357	1,020	1,440	1,280	1,100	256	190
8	75	111	274	.....	.....	420	1,060	1,360	1,400	1,160	284	190
9	71	121	398	.....	.....	545	1,130	1,240	1,440	1,160	300	190
10	67	131	304	.....	.....	630	1,160	1,130	1,320	1,100	284	190
11	67	121	289	.....	.....	690	1,200	1,060	1,240	1,100	270	190
12	71	116	260	.....	.....	720	1,160	980	1,160	1,100	256	190
13	75	111	246	.....	.....	750	1,100	945	1,240	1,100	256	184
14	93	111	219	.....	660	690	1,160	945	1,320	980	256	178
15	80	131	206	.....	690	630	1,160	945	1,400	945	242	178
16	75	161	194	.....	720	660	1,100	945	1,520	1,060	242	178
17	71	172	194	.....	750	660	1,130	1,020	1,640	1,060	228	172
18	71	274	183	.....	720	660	1,100	1,060	1,840	945	228	178
19	75	492	183	.....	690	720	1,020	1,160	1,680	875	214	166
20	75	398	183	.....	518	1,170	980	1,240	1,400	875	214	161
21	75	289	492	.....	600	1,280	1,020	1,200	1,240	810	202	161
22	75	274	1,440	.....	600	1,240	945	1,160	1,160	780	202	156
23	93	420	1,400	720	572	1,100	910	1,100	1,100	750	214	159
24	98	304	945	690	572	1,020	875	1,020	1,200	720	202	156
25	111	260	750	.....	518	1,020	980	1,020	1,200	660	202	156
26	111	274	572	.....	492	1,280	1,100	1,100	1,280	600	202	161
27	102	219	492	.....	467	1,320	1,160	1,200	1,280	572	190	161
28	93	206	443	.....	467	1,240	1,240	1,280	1,200	518	202	156
29	106	194	377	.....	443	1,100	1,160	1,240	1,130	492	202	156
30	102	183	420	.....	.....	1,020	1,200	1,130	1,100	467	202	156
31	161	.....	398	.....	.....	945	.....	1,100	.....	492	190	.....

NOTE.—Mean discharge estimated as 250 second-feet Jan. 4–10; 200 second-feet, Jan. 11–22; 300 second-feet, Jan. 25–31; 250 second-feet, Feb. 1–9; 500 second-feet, Feb. 10–13.

Monthly discharge of White Salmon River at splash dam near Trout Lake, Wash., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	161	67	85.2	5,240
November	492	111	201	12,000
December	1,440	172	398	24,500
January	720	.....	276	17,000
February	.....	.....	473	27,200
March	1,320	357	782	48,100
April	1,240	875	1,070	63,700
May	1,640	945	1,190	73,200
June	1,840	1,100	1,310	78,000
July	1,640	467	962	59,200
August	443	190	250	15,400
September	228	156	177	10,500
The year	1,840	67	598	434,000

WHITE SALMON RIVER AT HUSUM, WASH.

LOCATION.—In SE. ¼ 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, 1916.

GAGE.—Vertical staff on left 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, 6.6 feet June 18 (discharge, 3,200 second-feet); minimum stage recorded, 2.70 feet October 1 and 22 (discharge, 450 second-feet).

1909–1916: 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 practically permanent. R. ting curve well defined. Gage read to hundredths once daily. Daily discharge ascertained by applying daily gage height to rating rable. Records good.

Discharge measurements of White Salmon River at Husum, Wash., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19	P. V. Hodges	2.72	455	May 7	C. L. Batchelder	5.80	2,520
Jan. 24	C. L. Batchelder	4.00	1,150	June 25	.....do	5.42	2,110

Daily discharge, in second-feet, of White Salmon River at Husum, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	450	585	585	770	675	1,020	1,780	1,940	1,940	2,100	1,260	1,020
2	495	518	585	720	675	1,020	2,180	2,100	1,940	2,620	1,330	1,020
3	495	518	585	770	675	1,020	1,860	2,200	2,020	2,800	1,200	1,020
4	495	518	639	770	675	1,020	1,780	2,440	2,180	2,440	1,200	1,020
5	495	495	675	720	675	970	1,780	2,620	2,260	2,260	1,200	970
6	495	518	675	675	675	970	1,780	2,440	2,180	2,020	1,200	970
7	495	518	770	675	675	970	1,780	2,260	2,180	2,020	1,200	970
8	495	518	720	630	720	1,330	1,780	2,100	2,260	2,100	1,200	970
9	472	518	970	630	970	1,330	1,860	2,020	2,260	1,940	1,260	970
10	472	518	870	630	1,260	1,470	1,860	1,940	2,100	1,940	1,200	970
11	472	518	770	630	1,470	1,540	1,940	1,860	2,100	1,940	1,200	970
12	472	495	720	585	1,330	1,620	1,860	1,780	2,100	1,940	1,200	920
13	495	472	720	585	1,330	1,620	1,860	1,780	2,180	2,020	1,200	920
14	495	472	675	585	1,260	1,540	1,860	1,780	2,260	2,100	1,140	920
15	472	450	675	585	1,260	1,470	1,860	1,700	2,260	1,860	1,140	920
16	472	495	630	585	1,330	1,400	1,860	1,780	2,440	1,860	1,140	920
17	450	585	630	585	1,470	1,400	1,860	1,780	2,620	1,860	1,140	920
18	450	675	630	585	1,330	1,470	1,780	1,860	3,200	1,860	1,080	920
19	450	870	585	585	1,330	1,470	1,700	1,940	2,900	1,780	1,080	920
20	450	820	630	630	1,330	2,180	1,700	2,020	2,440	1,780	1,080	870
21	450	720	1,940	630	1,200	2,260	1,780	2,020	2,100	1,780	1,080	870
22	450	675	2,180	675	1,140	2,180	1,620	1,940	2,100	1,700	1,080	870
23	495	870	2,020	970	1,140	1,940	1,620	1,860	2,100	1,620	1,080	870
24	518	770	1,330	1,080	1,080	1,780	1,700	1,780	2,100	1,620	1,080	870
25	495	675	1,330	970	1,080	1,940	1,780	1,780	2,100	1,540	1,080	870
26	495	675	1,080	870	1,080	2,440	1,780	1,780	2,260	1,470	1,080	870
27	495	675	970	820	1,020	2,350	1,860	1,940	2,180	1,470	1,140	870
28	472	675	970	770	1,020	2,260	1,940	2,100	2,100	1,400	1,080	870
29	450	675	870	770	1,020	1,940	1,940	2,100	2,020	1,330	1,080	870
30	472	585	770	720	.....	1,800	1,940	1,940	1,940	1,330	1,080	870
31	518	.....	770	675	.....	1,780	.....	1,940	.....	1,300	1,080	.....

Monthly discharge of White Salmon River at Husum, Wash., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	518	450	479	29,500
November	870	450	602	35,800
December	2,180	585	902	55,500
January	1,080	585	706	43,400
February	1,470	675	1,070	61,600
March	2,440	970	1,600	98,400
April	2,180	1,620	1,820	108,000
May	2,620	1,700	1,990	122,000
June	3,200	1,940	2,230	133,000
July	2,800	1,300	1,860	114,000
August	1,330	1,080	1,150	70,700
September	1,020	870	927	55,200
The year	3,200	450	1,280	927,000

WHITE SALMON RIVER NEAR UNDERWOOD, WASH.

LOCATION.—In NW. ¼ sec. 14, T. 3 N., R. 10 E., Klickitat County, about 200 yards below Northwestern Electric Co.'s power plant, 2½ miles north of Underwood.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 11, 1915, to September 30, 1916; also October 18, 1912, to February 26, 1913, at Condit 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 from water-stage recorder, 5.0 feet about 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. Gage-height record used for only a few days prior to installation of Friez recorder in January, 1916, and there are many gaps in record thereafter. Daily discharge ascertained by use of discharge integrator, or by averaging discharge for 2-hour intervals. Discharge for periods for which gage-height record is missing or is impossible of interpretation has been determined from record of electrical output of power plant. The curve of relation of output to discharge is fairly well defined. Records good except for estimated periods. (See footnote to table of daily discharge.)

Discharge measurements of White Salmon River near Underwood, Wash., during the years ending Sept. 30, 1915 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1914.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Dec. 9	C. G. Paulsen	1.01	767	Jan. 22	C. L. Batchelder	1.42	983
				23	do	2.24	1,520
1915.				23	do	2.38	1,640
Jan. 15	do	1.08	788	24	do	2.37	1,590
Feb. 5	do	1.06	792	May 7	do	3.60	2,680
June 6	C. L. Batchelder	1.22	904	June 25	do	3.10	2,210
July 25	do	.72	630				
Sept. 18	do	.80	616				
Oct. 2	P. V. Hodges	.14	379				

Daily discharge, in second-feet, of White Salmon River near Underwood, Wash., for the years ending Sept. 30, 1915 and 1916.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1915.			1915.			1915.		
1		a 620	11	580	610	21	620	a 595
2		a 610	12	590	380	22	650	a 558
3		a 620	13	b 590	a 550	23	b 600	a 590
4		a 610	14	a 590	a 600	24	616	a 590
5		a 354	15	550	a 570	25	600	a 575
6		622	16	627	565	26	a 570	410
7		638	17	568	570	27	a 597	550
8		a 626	18	570	a 630	28	603	600
9		570	19	580	a 355	29	500	590
10		580	20	600	a 575	30	675	580
						31	a 580	

a Computed from electric output of power plant.
b Estimated.

Daily discharge, in second-feet, of White Salmon River near Underwood, Wash., for the years ending Sept. 30, 1915 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.											
1	584	a615	a680	.....	1,400	2,400	2,310	.....	2,150	1,380	1,050
2	a560	a695	a710	.....	1,390	2,400	2,400	.....	2,570	1,310	1,030
3	a336	573	a720	.....	1,450	2,490	2,580	.....	2,800	1,280	1,120
4	a546	565	a720	.....	1,420	2,490	2,870	.....	2,500	b1,300	1,120
5	a588	a545	700	.....	b1,490	2,400	2,870	.....	2,280	b1,320	1,100
6	a570	a607	860	.....	1,560	2,310	2,870	.....	2,120	1,350	1,070
7	a547	a336	.....	.....	1,550	2,310	2,770	.....	2,150	1,400	1,050
8	a560	a500	.....	.....	1,960	2,310	2,580	.....	2,130	1,300	1,050
9	a583	a550	.....	.....	2,350	.....	2,400	.....	2,130	1,300	1,070
10	a356	a620	.....	.....	2,550	.....	2,310	.....	2,100	1,360	b1,060
11	a475	a600	.....	.....	2,630	.....	2,130	.....	2,020	1,310	1,050
12	a560	a493	.....	.....	2,710	.....	1,950	.....	2,000	1,320	1,040
13	a528	a510	.....	.....	2,670	.....	.....	2,130	2,000	.....	1,030
14	a513	a380	.....	.....	2,330	.....	.....	2,210	1,910	.....	1,020
15	a530	a513	.....	.....	1,870	2,400	.....	2,330	1,950	.....	1,010
16	a510	a624	.....	.....	1,660	2,310	.....	2,550	2,020	.....	1,040
17	a365	a645	.....	.....	1,690	2,310	2,040	2,700	2,050	.....	1,040
18	465	a670	.....	.....	1,710	2,310	2,170	b3,300	1,950	.....	1,030
19	517	690	.....	.....	b2,000	2,220	2,210	b3,000	1,900	1,160	1,010
20	510	860	.....	.....	b3,000	2,130	2,200	2,580	1,850	1,140	980
21	492	780	.....	.....	3,470	2,220	1,990	2,270	1,810	1,150	980
22	a516	860	.....	.....	3,470	2,130	1,990	2,140	1,710	.....	960
23	a540	1,120	.....	.....	3,070	2,100	1,990	2,150	1,560	.....	950
24	a360	920	.....	.....	2,770	2,040	1,940	2,220	1,610	.....	910
25	a660	960	.....	.....	3,070	2,040	1,910	2,220	1,550	.....	931
26	a523	830	.....	1,490	3,570	2,220	1,950	2,230	1,490	1,130	908
27	a527	770	.....	1,410	3,470	2,310	.....	2,250	1,440	1,120	879
28	a530	b700	.....	1,400	3,070	2,310	.....	2,180	1,420	1,100	861
29	a625	810	.....	1,400	2,770	2,310	.....	2,050	1,350	1,080	858
30	a605	a690	.....	.....	2,490	2,310	.....	2,030	1,340	1,060	953
31	a318	.....	.....	.....	2,400	.....	.....	.....	1,370	1,020	.....

a Computed from electric output of power plant. b Estimated.

NOTE.—Mean discharge estimated as follows:

1916.	Second-feet.	1916.	Second-feet.
Apr. 9–14	2,400	June 1–12	2,300
May 13–16 and 27–31	2,000	Aug. 13–18	1,240

Monthly discharge of White Salmon River near Underwood, Wash., for the years ending Sept. 30, 1915 and 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915.				
August 11–31	675	500	593	24,700
September	638	354	563	33,500
The period	.....	.....	.....	58,200
1915–16.				
October	660	318	512	31,500
November	1,120	336	668	39,700
December	.....	.....	a1,000	61,500
January	.....	.....	a850	52,300
February	.....	.....	a1,400	80,500
March	3,570	1,390	2,360	145,000
April	2,490	2,040	2,310	137,000
May	2,870	1,910	2,210	136,000
June	3,300	2,030	2,340	139,000
July	2,800	1,340	1,910	117,000
August	1,400	1,020	1,220	75,000
September	1,120	858	1,010	60,100
The year	3,570	318	1,480	1,070,000

a Estimated from record at Husum.

SANDY RIVER BASIN.

SANDY RIVER NEAR MARMOT, OREG.

LOCATION.—In sec. 24, T. 2 S., R. 5 E., at Van der Hoof ranch, about 1½ miles above Marmot, Clackamas County, 2 miles by river above Sandy River dam of Portland Railway, Light & Power Co., and 5 miles below mouth of Salmon River.

DRAINAGE AREA.—267 square miles measured on topographic and Forest Service maps.

RECORDS AVAILABLE.—August 15, 1911, to December 21, 1915; station discontinued.

GAGE.—Friez water-stage recorder on right bank, referred to a vertical staff on the stilling well. Observer, O. G. Olsen.

DISCHARGE MEASUREMENTS.—Made from a cable about a mile below gage, just within the backwater of the dam.

CHANNEL AND CONTROL.—Rocks and gravel; may shift slightly.

EXTREMES OF DISCHARGE.—Maximum stage during year, from water-stage recorder, 10.5 feet about 11 p. m., December 21 (discharge, estimated from extension of rating curve, 18,500 second-feet); gage washed out at this time; stage may have gone somewhat higher during night. Minimum stage from water-stage recorder, 1.00 foot October 11 and 12 (discharge, 300 second-feet).

1911–1915: Maximum stage recorded December 21, 1915; minimum stage recorded, 0.95 foot September 29 and 30, 1915 (discharge, 285 second-feet).

ICE.—Stage-discharge relation practically unaffected.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined. Operation of recorder satisfactory until it was washed out about 11 p. m., December 21. Daily discharge ascertained by applying to the rating table mean daily gage heights determined by inspecting the gage-height graph, or, for days of considerable fluctuation, by averaging results obtained by applying to the table the gage heights for 2-hour intervals. Results excellent.

The following discharge measurement was made by Batchelder and Hodges:
November 23, 1915: Gage height, 6.40 feet; discharge, 7,020 second-feet.

Daily discharge in second-feet, of Sandy River near Marmot, Oreg., for the period Oct. 1 to Dec. 21, 1915.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	374	1230	2,200	11	315	820	1,940	21	370	3,950	8,220
2	600	975	1,890	12	303	850	1,750	22	370	3,900	.....
3	550	940	1,940	13	410	760	1,570	23	500	8,020	.....
4	414	850	2,040	14	760	700	1,440	24	625	4,420	.....
5	370	820	3,950	15	550	1,650	1,350	25	1,010	6,320	.....
6	346	790	3,770	16	450	2,360	1,270	26	910	5,220	.....
7	330	700	2,910	17	410	6,670	1,270	27	880	3,120	.....
8	324	675	2,700	18	386	7,450	1,150	28	700	2,440	.....
9	324	675	3,200	19	422	6,810	1,080	29	625	3,770	.....
10	327	675	2,380	20	386	3,680	1,230	30	575	2,910	.....
								31	880	.....	.....

Monthly discharge of Sandy River near Marmot, Oreg., for the period Oct. 1 to Dec. 21, 1915.

[Drainage area, 267 square miles.]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,010	303	510	31,400
November	8,020	675	2,800	167,000
December 1–21	8,220	1,080	2,330	97,000

SANDY RIVER AT DAM NEAR MARMOT, OREG.

LOCATION.—In NE. ¼ sec. 13, T. 2 S., R. 5 E., at 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.

RECORDS AVAILABLE.—December 22, 1915, to September 30, 1916.

GAGE.—Vertical staff on right abutment of dam near head gates of canal; read by O. G. Olsen.

DISCHARGE MEASUREMENTS.—Made from cable near upper end of backwater of dam; discharge of Sandy River canal deducted.

CONTROL.—Broad-crested spillway, 358 feet long; elevation somewhat uneven. A low section was raised by flashboards on September 26. Lowest point of spillway at gage height 31.0 feet or 731 feet above sea level.

EXTREMES OF DISCHARGE.—Maximum stage 38.4 feet during night of December 21–22; determined from high-water marks the next morning (discharge, estimated from extension of rating curve, 19,900 second-feet); minimum stage recorded, 31.12 feet September 29 (discharge, 13 second-feet).

ICE.—A little ice occasionally forms on the crest during the very coldest weather.

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. (See p. 112.)

REGULATION.—The storage back of dam serves to lessen amount of diurnal fluctuation caused by melting glaciers but has no effect for period of a day or over.

ACCURACY.—Stage-discharge relation changed September 26, when flashboards were placed in a low point in crest of dam. Two fairly well defined rating curves used, based on comparison of gage heights at dam and at old station above pond during period November 1 to December 19, 1915. Daily discharge ascertained by applying to the rating table the daily gage readings. Records good.

The following discharge measurement was made by C. L. Batchelder:

August 31, 1916: Gage height, 31.62 feet; discharge, 140 second-feet.

Daily discharge, in second-feet, of Sandy River at dam near Marmot, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	1,200	664	1,150	1,980	2,180	1,700	1,790	558	140
2	.....	.....	.....	1,040	1,040	1,060	2,180	2,500	1,790	3,320	547	140
3	.....	.....	.....	880	1,810	1,150	1,980	2,840	1,880	3,960	536	186
4	.....	.....	.....	848	1,260	1,040	1,790	2,960	1,980	3,080	536	190
5	.....	.....	.....	784	1,120	880	1,700	3,080	1,880	2,280	481	182
6	.....	.....	.....	736	2,610	1,120	1,520	3,080	1,790	1,790	470	165
7	.....	.....	.....	692	7,500	1,280	1,790	2,500	1,880	1,790	452	151
8	.....	.....	.....	692	5,150	2,390	1,980	2,280	1,980	1,630	752	193
9	.....	.....	.....	664	3,960	3,700	2,080	2,180	1,790	1,410	636	310
10	.....	.....	.....	664	5,150	3,960	2,280	2,080	1,700	1,280	514	286
11	.....	.....	.....	452	5,150	3,960	2,840	1,880	1,700	1,280	461	338
12	.....	.....	.....	416	3,200	3,830	2,180	1,980	1,700	1,310	470	536
13	.....	.....	.....	380	2,610	3,200	1,880	1,880	1,790	1,280	470	514
14	.....	.....	.....	366	3,440	2,390	2,180	1,880	1,880	1,140	461	461
15	.....	.....	.....	352	3,960	1,980	2,180	1,880	1,880	1,110	380	215
16	.....	.....	.....	345	4,220	1,880	1,980	1,880	2,080	1,360	310	196
17	.....	.....	.....	350	3,960	1,980	2,080	2,080	2,180	1,520	304	186
18	.....	.....	.....	350	3,570	2,080	2,080	2,080	2,180	1,360	317	182
19	.....	.....	.....	380	2,960	2,500	1,700	2,180	2,180	1,170	286	120
20	.....	.....	.....	420	2,610	4,220	1,880	1,980	2,080	1,040	256	137
21	.....	.....	.....	470	2,280	3,700	2,720	2,080	2,080	944	200	151
22	.....	.....	12,400	580	2,080	3,830	2,280	2,080	1,790	848	134	56
23	.....	.....	4,800	1,330	1,790	2,720	1,880	1,980	1,700	816	144	32
24	.....	.....	2,960	1,330	1,610	2,280	1,880	1,880	1,610	832	158	24
25	.....	.....	2,280	928	1,560	5,900	2,080	2,390	1,660	736	179	20
26	.....	.....	2,080	720	1,440	6,700	2,280	2,080	1,980	636	175	31
27	.....	.....	1,700	608	1,380	4,220	2,720	1,980	1,790	536	172	18
28	.....	.....	2,280	536	1,250	3,080	2,390	1,880	1,660	470	179	14
29	.....	.....	1,700	481	1,280	2,500	2,280	1,980	1,540	434	165	13
30	.....	.....	1,360	470	.....	2,180	2,180	2,080	1,660	558	162	13
31	.....	.....	1,200	470	.....	1,980	.....	1,790	.....	366	151	.....

NOTE.—Daily discharge estimated on account of ice Jan. 17 to 21.

Monthly discharge of Sandy River at dam near Marmot, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 22–31	12,400	1,200	3,280	65,100
January	1,330	345	643	39,500
February	7,500	664	2,780	160,000
March	6,700	880	2,740	168,000
April	2,840	1,520	2,100	125,000
May	3,080	1,790	2,180	134,000
June	2,180	1,540	1,850	110,000
July	3,960	434	1,370	84,200
August	752	134	355	21,800
September	536	13	173	10,300
The period				918,000

Combined daily discharge, in second-feet, of Sandy River and canal at dam near Marmot, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	1,330	897	1,290	2,050	2,210	1,820	1,870	797	565
2	.....	.....	.....	1,280	1,230	1,200	2,250	2,530	1,940	3,390	786	567
3	.....	.....	.....	1,120	2,000	1,290	2,050	2,870	2,060	3,970	775	613
4	.....	.....	.....	1,080	1,440	1,210	1,860	2,990	2,160	3,090	774	593
5	.....	.....	.....	1,010	1,300	1,080	1,860	3,110	2,060	2,320	717	541
6	.....	.....	.....	965	2,800	1,360	1,790	3,110	1,970	1,860	706	524
7	.....	.....	.....	921	7,690	1,360	1,860	2,530	2,060	1,820	688	510
8	.....	.....	.....	921	5,340	2,600	2,050	2,410	2,160	1,680	991	552
9	.....	.....	.....	893	4,150	3,830	2,150	2,220	1,950	1,560	874	671
10	.....	.....	.....	893	5,310	4,090	2,350	2,140	1,880	1,330	766	650
11	.....	.....	.....	752	5,280	4,090	2,910	1,950	1,880	1,330	731	490
12	.....	.....	.....	748	3,300	3,960	2,250	2,060	1,880	1,370	712	537
13	.....	.....	.....	712	2,710	3,330	1,950	1,960	1,970	1,400	706	515
14	.....	.....	.....	698	3,540	2,510	2,310	2,000	2,060	1,260	697	462
15	.....	.....	.....	684	4,060	2,090	2,310	2,000	2,060	1,280	690	394
16	.....	.....	.....	677	4,320	1,990	2,110	2,000	2,260	1,490	664	483
17	.....	.....	.....	634	4,060	2,020	2,210	2,200	2,360	1,640	658	502
18	.....	.....	.....	642	3,670	2,190	2,210	2,200	2,360	1,480	671	498
19	.....	.....	.....	672	3,060	2,610	1,830	2,300	2,360	1,290	640	486
20	.....	.....	.....	712	2,700	4,340	2,010	2,100	2,260	1,160	610	440
21	.....	.....	.....	762	2,370	3,820	2,850	2,200	2,260	1,090	590	480
22	.....	.....	12,500	872	2,170	3,950	2,410	2,100	1,940	1,110	550	433
23	.....	.....	4,860	1,630	1,930	2,840	2,010	2,100	1,850	1,100	560	417
24	.....	.....	3,020	1,630	1,800	2,400	2,010	2,000	1,790	1,100	574	404
25	.....	.....	2,340	1,230	1,750	5,970	2,130	2,510	1,840	978	595	413
26	.....	.....	2,210	1,020	1,630	6,710	2,410	2,200	2,160	922	591	424
27	.....	.....	1,820	908	1,530	4,230	2,790	2,100	1,970	892	588	416
28	.....	.....	2,410	836	1,440	3,090	2,420	2,000	1,840	826	595	405
29	.....	.....	1,830	778	1,340	2,520	2,310	2,100	1,720	790	581	413
30	.....	.....	1,490	762	.....	2,210	2,210	2,200	1,740	836	578	411
31	.....	.....	1,330	762	.....	2,050	.....	1,910	.....	875	570	.....

Combined monthly discharge of Sandy River and Sandy River canal at dam near Marmot, Oreg., for the year ending Sept. 30, 1916.

[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	1,010	303	510	1.91	2.20	31,400
November	8,020	675	2,800	10.5	11.71	167,000
December	12,500	1,070	2,680	10.0	11.53	165,000
January	1,630	634	920	3.45	3.98	56,600
February	7,690	897	2,920	11.0	11.86	169,000
March	6,710	1,080	2,850	10.7	12.34	175,000
April	2,910	1,790	2,200	8.24	9.19	131,000
May	3,110	1,910	2,270	8.50	9.80	140,000
June	2,360	1,720	2,020	7.57	8.45	120,000
July	3,970	790	1,520	5.69	6.56	93,500
August	991	550	678	2.54	2.93	41,700
September	671	394	493	1.85	2.06	29,300
The year	12,500	303	1,820	6.82	92.61	1,320,000

NOTE.—Records of Sandy River near Marmot were used for Oct. 1 to Dec. 21, in order to complete the year.

LOST CREEK NEAR BRIGHTWOOD, OREG.

LOCATION.—In NE. ¼ 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, 1916.

GAGE.—Stevens continuous water-stage recorder referred to a vertical staff on left bank. Gage reader, 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, 3.75 feet at 1 a. m. December 22 (discharge, 1,330 second-feet); minimum stage from water-stage recorder, 0.40 foot October 1 (discharge, 15 second-feet).

1913–1916: Maximum stage was that recorded during 1916; minimum stage recorded, 0.38 foot September 25, 1915 (discharge, 15 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during flood of December 21 and 22. Rating curves well defined between 15 and 150 second-feet were used October 1 to December 21, and December 22 to September 30. Operation of water-stage recorder satisfactory throughout year. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph. Records excellent except for extremely high water.

Discharge measurements of Lost Creek near Brightwood, Oreg., during the year ending Sept. 30, 1916.

[Made by C. L. Batchelder.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Apr. 28	1.50	129	Sept. 1	0.57	26.3
July 25	.91	42.3	17	.59	28.2

Daily discharge, in second-feet, of Lost Creek near Brightwood, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	16	84	131	47	41	49	116	118	93	116	37	27
2	29	70	116	44	126	45	126	148	105	175	36	29
3	25	66	131	42	79	46	126	165	126	208	36	33
4	20	57	133	40	61	41	120	165	132	150	36	30
5	18	56	238	39	51	40	103	162	107	122	34	29
6	17	53	218	38	175	40	103	162	110	102	34	28
7	17	47	188	36	362	40	112	124	124	96	34	27
8	17	46	179	35	208	96	124	110	134	91	58	29
9	16	43	190	34	184	160	124	98	126	82	41	36
10	17	43	145	34	296	193	142	88	95	74	37	36
11	17	43	122	33	193	170	160	83	96	76	35	32
12	17	39	106	33	126	160	124	90	103	77	35	32
13	25	37	93	34	130	134	114	91	118	73	34	30
14	36	37	80	32	244	98	134	90	130	64	34	30
15	29	154	69	30	282	85	136	90	144	64	33	29
16	26	271	63	30	300	82	124	98	152	74	33	28
17	24	388	61	29	220	88	130	110	148	80	34	28
18	24	480	56	29	162	93	118	116	142	70	35	28
19	26	505	53	28	150	152	100	120	124	62	32	28
20	24	234	63	28	130	259	118	105	105	59	32	27
21	22	280	495	28	116	214	144	118	88	56	31	27
22	22	284	630	43	103	190	126	114	83	49	30	27
23	31	434	196	110	90	126	107	102	100	47	30	27
24	39	224	128	85	83	100	108	103	98	44	30	27
25	64	452	116	58	76	385	128	150	102	43	29	27
26	58	265	93	46	69	435	138	134	124	41	29	28
27	54	168	79	40	61	232	152	116	110	41	29	28
28	46	152	82	37	56	160	132	110	96	40	29	27
29	39	234	63	35	52	126	118	105	88	38	29	27
30	38	173	55	34	.....	110	105	103	95	39	28	26
31	72	.....	50	34	.....	107	.....	91	.....	39	27	.....

Monthly discharge of Lost Creek near Brightwood, Oreg., for the year ending Sept. 30, 1916.

[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	72	16	29.8	2.66	3.07	1,830
November	505	37	181	16.2	18.07	10,800
December	630	50	143	12.8	14.76	8,790
January	110	28	40.2	3.59	4.14	2,470
February	362	41	146	13.0	14.02	8,400
March	435	40	137	12.2	14.07	8,420
April	160	103	124	11.1	12.38	7,380
May	165	83	115	10.3	11.87	7,070
June	152	83	113	10.1	11.27	6.720
July	208	38	77.2	6.90	7.96	4,750
August	58	27	33.6	3.00	3.46	2,070
September	36	26	28.9	2.58	2.88	1,720
The year	630	16	96.9	8.65	117.95	70,400

SANDY RIVER CANAL NEAR MARMOT, OREG.

LOCATION.—In NE. ¼ 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, 1916.

GAGE.—Vertical staff in stilling well; datum even with bottom of canal. Gurley simplex gage used beginning July 24, 1916.

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 during year from water-stage recorder, 3.97 feet September 2 and 3 (discharge, 427 second-feet); minimum stage, 0.10 foot September 11 to 15 (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 which was obtained after July 24 by inspecting the recorder graphs. Records excellent.

Sandy River canal diverts water from Sandy River in the NE, ¼ sec. 13, T 2 S., R. 5 E., into 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 tailrace of the power plant discharges into Bull Run River in the NE. ¼ sec. 6, T. 2, S., R. 5 E.

Discharge measurements of Sandy River canal near Marmot, Oreg., during the years 1914 and 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1914.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Jan. 28	R. R. Randell	2.50	194	July 24	C. L. Batchelder	0.45	8.0
Aug. 28	Dean and Ewing [a]	3.10	280	24	do	1.19	46.8
29	Frank Ewing	3.25	291	24	do	1.90	119
				Aug. 31	do	3.95	425
				Oct. 16	F. F. Henshaw	3.52	351

[a] Employee of Portland Railway Light & Power Co.

Daily discharge, in second-feet, of Sandy River canal near Marmot, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	.....	.....	128	233	140	73	28	116	78	239	425
2	.....	.....	.....	236	194	140	73	28	146	68	239	427
3	.....	.....	.....	236	187	140	68	28	180	10	239	427
4	.....	.....	.....	229	183	169	68	28	180	10	238	403
5	.....	.....	.....	229	180	201	155	28	180	52	236	359
6	.....	.....	.....	229	191	244	268	28	180	73	236	359
7	.....	.....	.....	229	194	80	73	28	180	34	236	359
8	.....	.....	.....	229	194	211	68	28	180	52	239	359
9	.....	.....	.....	229	194	128	71	42	180	152	238	361
10	.....	.....	.....	229	159	128	73	60	180	52	252	364
11	.....	.....	.....	300	128	128	73	71	180	52	270	152
12	.....	.....	.....	332	104	128	73	82	180	64	242	1
13	.....	.....	.....	332	104	126	73	82	180	116	236	1
14	.....	.....	.....	332	104	116	128	122	180	116	236	1
15	.....	.....	.....	332	104	114	128	122	180	166	310	179
16	.....	.....	.....	332	104	110	128	122	180	134	354	287
17	.....	.....	.....	284	104	41	128	122	180	116	354	316
18	.....	.....	.....	292	104	110	128	122	180	116	354	316
19	.....	.....	.....	292	102	110	128	122	180	116	354	366
20	.....	.....	.....	292	94	116	128	122	180	116	354	303
21	.....	.....	.....	292	92	116	128	122	180	146	390	329
22	.....	.....	92	292	92	116	128	122	146	260	416	377
23	.....	.....	64	300	140	116	128	122	146	284	416	385
24	.....	.....	56	300	194	116	128	122	180	263	416	380
25	.....	.....	64	300	194	68	48	122	180	242	416	393
26	.....	.....	128	300	194	13	128	122	180	286	416	393
27	.....	.....	128	300	152	12	68	122	180	356	416	398
28	.....	.....	128	300	194	10	28	122	180	356	416	391
29	.....	.....	128	297	64	16	28	122	180	356	416	400
30	.....	.....	128	292	.....	34	28	122	78	278	416	398
31	.....	.....	128	292	.....	68	.....	122	.....	239	419	.....

Monthly discharge of Sandy River canal near Marmot, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December 22–31	128	56	104	2,060
January	332	128	277	17,000
February	233	64	147	8,460
March	244	10	109	6,700
April	268	28	98.2	5,840
May	122	28	88.9	5,470
June	180	78	171	10,200
July	356	10	154	9,470
August	419	236	323	19,900
September	427	1	320	19,000
The period				93,100

BULL RUN RIVER NEAR BULL RUN, OREG.

LOCATION.—In sec. 25, T. 1 S., R. 5 E., 1¼ 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, 1916; also readings on a gage maintained by city water department, January 5, 1895, to November 13, 1906.

GAGE.—Friez water-stage recorder referred to vertical staff on left bank. Datum raised 2 feet July 26, 1916. Prior to July 28, 1909, an inclined staff at headworks 1¼ miles below present gage. Gage readers, gatemen at headworks.

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

CHANNEL AND CONTROL.—Rocks and gravel; shifting in extreme floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.5 feet (referred to old datum) from high-water mark, about 10 p. m. December 21 (discharge, 13,800 second-feet). Minimum stage from water-stage recorder, 2.70 feet October 9 (discharge, 112 second-feet).

1895–1916: 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 1¼ miles below the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during flood of December 21–22. Rating curves for water-stage recorder well defined between 100 and 4,000 second-feet and applicable October 1 to December 20 and December 21 to September 30, respectively. Operation of water-stage recorder unsatisfactory at times and record from staff gage at headworks used Staff gage read twice daily. Gage-height records October 1 to 3 affected by backwater from flash boards on diversion dam; correction obtained by comparison of records with those of water-stage recorder; rating curves fairly well defined. For period for which water-stage recorder was used, daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging the bihourly discharge. For the staff gage, daily discharge ascertained by applying mean daily gage height to rating table. Records excellent except for discharge above 4,000 second-feet and discharge for October, for which they are only fair.

Discharge measurements of Bull Run River near Bull Run, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 23	J. C. Kuhns [a]	4.96	1,340	July 26	C. L. Batchelder	[b] 1.41	324
24	do	4.76	1,230	Aug. 15	do	1.05	194
Mar. 22	Hodges and Batchelder.	5.98	2,510	31	do	.87	134
Apr. 27	C. L. Batchelder	5.18	1,540				

[a] Assistant forest ranger. [b] Datum of gage raised 2.00 feet on this date.

Daily discharge, in second-feet, of Bull Run River near Bull Run, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.
1	120	1,070	1,150	515	335	610	1,020	1,220	900	980	250	134
2	490	853	965	472	2,220	590	1,060	1,390	879	2,480	235	145
3	425	805	917	405	900	570	1,060	1,480	908	2,420	224	225
4	250	655	930	375	542	530	1,020	1,480	956	1,480	214	218
5	185	700	2,220	360	488	460	916	1,440	851	1,100	207	187
6	170	599	2,120	360	1,280	582	851	1,630	830	872	207	169
7	155	515	1,730	322	4,620	711	893	1,260	851	739	201	160
8	155	468	1,640	304	3,560	2,290	972	1,390	879	666	300	210
9	112	459	1,780	300	3,480	3,140	964	1,340	830	600	288	296
10	170	435	1,240	280	3,870	2,940	1,260	1,220	718	542	242	276
11	155	622	1,000	257	3,710	2,420	1,680	1,060	684	498	224	221
12	155	633	853	235	1,910	2,360	1,220	948	718	471	214	194
13	288	556	811	210	1,580	1,850	1,020	886	774	445	210	175
14	1,420	541	711	194	1,970	1,300	1,260	858	830	410	204	163
15	480	1,860	633	186	2,220	1,020	1,340	879	893	396	191	157
16	346	2,370	599	166	2,290	980	1,140	956	956	521	191	145
17	278	5,380	594	158	2,030	1,020	1,180	1,020	948	795	204	142
18	262	4,450	535	238	1,680	1,020	1,140	1,100	916	690	228	142
19	360	4,220	515	180	1,390	1,390	1,020	1,020	964	570	201	140
20	330	2,060	661	206	1,220	2,480	1,300	924	1,100	504	191	137
21	250	2,240	8,830	248	1,060	2,620	1,740	1,060	980	445	185	134
22	238	2,590	6,060	401	940	2,550	1,390	1,220	830	410	175	134
23	473	4,960	2,420	1,300	844	1,630	1,140	1,100	858	386	169	132
24	577	2,350	1,530	1,140	802	1,260	1,100	1,100	774	359	163	132
25	1,000	7,920	1,680	781	739	5,020	1,140	1,060	802	337	157	132
26	865	2,610	1,080	630	684	5,670	1,180	908	886	329	145	132
27	734	1,600	890	526	602	3,200	1,630	865	795	324	145	129
28	556	1,350	950	450	570	1,850	1,530	865	700	296	145	132
29	454	2,590	775	410	610	1,390	1,390	916	619	288	145	132
30	425	1,680	632	360	.....	1,180	1,220	1,100	602	272	142	134
31	1,100	.....	590	340	.....	1,020	.....	940	.....	265	137	.....

NOTE.—Daily discharge ascertained from readings on staff gage at headworks as follows: Oct. 1–8, 10–15, 17–22, Nov. 23–27, Dec. 26–31, Jan. 2–7, 13–14, 16–21, Jan. 30 to Feb. 1, Feb. 6–11, Feb. 27 to Mar. 4.

Monthly discharge of Bull Run River near Bull Run, Oreg., for the year ending Sept. 30, 1916.

[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	1,420	112	419	4.11	4.74	25,800
November	7,920	435	1,970	19.3	21.53	117,000
December	8,830	515	1,520	14.9	17.18	93,500
January	1,300	158	397	3.89	4.48	24,400
February	4,620	335	1,660	16.3	17.58	95,500
March	5,670	460	1,800	17.6	20.29	111,000
April	1,740	851	1,190	11.7	13.05	70,800
May	1,630	858	1,120	11.0	12.68	68,900
June	1,100	602	841	8.25	9.20	50,000
July	2,480	265	674	6.61	7.62	41,400
August	300	137	198	1.94	2.24	12,200
September	296	129	165	1.62	1.81	9,820
The year	8,830	112	992	9.73	132.40	720,000

LITTLE SANDY RIVER NEAR MARMOT, OREG.

LOCATION.—In SW. ¼ sec. 6, T. 2 S., R. 6 E., at trail bridge at Little Sandy ranger station, 1½ miles north of Marmot, Clackamas County.

DRAINAGE AREA.—17.2 square miles (measured on topographic map).

RECORDS AVAILABLE.—August 14, 1913, to September 30, 1916.

GAGE.—Stevens water-stage recorder referred to vertical staff on left bank just below bridge. Gage reader, 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 during year, from water-stage recorder, 4.55 feet at 4. p. m. November 17 (discharge, 1,510 second-feet); minimum stage from water-stage recorder, 0.40 foot August 31 and September 1 (discharge, 19 second-feet).

1913–1916: Maximum stage recorded during 1916. Minimum stage recorded, 0.21 foot August 28, 1914 (discharge, 12 second-feet).

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

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve revised slightly below 36 second-feet. Curve well defined between 15 and 600 second-feet. Operation of water-stage recorder unsatisfactory October 1 to November 13 and February 29 to March 8. Daily discharge ascertained by applying to the rating table the mean daily gage height determined by inspecting gage-height graph. Records excellent for periods during which water-stage recorder was operating; fair for periods for which discharge was estimated.

Discharge measurements of Little Sandy River near Marmot, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 23	Batchelder and Hodges	2.60	497
July 25	C. L. Batchelder	.90	52
Aug. 31	.....do	.40	20.7

Daily discharge, in second-feet, of Little Sandy River near Marmot, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	121	231	92	86	.....	173	213	178	231	37	19
2	150	128	199	81	448	.....	175	257	178	618	35	20
3	100	116	199	73	312	.....	178	270	199	546	34	42
4	50	105	202	69	196	.....	175	263	196	309	33	35
5	35	96	402	63	148	.....	152	244	168	207	31	31
6	22	88	422	61	327	.....	141	280	170	158	31	26
7	21	78	362	57	735	.....	154	202	180	128	31	24
8	20	71	312	56	582	400	175	210	188	109	66	34
9	19	67	362	53	505	510	166	207	170	95	54	60
10	19	62	263	51	546	488	237	202	139	83	41	50
11	18	80	207	46	564	410	327	175	141	74	36	37
12	18	100	173	45	350	422	225	166	154	69	34	32
13	80	120	161	43	274	350	183	154	166	66	32	29
14	150	86	139	41	298	250	231	154	173	59	31	26
15	110	219	122	38	335	196	240	161	180	57	29	24
16	80	369	119	37	350	180	196	185	180	92	29	23
17	82	815	119	37	316	180	213	202	166	161	32	22
18	85	765	107	35	274	183	188	222	156	130	42	22
19	88	668	104	34	244	247	161	213	183	104	35	22
20	90	389	121	34	219	414	207	180	231	89	31	21
21	93	474	708	35	204	405	327	216	196	77	29	20
22	96	435	815	53	185	422	247	228	150	69	27	20
23	98	717	381	114	161	288	199	199	166	63	26	20
24	150	385	247	109	146	219	199	191	135	57	25	20
25	200	740	240	88	119	663	207	194	137	54	24	25
26	180	439	180	72	104	704	219	178	163	52	23	42
27	150	280	147	65	101	474	312	163	143	51	23	36
28	80	257	173	59	98	320	247	168	133	47	22	27
29	75	465	135	52	100	231	228	180	121	43	21	24
30	68	316	115	52	.....	188	199	213	126	41	20	22
31	200	.....	103	50	.....	170	.....	170	.....	40	19	.....

NOTE.—Daily discharge estimated from comparison of hydrographs of Bull Run and Sandy Rivers, and high and low stages indicated by recorder for interval between visits as follows: Oct. 1–5, 7–22, 24–31, Nov. 2–7, 9–13, and Feb. 29 to Mar. 8. Mean discharge March 1–7 estimated to be 100 second-feet.

Monthly discharge of Little Sandy River near Marmot, Oreg., for the year ending Sept. 30, 1916.

[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	200	18	85.7	4.98	5.74	5,270
November	815	62	302	17.6	19.64	18,000
December	815	103	244	14.2	16.37	15,000
January	114	34	57.9	3.37	3.88	3,560
February	735	86	287	16.7	18.01	16,500
March	704	.....	291	16.9	19.48	17,900
April	327	141	209	12.2	13.61	12,400
May	280	154	202	11.7	13.49	12,400
June	231	121	166	9.65	10.77	9,880
July	618	40	128	7.44	8.58	7,870
August	66	19	31.7	1.84	2.12	1,950
September	60	19	28.5	1.66	1.85	1,700
The year	815	18	169	9.83	133.54	122,000

WILLAMETTE RIVER BASIN.

MIDDLE FORK OF WILLAMETTE RIVER AT JASPER, OREG.

LOCATION.—In NW. ¼ 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 September 30, 1916.

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, 12.4 feet at 8 a. m. February 7 (discharge, 60,400 second-feet); minimum stage recorded, 2.80 feet October 1, 2, 7–13, 18–22, and 31 (discharge, 610 second-feet).

1905–1912 and 1913–1916: 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 changed February 7. Rating curves well defined between 700 and 10,000 second-feet. Gage read to quarter-tenths daily; during high water, more often. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent.

Discharge measurements of Middle Fork of Willamette River at Jasper, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 25	P. V. Hodges	6.38	9,930
Sept. 28	C. L. Batchelder	3.38	984

Daily discharge, in second-feet, of Middle Fork of Willamette River at Jasper, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	610	760	9,300	3,680	2,820	4,440	5,820	5,100	3,320	5,100	1,780	1,110
2	610	760	7,340	3,170	6,060	5,820	5,460	5,100	3,320	7,500	1,780	1,110
3	680	860	6,060	2,930	10,900	4,440	5,100	5,100	6,200	7,500	1,700	1,340
4	680	860	7,340	2,710	9,800	5,820	4,760	5,820	3,320	5,820	1,620	1,480
5	645	860	6,480	2,500	7,340	8,500	4,440	6,200	3,860	5,100	1,620	1,280
6	610	760	27,200	2,300	33,500	9,550	4,440	8,000	3,860	4,440	1,550	1,220
7	610	760	15,600	2,300	59,300	10,100	3,860	9,550	3,860	3,860	1,480	1,160
8	610	1,020	11,400	1,820	31,300	8,500	3,860	8,500	4,140	3,860	1,480	1,160
9	610	1,190	12,000	1,960	19,600	8,500	4,140	11,800	4,440	3,580	1,480	1,340
10	610	1,020	9,800	2,820	18,100	9,550	4,140	10,600	4,140	3,320	1,480	1,410
11	610	1,080	9,300	2,500	18,800	11,800	7,050	8,500	3,860	3,080	1,410	1,280
12	610	2,210	6,480	2,300	15,300	11,800	6,600	7,050	3,580	3,080	1,340	1,220
13	610	1,550	6,060	2,400	11,800	10,100	5,460	5,820	3,320	2,860	1,550	1,160
14	680	1,190	5,280	2,300	12,900	8,000	5,100	5,100	3,860	2,860	1,480	1,110
15	760	1,190	4,580	2,210	15,300	6,600	5,100	4,760	4,440	2,660	1,410	1,110
16	680	7,340	3,680	1,960	15,300	6,600	4,760	4,440	5,100	4,760	1,340	1,060
17	645	6,900	4,260	1,820	14,700	5,820	4,760	4,440	5,820	6,600	1,410	1,060
18	610	14,400	3,680	1,820	14,100	6,200	4,760	4,440	5,820	5,460	1,780	1,060
19	610	7,800	3,420	1,820	12,900	6,600	5,100	5,100	5,100	4,140	1,550	1,060
20	610	6,900	3,170	1,680	11,200	8,000	4,440	4,440	4,760	3,580	1,410	1,000
21	610	13,800	6,480	1,680	10,100	11,200	4,440	4,440	4,140	3,080	1,340	1,000
22	610	8,800	13,800	1,750	9,550	11,800	9,000	4,440	3,320	2,860	1,280	1,000
23	680	16,300	13,800	3,170	8,500	11,800	6,600	4,440	3,080	2,660	1,220	1,000
24	1,020	15,000	9,800	12,000	7,050	9,550	5,820	4,440	2,860	2,460	1,220	1,000
25	810	26,400	8,800	10,400	6,200	9,550	5,820	4,140	2,860	2,280	1,220	1,000
26	810	34,400	7,340	7,800	5,820	11,800	5,460	4,440	3,860	2,190	1,160	1,000
27	680	15,000	5,660	5,660	3,860	14,700	5,820	4,140	4,760	2,100	1,160	1,000
28	680	9,800	5,660	4,260	4,760	11,800	6,600	4,140	4,760	2,020	1,160	1,000
29	645	10,900	5,660	3,680	4,440	9,000	6,600	3,860	5,460	1,940	1,160	1,000
30	645	13,800	4,580	3,170	.....	7,500	5,820	3,860	4,440	1,860	1,110	950
31	610	.....	3,960	2,710	.....	6,200	.....	3,580	.....	1,780	1,110	.....

Monthly discharge of Middle Fork of Willamette River at Jasper, Oreg., for the year ending Sept. 30, 1916.

[Drainage area, 1,450 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	610	661	0.456	0.53	40,600
November	34,400	760	7,440	5.13	5.72	443,000
December	27,200	3,170	8,000	5.52	6.36	492,000
January	12,000	1,680	3,330	2.30	2.65	205,000
February	59,300	2,820	13,800	9.52	10.27	794,000
March	14,700	4,440	8,760	6.04	6.96	539,000
April	9,000	3,860	5,370	3.70	4.13	320,000
May	11,800	3,580	5,670	3.91	4.51	349,000
June	6,200	2,860	4,190	2.89	3.22	249,000
July	7,500	1,780	3,690	2.54	2.93	227,000
August	1,780	1,110	1,410	.972	1.12	86,700
September	1,480	950	1,120	.772	.86	66,600
The year	59,300	610	5,250	3.62	49.26	3,810,000

WILLAMETTE RIVER AT ALBANY, OREG.

LOCATION.—In SW. ¼ 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 7 miles above Santiam River.

DRAINAGE AREA.—4,860 square miles.

RECORDS AVAILABLE.—November 24, 1878, to April 30, 1882, and January 21, 1892, to September 30, 1916; some fragmentary records, 1883 to 1888.

GAGE.—Vertical staff in two sections on right bank.

DISCHARGE MEASUREMENTS.—Made from Southern Pacific bridge.

CHANNEL AND CONTROL.—Sand and fine gravel; control practically permanent. About gage height 17.0 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, 27.7 feet February 8 (discharge, 165,000 second-feet); minimum stage recorded, 0.5 foot October 13–15 and 20–22 (discharge, 2,400 second-feet).

1878–1882 and 1892–1916: 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

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 practically permanent. Rating curve well defined below 60,000 second-feet and fairly well defined between 60,000 and 200,000 second-feet. 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 United States Weather Bureau.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Willamette River at Albany, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,760	2,580	41,900	17,100	15,600	14,700	23,500	16,200	11,200	12,300	6,450	4,150
2	2,760	2,950	31,300	15,600	20,700	15,300	21,100	15,000	10,900	13,500	6,210	4,150
3	2,760	3,330	26,000	14,400	29,400	18,400	19,400	14,700	10,600	16,800	6,210	4,360
4	2,760	3,330	25,600	13,800	37,800	27,100	18,100	14,100	10,600	17,500	5,970	4,810
5	2,760	3,140	28,200	13,200	36,900	32,200	17,100	15,600	10,900	15,300	5,970	5,500
6	2,760	3,140	34,700	12,600	34,700	39,100	15,900	15,900	11,200	13,500	5,970	5,040
7	2,760	3,140	61,100	12,900	57,500	51,500	14,700	18,400	11,200	12,300	5,730	4,810
8	2,760	3,140	61,600	15,300	146,000	52,500	13,800	20,000	11,200	11,500	5,500	4,580
9	2,760	3,530	45,100	17,500	151,000	43,700	13,800	20,400	11,500	10,900	5,500	4,580
10	2,580	4,360	41,900	19,400	95,900	37,300	14,100	26,300	11,800	10,300	5,500	4,810
11	2,580	4,150	38,200	19,400	68,200	33,900	15,000	27,500	11,200	9,760	5,500	5,040
12	2,580	4,150	34,300	17,500	63,200	35,100	18,400	24,500	10,900	9,220	5,270	5,040
13	2,400	7,170	29,700	17,500	55,000	33,900	17,500	23,100	10,300	9,220	5,270	4,810
14	2,400	6,210	26,000	17,500	42,800	30,900	16,500	18,700	10,000	8,950	5,270	4,810
15	2,400	5,270	22,800	15,300	40,000	26,300	14,700	15,900	10,600	8,690	5,270	4,810
16	2,950	5,270	19,700	13,800	40,500	22,800	14,100	15,300	11,500	8,950	5,270	4,360
17	2,760	16,200	18,400	12,300	39,100	21,100	14,100	14,700	12,300	11,200	5,270	4,150
18	2,580	13,500	18,700	11,200	36,900	20,000	14,100	14,400	13,200	16,500	5,040	3,940
19	2,580	30,500	17,100	10,600	34,300	19,400	14,400	14,100	13,500	14,400	5,730	3,940
20	2,400	26,300	16,200	9,760	30,500	20,000	15,000	14,100	12,300	12,300	5,500	3,940
21	2,400	24,200	17,100	10,600	27,100	26,700	14,700	13,800	12,300	11,200	5,500	3,940
22	2,400	30,900	26,700	12,600	25,300	33,400	15,600	13,200	11,500	10,000	5,270	3,940
23	2,580	27,500	40,900	15,600	23,500	36,500	22,100	13,200	10,300	8,950	5,040	3,940
24	2,580	33,400	45,600	26,700	21,100	37,800	19,400	12,900	9,490	8,690	4,810	3,940
25	3,330	42,300	35,600	40,000	19,400	32,600	17,100	12,600	9,490	8,430	4,580	3,730
26	3,330	44,200	30,500	38,200	17,800	39,100	16,500	12,900	9,490	7,920	4,360	3,730
27	2,950	72,900	26,700	31,300	16,500	53,500	15,900	13,200	10,900	7,670	4,360	3,730
28	2,950	65,900	23,500	24,500	15,900	57,500	15,300	12,900	12,300	7,420	4,360	3,730
29	2,760	40,000	23,100	20,400	14,700	47,100	16,800	12,600	12,300	7,170	4,360	3,730
30	2,760	38,700	21,400	17,800	.....	34,700	17,100	12,000	13,200	6,930	4,360	3,730
31	2,580	.....	18,700	15,300	.....	27,500	.....	11,800	.....	6,690	4,150	.....

Monthly discharge of Willamette River at Albany, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	3,330	2,400	2,700	166,000
November	72,900	2,580	19,000	1,130,000
December	61,600	16,200	30,600	1,880,000
January	40,000	9,760	17,700	1,090,000
February	151,000	14,700	43,400	2,500,000
March	57,500	14,700	33,000	2,030,000
April	23,500	13,800	16,500	982,000
May	27,500	11,800	16,100	990,000
June	13,500	9,490	11,300	672,000
July	17,500	6,690	10,800	664,000
August	6,450	4,150	5,280	325,000
September	5,500	3,730	4,330	258,000
The year	151,000	2,400	17,500	13,700,000

WILLAMETTE RIVER AT SALEM, OREG.

LOCATION.—In NW. ¼ sec. 27, T. 7 S., R. 3 W., at foot of Trade Street, Salem, Marion County, about a mile above mouth of Mill Creek.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 1, 1892, to December 31, 1916, when measurements were discontinued by the Geological Survey. Records continuous through the summer low-water periods since 1904 only. Discharge records have been computed only for period beginning October 1, 1909.

GAGE.—Vertical staff in four sections on Oregon-Washington Railroad & Navigation Co.'s dock on right bank of a slough, near its mouth; read by C. C. Graham.

DISCHARGE MEASUREMENTS.—Made from Southern Pacific bridge, about half a mile below gage. From 1910 to 1912, from highway bridge a short distance above the railroad bridge. Conditions favorable except for low velocities at low stages.

CHANNEL AND CONTROL.—Channel deep at bridge; overflows at high stages over left bank. Control of gravel and sand; somewhat shifting during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period October 1, 1915, to December 31, 1916, 26.0 feet at 12.30 p. m. February 9 (discharge, 242,000 second-feet); minimum stage recorded, −1.4 feet October 2–3 and 10–14, 1915 (discharge, 3,380 second-feet).

1909–1916: Maximum stage recorded, 30.5 feet at 8 a. m. November 25, 1909 (discharge, 315,000 second-feet); minimum stage recorded, −1.46 feet; (discharge, 3,310 second-feet) September 8, 1915.

Maximum stage ever known, about 39 feet December 4, 1861 (discharge estimated from an extension of rating curve as 500,000 second-feet). The flood of January 16, 1881, reached a stage of 36.3 feet (discharge, 428,000 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—Water is diverted from North Santiam River near Stayton into Mill Creek. Within the city limits it is again diverted into a power canal, which discharges just above the gage. Thus, the flow past the gage may be more or less than its natural run-off, but by an amount too slight to be appreciable.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed February 8 or 9, 1916. Rating curve October 1 to February 7, well defined between 3,200 and 30,000 second-feet; February 8 to December 31, fairly well defined. Gage read to tenths once daily. Daily discharge ascertained by applying to rating table the daily gage readings. Records good.

COOPERATION.—Gage-height records furnished by the Weather Bureau, which continues to maintain the station.

Discharge measurements of Willamette River at Salem, Oreg., for the period Oct. 1, 1915, to Dec. 31, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 8	P. V. Hodges	23.05	[a] 206,000	Feb. 9	P. V. Hodges	26.10	[a] 249,000
8	do	24.15	[a] 217,000	Oct. 10	W. E. Dickinson	−1.01	4,600
Feb. 9	do	26.17	[a] 247,000				

[a] Surface velocity observed and coefficient of 0.90 used to reduce to mean velocity.

Daily discharge, in second-feet, of Willamette River at Salem, Oreg., for the period Oct. 1, 1915, to Dec. 31, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.												
1	3,640	4,060	81,900	31,000	28,000	29,800	51,800	34,100	22,100	23,200	10,100	6,060
2	3,380	7,200	66,400	29,200	44,500	29,800	45,400	32,200	21,100	26,800	10,100	6,060
3	3,380	6,400	53,600	26,200	68,000	35,500	42,500	31,600	20,600	32,800	9,800	6,060
4	3,780	6,400	53,600	25,000	78,300	56,600	39,000	32,800	20,100	36,900	9,460	6,540
5	3,920	6,160	56,000	24,400	71,200	60,800	36,900	33,400	21,100	31,600	9,140	8,200
6	3,780	5,700	86,400	22,000	68,800	68,000	34,100	34,800	21,600	26,800	8,820	7,900
7	3,640	5,280	109,000	22,000	129,000	94,100	31,600	39,700	21,100	23,800	8,820	7,060
8	3,510	5,080	115,000	28,000	207,000	97,000	30,400	41,100	21,100	21,600	8,500	6,800
9	3,510	5,480	95,000	31,000	248,000	93,200	29,800	45,400	22,100	20,600	8,200	6,540
10	3,380	6,660	87,300	33,400	214,000	81,500	29,800	52,600	22,600	19,600	8,200	7,060
11	3,380	6,660	77,400	32,800	160,000	72,500	32,800	55,000	23,800	18,100	8,200	7,340
12	3,380	6,920	68,000	29,800	145,000	73,400	39,000	48,600	20,100	17,100	7,900	7,060
13	3,380	11,000	59,200	29,800	119,000	72,500	37,600	42,500	19,600	16,600	7,900	6,540
14	3,380	10,200	50,400	29,200	97,000	67,100	32,800	40,400	21,100	16,100	7,620	6,300
15	3,780	8,740	43,800	25,600	86,900	55,800	31,600	34,100	22,100	15,200	7,620	6,060
16	4,360	9,820	37,500	22,000	86,900	47,800	31,000	31,000	24,400	15,200	7,620	5,820
17	4,060	30,400	36,800	19,800	85,100	43,900	30,400	30,400	26,200	19,600	7,620	5,820
18	3,780	54,400	36,100	18,300	80,600	41,800	29,800	30,400	26,800	30,400	7,620	5,600
19	3,640	79,200	32,800	16,800	74,300	39,700	30,400	29,800	25,000	28,000	8,200	5,600
20	3,510	81,000	31,000	15,300	65,300	48,600	31,000	29,200	24,400	23,200	8,200	5,600
21	3,510	58,400	33,400	16,800	59,000	66,200	32,200	28,000	22,100	19,600	7,620	5,600
22	3,510	68,000	73,800	22,600	53,400	77,000	45,400	26,800	19,600	17,600	6,540	5,380
23	3,510	64,000	118,000	32,200	49,400	86,900	47,000	26,800	18,100	16,100	6,540	5,380
24	3,780	87,300	104,000	60,000	45,400	81,500	41,100	26,800	17,600	14,700	6,300	5,180
25	4,700	86,400	77,400	74,700	40,400	72,500	36,900	25,600	17,600	14,300	6,300	5,180
26	5,480	111,000	62,400	70,400	36,900	105,000	35,500	26,800	17,600	12,900	6,300	5,180
27	5,280	120,000	54,400	58,400	34,800	135,000	34,100	26,800	21,100	12,500	6,300	5,180
28	4,880	120,000	46,600	45,900	32,800	135,000	36,900	26,800	23,200	12,100	6,300	5,180
29	4,700	90,000	45,900	37,500	29,800	109,000	39,700	25,600	22,600	11,700	6,300	5,180
30	4,360	87,300	41,000	31,000	.....	78,800	34,100	24,400	23,200	10,900	6,300	5,180
31	4,210	.....	36,100	28,000	.....	59,900	.....	23,800	.....	10,500	6,300	.....

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1916.				1916.				1916.			
1	5,180	7,340	51,800	11	4,600	17,100	39,700	21	4,600	9,140	36,200
2	5,180	7,620	41,100	12	4,600	15,200	34,100	22	4,420	8,820	45,400
3	4,980	7,060	36,200	13	4,600	12,900	30,400	23	4,420	8,500	46,200
4	4,780	10,500	41,800	14	4,600	11,300	30,400	24	4,420	8,820	43,200
5	4,780	19,100	51,000	15	4,600	10,100	28,000	25	4,420	9,460	39,700
6	4,780	19,600	64,400	16	4,600	9,140	25,600	26	4,250	29,800	32,200
7	4,780	22,100	59,000	17	4,600	8,820	23,200	27	4,250	45,400	29,200
8	4,780	26,800	50,200	18	4,600	8,200	22,100	28	4,250	62,600	25,600
9	4,780	21,100	46,200	19	4,600	8,820	21,100	29	4,600	63,500	23,200
10	4,600	17,100	43,200	20	4,600	9,460	25,600	30	4,780	51,800	21,100
								31	6,060	.....	18,600

Monthly discharge of Willamette River at Salem, Oreg., for the period Oct. 1, 1915, to Dec. 31, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915–16.				
October	5,480	3,380	3,890	239,000
November	120,000	4,060	41,600	2,480,000
December	118,000	31,000	63,600	3,910,000
January	74,700	15,300	31,900	1,960,000
February	248,000	28,000	87,500	5,030,000
March	135,000	29,800	71,500	4,400,000
April	51,800	29,800	36,000	2,140,000
May	55,000	23,800	33,500	2,060,000
June	26,800	17,600	21,700	1,290,000
July	36,900	10,500	19,900	1,220,000
August	10,100	6,300	7,770	478,000
September	8,200	5,180	6,090	362,000
The year	248,000	3,380	35,200	25,600,000
1916.				
October	6,060	4,250	4,680	288,000
November	63,500	7,060	18,900	1,120,000
December	64,400	18,600	36,300	2,230,000

SALMON CREEK NEAR OAKRIDGE, OREG.

LOCATION.—In NW. ¼ sec. 13, T. 21 S., R. 3 E., about a mile above Southern Pacific Railroad bridge and 3 miles east of Oakridge, Lane County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 6, 1913, to March 7, 1916.

GAGE.—Stevens continuous water-stage recorder on right bank about a mile above the railroad bridge; used since October 1, 1914. Vertical staff on right bank 500 feet above railroad bridge was read to November 21, 1913. Inclined staff at different datum, 200 feet above railroad bridge, used November 22, 1913, to September 30, 1914. Observer, Flora Warner.

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

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.92 feet at 3 p. m., November 25 (discharge, 2,610 second-feet); minimum stage recorded, 0.23 foot at 8 p. m., October 30 (discharge, 98 second-feet).

1913–1916: Maximum and minimum stages recorded during 1916.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed November 25. Former curve revised by means of flood measurements in 1917. Rating curves used as follows: October 1 to November 25, well defined between 100 and 700 second-feet; November 26 to March 7, well defined between 150 and 1,600 second-feet. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph. Records excellent.

Discharge measurements of Salmon Creek near Oakridge, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 22	P. V. Hodges	0.95	233
Sept. 27	C. L. Batchelder	.73	153

Daily discharge, in second-feet, of Salmon Creek near Oakridge, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
1	113	131	880	452	290	610	16	113	296	484	234	1,290	.....
2	122	122	762	416	410	568	17	110	437	470	226	1,340	.....
3	131	131	726	398	589	568	18	107	802	440	226	1,290	.....
4	114	122	726	368	519	589	19	106	658	416	222	1,180	.....
5	110	114	880	345	491	589	20	106	793	458	210	1,100	.....
6	112	112	1,270	335	1,630	603	21	105	970	690	204	1,050	.....
7	112	110	1,090	320	2,210	596	22	104	766	1,100	222	980	.....
8	110	131	950	320	1,530	.....	23	152	1,100	1,090	477	910	1,100
9	109	129	960	315	1,210	.....	24	136	900	930	596	840	.....
10	109	120	860	295	1,210	.....	25	124	1,580	830	568	800	.....
11	109	138	762	275	1,140	.....	26	119	1,630	735	484	762	.....
12	109	152	674	275	1,000	.....	27	113	1,100	650	422	717	.....
13	113	136	634	275	970	.....	28	109	860	642	362	674	.....
14	131	129	575	255	1,110	.....	29	105	1,100	582	325	642	.....
15	119	196	519	246	1,240	.....	30	101	1,040	519	290	.....	.....
							31	122	.....	477	275	.....	.....

Monthly discharge of Salmon Creek near Oakridge, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	152	101	115	7,070
November	1,630	110	534	31,800
December	1,270	416	735	45,200
January	596	204	330	20,300
February	2,210	290	1,000	57,500
March 1-7	610	568	589	8,180
The period	.....	.....	.....	170,000

NORTH FORK OF MIDDLE FORK OF WILLAMETTE RIVER NEAR OAKRIDGE, OREG.

LOCATION.—In SE. ¼ sec. 7, T. 21 S., R. 3 E., just below highway bridge about 2 miles north of Oakridge and about a mile above former station.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 1, 1913, to February 26, 1916, when station was discontinued. Fragmentary records October 12, 1909, to September 30, 1912, at station formerly maintained a mile below.

GAGE.—Stevens continuous water-stage recorder just below highway bridge; also inclined staff in the SW. ¼ sec. 8, 100 feet above railroad bridge. Gage reader, Flora Warner.

DISCHARGE MEASUREMENTS.—Made from cable at old gage, a mile below present site, or by wading at low water.

CHANNEL AND CONTROL.—Rock overlain with heavy gravel; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.3 feet at 3 p. m. November 25 and at 9 a. m. February 7 (discharge, estimated by extension of rating curve, 6,320 second-feet); minimum stage recorded, 0.39 foot at 10 p. m. October 30 (discharge, 129 second-feet).

1909–1912 and 1913–1916: Maximum stage recorded, 12.4 feet November 22, 1909 (discharge not computed); minimum stage recorded was that of 1916.

DIVERSIONS.—None.

REGULATION.—None at present; storage reservoir on Waldo Lake not being used.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 130 and 1,700 second-feet. Operation of water-stage recorder satisfactory for periods for which records are published. Daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph. Records fair except for October, for which month they are excellent.

Discharge measurements of North Fork of Middle Fork of Willamette River near Oakridge, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 24	P. V. Hodges	2.92	1,110
Sept. 28	Batchelder and Reineking	.75	181

Daily discharge, in second-feet, of North Fork of Middle Fork of Willamette River near Oakridge, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Jan.	Feb.	Day.	Oct.	Nov.	Jan.	Feb.
1	138	168	.....	546	16	140	703	.....	2,470
2	144	157	.....	806	17	138	1,090	.....	2,470
3	157	174	.....	1,120	18	138	2,380	.....	2,290
4	148	157	.....	930	19	136	1,620	.....	2,080
5	142	152	.....	838	20	136	1,760	.....	1,730
6	140	148	.....	4,200	21	134	2,470	.....	1,420
7	139	150	.....	5,720	22	134	1,730	408	1 170
8	138	178	.....	3,870	23	158	2,650	806	930
9	138	180	.....	2,850	24	182	2,080	1,150	634
10	138	172	.....	2,750	25	160	4,090	1,040	472
11	138	209	.....	2,750	26	152	3,760	871	391
12	136	236	.....	2,290	27	148	2,380	760	.....
13	138	202	.....	2,040	28	144	1,730	678	.....
14	164	184	.....	2,290	29	142	2,650	611	.....
15	152	318	.....	2,560	30	133	2,500	551	.....
					31	145	.....	506	.....

Monthly discharge of North Fork of Middle Fork of Willamette River near Oakridge, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	182	133	144	8,850
November	4,090	148	1,210	72,000
January 22–31	1,150	408	738	14,600
February 1–26	5,720	391	1,990	103,000

McKENZIE RIVER NEAR McKENZIE BRIDGE, OREG.

LOCATION.—In SE. ¼ sec. 17, T. 16 S., R. 6 E., at Paradise ranger station, about 2 miles above highway bridge at McKenzie Bridge, Lane County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 8, 1910, to September 30, 1916.

GAGE.—Vertical staff on left bank at Paradise ranger station; read by S. L. Taylor. Another gage, which was formerly read, is located at Hayes ranch, one-half mile above McKenzie Bridge, and a third is attached to the abutment of the highway bridge at McKenzie 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, 4.5 feet February 7 (discharge, 5,260 second-feet); minimum stage recorded, 1.42 feet November 7 (discharge, 924 second-feet).

1910–1916: Maximum stage recorded, 5.0 feet on gage at highway bridge, January 13, 1912 (discharge, 7,400 second-feet); minimum stage recorded during 1916.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Gage read to quarter-tenths once a day. Rating curve well defined between 1,000 and 2,500 second-feet. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

COOPERATION.—Gage height record at ranger station furnished by United States Forest Service, C. R. Seitz, supervisor.

No discharge measurements made during year.

Daily discharge, in second-feet, of McKenzie River near McKenzie Bridge, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	966	2,610	.....	1,360	1,940	2,260	2,540	2,260	2,840	1,830	1,520
2	.....	966	2,260	.....	1,380	1,860	2,260	2,540	2,260	2,840	1,790	1,520
3	.....	966	2,260	.....	1,420	1,880	2,260	2,690	2,260	2,840	1,770	1,620
4	.....	955	2,260	.....	1,380	1,790	2,260	2,920	2,400	2,840	1,760	1,570
5	.....	945	2,540	.....	1,360	1,750	2,130	3,000	2,400	2,690	1,750	1,520
6	.....	935	2,690	1,520	2,540	1,790	2,130	3,240	2,400	2,540	1,720	1,520
7	.....	924	2,840	1,490	5,260	1,770	2,130	3,000	2,400	2,540	1,690	1,490
8	.....	945	2,690	1,470	3,660	1,750	2,130	2,920	2,540	2,540	1,680	1,520
9	.....	945	2,920	1,420	3,000	1,720	2,260	2,840	2,540	2,690	1,670	1,550
10	.....	955	2,540	1,400	3,160	1,750	2,260	2,690	2,540	2,400	1,670	1,520
11	.....	966	2,400	1,380	3,660	1,880	2,400	2,540	2,400	2,400	1,660	1,490
12	945	980	2,260	1,380	3,440	1,880	2,330	2,400	2,490	2,400	1,660	1,470
13	945	966	2,130	1,360	3,220	1,880	2,260	2,400	2,580	2,400	1,650	1,460
14	945	945	2,000	1,340	3,000	1,880	2,200	2,260	2,680	2,330	1,650	1,460
15	945	966	1,940	1,310	3,160	1,880	2,260	2,290	2,780	2,260	1,650	1,450
16	945	1,290	1,880	1,290	3,160	1,860	2,200	2,320	2,880	2,400	1,650	1,450
17	945	1,880	3,770	1,270	3,240	1,860	2,200	2,340	2,980	2,400	1,650	1,450
18	945	2,400	.....	1,270	3,160	2,000	2,200	2,370	3,080	2,330	1,650	1,450
19	945	2,400	.....	1,270	2,920	2,400	2,130	2,400	2,920	2,260	1,620	1,420
20	950	1,770	.....	1,270	2,760	2,690	2,130	2,400	2,760	2,210	1,590	1,420
21	955	2,130	.....	1,270	2,690	2,760	2,690	2,330	2,770	2,160	1,570	1,420
22	960	1,940	.....	1,270	2,540	3,000	2,400	2,400	2,790	2,110	1,570	1,400
23	966	3,080	.....	1,570	2,470	2,690	2,400	2,330	2,810	2,060	1,570	1,400
24	945	2,330	.....	1,880	2,400	2,400	2,330	2,260	2,820	2,000	1,570	1,400
25	945	4,410	.....	1,620	2,260	2,400	2,400	2,330	2,830	2,000	1,570	1,390
26	945	3,550	.....	1,550	2,200	3,000	2,540	2,350	2,840	2,000	1,550	1,390
27	940	2,690	.....	1,470	2,130	3,320	2,690	2,370	2,840	1,970	1,550	1,380
28	935	2,260	.....	1,450	2,060	2,840	2,760	2,400	2,840	1,940	1,550	1,380
29	930	3,320	.....	1,380	2,000	2,670	2,620	2,400	2,840	1,910	1,550	1,380
30	924	2,970	.....	1,360	.....	2,500	2,540	2,350	2,840	1,880	1,520	1,360
31	945	.....	.....	1,360	.....	2,330	.....	2,300	.....	1,860	1,520	.....

NOTE.—Gage not read and discharge interpolated as follows: Oct. 14–15, 17–18, 20–22, 27–29, Jan. 18–21, Feb. 12–13, Mar. 12–13, 29–30, May 15–18, 26–27, 30–31, June 12–17, 21–25, June 27 to July 1, July 20–22, 27–29, Aug. 8–13, 22–23, Sept. 13–15, 24–27; also for occasional periods of one day. Mean discharge estimated Oct. 1–11, 952 second-feet; Dec. 18–31, 1,680 second-feet; Jan. 1–5, 1,560 second-feet.

Monthly discharge of McKenzie River near McKenzie Bridge, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	966	924	947	58,200
November	4,410	924	1,760	105,000
December	2,920	.....	2,050	126,000
January	1,880	1,270	1,430	87,900
February	5,260	1,360	2,650	152,000
March	3,320	1,720	2,200	135,000
April	2,760	2,130	2,330	139,000
May	3,240	2,260	2,510	154,000
June	3,080	2,260	2,660	158,000
July	2,840	1,860	2,320	143,000
August	1,830	1,520	1,640	101,000
September	1,620	1,360	1,460	86,900
The year	5,260	924	1,990	1,450,000

NORTH SANTIAM RIVER AT NIAGARA, OREG.

LOCATION.—In SE. ¼ 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, 1916.

GAGE.—Vertical staff in two sections on right bank, about 200 feet below the mouth of Badbanks Creek; read by 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, 9.6 feet February 7 (discharge, 19,500 second-feet); minimum stage recorded, 1.3 feet October 10 and 11 (discharge, 460 second-feet).

1908–1916: Maximum stage, 16.4 feet (determined from high-water mark) 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 permanent 1913 to 1916, during which period discharge measurements were made by engineers of U. S. Geological Survey. Rating curve well defined between 400 and 2,000 second-feet and fairly well defined between 2,000 and 60,000 second-feet; defined mostly by measurements during 1917. Gage read to half-tenths once daily. Daily discharge ascertained by applying gage readings to rating table. Records good except those for discharge above 10,000 second-feet, which are fair.

During 1909, 1910, and 1911, discharge measurements were made by private engineers, and results obtained by using their measurements are not consistent with results obtained at other stations on the river maintained by the Survey. No estimates of discharge have been made prior to October 1, 1912, on account of uncertainty of rating curve. The tables of gage heights and discharge measurements for the earlier years have all been published.

COOPERATION.—Gage height records furnished by O'Neil Bros. & Callahan, owners of the power site at the station.

The following discharge measurement was made by P. V. Hodges:

September 6, 1915: Gage height, 1.39 feet; discharge, 525 second-feet.

Daily discharge, in second-feet, of North Santiam River at Niagara, Oreg., for the years ending Sept. 30, 1913–1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	800	1,560	1,560	4,060	1,680	1,350	8,060	2,740	4,800	2,600	1,150	800
2	800	1,560	1,800	3,880	1,680	1,350	6,900	2,460	5,200	2,320	1,150	800
3	800	1,800	2,460	6,680	1,680	2,040	4,800	2,460	5,000	2,460	1,150	970
4	880	2,040	2,460	5,200	1,680	2,180	5,400	2,600	4,600	2,740	1,150	880
5	880	4,420	2,040	4,060	1,560	2,460	6,240	2,460	4,060	2,600	1,150	1,060
6	800	6,900	1,800	3,360	1,560	2,600	5,000	3,520	3,360	2,460	1,150	880
7	800	7,580	1,800	3,040	1,560	2,740	4,240	4,800	3,520	2,180	1,150	880
8	800	7,120	1,680	3,200	1,450	3,200	3,880	5,200	3,040	1,920	1,060	880
9	800	8,060	1,680	2,880	1,450	3,360	3,700	5,400	2,880	1,920	1,060	880
10	800	6,900	1,680	2,600	1,450	3,520	3,880	5,400	2,740	2,040	1,060	970
11	800	5,400	1,560	2,460	1,350	3,360	4,800	5,400	2,600	1,800	970	1,150
12	720	16,200	1,560	2,600	1,350	2,880	5,400	5,200	2,600	1,800	970	1,680
13	720	9,500	1,800	2,880	1,350	2,460	4,800	4,420	2,740	1,680	970	1,150
14	720	7,340	1,800	2,600	1,800	2,180	4,600	3,700	2,740	1,560	1,060	880
15	720	5,400	2,460	2,460	3,040	2,180	4,420	4,060	2,740	1,450	1,060	800
16	720	4,420	2,740	2,180	3,200	2,040	3,880	4,240	2,180	1,350	970	800
17	880	3,520	2,600	2,040	4,240	2,180	3,700	4,420	2,180	1,450	970	800
18	800	3,520	5,000	2,040	3,520	2,740	4,240	4,420	2,180	1,450	970	720
19	1,450	3,040	3,520	2,040	2,880	2,740	4,420	4,800	2,600	1,450	880	800
20	1,350	3,040	2,740	1,800	2,600	2,460	4,240	4,240	2,460	1,450	970	720
21	1,060	2,740	2,600	1,920	2,320	2,320	4,600	4,420	2,460	1,450	1,060	800
22	3,520	2,180	2,180	1,680	2,040	1,920	4,420	4,600	4,240	1,450	970	880
23	2,740	2,040	2,040	1,560	1,920	1,920	3,880	5,400	5,000	1,450	970	800
24	2,180	2,040	1,920	1,680	1,800	1,920	3,520	5,400	4,060	1,450	880	800
25	2,320	1,800	1,920	2,320	1,680	2,040	4,420	5,400	3,520	1,450	880	720
26	2,320	1,560	1,800	2,320	1,560	2,040	4,240	5,200	3,040	1,350	1,350	720
27	2,040	1,560	1,800	2,180	1,450	2,040	4,060	5,400	2,740	1,250	880	720
28	1,800	1,450	1,800	2,040	1,450	2,040	3,520	4,600	2,460	1,250	880	800
29	2,040	1,450	1,920	1,920	.....	4,420	3,360	4,060	2,460	1,250	880	800
30	1,920	1,560	6,680	1,920	.....	10,000	3,200	3,880	2,600	1,250	800	800
31	1,680	.....	6,020	1,800	.....	8,060	.....	4,060	.....	1,250	880	800
1913–14.												
1	800	970	3,880	2,320	2,600	7,820	1,920	1,920	.....	1,350	650	.....
2	800	970	2,880	2,600	2,320	5,200	1,680	1,920	.....	1,350	650	.....
3	720	970	2,600	3,360	2,040	5,000	1,800	1,920	.....	1,350	650	.....
4	720	2,880	2,180	5,000	2,040	4,800	2,880	2,180	.....	1,250	650	.....
5	720	4,420	2,040	6,680	.....	5,200	3,360	2,460	.....	1,250	650	580
6	800	3,520	1,920	6,020	.....	5,200	2,740	2,040	.....	1,250	650	580
7	7,580	3,040	1,800	5,800	.....	5,600	2,320	2,040	2,320	1,250	650	650
8	3,200	3,040	1,800	5,600	.....	5,200	2,600	2,040	2,320	1,150	650	720
9	2,880	2,180	1,800	4,420	.....	4,600	3,040	2,040	2,180	970	650	720
10	2,600	2,180	1,800	4,060	.....	4,240	3,040	2,040	2,180	970	650	800
11	2,600	2,040	1,800	3,880	2,180	3,700	3,040	2,180	2,040	970	650	880
12	2,320	1,800	1,680	3,520	2,180	3,700	3,200	2,180	2,600	970	540	970
13	2,320	1,680	1,680	2,600	2,180	3,700	3,700	2,180	2,600	970	650	1,060
14	2,320	1,560	1,560	2,600	2,180	3,700	4,420	2,040	2,460	970	650	1,060
15	2,320	1,560	1,560	2,600	2,180	3,700	7,580	2,040	2,180	970	650	1,350
16	2,320	1,450	1,450	2,460	2,130	3,700	.....	2,040	2,040	970	650	1,800
17	2,180	1,450	1,450	2,460	2,090	3,700	.....	2,180	1,920	880	650	2,180
18	2,040	1,450	1,350	2,460	2,040	3,520	.....	1,920	1,800	880	650	2,600
19	1,920	1,450	1,350	2,180	2,230	3,360	4,060	1,920	1,560	800	650	3,040
20	1,680	1,450	1,350	1,920	2,410	3,200	3,520	1,920	1,450	800	650	2,880
21	1,560	1,450	1,450	4,420	2,600	3,040	3,040	1,920	1,450	800	.....	2,320
22	1,560	2,040	1,350	8,300	3,040	2,880	2,740	2,040	1,450	800	.....	1,800
23	1,350	5,000	1,350	7,820	2,740	2,740	2,880	1,920	1,350	720	.....	1,350
24	1,250	3,700	1,250	6,900	4,600	2,600	2,600	1,680	1,250	720	.....	1,150
25	2,180	3,040	1,250	5,400	4,240	2,460	2,600	1,680	1,150	720	.....	970
26	2,040	3,360	1,350	4,800	3,880	2,320	2,460	1,680	1,150	720	.....	970
27	1,350	3,360	1,350	3,880	7,340	2,040	2,180	1,800	1,350	650	.....	970
28	1,060	5,000	1,350	3,360	6,900	1,800	2,180	1,680	1,450	650	.....	880
29	1,040	5,200	1,350	3,040	.....	1,680	1,920	1,560	1,450	650	.....	880
30	1,020	5,000	1,450	2,880	.....	1,680	2,040	1,560	1,450	650	.....	880
31	990	.....	1,920	2,740	.....	1,800	.....	1,560	.....	650	.....	.....

Daily discharge, in second-feet of North Santiam River at Niagara, Oreg., for the years ending Sept. 30, 1913–1916—Continued.

DAY.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914–15.												
1	800	1,920	1,350	1,800	3,200	2,040	3,040	1,560	2,740	970	720	580
2	1,920	2,460	1,350	2,180	4,600	2,040	3,520	1,350	2,460	970	650	580
3	1,560	2,880	1,350	1,920	3,360	1,920	3,360	1,350	2,040	880	650	580
4	1,250	2,460	1,350	1,800	3,200	1,800	3,360	1,250	1,920	880	650	580
5	1,150	2,040	1,350	1,800	2,880	1,800	3,200	1,250	1,800	880	650	580
6	1,150	2,460	1,350	1,680	2,740	2,040	3,040	1,250	1,800	880	650	520
7	1,060	2,040	1,250	2,320	2,600	1,920	2,880	1,250	1,680	880	650	520
8	1,060	1,800	1,200	3,200	2,460	1,920	2,600	1,250	1,680	880	650	490
9	1,060	1,680	1,150	2,600	2,460	1,800	2,460	1,350	1,560	880	650	490
10	1,060	1,800	1,150	2,320	2,460	1,800	2,320	2,180	1,560	880	615	460
11	1,150	1,920	1,150	2,040	2,320	1,680	2,320	2,460	1,450	880	615	460
12	1,450	2,040	1,060	2,320	2,180	1,560	2,460	2,740	1,450	880	615	520
13	1,350	4,800	1,020	3,040	2,040	1,800	2,600	2,740	1,560	880	615	580
14	1,250	3,520	970	3,520	1,800	2,880	2,460	2,740	1,560	880	615	550
15	1,150	2,880	970	3,200	1,680	3,360	2,460	2,740	1,560	880	615	520
16	1,250	2,460	970	2,740	1,560	3,700	2,320	2,600	1,450	970	615	520
17	1,350	2,180	880	2,320	1,450	3,700	2,180	2,600	1,350	970	615	490
18	1,450	2,040	970	2,040	1,350	3,520	2,180	2,600	1,250	880	580	490
19	6,240	1,920	970	2,040	1,350	3,360	2,040	2,600	1,150	880	580	490
20	4,240	1,920	880	2,040	1,560	3,200	2,040	2,600	1,150	800	580	460
21	3,520	1,800	880	1,800	2,180	3,200	1,920	2,600	1,060	800	580	460
22	2,740	1,680	880	1,800	2,040	3,040	1,800	2,600	1,060	720	580	460
23	2,180	1,680	880	1,800	2,040	2,740	1,800	2,600	1,060	800	580	430
24	1,920	1,560	880	1,680	2,320	2,460	1,680	2,600	1,060	800	550	430
25	1,450	1,450	880	1,560	2,460	2,320	1,560	2,600	1,060	720	580	430
26	1,450	1,350	880	1,450	2,460	2,180	1,560	3,200	1,060	720	580	460
27	1,350	1,350	1,060	1,350	2,180	2,040	1,560	3,200	1,060	720	580	520
28	1,250	1,350	1,450	1,350	2,040	2,320	1,560	3,520	970	720	580	490
29	1,250	1,350	1,350	1,350	.....	2,740	1,560	3,200	880	800	580	490
30	1,350	1,350	1,450	1,450	.....	2,880	1,560	2,740	970	720	580	490
31	1,560	.....	1,560	1,680	.....	3,040	.....	2,320	.....	720	580	.....
1915–16.												
1	520	800	4,420	2,320	1,800	3,040	5,400	4,240	3,040	3,200	1,800	970
2	520	1,150	4,060	2,180	1,680	2,880	4,240	4,800	3,040	3,040	1,800	1,350
3	520	1,060	4,060	2,040	1,560	2,740	4,060	5,200	2,880	3,040	1,800	1,560
4	580	1,060	3,700	2,040	1,450	2,880	3,700	5,800	2,880	3,200	1,680	1,680
5	550	970	8,300	1,920	2,320	3,200	3,360	6,680	2,880	3,200	1,560	1,560
6	520	880	7,580	1,920	10,900	3,200	3,520	7,120	2,880	3,200	1,560	1,560
7	490	880	6,680	1,800	19,500	3,520	3,520	6,680	2,880	3,200	1,560	1,450
8	490	800	6,020	1,680	12,400	3,520	3,700	5,600	3,040	3,200	1,560	1,250
9	490	970	5,200	1,560	7,820	3,360	3,880	4,800	3,200	3,200	1,450	1,350
10	460	1,060	4,600	1,560	6,900	3,200	3,880	4,420	3,360	3,200	1,350	1,150
11	460	1,060	4,420	1,450	6,020	2,880	4,240	4,420	3,880	3,360	1,350	1,150
12	490	1,060	3,880	1,350	5,600	2,740	3,880	4,240	4,060	3,360	1,350	1,060
13	520	1,150	3,360	1,350	5,200	2,460	3,700	4,240	4,420	3,360	1,250	1,060
14	520	1,920	3,040	1,250	4,600	2,460	3,360	4,240	4,800	3,200	1,250	1,020
15	520	2,880	2,880	1,250	4,240	2,460	3,360	4,240	5,000	3,200	1,150	970
16	490	2,180	2,600	1,250	4,060	2,460	3,360	4,240	5,200	3,200	1,150	880
17	490	15,000	2,880	1,200	3,880	2,600	3,700	4,060	5,400	3,200	1,350	880
18	490	11,800	2,460	1,200	4,060	2,880	4,060	4,060	5,800	3,200	1,350	880
19	520	8,780	4,800	1,250	4,880	3,360	4,420	3,880	5,600	3,040	1,250	970
20	490	7,340	10,600	1,250	5,400	4,800	4,600	3,700	4,800	2,880	1,150	970
21	490	6,240	16,200	1,350	5,800	6,240	4,600	3,700	4,240	2,880	1,150	925
22	520	5,200	17,400	1,800	5,200	7,820	4,240	3,520	3,880	2,740	1,100	880
23	580	7,820	12,700	2,180	4,800	6,460	4,060	3,360	3,520	2,600	1,060	880
24	580	8,300	7,820	2,600	4,060	5,800	4,420	3,200	3,200	2,460	1,060	880
25	650	16,200	5,400	2,740	3,880	8,540	4,600	3,040	3,200	2,460	1,020	880
26	800	8,060	4,060	2,600	3,700	11,800	4,800	2,880	3,040	2,320	1,020	840
27	760	5,400	3,200	2,320	3,360	10,600	4,800	3,040	2,880	2,180	970	840
28	720	5,200	2,880	2,180	3,200	10,000	4,800	3,040	2,880	2,040	970	800
29	650	4,800	2,740	1,920	3,040	9,020	4,600	3,040	3,040	2,040	880	800
30	615	4,420	2,600	1,680	.....	8,060	4,420	3,200	3,200	1,800	880	800
31	685	.....	2,460	1,800	.....	6,900	.....	3,200	.....	1,800	880	.....

NOTE.—Mean discharge during 1914 estimated by comparison with flow at Jefferson as follows: Feb. 5–10, 2,040second-feet; Apr. 16–18, 8,000 second-feet; June 1-6, 2,000 second-feet; Aug. 21–31, 620 second-feet; and Sept. 1–4, 580 second-feet.

Monthly discharge of North Santiam River at Niagara Oreg., for the years ending Sept. 30, 1913–1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1912–13.				
October	3,520	720	1,310	80,600
November	16,200	1,450	4,260	253,000
December	6,680	1,560	2,430	149,000
January	6,680	1,560	2,690	165,000
February	4,240	1,350	1,980	110,000
March	10,000	1,350	2,860	176,000
April	6,900	3,200	4,530	270,000
May	5,400	2,460	4,330	266,000
June	5,200	2,180	3,230	192,000
July	2,740	1,250	1,730	106,000
August	1,350	800	1,010	62,100
September	1,680	720	878	52,200
The year	16,200	720	2,600	1,880,000
1913–14.				
October	7,580	720	1,880	116,000
November	5,200	970	2,570	153,000
December	3,880	1,250	1,720	106,000
January	8,300	1,920	4,070	250,000
February	7,340	2,040	2,800	156,000
March	7,820	1,680	3,670	226,000
April	.....	1,680	3,450	205,000
May	2,460	1,560	1,940	119,000
June	2,600	1,150	1,840	109,000
July	1,350	650	937	57,600
August	650	.....	639	39,300
September	3,040	580	1,210	72,000
The year	.....	580	2,220	1,610,000
1914–15.				
October	6,240	800	1,710	105,000
November	4,800	1,350	2,070	123,000
December	1,560	880	1,120	68,900
January	3,520	1,350	2,070	127,000
February	4,600	1,350	2,320	129,000
March	3,700	1,560	2,480	152,000
April	3,520	1,560	2,310	137,000
May	3,520	1,250	2,310	142,000
June	2,740	880	1,450	86,300
July	970	720	843	51,800
August	720	550	611	37,600
September	580	430	504	30,000
The year	6,240	430	1,650	1,189,600
1915–16.				
October	800	460	554	34,100
November	16,200	800	4,480	267,000
December	17,400	2,460	5,580	343,000
January	2,740	1,200	1,770	109,000
February	19,500	1,450	5,220	300,000
March	11,800	2,460	4,900	301,000
April	5,400	3,360	4,110	245,000
May	7,120	2,880	4,250	261,000
June	5,800	2,880	3,740	223,000
July	3,360	1,800	2,870	176,000
August	1,800	880	1,280	78,700
September	1,680	800	1,070	63,700
The year	19,500	460	3,310	2,400,000

SANTIAM RIVER AT JEFFERSON, OREG.

LOCATION.—In NE. ¼ sec. 11, T. 10 S., R. 3 W., at the Southern Pacific Railroad bridge in Jefferson, Marion County, about 2½ miles below junction of North and South Santiam rivers, and 9 miles above mouth.

DRAINAGE AREA.—1,890 square miles.

RECORDS AVAILABLE.—July 19, 1905, to July 1, 1906; May 15, 1908, to September 30, 1916; when station was discontinued by the Geological Survey.

GAGE.—Vertical staff on right bank.

DISCHARGE MEASUREMENTS.—Made from Southern Pacific Railroad bridge or from the highway bridge just below it.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.0 feet February 7 (discharge, 73,200 second-feet); minimum stage recorded, 0.7 foot October 1 (discharge, 630 second-feet).

1905–6 and 1908–1916: Maximum stage recorded, 18.2 feet during night of November 22, 1909 (discharge, 108,000 second-feet); minimum stage recorded, 0.4 foot September 16 to 20, 1909, and September 11 to 17, 1910 (discharge, 350 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—The Albany power canal diverts from South Santiam River near Lebanon; the Salem power canal from North Santiam River near Stayton. Water is diverted from the North Santiam for irrigation near West Stayton.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve fairly well defined. Gage read to tenths once daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

COOPERATION.—Gage records furnished by United States Weather Bureau, which continues to maintain the station.

The following discharge measurement was made by W. E. Dickinson:
October 11, 1916: Gage height, 0.82 foot; discharge, 793 second-feet.

Daily discharge, in second-feet, of Santiam River at Jefferson, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	630	2,550	23,100	8,950	8,500	9,400	16,800	13,300	8,500	9,850	3,020	1,350
2	760	3,790	17,300	8,100	17,300	8,950	15,800	13,300	8,100	13,800	3,020	1,350
3	760	3,530	16,800	6,900	26,100	11,800	14,800	14,300	8,100	14,300	2,780	1,520
4	1,040	3,020	21,300	6,500	18,900	14,800	14,300	14,800	8,500	14,800	2,550	1,520
5	1,040	2,550	17,800	5,800	14,800	13,800	12,800	15,800	8,500	13,800	2,330	1,520
6	900	2,330	43,400	5,800	18,900	16,800	11,300	16,800	8,100	9,850	2,110	1,700
7	900	1,900	32,100	5,500	73,200	21,900	11,300	17,800	8,100	8,500	2,110	1,700
8	900	1,900	24,900	6,500	58,800	18,300	11,300	18,900	7,700	7,700	2,110	1,700
9	760	2,110	30,900	6,500	41,300	22,500	11,800	18,900	7,700	7,300	1,900	1,700
10	760	2,550	24,900	6,900	35,100	22,500	11,800	18,300	7,700	7,300	1,900	1,520
11	760	2,780	21,300	5,800	44,100	23,100	16,800	17,300	7,300	6,500	1,900	1,520
12	760	5,800	17,300	5,200	35,700	23,700	16,800	14,800	7,300	5,800	1,900	1,520
13	760	4,610	16,800	5,800	27,300	24,300	14,300	18,300	8,100	5,500	1,900	1,350
14	900	3,790	14,800	5,200	24,900	19,500	12,300	17,300	8,500	5,500	1,700	1,350
15	1,700	3,020	12,300	4,900	28,500	16,300	13,800	16,300	9,850	4,900	1,700	1,190
16	1,350	26,100	10,800	4,330	28,500	14,800	12,800	14,800	10,800	5,500	1,520	1,040
17	1,190	15,800	12,300	4,060	27,900	14,800	12,300	11,800	11,800	7,700	1,520	1,040
18	1,040	55,300	10,800	3,790	26,100	14,800	12,300	11,800	12,300	9,850	1,520	1,040
19	900	41,300	8,950	3,790	23,100	16,800	12,800	10,800	11,300	8,500	1,700	1,040
20	760	30,900	8,950	3,270	20,100	26,100	11,800	9,850	9,850	7,700	1,700	1,040
21	760	30,300	17,300	3,270	18,900	29,100	16,800	9,850	9,400	6,900	1,700	1,040
22	760	29,100	48,300	3,530	17,800	33,300	22,500	10,300	7,700	5,800	1,520	1,040
23	900	35,700	38,100	10,800	16,300	28,500	20,100	11,300	6,900	4,900	1,520	1,040
24	1,520	36,900	27,300	29,100	14,800	22,500	17,300	11,300	5,800	4,330	1,520	1,040
25	1,900	27,300	22,500	19,500	13,800	21,300	14,800	11,300	7,700	4,060	1,520	1,040
26	2,110	46,900	18,900	15,300	12,300	44,800	14,800	11,300	8,950	4,060	1,520	1,040
27	1,900	30,900	14,800	12,300	11,800	44,800	15,300	10,800	8,950	3,530	1,520	1,040
28	1,700	21,900	14,800	9,850	10,300	31,500	15,800	9,850	8,950	3,270	1,350	1,040
29	1,350	28,500	13,300	8,950	9,400	23,700	16,800	9,400	8,500	3,270	1,350	1,040
30	1,350	30,900	11,300	7,300	.....	19,500	15,300	9,400	7,700	3,020	1,350	1,040
31	1,350	.....	9,850	6,900	.....	16,800	.....	8,500	.....	3,020	1,350	.....

Monthly discharge of Santiam River at Jefferson, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	2,110	630	1,100	67,600
November	55,300	1,900	17,800	1,060,000
December	48,300	8,950	20,100	1,240,000
January	29,100	3,270	7,750	477,000
February	73,200	8,500	25,000	1,440,000
March	44,800	8,950	21,600	1,330,000
April	22,500	11,300	14,600	869,000
May	18,900	8,500	13,500	830,000
June	12,300	5,800	8,620	513,000
July	14,800	3,020	7,120	438,000
August	3,020	1,350	1,840	113,000
September	1,700	1,040	1,270	75,600
The year	73,200	630	11,600	8,450,000

CLACKAMAS RIVER NEAR CAZADERO, OREG.

LOCATION.—In NE. ¼ 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, 1916.

GAGE.—Friez water-stage recorder referred to a vertical staff on right bank. Gage reader, J. A. Brooks.

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, 39.2 feet at 5 a. m. December 22 (discharge, 24,200 second-feet); minimum stage recorded, 25.7 feet October 8 to 10 (discharge, 705 second-feet).

1909-1916: Maximum stage recorded, 43.7 feet at 1 p. m. November 22, 1909 (discharge, 46,800 second-feet); minimum stage recorded, 25.7 feet October 8 to 10, 1915.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve revised slightly by means of measurements in 1916; well defined between 700 and 6,000 second-feet. Operation of water-stage recorder unsatisfactory at times; float frozen in well January 14 to 22 and 28 to 30; staff gage read twice each day; float resting on sand August 6 to September 30; staff gage read once each week. For periods when water-stage recorder was operating, daily discharge ascertained by applying to the rating table mean daily gage height determined by inspecting gage-height graph, or, for days of considerable fluctuation, by use of discharge integrator. For days when staff gage was read, discharge ascertained by applying mean daily gage height to rating table. Records excellent except as follows: December, February, and August, good; September, fair.

Discharge measurements of Clackamas River near Cazadero, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 29	Ewing and Scupham [a]	31.60	7,410	June 2	H. S. Scupham	28.72	3,960
May 31–June 1	H. S. Scupham	28.73	4,000	21	do	29.25	4,730
				Aug. 9	do	26.75	1,590

[a] Employees of Portland Railway, Light & Power Co.

Daily discharge, in second feet, of Clackamas River near Cazadero, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	760	1,400	4,740	2,730	2,490	3,180	4,740	4,870	4,090	4,740	1,850	1,150
2	760	1,270	4,090	2,550	4,870	2,980	4,610	5,260	4,090	6,750	1,800	1,150
3	781	1,250	3,830	2,430	4,090	3,310	4,610	6,050	4,090	6,470	1,890	1,400
4	760	1,180	3,960	2,250	3,180	3,050	4,610	6,470	4,610	5,520	1,800	1,350
5	732	1,100	6,380	2,130	2,670	2,860	4,350	6,610	4,610	4,870	1,600	1,320
6	722	1,070	7,600	2,070	5,340	3,380	4,090	6,890	4,480	4,350	1,550	1,300
7	710	1,000	6,330	1,960	15,700	3,380	4,220	6,190	4,610	4,090	1,500	1,250
8	705	1,000	5,650	1,960	11,100	4,350	4,480	6,050	4,870	3,960	1,850	1,350
9	705	1,030	6,610	1,960	8,560	5,130	4,610	5,910	5,000	3,830	1,750	1,650
10	705	980	5,520	1,900	9,760	5,390	5,000	5,390	4,610	3,500	1,650	1,560
11	710	1,140	4,740	1,800	11,500	5,910	5,650	4,870	4,350	3,380	1,550	1,470
12	710	1,310	4,090	1,700	7,900	5,910	5,130	4,610	4,350	3,380	1,450	1,370
13	732	1,120	3,830	1,600	6,470	5,520	4,740	4,350	4,610	3,240	1,450	1,280
14	1,060	1,000	3,440	1,550	6,470	4,740	4,870	4,090	5,000	3,050	1,450	1,180
15	894	1,800	3,050	1,450	7,170	4,350	4,870	4,090	5,390	2,920	1,450	1,090
16	795	3,850	2,860	1,360	7,600	4,090	4,610	4,220	5,910	3,240	1,400	1,000
17	760	6,620	2,860	1,530	7,600	3,960	4,610	4,480	6,190	3,380	1,400	1,000
18	744	8,190	2,670	1,700	7,030	4,220	4,610	4,740	6,190	3,120	1,400	1,000
19	744	7,900	2,430	1,550	6,470	4,870	4,350	4,870	5,650	2,790	1,400	1,000
20	738	5,650	2,790	1,550	5,650	6,890	4,220	4,610	5,390	2,670	1,380	1,000
21	727	5,990	8,630	1,550	5,130	7,170	5,650	4,610	4,870	2,550	1,350	1,000
22	727	5,780	18,800	1,750	4,740	7,900	5,260	4,740	4,350	2,430	1,330	1,000
23	937	12,300	8,900	5,220	4,350	6,470	4,610	4,610	4,480	2,310	1,310	1,000
24	1,090	7,110	6,330	5,650	4,220	5,520	4,480	4,350	4,350	2,190	1,290	1,000
25	1,270	10,600	5,650	4,090	4,090	8,220	4,870	4,350	4,350	2,070	1,260	1,000
26	1,130	8,590	4,870	3,180	3,830	12,900	5,000	4,220	4,870	2,020	1,240	1,000
27	1,070	5,650	4,220	2,790	3,640	9,940	5,650	4,350	4,870	1,960	1,220	1,000
28	955	4,480	4,220	2,310	3,440	7,170	5,520	4,480	4,350	1,960	1,200	1,000
29	894	7,170	3,830	2,190	3,310	6,050	5,390	4,480	4,090	1,900	1,180	1,000
30	870	6,050	3,380	2,070	.....	5,260	5,000	4,350	3,960	1,850	1,160	1,000
31	910	.....	3,050	2,070	.....	4,870	.....	4,090	.....	1,850	1,150	.....

Monthly discharge of Clackamas River near Cazadero, Oreg., for the year ending Sept. 30, 1916.

[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	1,270	705	832	1.21	1.40	51,200
November	12,300	980	4,120	6.01	6.70	245,000
December	18,800	2,430	5,140	7.50	8.65	316,000
January	5,650	1,360	2,280	3.33	3.84	140,000
February	15,700	2,490	6,150	8.98	9.68	354,000
March	12,900	2,860	5,450	7.96	9.18	335,000
April	5,650	4,090	4,810	7.02	7.83	286,000
May	6,890	4,090	4,940	7.21	8.31	304,000
June	6,190	3,960	4,750	6.93	7.73	283,000
July	6,750	1,850	3,300	4.82	5.56	203,000
August	1,850	1,150	1,460	2.13	2.46	89,800
September	1,650	1,000	1,160	1.69	1.89	69,000
The year	18,800	705	3,690	5.39	73.23	2,680,000

OAK GROVE FORK OF CLACKAMAS RIVER AT TIMOTHY MEADOWS, NEAR CAZADERO, OREG.

LOCATION.—In T. 5 S., R. 8 E., about sec. 26 (unsurveyed), at Timothy Meadows, about 11¼ miles above station at intake, 17 miles above mouth of Oak Grove Fork, and 43 miles above Cazadero, Clackamas County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 25, 1913, to November 26, 1916, when station was temporarily discontinued.

GAGE.—Stevens continuous water-stage recorder on right bank; inspected by H. S. Scupham.

DISCHARGE MEASUREMENTS.—Made from footbridge 20 feet above gage.

CHANNEL AND CONTROL.—Channel, gravel. Control practically permanent but may be affected by drift logs.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year 2.37 feet at 5 p. m. June 17 (discharge, 584 second-feet); minimum stage recorded, 0.43 foot at 6 p. m. November 11, 1915 (discharge, 100 second-feet).

1913–1916: Maximum and minimum stages are those of 1916.

ICE.—Never any ice, as stream is largely spring fed.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed during high water of 1916. Well-defined rating curve, based on discharge measurements from 1913 to 1915, used to April 18; curve used thereafter well defined below 250 second-feet. Operation of water-stage recorder satisfactory except when the clock ran down between inspections. Daily discharge ascertained by applying to rating table the mean daily gage height obtained by inspecting gage-height graph. Records excellent except for periods when clock was not running and for high stages, when the exact time and amount of shift is uncertain.

COOPERATION.—Field data furnished by the Portland Railway, Light & Power Co.

Discharge measurements of Oak Grove Fork of Clackamas River at Timothy Meadows near Cazadero, Oreg., during the year ending Sept. 30, 1916.

[Made by H. S. Scupham.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
July 20	1.10	252
26	1.04	222

Daily discharge, in second-feet, of Oak Grove Fork of Clackamas River at Timothy Meadows near Cazadero, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	116	112	152	154	.....	159	245	340	378	385	208	162
2	118	112	150	152	.....	157	252	353	378	400	205	160
3	120	114	146	152	.....	155	258	366	392	400	202	170
4	120	114	145	148	.....	154	247	407	424	370	200	166
5	120	110	170	148	.....	150	241	440	424	355	200	164
6	120	110	159	143	.....	148	243	440	440	328	195	164
7	120	108	161	141	.....	145	258	424	458	328	195	166
8	116	106	168	140	.....	157	269	424	496	315	210	168
9	115	104	172	138	.....	159	280	407	476	302	202	172
10	115	102	166	138	.....	159	285	378	458	302	200	172
11	115	100	155	136	.....	157	280	366	458	290	192	172
12	114	104	141	136	.....	157	.....	340	458	290	190	172
13	114	102	139	134	.....	155	.....	340	476	278	190	170
14	114	102	143	134	.....	155	.....	340	496	278	188	172
15	114	108	141	148	.....	157	.....	340	496	265	188	172
16	114	109	139	168	.....	170	.....	353	516	290	186	174
17	114	124	138	152	196	175	.....	366	556	278	184	174
18	114	131	134	145	198	179	.....	366	556	278	184	172
19	114	129	131	148	198	194	.....	378	540	262	184	170
20	114	124	132	.....	196	214	.....	378	520	250	184	170
21	114	132	226	.....	192	222	.....	392	500	242	182	168
22	114	141	366	.....	188	224	292	392	480	238	178	164
23	116	179	304	.....	183	218	280	378	460	230	176	162
24	116	154	258	.....	179	218	292	366	445	232	172	160
25	116	185	229	.....	177	248	316	378	430	230	170	.....
26	116	170	202	.....	172	269	316	366	460	222	166	.....
27	116	154	190	.....	166	269	316	378	445	220	164	.....
28	114	155	185	.....	164	260	316	392	430	218	164	.....
29	112	168	172	.....	163	249	316	392	400	215	162	.....
30	110	159	163	.....	.....	241	316	378	385	212	162	.....
31	110	.....	157	.....	.....	245	.....	366	.....	210	160	.....

Daily discharge, in second-feet, of Oak Grove Fork of Clackamas River at Timothy Meadows near Cazadero, Oreg., for the period Oct. 1 to Nov. 26, 1916.

Day.	Oct.	Nov.	Day.	Oct.	Nov..	Day.	Oct.	Nov.
1	154	134	11	.....	140	21	146	134
2	154	132	12	.....	138	22	156	134
3	156	134	13	.....	140	23	150	136
4	156	142	14	150	140	24	154	140
5	.....	156	15	150	136	25	160	146
6	.....	148	15	148	136	26	152	146
7	.....	146	17	148	138	27	154	.....
8	.....	150	18	148	136	28	150	.....
9	.....	146	19	148	136	29	140	.....
10	.....	142	20	146	136	30	138	.....
						31	134	.....

NOTE.—Daily discharge interpolated Oct. 10–13, 1915, and June 19–22. Mean discharge estimated as follows, by comparison with record at intake:

	Second-feet.
Jan. 20–31	160
Feb. 1–16	200
Sept. 25–30	165

Mean discharge Apr. 12–21, estimated as 286 second-feet, and Oct. 5–13, 1916, as 153 second-feet, by interpolation.

Monthly discharge of Oak Grove Fork of Clackamas River at Timothy Meadows near Cazadero, Oreg., for the period Oct. 1, 1915, to Nov. 26, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1915-16.				
October	120	110	115	7,070
November	185	100	127	7,560
December	366	131	175	10,800
January	.....	136	151	9,280
February	a 260	.....	192	11,000
March	269	145	191	11,700
April	316	245	283	16,800
May	440	340	378	23,200
June	556	378	461	27,400
July	400	210	281	17,300
August	210	160	185	11,400
September	174	160	168	10,000
The year	556	100	225	164,000
1916.				
October	160	134	151	9,280
November 1-26	156	132	140	7,220
The period	.....	.....	.....	16,500

a Indicated on recorder graph while clock was stopped, probably occurred on Feb. 10.

OAK GROVE FORK OF CLACKAMAS RIVER AT INTAKE NEAR CAZADERO, OREG.

LOCATION.—In SW. ¼ 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 September 30, 1916.

GAGE.—Friez water-stage recorder installed on left bank since October, 1913; Watson recording gage used March, 1912, to September, 1913; vertical staff prior to 1912.

DISCHARGE MEASUREMENTS.—Made from cable; velocities high; channel straight.

CHANNEL AND CONTROL.—Gravel; fairly permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.51 feet at 4 a. m. December 22 (discharge, 1,670 second-feet); minimum stage recorded, 0.58 foot at 4 p. m. October 26 (discharge, 334 second-feet).

1909–1915: 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 changed slightly during high water; shift assumed to have come during the long flood of June rather than during the slightly higher short flood of December 22. Two rating curves, fairly well defined for 1916, used October 1 to June 15 and June 23 to September 30, the former based on one measurement in 1915 and the latter on two measurements in 1917. Operation of water-stage recorder satisfactory, except March 23 to May 2, 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 excellent, except for periods for which they are estimated, for which they are fair.

COOPERATION.—Field data furnished by Portland Railway, Light & Power Co.

No discharge measurement was made during year.

Daily discharge, in second-feet, of Oak Grove Fork of Clackamas River at intake near Cazadero, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	347	344	550	550	496	606	.....	.....	1,060	1,060	520	.....
2	347	340	525	535	535	590	.....	.....	1,060	1,140	515	.....
3	347	340	525	520	520	585	.....	1,220	1,100	1,060	510	.....
4	347	340	515	510	510	570	.....	1,320	1,100	980	505	.....
5	347	340	630	500	505	550	.....	1,410	1,100	940	505	.....
6	347	340	630	496	678	545	.....	1,410	1,100	900	505	.....
7	347	340	630	491	980	535	.....	1,360	1,180	865	505	.....
8	347	340	654	486	980	570	.....	1,270	1,220	865	500	458
9	347	340	708	482	940	600	.....	1,220	1,220	830	495	471
10	347	340	660	473	1,060	606	.....	1,180	1,180	795	490	462
11	350	340	624	460	1,100	630	.....	1,100	1,180	760	485	453
12	350	340	590	455	980	654	.....	1,060	1,180	760	480	448
13	350	340	570	455	892	660	.....	1,020	1,180	760	480	444
14	347	340	545	455	868	642	.....	980	1,220	724	480	444
15	344	400	520	455	860	636	.....	980	1,270	718	480	435
16	340	450	515	500	868	642	.....	980	.....	748	480	435
17	340	550	491	470	892	654	.....	1,020	.....	748	485	435
18	340	600	478	460	900	666	.....	.....	.....	712	490	435
19	340	660	473	460	876	727	.....	.....	.....	682	490	435
20	340	535	482	455	839	868	.....	.....	.....	661	485	435
21	340	555	790	447	797	724	.....	.....	.....	640	480	435
22	340	600	1,410	455	755	940	.....	.....	.....	622	476	435
23	340	876	1,030	575	727	.....	.....	.....	1,100	604	471	435
24	340	642	860	560	720	.....	.....	.....	1,080	598	471	435
25	340	811	790	525	702	.....	.....	1,100	1,060	580	471	435
26	340	720	696	505	684	.....	.....	1,100	1,050	570	466	444
27	354	606	648	500	660	.....	.....	1,140	1,030	560	466	435
28	347	580	630	496	642	.....	.....	1,140	1,010	550	462	431
29	347	660	600	486	624	.....	.....	1,140	1,000	545	462	427
30	347	590	580	482	.....	.....	.....	1,100	980	540	458	427
31	344	.....	570	486	.....	.....	.....	1,060	.....	530	458	.....

NOTE.—Daily discharge interpolated June 24–29 and Sept. 16–24; estimated Nov. 15–17 and Jan. 16–18. Mean for periods when gage was not working estimated from comparisons with records for station at Timothy Meadows or by interpolation as follows:

	Second-feet.		Second-feet.
Mar. 23–31	770	June 16–22	1,300
May 1 and 2	1,200	Sept. 1–7	480
May 18–24	1,060		

Monthly discharge of Oak Grove Fork of Clackamas River at intake near Cazadero, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	354	340	345	21,200
November	876	340	487	29,000
December	1,410	473	643	39,500
January	575	447	490	30,100
February	1,100	496	779	44,800
March	.....	535	682	41,900
April	.....	.....	[a] 860	51,200
May	1,410	980	1,130	69,500
June	.....	980	1,160	69,000
July	1,140	530	743	45,700
August	520	458	485	29,800
September	.....	427	450	26,800
The year	.....	340	687	498,000

[a] Estimated by comparison with discharge at Timothy Meadows.

LEWIS RIVER BASIN.

LEWIS RIVER NEAR AMBOY, WASH.

LOCATION.—In sec. 36, T. 6 N., R. 3 E., at Cresaps ferry crossing, on county road from Amboy to Cougar, 1½ 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, page 74, and checked on Forest Service map).

RECORDS AVAILABLE.—January 20, 1911, to September 30, 1916.

GAGE.—Inclined staff on left bank, replacing vertical staff at same site and datum. Gage reader, Philip Hanley.

DISCHARGE MEASUREMENTS.—Made from cable at gage.

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

EXTREMES OF STAGE.—Maximum stage recorded during year, 12.0 feet at 12 p. m. December 21 (discharge, 37,700 second-feet); minimum stage recorded, 0.15 foot at 4 p. m. October 11 (discharge, 735 second-feet).

1911–1916: Maximum stage recorded was that of 1916; minimum stage recorded, 0.08 foot September 30, 1915 (discharge, 686 second-feet).

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

DIVERSIONS.—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 heights to rating table. Records excellent.

Discharge measurements of Lewis River near Amboy, Wash., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 16	P. V. Hodges	3.55	5,920	Nov. 18	P. V. Hodges	4.68	8,980
17	do	4.50	8,760	June 27	do	3.70	6,530
17	do	5.52	11,800	Sept. 2	C. L. Batchelder	.68	1,160

Daily discharge, in second-feet, of Lewis River near Amboy, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	735	4,000	5,120	4,000	2,320	4,650	6,890	7,430	5,600	6,100	2,940	1,910
2	1,120	5,600	5,120	3,810	2,320	4,650	6,620	8,300	5,850	11,100	3,110	1,910
3	1,160	4,650	5,120	3,630	2,180	4,420	6,360	10,200	6,620	12,400	2,940	1,910
4	910	4,420	6,100	3,630	2,180	4,200	6,100	10,200	7,160	11,400	2,780	1,790
5	840	3,450	8,000	3,450	2,620	4,200	6,100	10,200	7,160	8,910	2,780	1,670
6	840	2,780	8,300	3,280	4,200	5,360	5,850	11,100	7,160	7,160	2,620	1,670
7	805	2,180	10,500	3,110	5,600	6,360	6,100	10,800	7,160	6,100	2,620	1,670
8	805	2,040	11,800	2,940	7,710	9,530	6,100	10,200	8,300	6,100	2,470	1,450
9	770	1,910	10,800	2,780	11,400	12,100	6,620	8,600	7,710	6,620	2,470	1,450
10	735	1,910	8,600	2,620	19,900	10,800	7,160	7,710	6,890	6,360	2,470	1,350
11	735	1,790	7,710	2,470	14,800	9,840	7,710	7,160	6,360	6,100	2,470	1,350
12	805	1,910	6,620	2,180	10,200	9,840	7,160	6,890	6,620	5,850	2,320	1,250
13	1,120	1,790	5,600	1,910	8,910	8,910	7,160	7,160	7,160	5,600	2,180	1,250
14	1,200	1,790	5,120	1,790	10,500	8,000	7,160	7,160	7,710	5,120	2,180	1,200
15	1,030	4,650	4,420	1,670	11,100	6,890	8,000	6,890	9,530	5,120	2,040	1,250
16	910	6,620	3,810	1,560	12,400	6,360	6,620	6,890	10,200	4,650	2,040	1,200
17	840	5,600	3,810	1,560	11,400	6,620	6,620	7,160	11,400	4,650	2,180	1,200
18	840	10,200	3,810	1,450	10,200	6,100	7,160	7,430	11,400	4,420	2,040	1,160
19	910	15,500	3,450	1,670	9,530	6,620	6,890	7,160	10,800	4,200	1,910	1,160
20	875	11,400	3,810	1,910	8,910	12,100	6,890	6,620	9,840	4,200	1,790	1,160
21	875	8,910	22,700	2,620	8,000	12,700	8,300	7,160	8,910	4,000	1,790	1,120
22	910	8,910	23,900	3,450	7,160	9,840	7,160	6,890	6,620	4,000	1,790	1,120
23	1,250	13,400	14,100	8,910	6,360	9,840	7,160	6,620	5,600	3,810	1,670	1,120
24	2,320	11,400	11,800	9,220	6,100	8,000	6,620	5,850	5,600	3,810	1,670	1,070
25	4,650	12,100	9,840	8,300	5,850	14,800	6,360	5,600	6,100	3,630	1,670	1,160
26	3,630	10,200	7,710	7,710	5,600	23,900	6,620	5,600	6,360	3,450	1,670	1,250
27	2,620	7,430	6,890	6,890	5,360	17,700	8,910	5,850	6,620	3,280	1,560	1,200
28	2,040	6,100	6,100	3,810	5,360	12,400	10,500	5,600	6,100	3,280	1,560	1,160
29	1,670	6,360	5,850	2,780	5,120	9,840	8,600	5,600	5,600	3,110	1,670	1,070
30	1,400	6,100	4,880	2,620	.....	8,600	7,710	5,600	4,200	2,940	1,670	1,070
31	2,320	.....	4,200	2,470	.....	7,710	.....	5,360	.....	2,940	1,790	.....

Monthly discharge of Lewis River near Amboy, Wash., for the year ending Sept. 30, 1916.

[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	4,650	735	1,340	2.02	2.33	82,400
November	15,500	1,790	6,170	9.28	10.35	367,000
December	23,900	3,450	7,920	11.9	13.72	487,000
January	9,220	1,450	3,550	5.34	6.16	218,000
February	19,900	2,180	7,700	11.6	12.51	443,000
March	23,900	4,200	9,130	13.7	15.79	561,000
April	10,500	5,850	7,110	10.7	11.94	423,000
May	11,100	5,360	7,450	11.2	12.91	458,000
June	11,400	4,200	7,410	11.2	12.50	441,000
July	12,400	2,940	5,500	8.27	9.53	338,000
August	3,110	1,560	2,160	3.25	3.75	133,000
September	1,910	1,070	1,340	2.02	2.25	79,700
The year	23,900	735	5,550	8.35	113.74	4,030,000

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 to September 30, 1916.

GAGE.—Vertical staff bolted to rock ledge; lower section on left bank; upper section, in a cove on right bank opposite lower section. Gage reader, L. A. Van Fleet. Gage at same location, but with datum 2 feet lower, used 1911 to January, 1912, and one with datum 3 feet lower 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 August 18 to September 30, 1.82 feet at 6 p. m. September 3 (discharge, 605 second-feet); minimum stage recorded, 1.01 feet at noon September 30 (discharge, 276 second-feet).

1911–1913: Water over gage 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. Daily discharge ascertained by applying daily gage heights to rating table. Record excellent for discharge above 300 second-feet; good from 250 to 300 second-feet; fair below 250 second-feet.

1911–1913: Stage-discharge relation permanent and rating curve well defined above 300 second-feet. Observer somewhat careless. Records of discharge above 300 second-feet, good; below this they are fair.

Discharge measurements of Kalama River near Kalama, Wash., during the years ending Sept. 30, 1912–1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 19, 1911	R. C. Pierce.....	1.08	302	Sept. 20, 1916	C. L. Batchelder..	1.07	315
Nov. 19, 1912	James E. Stewart.	[a] 3.82	1,970	Sept. 21, 1916	.....do.....	1.05	303
July 5, 1913	H. M. Nelson.....	1.96	675				

[a] Gage height revised on basis of further study of notes.

Daily discharge, in second-feet, of Kalama River near Kalama, Wash., for the years ending Sept. 30, 1911–1913 and 1916.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1911.				1911.				1911.			
1.....	.....	261	232	11.....	396	246	276	21.....	325	246	415
2.....	.....	261	292	12.....	396	246	246	22.....	308	246	360
3.....	.....	261	276	13.....	378	246	276	23.....	308	232	308
4.....	.....	261	276	14.....	360	246	276	24.....	292	232	292
5.....	.....	261	276	15.....	342	246	500	25.....	292	232	292
6.....	435	261	276	16.....	342	246	870	26.....	292	232	292
7.....	455	261	261	17.....	342	246	700	27.....	292	232	292
8.....	435	261	261	18.....	342	246	455	28.....	292	232	276
9.....	415	261	342	19.....	342	246	455	29.....	276	232	261
10.....	396	261	292	20.....	342	276	455	30.....	276	232	261
								31.....	276	232	.....

Daily discharge, in second-feet, of Kalama River near Kalama, Wash., for the years ending Sept. 30, 1911–1913 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Day.	Oct.	Nov.	Dec.	Jan.
1911–12.					1911–12.				
1	261	246	700	1,050	16	342	1,700	1,620	.....
2	308	246	810	930	17	325	2,410	1,460	.....
3	308	246	700	810	18	325	2,610	1,250	.....
4	378	246	700	755	19	308	4,930	1,390	.....
5	308	478	810	700	20	308	3,150	1,180	.....
6	292	455	1,460	700	21	308	2,510	1,050	.....
7	292	1,110	1,110	1,050	22	292	1,780	1,050	.....
8	292	1,780	1,050	700	23	276	1,460	810	.....
9	276	1,180	870	1,250	24	276	1,180	1,320	.....
10	500	810	1,320	1,320	25	276	1,050	1,250	.....
11	455	755	1,180	1,180	26	276	1,320	1,180	.....
12	378	645	1,110	.....	27	261	1,110	1,620	.....
13	360	1,540	1,050	.....	28	246	990	1,460	.....
14	396	2,930	990	.....	29	246	870	1,320	.....
15	342	2,310	1,180	.....	30	246	870	1,320	.....
					31	276	.....	1,180	.....

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.										
1	700	5,770	1,950	930	2,130	930	1,180	930	342	276
2	930	4,530	2,130	870	1,950	870	1,700	930	342	246
3	2,220	5,770	2,310	1,180	1,620	870	1,780	870	360	700
4	2,310	5,490	2,130	1,460	1,460	810	990	810	360	2,040
5	1,320	4,140	1,950	1,620	2,930	810	930	700	360	1,320
6	1,180	3,150	1,700	1,780	2,130	1,050	810	700	360	1,320
7	990	2,710	1,620	2,130	1,950	1,950	810	645	325	1,250
8	930	2,710	1,460	1,700	1,950	2,130	870	620	325	1,180
9	930	2,510	1,320	1,780	1,780	2,510	930	620	325	1,110
10	930	1,950	1,320	1,620	1,700	2,130	870	645	308	1,050
11	810	1,950	1,320	1,320	1,620	2,610	810	620	308	1,050
12	810	2,310	1,250	1,320	1,620	3,150	870	545	308	700
13	810	2,510	1,320	1,180	1,780	2,610	930	545	342	455
14	930	2,710	1,700	1,250	1,460	1,700	1,320	545	342	415
15	1,320	2,610	2,130	1,320	1,620	1,700	1,250	522	342	378
16	1,700	2,310	2,610	1,460	1,390	1,320	1,180	455	360	378
17	1,320	2,130	3,150	1,700	1,320	1,320	1,050	455	360	342
18	4,140	2,130	3,390	1,950	1,460	1,180	990	455	396	342
19	2,930	2,220	3,150	1,950	1,620	1,110	1,320	455	378	342
20	2,130	1,780	2,220	1,320	1,700	1,050	1,620	455	342	325
21	1,620	1,700	1,700	1,780	1,700	990	1,700	435	342	325
22	1,620	1,620	1,460	1,700	1,620	1,110	3,150	435	325	308
23	1,620	1,620	1,460	1,620	1,320	1,320	2,130	415	308	276
24	1,620	1,950	1,180	1,460	1,180	1,540	1,700	415	292	276
25	1,620	4,140	1,180	1,320	990	1,320	1,320	396	276	276
26	2,130	5,490	1,050	1,180	1,320	1,180	1,110	378	276	276
27	2,510	3,040	990	1,320	1,700	1,050	990	378	276	276
28	3,750	2,310	930	1,700	1,780	990	930	360	276	246
29	5,770	1,460	.....	3,150	1,320	930	870	360	276	246
30	5,770	1,460	.....	4,660	990	930	930	360	276	246
31	5,770	1,700	.....	3,750	.....	990	.....	360	276	.....

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1916.			1916.			1916.		
1	.....	342	11	.....	342	21	396	292
2	.....	342	12	.....	342	22	378	276
3	.....	478	13	.....	325	23	378	276
4	.....	378	14	.....	325	24	342	276
5	.....	378	15	.....	325	25	360	292
6	.....	342	16	.....	308	26	360	325
7	.....	342	17	.....	308	27	378	292
8	.....	342	18	.....	308	28	360	276
9	.....	360	19	435	292	29	360	276
10	.....	325	20	396	292	30	342	276
						31	342	.....

Monthly discharge of Kalama River near Kalama, Wash.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1911.				
July 6–31	455	276	344	17,700
August	276	232	248	15,200
September	870	232	345	20,500
1911–12.				
October	500	246	314	19,300
November	4,930	246	1,430	85,100
December	1,620	700	1,150	70,700
January 1–11	1,320	700	950	20,700
1912–13.				
December	5,770	700	2,040	125,000
January	5,770	1,460	2,830	174,000
February	3,390	930	1,790	99,400
March	4,660	870	1,730	106,000
April	2,930	990	1,640	97,600
May	3,150	810	1,420	87,300
June	3,150	810	1,230	73,200
July	930	360	542	33,300
August	396	276	325	20,000
September	2,040	246	599	35,600
1916.				
August 19–31	435	342	371	9,570
September	478	276	322	19,200

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 Pl. I, Water-Supply Paper 313).

RECORDS AVAILABLE.—August 19, 1907, to January 12, 1913; April 14, 1913, to September 30, 1916.

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. L. Jennings.

DISCHARGE MEASUREMENTS.—Made from cable 30 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders; practically permanent. One channel at all stages. Banks not subject to overflow. Collection of drift below gage and its removal during high stages causes changes in stage-discharge relation. Stage of zero flow, mean of several determinations, gage height 0.5 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.3 feet June 15 (discharge, 3,060 second-feet); minimum stage recorded, 0.21 foot October 11 (discharge, 58 second-feet).

1907–1916: Maximum stage recorded, above top of gage (8.0 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.—Record discontinued during winter.

DIVERSIONS.—None.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage read to hundredths. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent.

COOPERATION.—Gage-height record furnished by Portland Railway, Light & Power Co.

The following discharge measurement was made by J. T. Hartson:
June 15: Gage height, 5.30 feet; discharge, 3,060 second-feet.

Daily discharge, in second-feet, of Ohanapecosh River near Lewis, Wash., for the years ending Sept. 30, 1907–1914 and 1916.

Day.	Aug.	Sept.	Day.	Aug.	Sept.	Day.	Aug.	Sept.
1907.			1907.			1907.		
1	.....	132	11	.....	111	21	132	155
2	.....	155	12	.....	111	22	155	132
3	.....	132	13	.....	111	23	180	132
4	.....	132	14	.....	111	24	210	132
5	.....	132	15	.....	132	25	180	132
6	.....	132	16	.....	340	26	155	132
7	.....	132	17	.....	270	27	132	132
8	.....	132	18	.....	240	28	132	132
9	.....	111	19	132	210	29	132	111
10	.....	111	20	132	155	30	111	111
						31	111	.....

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1907–08.												
1	111	111	.....	305	132	255	305	1,110	820	2,460	460	132
2	132	155	820	305	180	225	270	1,170	820	2,300	420	132
3	111	132	725	270	180	225	305	990	820	2,220	340	144
4	111	111	770	270	180	210	305	870	770	1,820	340	144
5	111	111	770	270	210	195	305	820	820	1,590	322	144
6	111	111	635	270	210	180	270	930	930	1,520	322	144
7	111	111	590	270	195	180	270	1,450	1,240	1,740	305	144
8	111	111	545	305	180	168	255	1,170	2,140	1,980	305	144
9	91	111	460	340	180	155	270	990	2,460	2,060	270	122
10	91	111	420	340	195	155	305	820	2,620	1,820	270	122
11	91	91	380	305	195	180	340	680	2,620	1,740	255	144
12	91	91	380	270	155	210	460	635	2,060	1,900	240	144
13	91	91	460	270	155	725	635	590	1,980	2,060	240	144
14	91	132	420	255	155	1,050	635	568	2,220	1,590	255	144
15	91	132	340	210	168	3,730	635	635	2,540	1,380	240	144
16	91	180	305	225	195	3,730	380	545	1,820	1,380	240	122
17	91	155	305	240	240	1,520	770	500	1,590	1,110	240	111
18	91	132	270	225	240	990	1,820	680	1,380	1,240	240	111
19	91	155	255	210	225	725	2,220	725	1,240	1,170	240	111
20	91	155	255	270	210	590	2,300	725	990	1,110	225	111
21	91	155	305	255	195	500	1,520	770	820	1,240	225	111
22	91	500	460	210	195	340	1,110	770	820	1,240	225	111
23	91	305	870	210	195	460	990	930	870	990	210	101
24	91	.....	1,450	195	195	545	1,050	1,110	1,170	990	195	91
25	91	.....	990	195	195	545	870	1,310	1,900	680	180	82
26	91	.....	870	195	270	500	725	1,050	1,900	590	155	72
27	91	.....	820	195	305	460	725	930	1,380	480	144	82
28	91	.....	545	180	305	380	635	1,050	1,240	460	195	82
29	155	.....	460	180	270	380	635	1,110	1,380	420	180	82
30	111	.....	380	168	.....	340	770	930	1,980	420	144	101
31	111	.....	340	132	.....	305	.....	820	.....	440	144	.....

Daily discharge, in second-feet, of Ohanapecosh River near Lewis, Wash., for the years ending Sept. 30, 1907–1914 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1908–09.												
1	132	635	255	195	240	270	522	480	2,140	1,110	400	168
2	101	820	240	225	225	255	480	545	3,060	1,240	322	195
2	91	680	240	270	255	255	420	1,050	2,460	1,520	340	195
4	82	480	225	420	255	255	380	1,590	2,140	1,240	340	195
5	82	360	210	360	255	240	340	1,170	1,900	1,170	322	195
6	72	305	195	305	240	240	322	870	1,660	1,170	270	195
7	82	270	195	305	240	225	288	770	1,590	1,110	270	168
8	82	111	225	255	225	225	288	680	1,520	990	270	155
9	82	210	210	240	210	225	340	725	1,660	1,170	255	144
10	91	195	195	225	210	210	360	680	1,880	1,050	270	144
11	82	180	180	225	195	210	360	590	2,220	1,380	240	144
12	91	168	210	180	180	210	380	590	2,140	990	240	122
13	180	155	270	180	180	225	400	590	1,740	770	240	132
14	255	150	255	168	180	225	420	590	1,590	770	240	122
15	180	144	225	195	195	240	400	635	2,140	870	225	122
16	144	240	210	210	305	270	380	680	1,820	870	210	122
17	122	635	180	440	680	305	360	680	1,740	680	210	122
18	91	1,660	180	680	635	305	340	680	1,660	590	210	111
19	132	820	180	1,380	545	305	340	820	1,660	568	225	101
20	111	930	180	2,060	568	270	380	770	1,450	590	225	155
21	111	870	168	1,660	360	255	340	680	1,380	590	180	144
22	101	820	168	870	322	255	360	680	1,240	635	180	111
23	111	725	180	680	305	255	380	725	1,310	635	168	101
24	122	568	168	590	305	255	340	870	1,240	590	168	111
25	91	460	240	440	305	270	380	1,110	1,170	545	155	122
26	111	380	270	380	288	322	590	1,590	1,660	480	322	111
27	144	340	322	340	288	380	590	1,820	1,660	460	210	111
28	144	305	340	270	305	380	568	1,660	1,050	420	168	122
29	340	305	305	255	.....	380	545	1,380	990	420	155	132
30	635	305	255	255	.....	340	480	1,310	1,110	440	155	122
31	770	.....	225	255	.....	400	.....	1,740	.....	420	155	.....
1909–10.												
1	111	144	1,980	270	560	.....	585	990	2,060	750	290	124
2	101	3,330	1,310	233	485	.....	560	870	1,380	750	270	150
3	101	5,630	990	198	440	.....	535	930	1,110	690	270	150
4	91	1,820	750	198	395	.....	485	990	1,050	720	270	136
5	91	1,110	635	198	395	.....	485	990	1,380	690	270	136
6	168	770	610	198	395	.....	535	1,110	1,240	690	270	136
7	111	590	585	198	350	.....	560	1,660	1,050	690	350	111
8	111	680	560	198	310	.....	585	1,980	870	720	350	100
9	101	590	510	182	290	.....	635	2,140	930	750	440	100
10	101	568	418	182	270	.....	635	2,970	1,110	870	350	111
11	111	440	418	165	270	.....	810	2,540	2,300	750	270	100
12	101	400	1,660	165	252	.....	990	2,140	1,520	750	252	90
13	111	380	1,110	150	290	.....	870	1,820	1,110	870	233	100
14	101	322	870	150	270	930	750	1,520	1,110	585	233	100
15	101	288	720	136	252	1,240	720	1,310	1,110	560	198	100
16	91	270	585	136	233	1,310	750	1,170	1,170	560	165	111
17	82	270	560	111	198	1,740	810	1,240	990	535	150	136
18	82	3,830	510	150	198	1,590	930	1,660	930	510	150	111
19	91	4,330	462	150	198	1,900	1,170	1,520	1,240	510	165	111
20	132	2,140	418	150	198	1,450	1,820	1,170	1,050	510	165	136
21	155	1,240	372	198	182	1,740	1,520	1,170	870	510	198	165
22	122	3,830	350	810	165	1,660	1,310	1,380	750	485	182	182
23	111	7,500	330	2,060	182	1,380	1,520	1,980	720	372	150	150
24	168	4,130	310	1,980	290	1,240	2,140	2,380	750	350	136	136
25	122	2,220	310	1,240	462	1,110	2,620	2,140	870	395	136	111
26	111	1,380	290	930	440	810	2,700	1,740	930	372	136	111
27	101	870	290	750	510	750	1,900	1,740	930	330	136	100
28	101	1,240	290	635	440	635	1,660	1,310	870	310	136	111
29	111	4,750	252	585	.....	610	1,240	1,450	690	330	90	150
30	101	3,530	310	560	.....	585	1,050	1,590	750	310	124	182
31	111	...	290	635	.....	585	.....	1,820	.....	310	124	.....

Daily discharge, in second-feet, of Ohanapecosh River near Lewis, Wash., for the years ending Sept. 30, 1907–1914 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1910–11.												
1	330	288	340	192	114	58	480	585	2,210	870	260	154
2	198	221	530	179	97	58	480	700	2,050	870	225	140
3	1,980	255	640	154	97	63	408	820	1,430	1,050	260	140
4	1,010	221	670	166	97	69	340	1,220	1,150	1,110	225	128
5	880	221	585	166	97	69	295	1,290	760	1,050	225	167
6	880	340	530	206	97	75	255	880	880	1,240	225	115
7	1,010	2,930	585	295	89	82	238	700	1,010	1,110	210	154
8	820	1,150	585	255	89	82	238	612	940	870	195	128
9	760	1,080	585	255	89	82	275	612	1,080	755	181	176
10	480	1,860	505	221	89	82	295	530	1,360	650	195	225
11	408	2,650	362	192	82	82	295	480	2,130	650	181	203
12	362	1,500	295	179	82	75	238	505	2,620	700	181	181
13	295	940	238	154	82	75	221	530	2,460	650	167	238
14	295	700	255	143	82	75	192	480	2,140	810	167	295
15	295	585	255	143	75	97	206	530	1,170	810	167	378
16	275	430	221	143	75	123	206	820	1,660	930	154	460
17	1,010	340	206	154	75	166	221	820	1,520	755	154	398
18	530	295	206	154	75	206	255	880	1,380	650	154	335
19	480	275	192	154	75	221	238	820	1,240	575	167	298
20	340	585	192	133	75	340	238	700	1,110	505	154	260
21	295	1,440	179	123	75	385	340	760	1,110	460	140	251
22	255	2,290	166	114	75	430	385	940	1,380	375	140	242
23	238	1,570	255	105	69	760	430	760	1,050	355	140	212
24	430	1,010	340	105	69	670	585	640	810	375	140	181
25	760	700	295	105	75	430	1,010	640	810	395	140	174
26	430	585	295	97	75	385	760	505	870	355	140	167
27	340	530	275	97	69	362	640	505	1,450	295	140	154
28	318	385	238	97	69	255	505	530	1,110	278	140	140
29	295	385	192	89	.....	238	532	730	990	295	140	140
30	255	385	206	89	.....	255	559	1,150	870	278	140	140
31	238	.....	206	105	.....	340	.....	1,810	.....	260	140	.....
1911–12.												
1	140	84	482	172	650	218	335	528	1,210	.....	225	328
2	140	84	460	167	578	210	398	516	1,310	.....	225	395
3	140	84	438	160	505	202	460	505	1,280	.....	225	345
4	140	94	396	154	482	195	428	516	1,240	.....	210	295
5	128	104	355	154	460	181	395	528	1,570	.....	195	238
6	115	182	355	154	471	167	365	614	1,900	.....	195	181
7	115	260	355	151	482	167	335	700	2,020	.....	195	258
8	115	260	452	148	541	167	420	1,140	2,140	.....	202	335
9	115	260	550	155	600	162	505	1,590	1,800	.....	210	280
10	140	220	528	162	625	156	578	1,450	1,450	.....	210	225
11	134	181	505	238	650	148	650	1,310	1,560	.....	210	218
12	128	181	482	315	650	140	625	1,420	1,660	.....	202	210
13	134	181	460	988	650	139	600	1,520	1,590	.....	195	202
14	140	248	418	1,660	612	138	508	1,910	1,520	550	202	195
15	140	315	375	1,300	575	138	415	2,300	1,260	550	210	181
16	140	458	355	930	692	138	415	1,980	990	550	218	167
17	128	600	335	778	810	139	415	1,660	1,120	575	225	160
18	115	778	315	625	730	140	415	1,780	1,240	600	210	154
19	115	956	295	576	650	136	415	1,900	1,570	530	195	154
20	115	1,130	278	528	600	132	375	1,860	1,900	460	184	154
21	115	1,310	260	516	550	136	335	1,820	1,280	471	173	154
22	115	1,000	288	505	462	140	335	1,110	650	482	199	154
23	115	700	315	516	375	139	335	1,250	1,160	448	225	147
24	115	650	288	528	355	138	335	1,380	1,660	415	196	140
25	110	600	260	699	335	166	335	1,520	1,740	375	167	140
26	104	678	251	870	298	195	335	1,420	1,820	335	162	140
27	98	755	242	812	260	295	335	1,310	1,380	315	156	128
28	93	652	226	755	242	395	420	1,280	930	295	148	115
29	93	550	210	872	225	345	505	1,240	.....	278	140	115
30	93	516	194	990	.....	295	516	1,180	.....	260	200	115
31	88	.....	178	820	.....	315	.....	1,110	.....	242	260	.....

Daily discharge, in second-feet, of Ohanapecosh River near Lewis, Wash., for the years ending Sept. 30, 1907–1914 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	115	181	295	679	.....	.....	.....	483	2,380	1,820	612	140
2	115	174	422	763	.....	.....	.....	438	2,460	1,600	650	300
3	115	167	550	847	.....	.....	.....	449	2,540	1,380	638	460
4	115	196	462	930	.....	.....	.....	460	2,140	1,310	625	555
5	104	225	375	695	.....	.....	.....	482	1,740	1,240	520	650
6	93	280	335	460	.....	.....	.....	505	1,780	1,420	415	502
7	104	335	295	438	.....	.....	.....	1,010	1,820	1,590	438	355
8	115	788	286	415	.....	.....	.....	1,520	1,900	1,480	460	308
9	115	1,240	278	415	.....	.....	.....	1,380	1,980	1,380	438	260
10	115	1,140	286	415	.....	.....	.....	1,240	1,900	1,310	415	228
11	110	1,050	295	395	.....	.....	.....	1,120	1,820	1,240	405	195
12	104	1,440	295	375	.....	.....	.....	990	1,860	1,240	395	210
13	104	1,820	295	.....	.....	.....	.....	845	1,900	1,240	355	225
14	104	1,340	295	.....	.....	.....	575	700	1,600	1,120	315	208
15	104	870	295	.....	.....	.....	562	700	1,310	990	248	192
16	104	710	295	.....	.....	.....	550	700	1,340	990	181	186
17	122	550	295	.....	.....	.....	405	755	1,380	990	188	181
18	140	830	335	.....	.....	.....	260	810	1,600	1,120	195	154
19	147	1,110	375	.....	.....	.....	308	755	1,820	1,240	195	128
20	154	990	335	.....	.....	.....	355	700	1,900	1,380	195	148
21	174	870	295	.....	.....	.....	385	970	1,980	1,520	202	167
22	195	748	295	.....	.....	.....	415	1,240	2,180	1,480	210	145
23	181	625	295	.....	.....	.....	415	1,490	2,380	1,450	235	140
24	167	565	286	.....	.....	.....	415	1,740	2,220	1,280	260	128
25	181	505	278	.....	.....	.....	375	1,860	2,060	1,110	242	115
26	195	450	269	.....	.....	.....	335	1,980	1,900	932	225	115
27	202	395	260	.....	.....	.....	258	1,980	1,740	755	210	115
28	210	345	344	.....	.....	.....	181	1,980	1,700	702	195	128
29	202	295	428	.....	.....	.....	354	1,820	1,660	650	195	140
30	195	295	511	.....	.....	.....	528	1,660	1,740	612	195	126
31	188	.....	595	.....	.....	.....	.....	2,020	.....	575	168	.....
1913–14.												
1	113	.....	.....	167	.....	.....	.....	.....	.....	870	.....	.....
2	.....	295	460	.....	242	650	.....	.....	.....	.....	.....	93
3	104	.....	.....	167	.....	.....	375	.....	1,520	.....	.....	.....
4	.....	260	375	.....	225	438	.....	1,240	.....	.....	.....	.....
5	91	.....	.....	5,850	.....	.....	.....	.....	.....	.....	195	.....
6	.....	460	335	.....	210	375	755	.....	.....	.....	.....	.....
7	167	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8	.....	438	278	.....	181	375	.....	.....	.....	550	.....	95
9	140	.....	.....	.....	.....	.....	810	1,110	.....	.....	.....	82
10	.....	600	260	.....	181	375	.....	.....	505	.....	.....	.....
11	550	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	.....	460	260	.....	195	395	.....	.....	.....	.....	167	.....
13	990	.....	.....	550	.....	.....	1,310	1,520	.....	.....	.....	.....
14	.....	375	260	.....	195	755	.....	.....	810	.....	.....	.....
15	550	.....	.....	438	.....	.....	.....	.....	.....	415	.....	.....
16	.....	395	260	.....	195	810	1,240	.....	.....	.....	.....	128
17	460	.....	.....	395	.....	.....	.....	.....	.....	.....	.....	.....
18	.....	550	242	.....	181	755	.....	.....	.....	.....	.....	.....
19	438	.....	.....	335	.....	.....	.....	.....	.....	.....	128	.....
20	.....	460	225	.....	181	810	1,380	1,310	.....	.....	.....	.....
21	550	.....	.....	295	.....	.....	.....	.....	.....	260	.....	.....
22	.....	415	210	.....	242	700	.....	.....	.....	.....	.....	195
23	460	.....	.....	460	.....	.....	.....	.....	.....	.....	.....	.....
24	.....	990	181	.....	295	550	755	.....	700	.....	.....	.....
25	505	.....	.....	355	.....	.....	.....	.....	.....	.....	.....	.....
26	.....	700	167	.....	278	.....	.....	.....	.....	.....	113	.....
27	415	.....	.....	315	.....	395	700	870	.....	.....	.....	.....
28	.....	650	167	.....	460	.....	.....	.....	.....	.....	.....	.....
29	295	.....	.....	278	.....	335	.....	.....	.....	192	.....	128
30	.....	550	151	.....	.....	.....	550	.....	.....	.....	.....	.....
31	295	.....	.....	278	.....	335	.....	.....	.....	.....	.....	.....

Daily discharge, in second-feet, of Ohanapecosh River near Lewis, Wash., for the years ending Sept. 30, 1907–1914 and 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.												
1	77	870									1,240	
2			270					930	990			522
3												
4				204								
5	86	305								1,980	1,170	305
6			480				305	1,980	1,310			
7										1,820		
8	70	340		179							1,240	
9								990	2,220			270
10			680							2,220		
11	58			146			635					
12									2,060		1,110	235
13		235	400					680		2,300		
14											1,050	
15	77	288							3,060			
16			340					770				201
17							680					
18	75									1,660		
19											500	198
20		820	252					1,240	1,740			
21										1,520		
22	77	725					680				500	
23								1,050	1,900			173
24			590				635					
25	568									1,380		
26											568	158
27		322						870	1,900			
28			305									
29	340	288					930			1,170	545	
30			252					870	1,660			129
31												

NOTE.—Discharge Aug. 19, 1907, to Sept. 30. 1914, revised since publication in Water-Supply Papers 312, 332, 362, and 394. Daily discharge ascertained as follows: Aug. 19, 1907, to Nov. 22, 1909, and Nov. 23, 1909, to Oct. 3, 1910, from rating curves well defined above and fairly well defined below 150 second-feet; Oct. 4, 1910, to June 11, 1911, from rating curve fairly well defined above and poorly defined below 200 second-feet, June 12, 1911, to Sept. 30, 1914, from rating curve well defined above and fairly well defined below 100 second-feet; Oct. 1, 1915, to Sept. 30, 1916, from well-defined rating curve. Discharge for periods when gage was not read estimated by comparison with flow of Cowlitz River at Lewis as follows: Nov. 24 to Dec. 1, 1907, 1,100 second-feet; Nov. 23, 1909 (water over gage), 7,500 second-feet; Mar. 1–6, 1910, 1,100 second-feet; Mar. 7–13, 1910, 600 second-feet. Gage readings June 30 and July 6 to 12, 1912, apparently in error one foot, discharge estimated from corrected gage heights, after comparison with record of flow of adjacent streams, as follows: June 29–30, 800 second-feet; July 1–6, 700 second-feet; July 7–13, 600 second-feet. Gage height Jan. 5, 1914, estimated by observer, gage washed out. Discharge interpolated for other days when gage was not read. Gage read daily prior to September, 1911, and every second day from September, 1911, to September, 1913. Revised records good except for low water during winter of 1910–11, extremely low water during other years, and periods when discharge was estimated by comparison with adjacent streams, when they are only fair.

Monthly discharge of Ohanapecosh River near Lewis, Wash., for the years ending Sept. 30, 1907–1913.

[Drainage area, 116 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.
1907.						
August 19–31	210	111	146	1.26	0.61	3,770
September	340	111	146	1.26	1.41	8,690
1907–8.						
October	155	91	100	.862	0.99	6,150
November	----------	91	372	3.21	3.58	22,100
December	1,450	255	571	4.92	5.67	35,100
January	340	132	243	2.09	2.41	14,900
February	305	132	204	1.76	1.90	11,700
March	3,730	155	650	5.60	6.46	40,000
April	2,300	255	736	6.34	7.07	43,800
May	1,450	500	883	7.61	8.77	54,300
June	2,620	770	1,510	13.0	14.50	89,800
July	2,460	420	1,360	11.7	13.49	83,600
August	460	144	251	2.16	2.49	15,400
September	144	72	119	1.03	1.15	7,080
The year	3,730	72	584	5.03	68.48	424,000
1908–9.						
October	770	72	160	1.38	1.59	9,840
November	1,660	111	474	4.09	4.56	28,200
December	340	168	223	1.92	2.21	13,700
January	2,060	168	468	4.03	4.65	28,800
February	680	180	303	2.61	2.72	16,800
March	400	210	273	2.35	2.71	16,800
April	590	288	402	3.47	3.87	23,900
May	1,820	480	927	7.99	9.21	57,000
June	3,060	990	1,700	14.7	16.40	101,000
July	1,520	420	822	7.09	8.17	50,500
August	400	155	237	2.04	2.35	14,600
September	195	101	140	1.21	1.35	8,330
The year	3,060	72	511	4.41	59.79	369,000
1909–10.						
October	168	82	110	.948	1.09	6,760
November	7,500	144	1,950	16.8	18.74	116,000
December	1,980	252	615	5.30	6.11	37,800
January	2,060	111	448	3.86	4.45	27,500
February	560	165	319	2.75	2.86	17,700
March	----------	----------	1,030	8.88	10.24	63,300
April	2,700	485	1,100	9.48	10.58	65,500
May	2,970	870	1,590	13.7	15.79	97,800
June	2,300	690	1,090	9.40	10.49	64,900
July	870	310	566	4.88	5.63	34,800
August	440	90	215	1.85	2.13	13,200
September	182	90	125	1.08	1.20	7,440
The year	7,500	82	764	6.59	89.31	553,000
1910–11.						
October	1,980	198	532	4.59	5.29	32,700
November	2,930	221	870	7.50	8.37	51,800
December	670	166	343	2.96	3.41	21,100
January	295	89	154	1.33	1.53	9,470
February	114	69	82.5	.711	.74	4,580
March	760	58	216	1.86	2.14	13,300
April	1,010	192	379	3.27	3.65	22,600
May	1,810	480	758	6.53	7.53	46,600
June	2,620	760	1,360	11.7	13.05	80,900
July	1,240	260	656	5.66	6.52	40,300
August	260	140	174	1.50	1.73	10,700
September	460	115	212	1.83	2.04	12,600
The year	2,930	58	479	4.13	56.00	347,000

Monthly discharge of Ohanapecosh River near Lewis, Wash., for the years ending Sept. 30, 1907–1913—Continued.

Month.	Discharge in Second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1911–12.						
October	140	88	120	1.03	1.19	7,380
November	1,310	84	469	4.04	4.51	27,900
December	550	178	352	3.03	3.49	21,660
January	1,660	148	561	4.84	5.58	34,500
February	810	225	521	4.49	4.84	30,000
March	395	132	186	1.60	1.84	11,400
April	650	335	428	3.69	4.12	25,500
May	2,300	505	1,300	11.2	12.91	79,900
June	2,140	.....	1,420	12.2	13.61	84,500
July	.....	242	520	4.48	5.16	32,000
August	260	140	199	1.72	1.98	12,200
September	395	115	201	1.73	1.93	12,000
The year	2,300	84	522	4.50	61.16	379,000
1912–13.						
October	210	93	142	1.22	1.41	8,730
November	1,820	167	684	5.90	6.58	40,700
December	595	260	340	2.93	3.38	20,900
January 1–12	930	375	569	4.91	2.19	13,500
April 14–30	575	181	393	3.39	2.14	13,300
May	2,020	438	1,120	9.66	11.14	68,900
June	2,540	1,310	1,890	16.3	18.19	112,000
July	1,820	575	1,200	10.3	11.87	73,800
August	650	168	330	2.84	3.27	20,300
September	650	115	230	1.98	2.21	13,700

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 1½ miles below Lake Creek, in Lewis County.

DRAINAGE AREA.—275 square miles (measured on Pl. I, Water-Supply Paper 313).

RECORDS AVAILABLE.—July 1, 1911, to September 30, 1916.

GAGE.—Vertical staff bolted to solid rock on left bank 40 feet above suspension bridge; installed May 3, 1915; read by J. L. Jennings, William Sethe, and E. R. Voorhies. 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; likely to shift. 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 measurements made August 29, 1915, gage height −1.80 feet ±0.3 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.1 feet July 2 (discharge, 11,600 second-feet); minimum stage recorded, 0.39 foot October 12 (discharge, 360 second-feet).

1911–1916.—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 June 14–16. Rating curve used before change well defined below 8,000 second-feet; after change, fairly well defined. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage heights to rating table; shifting-control method used June 14–16. Records prior to June 14 excellent; subsequent to that date, 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, 1916.

[Made by J. T. Hartson.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 13	4.45	5,780
16	5.70	8,420
17	6.24	9,500

Daily discharge, in second-feet, of Cowlitz River at Lewis, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	654	2,290	942	960		1,420	1,860	2,940	2,440	4,550	2,580	1,330
2	1,040	1,860	883	883		1,320	1,860	3,310	2,770	11,600	2,420	1,390
3	861	1,420	1,170	920		1,270	2,000	4,750	3,500	8,920	2,580	1,170
4	683	1,220	1,480	846	850	1,120	2,140	4,530	4,530	5,880	2,420	1,220
5	504	1,220	1,510	811		1,080	2,140	4,970	3,900	4,550	2,420	930
6	443	960	1,540	776		1,080	2,000	5,410	3,500	4,120	2,110	870
7	424	920	1,990	744	920	1,040	2,000	4,110	3,900	4,330	2,110	810
8	407	811	2,440	712	1,000	1,540	2,290	3,500	4,750	6,340	2,420	850
9	390	744	2,440	712	1,220	6,540	2,440	3,120	5,410	5,780	2,110	770
10	360	712	2,000	683	2,440	5,410	2,600	2,600	3,900	5,210	2,110	735
11	360	683	1,680	654	2,140	4,750	2,770	2,290	3,500	5,880	2,340	700
12	360	654	1,370	654	1,660	4,750	2,440	2,140	3,900	7,030	2,580	735
13	654	600	1,220	654	1,760	4,110	2,290	2,000	5,410	6,110	2,260	700
14	712	575	1,120	600	1,860	3,120	2,440	2,000	6,340	4,550	2,260	668
15	575	654	1,000	654	3,310	2,600	2,440	2,140	7,360	4,550	1,970	668
16	443	683	960	654	3,900	2,440	2,290	2,440	9,270	5,650	1,640	668
17	443	1,120	920	600	3,500	2,290	2,140	2,940	9,640	5,650	1,450	700
18	443	1,170	920	600	3,120	2,290	2,140	3,120	8,920	3,910	1,220	700
19	462	4,320	884	592	2,770	3,200	1,800	3,500	6,340	3,300	1,120	668
20	424	2,440	846	583	2,600	4,110	1,860	3,120	4,550	4,120	1,020	700
21	443	2,290	1,480	575	2,440	4,110	1,730	2,940	3,300	4,330	1,170	700
22	443	2,140	3,500	654	2,440	3,500	1,660	2,770	3,110	3,700	1,280	668
23	776	2,290	2,440	1,170	2,140	2,770	1,600	2,440	4,330	3,300	1,450	635
24	654	1,660	2,000	1,220	2,000	2,600	1,540	2,290	5,210	3,300	1,640	605
25	2,440	1,730	1,730	1,000	1,860	2,440	1,860	2,290	5,210	2,930	1,700	575
26	1,860	1,540	1,480	920	1,860	2,440	2,140	2,290	6,340	2,420	1,510	635
27	1,420	1,270	1,320	846	1,860	2,290	2,290	2,600	5,650	2,420	1,390	635
28	1,220	1,160	1,220	811	1,730	2,080	2,770	2,940	4,550	2,420	1,450	575
29	920	1,040	1,170	744	1,540	1,860	1,860	2,770	3,700	2,420	1,450	605
30	846	1,000	1,080	744	.....	1,730	2,440	2,600	3,700	2,860	1,390	546
31	5,410	.....	1,000	712	.....	1,800	.....	2,600	.....	3,300	1,390	.....

NOTE.—Gage not read Feb. 1–6; discharge estimated by comparison with record of flow at Mossy Rock. Discharge interpolated one to three days in each month (gage not read).

Monthly discharge of Cowlitz River at Lewis, Wash., for the year ending Sept. 30, 1916.

[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	5,410	360	873	3.17	3.66	53,700
November	4,320	575	1,370	4.98	5.56	81,500
December	3,500	846	1,480	5.38	6.20	91,000
January	1,220	575	764	2.78	3.20	47,000
February	3,900	.....	1,900	6.91	7.45	109,000
March	6,540	1,040	2,680	9.75	11.24	165,000
April	2,770	1,540	2,130	7.75	8.65	127,000
May	5,410	2,000	3,010	10.9	12.57	185,000
June	9,640	2,440	4,960	18.0	20.08	295,000
July	11,600	2,420	4,690	17.1	19.71	288,000
August	2,580	1,020	1,840	6.69	7.71	113,000
September	1,390	546	772	2.81	3.14	45,900
The year	11,600	360	2,210	8.04	109.17	1,600,000

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 2½ 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, 1916 (fragmentary).

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, 14.6 feet at 7 p. m. June 18 (discharge, 23,500 second-feet); minimum stage recorded, 1.40 feet October 10–13 (discharge, 825 second-feet).

1912–1916: 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 October 10-13, 1915.

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed June 18. Rating curve for period before change well defined below 14,000 second-feet; for period after change, well defined below 8,000 second-feet. Gage read to half tenths once daily. Daily discharge ascertained by applying daily gage heights to rating table. Records good except for extremely high water.

Discharge measurements of Cowlitz River at Mossy Rock, Wash., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 30	C. G. Paulsen	4.69	5,210	Dec. 9	C. O. Brown	7.75	10,600
Dec. 1	do	4.46	4,780	10	do	7.15	9,690

Daily discharge, in second-feet, of Cowlitz River at Mossy Rock, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,220	5,670	4,780	4,260	2,330	5,670	7,470	8,930	8,010	10,300	6,440	3,310
2	1,300	3,920	4,260	3,920	2,210	5,490	7,470	9,360	8,190	10,900	6,260	3,310
3	1,610	3,600	5,670	3,600	2,210	5,310	7,470	12,600	8,380	22,700	6,080	3,310
4	1,400	3,290	6,210	3,290	2,330	5,000	7,470	13,700	12,300	17,900	5,360	3,310
5	1,300	2,720	6,390	3,140	2,460	4,600	7,470	14,700	11,900	15,900	5,360	3,160
6	1,220	2,720	6,750	3,000	2,460	4,430	7,290	14,800	11,000	13,100	5,360	2,870
7	1,130	2,460	6,930	2,860	2,590	4,600	7,110	15,400	11,200	11,600	5,360	2,460
8	975	2,460	8,380	2,860	3,920	7,470	7,290	12,400	11,700	11,800	5,360	2,590
9	862	2,210	10,800	2,720	5,310	12,100	7,470	10,800	12,600	12,400	5,540	2,460
10	825	2,090	9,480	2,460	9,300	16,700	7,830	9,300	13,000	13,300	5,360	2,330
11	825	2,210	7,830	2,330	9,670	16,700	8,190	8,560	10,800	13,300	5,360	2,210
12	825	1,970	6,570	2,210	10,000	16,300	8,740	7,650	10,000	13,300	5,180	2,090
13	825	1,970	6,030	2,210	8,380	14,800	8,380	7,470	12,800	13,300	5,360	1,970
14	1,300	1,850	5,310	2,210	9,300	13,600	8,010	7,470	14,800	12,400	5,000	1,740
15	1,730	2,090	4,780	2,330	10,800	11,200	8,190	7,470	16,000	10,100	4,820	1,630
16	1,220	2,210	4,600	2,330	14,300	9,860	7,650	7,290	19,200	12,200	4,640	1,520
17	1,130	2,460	4,260	2,210	15,200	8,930	7,290	7,470	20,300	11,800	3,960	1,520
18	1,050	4,600	4,090	2,210	13,600	8,380	7,110	8,190	23,000	10,500	3,470	1,420
19	975	7,830	3,920	2,210	12,600	8,380	6,930	8,930	21,700	9,780	3,310	1,420
20	900	9,300	3,760	2,210	12,300	11,200	6,570	9,860	16,600	8,660	3,160	1,420
21	1,050	8,010	6,030	2,090	11,200	14,800	6,390	9,300	12,400	8,660	3,010	1,420
22	1,050	8,380	20,900	2,090	10,200	14,100	6,210	9,120	9,960	8,660	2,870	1,420
23	1,130	8,740	14,800	2,210	9,300	11,900	6,030	8,190	8,660	8,300	3,010	1,420
24	1,300	9,120	12,300	3,600	8,560	11,200	5,850	7,830	9,780	7,740	3,310	1,420
25	1,850	8,560	9,860	3,000	7,650	10,600	6,030	7,470	12,900	7,560	3,310	1,420
26	2,460	8,010	8,560	3,140	7,470	13,900	6,570	7,470	13,300	6,820	3,310	1,520
27	3,000	6,750	7,110	2,860	7,110	11,700	7,470	7,650	13,300	6,260	3,310	1,520
28	2,460	5,850	6,570	2,720	6,570	10,000	8,380	8,010	13,100	5,900	3,310	1,520
29	2,330	5,670	6,570	2,460	6,210	9,300	8,560	8,380	10,500	5,900	3,310	1,630
30	2,210	5,130	5,130	2,090	.....	8,930	8,380	8,380	10,300	5,900	3,310	1,630
31	2,210	.....	4,600	2,090	.....	8,190	.....	8,010	.....	6,820	3,310	.....

NOTE.—Gage not read Nov. 25; discharge interpolated.

Monthly discharge of Cowlitz River at Mossy Rock, Wash., for the year ending Sept. 30, 1916.

[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	3,000	825	1,410	1.21	1.40	86,700
November	9,300	1,850	4,730	4.04	4.51	281,000
December	20,900	3,760	7,200	6.15	7.09	443,000
January	4,260	2,090	2,660	2.27	2.62	164,000
February	15,200	2,210	7,780	6.65	7.17	448,000
March	16,700	4,430	10,200	8.72	10.05	627,000
April	8,740	5,850	7,380	6.31	7.04	439,000
May	15,400	7,290	9,420	8.05	9.28	579,000
June	23,000	8,010	12,900	11.00	12.27	768,000
July	22,700	5,900	10,800	9.23	10.64	664,000
August	6,440	2,870	4,390	3.75	4.32	270,000
September	3,310	1,420	2,030	1.74	1.94	121,000
The year	23,000	825	6,730	5.75	78.33	4,890,000

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 Pl. I, Water-Supply Paper 313).

RECORDS AVAILABLE.—August 20, 1907, to September 30, 1916.

GAGE.—Vertical staff on right bank 350 feet above bridge; read by J. L. Jennings. 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 September 9, 1913, gage height -1.0 ± 0.1 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.65 feet at 4.50 p. m. June 15 (discharge, 1,370 second-feet); minimum stage recorded, 1.25 feet October 1 (discharge, 50 second-feet).

1907–1916: 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 well defined. Gage read to hundredths. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent.

COOPERATION.—Gage-height record furnished by Portland Railway, Light & Power Co.

The following discharge measurement was made by J. T. Hartson:

June 15: Gage height, 4.58 feet; discharge, 1,310 second-feet.

Daily discharge, in second-feet, of Clear Fork near Lewis, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Apr.	May	June.	July.	Aug.	Sept.
1	50	383							474	
2			150			383	418			230
3										
4				150						
5	81	219						880	400	188
6			278		266	880	600			
7								756		
8	59	150		108					418	
9						436	880			168
10			304					880		
11	52			82	455					
12		108							366	150
13			198			304	816	880		
14									350	
15	54	132					1,330			
16			159			334				132
17					319					
18	64							648	230	
19										124
20		418	115			514	816			
21								600		
22	68	350			242				230	
23						400	756			115
24			291		208					
25	304							535		
26							1,020		230	119
27		198					756			
28			198			400				
29	150	150			400			436	230	
30						334	648			108
31			150							

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, 1916.

GAGE.—Vertical staff spiked to cedar tree on right bank, 32 feet upstream from weir and 500 feet below outlet; read by J. L. Jennings. Zero of gage at elevation of crest of weir.

DISCHARGE MEASUREMENTS.—Made from foot bridge 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, 4.00 feet, morning reading, June 18 (discharge, 582 second-feet); minimum stage recorded, 0.57 foot October 21 and 22 (discharge, 36 second-feet).

1911–1916: Maximum stage recorded June 18, 1916; minimum stage recorded, 0.48 foot February 26 to March 3, 1915 (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 heights to rating table. Records good except for extremely low water.

COOPERATION.—Gage-height record furnished by Portland Railway, ight & Power Co.

The following discharge measurement was made by Hartson and Jennings:
June 14: Gage height, 2.22 feet; discharge, 253 second-feet.

Daily discharge, in second-feet, of Lake Creek at outlet of Packwood Lake, near Lewis, Wash., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	37	77	74	70	48	82	94	112	124	244	166	118
2	49	88	70	73	51	82	88	118	124	332	159	118
3	68	88	68	73		82	88	138	124	462	159	118
4	64	88	82	68		82	94	173	152	422	159	124
5	56	88	94	64	60	82	94	204	166	350	152	112
6	52	82	94	62		77	88	228	166	296	145	106
7	50	77	94	60		82	88	244	166	278	145	100
8	44	76	100	59	73	88	94	228	180	296	152	94
9	42	73	106	58	77	100	94	204	204	314	152	94
10	38	67	106	56	82	112	100	196	212	314	152	94
11	38	64	100	55	88	138	106	166	204	296	145	88
12	38	62	94	54	82	152	106	152	196	314	152	88
13	40	60	88	53	76	173	106	138	212	332	152	77
14	48	58	88	52	73	166	106	124	244	296	152	73
15	45	59	82	51	73	159	106	118	314	278	152	70
16	42	62	77	46	77	145	106	112	404	296	145	67
17	39	68	75	45	82	124	106	112	502	314	138	64
18	38	77	73	43	88	118	106	124	562	296	124	62
19	38	124	70	43	88	112	100	138	462	278	118	61
20	38	145	68	45	88	131	100	145	368	244	106	61
21	36	138	94	47	88	152	100	145	296	244	100	60
22	36	138	152	49	94	159	94	145	260	228	94	60
23	40	152	152	51	100	152	88	138	228	228	100	58
24	42	138	138	51	100	138	88	131	244	212	106	56
25	49	138	131	51	94	138	82	124	260	204	112	60
26	54	131	124	52	88	138	88	118	278	188	112	64
27	56	124	106	51	88	131	100	124	314	173	112	69
28	56	112	100	49	88	124	112	124	314	166	118	66
29	55	100	94	47	88	112	118	131	278	166	118	65
30	52	94	75	47	.....	106	118	131	244	152	124	60
31	63	.....	70	47	.....	100	.....	131	.....	159	124	.....

NOTE.—Gage not read Feb. 3–7; discharge estimated.

Monthly discharge of Lake Creek at outlet of Packwood Lake, near Lewis, Wash., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	68	36	46.5	2,860
November	152	58	94.9	5,650
December	152	68	94.8	5,830
January	73	43	53.9	3,310
February	100	48	78.4	4,510
March	173	77	121	7,440
April	118	82	98.6	5,870
May	244	112	149	9,160
June	562	124	260	15,500
July	462	152	270	16,600
August	166	94	134	8,240
September	124	56	80.2	4,770
The year	562	36	124	89,700

YOUNGS RIVER BASIN.

YOUNGS RIVER NEAR ASTORIA, OREG.

LOCATION.—In NE. ¼ 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 to September 30, 1916.

GAGE.—Vertical staff on right bank opposite cook house.

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 March 7 to September 30, 7.6 feet at 8 a. m. March 8; minimum stage, 2.30 feet September 1, 2, 6 to 8, 11 to 25, and 28 to 30.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Gage read to hundredths once daily. Rating curve not developed, owing to lack of discharge measurements.

The following discharge measurement was made by C. L. Batchelder:
August 8, 1916: Gage height, 2.50 feet; discharge, 23.2 second-feet.

Daily gage height, in feet, of Youngs River near Astoria, Oreg., for the year ending Sept. 30, 1916.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	3.55	3.20	2.95	2.70	.....	2.30
2	.....	3.40	3.10	2.80	2.65	.....	2.30
3	.....	3.30	3.00	2.80	2.62	.....	2.40
4	.....	3.30	3.00	2.80	2.50	.....	2.45
5	.....	3.28	3.00	2.85	2.50	.....	2.40
6	.....	3.20	3.35	2.72	2.45	.....	2.30
7	6.70	3.12	3.30	2.70	2.40	.....	2.30
8	7.40	3.10	4.10	2.70	2.40	2.50	2.30
9	5.85	3.10	4.20	2.78	2.50	.....	2.45
10	4.90	3.10	4.05	2.70	2.50	.....	2.40
11	4.45	3.30	3.85	2.68	2.50	.....	2.30
12	4.25	3.25	3.50	2.60	2.50	.....	2.30
13	3.95	3.10	3.50	2.58	2.50	.....	2.30
14	3.80	3.15	3.35	2.50	2.50	.....	2.30
15	3.65	3.15	3.30	2.50	2.50	.....	2.30
16	3.55	3.10	3.20	2.50	3.15	.....	2.30
17	3.52	3.50	3.10	2.50	3.55	.....	2.30
18	3.42	4.05	3.10	2.50	3.40	.....	2.30
19	3.60	3.90	3.00	2.65	3.00	.....	2.30
20	4.55	4.25	3.00	2.80	3.85	.....	2.30
21	5.60	3.85	3.10	2.75	3.75	.....	2.30
22	5.05	3.65	3.35	2.70	3.60	.....	2.30
23	4.45	3.48	3.20	2.62	3.70	.....	2.30
24	4.20	3.38	3.00	2.50	3.38	.....	2.30
25	7.05	3.35	3.00	2.50	2.88	.....	2.30
26	7.40	3.45	2.90	2.58	2.80	.....	2.40
27	5.35	3.30	2.80	2.70	2.70	.....	2.45
28	4.60	3.38	2.90	2.80	2.55	.....	2.30
29	4.18	3.30	3.00	2.78	2.50	.....	2.30
30	3.85	3.30	3.05	2.80	2.60	.....	2.30
31	3.65	.....	3.00	.....	2.85	.....	2.30

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, 1916.

GAGE.—Vertical staff on right bank about 100 feet above power house; read by Charles A. Lower.

DISCHARGE MEASUREMENTS.—Made from cable about 500 feet above gage.

CHANNEL AND CONTROL.—Control of large boulders; practically permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.9 feet March 20 (discharge, 2,870 second-feet); minimum stage recorded, 2.3 feet October 1 to 3, 5, 9, and 10 (discharge, 400 second-feet).

1913–1916: Maximum stage recorded, 5 feet at noon April 15, 1914 (discharge, 3,000 second-feet); minimum stage recorded, 2.3 feet September 30 to October 3, October 10, and November 7, 1915 (discharge 400 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 the quantity diverted.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve is well defined between 400 and 3,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

The following discharge measurement was made by C. L. Batchelder:
June 19, 1916: Gage height, 4.05 feet; discharge, 1,860 second-feet.

Daily discharge, in second-feet, of Rouge River below Prospect, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	400	430	700	595	532	1,300	1,690	1,800	1,300	1,360	700	560
2	400	430	665	532	532	1,150	1,690	2,020	1,420	1,740	700	560
3	400	430	780	560	560	1,100	1,690	2,250	1,580	1,470	700	700
4	415	430	1,050	532	560	1,050	1,690	2,490	1,740	1,360	700	560
5	400	430	950	505	560	1,050	1,580	2,490	1,800	1,360	665	560
6	415	430	2,020	505	860	1,100	1,580	2,610	1,800	1,250	630	560
7	415	400	1,580	505	2,020	1,050	1,640	2,250	1,910	1,250	630	560
8	415	430	1,250	485	1,910	950	1,800	2,130	2,020	1,250	630	532
9	400	430	1,300	485	1,580	950	1,800	2,020	2,020	1,200	630	560
10	400	430	1,050	485	1,910	1,100	2,250	1,800	1,910	1,150	630	560
11	415	430	950	448	1,910	1,360	2,490	1,740	1,800	1,150	630	560
12	415	430	820	448	1,640	1,640	2,020	1,690	1,800	1,150	630	560
13	430	430	860	448	1,520	1,640	1,910	1,580	1,800	1,150	630	532
14	430	430	780	448	1,470	1,520	1,910	1,580	1,800	1,100	630	532
15	430	430	700	430	1,690	1,470	1,910	1,580	2,020	1,050	700	560
16	430	560	630	448	1,910	1,470	1,800	1,690	2,020	1,300	630	560
17	415	465	630	465	2,020	1,580	1,800	1,740	2,020	1,360	630	560
18	415	630	595	465	2,250	1,800	1,800	1,800	1,910	1,200	700	532
19	415	560	560	465	2,020	2,020	1,580	1,910	1,800	1,050	630	532
20	415	630	595	465	2,020	2,870	1,520	1,910	1,690	1,100	630	532
21	415	950	630	465	1,910	2,490	1,740	1,800	1,580	1,050	630	532
22	415	595	665	465	2,020	2,250	1,690	1,740	1,420	1,000	595	532
23	485	905	780	532	1,800	2,020	1,640	1,640	1,360	905	595	532
24	448	700	700	1,000	1,740	1,800	1,800	1,580	1,300	905	595	532
25	430	1,050	740	950	1,640	1,690	2,020	1,520	1,300	860	560	532
26	430	1,200	665	740	1,580	1,690	2,020	1,470	1,580	860	560	532
27	415	780	595	595	1,580	2,020	2,130	1,520	1,520	740	560	532
28	415	595	665	560	1,360	1,800	2,020	1,640	1,360	740	560	532
29	415	950	560	532	1,360	1,690	1,800	1,580	1,420	740	630	532
30	415	905	430	532	.....	1,580	1,800	1,520	1,360	700	595	532
31	415	.....	560	532	.....	1,580	.....	1,470	.....	700	560	.....

Monthly discharge of Rogue River below Prospect, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	485	400	418	25,700
November	1,200	400	596	35,500
December	2,020	430	821	50,500
January	1,000	430	536	33,000
February	2,250	532	1,530	88,000
March	2,870	950	1,570	96,500
April	2,490	1,520	1,830	109,000
May	2,610	1,470	1,820	112,000
June	2,020	1,300	1,680	100,000
July	1,740	700	1,100	67,600
August	700	560	612	37,600
September	700	532	550	32,700
The year	2,870	400	1,090	788,000

Combined monthly discharge of Rogue River and California-Oregon Power Co.'s flume near Prospect, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	642	557	571	35,100
November	1,370	544	763	45,400
December	2,190	600	1,000	61,500
January	1,170	600	705	43,300
February	2,420	702	1,710	98,400
March	3,050	1,130	1,750	108,000
April	2,690	1,700	2,020	120,000
May	2,780	1,640	2,000	123,000
June	2,220	1,480	1,870	111,000
July	1,920	870	1,280	78,700
August	870	730	783	48,100
September	870	689	719	42,800
The year	3,050	544	1,260	915,000

ROGUE RIVER NEAR TOLO, OREG.

LOCATION.—In sec. 18, T. 36 S., R. 2 W., at Raygold, just below dam and power house of California-Oregon Power Co., 1¼ miles below Tolo, 7 miles above Gold Hill, and half a mile below mouth of Bear Creek.

DRAINAGE AREA.—2,020 square miles.

RECORDS AVAILABLE.—August 30, 1905, to September 30, 1916.

GAGE.—Friez water-stage recorder referred to vertical staff bolted to concrete pier of bridge near right bank. Gage reader, F. H. Farrar.

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, 9.15 feet at 1 a. m. February 7 (discharge, 20,600 second-feet); minimum stage estimated from water-stage recorder graph, −0.2 foot October 6 to 9 and 11 to 13 (discharge, about 460 second-feet). Recorder does not work below stages of +0.1 foot; During low-water period water goes below this stage for an hour or so each day after power plant is shut down.

1905-1916: Maximum stage recorded, 20.0 feet at 7.30 a. m., November 23, 1909 (discharge, estimated by extension of rating curve, 60,000 second-feet); minimum stage recorded in October, 1915.

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.—State-discharge relation practically permanent. Rating curve well defined between 800 and 6,000 second-feet. Operation of water-stage recorder satisfactory except January 17 to 20, May 23 to June 5, June 21 to July 16, July 26 to August 28, and September 24 to 30. Daily discharge ascertained by use of discharge integrator for period for which record was satisfactory; for other times, by applying to the rating table the reading at 6 a. m., which gives fairly closely the mean for the day. Records excellent except as follows: June and July, good; August, fair.

Discharge measurements of Rogue River near Tolo, Oreg., during the year ending Sept. 30, 1916.

[Made by C. L. Batchelder.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
April 18	3.30	4,280
June 16	2.80	3,570

Daily discharge, in second-feet, of Rogue River near Tolo, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,000	1,190	2,410	1,650	2,220	3,800	4,200	3,570	2,580	2,300	1,540	1,170
2	1,050	1,120	2,150	1,680	2,740	3,560	4,100	3,710	2,580	2,300	1,590	1,170
3	1,040	1,150	2,130	1,670	5,600	3,450	3,900	3,990	2,580	2,440	1,440	1,350
4	1,040	1,200	2,670	1,650	5,670	3,570	3,750	4,330	2,580	2,440	1,350	1,350
5	1,040	1,190	3,170	1,640	4,840	4,860	3,600	4,600	3,340	2,300	1,260	1,280
6	1,030	1,170	5,800	1,830	8,260	3,840	3,450	5,100	3,100	2,180	1,260	1,260
7	1,010	1,160	4,560	1,720	15,800	3,590	3,400	4,770	3,150	2,180	1,260	1,340
8	1,010	1,150	3,250	2,260	12,100	3,360	3,470	4,240	3,370	2,180	1,260	1,190
9	1,040	1,160	2,950	2,370	10,600	3,500	3,630	4,250	3,430	2,180	1,170	1,200
10	990	1,140	2,640	2,080	11,800	3,600	4,470	3,710	3,200	2,060	1,170	1,300
11	990	1,130	2,400	1,880	10,300	3,780	8,400	3,490	3,050	2,060	1,170	1,270
12	1,010	1,200	2,240	1,770	8,000	4,040	5,820	3,310	2,970	1,950	1,170	1,270
13	1,020	1,160	2,670	1,880	6,480	4,020	4,800	3,190	3,020	1,950	1,260	1,270
14	1,080	1,150	2,640	1,770	6,640	3,770	4,480	3,130	3,100	1,840	1,170	1,270
15	1,000	1,190	2,300	1,700	7,730	3,550	4,340	3,020	3,180	1,840	1,170	1,270
16	981	1,460	2,050	1,720	7,970	3,540	4,000	3,080	3,260	1,950	1,260	1,430
17	962	1,400	2,000	1,740	8,080	3,650	4,500	3,170	3,340	2,530	1,260	1,310
18	1,040	1,450	1,900	2,060	8,160	3,810	4,130	3,470	3,370	2,100	1,260	1,240
19	1,000	1,440	1,820	2,060	7,410	4,260	4,000	3,680	3,360	1,870	1,260	1,240
20	1,000	1,340	1,730	1,540	6,680	5,900	3,600	3,580	3,280	1,800	1,260	1,230
21	1,010	1,930	1,800	1,570	6,400	6,000	3,790	3,380	3,180	1,750	1,260	1,220
22	1,020	1,670	1,840	1,960	6,160	5,600	3,990	3,440	3,020	1,650	1,260	1,240
23	990	1,630	2,000	6,480	5,760	5,570	3,840	3,360	2,720	1,640	1,260	1,240
24	1,070	2,000	2,090	11,500	5,170	4,800	3,690	3,260	2,580	1,620	1,260	1,260
25	1,080	2,990	2,190	9,100	4,770	4,850	3,850	3,190	2,440	1,560	1,260	1,260
26	1,100	4,210	2,140	4,970	4,550	4,900	4,080	3,100	2,440	1,640	1,260	1,170
27	1,090	3,530	1,830	3,530	4,430	7,070	4,160	3,020	2,720	1,640	1,260	1,170
28	1,070	2,860	1,830	2,890	4,150	6,410	4,100	2,870	2,580	1,590	1,260	1,170
29	1,100	2,180	1,930	2,500	3,860	5,400	3,800	2,870	2,300	1,540	1,220	1,170
30	1,090	2,940	1,680	2,320	.....	4,750	3,510	2,720	2,300	1,540	1,220	1,170
31	1,070	.....	1,490	2,120	.....	4,270	.....	2,720	.....	1,540	1,170	.....

NOTE.—Daily discharge ascertained by use of integrator except as follows: Oct. 15, 17, 24; 25, Nov. 26, Dec. 6, 18, Jan. 5, 23–25; Feb. 6, 8–13, Apr. 30, June 13, 17, and Aug. 29 to Sept. 10, by applying to rating table mean gage height obtained by inspecting recorder graph; Jan. 17–20, May 27 to June 15, June 21 to July 16, July 26 to Aug. 28, and Sept. 24 to 30, by applying to rating table the gage reading at 6 a. m. on respective days; Oct. 16, Nov. 7, Dec. 19, Apr. 29, May 23–26, and June 14–16, interpolated.

Monthly discharge of Rogue River near Tolo, Oreg., for the year ending Sept., 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	1,100	962	1,030	63,300
November	4,210	1,120	1,680	100,000
December	5,800	1,490	2,400	148,000
January	11,500	1,540	2,760	170,000
February	15,800	2,220	6,980	401,000
March	7,070	3,360	4,420	272,000
April	8,400	3,400	4,160	248,000
May	5,100	2,720	3,530	217,000
June	3,430	2,300	2,940	175,000
July	2,530	1,540	1,940	119,000
August	1,590	1,170	1,270	78,100
September	1,430	1,170	1,250	74,400
The year	15,800	962	2,840	2,070,000

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, about 2 miles below Prospect, Jackson County.

RECORDS AVAILABLE.—August 1, 1913, to September 30, 1916.

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.

WINTER FLOW.—Stage-discharge relation never affected by ice.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 120 and 200 second-feet. Gage read to quarter-tenths daily. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

The following discharge measurement was made by C. L. Batchelder:

June 19: Gage height, 2.56 feet; discharge, 191 second-feet.

The California-Oregon Power Co.'s flume diverts water from Rogue River in the SE. ¼ sec. 30, T. 32 S., R. 3 E., and delivers it to the power plant in the NW. ¼ sec. 6, T. 33 S., R. 3 E., where ahead of about 500 feet is utilized.

Daily discharge, in second-feet, of California-Oregon Power Co.'s flume near Prospect, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	157	150	198	170	170	170	184	212	184	184	170	170
2	157	157	198	170	170	170	184	212	184	184	157	170
3	144	157	170	170	170	170	184	198	184	184	157	177
4	144	157	184	170	170	170	184	184	184	184	170	170
5	150	157	170	170	184	184	184	170	184	198	170	100
6	150	157	170	170	198	184	184	170	170	184	170	170
7	157	144	184	170	184	184	184	184	170	184	170	170
8	157	144	184	170	184	184	184	170	198	184	170	170
9	157	150	184	170	170	184	198	157	184	170	184	170
10	157	150	184	170	170	184	198	170	198	170	170	170
11	157	157	184	170	170	184	198	157	198	184	170	170
12	157	157	184	170	170	198	184	157	198	184	170	170
13	157	157	184	170	184	198	170	170	184	184	170	170
14	157	170	184	170	184	184	170	184	184	170	170	170
15	157	170	184	170	198	184	198	184	184	170	170	170
16	157	170	184	157	198	170	184	184	198	170	184	170
17	157	184	184	157	170	170	184	198	184	170	184	170
18	157	184	184	170	170	198	184	184	184	184	170	170
19	157	184	184	170	170	184	170	170	184	184	170	157
20	157	184	184	170	184	184	184	184	184	184	170	170
21	157	170	184	170	184	184	184	170	170	170	170	157
22	157	170	184	170	170	184	184	170	170	170	170	157
23	157	170	184	170	170	184	198	170	184	170	170	170
24	157	184	184	170	170	184	198	170	184	170	170	170
25	144	184	184	170	170	184	212	184	184	157	170	170
26	144	170	170	170	170	184	212	170	184	157	170	170
27	157	170	170	170	170	184	198	170	184	157	170	170
28	144	184	170	170	170	184	198	170	198	170	170	170
29	144	184	170	170	170	184	198	170	198	170	170	170
30	144	184	170	170	.....	184	212	184	198	170	170	170
31	150	.....	170	170	.....	184	.....	170	.....	170	170	170

Monthly discharge of California-Oregon Power Co.'s flume near Prospect, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	157	144	153	9,410
November	184	144	167	9,940
December	198	170	181	11,100
January	170	157	169	10,400
February	198	170	176	10,100
March	198	170	183	11,300
April	212	170	190	11,300
May	212	157	177	10,900
June	198	170	186	11,100
July	198	157	176	10,800
August	184	157	171	10,500
September	170	157	169	10,100
The year	212	144	175	127,000

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 to September 30, 1916.

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 footbridge 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 April 24 to September 30, 1916, 3.62 feet at 6 p. m. May 6 (discharge, 426 second-feet); minimum stage recorded, 1.70 feet at 8 p. m. August 2 (discharge, 20 second- feet). The flood of 1884 is said to have reached a stage of about 15 feet.

ICE.—No records during winter.

DIVERSIONS.—The Rogue River Valley canal diverts water above the station, the record at Bradshaw showing about the quantity carried past the gage. The municipal water supply for Medford, about 7.5 second-feet, is also 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 the station but above the old station at Tronson's ranch.

REGULATION.—Water stored in Fish Lake up to May 8 and some released September 18–20.

ACCURACY.—Stage-discharge relation changed during August owing to change in diversion dam below. Gage read to quarter-tenths twice daily. Well-defined rating curves used April 24 to August 19 and August 25 to September 30. Discharge August 20 to 24 computed by shifting-control method. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent except for April and August, for which they are good.

Discharge measurements of Little Butte Creek above Eagle Point, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 24	C. L. Batchelder	3.50	362	Aug. 31	R. P. Cowgill [a]	1.76	17.7
June 16	do	2.35	71.8	Sept. 5	do	1.95	27.2
Aug. 9	R. P. Cowgill [a]	1.77	23.9				

[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, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	263	175	61	26	21	16	.....	208	69	65	36	39
2	.....	252	169	95	21	22	17	.....	202	67	82	38	38
3	.....	263	158	76	21	28	18	.....	245	87	55	46	38
4	.....	270	158	66	24	27	19	.....	242	86	48	39	39
5	.....	302	160	59	21	29	20	.....	232	74	45	39	39
6	.....	393	152	53	26	30	21	.....	220	67	43	35	39
7	.....	360	138	45	25	30	22	.....	194	63	40	32	41
8	.....	310	132	42	27	31	23	.....	211	56	40	32	55
9	.....	355	125	40	21	31	24	360	235	56	36	32	56
10	.....	320	115	39	21	32	25	366	256	59	33	26	58
11	.....	286	104	36	26	31	26	366	238	63	33	22	62
12	.....	266	99	33	47	30	27	350	229	60	33	22	64
13	.....	249	86	33	40	28	28	366	211	63	31	25	66
14	.....	238	74	32	39	36	29	330	202	60	32	24	57
15	.....	229	74	32	40	36	30	286	189	59	31	21	59
							31	.....	181	.....	31	21	.....

Monthly discharge of Little Butte Creek above Eagle Point, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 24-30	366	286	346	4,800
May	393	181	253	15,600
June	175	56	96.9	5,770
July	95	31	45.8	2,820
August	47	21	29.5	1,810
September	66	21	39.7	2,360
The period	.....	.....	.....	33,200

LITTLE BUTTE CREEK NEAR EAGLE POINT, OREG.

LOCATION.—In SE. ¼ sec. 35, T. 35 S., R. 1 W., at H. B. Tronson's fruit ranch, 1½ miles above Eagle Point, Jackson County.

DRAINAGE AREA.—336 square miles.

RECORDS AVAILABLE.—July 13, 1907, to April 30, 1916, when station was discontinued.

GAGE.—Vertical staff spiked to alder trees on left bank; read by H. B. Tronson.

DISCHARGE MEASUREMENTS.—Made from cable suspension bridge 40 feet above gage or by wading.

CHANNEL AND CONTROL.—Sand at measuring section; solid rock control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.3 feet at 9 a. m. February 7 (discharge, 2,840 second-feet); minimum stage recorded, 0.25 foot October 1–3 (discharge, 18 second-feet).

1907–1916: Maximum stage recorded, 10.6 feet February 17, 1912 (discharge, 6,240 second-feet); minimum stage recorded, −0.15 foot (gage height) August 1, 2, and 13–20, 1915 (discharge, 7 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—Practically entire low-water flow diverted above this station. The principal diversions are the main canal of the Rogue River Valley Canal Co., the municipal water supply for Medford (about 7.5 second-feet), Eagle Point ditch, and water to irrigate several hundred acres along the creek. The record at this station gives the unappropriated flow and return water.

REGULATION.—Water was stored at Fish Lake during the winter of 1915–16 for the first time.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined between 30 and 600 second-feet. Gage read to half-tenths twice daily; readings not entirely reliable. Daily discharge ascertained by applying mean daily gage height to rating table. Records fair.

The following discharge measurement was made by C. L. Batchelder:
April 24, 1916: Gage height, 2.18 feet; discharge, 362 second-feet.

Daily discharge, in second-feet, of Little Butte Creek near Eagle Point, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr
1	18	44	103	73	136	220	473
2	18	44	93	93	370	205	428
3	18	44	93	93	1,000	205	388
4	21	44	93	103	703	205	370
5	24	44	351	93	518	220	351
6	24	44	388	93	564	205	316
7	24	44	235	103	2,060	190	283
8	24	49	190	473	610	176	283
9	24	49	136	220	541	162	283
10	24	49	136	190	850	176	541
11	24	49	113	149	633	190	1,090
12	24	49	113	136	496	220	633
13	24	49	162	113	473	267	564
14	24	54	190	113	473	283	518
15	29	54	162	103	428	300	473
16	38	124	113	103	496	267	473
17	36	73	176	113	564	267	564
18	33	64	149	113	587	267	496
19	33	44	113	113	518	251	473
20	36	44	149	113	473	388	473
21	36	41	93	103	473	351	473
22	36	41	93	113	428	370	473
23	36	73	149	388	428	473	473
24	38	93	113	950	388	473	450
25	38	190	428	950	351	473	450
26	38	162	103	473	283	388	428
27	38	113	93	220	267	1,240	428
28	41	103	162	176	251	633	388
29	41	113	176	136	236	518	351
30	41	113	124	124	.....	518	316
31	44	.....	93	124	.....	473	.....

Monthly discharge of Little Butte Creek near Eagle Point, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October	44	18	30.5	1,880
November	190	41	70.0	4,170
December	428	93	158	9,720
January	950	73	208	12,800
February	2,060	136	538	30,900
March	1,240	162	341	21,000
April	1,090	283	457	27,200
The period				108,000

DEAD INDIAN CREEK NEAR LILYGLEN, OREG.

LOCATION.—In NW. ¼ sec. 22, T. 38 S., R. 3 E., at R. P. Neill's ranch, about a mile west of Lilyglen and 17 miles east of Ashland, in Jackson County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—February 16 to May 25, 1916.

GAGE.—Vertical staff fastened to sunken log on left bank.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gravel and boulders; probably shifts during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded, 0.90 foot at 6 p. m. April 10 (discharge, 64 second-feet); minimum stage recorded, 0.20 foot at 2 p. m. May 16 (discharge, 5 second-feet).

ICE.—No information.

DIVERSIONS.—None at present. Water can be diverted from a point about 1,500 feet above the gage into the proposed Beaver Creek reservoir.

ACCURACY.—Stage-discharge relation permanent; gage read to half-tenths daily until April 10; occasionally thereafter. Rating curve well defined. Daily discharge ascertained by applying the daily gage reading to the rating table. Records fair.

Discharge measurements of Dead Indian Creek near Lilyglen, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Feb. 16	R. P. Cowgill [a]	0.45	11.6	Apr. 21	Batchelder and Cowgill.	0.57	21.6
Mar. 21	....do	.73	38.2	June 14	C. L. Batchelder	(b)	3.5
Apr. 21	Batchelder and Cowgill.	.57	21.5				

[a] Chief engineer Rogue River Valley Canal Co. [b] Gage had been destroyed.

Daily discharge, in second-feet, of Dead Indian Creek near Lilyglen, Oreg., for the year ending Sept. 30, 1916.

Day.	Feb.	Mar.	Apr.	May.	Day.	Feb.	Mar.	Apr.	May.
1		9	20	16	16	12	20	40	5
2		12	20	20	17	15	24	36	10
3		9	20	24	18	15	30	32	15
4		9	24	30	19	15	35	28	12
5		12	24	24	20	24	48	24	9
6		9	20	24	21	15	38	21	7
7		9	20	22	22	15	38	15	9
8		5	15	17	23	15	35	15	10
9		9	20	16	24	15	30	15	12
10		9	64	15	25	15	48	15	12
11		9	60	14	26	15	24	15	
12		9	56	12	27	15	24	16	
13		15	52	10	28	15	20	17	
14		15	48	9	29	12	20	14	
15		20	44	7	30		20	12	
					31		24		

NOTE.—Daily discharge interpolated Apr. 11-20, 23-25, 29, May 1, 2, 9, 11-13, 15, 17, 19, 22-23. Mean discharge estimated as 15 second-feet Feb. 1-15 and 12 second-feet May 26-31.

Monthly discharge of Dead Indian Creek near Lilyglen, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
February			15.1	869
March	48	5	20.6	1,270
April	64	12	27.4	1,630
May	30	5	14.0	861
The period				4,630

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 September 30, 1916. At station above city intake, about 3 miles above present station September 10, 1911, to March 31, 1913 (gives results slightly greater than present station).

GAGE.—Vertical staff on right bank; read by Will Mann.

DISCHARGE MEASUREMENTS.—Made by wading near gage.

CHANNEL AND CONTROL.—Boulders and gravel; permanent except in extremely high floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period April 20 to September 30, 1916, 2.3 feet May 11 and 13 (discharge, 110 second-feet); minimum stage recorded, 1.8 feet August 24 to September 1 (discharge, 38 second-feet).

ICE.—Stage-discharge relation probably 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. Water was released from storage beginning about September 18. Before this date the run-off was only slightly affected by the regulation.

ACCURACY.—Stage-discharge relation permanent during period covered by records. Rating curve well defined above 45 second-feet. Gage read to tenths every other day. Daily discharge ascertained by applying the gage reading to rating table. Records only fair on account of uncertainty in gage-height record.

Discharge measurements of North Fork of Little Butte Creek near Lake Creek, Oreg., during the year ending Sept. 30, 1916.

[Made by Cowgill and Batchelder.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 20	2.12	78
June 17	1.97	55

Daily discharge, in second-feet, of North Fork of Little Butte Creek near Lake Creek, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	60	.....	.....	48	38	16	.....	.....	54	92	48	.....
2	.....	.....	60	60	.....	.....	17	.....	75	.....	.....	.....	48
3	.....	60	.....	.....	48	48	18	.....	.....	75	60	48	.....
4	.....	.....	75	54	.....	.....	19	.....	92	.....	.....	.....	48
5	.....	68	.....	.....	48	48	20	78	.....	60	48	48	.....
6	.....	.....	60	48	.....	.....	21	.....	75	.....	.....	.....	48
7	.....	75	.....	.....	48	48	22	78	.....	48	48	48	.....
8	.....	.....	60	48	.....	.....	23	.....	92	.....	.....	.....	75
9	.....	92	.....	.....	54	48	24	75	.....	54	48	38	.....
10	.....	.....	54	48	.....	.....	25	.....	92	54	.....	.....	75
11	.....	110	.....	.....	54	48	26	75	.....	54	48	38	.....
12	.....	.....	54	48	.....	.....	27	.....	75	.....	.....	38	75
13	.....	110	.....	.....	48	48	28	75	.....	54	48	38	.....
14	.....	.....	54	48	.....	.....	29	.....	75	.....	.....	.....	75
15	.....	92	.....	.....	48	48	30	.....	.....	54	48	38	.....
							31	.....	60	.....	.....	.....	.....

Monthly discharge of North Fork of Little Butte Creek near Lake Creek, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 20-30	78	75	76.2	1,660
May	110	60	81.4	5,010
June	75	48	57.8	3,440
July	92	48	52.9	3,250
August	54	38	45.8	2,820
September	75	38	54.5	3,240
The period	.....	.....	.....	19,400

NOTE.—Monthly mean discharge is average of discharge given in daily-discharge table.

ROGUE RIVER VALLEY CANAL AT INTAKE NEAR LAKE CREEK, OREG.

LOCATION.—In SE. ¼ sec. 20, T. 36 S., R. 2 E., 100 feet below intake and about a mile east of Lake Creek, Jackson County.

RECORDS AVAILABLE.—April 1 to September 30, 1914; April 1 to October 14, 1915; April 20 to October 13, 1916, when station was discontinued.

GAGE.—Vertical staff on left bank 100 feet below intake; read by Will Mann.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Earth section; apparently changes slightly.

EXTREMES OF DISCHARGE.—Maximum stage recorded during irrigating seasons 1914, 1915, and 1916, 2.11 feet, at time of discharge measurement, August 9, 1916 (discharge, 46 second-feet). Canal dry during winter.

ACCURACY.—Stage-discharge relation affected by growth of aquatic plants. Two fairly well defined rating curves applicable as follows: April 20 to June 30 and July 30 to October 13. Discharge July 1 to 29 computed by shifting control method. Gage read to half-tenths every other day. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

Rogue River Valley canal diverts water from the right bank of North Fork of Little Butte Creek in sec. 20, T. 36 S., R. 2 E., to irrigate lands in the drainage basin of Bear Creek.

Discharge measurements of Rogue River Valley canal at intake, near Lake Creek, Oreg., during the year 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Apr. 20	Batchelder and Cowgill [a]	1.12	11.5
June 17	do	2.03	45.9
Aug. 9	R. P. Cowgill	2.11	45.6
Oct. 5	Batchelder and Reineking	1.50	16.4

[a] Chief engineer, Rogue River Valley Canal Co.

Daily discharge, in second-feet, of Rogue River Valley canal at intake, near Lake Creek, Oreg., for the period Oct. 1, 1915, to Oct. 13, 1916.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	14		22			32	38	32
2				25	38			
3	14		22			32	42	16
4				25	38			
5	14		16			32	38	16
6				38	38			
7	12		22			32	38	16
8				38	41			
9	14		22			42	38	16
10				38	41			
11			22			42	38	16
12	14			38	41			
13			22			38	32	14
14	12			41	41			
15			22			38	32	
16				41	24	45		
17			24	46			32	
18				50	36	45		
19			22				32	
20		11		50	36	45		
21			25				32	
22		11		44	36	45		
23			24				32	
24		11		47	36	32		
25			24	44			30	
26		10		50	36	35		
27			25			37	32	
28		18		47	36	37		
29			25				32	
30				47	32	37		
31			25					

Monthly discharge of Rogue River Valley canal at intake, near Lake Creek, Oreg., for the period Oct. 1, 1915, to Oct. 13, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October 1–15	14	12	13.4	399
April 20–30	18	10	12.2	266
May	25	16	22.8	1,400
June	50	25	41.8	2,490
July	41	24	36.7	2,260
August	45	32	38.0	2,340
September	42	30	34.5	2,050
October 1–13	32	14	18.0	464

NOTE.—A little water diverted prior to Apr. 20 of which no record was kept.

ROGUE RIVER VALLEY CANAL NEAR BROWNSBORO, OREG.

LOCATION.—In SW. ¼ 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, 1915, and 1916.

GAGE.—Vertical staff just at head of drop, installed June 5, 1916. Former gages were a few feet upstream.

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

CHANNEL AND CONTROL.—Solid rock at head of drop; practically permanent.

EXTREMES OF DISCHAGRE.—Maximum stage recorded during season, 2.10 feet June 21 to July 1, and July 9 (discharge, 41 second-feet).

1913 and 1915–16: Maximum diversion was that of 1916. Canal dry at times.

ACCURACY.—Stage-discharge relation practically permanent. Rating curve well defined between 30 and 41 second-feet but not defined below 30 second-feet. Gage read to tenths every other day. Records fair.

The Rogue River Valley canal diverts water from North Fork of Little Butte Creek in the SE. ¼ sec. 20, 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, 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
June 5	R. P. Cowgill[a]	2.00	35.7
17	Cowgill and Batchelder	2.10	40.8

[a] Chief engineer Rogue River Valley Canal Co.

Daily discharge, in second-feet, of Rogue River Valley canal near Brownsboro, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	June.	July.	Aug.	Sept.	Day.	Oct.	June.	July.	Aug.	Sept.
1		a 22	41			16					24
2	10			29	31	17		36	15	31	
3		a 22	36			18					24
4	9			29	31	19		36	36	31	
5		27	36			20					24
6	10			29	27	21		41	36	31	
7		36	36			22					24
8	9			29	27	23		41	31	31	
9		36	41			24					24
10	9			31	27	25		41	31	27	
11	9	36	36			26					24
12				31	27	27		41	31	27	
13	9	36	36			28					24
14				31	24	29		41	31	27	
15	9	36	36			30					24
						31			29	27	

a Estimated.

NOTE.—No flow Oct. 16 to about the middle of April; no record during April.

Monthly discharge of Rogue River Valley canal near Brownsboro, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
October (15 days)	10	9	9.4	280
May			a 18.0	1,110
June	41	a 22	35.2	2,090
July	41	15	33.6	2,070
August	31	27	29.4	1,810
September	31	24	25.7	1,530

a Estimated.

NOTE.—See footnote to table of daily discharge.

BEAR CREEK AT MEDFORD, OREG.

LOCATION.—In NW. ¼ 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 September 30, 1916.

GAGE.—Vertical staff at southeast corner of Page theater building, on left bank; read by 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, 4.75 feet at 8 a. m., February 10 (discharge, 1,240 second-feet); minimum stage recorded, 1.19 feet September 18 (discharge, 1.2 second-feet).

1915–16: Maximum stage recorded in 1916; minimum stage recorded, 1.25 feet August 20, 1915 (discharge, 0.2 second-foot).

ICE.—No ice since station was established.

DIVERSIONS.—A large area above the station is irrigated from flood waters of Bear Creek. Phoenix ditch, constructed in 1915, began diverting water above the station in April, 1916. (See p. 172.)

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed February 10. Rating curves used as follows: December 6 to February 10, fairly well defined; February 11 to September 30, well defined between 50 and 350 second-feet and fairly well defined below 50 second-feet. Gage read to hundredths daily most of the time. Daily discharge ascertained by applying mean daily gage height to rating table. Records good except as follows: December, fair; August and September, poor.

Discharge measurements of Bear Creek at Medford, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 18	Cowgill[a] and Cummings[b]	1.82	43.4	Apr. 24	Batchelder and Cowgill.	2.45	174
24	Cowgill and Burnett	2.64	269	May 12	R. P. Cowgill	2.20	111
Feb. 8	R. P. Cowgill	3.26	509	June 12	C. L. Batchelder	1.91	61.1
Apr. 17	Batchelder and Cowgill.	2.78	285	July 10	R. P. Cowgill	1.60	25.5
18	.....do.....	2.63	228	15	.....do.....	1.45	10.3
				Sept. 4	.....do.....	1.21	1.9

[a] Chief engineer, Rogue River Valley Canal Co. [b] Watermaster.

Daily discharge, in second-feet, of Bear Creek at Medford, Oreg., for the year ending Sept. 30, 1916.

Day.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	50	40	58	189	220	134	92	54	.....	.....
2	50	40	62	160	220	147	78	118	.....	.....
3	50	40	175	160	204	470	78	75	.....	1.8
4	50	40	138	160	189	482	75	68	.....	1.8
5	50	40	132	290	179	490	75	61	.....	.....
6	132	40	132	220	169	312	70	54	.....	.....
7	95	40	768	195	160	134	69	37	.....	.....
8	58	40	505	183	160	134	63	34	.....	.....
9	58	40	365	204	160	134	72	32	.....	.....
10	58	40	1,030	195	255	122	72	24	.....	3.3
11	58	40	580	220	535	118	69	20	.....	.....
12	58	40	390	255	350	115	66	16	.....	.....
13	58	40	330	248	310	111	63	19	.....	.....
14	58	40	354	204	290	106	63	12	.....	.....
15	58	40	378	204	290	102	62	12	.....	.....
16	55	40	402	204	255	92	62	30	.....	.....
17	52	40	426	204	290	92	62	47	.....	.....
18	49	44	450	220	238	111	80	37	.....	1.2
19	46	40	370	272	220	111	85	32	.....	.....
20	43	35	330	350	204	111	70	26	.....	.....
21	40	38	330	314	196	111	66	20	.....	.....
22	40	40	310	302	189	111	63	15	.....	.....
23	46	425	272	302	182	111	62	9.4	.....	.....
24	52	272	220	266	174	111	60	9.4	1.8	.....
25	58	290	189	255	160	111	60	8.0	.....	.....
26	52	160	195	272	160	111	58	6.0	.....	.....
27	46	116	255	390	160	111	56	4.6	.....	.....
28	40	92	220	350	153	111	54	3.3	.....	.....
29	49	62	220	298	146	111	52	2.6	.....	.....
30	40	69	.....	255	139	111	50	2.0	1.5	.....
31	40	58	.....	238	.....	102	.....	2.0	.....	.....

NOTE.—Daily discharge interpolated Dec. 7, 9–14, 16–20, 23–24, 26–27, Jan. 3–13, 15–16, 19, 21, Feb. 14–17, Apr. 21–23, 28–29, May 6, 11–12, 14, June 14–16, 21, 26–27, 29, July 4–5, 8, 11, 27, 29, 31. Mean discharge estimated as 50 second-feet Dec. 1–5. No record kept during October and November; practically no flow.

Monthly discharge of Bear Creek at Medford, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
December	132		54.5	3,350
January	290	40	78.1	4,800
February	1,030	58	331	19,000
March	390	160	244	15,000
April	535	139	219	13,000
May	490	92	156	9,590
June	92	50	66.9	3,980
July	118	2.0	28.7	1,760
August			a 1.8	111
September			a 1.5	89
The period				70,700

a Estimated.

PHOENIX DITCH NEAR TALENT, OREG.

LOCATION.—In NW. ¼ 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 to September 30, 1916.

GAGE.—Vertical staff on left of flume about 80 feet below intake; read by W. W. Brophy, the 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 stage recorded, 1.8 feet June 18 (discharge, 25 second-feet); canal dry in winter.

ACCURACY.—Stage-discharge relation apparently permanent. Gage read to hundredths almost every day in June and about three times a week the rest of the season. Rating curve well defined between 2 and 25 second-feet. Daily discharge ascertained by applying to the rating table the daily gage readings. Records good except the estimate for September, which is roughly approximate.

Discharge measurements of Phoenix ditch near Talent, Oreg., during the year ending Sept. 30, 1916.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Apr. 19	Batchelder and Cowgill[a]	0.66	3.6	July 21	R. P. Cowgill	1.70	23.1
May 13	R. P. Cowgill	1.02	10.5	Aug. 26	do	.69	4.1
July 8	do	1.20	12.8	30	do	.55	2.7
10	do	1.60	21.3				

a Chief engineer, Rogue River Valley Canal Co.

Daily discharge, in second-feet, of Phoenix ditch near Talent, Oreg., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	12	13	19	8.0	.....	16	.....	11	20	22	13	5.2
2	.....	13	16	20	5.2	.....	17	.....	12	20	22	15	.....
3	.....	13	22	21	3.2	.....	18	.....	13	25	22	15	.....
4	.....	11	22	21	1.0	.....	19	3.9	14	24	23	14	.....
5	.....	10	21	22	1.0	.....	20	4	14	23	23	14	.....
6	.....	9.4	21	23	1.0	.....	21	4	14	22	23	13	.....
7	.....	9.4	21	22	1.0	.....	22	4	13	20	22	9.4	.....
8	.....	9.4	20	22	.5	.....	23	4	13	19	21	7.7	.....
9	.....	9.4	20	22	.5	.....	24	11	13	21	20	6.0	.....
10	.....	9.4	19	21	.5	.....	25	10	12	21	19	4.4	.....
11	.....	9.4	18	21	1.0	.....	26	10	11	20	18	4.3	.....
12	.....	9.4	19	20	17	.....	27	10	11	21	16	3.9	.....
13	.....	9.4	19	18	15	.....	28	9.4	11	22	14	3.5	.....
14	.....	9.9	19	20	13	.....	29	10	11	21	12	3.1	.....
15	.....	10	21	23	11	.....	30	11	11	20	11	2.7	.....
							31	.....	11	.....	9	2.3	.....

NOTE.—Daily discharge interpolated June 4, 6–8, 19–20, Aug. 13, 16, 19–20, 22, 24–25, 27–29 and for days between readings made about twice weekly at other times. Discharge estimated Apr. 20–23 and Aug. 5–11.

Monthly discharge of Phoenix ditch near Talent, Oreg., for the year ending Sept. 30, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
April 19–30	11	3.9	7.3	174
May	14	9.4	11.3	695
June	25	13	20.3	1,210
July	23	9.0	19.7	1,210
August	17	0.5	6.78	417
September	.....	.....	*a* 3.0	179
The period	.....	.....	.....	3,880

a Estimated.

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, and May 12, 1907, to September 30, 1916.

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 STAGE.—Maximum stage recorded during year, 30.0 feet at 7 a. m., February 7 (discharge, estimated from extension of rating curve, 116,000 second-feet); minimum stage recorded, 0.10 foot October 1 to 24 (discharge, 950 second-feet).

1905–1916: 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 below 40,000 second-feet. Gage read to tenths twice a day. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

The following discharge measurement was made by C. L. Batchelder: September 29, 1916: Gage height, 0.39 foot; discharge, 1,220 second-feet.

Daily discharge, in second-feet, of Umpqua River near Elkton, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	950	1,040	15,700	8,600	10,500	8,120	15,700	7,220	5,260	4,230	2,150	1,450
2	950	1,040	14,400	9,100	12,600	8,360	14,400	6,800	4,900	4,730	2,150	1,780
3	950	1,240	13,200	8,120	16,800	10,800	13,800	6,400	4,560	6,800	2,150	1,670
4	950	1,240	16,800	7,220	24,800	18,500	13,200	6,400	4,230	6,800	1,900	1,450
5	950	1,140	23,800	6,400	21,300	50,400	12,600	6,400	3,910	6,400	1,900	1,450
6	950	1,240	49,100	6,010	49,100	37,100	12,600	7,220	3,590	6,010	1,670	1,340
7	950	1,240	33,100	8,120	111,000	27,200	10,800	9,350	3,290	5,400	1,670	1,240
8	950	1,240	23,800	15,700	58,000	21,300	9,350	12,300	3,590	4,730	1,900	1,240
9	950	1,450	19,900	17,400	42,300	19,900	8,360	16,000	3,590	4,230	1,670	1,140
10	950	1,670	18,500	15,000	42,300	20,600	9,100	16,400	3,290	3,910	1,670	1,140
11	950	2,410	16,800	12,900	38,300	20,200	9,900	14,700	2,990	3,590	1,450	1,140
12	950	3,140	15,400	12,000	31,100	19,200	13,200	12,600	2,690	3,290	1,450	1,140
13	950	3,750	14,400	11,400	23,800	17,800	12,600	10,800	2,690	3,290	1,670	1,140
14	950	4,560	13,200	10,500	20,200	17,100	11,100	8,600	2,690	3,590	1,450	1,140
15	950	5,440	12,600	9,600	26,600	16,400	9,600	8,120	2,410	4,070	1,450	1,140
16	950	6,600	12,000	9,100	27,600	15,700	9,100	7,660	2,410	4,900	1,450	1,140
17	950	8,120	11,100	8,600	25,800	15,000	8,600	7,220	2,690	7,660	1,670	1,140
18	950	6,800	10,200	8,120	24,800	13,800	8,120	6,800	2,690	9,100	1,900	1,140
19	950	6,400	9,600	7,220	22,700	13,500	7,660	6,800	2,690	7,010	1,670	1,140
20	950	6,800	9,350	6,010	20,600	14,400	7,660	6,800	2,990	6,200	1,670	1,140
21	950	8,120	11,400	7,010	20,200	15,000	9,100	6,400	3,290	5,630	1,670	1,140
22	950	9,100	14,700	7,660	18,800	18,800	12,600	6,010	3,590	5,260	1,560	1,140
23	950	10,200	15,400	11,700	17,400	22,000	12,000	5,630	3,910	4,900	1,450	1,140
24	950	15,000	13,800	54,800	15,700	20,600	11,100	5,820	3,590	4,560	1,450	1,140
25	1,040	24,400	12,300	41,100	13,800	18,500	10,200	6,400	3,290	4,230	1,450	1,140
26	1,240	45,100	11,400	28,300	12,600	21,300	9,600	6,010	3,290	3,910	1,450	1,140
27	1,140	29,100	10,800	21,300	9,600	27,200	8,600	5,630	3,590	3,590	1,340	1,140
28	1,040	17,800	10,200	16,000	9,100	25,500	8,600	5,440	3,910	3,290	1,240	1,140
29	1,040	17,100	9,600	12,000	8,600	21,600	8,120	5,630	4,560	2,990	1,240	1,140
30	1,040	19,900	8,360	11,400	.....	19,200	7,660	6,010	4,560	2,690	1,140	1,140
31	1,040	.....	8,120	10,800	.....	17,100	.....	5,630	.....	2,410	1,240	.....

Monthly discharge of Umpqua River near Elkton, Oreg., for the year ending Sept. 30, 1916.

[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	1,240	950	980	0.266	0.31	60,300
November	45,100	1,040	8,750	2.38	2.66	521,000
December	49,100	8,120	15,500	4.21	4.85	953,000
January	54,800	6,010	13,500	3.67	4.23	830,000
February	111,000	8,600	26,800	7.28	7.85	1,540,000
March	50,400	8,120	19,700	5.35	6.17	1,210,000
April	15,700	7,660	10,500	2.85	3.18	625,000
May	16,400	5,440	8,050	2.19	2.52	495,000
June	5,260	2,410	3,490	.948	1.06	208,000
July	9,100	2,410	4,820	1.31	1 51	296,000
August	2,150	1,140	1,610	.438	.50	99,000
September	1,780	1,140	1,220	.332	.37	72,600
The year	111,000	950	9,520	2.59	35.21	6,910,000

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, 1908, to July 20, 1909; December 19, 1914, to September 30, 1916, fragmentary.

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 STAGE.—Maximum stage during year from water-stage recorder, 3.45 feet May 3; minimum stage from water-stage recorder, 1.38 feet October 8 to 12 and 27 to 30.

1908–9 and 1915–16: Maximum stage recorded, 4.33 feet January 21, 1909; minimum stage recorded, 1.38 feet October 8 to 12, and 27 to 30, 1915.

ICE.—Stage-discharge relation unaffected, as much of water comes from springs.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Operation of water satisfactory during period covered by records. Rating curve not developed.

The following discharge measurement was made by J. C. Kuhns, assistant forest ranger:

October 15, 1915: Gage height, 1.40 feet; discharge, 603 second-feet.

Daily gage height, in feet, of North Umpqua River at Toketee Falls, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.40	1.41	.....	1.94	.....	.....	2.52	3.21	2.69	.....	.....	1.81
2	1.40	1.40	.....	.....	.....	.....	2.48	3.38	2.73	.....	.....	1.82
3	1.40	1.41	.....	.....	.....	.....	2.48	3.36	2.78	.....	2.00	1.87
4	1.40	1.42	.....	1.87	.....	.....	2.52	3.24	2.86	.....	1.96	1.82
5	1.39	1.40	.....	1.77	.....	.....	2.58	3.10	2.90	.....	1.94	1.80
6	1.39	1.40	.....	1.75	.....	.....	2.65	2.97	2.84	.....	1.91	1.80
7	1.39	1.41	.....	.....	.....	.....	2.91	2.85	2.77	.....	1.90	1.80
8	1.38	1.43	.....	1.77	.....	.....	2.89	2.77	2.74	.....	1.90	1.81
9	1.38	1.42	.....	1.77	.....	.....	2.79	2.71	2.78	.....	.....	1.79
10	1.38	1.42	.....	1.75	.....	.....	2.75	2.68	2.84	.....	1.90	1.78
11	1.38	1.44	2.10	.....	.....	.....	2.76	2.65	2.94	.....	1.90	1.78
12	1.38	1.45	2.00	1.70	.....	.....	2.73	2.65	3.05	.....	1.90	1.78
13	1.40	1.42	2.00	1.72	.....	.....	2.73	2.68	3.08	.....	1.90	1.76
14	1.42	1.43	.....	1.72	.....	.....	2.72	2.71	.....	.....	1.89	1.76
15	1.40	1.53	.....	1.68	.....	.....	2.67	2.74	.....	.....	1.90	1.76
16	1.40	1.56	.....	1.68	.....	.....	2.61	2.73	.....	.....	1.88	1.75
17	1.39	1.64	1.85	.....	.....	1.70	2.68	2.71	.....	.....	1.90	1.75
18	1.39	1.76	1.87	1.67	.....	2.20	2.78	2.68	.....	.....	1.90	1.75
19	1.38	1.60	1.82	1.63	.....	.....	2.73	2.65	.....	.....	1.87	1.75
20	1.39	1.77	1.92	1.63	.....	.....	2.72	2.62	.....	.....	1.86	1.75
21	1.38	1.75	2.15	1.64	.....	.....	2.78	2.59	.....	2.29	1.86	1.75
22	1.38	.....	.....	.....	.....	.....	2.87	2.55	.....	2.24	1.85	1.75
23	1.48	.....	.....	1.83	.....	2.80	2.97	2.56	.....	2.17	1.84	1.74
24	1.42	.....	.....	1.90	.....	2.71	3.05	2.57	.....	2.10	1.84	1.74
25	1.40	2.70	.....	1.86	.....	2.71	2.99	2.57	.....	2.05	1.83	1.74
26	1.40	.....	.....	.....	.....	2.69	2.92	2.54	.....	2.01	1.83	1.73
27	1.38	.....	.....	.....	.....	2.61	2.88	2.53	.....	2.01	1.84	1.74
28	1.38	.....	.....	1.75	.....	2.55	2.91	2.51	.....	2.01	1.84	1.74
29	1.38	.....	.....	1.72	.....	2.53	3.01	2.50	.....	2.00	1.84	1.73
30	1.38	.....	2.10	.....	.....	2.53	3.15	2.53	.....	.....	1.82	1.73
31	1.39	.....	2.05	.....	.....	2.52	.....	2.63	.....	.....	1.81	.....

NORTH UMPQUA RIVER NEAR HOAGLIN, OREG.

LOCATION.—In sec. 18, T. 26 S., R. 1 W., a quarter of a mile above national forest boundary, about 9 miles below Steamboat Creek, and 10 miles above Hoaglin post office, Douglas County.

DRAINAGE AREA.—849 square miles (measured on topographic map and Forest Service map).

RECORDS AVAILABLE.—February 20, 1911, to May 18, 1916, when station was discontinued.

GAGE.—Vertical staff on right bank; read by V. F. McLaughlin, forest ranger.

DISCHARGE MEASUREMENTS.—Made from cable above gage.

CHANNEL AND CONTROL.—Rocky and deep; practically permanent.

EXTREME OF DISCHARGE.—Maximum stage recorded during year, 14.0 feet February 7 (discharge not determined).

1911–1916: Maximum stage recorded is that of 1916; minimum stage recorded, 1.73 feet October 19, 1915 (discharge, 727 second-feet).

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 3,000 second-feet. Gage read to half-tenths when possible. Daily discharge ascertained by applying daily gage height to rating table. Records good for days for which gage was read.

COOPERATION.—Gage heights furnished by United States Forest Service, S. C. Bartrum supervisor.

The following discharge measurement was made by J. C. Kuhns of the Forest Service:

October 19, 1916: Gage height, 1.73 feet; discharge, 727 second-feet.

Daily discharge, in second-feet, of North Umpqua River near Hoaglin, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Jan.	Feb.	Mar.	Apr.	May.
1					2,820		3,340
2							
3			1,720		2,670		3,270
4						3,200	
5							
6			1,520				
7			1,570				
8			1,620			3,200	5,440
9							
10							
11							4,400
12			1,420			4,020	
13							
14			1,380				
15							3,040
16							
17							
18					3,750		3,270
19	727					3,580	
20		4,300	1,200				
21							
22			1,290			5,130	
23							
24		4,020		4,200		3,750	
25							
26			3,930				
27						4,200	
28							
29			2,120	3,200	4,820	3,660	
30							
31			1,670		3,040		

NORTH UMPQUA RIVER NEAR GLIDE, OREG.

LOCATION.—In SW. ¼ 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, 1916.

GAGE.—Vertical staff on left bank just below ferry landing; read by 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 period September 1, 1915, to September 30, 1916, 12.8 feet at 3 p. m. November 25 (discharge, 42,000 second-feet); minimum stage recorded, 0.05 foot October 1, 2, 7 to 13, and 18 to 22 (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.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage read to quarter-tenths twice daily. Daily discharge ascertained by applying the mean daily gage height to rating table. Records excellent except for extremely high water.

Discharge measurements of North Umpqua River near Glide, Oreg., during 1914–16.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1914.		*Feet.*	*Sec.-ft.*	1916.		*Feet.*	*Sec.-ft.*
Sept. 8	James E. Stewart	0.76	1,490	Feb. 7[a]	J. C. Kuhns	12.40	39,900
1915.				Apr. 5[a]	do	2.30	3,750
Aug. 10	Henshaw and Lundgren.	.22	854	June 20	C. L. Batchelder	1.82	2,980
Sept. 25	P. V. Hodges	.10	804				
Oct. 24	J. C. Kuhns[b]	.38	989				

[a] Made at Winchester, inflow estimated. [b] Assistant forest ranger.

Daily discharge, in second-feet, of North Umpqua River near Glide, Oreg., for the period Sept. 1, 1915, to Sept. 30, 1916.

Day.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	815	750	850	5,700	2,780	2,780	3,780	4,900	3,960	2,940	2,780	1,520	1,120
2	815	750	850	4,700	2,460	3,780	3,440	4,700	3,960	2,780	3,960	1,450	1,120
3	815	780	930	4,700	2,460	7,850	3,610	4,320	4,320	2,780	3,440	1,450	1,170
4	815	780	975	6,350	2,300	7,100	5,780	4,140	4,510	3,100	2,940	1,450	1,220
5	815	780	975	10,600	2,150	5,900	7,850	3,780	4,900	3,270	2,780	1,450	1,120
6	815	780	850	19,200	2,150	28,400	6,850	3,610	6,350	3,270	2,620	1,390	1,120
7	815	750	815	10,300	2,300	37,000	6,100	3,610	6,100	3,270	2,460	1,330	1,120
8	815	750	1,020	6,850	2,780	19,200	6,100	3,780	5,900	3,440	2,460	1,330	1,120
9	815	750	1,120	7,600	2,780	12,500	7,100	3,780	8,850	3,440	2,300	1,330	1,170
10	815	750	1,020	5,900	2,620	15,300	7,850	4,320	7,100	3,270	2,150	1,330	1,170
11	815	750	1,120	5,500	2,300	15,000	9,400	6,350	5,700	3,100	2,150	1,330	1,120
12	815	750	2,000	4,700	2,300	10,300	8,600	5,300	4,900	2,940	2,150	1,280	1,120
13	815	750	1,280	4,900	2,300	8,350	7,100	4,700	4,320	2,940	2,000	1,280	1,070
14	815	815	1,070	4,510	2,300	11,500	5,700	4,320	3,960	3,100	2,000	1,220	1,070
15	815	815	1,390	3,610	2,000	12,800	5,100	4,510	3,780	3,270	2,620	1,280	1,020
16	815	780	5,700	3,270	1,860	12,200	5,100	3,960	3,610	3,610	4,700	1,220	1,020
17	815	780	2,780	3,100	1,720	11,200	4,900	4,510	3,780	3,610	4,900	1,280	1,020
18	815	750	6,100	2,940	1,720	11,200	5,100	4,510	3,780	3,610	3,610	1,390	1,020
19	815	750	3,780	2,940	1,720	8,350	5,500	4,700	3,960	3,270	2,940	1,280	1,020
20	780	750	4,320	3,440	1,650	8,350	7,600	4,510	3,780	2,940	2,460	1,220	1,020
21	780	750	6,600	7,350	1,720	7,350	7,600	6,600	3,610	2,780	2,150	1,220	1,020
22	780	750	3,960	7,850	1,860	7,100	9,400	6,600	3,610	2,460	2,150	1,220	1,020
23	780	850	7,350	7,600	4,700	6,100	8,350	5,300	3,610	2,300	2,000	1,170	1,020
24	780	975	6,600	5,700	13,200	5,500	6,350	4,900	3,610	2,300	2,000	1,120	1,020
25	780	850	22,300	5,500	10,300	4,900	8,100	4,700	3,780	2,300	1,860	1,120	1,020
26	780	780	15,600	4,700	6,850	4,900	8,850	4,700	3,610	2,620	1,720	1,120	1,020
27	780	780	7,350	3,960	4,900	4,510	11,200	4,700	3,610	2,780	1,720	1,120	1,020
28	780	780	5,100	3,960	3,960	4,140	8,350	4,700	3,440	2,620	1,650	1,120	975
29	780	780	11,800	3,780	3,270	3,960	6,600	4,510	3,270	2,780	1,580	1,120	975
30	780	780	8,850	3,270	2,940	.....	5,500	3,960	3,100	2,460	1,580	1,120	930
31	.....	780	.....	2,940	2,620	.....	5,100	.....	2,940	.....	1,580	1,120	.....

Monthly discharge of North Umpqua River near Glide, Oreg., for the period Sept. 1, 1915, to Sept. 30, 1916.

[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.
1915.						
September	815	780	802	0.663	0.74	47,700
1915-16.						
October	975	750	780	.645	0.74	48,000
November	22,300	815	4,480	3.70	4.13	267,000
December	19,200	2,940	5,720	4.73	5.45	352,000
January	13,200	1,650	3,260	2.69	3.10	200,000
February	37,000	2,780	10,300	8.51	9.18	592,000
March	11,200	3,440	6,710	5.55	6.40	413,000
April	6,600	3,610	4,630	3.83	4.27	276,000
May	8,850	2,940	4,380	3.62	4.17	269,000
June	3,610	2,300	2,980	2.46	2.74	177,000
July	4,900	1,580	2,500	2.07	2.39	154,000
August	1,520	1,120	1,270	1.05	1.21	78,100
September	1,220	930	1,070	.884	.99	63,700
The year	37,000	750	3,980	3.29	44.77	2,890,000

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 September 30, 1916.

GAGE.—Stevens water-stage recorder on right bank. Gage reader, Richard Peterson. Vertical staff on Loon Lake was read 1907 to 1912, and for comparison in 1915 and 1916.

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

CHANNEL AND CONTROL.—Channel, gravel; control of bowlders 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, 13.1 feet at reference gage of water-stage recorder at 9 a. m. February 7 (discharge, 8,690 second-feet); minimum stage from water-stage recorder, 0.35 foot October 9 (discharge, 6 second-feet).

1907–1912: 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 for water-stage recorder changed during flood of February. Well-defined rating curves applicable October 1 to February 5 and February 23 to September 30, respectively. Operation of water-stage recorder satisfactory except October 1 to 23, January 16 to 22, February 6 to 22, May 7 to 21, June 20 to 23, and September 27 to 30. Daily discharge for periods when recorder was working ascertained by applying to the rating table the mean daily gage height obtained by inspecting the gage-height graph. For periods in January, February, and May, when recorder was not working, the mean of two or more readings daily on staff gage on Loon Lake have been applied to the rating table for this gage. Two fairly well defined rating curves used for lake gage, applicable in January and February and in May.

COOPERATION.—Field data furnished by J. G. Kelley, consulting engineer, Portland Oreg.

Discharge measurements of Mill Creek near Ash, Oreg., during the year ending Sept. 30, 1916.

[Made by M. S. Kelley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1915–16.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*	1916.	*Feet.*	*Sec.-ft.*
Nov. 6	0.64	27.7	Jan. 24	6.62	3,100	Feb. 11	4.68	1,890
Dec. 31	2.25	411	24	6.75	3,380	12	4.48	1,730
22	2.92	773	25	5.75	2,940	Mar. 3	2.67	540
29	2.65	607	25	5.65	2,520	6	4.85	1,900
31	2.50	547	27	4.20	1,490	9	4.20	1,390
Jan. 5	2.02	376	Feb. 3	4.65	1,890	16	2.25	382
7	2.15	415	4	5.15	2,210	Sept. 6	.50	[a] 12.5
9	3.55	1,080	6	6.45	3,150	21	.41	[a] 7.9
23	4.25	1,580	9	5.18	2,280	24	.39	[a] 7.2

[a] Measurement made by H. V. Eva.

Daily discharge, in second-feet, of Mill Creek near Ash, Oreg., for the year ending Sept. 30, 1916.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	14	950	468	565	222	455	146	92	57	24	9.8
2	.....	19	760	410	1,260	309	355	141	90	59	24	9.8
3	.....	22	690	378	1,780	610	303	130	87	59	23	11
4	.....	28	865	362	2,170	1,110	267	125	85	59	23	11
5	.....	30	1,160	338	1,890	1,500	234	118	80	57	22	12
6	.....	30	1,960	330	3,280	1,850	202	114	76	56	20	12
7	.....	33	1,820	390	7,880	1,810	182	140	74	53	19	12
8	.....	43	1,300	715	3,940	1,780	160	320	73	53	18	12
9	.....	86	1,220	1,040	2,460	1,390	155	715	70	50	17	12
10	.....	97	1,160	1,100	1,960	1,140	158	840	66	46	17	12
11	.....	97	1,100	920	1,960	990	153	665	62	37	16	12
12	.....	120	1,130	890	1,810	825	146	518	60	34	16	11
13	.....	162	1,010	890	1,360	665	155	410	56	32	15	11
14	.....	151	850	950	1,020	546	148	350	54	31	14	10
15	.....	170	690	890	835	459	136	300	50	32	14	10
16	.....	486	600	740	710	382	132	260	49	37	14	9.8
17	.....	600	565	620	590	330	129	230	49	45	13	9.8
18	.....	740	531	504	504	306	134	208	46	53	13	9.3
19	.....	790	472	426	426	297	160	178	46	53	12	8.8
20	.....	690	442	378	378	334	178	157	45	52	12	8.8
21	.....	1,070	442	426	332	499	202	145	44	47	12	8.0
22	.....	1,070	665	620	290	775	300	150	44	43	12	8.0
23	.....	1,500	980	1,750	240	1,080	312	148	43	40	12	7.5
24	8	2,060	790	3,040	222	960	261	146	42	37	12	7.5
25	10	2,920	690	2,480	210	875	222	134	40	34	11	7.2
26	11	4,080	640	1,960	195	1,110	200	123	40	33	11	7.2
27	12	2,700	580	1,540	180	1,640	180	116	40	31	11	7.2
28	13	1,750	565	1,070	172	1,670	172	108	44	30	11	7.2
29	13	1,300	610	815	175	1,170	170	104	50	30	9.8	6.8
30	13	1,190	590	625	.....	800	158	100	56	29	9.8	6.8
31	13	.....	526	495	.....	596	.....	96	.....	26	9.8	.....

NOTE.—Mean discharge estimated as 6 second-feet Oct. 1–8, and 7 second-feet Oct. 10–23. Daily discharge interpolated June 20–23 and Sept. 27–30.

Monthly discharge of Mill Creek near Ash, Oreg., for the year ending Sept. 30, 1916.

[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	13	6	7.9	0.878	1.01	486
November	4,080	14	802	8.91	9.94	47,700
December	1,960	442	850	9.44	10.88	52,300
January	3,040	330	889	9.88	11.39	54,700
February	7,880	172	1,340	14.9	16.07	77,100
March	1,850	222	904	10.0	11.53	55,600
April	455	129	204	2.27	2.53	12,100
May	840	96	240	2.67	3.08	14,800
June	92	40	58.4	.649	.72	3,480
July	59	26	43.1	.479	.55	2,650
August	24	9.8	15.1	.168	.19	928
September	12	6.8	9.58	.106	.12	570
The year	7,880	6	444	4.93	68.01	322,000

WILSON RIVER BASIN.

WILSON RIVER NEAR TILLAMOOK, OREG.

LOCATION.—In NE. ¼ sec. 24, T. 1 S., R. 9 W., at highway bridge above mouth of North Fork of Wilson River, about 7 miles from Tillamook, Tillamook County.

DRAINAGE AREA.—170 square miles (measured on map compiled by G. B. Lacey & Co.).

RECORDS AVAILABLE.—December 18, 1914, to September 30, 1915; August 29 to November 4, 1916, when station was discontinued.

GAGE.—Vertical staff in two sections on right bank; read by William Tinnerstet.

DISCHARGE MEASUREMENTS.—Made from lower side of highway bridge, or by wading.

CHANNEL AND CONTROL.—Gravel which probably shifts during high floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded for period August 29 to November 4, 1916, 2.5 feet November 4 (discharge, 900 second-feet); minimum stage recorded, 0.15 foot October 22 to 27 (discharge, 88 second-feet).

Maximum stage during February, 1916, was 20.8 feet (determined by leveling to high-water marks).

1915–1916: Minimum discharge is that of 1916.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation fairly permanent between floods. Rating curve well defined between 100 and 150 second-feet. Gage read to quarter-tenths once or twice a day. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of Wilson River near Tillamook, Oreg., during 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 29	C. L. Batchelder	0.51	131
Sept. 25	W. E. Dickinson	.40	117

Daily discharge, in second-feet, of Wilson River near Tillamook, Oreg., for the period Aug. 29 to Nov. 4, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1		130	108	390	16		118	92	
2		134	105	520	17		115	92	
3		235	112	635	18		115	92	
4		199	102	900	19		115	92	
5		168	102		20		115	91	
6		158	102		21		115	91	
7		158	100		22		108	88	
8		178	97		23		108	88	
9		178	97		24		108	88	
10		172	97		25		108	88	
11		148	96		26		118	88	
12		141	92		27		130	88	
13		130	92		28		112	91	
14		130	92		29	132	108	199	
15		122	92		30	130	108	210	
					31	130		498	

Monthly discharge of Wilson River near Tillamook, Oreg., for the period Aug. 29 to Nov. 4, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
September	235	108	136	8,090
October	498	88	115	7,070

NORTH FORK OF WILSON RIVER NEAR TILLAMOOK, OREG.

LOCATION.—In NW. ¼ sec. 24, T. 1 S., R. 9 W., 800 feet above mouth of North Fork, about 8 miles from Tillamook, and 11 miles from Bay City, Tillamook County.

DRAINAGE AREA.—17 square miles (measured on maps compiled by G. B. Lacey & Co.).

RECORDS AVAILABLE.—August 21, 1913, to September 30, 1915; August 29 to November 4, 1916, when station was discontinued.

GAGE.—Vertical staff on left bank; read by William Tinnerstet.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gravel and cobblestones; shifts in floods.

EXTREMES OF STAGE.—Maximum stage recorded for period August 29 to November 4, 2.5 feet November 4 (discharge, 295 second-feet); minimum stage recorded, 1.52 feet October 21 to 25 (discharge, 12 second-feet).

1913–1916: Maximum stage recorded, 5.10 feet September 4, 1913, and January 23, 1914 (discharge, 1,760 second-feet). A maximum stage of 16.0 feet occurred during February, 1916, as determined from high-water marks. (No attempt has been made to estimate the discharge.) This stage was caused by backwater from Wilson River. The fall at low water between the water surface at this station and that of Wilson River is 7 feet (determined August 29, 1916). The minimum stage is that of 1916.

ICE.—Stage-discharge relation unaffected by ice.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent between floods. Rating curve well defined between 15 and 30 second-feet and fairly well defined above 30 second-feet. Gage read to quarter-tenths once or twice a day. Daily discharge ascertained by applying mean daily gage height to rating table. Records good.

Discharge measurements of North Fork of Wilson River near Tillamook, Oreg., during 1916.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Aug. 29	C. L. Batchelder	1.44	22.7
29	....do	1.44	22.4
Sept. 25	W. E. Dickinson	1.41	19.8

Daily discharge, in second-feet, of North Fork of Wilson River near Tillamook, Oreg., for the period Aug. 29 to Nov. 4, 1916.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1		20	12	58	16		24	14	
2		24	15	76	17		20	14	
3		50	18	112	18		18	14	
4		36	18	295	19		18	14	
5		29	13		20		18	13	
6		29	14		21		18	12	
7		24	22		22		18	12	
8		42	13		23		18	12	
9		42	14		24		18	12	
10		42	14		25		18	12	
11		36	13		26		25	14	
12		27	14		27		24	14	
13		27	13		28		18	18	
14		24	14		29	22	18	98	
15		20	14		30	20	18	126	
					31	20		87	

Monthly discharge of North Fork of Wilson River near Tillamook, Oreg., for the period Aug. 29 to Nov. 4, 1916.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
September	50	18	25.4	1,510
October	126	12	22.8	1,400

MISCELLANEOUS MEASUREMENTS.

The results 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, 1916.

Walla Walla River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Mar. 18	Walla Walla water-supply conduit.	Mill Creek	Intake, 12 miles east of Walla Walla, Wash.		21.4
May 13	Mill Creek	Walla Walla River	Above diversion dam, 12 miles east of Walla Walla, Wash.		140
Aug. 17	do	do	do		55.2

Umatilla River basin.

Feb. 12	Umatilla River	Columbia River	Pendleton, Oreg	4.98	2,260
Apr. 6	do	do	do	4.62	1,700
May 3	do	do	do	4.65	1,620
June 5	do	do	do	4.13	785
Do	do	do	do	3.82	180

Miscellaneous discharge measurements in lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1916—Continued.

John Day River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Mar. 28	Owings Creek	Camas Creek	NW. ¼ sec. 29, T. 4 S., R. 32 E., near Ukiah, Oreg.		52

Deschutes River basin.

Aug. 12	Deschutes River	Columbia River	Pringle Falls, Oreg	1.3	950
Oct. 1	Spring River	Deschutes River	Mouth, in sec. 6, T. 20 S., R. 11 E., Oregon.		163
Aug. 11	do	do	do		200
May 10	Warm Spring River	do	Former station at He He sawmill, in sec. 7, T. 7 S., R. 11 E.	2.09	348
June 29	do	do	do	1.80	267
Aug. 23	do	do	do	1.28	128
May 10	Mill Creek	Warm Spring River	Former gaging station at Indian Service sawmill.	1.85	146
June 29	do	do	do	1.90	153
Aug. 23	do	do	do	1.25	60
Do	Beaver Creek	do	Sec. 14, T. 7 S., R. 11 E., near Simnasho, Oreg.		51
Jan. 18	Tygh Creek	White River	Former gaging station near Tygh Valley.	1.20	58
Mar. 4	do	do	do	2.31	308
May 9	do	do	do	2.23	278

Klickitat River basin.

Aug. 21	Fish Lake Stream	West Fork	One-fourth mile below Fish Lake	0.50	8.0
22	do	do	do	.50	8.2
Sept. 5	do	do	do	.48	7.2
26	Two Lakes Stream	Fish Lake Stream	1,000 feet below lower lake	.79	11.0
1	Surveyors Creek	Klickitat River	Sec. 12, T. 8 N., R. 13 E	.30	6.5
4	do	do	do	.30	10.0
22	do	do	do	.26	6.7

Hood River basin.

July 30	Mount Hood Canal	Diverts from East Fork of Hood River.	Near Mount Hood, Oreg		14.0

White Salmon River basin.

Oct. 1	White Salmon River	Columbia River	Below big springs, in sec. 25, T. 5 N., R. 10 E.	2.65	209
19	do	do	do	2.57	188

Willamette River basin.

Jan. 23	Middle Fork of Willamette River.	Willamette River	Former gaging station near Oakridge.	2.82	4,420

Youngs River basin.

Aug. 8	Youngs River	Columbia River	Below falls, near Astoria, Oreg		27.3

Miscellaneous discharge measurements in lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1916—Continued.

Rogue River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
June 13	South Fork of Little Butte Creek.	Littel Butte Creek..	Near Deadwood, Oreg.....	1.32	18.3
17	....do.....	....do.....	Mouth, near Lake Creek, Oreg..	.....	70
17	North Fork of Little Butte Creek.	....do.....	Former gaging station above city intake near Lake Creek, Oreg.	.82	56
Aug. 9	....do.....	....do.....	....do.....	.78	52
Sept. 2	....do.....	....do.....	....do.....	.75	60
5	....do.....	....do.....	....do.....	.76	52
June 15	Ashland Creek.....	Bear Creek.....	Lithia Park, Ashland, above dam.	1.38	63
July 3	Wagner Creek.....	....do.....	Near Talent, Oreg.....	1.07	5.5
11	....do.....	....do.....	....do.....	.97	2.7
25	....do.....	....do.....	....do.....	1.00	2.1
Aug. 23	....do.....	....do.....	....do.....	.86	1.4
July 8	Little Applegate River.	Applegate River....	Below mouth of Bear Gulch....	.....	13.2
26	....do.....	....do.....	....do.....	.....	5.2
July 7	McDonald Creek.....	Little Applegate River.	One-half mile above mouth.....	.....	25.4
26	....do.....	....do.....	....do.....	.....	11.3
7	Greeley Creek.....	....do.....	Above intake, Greeley ditch....	.....	1.0
26	....do.....	....do.....	....do.....	.....	.5

Coquille River basin.

Sept. 6	South Fork of Coquille River.	Coquille River.....	Above Middle Fork near Myrtle Point, in sec. 27, T. 29 S., R. 12 W.	.....	57
4	Salmon Creek.....	South Fork of Coquille River.	Mouth, at Powers.....	.....	15
6	Middle Fork.....	....do.....	Mouth, near Myrtle Point, sec. 27, T. 29 S., R. 12 W.	.....	37
5	North Fork.....	Coquille River.....	Sec. 5, T. 27 S., R. 11 W., 5 miles above Fairview, Oreg.	.....	13.8
5	Middle Creek.....	North Fork of Coquille River.	¾ mile above mouth, in sec. 7, T. 28 S., R. 11 W.	.....	15.3
5	East Fork.....	....do.....	Above Weakly Creek, in sec. 30, T. 28 S., R. 11 W.	.....	42

Coos River basin.

Sept. 7	South Fork.....	Coos River.....	½ mile above fish hatchery, 25 miles east of Marshfield.	.....	49
8	East Fork.....	Millicoma River.....	Sec. 36, T. 24 S., R. 11 W., above Glen Creek.	.....	18.5
8	Glen Creek.....	East Fork of Millicoma River.	1 mile above mouth.....	.....	9.8

Umpqua River basin.

Feb. 7	North Umpqua River.	Umpqua River.....	At former gaging station at Winchester.	15.6	41,300
Apr. 5	....do.....	....do.....	....do.....	4.05	3,910
Feb. 8	Oak Creek.....	North Umpqua River.	Former Oak Creek post office...	.....	101
Nov. 21	Lake Creek.....	Loon Lake.....	Salander's bridge near mouth...	.....	778
Dec. 28	Camp Creek.....	Mill Creek.....	County bridge, near Ash post office.	.....	184
Jan. 1	....do.....	....do.....	....do.....	.....	131
4	....do.....	....do.....	....do.....	.....	87
Sept. 9	Smith River.....	Umpqua River.....	Above Spencer Creek in sec. 34, T. 20 S., R. 10 W.	.....	43
9	Spencer Creek.....	Smith River.....	Mouth, in sec. 27, T. 20 S., R. 10 W.	.....	1.0
Sept. 10	North Fork.....	....do.....	Sec. 19, T. 20 S., R. 10 W., 3 miles above mouth.	.....	24

Miscellaneous discharge measurements in lower Columbia River basin and Pacific slope basins in Oregon during the year ending Sept. 30, 1916—Continued.

Siuslaw River basin.

Date.	Stream.	Tributary to or diverting from—	Locality.	Gage height.	Discharge.
				Feet.	*Sec-ft.*
Sept. 12	Siuslaw River	Pacific Ocean	Above Wildcat Creek, in sec. 29, T. 18 S., R. 8 W.		74
12	Wildcat Creek	Siuslaw River	Mouth		21

Alsea River basin.

Sept. 16	Alsea River	Pacific Ocean	Sec. 7, T. 14 S., R. 9 W., above Five Rivers, near Denzer, Oreg.		73
16	Five Rivers	Alsea River	Above Bear Creek, in sec. 17, T. 14 S., R. 9 W.		40
16	Lobster Creek	do	Mouth, in sec. 19, T. 14 S., R. 9 W.		19

Siletz River basin.

Sept. 14	Siletz River	Pacific Ocean	Former gaging station at Siletz, Oreg.	2.00	162

Nestucca River basin.

Sept. 26	Nestucca River	Pacific Ocean	Below Moon Creek near Blaine, Oreg.		66
26	Moon Creek	Nestucca River	Above East Creek		6.2
26	East Creek	Moon Creek	Mouth, near Blaine, Oreg.		10.2
26	Beaver Creek	Nestucca River	Beaver, Oreg.		19.5

Tillamook Bay basin.

Aug. 28	Tillamook River	Tillamook Bay	Sec. 8, T. 2 S., R. 9 W., near Tillamook, Oreg.		26
Sept. 26	do	do	Above Beulah Creek		27
Aug. 28	Trask River	do	Sec. 5, T. 2 S., R. 9 W., near Tillamook, Oreg.		147
Sept. 26	do	do	7 miles above Tillamook, Oreg.		122

INDEX.

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 results of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage features as indicated below:

Part I. North Atlantic slope basins.
II. South Atlantic 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 Superin-

tendent 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.
Madison, Wis., care of Railroad Commission of Wisconsin.
Topeka, Kans., 25 Federal Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, 421 Federal Building.
Boise, Idaho, 615 Idaho Building.
Portland, Oreg., 606 Post Office Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Cal., 328 Customhouse.
Los Angeles, Cal., 619 Federal Building.
Austin, Tex., Capitol Building.
Honolulu, Hawaii, 14 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 4,100 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
11th A, pt. 2	Monthly discharge and descriptive information	1884 to September, 1890.
12th A, pt. 2	do	1884 to June 30, 1891.
13th A, pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th A, pt. 2	Monthly discharge (long-time records, 1871 to 1893)	1888 to Dec. 31, 1893.
B 131	Descriptions, measurements, gage heights, and ratings	1893 and 1894.
16th A, pt. 2	Descriptive information only	
B 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W 11	Gage heights (also gage heights for earlier years)	1896.
18th A, pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for some earlier years).	1895 and 1896.
W 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th A, pt. 2	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.

Stream flow data in reports of the United States Geological Survey—Continued.

Report.	Character of data.	Year.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1809.
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.

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 1916. 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 1916, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, and 431, which contain records for the New England streams from 1903 to 1916. 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, 1899–1916.

Year.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII		
												North Pacific slope basins.		
	North Atlantic slope basins (St. John River to York River).	South Atlantic slope and eastern Gulf of Mexico basins (James River to the Mississippi).	Ohio River basin.	St. Lawrence River basin.	Hudson Bay and upper Mississippi River basins.	Missouri River basin.	Lower Mississippi River basin.	Western Gulf of Mexico basins.	Colorado River basin.	Great Basin.	Pacific slope basins in California.	Pacific slope basins in Washington 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] 36, 37	37	37	[d] 37, 38	38, [e] 39	38, [f] 39	38	38	38
1900 [g]	47, [h] 48	48	48, [i] 49	49	49	49, [j] 50	50	50	50	51	51	51	51	51
1901	65, 75	65, 75	65, 75	65, 75	[k] 65, 66, 75	66, 75	[k] 65, 66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75	66, 75
1902	82	[b] 82, 83	83	[l] 82, 83	[k] 83, 85	84	[k] 83, 84	84	85	85	85	85	85	85
1903	97	[b] 97, 98	98	97	[h] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	129	[k] 128, 130	130, [q] 131	[k] 128, 131	132	133	133, [r] 134	134	135	135	135
1905	[n] 165, [o] 166, [p] 167	[p] 167, 168	169	170	171	172	[k] 169, 173	174	175, [s] 177	176, [r] 177	177	178	178	[t] 177, 178
1906	[n] 201, [o] 202, [p] 203	[p] 203, 204	205	206	207	208	[k] 205, 209	210	211	212, [r] 213	213	214	214	214
1907–8	241	242	243	244	245	246	247	248	249	250, [r] 251	251	252	252	252
1909	261	262	263	264	265	266	267	268	269	270, [r] 271	271	272	272	272
1910	281	282	283	284	285	286	287	288	289	290	291	292	292	292
1911	301	302	303	304	305	306	307	308	309	310	311	312	312	312
1912	321	322	323	324	325	26	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

[a] Rating tables and index to Water-Supply Papers 35-39 contained in Water-Supply Paper 39. Tables fos 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 drainage 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 charge for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill rivers to James River.
[i] Scioto River.
[j] Loup and Platte rivers near Columbus, Nebr., and all tributaries below junction with Platte.
[k] Tributaries of Mississippi from east.
[l] Lake Ontario and tributaries to St. Lawrence River proper.
[m] Hudson Bay only.
[n] New England rivers only.
[o] Hudson River to Delaware River, inclusive.
[p] Susquehanna River to Yadkin River, inclusive.
[q] Platte and Kansas rivers.
[r] Great Basin in California except Truckee and Carson river basins.
[s] Below junction with Gila.
[t] Rogue, Umpqua, and Siletz rivers only.

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.—Date after a date indicates that station was being maintained September 30, 1916. 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.

PUGET SOUND DRAINAGE BASINS.

Elwha River at McDonald, Wash., 1897–1901.
Elwha River near Port Angeles, Wash., 1911–12.
Dungeness River at Sequin, Wash., 1897–98.
Dungeness River at Dungeness, Wash., 1898–1901.
Dosewallips River at Brinnon, Wash., 1910–11.
Duckabush River near Duckabush, Wash., 1910–11.
Skokomish River, North Fork (head of Skokomish River), nead Hoodsport, 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 near 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.

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., 1910–11.
Middle Fork of Nooksack River near Deming, Wash., 1910–11.

COLUMBIA RIVER BASIN.

Columbia River at Trail, British Columbia, 1913–
Columbia River at Wenatchee, Wash., 1910.
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–
Yaak River near Troy, Mont., 1910–
Moyie River at Snyder, Idaho, 1911–
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., 1898–1900.
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–
Lolo Creek near Lolo, Mont., 1910–
St. Regis River near St. Regis, Mont., 1910–1915.
Flathead River near Columbia Falls, Mont., 1910–
Flathead River at Demersville, near Kalispell, Mont., 1910–1912.
Flathead River at Damon's ranch, near Kalispell, Mont., 1910–1912.
Flathead River at Keller's ranch, near Holt, Mont., 1910–1912.
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–
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.
Little Bitterroot River near Marion, Mont., 1910–

[1] Revised decision of United States Geographic Board rendered Oct. 3, 1917.

Columbia River tributaries—Continued.
Yakima River tributaries—Continued.
New Reservation canal near Parker (Yakima City), Wash., 1904–
Old Reservation canal near 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 mouth of 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, 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, 1889–1890; 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–
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–
Snake River near Hagerman, Idaho, 1912–
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–
Pacific Creek near Moran, Wyo., 1906.
Buffalo River near Elk, Wyo., 1906.
Henrys Fork [2] 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.

[1] Decision of United States Geographic Board; formerly called South Fork of Snake River.
[2] Decision of United States Geographic Board; formerly called North Fork of Snake River.

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
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.
Bully Creek at Warm Springs, near Vale, Oreg., 1903–4; 1905–1907; 1911–
Bully Creek at Vale, Oreg., 1904–5.
Hope Mill ditch at Vale, Oreg., 1904–5.
Willow Creek near Malheur, Oreg., 1904–6; 1910–11; 1912–1915.
Willow Creek near Brogan, Oreg., 1910–
Willow Creek at Dell, Oreg., 1904–1906.
Cow Creek near Brogan, Oreg., 1912–
Pole Creek near Brogan, Oreg., 1912–13.
Nevada ditch below Vale, Oreg., 1904–5.
Payette River near Horseshoe Bend, Idaho, 1906–
Payette River at Payette, Idaho, 1895–1897.
North Fork of Payette River at Lardo, Idaho, 1908–
North Fork of Payette River at Van Wyck, Idaho, 1912–
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–
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.

Columbia River tributaries—Continued.
Deschutes River tributaries—Continued.
Crooked River tributaries—Continued.
Ochoco Creek tributaries—Continued.
Tableland ditch near Prineville, Oreg., 1915–
Elliot ditch near Prineville, Oreg., 1908–1910; 1914–
McKay Creek near Prineville, Oreg., 1915–
Metolius River at Allingham ranger station, near Sisters, Oreg., 1910–1913; 1915–
Metolius River at Hubbard's ranch, near Grandview, Oreg., 1910–1913.
Metolius River at Rigg's ranch, near Sisters, Oreg., 1908–1912.
Lake Creek near Sisters, Oreg., 1911–1913; 1915–
First Creek near Sisters, Oreg., 1915–
Jack Creek near Sisters, Oreg., 1915–
Canyon Creek near Sisters, Oreg., 1915–
Whitewater River near Grandview, Oreg., 1911–1913.
Shitike Creek at Warmspring, Oreg., 1911–
Trout Creek near Antelope, Oreg., 1915; 1916–
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., 1907–1908.
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 at 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–
Hood River at Winans, Oreg., 1905–1907; 1910–1912; 1913.
Hood River at Tucker Bridge, Oreg., 1897–1899; 1913–
Hood River at Powerdale, near Hood River, Oreg., 1913–
East Fork of Hood River near Mount Hood, Oreg., 1913–
East Fork Irrigation District canal near Mount Hood, Oreg., 1913–
West Fork of Hood River near Dee, Oreg., 1913–
Pacific Light & Power Co.'s tailrace near Hood River, Oreg., 1914; 1916–
White Salmon River at splash dam near Trout Lake, Wash., 1912–
White Salmon River at Husum, Wash., 1909–

[1] Records published in U. S. Geol. Survey Water-Supply Paper 272, pp. 428–429.

STREAMS BETWEEN COLUMBIA RIVER AND KLAMATH RIVER.

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 Goverrment 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 Harnei 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, 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 steam-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:

(*e*) 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 lands; 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. Leiberg, pp. 217–252, Pls. 48–61.

*Bitterroot Forest Reserve, by J. B. Leiberg, 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. Leiberg, 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. Leiberg, 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. Leiberg, 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 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. 5c.

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.

*139. Snoqualmie, Washington.

[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.

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 calssifiable 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 akaline 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, Cal., and on Long Island, N. Y., gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls. 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.
Silting of reservoirs, by W. M. Reed.
Farm-unit classification, by D. W. Ross.
Cost of power for pumping irrigating water, by H. A. Storrs.
Records of flow at current-meter gaging stations during the frozen season, by F. H. Tillinghast.

147. Destructive floods in 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 wells, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation; treatment of slop; sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, 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 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 wast 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. 111 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, Cal., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 50c.

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.

616. The data of geochemistry (third edition), by F. W. Clarke. 1916. 821 pp. 45c.

Earlier editions were published as Bulletins 330 and 491. Contains a discussion of the statement and interpretation of water analyses and a chapter on "Mineral wells and springs" (pp. 179–216). 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.

INDEX BY AREAS AND SUBJECTS.

[A=Annual Reports; M=Monograph; B=Bulletin; P=Professional Paper; W=Water-Supply Paper; G F=Geologic folio.]

[1] Many of the reports contain brief subject bibliographies. See abstracts.

[2] Many analyses of river, spring, and well waters are scattered through publications, as noted in abstracts.

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