DEPARTMENT OF THE INTERIOR
JOHN BARTON PAYNE, Secretary

UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, Director

Water-Supply Paper 462

SURFACE WATER SUPPLY OF THE UNITED STATES

1917

PART XII. NORTH PACIFIC SLOPE DRAINAGE BASINS

A. PACIFIC BASINS IN WASHINGTON AND UPPER COLUMBIA RIVER BASIN

NATHAN C. GROVER, Chief Hydraulic Engineer
G. L. PARKER and W. A. LAMB, District Engineers

Prepared in cooperation with the States of
WASHINGTON, MONTANA, and IDAHO

WASHINGTON
GOVERNMENT PRINTING OFFICE
1921

CONTENTS.

ILLUSTRATIONS.

SURFACE WATER SUPPLY OF PACIFIC SLOPE BASINS IN WASHINGTON AND UPPER COLUMBIA RIVER BASIN, 1917.

AUTHORIZATION AND SCOPE OF WORK.

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

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

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 of water supply for irrigation. Since the fiscal year ending June 30, 1895, successive sundry civil bills passed by Congress have carried the following item and appropriations:

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

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

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

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

Measurements of stream flow have been made at about 4,240 points in the United States and also at many points in Alaska and the

Hawaiian Islands. In July, 1917, 1,180 gaging stations were being maintained by the Survey and the cooperating organizations. Many miscellaneous discharge measurements were 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 the 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 work of a certain class. These terms may be divided into two groups—(1) those that represent a rate of flow, as second-feet, gallons per minute, miner's inches, and discharge in second-feet per square mile, and (2) those that represent the actual quantity of water, as run-off in 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.

"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 below the gage which determine the stage-discharge relation at the gage. It should be noted that the control may not be the same section or sections at all stages.

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

EXPLANATION OF DATA.

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

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

From the discharge measurements rating tables are prepared that give the discharge for any stage. The application of the daily gage heights to these rating tables gives the daily discharge from which the monthly and yearly mean discharge are computed.

The data presented for each gaging station in the area covered by this report comprises a description of the station, a table giving results of discharge measurements, a table showing the daily discharge, 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 channel, 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 the discharge in second-feet corresponding to the mean of the gage heights read each day. At

stations on streams subject to sudden or rapid diurnal fluctuation the discharge obtained from the rating table and the mean daily gage heights 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 weighting discharge for parts of the day or by use of the discharge integrator, an instrument operating on the principle of the planimeter and containing as an essential element the rating curve of the station.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest. As the gage height is the mean for the day, it does not indicate correctly the stage when the water surface was at crest height, and the corresponding discharge was consequently larger than that given in the column. Likewise, in the column headed "Minimum," the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" gives the average flow in cubic feet for each second during the month. On this average flow computations recorded in the remaining columns, which are defined on page 9, are based.

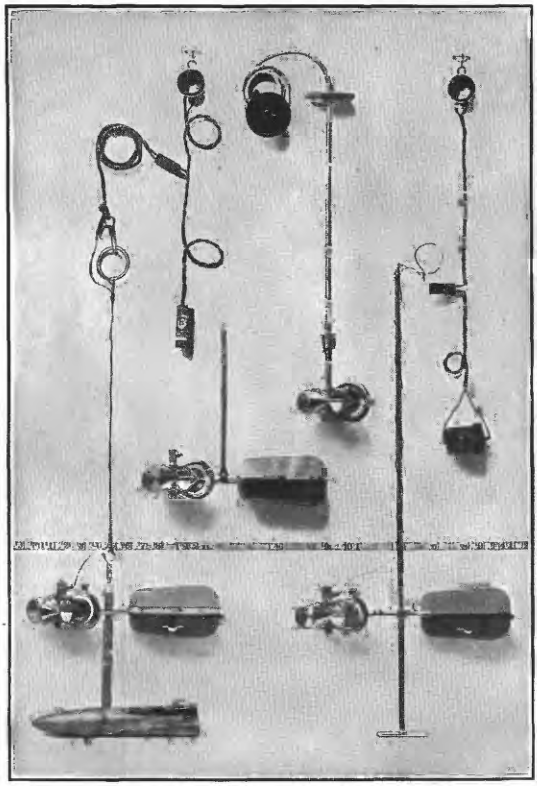
ACCURACY OF FIELD DATA AND COMPUTED RESULTS.

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

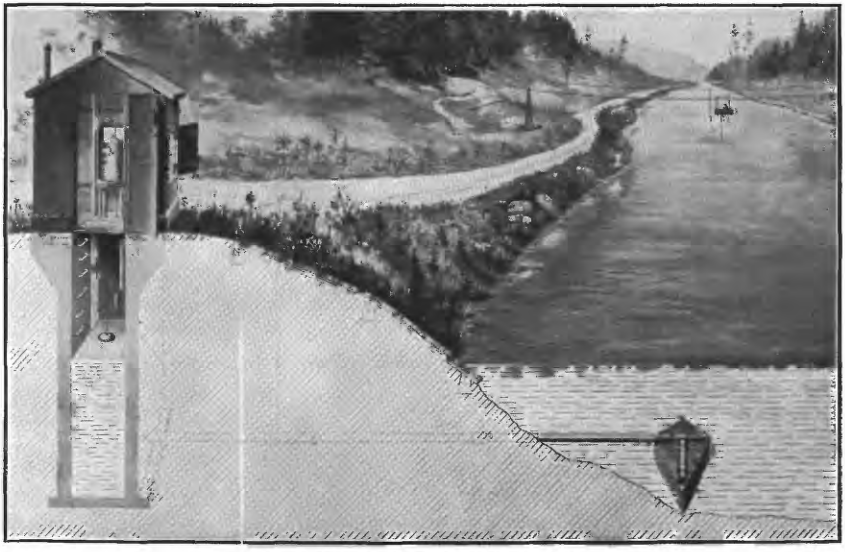
A paragraph in the description of the station or footnotes added to the tables gives information regarding the (1) permanence of the stage-discharge relation, (2) precision with which the discharge rating curve is defined, (3) refinement of gage readings, (4) frequency of gage readings, and (5) methods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

For the rating curves "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.

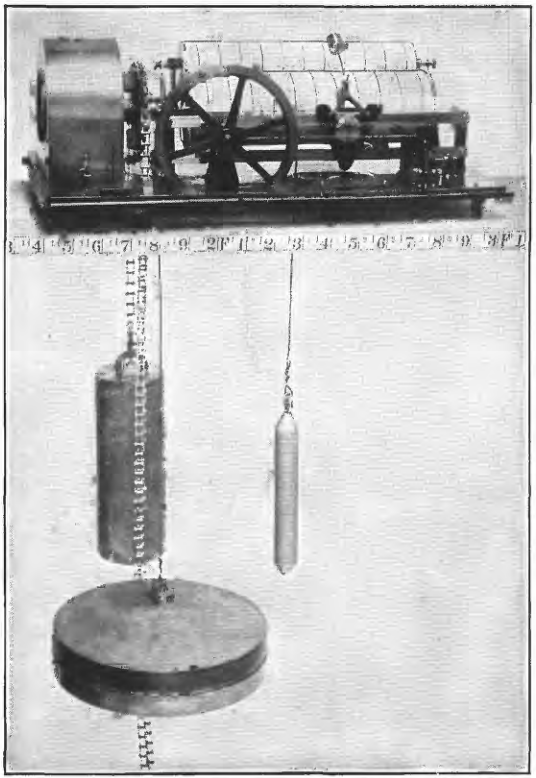
The monthly means for any station may represent with high accuracy the quantity of water flowing past the gage, but the figures showing discharge per square mile and depth of run-off in inches may be subject to gross errors caused by including large noncontributing districts in the measured drainage 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



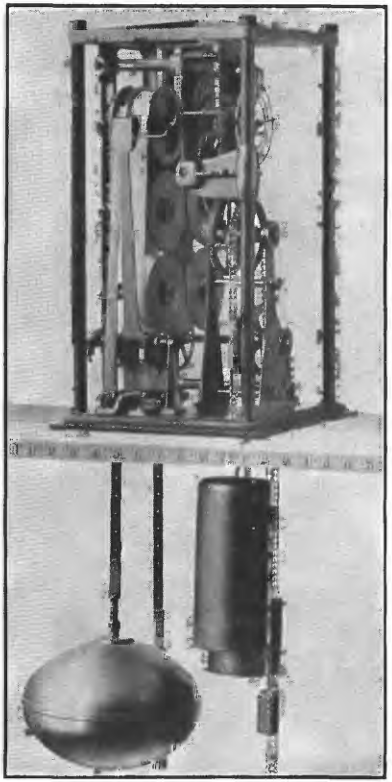
A. PRICE CURRENT METERS.



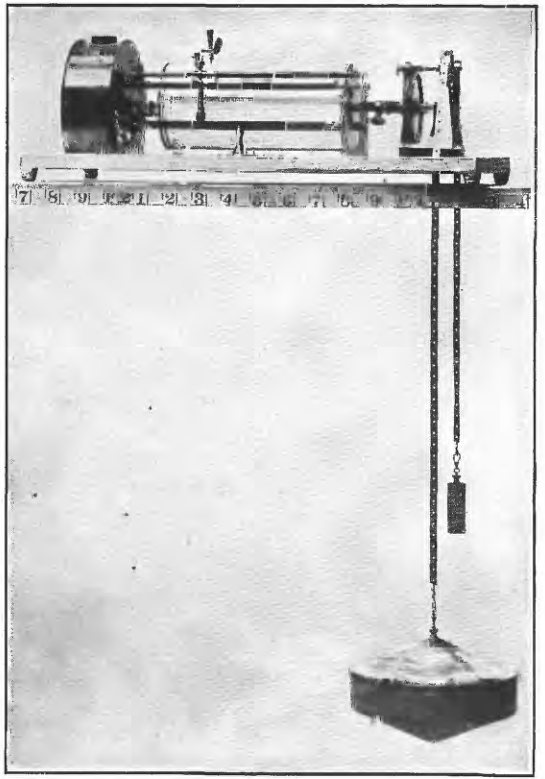
B. TYPICAL GAGING STATION.



A. STEVENS CONTINUOUS.



B. GURLEY PRINTING.



C. FRIEZ.

WATER-STAGE RECORDERS.

appear probable, and 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 records previously published.

COOPERATION.

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

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

The work in Washington was carried on in cooperation with the Board of Geological Survey, composed of Ernest Lister, governor and chairman of board; L. F. Hart, lieutenant governor and vice-chairman of board; W. W. Sherman, State treasurer and secretary of board; Henry Suzzallo, president of the University of Washington; and E. O. Holland, president of the State College. The board was efficiently represented in the cooperative investigations by Henry Landes, State geologist.

Acknowledgments are due to A. W. Mahon, State engineer of Montana, and to J. H. Smith, State engineer of Idaho, for the efficient manner in which they represented their States in the cooperative investigations.

Acknowledgments are also due to the United States Reclamation Service, the United States Forest Service, and the United States Office of Indian Affairs for assistance, suggestions, and the freest use of data gathered exclusively for them and paid for by them. The United States Weather Bureau furnished hydrographic and climatologic data used in discharge computations for a number of streams.

Acknowledgments are also due to the Hydrometric Survey of British Columbia for complete records of Columbia River at Trail, British Columbia, and for cooperation in the maintenance of the gaging station on Clark Fork at Metaline Falls, Wash.

Acknowledgment is made in the descriptions of gaging stations for gage-height records and discharge measurements furnished by cooperating parties.

DIVISION OF WORK.

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

Data for stations in Montana were collected and prepared for publication under the direction of W. A. Lamb, district engineer, assisted by A. H. Tuttle and E. W. Kramer, district engineer for the United States Forest Service.

Data for stations in the Yakima River basin, exclusive of those in the Yakima Indian Reservation, were collected and prepared for publication in cooperation with Paul Taylor, engineer in charge of hydrometric work, United States Reclamation Service, assisted by F. E. Moxley.

The manuscript was prepared by Lasley Lee and A. H. Tuttle and reviewed by B. L. Hopkins and W. R. King.

GAGING-STATION RECORDS.

QUINAULT RIVER BASIN.

QUINAULT RIVER AT QUINAULT LAKE, WASH.

LOCATION.—In sec. 25, T. 23 N., R. 10 W., at outlet of Quinault Lake, 4 miles southwest of Quinault and 33 miles north of Hoquiam, in Grays Harbor County.

DRAINAGE AREA.—264 square miles (measured on Plate I, U. S. Geol. Survey Prof. Paper 7).

RECORDS AVAILABLE.—October 29, 1911, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank 350 feet below Olympic Highway crossing at the outlet of Quinault Lake, installed September 27, 1916, at different datum from previous gage; inspected by C. S. Locke and Fred Halbert. Previous gages as follows: Prior to January 1, 1913, staff gage on south shore of lake 3 miles northeast of present site; January 1, 1913, to September 30, 1916, staff gage on Canoe Creek 400 feet above its mouth, 4 miles northeast of present site at datum 1.05 feet higher than datum of original gage. All readings prior to October 1, 1916, have been referred to datum of gage on Canoe Creek.

DISCHARGE MEASUREMENTS.—Made from boat or from cable 700 feet above gage.

CHANNEL AND CONTROL.—Bed composed of boulders. Well-defined control 600 feet below gage. Left bank high and wooded; not subject to overflow; right bank high, wooded, and subject to overflow at about gage height 20 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.76 feet at 7 a. m. November 4 (discharge, 6,670 second-feet); minimum stage recorded, 0.94 foot at 4 a. m. October 25 (discharge, 439 second-feet).

1911–1917: Maximum stage recorded, 16.3 feet at 8 a. m. January 6, 1914 (discharge, 32,500 second-feet); minimum stage recorded, 0.4 foot at 7 a. m. October 1, 1915 (discharge, 395 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Water-stage recorder not operating April 8–10 and 15–28, July 16 to August 1, and September 16 to 25. Rating curve well defined. Daily discharge ascertained by applying to rating table mean daily gage heights obtained by inspecting recorder graph or, for days of considerable fluctuation, by averaging results obtained by applying gage heights for shorter intervals. Records excellent except for periods when recorder was not operating.

Discharge measurements of Quinault River at Quinault Lake, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 4	J. E. Stewart	3.14	2,320	June 17	C. G. Paulsen	4.60	4,460
May 6	do	3.07	2,300	June 17	do	4.58	4,550
June 16	C. G. Paulsen	4.48	4,340	Sept. 1	do	1.76	919

Daily discharge, in second-feet, of Quinault River at Quinault Lake, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	630	3,200	2,240	1,210	1,360	1,150	2,240	2,850	4,380	3,500	1,810	879
2	600	3,820	2,440	1,360	1,360	1,100	2,180	2,710	4,550	3,730	1,930	871
3	580	5,000	4,190	1,470	1,910	1,050	2,120	2,500	4,210	3,970	1,990	823
4	562	6,550	4,720	1,780	2,920	1,160	2,240	2,380	3,730	4,050	1,990	801
5	540	5,790	4,050	4,430	3,500	1,470	3,280	2,240	3,430	3,970	1,930	766
6	531	4,720	3,280	4,890	3,430	1,580	3,660	2,180	3,280	3,730	1,870	745
7	519	3,730	2,780	4,210	3,200	1,580	3,580	2,440	3,430	3,580	1,810	787
8	507	3,360	2,440	3,810	2,990	1,520	3,480	2,710	3,580	3,430	1,690	847
9	499	4,210	2,180	3,810	2,850	1,420	3,390	3,130	3,890	3,360	1,640	871
10	492	4,550	1,930	3,430	2,780	1,360	3,300	3,500	3,730	3,360	1,580	871
11	488	3,660	1,810	3,060	2,920	1,260	3,200	3,580	3,430	3,360	1,520	1,020
12	484	2,990	1,930	2,710	2,990	1,200	3,060	3,730	3,060	3,430	1,520	1,190
13	481	2,500	2,310	2,380	2,780	1,170	2,920	3,890	2,920	3,500	1,520	1,360
14	484	2,180	2,310	2,120	2,500	1,140	2,920	3,660	3,200	3,500	1,520	1,360
15	478	1,930	2,120	1,930	2,380	1,090		3,360	3,730	3,660	1,470	1,310
16	484	1,690	1,990	1,690	2,500	1,040		2,990	4,380		1,470	
17	488	1,580	1,870	1,580	2,570	980		2,710	4,550		1,420	
18	484	1,520	1,930	1,470	2,440	954	2,350	2,440	4,210		1,360	
19	474	1,420	2,180	1,360	2,310	989		2,380	4,210	3,000	1,360	
20	467	1,310	2,180	1,310	2,120	1,040		2,310	4,130		1,420	
21	467	1,240	2,120	1,260	1,990	1,160		2,310	4,050		1,360	1,000
22	464	1,250	2,120	1,190	1,870	1,360		2,310	3,890		1,260	
23	456	1,230	2,050	1,150	1,690	1,940		2,380	3,660		1,180	
24	450	1,170	1,930	1,140	1,580	2,710		2,440	3,730		1,140	
25	446	1,260	1,690	1,260	1,470	2,570	2,950	2,440	3,890	2,350	1,100	
26	453	1,580	1,580	1,420	1,360	2,310		2,570	3,730		1,050	766
27	464	2,120	1,470	1,810	1,260	2,180		2,990	3,730		1,030	972
28	499	2,640	1,360	1,870	1,210	2,180		3,430	3,810	2,440	989	1,230
29	892	2,640	1,260	1,750	.....	2,710	2,920	3,890	3,660	2,310	972	1,200
30	1,430	2,440	1,210	1,580	.....	2,780	2,990	4,210	3,500	2,180	938	1,110
31	3,060	.....	1,160	1,470	.....	2,500	.....	4,380	.....	1,990	912	.....

NOTE.—Water-stage recorder not operating and discharge determined as follows: Apr. 8–10, discharge interpolated; Apr. 15–28, July 16–27, and Sept. 16–25, discharge estimated from range in stage indicated on gage-height chart while recorder was stopped and weather records; July 28 to Aug. 1, discharge ascertained from observer's readings on gage at Canoe Creek on July 28, 30, 31, and Aug. 1. Braced figures show mean discharge for periods included.

Monthly discharge of Quinault River at Quinault Lake, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 264 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	3,060	446	624	2.36	2.72	38,400
November	6,550	1,170	2,780	10.5	11.71	165,000
December	4,720	1,160	2,220	8.41	9.70	136,000
January	4,890	1,140	2,130	8.07	9.30	131,000
February	3,500	1,210	2,290	8.67	9.03	127,000
March	2,780	954	1,570	5.95	6.86	96,500
April	3,660	.....	1,760	6.67	7.44	105,000
May	4,380	2,180	2,940	11.1	12.80	181,000
June	4,550	2,920	3,790	14.4	16.07	226,000
July	4,050	1,990	2,210	8.37	9.65	136,000
August	1,990	912	1,440	5.45	6.28	88,500
September	1,360	745	693	2.62	2.92	41,200
The year	6,550	446	2,030	7.69	104.48	1,470,000

PUGET SOUND BASINS.

SKOKOMISH RIVER BASIN.

NORTH FORK OF SKOKOMISH RIVER NEAR HOODSPORT, WASH.

LOCATION.—In sec. 5, T. 22 N., R. 4 W., at footbridge on Forest Service trail to South Fork of Skokomish River, 4 miles below Lake Cushman and 4 miles northwest of Hoodsport, Mason County.

DRAINAGE AREA.—91 square miles (measured on Plate 1, U. S. Geol. Survey Prof. Paper 7).

RECORDS AVAILABLE.—August 17, 1910, to September 22, 1911; February 1, 1913, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank just below trail bridge, inspected by G. H. Moore.

DISCHARGE MEASUREMENTS.—Made from cable about a mile above gage or by wading.

CHANNEL AND CONTROL.—Channel curved above gage, straight below gage for 200 feet. Banks high, not subject to overflow. Control composed of rock and gravel, practically permanent. Stage of zero flow determined October 12, 1915, gage height 4.2 feet ± 0.3 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.61 feet at 3.30 a. m. November 4 (discharge, 2,260 second-feet); minimum stage recorded, 5.93 feet midnight to 2 a. m. October 26 (discharge, 119 second-feet).

1913–1917: Maximum stage estimated at 23.5 feet January 6, 1914, during part of day when recorder was not operating (discharge, about 14,000 second-feet); minimum stage recorded, 5.81 feet September 30, 1915 (discharge, 100 second-feet).

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

DIVERSIONS.—None above station.

REGULATION.—Flow subject to natural regulation at Lake Cushman.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Daily discharge ascertained by applying to rating table mean daily gage heights obtained by inspecting gage-height graph or, for days of considerable fluctuation, by averaging results obtained by applying gage heights for shorter intervals. Records excellent.

COOPERATION.—Gage-height record and discharge measurements furnished by city of Seattle.

Discharge measurements of North Fork of Skokomish River near Hoodsport, Wash., during the year ending Sept. 30, 1917.

[Made by G. H. Moore.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Oct. 7	6.09	145
Feb. 15	7.94	592

Daily discharge, in second-feet, of North Fork of Skokomish River near Hoodsport, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	166	872	521	317	290	317	521	854	1,440	984	462	220
2	166	1,110	780	340	312	309	491	764	1,310	1,140	462	216
3	162	1,510	1,490	366	406	300	476	730	1,100	1,220	476	206
4	159	2,010	1,220	428	630	353	536	696	965	1,180	462	202
5	151	1,440	890	1,380	747	406	836	662	890	1,140	448	198
6	148	1,100	696	1,220	713	406	854	730	908	1,060	434	196
7	146	836	582	890	662	392	890	890	1,060	984	406	214
8	146	696	536	730	646	366	965	984	1,220	965	379	251
9	144	946	476	696	630	353	890	1,220	1,220	965	366	237
10	141	965	420	662	679	332	818	1,310	1,020	984	353	229
11	140	713	392	630	836	319	872	1,310	908	965	353	292
12	138	566	448	582	854	317	818	1,360	818	984	353	340
13	136	491	551	536	747	317	764	1,310	836	1,020	253	406
14	136	434	536	491	679	302	764	1,140	1,060	984	353	335
15	135	392	491	448	614	288	713	1,020	1,310	984	337	290
16	136	366	463	420	679	276	630	927	1,440	984	332	264
17	140	340	437	392	696	271	582	836	1,360	984	330	240
18	140	337	448	379	630	271	551	800	1,180	946	319	220
19	136	327	506	366	598	280	551	800	1,220	908	304	202
20	133	309	506	340	536	297	646	800	1,220	872	295	188
21	132	297	491	332	491	322	872	818	1,140	836	290	178
22	128	330	476	317	476	340	890	836	1,020	747	273	171
23	127	335	462	300	433	506	800	872	965	646	266	168
24	124	317	420	290	392	679	730	890	1,100	598	262	164
25	124	379	392	304	379	566	747	890	1,100	566	257	162
26	125	491	366	322	366	476	800	965	1,020	582	248	164
27	138	646	353	379	340	434	836	1,220	1,060	598	242	178
28	153	730	335	379	332	462	854	1,400	1,140	614	237	198
29	329	646	322	353	.....	713	908	1,490	1,060	566	231	194
30	526	582	309	317	.....	679	927	1,490	965	506	226	175
31	1,230	.....	300	302	.....	566	.....	1,440	.....	476	224	.....

Monthly discharge of North Fork of Skokomish River near Hoodsport, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 91 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	1,230	124	195	2.14	2.47	12,000
November	2,010	297	684	7.52	8.39	40,700
December	1,490	300	536	5.89	6.79	33,000
January	1,380	290	491	5.40	6.23	30,200
February	854	290	564	6.20	6.46	31,300
March	713	271	394	4.33	4.99	24,200
April	965	476	751	8.25	9.20	44,700
May	1,490	662	1,010	11.1	12.80	62,100
June	1,440	818	1,100	12.1	13.50	65,500
July	1,220	476	871	9.57	11.03	53,600
August	476	224	333	3.66	4.22	20,500
September	406	162	223	2.45	2.73	13,300
The year	2,010	124	596	6.55	88.81	431,000

PUYALLUP RIVER BASIN.

PUYALLUP RIVER NEAR ELECTRON, WASH.

LOCATION.—In NE. ¼ NW. ¼ sec. 3, T. 16 N., R. 6 E., 1,000 feet above intake of Puget Sound Traction, Light & Power Co.'s flume, a quarter of a mile below Mowich River, and 10 miles southeast of Electron, Pierce County.

DRAINAGE AREA.—91 square miles (measured on Plate IV, Water-Supply Paper 313).

RECORDS AVAILABLE.—January 1, 1909, to September 30, 1917.

GAGE.—Friez water-stage recorder on left bank on downstream side of gaging bridge; inspected by H. O. Barber, H. A. Waite, R. H. Peters, and William Chambers.

DISCHARGE MEASUREMENTS.—Made from gaging bridge.

CHANNEL AND CONTROL.—Bed composed of boulders and glacial débris; shifting at all stages, owing to steep gradient.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.30 feet at 6 p. m. July 16 (discharge, 1,970 second-feet); minimum stage recorded, 0.51 foot at 11 a. m. March 21 (discharge, 150 second-feet).

1909–1917: Maximum stage recorded, 4.6 feet November 10, 1910 (discharge, 3,200 second-feet); minimum discharge on December 24, 1914, estimated at 112 second-feet (stage-discharge relation affected by ice).

ICE.—Stage-discharge relation slightly affected by ice; flow estimated from observer's notes, probable gage-height graph, and weather records.

DIVERSIONS.—None above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed frequently and was affected by ice January 15–19 and 29–31, and February 1 and 2. Rating curve developed in 1915 and well defined up to 1,400 second-feet, is adopted as standard form of curve for this station and changes in control indicated by frequent discharge measurements are assumed to yield curves parallel to this. See footnote to table of daily discharge. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting recorder graph and corrected as to time and amount of shift in accordance with discharge measurements, or, for days of considerable fluctuation, by applying gage heights for shorter intervals. Records good.

COOPERATION.—Puget Sound Traction, Light & Power Co. furnished gage-height record and made discharge measurements.

Discharge measurements of Puyallup River near Electron, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 4	Barber and Waite	0.61	191	Apr. 5	Barber and Waite	1.17	399
28	do	.60	169	18	do	.92	269
Nov. 4	do	1.42	538	May 5	do	1.09	339
24	do	.75	205	20	do	1.18	398
Dec. 5	do	.92	262	June 2	do	2.17	1,060
20	do	1.09	337	19	do	2.58	1,280
Jan. 9	do	1.26	433	July 7	Barber and Coffman	2.44	1,250
26	do	1.29	472	24	do	1.88	697
Feb. 5	do	1.61	650	Aug. 6	do	1.76	662
24	do	.92	271	24	do	1.72	630
Mar. 4	do	.91	268	Sept. 4	do	1.43	504
25	do	.58	165	19	Barber and Chambers	1.63	582

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	270	189	303	198	222	215	218	418	1,080	1,360	702	589
2	242	327	320	272	289	209	212	393	1,080	1,490	830	551
3	213	431	337	231	508	207	207	373	954	1,530	891	545
4	196	656	298	318	602	248	238	354	800	1,530	815	520
5	196	368	267	690	635	251	393	344	709	1,530	779	496
6	202	300	246	461	570	222	354	423	681	1,400	709	450
7	201	258	226	378	526	207	554	478	800	1,280	635	418
8	196	311	226	368	502	201	576	532	1,040	1,360	648	429
9	200	959	217	429	478	198	456	695	1,400	1,400	688	456
10	198	686	208	398	467	196	434	715	1,240	1,360	648	486
11	206	448	241	373	502	180	456	815	970	1,400	757	579
12	219	361	990	340	502	173	393	883	793	1,450	907	473
13	242	311	1,020	309	461	173	354	815	808	1,450	962	402
14	240	283	615	280	408	173	363	729	1,120	1,360	830	356
15	288	256	471	241	393	171	317	675	1,450	1,530	772	456
16	359	240	406	236	637	168	292	570	1,740	1,780	845	576
17	358	226	361	232	545	168	280	496	1,400	1,740	954	602
18	259	233	375	227	456	166	266	445	1,280	1,610	899	467
19	226	223	361	223	408	163	273	429	1,320	1,530	786	538
20	221	211	337	218	373	161	312	403	1,240	1,360	845	467
21	209	208	320	215	363	157	344	398	1,240	1,160	743	445
22	180	240	298	207	309	159	300	403	1,120	986	675	440
23	172	236	275	201	288	183	344	418	970	815	743	393
24	167	214	260	293	276	183	328	440	1,490	743	695	309
25	185	490	240	658	262	163	633	461	1,490	764	628	330
26	210	361	226	502	258	161	800	514	1,280	970	621	418
27	230	704	217	456	241	218	654	675	1,280	1,080	608	424
28	176	488	214	383	222	224	545	914	1,490	938	602	520
29	197	375	200	326	.....	340	484	1,080	1,490	722	621	368
30	206	337	197	273	.....	262	456	1,030	1,360	648	641	340
31	275	.....	194	228	.....	234	.....	970	.....	648	635	.....

NOTE.—Rating curves parallel to and varying from 0.01 foot lower to 0.24 foot higher in datum than standard rating curve of 1915 are used for the following periods: Oct. 1–4, Oct. 28 to Nov. 3, Nov. 4–9, Nov. 10 to Jan. 4, Jan. 5–25, Jan. 26 to Feb. 4, Feb. 5–16, Feb. 17 to Mar. 4, Mar. 25–29, Mar. 30 to Apr. 7, Apr. 8 to May 12, May 13 to June 1, June 2–16, June 17–24, June 25 to July 16, July 17–26, July 27 to Aug. 24, Sept. 5–9, Sept. 10–27, and Sept. 28–30. Shifting-control method used Oct. 5–28, Mar. 5–24, and Aug. 25 to Sept. 4.

Monthly discharge of Puyallup River near Electron, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 91 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	359	167	224	2.46	2.84	13,800
November	959	189	364	4.00	4.46	21,700
December	1,020	194	338	3.71	4.28	20,800
January	690	198	328	3.60	4.15	20,200
February	637	222	418	4.59	4.78	23,200
March	340	157	198	2.18	2.51	12,200
April	800	207	395	4.34	4.84	23,500
May	1,080	344	590	6.48	7.47	36,300
June	1,740	681	1,170	12.9	14.39	69,600
July	1,780	648	1,260	13.8	15.91	77,500
August	962	602	746	8.20	9.45	45,900
September	602	309	461	5.07	5.66	27,400
The year	1,780	157	541	5.95	80.74	392,000

PUYALLUP RIVER AT ALDERTON, WASH.

LOCATION.—On township line between sec. 25, T. 20 N., R. 4 E., and sec. 30, T. 20 N., R. 5 E., at county bridge No. 78, 1 mile north of Alderton, Pierce County, and 1½ miles above Stuck River.

DRAINAGE AREA.—410 square miles (measured on drainage map published in Water-Supply Paper 313).

RECORDS AVAILABLE.—November 20, 1914, to September 30, 1917.

GAGE.—Vertical staff in two sections on downstream side of bridge pier on right bank; read by C. E. Barney.

DISCHARGE MEASUREMENTS.—Made from bridge at gage.

CHANNEL AND CONTROL.—Bed composed of silt and gravel; shifting. Right bank is overflowed at gage height about 8 feet; left bank high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.90 feet at 8 a. m. December 13 (discharge, 6,630 second-feet); minimum stage recorded, 1.40 feet October 23 to 25 (discharge, 436 second-feet).

1914–1917: Maximum stage recorded, 8.6 feet December 22, 1915 (discharge, 12,800 second-feet); minimum stage recorded, 1.90 feet December 22 and 24, 1914, September 29–30 and October 12, 1915 (discharge, 390 second-feet).

ICE.—Stage-discharge relation slightly affected by ice for a few days during severe winters.

DIVERSIONS.—None.

REGULATION.—Operation of the Puget Sound Traction, Light & Power Co.'s plant at Electron does not materially affect natural flow, as pondage utilized is small.

ACCURACY.—Stage-discharge relation changed frequently but was not affected by ice. See footnote to table of daily discharge. Slight diurnal fluctuation. Gage read to hundredths once daily but oftener during high water. Daily discharge ascertained by applying mean daily gage height to rating table. Records excellent for October and from April to September, and good for remainder of year.

COOPERATION.—Inter-County River Improvement Commission of King and Pierce counties furnished gage-height record and made some discharge measurements.

Discharge measurements of Puyallup River at Alderton, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	Murray and Bullard	1.40	436	May 10	Murray, Sutherland, and Hunter.	3.20	2,340
Nov. 9	J. T. Hartson	3.38	2,370				
Dec. 7	R. F. Bullard	1.98	995	22	John McCombs	2.30	1,420
Feb. 7	do	3.26	2,490	June 8	Murray, Sutherland, and Monaghan.	3.52	2,760
Apr. 5	O. G. Murray	3.13	2,370				
26	John McCombs	4.19	3,640	July 26	John McCombs	2.82	2,050
30	do	2.96	2,030	Aug. 8	Carson and Lee	2.11	1,270

Daily discharge, in second-feet, of Puyallup River at Alderton, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	636	544	1,170	1,120	1,270	1,050	1,270	1,900	2,450	3,350	1,520	1,180
2	574	516	1,090	1,200	1,270	980	1,270	1,800	2,960	3,800	1,600	1,110
3	604	850	1,090	1,790	1,890	980	1,200	1,600	4,670	3,650	1,700	1,040
4	574	2,290	1,170	1,600	2,680	980	1,120	1,520	4,330	3,650	1,700	1,040
5	488	1,260	1,090	2,320	2,940	1,430	2,210	1,520	2,330	3,800	1,430	1,040
6	462	1,010	1,010	3,070	3,070	1,270	2,560	1,430	2,110	3,500	1,430	965
7	488	900	972	2,440	2,440	1,120	3,210	1,900	2,110	3,210	1,340	895
8	488	795	865	2,100	2,210	1,120	3,650	1,800	2,960	2,940	1,260	895
9	488	1,930	900	1,990	2,100	1,120	2,940	2,110	4,330	3,210	1,340	895
10	488	1,530	865	2,100	1,990	1,050	2,680	2,450	4,330	3,070	1,260	965
11	516	1,260	830	1,890	2,100	1,050	2,940	2,330	3,380	2,940	1,260	1,340
12	488	972	2,930	1,690	2,440	1,050	2,440	2,570	2,700	3,210	1,340	965
13	488	795	6,630	1,600	2,100	980	2,100	3,100	2,330	3,070	1,600	1,040
14	488	795	2,440	1,430	1,790	980	2,100	2,220	2,570	2,940	1,520	1,040
15	488	762	2,680	1,350	1,600	980	1,990	2,110	3,380	2,940	1,520	965
16	574	730	2,210	1,270	1,990	910	1,890	1,900	4,330	3,500	1,430	1,040
17	604	730	1,790	1,270	2,210	910	1,690	1,700	4,120	3,960	1,700	1,040
18	604	698	1,690	1,200	1,790	980	1,600	1,600	3,500	3,650	1,520	1,110
19	544	762	1,890	1,200	1,690	980	1,510	1,430	3,350	3,350	1,520	1,040
20	488	698	1,790	1,200	1,510	980	1,690	1,900	3,210	3,210	1,430	1,040
21	488	665	1,790	1,120	1,430	980	1,990	1,900	2,940	2,940	1,430	830
22	488	665	1,790	1,120	1,350	910	1,790	1,600	3,350	2,560	1,180	830
23	436	665	1,600	1,120	1,270	980	1,990	1,260	2,680	1,990	1,180	965
24	436	730	1,510	1,050	1,200	1,430	1,690	1,260	3,070	1,790	1,260	895
25	436	730	1,510	1,990	1,120	1,200	2,210	1,430	4,120	1,790	1,180	798
26	544	1,440	1,350	2,440	1,120	1,120	3,680	1,430	3,210	1,990	1,180	830
27	488	1,340	1,270	2,210	1,120	1,120	3,100	1,700	2,940	2,330	1,180	1,110
28	488	1,440	1,270	2,210	1,050	1,350	2,570	2,220	3,070	2,000	1,180	1,110
29	488	1,720	1,270	1,790	.....	1,600	2,220	2,570	3,650	1,800	1,180	1,040
30	488	1,440	1,270	1,510	.....	1,600	2,110	2,700	3,800	1,520	1,180	895
31	736	.....	1,120	1,350	.....	1,350	.....	2,450	.....	1,520	1,180	.....

NOTE.—Control changed at high water Nov. 4, Dec. 13, Apr. 26, and June 16, and changed gradually from July 27 to Aug. 7. Four rating curves were used during year as follows: Oct. 1 to Nov. 4, well defined Nov. 5 to Dec. 13, fairly well defined up to 4,000 second-feet; Dec. 14 to Apr. 25 and June 17 to July 26, well defined between 1,500 and 3,500 second-feet; Apr. 26 to June 16 and Aug. 8 to Sept. 30, well defined. Shifting-control method used July 27 to Aug. 7.

Monthly discharge of Puyallup River at Alderton, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	736	436	519	1.27	1.46	31,900
November	2,290	516	1,020	2.49	2.78	60,700
December	6,630	830	1,640	4.00	4.61	101,000
January	3,070	1,050	1,670	4.07	4.69	103,000
February	3,070	1,050	1,810	4.41	4.59	101,000
March	1,600	910	1,110	2.71	3.12	68,200
April	3,680	1,120	2,180	5.32	5.94	130,000
May	3,100	1,260	1,920	4.68	5.40	118,000
June	4,670	2,110	3,280	8.00	8.93	195,000
July	3,960	1,520	2,880	7.02	8.09	177,000
August	1,700	1,180	1,380	3.37	3.88	84,800
September	1,340	798	998	2.43	2.71	59,400
The year	6,630	436	1,700	4.15	56.20	1,230,000

PUYALLUP RIVER AT PUYALLUP, WASH.

LOCATION.—In sec. 21, T. 20 N., R. 4 E., 1,000 feet upstream from Puget Sound Electric Co.'s railway bridge, 1 mile north of Puyallup, Pierce County, and 2 miles below mouth of Stuck River.

DRAINAGE AREA.—914 square miles (measured on drainage map published in Water-Supply Paper 313).

RECORDS AVAILABLE.—May 1, 1914, to September 30, 1917.

GAGE.—Stevens water-stage recorder on right bank; inspected by engineers of Inter-County River Improvement Commission and of U. S. Geological Survey.

DISCHARGE MEASUREMENTS.—Made from cable 1,200 feet below gage; after March 1, 1917, from railway bridge.

CHANNEL AND CONTROL.—Stream bed at gage and cable composed of light alluvial silt; shifting at all stages. Control formed by section of stream bed extending some distance downstream.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 28.12 feet at 3.30 a. m. December 13 (discharge, 15,000 second-feet); minimum stage recorded 20.70 feet at 4 p. m. October 8 (discharge, 990 second-feet).

1914–1917: Maximum stage recorded, 31.84 feet at 3 a. m. December 22, 1915 (discharge, 22,300 second-feet); minimum stage recorded, October 8, 1916.

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

DIVERSIONS.—Two hydroelectric plants, owned by the Puget Sound Traction, Light & Power Co., divert water above station. Water for the Electron plant is diverted from Puyallup River 10 miles above Electron into an equalizing basin having a capacity of 185 acre-feet; water used at this plant is returned directly to the river. Water for the Dieringer plant is diverted from White River near Buckley into Lake Tapps (capacity, 51,000 acre-feet), and after use is discharged into Stuck River.

REGULATION.—See Diversions.

ACCURACY.—Stage-discharge relation changed continually owing to channel-improvement work. Discharge measurements made frequently. Rating curve used for period February 16 to December 31, 1915, based on 20 discharge measurements and well defined up to 20,000 second-feet, is adopted as the standard form of curve for the station, and changes in control are assumed to yield parallel curves. Parallel curves used for nine periods and shifting-control method for seven periods during year. See footnote to table of daily discharge. Daily discharge ascertained graphically by applying mean daily gage height to parallel rating curves. Records fair.

COOPERATION.—Inter-County River Improvement Commission of King and Pierce counties furnished gage-height record and made some discharge measurements.

Discharge measurements of Puyallup River at Puyallup, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	Murray and Bullard	21.13	1,230	Mar. 20	John McCombs	19.34	1,850
19	J. T. Hartson	21.30	1,330	Apr. 2	Bullard and Hampton	19.49	2,230
Nov. 6	R. F. Bullard	22.08	2,130	24	John McCombs	20.38	4,030
21	J. T. Hartson	21.43	1,600	May 10	Murray, Sutherland, and Hunter	22.03	6,700
Dec. 8	R. F. Bullard	21.72	1,910				
20	James E. Stewart	22.77	3,290	22	John McCombs	20.00	3,410
Jan. 6	Bullard and Phillips	23.78	5,000	June 8	Murray, Sutherland, and Monaghan	22.11	7,280
12	Stewart and Stewart	22.68	3,260				
22	R. F. Bullard	21.25	1,840	26	Paulsen and Carson	22.18	7,680
Feb. 6	....do	23.68	5,750	July 20	John McCombs	22.03	7,340
19	J. T. Hartson	22.30	3,750	Aug. 7	Lee and Carson	19.77	3,110
24	R. F. Bullard	20.98	2,160	Sept. 13	Parker and Carson	18.92	1,960
Mar. 2	.....do	20.08	1,640	24	O. G. Murray	18.54	1,640

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,230	1,360	2,130	1,600	2,200	1,710	2,040	4,920	7,960	7,410	3,160	
2	1,350	1,450	2,090	2,130	2,410	1,650	2,140	4,430	8,200	8,200	3,420	
3	1,330	1,730	1,790	3,260	3,520		2,080	4,100	7,880	8,250	3,590	
4	1,280	3,010	2,030	3,520	5,200		2,160	3,870	6,660	8,490	3,450	
5	1,300	1,900	1,970	5,920	5,890		3,510	3,530	5,510	8,800	3,260	
6	1,300	1,960	1,840	5,150	5,660	1,960	4,320	3,500	5,180	8,230	3,120	1,920
7	1,290	1,870		3,840	4,970		5,730	4,310	5,610	7,400	3,080	
8	1,130	1,760	1,650	3,300	4,560		7,960	4,690	7,210	6,840		
9	1,250	2,790		3,450	4,160		7,010	6,080	10,700	7,300		
10	1,300	3,060	1,530	3,470	3,960		5,510	6,500	10,300	7,130		
11	1,320	2,240	1,650	3,410	3,960		5,770	6,870	8,300	7,050	2,850	
12	1,280	1,650	6,220	3,160	4,500		5,210	7,110	6,830	7,200		2,080
13	1,330	1,720	12,100	2,830	4,130	1,730	4,530	6,770	6,140	6,940		1,930
14	1,340	1,640	6,700	2,370	3,750		4,450	6,360	7,170	6,670		1,620
15	1,230	1,560	4,400	2,250	3,430		4,100	5,870	10,100	6,870		1,740
16	1,300	1,530	3,590	2,160	4,450		4,030	5,150	12,200	7,700		1,700
17	1,460	1,530	2,830	2,120	4,750		3,730	4,460	11,900	7,900		2,120
18	1,420	1,560	3,210	2,050	3,920		3,490	4,040	10,200	7,250		2,020
19	1,360	1,330	3,460	1,890	3,690		3,280	4,240	9,680	7,100		1,970
20	1,330	1,450	3,330	1,860	3,200	1,640	3,790	3,480	9,020	7,120	2,640	2,050
21	1,350	1,570	3,480	1,640	2,930		4,230	3,550	8,420	6,340		1,830
22	1,180	1,580	3,360	1,770	2,570		3,870	3,500	7,870	5,400		1,840
23	1,250	1,560	3,000	1,810	2,360	1,690	4,160	3,570	9,040	4,580		1,770
24	1,280	1,520	2,420	1,830	2,170	2,130	3,930	3,680	7,810	4,240		1,770
25	1,270	1,860	2,350	4,010	1,930	1,840	5,370	3,730	8,350	4,030		1,650
26	1,290	1,960	2,310	4,710	2,140	1,830	8,500	3,820	7,400	4,200		1,530
27	1,350	3,410	2,220	4,330	2,030	2,150	7,530	4,440	7,400	4,710	2,200	1,600
28	1,340	4,320	2,000	3,580	1,860	2,470	6,510	6,510	8,300	4,200		1,820
29	1,140	2,870	1,920	3,220	.....	3,040	5,620	7,980	8,460	3,600		1,840
30	1,370	2,190	1,840	2,780	.....	2,520	5,420	8,030	8,050	3,250		1,600
31	1,480	.....	1,570	2,540	.....	2,230	.....	7,530	.....	3,200		.....

NOTE.—Recorder not operating Dec. 7–9, Mar. 3–13, and Sept. 30. Silt in stilling well prevented recorder from operating correctly at low water from Mar. 14–22 and Aug. 8 to Sept. 11. Discharge during these periods estimated from hydrograph showing combined flow of Puyallup River at Alderton, White River, and White River flume at Buckley, allowance being made for release of water stored at Lake Tapps. Rating curves parallel to standard rating curve made in 1915 used for following periods: Oct. 1 to Nov. 3, Nov. 4 to Dec. 11, Dec. 12 to Jan. 12, Feb. 20–24, Apr. 2–7, Apr. 8–24, May 22 to June 8, June 26 to July 20, and Sept. 13–30. Shifting-control method used Jan. 13 to Feb. 19, Feb. 25 to Mar. 2, Mar. 23 to Apr. 1, Apr. 25 to May 21, June 9–25, July 21 to Aug. 7, and Sept. 12. Braced figures show mean discharge for period included.

Monthly discharge of Puyallup River at Puyallup, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,480	1,120	1,310	80,600
November	4,320	1,330	2,000	119,000
December	12,100	1,530	2,970	183,000
January	5,920	1,600	2,970	183,000
February	5,890	1,860	3,580	199,000
March	3,040	.....	1,900	117,000
April	8,500	2,040	4,670	278,000
May	8,030	3,480	5,050	311,000
June	12,200	5,180	8,260	492,000
July	8,800	3,200	6,370	392,000
August	3,590	.....	2,730	168,000
September	.....	1,600	1,850	110,000
The year	12,200	1,130	3,630	2,630,000

WHITE RIVER AT BUCKLEY, WASH.

LOCATION.—In SE. ¼ sec. 34, T. 20 N.; R. 6 E., at Northern Pacific Railway bridge about a mile northeast of Buckley, Pierce County.

DRAINAGE AREA.—424 square miles (measured on Plate XI, Water-Supply Paper 313).

RECORDS AVAILABLE.—April 22, 1899, to August 31, 1903 (gage-height record only January 1, 1902, to August 31, 1903); June 8, 1910, to December 31, 1911; January 18, 1913, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank 40 feet below railway bridge at end of concrete wall protecting abutment of bridge; installed January 9, 1917. Previous gages as follows: April 22, 1899, to December 31, 1902, wire-and-weight gage on guard rail of highway bridge 500 feet above railroad bridge; January 1 to August 31, 1903, various temporary gages; June 8 to September 30, 1910, gage opposite Mud Mountain, 5 miles upstream; October 1, 1910, to December 31, 1911, inclined staff bolted to concrete wing wall about 15 feet above present gage and at datum 0.7 foot higher; January 18, 1913, to January 9, 1917, Fuller water-stage recorder at same site and datum as present gage. Recorder inspected by O. E. Osgood.

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

CHANNEL AND CONTROL.—Bed composed of small boulders and gravel; shifting; gradient steep. One channel at all stages. Right bank low and flat; left bank protected by concrete wing wall.

EXTREMES OF DISCHARGE.—Maximum combined daily discharge of river and flume during year, 6,520 second-feet June 16; minimum combined daily discharge, 393 second-feet October 25.

1899–1901, 1911, and 1913–1917: Maximum discharge, 14,600 second-feet November 22, 1901; minimum discharge, 390 second-feet October 3–4, 19–26, 1911, including flume.

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

DIVERSIONS.—White River flume diverts from river half a mile above gage. Total monthly discharge is computed from determinations of combined flow of river and flume.

ACCURACY.—Stage-discharge relation changed frequently; see footnote to table of daily discharge. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting gage-height graph or, for days of considerable fluctuation, by averaging results obtained by applying the gage heights for shorter intervals. Records good except for periods of extremely low water. Records of combined discharge of river and flume good.

COOPERATION.—Puget Sound Traction, Light & Power Co. furnished gage-height record and made discharge measurements.

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

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 6	Osgood and Rhodes...	24.13	7.85	May 9	Osgood and Rhodes...	27.30	2,960
6	.....do.....	24.13	7.22	29	Osgood and Rogers....	27.52	3,880
6	.....do.....	24.13	7.03	June 7	Osgood and Wolslegal.	27.20	2,420
Dec. 13	Hartson and Osgood..	27.32	2,510	18	Osgood and Rogers....	27.97	5,180
15	Osgood and Hartson..	25.95	572	July 6	.....do.....	27.42	3,470
15	.....do.....	25.74	418	27	.....do.....	26.70	1,530
Jan. 26	Osgood and Rhodes...	26.73	1,470	Aug. 22	O. E. Osgood.....	25.38	310
Mar. 3	.....do.....	24.45	28.5	30	.....do.....	25.22	280
Apr. 24	.....do.....	26.38	977	Sept. 12	Osgood and Wolslegal.	25.38	349

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	10.5	13	18	16	137	35	20	1,590	3,530	2,930	1,220	254
2	10.5	13	16	104	309	32	21	1,450	3,330	3,300	1,530	238
3	9.7	15	17	685	1,030	29	20	1,400	2,860	3,410	1,460	221
4	9.7	21	18	802	1,930	59	82	1,230	2,380	3,580	1,340	217
5	9.3	15	17	1,780	2,130	298	933	1,120	1,930	3,840	1,380	213
6	9.3	15	16	1,000	2,000	202	1,010	1,250	1,990	3,450	1,410	182
7	8.1	14	15	675	1,730	166	1,680	1,650	2,360	3,140	1,310	73
8	7.7	13	15	466	1,590	140	2,280	2,210	3,140	2,860	1,280	60
9	7.7	58	15	685	1,480	123	1,830	2,960	4,630	3,000	1,290	62
10	7.7	32	15	797	1,370	138	1,160	3,070	4,160	2,900	1,230	223
11	7.3	14	18	963	1,380	202	1,240	3,220	3,490	2,860	1,330	513
12	7.7	13	2,220	815	1,500	120	1,280	1,110	2,960	2,900	1,200	400
13	7.7	12	2,920	645	1,350	26	1,090	3,140	2,650	2,760	1,210	202
14	7.3	12	1,400	493	1,130	25	1,000	2,900	3,270	2,700	1,130	48
15	7.3	12	517	384	984	26	900	2,580	5,120	2,640	974	168
16	7.3	12	299	310	1,820	25	775	2,260	6,520	2,730	932	136
17	8.9	12	429	277	1,710	25	695	1,890	6,030	2,830	872	446
18	10.5	12	678	174	1,370	24	554	1,190	5,030	2,670	825	475
19	10.5	11	279	39	978	191	438	1,950	4,750	2,610	806	350
20	10.5	10.5	597	27	637	18	713	1,410	4,240	2,550	726	324
21	10.5	11	566	23	513	18	923	1,290	3,670	2,260	582	4.7
22	10.5	11	500	21	412	18	1,000	1,280	3,220	1,950	335	3.8
23	10.5	12	419	21	325	21	1,040	1,260	2,830	1,610	340	4.7
24	10.5	12	360	115	264	26	991	1,330	3,100	1,480	356	4.1
25	11	14	323	1,650	336	21	1,720	1,350	3,070	1,450	350	4.4
26	11	15	277	1,540	412	21	2,690	1,510	2,760	1,530	325	13
27	12	704	120	1,340	300	410	2,670	2,180	2,900	1,590	320	3.2
28	12	478	21	986	111	446	2,310	3,140	3,260	1,470	310	13
29	15	62	16	885	.....	660	2,040	3,710	3,180	1,160	300	3.2
30	13	24	16	534	.....	30	1,810	4,110	2,900	1,060	305	3.0
31	15	.....	15	549	.....	23	.....	3,490	.....	1,040	282	.....

NOTE.—Control changed at high water on Dec. 12, Jan. 5, Apr. 8, Apr. 26, May 30, June 16, and when water was turned in and out of flume several times on Sept. 17–20, probably for cleaning flume. Control changed gradually from June 19 to July 5 and Aug. 23 to Sept. 18. Six rating curves were used as follows: Oct. 1 to Dec. 12, fairly well defined; Dec. 13 to Jan. 5 and Apr. 9–26, well defined between 300 and 9,000 second-feet; Jan. 6 to Apr. 8 and May 31 to June 16, fairly well defined; April 27 to May 30 and July 6 to Aug. 22, fairly well defined; June 17–18, well defined; Sept. 19–30, fairly well defined. Method for shifting control used June 19 to July 5 and Aug. 23 to Sept. 18.

Monthly discharge of White River and flume at Buckley, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 424 square miles.]

Month.	Discharge in second-feet.						Run-off (combined).	
	Combined.		River (mean).	Flume (mean).	Combined.		Depth in inches.	Acre-feet.
	Maximum.	Minimum.			Mean.	Per square mile.		
October	634	634	9.88	462	472	1.11	1.28	29,000
November	1,990	502	55.8	725	781	1.84	2.05	46,500
December	4,220	598	407	751	1,160	2.74	3.16	71,300
January	2,400	614	606	656	1,260	2.97	3.42	77,500
February	2,690	792	1,040	616	1,660	3.92	4.08	92,200
March	1,030	610	116	616	732	1.73	1.99	45,000
April	3,240	742	1,160	566	1,730	4.08	4.55	103,000
May	4,640	1,700	2,070	614	2,680	6.32	7.29	165,000
June	6,520	2,920	3,510	600	4,110	9.69	10.81	245,000
July	4,460	1,500	2,460	555	3,020	7.12	8.21	186,000
August	1,580	913	879	342	1,220	2.88	3.32	75,000
September	872	588	162	572	734	1.73	1.93	43,700
The year	6,520	393	1,040	589	1,630	3.84	52.09	1,180,000

WHITE RIVER FLUME AT BUCKLEY, WASH.

LOCATION.—In sec. 35, T. 20 N., R. 6 E., on left side of White River 800 feet below intake, half a mile above Northern Pacific Railway crossing, and 1 mile northeast of Buckley, Pierce County.

RECORDS AVAILABLE.—January 18, 1913, to September 30, 1917.

GAGE.—Fuller water-stage recorder on right side of flume, 800 feet below headgate; inspected by O. E. Osgood.

DISCHARGE MEASUREMENTS.—Made from footbridge 8 feet below gage.

CHANNEL AND CONTROL.—Control formed by long section of flume bottom below gage. A rock spill a quarter of a mile below gage is partial control also. Stage-discharge relation affected by variable quantity of silt and rocks which work their way from intake to rock spill. Zero of gage at elevation of bottom of flume.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.13 feet at 4 p. m. November 27 (discharge, 1,880 second-feet); no flow in flume June 15–18 and August 6–10. These also are maximum and minimum values throughout period covered by records.

ICE.—Stage-discharge relation affected by ice during severe winters.

REGULATION.—Gates at intake are operated frequently to control flow.

ACCURACY.—Stage-discharge relation seriously affected by rocks washed into flume; not affected by ice during year. Two well-defined rating curves used October 1–23 and November 29 to January 8. Method for shifting control used during remainder of year. Daily discharge ascertained by applying to rating table mean gage heights obtained by inspecting gage-height graph or, for days of considerable fluctuation, by averaging results obtained by applying the gage heights for shorter intervals. Records good.

COOPERATION.—Puget Sound Traction, Light & Power Co. furnished gage-height record and made discharge measurements.

Water diverted in this flume from White River is used for power development at Dieringer and discharged into Stuck River.

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

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	O. E. Osgood	2.69	440	Feb. 12	O. E. Osgood	2.74	521
23	do	2.44	388	Mar. 20	Osgood and Rhodes	2.92	599
Nov. 10	do	4.32	985	20	do	2.92	600
29	do	4.42	1,100	Apr. 23	O. E. Osgood	2.77	492
Dec. 13	Osgood and Hartson	5.14	1,410	May 28	do	3.03	612
14	do	3.66	847	June 8	do	4.59	1,080
14	do	2.98	648	July 3	do	4.98	938
14	do	2.27	420	5	do	3.69	572
14	do	1.62	243	Aug. 21	do	3.10	374
Jan. 4	Osgood and Eernisse	4.13	1,000	21	do	4.00	587
8	O. E. Osgood	3.90	928	Sept. 12	do	2.86	351
25	do	3.20	676				

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	560	517	896	598	785	710	747	456	599	864	251	614
2	533	607	832	757	690	686	747	454	854	838	23	610
3	506	722	864	308	728	681	722	452	1,110	938	125	605
4	480	998	800	254	547	719	786	516	951	875	194	599
5	467	726	752	196	558	693	712	580	1,010	575	71	593
6	467	648	706	996	552	663	720	585	928	588	0	620
7	480	582	644	962	542	659	438	606	1,010	655	0	712
8	454	586	644	1,030	532	652	156	626	634	632	0	705
9	454	1,180	628	1,210	523	649	285	657	575	639	0	741
10	441	1,030	598	933	514	580	781	667	565	641	0	526
11	441	771	649	688	511	472	748	678	543	645	168	359
12	441	629	1,180	579	511	554	516	679	519	648	178	356
12	441	576	1,300	569	516	650	498	674	562	639	177	537
14	441	560	1,130	562	541	637	494	664	486	570	214	586
15	454	540	1,220	552	570	632	488	650	0	526	306	531
16	480	516	1,140	546	613	609	484	633	0	531	330	630
17	493	503	832	546	613	597	480	613	0	537	402	339
18	480	523	609	630	595	598	571	526	0	531	403	310
19	441	525	750	730	684	429	676	320	8	394	404	329
20	428	493	768	718	811	604	720	694	40	236	390	402
21	428	491	722	689	784	595	686	685	442	318	464	676
22	403	529	613	674	763	592	483	682	753	423	650	680
23	390	585	566	653	740	638	487	731	774	407	665	655
24	385	524	520	707	729	729	494	715	833	400	674	588
25	382	754	490	753	600	636	527	719	876	397	668	591
26	401	908	445	637	484	599	548	712	815	397	657	644
27	457	1,290	551	630	540	378	525	692	716	470	655	680
28	435	1,280	660	664	681	379	502	609	633	493	628	739
29	518	1,140	582	443	.....	367	486	639	882	472	632	632
30	514	1,030	598	617	.....	898	470	534	880	460	633	585
31	619	.....	598	500	.....	802	.....	597	.....	458	631	.....

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

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	619	382	462	28,400
November	1,290	491	725	43,100
December	1,300	445	751	46,200
January	1,210	196	656	40,300
February	811	484	616	34,200
March	898	367	616	37,900
April	786	156	566	33,700
May	731	320	614	37,800
June	1,110	0	600	35,700
July	938	236	555	34,100
August	674	0	342	21,000
September	741	310	572	34,000
The year	1,300	0	589	426,000

DUWAMISH RIVER BASIN.

CEDAR RIVER AT CEDAR FALLS, WASH.

LOCATION.—In sec. 4, T. 22 N., R. 8 E., below Seattle municipal power plant at Cedar Falls, King County, and 3½ miles above Taylor Creek.

DRAINAGE AREA.—83 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 9, 1914, to September 30, 1917.

GAGE.—Stevens water-stage recorder installed April 8, 1914, 0.7 mile below power plant; inspected by G. H. Moore.

DISCHARGE MEASUREMENTS.—Made from cable 90 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of small boulders and gravel; shifts at extreme high water. Banks high. One channel at all stages. Stage of zero flow, according to measurements from August 27, 1916, about gage height, 3.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage during year, 7.78 feet at 7 a. m. June 17 (discharge, 1,980 second-feet); minimum stage, 4.06 feet at 9.40 a. m. September 24 (discharge, 25 second-feet).

1914–1917: Maximum stage June 17, 1917; minimum stage, 3.85 feet at 6.30 p. m. August 29, 1915 (discharge, approximately 3.5 second-feet).

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

DIVERSIONS.—None.

REGULATION.—Flow partly controlled by storage and release of water in Cedar Lake reservoir to accommodate requirements of Seattle municipal power plant.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Operation of water-stage recorder satisfactory. Daily discharge ascertained by use of discharge integrator except for high water, for which it was ascertained by applying to rating table mean daily gage height obtained by inspecting recorder graph. Records excellent.

COOPERATION.—Gage-height record and part of the discharge measurements furnished by city engineer of Seattle.

Discharge measurements of Cedar River at Cedar Falls, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Jan. 30	G. H. Moore	5.66	476
June 18	Parker and Robinson	7.52	1,790
20	....do	7.06	1,390

Daily discharge, in second-feet, of Cedar River at Cedar Falls, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	187	102	285	250	384	292	217	754	1,400	1,250	314	267
2	236	121	283	291	373	286	276	675	1,660	1,360	301	194
3	244	162	223	294	728	282	278	628	1,770	1,430	294	199
4	236	245	285	307	1,240	254	295	580	1,580	1,400	279	262
5	238	192	287	330	1,420	296	300	538	1,260	1,430	214	213
6	239	236	290	327	1,370	287	301	469	1,050	1,330	265	161
7	235	245	290	480	1,170	287	304	597	978	1,220	260	158
8	181	253	292	604	1,000	279	254	695	1,040	1,090	258	149
9	229	265	282	707	880	273	294	868	1,360	1,140	262	158
10	237	255	242	834	789	267	306	1,060	1,470	1,130	261	150
11	241	257	290	823	699	217	414	1,170	1,430	1,080	243	148
12	228	207	327	726	737	276	473	1,200	1,200	1,060	181	140
13	232	249	334	621	708	273	474	1,180	1,060	1,020	218	132
14	210	259	309	514	642	279	464	1,170	1,150	706	258	130
15	164	263	302	513	585	278	401	1,070	1,470	293	262	125
16	156	265	301	449	618	275	439	946	1,770	562	261	147
17	139	263	246	400	682	273	413	815	1,840	754	269	124
18	88	266	297	367	611	228	382	714	1,730	798	250	127
19	68	222	303	347	636	275	370	641	1,540	795	189	124
20	69	255	302	333	569	279	415	533	1,430	748	251	127
21	66	264	296	264	508	279	470	570	1,360	676	271	135
22	61	274	290	330	427	282	461	548	1,360	569	277	157
23	60	268	283	318	408	283	536	542	1,270	557	274	109
24	51	273	251	337	372	280	532	570	1,320	493	280	142
25	51	282	243	346	292	227	567	606	1,730	373	271	154
26	51	251	276	508	322	274	745	645	1,620	359	225	166
27	52	308	278	605	313	285	878	688	1,470	351	271	172
28	51	301	280	558	304	292	893	944	1,430	339	272	172
29	42	298	284	541	.....	294	798	1,100	1,470	260	252	183
30	64	238	284	474	.....	289	823	1,290	1,340	327	259	161
31	90	.....	238	418	.....	274	.....	1,340	.....	327	265	.....

Monthly discharge of Cedar River at Cedar Falls, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	244	42	145	8,920
November	308	102	245	14,600
December	334	223	283	17,400
January	834	250	459	28,200
February	1,420	292	671	37,300
March	296	217	275	16,900
April	893	217	459	27,300
May	1,340	469	811	49,900
June	1,840	978	1,420	84,500
July	1,430	260	814	50,100
August	314	181	258	15,900
September	267	109	160	9,520
The year	1,840	42	498	361,000

CEDAR RIVER NEAR LANDSBERG, WASH.

LOCATION.—In Sec. 17, T. 22 N., R. 7 E., 1¾ miles above intake of Seattle water-supply system at Landsberg, 3 miles northeast of Ravensdale, King County, and about 5 miles below Taylor Creek.

DRAINAGE AREA.—135 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 30, 1914, to September 30, 1917. July 25, 1895, to September 30, 1898, at Clifford Bridge, 2 miles below present gage; March 24, 1901, to April 30, 1912, at intake of Seattle water-supply system, 1¾ miles below present gage. Early records not exactly comparable with those at present site because of a small difference in drainage area.

GAGE.—Stevens water-stage recorder installed April 29, 1914; referred to vertical staff on left bank; inspected by G. H. Moore.

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

CHANNEL AND CONTROL.—Bed composed of large boulders and gravel. Fairly permanent control formed by section of stream bed and by a broad riffle about 1,200 feet below gage. Logs may lodge on control. One channel at all stages. Stage of zero flow, according to measurements made August 27, 1916, about gage height 2.5 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.04 feet, June 17 (discharge, 2,240 second-feet); minimum stage, 4.62 feet October 23 to 28 (discharge, 223 second-feet).

1914–1917: Maximum stage recorded, 9.74 feet at 1 a. m. March 10, 1916 (discharge, 2,630 second-feet); minimum stage recorded, 4.35 feet at 1 a. m. October 15, 1914 (discharge, 162 second-feet).

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

DIVERSIONS.—None.

REGULATION.—Flow partly controlled by Cedar Lake reservoir to accommodate requirements of Seattle municipal power plant.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Daily discharge ascertained by use of discharge integrator. Records excellent except for periods in which recorder was not operating. See note to table of daily discharge.

COOPERATION.—Gage-height record and one discharge measurement furnished by city engineer of Seattle.

Discharge measurements of Cedar River near Landsberg, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Nov. 1	G. H. Moore	4.83	257
June 18	Parker and Robinson	8.83	2,090

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	404	294	589	518	775	612	597	1,280		1,620	537	432
2	444	355	596	669	790	597	674	1,180	1,980	1,680	530	365
3	455	422	529	704	1,240	588	665	1,120		1,740	526	368
4	448	633	580	832	1,860	632	782	1,060		1,740	514	427
5	446	465	588	1,100	2,040	747	939	1,000		1,800	445	385
6	449	476	565	964	1,920	676	858	941	1,460	1,680	514	345
7	442	472	550	1,040	1,680	652	914	1,070		1,510	505	342
8	393	489	552	1,150	1,480	633	870	1,140		1,390	500	338
9	429	526	539	1,320	1,350	615	859	1,300		1,420	502	352
10	440	550	493	1,400	1,260	600	850	1,470		1,410	499	356
11	448	508	549	1,370	1,210	540	988	1,560	1,740	1,350	476	358
12	426	442	990	1,220	1,240	600	1,010	1,590		1,320	415	347
13	434	465	1,120	1,080	1,180	599	971	1,560		1,280	431	342
14	412	467	832	953	1,110	598	971	1,560		1,020	483	341
15	369	460	735	914	1,030	595	889	1,440	1,840	560	482	340
16	355	456	706	834	1,100	586	900	1,320		794	477	363
17	339	453	642	757	1,130	582	877			990	482	335
18	287	458	697	715	1,050	541	827		2,100	1,030	460	338
19	262	423	766	685	1,120	596	819	1,040	1,920	1,020	396	331
20	260	434	740	664	1,060	602	957		1,800	979	450	334
21	256	445	737	584	1,010	597	1,050		1,740	910	470	332
22	260	480	682	650	909	598	980		1,740	799	470	360
23	244	487	644	638	825	654	1,050		1,620	784	465	
24	245	469	587	730	783	667	1,020	960	1,740	720	466	
25	243	533	561	1,060	652	573	1,150		2,100	585	450	340
26	239	640	579	1,110	682	605	1,410		1,980	567	405	
27	243	900	564	1,180	642	684	1,480		1,800	558	444	
28	242	811	559	1,070	624	700	1,440		1,800	566	458	355
29	254	684	551	1,010	.....	764	1,330	1,460	1,860	482	425	
30	258	600	547	909	.....	708	1,380		1,740	538	429	
31	318	.....	502	828	.....	662	.....		.....	540	432	.....

NOTE.—Water below intake part of each day Oct. 23–30; intake and channel leading to recorder clogged part of each day July 15, July 25 to Aug. 7, Sept. 6–15, and 17–22; gage-height graph for the short periods completed by comparison with record obtained at Cedar Falls. Recorder not operating Feb. 19–26, gage-height graph estimated from range in stage indicated by recorder and by comparison with records obtained at Landsberg weir and Cedar Falls. Recorder not operating May 17 to June 17, discharge estimated by adding 380 second-feet to flow at Cedar Falls. Recorder not operating Sept. 23–30, discharge estimated by adding 200 second-feet to flow at Cedar Falls on Sept. 23 and decreasing this increment 3 second-feet per day to Sept. 30. Braced figures show mean discharge for period included.

Monthly discharge of Cedar River near Landsberg, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	455	239	347	21,300
November	900	294	510	30,300
December	1,120	493	641	39,400
January	1,400	518	924	56,800
February	2,040	624	1,130	62,800
March	764	540	626	38,500
April	1,480	597	984	58,600
May	1,590	941	1,220	75,000
June	2,100	1,460	1,800	107,000
July	1,800	482	1,080	66,400
August	537	396	469	28,800
September	432	331	354	21,100
The year	2,100	239	837	606,000

SNOHOMISH RIVER BASIN.

SOUTH FORK OF SKYKOMISH RIVER NEAR INDEX, WASH.

LOCATION.—In NE. ¼ sec. 29, T. 27 N., R. 10 E., 300 feet above Sunset Falls and 2 miles above town of Index and mouth of North Fork, Snohomish County.

DRAINAGE AREA.—351 square miles (measured on topographic and county maps).

RECORDS AVAILABLE.—October 7, 1902, to September 30, 1905; April 26, 1911, to October 21, 1912; June 14, 1913, to September 30, 1917.

GAGE.—Inclined and vertical staff gage on right bank; installed October 1, 1916; read by M. J. Gruber. October 7, 1902, to September 30, 1905, vertical staff at site of present gage but at datum 0.39 foot higher. April 26, 1911, to February 25, 1914, vertical staff at site of present gage but at datum 1.00 foot higher. April 19, 1914, to September 30, 1916, inclined and vertical staff gage at same site and datum as present gage.

DISCHARGE MEASUREMENTS.—Made from cable a mile below gage.

CHANNEL AND CONTROL.—Bed at measuring section composed of gravel and small boulders. Sunset Falls, 300 feet below gage, forms solid rock control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.65 feet June 24 (discharge, 12,900 second-feet); minimum stage recorded, 0.80 foot October 25 (discharge, 332 second-feet).

1902–1905, 1911–1917: Maximum stage recorded, 17.0 feet at 10.05 a. m. January 6, 1914 (discharge, 16,700 second-feet); minimum stage recorded, 0.54 foot September 30, 1915 (discharge, 262 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

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

Discharge measurements of South Fork of Skykomish River near Index, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct 12	James E. Stewart	1.04	385
Sept. 2	John McCombs	2.09	735

Daily discharge, in second-feet, of South Fork of Skykomish River near Index, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	518	1,780	1,070	620	732	772	894	2,440	8,660	8,760	2,440	759
2	488	2,180	1,020	694	812	732	894	2,350	7,430	8,660	2,440	732
3	460	2,180	1,860	713	3,480	694	936	2,350	5,550	8,660	2,350	694
4	460	3,910	1,500	732	3,580	852	1,070	2,100	4,730	9,420	2,260	656
5	432	2,020	1,210	4,360	4,360	1,210	3,280	2,180	4,480	8,480	2,180	620
6	432	1,780	1,110	2,980	3,800	1,020	2,620	2,530	4,730	7,260	2,100	620
7	432	1,210	1,020	2,180	2,710	1,110	2,350	3,280	5,550	7,260	2,020	620
8	432	1,380	894	1,860	2,530	852	2,710	4,360	6,150	7,940	1,780	620
9	406	10,800	812	2,350	2,260	812	2,350	5,700	7,430	7,770	1,780	656
10	406	5,410	772	2,020	2,020	772	2,180	5,700	5,850	8,300	1,570	694
11	406	2,710	732	1,860	2,440	732	2,350	6,300	4,600	7,600	1,570	852
12	380	1,710	1,500	1,500	2,350	732	2,260	6,780	4,130	6,940	1,570	694
13	380	1,440	1,070	1,320	2,180	732	2,020	6,300	4,240	6,620	1,570	772
14	380	1,260	978	1,160	1,940	694	1,860	5,850	7,100	6,300	1,500	656
15	380	1,110	812	1,070	1,780	656	2,260	5,130	11,900	6,780	1,440	656
16	380	1,020	852	936	3,080	656	2,440	4,130	11,900	7,260	1,440	620
17	380	936	852	852	2,440	620	2,350	3,480	9,420	6,780	1,380	620
18	380	894	1,020	812	2,260	694	2,180	3,380	8,300	6,300	1,320	584
19	380	852	1,440	772	1,780	772	2,260	3,180	7,940	6,000	1,320	584
20	356	772	1,160	732	1,710	772	1,940	3,080	7,600	5,410	1,160	584
21	356	772	1,020	694	1,380	732	2,100	2,980	7,260	4,730	1,110	584
22	356	812	936	694	1,260	694	2,020	2,980	6,780	4,020	1,070	518
23	332	812	852	656	1,110	694	2,350	3,180	6,000	3,480	1,020	518
24	332	732	812	694	1,020	1,440	2,100	3,580	12,800	3,480	978	488
25	332	852	732	1,440	978	1,320	2,180	3,580	9,040	3,380	936	488
26	380	1,260	694	1,380	936	1,210	2,980	4,360	8,480	3,180	936	812
27	460	1,860	656	1,210	936	1,110	3,280	6,000	8,300	3,480	852	978
28	460	1,500	584	1,110	812	1,210	3,800	8,120	9,420	3,690	852	1,210
29	812	1,780	620	1,020	.....	1,320	3,280	8,120	9,040	3,380	812	812
30	732	1,160	620	936	.....	1,210	3,080	8,300	8,850	2,710	812	694
31	1,570	.....	550	812	.....	1,020	.....	7,940	.....	2,530	787	.....

NOTE.—Gage not read Jan. 3, July 1, Aug. 31, and Sept. 1; discharge interpolated.

Monthly discharge of South Fork of Skykomish River near Index, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 351 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	1,570	332	464	1.32	1.52	28,500
November	10,800	732	1,900	5.41	6.04	113,000
December	1,860	550	960	2.74	3.16	59,000
January	4,360	620	1,300	3.70	4.27	79,900
February	4,360	732	2,020	5.75	5.99	112,000
March	1,440	620	898	2.56	2.95	55,200
April	3,800	894	2,280	6.50	7.25	136,000
May	8,300	2,100	4,510	12.8	14.76	277,000
June	12,800	4,130	7,460	21.3	23.76	444,000
July	9,420	2,530	6,020	17.2	19.83	370 000
August	2,440	787	1,460	4.16	4.80	89,800
September	1,120	488	680	1.94	2.16	40,500
The year	12,800	332	2,490	7.09	96.49	1,800,000

MILLER CREEK NEAR MILLER RIVER, WASH.[1]

LOCATION.—In NE. ¼ sec. 33, T. 26 N., R. 11 E., 1¼ miles south of Miller River post office and 1½ miles above mouth of creek, in King County.

DRAINAGE AREA.—44.2 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 24, 1911, to September 30, 1917 (fragmentary).

GAGE.—Inclined staff on left bank, installed August 27, 1914; read by E. J. Moore, T. E. McGinnis, W. L. Nelson, and R. M. Filloon. May 24, 1911, to August 26, 1914, vertical staff 10 feet upstream from present gage at same datum.

DISCHARGE MEASUREMENTS.—Made from cable 900 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of large boulders and gravel; practically permanent. A log jam 500 feet below gage, at a water-surface elevation about 5 feet lower than at gage, may affect stage-discharge relation at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.40 feet at 10.20 a. m. June 16 (discharge, 1,700 second-feet). Maximum mean daily discharge for year occurred on June 24 (estimated by comparison with flow of South Fork of Skykomish River near Index at 1,900 second-feet). Minimum stage recorded, 0.19 foot October 24 and 25 (discharge, 33 second-feet).

1911–1917: Maximum stage recorded, 5.5 feet November 18–19, 1911, and October 31, 1915 (discharge 4,220 second-feet); minimum stage recorded, 0.07 foot August 31, 1915 (discharge, 24 second-feet).

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

REGULATION.—None.

DIVERSIONS.—None.

ACCURACY.—Stage-discharge relation permanent. Gage read to hundredths when ranger passes station. Rating curve well defined up to 2,000 second-feet. Daily discharge ascertained by applying daily gage heights to rating table. Discharge for days when gage was not read estimated by interpolation and by comparison with flow of South Fork of Skykomish River near Index. See footnote to table of daily discharge. Records only fair on account of fragmentary gage-height record.

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

The following discharge measurement was made by John McCombs:

August 29: Gage height, 0.72 foot; discharge, 94.2 second-feet.

[1] Formerly called Berlin.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	67	330	132	63	76	89	104		1,230	1,090	415	91
2	64	330	174	94	88	82	94		1,380	1,230	404	91
3	63	330	215	92	835	86	95	340	760	1,140	392	79
4	62	590	200	230	835	89	150		625	1,280	381	67
5	62	415	190	270	672	170	565		510	1,140	370	65
6	61	260	181	450	510	143	390		635	1,000		64
7	60	278	172	330	440	139	350		760	1,000	340	62
8	59		162	280	370		187	650	915	1,180		
9	58	880		278	312		330		1,230	1,140		70
10	57		110		295	110	295		625	1,090	312	
11	56	370			370		304	1,000	595	1,090	230	97
12	56	285	215	220	350	82	312	1,080	565	958		
13	53	200	187		295	78	295	1,000	595	915	222	
14	50	160	162			74	278	899	1,090	875		75
15	47	120	118		340	70	245	798	1,480	1,230	215	
16	44	112	114			65	221	696	1,700		209	
17	42	105	128		370	66	197	595	1,480	990	203	62
18	40	102	174	110	278	67		485	1,380		197	
19	39	95	200		260			460	1,090		162	
20	38	88	174		208	99	315	438	1,090	760	126	56
21	36	82	150	79	157			392	1,090	690	122	
22	34	79	132	78	143	62		415	1,020	588	121	50
23	34	108	126	77	140	62	330	460	900	485	119	49
24	33	105	91	100	137	187	350	485	1,900	503	118	48
25	33	116	86	295	94	172	370		1,300	520		48
26	35	195	77	222	92	156	468	700	1,280	538	106	110
27	81	280	71	148	89	141	565		1,090	520		140
28	62	215	65	75	187	144	650	1,140	1,280	503		230
29	98	148	63	72	.....	146	565	1,180	1,060	485	95	110
30	135	140	62	68	.....	130	510	1,180	835	462	93	100
31	330	.....	59	65	.....	114	.....	1,180	.....	438	91	.....

NOTE.—Discharge Oct. 4–6, 8–10, 19, 29, Nov. 1, 2, 12, 14, 16, 20, 30, Dec. 5–7, Jan. 22, 26, 27, 29, 30, Feb. 1, 5, 7, 20, 23, 26, Mar. 3, 13, 15, 17, 25, 26, 28, 30, Apr. 1, 11, 13, 16, 24, 26, May 14, 16, 30, June 6, 11, 20, 29, July 5, 22, 24, 25, 27, 28, 30, Aug. 2, 4, 6–9, 12–14, 16, 17, 19, 22, 23, 25–28, 30, Sept. 1, 3, 6, 18–21, and 23, interpolated. Discharge Nov. 4, 8–10, 27, Dec. 9–11, Jan. 6, 8, 10–20, 24, Feb. 11, 12, 14–16, Mar. 5, 8–11, 19–21, 23, Apr. 4, 6, 7, 18–22, 28, May 1–10, 12, 25–27, June 22–24, July 6, 16–19, Sept. 8–10, 12–16, 25–27, 29, and 30, estimated by comparison with record of flow of South Fork of Skykomish River near Index. Above a discharge of 200 second-feet flow of Miller Creek averages 15 per cent of flow of South Fork of Skykomish River near Index. Braced figures show mean discharge for periods included.

Monthly discharge of Miller Creek near Miller River, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 44.2 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	330	33	64.2	1.45	1.67	3,950
November	.....	79	276	6.24	6.96	16,400
December	215	59	136	3.08	3.55	8,360
January	.....	63	169	3.82	4.40	10,400
February	.....	.....	308	6.97	7.26	17,100
March	.....	.....	108	2.44	2.81	6,640
April	.....	.....	326	7.38	8.23	19,400
May	.....	.....	675	15.3	17.64	41,500
June	.....	.....	1,050	23.8	26.55	62,500
July	.....	438	865	19.6	22.60	53,200
August	415	91	220	4.98	5.74	13,500
September	.....	.....	79.1	1.79	2.00	4,710
The year	.....	33	356	8.05	109.41	258,000

NORTH FORK OF SKYKOMISH RIVER AT INDEX, WASH.

LOCATION.—In SE. ¼ sec. 17, T. 27 N., R. 10 E., at Index, Snohomish County, 1¾ miles above mouth.

DRAINAGE AREA.—143 square miles (measured on topographic and county maps).

RECORDS AVAILABLE.—August 24, 1910, to September 30, 1917.

GAGE.—Vertical staff installed November 27, 1911, on wing dam on right bank, directly back of house of observer, Lee Pickett, about one-third mile above highway bridge. August 24 to September 2, 1910, vertical staff on left bank 100 feet above tramway bridge. This gage destroyed in course of channel improvements. October 26, 1910, to November 26, 1911, vertical staff on right bank at lower end of wing dam and about 300 feet below site of present gage.

DISCHARGE MEASUREMENTS.—Made from cable 600 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed stream composed of gravel and large boulders. Right bank high, protected by pile and timber wing dam, and not subject to overflow; left bank slopes back gradually. Stage of zero flow, according to measurements made August 22, 1915, gage height −1.2 feet±0.3 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.7 feet November 9 (discharge, 7,660 second-feet); minimum stage recorded, 0.62 foot October 22, 24, and 25 (discharge, 130 second-feet).

1911–1917: Maximum stage recorded, 9.3 feet at 11 a. m. January 6, 1914 (discharge, 10,500 second-feet); minimum stage recorded, 0.45 foot at 1 p. m. September 29, 1915 (discharge, 97 second-feet).

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

DIVERSIONS.—None.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation changed at high water on November 9. Rating curves well defined. Slight diurnal fluctuation during summer months. Gage read once daily to quarter-tenths. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

The following discharge measurement was made by John McCombs:

August 31: Gage height, 1.46 feet; discharge, 415 second-feet.

Daily discharge, in second-feet, of North Fork of Skykomish River at Index, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	259	642	483	247	395	354	395	1,000	3,770	3,770	1,140	395
2	259	1,640	529	247	354	316	374	1,000	3,000	4,220	1,140	374
3	243	1,240	829	280	1,070	316	395	1,000	2,380	3,630	1,360	354
4	227	1,920	723	354	1,970	395	885	885	2,170	3,350	1,280	316
5	212	1,310	673	1,970	1,970	529	1,600	1,000	1,970	3,350	1,280	316
6	198	742	506	1,780	1,440	438	1,140	1,070	2,070	3,090	1,140	316
7	198	642	483	1,000	1,140	438	1,000	1,200	2,270	3,350	1,140	316
8	198	963	483	1,000	1,000	395	1,000	2,170	2,600	3,630	1,140	354
9	172	7,660	483	1,000	943	374	1,000	2,600	3,490	3,630	943	395
10	172	2,170	438	885	1,000	354	1,000	2,720	2,720	3,350	885	316
11	172	1,690	483	775	1,000	335	1,000	2,960	2,380	3,350	885	529
12	172	1,140	460	723	829	316	885	2,840	1,780	3,350	885	354
13	172	775	438	624	829	316	829	2,840	2,720	3,350	885	354
14	172	576	395	576	829	316	775	2,490	3,490	3,630	885	354
15	172	576	354	529	829	280	775	1,970	4,840	3,350	885	320
16	172	529	354	506	1,200	280	673	1,970	4,840	3,350	829	320
17	160	506	336	395	1,000	280	624	1,520	5,160	3,490	775	320
18	160	506	460	395	885	280	624	1,520	5,160	3,490	775	320
19	160	483	438	395	775	280	673	1,440	3,770	3,090	673	320
20	148	460	438	354	624	316	943	1,440	3,490	2,380	673	280
21	148	483	438	316	624	280	885	1,360	3,350	2,270	673	280
22	130	483	416	316	576	280	943	1,440	4,520	1,780	624	247
23	137	483	374	316	529	395	885	1,520	5,490	1,520	576	247
24	130	483	354	483	483	529	943	1,690	5,490	1,440	552	247
25	130	552	316	673	438	460	1,000	1,780	3,770	1,440	552	232
26	172	576	316	673	416	460	1,140	2,170	3,630	1,970	529	416
27	259	673	280	673	395	460	1,280	3,090	3,920	1,970	506	673
28	227	673	247	529	395	460	1,280	3,770	3,630	1,600	483	673
29	546	576	247	483	.....	529	1,280	3,920	3,350	1,440	460	438
30	848	529	247	460	.....	460	1,140	3,630	3,630	1,200	438	374
31	1,090	.....	247	395	.....	395	.....	3,770	.....	1,140	438	.....

NOTE.—Gage not read Sept. 15–19; discharge estimated by comparison with records of flow of adjacent streams.

Monthly discharge of North Fork of Skykomish River at Index, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 143 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	1,090	130	246	1.72	1.98	15,100
November	7,660	460	1,060	7.41	8.27	63,100
December	829	247	428	2.99	3.45	26,300
January	1,970	247	624	4.36	5.03	38,400
February	1,970	354	855	5.98	6.23	47,500
March	529	280	375	2.62	3.02	23,100
April	1,600	374	912	6.38	7.12	54,300
May	3,920	885	2,060	14.4	16.60	127,000
June	5,490	1,780	3,500	24.5	27.33	208,000
July	4,220	1,140	2,770	19.4	22.37	170,000
August	1,360	438	820	5.73	6.61	50,400
September	673	232	358	2.50	2.79	21,300
The year	7,660	130	1,170	8.18	110.80	844,000

SULTAN RIVER NEAR SULTAN, WASH.

LOCATION.—In sec. 8, T. 28 N., R. 8 E., at Horseshoe Bend, 4½ miles north of Sultan and mouth of river, Snohomish County.

DRAINAGE AREA.—Not measured.

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

GAGE.—Stevens water-stage recorder on left bank a quarter of a mile above Horseshoe Bend; inspected by Hans Mumm and Lloyd Fairbrook. Prior to October 29, 1915, Lietz water-stage recorder at Camp Habecker, 1½ miles upstream; inspected by G. D. Hite.

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

CHANNEL AND CONTROL.—In canyon. Control formed by large rocks, boulders, and heavy gravel. Not likely to change except at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.19 feet at 9.30 a. m. November 9 (discharge, 8,700 second-feet); minimum stage recorded, 0.75 foot from noon October 23 to noon October 25 (discharge, 90 second-feet).

1911–1917: Maximum stage recorded, 19.6 feet at Camp Habecker, 4 p. m. November 18, 1911 (discharge approximately 10,700 second-feet); minimum stage recorded, 4.52 feet at Camp Habecker September 29, 1915 (discharge, 71 second-feet).

ICE.—Stage discharge relation not seriously affected by ice. Water in stilling well freezes during very cold weather.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by backwater from drift on control from June 25 to September 30. Rating curve used prior to June 25 well defined; curve used from June 25 to September 30 well defined below 500 second-feet and poorly defined above that point. Operation of recorder satisfactory except December 3–6, when clock stopped, and August 15–26, when supply of record paper was exhausted. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting the recorder graph or, for days of considerable fluctuation, by averaging results obtained by applying gage height for shorter intervals. Records excellent except for latter part of June and for July when amount of backwater effect is doubtful, and for days when recorder was not working when discharge was estimated.

COOPERATION.—The city of Everett furnished gage-height record and assisted in making discharge measurements.

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

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	Stewart and Fairbrook.	1.50	180	Sept. 17	Parker and Mumm.....	1.36	153
3	James E. Stewart.....	1.42	[a] 169	24	Fairbrook and Hickey.	.95	107

[a] Measurement made at highway bridge near mouth, 7 miles below gage, yielded 178 second-feet; flow at gage 9 second-feet less based on measurement of two small tributaries (see p. 178) and estimated flow of other streams between gage and measuring point.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	202	711	434	198	270	219	332	1,090	2,780	1,840	472	161
2	180	1,610	653	380	315	210	359	930	3,260	1,960	536	153
3	166	2,570	1,090	379	2,270	202	359	905	2,170	1,770	570	145
4	158	2,870	852	1,420	2,500	388	1,140	860	1,590	1,960	536	139
5	149	1,160	592	3,040	2,340	696	2,400	860	1,390	1,630	504	132
6	142	750	462	1,570	1,530	418	1,410	1,030	1,520	1,440	457	128
7	137	573	373	1,110	1,090	359	1,260	1,390	1,810	1,380	636	125
8	131	2,210	345	1,140	980	318	1,590	1,800	2,130	1,380	442	144
9	126	5,640	306	1,260	882	293	1,170	2,200	2,720	1,540	442	137
10	120	1,860	282	905	838	270	1,000	1,930	1,890	1,420	382	141
11	117	1,010	282	792	1,490	248	1,320	2,090	1,520	1,440	354	228
12	113	690	646	630	1,600	238	1,030	2,250	1,290	1,420	382	190
13	111	518	711	518	1,090	238	838	2,010	1,700	1,360	396	292
14	109	434	484	434	860	228	815	1,810	2,420	1,360	354	202
15	107	373	373	373	770	228	750	1,520	2,780	1,420		174
16	107	332	359	318	1,270	219	630	1,360	2,780	1,420		164
17	107	293	359	293	905	210	610	1,090	2,420	1,420		157
18	105	318	746	270	710	219	573	955	2,090	1,330		148
19	102	306	798	259	573	259	573	1,030	2,010	1,190	290	139
20	99	270	518	248	501	270	815	930	1,850	1,050		134
21	96	248	467	228	434	248	1,170	905	1,930	919		126
22	92	282	373	228	373	248	838	980	1,620	781		118
23	90	293	332	238	345	440	930	1,060	1,420	570		120
24	90	248	293	301	306	520	815	1,170	3,860	553	228	109
25	93	686	259	1,320	282	373	1,200	1,260	2,900	587	215	128
26	135	952	238	866	270	293	1,560	1,590	2,040	698	201	416
27	248	1,220	219	792	248	386	1,360	2,010	1,880	781	188	672
28	190	875	210	554	238	434	1,320	2,420	2,040	895	179	817
29	687	592	193	403	.....	710	1,260	2,420	1,840	781	177	367
30	705	518	193	318	.....	518	1,140	2,340	1,700	570	172	259
31	1,270	.....	183	270	.....	388	.....	2,420	.....	457	168	.....

NOTE.—Water-stage recorder not operating Dec. 3-6; daily discharge ascertained by use of recorder graph showing range in stage while clock was stopped and by comparison with record of flow of North Fork of Skykomish River. Recorder not operating Aug. 15-26; discharge Aug. 15-23 and 25-26 interpolated after comparison with record of flow of North Fork of Skykomish River. Staff gage read on Aug. 24.

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

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,270	90	203	12,500
November	5,640	248	1,010	60,100
December	1,090	183	440	27,100
January	3,040	198	679	41,800
February	2,500	238	903	50,200
March	710	202	332	20,400
April	2,400	332	1,020	60,700
May	2,420	860	1,500	92,200
June	3,860	1,290	2,110	126,000
July	1,960	457	1,200	73,800
August	636	168	342	21,000
September	817	109	212	12,600
The year	5,640	90	827	598,000

MIDDLE FORK OF SNOQUALMIE RIVER NEAR NORTH BEND, WASH.

LOCATION.—In NE. ¼ SE. ¼ sec. 10, T. 23 N., R. 8 E., 1 mile southeast of North Bend, King County, and 2¾ miles above junction with North Fork.

DRAINAGE AREA.—184 square miles (measured on topographic and county maps).

RECORDS AVAILABLE.—August 10, 1907, to February 29, 1908; August 25, 1908, to September 30, 1917. All records prior to October 1, 1915, published in Water-Supply Paper 412.

GAGE.—Stevens water-stage recorder on left bank; installed August 7, 1915; inspected by E. H. Robinson. Prior to August 7, 1915, gage was at highway bridge 2¼ miles below present site.

DISCHARGE MEASUREMENTS.—Made by wading or from highway bridge at original station.

CHANNEL AND CONTROL.—Bed composed of large boulders. Channel slightly curved above and below station. Control shifts at extremely high water. Left bank high; right bank low and heavily wooded. Stage of zero flow, according to measurements made July 27, 1915, gage height −0.9 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.04 feet at 3 p. m. June 24 (discharge, 6,620 second-feet); minimum stage recorded, 1.65 feet from 7 p. m. October 23 to 4 a. m. October 24 (discharge, 177 second-feet).

1907–1917: Maximum stage, 13.4 feet (estimated by observer when water was above gage) November 23 and 29, 1909 (discharge not determined); stage may have been higher when water was above gage November 18, 1911 (discharge estimated by hydrographic comparison with North and South forks at 18,000 second-feet); minimum stage recorded, 1.50 feet at 1 p. m. September 30, 1915 (discharge, 146 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation remained permanent. Rating curve well defined. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting recorder graph or, for days of considerable fluctuation, by averaging results obtained by applying the gage height for shorter intervals. Records excellent.

COOPERATION.—Puget Sound Traction, Light & Power Co. furnished gage-height record and made some discharge measurements.

Discharge measurements of Middle Fork of Snoqualmie River near North Bend, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	E. H. Robinson	1.86	222	June 15	Parker and Robinson	5.97	4,720
Nov. 6	do	3.05	828	16	G. L. Parker	6.21	4,990
28	do	3.49	1,210	19	Robinson and Parker	5.37	3,580
Jan. 5	do	4.92	2,960	21	G. L. Parker	5.33	3,490
Feb. 6	do	4.36	2,150	21	E. H. Robinson	5.33	3,510
Mar. 7	do	2.57	506	July 20	do	4.41	2,140
Apr. 9	do	3.63	1,320	Aug. 27	do	2.32	407
May 9	do	4.93	2,920	Sept. 20	do	1.98	264

Daily discharge, in second-feet, of Middle Fork of Snoqualmie River near North Bend, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	323	721	696	331	540	431	551	1,300	3,810	3,560	1,060	351
2	297	1,880	702	518	586	407	586	1,210	4,500	4,060	1,090	331
3	284	3,000	1,010	586	3,320	394	580	1,130	3,170	3,980	1,170	319
4	271	2,100	980	1,080	3,560	517	1,040	1,060	2,270	4,240	1,130	304
5	257	1,170	829	2,700	3,230	828	2,410	1,020	1,870	3,720	1,060	293
6	244	871	689	2,010	2,270	609	1,580	1,300	2,000	3,310	980	279
7	231	708	586	1,480	1,690	540	1,430	1,740	2,410	3,150	936	279
8	231	1,580	551	1,300	1,480	512	1,630	2,240	2,880	3,150	794	286
9	223	4,480	507	1,800	1,340	470	1,340	3,000	3,810	3,560	836	293
10	216	2,800	460	1,390	1,250	436	1,210	2,850	2,700	3,310	781	311
11	208	1,870	460	1,210	1,530	407	1,340	3,000	2,200	3,150	754	431
12	208	943	1,060	1,020	1,690	394	1,170	3,080	1,870	3,150	747	376
13	205	800	1,300	843	1,390	385	1,020	2,850	2,340	3,080	788	368
14	202	690	857	721	1,170	376	1,020	2,550	3,980	3,000	754	331
15	200	610	702	627	1,060	376	929	2,200	4,860	3,150	715	304
16	200	550	658	563	2,120	359	829	1,740	5,040	3,230	696	297
17	205	515	658	518	1,560	347	829	1,430	4,240	3,150	670	301
18	211	495	1,030	481	1,210	359	808	1,340	3,640	2,850	652	297
19	202	486	1,280	455	1,020	431	801	1,390	3,640	2,620	627	276
20	192	417	907	436	885	450	1,020	1,300	3,390	2,410	568	272
21	184	394	815	417	781	426	1,250	1,250	3,560	2,070	536	269
22	184	566	708	431	702	472	1,060	1,300	3,150	1,740	502	253
23	179	640	592	486	640	820	1,130	1,390	2,700	1,390	470	246
24	177	507	540	626	586	921	1,060	1,480	5,220	1,300	476	240
25	190	866	486	1,910	551	658	1,580	1,580	4,320	1,340	455	246
26	210	1,210	431	1,520	507	546	2,480	1,870	3,640	1,480	431	436
27	230	1,650	403	1,210	476	683	2,070	2,630	3,640	1,630	407	696
28	270	1,280	372	943	455	721	1,800	3,560	4,060	1,530	389	747
29	310	914	339	747	.....	900	1,630	3,560	3,390	1,390	376	507
30	380	822	343	633	.....	734	1,480	3,390	3,080	1,170	372	385
31	740	.....	323	557	.....	609	.....	3,470	.....	1,130	372	.....

NOTE.—No gage-height record Oct. 3–6, 9–10, 25–31, Nov. 2–4, 11, and 13–18; discharge estimated by comparison with record of flow of the North Fork and checked with record of the South Fork.

Monthly discharge of Middle Fork of Snoqualmie River near North Bend, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 184 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	740	177	247	1.34	1.54	15,200
November	4,480	394	1,180	6.41	7.15	70,200
December	1,300	323	686	3.73	4.30	42,200
January	2,700	331	953	5.18	5.97	58,600
February	3,560	455	1,340	7.29	7.59	74,400
March	921	347	533	2.90	3.34	32,800
April	2,480	551	1,260	6.85	7.64	75,000
May	3,560	1,020	2,040	11.1	12.80	125,000
June	5,220	1,870	3,380	18.4	20.53	201,000
July	4,240	1,130	2,650	14.4	16.60	163,000
August	1,170	372	697	3.79	4.37	42,900
September	747	240	344	1.87	2.09	20,500
The year	5,220	177	1,270	6.90	93.92	921,000

NORTH FORK OF SNOQUALMIE RIVER NEAR NORTH BEND, WASH.

LOCATION.—In NE. ¼ sec. 26, T. 24 N., R 8 E., at Gabriel ranch, 2 miles above mouth and 3½ miles northeast of North Bend, King County.

DRAINAGE AREA.—About 102 square miles (measured on topographic and county maps).

RECORDS AVAILABLE.—July 4, 1907, to September 30, 1917. All records prior to October 1, 1915, published in Water-Supply Paper 412.

GAGE.—Friez water-stage recorder installed September 26, 1916, on right bank 200 yards southeast of ranch house. Previous gages as follows: July 21, 1907, to September 2, 1912, vertical staff at highway bridge one-eighth mile above mouth and 1½ miles below present site; September 2, 1912, to September 26, 1916, Fuller and Friez water-stage recorders at same site and datum as original gage. Recorder inspected by E. H. Robinson.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 200 yards above mouth.

CHANNEL AND CONTROL.—Bed composed of boulders and gravel; shifting at extremely high stages. Right bank not subject to overflow; left bank fairly high, not subject to overflow except at extremely high stages. Stage of zero flow, according to measurements made September 21, 1916, gage height −0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.35 feet at 4.45 p. m. June 24 (discharge, 3,680 second-feet); minimum stage recorded, 1.75 feet at 4 a. m. October 24 to 8 a. m. October 26 (discharge, 81 second-feet).

1907–1917: Maximum stage, determined by leveling to high-water mark, 14.5 feet November 18, 1911 (discharge, 11,100 second-feet); water above gage November 18, 19, 23, 24, 29, and 30, 1909, and stage may have exceeded that reached in 1911. Minimum stage recorded, 1.0 foot September 26–28, 1910 (discharge, 56 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge permanent during year. Rating curve well defined. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting recorder graph, or, for days of considerable fluctuation, by averaging results obtained by applying gage height for shorter periods. Records excellent.

COOPERATION.—Puget Sound Traction, Light & Power Co. furnished gage-height record and made some discharge measurements.

Discharge measurements of North Fork of Snoqualmie River near North Bend, Wash. during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 29	E. H. Robinson	3.33	614	June 16	Parker and Robinson	5.32	2,440
Jan. 6	do	4.10	1,120	17	Robinson and Parker	5.12	2,180
24	do	2.78	392	21	Parker and Robinson	4.68	1,720
Feb. 4	do	5.53	2,620	July 21	E. H. Robinson	3.62	808
Mar. 5	do	3.11	539	30	do	3.15	532
Apr. 3	do	2.68	386	Aug. 22	Robinson and Roberts	2.23	185
May 10	do	4.56	1,660	31	E. H. Robinson	1.99	122
June 10	do	4.66	1,690	Sept. 19	do	1.89	105

Daily discharge, in second-feet, of North Fork of Snoqualmie River near North Bend, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	171	480	491	254	422	331	355	910	2,050	1,830	481	119
2	158	1,040	520	373	435	313	347	840	2,630	1,880	481	115
3	148	1,730	713	409	1,770	309	331	780	2,070		486	113
4	141	1,420	632	659	2,750	340	790	726	1,520		458	107
5	134	720	510	1,710	2,510	515	1,620	704	1,230	1,700	430	103
6	130	726	444	1,220	1,670	413	1,060	849	1,230		404	102
7	123	714	392	941	1,230	367	980	1,180	1,420		367	100
8	117	1,160	371	875	1,100	343	1,140	1,320	1,710	1,470	339	103
9	115	2,400	343	1,330	945	324	945	1,720	2,330		335	105
10	109	1,330	320	1,020	910	305	840	1,620	1,720		313	109
11	105	728	313	910	1,310	288	910	1,670	1,420	1,400	302	130
12	102	616	666	756	1,470	278	810	1,720	1,180		291	136
13	98	510	875	626	1,060	274	704	1,570	1,470		291	158
14	95	435	660	560	875	271	665	1,370	2,160		274	151
15	91	388	550	500	810	267	616	1,230	2,570	1,320	261	134
16	90	347	510	453	1,340	258	560	1,060	2,570	1,320	254	127
17	90	320	491	413	1,060	248	550	875	2,170		245	119
18	90	324	617	388	756	245	545	810	1,880		232	107
19	88	331	774	367	726	254	545	875	1,880	1,100	220	100
20	87	295	605	355	643	258	676	810	1,780		208	98
21	84	278	545	335	575	258	875	810	1,670	840	196	95
22	82	357	486	328	525	254	726	840	1,470	780	185	91
23	82	458	435	331	476	316	738	910	1,320	616	174	90
24	81	363	400	367	440	363	692	980	2,770	590	169	88
25	81	526	367	996	422	313	1,040	1,020	2,300	595	161	93
26	84	780	335	942	396	284	1,620	1,180	1,880	648	156	184
27	113	1,060	313	750	371	331	1,420	1,490	1,780	704	151	350
28	134	880	295	626	355	392	1,230	1,940	2,000	692	143	453
29	193	638	271	540	.....	500	1,140	1,880	1,830	665	136	288
30	242	570	267	472	.....	453	1,020	1,780	1,720	535	130	211
31	530	.....	258	430	.....	404	.....	1,830	.....	510	123	.....

NOTE.—Intake clogged July 3–7, 9–14, and 17–20; discharge estimated by comparison with record of flow of the South Fork. Braced figures show mean discharge for periods included.

Monthly discharge of North Fork of Snoqualmie River near North Bend, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 102 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	530	81	129	1.26	1.45	7,930
November	2,400	278	731	7.17	8.00	43,500
December	875	258	476	4.67	5.38	29,300
January	1,710	254	653	6.40	7.38	40,200
February	2,750	355	977	9.58	9.98	54,300
March	515	245	325	3.19	3.68	20,000
April	1,620	331	850	8.33	9.29	50,600
May	1,940	704	1,200	11.80	13.60	73,800
June	2,770	1,180	1,860	18.2	20.31	111,000
July	1,880	510	1,170	11.5	13.26	71,900
August	486	123	271	2.66	3.07	16,700
September	453	88	143	1.40	1.56	8,510
The year	2,770	81	728	7.14	96.96	528,000

SOUTH FORK OF SNOQUALMIE RIVER AT NORTH BEND, WASH.

LOCATION.—In SE. ¼ sec. 9, T. 23 N., R. 8 E., at Cooper ranch, half a mile south of North Bend, King County, and 3½ miles above mouth.

DRAINAGE AREA.—84 square miles (measured on topographic map).

RECORDS AVAILABLE.—July 21, 1907, to February 29, 1908, and June 26, 1908, to September 30, 1917. All records prior to October 1, 1915, published in Water-Supply Paper 412.

GAGE.—Friez water-stage recorder on left bank at Cooper ranch installed October 2, 1916; inspected by E. H. Robinson. Previous gages as follows: July 6, 1907, to August 31, 1912, vertical staff at Northern Pacific Railway bridge 2½ miles above mouth, 1 mile below present site; September 1, 1912, to October 1, 1916, Fuller and Friez water-stage recorders at same site and datum as original gage.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 600 feet below bridge; prior to March 17, 1911, from bridge.

CHANNEL AND CONTROL.—Bed composed of gravel; shifting at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.54 feet at 5 a. m. June 16 (discharge, 2,200 second-feet); minimum stage recorded, 1.34 feet from 4 to 7 p. m. September 24 (discharge, 103 second-feet).

1907–1917: Maximum stage recorded, "Water over gage" November 3, 4, 19, 23, and 29, 1909 (gage height and discharge not determined); minimum stage recorded, 0.70 foot October 10, 11, 1908 (discharge, 68 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed at high water on June 16. Rating curves used before and after the change are well defined. Daily discharge ascertained by applying to rating table mean daily gage height determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging discharge for shorter periods. Records excellent.

COOPERATION.—Puget Sound Traction, Light & Power Co. furnished gage-height record and made some discharge measurements.

Discharge measurements of South Fork of Snoqualmie River at North Bend, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 6	E. H. Robinson	2.51	396	May 30	E. H. Robinson	5.22	1,520
28	do	3.04	588	June 2	do	5.68	1,820
Jan. 5	do	4.05	951	15	Parker and Robinson	6.00	1,890
24	do	2.16	315	17	Robinson and Parker	5.45	1,600
Feb. 3	do	4.11	1,000	July 20	E. H. Robinson	3.40	706
4	do	4.62	1,200	Aug. 21	do	1.71	183
Mar. 5	do	2.43	381	25	Robinson and Roberts	1.61	157
Apr. 3	do	2.26	350	28	E. H. Robinson	1.57	147
May 9	do	5.10	1,460	Sept. 18	do	1.40	113
10	do	4.98	1,370	22	do	1.36	106

Daily discharge, in second-feet, of South Fork of Snoqualmie River at North Bend, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	152	273	337	248	346	303	330	765	1,590	1,300	344	138
2	156	303	327	284	374	294	341	727	1,740	1,440	338	134
3	150	469	367	313	768	289	336	670	1,470	1,390	338	132
4	148	805	403	477	1,220	315	447	634	1,120	1,440	324	130
5	144	544	365	946	1,250	374	864	634	946	1,300	309	128
6	142	397	327	884	1,050	338	746	689	946	1,200	301	126
7	140	332	301	746	864	315	746	884	1,090	1,120	281	126
8	136	392	293	652	765	306	804	1,050	1,200	1,070	273	130
9	134	1,230	283	824	689	294	708	1,390	1,640	1,160	265	128
10	132	1,070	268	784	616	286	670	1,390	1,310	1,090	257	130
11	132	612	266	670	616	277	708	1,440	1,070	1,030	249	147
12	129	463	414	580	634	272	652	1,390	925	1,030	241	136
13	127	379	612	494	580	272	580	1,340	988	988	238	132
14	124	335	463	447	528	266	580	1,200	1,440	925	231	128
15	125	306	391	402	511	262	545	1,070	1,840	967	223	124
16	125	288	365	374	729	257	494	904	2,010	967	218	118
17	125	270	356	341	727	252	478	784	1,790	925	210	116
18	125	266	419	325	616	250	462	765	1,490	844	203	114
19	124	260	612	310	545	265	462	765	1,440	784	198	112
20	120	243	495	303	494	265	616	708	1,340	708	189	110
21	118	231	448	294	462	274	689	689	1,340	652	184	109
22	117	250	400	296	417	296	616	708	1,300	580	174	107
23	117	278	362	301	388	374	634	746	1,090	494	168	107
24	115	258	332	323	374	432	616	804	1,710	446	165	105
25	115	296	311	594	346	360	756	824	1,760	446	160	107
26	118	391	296	746	336	328	1,170	904	1,390	446	156	118
27	136	606	278	670	323	360	1,090	1,080	1,390	478	152	158
28	127	560	266	562	313	374	1,010	1,390	1,490	462	149	172
29	193	433	248	462	.....	432	925	1,540	1,390	430	147	147
30	224	382	248	402	.....	374	864	1,490	1,200	377	145	124
31	306	.....	243	374	.....	346	.....	1,490	.....	350	141	.....

NOTE.—Discharge interpolated on Oct. 1 as recorder was being moved to new site.

Monthly discharge of South Fork of Snoqualmie River at North Bend, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 84 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	306	115	141	1.68	1.94	8,670
November	1,230	231	431	5.13	5.72	25,600
December	612	243	358	4.26	4.91	22,000
January	946	248	498	5.93	6.84	30,600
February	1,250	313	603	7.18	7.48	33,500
March	432	250	313	3.73	4.30	19,200
April	1,170	330	665	7.92	8.84	39,600
May	1,540	634	996	11.9	13.72	61,200
June	2,010	925	1,380	16.4	18.30	82,100
July	1,440	350	866	10.3	11.87	53,200
August	344	141	225	2.68	3.09	13,800
September	172	105	126	1.50	1.67	7,500
The year	2,010	105	549	6.54	88.68	397.000

STILAGUAMISH RIVER BASIN.

SOUTH FORK OF STILAGUAMISH RIVER NEAR SILVERTON, WASH.

LOCATION.—In SW. ¼ sec. 23, T. 30 N., R. 9 E., one-eighth mile above Silverton ranger station, one-fourth mile below Martin Creek, and 2½ miles below Silverton, Snohomish County.

DRAINAGE AREA.—45.4 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 1, 1910, to December 14, 1917, when gage was washed out and station discontinued.

GAGE.—Vertical staff spiked to overhanging hemlock on right bank; read by G. E. Sawyer and A. J. Eldred.

DISCHARGE MEASUREMENTS.—Made from cable 30 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders; permanent. Right bank fairly high; not subject to overflow; left bank slopes back gradually and is covered by dense growth of alders. Stage of zero flow, according to measurements made in 1913 and 1916, gage height −0.5 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 6.17 feet at 3.45 p. m. December 14, 1917 (discharge, 4,680 second-feet); minimum stage recorded, 0.80 foot October 23–24, 1916 (discharge, 37 second-feet).

1910–1917: Maximum stage recorded, 7.0 feet November 20, 1910 (discharge, 5,720 second-feet, revised determination); minimum stage recorded, 0.7 foot September 7, 23, 25, 26, 29–30, 1915 (discharge, 29 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; affected by ice January 16–18, 31, and February 1. Gage read to hundredths once daily when ranger is at home. Rating curve well defined below 2,000 second-feet. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent except for periods of high water and periods in December, 1916, for which they were estimated by comparison with records of flow of nearest streams and are poor.

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

Discharge measurements of South Fork of Stilaguamish River near Silverton, Wash., during the period Oct. 1, 1916, to Dec. 28, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.ft.*			*Feet.*	*Sec.ft.*
Oct. 4	J. E. Stewart	1.07	70.9	June 20	J. E. Stewart	2.70	910
May 18	John McCombs	2.10	481	21	do	2.87	1,050
19	do	2.22	568	Nov. 14	Lasley Lee	1.34	138
June 3	do	2.54	812	Dec. 28	T. R. Newell	5.02	3,230

Daily discharge, in second-feet, of South Fork of Stilaguamish River near Silverton, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	98	550		92	215	116	224	485	1,170	1,080	363	116
2	98	425		116	233	116	311		1,080	1,340	363	113
3	77	2,100		143	396	129	550	450	808	1,000	352	110
4	72	1,340		213	732	143	845		695	1,080	352	106
5	70	396	350	1,170	920	213		518	658	882	342	104
6	68	368		585	658	176	610	585	779	920	337	103
7	60	316		379	455	143		732	920	960	331	92
8	56			379	425	116			1,170	1,000	326	92
9	55			455	396	103	396		1,080	960	311	126
10	53	1,100	152	379	455	103	518		845	920	306	159
11	52		123	326	732	92	518		695	920	302	183
12	51	342	186	278	658	92		860	600	920	302	194
13	50	268	186	255	518	103			680	882	292	183
14	48	241	152	233	396	92			770	845	278	143
15	47	213	123	213	352	92			965	845	271	129
16	47	186	152		485	63	380		1,170	845	264	116
17	47	169	123	165	396	63			1,140	920	255	118
18	48	186	316		352	63		485	1,110	808	246	120
19	46	138	246	116	302	92		550	1,080	695	235	120
20	45	138	186	103	278	92		518	920	695	224	118
21	42	138	152	92	213	92	695	540	1,000	585	213	116
22	42	169	138	103	194	92	658	563	845	602	205	172
23	37	152	123	92	176	103		585	732	620	198	302
24	37	205	123	92	159	143		585	2,000	620	190	333
25	40	368	110	302	159	116	640	658	1,700	620	174	365
26	80	316	110	255	129	103		845	1,080	658	159	396
27	118	808	98	116	129	201	550	1,260	1,000	396	143	352
28	138	425	110	143	116	209	620	1,170	1,080	695	143	363
29	770	368	110	159	.....	201	485	1,170	1,000	396	136	365
30	751	300	110	176	.....	213	518	1,260	960	396	129	365
31	732	.....	98	.....	.....	233	.....	1,170	.....	368	116	.....

Daily discharge, in second-feet, of South Fork of Stilaguamish River near Silverton, Wash., Oct. 1 to Dec. 14, 1917.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	442	162	302	11	92	194	695	21	68	326	.....
2	518	183	302	12	90	159	363	22	63	255	.....
3	485	600	302	13	81	143	3,690	23	56	194	.....
4	449	255	292	14	72	138	4,680	24		159	.....
5	422	143	278	15	70	116	.....	25	240	176	.....
6	396	72	213	16	92	103	.....	26		143	.....
7		352	233	17	81	92	.....	27	246	302	.....
8	200	255	273	18	75	90	.....	28	213	425	.....
9		213	311	19	75	80	.....	29	194	278	.....
10		176	302	20	72	278	.....	30	170	455	.....
								31	150	.....	.....

NOTE.—Gage not read Oct. 25, 26, Nov. 8-11, 30, Dec. 1-9, 1916; Apr. 5-8, 12-20, 23-26, May 2-4, 8-17, June 12, 13, Oct. 7-10, 24-26, Nov. 3, 18, 19, 1917; discharge estimated by comparison with flow of adjacent streams; braced figures show mean discharge for periods included. Gage not read Oct. 5, 9-14, 30, Nov. 14, 15, 1916; May 21, 22, June 15, 17, 18, July 7, 22, 24, Aug. 6, 7, 10, 15, 19, 20, 22, 23, 25, 29, Sept. 3, 5, 9, 17, 20, 24, 25, 29, 30, Oct. 1, 4, 5, 30, 31, 1917; discharge interpolated.

Monthly discharge of South Fork of Stilaguamish River near Silverton, Wash., for the period ending Dec. 14, 1917.

[Drainage area, 45.4 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
1916–17.						
October	770	37	128	2.82	3.25	7,870
November		138	502	11.1	12.38	29,900
December		98	206	4.54	5.23	12,700
January	1,170	92	247	5.44	6.27	15,200
February	920	116	380	8.37	8.72	21,100
March	233	63	126	2.78	3.20	7,750
April		224	510	11.2	12.50	30,300
May			762	16.8	19.37	46,900
June	2,000		991	21.8	24.32	59,000
July	1,340	368	789	17.4	20.06	48,500
August	363	116	253	5.57	6.42	15,600
September	396	92	189	4.16	4.64	11,200
The year		37	423	9.32	126.36	306,000
1917.						
October	518	56	200	4.41	5.08	12,300
November		72	217	4.78	5.33	12,900
December 1–14			874	19.3	10.05	24,300

SKAGIT RIVER BASIN.

SKAGIT RIVER AT REFLECTOR BAR, NEAR MARBLEMOUNT, WASH.

LOCATION.—In sec. 8, T. 36 N., R. 13 E. (unsurveyed), at Reflector Bar ranger station, just below mouth of Canyon Diablo, three-fourths mile above Stetattle Creek, 1½ miles below Thunder Creek, and 23 miles (by trail) northeast of Marblemount, in Whatcom County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—December 6, 1913, to September 30, 1917.

GAGE.—Stevens water-stage recorder on right bank, 75 feet below mouth of Canyon Diablo, installed April 13, 1914; inspected by Thomas Thompson and H. B. Cure. Prior to April 13, 1914, inclined staff at same site but at datum 2.00 feet higher.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet below gage.

CHANNEL AND CONTROL.—Control 200 feet below gage; composed of large boulders near right bank, clean gravel in center, and sand near left bank; may shift during floods. One channel at all stages. Banks not subject to overflow. Stage of zero flow, according to measurements made September 21, 1916, gage height −0.5 foot ±0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.19 feet at 3 a. m. June 16, (discharge, 19,700 second-feet); minimum stage recorded, 1.85 feet March 14 (discharge, 802 second-feet). Hydrographic comparison with flow of Sauk River at Darrington, Baker River near Concrete, and Skagit River near Sedro Woolley and study of weather records indicate that discharge may have been as low as 760 second-feet on December 30 and March 17.

1913–1917: Maximum stage recorded, 10.5 feet at 2 p. m. June 17, 1916 (discharge, 29,400 second-feet); minimum stage recorded, 1.74 feet from 1 to 10 a. m. January 28, 1915 (discharge, 707 second-feet). Hydrographic comparison with flow of Sauk River at Darrington, Baker River near Concrete, and Skagit River near Sedro Woolley and study of weather records indicate that discharge may have been 700 second-feet January 12, 13, and 31, 1916.

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage-height record fragmentary on account of intake to water-stage recorder not being low enough and unsatisfactory operation of recorder. Daily discharge ascertained by applying to rating table mean daily gage height obtained by inspecting gage-height graph. Records excellent except when recorder was not in operation. See note to table of daily discharge.

COOPERATION.—Station maintained in cooperation with United States Forest Service and Skagit Power Co.

Discharge measurements of Skagit River at Reflector Bar, near Marblemount, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.		Discharge.
		River gage.	Well gage.	
		Feet.	*Feet.*	*Sec.-ft.*
May 12	John McCombs	6.24	6.16	11,200
13	Parker and McCombs	6.47	6.37	11,700
Sept. 20	G. L. Parker	3.06	3.00	2,320

Daily discharge, in second-feet, of Skagit River at Reflector Bar, near Marblemount, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	May.	June.	July.	Aug.	Sept.
1	1,450	.....	992	.....	15,300	12,000	4,020	2,630
2	1,330	.....	992	.....	13,200	12,000	4,360	2,460
3	1,230	1,740	1,120	.....	10,900	12,000	4,720	2,380
4	1,160	.....	1,130	.....	9,400	12,000	4,480	2,210
5	1,120	.....	1,100	.....	8,860	12,000	4,360	2,210
6	1,070	.....	1,030	.....	9,760	12,000	4,250	2,110
7	1,040	.....	1,000	.....	10,900	11,300	3,800	2,000
8	1,040	.....	982	.....	12,800	10,100	3,590	1,980
9	1,060	.....	954	.....	14,500	11,300	3,700	2,000
10	1,090	.....	935	.....	12,000	11,600	3,700	2,060
11	1,130	.....	935	10,900	9,760	11,300	3,590	2,720
12	1,160	.....	.....	11,300	8,340	10,900	4,020	2,380
13	1,340	.....	.....	12,000	8,690	10,100	4,250	2,630
14	1,310	.....	.....	11,300	11,300	9,760	4,020	2,010
15	1,090	.....	.....	9,400	16,200	10,100	4,020	2,210
16	1,010	.....	.....	7,830	18,800	10,500	4,250	2,630
17	.....	1,310	.....	6,680	18,400	10,100	4,250	2,630
18	.....	1,250	.....	6,220	16,600	9,400	4,250	2,290
19	.....	1,190	.....	6,370	15,300	8,690	4,250	2,540
20	.....	1,150	.....	6,370	14,900	8,520	4,250	2,380
21	.....	1,130	.....	6,680	14,500	7,660	3,800	2,080
22	.....	1,120	.....	6,840	12,800	7,000	3,280	2,120
23	.....	1,080	.....	7,330	11,300	5,780	3,280	1,960
24	.....	1,040	.....	8,860	10,500	5,230	3,380	1,660
25	.....	1,080	.....	9,400	9,760	5,100	3,180	1,540
26	1,940	1,080	.....	11,600	10,100	5,780	3,080	2,510
27	.....	1,140	.....	14,900	11,300	6,680	3,080	2,810
28	.....	1,110	.....	17,100	12,000	6,220	2,990	2,290
29	.....	1,070	.....	18,400	11,600	5,100	3,180	1,710
30	.....	1,040	.....	16,200	10,500	4,360	3,280	1,570
31	.....	.....	.....	15,300	.....	4,020	2,990	.....

NOTE.—Water-stage recorder not operating Oct. 17 to Nov. 17 and Dec. 12 to May 10. Observer read gage Oct. 26, Nov. 3, Jan. 6, Mar. 14, Apr. 5, and 25. Discharge estimated by hydrographic comparison with flow of Sauk River at Darrington, Baker River below Anderson Creek, near Concrete, and Skagit River near Sedro Woolley and study of weather records. Recorder not operating satisfactorily July 2–5, discharge interpolated. Estimates of flow from Dec. 12 to May 10 used only to obtain monthly discharge; see table of monthly discharge.

Monthly discharge of Skagit River at Reflector Bar, near Marblemount, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October			1,230	75,600
November			1,390	82,700
December			930	57,200
January			910	56,000
February			1,250	69,400
March			925	56,900
April			2,000	119,000
May	18,400		2,180	503,000
June	18,800	8,340	12,300	732,000
July	12,000	4,020	8,990	553,000
August	4,720	2,990	3,800	234,000
September	2,810	1,540	2,220	132,000
The year	18,800		3,690	2,670,000

SKAGIT RIVER NEAR SEDRO WOOLLEY, WASH.

LOCATION.—In NW. ¼ sec. 36, T. 35 N., R. 4 E., at Northern Pacific Railway bridge three-fourths mile below intake of Beatty's Slough, 1½ miles south of Sedro Woolley, Skagit County, 21 miles above mouth, and 32 miles below Baker River.

DRAINAGE AREA.—2,930 square miles (measured on General Land Office and British Columbia maps).

RECORDS AVAILABLE.—May 1, 1908, to September 30, 1917.

GAGE.—Chain gage on railway bridge, installed September 27, 1916; read by E. J. Woods. Prior to September 27, 1916, vertical staff on upstream draw guard of railway bridge used for high and medium stages and one on downstream side of pile 50 feet above bridge used during low water. All gages set to same datum, zero of gage being elevation of extreme low water in Puget Sound.

DISCHARGE MEASUREMENTS.—Made from highway bridge one-third mile above gage. Beatty's Slough measured from highway bridge.

CHANNEL AND CONTROL.—Gravel; shifts at high stages. Banks not subject to overflow except during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 44.35 feet at 3 p. m. June 16 (discharge, 60,000 second-feet); minimum stage recorded, 32.05 feet October 24 (discharge, 2,800 second-feet).

1908–1917: Maximum stage recorded, 56.1 feet November 30, 1909 (discharge, 96,100 second-feet); minimum stage recorded, 32.3 feet September 29–30 and October 10–11, 1915 (discharge, 2,740 second-feet).

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

DIVERSION.—Beatty's Slough carries from 1.5 per cent of total flow at low stages to 8 per cent at high stages. Amount determined at each visit and added to flow measured in main channel.

REGULATION.—None.

ACCURACY.—Stage-discharge relation nearly permanent during year; not affected by ice. Rating curve well defined between 7,000 and 50,000 second-feet, fairly well defined above and below these limits. Gage read to half-tenths daily; crest gage heights observed or estimated. Practically no diurnal fluctuation. Records good.

187041°—21—WSP 462——4

Discharge measurements of Skagit River near Sedro Woolley, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 8	John McCombs	37.48	20,700
15	McCombs and Parker	39.57	30,800
Aug. 15	John McCombs	36.87	17,300

Daily discharge, in second-feet, of Skagit River near Sedro Woolley, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6,000	10,100	6,820	4,950	4,230	4,950	5,460	14,200	44,900	38,900	19,000	11,800
2	5,200	8,270	7,390	4,460	4,460	4,460	5,730	13,500	47,300	45,500	19,500	10,800
3	4,950	14,200	10,400	4,460	5,730	4,460	5,460	13,500	38,900	49,100	21,300	10,100
4	4,460	25,500	11,800	4,700	11,100	4,460	5,460	13,100	31,600	47,900	26,500	9,810
5	4,230	15,700	9,810	12,100	12,400	6,540	13,100	12,800	28,000	51,900	20,800	9,180
6	4,000	11,800	8,570	12,400	12,800	6,270	12,400	13,100	27,500	45,500	20,000	9,180
7	4,000	9,490	7,680	10,400	11,100	5,460	10,800	15,700	30,000	41,900	19,000	8,870
8	3,780	8,570	6,820	8,870	10,100	5,460	12,100	19,500	34,900	38,900	17,700	8,570
9	3,780	31,600	6,540	11,100	9,810	4,950	12,400	26,500	45,500	39,500	16,900	8,270
10	3,570	29,500	6,000	10,400	9,490	4,700	11,400	28,500	41,900	46,100	16,900	8,570
11	3,570	16,900	5,460	9,490	9,810	4,460	12,400	32,200	32,700	43,700	16,100	9,180
12	3,570	12,400	6,000	8,870	12,800	4,460	12,100	33,800	28,000	44,300	16,500	12,100
13	3,780	10,400	6,820	7,970	11,800	4,460	10,800	35,400	26,000	43,100	18,600	10,100
14	4,000	9,180	6,270	7,100	11,100	4,460	10,400	34,900	30,500	40,700	18,200	10,800
15	4,000	8,570	5,730	6,540	9,810	4,230	10,400	30,000	41,900	41,300	17,300	8,870
16	4,000	7,680	5,460	6,000	10,800	4,000	9,810	26,500	57,500	41,300	18,200	9,490
17	4,000	7,390	5,200	5,460	11,400	3,780	9,490	28,100	57,500	45,500	18,200	10,400
18	4,460	6,820	5,460	5,200	10,100	3,780	9,810	20,000	51,200	43,100	17,700	10,100
19	3,780	6,820	7,970	5,200	9,180	4,000	9,810	19,000	46,700	39,500	18,200	9,180
20	3,570	6,270	6,820	4,950	8,870	4,230	10,100	19,000	45,500	38,300	16,500	9,810
21	3,570	6,000	6,540	4,700	7,970	4,460	11,400	19,500	44,900	36,000	17,300	9,490
22	3,170	5,730	6,000	4,700	7,680	4,460	11,400	20,000	45,500	32,700	15,700	8,870
23	3,170	5,730	5,460	4,460	6,820	4,700	11,400	20,800	39,500	28,000	13,800	8,570
24	2,800	5,460	5,200	4,230	6,270	5,730	11,400	22,600	36,000	24,500	13,800	9,490
25	3,170	5,460	4,950	5,460	6,000	5,730	11,400	25,000	41,900	23,600	13,800	7,100
26	4,460	8,870	4,460	6,820	5,730	5,200	12,400	29,000	37,700	23,600	13,100	7,100
27	7,680	7,970	4,230	6,540	5,460	4,950	13,500	37,100	38,300	27,000	12,400	15,700
28	6,000	10,400	4,000	6,270	5,200	6,000	14,600	45,500	40,100	27,000	12,400	12,800
29	6,270	8,270	4,000	5,460	.....	6,820	14,900	50,500	46,700	29,000	12,100	10,400
30	7,100	7,680	3,780	5,200	.....	7,100	14,900	49,100	40,100	23,100	12,400	8,270
31	10,800	.....	3,780	4,230	.....	6,270	.....	45,500	.....	20,000	12,800	.....

Monthly discharge of Skagit River near Sedro Woolley, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 2,930 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	10,800	2,800	4,540	1.55	1.79	279,000
November	31,600	5,460	11,000	3.75	4.18	655,000
December	11,800	3,780	6,300	2.15	2.48	387,000
January	12,400	4,230	6,730	2.30	2.65	414,000
February	12,800	4,230	8,860	3.02	3.14	492,000
March	7,100	3,780	5,000	1.71	1.97	307,000
April	14,900	5,460	10,900	3.72	4.15	649,000
May	50,500	12,800	26,100	8.91	10.27	1,600,000
June	57,500	26,000	40,000	13.7	15.29	2,380,000
July	51,900	20,000	37,400	12.8	14.76	2,300,000
August	26,500	12,100	16,900	5.77	6.65	1,040,000
September	15,700	7,100	9,770	3.33	3.72	581,000
The year	57,500	2,800	15,300	5.22	71.05	11,100,000

SAUK RIVER AT DARRINGTON, WASH.

LOCATION.—In SE. ¼ sec. 24, T. 32 N., R. 9 E., half a mile southeast of Darrington, Snohomish County, 2½ miles below Clear Creek, and 23 miles above mouth.

DRAINAGE AREA.—293 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 15, 1914, to September 30, 1917.

GAGE.—Vertical staff in two sections attached to log crib on left bank, 700 feet above suspension footbridge; read by Paul Schmidt.

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

CHANNEL AND CONTROL.—Bed composed of gravel and large boulders. Left bank high and not subject to overflow; right bank flat and subject to overflow at extremely high stages. Stage of zero flow, according to measurements made September 7, 1915, gage height −1.70 feet ±0.5 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.90 feet at 8.25 a. m. June 16 (discharge, 7,390 second-feet); minimum stage recorded, 0.90 foot at 5.30 p. m. October 24 (discharge, 370 second-feet).

1914–1917: Maximum stage recorded, 8.47 feet at 4.30 p. m. April 2, 1915 (discharge, 20,400 second-feet); minimum stage recorded, 0.78 foot September 28–29, 1915 (discharge, 340 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Gage read to hundredths once daily. Rating curve well defined below 9,000 second-feet. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

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

Discharge measurements of Sauk River at Darrington, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 17	John McCombs	3.70	2,480	June 17	J. E. Stewart	5.74	7,040
June 2	do	5.07	5,240	18	do	5.45	6,070
2	do	4.89	5,110	18	do	5.33	5,600
16	J. E. Stewart	5.88	7,530	Aug. 13	C. G. Paulsen	3.44	2,150

Daily discharge, in second-feet, of Sauk River at Darrington, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	572	1,260	1,260	572	595	595	690	1,780	6,550	6,280	2,250	975
2	530	3,230	1,590	618	740	595	740	1,590	4,990	6,830	2,540	910
3	510	6,010	2,000	740	975	595	850	1,590	3,620	6,550	2,700	850
4	490	2,870	2,250	790	1,780	690	1,780	1,590	3,620	6,550	2,390	790
5	470	1,680	1,780	790	2,000	910	2,250	1,420	3,230	6,280	2,250	740
6	470	1,590	1,260	850	1,590	850	1,780	1,780	3,620	6,010	2,120	740
7	470	1,590	1,110	1,040	1,420	740	1,780	2,000	4,050	5,750	2,000	790
8	452	2,000	975	1,340	1,420	740	2,000	2,250	5,490	5,490	2,000	790
9	452	5,490	740	1,340	1,420	640	1,590	2,250	4,990	6,550	2,000	910
10	452	2,250	690	1,260	1,420	618	1,590	2,250	4,050	6,550	2,000	850
11	435	1,590	640	1,260	2,000	595	1,780	4,050	4,510	6,550	1,890	910
12	435	1,260	690	1,180	2,000	572	1,590	4,750	3,620	6,280	2,000	975
13	435	1,110	850	975	1,590	572	1,420	4,050	3,420	6,280	2,000	1,040
14	452	1,110	740	850	1,420	572	1,340	4,050	6,010	6,280	1,890	850
15	452	975	640	740	1,260	550	1,260	3,420	7,110	6,010	1,780	740
16	470	975	740	740	1,260	530	1,110	2,870	7,390	6,550	1,780	790
17	470	850	640	640	1,110	510	1,260	2,390	6,830	6,010	1,780	850
18	452	850	740	640	1,110	530	1,260	2,250	6,010	6,010	1,590	790
19	435	740	790	618	1,040	550	1,340	2,000	6,010	5,490	1,500	790
20	418	640	740	618	975	595	1,420	2,000	5,750	4,750	1,420	740
21	400	618	740	595	975	640	1,420	2,250	5,750	4,280	1,420	690
22	385	740	690	572	910	740	1,420	2,250	4,990	3,620	1,340	640
23	385	740	640	550	850	850	1,420	2,250	4,050	3,230	1,340	618
24	370	640	690	572	790	740	1,590	2,540	4,990	2,870	1,260	618
25	435	850	690	640	740	640	1,590	2,870	6,010	2,870	1,180	618
26	595	1,110	640	740	740	740	1,780	3,620	6,010	3,620	1,180	1,260
27	640	1,420	618	850	640	850	2,000	4,990	6,010	3,230	1,110	1,110
28	572	1,260	572	740	618	850	2,000	6,010	6,280	2,870	1,110	1,180
29	640	1,260	530	640	.....	850	1,780	6,280	6,280	2,390	1,110	790
30	1,260	1,110	490	595	.....	850	1,780	6,550	6,010	2,250	1,110	740
31	1,780	.....	530	550	.....	740	.....	6,550	.....	2,120	1,110	.....

Monthly discharge of Sauk River at Darrington, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 293 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	1,780	370	541	1.85	2.13	33,300
November	6,010	618	1,590	5.43	6.06	94,600
December	2,250	490	893	3.05	3.52	54,900
January	1,340	550	795	2.71	3.12	48,900
February	2,000	595	1,190	4.06	4.23	66,100
March	910	510	679	2.32	2.68	41,800
April	2,250	690	1,520	5.19	5.79	90,400
May	6,550	1,420	3,110	10.6	12.22	191,000
June	7,390	3,230	5,240	17.9	19.97	312,000
July	6,830	2,120	5,050	17.2	19.83	311,000
August	2,700	1,110	1,710	5.84	6.73	105,000
September	1,260	618	836	2.85	3.18	49,700
The year	7,390	370	1,930	6.59	89.46	1,400,000

BAKER RIVER BELOW ANDERSON CREEK, NEAR CONCRETE, WASH.

LOCATION.—In SE. ¼ sec. 30, T. 37 N., R. 9 E., 350 feet below Anderson Creek, a quarter of a mile above Baker River ranger station, and 11 miles above Concrete, Whatcom County.

DRAINAGE AREA.—184 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 10, 1910, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank; installed September 24, 1915; inspected by G. C. Burch. Previous gages as follows: September 10 to November 19, 1910, vertical staff at trail bridge one-eighth mile above Anderson Creek (readings reduced to datum of gage installed Oct. 22, 1910, by means of relation curve); October 22, 1910, to September 4, 1913, vertical and inclined staff gage on left bank, 30 feet above present gage; September 30, 1913, to September 23, 1915, one inclined and two vertical sections at practically the same site as the gages previously used but at different datum. Water-stage recorder referred to datum of staff gage last used, but slight change in location changed the rating.

DISCHARGE MEASUREMENTS.—Made from a cable 300 feet above gage.

CHANNEL AND CONTROL.—Bed composed of boulders and gravel over bedrock; not likely to shift except during extremely high water. Right bank high and rocky; left bank fairly high, wooded, subject to overflow at about 11-foot stage.

EXTREMES OF DISCHARGE.—Maximum stage during year, 7.21 feet from 9 to 12 p. m. July 16 (discharge, 8,210 second-feet); minimum stage, 2.42 feet from 2 to 3 p. m. October 24 (discharge, 499 second-feet).

1910-1917: Maximum stage recorded, 12.6 [1] feet at 3 p. m. January 6, 1914 (discharge, 24,900 second-feet, revised value); minimum stage recorded, 2.6 feet February 27 and March 1, 1911 (discharge, 410 second-feet).

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined to 10,000 second-feet. Daily discharge ascertained by applying to rating table mean daily gage heights determined by inspecting gage-height graph, or, for days of considerable fluctuation, by averaging results obtained by applying gage heights for shorter intervals. Records excellent.

COOPERATION.—Station maintained in cooperation with United States Forest Service.

Discharge measurements of Baker River below Anderson Creek, near Concrete, Wash., during the year ending Sept. 30, 1917.

[Made by John McCombs.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 10	5.84	3,620
Aug. 18	5.10	2,680

[1] Gage height 11.1 feet used for computing discharge, 1.5 feet being difference in comparative readings of the gage read by observer at 12-foot stage and the gage rated by meter measurements.

Daily discharge, in second-feet, of Baker River below Anderson Creek, near Concrete, Wash., for the year ending Sept. 30, 1917,

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	821	1,140	792	543	543	665	665	1,640	5,080	5,080	2,280	1,590
2	738	1,790	975	561	561	642	642	1,590	4,480	6,660	2,640	1,500
3	688	2,280	1,330	561	738	642	642	1,590	3,210	6,290	2,910	1,410
4	642	2,640	1,220	621	1,110	688	911	1,590	2,780	6,110	2,780	1,370
5	600	1,890	1,040	1,220	1,500	713	1,330	1,590	2,580	5,930	2,710	1,250
6	642	1,370	911	1,040	1,500	665	1,290	1,890	2,910	4,920	2,520	1,220
7	642	1,140	821	943	1,330	642	1,330	2,280	3,380	4,620	2,110	1,180
8	621	1,180	792	1,040	1,220	621	1,410	2,840	4,190	4,350	2,000	1,180
9	642	3,290	738	1,110	1,180	600	1,410	3,870	5,760	5,240	2,110	1,180
10	665	2,840	688	1,080	1,140	600	1,330	3,870	3,830	5,930	2,110	1,220
11	688	1,790	688	1,040	1,330	580	1,590	4,350	2,780	6,290	2,110	1,890
12	713	1,330	688	943	1,410	580	1,460	4,620	2,460	6,480	2,400	1,690
13	765	1,080	665	850	1,330	561	1,330	4,480	3,260	6,110	2,580	1,890
14	738	975	642	792	1,220	561	1,370	3,760	4,410	5,760	2,400	1,500
15	738	880	600	713	1,180	543	1,330	3,060	6,940	6,110	2,400	1,500
16	821	850	600	665	1,370	543	1,250	4,100	7,600	6,940	2,460	1,500
17	792	821	600	642	1,290	525	1,330	2,060	6,290	7,410	2,520	1,500
18	688	792	738	642	1,180	525	1,410	1,790	5,240	6,200	2,520	1,410
19	642	765	713	621	1,040	561	1,410	1,940	4,920	5,760	2,460	1,500
20	600	738	665	600	975	561	1,640	1,840	4,620	5,240	2,400	1,410
21	580	713	642	600	911	561	1,690	2,000	5,410	4,620	2,340	1,250
22	543	738	621	580	850	561	1,690	2,160	4,920	3,640	2,000	1,220
23	525	738	600	561	850	688	1,840	2,460	3,760	2,710	1,940	1,110
24	508	688	580	561	850	738	1,890	2,780		2,520	1,940	943
25	642	850	561	642	792	665	1,890	3,380		2,710	1,840	943
26	1,010	943	561	642	738	642	1,890	4,620	4,850	3,270	1,790	1,820
27	943	975	543	642	713	738	2,110	5,930		3,560	1,740	
28	792	975	525	600	688	738	2,220	6,480		4,630	1,690	1,450
29	975	911	525	580	.....	821	2,110	6,110		3,640	1,790	
30	975	850	525	561	.....	738	1,740	5,240		2,640	1,790	
31	1,250	.....	525	543	.....	688	.....	4,920	.....	2,280	1,740	.....

NOTE.—Recorder not operating June 24–30 and Sept. 27–30; discharge estimated by comparison with Sauk River at Darrington and Skagit River at Reflector Bar, near Marblemount; braced figures show mean discharge for periods included. Recorder not operating Aug. 19, 20, and Sept. 16; discharge interpolated.

Monthly discharge of Baker River below Anderson Creek, near Concrete, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 184 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	1,250	508	730	3.97	4.58	44,900
November	3,290	688	1,270	6.90	7.70	75,600
Decembeer	1,330	525	713	3.88	4.47	43,800
January	1,220	543	734	3.99	4.60	45,100
February	1,500	543	1,050	5.71	5.95	58,300
March	821	525	632	3.43	3.95	38,900
April	2,220	642	1,470	7.99	8.91	87,500
May	6,480	1,590	3,250	17.7	20.41	200,000
June	7,600	2,460	4,490	24.4	27.22	267,000
July	7,410	2,280	4,960	27.0	31.13	305,000
August	2,910	1,690	2,230	12.1	13.95	137,000
September	1,890	943	1,400	7.61	8.49	83,300
The year	7,600	508	1,910	10.40	141.36	1,390,000

UPPER COLUMBIA RIVER BASIN.

MAIN STREAM.

COLUMBIA RIVER AT TRAIL, B. C.

LOCATION.—At highway bridge at Trail, about 15 miles above international boundary and mouth of Clark Fork, and 18 miles below mouth of Kootenai River.

DRAINAGE AREA.—34,000 square miles.

RECORDS AVAILABLE.—April 18, 1913, to September 30, 1917.

GAGE.—Chain gage installed on bridge in June, 1913; read by C. A. Broderick. Original gage painted on bridge pier.

DISCHARGE MEASUREMENTS.—Made from bridge.

CHANNEL AND CONTROL.—Channel straight for a quarter of a mile above and below gage. Riffle control short distance below gage; apparently permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 33.95 feet July 8 (discharge, 224,000 second-feet); minimum stage recorded, 7.40 feet March 28 (discharge, 9,600 second-feet).

1913–1917: Maximum stage recorded, 41.6 feet June 14–15, 1913 (discharge, 312,000 second-feet); minimum stage recorded that of March 28, 1917.

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

DIVERSIONS.—A small amount of water is diverted above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Gage read daily to tenths. Rating curve well defined below and fairly well defined above 150,000 second-feet. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent for periods of low water and good for high water.

COOPERATION.—Complete record furnished by Hydrometric Survey of British Columbia.

Discharge measurements of Columbia River at Trail, B. C., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 26	Webb and Parker	12.60	34,300	May 16	Swan and Patterson	17.92	75,200
Nov. 28	Swan and Elliott	10.30	22,800	June 12	T. R. Patterson	31.22	195,300
Feb. 18	J. A. Elliott	8.23	13,870	Aug. 3	do	26.60	150,000
Mar. 26	Balls and Elliott	7.65	12,170				

Daily discharge, in second-feet, of Columbia River at Trail, B. C., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	57,700	34,300	23,100	15,300	12,500	11,400	10,200	28,200	173,000	211,000	158,000	96,200
2	56,400	34,000	23,100	15,000	12,500	11,300	10,400	29,000	176,000	210,000	151,000	94,200
3	55,000	33,800	23,100	14,800	12,500	11,200	10,600	29,800	176,000	210,000	145,000	91,700
4	53,000	33,600	22,900	14,800	12,500	11,200	10,800	30,500	177,000	214,000	139,000	88,600
5	51,700	33,600	22,800	14,500	12,600	11,100	11,000	31,200	176,000	217,000	134,000	85,000
6	50,400	33,500	22,500	14,500	12,600	11,100	11,500	31,700	176,000	220,000	129,000	81,600
7	49,100	33,400	22,200	14,800	12,700	11,000	11,800	33,500	176,000	222,000	125,000	78,100
8	47,800	33,200	21,700	14,900	12,700	11,000	12,500	34,100	179,000	224,000	122,000	74,800
9	46,500	32,700	21,500	15,000	12,800	10,900	13,000	36,900	184,000	223,000	119,000	72,000
10	45,200	32,200	21,200	15,100	12,900	10,800	13,500	39,200	187,000	222,000	116,000	69,100
11	44,600	31,700	21,000	15,200	13,000	10,800	14,200	42,800	197,000	221,000	114,000	66,700
12	43,400	31,300	20,700	15,100	12,900	10,800	14,800	47,200	194,000	220,000	111,000	65,400
13	42,200	30,700	20,400	15,000	12,800	10,700	15,400	51,700	194,000	219,000	109,000	64,400
14	41,000	30,200	20,000	14,800	12,700	10,700	15,900	58,800	194,000	217,000	106,000	63,500
15	40,400	29,400	19,700	14,500	12,600	10,600	16,400	65,600	194,000	216,000	104,000	62,600
16	39,800	28,900	19,200	14,200	12,500	10,600	16,500	73,100	197,000	214,000	104,000	61,800
17	38,600	28,100	19,000	14,000	12,500	10,600	17,500	79,300	201,000	211,000	103,000	61,100
18	38,000	27,700	18,800	13,900	12,400	10,600	18,100	85,200	206,000	209,000	104,000	60,600
19	38,000	27,200	18,600	13,800	12,300	10,500	18,600	90,200	210,000	207,000	107,000	60,300
20	37,400	26,800	18,500	13,600	12,200	10,400	19,200	94,600	214,000	205,000	108,000	60,300
21	36,700	26,200	18,400	13,800	12,100	10,300	19,700	98,900	216,000	203,000	108,000	60,400
22	36,900	25,800	18,200	13,600	12,000	10,200	20,300	104,000	218,000	200,000	109,000	60,800
23	36,300	25,400	18,000	13,500	11,900	10,000	21,200	108,000	220,000	198,000	109,000	61,100
24	35,100	25,100	17,900	13,200	11,800	9,800	22,200	114,000	219,000	196,000	109,000	61,000
25	36,300	24,700	17,800	13,100	11,700	10,400	23,100	120,000	218,000	193,000	107,000	60,600
26	36,300	24,300	17,400	13,000	11,600	9,800	24,100	128,000	218,000	187,000	107,000	60,300
27	36,300	24,000	17,000	12,900	11,500	9,800	25,100	138,000	217,000	179,000	106,000	59,900
28	36,300	23,600	16,700	12,800	11,400	9,600	26,200	147,000	215,000	174,000	104,000	59,500
29	35,600	23,300	16,300	12,600	.....	9,760	27,200	156,000	214,000	171,000	103,000	59,000
30	35,100	23,100	15,900	12,600	.....	10,000	27,500	162,000	212,000	168,000	100,000	58,000
31	34,700	.....	15,600	12,500	.....	10,100	.....	168,000	.....	164,000	98,000	.....

Monthly discharge of Columbia River at Trail, B. C., for the year ending Sept. 30, 1917.

[Drainage area, 34,000 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	57,700	34,700	42,300	1.24	1.43	2,600,000
November	34,300	23,100	29,100	.85	.95	1,730,000
December	23,100	15,600	19,600	.58	.67	1,210,000
January	15,300	12,500	14,100	.41	.47	867,000
February	13,000	11,400	12,400	.36	.37	689,000
March	11,400	9,600	10,600	.31	.36	652,000
April	27,500	10,200	17,300	.51	.57	1,030,000
May	168,000	28,200	79,200	2.33	2.69	4,870,000
June	220,000	173,000	198,000	5.82	6.49	11,800,000
July	224,000	164,000	205,000	6.03	6.95	12,600,000
August	158,000	98,000	115,000	3.38	3.90	7,070,000
September	96,200	58,000	68,600	2.02	2.25	4,080,000
The year	224,000	9,600	67,900	2.00	27.10	49,200,000

COLUMBIA RIVER AT WENATCHEE AND VERNITA, WASH.[1]

LOCATION.—Prior to January 1, 1916, in sec. 3, T. 22 N., R. 20 E., about a mile above highway bridge at Wenatchee, Chelan County, and 2 miles below Wenatchee River. From January 1 to December 31, 1916, at highway bridge at Wenatchee. Beginning January 13, 1917, in sec. 11, T. 13 N., R. 24 E., at Richmond ferry, half a mile north of Vernita and 6 miles below Priest Rapids, Benton County.

DRAINAGE AREA.—At Wenatchee, 88,500 square miles; at Vernita, 95,500 square miles. Areas in United States measured on topographic maps and United States Geological Survey maps, scale 1 : 500,000. Areas in British Columbia measured on Department of the Interior railway-belt maps, scale 1 : 500,000; Department of Mines, West Kootenay sheet, scale 1 : 253,440; and Department of Lands map, scale 1 : 1,125,000.

RECORDS AVAILABLE.—Daily discharge May 1, 1913, to September 30, 1917. Flood heights only, at Wenatchee, 1894 to 1903; continuous gage-height record at Wenatchee, April 18, 1904, to December 31, 1916; at Vernita, January 13 to September 30, 1917. Gage-height record at Wenatchee published by United States Weather Bureau.

GAGE.—Prior to January 1, 1916, staff gage, one inclined and six vertical sections reading from 0 to 64 feet, on right bank about a mile above highway bridge at Wenatchee; zero of gage 583 feet above sea level. January 1 to December 31, 1916, vertical staff reading from −2 to 61 feet on pier of highway bridge at Wenatchee; zero of gage 579.30 feet above sea level. January 13, 1917, lowest section installed on left bank at ferry at Vernita; upper sections installed on left bank in April and May, 1917. Temporary vertical staff gage in six sections installed on right bank at ferry in July and August, 1917. All gage readings at Vernita refer to same datum, 388.7 feet above sea level. Gages at Wenatchee read by Weather Bureau observers; at Vernita by J. P. Richmond.

DISCHARGE MEASUREMENTS.—Made from standard gaging car on ferry cable at Vernita or, when ice conditions are severe, from railroad bridge at Beverly. Measurements were also made at other points. See list of discharge measurements.

CHANNEL AND CONTROL.—Bed at both stations composed of gravel and boulders. High-water control for Wenatchee gages probably Rock Island Rapids about 14 miles below Wenatchee; low-water control stream bed for some distance below gages; apparently permanent; river relatively narrow and deep, making control very sensitive. High-water control for Vernita gage, Coyote Rapids 6 or 7 miles below gage; low-water control riffle noticeable at low stages about three-fourths mile below gage; apparently permanent.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 29.15 feet at 7 p. m. June 23 (discharge, 432,000 second-feet). Minimum discharge, 23,900 second-feet (current-meter measurement) January 31, during period in which stage-discharge relation was affected by ice.

1913–1917. Maximum stage recorded, 45.7 feet at Wenatchee, June 15 and 16, 1913 (discharge, 528,000 second-feet). Minimum discharge January 31, 1917.

Maximum stage recorded at Wenatchee by Weather Bureau and Great Northern Railway Co., 58.0 feet June 7, 1894 (discharge estimated by extending rating curve at 710,000 second-feet).

ICE.—Stage-discharge relation affected by ice except during mild winters. Flow estimated from discharge measurements, notes of ice, and weather records.

DIVERSIONS.—Some water is diverted for irrigation.

REGULATION.—None.

[1] Flow at Wenatchee and at Vernita practically the same; inflow very small percentage of total.

ACCURACY.—Stage-discharge relation at both stations permanent; affected by ice January 23 to February 25, 1914, January 26 to February 6, 1915, December 16, 1915, to February 23, 1916, January 14–26, 29–31, February 1–24, and March 1–18, 1917. Rating curves well defined. Gage at Wenatchee read once daily to tenths, at Vernita twice daily to hundredths. Daily discharge ascertained by applying mean daily gage-height to rating table. Monthly mean discharge at Wenatchee checked by comparison with records of flow of Columbia River at Trail, B. C., and tributaries above Wenatchee and with records of flow of Columbia River at The Dalles, Oreg., less the flow of tributaries between Wenatchee and The Dalles. Only six monthly mean discharge determinations varied more than 5 per cent from discharge computed from the records obtained above and below this station; the maximum variation was 7 per cent. These comparisons indicate that records at Wenatchee are excellent, except for November, 1913, January and November, 1914, January and March, 1915, and March, 1916, for which months they are considered good. Records obtained at Vernita are excellent even during January, February, and March, 1917, when stage-discharge relation was affected by ice, because 23 discharge measurements were made during those months, of which 16 indicated backwater due to ice, and 7 indicated open-channel conditions.

COOPERATION.—Gage-height record at Wenatchee furnished by United States Weather Bureau. Station at Vernita maintained in cooperation with Washington Irrigation and Development Co.

Discharge measurements of Columbia River at Wenatchee and Vernita, Wash., during 1910–1917.

Date.	Made by—	Made at—	Gage height.			Discharge.
			Wenatchee.		Vernita.	
			Old gage.	New gage.		
1910:			*Feet.*	*Feet.*	*Feet.*	*Sec.-ft.*
Apr. 22–24	Mead and Hill	Hanford	20.1	21.56	.....	182,000
Apr. 30–May 3	D. W. Mead	do	27.7	29.40	.....	266,000
May 11–13	do	do	32.0	33.70	.....	328,000
Oct. 31	Ebert and Storey	Richland ferry	9.3	9.12	.....	84,400
1911.						
Nov. 26	Charles Le dl	Wenatchee	5.59	3.08	.....	48,700
1912.						
Dec. 4–6	J. E. Stewart	do	6.66	5.10	.....	58,800
1913.						
Mar. 29	do	do	5.56	3.02	.....	40,400
June 15	Henshaw and Stewart	Pasco	45.6	46.76	.....	[a] 526,000
Nov. 20	F. B. Storey	do	6.9	5.50	.....	59,100
1915.						
Jan. 26–27	J. E. Stewart	Beverly	4.8	1.22	.....	[b] 33,400
Jan. 30	do	Pasco	4.8	.....	.....	[b] 30,600

[a] Discharge of Yakima River deducted. [b] Stage-discharge relation affected by ice.

Discharge measurements of Columbia River at Wenatchee and Vernita, Wash., during 1910–1917—Continued.

Date.	Made by—	Made at—	Gage height.			Discharge.
			Wenatchee.		Vernita.	
			Old gage.	New gage.		
1917.			*Feet.*	*Feet.*	*Feet.*	*Sec.-ft.*
Jan. 3	Stewart and McCombs	Wenatchee	4.74	0.95	.....	[a]29,900
5	do	Beverly	4.87	1.4	.....	[a]29,900
9	Paulsen and McCombs	do	4.76	1.1	.....	[a]31,100
10	do	do	4.85	1.0	.....	[a]30,900
17	do	do	4.50	.35	1.02	[a]28,700
18	do	do	4.50	.3	1.30	[a]26,500
19	do	do	4.50	.3	1.20	[a]26,500
24	J. E. Stewart	Wenatchee	4.76	1.00	1.15	[a]29,800
24	Paulsen and McCombs	Beverly	4.65	.7	1.15	[a]30,500
26	do	do	4.8	1.0	1.15	[a]30,900
27	C. G. Paulsen	do	4.7	1.00	.92	32,200
28	do	Vernita	4.5	.8	.76	31,000
31	Paulsen and McCombs	Beverly	4.25	.4	.50	[a]23,900
Feb. 1	do	do	4.25	.2	1.10	[a]26,600
10	do	Wenatchee	4.74	.89	1.10	[a]32,400
12	John McCombs	Beverly	4.75	.9	1.00	[a]32,300
13	do	Vernita	4.65	.8	1.03	[a]31,300
14	do	do	4.65	.9	1.00	[a]31,400
15	do	do	4.65	.8	.98	[a]31,100
17	do	Beverly	4.75	.9	1.00	[a]31,300
Mar. 26	C. G. Paulsen	do	4.45	.2	.40	27,700
27	do	Vernita	4.45	.1	.44	28,900
Apr. 4	John McCombs	Beverly	4.70	.9	1.10	32,300
14	do	Vernita	6.38	4.6	4.18	52,000
15	do	do	6.72	5.2	4.74	55,800
17	do	Beverly	7.02	5.7	5.10	58,800
19	do	Vernita	7.20	6.0	5.51	62,400
22	do	do	7.62	6.7	5.88	65,400
28	C. G. Paulsen	do	9.06	8.8	7.67	81,000
May 25	do	do	26.90	28.6	21.80	269,000
July 14	do	do	35.14	36.8	26.65	376,000
16	do	do	34.30	36.0	26.24	366,000
Aug. 22	John McCombs	do	15.82	16.8	13.58	143,000
23	do	do	15.82	16.8	13.74	145,000
Oct 23	do	do	8.15	7.5	6.12	68,400
Dec. 4	T. R. Newell	do	5.40	2.7	2.99	44,100
5	do	do	5.40	2.7	3.04	44,800

[a] Stage-discharge relation affected by ice.

NOTE.—Gage heights listed for old gage at Wenatchee refer to correct datum. Gage heights on old gage from May 1, 1913, to Dec. 31, 1915, published by U. S. Weather Bureau are subject to datum corrections as follows:

Below 4.8 feet, +0.6 foot; 4.9 to 5.9 feet, +0.55 foot; 5.9 to 7.2 feet, +0.5 foot; 7.2 to 8.8 feet, +0.45 foot; 8.8 to 13.3 feet, +0.5 foot; 13.3 to 14.7 feet, +0.4 foot; 14.7 to 16 feet, +0.3 foot; 16 to 22 feet, +0.2 foot; 22 to 25 feet, +0.1 foot; 25 to 30 feet, +0.2 foot; 30 to 35 feet, no correction; 35 to 40 feet, −0.2 foot; 40 to 45 feet, −0.3 foot. Well-defined relation curve between old and new gages at Wenatchee based on many comparisons used to refer earlier measurements to new gage and later measurements to old gage.

Daily discharge, in second-feet, of Columbia River at Wenatchee, Wash., for the period, May 1, 1913, to Dec. 31, 1916.

Day.	May.	June.	July.	Aug.	Sept.
1913.					
1	151,000	354,000	472,000	230,000	127,000
2	152,000	375,000	468,000	226,000	128,000
3	152,000	400,000	455,000	222,000	129,000
4	150,000	424,000	428,000	218,000	129,000
5	150,000	437,000	417,000	212,000	128,000
6	149,000	442,000	407,000	199,000	129,000
7	150,000	470,000	397,000	196,000	130,000
8	150,000	473,000	385,000	191,000	130,000
9	155,000	482,000	378,000	189,000	130,000
10	164,000	490,000	371,000	187,000	129,000
11	174,000	508,000	364,000	186,000	128,000
12	186,000	520,000	352,000	184,000	126,000
13	194,000	522,000	341,000	181,000	125,000
14	199,000	527,000	339,000	179,000	123,000
15	202,000	528,000	327,000	176,000	120,000
16	207,000	528,000	318,000	175,000	118,000
17	210,000	526,000	309,000	173,000	115,000
18	213,000	515,000	295,000	172,000	113,000
19	216,000		285,000	167,000	112,000
20	219,000		272,000	163,000	110,000
21	225,000		258,000	160,000	109,000
22	226,000		249,000	155,000	107,000
23	230,000		242,000	151,000	105,000
24	236,000		240,000	147,000	103,000
25	242,000	490,000	239,000	143,000	102,000
26	258,000		238,000	139,000	101,000
27	273,000		238,000		97,000
28	287,000		237,000		93,000
29	300,000		236,000	133,000	88,000
30	313,000		234,000		84,200
31	336,000		233,000		

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913–14.												
1	83,300	64,000	56,700	39,400		46,600	64,000	160,000	305,000	305,000	203,000	108,000
2	81,500	64,000	56,700	39,400		46,600	64,000	166,000	306,000	304,000	198,000	108,000
3	71,600	64,000	55,600	39,400		46,600	63,000	172,000	306,000	304,000	195,000	107,000
4	71,600	64,000	53,400	38,200		49,000	61,000	184,000	313,000	304,000	186,000	105,000
5	77,000	63,000	53,400	38,200		49,000	58,900	196,000	317,000	304,000	181,000	105,000
					36,000							
6	77,000	63,000	53,400	40,600		49,000	62,000	197,000	324,000	302,000	177,000	103,000
7	75,200	63,000	51,200	41,800		49,000	65,000	197,000	326,000	301,000	175,000	101,000
8	73,400	63,000	51,200	44,200		49,000	68,000	199,000	321,000	301,000	171,000	100,000
9	73,400	62,000	51,200	44,200		49,000	78,800	200,000	318,000	301,000	168,000	98,000
10	71,600	62,000	49,000	44,200		49,000	83,300	203,000	318,000	297,000	165,000	97,000
11	71,600	62,000	49,000	44,200		49,000	88,000	211,000	317,000	296,000	162,000	94,000
12	69,800	61,000	49,000	41,800		49,000	92,000	217,000	314,000	296,000	160,000	93,000
13	69,800	61,000	49,000	41,800		49,000	97,000	222,000	309,000	296,000	156,000	93,000
14	69,800	60,000	46,600	41,800		49,000	101,600	228,000	308,000	292,000	151,000	91,000
15	69,800	60,000	46,600	40,600		49,000	108,000	242,000	313,000	291,000	148,000	90,000
					39,000							
16	69,800	58,900	46,600	40,600		51,200	119,000	249,000	321,000	291,000	142,000	88,000
17	69,800	58,900	44,200	40,600		51,200	125,000	270,000	328,000	290,000	139,000	86,000
18	69,800	58,900	44,200	41,800		53,400	131,000	272,000	331,000	288,000	133,000	83,300
19	68,000	58,900	44,200	41,800		53,400	137,000	282,000	336,000	286,000	131,000	80,600
20	68,000	58,900	44,200	41,800		57,800	138,000	285,000	339,000	285,000	129,000	78,800
21	68,000	58,900	41,800	41,800		60,000	142,000	290,000	343,000	284,000	127,000	77,000
22	68,000	58,900	41,800	41,800		62,000	145,000	292,000	339,000	281,000	125,000	75,200
23	68,000	57,800	41,800		44,000	63,000	149,000	300,000	336,000	281,000	124,000	73,400
24	68,000	57,800	41,800			64,000	150,000	302,000	338,000	279,000	121,000	73,400
25	68,000	57,800	41,800			65,000	150,000	308,000	335,000	278,000	120,000	71,600
26	66,000	57,800	40,600		44,200	66,000	152,000	312,000	321,000	263,000	118,000	69,800
27	66,000	56,700	40,600	42,000	46,600	66,000	155,000	313,000	330,000	252,000	117,000	69,800
28	66,000	56,700	40,600		46,600	66,000	156,000	315,000	319,000	239,000	115,000	69,800
29	66,000	56,700	39,400			66,000	158,000	318,000	310,000	224,000	111,000	69,800
30	66,000	56,700	39,400			66,000	160,000	319,000	305,000	217,000	110,000	69,800
31	64,000		39,400			66,000		312,000		209,000	109,000	

Daily discharge, in second-feet, of Columbia River at Wenatchee, Wash., for the period May 1, 1913, to Dec. 31, 1916—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1914-15.												
1	69,800	68,000	71,600	38,200		34,600	56,700	140,000	228,000	198,000	187,000	151,000
2	69,800	68,000	71,600	38,200		34,600	58,900	145,000	224,000	200,000	187,000	149,000
3	69,800	69,800	69,800	38,200		34,600	64,000	146,000	222,000	201,000	186,000	146,000
4	69,800	69,800	69,800	38,200	32,000	34,600	69,800	148,000	221,000	201,000	185,000	142,000
5	69,800	69,800	69,800	38,200		34,600	71,600	222,000	219,000	203,000	185,000	139,000
6	69,800	69,800	68,000	38,200		34,600	77,000	151,000	217,000	204,000	184,000	137,000
7	69,800	69,800	67,000	37,000	32,200	34,600	78,800	153,000	213,000	206,000	183,000	133,000
8	69,800	69,800	66,000	37,000	32,200	34,600	78,800	155,000	211,000	206,000	182,000	130,000
9	69,800	69,800	65,000	37,000	32,200	34,600	80,600	159,000	210,600	206,000	181,000	126,000
10	69,800	71,600	65,000	37,000	32,200	34,600	81,500	166,000	208,000	204,000	179,000	124,000
11	69,800	71,600	64,000	37,000	32,200	34,600	82,400	171,000	203,000	204,000	178,000	120,000
12	69,800	71,600	63,000	37,000	32,200	34,600	82,400	176,000	201,000	203,000	177,000	115,000
13	69,800	71,600	62,000	37,000	32,200	34,600	83,300	180,000	199,000	202,000	175,000	110,000
14	69,800	71,600	60,000	35,800	32,200	34,600	85,100	183,000	195,000	201,000	173,000	108,000
15	71,600	71,600	58,900	35,800	32,200	34,600	90,000	188,000	194,000	199,000	173,000	104,000
16	71,600	71,600	55,600	35,800	32,200	35,800	93,000	190,000	194,000	198,000	173,000	100,000
17	69,800	71,600	54,500	35,800	32,200	37,000	98,000	195,000	194,000	198,000	173,000	97,000
18	69,800	71,600	54,500	35,800	32,200	38,200	101,000	198,000	192,000	195,000	172,000	94,000
19	69,800	71,600	52,300	35,800	32,200	40,600	108,000	199,000	192,000	192,000	172,000	91,000
20	69,800	71,600	49,000	35,800	32,200	43,000	116,000	209,000	191,000	190,000	172,000	87,000
21	69,800	73,400	49,000	35,800	32,200	44,200	120,000	213,000	191,000	189,000	172,000	83,300
22	69,800	73,400	46,600	35,800	32,200	46,600	126,000	217,000	190,000	187,000	170,000	80,600
23	69,800	73,400	46,600	35,800	33,400	49,000	126,000	219,000	190,000	186,000	168,000	75,200
24	69,800	73,400	46,600	35,800	33,400	51,200	127,000	220,000	190,000	185,000	165,000	73,400
25	69,800	73,400	46,600	34,600	34,600	51,200	128,000	221,000	190,000	185,000	161,000	71,600
26	69,800	73,400	46,600		34,600	51,200	129,000	221,000	192,000	183,000	159,000	68,000
27	69,800	73,400	46,600		34,600	53,400	131,000	222,000	194,000	186,000	158,000	68,000
28	69,800	73,400	44,200		34,600	53,400	132,000	223,000	196,000	188,000	155,000	67,000
29	69,800	73,400	41,800	32,000		53,400	134,000	226,000	197,000	188,000	154,000	67,000
30	69,800	73,400	40,600			54,500	136,000	230,000	197,000	188,000	153,000	66,000
31	68,000	.....	38,200		.....	54,500	.....	232,000	.....	188,000	152,000	.....
1915-16.												
1	66,000	51,800	49,600			47,900	110,000	172,000	264,000	520,000	319,000	150,000
2	66,000	51,800	49,600			46,700	112,000	177,000	264,000	519,000	309,000	148,000
3	65,000	51,800	49,600			47,300	113,000	183,000	265,000	519,000	300,000	148,000
4	63,000	54,000	49,600			46,100	115,000	198,000	269,000	519,000	290,000	148,000
5	62,000	54,000	49,600	35,000	28,000	45,000	116,000	212,000	272,000	519,000	282,000	148,000
6	60,000	54,000	49,600			45,000	118,000	224,000	275,000	517,000	276,000	148,000
7	60,000	54,000	49,600			43,800	118,000	233,000	277,000	511,000	266,000	149,000
8	59,000	55,000	49,600			45,600	119,000	241,000	278,000	504,000	261,000	149,000
9	58,000	55,000	47,400			45,000	121,000	252,000	283,000	504,000	255,000	149,000
10	58,000	55,000	47,400			46,700	124,000	253,000	288,000	500,000	247,000	148,000
11	57,000	56,000	47,400			51,400	126,000	253,000	295,000	495,000	240,000	146,000
12	56,000	55,000	47,400			58,500	128,000	253,000	296,000	492,000	235,000	144,000
13	56,000	55,000	47,400			62,600	131,000	253,000	300,000	488,000	230,000	142,000
14	55,000	55,000	47,400			64,400	134,000	253,000	306,000	487,000	224,000	139,000
15	55,000	54,000	47,400	29,000	36,000	72,300	137,000	252,000	317,000	482,000	217,000	135,000
16	55,000	54,000				69,200	139,000	251,000	331,000	479,000	213,000	130,000
17	54,000	54,000				71,100	143,000	249,000	352,000	477,000	206,000	127,000
18	54,000	54,000				74,800	144,000	247,000	371,000	469,000	200,000	123,000
19	54,000	55,000				73,600	145,000	246,000	387,000	458,000	196,000	119,000
20	54,000	55,000	45,000		40,000	74,800	146,000	247,000	398,000	456,000	193,000	115,000
21	51,800	55,000				77,400	146,000	253,000	415,000	448,000	188,000	112,000
22	51,800	55,000				79,440	146,000	257,000	427,000	440,000	185,000	109,000
23	51,800	56,000				85,600	145,000	257,000	442,000	428,000	180,000	105,000
24	51,800	56,000			45,000	89,200	144,000	254,000	460,000	418,000	173,000	102,000
25	51,800	57,000			46,700	94,400	144,000	252,000	472,000	406,000	169,000	100,000
26	51,800	57,000		33,000	46,100	96,800	146,000	249,000	490,000	394,000	163,000	96,800
27	51,800	55,000	42,000		46,000	98,400	147,000	252,000	498,000	380,000	159,000	95,200
28	51,800	54,000			46,700	102,000	152,000	255,000	506,000	366,000	155,000	95,200
29	51,800	54,000			46,700	107,000	160,000	259,000	514,000	352,000	153,000	92,200
30	51,800	51,800			.....	110,000	168,000	263,000	520,000	341,000	152,000	90,700
31	51,800	.....			.....	109,000	.....	264,000	.....	328,000	151,000	.....

Daily discharge, in second-feet, of Columbia River at Wenatchee, Wash., for the period May 1, 1913, to Dec. 31, 1916—Continued.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1916.				1916.			
1	87,700		41,600	16	65,600		36,800
2	87,700		41,000	17	64,400		37,300
3	84,900	53,000	40,500	18	63,200	46,000	37,300
4	83,500		39,400	19	61,400		37,300
5	81,400		38,900	20	59,600		37,300
6	80,700		38,900	21	59,600		37,800
7	80,000		37,800	22	56,100		38,300
8	77,400	52,000	37,800	23	54,900	45,000	38,300
9	74,200		37,300	24	57,300		38,300
10	73,000		37,300	25	58,500		37,800
11	71,100		36,800	26	59,600		36,800
12	68,000		36,800	27	59,600		
13	68,000	50,000	36,800	28	58,500	43,000	
14	65,600		36,800	29	58,500		33,000
15	65,600		36,800	30	58,500		
				31	56,100	.....	

Daily discharge, in second-feet, of Columbia River at Vernita, Wash., for the year ending Sept. 30, 1917.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	29,900	26,600	29,900	33,800	91,100	380,000	414,000	252,000	131,000
2	29,900	26,900	29,400	33,200	94,000	389,000	412,000	246,000	128,000
3	29,900	27,000	28,800	32,600	94,900	396,000	407,000	236,000	126,000
4	29,900	27,200	28,100	32,600	96,800	398,000	407,000	222,000	124,000
5	29,900	27,700	28,000	33,200	98,700	396,000	405,000	214,000	120,000
6	30,200	28,400	28,000	33,800	99,700	391,000	405,000	205,000	117,000
7	30,500	29,500	28,000	34,400	101,000	391,000	403,000	197,000	113,000
8	30,700	30,500	28,000	35,700	103,000	394,000	403,000	191,000	109,000
9	31,100	31,400	27,900	38,200	105,000	396,000	400,000	184,000	107,000
10	30,900	32,100	27,900	41,300	109,000	400,000	398,000	176,000	103,000
11	30,700	32,000	27,700	44,400	117,000	405,000	394,000	172,000	99,700
12	30,300	31,600	27,700	47,700	127,000	405,000	384,000	168,000	96,800
13	30,000	31,500	28,500	49,000	139,000	403,000	380,000	161,000	94,000
14	29,700	31,500	29,100	52,400	156,000	400,000	373,000	158,000	91,100
15	29,400	31,400	29,500	56,600	169,000	403,000	366,000	154,000	89,200
16	29,000	31,400	29,600	57,400	184,000	410,000	364,000	150,000	87,400
17	28,700	31,400	29,600	59,000	196,000	416,000	359,000	148,000	85,600
18	26,500	31,400	29,200	61,400	206,000	426,000	354,000	145,000	84,700
19	26,500	31,400	29,500	62,200	214,000	428,000	348,000	144,000	83,800
20	27,300	31,400	29,500	63,000	221,000	428,000	345,000	143,000	82,900
21	28,000	31,400	28,900	64,600	229,000	428,000	341,000	142,000	82,000
22	28,800	31,400	28,300	65,400	238,000	428,000	334,000	143,000	81,100
23	29,500	31,400	27,100	68,000	248,000	430,000	328,000	144,000	80,200
24	30,200	31,300	28,300	69,700	259,000	428,000	319,000	144,000	80,200
25	30,600	31,300	28,300	73,100	274,000	428,000	313,000	143,000	80,200
26	30,900	32,000	28,300	74,800	286,000	428,000	304,000	143,000	80,200
27	31,300	30,700	28,300	78,400	298,000	426,000	294,000	143,000	79,300
28	30,700	30,700	28,900	81,100	319,000	423,000	284,000	140,000	78,400
29	28,500	.....	30,100	84,700	334,000	421,000	274,000	138,000	79,300
30	26,500	.....	32,000	88,300	350,000	419,000	267,000	136,000	78,400
31	24,600	.....	33,200	.....	373,000	.....	259,000	133,000	.....

NOTE.—Gage not read June 19-30, and Aug. 27-31, 1913; discharge estimated by interpolation. Gage-height record for November, 1916, unreliable. Observer read only to nearest half foot during that month and apparently read too low. Excellent record obtained at Priest Rapids, Wash., is used for that month. Daily discharge Jan. 1-13, 1917, before gage was installed at Vernita, same as ascertained at temporary gaging station at Beverly, there being practically no inflow between the stations. Stage-discharge relation at Beverly was affected by ice during that period. Braced figures show mean discharge for period included.

Monthly discharge of Columbia River at Wenatchee and Vernita, Wash., for the years ending Sept. 30, 1913–1917.

[Drainage area at Wenatchee, 88,500 square miles; at Vernita, 95,500 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
1913.						
May	336,000	149,000	209,000	2.36	2.72	12,900,000
June	528,000	354,000	480,000	5.42	6.05	28,600,000
July	472,000	233,000	323,000	3.65	4.21	19,900,000
August	230,000	.....	174,000	1.97	2.27	10,700,000
September	130,000	84,200	116,000	1.31	1.46	6,900,000
The period	.....	.....	.....	.....	.....	79,000,000
1913–14.						
October	83,300	64,000	70,500	.797	.92	4,330,000
November	64,000	56,700	60,200	.680	.76	3,580,000
December	56,700	39,400	46,600	.527	.61	2,870,000
January	44,200	.....	41,500	.469	.54	2,550,000
February	46,600	.....	39,600	.447	.47	2,200,000
March	66,000	46,600	55,000	.621	.72	3,380,000
April	160,000	58,900	111,000	1.25	1.40	6,600,000
May	319,000	160,000	249,000	2.81	3.24	15,300,000
June	343,000	305,000	332,000	3.75	4.18	19,200,000
July	305,000	209,000	282,000	3.19	3.68	17,300,000
August	203,000	109,000	147,000	1.66	1.91	9,040,000
September	108,000	69,800	87,600	.990	1.10	5,210,000
The year	343,000	.....	127,000	1.44	19.53	91,600,000
1914–15.						
October	71,600	68,000	69,900	.790	.91	4,300,000
November	73,400	68,000	71,500	.808	.90	4,250,000
December	71,600	38,200	56,500	.638	.74	3,470,000
January	38,200	.....	35,800	.405	.47	2,200,000
February	34,600	.....	32,600	.368	.38	1,810,000
March	54,500	34,600	41,200	.466	.54	2,530,000
April	136,000	56,700	98,200	1.11	1.24	5,840,000
May	232,000	140,000	189,000	2.14	2.47	11,600,000
June	228,000	190,000	202,000	2.28	2.54	12,000,000
July	206,000	183,000	196,000	2.21	2.55	12,100,000
August	187,000	152,000	172,000	1.94	2.24	10,600,000
September	151,000	66,000	104,000	1.18	1.32	6,190,000
The year	232,000	.....	106,000	1.20	16.30	76,900,000
1915–16.						
October	66,000	51,800	56,000	.633	.73	3,440,000
November	57,000	51,800	54,500	.616	.69	3,240,000
December	49,600	.....	46,000	.520	.60	2,830,000
January	.....	.....	32,400	.366	.42	1,990,000
February	46,700	.....	36,200	.409	.44	2,080,000
March	110,000	43,800	70,400	.795	.92	4,330,000
April	168,000	110,000	135,000	1.53	1.71	8,030,000
May	264,000	172,000	241,000	2.72	3.14	14,800,000
June	520,000	264,000	361,000	4.08	4.55	21,500,000
July	520,000	328,000	459,000	5.19	5.98	28,200,000
August	319,000	151,000	219,000	2.47	2.85	13,500,000
September	150,000	90,700	127,000	1.44	1.61	7,560,000
The year	520,000	.....	153,000	1.73	23.64	112,000,000
1916–17.						
October	87,700	54,900	67,700	.765	.88	4,160,000
November	.....	.....	48,200	.545	.61	2,870,000
December	41,600	.....	37,200	.420	.48	2,290,000
January	31,300	24,600	29,400	.308	.36	1,810,000
February	32,100	26,600	30,400	.318	.33	1,690,000
March	33,200	27,100	28,900	.303	.35	1,780,000
April	88,300	32,600	55,000	.576	.64	3,270,000
May	373,000	91,100	191,000	2.00	2.31	11,700,000
June	430,000	380,000	410,000	4.29	4.79	24,400,000
July	414,000	259,000	356,000	3.73	4.30	21,900,000
August	252,000	133,000	168,000	1.76	2.03	10,300,000
September	131,000	78,400	95,800	1.00	1.12	5,700,000
The year	430,000	24,600	127,000	1.34	18.20	91,900,000

KOOTENAI RIVER BASIN.

KOOTENAI RIVER AT LIBBY, MONT.

LOCATION.—In sec. 3, T. 30 N., R. 31 W., at highway bridge opposite Great Northern Railway station at Libby, Lincoln County.

DRAINAGE AREA.—11,000 square miles.

RECORDS AVAILABLE.—October 13, 1910, to September 30, 1917.

GAGE.—Chain gage on left span of highway bridge, prior to completion of bridge a temporary staff gage fastened to an old stump on the right bank at lower side of bridge. In February, 1913, gage datum lowered 2 feet; all readings prior to change reduced to new datum.

DISCHARGE MEASUREMENTS.—Made from highway bridge, prior to erection of bridge from ferry cable.

CHANNEL AND CONTROL.—Channel broken by two piers, Bed of stream composed of small rocks probably permanent; current fairly swift and uniformly distributed.

EXTREMES OF DISCHARGE.—Maximum stage reported during year, 12.99 feet at 8.30 a. m. June 18 (discharge, 65,000 second-feet); minimum stage, 2.40 feet April 2 and 4 (discharge, 3,330 second-feet).

1910–1917: Maximum stage, 19.17 feet June 21, 1916 (discharge, 130,000 second-feet); minimum stage, 1.4 feet February 7, 1914 (discharge, 1,690 second-feet).

ICE.—Stage-discharge relation found to be seriously affected by ice December 7 to March 28; flow not computed for this period.

DIVERSIONS.—None of importance.

ACCURACY.—Stage-discharge relation permanent. Rating table well defined between 3,400 and 25,000 second-feet used throughout year. Gage read once daily (occasionally twice daily) to hundredths. Daily discharge obtained by applying daily or mean daily gage height to rating table, except for days when gage was not read and discharge was interpolated, as follows: October 11, 22, 29; November 2, 5, 12, 24–28, 30; December 1, 3; July 8; August 15; and September 23. Records good.

COOPERATION.—Gage-height records furnished by United States Forest Service.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Kootenai River at Libby, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7,890	5,970	4,810	.....	3,330	7,560	34,000	38,000	13,700	8,230
2	7,890	5,820	4,530	.....	3,330	7,230	34,000	36,100	13,300	8,230
3	7,560	5,670	4,800	.....	3,330	7,890	34,000	38,200	12,000	7,560
4	7,230	5,970	5,080	.....	3,330	7,560	32,700	41,200	11,600	7,560
5	7,230	5,970	5,080	.....	4,020	7,890	30,100	43,500	11,600	7,230
6	7,230	5,970	5,080	.....	4,270	8,920	28,800	42,700	11,600	6,910
7	6,910	5,970	.....	.....	4,530	9,650	30,100	42,000	11,600	6,910
8	6,910	5,970	.....	.....	5,370	11,600	34,700	39,000	12,000	6,590
9	6,590	5,670	.....	.....	5,370	13,700	42,000	36,100	12,000	6,590
10	6,590	5,970	.....	.....	5,670	15,400	51,700	34,700	11,600	6,590
11	6,590	5,670	.....	.....	6,280	17,800	55,100	33,400	11,200	6,590
12	6,590	4,840	.....	.....	6,280	21,300	47,500	33,400	11,200	6,590
13	6,280	4,020	.....	.....	6,280	25,800	39,700	32,700	11,200	6,590
14	6,280	3,780	.....	.....	5,970	30,100	35,400	31,400	10,800	6,590
15	6,590	3,550	.....	.....	6,280	36,100	36,100	28,200	10,800	6,590
16	6,280	3,330	.....	.....	5,970	37,500	45,100	25,800	10,800	6,590
17	5,970	3,550	.....	.....	5,670	36,100	58,600	25,200	10,800	6,590
18	6,280	3,550	.....	.....	5,370	32,700	65,000	25,200	10,800	6,280
19	6,280	4,800	.....	.....	5,370	28,200	60,400	23,000	10,800	6,590
20	6,280	4,020	.....	.....	5,370	24,700	54,300	25,200	10,800	6,590
21	6,280	4,800	.....	.....	5,670	24,100	54,300	24,100	10,800	6,590
22	5,970	4,530	.....	.....	7,230	25,200	52,500	22,400	10,800	6,590
23	5,970	4,800	.....	.....	7,230	28,200	49,200	20,800	10,400	6,590
24	5,970	4,900	.....	.....	8,230	33,400	43,500	20,300	10,400	6,590
25	5,970	5,000	.....	.....	8,230	40,400	41,200	19,200	10,000	6,590
26	5,970	5,100	.....	.....	8,230	44,300	39,900	17,300	9,650	6,590
27	5,970	5,200	.....	.....	7,890	43,500	37,500	16,400	9,280	6,280
28	5,970	5,290	.....	.....	7,890	42,700	37,500	15,400	9,280	6,280
29	5,820	5,370	.....	3,550	7,890	45,900	38,200	15,900	8,920	5,970
30	5,670	5,090	.....	3,780	7,560	45,100	39,000	15,900	8,920	5,970
31	5,970	.....	.....	3,330	.....	39,000	.....	15,000	8,230	.....

Monthly discharge of Kootenai River at Libby, Mont., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	7,890	5,670	6,480	398,000
November	5,970	3,330	5,000	298,000
December 1–6	5,080	4,530	4,900	58,300
March 29–31	3,780	3,330	3,550	21,100
April	8,230	3,330	5,910	352,000
May	45,900	7,230	25,800	1,590,000
June	65,000	28,800	42,700	2,540,000
July	43,500	15,000	28,300	1,740,000
August	13,700	8,230	10,900	670,000
September	8,230	5,970	6,730	400,000

CLARK FORK BASIN.

CLARK FORK AT ST. REGIS, MONT.

LOCATION.—In sec. 19, T. 18 N., R. 27 W., at McLeod's ferry at St. Regis, Mineral County, about half a mile below mouth of St. Regis River.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—October 26, 1910, to September 30, 1917.

GAGE.—Vertical staff in four sections on left bank at old ferry landing, read by Archie McLeod. Temporary gage at same datum used October 1 to February 24, March 1 to May 9, and July 14 to September 30.

DISCHARGE MEASUREMENTS.—Made from ferry cable at gage.

CHANNEL AND CONTROL.—Channel is permanent both above and below the station. Both banks are high and are not overflowed. The point of control is not sharply defined, but is formed by the bed of the stream for a distance of several hundred feet below the gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 18.5 feet May 29 (discharge, 59,100 secood-feet); minimum stage recorded, 4.2 feet November 14 (discharge, 2,780 second-feet).

1910–1917: Maximum stage recorded, 19.1 feet May 30–31, 1913 (discharge, 62,800 second-feet); minimum stage recorded, 2.9 feet January 4, 1912 (discharge, 1,710 second-feet).

ICE.—Stage-discharge relation affected by ice; data insufficient to warrant computations of discharge December 26 to March 10.

DIVERSIONS.—Water diverted from several of the tributaries to irrigate lands in the Bitterroot Valley and in the vicinity of Missoula.

REGULATION.—Practically none.

ACCURACY.—Stage-discharge relation permanent, as indicated by a measurement made September 24, 1918. Rating table well defined between 3,000 and 63,000 second-feet. Gage read to tenths once daily. Daily discharge obtained by applying daily gage height to rating table. Records good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Clark Fork near St. Regis, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4,420	5,030	3,720	.....	5,900	11,400	46,700	32,600	7,000	3,720
2	4,420	5,240	3,890	.....	5,460	11,100	44,000	30,700	6,780	3,720
3	4,610	4,820	3,890	.....	4,820	10,800	40,600	28,900	6,560	3,550
4	4,820	5,030	4,060	.....	4,420	10,800	38,000	28,400	6,340	3,890
5	4,820	5,030	4,060	.....	4,610	10,800	35,000	28,400	6,120	3,550
6	4,820	5,030	3,890	.....	6,120	11,400	34,000	27,600	6,120	3,890
7	5,030	5,240	3,550	.....	7,720	12,000	33,500	26,300	5,900	4,230
8	4,820	5,240	3,380	.....	7,960	14,500	34,000	25,900	5,680	4,230
9	5,030	5,240	3,380	.....	8,200	17,300	40,100	25,000	5,680	4,230
10	5,030	4,820	3,230	.....	10,200	23,800	45,000	24,600	5,460	4,420
11	5,240	4,060	3,230	9,450	10,200	29,300	46,700	23,000	5,240	4,230
12	5,240	3,890	3,550	7,000	10,200	25,400	45,000	22,200	5,240	4,420
13	5,240	3,380	3,720	4,420	11,400	28,400	40,100	20,100	5,240	4,420
14	5,240	2,780	3,890	3,720	11,400	32,600	36,000	18,000	5,030	4,230
15	5,240	3,100	3,720	3,550	10,500	39,600	35,000	16,600	5,030	4,230
16	5,240	3,100	3,550	3,550	9,970	44,000	38,500	15,900	4,820	4,230
17	5,460	3,550	3,720	3,550	8,700	44,000	44,500	14,800	4,820	4,230
18	5,030	4,230	3,550	3,380	8,200	44,000	48,900	13,800	4,610	4,230
19	5,240	4,610	3,550	3,550	8,200	38,000	52,400	12,900	4,420	4,420
20	5,240	4,060	3,550	3,230	7,960	35,500	51,800	12,300	4,060	4,420
21	5,240	3,890	3,550	3,230	8,450	35,000	49,400	11,700	4,060	4,420
22	5,240	3,890	3,380	2,780	9,700	36,000	47,800	10,800	3,890	4,420
23	5,460	4,230	3,100	2,620	11,100	35,500	44,500	10,500	3,720	4,420
24	5,460	4,420	3,100	2,620	12,600	36,000	41,800	10,200	3,550	4,060
25	5,460	4,610	2,480	2,980	13,800	40,100	40,100	9,700	3,380	4,060
26	5,460	3,720	.....	3,100	13,800	44,500	39,000	8,950	3,380	4,420
27	5,240	3,890	.....	3,100	14,500	51,200	37,500	8,450	3,550	4,820
28	5,240	3,890	.....	3,100	14,200	56,000	35,500	8,200	3,550	5,030
29	5,240	3,720	.....	3,550	13,200	59,100	34,500	7,960	3,550	4,420
30	5,240	3,720	.....	4,060	12,300	57,900	34,000	7,480	3,550	4,230
31	4,820	.....	.....	5,240	.....	54,800	.....	7,240	3,720	.....

Monthly discharge of Clark Fork near St. Regis, Mont., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	5,460	4,420	5,110	314,000
November	5,240	2,780	4,250	253,000
December 1–25	4,060	2,480	3,550	176,000
March 11–31	9,450	2,620	3,890	162,000
April	14,500	4,420	9,530	567,000
May	59,100	10,800	32,300	1,990,000
June	52,400	33,500	41,100	2,450,000
July	32,600	7,240	17,700	1,090,000
August	7,000	3,380	4,840	298,000
September	5,030	3,550	4,230	252,000

CLARK FORK NEAR PLAINS, MONT.

LOCATION.—In lot 7, sec. 1, T. 19 N., R. 26 W., at Cooper's ferry, about 3 miles above Plains, Sanders County, and 7 miles below mouth of Flathead River.

DRAINAGE AREA.—19,900 square miles.

RECORDS AVAILABLE.—October 28, 1910, to September 30, 1917.

GAGE.—Barrett and Lawrence water-stage recorder installed November 28, 1911, 50 feet below an overhanging chain gage on right bank, 150 feet below the point where old ferry crossed; datum that of chain gage, which was read before installation of recorder.

DISCHARGE MEASUREMENTS.—Made from highway bridge at Plains, 3 miles below gage prior to April 26, 1917. The station was rated by measurements made from a ferry cable 150 feet above the gage. This cable has since been removed. A new cable was installed April 26, 1917.

CHANNEL AND CONTROL.—The river is deep, and the current is only moderately swift even at flood stages. The banks are high and are not overflowed. The channel is practically permanent. There is no well defined point of control.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 17.0 feet, June 20 (discharge, 106,000 second-feet); minimum stage, 4.8 feet September 12–14 (discharge, 9,030 second-feet).

1910–1917: Maximum stage recorded, 17.9 feet June 5, 1913, and July 2, 1916 (discharge, 115,000 second-feet); minimum stage recorded, 3.6 feet March 9–10, 1913 (discharge, 5,290 second-feet).

ICE.—Stage-discharge relation not seriously affected by ice, but records were discontinued during winter months of this year.

DIVERSIONS.—Numerous diversions are made for irrigation from the headwaters of Clark Fork and tributaries to Flathead River.

REGULATION.—Flathead Lake furnishes a natural but uncontrolled regulation.

ACCURACY.—Stage-discharge relation practically permanent during year. Rating curve well defined between 8,000 and 80,000 second-feet but poorly defined for higher and lower stages. Chain gage read to half-tenths once or twice a week during January and from April to September; recorder in operation May 13–31 and June 6 to September 30. No records obtained October to December and during February and March. Daily discharge ascertained by applying to rating table daily gage height or mean daily gage height obtained by inspecting recorder graph. Records good.

Discharge measurements of Clark Fork near Plains, Mont., during the year ending Sept. 30, 1917.

[Made by W. A. Lamb.]

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
Apr. 26	7.08	19,500
July 15	12.0	57,525

Daily discharge, in second-feet, of Clark Fork near Plains, Mont., for the year ending Sept. 30, 1917.

Day.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	9,350	.....	95,400	85,400	27,100	11,500
2	.....	.....	.....	91,400	81,500	25,800	11,500
3	9,350	.....	.....	88,700	79,600	25,100	11,100
4	.....	.....	.....	86,000	79,600	23,800	11,500
5	.....	.....	17,700	83,300	77,700	23,800	11,100
6	10,700	.....	.....	80,600	75,800	22,500	10,700
7	.....	.....	.....	79,600	73,800	21,800	10,000
8	.....	11,500	.....	79,600	71,900	21,200	10,400
9	.....	.....	.....	85,400	71,900	20,600	10,400
10	11,900	.....	.....	91,400	70,000	20,000	9,680
11	.....	.....	.....	95,400	68,200	19,400	9,350
12	.....	.....	36,700	95,400	66,300	18,800	9,030
13	12,300	.....	43,800	91,400	62,600	18,800	9,030
14	.....	.....	49,900	87,400	58,900	18,200	9,030
15	.....	14,600	58,900	85,400	57,100	17,700	9,350
16	18,200	.....	66,300	89,400	53,400	17,700	9,680
17	.....	.....	71,900	93,400	51,600	17,100	9,680
18	.....	.....	71,900	99,500	49,900	15,500	9,680
19	.....	.....	70,000	104,000	48,100	15,000	9,680
20	17,100	.....	68,200	106,000	44,700	15,000	9,350
21	.....	12,700	70,000	104,000	43,000	14,600	9,350
22	.....	.....	71,900	102,000	41,400	14,100	9,350
23	16,600	.....	71,900	99,500	39,800	14,100	9,350
24	.....	.....	73,800	97,400	38,200	13,600	9,350
25	.....	.....	77,700	95,400	36,700	13,200	9,680
26	.....	.....	83,500	95,400	35,100	12,700	9,680
27	15,500	.....	89,400	91,400	33,600	12,700	10,000
28	.....	20,600	95,400	89,400	32,100	12,300	9,680
29	.....	.....	99,500	87,400	30,600	12,300	9,680
30	.....	.....	102,000	85,400	29,200	11,900	9,350
31	.....	.....	99,500	.....	27,800	11,500	.....

Monthly discharge of Clark Fork near Plains, Mont. for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
May 12–31	102,000	36,700	73,600	2,920,000
June	106,000	79,600	91,900	5,470,000
July	85,400	27,800	55,300	3,400,000
August	27,100	11,500	17,700	1,090,000
September	11,500	9,030	9,910	590,000
The period				13,500,000

PEND OREILLE LAKE AT SANDPOINT, IDAHO.

LOCATION.—In sec. 23, T. 57 N., R. 2 W. Boise meridian, on west side of lake, at municipal wharf at Sandpoint, Bonner County.

DRAINAGE AREA.—22,900 square miles.

RECORDS AVAILABLE.—March 18, 1914, to September 30, 1917.

GAGE.—Vertical staff in two sections on pile at municipal wharf; read to hundredths by T. Crane, W. W. Schwartz, Jessie Cheeld, and M. C. Payne.

EXTREMES OF STAGE.—Maximum stage recorded during the year, 24.36 feet June 25; minimum stage recorded, 4.95 feet March 16.

1914–1917: Maximum stage recorded, 26.0 feet July 6, 1916; minimum stage recorded March 16, 1917.

ICE.—During winter ice at gage renders observations difficult.

DIVERSIONS.—Considerable water diverted from tributaries of Clark Fork for irrigation.

REGULATION.—None.

COOPERATION.—Record furnished by United States Forest Service.

Daily gage height, in feet, of Pend Oreille Lake at Sandpoint, Idaho, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	6.30	.....	.....	.....	.....	.....	.....	22.80	.....	12.75	7.30
2	.....	.....	5.85	.....	5.05	4.98	.....	9.45	23.05	23.10	12.50	.....
3	.....	6.25	.....	.....	.....	.....	.....	9.50	23.20	22.75	12.10	.....
4	7.50	.....	5.85	.....	.....	.....	.....	9.55	23.25	.....	.....	7.00
5	.....	6.30	.....	5.30	.....	.....	5.40	9.60	.....	22.25	.....	6.90
6	.....	6.30	5.80	.....	.....	.....	5.50	.....	22.90	21.92	11.35	6.85
7	7.30	6.25	5.80	.....	.....	.....	5.60	9.70	22.75	21.62	11.00	6.80
8	.....	.....	.....	.....	.....	.....	5.85	9.75	22.65	.....	10.75	6.75
9	7.20	6.30	5.80	.....	5.15	5.00	6.05	9.95	.....	20.95	10.55	.....
10	7.15	6.30	5.75	.....	.....	.....	6.18	10.30	22.65	20.65	10.40	6.60
11	7.10	6.30	5.70	5.40	.....	.....	.....	10.75	22.80	20.30	10.15	6.55
12	7.05	.....	.....	.....	.....	.....	.....	11.30	22.90	20.05	.....	6.50
13	7.00	6.25	5.65	.....	.....	.....	6.88	.....	23.05	19.75	9.80	6.48
14	6.98	6.20	.....	.....	.....	.....	7.18	12.30	23.09	19.40	9.60	6.45
15	6.95	6.10	5.60	.....	.....	.....	.....	13.10	23.02	.....	9.45	6.40
16	.....	6.05	5.55	.....	.....	4.95	7.40	.....	23.02	18.52	9.25	.....
17	6.85	.....	.....	.....	5.20	.....	7.50	14.90	23.15	18.05	9.10	6.25
18	.....	5.90	.....	.....	.....	.....	7.65	15.67	23.28	17.70	9.00	6.20
19	6.75	.....	5.50	5.10	.....	.....	7.70	16.28	23.45	17.35	.....	6.18
20	6.70	5.80	5.55	.....	.....	.....	.....	17.00	23.67	16.95	8.70	6.12
21	6.65	5.80	.....	.....	.....	.....	7.83	.....	24.00	16.48	8.55	6.10
22	6.55	5.80	5.55	.....	.....	.....	.....	17.60	24.15	.....	8.40	6.05
23	6.50	5.80	5.55	.....	5.15	5.00	8.00	18.00	24.25	15.80	8.30	.....
24	6.45	5.80	.....	.....	.....	.....	.....	18.50	24.35	15.50	8.15	5.95
25	6.40	5.85	.....	.....	.....	.....	8.45	.....	24.36	15.05	8.00	5.92
26	6.38	5.85	.....	.....	.....	.....	8.60	19.25	24.30	14.70	.....	5.90
27	6.35	5.85	.....	5.05	.....	.....	8.80	.....	24.20	14.35	7.80	5.88
28	6.30	5.85	.....	.....	.....	.....	9.00	20.33	.....	14.00	7.70	5.87
29	.....	5.85	.....	.....	.....	.....	.....	.....	23.90	.....	7.60	5.85
30	6.30	.....	.....	.....	.....	5.10	9.20	21.80	23.65	13.35	7.50	.....
31	6.30	.....	.....	.....	.....	.....	.....	22.35	.....	13.00	7.40	.....

CLARK FORK AT METALINE FALLS, WASH.

LOCATION.—In SE. ¼ sec. 21, T. 39 N., R. 43 E., about three-eighths mile above Metaline Falls, opposite town of Metaline Falls, Pend Oreille County, 11 miles south of international boundary.

DRAINAGE AREA.—25,100 square miles. Areas in United States measured on maps issued by United States Geological Survey on scale 1:500,000; area of the Flathead River basin in British Columbia measured on Department of Lands map, scale 1:1,125,000; area of the Priest River basin in British Columbia measured on Nelson sheet, British Columbia map.

RECORDS AVAILABLE.—November 4, 1908, to September 4, 1910 (gage heights only; data insufficient for determination of discharge); October 1, 1912, to September 30, 1917.

GAGE.—Vertical and inclined staff, in 5 sections, reading from 0 to 55 feet, on right bank, three-eighths mile above the falls; installed December 10, 1916. Previous gages as follows: November 4, 1908, to September 4, 1910, on right bank about three-fourths mile above the falls; October 1 to December 27, 1912, on right bank just below Sullivan Creek, 500 feet above the falls; January 16, 1913, to January 24, 1914, at same site but at different datum; January 25 to February 2, 1914, temporary gage at different datum; February 12, 1914, to December 9, 1916, vertical and inclined staff, in 5 sections, reading from 0 to 54 feet, on right bank 500 feet above the falls and at different datum. All readings from October 1, 1912, to February 2, 1914, reduced to datum of gage installed February 12, 1914.

DISCHARGE MEASUREMENTS.—Made from cable three-eighths mile above the falls. Flow of Sullivan Creek added to flow measured at cable.

CHANNEL AND CONTROL.—Banks high and not subject to overflow. Sensitive and permanent control formed by Metaline Falls, where water surface drops 20 feet in a distance of 1,200 feet. Elevation water surface at medium low stage, 1,970 feet above sea level.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 36.2 feet June 25 and 26 (discharge, 122,000 second-feet); minimum stage recorded, 0.10 foot December 27 (discharge, 5,960 second-feet).

1912–1917: Maximum stage recorded, 41.2 feet June 16, 1913 (discharge, 139,000 second-feet, revised); minimum stage recorded December 27, 1916.

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

DIVERSIONS.—Numerous small diversions from upper tributaries for irrigation.

ACCURACY.—Stage-discharge relation permanent. Gage read to hundredths daily. No diurnal fluctuation. Rating curves well defined. Daily discharge ascertained by applying daily gage height to rating table. Records excellent.

COOPERATOIN.—Station maintained in cooperation with Hydrometric Survey of British Columbia. Gage-height record furnished by Hugh L. Cooper Co.

Discharge measurements of Clark Fork at Metaline Falls, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.		Discharge.
		Old.	New.	
		Feet.	*Feet.*	*Sec.-ft.*
Oct. 21	Webb and Parker	8.66	6.76	15,500
22	G. L. Parker	8.55	6.65	14,900
Dec. 7	C. G. Paulsen	6.82	4.92	12,200
11	....do	6.61	4.71	11,700
Mar. 23	....do	4.60	2.70	8,650
24	....do	4.45	2.55	8,440
July 17	....do	29.91	28.07	83,300
18	....do	29.36	27.52	80,700
19	....do	28.92	27.08	78,300
Sept. 23	John McCombs	7.24	5.34	12,500

Daily discharge, in second-feet, of Clark Fork at Metaline Falls, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20,200	13,900	12,100	9,350	8,240	9,070	9,800	28,600	106,000	117,000	47,800	18,300
2	19,700	13,900	12,100	9,350	8,370	8,650	9,950	29,100	110,000	116,000	46,200	17,900
3	19,700	13,900	12,600	9,500	9,070	8,240	10,100	29,400	112,000	114,000	44,600	17,400
4	19,500	13,900	12,500	9,650	9,350	8,510	10,200	29,600	114,000	113,000	43,300	17,000
5	19,100	13,900	12,300	9,800	9,650	9,070	10,600	30,100	114,000	111,000	41,500	16,600
6	18,900	13,900	12,300	9,950	9,800	9,070	11,200	30,400	114,000	109,000	40,300	16,200
7	18,600	13,900	12,100	9,950	9,650	8,930	11,900	30,400	114,000	106,000	38,500	16,200
8	18,400	13,900	12,100	9,950	9,650	8,790	12,500	30,900	113,000	104,000	37,400	15,800
9	18,400	13,900	12,100	10,200	9,800	8,930	13,200	31,700	112,000	102,000	36,000	15,700
10	18,200	13,800	11,900	10,600	9,950	9,210	14,000	32,700	111,000	102,000	34,600	15,500
11	18,000	13,600	11,700	10,600	9,950	9,350	14,700	34,100	112,000	99,600	33,500	15,300
12	17,800	13,900	11,500	10,400	10,100	9,070	15,800	36,500	112,000	94,300	32,200	15,100
13	17,600	13,900	11,400	9,950	10,200	8,790	16,600	39,100	112,000	92,400	31,400	14,900
14	17,400	13,600	11,400	9,800	10,200	8,790	17,400	42,100	113,000	89,500	30,400	14,900
15	17,100	13,600	11,200	9,650	10,200	8,510	18,500	45,500	114,000	86,700	29,400	14,700
16	16,900	13,600	11,000	9,500	9,950	8,650	19,800	48,800	114,000	84,900	28,400	14,300
17	16,500	13,400	10,900	9,350	9,650	8,790	20,200	52,400	114,000	82,600	27,300	14,000
18	16,300	13,200	10,900	9,070	9,650	8,790	20,400	57,600	114,000	79,900	26,200	13,800
19	15,900	12,800	10,900	8,930	9,950	8,950	20,800	62,700	114,000	78,200	25,900	13,600
20	15,900	12,500	10,600	9,350	9,950	8,650	21,100	66,700	116,000	76,000	25,400	13,600
21	15,500	12,300	10,900	8,930	10,100	8,790	22,000	70,500	117,000	73,000	24,500	13,200
22	15,500	12,100	10,900	9,210	9,950	8,790	22,200	73,400	118,000	70,500	23,300	13,100
23	15,100	12,100	10,900	9,070	9,650	8,650	22,600	76,000	119,000	68,000	22,600	12,900
24	15,100	11,800	10,900	9,070	9,500	8,510	22,900	78,600	121,000	65,100	22,400	12,700
25	14,700	12,100	10,900	9,210	9,350	8,650	24,000	81,700	122,000	63,100	22,000	12,400
26	14,700	12,300	8,430	9,350	9,070	8,650	24,500	84,400	122,000	60,700	21,300	12,000
27	14,300	12,500	5,960	9,210	9,070	8,790	25,200	87,200	121,000	59,100	20,600	11,900
28	14,300	12,500	6,680	9,070	9,210	9,070	26,400	90,000	121,000	58,000	20,200	11,900
29	14,100	12,500	7,170	9,070	.....	9,350	27,100	93,800	121,000	54,200	19,800	11,900
30	13,900	12,300	8,790	8,930	.....	9,350	28,100	98,600	119,000	51,600	19,100	11,900
31	13,900	.....	9,350	8,240	.....	9,650	.....	103,000	.....	49,900	18,700	.....

NOTE.—Extremely low discharge Dec. 27 due to ice jam above gaging station. Gage not read Dec. 26 and Aug. 17; discharge interpolated.

Monthly discharge of Clark Fork at Metaline Falls, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 25,100 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	20,200	13,900	16,800	0.669	0.77	1,030,000
November	13,900	11,800	13,200	.526	.59	786,000
December	12,600	5,960	10,800	.430	.50	664,000
January	10,600	8,240	9,490	.378	.44	584,000
February	10,200	8,240	9,620	.383	.40	534,000
March	9,650	8,240	8,870	.353	.41	545,000
April	28,100	9,800	18,100	.721	.80	1,080,000
May	103,000	28,600	55,700	2.22	2.56	3,420,000
June	122,000	106,000	115,000	4.58	5.11	6,840,000
July	117,000	49,900	84,900	3.38	3.90	5,220,000
August	47,800	18,700	30,100	1.20	1.38	1,850,000
September	18,300	11,900	14,500	.578	.64	863,000
The year	122,000	5,960	32,400	1.29	17.50	23,400,000

RACETRACK CREEK NEAR ANACONDA, MONT.

LOCATION.—In sec. 13, T. 6 N., R. 11 W., opposite Racetrack Creek ranger station near Anaconda, Powell County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 25, 1914, to September 30, 1917. From July 11, 1911, to November 9, 1912, station maintained in sec. 15, T. 6 N., R. 11 W., above the falls.

GAGE.—Vertical staff on right bank, opposite Racetrack Creek ranger station; read to tenths twice a day by W. E. Jackson. From July 11, 1911, to June 17, 1912, vertical staff on left bank, 2 miles above present gage. From June 18 to November 9, 1912, vertical staff on left bank, 300 feet above previous gage and at different datum.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Gravel and sand; slightly shifting. Banks high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.00 feet at 6.30 a. m. June 18; minimum stage recorded, 1.50 feet April 15, 16, 18–20, May 1–5.

1911–12 and 1914–17: Maximum stage recorded, 6.8 feet June 10-14, 1912 (discharge, 515 second-feet); minimum stage recorded, February 22, 24, and 26, 1912, (discharge, 16 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; record discontinued during the winter.

DIVERSIONS.—One small diversion during the irrigation season.

REGULATION.—None.

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

No discharge measurements were made during the year. Data inadequate for determination of discharge.

Daily gage height, in feet, of Racetrack Creek near Anaconda, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.7	1.7	.....	1.5	2.7	3.8	.....	1.7
2	1.7	1.7	.....	1.5	2.7	3.8	.....	1.7
3	1.7	1.7	.....	1.5	2.7	3.85	.....	1.7
4	1.7	1.7	.....	1.5	2.6	4.05	2.0	1.7
5	1.7	1.7	.....	1.5	2.5	4.0	2.0	1.7
6	1.7	1.7	.....	1.62	.....	3.8	2.0	1.7
7	1.7	1.7	.....	1.7	.....	3.8	2.0	1.7
8	1.7	1.7	.....	1.72	.....	3.65	2.05	1.7
9	1.7	1.7	.....	1.78	.....	3.55	2.1	1.7
10	1.7	1.7	.....	1.85	.....	3.45	2.1	1.7
11	1.7	.....	.....	1.95	3.3	3.25	2.1	1.7
12	1.7	.....	.....	2.05	3.0	3.1	2.05	1.7
13	1.7	.....	.....	2.2	3.0	2.95	2.0	1.7
14	1.7	.....	.....	2.55	3.3	2.85	1.95	1.7
15	1.7	.....	1.5	2.95	3.7	2.65	1.95	1.7
16	1.7	.....	1.5	2.98	4.45	2.55	1.9	1.7
17	1.7	.....	1.55	2.7	4.85	2.45	1.9	1.7
18	1.7	.....	1.5	2.58	4.85	.....	1.9	1.6
19	1.7	.....	1.5	2.62	4.75	.....	1.9	1.6
20	1.7	.....	1.5	2.7	4.6	.....	1.9	1.6
21	1.7	.....	1.52	2.62	4.5	2.2	1.85	1.6
22	1.7	.....	1.52	2.55	4.55	2.2	1.8	1.6
23	1.7	.....	1.58	2.55	4.45	.....	1.8	1.72
24	1.7	.....	1.6	2.95	4.45	.....	1.8	1.9
25	1.7	.....	1.62	3.55	4.4	.....	1.8	1.8
26	1.7	.....	1.6	3.5	4.3	.....	1.8	1.7
27	1.7	.....	1.6	3.5	4.25	.....	1.3	1.7
28	1.7	.....	1.6	3.5	4.25	2.1	.....	1.7
29	1.7	.....	1.6	2.95	4.25	2.1	1.75	.....
30	1.7	.....	1.55	2.85	4.1	.....	1.7	.....
31	1.7	.....	.....	2.8	.....	.....	1.7	.....

WEST FORK OF BITTERROOT RIVER NEAR DARBY, MONT.

LOCATION.—In sec. 27, T. 2 N., R. 21 W., approximately 500 feet downstream from Trapper Creek ranger station, half a mile below mouth of Trapper Creek, and 10 miles south of Darby, Ravalli County.

DRAINAGE AREA.—572 square miles.

RECORDS AVAILABLE.—September 19, 1920, to September 30, 1917 (fragmentary).

GAGE.—Overhanging chain gage on left bank. It was read daily by Curtis Matteson, forest ranger, when at the station.

DISCHARGE MEASUREMENTS.—Made by wading or from cable near the gage.

CONTROL.—Small rock; uniform; probably permanent. Both banks are high and will not be overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.60 feet June 17 (discharge, 6,730 second-feet); minimum stage recorded, 2.0 feet November 6, 1916, and September 4–11, 1917 (discharge, 148 second-feet).

1910, 1917: Maximum stage recorded June 17, 1917; minimum stage recorded, 1.85 feet August 28 to September 7, 1914 (discharge, 106 second-feet).

ICE.—Discharge relation seriously affected by ice; observations discontinued during winter.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation practically permanent; rating curve, based on three current-meter measurements made in 1913, 1916, and 1918 is fairly well defined below 4,000 second-feet. Gage read once daily when forest ranger was at station. Discharge ascertained only for days on which gage was read by applying gage height to rating table. Records poor.

Daily discharge, in second-feet, of West Fork of Bitterroot River near Darby, Mont., for the year ending Sept. 30, 1917.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		583				182	16					301	
2						165	17		3,660	6,730		293	
3		583				165	18			6,040		280	
4						148	19	390				301	
5		583				148	20					267	
6						148	21					259	
7		807				148	22					239	
8						148	23	870				219	
9			2,570			148	24					219	
10						148	25					219	
11				1,590		148	26		4,680			219	
12		3,020			301		27	1,020				189	
13	345				301		28		4,680			182	
14					301		29					182	
15					301		30					182	
							31					182	

NOTE.—Discharge November 6, 148 second-feet. Discharge determined only for days on which gage was read.

ST. REGIS RIVER NEAR ST. REGIS, MONT.

LOCATION.—In NE. ¼ sec. 28, T. 18 N., R. 28 W., at St. Regis ranger station, about 3 miles above town of St. Regis and junction with Clark Fork, Missoula County.

DRAINAGE AREA.—278 square miles.

RECORDS AVAILABLE.—September 17, 1910, to September 30, 1917.

GAGE.—Vertical staff on left bank 100 feet below suspension bridge at ranger station; read by E. P. Mizell.

DISCHARGE MEASUREMENTS.—Made by wading or from bridge.

CHANNEL AND CONTROL.—Small rock; shallow and probably permanent. Banks fairly high and not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.65 feet May 28 (discharge, 7,740 second-feet); minimum stage recorded, 2.00 feet September 19, 22, 26, 29 (discharge, 135 second-feet).

1910–1917: Maximum stage recorded, 8.65 feet May 28, 1917 (discharge, 7,740 second-feet); minimum stage recorded, 1.75 feet August 30 to September 2, 1915 (discharge, 85 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; observations discontinued during winter.

REGULATIONS.—None. The snow melting in the mountains causes a small amount of diurnal fluctuation during the spring.

ACCURACY.—Stage-discharge relation assumed permanent although no current-meter measurements have been made since 1914. Rating curve fairly well defined. Gage read to half-tenths twice daily, records fragmentary. Discharge ascertained only for days on which gage was read by applying daily gage height to rating table. Records otherwise, poor.

COOPERATION.—Field data furnished by United States Forest Service.

The following discharge measurement has not been heretofore published: March 11, 1914: Gage height 2.50 feet; discharge, 311 second-feet.

Daily discharge, in second-feet, of St. Regis River near St. Regis, Mont., for the years ending Sept. 30, 1916–17.

Day.	Oct.	Nov.	Dec.	Apr.	May.	June.	July.	Aug.	Sept.
1915–16.									
1	90	.....	160	1,120	2,590	2,120	.....	410	225
2	90	.....	160	1,230	2,970	2,230	2,120	410	208
3	90	.....	148	1,350	3,510	2,350	2,010	385	208
4	90	.....	135	1,400	4,380	3,170	1,840	385	245
5	90	.....	135	1,440	5,580	3,510	1,740	360	245
6	90	.....	130	1,400	5,420	2,900	1,590	360	225
7	90	.....	115	1,490	5,580	2,710	1,490	335	225
8	90	.....	110	1,740	4,010	2,970	1,400	335	225
9	90	.....	110	1,790	3,240	3,510	.....	335	225
10	90	.....	110	1,960	2,530	3,510	.....	310	208
11	90	.....	110	2,290	2,180	2,900	.....	310	208
12	90	.....	.....	2,470	2,010	2,710	.....	310	197
13	90	.....	.....	2,530	1,840	2,710	.....	310	190
14	90	.....	.....	2,050	1,790	2,900	.....	310	190
15	90	.....	.....	2,050	1,840	3,380	.....	310	190
16	90	.....	.....	2,230	2,060	4,080	.....	310	190
17	100	.....	.....	2,230	2,410	4,080	.....	310	175
18	90	.....	.....	2,010	2,840	4,080	.....	335	175
19	90	.....	.....	1,900	3,100	4,080	.....	335	160
20	90	.....	.....	1,790	3,170	.....	.....	320	160
21	100	135	.....	1,740	3,040	.....	.....	310	160
22	100	135	.....	1,590	2,530	.....	.....	288	160
23	90	135	.....	1,540	2,290	.....	713	288	160
24	90	135	.....	1,640	2,060	.....	652	265	160
25	90	135	.....	2,060	2,010	.....	592	265	175
26	90	135	.....	3,310	2,010	.....	532	265	190
27	90	135	.....	4,450	2,010	.....	520	265	190
28	90	135	.....	3,650	2,290	.....	520	257	175
29	90	140	.....	2,780	2,350	.....	476	245	166
30	90	148	.....	2,470	2,350	.....	454	233	160
31	90	.....	.....	.....	2,230	.....	438	225	.....

Daily discharge, in second-feet, of St. Regis River near St. Regis, Mont., for the years ending Sept. 30, 1916–17.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1916–17.							
1	160	.....	.....	3,800	1,280	315	160
2	160	.....	2,970	3,800	1,260	292	.....
3	160	.....	.....	2,780	1,210	288	.....
4	160	.....	.....	2,590	1,170	270	.....
5	160	.....	3,240	2,410	1,110	265	160
6	160	.....	.....	2,590	1,010	265	.....
7	160	1,300	.....	3,100	1,030	265	.....
8	160	.....	.....	3,380	935	245	160
9	160	.....	3,650	4,380	886	225	.....
10	160	.....	.....	3,510	817	218	.....
11	160	1,490	.....	2,710	752	208	.....
12	160	.....	4,230	2,230	713	.....	148
13	160	.....	.....	2,060	652	.....	.....
14	160	1,300	.....	2,290	652	.....	.....
15	.....	.....	.....	2,840	592	190	148
16	.....	.....	5,420	3,380	568	.....	.....
17	.....	.....	.....	3,310	532	.....	.....
18	.....	1,400	.....	2,840	509	190	.....
19	.....	.....	4,810	2,780	465	.....	135
20	.....	.....	.....	2,470	476	.....	.....
21	.....	1,790	.....	2,350	438	.....	.....
22	.....	.....	.....	2,120	410	175	135
23	.....	.....	5,580	1,790	370	.....	.....
24	.....	.....	.....	1,840	370	.....	.....
25	.....	.....	.....	1,690	385	160	.....
26	.....	.....	5,900	1,640	385	.....	135
27	.....	.....	.....	1,440	370	.....	.....
28	.....	2,590	7,740	1,540	360	160	.....
29	.....	.....	.....	1,570	340	.....	135
30	.....	.....	5,900	1,400	335	.....	.....
31	.....	.....	4,230	.....	315	.....	.....

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

Monthly discharge of St. Regis River near St. Regis, Mont., for the years ending Sept. 30, 1916–17.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
1915–16.				
October	100	90	91.0	5,600
November 21–30	148	135	137	2,720
December 1–11	160	110	129	2,810
January	.....	.....	.....	.....
February	.....	.....	.....	.....
March	.....	.....	.....	.....
April	4,450	1,120	2,060	123,000
May	5,580	1,790	2,840	175,000
June	.....	.....	.....	.....
July	.....	.....	.....	.....
August	410	225	313	19,200
September	245	160	192	11,400
1916–17.				
October 1–14	160	160	160	4,440
June	4,380	1,400	2,550	152,000
July	1,280	315	668	41,100

FLATHEAD RIVER NEAR COLUMBIA FALLS, MONT.

LOCATION.—In sec. 7, T. 31 N., R. 19 W., at Potter's ranch, three-quarters of a mile above junction with Middle Fork of Flathead River and about 10 miles northeast of Columbia Falls, Flathead County.

DRAINAGE AREA.—1,620 square miles.

RECORDS AVAILABLE.—September 22, 1910, to September 30, 1917.

GAGE.—Vertical staff, on right bank near Potter's ranch buildings. It is read twice a day by J. F. Potter.

DISCHARGE MEASUREMENTS.—Made from cable about three-fourths of a mile above gage.

CHANNEL AND CONTROL.—Rocky, clean, and practically permanent. The banks are high and are not overflowed.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.0 feet at 6 p. m. June 17, (discharge, 24,900 second-feet); minimum stage recorded, 1.00 foot November 13 and 14 (discharge, 510 second-feet).

1910-1917: Maximum stage recorded, 9.8 feet June 20, 1916 (discharge, 29,500 second-feet); minimum stage recorded, 0.7 foot November 10, 1911, and February 5-6, 1914 (discharge, 350 second-feet).

ICE.—Discharge relation seriously affected by anchor ice January 16 to February 10. Data insufficient for computing discharge during this period.

DIVERSIONS.—None of importance.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating table well defined. Gage read to tenths twice daily. Daily discharge obtained by applying mean daily gage height to rating table. Records good.

Daily discharge, in second-feet, of Flathead River near Columbia Falls, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,390	1,010	850	1,100	.....	850	930	1,500	10,700	11,900	2,520	1,190
2	1,390	1,010	850	1,100	.....	850	930	1,800	12,300	11,900	2,290	1,190
3	1,290	1,010	850	1,100	.....	850	930	1,860	13,000	11,900	2,290	1,100
4	1,290	1,010	850	1,100	.....	850	930	1,860	11,900	11,900	2,140	1,100
5	1,290	1,010	850	1,100	.....	930	1,060	1,930	10,100	11,500	2,000	1,100
6	1,190	1,010	850	1,100	.....	930	1,140	2,000	9,940	11,300	2,000	1,100
7	1,190	1,010	600	1,100	.....	1,010	1,140	2,910	12,500	10,500	1,860	1,100
8	1,190	1,010	570	1,100	.....	1,010	1,010	3,990	16,700	9,760	1,860	1,100
9	1,190	1,010	570	1,100	.....	1,010	930	4,620	23,200	9,050	1,800	1,100
10	1,190	1,010	570	970	1,100	1,010	850	5,980	24,000	8,540	1,730	1,060
11	1,100	930	570	930	1,100	810	850	6,480	19,800	8,060	1,730	1,010
12	1,100	700	570	930	1,100	810	850	8,710	16,400	7,450	1,610	1,010
13	1,100	510	570	810	1,100	850	850	10,700	15,400	6,480	1,610	1,010
14	1,060	510	665	770	1,100	850	850	14,400	14,100	5,620	1,610	1,010
15	1,060	735	700	930	1,100	850	850	17,400	15,900	5,500	1,500	970
16	1,060	850	810	.....	1,100	850	850	18,200	18,800	5,280	1,500	970
17	1,060	850	850	.....	1,100	850	850	15,400	24,300	5,060	1,500	930
18	1,010	850	850	.....	770	850	850	12,100	23,200	5,060	1,500	930
19	1,010	850	930	.....	700	850	850	10,700	20,700	4,840	1,500	930
20	1,010	850	930	.....	700	850	890	9,940	20,400	4,620	1,500	930
21	1,010	850	930	.....	700	850	1,060	10,300	20,100	4,400	1,500	930
22	1,010	850	930	.....	700	850	1,340	10,900	19,000	4,090	1,500	930
23	1,010	850	930	.....	700	850	1,610	11,500	16,900	3,800	1,500	930
24	930	850	930	.....	700	850	1,610	12,800	14,900	3,610	1,500	930
25	930	850	890	.....	700	850	1,610	15,900	15,100	3,430	1,500	930
26	930	850	570	.....	810	850	1,610	17,400	14,400	3,250	1,500	930
27	930	850	570	.....	850	850	1,860	16,400	13,700	3,080	1,340	930
28	970	850	570	.....	850	850	1,860	16,900	13,700	2,910	1,290	930
29	1,010	850	930	.....	.....	950	1,560	16,900	13,000	2,830	1,290	930
30	1,010	850	930	.....	.....	850	1,500	14,600	12,100	2,830	1,190	930
31	1,010	.....	1,010	.....	.....	850	.....	12,300	.....	2,750	1,190	.....

Monthly discharge of Flathead River near Columbia Falls for the year ending Sept. 30, 1917.

[Drainage area, 1,620 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	1,390	930	1,090	0.673	0.78	67,000
November	1,010	510	874	.540	.60	52,000
December	1,010	570	776	.479	.55	47,700
January 1–15	1,100	770	1,020	.630	.35	30,300
February 10–28	1,100	700	894	.552	.39	33,700
March	1,010	810	873	.539	.62	53,700
April	1,860	850	1,130	.698	.78	67,200
May	18,200	1,500	9,950	6.14	7.08	612,000
June	24,300	9,940	16,200	10.0	11.2	964,000
July	11,900	2,750	6,550	4.04	4.66	403,000
August	2,520	1,190	1,660	1.02	1.18	102,000
September	1,190	930	1,000	.617	.69	59,500

FLATHEAD LAKE AT POLSON, MONT.

LOCATION.—In SE. ¼ sec. 4, T. 22 N., R. 20 W., at steamboat dock at south end of lake at Polson, Flathead County.

RECORDS AVAILABLE.—August 23, 1908, to September 30, 1917.

GAGE.—Vertical staff attached to a pile at end of pier; datum, 2,803 feet above sea level. In previous reports this datum is incorrectly given as 2,800 feet.

EXTREMES OF STAGE.—Maximum stage recorded during year, 90.5 feet June 23; minimum stage recorded, 79.0 feet March 18 and 24.

1908–1917: Maximum stage recorded, 92.7 feet July 1, 2, and 4, 1916; minimum, 78.5 feet February 16–22, 1913.

COOPERATION.—Records furnished by United States Reclamation Service.

Daily gage height, in feet, of Flathead Lake at Polson, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	81.5	80.9	80.0	79.7	79.3	.....	.....	.....	88.8	89.6
2	81.5	80.9	80.0	79.7	79.3	.....	.....	.....	88.8	89.5
3	81.5	80.8	80.0	79.7	79.3	79.1	.....	.....	88.7	89.3
4	81.4	80.8	79.9	79.7	79.3	79.1	.....	.....	88.7	89.1
5	81.4	80.9	79.9	79.7	79.3	.....	.....	80.8	88.7	88.9
6	81.4	80.9	79.9	79.6	79.3	.....	.....	80.9	88.5	88.8
7	81.3	81.0	79.9	79.6	79.3	.....	.....	.....	88.4	.....
8	81.3	81.0	79.9	79.6	79.2	.....	.....	.....	88.5	.....
9	81.3	81.0	79.9	79.6	79.2	.....	.....	.....	88.6	.....
10	81.3	81.1	79.9	79.6	79.2	79.1	.....	.....	88.3	.....
11	81.2	81.1	79.9	79.6	79.2	79.1	.....	81.7	89.3	.....
12	81.2	81.0	79.9	79.6	79.2	.....	.....	82.0	89.5	.....
13	81.2	80.9	79.9	79.6	79.2	.....	.....	82.5	89.5	.....
14	81.2	80.9	79.9	79.6	79.2	.....	.....	83.0	89.5	.....
15	81.2	80.8	79.9	79.5	79.2	.....	.....	83.6	89.4	.....
16	81.1	80.8	79.9	79.5	79.2	.....	.....	84.3	89.3	.....
17	81.1	80.7	79.8	79.5	79.2	79.1	.....	85.2	89.5	.....
18	81.1	80.7	79.8	79.5	79.2	79.0	.....	85.7	89.8	.....
19	81.1	80.6	79.8	79.5	79.2	.....	.....	86.2	90.1	.....
20	81.1	80.6	79.8	79.5	79.2	.....	.....	86.4	90.3	.....
21	81.1	80.5	79.8	79.5	79.1	.....	.....	86.6	90.4	.....
22	81.0	80.5	79.8	79.5	79.1	.....	79.5	86.7	90.4	.....
23	81.0	80.4	79.8	79.4	79.1	.....	.....	86.8	90.5	.....
24	81.0	80.4	79.8	79.4	79.1	79.0	.....	87.0	90.4	.....
25	81.0	80.3	79.8	79.4	79.1	.....	.....	87.2	90.4	.....
26	81.0	80.3	79.7	79.4	.....	.....	.....	87.4	90.3	.....
27	81.0	80.2	79.7	79.4	.....	.....	.....	87.8	.....	.....
28	80.9	80.2	79.7	79.4	.....	.....	80.1	88.1	90.0	.....
29	80.9	80.1	79.7	79.4	.....	.....	80.2	88.4	89.8	.....
30	80.9	80.1	79.7	79.4	.....	.....	.....	88.6	89.7	.....
31	80.9	.....	79.7	79.3	.....	.....	.....	88.8	.....	.....

FLATHEAD RIVER NEAR POLSON, MONT.

LOCATION.—In sec. 19, T. 22 N., R. 21 W., at Mischell's ferry, at Norrisvale, 5 miles below Newell tunnel, 15 miles northwest of Ronan, and 12 miles below Polson, Flathead County.

DRAINAGE AREA.—7,010 square miles.

RECORDS AVAILABLE.—July 23, 1907, to September 30, 1917.

GAGE.—Vertical staff in four sections on left bank installed April 9, 1916. Prior to April 9, 1916, a chain gage on right bank at same datum. Gage was read once daily by M. Slyapich.

DISCHARGE MEASUREMENTS.—Made from car on ferry cable about 80 feet below gage.

CHANNEL AND CONTROL.—Permanent riffle about 1,000 feet below gage forms low-water control. Current fairly swift. Banks are high.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 14.1 feet June 23, 1917 (discharge, 59,100 second-feet); minimum stage, 1.00 feet March 12, 1917 (discharge, 2,000 second-feet).

1907–1917: Maximum stage recorded, 16.4 feet June 12, 1913 (discharge, 75,400 second-feet); minimum stage recorded, March 12, 1917.

ICE.—Stage-discharge relation not seriously affected by ice, and open channel rating assumed applicable.

DIVERSIONS.—Several small diversions from tributaries above Flathead Lake.

REGULATION.—Flathead Lake forms a natural regulation.

ACCURACY.—Stage-discharge relation is practically permanent. Rating curve is well defined. Gage read to tenths once a day except October 10–14 and October 25 to November 8. Daily discharge determined by applying daily gage height to rating table or by interpolating for days on which gage was not read. Records good.

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

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Flathead River near Polson, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	9,000	5,150	4,330	2,790	2,590	2,310	2,230	4,670	46,200	52,200	17,500	6,760
2	9,310	5,090	4,170	2,790	2,400	2,310	2,230	4,850	46,900	51,600	17,100	6,520
3	9,000	5,030	4,170	2,690	2,400	2,310	2,230	5,040	46,900	50,200	16,200	6,290
4	8,700	4,970	3,740	2,690	2,490	2,310	2,230	5,230	46,200	49,600	16,200	6,060
5	8,400	4,910	3,880	2,790	2,490	2,310	2,230	5,630	45,600	48,200	15,700	5,840
6	8,110	4,850	3,880	2,790	2,490	2,310	2,230	5,840	44,200	47,500	14,800	5,630
7	8,110	4,790	3,880	2,790	2,490	2,310	2,310	6,060	44,200	46,900	14,000	5,430
8	7,820	4,730	3,740	2,790	2,490	2,230	2,310	6,520	43,600	46,200	14,000	5,230
9	7,540	4,670	3,740	2,690	2,490	2,230	2,310	7,270	44,200	44,900	13,600	5,230
10	7,370	5,690	3,600	2,790	2,490	2,230	2,310	8,400	46,900	43,600	12,800	5,230
11	7,200	5,040	3,470	2,690	2,490	2,070	2,400	9,620	49,600	42,900	12,400	5,040
12	7,030	4,670	3,470	2,790	2,490	2,000	2,490	10,900	52,900	41,600	12,000	5,040
13	6,860	4,670	3,600	2,790	2,490	2,150	2,690	13,200	52,200	41,000	12,000	4,850
14	6,690	4,670	3,600	2,790	2,490	2,310	2,790	14,800	52,900	38,400	11,600	4,670
15	6,520	4,670	3,600	2,790	2,400	2,310	2,790	17,500	50,900	37,800	11,300	4,500
16	6,520	4,500	3,600	2,690	2,400	2,230	2,790	23,600	50,900	35,200	10,900	4,500
17	6,290	4,500	3,600	2,690	2,590	2,230	2,900	25,800	51,600	34,000	10,600	4,330
18	6,060	4,330	3,600	2,690	2,590	2,230	2,790	26,400	52,900	33,400	10,200	4,170
19	6,060	4,500	3,470	2,690	2,490	2,230	2,790	29,800	55,600	31,600	9,930	4,170
20	5,840	4,500	3,600	2,590	2,490	2,230	2,900	32,200	57,000	29,800	9,620	4,170
21	5,630	4,330	3,470	2,690	2,490	2,230	3,010	32,800	57,700	29,300	9,310	4,170
22	5,630	4,330	3,470	2,690	2,490	2,230	3,010	33,400	58,400	27,500	9,000	4,020
23	5,630	4,330	3,470	2,590	2,400	2,230	3,120	34,600	59,100	27,000	8,700	4,020
24	5,630	4,170	3,470	2,490	2,400	2,150	3,350	35,200	58,400	24,700	8,700	4,020
25	5,570	4,170	3,350	2,490	2,490	2,230	3,600	36,500	57,700	23,600	8,700	4,020
26	5,510	4,170	3,350	2,490	2,400	2,230	3,880	37,800	57,000	22,600	8,400	3,880
27	5,450	4,170	3,230	2,490	2,400	2,230	4,170	40,300	56,300	22,000	8,110	3,880
28	5,390	4,170	3,350	2,490	2,400	2,230	5,040	44,200	55,600	21,000	7,820	3,880
29	5,330	4,170	3,600	2,490	.....	2,230	4,670	44,900	55,000	20,000	7,270	3,880
30	5,270	4,020	4,020	2,490	.....	2,230	4,850	45,600	53,600	19,000	7,540	3,740
31	5,210	.....	3,120	2,490	.....	2,230	.....	46,200	.....	18,500	7,010	.....

Monthly discharge of Flathead River near Polson, Mont., for the year ending Sept. 30, 1917.

[Drainage area, 7,010 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	9,310	5,210	6,730	0.960	1.11	414,000
November	5,630	4,020	4,600	.656	.73	274,000
December	4,330	3,120	3,630	.518	.60	223,000
January	2,790	2,490	2,670	.381	.44	164,000
February	2,590	2,400	2,470	.352	.37	137,000
March	2,310	2,000	2,240	.320	.37	138,000
April	5,040	2,230	2,960	.422	.47	176,000
May	46,200	4,670	22,400	3.20	3.69	1,380,000
June	59,100	43,600	51,700	7.38	8.23	3,080,000
July	52,200	18,500	35,500	5.06	5.83	2,180,000
August	17,500	7,010	11,400	1.63	1.88	701,000
September	6,760	3,740	4,770	.680	.76	284,000
The year	59,100	2,000	12,600	1.80	24.50	9,150,000

MIDDLE FORK OF FLATHEAD RIVER AT BELTON, MONT.

LOCATION.—In NW. ¼ sec. 36, T. 32 N., R. 19 W., at Hotel Belton, half a mile below highway bridge at Belton and about 2 miles above Lake McDonald outlet, in Flathead County.

DRAINAGE AREA.—900 square miles.

RECORDS AVAILABLE.—October 5, 1910, to September 30, 1917.

GAGE.—Sloping gage on left bank directly back of Hotel Belton; read by Mrs. S. C. Brock.

DISCHARGE MEASUREMENTS.—Made from cable 200 feet below gage.

CHANNEL AND CONTROL.—Practically permanent. Banks high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 12.40 feet May 15 (discharge, 20,800 second-feet); minimum stage recorded, 1.65 feet March 27–29 and April 3 (discharge, 280 second-feet).

1910–1917: Maximum stage recorded, 20.0 feet at 9 a. m. June 21, 1916 (discharge determined by extension of rating curve, 49,000 second-feet); minimum stage recorded, 1.3 feet March 29–30, 1912 (discharge, 182 second-feet).

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

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating table fairly well defined between 325 and 20,000 second-feet. Gage read to half-tenths daily. Daily discharge obtained by applying daily gage height to rating table. Records good.

No discharge measurements were made during the year.

Daily discharge, in second-feet, of Middle Fork of Flathead River at Belton, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,020	1,020	960	.....	295	1,320	8,020	9,060	2,140	710
2	1,020	1,100	960	.....	295	1,400	5,980	8,830	2,190	650
3	960	1,130	895	.....	280	1,530	7,250	8,260	2,300	650
4	928	1,160	770	.....	295	1,670	7,800	8,140	2,240	650
5	928	1,160	770	.....	380	1,720	9,300	7,690	2,240	620
6	895	1,160	740	.....	440	1,970	10,000	7,250	2,190	620
7	862	1,160	740	.....	650	2,900	10,500	6,920	1,970	590
8	862	1,240	710	.....	590	5,000	13,500	6,400	1,770	590
9	830	1,240	710	.....	535	6,190	17,400	6,400	1,480	590
10	800	1,240	710	.....	650	7,250	14,200	5,980	1,360	590
11	770	1,160	710	.....	740	9,300	12,300	5,780	1,160	590
12	770	1,160	710	295	800	11,200	9,540	5,380	1,160	590
13	740	1,160	710	295	862	13,400	8,370	4,810	1,130	590
14	740	1,160	680	310	895	14,800	9,780	4,100	1,100	590
15	740	1,160	650	310	862	20,800	11,000	3,930	1,020	590
16	710	1,160	650	310	862	18,600	14,800	3,610	960	620
17	710	1,160	590	310	830	12,700	17,700	3,310	960	620
18	710	1,160	590	310	800	10,900	13,600	3,240	960	620
19	710	1,160	590	295	770	9,060	13,600	3,170	960	620
20	710	1,130	562	295	770	9,180	13,100	3,030	960	620
21	710	1,130	562	295	770	9,060	12,000	2,840	960	590
22	710	1,130	535	295	830	8,940	10,500	2,530	960	590
23	710	1,130	510	295	1,130	8,830	9,540	2,300	960	590
24	710	1,130	485	295	1,620	10,900	9,420	2,300	960	562
25	710	1,130	462	295	1,670	14,500	9,300	2,190	960	562
26	740	1,130	440	295	1,620	14,500	9,300	2,140	960	562
27	740	1,130	440	280	1,580	13,400	9,060	1,970	862	562
28	740	1,130	.....	280	1,440	13,000	9,300	1,920	830	562
29	740	960	.....	280	1,440	12,800	9,540	1,870	770	535
30	960	960	.....	295	1,400	11,500	9,780	1,870	740	535
31	960	.....	.....	295	.....	9,540	.....	1,970	740	.....

NOTE.—Data inadequate to determine discharge Dec. 28, to Mar. 11.

Monthly discharge of Middle Fork of Flathead River at Belton, Mont., for the year ending Sept. 30, 1917.

[Drainage area, 900 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	1,020	710	801	0.890	1.02	49,300
November	1,240	960	1,140	1.27	1.42	67,800
December 1–27	960	440	661	.734	.74	35,900
March 12–31	310	280	296	.329	.24	11,700
April	1,670	280	870	.967	1.08	51,800
May	20,800	1,320	9,290	10.3	11.9	571,000
June	17,700	5,980	10,800	12.0	13.4	643,000
July	9,060	1,870	4,490	4.99	5.75	276,000
August	2,300	740	1,290	1.43	1.65	79,300
September	710	535	599	.666	.74	35,600

BIG CREEK NEAR POLSON, MONT.

LOCATION.—Near township line between sec. 4, T. 22 N., R. 19 W., and sec. 33, T. 23 N., R. 19 W., about three-fourths mile above mouth, just below power house of the Mission Range Power Co., about 7 miles east of Polson, Flathead County.

DRAINAGE AREA.—Not measured.

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

GAGE.—Stevens' eight-day water-stage recorder on left bank; installed June 14; prior to that date temporary gage on left bank 200 feet below.

CHANNEL AND CONTROL.—An artificial control at gage. The control was repaired August 18, but was not completed until after September 30, 1917. Both banks high and are not overflowed. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage reported during year, 2.4 feet at 6 p. m. June 9 (discharge, from extension of rating curve, 104 second-feet); minimum stage, 0.92 foot September 2 (stage-discharge relation affected by shifting control; discharge, 3.7 second-feet).

ICE.—Station not operated during ice period.

DIVERSIONS.—None.

REGULATION.—Operation of power plant materially affected flow, the maximum effect being during low-water flow.

ACCURACY.—Stage-discharge relation affected by changes made in the artificial control on August 18, and by probable filling of channel for period August 19 to September 30. Rating curve used June 1 to August 18 well defined between 10 and 25 second-feet. Gage heights June 1–13 are mean of observer's readings twice daily to hundredths. June 14 to September 30 ascertained from recorder graph by inspection. Daily discharge ascertained by applying gage height to rating table for period June 1 to August 18. Shifting-control method used August 19 to September 30. Records good to August 18 and poor thereafter.

Discharge measurements of Big Creek near Polson, Mont., during the year ending Sept. 30, 1917.

[Made by W. A. Lamb.]

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
May 19	1.20	18.3
July 16	1.08	13.0

NOTE.—Measurements referred to temporary gage 200 feet below site of recording gage.

Daily discharge, in second-feet, of Big Creek near Polson, Mont., for the year ending Sept. 30, 1917.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1	23.5	23.2	7.6	10.0	16	38	12.9	8.2	5.8
2	32	23.0	7.6	3.7	17	35	10.7	8.5	7.6
3	26	25	7.3	5.4	18	33	10.7	8.8	6.7
4	24.0	25	7.6	5.4	19	33	10.3	10.0	6.2
5	23.5	24.6	7.3	5.4	20	31	10.0	12.6	6.7
6	23.5	23.0	7.3	5.0	21	27	9.4	11.0	7.6
7	36	22.5	7.9	4.5	22	28	9.4	11.0	7.6
8	46	20.5	7.6	5.4	23	25	8.8	10.5	6.7
9	90	18.0	7.3	4.5	24	25	8.8	7.6	11.0
10	77	18.0	7.1	6.7	25	24.6	8.2	7.6	11.5
11	48	17.2	7.1	6.7	26	24.6	8.2	8.6	10.5
12	32	15.8	7.3	6.2	27	26	7.9	11.5	9.6
13	26	14.4	7.9	7.6	28	24.6	7.6	14.4	9.1
14	30	12.9	8.5	9.1	29	22.5	7.6	15.0	9.6
15	37	13.3	8.2	6.7	30	23.5	7.9	13.2	9.1
					31	.....	7.9	11.5	.....

Monthly discharge of Big Creek near Polson, Mont., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
June	90	22.5	33.2	1,980
July	25	7.6	14.3	879
August	15	7.1	9.15	563
September	11.5	3.7	7.25	431
The year				3,850

LITTLE BITTERROOT RIVER NEAR NIARADA, MONT.

LOCATION.—In T. 24 N., R. 24 W., at Angus McDonald's ranch, 2 miles southwest of Niarada, Sanders County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—April 8, 1908, to December 2, 1909,[1] and April 12, 1916, to September 30, 1917.

GAGE.—Vertical staff on upstream end of the footbridge opposite McDonald's ranch house; read once daily by Angus McDonald. From April 8, 1908, to December 2, 1909, records obtained from a staff gage at practically same location but at a different datum.

DISCHARGE MEASUREMENTS.—Made from footbridge or by wading.

CHANNEL AND CONTROL.—The bed of the stream is composed of silt and cobblestones and is slightly shifting. Banks are high and covered with heavy growth of willows and underbrush. Stage-discharge relation slightly affected by overhanging brush at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.30 feet May 17 (discharge, 325 second-feet); minimum stage, 0.60 foot August 28 (discharge, 3.0 second-feet).

April 8, 1908, to December 2, 1909, and April 12, 1916, to September 30, 1917: Maximum stage recorded, 5.30 feet May 7, 1916 (discharge, 412 second-feet); minimum stage, August 28, 1917.

ICE.—Stage-discharge relation probably affected by ice; observations discontinued during winter.

ACCURACY.—Stage-discharge relation remained permanent during year. Rating curve fairly well defined between 12 and 140 second-feet was verified by two current-meter measurements in December, 1917. Gage read to half-tenths once daily. Daily discharge ascertained by applying daily gage height to rating table. Records fair.

COOPERATION.—Records furnished by United States Reclamation Service.

[1] Station known as Little Bitterroot River near Dayton, Mont.

Daily discharge, in second-feet, of Little Bitterroot River near Niarada, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	18	18	35	92	129	30	17	5
2	18	16	35	95	122	30	16	5
3	18	18	35	98	119	26	15	5
4	18	18	35	103	116	26	15	5
5	18	18	35	107	103	21	14	5
6	18	18	35	110	98	21	14	5
7	18	15	35	119	95	21	13	5
8	18	15	39	129	92	18	13	5
9	18	16	49	135	92	18	12	5
10	18	15	59	142	92	18	12	5
11	16	15	54	149	86	18	11	5
12	16	15	44	179	86	18	11	6
13	16	15	54	203	81	18	10	6
14	16	15	59	229	70	18	10	6
15	16	15	39	245	70	18	9	6
16	18	15	44	292	70	18	9	6
17	20	15	30	325	70	18	8	6
18	20	15	30	224	70	18	8	6
19	16	15	65	186	65	18	7	6
20	15	15	98	149	65	18	7	6
21	15	15	92	146	65	18	6	6
22	20	15	101	149	65	18	6	6
23	17	15	116	149	65	18	5	6
24	22	15	110	149	62	18	5	6
25	15	15	116	156	62	18	4	5
26	15	15	89	179	59	18	4	5
27	16	15	89	179	54	18	4	4
28	16	15	86	160	52	18	3	4
29	15	15	84	149	49	18	4	4
30	16	15	86	171	44	18	5	4
31	18	.....	.....	149	.....	18	5	.....

Monthly discharge of Little Bitterroot River near Niarada, Mont., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	22	15	17.2	1,060
November	18	15	15.6	925
April	116	30	62.6	3,720
May	325	92	163	10,000
June	129	44	78.9	4,690
July	30	18	19.6	1,200
August	17	3	9.10	558
September	6	4	5.30	315

CROW CREEK NEAR RONAN, MONT.

LOCATION.—In SW. ¼ sec. 13, T. 20 N., R. 20 W., 500 feet above old highway bridge about a quarter of a mile above present bridge on stage road from St. Ignatius to Ronan; 3 miles south of Ronan, Missoula County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 21, 1906, to September 30, 1917.

GAGE.—Staff gage nailed to corner of the spring house on the Nordgren ranch since August 13, 1917. From September 21, 1906, to September 7, 1913, a staff gage on left abutment of old highway bridge was read; September 7, 1913, to August 13, 1917, staff gage on center pier of same bridge. Present gage set to read same as gage at old bridge, but at independent datum.

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

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.2 feet at 7 a. m. June 23 (discharge, 700 second-feet); minimum stage recorded, 0.32 foot September 19–21 (discharge, 3.2 second-feet).

1906–1917: Maximum stage recorded, 10.85 feet June 6, 1908 (discharge, 1,400 second-feet); minimum stage recorded September 19–21, 1917.

These records are for the open season only, and a lower flow may have occurred during the winter.

ICE.—Stage-discharge relation affected by ice December 12 to March 24; flow not computed. Gage record obtained December 12–31.

DIVERSIONS.—Water is diverted above the station by the Pablo feeder canal to irrigate about 12,400 acres.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during open season. Rating curves used before and after August 13 were fairly well defined. Gage read twice daily to tenths, occasionally to half-tenths. Daily discharge ascertained by applying gage heights to rating tables. Records fair.

COOPERATION.—Records furnished by United States Reclamation Service.

Discharge measurements of Crow Creek near Ronan, Mont., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 1	W. A. Lamb	1.60	48.1
Aug. 13	R. O. Crawford	.68	10.5

Daily discharge, in second-feet, of Crow Creek near Ronan, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	46	9.5	9.5	.....	41	100	390	420	24	6.4
2	46	9.5	9.5	.....	46	115	405	390	20	6.1
3	46	9.5	9.2	.....	41	123	420	375	17	5.7
4	46	7.5	8.9	.....	46	130	435	307	14	5.7
5	46	7.5	8.6	.....	41	170	450	260	28	5.1
6	46	7.5	8.3	.....	46	188	465	237	20	4.7
7	46	7.5	8.1	.....	46	198	480	227	17	4.0
8	41	7.5	7.9	.....	50	217	497	198	14	4.0
9	41	7.5	7.7	.....	55	227	497	163	14	3.8
10	36	7.5	7.5	.....	73	270	497	138	14	4.0
11	34	7.5	9.5	.....	80	347	497	115	14	3.8
12	34	5.9	.....	.....	71	375	515	87	11	3.8
13	30	7.1	.....	.....	68	307	515	61	11	3.6
14	28	6.5	.....	.....	61	294	530	55	13.2	3.6
15	28	7.5	.....	.....	50	307	530	50	11.4	3.6
16	28	6.5	.....	.....	50	320	547	46	11.1	3.8
17	14	7.5	.....	.....	46	333	547	46	11.1	3.6
18	13	8.5	.....	.....	50	333	562	46	10.9	3.4
19	12	7.5	.....	.....	46	333	562	50	10.9	3.2
20	12	7.5	.....	.....	46	347	580	61	10.3	3.2
21	12	7.5	.....	.....	46	347	630	73	9.7	3.2
22	12	7.5	.....	.....	46	320	665	68	8.5	3.4
23	12	7.5	.....	.....	46	307	700	55	8.2	3.6
24	12	7.5	.....	.....	46	294	665	55	8.2	7.3
25	12	7.5	.....	36	46	294	630	55	8.2	5.7
26	12	8.5	.....	36	46	307	598	55	8.2	4.9
27	9.5	9.5	.....	36	50	320	562	50	7.6	3.6
28	11	9.5	.....	36	55	333	530	55	6.1	3.6
29	9.5	12	.....	36	68	347	497	55	5.9	4.7
30	9.5	12	.....	36	87	360	375	36	5.7	3.6
31	9.5	.....	.....	36	.....	375	.....	28	12.8	.....

Monthly discharge of Crow Creek near Ronan, Mont., for the year ending September 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	46	9.5	25.6	1,570
November	12	6.5	8.07	480
December 1–11	9.5	7.5	8.61	188
March 25–31	36	36	36.0	500
April	87	41	53	3,150
May	375	100	279	17,200
June	700	375	526	31,300
July	420	28	126	7,750
August	28	5.7	12.5	769
September	7.3	3.2	4.29	255

MISSION CREEK NEAR ST. IGNATIUS, MONT.

LOCATION.—In SW. ¼ sec. 10, T. 18 N., R. 20 W., about 1 mile downstream from St. Ignatius, Missoula County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 21, 1906, to September 30, 1917.

GAGE.—Vertical staff on the left bank, about 500 feet below the house of T. L. Cope Original gage was destroyed July 5, 1907. A new gage was installed July 24, 1907, a short distance downstream and with a datum 0.30 foot lower. On January 25, 1908, this gage was lowered 0.39 foot. On June 7, 1908, the gage was again destroyed and June 26, 1908, a vertical staff gage was installed 20 feet farther downstream and at a different datum. On January 29, 1912, a chain gage was installed on the left bank, about 200 feet above the last gage and at a different datum. On May 19, 1913, the present gage was installed at the same location and datum as the chain gage. Gage read by Mrs. T. L. Cope.

DISCHARGE MEASUREMENTS.—Made by wading or from a bridge 2 miles above the gage.

CHANNEL AND CONTROL.—Bed composed of gravel; shifts slightly at high water. Current swift. No definite point of control. Left bank high and not subject to overflow; right bank low, but subject to overflow only at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.10 feet June 17 (discharge, 426 second-feet); minimum stage recorded, 1.78 feet April 4 (discharge, 11 second-feet).

1906–1917: Maximum discharge estimated at 2,000 second-feet, June, 1908; minimum stage recorded, 0.2 foot, January 30 to February 4, 17–25; March 9–12, 1908; February 28, 1911 (discharge, 8 second-feet).

ICE.—Discharge relation not seriously affected by ice; open channel rating curve assumed applicable.

DIVERSIONS.—Mission canal of the United States Reclamation Service and several private ditches divert water above the gage.

REGULATION.—St. Mary Lake gives a small amount of natural regulation.

ACCURACY.—Stage-discharge relation affected by shifting control. Rating curves well defined between 20 and 300 second-feet. Gage read to half-tenths two or three times a week and daily during rapidly changing stage. Discharge obtained by applying gage heights to rating table and interpolating for days on which gage was not read. Records fair.

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

Discharge measurements of Mission Creek near St. Ignatius, Mont., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 1	W. A. Lamb	2.35	50
July 18	R. O. Crawford	3.08	191

Daily discharge, in second-feet, of Mission Creek near St. Ignatius, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	50	35	27	16	16	12	12	31	155	265	100	65
2	49	35	27	16	16	12	12	28	148	265	96	65
3	47	35	27	16	16	12	11	24	142	265	91	65
4	46	35	27	16	15	12	11	21	135	265	91	65
5	44	35	27	16	14	12	12	24	116	265	91	65
6	43	34	27	16	14	12	13	26	107	265	91	72
7	42	32	27	16	14	12	14	29	98	265	91	78
8	41	31	27	16	14	12	15	31	197	265	88	78
9	40	30	27	16	14	12	16	43	296	265	84	78
10	40	30	27	16	14	12	20	55	270	265	84	78
11	40	29	26	16	14	12	23	62	245	265	84	81
12	38	28	26	16	14	12	27	116	200	253	84	84
13	35	27	25	16	14	12	29	96	155	242	84	84
14	35	27	24	16	14	12	31	76	198	230	84	84
15	35	27	24	16	14	12	26	55	296	218	84	82
16	35	27	23	16	14	12	21	35	348	218	84	80
17	35	27	23	16	14	12	21	33	426	218	84	78
18	35	27	22	16	14	12	21	31	415	192	84	78
19	35	27	22	16	14	12	21	29	390	196	81	78
20	35	27	21	16	13	12	21	27	378	196	78	81
21	35	27	21	16	13	12	21	90	365	176	78	84
22	35	27	20	16	12	12	26	90	315	169	78	82
23	35	27	20	16	12	12	31	116	290	163	75	81
24	35	27	19	16	12	12	29	135	290	156	72	80
25	35	27	19	16	12	12	27	176	265	156	70	78
26	35	27	18	16	12	12	27	155	265	138	67	78
27	35	27	18	16	12	12	28	166	265	121	65	78
28	35	27	17	16	12	12	29	176	278	116	65	78
29	35	27	17	16	.....	12	30	245	290	110	65	78
30	35	27	16	16	.....	12	31	222	265	105	65	78
31	35	.....	16	16	.....	12	.....	198	.....	105	65	.....

Monthly discharge of Mission Creek near St. Ignatius, Mont., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	50	35	38.2	2,350
November	35	27	29.2	1,740
December	27	16	22.8	1,400
January	16	16	16.0	984
February	16	12	13.7	761
March	12	12	12.0	738
April	31	11	21.9	1,300
May	245	21	85.2	5,240
June	426	98	253	15,100
July	265	105	206	12,700
August	100	65	80.7	4,960
September	84	65	77.1	4,590
The year	426	11	71.6	51,900

POST CREEK NEAR ST. IGNATIUS, MONT.

LOCATION.—On line between SW. ¼ sec. 24 and SE. ¼ sec. 23, T. 19 N., R. 20 W., at new highway bridge on stage road between St. Ignatius and Ronan, about a mile below North Fork of Post Creek and 5 miles north of St. Ignatius, Missoula County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—September 19, 1911, to September 30, 1917. For station 3 miles above, at Fitzpatrick's ranch, September 1, 1906, to May 9, 1911; for station at Deschamp's ranch 1½ miles above, from April 20, 1911, to November 11, 1911. Considerable inflow from springs between present and former sites. North Fork of Post Creek also enters below the two former stations and above the present one.

GAGE.—Chain gage on downstream side of highway bridge; read by I. H. Lee.

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

CHANNEL AND CONTROL.—Gravel and small boulders; free from vegetation; shifting at high stages. The banks are fairly high and not subject to overflow except at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.60 feet June 18 and 19 (discharge, 466 second-feet); minimum stage recorded, 2.20 feet February 18–20, March 14–23, May 2–7, August 21 to September 8 (discharge, 23 second-feet).

1906–1917: Maximum stage recorded, 8.48 feet about June 10, 1908; gage washed out; discharge estimated at 2,200 second-feet. Minimum stage recorded, 2.0 feet September 3, 1914; (discharge, 20 second-feet).

ICE.—Discharge relation not seriously affected by ice, except for short periods.

DIVERSIONS.—Two small ditches divert water above the old station at Fitzpatrick's ranch. The United States Reclamation Service diverts water above the station for irrigation and for storage in Ninepipe reservoir.

REGULATIONS.—McDonald's Lake affords a small amount of natural regulation.

ACCURACY.—Stage-discharge relation practically permanent during year. Rating curve, based on four current-meter measurements in 1917 and 1918 and one in 1916, is fairly well defined. Gage read to tenths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records fair.

COOPERATION.—Records furnished by United States Reclamation Service.

The following discharge measurement was made by R. O. Crawford, August 13, 1917: Gage height, 2.38 feet; discharge, 40.6 second-feet.

Daily discharge, in second-feet, of Post Creek near St. Ignatius, Mont., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July,	Aug.	Sept.
1	71	30	30	30	30	30	30	30	159	323	38	23
2	65	34	34	30	30	30	38	23	124	323	38	23
3	71	30	30	30	30	30	30	23	124	323	38	23
4	77	34	27	30	30	30	38	23	97	350	30	23
5	71	30	24	38	30	30	55	23	84	350	30	23
6	65	34	27	38	30	30	38	23	84	350	30	23
7	71	30	24	38	30	30	38	23	97	377	30	23
8	65	34	27	38	30	30	38	30	159	323	30	23
9	71	30	24	38	30	30	38	30	271	323	30	30
10	65	34	27	38	30	30	38	38	406	350	30	30
11	71	30	24	38	30	30	46	38	350	323	30	30
12	65	34	27	38	38	30	74	38	247	296	38	30
13	71	24	24	38	38	30	46	55	247	247	38	30
14	65	27	27	38	38	23	38	74	223	74	38	30
15	60	24	24	30	38	23	46	159	223	55	38	30
16	41	27	27	30	38	23	46	159	323	74	30	30
17	41	24	27	30	30	23	38	124	435	55	30	30
18	37	27	.....	30	23	23	38	97	466	38	30	30
19	37	24	.....	30	23	23	38	84	466	38	30	30
20	30	27	.....	30	23	23	38	84	406	30	30	30
21	34	24	.....	30	30	23	38	84	406	30	23	30
22	30	27	.....	30	30	23	38	84	377	30	23	30
23	34	24	.....	30	30	23	38	97	323	30	23	30
24	30	27	.....	30	30	30	38	110	323	30	23	46
25	34	24	.....	30	30	30	38	124	323	30	23	55
26	30	27	.....	30	30	30	38	97	296	30	23	46
27	34	30	.....	30	30	46	38	84	296	30	23	30
28	30	34	.....	30	30	55	30	97	296	30	23	30
29	34	30	.....	30	.....	65	30	124	296	38	23	30
30	30	34	.....	30	.....	46	30	200	323	38	23	30
31	34	.....	.....	30	.....	30	.....	178	.....	38	23	.....

Monthly discharge of Post Creek near St. Ignatius, Mont., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	77	30	50.5	3,100
November	34	24	25.6	1,770
December 1–17	34	24	26.7	899
January	38	30	32.6	2,000
February	38	23	30.7	1,700
March	65	23	30.7	1,880
April	74	30	39.5	2,350
May	200	23	79.3	4,860
June	466	84	275	16,300
July	377	30	160.5	9,850
August	38	23	29.3	1,800
September	55	23	30	1,780

PRIEST RIVER AT OUTLET OF PRIEST LAKE, NEAR COOLIN, IDAHO.

LOCATION.—In SW. ¼ sec. 5, T. 59 N., R. 4 W., at south end of Priest Lake, 2 miles northwest of Coolin, Bonner County.

DRAINAGE AREA.—572 square miles.

RECORDS AVAILABLE.—June 18, 1911, to December 23, 1917, when station was discontinued; fragmentary.

GAGE.—Stevens water-stage recorder on right bank 600 feet below outlet; installed November 24, 1914; inspected by H. P. Gable and J. K. Ward. June 18, 1911, to April 6, 1912, and July 13, 1912, to January 8, 1913, two vertical staff gages on wharf at Coolin (not accurately referred to bench marks before being destroyed by ice). April 18, 1913, to November 23, 1914, and August 26 to October 9, 1915 (when water-stage recorder was not operating), inclined staff about 200 feet east of wharf at Coolin.

DISCHARGE MEASUREMENTS.—Prior to September 17, 1913, made from a boat at outlet; after that date, made from a cable about 300 feet above gage.

CHANNEL AND CONTROL.—Bed rough; banks high; control permanent. Many large boulders and angular rocks at control catch logs and cause backwater.

EXTREMES OF DISCHARGE.—1911–1917: Maximum stage recorded, 6.83 feet at 1.30 p. m. May 30, 1917 (discharge, 7,290 second-feet). Minimum discharge occurred in December, 1916 (stage-discharge relation affected by logs and discharge not determined).

ICE.—Ice forms on lake occasionally in river just below outlet. Stage-discharge relation not affected except possibly for short periods when ice from lake jams on rocks at control.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation affected by logs from October 17 to about May 29; not affected by ice during year. Rating curves well defined. Daily discharge obtained by applying to rating table mean daily gage height determined by inspecting gage-height graph. During period when stage-discharge relation was affected by logs, discharge estimated from gage-height record, discharge measurements, weather records, and observer's notes. Records excellent except for the period from October 18 to May 29, for which, on account of uncertainty as to amount of backwater, they are poor.

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

Discharge measurements of Priest River at outlet of Priest Lake, near Coolin, Idaho, during the period Oct. 1, 1916, to Dec. 23, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 17	G. L. Parker	0.79	308	Mar. 17	C. G. Paulsen	1.28	308
Mar. 16	C. G. Paulsen	1.28	297	Oct. 7	G. L. Parker	.55	252

Daily discharge, in second-feet, of Priest River at outlet of Priest Lake, near Coolin, Idaho, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	440								7,240	4,000	980	400
2	432								7,080	3,860	945	391
3	432								6,920	3,720	910	378
4	422								6,760	3,580	878	373
5	414								6,600	3,450	845	368
6	409	250	250	280	300	310	380	1,450	6,440	3,260	780	360
7	404								6,280	3,120	767	355
8	396								6,280	3,000	728	355
9	386								6,440	2,810	703	351
10	391								6,600	2,690	679	343
11	386								6,440	2,570	655	347
12	386								6,280	2,450	638	351
13	378							2,950	6,120	2,340	622	347
14	378								5,960	2,230	611	343
15	373								5,960	2,120	600	339
16	340	250	250	290	290	310	490		6,120	2,020	594	335
17	308								6,280	1,920	578	331
18								4,250	6,280	1,820	567	327
19	270								5,960	1,720	556	323
20									5,960	1,630	535	319
21									5,640	1,580	520	311
22									5,480	1,500	505	307
23								4,950	5,330	1,400	490	299
24									5,180	1,360	485	291
25					300				5,030	1,320	465	283
26	250	250	240	280		340	800		4,880	1,240	460	279
27									4,730	1,200	455	279
28								6,450	4,430	1,120	440	272
29					.....				4,430	1,080	432	268
30					.....			7,240	4,140	1,050	422	261
31		.....			.....		.....	7,240	.....	1,020	418	.....

Daily discharge, in second-feet, of Priest River at outlet of Priest Lake, near Coolin, Idaho, for the period Oct. 1 to Dec. 23, 1917.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1	254	172	181	11	244	187	202	21	202	184	347
2	250	172	178	12	244	187	212	22	199	184	364
3	244	175	184	13	236	190	222	23	193	184	364
4	247	181	199	14	233	190	230	24	193	184	.....
5	247	187	202	15	230	187	230	25	187	184	.....
6	247	187	208	16	219	187	264	26	187	181	.....
7	254	187	205	17	219	184	279	27	190	184	.....
8	258	187	202	18	212	184	308	28	187	190	.....
9	258	187	205	19	205	181	327	29	187	193	.....
10	247	187	202	20	202	181	339	30	187	184	.....
								31	178	.....	.....

Monthly discharge of Priest River at outlet of Priest Lake, near Coolin, Idaho, for the period Oct. 1, 1916, to Dec. 23, 1917.

[Drainage area, 572 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
1916–17.						
October	440		330	0.577	0.67	20,300
November			250	.437	.49	14,900
December			246	.430	.50	15,100
January			283	.495	.57	17,400
February			296	.517	.54	16,400
March			321	.561	.65	19,700
April			557	.974	1.09	33,100
May	7,240		3,780	6.61	7.62	232,000
June	7,240	4,140	5,910	10.3	11.49	352,000
July	4,000	1,020	2,200	3.85	4.44	135,000
August	980	418	621	1.09	1.26	38,200
September	400	261	330	.577	.64	19,600
The year	7,240		1,260	2.20	29.96	914,000
1917.						
October	258	178	221	.386	.44	13,600
November	193	172	184	.322	.36	10,900
December 1–23	364	178	246	.430	.37	11,200

SULLIVAN LAKE NEAR METALINE FALLS, WASH.

LOCATION.—Approximately in sec. 31, T. 39 N., R. 44 E. (unsurveyed), near forest ranger station at north end of Sullivan Lake, about 4½ miles east of Metaline Falls, Pend Oreille County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 16, 1912, to September 30, 1917.

GAGE.—Since May 9, 1913, float gage on dam at outlet of lake; read once daily, to half-tenths, by A. J. McDougall. Prior to May 9, 1913, gage was a vertical staff at same site.

EXTREMES OF STAGE.—Maximum stage recorded during year, 25.80 feet June 19; minimum stage recorded, 6.30 feet April 28 to May 1.

1912–1917: Maximum stage recorded, 26.6 feet June 17–20, 1916; minimum stage recorded that of April 28 to May 1, 1917.

REGULATION.—Most of the surplus flow of Sullivan Creek is diverted into the lake. Sufficient water is stored in the lake to afford a continuous flow of about 60 second-feet in flume of Inland Portland Cement Co. Zero of gage at elevation of gate sills; crest of log chute is 22 feet and crest of spillway 25 feet above gate sills.

COOPERATION.—Gage-height record furnished by Inland Portland Cement Co.

Daily gage height, in feet, of Sullivan Lake near Metaline Falls, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	20.00	17.60	15.85	13.75	11.40	9.50	7.15	6.30	17.40	25.20	23.70	21.10
2	19.90	17.60	15.80	13.70	11.30	9.40	7.00	6.40	18.00	25.25	23.60	21.00
3	19.85	17.55	15.70	13.60	11.20	9.30	6.90	6.40	18.60	25.20	23.50	20.95
4	19.80	17.55	15.60	13.55	11.10	9.30	6.80	6.50	18.90	25.20	23.40	20.90
5	19.70	17.55	15.60	13.50	11.00	9.20	6.80	6.55	19.30	25.20	23.30	20.80
6	19.60	17.50	15.50	13.45	10.90	9.10	6.80	6.60	20.05	25.20	23.20	20.70
7	19.55	17.50	15.45	13.35	10.85	9.00	6.90	6.50	20.60	25.20	23.10	20.60
8	19.50	17.40	15.35	13.30	10.80	8.90	7.00	6.50	21.10	25.20	23.00	20.50
9	19.45	17.30	15.35	13.20	10.70	8.80	6.90	6.50	21.80	25.20	23.00	20.40
10	19.40	17.25	15.30	13.15	10.60	8.70	6.80	6.50	22.00	25.10	22.95	20.35
11	19.35	17.20	15.20	13.10	10.55	8.60	6.70	6.55	22.90	25.00	22.90	20.20
12	19.35	17.15	15.10	13.05	10.50	8.50	6.60	6.55	23.80	24.90	22.85	20.15
13	19.30	17.15	15.10	13.00	10.40	8.40	6.50	6.55	24.00	24.85	22.80	20.10
14	19.25	17.15	15.00	12.90	10.40	8.30	6.50	6.90	24.60	24.80	22.60	20.00
15	19.20	17.10	14.95	12.85	10.35	8.20	6.50	7.90	25.10	24.75	22.50	19.95
16	19.20	17.00	14.85	12.80	10.30	8.20	6.50	8.40	25.30	24.75	22.45	19.90
17	19.15	16.95	14.80	12.70	10.20	8.10	6.50	8.50	25.40	24.70	22.40	19.80
18	19.10	16.90	14.70	12.60	10.10	8.10	6.50	9.20	25.60	24.70	22.35	19.65
19	19.00	16.85	14.60	12.50	10.10	8.05	6.40	9.40	25.80	24.60	22.20	19.50
20	18.85	16.80	14.60	12.40	10.10	8.05	6.40	9.60	25.70	24.55	22.10	19.50
21	18.70	16.75	14.50	12.30	10.10	8.00	6.40	9.90	25.70	24.45	21.95	19.50
22	18.50	16.65	14.40	12.20	10.10	7.95	6.40	10.90	25.60	24.40	21.90	19.45
23	18.40	16.60	14.35	12.10	10.00	7.90	6.40	11.60	25.60	24.30	21.80	19.40
24	18.30	16.50	.....	12.05	9.95	7.80	6.45	12.80	25.60	24.20	21.75	19.30
25	18.20	16.45	.....	12.00	9.85	7.70	6.50	13.60	25.50	24.00	21.70	19.20
26	18.15	16.40	.....	11.90	9.75	7.65	6.50	13.90	25.40	23.95	21.60	19.10
27	18.10	16.25	14.05	11.80	9.70	7.55	6.40	14.20	25.30	23.90	21.40	19.05
28	18.00	16.10	14.00	11.75	9.60	7.50	6.30	15.00	25.20	23.80	21.30	19.00
29	17.85	16.00	13.90	11.70	.....	7.45	6.30	15.30	25.20	23.80	21.25	18.95
30	17.70	15.90	13.85	11.60	.....	7.40	6.30	16.00	.....	23.80	21.20	18.90
31	17.60	.....	13.80	11.50	.....	7.30	.....	16.60	.....	23.75	21.15	.....

NOTE.—Mean gage height for year 15.68 feet.

SULLIVAN CREEK NEAR METALINE FALLS, WASH.

LOCATION.—In sec. 30, T. 39 N., R. 44 E., one-eighth mile below Outlet Creek, half a mile below Sullivan Lake, and about 4 miles east of Metaline Falls, Pend Oreille County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—May 16, 1912, to September 30, 1917.

GAGE.—Vertical staff in four sections on left bank; installed September 21, 1917; read by A. J. McDougall. Prior to September 21, 1917, vertical staff on right bank directly opposite present gage and at same datum.

DISCHARGE MEASUREMENTS.—Made by wading or from cable 40 feet below gage.

CHANNEL AND CONTROL.—Stream bed of cobblestones and coarse gravel; likely to shift. Banks high and not subject to overflow. Gradient steep. Stage of zero flow, according to measurements made July 18, 1917, gage height 1.5 feet ±0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.2 feet June 19 (discharge, 1,400 second-feet); minimum stage recorded, 1.19 feet January 30 and 31 (discharge, 69 second-feet).

1912–1917: Maximum stage recorded, 4.2 feet June 2, 1913 (discharge, 1,650 second-feet); minimum stage recorded, 1.10 feet February 1, 1913 (discharge, 53 second-feet).

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

DIVERSIONS.—Water is diverted from Sullivan Creek for storage in Sullivan Lake about a mile above station, but entire run-off of drainage basin passes gage.

REGULATION.—Storage in Sullivan Lake is used by Inland Portland Cement Co. to increase low-water flow.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined below and fairly well defined above 500 second-feet. Gage read once daily to half-tenths. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent except for periods of high water.

COOPERATION.—Station maintained in cooperation with United States Forest Service and Inland Portland Cement Co.

Discharge measurements of Sullivan Creek near Metaline Falls, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 12	C. G. Paulsen	1.27	82.6
July 18	.....do	1.68	185
Sept 21	John McCombs	1.30	88.7

Daily discharge, in second-feet, of Sullivan Creek near Metaline Falls, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	120	97	86	77	77	77	77	120	694	790	200	88
2	120	97	86	86	77	77	77	120	694	742	183	79
3	120	97	97	86	77	77	86	120	694	742	183	88
4	120	97	97	86	86	77	97	133	694	694	183	88
5	108	120	97	77	97	86	97	148	694	694	166	88
6	108	120	97	97	77	77	97	148	574	694	166	88
7	108	120	97	86	77	77	97	180	574	598	151	88
8	97	108	97	77	77	77	97	180	646	574	166	88
9	97	97	97	77	77	77	97	215	742	550	151	88
10	97	97	97	77	77	77	97	258	892	574	136	88
11	97	97	86	77	86	77	97	299	742	526	136	99
12	97	86	86	77	86	77	97	299	646	410	136	110
13	97	97	86	77	86	77	97	320	646	320	136	99
14	97	97	86	69	86	77	97	433	742	278	110	99
15	97	97	86	69	86	77	97	550	790	238	110	88
16	97	97	86	69	86	77	108	598	890	238	123	88
17	97	97	86	69	86	77	108	622	1,190	238	110	88
18	97	97	86	69	77	77	97	574	1,290	193	99	88
19	97	97	86	69	77	77	108	479	1,400	238	99	88
20	97	97	86	69	77	77	108	342	1,290	238	99	88
21	97	97	86	69	77	77	108	387	1,240	238	99	88
22	97	97	86	77	77	77	108	410	1,190	219	99	88
23	97	97	86	77	86	86	120	479	1,190	258	99	88
24	97	97	84	77	86	86	120	646	1,240	258	99	95
25	97	97	82	77	86	86	120	840	1,190	258	99	95
26	97	97	79	77	77	86	120	790	990	278	88	97
27	97	97	77	77	77	86	120	742	890	278	88	101
28	97	86	77	77	77	86	120	890	840	238	88	97
29	97	86	77	77	.....	77	120	1,040	790	238	88	97
30	108	86	77	69	.....	77	120	890	790	219	88	97
31	108	.....	77	69	.....	77	.....	790	.....	219	88	.....

NOTE.—Gage not read Dec. 24–26; discharge interpolated.

Monthly discharge of Sullivan Creek near Metaline Falls, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	120	97	102	6,270
November	120	86	98.2	5,840
December	97	77	87.0	5,350
January	97	69	76.2	4,690
February	97	77	81.2	4,510
March	86	77	79.0	4,860
April	120	77	104	6,190
May	1,040	120	453	27,900
June	1,400	574	896	53,300
July	790	193	396	24,300
August	200	88	125	7,690
September	110	79	91.6	5,450
The year	1,400	69	216	156,000

KETTLE RIVER BASIN.

CURLEW CREEK NEAR CURLEW, WASH.

LOCATION.—In sec. 21, T. 38 N., R. 33 E., 400 feet below mouth of Lambert Creek, half a mile below outlet of Curlew Lake, 9 miles above Curlew, and 12 miles northeast of Republic, Ferry County.

DRAINAGE AREA.—93 square miles (measured on topographic and Colville National Forest maps; uncertain because divide between Curlew Creek and Sanpoil River can not be determined accurately).

RECORDS AVAILABLE.—May 4 to September 30, 1917.

GAGE.—Vertical staff on right bank attached to upstream wing wall of railroad culvert; read by Henry Kuehne.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Permanent and sensitive control formed by wooden culvert having a free fall of 1 foot. Banks above gage fairly high, not subject to overflow. Channel below culvert crooked, subject to overflow at high stages. Stage of zero flow, according to measurements made September 14, 1917; gage height −0.03 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 3.08 feet May 30, June 2 and 6 (discharge, 65 second-feet); minimum stage recorded, 0.18 foot September 5, 6, 8, and 9 (discharge, 1.4 second-feet).

ICE.—Stage-discharge relation may be affected by ice.

DIVERSIONS.—None.

REGULATION.—Natural storage in Curlew Lake.

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

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

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 4	C. G. Paulsen	1.01	11.2	Sept. 14	John McCombs	0.31	2.29
June 17	John McCombs	2.38	44.0	14	....do	.31	2.30
July 10	McCombs and Charles	1.19	15.5				

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

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	65	24	3.7	1.5	16	34	44	11.2	2.6	2.1
2	.....	65	24	3.6	1.5	17	34	44	9.6	2.5	2.0
3	.....	62	22	3.5	1.5	18	33	42	8.8	2.5	2.1
4	11.6	62	21	3.4	1.4	19	34	39	8.1	2.4	1.9
5	11.6	65	21	3.3	1.4	20	39	39	7.5	2.4	1.8
6	12.6	65	19.9	3.2	1.4	21	39	37	6.5	2.3	1.7
7	12.6	62	17.8	3.0	1.4	22	42	36	6.4	2.2	1.6
8	16.8	59	16.8	2.9	1.4	23	44	34	5.4	2.1	1.6
9	18.8	56	15.7	2.9	1.4	24	47	33	5.5	2.1	1.6
10	19.9	56	15.7	3.0	1.7	25	62	32	5.2	2.1	1.5
11	21	53	14.6	2.9	2.1	26	62	32	4.4	2.0	1.5
12	24	53	13.6	2.8	2.1	27	65	29	4.6	1.9	1.4
13	29	50	12.6	2.8	2.2	28	65	27	4.5	1.9	1.5
14	32	50	12.6	2.7	2.4	29	65	27	4.0	1.8	1.4
15	34	47	11.4	2.6	2.2	30	65	26	3.9	1.8	1.4
						31	62	.....	3.9	1.6	.....

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

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
May 4–31	65	11.6	37.0	2,050
June	65	26	46.4	2,760
July	24	3.9	11.7	719
August	3.7	1.6	2.60	160
September	2.4	1.4	1.69	101

HALL CREEK BASIN.

HALL CREEK AT INCHELIUM, WASH.

LOCATION.—In NE. ¼ sec. 6, T. 32 N., R. 37 E., half a mile above highway bridge, three-fourths mile above mouth of creek, and three-fourths mile northwest of Inchelium, in Ferry County.

DRAINAGE AREA.—163 square miles; at former location at Wires bridge, 3 miles above mouth, 160 square miles (measured on topographic, Colville Indian Reservation, and Colville National Forest maps).

RECORDS AVAILABLE.—December 18, 1912, to September 30, 1917.

GAGE.—Stevens water-stage recorder on right bank, three-fourths mile above bridge; installed August 27, 1916; inspected by Walter Johnson. For description of previous gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable 15 feet below gage.

CHANNEL AND CONTROL.—Bed of stream composed of gravel and boulders; permanent except at extremely high stages. Channel straight above and below gage. Banks high. Stage of zero flow determined June 22 and September 17, 1917, gage height 0.4 foot ± 0.05 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.69 feet at midnight May 13 (discharge, 634 second-feet); minimum discharge occurred during period in which stage-discharge relation was affected by ice.

1912–1917: Maximum stage recorded, 3.10 feet at 6.20 a. m., April 16, 1914 (discharge, 965 second-feet); minimum discharge, 13.8 second-feet (current-meter measurement) January 19, 1916.

ICE.—Stage-discharge relation seriously affected by ice; winter flow estimated from observer's notes, weather records, and discharge measurements.

DIVERSIONS.—Water is diverted for use at Gwen mine power plant but is returned above gage.

REGULATION.—Effect of operation of power plant negligible.

ACCURACY.—Stage-discharge relation permanent during year except as affected by ice November 13–21, December 6–19, 21–31, January 1 to February 5, and February 24 to March 5. Rating curve well defined below 450 second-feet. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent except during periods when stage-discharge relation was affected by ice and for short periods during high water.

Discharge measurements of Hall Creek at Inchelium, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	G. L. Parker	1.58	24.6	May 6	C. G. Paulsen	2.86	259
Dec. 20	C. G. Paulsen	3.03	25.9	June 22	John McCombs	2.45	138
Feb. 4	do	1.69	24.0	Sept. 17	do	1.50	18.8

Daily discharge, in second-feet, of Hall Creek at Inchelium, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	25	31	24				24	185	384	104	35	18
2	25	30	24		20		25	188	360	90	34	18
3	26	31	24			20	26	212	340	93	32	18
4	26	51	25		24		27	215	320	88	30	18
5	26	49	24		22		31	224	312	82	29	18
6	26	36		22	20	21	35	251	282	76	27	18
7	26	29			19	21	44	276	265	72	26	20
8	25	30			19	21	62	308	254	68	25	21
9	26	30			20	21	68	344	240	65	24	21
10	26	29			20	20	74	416	230	60	22	21
11	26	28			21	21	79	455	224	58	21	22
12	26	27			22	22	85	495	215	54	22	22
13	25	20	22		22	23	83	568	198	52	22	22
14	26	20			24	21	83	604	182	50	22	22
15	26	20			25	21	83	580	170	49	21	20
16	26	20		17	25	21	85	538	162	49	21	20
17	25	20			24	21	83	465	155	48	20	20
18	24	20			24	22	80	408	145	46	20	20
19	24	20			23	23	82	388	140	45	21	18
20	25	20	26		22	22	83	380	131	44	20	18
21	25	20			21	24	140	364	131	41	20	18
22	25	24			23	23	158	364	131	41	20	18
23	24	26			22	23	160	392	131	39	20	18
24	24	27				23	162	416	138	39	21	18
25	24	25				23	170	485	140	39	20	17
26	24	25	23	20	18	22	172	520	126	40	20	18
27	24	25				24	192	510	118	43	19	18
28	24	25				25	209	490	115	41	18	18
29	25	24			.....	27	212	470	113	40	19	18
30	28	24			.....	27	200	440	113	39	19	18
31	30	.....			.....	24	.....	408	.....	37	18	.....

NOTE.—No gage-height record Oct. 21, 27, 30, and Apr. 9–11; discharge interpolated.

Monthly discharge of Hall Creek at Inchelium, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	30	24	25.4	1,560
November	51	.....	26.9	1,600
December	.....	.....	22.8	1,400
January	.....	.....	19.7	1,210
February	25	.....	21.1	1,170
March	27	.....	22.1	1,360
April	212	24	101	6,010
May	604	185	400	24,600
June	384	113	199	11,800
July	104	37	56.2	3,460
August	35	18	22.8	1,400
September	22	17	19.1	1,140
The year	604	.....	78.3	56,700

STRANGER CREEK BASIN.

STRANGER CREEK AT METEOR, WASH.

LOCATION.—In sec. 21, T. 32 N., R. 36 E., at highway bridge at Meteor, about 8 miles southwest of Inchelium, Ferry County.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—August 29, 1916, to September 30, 1917.

GAGE.—Vertical staff on right bank 15 feet below bridge; read by E. J. Sparling.

DISCHARGE MEASUREMENTS.—From highway bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel. One channel at all stages. Left bank subject to overflow at extremely high stages. Concrete control 6 feet below gage. Stage of zero flow determined July 7, 1917, gage height, −0.05 foot ±0.02 foot.

EXTREMES OF DISCHARGE.—1916–1917: Maximum stage recorded, 2 feet from May 15 to 18 (discharge, 164 second-feet); minimum stage recorded, 0.27 foot from September 24 to 30 (discharge, 3.0 second-feet).

ICE.—Stage-discharge relation seriously affected by ice for short periods; flow estimated from observer's notes, weather records, and comparison with record of flow of Stranger Creek at Inchelium.

DIVERSIONS.—None.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; affected by ice November 14–16, 23–25, December 7–11, January 14–18, 31, February 1–2, February 17, 18, 21, 22, 24–28, March 1, 16, and 17. Rating curve well defined. Gage read twice daily to hundredths. Daily discharge ascertained by applying mean daily gage heights to rating table. Open-water records excellent.

Discharge measurements of Stranger Creek at Meteor, Wash, during the years ending Sept. 30, 1916–7.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1916.		*Feet.*	*Sec.-ft.*	1916–17.		*Feet.*	*Sec.-ft.*
Apr. 12	C. G. Paulsen	(a)	153	Dec. 20	C. G. Paulsen	0.40	6.74
Aug. 29	.....do	0.50	9.99	Feb. 4	.....do	.33	4.43
				May 6	.....do	1.38	75.6
1916–17.				June 22	John McCombs	.89	35.9
Oct. 30	G. L. Parker	.34	4.24	July 7	.....do	.68	19.5

a Before concrete control was built. No gage height available.

Daily discharge, in second-feet, of Stranger Creek at Meteor, Wash., for the period Aug. 29, 1916, to Sept. 30, 1917.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	9.9	5.6	5.0	6.9	5.6	4	6	9.5	77	112	25	8.7	3.7
2	.....	9.9	5.3	5.0	6.9	5.9	4	6.2	9.1	77	105	25	8.4	3.5
3	.....	9.9	5.3	5.6	4.4	6.2	4.2	6.2	9.5	77	99	23	8.4	3.5
4	.....	9.5	5.0	9.9	8.0	6.2	4.4	6.2	10.7	77	93	23	8.0	3.5
5	.....	9.1	5.0	6.9	7.6	6.6	4.4	6.2	11.6	82	88	22	7.6	3.3
6	.....	9.1	4.7	6.2	5.6	6.6	4.4	6.2	12.4	82	88	20	7.6	3.3
7	.....	8.4	4.7	6.2		6.9	4.4	6.2	14.7	82	82	18.9	7.3	3.3
8	.....	8.4	4.7	6.2		6.9	4.7	6.2	18.3	88	72	17.3	6.9	3.3
9	.....	8.4	4.7	6.2		7.3	5.0	6.2	16.1	93	67	17.7	6.9	3.3
10	.....	8.4	4.7	6.2	5	7.6	5.0	6.2	16.1	99	62	17.7	6.2	3.5
11	.....	8.0	4.4	5.9		7.6	5.0	6.6	19.5	118	61	17.2	6.2	3.5
12	.....	7.3	4.4	5.0	6.9	8.0	5.6	6.9	20	125	59	17.2	6.2	3.5
13	.....	7.3	4.4	4.4	6.9	7.6	5.6	7.3	20	140	56	16.1	6.2	3.7
14	.....	7.3	4.4		6.9		5.6	7.6	20	156	53	16.1	5.9	3.5
15	.....	6.6	4.4	4	6.9		6.2	7.6	24	164	51	15.1	5.6	3.5
16	.....	6.6	4.4		6.9	5	6.2	7	25	164	51	15.1	5.6	3.3
17	.....	6.6	4.4	4.4	6.6		6	7	25	164	47	14.2	5.3	3.3
18	.....	6.6	4.4	4.4	6.2		6	8.0	25	164	43	14.2	5.3	3.1
19	.....	6.6	4.4	5.0	6.2	5.0	6.6	7.6	26	164	41	13.3	5.0	3.1
20	.....	5.9	4.4	5.0	6.2	5.6	6.6	8.4	30	156	39	12.9	5.0	3.1
21	.....	5.9	4.4	5.0	6.2	5.0	7	8.0	35	148	37	12.4	5.0	3.1
22	.....	5.9	4.4	5.0	6.2	5.0	7	8.4	38	140	35	12.0	5.0	3.1
23	.....	5.9	4.4		6.2	5.0	7.6	8.4	41	140	34	11.6	4.7	3.1
24	.....	5.9	4.4	5	6.2	5.0		6.9	46	132	33	11.2	4.4	3.1
25	.....	5.9	4.4		6.2	5.0		8.0	52	132	33	10.7	4.4	3.0
26	.....	5.9	4.4	5.3	6.2	5.6	6	8.4	55	132	31	10.3	4.4	3.0
27	.....	5.9	4.4	5.6	6.2	5.6		8.7	60	132	30	9.9	4.2	3.0
28	.....	5.9	4.4	6.2	6.2	5.6		9.1	62	125	28	9.9	3.9	3.0
29	9.9	5.6	5.3	6.2	6.2	5.6	.....	9.5	67	125	26	9.1	3.9	3.0
30	9.9	5.6	5.0	6.2	5.9	5.6	.....	9.1	72	118	26	8.7	3.7	3.0
31	9.9	.....	5.6	.....	5.6	4	.....	9.5	.....	118	.....	8.7	3.7	.....

Monthly discharge of Stranger Creek at Meteor, Wash., for the period Aug. 29, 1916, to Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
1916.				
August 29–31	9.9	9.9	9.90	59
September	9.9	5.6	7.27	433
The period	.....	.....	.....	492
1916–17.				
October	5.6	4.4	4.67	287
November	9.9	.....	5.47	325
December	8.4	.....	6.30	387
January	8.0	.....	5.86	360
February	.....	.....	5.55	308
March	9.5	.....	7.41	456
April	72	9.1	29.7	1,770
May	164	77	122	7,500
June	112	26	56.1	3,340
July	25	8.7	15.4	947
August	8.7	3.7	5.79	356
September	3.7	3.0	3.27	195
The year	164	3.0	22.4	16,200

STRANGER CREEK AT INCHELIUM, WASH.

LOCATION.—In sec. 5, T. 32 N., R. 37 E., about half a mile above mouth and half a mile south of Inchelium, Ferry County, below all tributaries.

DRAINAGE AREA.—74 square miles (measured on Colville Indian Reservation map, edition of 1913).

RECORDS AVAILABLE.—March 18, 1914, to June 30, 1917, when station was discontinued.

GAGE.—Vertical staff on right bank; read by Walter Johnson.

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

CHANNEL AND CONTROL.—Bed of stream composed of sand and gravel; overhanging brush partially obstructs flow at high stages. One channel at all stages. Timber artificial control built November 21, 1915. Stage of zero flow determined September 16, 1917, gage height 0.02 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during period, 2 feet May 17 and 18 (discharge, 142 second-feet); minimum stage occurred in January when stage-discharge relation was affected by ice.

1914–1917: Maximum stage recorded, 3.80 feet April 18, 1914 (discharge, 209 second-feet). Minimum discharge estimated 3.2 second-feet in December, 1914, when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation affected by ice for short periods; winter flow estimated from flow of Stranger Creek at Meteor, observer's notes, and weather records.

DIVERSIONS.—Several small ditches divert water for irrigation above gage.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; affected by ice January 14–23. Rating curve well defined. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Records excellent except when stage-discharge relation was affected by ice.

Discharge measurements of Stranger Creek at Inchelium, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	G. L. Parker	0.50	7.33	June 22	John McCombs	1.00	35.7
Dec. 20	C. G. Paulsen	.54	10.8	July 8	do	.77	23.5
Feb. 4	do	.54	7.97	Sept. 16	do	.36	5.70
May 7	do	1.40	77.1				

Daily discharge, in second-feet, of Stranger Creek at Inchelium, Wash., for the period Oct. 1, 1916, to June 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	7.0	6.7	8.0	8.0	8.5	9.5	24	68	100
2	7.0	6.1	8.5	7.5	8.5	9.5	24	68	95
3	7.0	6.1	10	7.5	9.5	8.5	21	68	95
4	7.0	14	11	7.5	9.0	8.0	23	68	90
5	7.0	10	11	9.5	9.5	9.5	30	68	84
6	7.0	8.0	11	10	9.5	11	30	68	78
7	7.0	7.0	10	10	10	12	34	73	78
8	7.0	7.0	10	10	10	12	46	73	68
9	7.0	7.0	10	10	10	11	46	78	63
10	6.7	7.0	10	10	10	12	38	84	63
11	6.7	7.0	10	7.0	12	10	40	90	61
12	6.7	7.0	9.5	5.5	12	10	42	95	58
13	6.7	7.0	9.0	5.2	12	9.5	40	112	58
14	6.7	6.7	7.5		12	10	36	118	58
15	6.7	6.4	7.5		13	14	34	124	57
16	6.7	6.1	7.5	5	12	17	34	130	55
17	6.7	6.1	7.0		12	16	35	142	46
18	6.7	6.1	7.5		12	18	35	142	39
19	6.7	6.1	7.5		14	14	36	136	40
20	6.4	6.1	8.0		12	14	38	136	38
21	6.4	6.4	7.5	8	12	14	42	136	38
22	6.1	6.1	7.5		12	12	46	130	38
23	6.1	6.1	7.5		14	14	45	130	36
24	6.1	6.1	9.0	12	13	13	46	130	36
25	6.1	6.1	9.0	12	14	14	48	124	38
26	6.1	6.4	9.0	12	13	14	50	124	32
27	6.1	9.5	8.0	12	12	19	54	124	30
28	6.1	8.0	8.0	9.5	10	18	58	124	26
29	7.0	7.0	8.0	9.5	.....	18	60	118	26
30	7.0	7.0	8.0	9.0	.....	26	63	106	24
31	6.7	.....	8.0	8.0	.....	26	.....	106	.....

Monthly discharge of Stranger Creek at Inchelium, Wash., for the period Oct. 1, 1916, to June 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	7	6.1	6.65	409
November	14	6.1	7.07	421
December	11	7	8.71	536
January	12	.....	8.28	509
February	14	8.5	11.3	628
March	26	8	13.7	842
April	63	21	39.9	2,370
May	142	68	106	6,520
June	100	24	54.9	3,270
The period	.....	.....	.....	15,500

SPOKANE RIVER BASIN.

COEUR D'ALENE LAKE AT COEUR D'ALENE, IDAHO.

LOCATION.—In SW. ¼ SW. ¼ sec. 13, T. 50 N., R. 4 W., at Johnson's wharf, 800 feet southeast of railroad station at Coeur d'Alene, Kootenai County.

DRAINAGE AREA.—3,690 square miles (measured on United States Geological Survey maps, scale 1:500,000).

RECORDS AVAILABLE.—February 11, 1905, to September 30, 1917. April 25, 1903, to February 10, 1905, St. Joe Boom Co.'s gage, at mouth of St. Joe River.

GAGE.—Vertical staff on pile at wharf, read to hundredths daily by Henry Kloppenburg. Gage datum is 2,100 feet above mean sea level.

EXTREMES OF STAGE.—Maximum stage recorded during year, 35.90 feet May 17; minimum stage recorded, 21.38 feet March 25 and 26.

1903–1917: Maximum stage recorded that of May 17, 1917; minimum stage recorded, 19.9 feet on October 10–12, 1904, September 24–25, 1905, October 14 to November 3, 1906.

DIVERSIONS.—None.

REGULATION.—Considerable storage is used by the Washington Water Power Co., to increase low-water flow of Spokane River; regulation is affected by tainter gates and bear-trap dam at Post Falls.

COOPERATION.—Gage-height record furnished by the Washington Water Power Co.

Daily gage height, in feet, of Coeur d'Alene Lake at Coeur d'Alene, Idaho, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	25.16	24.36	24.38	23.62	23.22	22.86	22.10	31.80	35.20	28.46	26.17	24.50
2	25.14	24.36	24.36	23.62	23.18	22.76	22.20	31.74	34.92	28.18	26.13	24.46
3	25.12	24.36	24.38	23.62	23.20	22.72	22.24	31.56	34.70	27.96	26.09	24.42
4	25.08	24.38	24.42	23.62	23.16	22.62	22.30	31.44	34.46	27.66	26.05	24.36
5	25.06	24.44	24.44	23.62	23.18	22.62	22.42	31.34	34.12	27.46	26.01	24.32
6	25.04	24.46	24.46	23.62	23.22	22.56	22.86	31.18	33.74	27.20	25.99	24.24
7	24.98	24.46	24.42	23.62	23.24	22.46	23.54	31.16	33.36	26.96	25.95	24.20
8	24.96	24.46	24.42	23.62	23.26	22.42	24.32	31.30	33.06	26.70	26.86	24.14
9	24.94	24.46	24.40	23.64	23.26	22.34	25.26	31.64	32.90	26.58	25.80	24.06
10	24.94	24.45	24.36	23.64	23.26	22.26	26.04	32.18	32.86	26.48	25.78	24.00
11	24.92	24.54	24.36	23.68	23.28	22.14	26.70	32.74	32.86	26.54	25.74	23.96
12	24.88	24.58	24.34	23.68	23.32	22.04	27.28	33.36	32.68	26.63	25.70	23.92
13	24.86	24.58	24.34	23.66	23.32	21.96	27.70	34.00	32.38	26.65	25.66	23.88
14	24.84	24.54	24.32	23.64	23.30	21.88	28.00	34.50	32.00	26.65	25.62	23.84
15	24.84	24.52	24.28	23.62	23.26	21.82	28.26	34.80	31.76	26.63	25.56	23.80
16	24.80	24.48	24.24	23.58	23.24	21.74	28.46	35.50	31.56	26.64	25.50	23.76
17	24.78	24.46	24.16	23.54	23.20	21.66	28.54	35.90	31.46	26.63	25.45	23.72
18	24.72	24.44	24.14	23.50	23.18	21.62	28.52	35.80	31.44	26.61	25.41	23.66
19	24.70	24.42	24.14	23.46	23.22	21.56	28.50	35.50	31.38	26.59	25.37	23.60
20	24.66	24.42	24.10	23.44	23.24	21.54	28.52	35.20	31.26	26.57	25.33	23.56
21	24.64	24.40	24.06	23.40	23.22	21.52	28.64	34.96	31.10	26.55	25.24	23.52
22	24.60	24.36	24.06	23.36	23.18	21.46	28.88	34.68	30.90	26.53	25.19	23.46
23	24.58	24.34	24.06	23.34	23.16	21.46	29.36	34.44	30.66	26.51	25.12	23.40
24	24.54	24.32	24.04	23.34	23.10	21.42	29.84	34.40	30.40	26.48	25.06	23.38
25	24.50	24.32	24.00	23.34	23.08	21.38	30.44	34.52	30.12	26.45	25.01	23.36
26	24.46	24.38	23.94	23.30	23.06	21.38	30.90	34.76	29.86	26.40	24.94	23.34
27	24.44	24.42	23.84	23.32	23.00	21.42	31.24	34.90	29.56	26.35	24.85	23.32
28	24.42	24.42	23.78	23.34	22.90	21.52	31.48	35.00	29.26	26.31	24.82	23.28
29	24.42	24.38	23.74	23.32	.....	21.64	31.66	35.02	29.00	26.28	24.73	23.24
30	24.40	24.40	23.68	23.30	.....	21.80	31.76	35.20	28.76	26.25	24.66	23.18
31	24.40	.....	23.64	23.26	.....	21.96	.....	35.34	.....	26.21	25.58	.....

NOTE.—Mean gage height for the year 25.93 feet

SPOKANE RIVER AT POST FALLS, IDAHO.

LOCATION.—In sec. 4, T. 50 N., R. 5 W. Boise meridian, a quarter of a mile below power plant of Washington Water Power Co., three-fourths mile below intake of Spokane Valley Land & Water Co.'s canal, and 1 mile west of Post Falls, Kootenai County.

DRAINAGE AREA.—3,740 square miles (measured on map issued by United States Geological Survey, scale 1:500,000).

RECORDS AVAILABLE.—January 1, 1913, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff in three sections on left bank; read by Nils Lindberg. Elevation of zero of gage, 2,000 feet above sea level.

DISCHARGE MEASUREMENTS.—Made from cable 300 feet below gage.

CHANNEL AND CONTROL.—River bed at and below gage composed of large gravel and boulders; shifts during floods. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 79.20 feet at 7.30 a. m. May 18 (discharge, 39,800 second-feet); minimum stage recorded, 66.88 feet at 7.30 a. m. October 25 (discharge, 1,280 second-feet).

1911–1917: Maximum stage recorded on May 18, 1917; minimum stage recorded, 66.20 feet October 25, 1914 (discharge, 875 second-feet).

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

DIVERSIONS.—Spokane Valley Land & Water Co.'s canal diverts above gage for irrigation. Mean diversion during year, 59 second-feet. Storage in Coeur d'Alene Lake partly regulated by operation of gates in dam at Post Falls.

REGULATION.—Varying load on power plant causes fluctuation in stage.

ACCURACY.—Stage-discharge relation changed at high water on May 17. Rating curves well defined. Gage read twice daily to hundredths. When discharge is less than 5,000 second-feet stage is variable, owing to changing load at power plant, and the mean of two readings daily may not indicate true mean stage. Daily discharge ascertained by applying mean of daily gage readings to rating table. Records for discharge below 5,000 second-feet good; above 5,000 second-feet excellent.

COOPERATION.—Gage-height record furnished by the Washington Water Power Co.

Discharge measurements of Spokane River at Post Falls, Idaho, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 22	J. E. Stewart	66.98	1,380	June 25	John McCombs	74.39	19,900
Mar. 14	C. G. Paulsen	68.18	2,730	July 5	do	72.20	12,400
May 16	do	78.84	38,100	20	C. G. Paulsen	68.08	2,790

Daily discharge, in second-feet, of Spokane River at Post Falls, Idaho, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,470	1,560	1,770	1,880	1,770	3,050	3,050	25,200	37,000	15,700	2,280	2,040
2	1,470	1,560	1,880	1,880	1,770	3,050	3,350	25,200	36,200	15,000	2,280	1,810
3	1,470	1,560	1,770	1,880	1,880	3,050	3,350	24,800	34,800	14,300	2,280	1,920
4	1,470	1,470	1,770	1,880	1,880	2,500	3,510	24,400	34,400	12,700	2,160	2,040
5	1,470	1,380	1,880	1,880	1,880	3,050	3,830	24,000	33,100	12,400	2,160	2,040
6	1,560	1,470	1,770	1,880	1,880	3,050	4,530	23,600	31,400	12,000	2,160	1,810
7	1,560	2,000	1,660	1,880	2,630	3,050	5,290	23,200	30,100	11,400	2,160	1,810
8	1,380	2,120	1,770	1,880	2,500	3,050	6,780	23,600	28,800	10,200	2,280	2,040
9	1,560	1,770	1,770	1,880	2,500	3,050	8,500	24,400	28,400	11,100	2,160	2,040
10	1,560	1,770	1,770	1,880	2,500	3,200	10,700	26,000	28,400	7,040	2,160	1,810
11	1,560	1,770	1,770	1,880	1,880	2,910	12,500	27,900	28,000	2,970	2,160	1,700
12	1,560	1,770	1,770	1,880	2,630	3,670	13,500	29,900	27,600	3,280	1,920	1,700
13	1,470	1,660	1,770	1,880	2,910	2,630	14,500	31,900	26,800	3,610	2,040	1,920
14	1,470	1,660	1,770	1,880	3,050	2,770	15,500	32,700	25,200	3,440	2,040	1,810
15	1,380	1,660	1,660	1,880	3,350	2,770	15,900	34,300	24,400	3,440	2,280	1,810
16	1,560	1,770	1,770	1,880	3,200	2,630	16,200	36,700	24,000	3,440	2,160	1,920
17	1,380	1,770	1,770	1,880	3,200	2,500	16,600	37,900	23,600	3,440	2,160	1,810
18	1,470	1,770	1,880	1,880	2,500	2,370	16,600	39,800	23,600	3,440	2,160	1,810
19	1,560	1,770	1,770	1,880	3,200	2,630	16,600	38,400	23,200	3,280	1,920	1,810
20	1,470	1,770	1,880	1,880	3,200	2,240	16,600	37,500	22,900	2,680	1,920	1,810
21	1,470	1,770	1,770	1,880	3,200	2,370	16,900	36,200	22,500	2,820	1,920	1,700
22	1,380	2,000	1,770	1,880	3,200	2,120	17,600	35,300	22,100	2,540	2,280	1,810
23	1,470	1,770	1,770	1,880	3,200	2,240	18,700	33,900	21,400	2,540	2,160	1,810
24	1,560	1,770	1,770	1,880	3,200	2,120	20,200	33,900	20,600	2,540	2,040	1,810
25	1,380	1,770	1,770	1,880	2,370	2,000	21,700	34,400	19,900	2,680	1,920	1,810
26	1,470	1,770	1,880	1,880	3,200	2,000	22,900	35,700	19,200	2,540	2,160	1,810
27	1,560	1,770	1,880	1,770	3,200	2,120	23,600	36,200	18,400	2,540	2,040	1,700
28	1,560	1,770	1,880	1,770	3,050	2,240	24,400	36,600	17,700	2,410	2,160	1,810
29	1,380	1,770	1,880	1,770	.....	2,370	24,800	36,200	17,000	2,280	2,410	1,700
30	1,560	1,770	1,880	1,770	.....	2,500	25,200	37,000	16,300	2,410	2,160	1,810
31	1,560	.....	1,880	1,770	.....	2,910	.....	37,500	.....	2,280	2,040	.....

NOTE.—Discharge July 10 interpolated.

Combined monthly discharge of Spokane River and Spokane Valley Land and Water Co's. canal at Post Falls, Idaho, for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.					Combined run-off in acre-feet.
	Combined.		River.	Canal.	Total.	
	Maximum.	Minimum.	Mean.	Mean.	Mean.	
October	1,620	1,440	1,490	58.5	1,550	95,300
November	2,160	1,420	1,730	39.5	1,770	105,000
December	1,920	1,690	1,800	28.0	1,830	113,000
January	1,880	1,770	1,860	.0	1,860	114,000
February	3,400	1,770	2,680	40.3	2,720	151,000
March	3,710	2,040	2,650	38.4	2,690	165,000
April	25,200	3,080	14,100	39.6	14,100	839,000
May	39,900	23,300	31,800	82.9	31,900	1,960,000
June	37,100	16,400	25,600	103	25,700	1,530,000
July	15,800	2,390	5,890	116	6,010	370,000
August	2,500	2,010	2,130	97.2	2,230	137,000
September	2,120	1,760	1,840	61.5	1,900	113,000
The year	39,900	1,420	7,800	58.9	7,860	5,690,000

SPOKANE RIVER AT SPOKANE, WASH.

LOCATION.—In sec. 9, T. 25 N., R. 43 E., above Washington Water Power Co.'s steam plant in Spokane, 2.8 miles above Spokane Falls, and about 4 miles above Latah Creek, Spokane County.

DRAINAGE AREA.—3,910 square miles (measured on map issued by United States Geological Survey; scale 1:500,000).

RECORDS AVAILABLE.—March 22, 1891, to September 30, 1917.

GAGE.—Stevens water-stage recorder on right bank 500 feet above Washington Water Power Co.'s steam plant; installed July 31, 1915; inspected daily by power plant attendant. For description of earlier gages see Water-Supply Paper 412. Approximate elevation of gage datum, 1,800 feet above sea level.

DISCHARGE MEASUREMENTS.—Made from cable 75 feet upstream from gage.

CHANNEL AND CONTROL.—Bed composed of gravel and boulders. One channel at all stages. Control is stretch of channel contracted by bridge structures and embankments between station and crest of Spokane Falls; shifts at extremely high water.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 83.8 feet at midnight May 17 (discharge, 41,900 second-feet); minimum stage recorded, 69.14 feet at noon October 16 (discharge, 1,930 second-feet).

1891–1917: Maximum stage recorded that of May 17, 1917; minimum stage recorded, 1.3 feet (Martha Street gage) September 28–30, 1905 (discharge, 1,240 second-feet).

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

DIVERSIONS.—Water is diverted above the station for irrigation by the Spokane Valley Land & Water Co.'s canal. (See p. 107.)

REGULATION.—Flow is partly regulated by storage in Coeur d'Alene Lake.

ACCURACY.—Stage-discharge relation changed at high water at midnight May 17. Rating curves used before and after the change well defined. Water-stage recorder removed on account of high water May 14 to June 15; gage read once daily during this period except on May 17 and 18 when several readings were made. Daily discharge ascertained by applying to rating table daily mean gage heights obtained by inspecting gage-height graph or, for a few days of considerable fluctuation, by averaging results obtained by applying gage heights for shorter intervals. Records excellent.

COOPERATION.—Gage-height record furnished by the Washington Water Power Co.

Discharge measurements of Spokane River at Spokane, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Dec. 14	C. G. Paulsen	69.51	2,320
July 4	John McCombs	75.45	13,300

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,120	2,060	2,300	2,360	2,240	3,070	3,350	26,500	37,700	15,500	3,000	2,600
2	2,060	2,060	2,360	2,360	2,240	3,070	3,500	26,500	36,900	14,700	3,000	2,420
3	2,120	2,120	2,300	2,360	2,300	3,070	3,570	26,200	36,200	14,000	2,930	2,480
4	2,120	2,060	2,180	2,360	2,420	2,870	3,640	25,800	35,000	13,200	2,930	2,540
5	2,120	2,060	2,360	2,360	2,360	3,070	3,800	25,200	33,900	12,700	2,930	2,600
6	2,120	2,060	2,360	2,420	2,360	3,070	4,190	24,800	32,400	12,200	2,930	2,480
7	2,060	2,420	2,300	2,420	2,740	3,000	5,220	24,500	30,900	11,800	2,860	2,480
8	2,060	2,610	2,300	2,420	2,680	3,000	6,320	24,800	29,800	10,600	2,800	2,480
9	2,060	2,420	2,240	2,420	2,610	3,000	8,220	25,800	29,100	9,330	2,800	2,600
10	2,120	2,300	2,300	2,420	2,540	3,000	10,100	27,200	28,700	6,510	2,800	2,480
11	2,060	2,300	2,300	2,360	2,540	3,210	11,900	29,000	28,700	4,410	2,740	2,360
12	2,120	2,300	2,240	2,360	2,540	3,350	13,100	31,200	28,400	4,570	2,670	2,360
13	2,120	2,300	2,300	2,360	2,680	3,140	14,100	33,800	27,300	4,730	2,540	2,360
14	2,060	2,240	2,360	2,360	2,940	3,140	14,900	35,300	25,900	4,570	2,600	2,360
15	2,000	2,240	2,300	2,360	3,070	3,070	15,600	26,800	24,900	4,570	2,800	2,420
16	2,060	2,240	2,300	2,360	3,070	2,940	16,200	38,800	23,900	4,410	2,800	2,480
17	2,000	2,300	2,360	2,300	3,070	2,870	16,400	41,500	23,600	4,410	2,740	2,480
18	2,000	2,360	2,360	2,300	2,870	2,800	16,700	40,400	23,300	4,250	2,740	2,420
19	2,060	2,360	2,300	2,360	2,940	2,680	16,700	39,300	23,000	4,090	2,600	2,360
20	2,060	2,360	2,360	2,360	3,140	2,680	16,700	38,100	22,600	3,720	2,540	2,420
21	2,000	2,360	2,360	2,360	3,070	2,610	17,000	36,900	22,300	3,640	2,540	2,420
22	2,000	2,360	2,360	2,300	3,140	2,610	17,800	36,200	21,700	3,560	2,740	2,420
23	2,060	2,360	2,360	2,300	3,070	2,610	18,900	35,400	21,100	3,350	2,800	2,420
24	2,120	2,360	2,360	2,300	3,140	2,610	20,400	34,600	20,500	3,420	2,670	2,360
25	2,060	2,420	2,360	2,300	3,000	2,540	21,900	34,600	19,900	3,280	2,600	2,360
26	2,060	2,480	2,360	2,300	3,000	2,540	23,500	35,400	19,000	3,420	2,540	2,360
27	2,060	2,420	2,420	2,240	3,140	2,540	24,800	36,200	18,200	3,280	2,480	2,420
28	2,060	2,360	2,360	2,240	3,070	2,610	25,500	36,900	17,400	3,210	2,480	2,360
29	2,060	2,360	2,360	2,240	.....	2,800	26,200	36,900	16,800	3,140	2,600	2,360
30	2,000	2,300	2,360	2,180	.....	2,940	26,500	37,700	16,000	3,070	2,740	2,360
31	2,060	.....	2,360	2,180	.....	3,140	.....	38,100	.....	3,000	2,670	.....

SPOKANE RIVER BELOW LITTLE FALLS, NEAR LONG LAKE, WASH.

LOCATION.—In NW. ¼ sec. 19, T. 27 N., R. 39 E., in Lincoln County, just above Chamokane Ferry, 1½ miles below Little Falls power plant of Washington Water Power Co., 4 miles below Chamokane Creek, and 5 miles below Long Lake.

DRAINAGE AREA.—5,690 square miles (measured on map issued by United States Geological Survey; scale, 1:500,000).

RECORDS AVAILABLE.—November 5, 1912, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank; gage datum 1,200 feet above mean sea level.

DISCHARGE MEASUREMENTS.—Made from cable 50 feet below gage.

CHANNEL AND CONTROL.—Bed composed of large boulders; shifting at high stages. Both banks high; one channel at all stages. No noticeable riffle control below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 90.32 feet at 8.30 p. m. May 18 (discharge, 41,300 second-feet); minimum mean daily discharge, 2,080 second-feet November 7 (water below intake elevation 75.05 feet part of day).

1912–1917: Maximum stage that of May 18, 1917; minimum mean daily discharge, 1,820 second-feet November 14, 1915 (water below intake elevation 75.05 feet for 20 hours during day).

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

DIVERSIONS.—Spokane Valley Land & Water Co. diverts water for irrigation above the station. (See p. 107.)

REGULATION.—Flow affected considerably by power regulation at Little Falls and Long Lake, and slightly by power regulation at Nine-mile, Spokane, and Post Falls. Low-water flow is affected by regulation of storage in Coeur d'Alene Lake.

ACCURACY.—Stage-discharge relation for high water changed May 1. Rating curves used before and after the change well defined. Water fell below intake part of each day November 7 and 8; range in stage when below intake estimated on gage-height graph. Daily discharge April 16 to July 7 ascertained by applying to rating table mean daily gage heights obtained by inspecting gage-height graph and by use of discharge integrator for rest of year. Records excellent.

COOPERATION.—Gage-height record furnished by Washington Water Power Co.

Discharge measurements of Spokane River below Little Falls, near Long Lake, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 24	J. E. Stewart	75.59	2,490
May 9	Paulsen and Daniels	86.30	26,600

Daily discharge, in second-feet, of Spokane River below Little Falls, near Long Lake, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2,710	2,900	3,160	2,920	2,780	3,620	6,240	28,600	40,100	18,200	3,930	3,130
2	2,910	2,930	3,080	3,080	2,830	3,670	6,100	28,600	39,700	17,600	3,930	3,060
3	2,880	3,070	2,990	3,050	2,860	3,750	6,430	28,200	38,700	17,000	3,810	3,190
4	2,850	4,080	3,100	3,070	2,790	3,730	6,500	27,600	38,300	15,800	3,840	3,380
5	2,820	3,450	3,200	3,030	2,860	3,640	6,620	27,200	37,200	15,300	3,630	3,130
6	2,840	2,610	3,190	3,040	3,220	3,840	7,940	26,900	39,400	14,800	3,780	3,380
7	2,850	2,080	3,150	2,810	3,840	3,580	9,070	26,500	34,700	14,000	3,840	3,230
8	2,730	2,240	3,080	3,030	4,080	3,690	10,200	26,500	33,600	13,000	3,650	3,330
9	2,860	2,820	3,090	2,980	3,850	3,680	12,900	26,900	32,500	12,300	3,740	2,710
10	2,870	2,900	2,910	3,050	3,670	3,660	14,600	27,900	32,200	8,650	3,720	3,940
11	2,840	2,930	3,070	3,070	3,580	3,700		29,300	31,800	6,910	3,800	4,080
12	2,800	2,790	3,080	3,100	3,520	3,760		31,100	31,500	6,260	3,370	3,510
13	2,860	3,060	2,980	3,050	3,490	3,850	17,400	33,300	30,700	6,070	3,490	3,260
14	2,880	2,930	3,050	3,000	3,530	3,770		35,100	29,700	6,000	3,430	3,210
15	2,860	2,970	3,020	2,950	3,710	3,660		36,500	28,200	5,870	3,260	3,310
16	2,860	2,920	2,950	2,980	3,780	3,580	19,200	37,900	27,600	5,770	3,460	2,880
17	2,840	2,960	2,840	2,920	3,890	3,510	19,200	39,700	26,900	5,700	3,410	3,170
18	2,810	2,970	3,070	2,850	3,970	3,440	19,200	40,900	26,500	5,610	3,220	3,060
19	2,810	2,890	3,030	2,930	4,080	3,460	18,900	40,900	26,200	5,390	3,430	3,030
20	2,830	3,050	3,050	2,980	3,690	3,440	19,200	40,500	25,900	5,240	3,590	3,050
21	2,820	2,960	3,020	2,790	3,790	3,410	19,500	39,700	25,500	4,980	3,550	3,000
22	2,700	3,030	3,060	2,880	3,770	3,450	20,000	39,000	25,200	4,780	3,390	2,560
23	2,900	3,040	3,100	2,950	3,760	3,450	20,900	38,300	24,500	4,680	3,140	2,290
24	2,730	2,960	3,020	2,920	3,750	3,730	21,700	37,600	23,800	4,570	3,390	2,910
25	2,640	3,120	2,800	2,920	3,710	4,480	22,800	37,600	23,200	4,450	3,570	2,900
26	2,690	2,940	2,920	2,920	3,700	4,950	24,200	37,900	22,200	4,380	3,120	2,890
27	2,730	3,120	3,000	2,900	3,760	5,410	25,400	38,700	21,600	4,340	3,450	2,960
28	2,800	3,130	3,000	2,890	4,020	7,030	25,600	39,400	20,600	4,250	3,570	2,960
29	2,610	3,170	3,100	2,910	.....	7,600	26,200	40,100	19,700	4,120	3,340	3,020
30	2,920	3,070	3,100	2,840	.....	7,820	26,800	39,700	19,100	4,070	3,770	2,750
31	2,850	.....	2,930	2,840	.....	6,770	.....	40,100	.....	3,950	3,490	.....

NOTE.—No gage-height record Jan. 13–14, discharge interpolated; and Apr. 11–15 discharge estimated by comparison with record at Spokane.

Monthly discharge of Spokane River below Little Falls, near Long Lake, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	2,920	2,610	2,810	173,000
November	4,080	2,080	2,970	177,000
December	3,200	2,800	3,040	187,000
January	3,100	2,790	2,960	182,000
February	4,080	2,780	3,580	199,000
March	7,820	3,410	4,230	260,000
April	26,800	6,100	16,700	994,000
May	40,900	26,500	34,500	2,120,000
June	40,100	19,100	29,200	1,740,000
July	18,200	3,950	8,190	504,000
August	3,930	3,120	3,550	218,000
September	4,080	2,290	3,110	185,000
The year	40,900	2,080	9,580	6,940,000

ST. JOE RIVER AT AVERY, IDAHO.

LOCATION.—In sec. 15, T. 45 N., R. 5 E., at Avery, Shoshone County, half a mile below junction of North and South forks.

DRAINAGE AREA.—Not measured.

RECORDS AVAILABLE.—January 1, 1911, to June 30, 1917, when station was discontinued.

GAGE.—Vertical and inclined staff installed September 18, 1912, on left bank 20 feet above suspension bridge, about 500 feet below Chicago, Milwaukee & St. Paul Railway depot; read by W. H. Daugs. January 1 to July 2, 1911, and May 13, to September 16, 1912, gage on old bridge pier a short distance below the Mountain View Hotel, about 700 feet below present site; July 11, 1911, to May 10, 1912, gage in front of post office and about 100 feet below present site.

DISCHARGE MEASUREMENTS.—Made from the suspension bridge or by wading.

CHANNEL AND CONTROL.—Channel wide and shallow with steep gradient; bed composed of gravel and small boulders; shifting during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.2 feet at 7 a. m. May 15 (discharge, 17,400 second-feet); minimum stage recorded, 0.47 foot at 5 p. m. October 16, and 8 a. m., October 26 (discharge, 318 second-feet).

1911–1917: Maximum stage recorded, 7.3 feet at 5 a. m. May 28, 1913 (discharge 17,900 second-feet). Minimum flow possibly occurs during winter when stage-discharge relation is seriously affected by ice. Data insufficient for estimating flow during January and February, 1911, or December, 1911, and January, 1912.

ICE.—Stage-discharge relation seriously affected by ice. Records discontinued during winter.

DIVERSIONS.—Above all important diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation probably remained permanent during period; affected by ice November 13 to March 31. Rating curve used well defined below and fairly well defined above 3,000 second-feet. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records for high water, poor; medium water, good; low water, excellent.

COOPERATION.—Gage-height record furnished by the United States Forest Service.

The following discharge measurement was made by G. L. Parker:

October 15: Gage height, 0.49 foot; discharge, 336 second-feet.

Daily discharge, in second-feet, of St. Joe River at Avery, Idaho, for period Oct. 1, 1916, to June 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	Day.	Oct.	Nov.	Apr.	May.	June.
1	422	356	594	3,260	8,460	16	327	.....	1,570	11,100	9,020
2	428	345	555	3,160	8,600	17	336	.....	1,290	7,920	9,020
3	433	492	433	3,260	7,240	18	336	.....	1,480	6,570	8,600
4	400	444	468	3,260	6,030	19	336	.....	1,480	7,240	6,980
5	389	542	720	3,260	5,620	20	336	.....	1,670	6,980	6,570
6	378	492	825	4,960	5,760	21	336	.....	2,430	6,700	6,160
7	367	468	950	5,620	6,700	22	345	.....	3,380	7,240	5,760
8	378	480	1,180	7,780	7,240	23	336	.....	4,700	8,740	4,570
9	356	608	1,380	8,740	11,300	24	336	.....	4,540	11,000	4,410
10	367	982	1,290	9,300	10,100	25	336	.....	4,540	11,100	3,760
11	367	650	1,670	10,400	7,240	26	318	.....	4,020	11,100	3,380
12	367	444	1,380	11,600	5,900	27	336	.....	4,540	11,000	3,260
13	356	.....	1,290	11,000	5,490	28	367	.....	4,020	11,600	3,260
14	356	.....	1,570	13,500	6,160	29	336	.....	3,890	14,000	3,260
15	336	.....	1,770	15,800	7,650	30	367	.....	3,640	11,000	3,260
						31	356	.....	.....	8,600	.....

NOTE.—Gage not read Oct. 2; discharge interpolated. Stage-discharge relation affected by ice Nov. 13 to Mar. 31.

Monthly discharge of St. Joe River at Avery, Idaho, for the period Oct. 1, 1916, to June 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	433	318	359	22,100
November 1–12	982	345	525	12,500
April	4,700	433	2,110	126,000
May	15,800	3,160	8,610	529,000
June	11,300	3,260	6,360	378,000

SPOKANE VALLEY LAND & WATER CO.'S CANAL AT POST FALLS, IDAHO.

LOCATION.—In NE. ¼ sec. 4, T. 50 N., R. 5 W. Boise meridian, on right bank of Spokane River, 1,200 feet below canal head gates and half a mile west of Post Falls, Kootenai County.

RECORDS AVAILABLE.—May 20, 1911, to September 30, 1917, when station was discontinued.

GAGE.—Vertical staff on left side of flume; read by Emil Johnson and J. D. Anderson. Prior to April 21, 1915, a vertical staff at end of flume, about 1,200 feet below present gage.

DISCHARGE MEASUREMENTS.—Made from crossties on top of flume or from footbridge across flume one-fourth mile below gage.

CHANNEL AND CONTROL.—Flume and canal section below gage; shifts occasionally, owing to effect of gravel bar at end of flume and plant growth.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.95 feet July 29 and 30 (discharge, 126 second-feet). No water in canal December 26 to February 5.

1911–1917: Maximum stage recorded, 3.20 feet June 18–22, 1911 (discharge, 170 second-feet). No water in canal June 23–28, 1911, January 7–9, 1912, January 16–23, 1916, January 28 to February 8, 1916, and December 26, 1916, to February 5, 1917.

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

ACCURACY.—Stage-discharge relation changed during winter when canal was dry, and gradually changed from March 14 to July 19. Two fairly well-defined rating curves used before and after the former change. Curve parallel to previous curves used July 20 to September 30. Gage read once daily to half-tenths. Daily discharge ascertained by applying daily gage height to rating table except from March 14 to July 19, for which period shifting-control method was used. Records prior to March 14, good; after that date, fair.

COOPERATION.—Gage-height record furnished by Spokane Valley Land & Water Co.

Canal diverts water from right bank of Spokane River in SE. ¼ sec. 3, T. 50 N., R. 5 W. Boise meridian. Water is used for irrigation.

Discharge measurements of Spokane Valley Land & Water Co.'s canal at Post Falls, Idaho, during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 23	J. E. Stewart	1.84	54.5	June 25	John McCombs	2.56	107
Mar. 14	C. G. Paulsen	1.30	34.8	July 20	C. G. Paulsen	2.90	121
May 16	do	2.23	85.8				

Daily discharge, in second-feet, of Spokane Valley Land & Water Co.'s canal at Post Falls, Idaho, for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	64	41	36	.....	46	35	61	98	106	114	76
2	64	41	36	.....	46	35	61	98	106	114	76
3	64	41	36	.....	46	35	61	94	106	114	76
4	64	41	36	.....	44	35	61	94	106	106	76
5	64	41	36	.....	44	35	61	102	102	114	76
6	64	41	36	31	44	35	61	102	102	114	76
7	64	41	36	31	44	35	61	102	102	114	76
8	64	41	36	31	44	35	70	102	102	114	76
9	58	41	36	44	44	35	70	102	110	106	58
10	58	41	34	44	44	42	80	102	110	106	58
11	58	41	34	55	39	42	80	102	118	98	58
12	58	41	34	55	39	42	80	102	122	90	58
13	58	41	34	55	35	42	80	102	122	90	58
14	58	41	34	55	35	42	87	102	122	90	58
15	58	41	34	55	35	39	87	102	122	90	58
16	58	41	34	55	35	39	87	102	122	90	58
17	58	41	34	55	35	39	87	102	122	90	58
18	58	41	34	55	35	39	87	102	122	90	55
19	58	38	34	52	35	39	87	106	122	90	55
20	58	38	34	52	35	39	90	106	122	90	55
21	58	38	34	52	35	39	90	106	122	90	55
22	58	38	34	52	35	39	98	110	122	90	55
23	55	38	34	52	35	42	98	110	122	90	55
24	55	38	34	52	35	42	98	110	122	90	55
25	55	38	34	49	35	42	98	106	122	90	55
26	55	36	.....	49	35	42	98	106	122	90	55
27	55	36	.....	49	35	42	98	106	122	90	55
28	55	36	.....	49	35	42	98	106	122	90	55
29	55	36	.....	.....	35	49	98	106	126	90	55
30	52	36	.....	.....	35	49	98	106	126	90	55
31	52	.....	.....	.....	35	.....	98	.....	114	90	.....

Monthly discharge of Spokane Valley Land & Water Co.'s canal at Post Falls, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	64	52	58.5	3,600
November	41	36	39.5	2,350
December (25 days)	36	34	34.7	1,720
February (23 days)	55	31	49.1	2,240
March	46	35	38.4	2,360
April	49	35	39.6	2,360
May	98	61	82.9	5,100
June	110	94	103	6,130
July	126	102	116	7,130
August	114	90	97.2	5,980
September	76	55	61.5	3,660
The year				42,600

NOTE.—No flow Dec. 26 to Feb. 5.

SANPOIL RIVER BASIN.

SANPOIL RIVER AT KELLER, WASH.

LOCATION.—In NW. ¼ NW. ¼ sec. 9, T. 29 N., R. 33 E., just below highway bridge at Keller, Ferry County, three-fourths mile below Silver Creek, and about 22 miles north of Wilbur.

DRAINAGE AREA.—971 square miles (measured on Colville Indian Reservation map).

RECORDS AVAILABLE.—April 29, 1911, to October 31, 1917, when station was discontinued.

GAGE.—Vertical staff on right bank 100 feet below bridge; read by Mrs. C. A. Sovereign.

DISCHARGE MEASUREMENTS.—Made from bridge or by wading.

CHANNEL AND CONTROL.—Bed composed of rock and gravel; likely to shift at extremely high water. Some water carried through slough on left side during floods.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.54 feet May 15 (discharge, 1,620 second-feet); minimum stage recorded, 0.48 foot at 6.30 a. m., October 4, 1917 (discharge, 29 second-feet).

1911–1917: Maximum stage recorded, 3.78 feet at 7.30 a. m., April 13, 1916 (discharge, 1,920 second-feet); minimum stage recorded, 0.45 foot September 1, 1914 (discharge, 26 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; records discontinued during winter months.

DIVERSIONS.—A small quantity of water diverted occasionally above gage for use in a cyanide plant.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed at high water on May 15; affected by ice November 14–18. Rating curves used before and after the change fairly well defined. Gage read twice daily to hundredths. Daily discharge ascertained by applying daily mean gage heights to rating table. Open-water records good.

Discharge measurements of Sanpoil River at Keller, Wash., during the period Oct. 1, 1916, to Oct. 31, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	J. E. Stewart	0.78	57.7	Oct. 6	John McCombs	0.53	33.3
May 12	C. G. Paulsen	3.18	1,340	6	Do	.53	34.0

Daily discharge, in second-feet, of Sanpoil River at Keller, Wash., for the period Oct. 1, 1916, to Oct. 31, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	55	69	101	930	1,090	270	73	34	36
2	57	67	110	891	1,010	263	67	33	35
3	58	79	108	852	970	255	67	33	31
4	58	95	114	852	930	240	64	33	31
5	58	108	130	852	891	226	61	33	34
6	58	108	156	891	852	220	60	33	34
7	58	103	225	930	814	210	59	35	33
8	58	103	636	970	776	197	59	38	33
9	58	95	542	1,090	704	188	57	41	33
10	58	88	512	1,170	670	177	56	41	34
11	60	81	542	1,260	636	168	56	43	35
12	58	64	704	1,350	636	158	54	45	35
13	58	53	740	1,440	604	150	53	46	34
14	58		704	1,530	572	140	52	46	34
15	58		670	1,620	542	136	51	45	34
16	58	60	670	1,620	512	131	48	45	35
17	58		636	1,530	484	127	46	41	35
18	58		604	1,440	456	120	43	39	36
19	57	71	572	1,350	430	114	42	38	36
20	58	75	604	1,260	430	109	43	38	37
21	61	74	776	1,170	404	105	41	37	39
22	58	74	930	1,170	380	97	41	37	39
23	58	84	1,010	1,260	380	94	40	37	40
24	61	90	1,010	1,260	380	90	40	36	40
25	61	86	1,010	1,260	356	87	39	36	41
26	61	84	970	1,350	356	85	38	36	42
27	64	84	930	1,440	334	87	37	36	42
28	63	84	970	1,350	311	85	37	36	41
29	66	84	1,010	1,260	290	83	35	37	40
30	69	81	970	1,170	270	80	35	37	39
31	67	.....	.....	1,170	.....	73	34	.....	39

NOTE.—Stage-discharge relation affected by ice Nov. 14–18, discharge estimated by comparison with record of flow of Nespelem River at Nespelem.

Monthly discharge of Sanpoil River at Keller, Wash., for the period Oct. 1, 1916, to Oct. 31, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	69	55	59.5	3,660
November	108	53	79.5	4,730
April	1,010	101	622	37,000
May	1,620	852	1,220	75,000
June	1,090	270	582	34,600
July	270	73	147	9,040
August	73	34	49.3	3,030
September	46	33	38.2	2,270
October	42	31	36.4	2,240

NOTE.—Records discontinued December to March, inclusive, on account of ice.

NESPELEM RIVER BASIN.

NESPELEM RIVER AT NESPELEM, WASH.

LOCATION.—In SE. ¼ sec. 24, T. 31 N., R. 30 E., about half a mile above Nespelem, Okanogan County, 5 miles above Little Nespelem River, and 6 miles above mouth.

DRAINAGE AREA.—122 square miles (measured on map Colville Indian Reservation, edition of 1911.)

RECORDS AVAILABLE.—May 1, 1911, to September 30, 1917.

GAGE.—Vertical staff on left bank at gaging bridge, installed October 19, 1916; read by Erwin Lynch and Charles Kronk. Prior to July 30, 1913, gage was about 1,000 feet upstream at different datum; July 30, 1913, to November 4, 1915, vertical staff at same site as present gage but at datum 0.38 foot lower; November 5, 1915, to October 18, 1916, inclined staff at same site as present gage but at datum 0.47 foot lower.

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

CHANNEL AND CONTROL.—Bed composed of gravel and boulders; overgrown with aquatic plants during summer months. Concrete control built in November, 1915. New concrete control built at same site in October, 1916. Right bank flat; subject to overflow at gage height 4.0 feet; left bank high; not subject to overflow. Stage of zero flow for new control, determined October 3, 1917, gage height 0.4 foot ±0.02 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.2 feet at 10 a. m. May 14 (discharge, 397 second-feet); minimum stage recorded, 0.73 foot January 16–17 and March 1 and 2 (discharge, 6.7 second-feet).

1911–1917: Maximum stage recorded, 4.75 feet at 9 a. m. April 16, 1914 (discharge, 442 second-feet); minimum stage recorded that of January 16–27 and March 1 and 2, 1917.

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

DIVERSIONS. Above all diversions.

ACCURACY.—Stage-discharge relation changed when new concrete control was built in October, 1916; not affected by ice. Rating curve for old concrete control fairly well defined below 50 second-feet; rating curve for new control fairly well defined from 50 to 200 second-feet and well defined above and below those limits. Gage read once daily to half-tenths prior to May 22 and to hundredths after that date. Daily discharge ascertained by applying daily gage heights to rating table. Records for October, April, and June, good; for remainder of year excellent.

Discharge measurements of Nespelem River at Nespelem, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 13	J. E. Stewart	[a] 1.93	11.9
May 11	C. G. Paulsen	[b] 3.11	267

[a] Inclined gage. [b] Vertical gage. Inclined gage read 3.58 feet.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	11.5	10.1	16.0	10.1	10.1	6.7	19.6	196	218	55	13.8	9.0
2	11.5	10.1	16.0	10.1	10.1	6.7	16.0	185	218	51	13.8	8.5
3	11.5	10.1	19.6	10.1	10.1	8.0	16.0	174	207	49	13.8	8.5
4	11.5	16.0	16.0	10.1	12.7	12.7	16.0	185	196	45	13.3	8.5
5	11.5	19.6	16.0	10.1	12.7	12.7	19.6	185	196	44	12.7	8.5
6	11.5	19.6	16.0	10.1	12.7	12.7	19.6	196	185	42	12.7	8.5
7	11.5	19.6	16.0	10.1	12.7	12.7	19.6	218	174	40	12.2	8.5
8	11.5	16.0	16.0	10.1	16.0	16.0	51	229	163	36	11.7	9.0
9	11.5	16.0	16.0	10.1	16.0	16.0	45	241	141	33	11.7	9.0
10	11.5	16.0	16.0	10.1	16.0	16.0	51	253	141	30	11.2	9.0
11	11.5	16.0	16.0	8.0	16.0	16.0	51	265	136	27	11.2	9.0
12	11.5	16.0	16.0	8.0	16.0	12.7	64	277	130	24	10.6	9.0
13	11.5	12.7	16.0	8.0	16.0	12.7	64	337	124	22	10.6	9.0
14	11.5	12.7	16.0	8.0	16.0	12.7	71	373	113	21	10.6	9.0
15	11.3	12.7	16.0	8.0	16.0	12.7	71	361	101	21	10.6	9.0
16	11.0	12.7	16.0	6.7	16.0	12.7	71	337	101	20.3	10.6	8.5
17	10.8	12.7	16.0	6.7	16.0	16.0	71	313	95	20.3	10.6	8.5
18	10.6	12.7	16.0	6.7	16.0	16.0	71	289	92	19.6	10.6	8.5
19	10.3	12.7	16.0	6.7	10.1	12.7	71	277	88	18.8	10.6	8.5
20	10.1	12.7	16.0	6.7	12.7	12.7	119	265	85	18.1	10.6	8.5
21	10.1	12.7	16.0	6.7	16.0	12.7	101	253	82	17.4	10.1	8.5
22	10.1	12.7	16.0	6.7	16.0	12.7	124	265	80	16.7	10.1	8.5
23	10.1	12.7	12.7	6.7	12.7	12.7	136	265	82	16.0	10.1	8.5
24	10.1	16.0	12.7	6.7	12.7	12.7	152	265	81	16.0	9.6	8.5
25	10.1	16.0	12.7	6.7	10.1	16.0	152	265	75	15.2	9.6	8.5
26	10.1	16.0	10.1	6.7	10.1	16.0	152	265	68	15.2	9.6	8.5
27	10.1	16.0	10.1	6.7	10.1	19.6	163	265	62	14.5	9.6	8.5
28	10.1	16.0	10.1	8.0	10.1	19.6	163	253	58	14.5	9.0	8.5
29	10.1	16.0	10.1	8.0	.....	19.6	174	241	59	14.5	9.0	8.5
30	10.6	16.0	10.1	8.0	.....	19.6	185	241	55	14.5	9.0	8.5
31	10.1	.....	10.1	8.0	.....	19.6	.....	229	.....	14.5	9.0	.....

NOTE.—No gage-height record Oct. 15–19; new concrete control being built; discharge interpolated.

Monthly discharge of Nespelem River at Nespelem, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	11.5	10.1	10.9	670
November	19.6	10.1	14.6	869
December	19.6	10.1	14.7	904
January	10.1	6.7	8.17	502
February	16.0	10.1	13.5	750
March	19.6	6.7	14.1	867
April	185	16.0	83.3	4,960
May	373	174	257	15,800
June	218	55	120	7,140
July	55	14.5	26.0	1,600
August	13.8	9.0	10.9	670
September	9.0	8.5	8.65	515
The year	373	6.7	48.7	35,200

OKANOGAN RIVER BASIN.

OKANOGAN RIVER AT OKANOGAN, WASH.

LOCATION.—In sec. 16, T. 33 N., R. 26 E., at Okanogan, Okanogan County, a quarter of a mile above Salmon Creek.

DRAINAGE AREA.—7,740 square miles (measured on topographic maps of Okanogan National Forest, Colville Indian Reservation, and Canadian Railway belt).

RECORDS AVAILABLE.—May 10, 1911, to September 30, 1917.

GAGE.—Inclined and vertical staff gage on left bank 300 feet above steamboat dock at Okanogan, installed March 3, 1917; read by J. B. Gordon. Prior to October 21, 1915, and from April 28 to August 27, 1916, vertical staff attached to steamboat dock; October 21, 1915, to April 27, 1916, and August 28, 1916, to March 2, 1917, inclined gage at same site as present gage. All gages at same datum.

DISCHARGE MEASUREMENTS.—Made from boat at gage or from highway bridge at Omak, 4 miles upstream.

CHANNEL AND CONTROL.—Bed composed of boulders and cobblestones; likely to shift at extremely high water. Banks fairly high. One channel at all stages. Stage of zero flow, estimated on February 8, 1917, gage height −2.5 feet ±0.5 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 11.2 feet June 18 (discharge, 16,100 second-feet); minimum stage recorded, 1.76 feet January 31 and February 1 (discharge, 640 second-feet).

1911–1917: Maximum stage recorded, 12.21 feet June 20, 1916 (discharge, 22,200 second-feet); minimum discharge estimated at 630 second-feet January 12, 1916 (stage-discharge relation affected by ice).

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

DIVERSIONS.—Numerous small ditches divert water for irrigation above the station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year except as affected by ice February 25 to March 2. Rating curve well defined. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage height to rating table. Records excellent during open season.

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

Discharge measurements of Okanogan River at Okanogan, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.		Discharge.
		Old gage.	New gage.	
		Feet.	*Feet.*	*Sec.-ft.*
Oct. 27	C. O. Brown	2.40	2.44	1,060
Feb. 8	C. J. Paulsen	.....	2.06	828
28	John McCombs	.....	2.06	777
June 12	.....do	9.28	9.70	12,200
Sept. 9	.....do	.....	2.44	1,100

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,380	1,100	960	733	660	795	770	1,180	15,700	9,900	2,710	1,340
2	1,340	1,030	960	770	660	812	770	1,180	15,700	9,600	2,710	1,310
3	1,340	1,030	960	830	660	830	770	1,180	15,000	9,800	2,590	1,290
4	1,340	1,100	960	890	715	830	770	1,180	14,200	9,700	2,360	1,260
5	1,260	1,100	960	890	770	830	770	1,180	13,100	9,600	2,290	1,180
6	1,260	1,100	890	890	830	830	770	1,180	12,000	9,600	2,210	1,180
7	1,260	1,100	830	890	830	830	770	1,180	12,400	8,700	2,140	1,150
8	1,260	1,030	860	890	830	890	830	1,340	12,900	7,350	2,140	1,130
9	1,260	1,030	890	890	830	960	890	1,520	13,300	6,990	2,030	1,100
10	1,260	1,030	890	890	830	960	890	1,820	14,900	6,990	2,030	1,100
11	1,260	1,030	890	860	860	960	890	3,070	14,700	6,810	1,920	1,180
12	1,260	1,030	960	830	890	960	890	4,360	12,900	6,630	1,920	1,180
13	1,260	1,030	890	770	890	960	960	5,760	12,000	6,100	1,920	1,180
14	1,260	960	860	740	890	960	890	6,450	11,500	5,930	1,820	1,180
15	1,260	960	830	710	890	960	890	7,350	11,700	5,600	1,720	1,180
16	1,260	960	830	710	890	960	890	7,170	13,300	5,280	1,720	1,150
17	1,260	890	830	710	890	890	890	6,630	14,700	4,960	1,620	1,130
18	1,180	890	830	710	890	860	890	6,100	16,100	4,810	1,620	1,100
19	1,180	898	830	710	890	830	890	5,760	16,100	4,660	1,620	1,100
20	1,180	906	830	710	830	770	890	6,020	15,400	4,210	1,620	1,100
21	1,100	914	890	740	800	830	890	6,270	14,700	3,930	1,620	1,030
22	1,100	921	890	770	770	830	925	6,450	14,000	3,800	1,620	1,030
23	1,100	928	890	770	770	830	960	6,990	13,300	3,680	1,620	1,030
24	1,100	936	830	770	770	830	960	7,530	12,300	3,550	1,620	1,030
25	1,100	944	770	830	772	830	890	8,300	11,300	3,310	1,520	1,430
26	1,030	952	710	830	774	830	890	9,100	10,400	3,070	1,520	1,030
27	1,030	960	660	830	775	770	890	10,800	10,200	3,070	1,520	1,030
28	1,030	960	660	830	777	830	1,030	12,400	10,200	3,070	1,430	1,030
29	1,060	960	660	830	.....	890	1,060	14,500	10,200	2,990	1,400	960
30	1,100	960	660	745	.....	830	1,100	15,400	10,200	2,910	1,370	1,000
31	1,100	.....	697	660	.....	770	.....	16,100	.....	2,830	1,340	.....

NOTE.—Gage not read Nov. 19–26 and on an average 6 days a month during year; discharge interpolated. Affected by ice Feb. 25 to Mar. 2.

Monthly discharge of Okanogan River at Okanogan, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,380	1,030	1,200	73,800
November	1,100	890	988	58,800
December	960	660	841	51,700
January	890	660	794	48,800
February	890	660	808	44,900
March	960	770	863	53,100
April	1,100	770	886	52,700
May	16,100	1,180	5,980	368,000
June	16,100	10,200	13,100	780,000
July	9,900	2,830	5,790	356,000
August	2,710	1,340	1,850	114,000
September	1,430	960	1,140	67,800
The year	16,100	660	2,860	2,070,000

SIMILKAMEEN RIVER NEAR OROVILLE, WASH.

LOCATION.—In SE. ¼ sec. 13, T. 40 N., R. 25 E., at Okanogan Valley Power Co.'s plant, 4 miles above Oroville, Okanogan County, and 5 miles above mouth; below all tributaries.

DRAINAGE AREA.—3,450 square miles (measured on topographic maps and Canadian Railway belt maps).

RECORDS AVAILABLE.—May 14, 1911, to September 30, 1917.

GAGE.—Vertical staff in seven sections on left bank—three sections 15 feet above tailrace and four sections nailed to power house; read by G. M. Rayburn.

DISCHARGE MEASUREMENTS.—Made from highway bridge at Oroville, 4 miles below gage.

CHANNEL AND CONTROL.—Narrow canyon at gage and control; fairly permanent. Banks high, not subject to overflow. Lower falls (25 feet high) 150 feet above gage

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 15.6 feet at 6 p.m. May 29 (discharge, 16,300 second-feet); minimum uncertain, but estimated at 230 second-feet January 31 (stage-discharge relation affected by ice).

1911–1917: Maximum stage recorded, 18.3 feet at 7 a. m.

June 19, 1916 (discharge, 20,600 second-feet). Minimum discharge uncertain, but estimated to be that of January 31 of this year.

ICE.—Stage-discharge relation seriously affected by ice; winter flow estimated from observer's notes, weather records, and discharge measurements.

DIVERSIONS.—Some water is diverted for irrigation from tributaries above the station. The diversion by the West Okanogan irrigation district was measured as follows: July 13: Gage height, 3.90 feet; discharge, 109 second-feet.

ACCURACY.—Stage-discharge relation permanent; affected by ice November 13 to March 15. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Open-water records excellent; other records poor.

COOPERATION.—Gage-height record furnished by the Okanogan Valley Power Co.

Discharge measurements of Similkameen River near Oroville, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 24	C. O. Brown	1.54	548	June 14	John McCombs	11.38	9,650
Feb. 6[a]	C. G. Paulsen	1.66	455	July 12	do	7.46	4,830
Mar. 6[a]	John McCombs	1.61	420	Sept. 11	do	1.32	453

[a] Stage-discharge relation affected by ice.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	662	617					435	809	14,300	8,200	1,580	531
2	617	617					435	758	14,300	8,520	1,450	511
3	617	573					435	809	12,000	8,390	1,380	510
4	617	617					435	862	10,800	8,260	1,320	472
5	617	662				400	435	862	10,100	8,260	1,260	491
6	617	662	500	550	400		435	915	10,600	7,610	1,200	491
7	617	617					453	1,020	11,000	6,740	1,140	472
8	617	573					472	1,080	11,900	6,260	1,080	491
9	617	573					491	1,520	13,400	5,820	1,080	472
10	617	617					472	2,430	13,100	5,600	1,020	453
11	617	862				430	491	3,780	11,200	5,270	970	453
12	617	511					491	5,160	10,100	4,940	970	472
13	617						491	6,150	9,860	4,540	915	472
14	617						491	6,860	10,000	4,240	915	472
15	617		520	340	410		491	6,500	11,600	3,960	862	472
16	573					453	491	6,040	13,700	3,780	809	453
17	573	570				453	491	5,600	15,000	3,600	809	453
18	573					453	491	5,160	14,800	3,330	758	453
19	573					453	491	5,050	13,900	3,070	758	435
20	573					453	511	5,490	13,100	2,830	809	435
21	573					453	511	5,710	12,200	2,670	862	417
22	531					453	531	6,150	11,800	2,510	809	417
23	531					435	531	6,740	10,400	2,350	809	417
24	531					435	531	7,480	9,440	2,130	758	400
25	531				370	435	573	8,260	8,780	1,990	709	382
26	531	540	410	400		435	617	9,300	8,520	1,920	709	382
27	531					435	617	11,400	8,650	1,850	709	382
28	573					435	709	13,600	8,780	1,850	617	382
29	617					453	758	15,900	8,910	1,850	573	417
30	617					435	758	15,100	8,260	1,850	573	417
31	617					435	.....	14,300	.....	1,640	531	.....

NOTE.—Discharge estimated on account of ice November 13 to March 15.

Monthly discharge of Similkameen River near Oroville, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	662	531	592	36,400
November	862	.....	583	34,700
December	.....	.....	475	29,200
January	.....	.....	429	26,400
February	.....	.....	395	21,900
March	.....	.....	430	26,400
April	758	435	519	30,900
May	15,900	758	5,830	358,000
June	15,000	8,260	11,400	678,000
July	8,520	1,640	4,380	269,000
August	1,580	531	927	57,000
September	531	382	449	26,700
The year	15,900	.....	2,200	1,590,000

SALMON CREEK NEAR CONCONULLY, WASH.

LOCATION.—In sec. 18, T. 35 N., R. 25 E., half a mile below Conconully reservoir, Okanogan project of United States Reclamation Service, 2 miles south of Conconully, and about 14 miles above Okanogan, Okanogan County.

DRAINAGE AREA.—121 square miles (revised measurement); 152 square miles at Jones ranch.

RECORDS AVAILABLE.—July 6, 1910, to September 30, 1917. From May 27, 1903, to March 31, 1912, records were obtained at Jones ranch in sec. 31, T. 34 N., R. 26 E., about 6 miles above Okanogan.

GAGE.—Vertical staff half a mile below reservoir indicates head on weir; read by Allen Honey.

DISCHARGE MEASUREMENTS.—Made from footbridge near gage.

CHANNEL AND CONTROL.—20-foot rectangular sharp-crested weir with two end contractions; prior to October 1, 1912, a 20-foot Cippoletti weir.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 2.25 feet from 9 a. m. June 1 to 8 a. m. June 2 (discharge, 252 second-feet); minimum stage recorded, 0.06 foot September 20 to 30 (discharge, 1.3 second-feet).

1903–1917: Maximum stage recorded, 3.63 feet April 29, 1904 (discharge, 577 second-feet). No flow 4 p. m. October 3 to 6 p. m. October 11, 1910, when water was being stored in Salmon Lake and Conconully reservoirs.

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

DIVERSIONS.—None.

REGULATION.—Flow controlled by storage in Salmon Lake reservoir (capacity 2,600 acre-feet) and Conconully reservoir (capacity 13,000 acre-feet). Monthly summaries of flow for 1912–1917 have been corrected for storage.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage read to hundredths once daily; oftener when head was changed. Daily discharge ascertained by applying gage heights to rating table, or, for days when head was changed, by weighting the results obtained by subdividing days and ascertaining discharge for periods by applying gage heights to rating table. Records excellent.

COOPERATION.—Gage-height record and storage determinations furnished by United States Reclamation Service.

The following discharge measurement was made by John McCombs:
July 14: Gage height, 1.59 feet; discharge, 149 second-feet.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3.6	18.4	2.8	2.8	2.8	2.8	2.8	3.2	244	118	139	94
2	3.6	23	2.8	2.8	2.8	2.8	3.2	3.2	241	119	132	1.7
3	3.6	24	2.8	2.8	2.8	2.8	2.8	3.2	220	122	132	1.7
4	3.6	31	2.8	2.8	2.8	2.8	2.8	3.2	200	122	129	1.7
5	3.6	34	2.8	2.8	2.8	2.8	2.8	3.2	183	122	129	1.7
6	3.6	36	2.8	2.8	2.8	2.8	2.8	3.6	161	124	129	1.7
7	3.6	36	2.8	2.8	2.8	2.8	2.8	3.6	153	132	131	19.4
8	3.6	34	2.8	2.8	2.8	2.8	2.8	3.6	176	135	133	112
9	3.6	30	2.8	2.8	2.8	2.8	2.8	3.6	216	138	131	114
10	3.6	29	2.8	2.8	2.8	2.8	2.8	3.6	207	139	130	119
11	3.6	26	2.8	2.8	2.8	2.8	2.8	3.6	195	143	126	119
12	3.6	2.8	2.8	2.8	2.8	2.8	2.8	3.6	164	143	127	121
13	3.6	2.8	2.8	2.8	2.8	2.8	2.8	3.6	152	146	124	109
14	5.2	2.8	2.8	2.8	2.8	2.8	2.8	4.0	153	146	132	82
15	6.0	2.8	2.8	2.8	2.8	2.8	2.8	4.0	153	146	130	1.9
16	5.1	2.8	2.8	2.8	2.8	2.8	2.8	4.0	181	146	125	1.7
17	5.1	2.8	2.8	2.8	2.8	2.8	2.8	4.0	207	149	124	1.7
18	5.1	2.8	2.8	2.8	2.8	2.8	2.8	4.0	194	149	124	1.7
19	5.1	2.8	2.8	2.8	2.8	2.8	2.8	4.0	170	149	121	1.7
20	5.1	2.8	2.8	2.8	2.8	2.8	3.2	4.0	154	149	119	1.3
21	7.4	2.8	2.8	2.8	2.8	2.8	3.2	11.0	141	147	120	1.3
22	11.7	2.8	2.8	2.8	2.8	2.8	3.2	18.0	126	147	126	1.3
23	13.4	2.8	2.8	2.8	2.8	2.8	3.2	25	120	144	132	1.3
24	13.4	2.8	2.8	2.8	2.8	2.8	3.2	46	122	143	130	1.3
25	14.2	2.8	2.8	2.8	2.8	2.8	3.2	57	122	144	125	1.3
26	16.5	2.8	2.8	2.8	2.8	2.8	3.2	37	121	146	118	1.3
27	19.1	2.8	2.8	2.8	2.8	2.8	3.2	44	119	146	119	1.3
28	19.5	2.8	2.8	2.8	2.8	2.8	3.2	60	119	143	120	1.3
29	21.2	2.8	2.8	2.8	.....	2.8	3.2	130	118	143	117	1.3
30	23	2.8	2.8	2.8	.....	2.8	3.2	181	118	142	113	1.3
31	17.0	.....	2.8	2.8	.....	2.8	.....	234	.....	140	112	.....

Monthly discharge of Salmon Creek near Conconully, Wash., for the year ending Sept. 30, 1917.

Month.	Observed discharge in second-feet.			Run-off in acre-feet.			Mean discharge without storage in second-feet.
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Without storage.	
October	23	3.6	8.38	515	+ 278	793	12.9
November	36	2.8	12.5	744	− 197	547	9.19
December	2.8	2.8	2.80	172	+ 697	869	14.1
January	2.8	2.8	2.80	172	+ 438	610	9.92
February	2.8	2.8	2.80	156	+ 379	535	9.63
March	2.8	2.8	2.80	172	+ 360	532	8.65
April	3.2	2.8	2.95	176	+1,020	1,200	29.2
May	234	3.2	29.5	1,810	+5,110	6,920	113
June	244	118	165	9,820	+ 270	10,100	170
July	149	118	139	8,550	−6,330	2,220	36.1
August	139	112	126	7,750	−7,250	500	8.13
September	121	1.3	30.7	1,830	−1,180	650	10.9
The year	244	1.3	44.0	31,900	−6,400	25,500	35.2

METHOW RIVER BASIN.

METHOW RIVER AT PATEROS, WASH.

LOCATION.—In sec. 2, T. 29 N., R. 23 E., three-fourths mile above highway bridge at Pateros, Okanogan County, 1 mile above mouth.

DRAINAGE AREA.—1,850 square miles (measured on topographic and Forest Service maps).

RECORDS AVAILABLE.—May 3, 1903, to September 30, 1917.

GAGE.—Inclined and vertical staff gage on left bank 500 feet below observer's house; read by F. W. Robinson. Prior to June 17, 1903, gage was half a mile farther downstream.

DISCHARGE MEASUREMENTS.—Made from cable 1,000 feet upstream or by wading.

CHANNEL AND CONTROL.—Bed of stream composed of large boulders and gravel; shifts at extremely high stages. One channel at all stages. Right bank high and not subject to overflow; left bank not subject to overflow below gage height 12 feet. Stage of zero flow, according to measurements made September 8, 1917, gage height 1.5 feet ±0.05 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.10 feet at 12.30 p. m. June 16 (discharge, 10,000 second-feet); minimum stage occurred during period in which stage-discharge relation was affected by ice.

1903–1917: Maximum stage recorded, 11.6 feet, May 11, 1910 (discharge, as revised, 14,900 second-feet). Minimum flow estimated at 230 second-feet February 5 and 6, 1914, when stage-discharge relation was affected by ice.

ICE.—Stage-discharge relation seriously affected by ice; winter flow estimated from discharge measurements, observer's notes, and weather records.

DIVERSIONS.—Many small ditches divert water for irrigation above station.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; affected by ice December 27 to March 13. Rating curve well defined. Gage read to hundredths twice daily; oftener during high water. Daily discharge ascertained by applying mean daily gage heights to rating table. Open-water record excellent.

Discharge measurements of Methow River at Pateros, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 29	C. O. Brown	4.18	496	June 10	John McCombs	9.14	7,790
29	do	4.19	502	11	do	8.46	6,480
Feb. 7[a]	John McCombs	5.18	408	Sept. 8	do	4.03	391
25[a]	do	4.18	336	13	do	4.03	463
26[a]	do	4.12	351	13	do	4.02	434

[a] Stage-discharge relation affected by ice.

Daily discharge, in second-feet, of Methow River at Pateros, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	529	506	446				376	506	8,350	4,880	1,080	486
2	529	506	446				376	486	7,430	5,490	1,040	486
3	529	506	486				376	506	6,120	5,490	992	465
4	429	529	465				376	506	5,490	5,910	950	465
5	529	529	465	470	390		392	529	5,280	5,700	950	446
6	506	529	446				392	552	5,490	5,080	910	465
7	529	506	392			400	410	578	6,120	4,490	870	446
8	529	506	392				427	633	7,430	3,940	870	446
9	529	506	410				446	1,080	8,350	3,940	832	427
10	552	506	410				446	1,710	7,430	4,300	760	446
11	529	506	465				465	2,420	6,330	3,940	760	446
12	529	486	506				465	3,130	5,490	3,600	725	465
13	529	446	529				465	3,770	5,280	3,280	694	446
14	506	465	465			376	465	4,120	5,910	2,980	694	427
15	506	486	427	350	390	376	465	3,940	7,430	2,830	694	427
16	506	486	427			376	465	3,600	9,780	2,690	662	427
17	486	506	465			376	465	3,130	9,060	2,690	633	427
18	486	529	486			376	465	2,830	8,350	2,420	633	427
19	486	529	486			376	465	2,690	8,120	2,290	694	427
20	486	486	552			376	465	2,830	7,890	2,170	694	410
21	486	486	578			376	506	3,130	7,430	2,050	662	427
22	486	486	506			376	486	3,280	6,990	1,930	633	410
23	506	486	529			392	465	3,940	5,910	1,820	633	410
24	506	486	552			392	486	4,490	5,280	1,600	604	410
25	506	465	506		350	376	486	5,280	4,880	1,500	578	410
26	506	465	465	380		376	486	7,210	4,880	1,400	578	392
27	506	486				376	506	8,120	4,880	1,300	552	392
28	506	486				376	506	9,300	5,280	1,300	529	392
29	506	486	350		.....	376	506	9,780	5,280	1,300	506	410
30	506	465			.....	376	506	8,820	4,880	1,210	506	410
31	506	.....			.....	376	.....	8,120	.....	1,120	486	.....

NOTE.—Discharge estimated on account of ice December 27 to March 13.

Monthly discharge of Methow River at Pateros, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	552	486	512	31,500
November	529	446	495	29,500
December	578	.....	453	27,900
January	.....	.....	399	24,500
February	.....	.....	379	21,000
March	.....	.....	387	23,800
April	506	376	454	27,000
May	9,780	486	3,580	220,000
June	9,780	4,880	6,560	390,000
July	5,910	1,120	3,060	188,000
August	1,080	486	723	44,500
September	486	392	432	25,700
The year	9,780	.....	1,460	1,050,000

CHELAN RIVER BASIN.

LAKE CHELAN AT CHELAN, WASH.

LOCATION.—In sec. 13, T. 27 N., R. 22 E., at Forest Service boat landing at Chelan, Chelan County, a quarter of a mile above highway bridge at outlet.

DRAINAGE AREA.—950 square miles (measured on topographic and Forest Service maps).

RECORDS AVAILABLE.—September 1 to October 15, 1897; January 1, 1898, to December 31, 1899; January 1 to June 30, 1905; December 5, 1910, to September 30, 1917.

GAGE.—Vertical staff on pile at landing; installed December 5, 1910; datum 1,076.15 feet above sea level. Gage read by W. E. Naylor. Gage used from 1897 to 1899 was at Lakeside, about a mile west of Chelan; datum 1,070.18 feet above sea level. In 1905 gage was on a bent of the upper bridge at Chelan; elevation not determined.

EXTREMES OF STAGE.—Maximum stage recorded during year, 5.77 feet June 4; minimum stage recorded, 1.04 feet April 1.

1898-99 and 1911–1917: Maximum stage recorded, 7.2 feet June 18, 1916; minimum stage recorded, 6.60 feet January 27–28, and December 2–5, 1898. (See "Gage" for difference in datum.)

REGULATION.—The height of water in the lake is controlled by operation of gates in the dam at outlet.

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

Daily gage height, in feet, of Lake Chelan at Chelan, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	2.95						1.04			5.15		
2												
3			2.85									
4									5.77			
5					2.45	2.54					3.35	
6		2.70						2.00				
7				2.60								
8	2.60						1.18			5.36		
9												
10			2.84									3.62
11					2.62	2.49			5.30			
12												
13		2.70						2.88			3.54	
14												
15	2.60						1.45			5.20		
16												3.58
17			2.63						5.50			
18					2.60							
19		2.55				1.75					3.95	
20								3.33				
21												
22							1.65			4.85		
23												
24			2.80						5.60			3.60
25						1.34						
26		2.61			2.50						3.92	
27								4.33				
28				2.82	2.52							
29	2.70						2.00					
30							2.10					3.40
31			2.70			1.14		5.17				

CHELAN RIVER AT CHELAN, WASH.

LOCATION.—In sec. 13, T. 27 N., R. 22 E., at lower highway bridge at Chelan, Chelan County, 800 feet below flashboard dam at outlet of Chelan Lake and 4 miles northwest of Chelan Falls.

RECORDS AVAILABLE.—November 6, 1903, to September 30, 1917.

DRAINAGE AREA.—950 square miles (measured on topographic maps).

GAGE.—Vertical staff on fourth bent of left approach to lower highway bridge; read by W. E. Naylor and E. O. Blankenship.

DISCHARGE MEASUREMENTS.—Made from upper highway bridge 1,000 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of boulders and gravel; shifting at extremely high water. Channel curved above gage, but practically straight below. Banks high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.13 feet June 22 (discharge, 7,490 second-feet). Practically no flow for part of day on January 30; river frozen solid at dam so no water could flow over.

1903–1917: Maximum stage recorded, 11.48 feet June 20, 1916 (discharge, 9,780 second-feet); minimum stage recorded that of January 30, 1917.

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

DIVERSIONS.—Several irrigation ditches divert from tributaries a very small proportion of the run-off.

REGULATION.—Flashboard dam 800 feet above gage controls lake level at low water in the interest of navigation.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage heights to rating table. Records excellent except for periods in which gage was not read.

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

Discharge measurements of Chelan River at Chelan, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 21	C. O. Brown	4.32	394	June 13	John McCombs	9.43	6,260
23	do	4.30	396	July 17	do	9.63	6,610
Mar. 9	John McCombs	4.63	469	Sept. 18	do	6.01	1,310
June 9	do	9.68	6,770				

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	870	370	370	330	415	392	905	565	6,760	6,590	4,150	1,480
2	870	350	370	330	392	392	870	1,180	6,930	6,590	4,000	1,450
3	870	370	370	330	415	392	810	1,700	6,840	6,760	3,400	1,410
4	870	370	370	330	415	392	810	1,820	6,760	6,840	2,950	1,380
5	870	360	350	330	415	392	755	1,820	6,590	6,930	2,950	1,380
6	870	350	350	370	415	392	700	1,820	6,420	7,100	2,950	1,380
7	810	350	330	350	415	465	605	1,820	6,420	7,100	2,800	1,280
8	810	370	370	330	415	495	568	1,940	6,590	7,020	2,650	1,280
9	810	392	330	350	415	495	530	1,940	6,590	6,930	2,650	1,230
10	810	370	340	350	415	465	530	2,220	6,680	6,930	2,080	1,180
11	415	370	350	350	415	465	530	2,360	6,760	6,870	2,080	1,280
12	440	350	350	262	415	465	530	2,650	6,590	6,820	1,550	1,280
13	440	330	370	294	392	940	370	2,950	6,250	6,760	1,020	1,380
14	440	330	330	312	392	1,380	415	3,250	6,250	6,700	1,180	1,280
15	416	330	350	330	392	1,700	415	3,550	6,420	6,650	1,180	1,100
16	392	330	350	330	392	1,940	415	3,550	6,590	6,590	1,280	1,100
17	392	330	350	350	370	1,820	465	3,700	6,930	6,590	1,480	1,100
18	392	330	350	330	381	1,700	465	3,550	7,270	6,590	1,580	1,100
19	392	330	350	312	392	1,580	465	3,700	7,270	6,590	1,580	1,100
20	392	330	330	312	392	1,580	495	3,700	7,440	6,420	1,580	1,100
21	392	330	330	321	370	1,480	465	3,700	7,440	6,420	1,700	1,100
22	392	330	330	330	381	1,380	498	3,850	7,440	6,160	1,700	1,020
23	392	330	330	312	392	1,280	530	4,000	7,270	5,910	1,700	1,060
24	392	330	337	312	392	1,280	495	4,150	7,180	5,570	1,700	1,100
25	392	330	343	330	392	1,190	530	4,300	7,100	5,410	1,700	940
26	370	340	350	330	392	1,100	495	4,610	6,930	5,250	1,640	1,020
27	370	350	330	330	392	1,100	530	5,010	6,760	5,090	1,580	940
28	370	370	330	330	392	1,100	530	5,410	5,590	5,090	1,580	940
29	370	330	330	330	.....	1,180	530	5,910	6,760	4,860	1,580	940
30	370	350	330	220	.....	1,020	530	6,250	6,590	4,620	1,700	940
31	392	.....	330	220	.....	940	.....	6,590	.....	4,380	1,480	.....

NOTE.—Gage not read Sundays (except June 15), Oct. 17–23, July 11–15, and a few other days; discharge interpolated. Sudden decrease or increase in daily discharge due to inserting or removing flashboards in dam to regulate elevation of lake surface for navigation. Decreased flow of January 30 and 31 caused by ice at dam above gage; practically no flow for at least part of day on Jan. 30; river frozen solid at dam.

Monthly discharge of Chelan River at Chelan, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	870	370	541	33,300
November	392	330	347	20,600
December	370	330	345	21,200
January	370	.....	321	19,700
February	415	370	398	22,100
March	1,940	392	996	61,200
April	905	370	559	33,300
May	6,590	565	3,340	205,000
June	7,440	6,250	6,810	405,000
July	7,100	4,380	6,260	385,000
August	4,150	1,020	2,040	125,000
September	1,480	940	1,180	70,200
The year	7,440	.....	1,940	1,400,000

ENTIAT RIVER BASIN.

ENTIAT RIVER AT ENTIAT, WASH.

LOCATION.—In sec. 18, T. 25 N., R. 21 E., one-eighth mile below power house of Wenatchee Valley Gas & Electric Co., three-fourths mile above Entiat, Chelan County, and about a mile above mouth.

DRAINAGE AREA.—419 square miles (measured on topographic map).

RECORDS AVAILABLE.—October 5, 1910, to September 30, 1917.

GAGE.—Inclined staff on left bank one-eighth mile below power house; read by L. G. Asher.

DISCHARGE MEASUREMENTS.—Made from private bridge 200 feet below power house or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and boulders; shifting at extremely high water. One channel at all stages. Left bank high; not subject to overflow; right bank slopes gradually.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.98 feet June 30 (discharge, 3,120 second-feet); minimum stage recorded, 0.68 foot November 13 (discharge, 62 second-feet). Discharge may have been lower during period in which stage-discharge relation was affected by ice.

1910–1917: Maximum stage recorded, 5.00 feet June 17, 1916 (discharge, 5,150 second-feet); minimum stage recorded that of November 13, 1916.

ICE.—Stage-discharge relation seriously affected by ice, winter flow estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—Several diversions above station for irrigation. Entiat Irrigation Co.'s high line canal (capacity about 15 second-feet) diverts water above station.

REGULATION.—Flow affected by changes in load at power plant.

ACCURACY.—Stage-discharge relation permanent during year except as affected by ice December 6–22, December 26 to January 9, January 12 to February 6, February 28, and March 1. Rating curves fairly well defined. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage heights to rating table. Some fluctuation at extremely low water due to regulation at power house. Open-water record good; others fair.

COOPERATION.—Gage-height record furnished by Wenatchee Valley Gas & Electric Co.

Discharge measurements of Entiat River at Entiat, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 20	C. O. Brown	1.02	154	Mar. 7	John McCombs	0.87	98.3
31	do	1.02	158	June 8	do	3.60	2,530
Jan. 2[a]	Stewart and McCombs	1.88	117	Sept. 7	do	1.08	174
Feb. 6	John McCombs	.92	117				

[a] Stage-discharge relation affected by ice.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	183	145	111			98	100	222	2,290	1,830	446	228
2	190	145	114			95	95	222	2,290	1,830	446	220
3	183	142	114		100	103	92	222	2,450	1,900	420	212
4	183	145	117			111	120	222	1,900	1,900	420	204
5	186	145	117	120		117	123	345	1,680	2,290	420	190
6	183	139			117	114	123	345	1,680	1,980	394	190
7	179	145			117	106	126	370	1,900	1,980	394	176
8	179	142			117	111	133	473	2,450	1,900	394	190
9	176	139			117	100	148	620	2,290	1,760	394	204
10	176	159	110	117	114	92	155	790	2,290	1,680	370	190
11	172	139		117	117	90	165	990	2,290	1,540	345	198
12	172	133			114	100	212	1,130	2,290	1,460	345	204
13	172	62			114	106	198	1,180	2,130	1,400	345	190
14	169	65			109	103	205	1,180	2,290	1,350	345	190
15	162	74			106	100	220	1,180	2,290	1,180	345	190
16	155	92		80	106	100	224	1,080	2,950	1,130	345	183
17	152	106			120	95	212	1,080	2,950	1,130	345	183
18	152	106	120		117	92	212	1,080	2,950	1,080	222	183
19	148	109			117	95	209	1,080	2,950	1,040	222	190
20	155	111			114	95	220	1,080	2,610	948	222	190
21	152	109			114	117	224	1,080	2,450	905	222	190
22	152	109			111	123	236	1,130	2,290	905	299	176
23	148	114	123		117	123	244	1,180	1,900	755	295	162
24	148	117	130		117	123	248	1,400	1,900	620	286	152
25	145	114	109		120	123	248	1,680	1,830	560	269	142
26	145	123		120	120	111	252	1,900	1,830	560	265	142
27	145	130			120	109	278	2,290	1,830	560	248	155
28	142	133	75		100	92	295	2,610	1,900	560	236	155
29	142	130			.....	95	222	3,120	1,830	560	244	148
30	145	120			.....	109	299	3,120	1,830	501	240	142
31	155	.....			.....	103	.....	2,450	.....	473	236	.....

NOTE.—Discharge estimated on account of ice Dec. 6–22, Dec. 26–Jan. 9, Jan. 12–Feb. 5.

Monthly discharge of Entiat River at Entiat, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	190	142	163	10,000
November	162	62	121	7,200
December	.....	.....	107	6,580
January	.....	.....	107	6,580
February	.....	.....	112	6,220
March	123	90	105	6,460
April	299	92	195	11,600
May	3,120	222	1,190	73,200
June	2,950	1,680	2,220	132,000
July	2,290	473	1,230	75,600
August	446	222	323	19,900
September	228	142	182	10,800
The year	3,120	62	506	366,000

WENATCHEE RIVER BASIN.

WENATCHEE RIVER NEAR LEAVENWORTH, WASH.

LOCATION.—In SW. ¼ sec. 12, T. 26 N., R. 17 E., 1,500 feet below highway bridge, half a mile below Beaver Creek, and about 14 miles north of Leavenworth, Chelan County.

DRAINAGE AREA.—591 square miles (measured on topographic maps).

RECORDS AVAILABLE.—November 27, 1910, to September 30, 1917.

GAGE.—Vertical and inclined staff gage on left bank 1,500 feet below highway bridge since September 6, 1913; read by R. E. Nickles and P. H. Hertzog. November 27, 1910, to September 5, 1913, vertical staff 15 feet downstream at same datum.

DISCHARGE MEASUREMENTS.—Made from cable three-eighths mile above gage.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders; likely to shift during extremely high water. One channel at all stages. Banks high and not subject to overflow. Stage of zero flow, determined February 8 and October 3, 1915, gage height 1.5 and ±0.2 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.40 feet May 30 (discharge, 11,000 second-feet); minimum stage occurred during period in which stage-discharge relation was affected by ice.

1910–1917: Maximum stage recorded, 10.25 feet at 6 p. m. June 18, 1916 (discharge, 16,500 second-feet); minimum stage recorded, 2.53 feet October 11 and 12, 1915 (discharge, 316 second-feet).

ICE.—Stage-discharge relation seriously affected by ice. Winter flow estimated from observer's notes, discharge measurements, and weather records.

DIVERSIONS.—The Wenatchee Park Land & Irrigation Company diverted a maximum of about 10 second-feet from Chiwawa Creek for short periods during irrigation season.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent during year, except as affected by ice December 29 to January 2, January 15–21, and January 31 to February 2. Rating curve well defined. Gage read once daily to hundredths. Daily discharge ascertained by applying daily gage heights to rating table. Open-water records excellent.

COOPERATION.—Gage-height record furnished by Quincy Valley Irrigation District.

Discharge measurements of Wenatchee River near Leavenworth, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 18	C. O. Brown	2.83	518	Mar. 10	John McCombs	2.80	457
Nov. 3	do	2.95	586	June 6	do	6.58	6,310
Dec. 31[a]	Stewart and McCombs	3.13	363	Aug. 25	do	3.49	1,090
Feb. 3	John McCombs	2.73	474				

[a] Stage-discharge relation affected by ice.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	580	540	470	361	400	470	438	1,790	10,100	7,200	2,460	980
2	580	560	457	359		470	444	1,790	9,300	7,710	2,610	930
3	540	580	405	357	464	505	464	1,790	7,710	8,760	2,460	880
4	540	580	457	363	540	540	505	1,790	6,230	9,570	2,460	880
5	505	580	457	405	620	540	580	1,920	6,000	9,030	2,460	790
6	505	540	444	505	700	540	580	1,920	6,230	8,230	2,180	790
7	505	505	438	505	700	540	620	2,180	7,200	7,710	2,180	745
8	470	470	418	505	660	505	700	2,760	7,710	7,200	2,050	745
9	470	1,030	405	540	660	505	700	3,740	8,230	7,970	2,050	745
10	470	1,030	405	540	620	470	745	4,490	7,710	8,490	1,920	745
11	464	980	405	540	620	470	745	5,330	6,710	7,710	1,920	930
12	464	660	424	470	620	464	835	6,000	5,770	7,710	1,790	880
13	464	580	431	418	580	457	835	6,710	5,550	7,450	1,790	880
14	470	580	405	405	580	444	835	6,710	6,230	7,200	1,790	745
15	470	505	393		540	438	835	6,230	8,230	6,950	1,790	700
16	470	470	412		660	438	835	5,770	10,400	6,950	1,790	700
17	505	470	405		700	438	835	5,550	11,000	7,200	1,660	745
18	505	505	412	370	700	438	880	4,490	11,000	6,230	1,660	745
19	470	470	431		700	444	880	4,490	10,400	6,230	1,790	745
20	470	470	431		660	438	930	4,490	9,570	5,770	1,540	700
21	457	457	424		660	470	980	4,490	9,300	5,550	1,480	700
22	444	470	418	405	620	505	1,030	4,900	8,490	4,690	1,360	700
23	431	470	418	431	620	505	1,140	5,110	7,970	4,110	1,240	700
24	424	438	412	424	580	540	1,190	5,770	7,450	3,740	1,240	620
25	418	457	363	457	580	580	1,240	5,770	7,200	3,390	1,190	580
26	418	444	381	470	580	505	1,240	6,230	7,200	3,390	1,790	580
27	470	470	393	505	580	505	1,480	8,230	7,710	3,070	1,080	700
28	470	470	345	470	580	505	1,540	9,300	8,230	3,070	1,080	745
29	505	470	.....	470	.....	505	1,660	10,700	8,230	3,070	1,030	660
30	505	470	320	444	.....	464	1,660	11,000	7,710	2,610	1,030	620
31	580	.....	363	360	.....	464	.....	10,100	.....	2,760	1,080	.....

NOTE.—Gage not read Nov. 2 and July 28, discharge interpolated. Discharge estimated because of ice Dec 29–Jan. 2, Jan. 15–21, and Jan. 31–Feb. 2.

Monthly discharge of Wenatchee River near Leavenworth, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 591 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches.	Acre-feet.
October	580	418	485	0.821	0.95	29,800
November	1,030	438	557	.942	1.05	33,100
December	470	.....	408	.690	.80	25,100
January	540	357	429	.726	.84	26,400
February	700	.....	604	1.02	1.06	33,500
March	580	438	487	.824	.95	29,900
April	1,660	488	913	*1.54	1.72	54,300
May	11,000	1,790	5,210	8.82	10.17	320,000
June	11,000	5,550	8,090	13.6	15.17	478,000
July	9,570	2,610	6,150	10.4	11.99	378,000
August	2,610	1,030	1,740	2.94	3.39	107,000
September	980	580	754	1.28	1.43	44,900
The year	11,000	.....	2,160	3.65	49.52	1,560,000

WENATCHEE RIVER AT DRYDEN, WASH.

LOCATION.—In SW. ¼ sec. 26, T. 24 N., R. 18 E., at Wenatchee Valley Gas & Electric Co.'s plant a quarter of a mile north of Dryden, Chelan County, 1 mile below intake of Wenatchee Valley canal, 2 miles below Peshastin Creek, and 4 miles above Cashmere.

DRAINAGE AREA.—1,200 square miles (measured on topographic maps).

RECORDS AVAILABLE.—October 1, 1911, to September 30, 1917, when station was discontinued. Estimates for the years ending September 30, 1913 and 1914, and for the month of September, 1915, have been revised and are published in this report.

GAGE.—Vertical staff on cribbing at upstream side of tailrace; read by Percy Burrow. Datum lowered 0.50 foot on November 1, 1916. An inclined gage, installed October 24, 1915, on left bank 80 feet below power plant was used to June 17, 1916 (except May 5–7), when it was destroyed.

DISCHARGE MEASUREMENTS.—Made from highway bridge 3 miles below gage.

CHANNEL AND CONTROL.—Bed composed of solid rock and boulders. High-water control permanent; low-water control shifting. Left bank high; right bank, which is fairly high, slopes back gradually. Channel curved above and below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.85 feet at 6 a. m. May 30 and June 17 (discharge, 16,200 second-feet); minimum discharge occurred during period in which stage-discharge relation was affected by ice.

1904[1]–1917: Maximum stage recorded, 11.1 feet, high-water mark, December 30 or 31, 1917 (discharge, 27,100 second-feet); minimum stage recorded, −0.3 foot September 14–16, 1915 (discharge, 470 second-feet); stage may have been lower during the period from September 17 to October 28, 1915, for which gage heights are not available.

ICE.—Stage-discharge relation seriously affected by ice for short periods; flow estimated from discharge measurements, observer's notes, and weather records.

DIVERSIONS.—Wenatchee Valley canal is the most important diversion above station. Records of flow in canal are combined with those of river to give total flow.

REGULATION.—By storage in mill pond at Leavenworth.

ACCURACY.—Stage-discharge relation changed November 10 and May 30; affected by ice December 28 to January 9, January 14–24, and February 1–4; affected at low water by operation of turbines. Rating curve used prior to November 11 and after May 30 well defined; curve used November 11 to May 30 fairly well defined below and well defined above 3,000 second-feet. Gage read twice daily to hundredths. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent for May to August; good for October, February to April, and September; fair for November and December; and poor for January.

COOPERATION.—Gage-height record furnished by Wenatchee Valley Gas & Electric Co.

[1] Gaging station called "Wenatchee River at Cashmere," 1904–1910.

Discharge measurements of Wenatchee River at Dryden, Wash., during the year ending Sept. 30, 1917, and recomputed measurements of other years.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
1912.		*Feet.*	*Sec.-ft.*	1914–15.		*Feet.*	*Sec.-ft*
June 9	R. C. Pierce	6.10	[a] 12,400	Oct. 27	I. L. Collier	1.16	[b] 1,450
1912–13.				Feb. 7	J. T. Hartson	.32	[b] 711
Dec. 2	J. E. Stewart	.67	[b] 930	1916–17.			
Mar. 27	do	1.02	[b] 1,200	Oct. 19	C. O. Brown	.15	776
June 5	F. B. Storey	8.10	[a] 18,600	Nov. 4	do	[e] .82	853
Sept. 10	J. T. Hartson	1.78	[b] 2,060	Jan. 1	J. E. Stewart	[f] .78	566
1913–14.				Feb. 4	John McCombs	.90	795
July 8	C. O. Brown	3.20	[c] 4,810	Mar. 9	do	.90	820
Aug. 17	do	.90	[b] 1,190	June 7	do	5.98	10,600
Sept. 21	do	.85	[d] 1,170	Aug. 27	do	1.54	1,420

[a] Coefficient 0.80 used to reduce surface velocities to mean in vertical.
[b] Discharge corrected plus 1 per cent on account of arrangement of meter and weight.
[c] Discharge corrected plus 4 per cent on account of arrangement of meter and weights.
[d] Estimated inflow between gage and measuring section deducted from measured discharge.
[e] Datum lowered 0.50 foot November 4.
[f] Stage-discharge relation affected by ice.

NOTE.—Results of discharge measurements prior to 1916–17, revised since publication in Water-Supply Papers 332, 362, 392, and 412.

Daily discharge, in second-feet, of Wenatchee River at Dryden, Wash., for the years ending Sept. 30, 1913–14.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1912–13.												
1	580	760	1,200	880	1,110	1,200	1,400	4,340	17,300	10,800	3,990	1,120
2	580	710	1,020	880	1,110	1,200	1,290	4,340	19,300	10,000	5,200	1,040
3	620	710	1,300	1,300	1,110	1,610	1,400	4,130	20,600	9,170	3,250	1,040
4	620	760	1,400	1,200	1,110	1,200	1,400	3,930	20,600	8,900	4,580	2,570
5	660	760	1,300	1,020	1,110	1,200	1,630	3,730	18,900	7,840	3,990	3,800
6	620	760	1,200	940	1,020	1,200	1,630	4,340	16,600	8,900	3,430	2,900
7	620	760	1,110	1,020	880	1,200	1,510	5,200	15,700	10,000	3,250	2,260
8	620	1,200	1,110	940	880	1,300	1,510	6,590	16,300	9,720	2,900	1,980
9	660	880	1,110	940	880	1,300	1,630	9,720	16,600	9,170	3,070	1,720
10	620	760	1,020	940	880	1,400	2,330	10,600	15,100	8,900	2,570	1,980
11	620	880	1,110	940	880	1,500	2,990	10,000	14,400	8,630	2,410	1,490
12	580	1,020	1,020	880	880	1,500	2,820	9,170	15,100	8,100	2,410	1,390
13	580	1,020	1,020	880	880	1,500	3,540	8,630	15,100	7,080	1,980	1,290
14	580	1,020	1,020	880	880	1,400	4,130	8,100	14,100	6,110	1,980	1,290
15	580	1,020	940	880	940	1,400	4,980	7,840	12,000	5,650	1,720	1,200
16	580	940	940	880	1,400	1,730	4,760	7,330	10,300	5,200	1,490	1,120
17	880	940	940	880	1,980	1,400	5,200	7,330	9,720	5,420	1,490	1,120
18	760	940	940	880	2,110	1,850	5,200	6,880	9,720	5,650	1,390	1,120
19	820	1,200	940	820	1,980	1,500	5,880	6,590	11,700	7,080	1,290	1,120
20	760	1,500	940	820	1,730	1,850	6,590	7,080	13,200	7,580	1,290	1,120
21	760	1,400	880	760	1,730	1,400	7,080	8,100	12,600	8,630	1,290	1,120
22	760	1,400	880	820	1,730	1,400	6,590	9,170	12,300	8,900	1,290	1,120
23	760	1,200	880	880	1,500	1,200	6,350	11,100	12,300	8,900	1,290	1,290
24	760	1,500	880	820	1,610	1,400	5,650	12,600	12,000	8,100	1,290	1,290
25	760	1,610	880	940	1,400	1,300	5,200	13,500	11,100	7,580	1,490	1,040
26	760	1,200	880	1,300	1,400	1,300	5,650	14,400	10,300	7,080	1,490	1,040
27	760	1,110	880	1,300	1,400	1,200	5,650	15,700	10,000	6,110	1,290	970
28	760	1,200	880	1,200	1,300	1,200	5,200	15,400	10,800	5,650	1,290	835
29	760	1,110	820	1,200	.....	1,300	4,760	14,400	10,800	4,990	1,290	720
30	760	1,110	820	1,200	.....	1,300	4,550	13,800	10,800	3,610	1,200	720
31	760	.....	880	1,200	.....	1,400	.....	15,400	.....	3,990	1,120	.....

Daily discharge, in second-feet, of Wenatchee River at Dryden, Wash., for the years ending Sept. 30, 1913–1914—Continued.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1913-14.												
1	835	1,490	1,850	970	1,290	1,390	2,260	5,420	8,560	6,430	1,820	905
2	835	900	1,720	970	1,200	1,390	2,120	7,580	11,600	6,930	1,500	840
3	775	1,120	1,600	900	1,120	1,290	2,260	9,720	12,700	6,930	1,400	840
4	775	1,200	1,490	970	1,200	1,290	2,570	10,300	10,600	6,930	1,500	725
5	775	1,200	1,490	1,290	1,120	1,290	2,900	8,630	8,560	6,430	1,500	780
6	835	1,290	1,390	2,260	1,040	1,290	3,800	8,100	7,440	5,480	1,500	725
7	835	1,390	1,390	3,610	1,040	1,200	3,990	7,580	5,710	4,800	1,500	725
8	835	1,290	1,290	3,610	970	1,390	4,580	7,330	5,020	4,580	1,500	725
9	835	1,290	1,200	3,250	1,040	1,720	4,780	7,330	4,580	4,580	1,300	725
10	835	1,200	1,290	2,900	1,040	1,600	5,420	7,080	4,150	4,580	840	725
11	1,200	1,290	1,200	2,570	1,040	1,490	5,880	7,580	4,360	4,150	1,220	725
12	2,900	1,290	1,200	2,260	1,040	1,490	6,350	8,100	4,580	4,360	1,220	725
13	2,410	1,200	1,200	2,120	970	1,600	7,080	8,900	5,480	4,580	1,220	675
14	2,570	1,200	1,120	2,120	970	1,850	7,330	10,800	6,680	4,150	1,220	675
15	2,260	1,200	1,120	1,980	900	2,260	7,840	12,900	7,980	3,950	1,220	675
16	1,980	1,720	1,120	1,980	900	2,730	7,840	13,200	9,880	3,570	1,220	725
17	1,720	3,070	1,120	1,720	970	2,730	7,080	12,000	10,900	3,060	1,220	840
18	1,600	2,900	1,120	1,720	970	3,070	6,590	10,800	10,900	3,220	1,130	840
19	1,720	2,570	1,290	1,720	900	3,250	8,630	10,300	9,880	3,060	975	1,050
20	1,980	2,410	1,200	1,600	900	3,610	7,840	10,300	8,260	3,060	975	1,220
21	1,980	1,980	1,040	1,490	970	3,610	7,330	10,600	6,190	2,750	975	1,130
22	1,980	1,980	1,040	1,490	970	3,610	7,080	11,100	5,480	2,460	1,050	1,130
23	1,850	2,120	1,040	1,490	970	3,610	6,590	11,400	5,020	2,190	1,050	1,050
24	1,980	2,120	970	1,390	1,040	3,610	6,110	12,000	4,800	2,060	975	975
25	2,260	2,120	970	1,290	970	3,430	5,650	11,100	5,480	2,600	975	975
26	1,980	1,980	970	1,290	970	3,250	5,650	9,720	5,020	1,710	975	1,130
27	1,720	2,120	970	1,290	1,120	2,900	5,200	8,360	5,020	1,820	905	1,400
28	1,720	1,980	970	1,290	1,490	3,070	4,990	7,080	5,020	1,940	905	1,300
29	1,600	1,850	970	1,290	.....	2,570	4,780	6,830	5,250	1,600	905	1,130
30	1,490	1,850	900	1,290	.....	2,570	4,780	6,350	5,710	1,500	905	1,050
31	1,490	.....	835	1,290	.....	2,410	.....	7,080	.....	1,130	905	.....

Daily discharge, in second-feet, of Wenatchee River at Dryden, Wash., for September, 1915.

Day.	Discharge.	Day.	Discharge.	Day.	Discharge.
1	760	11	580	21	480
2	760	12	580	22	
3	660	13	500	23	
4	620	14	470	24	
5	710	15	470	25	
6	660	16	470	26	
7	660	17	480	27	
8	660	18		28	
9	580	19		29	
10	580	20		30	

Daily discharge, in second-feet, of Wenatchee River at Dryden, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	970	850	750			880	690	2,460	14,700	10,500	3,110	1,270
2	1,040	800	750			810	880	2,460	13,800	11,700	3,110	1,190
3	970	850	750		620	810	690	2,610	11,100	12,900	3,270	1,190
4	850	850	750			880	810	2,610	9,340	13,800	3,270	1,110
5	850	910	750	760	950	880	950	2,610	8,780	13,500	3,110	1,040
6	850	850	750		950	880	1,110	2,760	9,060	12,600	2,950	1,110
7	800	750	690		1,030	880	1,030	3,230	10,500	11,700	2,800	750
8	800	750	690		1,030	880	1,190	4,140	11,700	10,800	2,650	850
9	800	850	690		1,030	810	1,190	5,650	12,600	11,700	2,510	970
10	800	1,360	690	950	950	810	1,190	6,890	11,400	12,300	2,370	1,040
11	800	1,030	690	880	950	750	1,190	8,780	9,340	11,700	2,240	1,110
12	800	810	750	810	950	810	1,370	9,340	8,500	11,100	2,240	1,190
13	750	750	750	690	880	810	1,190	9,920	8,220	10,500	2,110	1,110
14	750	640	750		880	810	1,470	9,920	9,060	9,920	2,240	1,040
15	800	640	640		880	750	1,370	9,340	12,000	9,630	2,110	970
16	750	640	690		880	690	1,370	7,950	15,400	9,630	2,110	970
17	800	690	690		1,030	690	1,370	7,150	16,000	9,920	2,110	970
18	800	750	690		1,030	690	1,370	6,380	15,400	9,340	2,110	970
19	800	810	750	620	1,030	690	1,370	6,130	14,700	8,780	1,870	970
20	800	810	750		1,030	640	1,470	6,380	14,100	8,220	1,870	970
21	750	750	690		1,030	640	1,580	6,630	13,500	7,680	1,870	970
22	750	750	690		950	640	1,580	7,150	15,400	6,630	1,760	970
23	710	880	690		950	750	1,690	7,680	10,800	5,190	1,650	910
24	710	810	750		880	1,110	1,810	8,220	10,500	4,970	1,550	873
25	710	750	690	750	950	880	1,810	9,060	11,100	4,550	1,270	837
26	710	810	640	750	880	810	1,930	10,200	10,500	4,350	1,450	800
27	710	600	560	750	810	690	2,180	12,300	10,800	4,760	1,360	850
28	710	690		750	810	1,030	2,320	14,400	11,700	4,550	1,550	910
29	750	750		750	.....	600	2,610	16,000	11,700	3,440	1,110	910
30	750	750	570	640	.....	750	2,610	16,000	10,500	3,610	1,270	850
31	800	.....		560	.....	750	.....	15,400	.....	3,440	1,270	.....

NOTE.—Records April 1, 1913, to May 31, 1914, and September, 1915, revised since publication in Water-Supply Papers 362, 392, and 412. Revised records considered excellent. Gage not read September 24 and 25, 1917, discharge interpolated.

Combined monthly discharge of Wenatchee River and Wenatchee Valley canal at Dryden, Wash., for the years ending Sept. 30, 1912, 1913, 1914, 1915, and 1917.

Month.	Discharge in second-feet.					Combined run-off in acre-feet.
	Combined.		River.	Canal.	Total.	
	Maximum.	Minimum.	Mean.	Mean.	Mean.	
1911–12.						
October	808	628	644	48.0	692	42,500
November	5,950	580	1,740	.0	1,740	104,000
December	1,610	880	1,250	.0	1,250	76,900
January	1,610	710	1,000	.0	1,000	61,500
February	1,400	880	1,080	.0	1,080	62,100
March	2,110	760	1,040	.0	1,040	64,000
April	4,420	2,250	3,250	29.8	3,280	195,000
May	18,000	4,210	9,720	68.7	9,790	602,000
June	14,500	5,580	10,000	93.0	10,100	601,000
July	6,540	1,720	3,370	106	3,480	214,000
August	1,970	939	1,270	118	1,390	85,500
September	1,230	654	784	89.9	874	52,000
The year	18,000	580	2,930	46.3	2,980	2,160,000
1912–13.						
October	954	654	687	45.3	732	45,000
November	1,610	710	1,050	.0	1,050	62,500
December	1,400	820	1,000	.0	1,000	61,500
January	1,300	760	981	.0	981	60,300
February	2,110	880	1,280	.0	1,280	71,100
March	1,850	1,200	1,380	.0	1,380	84,800
April	7,080	1,290	3,950	.0	3,950	235,000

Combined monthly discharge of Wenatchee River and Wenatchee Valley canal at Dryden, Wash., for the years ending Sept. 30, 1912, 1913, 1914, 1915, and 1917—Continued.

Month.	Discharge in second-feet.					Combined run-off in acre-feet.
	Combined.		River.	Canal.	Total.	
	Maximum.	Minimum.	Mean.	Mean.	Mean.	
1912-13.						
May	15,700	3,730	9,010	0.0	9,010	554,000
June	20,700	9,830	13,800	108	13,900	827,000
July	10,900	3,730	7,530	116	7,650	470,000
August	5,320	1,240	2,190	118	2,310	142,000
September	3,920	808	1,430	120	1,550	92,200
The year	20,700	654	3,700	42.5	3,740	2,710,000
1913-14.						
October	2,960	863	1,570	68.8	1,640	101,000
November	3,070	959	1,710	11.3	1,720	102,000
December	1,850	835	1,200	.0	1,200	73,800
January	3,610	900	1,790	.0	1,790	110,000
February	1,490	900	1,040	.0	1,040	57,800
March	3,610	1,200	2,340	.0	2,340	144,000
April	8,670	2,120	5,510	33.5	5,540	330,000
May	13,300	5,490	9,210	86.9	9,300	572,000
June	12,800	4,250	7,030	101	7,130	424,000
July	7,030	1,240	3,760	104	3,860	237,000
August	1,930	948	1,180	113	1,290	79,300
September	1,450	776	904	90.5	994	59,100
The year	13,300	776	3,110	51.1	3,160	2,290,000
1914-15.						
October	1,980	824	1,290	36.2	1,330	81,800
November	5,480	1,850	2,960	.0	2,960	176,000
December	2,110	940	1,240	.0	1,240	76,200
January	940	620	787	.0	787	48,400
February	820	660	705	.0	705	39,200
March	3,380	660	1,550	.0	1,550	95,300
April	9,200	2,710	5,530	21.4	5,550	330,000
May	6,300	3,150	3,900	113	4,010	247,000
June	4,700	1,320	2,590	122	2,710	161,000
July	2,250	1,010	1,360	104	1,460	89,800
August	1,330	888	931	128	1,060	65,200
September	888	.....	548	102	650	38,700
The year	9,200	.....	1,950	52.5	2,000	1,450,000
1916-17.						
October	1,050	722	795	12.0	807	49,600
November	1,370	600	798	5.8	804	47,800
December	750	.....	690	.0	690	42,400
January	950	.....	708	.0	708	43,500
February	1,030	.....	901	.0	901	50,000
March	1,110	600	790	.0	790	48,600
April	2,710	690	1,450	37.4	1,490	88,700
May	16,100	2,560	7,730	116	7,850	483,000
June	16,200	8,370	11,700	148	11,800	702,000
July	14,000	3,600	8,820	163	8,980	552,000
August	3,450	1,300	2,140	178	2,320	143,000
September	1,460	939	989	189	1,180	70,200
The year	16,200	.....	3,140	71.1	3,210	2,320,000

NOTE.—Gage-height and discharge for August 11, 1912, published in Water-Supply Paper 332, in error. Discharge that day estimated by interpolation at 1,250 second-feet, making mean for month 1,270 second-feet. Monthly summaries for 1912, 1913, 1914, and 1915 have been revised since publication in previous reports.

WENATCHEE VALLEY CANAL AT DRYDEN, WASH.

LOCATION.—In sec. 26, T. 24 N., R. 18 E., directly across river from Dryden, Chelan County, 1,300 feet below Dryden power house, and 1½ miles below canal intake.

RECORDS AVAILABLE.—Irrigation seasons 1911–1917. Station discontinued September 30, 1917. Estimates for the year ending Sept. 30, 1912, have been revised and are published in this report.

GAGE.—Enameled gage on left side of flume; installed April 29, 1915; read by employees of Wenatchee Valley Gas & Electric Co. Prior to April 29, 1915, gage was 300 feet above present site.

DISCHARGE MEASUREMENTS.—Made from foot plank near gage.

CHANNEL AND CONTROL.—Control is section of flume extending some distance below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.20 feet from 7 a. m. August 27, to September 30 (discharge, 189 second-feet); no flow from 1 p. m. November 15 to 11 a. m. April 14.

1911–1917: Maximum stage recorded that of August 27 to September 30, 1917; no flow during nonirrigating seasons.

ACCURACY.—Stage-discharge relation changed during winter. Rating curves used before and after the change fairly well defined. Gage read twice daily to hundredths and time of changing gates noted. Daily discharge ascertained by applying mean daily gage heights to rating table; or, for days when gates were changed, by subdividing days and applying gage heights for intervals. Records good.

COOPERATION.—Gage-height record furnished by Wenatchee Valley Gas & Electric Co.

Canal diverts water from left bank of Wenatchee River in sec. 27, T. 24 N., R. 18 E. Water is used for irrigation.

Discharge measurements of Wenatchee Valley canal at Dryden, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
Oct. 18	C. O. Brown	0.49	11.3
June 6	John McCombs	2.75	138
Aug. 26	....do	3.05	171

Daily discharge, in second-feet, of Wenatchee Valley canal at Dryden, Wash., for the years ending Sept. 30, 1912 and 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1911–12.							
1	48	.....	58	80	105	112	119
2	48	.....	58	80	105	113	119
3	48	.....	58	80	105	116	119
4	48	.....	58	80	105	116	119
5	48	.....	58	80	105	116	119
6	48	.....	58	80	105	116	119
7	48	.....	58	80	105	116	119
8	48	.....	58	86	105	119	105
9	48	7	58	86	105	119	92
10	48	13	58	86	105	119	92
11	48	21	63	92	105	119	92
12	48	21	63	92	105	119	92
13	48	21	63	92	105	119	92
14	48	31	69	92	105	119	92
15	48	31	69	92	105	119	92
16	48	39	69	92	105	119	80
17	48	39	69	92	105	119	74
18	48	39	74	99	105	119	74
19	48	48	74	99	105	119	74
20	48	48	74	99	105	119	74
21	48	48	74	99	105	119	74
22	48	53	74	99	105	119	74
23	48	53	74	99	105	119	74
24	48	53	80	105	105	119	74
25	48	53	80	105	105	119	74
26	48	53	80	105	105	119	74
27	48	53	80	105	105	119	74
28	48	53	80	105	109	119	74
29	48	58	80	105	109	119	74
30	48	58	80	105	109	119	74
31	48	.....	80	.....	109	119	.....

Daily discharge, in second-feet, of Wenatchee Valley canal at Dryden, Wash., for the years ending Sept. 30, 1912 and 1917—Continued.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1916–17.								
1	12	12	.....	103	134	153	176	189
2	12	12	.....	103	134	153	176	189
3	12	12	.....	103	134	153	176	189
4	12	12	.....	103	134	153	176	189
5	12	12	.....	103	134	153	176	189
6	12	12	.....	103	134	153	176	189
7	12	12	.....	103	134	153	176	189
8	12	12	.....	103	147	153	176	189
9	12	12	.....	103	153	153	176	189
10	12	12	.....	103	153	153	176	189
11	12	12	.....	103	153	153	176	189
12	12	12	.....	103	153	153	176	189
13	12	12	.....	103	153	153	176	189
14	12	12	17	103	153	153	176	189
15	12	6	34	103	153	153	176	189
16	12	.....	40	103	153	158	176	189
17	12	.....	40	103	153	164	176	189
18	12	.....	44	103	153	164	176	189
19	12	.....	52	114	153	170	176	189
20	12	.....	52	126	153	176	176	189
21	12	.....	52	126	153	176	176	189
22	12	.....	56	134	153	176	176	189
23	12	.....	68	143	153	176	176	189
24	12	.....	79	143	153	176	176	189
25	12	.....	84	143	153	176	176	189
26	12	.....	93	143	153	176	176	189
27	12	.....	103	143	153	176	185	189
28	12	.....	103	139	153	176	189	189
29	12	.....	103	134	153	164	189	189
30	12	.....	103	134	153	164	189	189
31	12	.....	.....	134	.....	176	189	.....

NOTE.—Records for year ending Sept. 30, 1912, revised since publication in Water-Supply Paper 332.

Monthly discharge of Wenatchee Valley canal at Dryden, Wash., for the years ending Sept. 30, 1912 and 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
1911–12.				
October	48	48	48.0	2,950
April 9–30	58	7	40.6	1,770
May	80	58	68.7	4,220
June	105	80	93.0	5,530
July	109	105	106	6,520
August	119	112	118	7,260
September	119	74	89.9	5,350
1916–17.				
October	12	12	12.0	738
November 1–15	12	6	11.6	345
April 14–30	103	17	66.1	2,230
May	143	103	116	7,130
June	153	134	148	8,810
July	176	153	163	10,000
August	189	176	178	10,900
September	189	189	189	11,200

YAKIMA RIVER BASIN.

KEECHELUS LAKE NEAR MARTIN, WASH.

LOCATION.—At outlet of lake, 1¼ miles northeast of Meadow Creek station on Chicago, Milwaukee & St. Paul Railway, 3½ miles northwest of Martin, Kittitas County, and 9½ miles northwest of Easton.

DRAINAGE AREA.—55 square miles (measured on topographic maps).

RECORDS AVAILABLE.—January 12, 1906, to September 30, 1917.

GAGE.—Vertical staff; position changed frequently during 1914 and 1915 to accommodate work on construction of new dam; read to hundredths twice daily by employees of the United States Reclamation Service. Since August 19, 1914, gages have been set to sea-level datum; prior to that date at height of gate sill in temporary crib dam—elevation, 2,457 feet.

EXTREMES OF STAGE.—Maximum stage recorded during the year, 2,470.34 feet at 7 a. m. August 9 (capacity, 61,270 acre-feet); minimum stage recorded, 2,431.99 feet at 7.30 a. m. January 4 (capacity, 8,780 acre-feet).

1906–1917: Maximum stage recorded, 2,471.38 feet November 23, 1909 (capacity, storage plane new reservoir, 62,910 acre-feet); minimum stage recorded that of January 3 and 4, 1917.

STORAGE.—Capacity of new reservoir, 152,000 acre-feet; elevation of gate sill and spillway crest, 2,425 feet and 2, 515 feet, respectively. Record of storage or release each month used to determine discharge without storage for gaging station below dam.

COOPERATION.—Capacities computed by United States Reclamation Service.

Daily capacity, in acre-feet, of Keechelus Lake near Martin, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30,280	34,540	29,640	8,870	14,210	28,260	27,040	27,410	39,450	60,740	60,680	61,080
2	30,440	34,840	28,390	8,840	14,590	28,500	26,980	27,460	39,620	60,910	60,680	61,050
3	30,600	35,250	27,260	8,820	15,210	28,690	26,880	27,500	39,420	60,830	60,680	61,040
4	30,690	35,790	26,010	8,820	16,210	29,060	26,810	27,490	40,480	60,710	60,800	61,050
5	30,810	36,170	24,690	8,970	17,310	29,440	26,900	27,480	41,380	60,620	60,800	61,050
6	30,950	36,500	23,700	9,200	18,410	29,630	26,970	27,460	42,260	60,690	60,800	61,080
7	31,050	36,850	22,560	9,400	19,220	29,270	27,080	27,380	43,420	60,680	60,710	61,020
8	31,160	37,180	21,560	9,500	19,900	28,860	27,300	27,300	44,780	60,550	60,980	60,940
9	31,270	38,220	20,560	9,740	20,480	28,410	27,420	27,380	46,640	60,960	61,270	60,960
10	31,380	38,140	19,480	9,880	20,940	27,990	27,540	27,500	48,320	60,880	61,150	60,960
11	31,510	37,520	18,490	10,050	21,370	27,730	27,780	27,360	49,240	60,620	60,870	61,020
12	31,560	36,700	17,570	10,060	21,810	27,700	27,450	27,090	49,130	60,710	60,650	61,020
13	31,680	35,770	16,590	10,040	22,190	27,680	27,410	26,770	49,200	60,690	60,550	60,350
14	31,820	34,790	15,670	10,040	22,540	27,610	27,540	26,550	49,840	60,710	60,540	57,550
15	31,940	34,490	14,770	9,980	22,880	27,490	27,600	27,440	51,940	60,910	60,400	54,690
16	32,050	34,260	13,850	9,910	23,420	27,410	27,050	28,180	53,920	61,020	60,240	52,040
17	32,130	34,290	13,110	9,810	23,990	27,290	26,960	28,980	54,630	60,960	60,170	51,980
18	32,230	34,330	12,480	9,730	24,530	27,200	27,200	30,000	54,840	60,650	60,200	52,130
19	32,310	34,410	12,180	9,670	24,980	27,180	27,440	31,050	55,490	60,550	60,180	52,260
20	32,420	34,410	11,710	9,580	25,450	27,100	27,200	31,960	56,360	60,620	60,170	52,360
21	32,500	34,410	11,410	9,830	25,870	27,120	26,940	32,900	56,570	60,630	60,120	52,490
22	32,600	34,480	11,060	10,100	26,220	27,220	26,650	33,840	57,180	60,710	60,120	52,610
23	32,690	34,540	10,760	10,340	26,550	27,280	26,590	34,870	58,610	60,710	60,150	52,700
24	32,800	34,570	10,540	10,630	26,880	27,330	26,480	35,960	60,240	60,770	60,370	52,760
25	32,880	34,680	10,190	11,110	27,200	27,360	26,480	37,190	60,740	60,830	60,540	52,920
26	33,010	34,730	9,960	11,740	27,460	27,250	26,560	38,240	60,870	60,930	60,710	53,030
27	33,120	34,950	9,700	12,460	27,760	27,220	26,770	38,240	60,660	61,010	60,870	53,160
28	33,240	33,750	9,500	12,970	28,020	27,220	26,980	38,790	60,710	60,930	61,020	53,300
29	33,490	32,370	9,280	13,310	.....	27,220	27,200	39,370	60,430	60,770	61,150	53,490
30	33,790	31,050	9,100	13,430	.....	27,170	27,380	39,400	60,460	60,680	61,150	53,590
31	34,250	.....	8,960	13,530	.....	27,100	.....	39,330	.....	60,680	61,120	.....

YAKIMA RIVER NEAR MARTIN, WASH.

LOCATION.—Below dam at outlet of Keechelus Lake, 1½ miles east of Meadow Creek station on Chicago, Milwaukee & St. Paul Railway, 3½ miles northwest of Martin, and 9½ miles northwest of Easton, Kittitas County.

DRAINAGE AREA.—55 square miles (measured on topographic maps).

RECORDS AVAILABLE.—October 18 to November 14, 1903; January 28, 1904, to September 30, 1917.

GAGE.—Inclined staff gage in paved section on left side of outlet works, installed December 2, 1916. Previous gage vertical staff just above cable, 1¼ miles below dam, installed May 4, 1915. Gage read by A. L. Flint. For description of former gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable 1¼ miles below dam or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel; shifts at high stages. Logs and brush sometimes lodge on riffle control below gage and cause backwater.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 9.95 feet at 6.40 p. m. September 13 (discharge, 1,860 second-feet); minimum stage recorded, 1.07 feet from January 25 to February 12 (discharge, 0.7 second-feet).

1904–1917: Maximum discharge, 7,370 second-feet at 10.45 a. m. March 26, 1915, when temporary crib dam was washed out (gage destroyed; discharge computed from hourly gage readings of lake surface and estimated natural inflow to lake); practically no flow when gates in Keechelus reservoir dam are closed.

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

DIVERSIONS.—None.

REGULATION.—Flow partly controlled by storage and release of water at Keechelus reservoir. Monthly discharge without storage determined from records of stage at reservoir.

ACCURACY.—Stage-discharge relation permanent during year. Rating curves fairly well defined except for extremely low water. Gage read twice daily to hundredths. Daily discharge ascertained by applying mean daily gage heights to rating table. Records fair for periods of extremely low water, for which the rating curves are poorly defined; good for rest of year.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Yakima River near Martin, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Jan. 5	F. E. Moxley	3.41	148	Apr. 16	F. E. Moxley	5.90	520
Apr. 10	do	3.33	130	16	do	4.18	223
10	do	2.90	100	17	do	3.61	153
11	do	2.24	42.0	17	do	1.09	[a].5
11	do	5.00	348	June 6	do	4.46	283
12	do	5.50	437	20	do	7.30	872
12	do	4.50	295	20	do	8.40	1,190
13	do	3.85	177	21	do	8.90	1,450
14	do	3.11	105	Aug. 7	Moxley and Peterson	4.40	252
14	do	2.85	83.3				

[a] Gates closed. This amount estimated as seepage.

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	3	9	851	148	1	1	128	285	1,260	1,160	316	104
2	3	10	803	138	1	1	128	285	1,380	1,380	316	104
3	3	10	634	138	1	1	128	285	713	1,500	316	82
4	3	10	634	138	1	1	128	285	256	1,620	316	66
5	3	8	609	148	1	1	128	316	256	1,420	316	66
6	3	7	585	159	1	104	128	367	256	1,220	316	66
7	3	7	585	170	1	350	128	499	270	1,260	285	74
8	3	7	585	181	1	350	128	585	270	1,130	9	82
9	3	315	585	181	1	350	128	741	270	1,130	109	82
10	3	742	585	205	1	285	109	980	285	1,300	316	82
11	3	742	634	205	1	159	193	1,160	499	1,220	316	82
12	3	692	660	205	1	138	316	1,160	741	1,100	300	82
13	3	692	660	205	1	138	148	1,160	741	1,100	217	634
14	3	586	585	205	1	138	100	1,160	499	980	217	1,830
15	3	256	585	193	1	128	243	316	300	980	256	1,780
16	3	202	540	193	1	128	316	230	1,100	1,040	230	459
17	3	103	479	193	1	128	86	54	1,380	1,130	181	5
18	3	103	421	193	1	128	1	1	1,260	1,040	159	3
19	3	103	385	193	1	128	95	1	890	860	159	2
20	3	103	350	58	1	128	316	1	1,040	741	159	2
21	3	103	333	1	1	128	316	1	1,300	686	138	2
22	3	103	300	1	1	128	316	1	634	540	128	2
23	3	103	270	1	1	128	316	1	256	459	47	2
24	3	95	243	1	1	128	285	1	713	421	5	1
25	3	95	217	1	1	128	270	1	1,300	421	5	1
26	3	95	205	1	1	128	256	256	1,300	421	5	1
27	3	430	181	1	1	128	256	950	1,460	479	5	1
28	4	795	170	1	1	128	256	980	1,420	421	6	1
29	5	795	170	1	.....	128	256	1,190	1,540	459	41	1
30	6	851	159	1	.....	128	270	1,380	1,010	350	104	1
31	8	.....	148	1	.....	128	.....	1,340	.....	316	104	.....

Monthly discharge of Yakima River near Martin, Wash., for year ending Sept. 30, 1917.

[Drainage area, 55 square miles.]

Month.	Observed discharge (second-feet).			Run-off (acre-feet).			Discharge without storage (second-feet).		Run-off (depth in inches).
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Without storage.	Mean.	Per square mile.	
October	8	3	3.35	206	+ 4,100	4,310	70.1	1.27	1.46
November	851	7	272	16,200	− 3,190	13,000	218	3.96	4.42
December	851	148	457	28,100	−22,100	6,000	97.6	1.77	2.04
January	205	1	112	6,860	+ 4,580	11,400	185	3.36	3.87
February	1	1	1	55.5	+14,500	14,600	263	4.78	4.98
March	350	1	135	8,320	− 918	7,400	120	2.18	2.51
April	316	1	196	11,600	+ 279	11,900	200	3.64	4.06
May	1,380	1	515	31,700	+11,900	43,600	709	12.9	14.87
June	1,540	256	820	48,800	+21,100	69,900	1,170	21.3	23.76
July	1,620	316	912	56,100	+ 217	56,300	916	16.6	19.14
August	316	5	174	10,700	+ 439	11,100	181	3.29	3.79
September	1,830	1	190	11,300	− 7,520	3,780	63.5	1.15	1.28
The year	1,830	1	318	230,000	+23,400	253,000	349	6.35	86.18

YAKIMA RIVER AT CLE ELUM, WASH.

LOCATION.—In sec. 27, T. 20 N., R. 15 E., at highway bridge at Cle Elum, Kittitas County, just above Roslyn Creek, 3 miles below mouth of Cle Elum River, and 6½ miles above Teanaway River.

DRAINAGE AREA.—500 square miles (measured on topographic maps).

RECORDS AVAILABLE.—August 24, 1906, to September 30, 1917.

GAGE.—Friez water-stage recorder on right bank under highway bridge; installed July 12, 1911; inspected by T. J. Denny. For description of previous gages see Water-Supply Paper 442.

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

CHANNEL AND CONTROL.—Bed composed of gravel and cobblestones; permanent except during floods. One channel at all stages. Control at low water formed by broad riffle about 1,200 feet below gage; at high water by a section of stream bed extending about one-fourth mile below gage.

EXTREMES OF DISCHARGE.—Maximum stage during year, 7.70 feet at 7 a. m. May 30 (discharge, 10,100 second-feet); minimum stage, 1.48 feet from midnight January 22 to 8 a. m. January 25 (discharge, 327 second-feet).

1906–1917: Maximum stage, measured from high-water marks, 12.5 feet November 14, 1906 (discharge about 25,600 second-feet); minimum stage recorded, 1.11 feet at 6 p. m. September 30, 1915 (discharge, 192 second-feet).

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

DIVERSIONS.—None.

REGULATION.—Flow partly regulated by storage and release of water at Keechelus Kachess, and Cle Elum reservoirs. Monthly discharge without storage determined from records of stage at reservoirs.

ACCURACY.—Stage-discharge relation permanent until August 8, unstable after that date; not affected by ice. Rating curve well defined. Water-stage recorder inspected daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Shifting-control method used August 9 to September 30. Records good for period in which control was shifting; excellent for rest of year.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Yakima River at Cle Elum, Wash., during the year ending Sept. 30, 1917.

[Made by F. E. Moxley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 1	2.25	758	June 4	5.88	5,640
21	1.53	365	21	6.60	7,490
Jan. 4	2.11	684	Aug. 8	3.96	2,330
May 10	6.05	6,040			

Daily discharge, in second-feet, of Yakima River at Cle Elum, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	812	745	1,080	476	574	738	524	2,190	9,280	5,670	1,680	1,940
2	777	739	1,040	481	574	681	540	2,190	8,500	6,130	1,680	1,880
3	758	745	962	466	644	471	551	2,190	7,770	6,590	2,060	1,830
4	739	745	1,040	644	805	451	609	2,120	5,900	7,050	2,190	1,830
5	726	758	1,000	675	758	446	738	2,120	5,340	7,050	2,120	1,780
6	707	752	985	726	798	441	832	2,260	5,340	6,360	2,260	1,780
7	719	713	962	771	791	549	882	2,610	5,670	5,900	2,330	1,830
8	853	578	985	785	745	726	947	3,430	6,360	5,670	2,260	1,830
9	832	594	925	809	694	738	1,020	4,600	6,590	5,450	2,260	1,590
10	739	825	875	732	663	719	1,100	5,900	6,360	5,900	2,470	1,550
11	739	1,000	853	700	626	644	1,180	6,820	5,670	5,670	2,680	1,220
12	732	1,000	925	681	603	563	1,460	7,050	5,340	5,340	2,610	1,180
13	732	1,000	1,000	644	574	540	1,420	7,050	5,010	5,120	2,470	1,100
14	719	970	992	656	551	529	1,420	6,990	5,230	4,800	2,400	1,640
15	719	745	925	669	563	524	1,460	6,130	5,900	4,500	2,400	1,730
16	732	529	903	681	719	518	1,610	5,010	7,530	4,400	2,330	1,780
17	745	617	860	669	791	518	1,460	4,300	8,760	4,500	2,260	1,220
18	745	623	853	706	846	513	1,460	3,850	8,250	4,400	2,120	1,020
19	745	431	860	785	896	524	1,340	3,680	7,780	4,030	2,060	839
20	745	392	784	632	903	508	1,640	3,590	7,290	3,680	2,000	785
21	739	368	739	407	882	502	1,830	3,680	7,290	3,350	1,940	765
22	739	359	688	335	839	513	1,830	3,760	7,050	3,040	1,940	758
23	739	368	670	327	798	529	1,830	4,020	5,900	2,750	2,120	751
24	732	350	600	327	771	563	1,830	4,120	5,450	2,330	2,060	745
25	726	354	556	391	836	551	1,940	4,600	6,820	2,060	2,120	738
26	726	364	540	540	910	529	2,000	5,010	6,590	2,000	2,120	738
27	719	417	534	563	825	535	2,060	6,820	6,590	2,000	2,000	732
28	719	784	578	518	785	529	2,000	8,010	6,820	2,060	1,940	732
29	758	1,040	556	476	.....	535	2,190	9,550	7,050	2,120	1,880	732
30	765	1,080	550	456	.....	529	2,190	9,820	6,360	2,060	1,940	726
31	752	.....	503	471	.....	524	.....	9,280	.....	1,830	2,000	.....

Monthly discharge of Yakima River at Cle Elum, Wash., for year ending Sept. 30, 1917.

Month.	Observed discharge (second-feet).			Run-off (acre-feet).			Discharge without storage (second-feet).		Run-off (depth in inches).
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Without storage.	Mean.	Per square mile.	
October	853	707	746	45,800	−22,100	23,700	385	0.770	0.89
November	1,080	350	666	39,600	+ 1,730	41,300	694	1.39	1.55
December	1,080	503	817	50,200	−14,400	35,800	582	1.16	1.34
January	809	327	587	36,100	+16,500	52,600	855	1.71	1.97
February	910	551	742	41,200	+32,000	73,200	1,320	2.64	2.75
March	738	441	554	34,100	+10,700	44,800	729	1.46	1.68
April	2,190	524	1,400	83,100	+12,200	95,300	1,600	3.20	3.57
May	9,820	2,120	4,930	303,000	+51,300	354,000	5,760	11.5	13.26
June	9,280	5,010	6,660	396,000	+20,900	417,000	7,010	14.0	15.62
July	7,050	1,830	4,320	265,000	+ 3,930	269,000	4,370	8.74	10.08
August	2,680	1,680	2,150	132,000	−74,700	57,300	932	1.86	2.14
September	1,940	726	1,260	74,900	−48,100	26,800	450	.900	1.00
The year	9,820	327	2,070	1,500,000	−10,000	1,490,000	2,060	4.12	55.85

YAKIMA RIVER AT UMTANUM, WASH.

LOCATION.—In sec. 30, T. 16 N., R. 19 E., at Umtanum, Kittitas County, half a mile above Umtanum Creek and 10 miles south of Ellensburg.

DRAINAGE AREA.—1,620 square miles (measured on topographic maps and Plate I, Water-Supply Paper 369).

RECORDS AVAILABLE.—August 25, 1906, to May 20, 1907; August 10, 1907, to November 15, 1915; irrigation seasons 1916–17.

GAGE.—Stevens water-stage recorder on right bank 100 feet east of Northern Pacific Railway section house at Umtanum; installed July 10, 1914; inspected by Tom Letos. For description of previous gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable 100 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of rocks and gravel; slightly shifting. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.56 feet at 6 p. m. May 30 (discharge, 13,100 second-feet); minimum stage recorded, 3.67 feet at 5 p. m. September 30 (discharge, 676 second-feet).

1906–1917: Maximum stage recorded, 14.2 feet November 15 or 16, 1906 (estimated from high-water marks; discharge, about 41,000 second-feet); minimum stage recorded, 2.86 feet at 7 p. m. October 3, 1915 (discharge, 138 second-feet).

ICE.—Record discontinued during winter.

DIVERSIONS.—Water diverted above gage for irrigation of about 40,000 acres in Kittitas Valley.

REGULATION.—Flow partly regulated by storage and release of water at Keechelus, Kachess, and Cle Elum reservoirs.

ACCURACY.—Stage-discharge relation permanent during year. Rating curve well defined. Water-stage recorder inspected twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Yakima River at Umtanum, Wash., during the year ending Sept. 30, 1917.

[Made by F. E. Moxley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 2	3.94	922	June 12	6.65	6,590
Mar. 30	3.93	987	25	6.86	7,580
May 14	7.67	10,200	Aug. 10	4.76	2,100

Daily discharge, in second-feet, of Yakima River at Umtanum, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	955	870	3,760	11,800	6,620	1,800	1,890
2	900	880	3,640	11,100	6,780	1,550	1,890
3	840	900	3,760	10,000	7,100	1,670	1,850
4	830	955	3,640	8,060	7,580	1,910	1,830
5	810	1,130	3,760	6,940	7,580	1,890	1,800
6	791	1,440	3,880	6,780	7,100	1,990	1,780
7	772	1,550	4,630	7,100	6,620	2,040	1,780
8	752	1,660	5,740	7,740	6,170	2,060	1,880
9	810	1,880	7,580	8,380	5,740	2,090	1,800
10	810	1,990	8,710	8,060	5,580	2,130	1,720
11	734	2,130	9,710	7,420	6,020	2,420	1,440
12	714	2,240	10,000	6,620	5,740	2,510	1,290
13	724	2,420	10,000	6,320	5,310	2,420	1,240
14	724	2,420	9,710	6,170	5,170	2,330	1,300
15	714	2,420	9,710	6,620	4,760	2,330	1,580
16	724	2,510	8,060	8,060	4,630	2,240	1,810
17	743	2,420	6,780	9,710	4,630	2,160	1,600
18	762	2,330	5,880	9,710	4,630	2,130	1,250
19	820	2,330	5,450	9,040	4,380	2,020	1,150
20	840	2,510	5,450	8,710	3,880	1,990	1,130
21	850	2,800	5,590	8,060	3,530	1,940	1,120
22	840	3,100	5,880	8,060	3,200	1,860	1,110
23	840	3,100	6,170	7,260	2,900	1,930	1,120
24	840	3,310	6,470	6,470	2,510	1,990	1,110
25	850	3,420	6,940	6,940	2,330	1,940	820
26	850	3,530	7,580	7,740	2,240	1,990	771
27	880	4,250	9,040	7,420	2,160	1,990	705
28	870	4,120	10,800	7,580	2,160	1,940	705
29	870	4,250	12,200	7,740	2,240	1,880	705
30	900	4,120	12,900	7,580	2,160	1,860	686
31	900	.....	12,500	.....	2,020	1,910	.....

Monthly discharge of Yakima River at Umtanum, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	955	714	815	50,100
April	4,250	870	2,430	145,000
May	12,900	3,640	7,290	448,000
June	11,800	6,170	7,970	474,000
July	7,580	2,020	4,630	285,000
August	2,150	1,550	2,030	125,000
September	1,890	686	1,360	81,000

YAKIMA RIVER NEAR PARKER, WASH.[1]

LOCATION.—In sec. 28, T. 12 N., R. 19 E., below Sunnyside diversion dam, 2 miles below Union Gap, 1½ miles east of Parker, Yakima County, 3½ miles northwest of Wapato, and 11 miles below mouth of Naches River.

DRAINAGE AREA.—3,560 square miles (measured on topographic maps and Plate I of Water-Supply Paper 369).

RECORDS AVAILABLE.—April 25, 1908, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank about 600 feet below Sunnyside diversion dam; installed August 17, 1915; inspected by Henry Hansen. For description of previous gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable 80 feet above gage or by wading.

CHANNEL AND CONTROL.—Bed composed of solid rock, large boulders, and gravel. One channel at all stages. Control formed by diagonal riffle just below Oregon-Washington Railroad & Navigation Co.'s bridge and about 250 feet below gage; may shift slightly during extreme floods. Supports of railway bridge form part control at high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.34 feet at 11 a. m. May 30 (discharge, 19,800 second-feet); minimum stage recorded, 2.06 feet at 8 p. m. September 30 (discharge, 87 second-feet).

1908–1917: Maximum stage recorded, 9.82 feet November 25, 1909 (discharge, 33,400 second-feet); minimum stage recorded, −0.65 foot October 26, 1911, and 1.23 feet August 25 and 28, 1915 (discharge practically zero).

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

DIVERSIONS.—Water diverted above gage for irrigation of about 250,000 acres.

REGULATION.—Flow partly regulated by diversions and by storage and release of water at Keechelus, Kachess, Cle Elum, and Bumping reservoirs.

ACCURACY.—Stage-discharge relation permanent during year. Rating curves well defined. Water-stage recorder inspected twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Yakima River near Parker, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*			*Feet.*	*Sec. ft.*
Oct. 14	F. E. Moxley	3.12	555	May 29	Moxley and Mineah	10.06	18,800
Nov. 6	.....do	4.32	1,740	June 16	F. E. Moxley	8.97	13,500
Dec. 14	.....do	4.35	1,720	July 30	.....do	3.95	1,310
Jan. 17	.....do	3.79	1,050	Aug. 20	.....do	3.11	508
May 9	Moxley and Hall	7.74	8,800	Sept. 6	Moxley and Taylor	2.96	463
19	F. E. Moxley	7.00	6,530				

[1] Formerly called "Yakima River near Wapato, Wash."

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

Day.	Oct.	Nov.	Dec	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	646	1,530	1,700	1,190	924	1,640	1,020	3,670	17,100	9,230	874	420
2	558	1,580	1,700	1,420	1,250	1,530	977	3,220	15,600	8,900	571	438
3	551	1,580	1,700	1,300	1,580	1,530	942	3,400	13,400	9,920	463	438
4	519	1,580	1,700	1,310	1,820	1,420	951	3,400	11,000	11,000	585	403
5	525	1,640	1,700	1,530	1,940	1,360	1,020	3,220	8,580	11,400	703	403
6	487	1,700	1,640	1,420	2,060	1,360	1,380	3,490	7,950	11,000	625	469
7	380	1,640	1,580	1,420	1,940	1,310	1,700	4,450	8,900	9,230	710	456
8	385	1,580	1,530	1,530	1,880	1,290	1,880	6,160	11,400	8,260	762	793
9	487	1,480	1,580	1,580	1,820	1,480	2,000	8,900	13,000	7,950	695	924
10	558	1,530	1,580	1,640	1,700	1,530	2,200	11,000	13,000	8,260	660	695
11	545	1,700	1,530	1,530	1,700	1,530	2,400	13,400	11,000	7,950	762	646
12	513	1,760	1,530	1,480	1,640	1,480	2,470	14,600	9,230	7,360	924	463
13	532	1,700	1,580	1,310	1,580	1,420	2,610	14,600	8,260	6,810	882	385
14	551	1,580	1,700	1,220	1,530	1,360	2,610	13,800	8,260	6,290	785	380
15	688	1,700	1,700	1,150	1,480	1,290	2,610	13,400	10,300	5,680	703	840
16	817	1,580	1,580	1,040	1,530	1,270	2,400	11,000	13,400	5,440	688	1,010
17	840	1,420	1,580	1,100	2,060	1,250	2,400	8,900	16,100	5,560	725	1,030
18	882	1,420	1,530	1,230	2,130	1,250	2,130	7,080	16,100	5,560	725	710
19	968	1,480	1,480	1,310	2,060	1,300	2,060	6,550	14,600	4,990	591	545
20	1,010	1,350	1,530	1,360	2,060	1,290	2,000	6,420	13,800	4,350	558	403
21	1,090	1,260	1,480	1,640	2,000	1,280	2,330	6,550	12,600	4,050	538	326
22	1,090	1,200	1,400	1,530	1,940	1,090	2,540	6,810	12,200	3,490	475	228
23	1,110	1,170	1,360	1,410	1,880	968	2,680	7,360	11,000	2,610	444	162
24	1,060	1,140	1,290	1,290	1,820	1,070	2,900	7,950	9,570	2,200	571	149
25	1,090	1,200	1,140	1,250	1,760	1,040	3,140	8,580	9,570	1,760	500	149
26	1,080	1,080	1,090	1,530	1,820	1,040	3,490	9,570	10,300	1,530	558	125
27	1,090	1,090	1,060	1,480	1,880	986	4,250	11,800	9,920	1,410	564	128
28	1,120	1,150	986	1,480	1,760	1,030	4,560	14,600	10,300	1,340	487	128
29	1,130	1,290	1,010	1,350	.....	1,080	4,560	17,600	11,000	1,330	426	101
30	1,260	1,580	1,110	1,230	.....	1,100	4,350	19,600	10,600	1,290	374	101
31	1,330	.....	1,120	995	.....	1,070	.....	18,600	.....	1,120	397	.....

Monthly discharge of Yakima River near Parker, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,330	380	803	49,400
November	1,760	1,080	1,460	86,700
December	1,700	986	1,460	89,600
January	1,640	995	1,360	83,800
February	2,130	924	1,770	98,300
March	1,640	968	1,280	78,600
April	4,560	942	2,420	144,000
May	19,600	3,220	9,340	575,000
June	17,100	7,950	11,600	690,000
July	11,400	1,120	5,720	352,000
August	924	374	623	38,300
September	1,030	101	448	26,700
The year	19,600	101	3,190	2,310,000

Combined monthly discharge of Yakima River near Parker, Wash., New Reservation, Old Reservation, and Sunnyside canals near Parker, Wash., for the year ending Sept. 30, 1917.

Month.	Combined mean discharge in second-feet.	Run-off in acre-feet.	Month.	Combined mean discharge in second-feet.	Run-off in acre-feet.
October	1,400	86,100	May	11,300	695,000
November	1,460	86,900	June	13,700	815,000
December	1,460	89,800	July	7,940	488,000
January	1,360	83,600	August	2,660	164,000
February	1,770	98,300	September	1,760	105,000
March	1,380	84,800			
April	3,260	194,000	The year	4,130	2,990,000

YAKIMA RIVER NEAR PROSSER, WASH.

LOCATION.—In SE. ¼ sec. 36, T. 9 N., R. 24 E., 1¼ miles northeast of Prosser, Benton County, and 40 miles above mouth.

DRAINAGE AREA.—5,340 square miles (measured on project map of United States Reclamation Service).

RECORDS AVAILABLE.—June 1 to October 10, 1904; June 8 to December 30, 1905; February 1 to October 12, 1906; August 4, 1913, to October 31, 1915; irrigation seasons, 1916–17.

GAGE.—Stevens water-stage recorder on right bank, 1¼ miles below Prosser Falls; installed August 4, 1913. June 1, 1904, to December 30, 1905, chain gage on highway bridge 600 feet below Prosser Falls. February 1 to October 12, 1906, inclined staff at approximately same site as present gage but at different datum. Recorder inspected by T. Martinson.

DISCHARGE MEASUREMENTS.—Made from cable 1,000 feet above gage or from a boat.

CHANNEL AND CONTROL.—Bed composed of rock and large boulders; changes only during floods. Control formed by broad riffle about 800 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 10.43 feet at 10.30 a. m. June 1 (discharge, 18,200 second-feet); minimum stage recorded, 1.46 feet at 9 a. m. September 30 (discharge, 509 second-feet).

1904–1906 and 1914–1917: Maximum flow measured by floats (not referred to gage) at 3 p. m. November 17, 1906 (discharge, 62,800 second-feet); maximum stage occurred at 9 a. m. on same date at stage three-fourths inch above that of measurement; minimum stage recorded, 2.60 feet August 19, 26, 30, 31, and September 30, 1906 (discharge about 40 second-feet).

ICE.—Record discontinued during winter.

DIVERSIONS.—Water diverted above gage for irrigation of about 250,000 acres.

REGULATION.—Flow partly regulated by diversions and by storage and release of water of Keechelus, Kachess, Cle Elum, and Bumping reservoirs.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Water-stage recorder inspected once daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Yakima River near Prosser, Wash., during the year ending Sept. 30, 1917.

[Made by F. E. Moxley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 3	2.50	1,250	June 13	7.66	10,200
Nov. 4	3.36	2,140	27	7.96	10,900
Mar. 31	3.24	1,970	Aug. 21	2.37	1,040
May 17	8.07	11,200			

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

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	1,470	1,720	4,950	18,200	10,800	1,720	863
2	1,340	1,670	4,410	17,200	9,770	1,510	836
3	1,250	1,620	3,980	16,300	10,000	1,260	863
4	1,200	1,620	4,060	14,200	10,600	1,170	863
5	1,160	1,620	3,980	11,700	11,400	1,170	877
6	1,160	1,840	3,980	9,770	11,400	1,260	877
7	1,200	2,130	4,230	9,510	10,600	1,260	863
8	1,120	2,560	5,320	10,600	9,770	1,260	906
9	969	2,750	7,160	12,200	8,750	1,260	1,130
10	1,120	2,820	9,510	13,400	8,510	1,220	1,410
11	1,160	3,020	11,700	13,100	8,510	1,170	1,220
12	1,120	3,300	13,100	11,700	8,270	1,170	1,170
13	1,120	3,300	14,000	10,000	7,810	1,360	1,090
14	1,080	3,300	14,200	9,510	7,370	1,410	996
15	1,120	3,300	14,000	9,770	6,950	1,310	979
16	1,160	3,230	13,100	11,400	6,320	1,220	1,170
17	1,340	3,090	11,400	13,700	6,320	1,170	1,520
18	1,340	3,020	9,510	15,400	6,320	1,170	1,560
19	1,380	2,820	8,040	15,700	6,110	1,130	1,310
20	1,470	2,680	7,590	15,100	5,510	1,130	1,130
21	1,520	2,680	7,370	14,200	4,950	1,010	1,010
22	1,520	3,020	7,590	13,400	4,770	964	964
23	1,570	3,230	7,810	12,800	4,060	956	898
24	1,570	3,370	8,270	11,400	3,440	934	870
25	1,570	3,590	9,000	10,600	2,880	934	836
26	1,620	3,900	9,770	10,600	2,560	898	809
27	1,620	4,230	10,800	10,800	2,310	949	722
28	1,570	4,950	12,800	10,600	2,070	972	767
29	1,620	5,130	14,500	11,100	2,010	920	688
30	1,620	5,320	16,600	11,400	2,010	877	660
31	1,670	.....	17,800	.....	1,950	836	.....

Monthly discharge of Yakima River near Prosser, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	1,670	969	1,350	83,000
April	5,320	1,620	3,030	180,000
May	17,800	3,980	9,370	576,000
June	18,200	9,510	12,500	744,000
July	11,400	1,950	6,580	405,000
August	1,720	836	1,150	70,700
September	1,560	660	995	59,200

KACHESS LAKE NEAR EASTON, WASH.

LOCATION.—In sec. 24, T. 21 N., R. 13 E. (unsurveyed), at lake outlet, 2½ miles northwest of Easton, Kittitas County.

DRAINAGE AREA.—63 square miles (measured on topographic maps).

RECORDS AVAILABLE.—September 20, 1905, to September 30, 1917.

GAGE.—Stevens water-stage recorder installed in gate tower November 25, 1915, for use when gates are closed, and staff gage in three sections (datum, mean sea level). Observer, I. Pennington. For description of present staff gage and former gages see Water-Supply Paper 442.

EXTREMES OF CAPACITY.—Maximum stage recorded during year, 2,257,98 feet at 5 p. m. July 28 (capacity, 220,950 acre-feet); minimum stage recorded, 2,232.86 feet at 3.30 p. m. September 30 (capacity, 118,880 acre-feet).

1906–1917: Maximum stage recorded, 2,258.10 feet July 25, 1916 (capacity, 221,480 acre-feet); minimum stage recorded, 2,197.73 feet September 26–27, 1915 (capacity, 13,730 acre-feet).

STORAGE.—Capacity of reservoir at crest of spillway, 221,000 acre-feet (revised determination). Elevation of gate sill and spillway crest, 2,192.75 feet and 2,258.00 feet, respectively. Record of storage or release each month used for determining discharge without storage at gaging station below dam.

COOPERATION—Capacities computed by United States Reclamation Service.

Daily capacity, in acre-feet, of Kachess Lake near Easton, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	155,550	129,750	130,120	135,580	145,750	157,340	165,800	179,300	211,520	213,190	220,330	160,340
2	155,070	128,890	130,380	135,770	146,330	157,460	166,090	179,930	211,960	213,450	220,150	157,540
3	154,440	127,950	130,610	136,150	146,720	157,620	166,290	180,550	211,470	204,060	219,400	154,830
4	153,880	127,030	130,760	136,530	147,300	158,340	166,410	181,180	210,680	214,500	218,290	151,830
5	153,250	126,540	131,060	137,100	148,040	158,660	166,990	181,850	209,810	214,860	216,880	149,010
6	152,620	126,690	131,140	137,480	148,860	158,940	167,230	182,570	208,980	215,080	215,380	145,860
7	151,990	124,920	131,140	137,830	149,250	159,340	167,600	183,320	208,500	215,470	213,760	142,230
8	151,320	124,920	131,440	138,170	149,760	159,460	168,090	184,420	208,280	215,870	211,520	139,400
9	150,110	124,920	131,740	138,440	150,220	159,540	168,460	184,880	208,200	216,440	209,850	137,100
10	149,050	125,800	131,700	138,740	150,620	159,660	168,700	186,530	207,760	216,970	208,280	135,090
11	148,040	126,210	131,920	139,200	151,010	159,740	169,280	188,230	207,150	217,320	206,540	134,140
12	147,150	126,400	132,260	139,360	151,160	159,860	169,850	189,970	206,280	217,680	204,980	132,410
13	146,140	126,580	132,450	139,550	151,950	159,940	170,260	191,540	205,670	217,850	203,070	131,290
14	145,200	126,770	132,560	139,740	152,110	160,140	170,630	192,910	206,370	217,940	201,290	131,360
15	144,240	126,950	132,790	139,890	152,300	160,420	171,040	194,150	207,940	218,380	199,180	131,590
16	143,310	127,030	133,020	140,050	152,980	160,580	171,370	195,520	210,160	218,820	197,460	131,170
17	142,460	126,910	133,130	140,160	153,410	160,740	171,620	196,380	211,780	219,270	195,740	129,370
18	141,460	126,400	133,390	140,320	153,770	160,940	171,860	197,070	212,840	219,530	193,810	127,950
19	140,470	126,690	134,260	140,510	154,160	161,150	172,200	197,930	213,100	219,710	191,890	127,430
20	139,590	126,800	134,370	140,660	154,560	161,350	172,650	198,750	213,100	219,840	190,180	126,770
21	138,630	126,840	134,630	141,120	154,950	161,550	173,100	199,570	213,190	220,060	188,230	126,030
22	137,670	127,140	134,820	141,430	155,350	162,350	173,520	200,430	213,140	220,150	186,280	125,100
23	136,760	127,320	134,970	141,620	155,750	162,760	174,020	201,640	212,750	220,150	184,340	124,360
24	135,810	127,430	135,010	141,890	156,060	163,160	174,640	202,810	212,570	220,240	181,100	123,620
25	134,900	127,770	135,050	142,420	156,340	163,570	175,220	204,020	212,920	220,420	178,710	122,840
26	134,030	128,140	135,240	142,850	156,620	164,010	175,800	205,280	212,920	220,600	176,130	121,960
27	133,130	128,740	135,280	143,620	156,900	164,380	176,380	207,020	212,840	220,680	173,680	121,220
28	132,230	129,110	135,310	144,200	157,140	164,910	177,170	208,850	213,270	220,860	171,120	120,480
29	131,550	129,450	135,350	144,580	.....	165,190	177,880	210,160	213,540	220,820	168,620	119,750
30	130,950	129,930	135,430	144,850	.....	165,400	178,630	210,820	213,320	220,640	165,840	119,020
31	130,500	.....	135,430	145,050	.....	165,600	.....	211,210	.....	220,420	163,080	.....

KACHESS RIVER NEAR EASTON, WASH.

LOCATION.—In sec. 3, T. 20 N., R. 13 E., three-fourths mile below Kachess storage dam, one-fourth mile above mouth, and 2 miles northwest of Easton, Kittitas County.

DRAINAGE AREA.—64 square miles (measured on topographic maps).

RECORDS AVAILABLE.—November 20, 1903, to September 30, 1917.

GAGE.—Stevens water-stage recorder at highway bridge, installed August 15, 1916; original staff gage on left bank a quarter of a mile below Kachess storage dam was replaced by water-stage recorder at same site and datum July 22, 1913. Gage inspected by I. Pennington.

DISCHARGE MEASUREMENTS.—Made from cable half a mile above gage, or by wading.

CHANNEL AND CONTROL.—Bed at station composed of light gravel and sand; slightly shifting. One channel at all stages. Control formed by broad riffle 125 feet below gage.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.68 feet at 7 p. m. September 6 (discharge, 1,460 second-feet). Practically no flow November 11–15 and November 19 to May 7.

1904–1917: Maximum stage recorded, 8.0 feet at 8.30 a. m. November 16, 1906 (discharge, 1,760 second-feet[1]). Practically no flow when gates in dam are closed.

ICE.—No flow during winter; gates closed.

DIVERSIONS.—None.

REGULATION.—Flow controlled by storage and release of water in Kachess reservoir. Monthly discharge, without storage, determined from records of stage of reservoir.

ACCURACY.—Stage-discharge relation permanent in October and November; shifting, May 8 to August 7; permanent August 8 to end of year. Rating curves used October and November well defined; August 8 to September 30 poorly defined. Shifting-control method used May 8 to August 7. Water-stage recorder inspected daily. Daily discharge ascertained by applying mean daily gage heights to rating curve or, for days of considerable fluctuation, by averaging results obtained by applying the gage heights for shorter intervals. Records for October and November excellent; fair for rest of year.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Kachess River near Easton, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Nov. 2	Moxley and Pennington.	4.65	492	June 22	F. E. Moxley.....	6.08	1,050
May 10	.....do.....	4.47	299	22	.....do.....	6.30	1,180
June 7	F. E. Moxley.....	6.10	1,130	Aug. 8	Moxley and Pennington.	5.80	966

[1] Revised from original data. The river reached a stage of 7.5 feet November 25, 1909, and the discharge of 1,790 second-feet published for that date in Water-Supply Paper 272, p. 174, and Water-Supply Paper 369, p. 62, is probably too large.

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

Day.	Oct.	Nov.	May.	June.	July.	Aug.	Sept.
1	308	493	.....	1,170	960	236	1,350
2	308	493	.....	1,170	960	350	1,350
3	308	493	.....	1,170	860	635	1,290
4	308	493	.....	1,110	910	760	1,350
5	308	493	.....	1,110	860	960	1,350
6	308	493	.....	1,110	760	960	1,410
7	412	443	.....	1,110	660	960	1,410
8	512	246	222	1,110	660	960	1,290
9	493	167	265	1,110	660	960	1,170
10	493	52	314	1,110	660	960	960
11	493	.....	369	1,060	660	960	810
12	493	.....	350	960	660	960	760
13	493	.....	350	810	660	960	557
14	493	.....	332	560	585	960	184
15	493	.....	196	492	492	960	161
16	493	64	130	710	492	960	391
17	493	236	117	810	492	960	810
18	493	98	114	910	492	960	692
19	493	.....	114	1,060	492	960	492
20	493	.....	112	1,060	369	960	428
21	493	.....	114	1,060	314	960	428
22	493	.....	114	1,060	297	1,100	428
23	493	.....	116	1,060	236	1,230	428
24	493	.....	119	1,060	184	1,230	428
25	493	.....	119	1,060	184	1,230	428
26	493	.....	141	1,060	184	1,230	428
27	493	.....	297	1,010	196	1,230	428
28	493	.....	635	960	236	1,230	428
29	493	.....	1,010	960	281	1,290	428
30	493	.....	1,110	960	281	1,350	428
31	493	.....	1,170	.....	250	1,350	.....

Monthly discharge of Kachess River near Easton, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 64 square miles.]

Month.	Observed discharge (second-feet).			Run-off (acre-feet).			Discharge without storage (second-feet).		Run-off (depth in inches).
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Without storage.	Mean.	Per square mile.	
October	512	308	455	28,000	−25,800	2,200	35.8	0.559	0.64
November	493	0	139	8,260	− 562	7,700	129	2.02	2.25
December	0	0	0	0	+ 5,490	5,490	89.3	1.40	1.61
January	0	0	0	0	+ 9,620	9,620	156	2.44	2.81
February	0	0	0	0	+12,100	12,100	218	3.41	3.55
March	0	0	0	0	+ 8,460	8,460	138	2.16	2.49
April	0	0	0	0	+13,000	13,000	218	3.41	3.80
May	1,170	0	256	15,700	+32,600	48,300	786	12.3	14.20
June	1,170	492	999	59,400	+ 2,110	61,500	1,030	16.1	17.96
July	960	184	516	31,700	+ 7,100	38,800	631	9.86	11.37
August	1,350	236	993	61,000	−57,300	3,700	60.2	.940	1.08
September	1,410	161	750	44,600	−44,100	500	8.40	.131	.15
The year	1,410	0	344	249,000	−37,200	212,000	293	4.58	61.91

CLE ELUM LAKE NEAR ROSLYN, WASH.

LOCATION.—In sec. 10, T. 20 N., R. 14 E., at lake outlet, 4 miles northwest of Roslyn, Kittitas County, and 7½ miles northwest of Cle Elum.

DRAINAGE AREA.—202 square miles (measured on topographic maps).

RECORDS AVAILABLE.—May 4 to June 9, 1906; October 1, 1906, to September 30, 1917.

GAGE.—Water-stage recorder installed November 8, 1916. Vertical staff on left abutment of temporary crib dam, installed June 17, 1907; zero at elevation of gate sills, 2,122.75 feet. Considerable fall between lake and dam for stages below 5.0 feet. Auxiliary gages installed October, 1907, and July 16, 1915, at same datum and about 200 feet above dam used to obtain true elevation of lake at low stages. Observers, A. D. Nichols and J. G. Giddings.

EXTREMES OF CAPACITY.—Maximum stage recorded during year, 14.80 feet at 6 a. m. May 30 (capacity, 32,340 acre-feet); minimum stage recorded, 2.40 feet from 5 p. m. October 3 to 6 a. m. October 4 (capacity, 4,990 acre-feet).

1907–1917: Maximum stage recorded, 16.70 feet November 24, 1909 (capacity 37,050 acre-feet); minimum stage estimated at 1.15 feet August 31, 1906 (capacity 2,380 acre-feet).

STORAGE.—Capacity of reservoir at crest of spillway (gage height 11.3 feet), 24,100 acre-feet. Storage or release each month used for determining discharge without storage for gaging station below dam.

COOPERATION.—Capacities computed by United States Reclamation Service.

Daily capacity, in acre-feet, of Cle Elum Lake near Roslyn, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7,970	7,720	13,230	15,440	17,180	22,600	26,310	25,080	31,660	29,330	25,880	8,140
2	7,110	7,880	13,280	15,460	17,090	22,600	26,400	24,990	31,060	29,950	25,510	8,040
3	6,250	8,040	13,420	15,240	17,090	22,820	26,500	24,990	29,830	30,120	24,690	8,040
4	4,990	8,200	13,550	14,040	17,700	23,110	26,590	24,920	29,090	30,450	24,470	8,040
5	7,260	8,350	13,700	13,550	18,430	23,500	26,780	24,990	28,830	30,350	24,670	7,930
6	7,090	8,670	13,830	13,190	19,150	23,630	27,050	25,080	28,930	29,880	24,690	7,830
7	6,840	8,860	13,890	13,020	19,810	23,700	27,470	25,530	29,000	29,640	23,630	8,040
8	6,880	9,200	13,960	12,640	20,460	23,900	27,940	26,430	30,040	29,300	22,560	8,310
9	6,560	9,830	14,000	13,230	21,050	23,900	28,310	27,420	30,280	29,400	21,230	8,780
10	6,670	10,360	14,000	14,260	21,490	23,900	29,020	28,550	29,970	29,680	21,120	8,880
11	6,720	10,480	14,040	14,470	21,980	23,990	29,500	29,330	29,260	29,640	19,370	9,510
12	6,770	10,600	14,110	14,680	22,310	24,100	29,880	29,590	28,620	29,260	17,850	9,730
13	6,820	10,710	14,240	14,810	22,600	24,130	30,070	29,680	28,500	29,040	16,980	10,430
14	6,870	10,830	14,340	14,980	22,960	24,130	30,210	29,500	29,070	28,930	15,910	10,580
15	6,920	11,080	14,260	15,160	23,180	24,130	29,880	28,950	30,350	28,690	15,160	10,740
16	6,980	11,190	14,390	15,240	23,680	24,130	29,300	28,550	31,760	28,690	14,620	10,890
17	7,040	11,360	14,410	15,280	24,810	24,130	28,780	27,840	31,900	28,710	14,090	11,150
18	7,090	11,420	14,510	15,370	24,810	24,130	27,940	27,450	31,370	28,550	13,440	11,420
19	7,050	11,530	14,560	15,440	25,060	24,130	27,310	27,330	30,980	28,270	12,700	11,740
20	7,060	11,660	14,860	15,500	25,210	24,170	26,640	27,450	30,690	27,980	11,960	11,740
21	7,070	11,740	15,070	15,690	25,240	24,490	25,970	27,680	30,450	27,750	11,210	11,740
22	7,090	11,780	15,160	15,780	25,120	24,490	25,080	27,840	30,160	27,560	10,470	11,740
23	7,050	11,850	15,220	15,800	25,120	24,760	24,130	28,310	29,640	27,290	10,230	11,740
24	7,000	12,000	15,260	15,760	24,670	25,210	23,340	28,740	29,730	26,940	9,980	11,530
25	6,980	12,170	15,280	16,270	24,490	25,400	22,960	29,120	30,070	26,640	9,740	11,630
26	7,060	12,340	15,330	16,450	23,950	25,530	22,530	29,260	29,970	26,500	9,500	11,530
27	7,140	12,490	15,370	16,770	23,340	25,650	23,050	30,240	29,850	26,640	9,260	11,530
28	7,220	12,910	15,350	16,770	23,050	25,900	24,470	31,220	30,120	26,540	9,020	11,630
29	7,300	12,910	15,280	16,880	.....	26,100	25,010	31,970	30,070	26,520	8,780	11,740
30	7,440	13,060	15,260	17,440	.....	26,130	25,140	32,220	29,540	26,360	8,560	11,850
31	7,580	.....	15,310	17,630	.....	26,220	.....	31,900	.....	26,150	8,350	.....

CLE ELUM RIVER NEAR ROSLYN, WASH.

LOCATION.—In sec. 10, T. 20 N., R. 14 E., below temporary crib dam at outlet of Cle Elum Lake, 4 miles northwest of Roslyn, in Kittitas County, and 7½ miles northwest of Cle Elum.

DRAINAGE AREA.—202 square miles (measured on topographic maps).

RECORDS AVAILABLE.—October 10, 1903, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank 800 feet below temporary crib dam; installed October 14, 1913; inspected by A. D. Nichols. For description of previous gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable about 350 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of coarse gravel and boulders; shifting at high water. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 7.91 feet at 12 m. May 29 (discharge, 5,680 second-feet); minimum stage, 0.15 foot at 2 p. m. September 10 (discharge, 7 second-feet).

1904–1917: Maximum stage recorded, 14.05 feet at 2 p. m. November 15, 1906 (discharge, 18,700 second-feet); minimum stage recorded, zero at 6 p. m. September 28, 1914 (discharge practically zero).

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

DIVERSIONS.—None.

REGULATION.—Flow partly controlled by storage and release of water at Cle Elum reservoir. Monthly discharge without storage determined from records of stage at reservoir.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined up to 4,500 second-feet. Water-stage recorder inspected daily. Daily discharge ascertained by applying to rating table daily mean gage heights obtained by inspecting gage-height graph or, for days of considerable fluctuation, by averaging results obtained by applying gage heights for shorter intervals. Records excellent except for extremely high water.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Cle Elum River near Roslyn, Wash., during the year ending Sept. 30, 1917.

[Made by F. E. Moxley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Nov. 1	1.16	131	June 5	5.28	2,550
Jan. 6	2.00	347	23	5.79	3,060
May 11	6.24	3,580	Aug. 6	3.04	806

Daily discharge, in second-feet, of Cle Elum River near Roslyn, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	342	133	139	139	291	444	191	1,060	4,600	2,880	910	482
2	329	139	137	143	294	334	194	1,030	4,110	3,190	964	408
3	319	148	139	264	297	159	196	1,060	3,300	3,410	1,120	362
4	310	154	141	355	221	175	196	1,060	2,780	3,630	1,000	348
5	288	150	143	355	152	184	196	1,030	2,580	3,630	851	329
6	282	150	139	355	154	186	198	1,090	2,680	3,410	880	268
7	268	146	139	355	163	189	198	1,250	2,980	3,080	1,060	184
8	259	146	143	355	159	189	196	1,640	3,300	2,880	1,220	124
9	170	139	139	246	166	191	208	2,300	3,520	2,980	1,290	110
10	123	146	137	143	179	196	231	2,980	3,300	3,080	1,360	102
11	121	146	139	141	179	196	313	3,520	2,880	3,080	1,290	133
12	131	148	139	143	189	198	398	3,750	2,440	3,080	1,220	128
13	114	154	137	146	196	196	461	3,750	2,390	2,680	1,180	114
14	115	139	139	141	198	191	522	3,630	2,780	2,580	1,180	124
15	119	141	141	139	203	196	764	3,410	3,750	2,480	1,150	135
16	139	139	141	141	198	198	699	2,980	4,730	2,390	1,090	137
17	154	135	141	143	245	198	709	2,530	4,860	2,440	1,030	116
18	148	131	152	148	345	198	822	2,300	4,350	2,350	970	52
19	150	137	148	143	413	196	851	2,260	4,110	2,170	910	226
20	150	143	146	143	436	191	880	2,350	3,870	2,040	851	251
21	150	131	150	143	453	194	970	2,480	3,630	1,880	793	251
22	148	148	139	148	444	191	970	2,580	3,410	1,800	737	254
23	150	148	137	143	420	189	970	2,780	3,080	1,600	704	254
24	150	133	141	148	428	184	1,030	3,080	2,880	1,440	715	251
25	152	135	143	148	564	184	1,000	3,410	3,300	1,290	822	248
26	148	139	139	143	597	184	970	3,520	3,300	1,180	822	245
27	150	154	137	143	522	184	822	4,230	3,190	1,180	704	242
28	150	146	137	148	478	184	822	4,990	3,300	1,180	637	248
29	154	148	135	143	.....	191	1,030	5,530	3,410	1,220	573	256
30	154	146	135	143	.....	194	1,090	5,530	2,980	1,120	531	262
31	154	.....	135	194	.....	196	.....	4,990	.....	1,030	522	.....

Monthly discharge of Cle Elum River near Roslyn, Wash., for year ending September 30, 1917.

[Drainage area, 202 square miles.]

Month.	Observed discharge (second-feet).			Run-off (acre-feet).			Discharge without storage (second-feet).		Run-off (depth in inches).
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Without storage.	Mean.	Per square mile.	
October	342	114	184	11,300	− 457	10,800	176	0.871	1.00
November	154	131	143	8,510	+ 5,480	14,000	235	1.16	1.29
December	152	135	140	8,620	+ 2,240	10,900	177	.876	1.01
January	355	139	187	11,500	+ 2,330	13,800	224	1.11	1.28
February	597	152	307	17,000	+ 5,410	22,400	403	2.00	2.08
March	444	159	203	12,500	+ 3,170	15,700	255	1.26	1.45
April	1,090	191	603	35,900	− 1,080	34,800	585	2.90	3.24
May	5,530	1,030	2,840	175,000	+ 6,760	182,000	2,960	14.6	16.83
June	4,860	2,390	3,390	202,000	− 2,360	200,000	3,360	16.6	18.52
July	3,630	1,030	2,330	143,000	− 3,390	140,000	2,280	11.3	13.03
August	1,360	522	938	57,700	−17,800	39,900	649	3.22	3.71
September	482	52.0	221	13,200	+ 3,490	16,700	281	1.39	1.55
The year	5,530	52.0	962	696,000	+ 3,810	701,000	969	4.80	64.99

NACHES RIVER AT OAK FLAT, NEAR NILE, WASH.

LOCATION.—In sec. 34, T. 15 N., R. 16 E., just above Oak Flat, three-fourths mile above intake of Selah Valley canal, 2 miles above Tieton River, and 8 miles southeast of Nile, Yakima County.

DRAINAGE AREA.—640 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 25, 1904, to November 15, 1915; irrigation seasons 1916–17. Station discontinued October 31, 1917.

GAGE.—Stevens water-stage recorder on left bank; installed November 29, 1914; inspected by D. A. Noble and Patrick Stevens. For description of previous gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable 75 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and boulders; shifting at medium and high water; gradient steep. One channel at all stages. Stage of zero flow, about gage height 1.65 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.18 feet at 10 a. m. June 17 (discharge, 6,550 second-feet); minimum stage recorded, 3.44 feet at 10 p. m. October 23, 1917 (discharge, 171 second-feet).

1904–1917: Maximum stage recorded, 10.3 feet, determined from high-water marks during morning of November 15, 1906, when water was over gage (discharge, 21,900 second-feet); minimum stage recorded, 3.44 feet from 8 a. m. to 6 p. m. October 1, 1915 (discharge, 138 second-feet).[1]

ICE.—Record discontinued during winter.

DIVERSIONS.—Numerous small tracts irrigated above station; aggregate depletion less than 5 per cent of flow.

REGULATION.—Flow partly controlled by storage and release of water at Bumping reservoir. Monthly discharge without storage determined from records of stage at reservoir.

ACCURACY.—Stage-discharge relation changed slightly during winter period when record was discontinued. Rating curves used before the change fairly well defined; curve used after the change well defined. Water-stage recorder inspected daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Record good for October, 1916; excellent for rest of year.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Naches River at Oak Flat, near Nile, Wash., during the year ending Sept. 30, 1917.

[Made by F. E. Moxley.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Oct. 7	3.92	367	June 2	7.20	4,120
Nov. 3	3.92	330	15	7.38	4,780
Mar. 27	3.58	224	July 23	5.57	1,540
May 16	6.77	3,270	Aug. 18	4.78	861

[1] Minimum stage of 3.0 feet recorded September 18–21, 1904, not considered reliable; discharge of 139 second-feet, published in Water-Supply Paper 135, p. 97, too small. Correct discharge September 18–21, 1904, probably 180 second-feet.

Daily discharge, in second-feet, of Naches River at Oak Flat, near Nile, Wash., for the period Oct. 1, 1916, to Oct. 31, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	430	216	1,160	4,800	4,130	888	620	290
2	430	219	1,160	4,080	4,280	810	608	271
3	430	219	1,300	3,240	4,440	1,000	601	257
4	421	219	1,210	2,800	4,680	795	594	236
5	417	257	1,350	2,560	4,560	744	570	226
6	417	322	1,400	2,800	4,200	737	546	216
7	356	356	1,810	3,540	3,860	936	540	210
8	347	412	2,560	4,560	3,540	928	576	204
9	343	458	3,440	5,040	3,540	920	588	197
10	335	473	4,080	4,680	3,540	904	588	194
11	335	540	4,800	3,750	3,340	888	576	191
12	323	576	4,800	3,150	3,240	857	564	191
13	311	558	4,680	2,880	3,060	849	552	188
14	303	546	4,440	3,340	2,800	849	546	182
15	296	522	3,970	4,680	2,720	833	534	180
16	286	484	3,340	5,880	2,720	818	517	180
17	275	437	2,800	6,360	2,880	810	506	180
18	268	432	2,640	5,760	2,720	849	528	180
19	265	453	2,640	5,640	2,400	841	512	180
20	259	479	2,560	5,160	2,190	833	517	180
21	247	534	2,560	4,920	2,000	826	495	180
22	244	576	2,800	4,560	1,810	818	484	180
23	241	660	2,880	4,080	1,590	810	473	174
24	238	803	3,060	4,020	1,440	803	448	177
25	238	920	3,060	3,970	1,300	773	432	197
26	241	1,120	3,340	3,750	1,210	681	422	226
27	244	1,350	4,680	3,750	1,250	694	398	226
28	247	1,440	5,400	3,540	1,210	687	361	213
29	265	1,490	6,000	4,560	1,120	667	322	194
30	278	1,300	5,640	3,970	1,020	653	306	188
31	307	.....	5,040	.....	952	640	.....	191

Monthly discharge of Naches River at Oak Flat, near Nile, Wash., for period Oct. 1, 1916, to Oct. 31, 1917.

Month.	Observed discharge (second-feet).			Run-off (acre-feet).			Discharge without storage (second-feet).		Run-off (depth in inches).
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Without storage.	Mean.	Per square mile.	
October, 1916	430	238	311	19,100	− 4,170	14,930	243	0.380	0.44
April	1,490	216	612	36,400	+ 3,000	39,400	662	1.03	1.15
May	6,000	1,160	3,240	200,000	+20,000	220,000	3,580	5.59	6.44
June	6,360	2,560	4,190	250,000	+ 9,260	259,000	4,350	6.80	7.59
July	4,680	952	2,700	166,000	− 1,370	165,000	2,680	4.19	4.83
August	1,000	640	811	49,900	−17,900	32,000	520	.812	.94
September	620	306	511	30,400	−13,600	16,800	282	.441	.49
October, 1917	290	174	203	12,500	− 790	11,700	190	.297	.34

NACHES RIVER BELOW TIETON RIVER, NEAR NACHES, WASH.

LOCATION.—In sec. 35, T. 15 N., R. 16 E., 600 feet below Tieton River, 500 feet above intake of Wapatox power canal, and 5 miles northeast of Naches, Yakima County.

RECORDS AVAILABLE.—August 4 to October 28, 1905; March 16, 1909, to October 31, 1912; May 10 to September 30, 1915; April 13, 1916, to September 30, 1917.

DRAINAGE AREA.—942 square miles, revised value; measured on topographic maps and drainage map published in Water-Supply Paper 369.

GAGE.—Steven's water-stage recorder on left bank, installed December 7, 1916; referred to new vertical and inclined staff gage in three sections, at same datum as previous gage; inspected by O. T. Fluornoy and N. E. Wroy. Previous gages as follows: August 4 to October 28, 1905, vertical staff nailed to stump on left bank at nearly same site as present gage but at different datum; March 16, 1909, to December 7, 1916, inclined and vertical staff on left bank in two sections, 8 feet above cable; April 3, 1916, vertical staff installed to supplement inclined and vertical sections.

DISCHARGE MEASUREMENTS.—Made from cable at gage.

CHANNEL AND CONTROL.—Bed of stream composed of small boulders and gravel; shifts at extremely high water. One channel except at extremely high stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 8.30 feet at 5 a. m. June 17 (discharge, 8,440 second-feet); minimum discharge estimated at 270 second-feet on December 27, when stage-discharge relation was affected by ice.

1905; 1909–1917: Maximum stage recorded, 8.9 feet at 8 a. m. November 24, 1909 (discharge, 18,800 second-feet); minimum flow occurred on December 27, 1916.

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

REGULATION.—Flow partly controlled by storage and release of water at Bumping Lake. See record for Bumping Lake and table of monthly discharge for Bumping River near Nile, Wash.

DIVERSIONS.—Above all important diversions except Selah Valley and Tieton canals.

ACCURACY.—Stage-discharge relation changed during winter of 1915–16, when record was discontinued; affected by ice November 16–21, 1916, and December 7, 1916, to February 8, 1917; affected by backwater from head gates of Wapatox power canal October 12–21 and April 1–2. Rating curve used for 1915, fairly well defined; curves used for old and new gages in 1916 and 1917, well defined. Gage read to hundredths once daily in September, 1915; twice daily May to August, 1915, and April and May, 1916; three times daily June to November, 1916. Operation of water-stage recorder satisfactory. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good except when stage-discharge relation was affected by ice or by operation of gates of Wapatox power canal.

COOPERATION.—Maintained by United States Reclamation Service in cooperation with Pacific Power & Light Co. United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Naches River below Tieton River, near Naches, Wash., during the years ending Sept. 30, 1915 to 1917.

Date.	Made by—	Gage height.		Discharge.
		Old gage.	New gage.	
1915.		*Feet.*	*Feet.*	*Sec.-ft.*
June 23	Moxley and Taylor	2.46	.....	638
Aug. 7	F. E. Moxley	2.76	.....	819
26	Calland and Moxley	1.77	.....	314
Sept. 27	.....do	1.58	.....	269
1916.				
Apr. 3	F. E. Moxley	4.85	.....	3,530
18	.....do	5.08	.....	3,850
26	.....do	5.46	.....	4,580
May 8	.....do	6.15	.....	6,500
13	.....do	4.81	.....	3,590
20	Parker and Taylor	5.77	.....	5,450
June 10	Moxley and Taylor	6.11	.....	6,500
16	.....do	7.20	.....	9,620
Oct. 16	F. E. Moxley	2.63	.....	489
Dec. 7	.....do	1.74	1.96	325
9	.....do	1.94	2.23	421
15	.....do	.....	2.22	419
1917.		*Feet.*	*Feet.*	*Sec.-ft.*
Jan. 3	F. E. Moxley	.....	2.55	556
16	.....do	.....	3.86	480
27	.....do	.....	2.55	459
Feb. 24	.....do	.....	2.63	651
Mar. 14	.....do	.....	2.09	392
27	.....do	.....	2.05	380
May 16	.....do	.....	5.78	4,150
23	.....do	.....	5.42	3,590
June 2	.....do	.....	6.67	5,390
15	.....do	.....	7.17	6,500
July 21	.....do	.....	4.91	2,870
28	.....do	.....	3.82	1,550
Aug. 17	.....do	.....	3.11	908
31	.....do	.....	2.50	571

Daily discharge, in second-feet, of Naches River below Tieton River, near Naches, Wash., for the year ending Sept. 30, 1915.

Day.	May.	June.	July.	Aug.	Sept.	Day.	May.	June.	July.	Aug.	Sept.
1	.....	1,540	462	535	284	17	1,210	980	420	363	244
2	.....	1,370	485	620	284	18	1,310	715	420	329	220
3	.....	1,260	535	650	244	19	1,370	650	420	314	314
4	.....	1,160	590	823	220	20	1,260	590	462	298	298
5	.....	1,310	980	750	220	21	1,160	535	535	298	270
6	.....	1,420	563	750	198	22	1,110	563	510	590	270
7	.....	1,310	510	785	188	23	1,060	590	485	363	257
8	.....	1,160	400	860	188	24	1,060	650	355	246	244
9	.....	940	420	940	209	25	1,020	535	563	329	270
10	2,200	823	440	440	232	26	980	510	590	314	244
11	1,920	750	462	400	244	27	1,020	485	590	314	270
12	1,660	715	462	381	270	28	1,920	440	590	298	270
13	1,540	715	510	329	270	29	1,660	420	650	485	244
14	1,370	785	462	346	244	30	1,540	420	590	314	232
15	1,260	715	420	563	232	31	1,420	.....	563	329	.....
16	1,110	900	440	381	232						

Daily discharge, in second-feet, of Naches River below Tieton River, near Naches, Wash., for the year ending Sept. 30, 1916.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	5,650	4,590	5,050	2,590	1,160	17	4,370	4,260	10,600	5,530	1,440	694
2	.....	7,150	4,820	7,890	2,500	1,070	18	4,040	4,480	11,600	4,820	1,200	713
3	.....	8,360	5,170	10,300	2,410	1,040	19	3,430	5,290	11,000	4,150	1,040	632
4	.....	9,960	6,720	8,360	2,320	1,070	20	3,160	5,530	8,680	4,150	950	644
5	.....	9,960	6,440	6,860	2,180	1,000	21	3,160	5,290	6,720	4,370	927	632
6	.....	9,320	5,910	6,040	2,060	965	22	2,990	5,050	5,780	4,150	1,130	609
7	.....	7,890	6,040	5,530	1,940	883	23	2,750	4,480	5,910	3,730	1,160	496
8	.....	6,720	6,720	6,310	1,940	806	24	2,830	4,040	6,720	3,530	1,220	471
9	.....	5,530	7,440	7,590	2,000	537	25	3,430	3,940	7,000	3,340	1,250	592
10	.....	4,700	6,720	7,150	1,940	752	26	4,700	4,590	7,290	3,070	1,210	669
11	.....	4,150	5,780	6,440	1,820	746	27	5,910	5,530	7,740	2,680	1,130	706
12	.....	3,730	5,530	7,000	1,760	723	28	5,910	6,040	6,580	2,600	1,160	663
13	4,150	3,430	6,170	7,440	1,880	726	29	5,050	5,530	5,530	2,530	1,160	580
14	4,930	3,250	7,290	6,040	1,880	706	30	5,050	4,930	5,050	2,390	1,150	558
15	5,050	3,430	8,680	5,530	1,700	688	31	.....	4,700	.....	2,680	1,110	.....
16	4,700	3,730	9,640	5,530	1,590	700							

Daily discharge, in second-feet, of Naches River below Tieton River, near Naches, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	537	537	373			511	360	1,530	6,660	5,130	1,080	585
2	553	531	380			460	369	1,480	5,810	5,470	1,000	521
3	553	586	384			511	360	1,630	4,800	5,980	1,200	532
4	537	650	384			501	369	1,530	4,000	6,320	1,000	521
5	537	609	380	480	530	490	441	1,730	3,700	6,150	935	490
6	417	575	350			470	526	1,780	4,000	5,810	970	470
7	462	537				460	580	2,300	5,130	5,300	1,080	526
8	471	511				436	657	3,100	6,490	4,800	1,080	585
9	471	569			521	422	733	4,160	7,000	4,960	1,040	596
10	453	713			501	413	782	5,300	6,320	5,130	1,000	607
11	458	592	420		537	399	870	6,150	5,300	4,640	935	563
12		369			480	399	870	6,150	4,320	4,640	970	516
13	470	307		410	475	386	806	5,810	4,160	4,480	935	480
14		380			460	369	838	5,470	4,800	4,000	970	490
15		422			490	360	794	5,130	6,320	3,920	970	532
16	489				675	348	675	4,160	7,900	3,920	935	480
17					838	356	640	3,620	8,260	4,160	935	470
18					733	377	612	3,250	7,540	3,770	935	501
19	450	420	400		675	373	635	3,250	7,360	3,400	935	475
20					652	373	698	3,100	6,830	3,100	903	485
21				620	618	369	800	3,250	6,490	2,750	870	451
22	413	426			618	360	806	3,400	6,150	2,360	838	432
23	413	422			640	373	970	3,550	5,470	2,180	838	413
24	409	435			640	377	1,080	4,000	5,300	1,780	806	404
25	409	430			698	391	1,340	4,000	5,470	1,580	870	369
26	413	401	420		663	356	1,630	4,480	5,130	1,530	769	369
27	417	444		460	596	364	1,890	5,980	5,130	1,530	757	373
28	426	430			547	391	1,950	7,000	5,810	1,530	692	348
29	426	409			.....	381	2,000	7,900	5,980	1,430	618	327
30	462	396			.....	356	1,730	7,540	5,300	1,380	590	364
31	506	.....			.....	360	.....	6,830	.....	1,200	563	.....

NOTE.—Stage-discharge relation affected by backwater from Wapatox power canal October 12–21 and April 1 and 2; discharge October 16 obtained from current-meter measurement; discharge October 12–15 and 17–21 estimated by interpolation; discharge April 1 and 2 estimated. Stage-discharge relation affected by ice November 16–21 and December 6 to February 8; flow estimated from discharge measurements, observer's notes, and weather records.

Monthly discharge of Naches River below Tieton River, near Naches, Wash., for the years ending Sept. 30, 1915-1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
1915.				
May 10–31	2,200	980	1,370	59,800
June	1,540	420	832	49,500
July	980	400	518	31,900
August	940	298	479	29,400
September	314	188	247	14,700
The period	2,200	188	649	185,000
1915–16.				
Apr 13–30	5,910	2,750	4,200	150,000
May	9,960	3,250	5,510	338,000
June	11,600	4,590	7,000	416,000
July	10,300	2,390	5,250	323,000
August	2,590	927	1,600	98,600
September	1,160	471	741	44,100
The period	11,600	471	4,040	1,370,000

Monthly discharge of Naches River below Tieton River, near Naches, Wash., for the years ending Sept. 30, 1915–1917—Continued.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
1916–17.				
October	553	409	463	28,500
November	713	307	473	28,100
December	.....	.....	406	25,000
January	.....	.....	496	30,500
February	.....	.....	582	32,300
March	511	348	403	24,800
April	2,000	360	894	53,200
May	7,900	1,480	4,150	255,000
June	8,260	3,700	5,760	343,000
July	6,320	1,200	3,690	227,000
August	1,200	563	904	55,600
September	607	327	476	28,300
The year	8,260	.....	1,560	1,130,000

BUMPING LAKE NEAR NILE, WASH.

LOCATION.—At storage dam at outlet of Bumping Lake, 12 miles above American River and 19 miles west of Nile, Yakima County.

DRAINAGE AREA.—68 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 27 to November 22, 1909; November 3, 1910, to September 30, 1917.

GAGE.—Vertical staff on face of gate tower; datum, mean sea level. Prior to November 3, 1910, vertical staff on north shore of lake, one-fourth mile above outlet, at different datum. Gage read to hundredths twice daily by J. H. Nelson.

EXTREMES OF CAPACITY.—Maximum stage recorded during year, 3,427.95 feet June 17 (capacity, 36,290 acre-feet); minimum stage recorded, 3,392.95 feet March 8 (capacity, 2,510 acre-feet).

1911–1917: Maximum stage recorded, 3,428 feet July 9, 1915 (capacity, 36,730 acre-feet); minimum stage recorded, 3,391 feet February 12–15, 1916 (capacity, 1,260 acre-feet).[1]

STORAGE.—Capacity of reservoir at crest of spillway, 33,700 acre-feet. Elevation of gate sill and spillway crest, 3,389 feet and 3,426 feet, respectively. Storage or release each month used for determining discharge without storage for gaging station below dam.

COOPERATION.—Capacities computed by United States Reclamation Service.

[1] Minimum storage, 775 acre-feet, published in preceding water-supply papers is incorrect, as it was determined from poorly defined storage table published in Water-Supply Paper 312.

Daily capacity, in acre-feet, of Bumping Lake near Nile, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	11,110	7,100	5,530	5,530	2,880	2,680	3,770	7,060	28,180	35,690	34,360	15,940
2	11,010	7,100	5,670	5,390	2,720	2,640	3,790	7,330	29,710	35,820	34,430	15,340
3	10,860	7,170	5,740	5,200	2,660	2,610	3,820	7,600	30,920	35,890	34,300	14,760
4	10,750	7,170	5,880	5,150	3,090	2,610	3,860	7,840	31,880	35,950	34,030	14,210
5	10,600	7,170	6,040	5,320	3,190	2,590	3,920	8,030	32,830	36,020	33,970	13,710
6	10,510	7,170	6,180	5,480	3,310	2,540	4,000	8,440	33,840	35,950	33,860	13,220
7	10,380	7,170	6,310	5,440	3,390	2,540	4,060	8,910	34,730	35,890	33,220	12,700
8	10,220	7,130	6,310	5,440	3,470	2,510	4,130	9,530	35,350	35,820	32,650	12,160
9	10,110	7,100	6,350	5,460	3,580	2,540	4,190	10,190	35,620	35,820	31,970	11,740
10	9,950	7,100	6,350	5,410	3,670	2,570	4,250	10,730	35,580	35,890	31,330	11,340
11	9,790	7,080	6,380	5,340	3,790	2,610	4,330	11,440	35,420	35,820	30,700	10,910
12	9,630	6,970	6,440	5,260	3,930	2,610	4,440	12,280	35,350	35,820	30,040	10,400
13	9,480	6,940	6,450	5,170	4,060	2,640	4,520	13,150	35,290	35,690	29,400	9,890
14	9,320	6,630	6,450	4,960	4,190	2,700	4,600	13,890	35,290	35,620	28,670	9,430
15	9,170	6,310	6,490	4,710	4,190	2,800	4,690	14,530	35,690	35,620	27,960	8,970
16	9,010	6,020	6,490	4,240	4,220	2,960	4,760	15,150	36,060	35,620	27,280	8,560
17	8,940	5,790	6,590	3,830	4,250	3,000	4,810	15,680	36,290	35,620	26,570	8,120
18	8,780	5,490	6,680	3,490	4,290	3,060	4,860	15,980	36,250	35,550	25,710	7,620
19	8,630	5,130	6,820	3,220	4,320	3,060	4,930	16,370	36,200	35,450	24,970	7,150
20	8,480	4,940	6,890	3,050	4,320	3,140	5,000	16,680	36,060	35,320	24,170	6,650
21	8,330	4,720	6,990	2,920	4,310	3,200	5,050	17,110	35,930	35,220	23,460	6,240
22	8,180	4,590	7,080	2,790	4,200	3,260	5,150	17,700	35,820	35,050	22,680	5,820
23	8,030	4,450	7,130	2,680	3,980	3,340	5,260	18,110	35,690	34,960	21,980	5,210
24	7,880	4,450	7,170	3,090	3,770	3,390	5,440	18,520	35,750	34,820	21,110	4,620
25	7,750	4,600	7,170	3,270	3,320	3,460	5,720	19,030	35,820	34,690	20,340	4,240
26	7,590	4,710	7,110	3,390	3,080	3,490	5,980	19,730	35,690	34,620	19,730	3,860
27	7,470	4,780	6,970	3,420	2,920	3,520	6,210	20,560	35,750	34,620	19,030	3,620
28	7,330	4,860	6,660	3,460	2,800	3,560	6,440	22,240	35,850	34,560	18,390	3,320
29	7,200	5,130	6,370	3,440	.....	3,590	6,590	23,400	35,950	34,560	17,700	3,110
30	7,100	5,390	6,070	3,360	.....	3,650	6,740	24,960	35,790	34,490	17,110	2,880
31	7,110	.....	5,810	3,030	.....	3,730	.....	26,530	.....	34,430	16,490	.....

BUMPING RIVER NEAR NILE, WASH.

LOCATION.—A quarter of a mile below spillway of Bumping Lake dam, half a mile below outlet conduit through storage dam, 11½ miles above American River, and 19 miles west of Nile, Yakima County.

DRAINAGE AREA.—68 square miles (measured on topographic maps).

RECORDS AVAILABLE.—June 13 to July 31, 1906; April 27, 1909, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank one-fourth mile below spillway of storage dam; installed June 17, 1913; inspected by J. H. Nelson. For description of previous gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable about 40 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of large angular rocks and gravel; shifts at extremely high water. Riffle control 60 feet below gage. Stage of zero flow, about gage height 0.6 foot.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.11 feet at 10 a. m. June 17 (discharge, 1,610 second-feet); minimum stage recorded, 0.88 foot at 9.15 a. m. January 25 (discharge, 0.8 second-foot).

1906 and 1909–1917: Maximum stage recorded, 7.0 feet November 14, 1906 (discharge about 4,300 second-feet); practically no flow when gates in outlet conduit are closed.

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

DIVERSIONS.—None.

REGULATION.—Flow partly controlled by storage and release of water at Bumping reservoir. Monthly discharge without storage determined from records of stage at reservoir.

ACCURACY.—Stage-discharge relation for medium stage changed slightly on June 18. Rating curves well defined below 1,000 second-feet. Water-stage recorder inspected daily. Daily discharge ascertained by applying the mean daily gage height to rating table except for days of considerable fluctuation, for which mean gage heights for shorter intervals were applied to rating table. Records excellent.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Bumping River near Nile, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 5	F. E. Moxley	2.37	167	Aug. 2	F. E. Moxley	3.27	500
5	Moxley and Taylor	1.40	16.3	2	do	3.53	648
Aug. 1	Moxley and Thomas	2.86	306	Sept. 26	do	2.59	202
1	F. E. Moxley	2.59	219	27	Taylor and Moxley	2.50	190

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

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	167	136	2.0	193	124	124	38.8	59.8	263	1,180	251	417
2	167	124	1.9	188	104	112	42.4	59.8	263	1,250	399	393
3	167	124	1.9	139	73.2	104	43.8	61.4	253	1,380	383	388
4	167	124	2.0	59.3	2.0	100	45.2	63.0	249	1,410	276	374
5	124	124	2.0	3.6	1.5	100	48.0	64.6	249	1,410	269	348
6	167	126	2.0	40.6	1.5	92.8	49.4	66.2	253	1,340	428	348
7	165	116	58.1	76.4	1.5	85.4	49.4	67.8	473	1,280	566	348
8	165	122	52.2	81.8	1.5	58.0	49.4	74.6	930	1,180	572	348
9	163	124	52.2	83.6	1.4	35.5	49.4	81.8	1,150	1,250	566	343
10	163	122	50.8	83.6	1.4	35.5	50.8	89.0	1,120	1,280	555	339
11	163	124	49.4	83.6	1.3	35.5	50.8	195	961	1,220	555	339
12	163	110	48.0	83.6	1.3	36.6	50.8	280	840	1,220	555	339
13	161	163	48.0	129	1.3	36.6	50.8	294	811	1,150	555	339
14	158	227	48.0	180	26.3	36.6	52.2	302	900	1,090	566	335
15	158	230	48.0	240	43.8	34.4	53.6	302	1,310	1,090	566	322
16	158	233	22.4	263	45.2	33.3	55.0	302	1,540	1,090	555	310
17	158	230	1.7	243	45.2	32.2	55.0	305	1,570	1,120	572	330
18	156	227	8.0	198	46.6	33.3	55.2	305	1,540	1,050	577	343
19	154	227	1.8	167	64.6	34.4	55.2	309	1,510	961	572	348
20	149	221	1.6	149	69.4	34.4	55.0	313	1,440	870	566	348
21	149	198	1.5	138	110	35.5	42.4	317	1,340	781	555	343
22	149	163	28.4	116	149	36.6	43.8	321	1,280	712	555	322
23	149	151	52.2	54.8	149	38.8	45.2	324	1,150	599	560	287
24	149	60.2	52.2	85.4	187	38.8	46.6	332	1,220	518	566	269
25	149	2.8	52.2	.9	198	36.6	50.8	340	1,250	461	502	243
26	149	2.4	85.4	12.7	172	35.5	53.6	352	1,180	441	466	214
27	149	2.2	182	49.4	154	36.6	56.6	365	1,220	451	471	186
28	149	2.0	204	48.0	136	36.6	59.8	382	1,340	426	466	174
29	149	2.0	204	58.2	.....	37.7	61.4	399	1,340	397	461	151
30	147	2.0	198	118	.....	37.7	59.8	373	1,220	356	446	132
31	145	.....	193	145	.....	37.7	.....	266	.....	322	426	.....

Monthly discharge of Bumping River near Nile, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 68 square miles.]

Month.	Observed discharge (second-feet).			Run-off (acre-feet).			Discharge without storage (second-feet).		Run-off (depth in inches).
	Maximum.	Minimum.	Mean.	Observed.	Stored.	Without storage.	Mean.	Per square mile.	
October	167	124	156	9,570	− 4,170	5,400	87.8	1.29	1.49
November	233	2.0	127	7,570	− 1,720	5,850	98.3	1.45	1.62
December	204	1.5	56.4	3,470	+ 414	3,880	63.1	.928	1.07
January	263	.9	113	6,960	− 2,780	4,180	68.0	1.00	1.15
February	198	1.3	68.3	3,790	− 227	3,560	64.1	.943	.98
March	124	32.2	51.7	3,180	+ 931	4,110	66.8	.982	1.13
April	61.4	38.8	50.7	3,020	+ 3,000	6,020	101	1.49	1.66
May	399	59.8	238	14,600	+19,800	34,400	559	8.22	9.48
June	1,570	249	1,010	59,800	+ 9,260	69,100	1,160	17.1	19.08
July	1,410	322	945	58,100	− 1,370	56,700	922	13.6	15.68
August	577	251	496	30,500	−17,900	12,600	205	3.01	3.47
September	417	132	311	18,500	−13,600	4,900	82.3	1.21	1.35
The year	1,570	.9	303	219,000	− 8,400	211,000	291	4.28	58.16

TIETON RIVER AT HEADWORKS OF TIETON CANAL, NEAR NACHES, WASH.

LOCATION.—In sec. 30, T. 14 N., R. 15 E. (unsurveyed), below intake of Tieton canal, 15 miles above mouth, and 16 miles southwest of Naches, Yakima County.

DRAINAGE AREA.—240 square miles (measured on topographic maps).

RECORDS AVAILABLE.—April 17 to September 17, 1906 (fragmentary gage-height record); July 5, 1907, to September 30, 1917.

GAGE.—Friez water-stage recorder on right bank about 1,000 feet below intake of Tieton canal; inspected by employees of United States Reclamation Service. For description of previous gages see Water-Supply Paper 442.

DISCHARGE MEASUREMENTS.—Made from cable about 500 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and boulders; shifts slightly at high water; gradient steep. One channel at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 5.48 feet at 7 a. m. June 17 (discharge, 2,280 second-feet); minimum stage, 1.96 feet at 11 a. m. September 25 (discharge, 46 second-feet).

1907–1917: Maximum stage, 7.15 feet at 4 a. m. November 24, 1909 (discharge about 5,400 second-feet); minimum stage, 1.30 feet at 8 p. m. July 15, 1915 (discharge, 19 second-feet).

ICE.—Record discontinued during winter.

DIVERSIONS.—Tieton canal has diverted water above the gage since 1910. Diversions through canal added to mean monthly flow to determine natural monthly discharge.

REGULATION.—Flow slightly regulated by storage and release of water at Clear Creek reservoir about 15 miles above gage. Purpose of regulation to obviate diurnal fluctuation during irrigation season.

ACCURACY.—Stage-discharge relation for low water changed slightly during winter. Rating curve used before the change well defined; curve used after the change well defined above 150 second-feet. Water-stage recorder inspected twice daily during irrigation season and once or twice a week during rest of year. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Discharge measurements of Tieton River at headworks of Tieton canal, near Naches, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 9	F. E. Moxley	2.81	222	June 1	F. E. Moxley	4.91	1,630
Nov. 9	Taylor and Moxley	2.95	299	14	do	4.38	1,170
Apr. 4	F. E. Moxley	2.63	179	July 24	do	3.47	523
5	do	2.76	223	Aug. 16	do	2.72	193
May 15	do	4.40	1,160	Sept. 1	do	2.16	64.8

Daily discharge, in second-feet, of Tieton River at headworks of Tieton canal, near Naches, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	289	.....	496	1,670	1,300	381	87.0
2	289	.....	469	1,430	1,430	350	61.0
3	289	166	485	1,140	1,670	350	72.2
4	285	184	443	1,020	1,780	341	66.6
5	248	218	475	990	1,720	308	59.9
6	182	235	519	1,100	1,570	300	70.8
7	204	248	690	1,380	1,380	292	124
8	231	285	928	1,830	1,260	242	131
9	231	292	1,100	1,880	1,480	215	131
10	231	296	1,260	1,520	1,430	190	126
11	228	316	1,430	1,220	1,300	178	108
12	228	308	1,380	1,020	1,300	202	78.6
13	228	292	1,300	990	1,260	202	70.8
14	228	296	1,300	1,220	1,140	209	116
15	228	270	1,220	1,670	1,180	212	126
16	238	231	1,020	2,060	1,220	206	110
17	242	209	875	2,180	1,380	215	110
18	235	212	773	1,880	1,220	215	119
19	222	225	751	1,880	1,100	212	106
20	216	255	737	1,720	990	199	110
21	216	285	787	1,720	853	202	87.6
22	210	292	816	1,620	751	166	76.8
23	207	350	875	1,340	670	166	87.6
24	207	381	950	1,380	541	166	59.9
25	207	510	950	1,380	507	215	50.0
26	210	588	1,060	1,260	513	206	78.6
27	225	625	1,340	1,300	530	189	112
28	228	625	1,720	1,520	530	144	101
29	235	606	1,880	1,520	502	97.2	75
30	235	530	1,830	1,300	454	97.2	144
31	255	.....	1,670	.....	438	81.4	.....

Combined monthly discharge of Tieton River and canal at headworks of Tieton canal, near Naches, Wash., for the year ending Sept. 30, 1917.

[Drainage area, 240 square miles.]

Month.	Discharge in second-feet.						Combined run-off.	
	Combined.				River (mean).	Canal (mean).	Depth in inches.	Acre-feet.
	Maximum.	Minimum.	Mean.	Per square mile.				
October	289	182	232	0.0	232	0.967	1.11	14,300
April 3–30	725	166	333	53.6	387	1.61	1.68	21,500
May	2,170	608	1,020	241	1,260	5.25	6.05	77,500
June	2,460	1,280	1,470	273	1,740	7.25	8.09	104,000
July	2,070	724	1,080	288	1,370	5.71	6.58	84,200
August	667	370	218	283	501	2.09	2.41	30,800
September	420	237	95.2	239	334	1.39	1.55	19,900

TIETON CANAL NEAR NACHES, WASH.

LOCATION.—In sec. 30, T. 14 N., R. 15 E. (unsurveyed), below canal intake and about 16 miles southwest of Naches, Yakima County.

RECORDS AVAILABLE.—Irrigation seasons 1910 to 1917.

GAGE.—Float gage installed in a stilling well about 500 feet below canal intake; read by Fullbright, Painter, and Douglas.

DISCHARGE MEASUREMENTS.—Made from a gaging bridge 30 feet below gage or by wading.

CHANNEL AND CONTROL.—Earth section merging into concrete-lined section 1,000 feet below gage.

EXTREMES OF DISCHARGE.—Irrigation seasons 1910–1917: Maximum stage recorded, 4.70 feet July 12–17, 1917 (discharge, 291 second-feet); no water in canal during nonirrigating season.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Canal diverts water from right bank of Tieton River in sec. 30, T. 14 N., R. 15 E. Water is used for irrigation.

Discharge measurements of Tieton canal near Naches, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
May 15	F. E. Moxley	4.30	263	June 29	F. E. Moxley	4.72	289
24	Moxley and Taylor	4.62	279	July 24	do	4.63	287
June 1	F. E. Moxley	4.66	292	Aug. 16	do	4.72	289
8	do	2.16	101	Sept. 1	do	4.63	287
14	do	4.67	284				

Daily discharge, in second-feet, of Tieton canal near Naches, Wash., for the year ending Sept. 30, 1917.

Day.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1			121	289	288	286	289
2			140	285	288	286	289
3			151	286	288	286	289
4			165	289	288	286	289
5			165	288	288	286	289
6			177	289	288	286	288
7			195	289	288	286	289
8			195	0	288	286	289
9			206	173	288	286	283
10			218	279	288	286	283
11			234	278	288	286	283
12		30	234	285	291	285	274
13		30	234	286	291	283	264
14		40	234	286	291	283	264
15		50	258	285	291	283	176
16		50	266	286	291	283	228
17		60	278	285	291	281	229
18	100	70	278	285	288	283	228
19	100	80	278	286	288	283	226
20	100	90	278	288	285	283	216
21	100	100	288	288	286	281	216
22	100	100	288	288	285	281	216
23	100	100	288	288	285	274	216
24	100	100	285	288	286	279	187
25	100	100	285	288	286	266	187
26	100	100	285	288	288	269	187
27		100	288	288	288	283	187
28		100	288	288	286	286	174
29		100	288	286	286	288	174
30		100	286	283	286	288	174
31			286		286	289	

Monthly discharge of Tieton canal near Naches, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
November 18–26	100	100	100	1,780
April 12–30	100	30	79	2,980
May	288	121	241	14,800
June	289	0	273	16,200
July	291	285	288	17,700
August	289	266	283	17,400
September	289	174	239	14,200

NORTH FORK OF AHTANUM CREEK NEAR TAMPICO, WASH.

LOCATION.—In NW. ¼ sec. 2, T. 12 N., R. 15 E., at Prior ranch, 100 feet below Nasty Creek and 3½ miles northwest of Tampico, Yakima County.

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

RECORDS AVAILABLE.—August 26, 1907, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank about 300 feet southeast of ranch house; installed September 6, 1916. Previous gages as follows: August 26, 1907, to April 1, 1913, and August 20, 1915, to September 5, 1916, vertical staff at same site and datum as present gage: April 2, 1913, to August 19, 1915, Stevens water-stage recorder at same site and datum. Recorder inspected by F. W. Schott.

DISCHARGE MEASUREMENTS.—Made from gaging bridge 40 feet below gage or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and boulders. Banks high; not subject to overflow. Concrete control 50 feet below gage installed in November, 1915. Stage of zero flow since construction of control, gage height 1.45 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 3.60 feet at midnight June 7 and 8 (discharge, 412 second-feet); minimum stage recorded, 1.60 feet at noon November 12 (discharge, 7.0 second-feet).

1907–1917: Maximum stage recorded, 4.60 feet at 9 a. m. June 18, 1916 (discharge, 728 second-feet); minimum stage recorded that of November 12, 1916.

ICE.—Stage-discharge relation seriously affected by ice. Record discontinued during ice season.

DIVERSIONS.—Station is above all diversions.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined. Mean daily stage determined by inspecting graph. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent.

Discharge measurements of North Fork of Ahtanum Creek near Tampico, Wash., during the year ending Sept. 30, 1917.

Date	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*			*Feet.*	*Sec. ft.*
Mar. 5	C. G. Paulsen	1.81	20.6	July 24	C. G. Paulsen	2.19	59.5
Apr. 25	do	*2.20	59.5	Sept. 4	Lasley Lee	1.87	24.4
May 28	do	3.30	317				

Daily discharge, in second-feet, of North Fork of Ahtanum Creek near Tampico, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	30	30	27		.....	20	63	316	209	45	25
2	31	30	27	23	.....	21	63	277	207	44	25
3	32	29	27		.....	21	68	238	215	42	25
4	32	33	27		.....	23	70	222	220	40	25
5	32	30	27	23	21	32	80	238	202	39	24
6	32	29	23	23	20	32	89	274	184	38	23
7	32	30	20	22	20	34	122	343	169	38	23
8	31	30	26	21	20	39	172	382	160	37	28
9	31	32	23	21	20	40	199	370	157	36	33
10	31	30	26	21	20	39	217	311	148	35	31
11	30	23	26	20	20	44	246	272	133	34	28
12	30	10	28	19	20	46	235	255	126	33	25
13	30	11	26	11	20	45	228	260	117	33	23
14	29	18	22	.....	21	46	233	283	111	32	22
15	29	24	20	.....	20	42	230	319	104	32	23
16	28	26	26	.....	19	40	199	349	100	32	23
17	28	31	26	.....	20	36	184	340	93	32	22
18	29	34	26	.....	20	36	169	314	85	32	22
19	29	33	25	.....	20	36	169	314	78	30	22
20	29	31	24	.....	19	37	167	297	73	29	22
21	29	29	24	.....	19	40	176	283	70	28	22
22	28	30	22	.....	19	40	174	260	66	28	21
23	28	29	22	.....	19	44	189	244	61	28	21
24	29	28	24	.....	19	50	204	246	57	27	20
25	29	28	24	.....	19	62	225	230	55	28	20
26	29	28	23	.....	19	71	260	220	55	27	20
27	28	32		.....	20	76	305	225	52	26	20
28	28	31		.....	21	76	349	246	52	26	20
29	29	30	18	.....	26	76	376	238	51	26	20
30	29	29		.....	23	68	346	215	48	25	20
31	32	.....		.....	22	.....	322	.....	47	25	.....

NOTE.—Recorder not operating Dec. 27 to Jan 4; discharge estimated by hydrographic comparison with Toppenish, Simcoe, and Satus creeks and study of weather records. No gage-height record July 22 and 23; discharge interpolated.

Monthly discharge of North Fork of Ahtanum Creek near Tampico, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean	
October	32	28	29.8	1,830
November	34	10	28.0	1,670
December	28	.....	23.6	1,450
January 1–13	.....	.....	21.0	541
March 5–31	26	19	20.2	1,080
April	76	20	43.7	2,600
May	376	63	198	12,200
June	382	215	279	16,600
July	220	47	113	6,950
August	45	25	32.5	2,000
September	33	20	23.2	1,380

SOUTH FORK OF AHTANUM CREEK AT CONRAD RANCH, NEAR TAMPICO, WASH.

LOCATION.—In W. ½ sec. 23, T. 12 N., R. 15 E., at Conrad ranch, 2½ miles above junction with North Fork and 2¾ miles southwest of Tampico, Yakima County.

DRAINAGE AREA.—26 square miles (measured on topographic maps and Plate I, Water Supply Paper 369).

RECORDS AVAILABLE.—March 15, 1915, to September 30, 1917.

GAGE.—Vertical staff on left bank about 75 feet from ranch house; read by Mrs. W. B. Conrad.

DISCHARGE MEASUREMENTS.—Made by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and sand. Banks high and wooded. Concrete control 7 feet below gage. Stage of zero flow determined September 6, 1916, and September 4, 1917, gage height 1.2 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during the year, 2.45 feet 7.15 p. m. May 29 (discharge, 100 second-feet); minimum stage occurred in November when stage-discharge relation was affected by ice.

1915–1917: Maximum stage recorded, 3.10 feet June 19, 1916 (discharge, 216 second-feet); minimum stage recorded, 0.60 foot September 25–26, 1915 (discharge, 4.3 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, record of flow of the North Fork, and weather records. Record discontinued from December 1 to March 31.

DIVERSIONS.—Small ditch diverting above gage supplies water to Conrad's hop fields.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent; affected by ice November 12–18. Rating curve well defined. Gage read to hundredths twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records excellent except for period when stage-discharge relation was affected by ice.

Discharge measurements of South Fork of Ahtanum Creek at Conrad ranch, near Tampico, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Mar. 5	C. G. Paulsen	1.52	6.85	July 24	C. G. Paulsen	1.68	14.3
Apr. 25	do	1.78	23.0	Sept. 4	Lasley Lee	1.55	7.67
May 28	do	2.23	71.5				

Daily discharge, in second-feet, of South Fork of Ahtanum Creek at Conrad ranch, near Tampico, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Apr.	May.	June.	July.	Aug.	Sept.
1	11.1	10.5	8.7	23	74	40	11.6	8.3
2	11.6	9.9	8.7	21	69	35	11.6	8.3
3	11.6	9.9	8.7	23	57	31	11.1	8.3
4	11.1	9.9	8.7	22	50	31	11.6	8.0
5	11.1	9.9	12.8	23	48	31	11.6	8.0
6	11.6	10.5	12.8	25	58	30	11.6	8.0
7	11.1	9.9	12.8	33	74	29	11.6	8.0
8	10.5	9.9	14.0	37	86	26	10.5	9.1
9	10.5	10.5	15.1	40	83	25	9.5	10.5
10	10.5	9.5	15.7	42	76	23	9.5	9.5
11	9.9	9.5	17.4	48	73	23	9.5	8.7
12	10.5		17.4	48	64	21	9.5	8.7
13	10.5	6.0	16.5	47	61	21	9.5	8.7
14	10.5		16.5	46	67	18.2	9.5	8.7
15	9.9		15.7	44	76	19.8	9.5	8.7
16	9.9		14.5	40	90	18.2	9.5	8.7
17	9.9	11.5	13.4	37	86	18.2	9.1	8.7
18	9.9		13.4	35	76	16.5	9.1	8.7
19	9.9	10.5	12.8	33	76	18.2	9.1	8.7
20	10.5	9.9	14.0	31	70	16.5	9.5	8.7
21	9.9	9.9	14.0	33	64	15.1	9.1	8.7
22	9.9	9.5	15.1	35	62	14.0	8.7	8.0
23	9.9	9.5	16.5	37	60	14.0	8.7	8.0
24	9.9	9.5	17.4	40	55	14.5	8.7	8.3
25	9.9	9.5	22	48	50	14.0	8.7	8.3
26	9.9	9.5	24	57	47	15.1	8.7	8.3
27	9.9	11.6	25	64	46	14.0	8.7	8.3
28	9.5	10.5	26	78	44	14.0	8.3	8.0
29	10.5	9.9	25	94	44	12.8	8.7	8.0
30	10.5	9.9	23	86	42	12.8	8.7	8.0
31	10.5	.....	.....	79	.....	12.2	8.7	.....

NOTE.—Stage-discharge relation affected by ice Nov. 12–18; flow estimated from observer's notes, record of flow of the North Fork, and weather records.

Monthly discharge of South Fork of Ahtanum Creek at Conrad ranch, near Tampico, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	11.6	9.5	10.4	640
November	.....	.....	9.60	571
April	26	8.7	15.9	946
May	94	21	43.5	2,670
June	90	42	64.3	3,830
July	40	12.2	20.8	1,280
August	11.6	8.3	9.67	595
September	10.5	8.0	8.50	506

NEW RESERVATION CANAL AT PARKER, WASH.

LOCATION.—In sec. 20, T. 12 N., R. 19 E., about a mile below intake of canal, three-fourths mile northwest of Parker, Yakima County, and 5½ miles northwest of Wapato.

RECORDS AVAILABLE.—Irrigation seasons 1904 to 1917.

GAGE.—Vertical staff at highway bridge a quarter of a mile below intake; installed before opening of irrigation season in 1917. Gages previously used as follows: Prior to April 1, 1911, gage about a mile below intake; April 1, 1911, to April 26, 1916, about three-fourths mile below intake; April 26 to October 14, 1916, at highway bridge about a mile below intake. Gage read by G. M. Bougher.

DISCHARGE MEASUREMENTS.—Made from highway bridge.

CHANNEL AND CONTROL.—Bed composed of gravel and small stones. Channel at times obstructed by aquatic plants. Operation of checks below gage renders control unstable.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 6.14 feet July 3 (discharge, 869 second-feet); canal dry October 15 to April 17.

1904–1917: Maximum stage recorded that of July 3, 1917; minimum stage, no flow reported during nonirrigating seasons. Canal dry except during irrigation seasons.

ACCURACY.—Stage-discharge relation at both stations permanent. Rating curves fairly well defined. Gage read twice daily. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge. Some discharge measurements were also made by United States Office of Indian Affairs.

Canal diverts water from right bank of Yakima River in sec. 20, T. 12 N., R. 19 E., about 2 miles above intake of Old Reservation canal. Water is used for irrigation.

Discharge measurements of New Reservation canal at Parker, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 2	R. Skillin	3.44	238	July 13	R. Skillin	6.09	840
8	do	3.62	276	26	K. H. Breuhn	5.37	656
13	F. E. Moxley	3.64	265	30	F. E. Moxley	5.25	631
Nov. 6	do	1.10	15.8	Aug. 2	K. H. Breuhn	5.35	674
Apr. 4	R. Skillin	1.10	35.8	8	Breuhn and Skillin	5.71	756
19	Skillin and Breuhn	3.36	294	13	F. E. Moxley	5.72	737
21	R. Skillin	3.72	346	15	R. Skillin	5.55	722
24	do	4.39	484	20	do	4.97	614
26	do	4.92	595	24	do	4.97	607
May 3	do	5.16	647	24	F. E. Moxley	4.98	579
7	do	5.42	709	Sept. 1	Breuhn and Skillin	4.92	599
8	F. E. Moxley	5.45	707	10	do	4.43	485
26	R. Skillin	5.90	830	11	R. Skillin	4.33	475
June 18	Skillin and Moxley	5.32	666	15	do	3.39	287
29	R. Skillin	6.07	849	20	do	3.28	262
July 3	Skillin and Moxley	6.15	884	24	do	3.06	237

Daily discharge, in second-feet, of New Reservation canal at Parker, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	242	.....	614	811	847	649	588
2	237	.....	629	792	857	667	588
3	232	.....	645	792	869	693	588
4	238	.....	645	792	835	707	576
5	242	.....	704	787	849	718	571
6	240	.....	709	792	723	725	559
7	252	.....	713	801	736	727	546
8	307	.....	720	811	594	750	310
9	293	.....	741	813	631	753	521
0	279	.....	759	801	674	753	506
11	275	.....	769	792	725	753	472
12	275	.....	504	766	804	753	444
13	271	.....	350	702	840	753	426
14	271	.....	555	704	828	739	340
15	.....	.....	743	557	821	736	275
16	.....	.....	741	550	821	734	275
17	.....	.....	757	697	825	605	275
18	.....	220	741	677	835	605	280
19	.....	248	741	640	835	605	276
20	.....	321	741	649	835	603	268
21	.....	348	755	686	410	601	273
22	.....	289	759	697	390	601	235
23	.....	384	776	743	792	605	222
24	.....	464	782	736	759	605	220
25	.....	517	809	776	695	605	210
26	.....	584	821	789	677	605	206
27	.....	578	816	799	677	605	205
28	.....	576	818	816	677	605	205
29	.....	592	778	837	663	588	205
30	.....	605	725	845	645	588	194
31	.....	.....	773	.....	647	588	.....

Monthly discharge of New Reservation canal at Parker, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October 1–14	307	232	261	7,250
April 18–30	605	220	440	11,400
May	821	350	714	43,900
June	845	550	748	44,500
July	869	390	736	45,300
August	753	588	665	40,900
September	588	194	362	21,500

OLD RESERVATION CANAL AT PARKER, WASH.

LOCATION.—In sec. 28, T. 12 N., R. 19 E., about 300 feet below intake and 500 feet above controlling waste of first lateral, 1 mile east of Parker, Yakima County, and 3½ miles northwest of Wapato.

RECORDS AVAILABLE.—Irrigation seasons 1904 to 1917.

GAGE.—Vertical staff on left side about 10 feet upstream from private farm bridge; read by Frank Sutton. Prior to June 23, 1908, vertical staff on downstream end of right retaining wall of Northern Pacific Railway bridge, about half a mile below site of present gage and at different datum.

DISCHARGE MEASUREMENTS.—Made from gaging bridge at gage.

CHANNEL AND CONTROL.—Bed of old slough. Velocities high. No obstruction from growth of aquatic plants. Fairly permanent for each irrigation season.

EXTREMES OF DISCHARGE.—1904–1917: Maximum stage recorded, 5.21 feet May 28 and June 8, 1917 (discharge, 337 second-feet). No water diverted during non-irrigating seasons.

ACCURACY.—Stage-discharge relation permanent. Rating curve fairly well defined. Gage read twice daily to hundredths. Daily discharge ascertained by applying mean daily gage heights to rating table. Records good.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge. Some discharge measurements were also made by United States Office of Indian Affairs.

Canal diverts water from right bank of Yakima River in sec. 28, T. 12 N., R. 19 E., about half a mile above intake of Sunnyside canal. Water is used for irrigation.

Discharge measurements of Old Reservation canal at Parker, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec. ft.*			*Feet.*	*Sec. ft.*
Oct. 2	R. Skillin	2.28	79.6	June 29	R. Skillin	4.80	298
8	do	2.21	80.3	July 26	F. E. Moxley	3.90	214
13	F. E. Moxley	2.09	76.5	27	K. H. Breuhn	3.90	190
Nov. 6	do	.48	5.38	31	do	3.72	208
Apr. 17	Skillin and Breuhn	2.88	136	Aug. 8	Breuhn and Skillin	3.79	206
24	R. Skillin	3.42	186	13	F. E. Moxley	3.90	212
27	do	3.79	225	18	K. H. Breuhn	3.76	208
May 2	do	4.32	272	23	do	3.55	185
8	do	4.73	306	24	F. E. Moxley	3.70	187
8	F. E. Moxley	4.88	306	27	K. H. Breuhn	3.61	190
29	R. Skillin	5.15	335	Sept. 4	do	3.38	174
June 7	do	5.29	335	10	Breuhn and Skillin	3.27	150
16	F. E. Moxley	4.28	258	14	R. Skillin	2.88	125
19	R. Skillin	4.50	270	20	do	2.35	89.7
27	F. E. Moxley	4.72	300	24	do	2.37	84.8

Daily discharge, in second-feet, of Old Reservation canal at Parker, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Apr.	May.	June.	July.	Aug.	Sept.
1	59	6	225	321	286	189	178
2	65	18	241	321	281	182	178
3	65	31	257	326	306	184	169
4	73	28	261	326	316	193	170
5	73	40	257	321	321	207	169
6	72	52	266	328	316	200	171
7	70	46	279	336	311	205	169
8	70	49	296	337	288	207	169
9	70	54	304	328	292	198	158
10	73	86	302	316	311	198	158
11	73	93	314	299	321	211	158
12	72	95	316	297	316	216	144
13	70	104	316	279	314	214	136
14	70	109	314	279	311	207	126
15	.....	110	306	274	304	202	97
16	.....	117	308	259	301	200	98
17	.....	123	306	259	301	205	94
18	.....	122	297	261	300	206	90
19	.....	125	297	263	295	196	90
20	.....	140	306	268	286	189	84
21	.....	156	314	274	279	188	84
22	.....	162	324	281	270	184	84
23	.....	170	326	288	252	182	90
24	.....	170	328	288	238	193	90
25	.....	184	326	306	229	189	82
26	.....	198	331	314	220	189	78
27	.....	203	331	288	216	189	80
28	.....	211	337	292	216	182	82
29	.....	220	326	299	211	180	82
30	.....	220	326	292	211	175	82
31	.....	.....	318	.....	205	178	.....

Monthly discharge of Old Reservation canal at Parker, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October 1–14	73	59	69.3	1,920
April	220	6	115	6,830
May	337	225	302	18,600
June	337	259	297	17,700
July	321	205	278	17,100
August	216	175	195	12,000
September	178	78	121	7,220

SUNNYSIDE CANAL NEAR PARKER,[1] WASH.

LOCATION.—In sec. 28, T. 12 N., R. 19 E., about 600 feet below intake, 1½ miles east of Parker, and 3½ miles northwest of Wapato, Yakima County.

RECORDS AVAILABLE.—Irrigation seasons 1904–1917.

GAGE.—Lietz water-stage recorder on right side; installed April 20, 1909, referred to vertical staff gage installed April 6, 1908. Prior to April 6, 1908, vertical staff on left side about 200 feet above site of present gage and at different datum. An inclined staff gage, installed April 6, 1907, at about same site as present gage, was in use during 1907, but gage heights were referred to datum of original gage. Recorder inspected daily by employees of United States Reclamation Service.

DISCHARGE MEASUREMENTS.—Made from gaging bridge 30 feet below gage.

[1] Formerly described as "near Wapato."

CHANNEL AND CONTROL.—Bottom of canal gravel; fairly permanent. Operation of flashboard at drop No. 1 makes control changeable.

EXTREMES OF DISCHARGE.—1904–1917: Maximum mean daily discharge, 1,270 second-feet on July 21, 1917. No water in canal during nonirrigating seasons.

ACCURACY.—Stage-discharge relation affected by variable velocity of approach due to different gate openings at headworks and by operation of flashboards at drop No. 1. Daily discharge ascertained by shifting-control method, and as discharge measurements were made frequently records are excellent.

COOPERATION.—United States Reclamation Service made discharge measurements and computed discharge.

Canal diverts water from left bank of Yakima River in sec. 28, T. 12 N., R. 19 E., about half a mile below head gate of Old Reservation canal. Water is used for irrigation.

Discharge measurements of Sunnyside canal near Parker, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 11	G. D. Hall	3.30	499	June 19	Hall and Bolton	4.95	1,073
23	do	2.74	356	28	G. D. Hall	5.17	1,193
30	do	2.54	305	July 11	Hall and Austin	5.32	1,207
Mar. 23	Hall and Shugert	2.34	306	18	Hall and James	5.37	1,227
Apr. 4	G. D. Hall	2.82	396	30	G. D. Hall	5.28	1,180
11	do	2.99	447	Aug. 10	do	5.405	1,215
24	do	3.73	664	20	Hall and Moore	5.52	1,213
May 9	Hall and Moxley	4.67	967	29	G. D. Hall	5.285	1,132
17	Hall and Shugert	4.955	1,083	Sept. 10	do	4.57	886
29	G. D. Hall	4.65	981	19	do	4.19	750
June 9	do	4.685	969	28	do	4.12	720

Daily discharge, in second-feet, of Sunnyside canal near Parker, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	637	.....	344	829	980	1,200	1,180	1,060
2	614	.....	351	843	987	1,210	1,190	1,040
3	611	.....	374	869	991	1,200	1,200	1,020
4	588	.....	395	869	980	1,180	1,190	1,000
5	582	.....	395	903	970	1,160	1,190	967
6	563	.....	400	907	987	1,180	1,190	987
7	552	.....	391	914	984	1,180	1,190	963
8	549	.....	395	921	984	1,190	1,190	945
9	532	.....	415	945	973	1,190	1,190	897
10	505	.....	422	952	973	1,200	1,210	869
11	500	.....	439	949	987	1,210	1,220	859
12	495	.....	469	973	1,010	1,200	1,210	822
13	484	.....	482	980	1,010	1,210	1,210	789
14	474	.....	477	980	1,000	1,210	1,210	796
15	454	.....	479	1,000	991	1,220	1,210	796
16	444	.....	479	1,020	1,010	1,230	1,210	793
17	429	.....	487	1,040	1,010	1,230	1,190	780
18	417	.....	513	1,070	1,030	1,220	1,190	755
19	415	.....	538	1,070	1,060	1,240	1,210	758
20	412	.....	566	1,070	1,060	1,260	1,210	751
21	386	.....	626	1,080	1,070	1,270	1,200	748
22	356	306	640	1,080	1,070	1,240	1,190	748
23	356	310	655	1,070	1,070	1,250	1,190	748
24	354	308	681	1,050	1,070	1,230	1,190	751
25	349	306	702	1,040	1,090	1,220	1,180	739
26	335	303	730	1,040	1,120	1,210	1,180	733
27	335	301	764	1,010	1,160	1,220	1,160	717
28	326	301	770	1,000	1,180	1,210	1,130	714
29	315	301	815	977	1,190	1,200	1,130	696
30	308	363	812	980	1,190	1,190	1,100	677
31	301	351	.....	991	.....	1,190	1,080	.....

Monthly discharge of Sunnyside canal near Parker, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	637	301	451	27,700
March	363	0	102	6,270
April	815	344	534	31,800
May	1,080	829	982	60,400
June	1,190	970	1,040	61,900
July	1,270	1,160	1,210	74,400
August	1,220	1,080	1,180	72,600
September	1,060	677	831	49,400
The year	1,270	0	531	384,000

TOPPENISH CREEK NEAR FORT SIMCOE, WASH.

LOCATION.—In sec. 26, T. 10 N., R. 16 E., at Olney's ranch, 1½ miles below highway bridge, 3½ miles southeast of Fort Simcoe, and 5 miles southwest of White Swan, Yakima County.

DRAINAGE AREA.—124 square miles (measured on Plate I, Water-Supply Paper 369).

RECORDS AVAILABLE.—February 27, 1909, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank half a mile east of ranch house; installed August 19, 1915. Previous gages as follows: February 27, 1909, to July 22, 1913, chain gage on left bank a quarter of a mile above site of present gage; July 23, 1913, to August 18, 1915, vertical staff attached to cottonwood tree on right bank 150 feet above site of present gage.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed composed of gravel and small boulders. Concrete control 18 feet below gage. Banks covered with brush; subject to overflow at extremely high water. Stage of zero flow determined September 10, 1917, gage height 1.80 feet.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.22 feet at 10 a. m. May 11 (discharge, 585 second-feet); minimum stage recorded, 2.25 feet August 20, 21, and 24–27 (discharge 13.7 second-feet).

1909–1917: Maximum stage recorded, 5.46 feet at noon May 4, 1916 (discharge, 1,650 second-feet); minimum stage recorded, 0.95 foot January 17, 1915 (discharge, 3.5 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; flow estimated by hydrographic comparison with records of flow of nearest streams and study of weather records.

DIVERSIONS.—A small irrigating ditch diverts water above station. Diversion of spring run-off into a reservoir on Simcoe Creek for use in irrigating Indian lands is proposed.

REGULATION.—None.

ACCURACY.—Stage-discharge relation permanent, except affected by ice January 14–20 and February 25 to March 2. Rating curve well defined. Daily discharge ascertained by applying to rating table mean daily gage heights obtained by inspecting gage-height graph. Open season records excellent.

Discharge measurements of Toppenish Creek near Fort Simcoe, Wash., during the year ending Sept. 30, 1917.

[Made by C. G. Paulsen.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 23	2.50	32.4	May 27	3.80	393
Mar. 3	2.50	30.6	Sept. 10	2.37	20.5
Apr. 23	3.16	157			

Daily discharge, in second-feet, of Toppenish Creek near Fort Simcoe, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	17.5	30	32	29	28	31	74	239	279	38	18.7	14.2
2	21	29	31	29	30	31	67	221	249	36	18.1	14.7
3	21	28	35	30	30	32	64	235	218	34	17.5	14.7
4	22	31	38	31	32	32	66	235	191	33	16.8	14.7
5	22	32	33	46	33	33	93	253	175	31	16.8	14.7
6	22	31	31	46	34	33	105	260	163	30	16.2	15.2
7	22	32	29	41	34	33	124	301	157	29	16.8	15.2
8	22	30	30	41	34	35	160	384	152	28	16.8	15.7
9	22	31	30	43	35	35	154	487	143	28	16.8	18.1
10	22	32	30	46	35	35	149	500	132	27	16.2	20
11	22	32	30	45	35	34	179	561	119	26	16.2	18.7
12	21	30	29	42	34	33	182	528	107	25	16.2	17.5
13	22	27	30	39	35	33	160	491	96	24	15.7	16.8
14	22	27	29		35	33	152	473	87	23	15.7	16.2
15	22	27	29		35	32	143	464	82	23	15.2	16.2
16	21	29	28	33	36	31	137	397	74	22	15.2	16.2
17	21	30	28		39	31	124	359	70	22	14.7	16.2
18	21	30	27		38	31	117	317	66	22	14.7	15.7
19	22	29	27		36	32	114	298	61	21	14.2	15.2
20	23	29	26		35	34	124	301	58	21	13.7	15.2
21	23	29	31	39	35	35	149	305	56	20	13.7	14.7
22	24	30	31	38	34	34	152	298	55	20	14.2	15.2
23	24	31	32	38	33	35	157	301	53	20	14.2	15.7
24	25	30	31	35	32	43	179	298	56	20	13.7	15.7
25	26	30	29	31	32	42	221	309	52	20	13.7	15.7
26	26	31	27	31	32	40	290	338	49	20	13.7	15.7
27	27	38	28	30	31	40	305	372	45	20	13.7	15.7
28	27	40	28	30	31	53	317	380	43	19.4	14.2	15.7
29	27	34	28	29	.....	140	301	389	45	19.4	14.2	15.7
30	28	33	28	28	.....	109	275	359	42	19.4	14.2	15.7
31	34	.....	28	28	.....	85	.....	301	.....	18.7	14.2	.....

NOTE.—Stage-discharge relation affected by ice Jan. 14–20 and Feb. 25 to Mar. 2. Recorder not operating Jan. 29 to Feb. 1. Discharge for these periods estimated by hydrographic comparison with Satus, Simcoe, and North Fork of Ahtanum creeks and study of weather records.

Monthly discharge of Toppenish Creek near Fort Simcoe, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	34	17.5	23.3	1,430
November	40	27	30.7	1,830
December	38	26	29.8	1,830
January	46	.....	35.4	2,180
February	39	.....	33.7	1,870
March	140	31	42.3	2,600
April	317	64	161	9,580
May	561	221	353	21,700
June	279	42	106	6,310
July	39	18.7	24.5	1,510
August	18.7	13.7	15.4	947
September	20	14.2	15.9	946
The year	561	13.7	72.9	52,700

SIMCOE CREEK BELOW SPRING CREEK, NEAR FORT SIMCOE, WASH.

LOCATION.—In sec. 34, T. 11 N., R. 16 E., at site of proposed reservoir, 4 miles northeast of Fort Simcoe, Yakima County.

DRAINAGE AREA.—77 square miles (measured on Plate I, Water-Supply Paper 369).

RECORDS AVAILABLE.—November 20, 1915, to September 30, 1917. For a station just above Spring Creek, February 28, 1909, to November 20, 1915.

GAGE.—Stevens water-stage recorder on left bank just below Spring Creek; inspected twice a month by Martin Schuler.

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

CHANNEL AND CONTROL.—Bed composed of sand and gravel. Concrete control, 16 feet below gage. Banks fairly high; not subject to overflow.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 1.51 feet at 8.30 p. m. May 28 and 29 (discharge, 131 second-feet); minimum stage recorded, 0.18 foot September 18–30 (discharge, 0.3 second-foot).

1916–17: Maximum stage recorded, 6.14 feet at 5 p. m. February 10, 1916 (discharge, 731 second-feet); minimum stage recorded, 0.17 foot November 20, 1915 (discharge, 0.2 second-foot).

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

ACCURACY.—Stage-discharge relation permanent. Rating curve well defined below 50 second-feet. Recorder not operating satisfactorily December 24 to January 13. Daily discharge ascertained by applying mean daily gage height to rating table. Records good, except for extremely low water and period when recorder was not operating.

Discharge measurements of Simcoe Creek below Spring Creek, near Fort Simcoe, Wash., during the year ending Sept. 30, 1917.

[Made by C. G. Paulsen.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Dec. 23	0.42	5.28	May 27	1.28	101
Mar. 2	.46	7.68	Sept. 10	.25	.63
Apr. 22	.67	19.4			

Daily discharge, in second-feet, of Simcoe Creek below Spring Creek, near Fort Simcoe, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.7	2.3	4.5		6.6	7.5	8.0	31	75	6.6	2.9	0.7
2	2.0	2.3	4.5		7.0	8.0	8.0	30	62	6.6	2.6	.9
3	2.0	2.6	4.8		7.5	10	8.0	29	52	6.2	2.6	.9
4	2.0	2.6	4.8	6.6	7.5	11	7.5	28	45	5.7	2.6	.9
5	2.0	2.6	4.8		7.5	10	8.0	28	39	5.7	2.6	.9
6	2.3	2.9	4.8		7.0	9.3	8.8	28	36	5.7	2.6	.7
7	2.3	3.2	4.8		7.0	9.3	9.8	32	36	5.7	2.6	.7
8	2.0	2.9	4.8		7.5	9.3	12	41	35	5.7	2.3	.9
9	2.0	2.6	4.8		7.5	8.4	14	50	35	5.2	2.3	1.0
10	2.3	2.9	4.8	6.8	7.5	8.4	15	55	32	5.2	2.0	.9
11	2.3	2.9	5.2		7.5	8.8	18	67	28	5.2	1.7	.7
12	2.3	3.2	6.6		7.5	8.8	20	77	25	5.2	1.6	.7
13	2.3	3.6	6.6		7.5	9.3	21	77	22	4.8	1.4	.7
14	2.3	4.2	6.6	6.6	7.5	9.3	21	75	20	4.8	1.4	.6
15	2.3	4.2	6.6	6.6	7.5	8.8	21	77	18	4.8	1.4	.6
16	2.3	4.5	7.0	6.6	7.5	8.4	19	74	16	4.5	1.3	.4
17	2.0	4.5	7.5	6.6	7.5	8.4	18	67	15	4.5	1.3	.4
18	2.3	4.5	7.5	6.2	7.5	8.4	17	60	14	4.2	1.3	.3
19	2.6	4.5	7.5	6.2	7.5	8.0	17	54	13	3.8	1.4	.3
20	2.6	4.5	7.5	6.6	7.5	8.4	17	52	12	3.8	1.4	.3
21	2.6	4.5	6.9	7.0	7.5	8.0	18	52	11	3.6	1.4	.3
22	2.3	4.5	6.3	8.4	7.0	8.0	19	52	10	3.6	1.4	.3
23	2.3	4.5	5.7	8.8	7.0	8.0	19	52	10	3.6	1.1	.3
24	2.0	4.5		8.8	7.5	8.0	20	57	9.8	3.6	1.1	.3
25	2.0	4.5		8.4		8.0	25	67	9.3	3.6	1.0	.3
26	2.0	4.5	5.2	8.4	7.5	8.0	28	77	8.4	3.2	1.0	.3
27	1.7	4.8		8.0		8.0	32	94	8.4	2.9	1.0	.3
28	1.7	4.8		8.0		8.0	34	114	8.0	2.9	.9	.3
29	1.7	4.8		7.5	.....	8.0	35	121	7.5	2.9	1.0	.3
30	2.0	4.5		7.5	.....	8.0	34	110	7.0	2.9	.7	.3
31	2.0	.....	4.8	6.6	.....	8.0	.....	90	.....	2.9	.7	.....

NOTE.—Recorder not operating satisfactorily Dec. 24 to Jan. 13; gage-height record Dec. 21–23 and Feb. 25–28 lost. Discharge Dec. 23 and 31 determined from engineer's and observer's gage readings on those dates; discharge Dec. 21 and 22 interpolated; discharge Dec. 24–30, Jan. 1–13, and Feb. 25–28, estimated by hydrographic comparison with Satus, Toppenish, and North Fork of Ahtanum creeks.

Monthly discharge of Simcoe Creek below Spring Creek, near Fort Simcoe, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	2.6	1.7	2.14	132
November	4.8	2.3	3.78	225
December	7.5	.....	5.68	349
January	8.8	.....	7.10	437
February	7.5	6.6	7.38	410
March	11	7.5	8.57	527
April	35	7.5	18.4	1,090
May	121	28	61.9	3,810
June	75	7.0	24.0	1,430
July	6.6	2.9	4.50	277
August	2.9	.7	1.63	100
September	1.0	.3	.55	33
The year	121	.3	12.2	8,820

RESERVATION DRAIN AT ALFALFA, WASH.

LOCATION.—In sec. 29, T. 10 N., R. 21 E., at highway bridge a quarter of a mile southeast of Alfalfa, Yakima County, about 2 miles above mouth of drain.

RECORDS AVAILABLE.—December 5, 1912, to September 30, 1917; miscellaneous measurements 1911 and 1912.

GAGE.—Vertical staff on right bank under highway bridge; read by Miss Nellie Ide.

DISCHARGE MEASUREMENTS.—Made from footbridge 1,000 feet below gage.

CHANNEL AND CONTROL.—Bed composed of gravel. Shifting. Banks high. Current swift at all stages.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 3.68 feet May 31 (discharge, 389 second-feet); minimum stage recorded was discharge measurement on March 24, gage height 2.66 (discharge, 161 second-feet).

1913–1917: Maximum stage recorded, about 4.8 feet, as determined by levels in 1916, during period in which water was over gage (discharge, 590 second-feet); minimum stage recorded, 1.8 feet July 3, August 12, 15–31, September 1–14, 19, 1915 (discharge, 145 second-feet).

ICE.—Ice does not form at this station.

DIVERSIONS.—None.

REGULATIONS.—None.

ACCURACY.—Stage-discharge relation changed gradually from May 8 to 25. Rating curves well defined. Shifting-control method used May 8 to 25. Gage read to quarter-tenths once daily. Daily discharge ascertained by applying gage heights to rating table. Records excellent except for month of May, for which they are only fair, on account of uncertainty as to rate of change of control and length of period in which control was changing.

Reservation drain carries the return water from irrigation by the reservation canals and the underflow of Toppenish Valley. During the low-water period practically the whole flow of Toppenish Creek is carried into this channel by seepage.

Discharge measurements of Reservation drain at Alfalfa, Wash., during the year ending Sept. 30, 1917.

Date.	Made by—	Gage height.	Discharge.	Date.	Made by—	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
Oct. 7	R. Skillin	3.06	244	Apr. 14	R. Skillin	2.73	174
13	do	3.02	234	20	C. G. Paulsen	2.80	194
24	do	2.88	204	21	R. Skillin	2.83	188
Nov. 2	do	2.86	202	28	do	2.83	197
10	do	2.84	199	May 5	do	2.96	219
23	do	2.82	197	12	do	3.20	269
Dec. 2	do	2.90	204	19	do	3.33	294
9	do	2.84	195	26	C. G. Paulsen	3.48	344
16	do	2.84	194	26	R. Skillin	3.48	328
23	do	2.86	204	June 2	do	3.65	364
30	do	2.83	194	16	do	3.45	326
Jan. 6	do	2.88	205	23	do	3.43	322
13	do	2.85	196	30	do	3.35	302
20	do	2.78	181	July 7	do	3.30	300
27	do	2.78	178	14	do	3.21	272
Feb. 3	do	2.76	180	22	C. G. Paulsen	3.20	283
10	do	2.78	182	23	George Sargent	3.30	268
17	do	2.79	189	27	Bruhn and Sargent	3.15	247
24	do	2.77	182	Aug. 11	R. Skillin	3.16	272
Mar. 1	C. G. Paulsen	2.74	186	25	T. Bruhn	3.20	274
3	R. Skillin	2.74	179	31	do	3.23	287
10	do	2.74	175	Sept. 7	Bruhn and Skillin	3.40	319
17	do	2.72	173	8	C. G. Paulsen	3.42	327
24	do	2.66	161	22	R. Skillin	3.36	300
31	do	2.66	165	29	do	3.15	264
Apr. 7	do	2.70	169				

Daily discharge, in second-feet, of Reservation drain at Alfalfa, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	249	193	211	193	184	184	166	230	367	299	255	277
2	230	202	211	193	184	184	166	220	367	299	255	277
3	230	202	211	193	184	184	175	230	367	299	234	277
4	230	202	211	193	184	184	175	230	367	299	255	299
5	230	202	211	211	184	184	175	220	367	299	244	322
6	230	202	202	211	184	184	175	220	344	299	255	322
7	249	211	202	211	184	184	175	220	322	299	255	322
8	230	202	202	211	193	175	175	230	322	299	255	322
9	230	202	202	202	193	184	175	230	322	299	255	322
10	230	193	193	202	193	184	175	231	322	299	255	322
11	230	193	193	202	193	175	175	250	322	299	266	344
12	230	193	193	202	193	175	175	270	344	277	277	344
13	230	193	193	202	193	175	175	271	344	277	277	322
14	230	193	202	193	193	175	175	271	344	277	277	322
15	230	193	202	193	193	175	175	293	344	277	277	299
16	220	193	202	193	193	175	184	293	322	277	277	322
17	211	193	193	193	193	175	211	294	322	277	277	322
18	211	193	193	193	193	175	193	316	344	277	277	322
19	211	193	193	193	193	175	193	295	344	277	277	322
20	211	193	193	193	193	175	193	296	322	299	277	322
21	211	193	202	184	193	175	193	296	322	299	277	299
22	211	193	202	184	184	175	193	297	322	277	277	322
23	211	193	202	184	184	166	175	297	322	299	277	299
24	211	193	202	184	184	166	175	321	322	277	266	277
25	211	202	202	184	184	175	175	321	322	277	277	277
26	211	211	193	184	184	175	175	344	322	277	277	277
27	211	211	193	184	184	175	193	344	322	266	277	277
28	211	202	193	184	184	175	193	367	322	255	277	266
29	211	211	193	193	.....	175	211	367	299	266	277	266
30	202	211	202	184	.....	175	230	367	322	277	277	255
31	202	.....	193	184	.....	166	.....	389	.....	277	277	.....

Monthly discharge of Reservation drain at Alfalfa, Wash., for the year ending Sept. 30. 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	249	202	221	13,600
November	211	193	199	11,800
December	211	193	200	12,300
January	211	184	194	11,900
February	193	184	188	10,400
March	184	166	177	10,900
April	230	166	183	10,900
May	389	220	285	17,500
June	367	299	334	19,900
July	299	255	286	17,600
August	277	234	268	16,500
September	344	255	304	18,100
The year	389	166	237	171,000

SATUS CREEK BELOW DRY CREEK, NEAR TOPPENISH, WASH.

LOCATION.—In sec. 24, T. 9 N., R. 19 E., at dam site about a mile below mouth of Dry Creek and 9 miles southwest of Toppenish, Yakima County.

DRAINAGE AREA.—427 square miles (measured on topographic maps and map of Yakima Indian Reservation).

RECORDS AVAILABLE.—June 22, 1913, to September 30, 1917.

GAGE.—Stevens water-stage recorder on left bank.

DISCHARGE MEASUREMENTS.—Made from cable or by wading.

CHANNEL AND CONTROL.—Bed composed of small boulders and gravel; shifting.

EXTREMES OF DISCHARGE.—Maximum stage recorded during year, 4.00 feet at 10 a. m. March 29 (discharge, 635 second-feet); minimum stage recorded, 1.22 feet parts of days August 24–26 (discharge, 11 second-feet).

1913–1917: Maximum stage recorded, 9.15 feet December 22, 1915 (from high-water marks in well; discharge, 3,870 second-feet); minimum stage recorded, 0.28 foot at 10 p. m. August 28 and 4 a. m. August 30, 1915 (discharge, 6.6 second-feet).

ICE.—Stage-discharge relation seriously affected by ice; flow estimated from observer's notes, weather records, and comparison with records of flow of adjacent streams.

DIVERSIONS.—Entire flow of Satus Creek above Lazy Creek is diverted for irrigation during July and August; records for summer months show only run-off of Lazy and Dry creeks and seepage return from upper Satus Creek.

REGULATION.—None.

ACCURACY.—Stage-discharge relation changed continually, except for periods from February 25 to April 7 and April 8 to May 26; seriously affected by ice January 14–19 and 30–31. Rating curve used February 25 to April 7 fairly well defined. Rating curve used April 8 to May 26 well defined. Shifting-control method for remainder of year. Daily discharge ascertained by applying to the rating table mean daily gage height obtained by inspecting graph or, for days of considerable fluctuation by applying gage heights for shorter intervals. Records good except when stage-discharge relation was affected by ice.

Discharge measurements of Satus Creek below Dry Creek, near Toppenish, Wash., during the year ending Sept. 30, 1917.

[Made by C. G. Paulsen.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
Feb. 28	1.70	42.2	July 22	1.48	28.2
Apr. 21	3.07	382	Sept. 8	1.30	14.3
May 26	2.86	318			

Daily discharge, in second-feet, of Satus Creek below Dry Creek, near Toppenish, Wash., for the year ending Sept. 30, 1917.

Day.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	24	40	37	36	31	37	186		301	89	22	12
2	26	38	38	37	41	36	163		282	84	21	13
3	27	38	40	41	48	43	154		253	81	20	12
4	28	39	45	44	68	44	150	270	237	77	19	12
5	28	42	43	65	88	50	304		237	72	19	12
6	28	36	40	118	92	50	323		240	68	18	12
7	28	36	34	89	81	50	366		247	64	18	12
8	26	35	38	77	77	51	552		266	62	18	14
9	27	35	39	77	71	52	482		279	58	17	15
10	28	36	38	81	68	52	456	350	247	54	16	16
11	29	36	40	78	67	51	508		216	51	16	14
12	28	29	41	70	64	50	464		191	48	15	14
13	28	22	41	56	63	50	386	315	184	45	15	14
14	28	25	43		62	49	371	312	191	43	15	14
15	29	28	37		62	46	353	310	191	40	14	15
16	29	30	48	35	63	46	324	290	208	37	14	15
17	29	31	45		67	45	304	271	211	35	14	15
18	29	34	45		67	46	315	258	186	33	14	14
19	30	35	45		64	48	290	242	181	30	14	14
20	31	33	46	42	62	49	287	234	170	28	12	14
21	32	32	46	45	58	49	362	227	161	27	12	14
22	33	33	48	48	54	49		224	146	27	13	14
23	33	33	45	48	50	49	390	227	138	27	13	14
24	34	33	44	48	54	53		237	140	28	12	15
25	34	33	41	49	49	58		290	138	28	12	14
26	35	36	35	46	51	59		321	118	27	12	14
27	36	39	36	45	44	61		324	112	27	12	14
28	36	52	33	44	45	77	430	324	107	26	12	14
29	36	42	28	41	.....	463		332	105	25	12	14
30	38	39	30	34	.....	318		326	98	24	12	14
31	39	.....	33	28	.....	226	.....	301	.....	22	12	.....

NOTE.—Stage-discharge relation affected by ice Jan. 14–19 and 30–31; flow estimated from observer's notes, weather records, and hydrographic comparison with Toppenish, Simcoe, and North Fork of Ahtanum creeks. Recorder not operating Apr. 22 to May 12 (range in stage during period indicated by recorder); discharge estimated by hydrographic comparison with Toppenish Creek.

Monthly discharge of Satus Creek below Dry Creek, near Toppenish, Wash., for the year ending Sept. 30, 1917.

Month.	Discharge in second-feet.			Run-off in acre-feet.
	Maximum.	Minimum.	Mean.	
October	39	24	30.5	1,880
November	52	22	35	2,080
December	48	28	40.1	2,470
January	118	.....	51.5	3,170
February	92	31	61.1	3,390
March	463	36	77.6	4,770
April	552	150	360	21,400
May	.....	224	293	18,000
June	301	98	193	11,500
July	89	22	44.7	2,750
August	22	12	15	922
September	16	12	13.8	821
The year	552	12	101	73,200

MISCELLANEOUS MEASUREMENTS.

The following discharge measurements are arranged in the same order of drainage basin as the regular gaging stations.

Miscellaneous discharge measurements in drainage basins in Washington during the year ending Sept. 30, 1917.

Soleduck River drainage basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
Aug. 29	Soleduck River	Pacific Ocean	10 miles below mouth of South Fork.	2.20	159
30	do	do	do	2.19	154

Snohomish River drainage basin.

Sept. 16	Miner Creek	Sultan River	Near mouth, about 1 mile above Horseshoe Bend.	.26	2.12
Oct. 3	Wood Creek	do	Near mouth, about ½ mile below Horseshoe Bend.		6.40

Stilaguamish River drainage basin.

June 19	Deer Creek	North Fork of Stilaguamish River.	Highway bridge at Oso, Wash.		914

Kettle River drainage basin.

May 4	Lambert Creek	Curlew Creek	Near mouth, 1 mile below Curlew Lake		1.93
June 17	do	do	do		8.56
July 10	do	do	do		2.47
14	do	do	do		1.45
31	do	do	do		.15

Okanogan River drainage basin.

Oct. 24	Okanogan River	Columbia River	Oroville, Wash.		411
Feb. 7	do	do	do		242
Mar. 6	do	do	do		248
July 13	West Okanogan Valley irrigation district canal.	Similkameen River	400 feet below head gate, 2½ miles below Nighthawk, Wash.	3.90	109

Yakima River drainage basin.

May 27	Abe Lincoln ditch [a]	Toppenish Creek	½ mile below gage on Toppenish Creek, about 2 miles below head of ditch.		5.34
Sept. 10	do	do	¾ mile below head of ditch		3.15

[a] Formerly called Nicol ditch.

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 result of stream-flow measurements are now published annually in 12 parts, each part covering an area whose boundaries coincide with natural drainage as indicated below:

Part I. North Atlantic slope basins.
II. South Atlantic slope and eastern Gulf of Mexico basins.
III. Ohio River basin.
IV. St. Lawrence River basin.
V. Upper Mississippi River and Hudson Bay basins.
VI. Missouri River basin.
VII. Lower Mississippi River basin.
VIII. Western Gulf of Mexico basins.
IX. Colorado River basin.
X. Great Basin.
XI. Pacific slope basins in California.
XII. North Pacific slope basins, in three volumes:
A, Pacific slope basins in Washington and upper Columbia River basin.
B, Snake River basin.
C, Lower Columbia River basin and Pacific slope basins in Oregon.

HOW GOVERNMENT REPORTS MAY BE OBTAINED OR CONSULTED.

Water-supply papers and other publications of the United States Geological Survey containing data in regard to the water resources of the United States may be obtained or consulted as indicated below.

1. Copies may be obtained free of charge by applying to the Director of the Geological Survey, Washington, D. C. The edition printed for free distribution is, however, small and is soon exhausted.

2. Copies may be purchased at nominal cost from the Superintendent of Documents, Government Printing Office, Washington, D. C., who will on application furnish lists giving prices.

3. Sets of the reports may be consulted in the libraries of the principal cities in the United States.

4. Complete sets are available for consultation in the local offices of the water-resources branch of the Geological Survey, as follows:

Boston, Mass., 2500 Customhouse.
Albany, N. Y., 704 Journal Building.
Atlanta, Ga., Post Office Building.
Nashville, Tenn., 306 Customhouse.
Madison, Wis., care of Railroad Commission of Wisconsin.
Topeka, Kans., 23 Federal Building.
Helena, Mont., Montana National Bank Building.
Denver, Colo., 403 New Post Office Building.
Salt Lake City, Utah, 313 Federal Building.
Boise, Idaho, 615 Idaho Building.
Portland, Oreg., 606 Post Office Building.
Tacoma, Wash., 406 Federal Building.
San Francisco, Calif., 328 Customhouse.
Los Angeles, Calif., 619 Federal Building.
Austin, Tex., Capitol Building.
Honolulu, Hawaii, 25 Capitol Building.

A list of the Geological Survey's publications may be obtained by applying to the Director of the United States Geological Survey, Washington, D. C.

STREAM-FLOW REPORTS.

Stream-flow records have been obtained at more than 4,200 points in the United States, and the data obtained have been published in the reports tabulated below:

Stream-flow data in reports of the United States Geological Survey.

[A=Annual Report; B=Bulletin; W=Water Supply Paper.]

Report.	Character of data.	Year.
10th A, pt. 2	Descriptive information only	
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.
20th A, pt. 4	Monthly discharge (also for many earlier years)	1898.
W 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.

Stream-flow data in reports of the United States Geological Survey—Continued.

[A=Annual Report; B=Bulletin; W=Water-Supply Paper.]

Report.	Character of data.	Year.
21st A, pt. 4	Monthly discharge	1899.
W 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d A, pt. 4	Monthly discharge	1900.
W 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W 75	Monthly discharge	1901.
W 82 to 85	Complete data	1902.
W 97 to 100	do	1903.
W 124 to 135	do	1904.
W 165 to 178	do	1905.
W 201 to 214	do	1906.
W 241 to 252	do	1907–8.
W 261 to 272	do	1909.
W 281 to 292	do	1910.
W 301 to 312	do	1911.
W 321 to 332	do	1912.
W 351 to 362	do	1913.
W 381 to 394	do	1914.
W 401 to 414	do	1915.
W 431 to 444	do	1916.
W 451 to 464	do	1917.

The records at most of the stations discussed in these reports extend over a series of years, and miscellaneous measurements at many points other than regular gaging stations have been made each year. An index of the reports containing records obtained prior to 1904 has been published in Water-Supply Paper 119.

The table following gives, by years and drainage basins, the numbers of the papers on surface-water supply published from 1899 to 1917. The data for any particular station will, as a rule, be found in the reports covering the years during which the station was maintained. For example, data for Machias River at Whitneyville, Me., 1903 to 1917, are published in Water-Supply Papers 97, 124, 165, 201, 241, 261, 281, 301, 321, 351, 381, 401, 431, and 451, which contain records for the New England streams from 1903 to 1917. Results of miscellaneous measurements are published by drainage basins.

In these papers and in the following lists the stations are arranged in downstream order. The main stem of any river is determined by measuring or estimating its drainage area—that is, the headwater stream having the largest drainage area is considered the continuation of the main stream, and local changes in name and lake surface are disregarded. All stations from the source to the mouth of the main stem of the river are presented first, and the tributaries in regular order from source to mouth follow, the streams in each tributary basin being listed before those of the next basin below.

In exception to this rule the records for Mississippi River are given in four parts, as indicated on page III, and the records for large lakes are presented in order of the streams around the rim of the lake.

Numbers of water-supply papers containing results of stream measurements, 1899–1917.

Year.	I North Atlantic slope basins (St. John River to York River).	II South Atlantic slope and eastern Gulf of Mexico basins (James River to the Mississippi).	III Ohio River basin.	IV St. Lawrence River basin.	V Hudson Bay and upper Mississippi River 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.		
												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	[k] 98, 99, [m] 100	99	[k] 98, 99	99	100	100	100	100	100	100
1904	[n] 124, [o] 125, [p] 126	[p] 126, 127	128	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	326	327	328	329	330	331	332–A	332–B	332–C
1913	351	352	353	354	355	356	357	358	359	360	361	362–A	362–B	362–C
1914	381	382	383	384	385	386	387	388	389	390	391	392	393	394
1915	401	402	403	404	405	406	407	408	409	410	411	412	413	414
1916	431	432	433	434	435	436	437	438	439	440	441	442	443	444
1917	451	452	[i] 453	454	455	456	457	458	459	460	461	462	463	464

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water Supply Paper 39. Tables for monthly discharge for 1899 in Twenty-first Annual Report, Part IV.
[b] James River only.
[c] Gallatin River.
[d] Green and Gunnison rivers and Grand River above junction with Gunnison.
[e] Mohave River only.
[f] Kings and Kern rivers and south Pacific slope basins.
[g] Rating tables and index to Water-Supply Papers 47–52 and data on precipitation, wells, and irrigation in California and Utah contained in Water-Supply Paper 52. Tables for monthly discharge for 1900 in Twenty-second Annual Report, Part IV.
[h] Wissahickon and Schuylkill rivers to James River.
[i] 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.—Dash after date indicates that station was being maintained September 30, 1917. Period after a date indicates discontinuance.

BETWEEN COLUMBIA RIVER AND PUGET SOUND.

Chehalis River at Centralia, Wash., 1910–11.
Quinault River at Quinault Lake, Wash., 1911–
Soleduck River near Quillayute, Wash., 1897–1901.
    Kalawa River near Forks, Wash., 1897–1901.
Elwha River at McDonald, Wash., 1897–1901.
Elwha River near Port Angeles, Wash., 1911–12.
Dungeness River at Sequim, Wash., 1897–98.
Dungeness River at Dungeness, Wash., 1898–1901.

PUGET SOUND DRAINAGE BASINS.

Dosewallips River at Brinnon, Wash., 1910–11.
Duckabush River near Duckabush, Wash., 1910–11.
Skokomish River, North Fork (head of Skokomish River), near 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 at Alderton, Wash., 1914–
Puyallup River at Puyallup, Wash., 1914–
    Carbon River at Fairfax, Wash., 1910–1912.
    White River below Forks, near Enumclaw, Wash., 1911–12.
    White River at Buckley, Wash., 1899–1903; 1910–11; 1913–
        Greenwater River at mouth, near Enumclaw, Wash., 1911–12.
        White River flume at Buckley, Wash., 1913–
        Green River at Kanaskat, Wash., 1911.
Duwamish River:
    Cedar River at Vaughn Bridge, near Cedar Lake, Wash., 1898–99.
    Cedar River at Cedar Lake, near North Bend, Wash., 1902–3.

[1] Revised decision of United States Geographic Board rendered Oct. 3, 1917.

COLUMBIA RIVER BASIN.

Columbia River at Trail, British Columbia, 1913–
Columbia River at Wenatchee, Wash., 1910; 1913–1916.
Columbia River at Vernita, Wash., 1917–
Columbia River near Julia, Wash., 1905.
Columbia River at Hanford, Wash., 1910.
Columbia River at Pasco, Wash., 1904–1910.
Columbia River at Cascade Locks and The Dalles, Oreg., 1878–
Kootenai River at Libby Mont., 1910–
Kootenai River at Crossport, Idaho, 1904.
Kootenai River near Bonners Ferry, Idaho, 1904.
Kootenai River near Porthill, Idaho, 1904.
Callahan Creek at Troy, Mont., 1911–1916.
Yaak River near Troy, Mont., 1910–1916.
Moyie River at Snyder, Idaho, 1911–1916.
Clark Fork at Missoula, Mont., 1898-1907.
Clark Fork at St. Regis, Mont., 1910–
Clark Fork near Plains, Mont., 1910–
Pend Oreille Lake at Sandpoint, Idaho, 1914–
Clark Fork at Priest River, Idaho, 1903–1905.
Clark Fork at Newport, Wash., 1904–1910.
Clark Fork at Metaline Falls, Wash., 1908–1910; 1912–
Racetrack Creek near Anaconda, Mont., 1911–12; 1914–
Little Blackfoot River and ditch near Elliston, Mont., 1910-1915.
Rock Creek near Quigley, Mont., 1910–1912.
Big Blackfoot River at Bonner, Mont., 1898–1905.
Rattlesnake Creek at Missoula, Mont., 1899–1900.
Bitterroot River, West Fork (head of Bitterroot River), near Darby, Mont., 1910–
Bitterroot River near Grantsdale, Mont., 1902–1907.
Bitterroot River near Missoula, Mont., 1898–1901; 1903–4.
East Fork of Bitterroot River near Darby, Mont., 1910–1916.
Lolo Creek near Lolo, Mont., 1910–1916.
St. Regis River near St. Regis, Mont., 1910–
Flathead River near Columbia Falls, Mont., 1910–
Flathead River at Demersville, near Kalispell, Mont., 1909–1912.
Flathead River at Damon's ranch near Kalispell, Mont., 1909-1912.
Flathead River at Keller's ranch, near Holt., Mont., 1909–1912.
Flathead Lake (on Flathead River) near Holt, Mont., 1900.
Flathead Lake at Polson, Mont., 1908–
Flathead River near Polson, Mont., 1907–
Middle Fork of Flathead River at Belton, Mont., 1910–
Lake McDonald outlet at Lake McDonald, Mont., 1912–1914.
South Fork of Flathead River near Columbia Falls, Mont., 1910–1916.
Stillwater River near Kalispell, Mont., 1906–7.
Whitefish River near Kalispell, Mont., 1906.
Ashley Creek, Kila, Mont., 1916.
Swan River near Big Fork, Mont., 1910–11
Big Creek, near Polson, Mont., 1917–
Little Bitterroot River near Marion, Mont., 1910–1916.
Little Bitterroot River near Hubbart, Mont., 1909–1916.
Little Bitterroot River near Niarada (Dayton), Mont., 1908–9; 1916.
Crow Creek near Ronan, Mont., 1906–

Columbia River tributaries—Continued.
Yakima River tributaries—Continued.
New Reservation canal at Parker (Yakima City), Wash., 1904–
Old Reservation canal at Parker (Wapato), Wash., 1904–
Sunnyside canal near Parker (Wapato), Wash., 1904–
Toppenish Creek near Fort Simcoe, Wash., 1909–
Toppenish Creek near White Swan (Wapato)' Wash., 1909–1912.
Toppenish Creek at railway bridge, near Toppenish, Wash., 1894–1896.
Toppenish Creek near Toppenish, Wash., 1908–9.
Toppenish Creek at Alfalfa, Wash., 1909–1912.
Simcoe Creek near Fort Simcoe, Wash., 1909–
Reservation drain at Alfalfa, Wash., 1912–
Satus Creek near Toppenish, Wash., 1908–1913.
Satus Creek below Dry Creek, near Toppenish, Wash., 1913–
Satus Creek near Alfalfa, Wash., 1905.
Satus Creek near Satus, Wash., 1894–1896.
Kiona canal near Kiona, Wash., 1904–1906; 1908–1911.
Kennewick canal near Richland (Kennewick), Wash., 1904–5; 1910–11.
Lower Yakima canal near Kiona, Wash., 1905; 1910–11.
Snake River at south boundary of Yellowstone National Park, Wyo., 1913–
Jackson Lake (Snake River) at Moran, Wyo., 1909–10 (fragmentary); 1911–
Snake River [1] near Moran, Wyo., 1903–
Snake River [1] at Grovont, Wyo., 1899.
Snake River at Alpine, Idaho, 1916–
Snake River [1] near Lyon, Idaho, 1903–1911.
Snake River [1] near Heise, Idaho, 1910–
Snake River at Idaho Falls, Idaho, 1889–90; 1892–1894.
Snake River near Shelley, Idaho, 1915–
Snake River near Firth, Idaho, 1915–
Snake River at Porterville Bridge near Blackfoot, Idaho, 1916–
Snake River near Blackfoot, Idaho, 1910–
Snake River at Neeley, Idaho, 1906–
Lake Walcott (on Snake River) near Minidoka, Idaho, 1909–
Snake River at Howells Ferry, near Minidoka, Idaho, 1910–
Snake River at Montgomery Ferry, near Minidoka, Idaho, 1895–1899; 1901–1910.
Lake Milner (on Snake River) at Milner, Idaho, 1911–
Snake River at Milner, Idaho, 1909–
Snake River near Twin Falls, Idaho, 1911–1917.
Snake River near Hagerman, Idaho, 1912–1917.
Snake River at King Hill, Idaho, 1909–
Snake River near Murphy, Idaho, 1912; 1913–
Snake River at Weiser, Idaho, 1910–
Snake River at Lewiston, Idaho, 1910.
Snake River at Riparia, Wash., 1916–
Snake River near Burbank, Wash., 1907–1917.
Pacific Creek near Moran, Wyo., 1906; 1917.
Buffalo Fork near Elk (Moran), Wyo., 1906; 1917.
Spread Creek near Elk, Wyo., 1917.
Cottonwood Creek near Teton, Wyo., 1917.
Spring Creek near Teton, Wyo., 1917.
Spring Creek near Zenith, Wyo., 1917.
Gros Ventre River at Zenith, Wyo., 1917.

[1] Decision of United States Geographic Board; formerly called South Fork of Snake River.

[1] Decision of United States Geographic Board; formerly called North Fork of Snake River.

Columbia River tributaries—Continued.
Snake River tributaries—Continued.
Owyhee River near Owyhee, Nev., 1913–
Owyhee River at Owyhee, Oreg., 1890–1896; 1903–1916.
South Fork of Owyhee River near Tuscarora, Nev., 1913.
Jack Creek near Tuscarora, Nev., 1913–
Jordan Creek near Jordan Valley, Oreg., 1911–
Cow Creek at Narrows, near Jordan Valley, Oreg., 1914.
Cow Creek at mouth, near Jordan Valley, Oreg., 1914.
Owyhee canal near Owyhee, Oreg., 1904–5; 1911–1916.
Boise River near Twin Springs, Idaho, 1911–
Boise River at Dowling's ranch, near Arrowrock, Idaho, 1911–
Boise River below Moore Creek, near Arrowrock, Idaho, 1915–16.
Boise River near Highland, Idaho (replaces the Boise station), 1905–1915.
Boise River near Boise, Idaho, 1894–1904.
Boise River at Caldwell, Idaho, 1895–96.
Cottonwood Creek near Arrowrock, Idaho, 1914–1917.
South Fork of Boise River near Lenox, Idaho, 1911–
Little Camas Creek below reservoir near Bennett, Idaho, 1917.
Little Camas canal at heading near Bennett, Idaho, 1917.
Little Camas canal above tunnel No. 9, near Bennett, Idaho, 1917.
Smith Creek near Lenox, Idaho, 1916–17.
Long Gulch Creek near Lenox, Idaho, 1916.
Rattlesnake Creek near Lenox, Idaho, 1916–17.
Willow Creek near Lenox, Idaho, 1916–17.
Little Camas Creek near Little Camas Store, Idaho, 1896.
Moore Creek near Arrowrock, Idaho, 1915–
Grimes Creek near Centerille, Idaho, 1910.
Dry Creek:
Spring Creek near Boise, Idaho, 1911–12.
Wilson ditch near Ontario, Oreg.; 1904–5.
Malheur River near Drewsey, Oreg., 1914.
Malheur River at Warmsprings reservoir site, near Riverside, Oreg., 1914–1917.
Malheur River above South Fork, at Riverside, Oreg., 1906–7; 1908–1910.
Malheur River at Riverside, Oreg., 1909–1915.
Malheur River near Namorf, Oreg., 1913–1917.
Malheur River near Harper ranch, near Westfall, Oreg., 1903–1905.
Malheur River near Little Valley, Oreg., 1914.
Malheur River at McLaughlin bridge, near Vale, Oreg., 1904–1906.
Malheur River at Vale, Oreg., 1890–91; 1895–96; 1903–1914.
Malheur River at Halliday bridge, near Ontario, Oreg., 1904–5.
Malheur River near Ontario, Oreg., 1903–4.
South Fork of Malheur River at Riverside, Oreg., 1910–1913; 1913–1915.
North Fork of Malheur River at Scotts ranch, near Beulah, Oreg., 1914.
North Fork of Malheur River at Foley's ranch, near Buelah, Oreg., 1909–1912; 1913–14.
Vines ditch near Little Valley, Oreg., 1904–5; 1914.
Malheur Farmers' canal above Vale, Oreg., 1904–5.
McLaughlin ditch above Vale, Oreg., 1904–5.
"J. H." ditch above Vale, Oreg., 1904–5.
Gellerman & Frohman ditch above Vale, Oreg., 1904–5.
Sand Hollow ditch above Vale, Oreg., 1904–5.
Bully Creek near Westfall, Oreg., 1911; 1912–13.

Columbia River tributaries—Continued.
Deschutes River at Crane Prairie, near Lapine, Oreg., 1907–1913; 1914–1917.
Deschutes River at Forest Service bridge, near Lapine, Oreg., 1910; 1912; 1913; 1914—1917.
Deschutes River near Lava, Oreg., 1905–1907; 1909–1911; 1912; 1913–1915.
Deschutes River at West's ranch, near Lava, Oreg., 1906–1909; 1914.
Deschutes River at Benham Falls, Oreg., 1909–1914.
Deschutes River at Lava Island, Oreg., 1915–16.
Deschutes River at Bend, Oreg., 1904–1914.
Deschutes River below Bend, Oreg., 1914–
Deschutes River at Tumalo [Laidlaw], Oreg., 1909–1912; 1914–15.
Deschutes River near Cline Falls, Oreg., 1910–11; 1912–13.
Deschutes River at Mecca, Oreg., 1911–
Deschutes River at Sherar, Oreg., 1912–1914.
Deschutes River at Moro, Oreg., 1897–1899.
Deschutes River at Moody (Biggs), Oreg., 1906–
Odell Creek near Crescent, Oreg., 1911; 1912; 1913; 1914.
Fall River near Lapine, Oreg., 1912.
East Fork at Crescent, Oreg., 1904–1908; 1910–1914.
East Fork at Morson intake, near Lapine, Oreg., 1914–1917.
East Fork near Lapine, Oreg., 1910–1913.
East Fork at Allen's ranch, near Lava, Oreg., 1905–1912; 1913–1915.
Crescent Creek at outlet of Crescent Lake, near Crescent, Oreg., 1911; 1912–1915.
Crescent Creek below Cold Creek, near Crescent, Oreg., 1912–13.
Crescent Creek near Crescent, Oreg., 1912–13; 1914.
Big Marsh Creek near Crescent, Oreg., 1912–1914.
Arnold Canal near Bend, Oreg., 1914–
Central Oregon canal near Bend, Oreg., 1905–
Pilot Butte canal near Bend, Oreg., 1905–
North canal near Bend, Oreg., 1913–
Swalley canal near Bend, Oreg., 1913–
Tumalo Creek near Tumalo [Laidlaw], Oreg., 1906–1914.
Tumalo Creek near Bend, Oreg., 1906–
Lewis Creek near Tumalo [Laidlaw], Oreg., 1908–9.
Wimer canal near Tumalo [Laidlaw], Oreg., 1906–1914; 1916–17.
Columbia Southern canal near Tumalo [Laidlaw], Oreg., 1906–1914; 1916.
Tumalo feed canal near Bend, Oreg., 1914–
Squaw Creek near Sisters, Oreg., 1906–
Squaw Creek canal near Sisters, Oreg., 1916–
McAllister's ditch near Sisters, Oreg., 1909–1913.
Crooked River near Post, Oreg., 1908–1911.
Crooked River at Hoffman's ranch, near Prineville, Oreg., 1913–14.
Crooked River near Prineville, Oreg., 1908–1912.
Crooked River at Prineville, Oreg., 1914.
Prineville flour mill tailrace at Prineville, Oreg., 1914.
Ochoco Creek near Howard, Oreg., 1910–11.
Ochoco Creek at Elliot's ranch, near Prineville, Oreg., 1908–1910; 1914–
Ochoco Creek at Prineville, Oreg., 1912; 1913–1915.
Marks Creek near Prineville, Oreg., 1916.
Mill Creek near Prineville, Oreg., 1916.
Tableland ditch near Prineville, Oreg., 1915–1917.
Elliot ditch near Prineville, Oreg., 1908–1910; 1914–1917.
McKay Creek near Prineville, Oreg., 1915–16.

Columbia River tributaries—Continued.
Little White Salmon River below Lava Creek, near Cook, Wash., 1903–1906.[1]
Little White Salmon River near Cook, Wash., 1909.
Latourell Creek at Latourell, Oreg., 1912–13.
Sandy River above Salmon River, at Brightwood, Oreg., 1910–1914.
Sandy River below Salmon River, near Brightwood, Oreg., 1907–1911.
Sandy River near Marmot, Oreg., 1911–1915.
Sandy River at and below dam near Marmot, Oreg., 1915–
Sandy River above Bull Run River, near Bull Run, Oreg., 1910–1912.
Sandy River below Bull Run River, near Bull Run, Oreg., 1910–1914.
Clear Fork of Sandy River near Welches, Oreg., 1913; 1914–15.
Lost Creek near Brightwood, Oreg., 1913–
Sandy River canal near Marmot, Oreg., 1916–
Still Creek near Rowe, Oreg., 1910–1912.
Salmon River near Rowe, Oreg., 1910–1912.
Salmon River at Welches, Oreg., 1913–14.
Salmon River at Fish Hatchery, near Brightwood, Oreg., 1912–13.
Bull Run River near Bull Run, Oreg., 1895–
Little Sandy River near Marmot, Oreg., 1913–
Little Sandy River near Bull Run, Oreg., 1911–1913.
Little Sandy flume near Bull Run, Oreg., 1912–13.
Willamette River, Middle Fork (head of Willamette River), above Salt Creek, near Oakridge, Oreg., 1913–14.
Willamette River, Middle Fork, below North Fork, near Oakridge, Oreg., 1911–12.
Willamette River, Middle Fork, at Jasper, Oreg., 1905–1912; 1913–1917.
Willamette River at Springfield, Oreg., 1911–1913.
Willamette River at Albany, Oreg., 1878–1880; 1892–.
Willamette River at Salem, Oreg., 1909–1916.
Willamette River at Oregon City, Oreg., 1909–1912.
Salt Creek near Oakridge, Oreg., 1913–14.
Salmon Creek near Oakridge, Oreg., 1913–
North Fork of Middle Fork of Willamette River near Oakridge (Hazeldell), Oreg., 1909–1912; 1913–1916.
Fall Creek near Fall Creek, Oreg., 1911.
Coast Fork of Willamette River near Goshen, Oreg., 1905–1912.
Row River near Disston, Oreg., 1910–1913.
McKenzie River at Clear Lake, Oreg., 1912–1915.
McKenzie River at McKenzie Bridge, Oreg., 1910–
McKenzie River at Martins Rapids, Oreg., 1910–11.
McKenzie River near Springfield, Oreg., 1905–1915.
Eugene power canal near Walterville, Oreg., 1912–1915.
North Santiam River near Hoover, Oreg., 1910–1913.
North Santiam River at Detroit, Oreg., 1907–1909.
North Santiam River at Niagara, Oreg., 1908–
North Santiam River at Mehama, Oreg., 1905–1907; 1910–1914.
Santiam River at Jefferson, Oreg., 1905–6; 1908–1916.
Marion Fork of Santiam River at Marion Lake, near Hoover, Oreg., 1907; 1909–1912.
Puzzle Creek near Detroit (Hoover), Oreg., 1907; 1909.
North Fork of Puzzle Creek near Hoover, Oreg., 1909–1912.
South Fork of Puzzle Creek near Hoover, Oreg., 1909–1912.
Pamelia Creek near Detroit, Oreg., 1907; 1909; 1913.

[1] Records published in U. S. Geol. Survey Water-Supply Paper 272, pp. 428–429.

Rogue River near Tolo, Oreg., 1905–
Rogue River near Galice, Oreg., 1906.
California-Oregon Power Co.'s flume near Prospect, Oreg., 1913–
Mill Creek near Prospect, Oreg., 1910.
Big Butte Creek, South Fork (head of Big Butte Creek), at Butte Falls, Oreg., 1910–11; 1915.
Little Butte Creek, South Fork (head of Little Butte Creek), near Deadwood, Oreg., 1917.
Little Butte Creek, South Fork, near Lake Creek, Oreg., 1910–1913.
Little Butte Creek above Eagle Point, Oreg., 1916–
Little Butte Creek near Eagle Point, Oreg., 1907–1916.
Dead Indian Creek near Lilyglen, Oreg., 1916–
North Fork of Little Butte Creek, near Lake Creek, Oreg., 1911–1913; 1916–
Rogue River Valley canal at intake, near Lake Creek, Oreg., 1914; 1915; 1916.
Rogue River Valley canal near Brownsboro, Oreg., 1913; 1915–
Bear Creek at Talent, Oreg., 1907–1914.
Bear Creek at Medford, Oreg., 1915–
Neil Creek near Ashland, Oreg., 1913.
George Dunn ditch near Ashland, Oreg., 1913.
Ashland Creek at Ashland, Oreg., 1913.
Wagner Creek near Talent, Oreg., 1913.
Phoenix ditch near Talent, Oreg., 1916–
Evans Creek at Wimer, Oreg., 1913.
Applegate River near Buncom, Oreg., 1911–1914.
Applegate River at Murphy, Oreg., 1907–1910.
Cameron ditch near Buncom, Oreg., 1911–1914.
East Fork of Little Applegate River near Buncom, Oreg., 1913.
Little Applegate River near Ruch, Oreg., 1913.
West Fork of Little Applegate River near Buncom, Oreg., 1913.
Spicer ditch near Buncom, Oreg., 1913.
Thompson Creek near Applegate, Oreg., 1913.
Slate Creek at Wonder, Oreg., 1913.
Grave Creek near Placer, Oreg., 1913.
Coquille River, South Fork, at Powers, Oreg., 1916–
South Umpqua River (head of Umpqua River) near Tiller, Oreg., 1910–11.
South Umpqua River near Brockway, Oreg., 1905–1912.
Umpqua River near Elkton, Oreg., 1905–
Cow Creek at Riddle, Oreg., 1911–12.
North Umpqua River at Tokeetee Falls near Hoaglin, Oreg., 1908–9; 1914–1917.
North Umpqua River near Hoaglin, Oreg., 1910–1912; 1914–1916.
North Umpqua River near Glide, Oreg., 1915–
North Umpqua River near Oakcreek, Oreg., 1905–1908; 1913–1915.
North Umpqua River at Winchester, Oreg., 1908–1913.
Calapooya Creek near Sutherlin, Oreg., 1912–13.
Luse canal near Sutherlin, Oreg., 1912–13.
Mill Creek near Ash, Oreg., 1907–1912; 1915–1917.
Siletz River at Siletz, Oreg., 1905–1912.
Wilson River near Tillamook, Oreg., 1914–1916.
North Fork of Wilson River near Tillamook, Oreg., 1913–1915; 1916.
Nehalem River at Salmonberry, near Balm, Oreg., 1913–14.

REPORTS ON WATER RESOURCES OF THE NORTH PACIFIC SLOPE DRAINAGE BASINS.

PUBLICATIONS OF UNITED STATES GEOLOGICAL SURVEY.

WATER-SUPPLY PAPERS.

Water-supply papers are distributed free by the Geological Survey as long as its stock lasts. An asterisk (*) indicates that this stock has been exhausted. Many of the papers marked in this way may, however, be purchased (at price noted) from the SUPERINTENDENT OF DOCUMENTS, Washington, D. C. Omission of the price indicates that the report is not obtainable from Government sources. Water-supply papers are of octavo size.

*4. A reconnaissance in Southeastern Washington, by I. C. Russell, 1897. 96 pp., 7 pls. 15c.

Describes an area "bordered on the south by Oregon, on the east by Idaho, on the north by Snake River, and on the west by the Columbia," and "briefly designated as lying south of Snake River," discusses climate, vegetation, topography and drainage, geologic formations—including the river terraces and soils—irrigation, and the artesian water supply, and gives an outline of the geological history of the region.

*44. Profiles of rivers in the United States, by Henry Gannett. 1901. 100 pp. 11 pls. 15c.

Gives elevations and distances along Columbia, Willamette, Flathead, and Snake rivers.

*53. Geology and water resources of Nez Perce County, Idaho, Part I, by I. C. Russell. 1901. 85 pp., 10 pls. 10c.

*54. Geology and water resources of Nez Perce County, Idaho, Part II, by I. C. Russell. 1901. 55 pp. (87–141).

Nos. 53 and 54 relate to an area "in western Idaho, bordered on the west by portions of Washington and Oregon," drained through Snake River to the Columbia; they describe the topography, geology, and soils of the region, discuss the relation of the surface features—plateaus, canyons, streams, etc.—to the geology and the climate, the source and quantity of the water supply, including springs and artesian wells, and refer briefly to the occurrence of building stones, lignite, gold, silver, and copper. They include also a short bibliography of artesian waters and two appendixes—one giving list of elevations, and the other notes concerning Portland cement.

55. Geology and water resources of a portion of Yakima County, Wash., by G. O. Smith. 1901. 68 pp., 7 pls. 10c.

Describes topography, climate, soil, agriculture, geology, and surface and ground waters of an area comprising about 50 square miles in the vicinity of North Yakima; discusses in some detail the artesian basins and wells.

*57. Preliminary list of deep borings in the United States, Part I (Alabama-Montana), by N. H. Darton. 1902. 60 pp. 5c.

*61. Preliminary list of deep borings in the United States, Part II, (Nebraska-Wyoming), by N. H. Darton. 1902. 67 pp. 5c.

Nos. 57 and 61 contain information as to depth, diameter, yield, and head of water in borings more than 400 feet deep; under head "Remarks" gives information concerning temperature, quality of water, purposes of boring, etc. The lists are arranged by States, and the States are arranged alphabetically. A second, revised, edition was published in 1905 as Water-Supply Paper 149 (q. v.). 5c.

*78. Preliminary report on artesian basins in southwestern Idaho and southeastern Oregon, by I. C. Russell. 1903. 53 pp., 2 pls. 5c.

Discusses briefly the rocks and geologic structure of a part of the Snake River Plains in Canyon and Owyhee counties, Idaho, and Malheur and Harney counties, Oreg.; describes briefly the conditions on which artesian flow depends, and in some detail the springs and drilled wells in the Lewis, Otis, Harney, and Whitehorse artesian basins; also describes artesian wells in alluvial deposits and discusses the size of drill holes, casings, etc., the preservation of well records, and the importance of laws to control the use of artesian waters; gives list of publications bearing on artesian waters.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer, 1904. 361 pp. 25c. [Inquiries concerning this report should be addressed to the Reclamation Service.] Contains:

Investigations in Idaho, by D. W. Ross. Describes the irrigable lands in the area drained by Snake River.

Investigations in Oregon, by J. T. Whistler. Mentions the Umatilla, Malheur, and Harney projects.

Work in Washington, by T. A. Noble. Describes the plains of Columbia River.

96. Destructive floods in the United States in 1903, by E. C. Murphy. 1904. 81 pp., 13 pls. 15c.

Gives an account of a flood (commonly spoken of as the "Heppner disaster") on Willow Creek, a tributary of Columbia River, in Morrow County, Oreg.

*103. A review of the laws forbidding pollution of inland waters in the United States, by E. B. Goodell. 1904. 120 pp. [Superseded by No. 152, q. v.]

Cites statutory restrictions of water pollution in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.

111. Preliminary report on the underground waters of Washington, by Henry Landes. 1905. 85 pp., 1 pl. 10c.

Describes, by counties, the municipal water supplies, deep wells, and springs in the State, giving also for each county a brief account of the climate, rainfall, topography, drainage, and geology.

118. Geology and water resources of a portion of east-central Washington, by F. C. Calkins. 1905. 96 pp., 4 pls. 5c.

Describes briefly the topography, geology, climate, vegetation, grazing, and agriculture on the Columbia Plains and in Kittitas Valley; discusses the streams, springs, and shallow and deep wells.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Cites legislative acts relating to ground waters in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.

*149. Preliminary list of deep borings in the United States, second edition, with additions, by N. H. Darton. 1905. 175 pp. 10c.

Gives, by States (and within the States by counties), location, depth, diameter, yield, height of water, and other available information, concerning wells 400 feet or more in depth; includes all wells listed in Water-Supply Papers 57 and 61; mentions also principal publications relating to deep borings.

*152. A review of the laws forbidding pollution of inland waters in the United States (second edition), by E. B. Goodell. 1905. 149 pp. 10c.

Cites statutory restrictions of water pollution in Idaho, Nevada, Oregon, Utah, Washington, and Wyoming.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

Gives estimates (p. 85) of flood discharge and frequency for Boise River at Boise and Weiser River at Weiser, Idaho.

*231. Geology and water resources of the Harney Basin region, Oregon, by G. A. Waring. 1909. 93 pp., 5 pls. 25c.

The greater part of the area covered by this report is in the Great Basin, but a small tract in the northeastern corner is drained by a number of small streams that are tributary to Malheur River.

253. Water powers of the Cascade Range, Part I, Southern Washington, by J. C. Stevens. 1910. 94 pp., 21 pls. 40c.

Discusses conditions governing hydraulic development, water laws of Washington, and variations in streams; describes the drainage basins of Klickitat, White Salmon, Little White Salmon, Lewis, and Toutle rivers; gives results of observations at gaging stations, and estimates of average minimum discharge and of the available horsepower at the power sites.

274. Some stream waters of the western United States, with chapters on sediment carried by the Rio Grande and the industrial application of water analyses, by Herman Stabler. 1911. 188 pp. 15c.

Describes collection of samples, plan of analytical work, and methods of analyses; discusses soap-consuming power of waters, water softening, boiler waters, and water for irrigation; gives results of analyses of waters of Boise, Malheur, Payette, and Palouse rivers, and Salmon Creek.

313. Water powers of the Cascade Range, Part II, Cowlitz, Nisqually, Puyallup, White, Green, and Cedar drainage basins, by F. F. Henshaw and G. L. Parker. 1913. 170 pp., 16 pls. 55c.

Describes the geological features and history of the drainage basins, topography and drainage, soils and vegetation, and precipitation; gives stream-flow records and discusses water powers, storage, and power sites; discusses also natural resources and harbors of the Pacific coast, central electric stations, and power utilization, and gives commercial and residential rates. See also 253.

316. Geology and water resources of a portion of south-central Washington, by G. A. Waring. 1913. 46 pp., 1 pl. 5c.

Describes settlements, climate and vegetation, agriculture, grazing, geographic provinces, relation of surface features and structure, and geology; discusses shallow and artesian waters and irrigation enterprises in Sunnyside and Reservation valleys, Horse Heaven Plateau, and the Columbia River Plains, and irrigation along lower Yakima River; gives tabulated data concerning wells and springs.

*339. Quality of the surface waters of Washington, by Walton Van Winkle. 1914. 105 pp., 2 pls. 15c.

Discusses briefly the natural and economic features of the State, the constituents and uses of the natural waters, purification of water, methods of analysis, and industrial and geochemical interpretation of the results of analysis; describes the general features of the principal drainage basins and gives the results of an investigation of the character of the river waters; treats briefly of the average chemical composition of river water, the economic value of the rivers, denudation, and the influence of natural features on the character of the waters.

344. Deschutes River, Oregon, and its utilization, by F. F. Henshaw, John H. Lewis, and E. J. McCaustland. 1914. 200 pp., 28 pls. 50c.

A report, prepared in cooperation with the State of Oregon, containing the results of measurements of stream flow, a discussion of the economic distribution of the water, and chapters on the quality of the water, the availability of the water supply, the developed water powers, undeveloped power sites, water rights and appropriations, the relation of the Federal Government to the development of water power, and Government permits for power and reservoir sites.

346. Profile surveys in the basin of Clark Fork of Columbia River, Montana-Idaho-Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 6 pp., 3 pls. (22 sheets). 50c.

*347. Profile surveys in Snake River basin, Idaho, prepared under the direction of R. B. Marshall, chief geographer. 1914. 12 pp., 3 pls. (37 sheets). 55c.

348. Profile surveys in Hood and Sandy River basins, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 2 pls. (6 sheets). 30c.

349. Profile surveys in Willamette River basin, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1914. 8 pp., 3 pls. (16 sheets). 30c.

363. Quality of the surface waters of Oregon, by W. Van Winkle. 1914. 137 pp., 2 pls. 20c.

Describes the topography, drainage, rocks and soils, climate, population, and industries of the State, the constituents of natural waters, water for domestic and industrial uses, and purification of water, methods of analysis, and interpretation of results of analysis; describes the general features of the river basins and the character of the river waters, discusses the conditions influencing the quality of the surface waters, average chemical composition, geochemical character, denudation, industrial value, and value for irrigation.

*364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of Soap and Omak lakes, Wash., and of mine waters from Butte, Mont.

366. Profile surveys of Snoqualmie, Sultan, and Skykomish rivers, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 7 pp., 3 pls. (12 sheets). 20c.

368. Profile surveys in Wenatchee River basin, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1914. 7 pp., 1 pl. (8 sheets). 20c.

369. Water powers of the Cascade Range, Part III, Yakima River basin, by G. L. Parker and F. B. Storey, 1916. 169 pp., 20 pls. 45c.

Describes the geography of the basin, the geologic history, physiography and river history, climate, settlement, and development, population, and transportation; gives stream-flow records and discusses natural conditions affecting stream flow; storage reservoirs, developed and undeveloped power sites; treats also of the industrial development of the region, discussing irrigation by gravity systems and by pumping, the production of coal and other minerals, and manufacturing; presents a scheme of development and utilization of stored water. The report was prepared under the direction of the Washington State Board of Geological Survey, and is based on data consisting of "stream-flow records, river plans and profiles, reservoir surveys, and field reconnaissance of the rivers and their various tributaries," obtained by the United States Geological Survey and the United States Reclamation Service, supplemented by a large amount of information furnished by private parties.

370. Surface water supply of Oregon, 1878–1910, by F. F. Henshaw and H. J. Dean. 1915. 829 pp., 1 pl. 45c.

Describes briefly the natural features of Oregon and in greater detail the general features of the river basins; consists principally of records of stream flow that have been carefully studied and recomputed when necessary to insure their best possible interpretation.

*376. Profile surveys in Chelan and Methow River basins, Washington, prepared under the direction of R. B. Marshall, chief geographer. 1915. 8 pp., 5 pls. 15c.

377. Profile surveys in Spokane River basin, Washington, and John Day River basin, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1915. 7 pp., 10 pls. 15c.

378. Profile surveys in 1914 on Middle Fork of Willamette River and White River, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1915. 8 pp., 6 pls. 15c.

379. Profile surveys in 1914 in Umpqua River basin, Oregon, prepared under the direction of R. B. Marshall, chief geographer. 1915. 7 pp., 13 pls. 20c.

*400. Contributions to the hydrology of the United States, 1916, Nathan C. Grover, chief hydraulic engineer, 1917. 108 pp., 7 pls. 15c. Contains:

(*b*) Artesian water for irrigation in Little Bitterroot Valley, Mont., by O. E. Meinzer.

419. Profile surveys in 1915 in Skagit River basin, Washington, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 8 pp., 12 pls. 15c.

420. Profile surveys along Henrys Fork, Idaho, and Logan River and Blacksmith Fork, Utah, prepared under the direction of W. H. Herron, acting chief geographer. 1916. 8 pp., 10 pls. 10c.

*425. Contributions to the hydrology of the United States, 1917, N. C. Grover, chief hydraulic engineer, 1918. Contains:

(*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 availabe water supply of the arid regions, the duty of water, flood waters, relation of rainfall to river flow; classifies the drainage basins; and describes the rivers of the Missouri, Arkansas, Rio Grande, Colorado, Sacramento, and San Joaquin basins, and the principal streams of the Great Basin in Nevada and Utah and the Snake River basin.

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*Engineering results of irrigation survey, by H. M. Wilson, pp. 351–427, Pls. 147–182. Describes structures on the Pocatello canal, Idaho.

Sixteenth Annual Report of the United States Geological Survey, 1894–95, Charles D. Walcott, Director. 1896. (Pts. II, III, and IV, 1895.) 4 parts. *Pt. II. Papers of an economic character, xix, 598 pp., 43 pls. $1.25. Contains:

The public lands and their water supply, by F. H. Newell, pp. 457–533, Pls. 35–39. Describes general character of the public lands, the lands disposed of (railroad, grant, and swamp lands, and private miscellaneous entries), lands reserved (Indian, forest, and military reservations), the vacant lands, and the rate of disposal of vacant land; discusses the streams, wells, and reservoirs as sources of water supply; gives details for each State.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Pts. II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. V, Forest reserves, xvii, 400 pp., 110 pls. $1.25. 16 maps in separate case, 75c. Contains:

*Priest River Forest Reserve, by J. B. 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

[1] Index maps showing areas in the North Pacific slope basins covered by topographic maps and by geologic folios will be mailed on receipt of request addressed to the Director, U. S. Geological Survey, Washington, D. C.

and geologic features of the country and its mineral products. The topographic map shows roads, railroads, waterways, and, by contour lines, the shapes of the hills and valleys and the height above sea level of all points in the quadrangle. The areal-geology map shows the distribution of the various rocks at the surface. The structural-geology map shows the relations of the rocks to one another underground. The economic-geology map indicates the location of mineral deposits that are commercially valuable. The artesian-water map shows the depth to underground-water horizons. Economic-geology and artesian-water maps are included in folios if the conditions in the areas mapped warrant their publication. The folios are of special interest to students of geography and geology and are valuable as guides in the development and utilization of mineral resources.

The folios numbered from 1 to 163, inclusive, are published in only one form (18 by 22 inches), called the library edition. Some of the folios that bear numbers higher than 163 are published also in an octavo edition (6 by 9 inches). Owing to a fire in the Geological Survey building May 18, 1913, the stock of geologic folios was more or less damaged by fire and water, but the folios are usable and are sold at the uniform price of 5 cents each, with no reduction for wholesale orders. This rate applies to folios in stock from 1 to 184, inclusive (except reprints), also the library edition of folio 186. The library edition of folios 185, 187, and higher numbers sells for 25 cents a copy, except that some folios which contain an unusually large amount of matter sell at higher prices. The octavo edition of folio 185 and higher numbers sells for 50 cents a copy except folio 193, which sells for 75 cents a copy. If 34 folios selling at 25 cents each (or their equivalent in higher-priced folios) are ordered at one time a discount of 40 per cent is allowed; $5.10 is the minimum amount accepted at this rate.

All the folios contain descriptions of the drainage of the quadrangles. The folios in the following list contain also brief discussions of the underground waters in connection with the economic resources of the areas and more or less information concerning the utilization of the water resources.

An asterisk (*) indicates that the stock of the folio is exhausted.

*45. Boise, Idaho.

86. Ellensburg, Wash. 5c.

*103. Nampa, Idaho–Oregon.

Describes the relief, drainage, climate, and vegetation of the area; discusses the geologic history and geologic formations, and, under "Economic geology," the surface waters available for irrigation, the springs and shallow wells, and the artesian wells; indicates areas of possible artesian flow.

104. Silver City, Idaho. 5c.

106. Mount Stuart, Wash. 5c.

*139. Snoqualmie, Wash.

MISCELLANEOUS REPORTS.

Other Federal bureaus and State and other organizations have from time to time published reports relating to the water resources of various sections of the country. Notable among those pertaining to the northern Pacific coast drainage basins are the reports of the commissioner of conservation of the State of Montana; the State land commission; the State engineer of Idaho; the Bureau of Industry, Agriculture, and Irrigation of Nevada; the State engineers of Nevada, Oregon, Utah, and Washington; the annual reports of the United States Reclamation Service; and the reports of the Chief of Engineers, U. S. Army. The following reports deserve special mention:

The Oregon system of water titles, by John H. Lewis: Oregon State Engineer Bull. 2, 1912.

State and National water laws, with a detailed statement of the Oregon system of water titles, by John H. Lewis, with a discussion by Clarence T. Johnston and L. J. Le Conte: Am. Soc. Civil Eng. Trans., vol. 76, pp. 637–758, 1913.

Report of the commission on conservation [State of Montana] on bills relating to public lands, water rights, and the protection and preservation of the forests: Helena, 1911; also report of the governor of the State of Montana on the same subject.

How to appropriate the public waters of the State of Nevada, compiled by W. M. Kearney, State engineer, 1911.

Requirements and regulations, including suggestions and instructions in relation to the appropriation, use, and measurement of water in the State of Nevada: State engineer of Nevada, 1912.

Irrigation pumping in Nevada, etc., by Charles Norcross: Nevada Bur. of Industry, Agr., and Irr. Bull. 8, 1913.

The water resources of Washington: Potable and mineral water, by H. G. Byers; artesian water, by C. A. Ruddy; water power, by R. E. Heine: Washington Geol. Survey Ann. Rept. for 1901, vol. 1, pt. 5, 1902.

Preliminary report on the Quincy Valley irrigation project, by Henry Landes and others: Washington Geol. Survey Bull. 14, 1912.

Biennial Report of the State Commissioner of Arid Lands [Washington], 1895–96 and 1897–98.

The irrigated lands of the State of Washington, by George M. Allen, deputy commissioner: State Bureau of Statistics and Immigration, 1910.

Irrigation laws of the State of Wyoming, prepared for publication in the office of the State engineer, 1909.

GEOLOGICAL SURVEY HYDROLOGIC REPORTS OF GENERAL INTEREST.

The following list comprises reports not readily classifiable by drainage basins and covering a wide range of hydrologic investigations:

WATER-SUPPLY PAPERS.

*1. Pumping water for irrigation, by H. M. Wilson. 1896. 56 pp., 9 pls.

Describes pumps and motive powers, windmills, water wheels, and various kinds of engines; also storage reservoirs to retain pumped water until needed for irrigation.

*3. Sewage irrigation, by G. W. Rafter. 1897. 100 pp., 4 pls. See Water-Supply Paper 22.) 10c.

Discusses methods of sewage disposal by intermittent filtration and by irrigation; describes utilization of sewage in Germany, England, and France, and sewage purification in the United States.

*8. Windmills for irrigation, by E. C. Murphy. 1897. 49 pp., 8 pls. 10c.

Gives results of experimental tests of windmills during the summer of 1896 in the vicinity of Garden, Kans; describes instruments and methods and draws conclusions.

*14. New tests of certain pumps and water lifts used in irrigation, by O. P. Hood. 1898. 91 pp., 1 pl.

Discusses efficiency of pumps and water lifts of various types.

*20. Experiments with windmills, by T. O. Perry. 1899. 97 pp., 12 pls. 15c.

Includes tables and descriptions of wind wheels, compares wheels of several types, and discusses results.

*22. Sewage irrigation, Part II, by G. W. Rafter. 1899. 100 pp., 7 pls. 15c.

Gives résumé of Water-Supply Paper 3; discusses pollution of certain streams, experiments on purification of factory wastes in Massachusetts, value of commercial fertilizers, and describes American sewage-disposal plants by States; contains bibliography of publications relating to sewage utilization and disposal.

*41. The windmill, its efficiency and economic use, Part I, by E. C. Murphy. 1901. 72 pp., 14 pls. 5c.

*42. The windmill, its efficiency and economic use, Part II, by E. C. Murphy. 1901. 75 pp. (73–147), 2 pls. (15–16). 10c.

Nos. 41 and 42 give details of results of experimental tests with windmills of various types.

*43. Conveyance of water in irrigation canals, flumes, and pipes, by Samuel Fortier. 1901. 86 pp., 15 pls. 15c.

*56. Methods of stream measurement. 1901. 51 pp., 12 pls. 15c.

Describes the methods used by the Survey in 1901–2. See also Nos. 64, 94, and 95.

*64. Accuracy of stream measurements, by E. C. Murphy. 1902. 99 pp., 4 pls. (See No. 95.) 10c.

Describes methods of measuring velocity of water and of measuring and computing stream flow and compares results obtained with the different instruments and methods; describes also experiments and results at the Cornell University hydraulic laboratory. A second, enlarged, edition published as Water-Supply Paper 95.

*67. The motions of underground waters, by C. S. Slichter. 1902. 106 pp., 8 pls. 15c.

Discusses origin, depth, and amount of ground waters; permeability of rocks and porosity of soils; causes, rates, and laws of motions of ground water; surface and deep zones of flow, and recovery of waters by open wells and artesian and deep wells; treats of the shape and position of the water table; gives simple methods of measuring yield of flowing well; describes artesian wells at Savannah, Ga.

72. Sewage pollution in the metropolitan area near New York City and its effect on inland water resources, by M. O. Leighton. 1902. 75 pp., 8 pls. 10c.

Defines "normal" and "polluted" waters and discusses the damage resulting from pollution.

*80. The relation of rainfall to run-off, by G. W. Rafter. 1903. 104 pp. 10c.

Treats of measurements of rainfall and laws and measurements of stream flow; gives rainfall, run-off, and evaporation formulas; discusses effects of forests on rainfall and run-off.

87. Irrigation in India (second edition), by H. M. Wilson. 1903. 238 pp., 27 pls. 25c.

First edition was published in Part II of the Twelfth Annual Report.

93. Proceedings of first conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1904. 361 pp. 25c. [Requests for this paper should be addressed to the U. S. Reclamation Service.]

Contains, in addition to an account of the organization of the hydrographic [water-resources] branch of the United States Geolcgical 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 geolcgy of the region about Marion, Ind., the contamination of rock wells and of streams by waste oil and brine.

*114. Underground waters of eastern United States; M. L. Fuller, geologist in charge. 1905. 285 pp., 18 pls. 25c.

Contains report on "Occurrence of underground waters," by M. L. Fuller, discussing sources, amount, and temperature of waters, permeability and storage capacity of rocks, water-bearing formations, recovery of water by springs, wells, and pumps, essential conditions of artesian flows, and general conditions affecting ground waters in eastern United States.

119. Index to the hydrographic progress reports of the United States Geological Survey, 1888 to 1903, by J. C. Hoyt and B. D. Wood. 1905. 253 pp. 15c.

120. Bibliographic review and index of papers relating to underground waters published by the United States Geological Survey, 1879–1904, by M. L. Fuller. 1905. 128 pp. 10c.

*122. Relation of the law to underground waters, by D. W. Johnson. 1905. 55 pp. 5c.

Defines and classifies underground waters, gives common-law rules relating to their use, and cites State legislative acts affecting them.

140. Field measurements of the rate of movement of underground waters, by C. S. Slichter. 1905. 122 pp., 15 pls. 15c.

Discusses the capacity of sand to transmit water, describes measurements of underflow in Rio Hondo, San Gabriel, and Mohave River valleys, Calif., and on Long Island, N. Y., gives results of tests of wells and pumping plants, and describes stovepipe method of well construction.

143. Experiments on steel-concrete pipes on a working scale, by J. H. Quinton. 1905. 61 pp., 4 pls. 5c.

Scope indicated by title.

145. Contributions to the hydrology of eastern United States, 1905; M. L. Fuller, geologist in charge. 1905. 220 pp., 6 pls. 10c.

Contains brief reports of general interest as follows:

Drainage of ponds into drilled wells, by Robert E. Horton. Discusses efficiency, cost, and capacity of drainage wells, and gives statistics of such wells in southern Michigan.

Construction of so-called fountain and geyser springs, by Myron L. Fuller.

A convenient gage for determining low artesian heads, by Myron L. Fuller.

146. Proceedings of second conference of engineers of the Reclamation Service, with accompanying papers, compiled by F. H. Newell, chief engineer. 1905. 267 pp. 15c. [Inquiries concerning this report should be addressed to the U. S. Reclamation Service.]

Contains brief account of the organization of the hydrographic [water-resources] branch and the Reclamation Service, reports of conferences and committees, circulars of instruction, and many brief reports on subjects closely related to reclamation, and a bibliography of technical papers by members of the service. Of the papers read at the conference those listed below (scope indicated by title) are of more or less general interest:

Proposed State code of water laws, by Morris Bien.
Power engineering applied to irrigation problems, by O. H. Ensign.
Estimates on tunneling in irrigation projects, by A. L. Fellows.
Collection of stream-gaging data, by N. C. Grover.
Diamond-drill methods, by G. A. Hammond.
Mean-velocity and area curves, by F. W. Hanna.
Importance of general hydrographic data concerning basins of streams gaged, by R. E. Horton.
Effect of aquatic vegetation on stream flow, by R. E. Horton.
Sanitary regulations governing construction camps, by M. O. Leighton.
Necessity of draining irrigated land, by Thos. H. Means.
Alkali soils, by Thos. H. Means.
Cost of stream-gaging work, by E. C. Murphy.
Equipment of a cable-ga ging 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 well, by Myron L. Fuller.

*162. Destructive floods in the United States in 1905, with a discussion of flood discharge and frequency and an index to flood literature, by E. C. Murphy and others. 1906. 105 pp., 4 pls. 15c.

*163. Bibliographic review and index of underground-water literature published in the United States in 1905, by M. L. Fuller, F. G. Clapp, and B. L. Johnson. 1906. 130 pp. 15c.

Scope indicated by title.

*179. Prevention of stream pollution by distillery refuse, based on investigations at Lynchburg, Ohio, by Herman Stabler. 1906. 34 pp., 1 pl. 10c.

Describes grain distillation; treatment of slop; sources, character, and effects of effluents on streams; discusses filtration, precipitation, fermentation, and evaporation methods of disposal of wastes without pollution.

*180. Turbine water-wheel tests and power tables, by R. E. Horton. 1906. 134 pp., 2 pls. 20c.

Scope indicated by title.

*185. Investigations on the purification of Boston sewage, by C.-E. A. Winslow and E. B. Phelps. 1906. 163 pp. 25c.

Discusses composition, disposal, purification, and treatment of sewages and tendencies in sewage-disposal practice in England, Germany, and the United States; describes character of crude sewage at Boston, removal of suspended matter, treatment in septic tanks, and purification in intermittent sand filteration and coarse material; gives bibliography.

*186. Stream pollution by acid-iron wastes, a report based on investigations made at Shelby, Ohio, by Herman Stabler. 1906. 36 pp., 1 pl.

Gives history of pollution by acid-iron wastes at Shelby, Ohio, and the resulting litigation; discusses effect of acid-iron liquors on sewage-purification processes, recovery of copperas from acid-iron wastes, and other processes for removal of pickling liquor.

*187. Determination of stream flow during the frozen season, by H. K. Barrows and R. E. Horton. 1907. 93 pp., 1 pl. 15c

Scope indicated by title.

*189. The prevention of stream pollution by strawboard waste, by E. B. Phelps. 1906. 29 pp., 2 pls.

Describes manufacture of strawboard, present and proposed methods of disposal of waste liquors, laboratory investigations of precipitation and sedimentation, and field studies of amount and character of water used, raw material and finished product, and mechanical filtration.

*194. Pollution of Illinois and Mississippi rivers by Chicago sewage (a digest of the testimony taken in the case of the State of Missouri *v.* the State of Illinois and the Sanitary District of Chicago), by M. O. Leighton. 1907. 369 pp., 2 pls.

Scope indicated by amplification of title.

*200. Weir experiments, coefficients, and formulas (revision of paper No. 150), by R. E. Horton. 1907. 195 pp., 38 pls. 35c.

Scope indicated by title.

*226. The pollution of streams by sulphite-pulp waste, a study of possible remedies, by E. B. Phelps. 1909. 37 pp., 1 pl. 10c.

Describes manufacture of sulphite pulp, the waste liquors, and the experimental work leading to suggestions as to methods of preventing stream pollution.

*229. The disinfection of sewage and sewage filter effluents, with a chapter on the putrescibility and stability of sewage effluents, by E. B. Phelps. 1909. 91 pp., 1 pl. 15c.

Scope indicated by title.

*234. Papers on the conservation of water resources. 1909. 96 pp., 2 pls. 15c.

Contains the following papers, whose scope is indicated by their titles: Distribution of rainfall, by Henry Gannett; Floods, by M. O. Leighton; Developed water powers, compiled under the direction of W. M. Steuart, with discussion by M. O. Leighton; Undeveloped water powers, by M. O. Leighton; Irrigation, by F. H. Newell; Underground waters, by W. C. Mendenhall; Denudation, by R. B. Dole and Herman Stabler; Control of catchment areas, by H. N. Parker.

*235. The purification of some textile and other factory wastes, by Herman Stabler and G. H. Pratt. 1909. 76 pp. 10c.

Discusses waste waters from wool scouring, bleaching and dyeing cotton yarn, bleaching cotton piece goods, and manufacture of oleomargarine, fertilizer, and glue.

236. The quality of surface waters in the United States, Part I, Analyses of waters east of the one hundredth meridian, by R. B. Dole. 1909. 123 pp. 10c.

Describes collection of samples, methods of examination, preparation of solutions, accuracy of estimates, and expression of analytical results.

238. The public utility of water powers and their governmental regulation, by René Tavernier and M. O. Leighton. 1910. 161 pp. 15c.

Discusses hydraulic power and irrigation, French, Italian, and Swiss legislation relative to the development of water powers, and laws proposed in the French Parliament; reviews work of bureau of hydraulics and agricultural improvements of the French department of agriculture, and gives résumé of Federal and State water-power legislation in the United States.

*255. Underground waters for farm use, by M. L. Fuller. 1910. 58 pp., 17 pls. 15c.

Discusses rocks as sources of water supply and the relative safety of supplies from different materials; springs and their protection; open or dug and deep wells, their location, yield, relative cost, protection, and safety; advantages and disadvantages of cisterns and combination wells and cisterns.

*257. Well-drilling methods, by Isaiah Bowman. 1911. 139 pp., 4 pls. 15c.

Discusses amount, distribution, and disposal of rainfall; water-bearing rocks; amount of ground water; artesian conditions; oil and gas bearing formations; gives history of well drilling in Asia, Europe, and the United States; describes in detail the various methods and the machinery used; discusses loss of tools and geologic difficulties, contamination of well waters and methods of prevention, tests of capacity and measurement of depth, and costs of sinking wells.

*258. Underground-water papers, 1910, by M. L. Fuller, F. G. Clapp, G. C. Matson, Samuel Sanford, and H. C. Wolff. 1911. 123 pp., 2 pls. 15c.

Contains the following papers (scope indicated by titles) of general interest:
Drainage by wells, by M. L. Fuller.
Freezing of wells and related phenomena, by M. L. Fuller.
Pollution of underground waters in limestone, by G. C. Matson.
Protection of shallow wells in sandy deposits, by M. L. Fuller.
Magnetic wells, by M. L. Fuller.

*315. The purification of public water supplies, by G. A. Johnson. 1913. 84 pp., 8 pls. 10c.

Discusses ground, lake, and river waters as public supplies, development of water-works systems in the United States, water consumption, and typhoid fever; describes methods of filtration and sterilization of water and municipal water softening.

334. The Ohio Valley flood of March-April, 1913 (including comparisons with some earlier floods), by A. H. Horton and H. J. Jackson. 1913. 96 pp., 22 pls. 20c.

Although relating specifically to floods in the Ohio Valley, this report discusses also the causes of floods and the prevention of damage by floods.

*337. The effects of ice on stream flow, by William Glenn Hoyt. 1913. 77 pp., 7 pls. 15c.

Discusses methods of measuring the winter flow of streams.

*345. Contributions to the hydrology of the United States, 1914; N. C. Grover, chief hydraulic engineer. 1915. 225 pp., 17 pls. 30c. Contains:

(*e*) A method of determining the daily discharge of rivers of variable slope, by M. R. Hall, W. E. Hall, and C. H. Pierce, pp. 53–65.

*364. Water analyses from the laboratory of the United States Geological Survey, tabulated by F. W. Clarke, chief chemist. 1914. 40 pp. 5c.

Contains analyses of waters from rivers, lakes, wells, and springs in various parts of the United States, including analyses of the geyser water of Yellowstone National Park, hot springs in Montana, brines from Death Valley, water from the Gulf of Mexico, and mine waters from Tennessee, Michigan, Missouri and Oklahoma, Montana, Colorado and Utah, Nevada and Arizona, and California.

371. Equipment for current-meter gaging stations, by G. J. Lyon. 1915. 64 pp., 37 pls. 20c.

Describes methods of installing automatic and other gages and of constructing gage wells shelters, and structures for making discharge measurements and artificial controls.

*375. Contributions to the hydrology of the United States, 1915; N. C. Grover, chief hydraulic engineer. 1916. 181 pp., 9 pls. 15c. Contains:

(*c*) The relation of stream gaging to the science of hydraulics, by C. H. Pierce and R. W. Davenport, pp. 77–84.

(*e*) A method of correcting river discharge for a changing stage, by B. E. Jones, pp. 117–130.

(*f*) Conditions requiring the use of automatic gages in obtaining records of stream flow, by C. H. Pierce, pp. 131–139.

Three papers presented at the conference of engineers of the water-resources branch in December, 1914.

*400. Contributions to the hydrology of the United States, 1916; N. C. Grover, chief hydraulic engineer. 108 pp., 7 pls. Contains:

(*a*) The people's interest in water-power resources, by G. O. Smith, pp. 1–8.
(*c*) The measurement of silt-laden streams, by R. C. Pierce, pp. 39–51.
(*d*) Accuracy of stream-flow data, by N. C. Grover and J. C. Hoyt, pp. 53–59.

416. The divining rod, a history of water witching, with a bibliography, by Arthur J. Ellis. 1917. 59 pp. 10c.

A brief paper published "merely to furnish a reply to the numerous inquries that are continually being received from all parts of the country" as to the efficacy of the divining rod for locating underground water

*425. Contributions to the hydrology of the United States, 1917; N. C. Grover, chief hydraulic engineer. 1918. Contains:

*(c) Hydraulic conversion tables and convenient equivalents, pp. 71–94. 1917.

427. Bibliography and index of the publications of the United States Geological Survey relating to ground water, by O. E. Meinzer. 1918. 169 pp., 1 pl.

Includes publications prepared, in whole or in part, by the Geological Survey that treat any phase of the subject of ground water or any subject directly applicable to ground water. Illustrated by map showing reports that cover specific areas more or less thoroughly.

ANNUAL REPORTS.

*Fifth Annual Report of the United States Geological Survey, 1883–84, J. W. Powell, Director. 1885. xxxvi, 469 pp., 58 pls. $2.25. Contains:

*The requisite and qualifying conditions of artesian wells, by T. C. Chamberlin, pp. 125–173, pl. 21. Scope indicated by title.

*Twelfth Annual Report of the United States Geological Survey, 1890–91, J. W. Powell, Director. 1891. 2 parts. *Pt. II, Irrigation, xviii, 576 pp., 93 pls. $2. Contains:

*Irrigation in India, by H. M. Wilson, pp. 363–561, pls. 107 to 146. See Water-Supply Paper 87

Thirteenth Annual Report of the United States Geological Survey, 1891–92, J. W. Powell, Director. 1892. (Pts. II and III, 1893.) 3 parts. *Pt. III, Irrigation, xi, 486 pp., 77 pls. $1.85. Contains:

*American irrigation engineering, by H. M. Wilson, pp. 101–349, pls. 11 to 146. Discusses the economical aspects of irrigation, alkaline drainage, silt, and sedimentation; gives brief history of legislation; describes perennial canals in Idaho, California, Wyoming, and Arizona; discusses water storage at reservoirs of the California and other projects, subsurface sources of supply, pumping, and subirrigation.

Fourteenth Annual Report of the United States Geological Survey, 1892–93, J. W. Powell, Director. 1893. (Pt. II, 1894.) 2 parts. *Pt. II, Accompanying papers, xx, 597 pp., 73 pls. $2.10. Contains:

*The potable waters of eastern United States, by W. J. McGee, pp. 1–47. Discusses cistern water, stream waters, and ground waters, including mineral springs and artesian wells.

*Natural mineral waters of the United States, by A. C. Peale, pp. 49–88, pls. 3 and 4. Discusses the origin and flow of mineral springs, the source of mineralization, thermal springs, the chemical composition and analysis of spring waters, geographic distribution, and the utilization of mineral waters; gives a list of American mineral-spring resorts; contains also some analyses.

Nineteenth Annual Report of the United States Geological Survey, 1897–98, Charles D. Walcott, Director. 1898. (Parts II, III, and V, 1899.) 6 parts in 7 vols. and separate case for maps with Pt. V. *Pt. II, Papers chiefly of a theoretic nature, v, 958 pp., 172 pls. $2.65. Contains:

*Principles and conditions of the movements of ground water, by F. H. King, pp. 59–294, pls. 6 to 16. Discusses the amount of waters stored in sandstone, in soil, and in other rocks, and the depth to which ground water penetrates; gravitational, thermal, and capillary movements of ground waters, and the configuration of the ground-water surface; gives the results of experimental investigations on the flow of air and water through a rigid, porous medium, and through sand, sandstones, and silts; discusses results obtained by other investigators, and summarizes results of observations; discusses also rate of flow of water through sand and rock, the growth of rivers, rate of filtration through soil, interference of wells, etc.

*Theoretical investigation of the motion of ground waters, by C. S. Slichter, pp. 295–384, pl. 17. Scope indicated by title.

PROFESSIONAL PAPERS.

*72. Denudation and erosion in the southern Appalachian region and the Monongahela basin, by L. C. Glenn. 1911. 137 pp., 21 pls. 35c.

Describes the topography, geology, drainage, forests, climate, and population, and transportation facilities of the region, the relation of agriculture, lumbering, mining, and power development to erosion and denudation, and the nature, effects, and remedies of erosion; gives details of conditions in Holston, Nolichucky, French Broad, Little Tennessee, and Hiwassee River basins, along Tennessee River proper, and in the basins of the Coosa-Alabama system, Chattahoochee, Savannah, Saluda, Broad, Catawba, Yadkin, New, and Monongahela rivers.

86. The transportation of débris by running water, by G. K. Gilbert, based on experiments made with the assistance of E. C. Murphy. 1914. 263 pp., 3 pls. 70c.

The results of an investigation which was carried on in a specially equipped laboratory at Berkeley, Calif., and was undertaken for the purpose of learning "the laws which control the movement of bed load and especially to determine how the quantity of load is related to the stream slope and discharge and to the degree of comminution of the débris."

105. Hydraulic-mining débris in the Sierra Nevada, by G. K. Gilbert. 154 pp., 34 pls. 1917. 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.

695. The data of geochemistry (fourth edition), by F. W. Clarke. 1920. 832 pp. 45c.

Earlier editions were published as Bulletins 330, 491, and 616. Contains a discussion of the statement and interpretation of water analyses and a chapter on "Mineral wells and springs" (pp. 175-211). Discusses the definition and classification of mineral waters, changes in the composition of water, deposits of calcareous, ocherous, and siliceous materials made by water, vadose and juvenile waters, and thermal springs in relation to volcanism. Describes the different kinds of ground water and gives typical analyses. Includes a brief bibliography of papers containing water analyses.

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.

187041°—21—WSP 462——15

INDEX OF STREAMS.

O