DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 249

SURFACE WATER SUPPLY OF THE UNITED STATES

1907–8

PART IX. COLORADO RIVER BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

W. B. FREEMAN AND R. H. BOLSTER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPER 249

SURFACE WATER SUPPLY OF THE UNITED STATES

1907-8

PART IX. COLORADO RIVER BASIN

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

W. B. FREEMAN AND R. H. BOLSTER

WASHINGTON
GOVERNMENT PRINTING OFFICE
1910

CONTENTS.

ILLUSTRATIONS.

SURFACE WATER SUPPLY OF THE COLORADO RIVER BASIN, 1907–8.

By W. B. Freeman and R. H. Bolster.

INTRODUCTION.

AUTHORITY FOR INVESTIGATIONS.

This volume contains results of flow measurements made on certain streams in the United States. The work was performed by the water-resources branch of the United States Geological Survey, either independently or in cooperation with organizations mentioned herein. These investigations are authorized by the organic law of the Geological Survey (Stat. L., vol. 20, p. 394), which provides, among other things, as follows:

> 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.

Inasmuch as water is the most abundant and most valuable mineral in nature, the investigation of water resources is included under the above provision for investigating mineral resources. The work has been supported since the fiscal year ending June 30, 1895, by appropriations in successive sundry civil bills passed by Congress under the following item:

> 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.

The various appropriations that have been made for this purpose are as follows:

Annual appropriations for the fiscal year ending June 30—

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

SCOPE OF INVESTIGATIONS.

These investigations are not complete nor do they include all the river systems or parts thereof that might purposefully be studied. The scope of the work is limited to that which can be provided with the appropriations available. The field covered and the character of the work are believed to be the best that could be accomplished under the controlling conditions. It would undoubtedly be of more scientific importance and ultimately of more practical value if the money now applied to wide areas were concentrated on a few small basins. Such a course is impossible because general appropriations made by Congress are applicable to all parts of the country. Each part demands its proportionate share of the benefits.

It is essential that records of stream flow shall be maintained during a period of years sufficient to cover all stages, in order that within reasonable limits the entire range of flow from the absolute maximum to the absolute minimum may be determined. The length of such a period manifestly varies for different streams and can not be absolutely determined. Experience has shown that the records should cover from five to ten years, or for some streams twenty years or more, the limit being determined by the relative importance of the stream and the interdependence of the results and other long-time records on adjacent streams.

In the performance of this work the Geological Survey endeavors to approach as nearly as possible the highest degree of precision which a rational expenditure of time and a judicious expenditure of a small amount of money will allow. In all engineering work there is a point of refinement beyond which it is needless and wasteful to proceed, and this principle applies with especial force to stream-flow measurements. It is confidently believed that with some unavoidable exceptions the stream-flow data presented in the publications of the Survey are sufficiently accurate for all practical purposes. Many of the records are, however, of insufficient length, owing to the unforeseen reduction of appropriations and consequent abandonment of many stations. All persons are cautioned to exercise the greatest care in the utilization of such incomplete records.

Records of varying lengths have been obtained at about 1,400 different points in the United States, and in addition the surface water supply of small areas in Seward Peninsula and the Yukon-Tanana region, Alaska, has been investigated. During 1907 and 1908 regular gaging stations were maintained by the Survey and cooperating organizations at about 740 points in the United States, and in addition numerous miscellaneous measurements were made. Data were also obtained in regard to precipitation, evaporation, storage reservoirs, river profiles, and water power in many sections of the country. These data will be made available in the regular surface water-supply papers and in special papers from time to time.

PURPOSES OF THE WORK.

Among the purposes for which the results contained in this volume are requisite are navigation, irrigation, domestic water supply, water power, swamp and overflow land drainage, and flood prevention. The demands of all these interests are immediate.

Navigation.—The Federal Government has expended more than $250,000,000 for the improvement of inland navigation and prospective expenditures will approximate several times this amount. It is obvious that the determination of stream flow is necessary to the intelligent solution of the many problems involved.

Irrigation.—The United States is now expending $42,000,000 on federal irrigation systems, and this amount is far exceeded by the private expenditures of this nature in the arid West. The integrity of any irrigation system is based absolutely on the amount of water available. Therefore investigations of stream flow in that portion of the country are of first importance in the redemption of the lands, as well as constituting an insurance of federal and private investments.

Domestic water supply.—The highest use of water is that of domestic supply, and while the federal interest in this aspect of the matter is less direct than in the aspects already named this use of water nevertheless has so broad a significance with respect to the general welfare that the Federal Government is ultimately and intimately concerned.

Water power.—The time is rapidly approaching when the development of the water power of the country will be an economic necessity. Our stock of coal is being rapidly depleted and the cost of steam power is increasing accordingly. Industry will cease its growth if cheap power is not available, and in that event the United States as a nation will cease to progress. Water power is the only avenue now open. When the electric transmission of power was accomplished, the relation of our water powers to national economy changed entirely. Previous to the day of electric transmission the importance of a water power was largely confined to the locality at which it was generated, but it has now become a pubilc utility in which the individual citizen is vitally interested. Inasmuch as the amount of water power that may be made available is dependent on the flow of rivers, the investigation of flow becomes a prerequisite in the judicious management of this source of energy.

Drainage of swamp and overflowed lands.—More than 70,000,000 acres of the richest land in this country are now practically worthless, or of precarious value, by reason of overflow and swamp conditions. When this land is drained it becomes exceedingly productive and its value increases many fold. Such reclamation would add to the national assets at least $700,000,000. The study of run-off is the first consideration in connection with drainage projects.

If, by the drainage of a large area into any particular channel that channel becomes so gorged with water which it had not hitherto been called upon to convey that overflow conditions are created in places where previously the land was not subject to inundation, then drainage results merely in an exchange of land values. This is not the purpose of drainage improvement.

Flood prevention.—The damage from floods in the United States exceeds $100,000,000 annually and in the year 1908 the aggregate damage, based on reliable data, approximated $250,000,000. Such an annual tax on the property of great regions should be reduced in the orderly progress of government. It goes without saying that any consideration of flood prevention must be based on a thorough knowledge of stream flow, both in the contributing areas which furnish the water and along the great lowland rivers.

PUBLICATIONS.

The data on stream flow collected by the United States Geological Survey since its inception have appeared in the annual reports, bulletins, and water-supply papers. Owing to natural processes of evolution and to changes in governmental requirements, the character of the work and the territory covered by these different publications has varied greatly. For the purpose of uniformity in the presentation of reports a general plan has been agreed upon by the United States Reclamation Service, the United States Forest Service, the United States Weather Bureau, and the United States Geological Survey, according to which the area of the United States has been divided into twelve parts, whose boundaries coincide with certain natural drainage lines. The areas so described are indicated by the following list of papers on surface water supply for 1907 and 1908. The dividing line between the North Atlantic and South Atlantic drainage areas lies between York and James rivers.

Papers on surface water supply of the United States, 1907–8.

Part.	No.	Title.	Part.	No.	Title.
I	241	North Atlantic coast.	VI	246	Missouri River basin.
II	242	South Atlantic coast and eastern Gulf of Mexico.	VII	247	Lower Mississippi River basin.
			VIII	248	Western Gulf of Mexico.
III	243	Ohio River basin.	IX	249	Colorado River basin.
IV	244	St. Lawrence River basin.	X	250	Great Basin.
V	245	Upper Mississippi River and Hudson Bay basins.	XI	251	California.
			XII	252	North Pacific coast.

The following table gives the character of data regarding stream flow at regular stations to be found in the various publications of the United States Geological Survey exclusive of all special papers. Numbers of reports are inclusive and dates also are inclusive so far as the data are available.

Stream-flow data in reports of the United States Geological Survey.

[Ann.= Annual Report; B.= Bulletin; W. S.= Water-Supply Paper.]

Report.	Character of data.	Year.
10th Ann., pt. 2	Descriptive information only	
11th Ann., pt. 2	Monthly discharge	1884 to Sept., 1890.
12th Ann., pt. 2	.....do	1884 to June 30, 1891.
13th Ann., pt. 3	Mean discharge in second-feet	1884 to Dec. 31, 1892.
14th Ann., 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 Ann., pt. 2	Descriptive information only	
B. 140	Descriptions, measurements, gage heights, ratings, and monthly discharge (also many data covering earlier years).	1895.
W. S. 11	Gage heights (also gage heights for earlier years)	1896.
18th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also similar data for earlier years).	1895 and 1896.
W. S. 15	Descriptions, measurements, and gage heights, eastern United States, eastern Mississippi River, and Missouri River above junction with Kansas.	1897.
W. S. 16	Descriptions, measurements, and gage heights, western Mississippi River below junction of Missouri and Platte, and western United States.	1897.
19th Ann., pt. 4	Descriptions, measurements, ratings, and monthly discharge (also some long-time records).	1897.
W. S. 27	Measurements, ratings, and gage heights, eastern United States, eastern Mississippi River, and Missouri River.	1898.
W. S. 28	Measurements, ratings, and gage heights, Arkansas River and western United States.	1898.
20th Ann., pt. 4	Monthly discharge (also for many earlier years)	1898.
W. S. 35 to 39	Descriptions, measurements, gage heights, and ratings	1899.
21st Ann., pt. 4	Monthly discharge	1899.
W. S. 47 to 52	Descriptions, measurements, gage heights, and ratings	1900.
22d Ann., pt. 4	Monthly discharge	1900.
W. S. 65, 66	Descriptions, measurements, gage heights, and ratings	1901.
W. S. 75	Monthly discharge	1901.
W. S. 82 to 85	Complete data	1902.
W. S. 97 to 100	.....do	1903.
W. S. 124 to 135	.....do	1904.
W. S. 165 to 178	.....do	1905.
W. S. 201 to 214	Complete data, except descriptions	1906.
W. S. 241 to 252	Complete data	1907–8.

NOTE.—No data regarding stream flow are given in the 15th and 17th annual reports.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing records prior to 1904 has been published in Water-Supply Paper 119. The first table which follows gives, by years and drainage basins, the numbers of the papers on surface water supply published from 1899 to 1908. Wherever the data for a drainage basin appear in two papers the number of one is placed in parentheses and the portion of the basin covered by that paper is indicated in the second table. For example, in 1904 the data for Missouri River were published in Water-Supply Papers 130 and 131, and the portion of the records contained in Water-Supply Paper 131, as indicated by the second table, is that relating to Platte and Kansas rivers.

Numbers of water-supply papers containing results of stream measurements, 1899–1908.

	1899.[a]	1900.[b]	1901.	1902.	1903.	1904.	1905.	1906.	1907–8.
Atlantic coast and eastern Gulf of Mexico:									
New England rivers	35	47	65,75	82	97	124	165	201	241
Hudson River to Delaware River, inclusive	35	47,(48)	65,75	82	97	125	166	202	241
Susquehanna River to York River, inclusive	35	48	65,75	82	97	126	167	203	241
James River to Yadkin River, inclusive	(35),36	48	65,75	(82),83	(97),98	126	167	203	242
Santee River to Pearl River, inclusive	36	48	65,75	83	98	127	168	204	242
St. Lawrence River	36	49	65,75	(82),83	97	129	170	206	244
Hudson Bay			66,75	85	100	130	171	207	245
Mississippi River:									
Ohio River	36	48,(49)	65,75	83	98	128	169	205	243
Upper Mississippi River	36	49	65,75	83	98,(99)	128, (130)	171	207	245
Missouri River	(36),37	49,(50)	66,75	84	99	130, (131)	172	208	246
Lower Mississippi River	37	50	(65), 66,75	(83),84	(98),99	(128), 131	(169), 173	(205), 209	247
Western Gulf of Mexico	37	50	66,75	84	99	132	174	210	248
Pacific coast and Great Basin:									
Colorado River	(37), 38	50	66,75	85	100	133, (134)	175, (177)	211, (213)	249, (251)
Great Basin	38, (39)	51	66,75	85	100	133, (134)	176, (177)	212, (213)	250, (251)
South Pacific coast to Klamath River, inclusive	(38), 39	51	66,75	85	100	134	177	213	251
North Pacific coast	38	51	66,75	85	100	135	(177), 178	214	252

[a] Rating tables and index to Water-Supply Papers 35–39 contained in Water-Supply Paper 39.
[b] 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.

Numbers of water-supply papers containing data covering portions of drainage basins.

No.	River basin.	Tributaries included.
35	James	
36	Missouri	Gallatin.
37	Colorado	Green, Gunnison, Grand above junction with Gunnison.
38	Sacramento	Except Kings and Kern.
39	Great Basin	Mohave.
48	Delaware	Wissahickon and Schuylkill.
49	Ohio	Scioto.
50	Missouri	Loup and Platte near Columbus, Nebr. All tributaries below junction with Platte.
65	Lower Mississippi	Yazoo.
82	James	
	St. Lawrence	Lake Ontario, tributaries to St. Lawrence River proper.
83	Lower Mississippi	Yazoo.
97	James	
98	Lower Mississippi	Do.
99	Upper Mississippi	Tributaries from the west.
128	Lower Mississippi	Yazoo.
130	Upper Mississippi	Tributaries from the west.
131	Missouri	Platte, Kansas.
134	Colorado	Data near Yuma, Ariz., repeated.
	Great Basin	Susan, Owens, Mohave.
169	Lower Mississippi	Yazoo.
177	Colorado	Below junction with Gila.
	Great Basin	Susan repeated, Owens, Mohave.
	North Pacific coast	Rogue, Umpqua, Siletz.
205	Lower Mississippi	Yazoo, Homochitto.
213	Colorado	Data at Hardyville repeated; at Yuma, Salton Sea.
	Great Basin	Owens, Mohave.
251	Colorado	All stations in Colorado and Great Basin drainages lying in California repeated.
	Great Basin	

The order of treatment of stations in any basin in these papers is downstream. The main stem of any river is determined on the

basis of drainage area, local changes in name and lake surface being disregarded. After all stations from the source to the mouth of the main stem of the river have been given, the tributaries are taken up in regular order from source to mouth. The tributaries are treated the same as the main stream, all stations in each tributary basin being given before taking up the next one below.

The exceptions to this rule occur in the records for Mississippi River, which are given in four parts, as indicated above, and in the records for large lakes, where it is often clearer to take up the streams in regular order around the rim of the lake than to cross back and forth over the lake surface.

DEFINITION OF TERMS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

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

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

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

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

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

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work.

CONVENIENT EQUIVALENTS.

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

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.

1 horsepower equals 1 second-foot falling 8.80 feet.

1⅓ horsepower equal about 1 kilowatt.

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

EXPLANATION OF TABLES.

For each drainage basin there is given a brief description of general conditions covering such features as area, source, tributaries, topography, geology, conditions of forestation, rainfall, ice conditions, irrigation, storage, power possibilities, and other special features of importance or interest.

For each regular current-meter gaging station are given in general, and so far as available, the following data: Description of station, list of discharge measurements, table of daily gage heights, rating table, table of monthly and yearly discharges and run-off. For stations located at weirs or dams the gage-height and rating tables are omitted and a table of daily discharge is substituted. For stations where the flow is computed by shifting-channel methods, a table of daily discharge is given in place of rating tables, which are not used in these methods of computation.

In addition to statements regarding the location and installation of current-meter stations the descriptions give information in regard to any conditions which may affect the constancy of the relation of gage height to discharge, covering such points as ice, logging, shifting conditions of flow, and backwater; also full information regarding diversions which decrease the total flow at the measuring section. Statements are also made regarding the accuracy and reliability of the data.

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

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. At most stations the gage is read in the morning and in the evening. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. All gage heights during ice conditions, backwater from obstructions, etc., are published as recorded, with suitable footnotes. The rating is not applicable for such periods unless the proper correction to the gage heights is known and applied. Attention is called to the fact that the zero of the gage is placed at an arbitrary datum and has no relation to zero flow or the bottom of the river. In general, the zero is located somewhat below the lowest known flow, so that negative readings shall not occur.

The discharge measurements and gage heights are the base data from which the rating tables and monthly-discharge tables are computed.

The rating table gives, either directly or by interpolation, the discharge in second-feet corresponding to every stage of the river recorded during the period for which it is applicable. It is published to enable engineers to determine the daily discharge by its application to the table of gage heights or to check results in the table of monthly discharge.

In the table of monthly discharge the column headed "Maximum" gives the mean flow, as determined from the rating table, 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 period when the water surface was at crest height and the corresponding discharge consequently larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow in cubic feet for each second during the month. On this the computations for the remaining columns, which are defined on page 13, are based.

FIELD METHODS OF MEASURING STREAM FLOW.

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

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

Weir method.—Relatively few stations are maintained at weirs or dams by the United States Geological Survey. Standard types of

sharp-crested and broad-crested weirs within the limits for which accurate coefficients have been experimentally obtained give very accurate records of discharge if properly maintained. At practically all broad-crested weirs, however, there is a diversion of water either through or around the dam, usually for the purpose of development of water power. The flow is often complicated and the records are subject to errors from such sources as leakage through the dam, backwater at high stages, uncertainty regarding coefficient, crest which is not level, obstructions from logs or ice, use of flashboards, old turbines with imperfect ratings, and many others depending on the type of development and the uses of the diverted water.

In general, records of discharge at dams are usually accurate enough for practical use if no others are available. It has been the general experience of the United States Geological Survey, however, that records at current-meter gaging stations under unobstructed channel conditions are more accurate than those collected at dams, and where the conditions are reasonably favorable are practically as good as those obtained at sharp-crested weirs.

The determination of discharge over the different types of weirs and dams is treated fully in "Weir experiments, coefficients, and formulas" (Water-Supply Paper 200[a]) and in the various text-books on hydraulics. "Turbine water-wheel tests and power tables" (Water-Supply Paper 180) treats of the discharge through turbines when used as meters. The editions of both of these water-supply papers are practically exhausted. They can, however, be consulted at most of the larger libraries of the country or they can be obtained from the Superintendent of Documents, Washington, D. C., at a cost of 20 cents for No. 180 and 35 cents for No. 200. Remittances must be made by postal money order, express order, or New York draft.

Velocity method.—Streams in general present throughout their courses to a greater or less extent all conditions of permanent, semi-permanent, and varying conditions of flow. In accordance with the location of the measuring section with respect to these physical conditions, current-meter gaging stations may in general be divided into four classes—(1) those with permanent conditions of flow; (2) those with beds which change only during extreme high water; (3) those with beds which change frequently but which do not cause a variation of more than about 5 per cent of the discharge curves from year to year; and (4) those with constantly shifting beds. In determining the daily flow different office methods are necessary for each class. The field data on which the determinations are based and the methods of collecting them are, however, in general the same.

[a] Water-Supply Paper 200 is a revision of No. 150, the edition of which is exhausted.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. They are located, as far as possible, at such points that the relation between gage height and discharge will always remain constant for any given stage. The experience of engineers of the Geological Survey has been that permanency of conditions of flow is the prime requisite of any current-meter gaging station when maintained for several years unless funds are available to cover all changes in conditions of flow. A straight, smooth section without cross currents, backwater, boils, etc., at any stage is highly desirable, but on most streams is not attainable except at the cost of a cable equipment. Rough, permanent sections, if measurements are properly made by experienced engineers, taking measuring points at a distance apart of 2 to 5 per cent or less of the total width, will within reasonable limits yield better results for a given outlay of money than semi-permanent or shifting sections with smooth, uniform current. So far as possible, stations are located where the banks are high and not subject to overflow at high stages and out of the influence of tributary streams, dams, or other artificial obstructions which might affect the relation between gage height and discharge.

A gaging station consists essentially of a gage for determining the daily fluctuations of stage of the river and some structure or apparatus from which discharge measurements are made, usually a bridge or cable.

The two factors required to determine the discharge of a stream past a section perpendicular to the mean direction of the current are the area of the cross section and the mean velocity of flow normal to that section.

In making a measurement with a current meter a number of points, called measuring points, are measured off above and in the plane of the measuring section at which observations of depth and velocity are taken. (See Pl. I, *B*.) These points are spaced ebually for those parts of the section where the flow is uniform and smooth and are spaced unequally for other parts according to the discretion and judgment of the engineer. In general the points should not be spaced farther apart than 5 per cent of the distance between piers, nor farther apart than the approximate mean depth of the section at the time of measurement.

The measuring points divide the total cross section into elementary strips at each end of which observations of depth and velocity are made. The discharge of any elementary strip is the product of the average of the depths at the two ends times the width of the strip times the average of the mean velocities at the two ends of the strip. The sum of the discharges of the elementary strips is the total

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

B. BRIDGE STATION AND CROSS SECTION OF STREAM.

Illustrating 0.2 and 0 8 depth method.

discharge of the stream. (For a discussion of methods of computing the discharge of a stream see Engineering News, June 25, 1908.)

Depths for the determination of the area are usually obtained by sounding with the current meter and cable. In rough sections or swift current an ordinary weight and cable are used, particular care being taken that all observations shall be in the plane of the cross section.

Two methods of determining the velocity of flow of a stream are in general use—the float method and the current-meter method.

The float method with its various modifications of surface, subsurface, and tube or rod floats is now considered obsolete in the ordinary practice of the United States Geological Survey. The use of this method is limited to special conditions where it is impracticable to use the current meter, such as in places where large quantities of ice or débris which may damage the meter are flowing with the current, and for miscellaneous measurements or other work where a high degree of accuracy is not necessary. Tube floats are very satisfactory for use in canals with regular bottoms and even flow of current. Measurements by the float method are made as follows: The velocity of flow of the stream is obtained by observing the time which it takes floats set free at different points across the stream to pass between two range lines about 200 feet apart. The area used is the mean value obtained from several cross sections measured between the two range lines. The chief disadvantages of this method are difficulty in obtaining the correct value of mean area for the course used and uncertainty regarding the proper coefficient to apply to the observed velocity. For further information regarding this method the reader is referred to Water-Supply Paper 95 and to the various text-books covering the general subject of stream flow.

The Price current meter is now used almost to the exclusion of other types of meters by the United States Geological Survey in the determination of the velocity of flow of water in open channels, a use for which it is adapted under practically all conditions. Plate II shows in the center the new type of penta-recording current meter equipped for measurements at bridge and cable stations. On the sides the same type of meter is shown equipped for wading measurements to record by the acoustic method on the left and by the electric method on the right. Briefly, the meter consists of six cups attached to a vertical shaft which revolves on a conical hardened steel point when immersed in moving water. The number of revolutions is indicated electrically. The rating, or relation between the velocity of the moving water and the revolutions of the wheel, is determined for each meter by drawing it through still water for a given distance at different speeds and noting the number of revolutions for each run. (See Pl. I, *A*.) From these data a rating table is prepared

which gives the velocity per second of moving water for any number of revolutions in a given time interval. The ratio of revolutions per second to velocity of flow in feet per second is very nearly a constant for all speeds and is approximately 0.45.

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

The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

In the vertical velocity curve method a series of velocity determinations are made in each vertical at regular intervals, usually about 10 to 20 per cent of the depth apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points, the vertical velocity curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. This method of obtaining the mean velocity in the vertical is probably the best known, but on account of the length of time required to make a complete measurement its use is largely limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. (See Pl. I, *B*.) On the assumption that the vertical velocity curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this multiple-point method gives the mean velocity very closely for open-water conditions and that in a completed measurement it seldom varies as much as 1 per cent from the value given by the vertical velocity curve method. Moreover, the indications are that it holds nearly as well for ice-covered rivers. It is very extensively used in the regular practice of the United States Geological Survey.

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

Extensive experiments by means of vertical velocity curves show that the thread of mean velocity generally occurs between 0.5 and 0.7 total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, and at this point the meter is held in most of the measurements made by the single-point method. A large number of vertical velocity curve measurements, taken on many streams and under varying conditions, show that the average

coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity. The variation of the coefficient from unity in individual cases is, however, greater than in the 0.2 and 0.8 method and the general results are not as satisfactory.

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

The vertical integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods. In using the Price meter great care should be taken that the vertical movement of the meter is not rapid enough to vitiate the accuracy of the resulting velocity.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8 and the vertical velocity curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, and the thickness and character of the ice. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper 187.

OFFICE METHODS OF COMPUTING AND STUDYING DISCHARGE AND RUN-OFF.

At the end of each year the field or base data for current-meter gaging stations, consisting of daily gage heights, discharge measurements, and full notes, are assembled. The measurements are plotted on cross-section paper and rating curves are drawn wherever feasible. The rating tables prepared from these curves are then applied to the tables of daily gage heights to obtain the daily discharges, and

from these applications the tables of monthly discharge and run-off are computed.

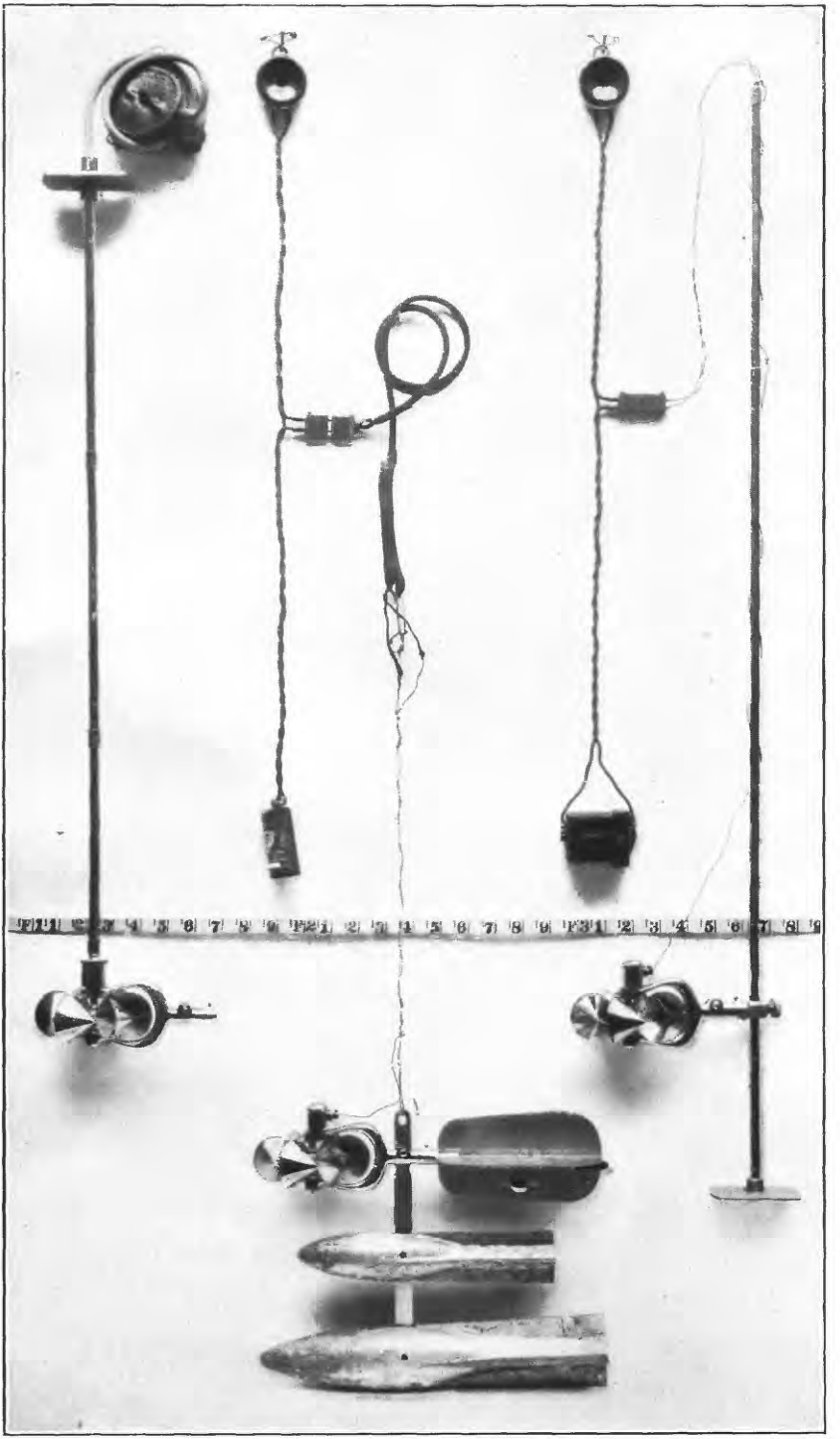
Rating curves are drawn and studied with special reference to the class of channel conditions which they represent. (See p. 17.) The discharge measurements for all classes of stations when plotted with gage heights in feet as ordinates and discharges in second-feet as abscissas define rating curves which are more or less generally parabolic in form. In many cases curves of area in square feet and mean velocity in feet per second are also constructed to the same scale of ordinates as the discharge curve. These are used mainly to extend the discharge curves beyond the limits of the plotted discharge measurements, and for checking purposes to avoid errors in the form of the discharge curve and to determine and eliminate erroneous measurements.

For every published rating table the following assumptions are made for the period of application of the table: (*a*) That the discharge is a function of and increases gradually with the stage; (*b*) that the discharge is the same whenever the stream is at a given stage, and hence such changes in conditions of flow as may have occurred during the period of application are either compensating or negligible, except that the rating as stated in the footnote of each table is not applicable for known conditions of ice, log jams, or other similar obstructions; (*c*) that the increased and decreased discharge due to change of slope on rising and falling stages is either negligible or compensating.

As already stated, the gaging stations may be divided into several classes, as indicated in the following paragraphs:

The stations of class 1 represent the most favorable conditions for an accurate rating and are also the most economical to maintain. The bed of the stream is usually composed of rock and is not subject to the deposit of sediment and loose material. This class includes also many stations located in a pool below which is a permanent rocky riffle that controls the flow like a weir. Provided the control is sufficiently high and close to the gage to prevent cut and fill at the gaging point from materially affecting the slope of the water surface, the gage height will for all practical purposes be a true index of the discharge. Discharge measurements made at such stations usually plot within 2 or 3 per cent of the mean-discharge curve, and the rating developed from that curve represents a very high degree of accuracy. For illustrative example of a station of this type see Water-Supply Paper 241.

Class 2 is confined mainly to stations on rough mountainous streams with steep slopes. The beds of such streams are as a rule comparatively permanent during low and medium stages, and when the flow is sufficiently well defined by an adequate number of discharge



PRICE PENTA-RECORDING CURRENT METERS.

measurements before and after each flood the stations of this class give nearly as good results as those of class 1. As it is seldom possible to make measurements covering the time of change at flood stage, the assumption is often made that the curves before and after the flood converged to a common point at the highest gage height recorded during the flood. Hence the only uncertain period occurs during the few days of highest gage heights covering the period of actual change in conditions of flow. For illustrative examples of stations of this type see Water-Supply Paper 246.

Class 3 includes most of the current-meter gaging stations maintained by the United States Geological Survey. If sufficient measurements could be made at stations of this class results would be obtained nearly equaling those of class 1, but owing to the limited funds at the disposal of the Survey this is manifestly impossible, nor is it necessary for the uses to which discharge data are applied. The critical points are as a rule at relatively high or low stages. The percentage error, however, is greater at low stages. No absolute rule can be laid down for stations of this class. Each rating curve must be constructed mainly on the basis of the measurements of the current year, the engineer being guided largely by the past history of the station and the following general law: If all measurements ever made at a station of this class are plotted on cross-section paper, they will define a mean curve which may be called a standard curve. It has been found in practice that if after a change caused by high stage, a relatively constant condition of flow occurs at medium and low stages, all measurements made after the change will plot on a smooth curve which is practically parallel to the standard curve with respect to their ordinates, or gage heights. This law of the parallelism of ratings is the fundamental basis of all ratings and estimates at stations with semi-permanent and shifting channels. It is not absolutely correct but, with few exceptions, answers all the practical requirements of estimates made at low and medium stages after a change at a high stage. This law appears to hold equally true whether the change occurs at the measuring section or at some controlling point below. The change is of course fundamentally due to change in the channel caused by cut, or fill, or both, at and near the measuring section. For all except small streams the changes in section usually occur at the bottom. The following simple but typical examples illustrate this law:

(*a*) If 0.5 foot of planking were to be nailed on the bottom of a well-rated wooden flume of rectangular section there would result, other conditions of flow being equal, new curves of discharge, area, and velocity, each plotting 0.5 foot above the original curves when referred to the original gage. In other words, this condition would be analogous to a uniform fill or cut in a river channel which either

reduces or increases all three values of discharge, area, and velocity for any gage height. In practice, however, such ideal conditions rarely exist.

(*b*) In the case of a cut or fill at the measuring section there is a marked tendency toward decrease or increase, respectively, of the velocity. In other words, the velocity has a compensating effect and if the compensation is exact at all stages the discharge at a given stage will be the same under both the new and the old conditions.

(*c*) In the case of uniform change along the crest of a weir or rocky controlling point, the area curve will remain the same as before the change, and it can be shown that here again the change in velocity curve is such that it will produce a new discharge curve essentially parallel to the original discharge curve with respect to their ordinates.

Of course in actual practice such simple changes of section do not occur. The changes are complicated and lack uniformity, a cut at one place being largely offset by a fill at another and vice versa. If these changes are very radical and involve large percentages of the total area—as, for example, on small streams—there may result a wide departure from the law of parallelism of ratings. In complicated changes of section the corresponding changes in velocity which tend to produce a new parallel discharge curve may interfere with each other materially, causing eddies, boils, backwater, and radical changes in slope. In such extreme conditions, however, the measuring section would more properly fall under class 4 and would require very frequent measurements of discharge. Special stress is laid on the fact that in the lack of other data to the contrary the utilization of this law will yield the most probable results.

Slight changes at low or medium stages of an oscillating character are usually averaged by a mean curve drawn among them parallel to the standard curve, and if the individual measurements do not vary more than 5 per cent from the rating curve the results are considered good for stations of this class. For illustrative example of a station of this type see Water-Supply Paper 242.

Class 4 comprises stations that have soft, muddy, or sandy beds. Good results can be obtained from such sections only by frequent discharge measurements, the frequency varying from a measurement every two or three weeks to a measurement every day, according to the rate of diurnal change in conditions of flow.

The following method of determining the daily discharge of streams of this class is now used by the engineers of the United States Geological Survey almost exclusively, owing to the rapidity with which the necessary computations can be made, the clearness with which all changes in conditions of flow, so far as known, can be followed, and the accuracy of the results obtained.

In the graphic method of determining the daily discharge of streams with changeable beds, which was devised by R. H. Bolster, the discharge measurements for the entire year are first plotted with discharges as abscissas and gage heights as ordinates. The points so plotted are considered chronologically and, even though scattered, will usually locate one or more fairly well defined curves, called standard curves. (See Pl. III.) In general the number and position of these standard curves are determined by the radical changes in the stream bed due to floods.

When stream beds change very rapidly it is necessary to change the position of the rating curve each day, making a new curve daily. This daily curve is of the same form as the standard curve and is parallel to it with respect to ordinates. For a day when a measurement is made the rating curve passes through such plotted measurement, the discharge for the day being read off from the scale of discharge in second-feet, at the point of intersection of the curve and the mean gage height for the day. In order to locate the rating curve for other days lines are drawn connecting consecutive measurements. These lines are called correction curves and should have the same curvature as that portion of the standard curve which lies vertically above or below them. These lines are divided into as many equal parts as there are days intervening between the measurements, on the assumption that the change in conditions of flow between any two consecutive measurements is uniform from day to day. The daily rating curve will then pass through these points of division, and the discharge is read directly from these curves at their point of intersection with the observed daily gage heights.

In order to facilitate the use of the method and obviate the use of daily rating curves, and make it as rapid in application as the common method for permanent stations, the standard curve or curves, together with a vertical line of reference, should be transferred from the original station sheet to tracing cloth, which can be readily shifted vertically to any desired position by always keeping the two vertical reference lines coincident with each other. Thus the daily rating curve, which is merely the standard curve transferred, can be placed in any desired position.

Another way of simplifying the work of applying this method is to use dividers. Always keep one point of the dividers coincident with the standard curve, and always keep both points on the same vertical line of discharge. By spreading the points, the point which is not coincident with the standard curve can be made to trace any daily rating curve desired.

In applying and modifying this method, judgment must be used for long-time intervals of no measurements or for radical changes in the stream bed caused by sudden floods. For another illustrative example of a station of this type see Water-Supply Paper 247.

The computations have, as a rule, been carried to three significant figures. Computation machines, Crelle's tables, and the 20-inch slide rule have been generally used. All computations are carefully checked.

After the computations have been completed they are entered in tables and carefully studied and intercompared to eliminate or account for all gross errors so far as possible. Missing periods are filled in, so far as is feasible, by means of comparison with adjacent streams. The attempt is made to complete years or periods of discharge, thus eliminating fragmentary and disjointed records. Full notes accompanying such estimates follow the monthly-discharge tables.

For most of the northern stations estimates have been made of the monthly discharge during frozen periods. These are based on measurements under ice conditions wherever available, daily records of temperature and precipitation obtained from the United States Weather Bureau climate and crop reports, observers' notes of conditions, and a careful and thorough intercomparison of results with adjacent streams. Although every care possible is used in making these estimates they are often very rough, the data for some of them being so poor that the estimates are liable to as much as 25 to 50 per cent error. It is believed, however, that estimates of this character are better than none at all, and serve the purpose of indicating in a relative way the proportionate amount of flow during the frozen period. These estimates are, as a rule, included in the annual discharge. The large error of the individual months has a relatively small effect on the annual total, and it is for many purposes desirable to have the yearly discharge computed even though some error is involved in doing so.

ACCURACY AND RELIABILITY OF FIELD DATA AND COMPARATIVE RESULTS.

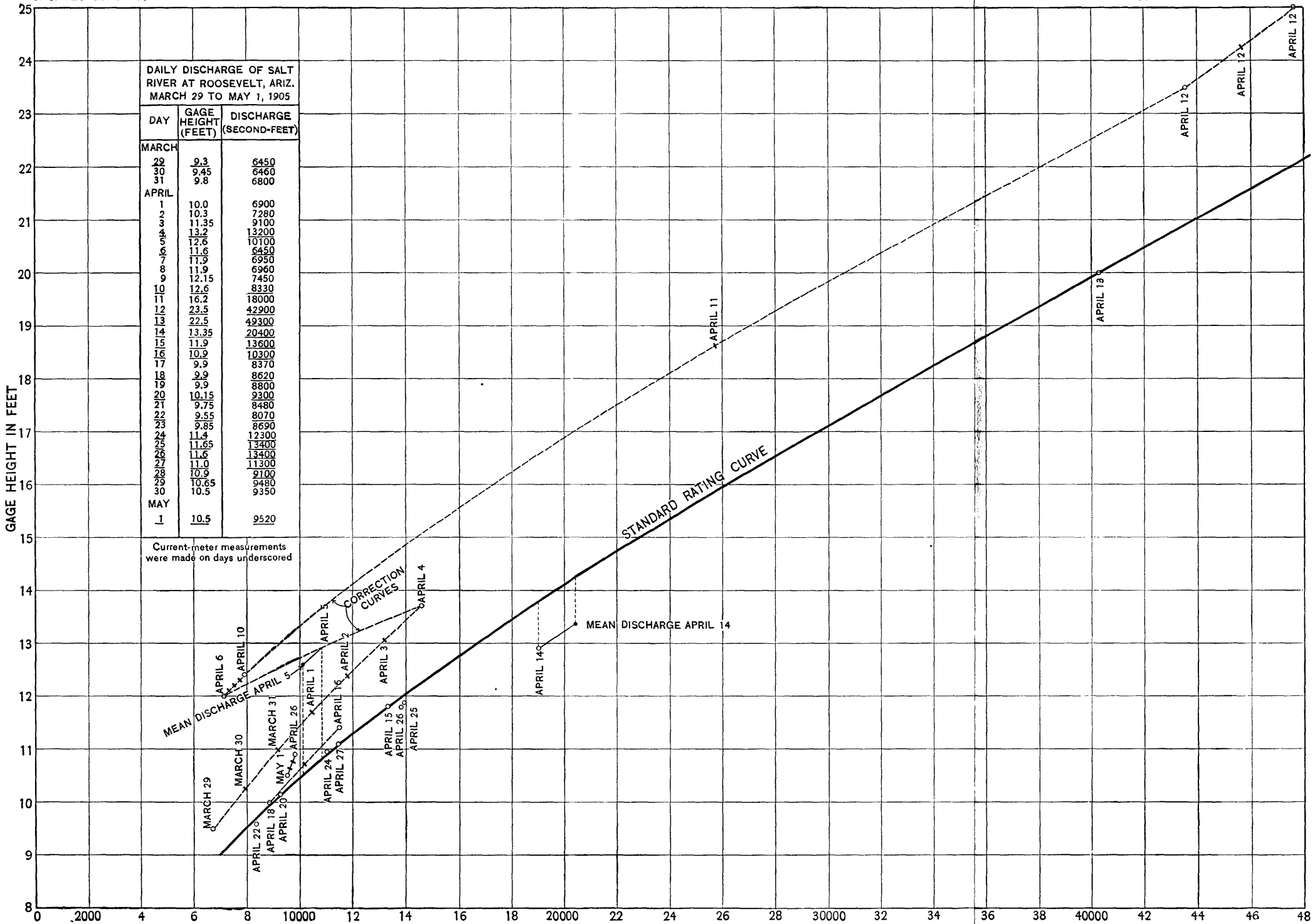
Practically all discharge measurements made under fair conditions are well within 5 per cent of the true discharge at the time of observation. Inasmuch as the errors of meter measurements are largely compensating, the mean rating curve, when well defined, is much more accurate than the individual measurements. Numerous tests and experiments have been made to test the accuracy of current-meter work. These show that it compares very favorably with the results from standard weirs, and, owing to simplicity of methods, usually gives results that are much more reliable than those from stations at dams, where uncertainty regarding the coefficient and complicated conditions of flow prevail.

The work is, of course, dependent on the reliability of the observers. With relatively few exceptions, the observers perform their work

DAILY DISCHARGE OF SALT RIVER AT ROOSEVELT, ARIZ. MARCH 29 TO MAY 1, 1905

DAY	GAGE HEIGHT (FEET)	DISCHARGE (SECOND-FEET)
MARCH		
29	9.3	6450
30	9.45	6460
31	9.8	6800
APRIL		
1	10.0	6900
2	10.3	7280
3	11.35	9100
4	13.2	13200
5	12.6	10100
6	11.6	6450
7	11.9	6950
8	11.9	6960
9	12.15	7450
10	12.6	8330
11	16.2	18000
12	23.5	42900
13	22.5	49300
14	13.35	20400
15	11.9	13600
16	10.9	10300
17	9.9	8370
18	9.9	8620
19	9.9	8800
20	10.15	9300
21	9.75	8480
22	9.55	8070
23	9.85	8690
24	11.4	12300
25	11.65	13400
26	11.6	13400
27	11.0	11300
28	10.9	9100
29	10.65	9480
30	10.5	9350
MAY		
1	10.5	9520

Current-meter measurements were made on days underscored



GRAPHIC METHOD OF DETERMINING DAILY DISCHARGE.

honestly. Care is taken, however, to watch them closely and to inquire into any discrepancies. It is, of course, obvious that one gage reading a day does not always give the mean height for that day. As an almost invariable rule, however, errors from this source are compensating and virtually negligible in a period of one month, although a single day's reading may, when taken by itself, be considerably in error.

In order to give engineers and others information regarding the probable accuracy of the computed results, footnotes are added to the rating tables and an accuracy column is inserted in the monthly-discharge table. In the rating tables "well defined" indicates in general that the rating is probably accurate within 5 per cent; "fairly well defined," within 10 per cent; "poorly defined" or "approximate," 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 accuracy column in the monthly-discharge table does not apply to the maximum or minimum nor to any individual day, but to the monthly mean. It is based on the accuracy of the rating, the probable reliability of the observer, and knowledge of local conditions. In this column, A indicates that the mean monthly flow is probably accurate within 5 per cent; B, within 10 per cent; C, within 15 per cent; D, within 25 per cent. Special conditions are covered by footnotes.

USE OF THE DATA.

In general the policy is followed of making available for the public the base data which are collected in the field each year by the Survey engineers. This is done to comply with the law, but also for the express purpose of giving to any engineer the opportunity of examining the computed results and of changing and adjusting them as may seem best to him. Although it is believed that the rating tables and computed monthly discharges are as good as the base data up to and including the current year will warrant, it should always be borne in mind that the additional data collected at each station from year to year nearly always throw new light on data already collected and published, and hence allow more or less improvement in the computed results of earlier years. It is therefore expected that the engineer who makes serious use of the data given in these papers will verify all ratings and make such adjustments in earlier years as may seem necessary. The work of compiling, studying, revising, and republishing data for different drainage basins for five or ten year periods or more is carried on by the United States Geological Survey so far as the funds for such work are available.

The values in the table of monthly discharge are so arranged as to give only a general idea of the conditions of flow at the station, and it

is not expected that they will be used for other than preliminary estimates. This is particularly true of the maximum and minimum figures, which in the very nature of the method of collecting these data are liable to large errors. The maximum value should be increased considerably for many stations in considering designs for spillways, and the minimum value should be considered for a group of, say, seven days and not for one day.

The rating table, provided the engineer accepts it, is published primarily to allow him to apply it directly to the daily gage heights and rearrange the daily discharges in order of magnitude or by some other method.

COOPERATION AND ACKNOWLEDGMENTS.

Special acknowledgments are due for assistance rendered or records furnished by the following parties: Vernon L. Sullivan, territorial engineer of New Mexico; Thos. W. Jaycox, state engineer of Colorado; Caleb Tanner, state engineer of Utah; the United States Indian Service; the United States Reclamation Service; the United States Forest Service; the Central Colorado Power Company; R. I. Meeker; Field, Fellows & Hinderlider; Chris J. Walbran; Wheeler & Whinnerah; Prof. Geo. J. Lyon; the Denver and Rio Grande Railroad Company; the Moffatt road; the Denver Union Water Company; and various engineers and irrigation and power companies, who have furnished the U. S. Geological Survey with valuable data.

All the stations maintained in the San Juan and Gila River drainage basins in New Mexico were in cooperation with the territorial engineer, and more than half of the expense was paid from territorial funds. Special mention should be made of the interest Mr. Sullivan, the territorial engineer, has shown in this work, and of his persistence in carrying it on, though greatly handicapped by lack of funds.

Mr. Tanner, state engineer of Utah, paid the salaries of the observers at about five stations in the Duchesne River drainage, in cooperation with the United States Indian Service and the United States Geological Survey.

Thanks are due Mr. Jaycox, state engineer of Colorado, for suggestions in carrying on the work, and for paying the salaries of some of the observers in Colorado during the first part of 1907.

The Uinta Irrigation Survey, of the United States Indian Service, has borne practically all the expense of discharge measurements at the stations in the Uinta Reservation and vicinity in Utah.

The United States Reclamation Service has furnished all the field data for the stations in the Gunnison drainage basin in Colorado, and the 1907 data for the Gila River drainage basin in New Mexico. It has also paid the expense of maintaining the station on the Grand at Palisades, Colo., for 1908.

All stations in Arizona have been maintained and all computed data furnished by the United States Reclamation Service.

The Salton Sea gage heights were furnished by the Southern Pacific Company, and measurements of flow into Salton Sea by H. R. Edwards, engineer for the New Liverpool Salt Company.

The Central Colorado Power Company has cooperated in the maintenance of practically all the stations in the Grand River drainage basin in Colorado, and has expended several thousand dollars for this work. Until July 1, 1908, the company paid the salaries of gage observers, and since that time it has borne practically all the expense of taking discharge measurements. Special thanks are due Mr. L. E. Ashbaugh and G. H. Matthes of this company for valuable suggestions and data which they have furnished.

Mr. R. I. Meeker was in charge of the work of this district from January 1 to May 1, 1907. He has since taken a very active interest in it, for which special acknowledgments are due him.

Field, Fellows & Hinderlider have furnished data on the flow of the upper Williams Fork in Colorado. Mr. Fellows, of this firm, through his intimate knowledge of the water resources of this section, has been able to give valuable information, and his assistance has been very much appreciated. The Denver and Rio Grande Railroad and the Moffatt road furnished transportation for the Survey hydrographers during the year 1907.

Many of the photographs contained in this paper were obtained from the United States Reclamation Service.

DIVISION OF WORK.

The field data in the Grand River drainage basin were collected under the direction of W. B. Freeman, district engineer, assisted by R. I. Meeker, Jas. B. Stewart, C. L. Chatfield, the engineers of the Central Colorado Power Company, and the United States Reclamation Service. The field data for the Gunnison River drainage were collected by the engineers of the United States Reclamation Service.

The field data in the Duchesne River drainage basin were collected under the direction of W. B. Freeman, district engineer, assisted by I. I. Price and R. H. Fletcher, under the more immediate supervision of H. C. Means, superintendent of irrigation, United States Indian Service.

The field data of the San Juan and Gila River drainage basins, in New Mexico, except those for Gila River near Cliff and San Francisco River at Alma, were taken under the general direction of W. B. Freeman, district engineer, but under the more immediate supervision of Vernon L. Sullivan, territorial engineer, assisted by Jas. B. Stewart, Robt. L. Cooper, and C. D. Miller.

All other field data in the lower Colorado River drainage were collected and the computations therefor were made by the United States Reclamation Service, except as indicated above.

The ratings, special estimates, and studies of the completed data were made by W. B. Freeman, R. H. Bolster, and F. F. Henshaw. The computations and preparation of the completed data for publication were made under the direction of R. H. Bolster, assistant engineer, by F. F. Henshaw, G. C. Stevens, H. D. Padgett, R. C. Rice, J. G. Mathers, and M. I. Walters. The entire report was edited by Mrs. B. D. Wood.

COLORADO RIVER DRAINAGE BASIN.

GENERAL FEATURES.

Colorado River is formed in the southeastern part of Utah by the junction of Grand and Green rivers. The Green is larger than the Grand and is the upward continuation of the Colorado. Including the Green, the entire length of the Colorado is about 2,000 miles. The region drained is about 800 miles long, varies in width from 300 to 500 miles, and contains about 300,000 square miles. It comprises the southwestern part of Wyoming, the western part of Colorado, the eastern half of Utah, practically all of Arizona, and small portions of California, Nevada, New Mexico, and old Mexico. Most of this area is arid, the mean annual rainfall being about 8½ inches. The streams receive their supply from the melting snows on the high mountains of Wyoming, Utah, and Colorado.

The basin comprises two distinct portions. The lower third is but little above the level of the sea, though here and there ranges of mountains rise to elevations of 2,000 to 6,000 feet. This part of the valley is bounded on the north by a line of cliffs which present a bold and in many places vertical step of hundreds or thousands of feet to the tableland above. The upper two-thirds of the basin stands from 4,000 to 8,000 feet above sea level, and is bordered on the east, west, and north by ranges of snow-clad mountains, which attain altitudes varying from 8,000 to 14,000 feet above sea level. Through this plateau the Colorado and its tributaries have cut narrow gorges or canyons in which they flow at almost inaccessible depths. At points where lateral streams enter the canyons are broken by narrow transverse valleys, diversified by bordering willows, clumps of box elder, and small groves of cottonwood. The whole upper basin of the Colorado is traversed by a labyrinth of these canyons, most of which are dry during the greater portion of the year, and carry water only during the melting of the snow and the brief period of the autumnal and spring rains.

Green River and its tributaries[a] drain an area rudely triangular in outline, bounded on the north and east by the Wind River Mountains and the ranges forming the Continental Divide, on the south and east by the White River Plateau and the Roan or Book Cliffs, and on the north and west by the Gros Ventre and Wyoming mountains and the great Wasatch Range. The greatest length of the basin, north and south, is about 370 miles. In an east-west direction it measures at its widest point about 240 miles. The total drainage area is approximately 41,000 square miles, and altitudes range from 14,000 feet in the high mountains to about 3,800 feet at the mouth of the Grand.

The area includes a large part of western Wyoming, northwestern Colorado, and eastern Utah. The Uinta and Uncompahgre Indian reservations are located in this basin in northeastern Utah.

The river heads on the western slope of the Wind River Mountains in western Wyoming, its ultimate source being a number of small lakes fed by the glaciers and immense snow deposits always to be found on Fremont and neighboring peaks. For perhaps 25 miles the river flows northwestward through the mountains. It then turns abruptly and runs in a general southerly direction across western Wyoming into Utah. A few miles below the Wyoming-Utah boundary another sharp turn carries the river eastward near the east end of the range. It then flows southward in Colorado for about 25 miles, turns back into Utah, and continues to flow in a southwesterly and southerly direction until it unites with the Grand to form the Colorado. Its length, measured roughly along the course, is approximately 425 miles.

The topography of the headwater region is rugged in the extreme. The Wind River Range on the east, and the Gros Ventre and Wyoming ranges on the southwest and west gradually close in as they extend outhward, forming a basin approximately 7,450 square miles in extent above the discontinued gaging station at Green River, Wyo.

The upper part of this basin is very narrow, but southward the valley opens out; near Fontanelle, Wyo., it is several miles wide; with benches and rolling table-lands extending westward to the foothills of the Wyoming Range and eastward to the bluffs which hug the east bank of the river. At Green River the valley is again narrow—only a few hundred yards in width—and for some distance southward the river runs between bluffs standing so close together that no flood plain is seen. Throughout much of its course in Utah the Green flows through a succession of long, deep, narrow canyons with walls ranging in height from a few hundred to as many thousand feet, separated by short valleys, containing small tracts of arable lands.

[a] The geology of this basin is described in the Eleventh Ann. Rept. U. S. Geol. and Geog. Survey Terr., for 1877, pp. 509–646. Information in regard to the hydrography is contained in the first to fourth annual reports of the Reclamation Service and in United States Geological Survey reports.

In its upper course the Green receives as tributaries numerous streams heading in the Wind River, Gros Ventre, and Wyoming ranges of mountains, some of them extending so far back into the abrupt, ragged canyons that they dovetail with streams flowing in the opposite direction.

The most important of these tributaries are New Fork River, Big Sandy Creek, Labarge Creek, Fontanelle Creek, Black Fork, and Henry Fork. South of the Uinta Mountains the first large stream flowing into the Green is the Yampa, which comes in from the east at the point where the Green turns westward to reenter Utah after its southward journey in Colorado.

Farther south Ashley Creek and Duchesne and White rivers discharge their waters into the Green, Ashley Creek and the Duchesne from the west and the White from the east.

Below this point the only tributaries of importance are Price, Minnie Maude, and San Rafael rivers, which enter from the west, the latter at a point about 32 miles above the junction of the Green and the Grande.

Except for the timber in the high mountains at the headwaters of Green River in Wyoming, the upper portion of the stream is not very extensively forested. The timbered land includes probably 1,500 square miles, with an average stand of about 4,000 feet board measure per acre in that section. Numerous tracts of irrigated and cultivated land extend from the Wyoming line up the river to elevations of 7,000 feet.[a]

In the Green River basin in Utah above the mouth of the Duchesne, there are about 600 square miles of timbered land, with an average stand of nearly 3,000 feet board measure per acre, while there are nearly 2,000 square miles of timbered area and woodland in the drainage basins of the White and Yampa rivers in Colorado.

In the 41,000 square miles which comprise the total drainage area of the Green River, there are considerably over 5,000 square miles of timbered land in addition to a considerable woodland area. The principal species of mountain timber are the Engelmann spruce and lodgepole pine.

Over the plains portion of the basin, which includes considerably over half of it, the average annual precipitation seems to be less than 10 inches annually; over much of the remainder the rainfall averages between 10 and 15 inches, and in only a very small area in the high mountains does the precipitation exceed 20 inches annually.

Throughout this whole basin winters are severe, and most of the streams have a heavy ice cover for several months. There is usually an abundance of snow in the high mountains, but the winters on the plains are frequently quite open. (See Pl. IV, *A* and *B*.)

[a] See also description of New Fork drainage basin in Water-Supply Paper 175, pp. 21 and 22.

A. SNOW AND ICE CONDITIONS ON COLORADO MOUNTAIN STREAMS.

B. THE CONTINENTAL DIVIDE NEAR TOLLAND, COLO.; ELEVATION, 11,666 FEET ABOVE SEA LEVEL.

The oldest and most extensive irrigation development in this basin is on the upper Green River in Wyoming. Recently large irrigation systems have been constructed in the Duchesne River basin. Considerable irrigation is practiced around Vernal, Utah, and also in the vicinity of Greenriver, Utah, along the line of the Denver and Rio Grande Railroad. Along White and Yampa rivers in Colorado, meadow irrigation is extensively practiced and projects are now on foot for the irrigation of 200,000 or 300,000 acres of land in that section.

Excellent reservoir sites are found on the headwaters of the Green River and its upper tributaries, and also along Yampa and White rivers, on Ashley Creek, and other tributaries in the northwestern corner of Utah, and at the headwaters of Duchesne River. A very considerable portion of the flow could be equalized by storage.

Not a water-power plant of any importance whatever exists in the whole drainage area of Green River, though splendid opportunities are presented at the headwaters of many of the tributary streams above all irrigation diversions. Theoretically, at the present time it would be possible, by utilizing known storage facilities, to develop about 1,500,000 horsepower in the basin of the Green, but it is unlikely that the development of this power will be a commercial possibility for a number of years. From Wells, Wyo., to the Wyoming state line, a distance of 225 miles, the stream has an average fall of 11 feet per mile; and from the Wyoming state line to the mouth of Minnie Maud Creek, a distance of 200 miles, the average fall is 7 feet per mile. The waters of this stream and its tributaries are practically unused except for irrigation.

From the junction of Grand and Green rivers the Colorado flows southwestward, passes across the northwestern corner of Arizona, then turns to the south and for the remainder of its course forms a part of the southeastern boundary of Nevada and California and the western boundary of Arizona. It empties into the Gulf of California about 60 miles below Yuma, Ariz. The canyons through which it flows are world-famed and need not here be described.

The Colorado has been called the Nile of America, and like the Nile it is subject to an annual summer rise which comes at the time when the water is most needed for irrigation. It is of interest to compare the Colorado with Nile and Susquehanna rivers. The Nile is similar in type, while the Susquehanna shows the difference in flow between arid and humid regions. In the comparison a normal year, based on a ten-year record for Colorado and Susquehanna rivers and such data as could be found in regard to the Nile, have been used. The Colorado has been taken as the standard of comparison.

The Nile has 5.7 times the drainage area and the Susquehanna about one-eighth the area of the Colorado.

The rainfall in the Nile basin is 3.8 times greater; that in the Susquehanna basin is 4.5 times greater. The run-off per square mile from the Nile basin is 1.9 times greater; that from the Susquehanna basin is 37 times greater. The ratio of run-off to rainfall in the Nile basin is 2 times smaller; that of the Susquehanna basin is 8.2 times greater.

The discharge of the Nile is 10.8 times greater; that of the Susquehanna is 4.5 times greater.

The maximum flow of the Colorado is from 70,000 to 110,000 second-feet and occurs in May, June, or July; for the Nile it is about 353,000 second-feet and occurs about the first of September; for the Susquehanna it is from 200,000 to 400,000 second-feet and occurs during March, April, and May.

The minimum flow of the Colorado is from 2,500 to 3,000 second-feet and occurs during January and February; that of the Nile is about 14,500 second-feet and occurs about the end of May; for the Susquehanna it is from 2,500 to 5,000 second-feet and occurs in September and October.

The mean flow of the Colorado is about 10,700 second-feet; for the Nile it is about 115,800 second-feet; for the Susquehanna it is about 43,000 second-feet.

The water of the Colorado carries an immense amount of sediment, reaching as high as 2,000 parts of sediment to 100,000 parts of water. Prof. R. H. Forbes, in Bulletin 44 of the University of Arizona Agricultural Experiment Station, says:

> On the basis of the profile, constructed from available data for the volume of flow of the Colorado and of the year's silt determinations made in the laboratory, it is estimated conservatively that the river during 1900 brought down about 61,000,000 tons of sedimentary material, which, condensed to the form of solid rock, is enough to cover 26.4 square miles 1 foot deep, or to make about 164 square miles of recently settled, submerged mud 1 foot deep, reckoning the whole amount of mud for the year to average 6.2 times the bulk of the solid sediment.

A comparatively small amount of land is irrigated by the waters of the Colorado, because the stream and its tributaries are situated so far below the level of the irrigable lands as to render their diversion extremely difficult or impracticable. Two pumping plants are in operation to lift water for irrigation at Yuma, and several at other points on the river above Yuma. The Imperial canal diverts water from the river at a point about 10 miles, by river, below Yuma.

The principal tributaries of the Colorado below the Grand and Green are San Juan, Little Colorado, Williams Fork, and Gila rivers, which enter from the east, and Virgin River, which enters from the west. With the exception of Virgin River and Williams Fork, these streams and their various tributaries are described in other parts of this report.

The following gaging stations have been maintained on the main Colorado River and in the Green River basin:

Green River at Green River, Wyo., 1895–1906.
Green River at Jensen, Utah, 1903–1906.
Green River at Ouray, Utah, 1904–5.
Green River at Greenriver, Utah, 1894–1896 and 1905–1908.
Colorado River at Hardyville, Ariz., 1905–1907.
Colorado River at Mohave City, Ariz., 1902–3.
Colorado River at Yuma, Ariz., 1895–1908.
Canal stations:
- Imperial canal (main) near Calexico, Cal., 1904–5.
- Boundary canal near Calexico, Cal., 1905.
- Wisteria canal near Calexico, Cal., 1905.
- Imperial canal 10 miles below Yuma, Ariz., Mexican boundary line, 1903–1905.
- Holt canal at Calexico, Cal., 1904–5.
- Hemlock canal at Calexico, Cal., 1904–5.
- Alamo channel near Calexico, Cal.
- Alamitos canal near Calexico, Cal., 1904–5.

Newfork River at Cora, Wyo., 1905.
Pine Creek at Pinedale, Wyo., 1904–1906.
Pole Creek at Fayette, Wyo., 1904–1906.
Fall Creek at Fayette, Wyo., 1904–5.
Boulder Creek at Boulder (Newfork), Wyo., 1904–1906.
Eastfork River at Newfork, Wyo., 1905–6.
Black Fork of Green River at Granger, Wyo., 1896–1900.
Yampa River at Steamboat Springs, Colo., 1904–1906.
Yampa River at Craig, Colo., 1901–2, 1904–1906.
Yampa River at Maybell, Colo., 1904–5.
Elk River at Trull, Colo., 1904–1906.
Elk Head Creek at Craig, Colo., 1906.
Fortification Creek at Craig, Colo., 1905–6.
Williams River at Hamilton, Colo., 1904–1906.
Milk Creek at Axial, Colo., 1904–5.
Little Snake River at Maybell, Colo., 1904.
Ashley Creek at Vernal, Utah, 1900–1904.
Ashley Creek (Dry Fork) at Vernal, Utah, 1904.
North Fork of White River at Buford, Colo., 1903–1906.
White River at Meeker, Colo., 1901–1906.
White River at White River City, Colo., 1895.
White River at Rangely, Colo., 1904–5.
White River at Dragon, Utah, 1906.
White River at Ouray, Utah, 1904.
South Fork of White near Buford, Colo., 1903–1906.
Marvine Creek near Buford, Colo., 1903–1906.
Duchesne River, North Fork, above Forks, Utah, 1904.
Duchesne River near Myton, Utah, 1899–1908.
Duchesne River, West Fork, above Forks, Utah, 1904.
Rock Creek (East Creek) 10 miles above mouth, Utah, 1904.
Strawberry River in Strawberry Valley, Utah, 1903–1906 and 1908.
Strawberry River at Theodore, Utah, 1908.
Indian Creek in Strawberry Valley, Utah, 1905–6.

Currant Creek 3 miles above mouth of Deep Creek, Utah, 1904.
Red Creek above narrows, Utah, 1904.
Lake Fork (West Fork) 10 miles above Forks, Utah, 1904.
Lake Fork below Forks, Utah, 1904, 1907–8.
Lake Fork near Myton, Utah, 1900–1904, 1907–8.
Lake Fork (East Fork) 8 miles above Forks, Utah, 1904.
Uinta River at Whiterocks, Utah, 1899–1904, 1907–8.
Uinta River at Fort Duchesne, Utah, 1899–1904, 1906–1908.
Uinta River at Ouray School, Utah, 1899–1904.
Whiterocks River at Whiterocks, Utah, 1899–1904, 1907–8.
Price River at Helper, Utah, 1904–1908.

COLORADO PROPER AND GREEN RIVER.

GREEN RIVER AT GREENRIVER, UTAH.

This station (originally called Blake) was established October 21, 1894, discontinued in November, 1896, and reestablished in February, 1905. It is located at the Rio Grande Western Railway bridge at Greenriver railroad station and near the Elgin post-office, in latitude 39° north, longitude 110° 9′ west, in the San Rafael quadrangle of the United States Geological Survey.

The station was established to determine the unappropriated run-off of the river, and the record is very valuable to owners of ranches along the river course. Several irrigation projects are completed and being promoted in this drainage basin.

The last diversion above the station is about 10 miles upstream; there are no diversions below the station. Price River enters from the west about 16 miles above the station.

A new bridge was erected at this point between the periods of maintenance of the original station and the present one. The present datum, as near as can be learned, is 1.68 feet below the original datum. Owing to change in conditions of flow due to the relocation of the bridge piers it is, however, impossible to utilize the early measurements in studies of discharge curves under the present conditions. The datum of the present chain gage has remained the same since its establishment.

At low and medium stages measurements are made from a ferryboat at a point about 450 feet above the bridge. At high stages measurements are made from the bridge.

The bed of the river at the bridge is mainly rock, overlain in places with silt at low stages. At high stages the high velocity of the current scours out this silt, and the changes in conditions of flow necessitate new ratings at frequent intervals.

Discharge measurements of Green River at Greenriver, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 21	La Rue and Burridge	470	5,110	11.50	41,500
July 17	G. T. Burridge	478	4,850	10.80	36,600
August 3	....do		3,890	8.70	22,500
August 28	La Rue and Burridge	453	3,200	7.20	11,400
1908.					
March 24	A. D. Williams	441	2.570	6.20	6,120
July 9	Hoyt and La Rue	470	3,750	8.00	14,800

Daily gage height, in feet, of Green River at Greenriver, Utah, for 1907 and 1908.

[George C. Mead and L. H. Green, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.6	4.5	6.4	6.7	7.8	10.65	11.6	8.85	6.6	5.5	5.3	4.7
2	4.55	4.45	6.25	6.55	7.9	10.45	11.6	8.65	6.6	5.35	5.3	4.6
3	4.5	4.4	6.25	6.35	8.05	10.4	11.55	8.5	6.6	5.3	5.3	4.7
4	4.45	4.4	6.05	6.15	8.05	10.4	11.7	8.4	6.6	5.4	5.3	4.65
5	4.4	4.5	5.85	6.1	7.95	10.85	11.8	8.35	6.85	5.6	5.3	4.6
6	4.4	4.65	5.7	5.85	7.8	11.35	12.0	8.2	6.5	5.65	5.3	4.6
7	4.25	4.7	5.55	5.85	7.75	11.9	12.1	8.1	6.45	5.7	5.3	4.5
8	4.1	5.0	5.6	6.2	7.65	12.15	12.2	8.0	6.4	5.7	5.3	4.5
9	4.25	5.25	5.45	6.55	7.6	12.45	12.2	8.0	6.4	5.6	5.3	4.5
10	4.4	5.6	5.2	6.65	7.45	12.7	12.1	7.9	6.3	5.6	5.2	4.5
11	4.4	6.1	5.2	6.85	7.45	12.9	12.1	7.7	6.2	5.75	5.2	4.4
12	4.4	6.35	5.25	6.95	7.65	12.85	12.0	7.65	6.1	5.9	5.2	4.4
13	4.3	6.1	5.3	6.9	7.9	12.7	11.85	7.5	6.0	6.0	5.2	4.4
14	4.3	5.8	5.3	7.15	8.75	12.45	11.55	7.5	5.95	6.15	5.2	4.4
15	4.3	5.6	5.2	7.75	9.15	12.2	11.35	7.45	5.9	6.15	5.2	4.4
16	4.4	5.5	5.2	8.1	9.3	11.9	10.95	7.4	5.9	5 95	5.1	4.3
17	4.4	5.55	5.2	8.5	9.3	11.75	10.7	7.25	5.85	5.75	5.1	4.3
18	4.35	5.4	5.1	8.85	9.15	11.65	10.45	7.1	5.8	5.6	5.05	4.3
19	4.3	5.4	5.0	9.0	9.0	11.5	10.1	7.0	5.65	5.6	5.0	4.3
20	4.25	5.4	5.0	9.3	9.0	11.5	9.75	6.95	5.6	5.5	5.0	4.3
21	4.35	5.4	5.0	9.25	9.55	11.55	9.55	6.85	5.6	5.45	5.0	4.2
22	4.45	5.75	6.0	8.95	10.55	11.5	9.35	6.8	5.5	5.4	4.9	4.2
23	4.2	5.95	5.2	8.6	11.1	11.5	9.15	6.7	5.5	5.4	4.9	4.2
24	4.1	6.0	6.2	8.2	11.6	11.4	9.0	6.65	5.5	5.4	4.9	4.2
25	4.0	5.65	7.4	8.0	11.95	11.4	9.0	6.7	5.4	5.4	4.8	4.2
26	3.85	5.8	7.5	7.95	12.15	11.3	9.0	6.75	5.4	5.4	4.8	4.2
27	4.05	5.85	7.5	7.8	12.05	11.4	9.0	7.15	5.4	5.4	4.7	4.3
28	4.2	6.25	7.4	7.8	12.2	11.45	9.0	7.0	5.4	5.4	4.7	4.3
29	4.35	.....	7.25	7.8	11.9	11.6	8.9	6.9	5.4	5.3	4.7	4.3
30	4.4	.....	7.05	7.8	11.4	11.6	8.9	6.8	5.4	5.3	4.7	4.3
31	4.5	.....	6.85	7.8	10.4	.....	8.8	6.7	.....	5.3	.....	4.3
1908.												
1	4.3	4.5	4.6	5.8	7.1	8.0	8.3	6.45	6.25	6.55	5.7	4.1
2	4.3	4.6	4.6	5.7	7.0	7.9	8.2	6.65	6.2	6.25	5.7	4.1
3	4.3	4.6	4.7	5.6	6.9	7.9	8.0	6.85	6.2	6.1	5.6	4.1
4	4.3	4.6	5.0	5.5	6.9	7.65	8.0	7.05	6.1	6.0	5.6	4.1
5	4.3	4.5	5.0	5.5	6.95	7.55	8.0	7.2	6.05	5.9	5.6	4.0
6	4.3	4.5	5.1	5.5	7.05	7.9	8.0	6.95	6.0	5.85	5.5	4.1
7	4.3	4.6	5.1	5.5	7.1	7.9	8.1	6.4	5.85	5.8	5.5	4.25
8	4.3	4.6	5.1	5.5	7.15	8.0	8.1	6.25	5.65	5.7	5.4	4.4
9	4.3	4.65	5.1	5.5	7.2	7.9	8.0	6.2	5.6	5.7	5.4	4.55
10	4.3	4.7	5.2	5.5	7.35	8.0	8.0	7.0	5.5	5.6	5.3	4.6
11	4.3	4.6	5.2	5.5	7.45	7.9	8.0	6.7	5.4	5.6	5.3	4.7
12	4.3	4.6	5.2	5.5	7.6	8.05	7.95	6.2	5.4	5.6	5.3	4.8
13	4.3	4.5	5.2	5.5	7.95	8.35	7.95	6.35	5.3	5.6	5.3	4.8
14	4.3	4.6	5.3	5.65	8.05	8.9	7.85	7.0	5.3	5.6	5.3	4.8
15	4.3	4.6	5.3	5.85	8.1	9.0	7.65	6.85	5.3	5.5	5.2	4.8

Daily gage height, in feet, of Green River at Greenriver, Utah, for 1907 and 1908.—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	4.3	4.6	5.5	6.1	8.0	9.4	7.6	6.85	5.2	5.5	5.15	4.7
17	4.3	4.5	5.95	6.2	7.7	9.5	7.6	6.9	5.2	5.5	5.1	4.5
18	4.3	4.5	6.0	6.35	7.6	9.6	7.5	6.9	5.2	5.65	5.0	4.4
19	4.4	4.5	5.8	6.55	7.5	9.6	7.4	6.8	5.2	5.9	5.0	4.3
20	4.5	4.5	5.7	6.75	7.5	9.7	7.3	6.8	5.1	6.15	4.9	4.3
21	4.55	4.5	5.85	7.05	7.6	9.7	7.2	6.9	5.0	6.15	4.8	4.3
22	4.65	4.5	6.1	7.35	7.75	9.6	7.1	6.9	6.3	6.0	4.8	4.3
23	4.6	4.6	6.35	7.55	7.85	9.5	7.0	6.9	5.9	5.9	4.9	4.3
24	4.5	4.6	6.2	7.75	7.9	9.65	7.0	6.8	5.8	5.8	4.9	4.3
25	4.5	4.6	6.1	7.8	8.05	9.5	6.9	6.75	6.2	5.8	5.1	4.3
26	4.5	4.7	6.1	7.8	7.8	9.35	6.65	6.7	6.0	5.8	5.1	4.3
27	4.5	4.7	6.0	7.65	7.75	9.1	6.55	6.7	5.7	5.8	5.2	4.3
28	4.6	4.6	5.85	7.55	7.95	9.0	6.4	6.65	5.85	5.7	5.2	4.3
29	4.6	4.6	5.75	7.45	8.05	8.75	6.2	6.6	5.9	5.7	5.1	4.3
30	4.6	.....	5.7	7.25	8.0	8.6	6.45	6.5	6.35	5.7	4.15	4.3
31	4.6	.....	5.7	.....	8.0	.....	6.2	6.35	.....	5.7	.....	4.3

Rating tables for Green River at Greenriver, Utah.

JANUARY 1, 1906, TO MAY 24, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.60	1,510	4.90	3,870	6.20	8,550	8.00	18,900
3.70	1,640	5.00	4,150	6.30	9,010	8.20	20,340
3.80	1,770	5.10	4,440	6.40	9,480	8.40	21,840
3.90	1,910	5.20	4,740	6.50	9,960	8.60	23,420
4.00	2,050	5.30	5,060	6.60	10,450	8.80	25,080
4.10	2,200	5.40	5,390	6.70	10,950	9.00	26,780
4.20	2,360	5.50	5,740	6.80	11,470	9.20	28,500
4.30	2,530	5.60	6,100	6.90	12,000	9.40	30,240
4.40	2,720	5.70	6,480	7.00	12,550	9.60	32,000
4.50	2,920	5.80	6,870	7.20	13,700	9.80	33,800
4.60	3,140	5.90	7,270	7.40	14,910	10.00	35,600
4.70	3,370	6.00	7,680	7.60	16,180	11.00	45,040
4.80	3,610	6.10	8,110	7.80	17,510	12.00	55,000

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on five discharge measurements made during 1906 and the form of the 1905 curve. It is well defined between gage heights 4.5 and 10.0 feet.

MAY 25, 1907, TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.s-ft.*
4.00	1,270	5.30	3,360	6.60	7,790	8.80	20,820
4.10	1,390	5.40	3,590	6.70	8,250	9.00	22,250
4.20	1,520	5.50	3,840	6.80	8,730	9.20	23,700
4.30	1,650	5.60	4,120	6.90	9,220	9.40	25,190
4.40	1,780	5.70	4,420	7.00	9,730	9.60	26,710
4.50	1,920	5.80	4,730	7.20	10,780	9.80	28,260
4.60	2,060	5.90	5,050	7.40	11,880	10.00	29,850
4.70	2,210	6.00	5,400	7.60	13,030	11.00	38,300
4.80	2,370	6.10	5,760	7.80	14,220	12.00	47,900
4.90	2,540	6.20	6,140	8.00	15,450	13.00	58,600
5.00	2,730	6.30	6,530	8.20	16,740		
5.10	2,930	6.40	6,930	8.40	18,070		
5.20	3,140	6.50	7,350	8.60	19,430		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1907 and 1908 and the form of previous curves. It is well defined above gage height 6.0 feet.

Monthly discharge of Green River at Greenriver, Utah, for 1907 and 1908.

[Drainage area, 38,200 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	3,140	1,840	2,580	0.068	0.08	159,000	C.
February	9,240	2,720	5,660	.148	.15	314,000	C.
March	15,500	4,150	7,800	.204	.24	480,000	C.
April	29,400	7,070	16,200	.424	.47	964,000	C.
May	51,000	15,200	29,200	.764	.88	1,800,000	C.
June	57,500	33,100	44,600	1.17	1.30	2,650,000	A.
July	50,000	20,800	35,800	.937	1.08	2,200,000	A.
August	21,200	8,020	12,500	.327	.38	769,000	B.
September	8,980	3,590	5,430	.142	.16	323,000	B.
October	5,950	3,360	4,110	.108	.12	253,000	C.
November	3,360	2,210	2,910	.076	.08	173,000	C.
December	2,210	1,520	1,770	.046	.05	109,000	C.
The year	57,500	1,520	14,000	.368	4.99	10,200,000	
1908.							
January	2,140	1,650	1,790	.047	.05	110,000	C.
February	2,210	1,920	2,030	.053	.06	117,000	C.
March	6,730	2,060	4,040	.106	.12	248,000	C.
April	14,200	3,840	7,380	.193	.22	439,000	A.
May	16,100	9,220	13,000	.340	.39	799,000	A.
June	27,500	12,700	20,400	.534	.60	1,210,000	A.
July	17,400	6,140	12,400	.325	.37	762,000	A.
August	10,800	6,140	8,370	.219	.25	515,000	A.
September	6,730	2,730	4,560	.119	.13	271,000	B.
October	7,570	3,840	4,810	.126	.15	296,000	B.
November	4,420	1,460	3,210	.084	.09	191,000	C.
December	2,370	1,270	1,760	.046	.05	108,000	C.
The year	27,500	1,270	6,980	.183	2.48	5,070,000	

COLORADO RIVER AT HARDYVILLE, ARIZ.

This station, which is located one-quarter mile above the deserted town of Hardyville and 7 miles above Fort Mohave, Ariz., was established May 11, 1905, and was discontinued October 1, 1907. It was maintained in cooperation with the State of California.

The bed of the stream is composed of cemented gravel and changes gradually as the river falls from flood stage to low water, a bar forming in that portion of the section nearest the right bank and altering conditions of flow materially. The right bank is composed of cemented gravel, is high and not subject to overflow; the left bank is made up of alluvial material, easily eroded, is low and wooded, and is liable to overflow at flood stages. Discharge measurements are made from a car and cable. The datum of the staff gage, which has remained the same since the establishment of the station, is at elevation 507.18 feet above sea level. The gage is located 275 feet below the cable from which discharge measurements are made.

Discharge measurements of Colorado River at Hardyville, Ariz., in 1907.

[By Carvin, Fackles, and Somers.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 5	6.95	9,270	April 6	9.15	22,300	July 6	15.30	104,000
January 12	6.56	7,410	April 13	9.36	24,800	July 13	14.40	100,000
January 19	6.88	8,890	April 20	12.28	42,500	July 18	13.00	64,200
January 26	6.69	7,910	April 28	10.92	35,200	July 20	12.9	57,200
February 2	6.89	8,260	May 4	10.45	31,600	July 27	11.2	50,800
February 9	7.30	10,500	May 11	9.95	26,900	August 3	10.65	45,900
February 16	7.30	10,500	May 18	10.60	38,300	August 10	9.72	44,100
February 23	7.45	11,600	May 25	13,45	67,900	August 17	8.80	27,200
March 2	7.69	14,200	June 1	14.40	65,600	August 24	8.60	23,400
March 9	8.11	14,900	June 8	13.78	65,300	September 1	8.60	21,800
March 16	7.59	15,000	June 11	15.38	110,000	September 8	8.40	22,300
March 23	7.80	14,200	June 22	15.40	104,000	October 6	7.20	13,400
March 30	9.78	29,200	June 29	14.70	81,000			

Daily gage height, in feet, of Colorado River at Hardyville, Ariz., for 1907.

[Marion Derrick, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	6.65	6.8	7.7	9.8	10.2	14.4	14.8	11.05	8.5
2	6.85	6.9	7.7	9.7	10.2	14.0	14.6	10.8	8.45
3	6.75	6.8	.....	9.5	10.2	13.2	15.0	10.65	8.9
4	6.9	6.8	7.8	9.5	10.45	.....	15.1	10.2	9.2
5	6.95	6.9	8.0	9.4	10.55	13.0	15.0	10.7	8.85
6	7.0	7.3	7.9	9.15	10.55	12.9	15.3	10.5	8.9
7	6.9	7.25	8.25	9.15	10.5	13.0	15.1	10.4	8.8
8	6.8	7.2	8.2	9.05	10.4	13.8	15.0	10.15	8.8
9	6.7	7.3	8.1	9.05	10.4	14.3	15.0	9.7	8.6
10	6.7	7.3	8.0	9.2	10.2	14.7	14.8	9.7	.....
11	6.6	7.3	8.3	9.3	10.0	15.35	14.7	9.45	8.1
12	6.55	.....	8.1	9.3	9.85	15.5	14.7	9.25	8.05
13	6.6	7.4	8.0	9.4	9.8	15.45	14.4	9.15	7.95
14	6.6	7.35	7.85	9.65	9.85	15.3	14.2	9.0	7.85
15	6.7	7.35	7.7	9.9	9.75	15.0	14.0	8.9	7.65
16	6.8	7.3	7.65	10.5	10.0	15.1	13.7	8.9	7.55
17	6.9	7.3	7.55	11.25	10.15	15.3	13.35	8.8	7.4
18	.....	7.4	7.5	11.8	10.65	15.0	13.0	8.75	7.5
19	6.9	7.5	7.6	12.05	11.1	15.4	13.2	8.7	7.6
20	6.85	7.6	7.5	12.35	11.3	15.4	12.9	8.6	7.35
21	6.75	7.45	.....	12.5	11.3	15.2	12.65	8.4	7.15
22	6.7	7.4	7.5	12.35	11.5	15.4	11.9	8.3	7.2
23	6.75	7.45	7.8	12.3	11.8	15.05	11.6	8.2	7.2
24	6.7	7.9	7.7	12.2	12.4	15.4	11.2	8.6	7.3
25	6.65	7.6	7.65	.....	13.6	14.8	10.9	.....	7.35
26	6.65	7.5	8.5	11.35	14.5	14.85	11.05	8.9	7.4
27	6.7	7.4	9.0	10.95	15.5	14.7	11.2	8.1	.....
28	6.65	7.9	9.6	10.75	15.0	14.7	10.9	8.0	7.35
29	6.65	.....	9.5	10.5	14.9	14.7	11.15	7.9	7.1
30	6.5	.....	9.6	10.3	14.4	14.7	11.1	8.5	7.05
31	6.65	.....	9.8	.....	.....	.....	11.1	8.75	.....

Daily discharge, in second-feet, of Colorado River at Hardyville, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	7,800	7,900	14,100	28,600	29,400	65,600	86,200	50,000	21,400
2	8,800	8,260	14,200	27,500	29,400	61,000	83,600	47,300	21,200
3	8,300	7,850	14,300	25,700	29,500	52,300	93,200	45,900	24,800
4	9,100	7,850	14,400	25,400	31,600	52,100	96,000	42,500	25,800
5	9,270	8,300	15,400	24,400	32,400	52,000	95,500	48,600	25,200
6	9,600	10,500	14,400	22,300	32,400	52,000	104,000	47,700	25,600
7	9,000	10,200	16,400	22,500	31,800	54,000	102,000	47,600	25,000
8	8,550	9,900	15,800	21,900	30,900	65,700	102,000	46,400	25,000
9	8,000	10,500	14,900	22,000	30,700	77,300	104,000	43,000	23,600
10	8,000	10,500	14,600	23,300	29,000	89,500	102,000	44,100	22,000
11	7,500	10,500	17,100	24,100	27,400	110,000	102,000	40,000	20,000
12	7,410	10,800	16,200	24,300	26,900	112,000	105,000	36,600	19,600
13	7,600	11,000	16,100	25,200	27,400	110,000	100,000	34,200	19,000
14	7,600	10,800	15,600	25,800	28,600	106,000	93,400	31,800	18,200
15	8,000	10,800	15,200	26,800	28,600	98,500	87,500	30,000	16,900
16	8,500	10,500	15,400	30,700	31,800	100,000	80,000	29,000	16,200
17	9,000	10,600	14,400	36,000	33,600	104,000	71,500	27,200	15,300
18	8,950	11,100	13,800	40,000	38,700	96,700	64,200	25,600	16,000
19	8,900	11,700	14,200	41,800	42,800	106,000	64,000	26,000	16,400
20	8,700	12,200	13,200	43,000	44,400	105,000	57,200	24,800	14,800
21	8,200	11,400	13,000	45,600	44,000	100,000	56,300	23,000	13,600
22	7,900	11,300	12,600	44,900	45,600	104,000	49,500	22,900	13,900
23	8,200	11,600	14,200	45,000	48,700	95,000	47,700	21,700	13,800
24	7,900	14,400	13,800	44,600	55,000	102,000	45,300	23,400	14,400
25	7,700	12,900	13,500	41,500	70,200	87,500	44,000	24,600	14,600
26	7,700	12,400	19,000	37,800	83,500	87,500	47,800	25,200	14,900
27	7,850	12,000	22,700	35,100	102,000	83,800	50,800	19,200	14,900
28	7,500	15,100	27,400	33,800	87,300	82,200	47,600	18,400	14,700
29	7,400	.....	26,800	31,900	82,000	81,000	50,800	17,500	13,000
30	6,700	.....	27,800	30,200	70,400	82,600	50,300	21,600	12,700
31	7,300	.....	29,000	.....	67,500	.....	50,400	20,600	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Colorado River at Hardyville, Ariz., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	9,600	6,700	8,160	502,000	B.
February	15,100	7,850	10,800	600,000	B.
March	29,000	12,600	16,800	1,030,000	B.
April	45,600	21,900	31,700	1,890,000	B.
May	102,000	26,900	44,900	2,760,000	B.
June	112,000	52,000	85,900	5,110,000	B.
July	104,000	44,000	75,300	4,630,000	B.
August	50,000	17,500	32,500	2,000,000	B.
September	25,800	12,700	18,400	1,090,000	B.
The period				19,600,000	

COLORADO RIVER AT YUMA, ARIZ.

This station, which is located in the town of Yuma, Ariz., 1½ miles below the mouth of Gila River, and 10 miles by river above the Mexican border, furnishes information concerning the amount of water available for irrigation along lower Colorado River and for diversion at the Laguna dam (Pl. V, *A*). Records of river height have been kept by the Southern Pacific Railroad Company since April 1, 1878.

The records given herewith are furnished by the United States Reclamation Service, through F. L. Sellew, project engineer, Yuma.

As the bed of the stream is composed of silt and sand and is very unstable, frequent measurements are necessary to properly define the daily discharge. The right bank is low, wooded, and liable to overflow; the left bank is not subject to overflow. Previous to May 31, 1903, discharge measurements were made from the railroad bridge. On that date a cable station was established at a point 600 feet below the bridge, and all measurements are now made from a car, except during highest floods, when a boat is used. At flood stages a large part of the water flows through an old channel and does not pass under the cable. At such times this overflow water is measured at the point where it passes under the railway trestle, one-third mile north of the main channel.

During the flood of May and June, 1905, there were two breaks in the railroad grade at Araz, Cal., 4 miles from Yuma, and the water passing through these is included in each discharge measurement of the Colorado.

The staff gage is in two sections, located at the railroad bridge, 600 feet above the cable station, the upper section reading above 24 feet being the original gage established in 1876. The elevation of the zero of the gage is 137.4 feet above sea level.

Discharge measurements of Colorado River at Yuma, Ariz., in 1907 and 1908.

[By Robertson, North, Dyer, and Priest.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*
January 1	22.75	36,600	March 25	22.0	26,200	June 12	27.1	81,800
January 3	20.85	24,700	March 27	21.5	20,200	June 15	28.05	94,400
January 5	20.6	18,800	March 30	23.0	31,200	June 17	28.55	101,000
January 7	20.2	15,200	April 1	22.8	29,000	June 19	29.15	106,000
January 9	20.0	15,900	April 3	23.2	32,100	June 22	29.05	108,000
January 11	20.7	18,200	April 6	22.7	29,200	June 24	28.9	112,000
January 14	22.0	29,700	April 8	22.4	27,400	June 26	28.9	114,000
January 16	20.5	20,400	April 10	22.2	24,700	June 29	28.6	115,000
January 18	19.8	16,300	April 13	22.45	25,900	July 1	28.3	113,000
January 21	21.7	27,300	April 15	22.5	26,000	July 6	27.4	107,000
January 23	20.6	22,100	April 17	23.0	29,500	July 8	27.5	108,000
January 25	20.15	15,900	April 20	24.8	41,500	July 10	27.8	110,000
January 28	19.7	13,200	April 22	25.55	46,900	July 15	27.8	114,000
January 30	19.6	12,700	April 24	25.8	49,900	July 17	27.5	110,000
February 2	22.05	29,500	April 27	25.6	45,700	July 20	26.75	102,000
February 4	21.6	27,100	April 29	24.7	44,600	July 22	25.65	92,000
February 6	20.6	18,800	May 1	23.75	35,500	July 24	24.8	82,400
February 8	20.4	17,900	May 4	23.2	32,400	July 29	23.1	58,600
February 11	20.9	20,300	May 6	23.1	33,000	July 31	22.8	55,400
February 13	20.6	17,400	May 8	23.3	33,900	August 3	23.3	61,900
February 16	20.5	16,600	May 11	23.2	32,800	August 5	22.85	55,300
February 18	20.4	14,900	May 13	22.8	30,400	August 7	22.45	50,600
February 20	20.2	14,100	May 15	22.65	29,100	August 10	22.15	49,900
February 23	21.0	17,400	May 18	22.8	28,600	August 12	21.45	41,300
February 25	20.7	15,000	May 20	23.5	31,900	August 14	20.95	33,900
February 28	21.9	22,900	May 22	24.4	37,500	August 17	20.45	32,900
March 2	20.75	16,700	May 25	24.7	41,300	August 19	20.25	28,600
March 5	21.0	18,000	May 27	25.55	51,000	August 22	20.25	26,800
March 9	24.65	46,200	May 29	27.0	61,800	August 24	19.95	24,500
March 11	22.2	26,500	June 1	28.4	72,400	August 26	20.5	27,300
March 13	21.75	24,900	June 3	29.1	77,000	August 29	20.3	25,000
March 16	21.2	19,700	June 6	28.95	87,100	August 31	19.6	23,100
March 18	20.8	16,900	June 8	27.75	80,100	September 2	22.25	43,300
March 20	20.4	14,800	June 10	26.9	72,200	September 4	21.25	35,000

A. INTAKE GATES ON CALIFORNIA SIDE OF LAGUNA DAM, YUMA PROJECT, ARIZONA.

B. MEASURING SECTION ON WHITEROCKS RIVER NEAR WHITEROCKS, UTAH.

Discharge measurements of Colorado River at Yuma, Ariz., in 1907 and 1908—Continued.

[By Robertson, North, Dyer, and Priest.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*
September 7	21.25	34,500	February 14	20.0	14,900	August 12	21.8	28,200
September 9	20.75	31,900	February 19	19.7	12,900	August 14	21.05	24,000
September 11	20.5	27,600	February 21	19.9	10,600	August 17	20.6	20,700
September 14	19.65	21,900	February 24	19.7	9,900	August 19	20.4	20,500
September 16	19.2	18,400	February 26	20.65	16,900	August 21	20.45	19,300
September 21	19.0	15,500	March 3	20.25	11,700	August 24	22.4	33,800
September 23	19.0	14,100	March 9	22.2	27,000	August 26	22.1	28,200
September 25	19.0	13,400	March 11	21.1	18,700	August 28	21.6	25,000
September 28	19.1	13,400	March 12	21.9	24,700	August 31	20.65	18,900
October 1	18.9	12,000	March 14	20.6	15,200	September 2	20.4	19,200
October 3	18.8	11,300	March 17	20.05	13,400	September 4	20.1	16,600
October 5	18.7	10,300	March 19	19.85	11,300	September 7	19.6	14,100
October 8	18.75	10,300	March 23	20.2	13,200	September 11	19.3	11,800
October 10	19.1	12,200	March 25	20.45	14,300	September 17	19.1	10,400
October 12	19.7	15,900	March 28	20.95	17,200	September 19	18.8	8,900
October 14	19.75	15,500	March 31	20.8	16,100	September 21	18.7	8,200
October 17	19.6	14,000	April 2	20.8	16,400	September 23	18.65	7,700
October 19	19.5	13,800	April 6	20.4	13,900	September 25	18.6	7,000
October 21	19.55	14,600	April 9	20.2	13,400	September 28	18.8	7,500
October 23	19.95	15,900	April 17	20.6	13,600	September 30	18.8	7,200
October 26	19.5	14,200	April 22	21.1	16,500	October 3	18.9	6,600
October 28	20.25	18,800	April 25	22.0	27,100	October 5	19.4	8,200
October 30	19.9	16,300	April 27	21.95	26,000	October 7	19.5	8,500
November 2	19.55	14,300	April 29	22.05	28,100	October 9	19.8	10,000
November 4	19.4	12,900	May 2	22.7	29,800	October 12	19.5	8,600
November 6	19.3	11,900	May 5	22.0	27,100	October 14	19.8	9,900
November 9	19.1	11,800	May 9	21.4	23,100	October 19	19.3	7,700
November 12	19.1	10,900	May 13	21.65	25,100	October 23	19.4	8,200
November 14	19.1	10,700	May 16	21.55	23,500	October 26	21.15	20,600
November 18	18.8	9,600	May 18	22.2	27,900	October 28	20.05	13,700
November 20	18.8	9,900	May 22	22.3	27,500	October 30	19.75	12,100
November 23	18.8	9,600	May 26	22.15	25,500	November 2	19.3	9,900
November 26	18.7	9,100	May 31	22.8	31,300	November 4	19.2	9,200
November 29	18.7	9,000	June 5	22.6	30,900	November 6	19.3	8,500
December 2	18.5	8,600	June 8	22.4	33,600	November 9	19.3	8,200
December 5	18.3	7,800	June 12	23.3	35,200	November 11	19.4	8,200
December 7	18.3	8,000	June 15	23.3	38,700	November 13	19.5	8,700
December 9	18.3	7,500	June 17	23.3	39,400	November 16	19.5	8,000
December 12	18.3	7,900	June 19	24.35	48,300	November 18	19.6	7,600
December 14	18.5	7,700	June 22	24.95	55,100	November 20	19.6	7,500
December 16	18.45	7,300	June 24	25.25	59,700	November 23	19.55	7,300
December 18	18.4	7,300	June 26	25.35	61,700	November 25	19.7	7,200
December 21	18.4	7,400	June 29	24.6	55,400	November 27	19.7	7,400
December 24	18.35	7,500	July 1	24.5	53,800	November 30	19.2	6,000
December 28	18.15	6,300	July 4	24.2	53,100	December 2	19.2	6,200
December 30	18.1	6,000	July 6	23.8	49,300	December 4	19.4	6,600
			July 8	23.05	41,100	December 7	19.6	7,400
1908.			July 10	22.3	35,400	December 9	19.6	7,700
January 2	18.0	5,800	July 13	21.9	31,200	December 11	19.55	7,400
January 5	18.2	6,400	July 15	21.5	29,800	December 12	19.5	7,300
January 8	18.6	7,400	July 17	21.2	28,800	December 14	19.4	6,900
January 11	18.4	6,900	July 20	21.0	25,600	December 16	19.1	6,100
January 13	18.3	6,700	July 22	20.7	24,600	December 17	19.4	7,300
January 16	18.2	5,900	July 24	20.7	24,100	December 19	27.1	72,500
January 18	18.1	5,600	July 27	20.55	21,600	December 20	27.3	68,900
January 20	18.1	5,600	July 29	20.1	19,300	December 22	21.5	25,400
January 27	18.4	6,300	July 31	20.2	18,900	December 23	23.1	37,200
January 30	18.4	6,100	August 3	20.85	22,700	December 26	20.6	19,400
February 5	18.7	7,400	August 5	20.7	21,400	December 28	19.8	14,800
February 7	23.95	45,000	August 7	21.1	25,200	December 30	19.2	11,200
February 11	19.7	14,200	August 10	22.05	31,900			

Daily gage height, in feet, of Colorado River at Yuma, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	22.95	19.55	20.85	22.85	23.75	28.45	28.3	23.1	20.65	18.9	19.9	18.6
2	21.2	21.55	20.8	22.9	23.45	28.9	28.05	23.1	22.25	18.9	19.55	18.5
3	20.9	22.4	21.25	23.2	23.3	29.1	27.65	23.3	21.6	18.8	19.4	18.5
4	20.7	21.5	21.0	23.05	23.2	29.2	27.4	23.05	21.2	18.65	19.4	18.4
5	20.6	21.1	21.1	22.8	23.1	29.15	27.4	22.85	21.55	18.7	19.35	18.3
6	20.3	20.65	21.25	22.75	23.15	28.9	27.35	22.5	21.5	18.7	19.3	18.3
7	20.2	20.35	22.85	22.65	23.25	28.3	27.35	22.45	21.25	18.75	19.2	18.3
8	19.9	20.6	27.0	22.35	23.3	27.7	27.5	22.45	20.65	18.75	19.2	18.3
9	20.0	20.95	24.55	22.2	23.3	27.25	27.7	22.3	20.75	19.0	19.1	18.3
10	20.7	21.0	23.2	22.2	23.2	26.85	27.8	22.15	21.0	19.1	19.15	18.3
11	20.7	20.9	22.3	22.4	23.15	26.95	28.05	21.85	20.5	19.1	19.1	18.3
12	23.7	20.75	21.7	22.5	23.0	27.15	28.0	21.45	20.0	19.7	19.1	18.3
13	23.3	20.6	21.85	22.45	22.85	27.45	28.05	21.25	19.65	19.7	19.1	18.4
14	22.0	20.5	21.8	22.5	22.65	27.75	27.95	20.95	19.65	19.75	19.1	18.5
15	21.1	20.55	21.35	22.5	22.65	28.05	27.8	20.65	19.35	19.4	19.0	18.4
16	20.5	20.5	21.15	22.8	22.75	28.25	27.65	20.5	19.2	19.4	18.9	18.45
17	19.95	20.4	20.9	23.05	22.7	28.55	27.5	20.45	19.15	19.6	18.8	18.45
18	19.8	20.4	20.7	23.5	22.8	28.85	27.45	20.3	19.05	19.65	18.8	18.4
19	21.4	20.35	20.55	24.25	23.0	29.1	27.1	20.25	18.95	19.5	18.8	18.35
20	22.85	20.2	20.4	24.8	23.6	29.15	26.75	20.1	18.9	19.35	18.8	18.4
21	21.5	20.55	20.4	25.15	24.1	29.15	26.1	20.3	19.0	19.55	18.85	18.4
22	21.0	21.25	20.4	25.5	24.45	29.1	25.65	20.25	19.25	19.2	18.8	18.5
23	20.6	20.95	20.4	25.75	24.6	29.0	25.3	20.1	19.0	19.95	18.8	18.5
24	20.3	20.75	20.55	25.85	24.7	28.9	24.85	19.95	19.0	19.9	18.8	18.35
25	20.1	20.7	22.3	25.85	24.75	28.9	24.3	20.2	19.0	19.8	18.7	18.3
26	20.0	21.4	22.3	25.75	25.05	28.85	23.6	20.5	19.0	19.5	18.7	18.3
27	19.8	21.85	21.5	25.6	25.5	28.75	23.25	20.4	19.05	19.4	18.6	18.3
28	19.7	21.3	21.7	25.3	26.15	28.7	23.0	20.5	19.1	20.25	18.65	18.15
29	19.6	.....	22.95	24.8	27.5	28.6	23.1	20.3	19.25	19.7	18.7	18.1
30	19.6	.....	23.0	24.3	27.95	28.4	22.8	19.9	19.05	19.9	18.6	18.1
31	19.6	.....	23.05	.....	.....	.....	22.8	19.6	.....	20.25	.....	18.0
1908.												
1	18.0	18.5	20.3	20.75	22.7	22.85	24.5	20.35	20.4	18.8	19.4	19.2
2	18.0	18.5	20.25	20.8	22.7	22.75	24.45	20.8	20.4	18.8	19.3	19.2
3	18.1	18.6	20.25	20.7	22.55	22.6	24.25	20.95	20.3	19.0	19.2	19.4
4	18.2	18.7	20.85	20.5	22.3	22.6	24.1	20.6	20.05	19.3	19.2	19.4
5	18.4	18.75	21.0	20.4	22.0	22.6	23.9	20.75	19.8	19.6	19.25	19.55
6	18.45	19.7	20.7	20.4	21.75	22.3	23.75	21.1	19.65	19.7	19.25	19.6
7	18.55	23.8	20.65	20.25	21.55	22.3	23.35	21.2	19.55	19.55	19.3	19.6
8	18.6	21.4	23.05	20.1	21.4	22.5	23.05	21.55	19.5	19.75	19.3	19.6
9	18.6	20.35	22.2	20.2	21.35	22.7	22.7	22.25	20.05	19.8	19.3	19.6
10	18.55	19.75	21.4	20.05	21.4	22.95	22.3	22.0	19.5	19.6	19.4	19.6
11	18.4	19.7	21.45	20.1	21.55	23.2	22.1	21.8	19.25	19.5	19.4	19.5
12	18.3	19.7	21.9	20.25	21.7	23.3	22.0	21.7	19.2	19.5	19.5	19.5
13	18.3	19.95	21.0	20.45	21.65	23.5	21.85	21.0	19.4	19.65	19.5	19.5
14	18.3	20.0	20.6	20.6	21.6	23.5	21.7	21.15	19.1	19.7	19.5	19.3
15	18.2	19.95	20.55	20.65	21.45	23.3	21.4	20.65	19.05	19.45	19.5	19.2
16	18.2	19.9	20.3	20.7	21.55	23.2	21.3	20.5	19.9	19.35	19.55	19.1
17	18.1	19.8	20.05	20.6	21.95	23.3	21.2	20.6	19.25	19.25	19.6	19.3
18	18.1	19.7	19.9	20.65	22.2	23.8	21.05	20.35	18.9	19.25	19.6	19.65
19	18.1	19.7	19.85	20.7	22.25	24.3	21.0	20.4	18.8	19.3	19.6	26.25
20	18.1	19.8	19.8	20.8	22.3	24.6	21.0	20.2	18.75	19.3	19.6	26.25
21	18.1	19.9	19.8	20.8	22.3	24.75	20.9	20.45	18.7	19.3	19.6	21.5
22	18.1	20.05	20.1	21.1	22.3	25.0	20.7	20.8	18.75	19.3	19.6	21.3
23	18.1	19.75	20.2	21.7	22.2	25.2	20.55	21.3	18.65	19.35	19.6	23.05
24	18.2	19.7	20.35	21.95	22.0	25.2	20.7	22.45	18.6	19.4	19.75	22.1
25	18.2	19.95	20.45	22.0	22.0	25.25	20.7	22.35	18.6	20.05	19.7	21.15
26	18.35	20.65	20.75	21.95	22.15	25.3	20.7	22.05	18.6	21.05	19.7	20.5
27	18.4	20.8	20.9	21.95	22.5	25.15	20.5	21.8	18.65	20.5	19.7	20.1
28	18.45	20.7	20.95	22.0	22.9	24.8	20.2	21.45	18.8	20.05	19.6	19.75
29	18.5	20.4	20.9	22.05	23.0	24.55	20.1	20.85	18.8	19.75	19.45	19.45
30	18.5	.....	20.85	22.45	22.9	24.55	20.2	20.9	18.85	19.7	19.2	19.15
31	18.4	.....	20.8	.....	22.75	.....	20.25	20.6	.....	19.6	.....	18.85

Daily discharge, in second-feet, of Colorado River at Yuma, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	38,400	12,400	17,200	29,300	35,500	72,900	113,000	57,500	31,100	12,000	16,300	8,800
2	26,900	25,700	16,900	29,900	32,600	76,200	111,000	58,500	43,300	11,600	14,300	8,600
3	25,000	31,300	19,300	32,100	31,200	77,000	110,000	61,900	38,400	11,300	12,900	8,500
4	21,600	26,600	18,000	30,700	32,400	77,700	110,000	58,200	35,000	10,300	12,900	8,100
5	18,800	24,400	18,500	28,500	31,800	77,400	110,000	55,300	38,000	10,300	12,500	7,800
6	16,000	19,200	19,300	29,200	33,000	87,100	107,000	51,200	37,600	10,100	11,900	7,900
7	15,200	17,700	28,600	28,900	33,700	83,300	107,000	50,600	34,500	10,200	11,800	8,000
8	16,100	19,000	68,700	27,100	33,900	80,100	108,000	50,600	35,500	10,300	11,800	7,800
9	15,900	20,500	45,100	24,700	33,900	77,200	110,000	50,300	31,900	11,500	11,800	7,500
10	18,400	20,800	34,500	24,700	33,500	72,200	110,000	49,900	33,300	12,200	11,600	7,600
11	18,200	20,300	27,300	24,700	32,800	72,700	112,000	46,200	27,600	12,200	11,200	7,700
12	44,300	18,900	24,700	28,000	30,600	81,800	112,000	41,300	24,200	15,900	10,900	7,900
13	40,900	17,400	25,800	25,900	30,400	86,500	114,000	38,300	21,900	15,600	10,800	7,800
14	29,700	16,600	25,400	26,000	29,500	90,400	113,000	33,900	21,900	15,500	10,700	7,700
15	24,400	17,000	21,100	26,000	29,100	94,400	114,000	29,500	19,600	13,500	10,500	7,500
16	20,400	16,600	19,200	28,100	30,000	97,100	114,000	32,200	18,400	13,500	10,200	7,300
17	17,100	14,900	17,600	29,500	29,600	101,000	110,000	32,900	17,700	14,000	10,000	7,300
18	16,300	14,900	16,200	33,000	28,600	105,000	110,000	29,700	16,300	14,000	9,600	7,300
19	25,200	14,700	15,600	38,200	29,600	106,000	104,000	28,600	14,900	13,800	9,800	7,300
20	33,400	14,100	14,800	41,500	31,900	106,000	102,000	25,400	14,200	13,600	9,900	7,300
21	25,800	15,500	14,800	43,800	34,700	106,000	94,900	29,200	15,500	14,600	9,700	7,400
22	23,900	18,400	14,800	46,900	37,500	108,000	92,000	26,800	16,500	13,200	9,600	7,500
23	22,100	17,200	14,800	48,300	38,700	110,000	88,900	25,700	14,100	15,900	9,600	7,500
24	18,000	15,400	15,900	49,900	39,300	112,000	82,400	24,500	13,800	15,900	9,400	7,500
25	15,200	15,000	38,400	50,500	41,300	113,000	76,800	25,800	13,400	15,500	9,300	7,200
26	15,000	19,600	28,400	49,300	45,700	114,000	68,800	27,300	13,100	14,200	9,100	7,100
27	13,800	22,600	20,200	45,700	51,000	115,000	62,700	26,300	13,200	13,800	8,800	6,900
28	13,200	19,000	21,700	46,200	57,800	115,000	58,800	27,300	13,400	18,800	8,900	6,300
29	12,700	.....	30,800	44,600	61,800	115,000	58,600	25,000	14,000	15,500	9,000	6,100
30	12,700	.....	31,200	43,500	65,500	115,000	52,400	23,900	13,200	16,300	8,800	6,000
31	12,700	.....	31,600	.....	68,800	.....	55,400	23,100	.....	17,800	.....	5,800
1908.												
1	5,800	6,300	13,400	15,900	32,000	32,200	53,800	18,600	17,300	7,200	10,200	6,000
2	6,100	6,300	12,500	16,400	29,800	31,300	53,000	22,400	19,200	7,200	9,900	6,200
3	6,100	6,500	11,700	15,800	29,500	30,300	49,800	22,700	19,300	6,600	9,400	6,700
4	6,400	6,900	16,000	14,600	28,500	30,600	53,100	21,800	16,600	7,900	9,200	6,600
5	7,000	7,400	16,500	14,300	27,100	30,900	52,400	21,400	14,000	8,200	9,600	7,000
6	7,200	9,500	14,000	13,900	25,400	30,000	49,300	24,900	12,700	9,200	8,500	7,400
7	7,300	45,000	13,400	13,500	24,100	31,200	45,000	25,200	14,100	8,500	8,500	7,400
8	7,400	30,000	33,000	13,100	23,200	33,600	41,100	29,500	13,600	9,200	8,500	7,400
9	7,400	19,000	27,000	13,400	23,100	33,900	37,300	36,100	16,400	10,000	8,200	7,700
10	7,200	15,000	20,900	12,900	23,300	34,300	35,400	31,900	13,600	9,000	8,200	7,700
11	6,900	14,200	18,700	13,000	24,500	34,800	33,900	30,100	11,800	8,500	8,200	7,400
12	6,800	14,200	24,700	13,200	25,200	35,200	33,100	28,200	11,000	8,600	8,700	7,300
13	6,700	14,800	18,500	13,400	25,100	36,000	31,200	23,700	12,600	9,300	8,700	7,300
14	6,700	14,900	15,200	14,000	25,000	35,600	29,100	24,000	10,300	9,900	8,700	6,900
15	6,400	14,800	15,000	14,100	23,000	38,700	29,800	21,800	9,900	8,400	8,700	6,100
16	5,900	14,600	14,300	14,000	23,500	40,200	29,100	20,900	16,400	8,000	8,000	6,100
17	5,800	14,300	13,400	13,600	26,000	39,400	28,800	20,700	10,400	7,500	7,600	7,300
18	5,600	12,900	12,500	13,800	27,900	43,600	28,300	18,900	9,000	7,500	7,600	8,300
19	5,600	12,900	11,300	14,000	28,000	48,300	28,100	20,500	8,900	7,700	7,600	72,500
20	5,600	11,800	10,500	14,700	28,100	50,400	25,600	20,300	8,600	7,700	7,500	68,900
21	5,600	10,600	10,100	14,800	27,800	51,700	24,000	19,300	8,200	7,700	7,500	25,400
22	5,600	11,500	13,400	16,500	27,500	55,100	24,600	22,600	8,600	7,700	7,500	25,400
23	5,600	10,000	13,200	24,000	27,000	57,900	24,100	25,600	7,700	8,200	7,300	37,200
24	5,800	9,900	14,000	27,100	26,000	59,700	24,100	33,800	7,200	8,200	7,200	29,800
25	5,800	11,700	14,300	27,100	25,000	59,700	24,100	33,400	7,000	11,400	7,200	22,900
26	6,100	16,900	16,000	26,200	25,500	61,700	24,100	28,200	7,000	20,600	7,200	19,400
27	6,300	17,400	17,000	26,000	29,900	58,700	21,600	22,600	7,700	16,000	7,400	15,800
28	6,400	17,000	17,200	27,000	32,800	50,700	19,800	25,000	7,500	13,700	7,300	14,800
29	6,400	16,000	17,000	28,100	33,700	55,400	19,300	20,200	7,500	11,800	6,700	12,800
30	6,300	.....	16,800	35,000	32,800	55,000	19,800	20,500	7,200	12,100	6,000	11,200
31	6,100	.....	16,100	.....	31,300	.....	18,900	18,900	.....	11,300	.....	9,100

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Colorado River at Yuma, Ariz., for 1907 and 1908.

[Drainage area, 225,000 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	44,300	12,700	21,500	0.096	0.11	1,320,000	B.
February	31,300	12,400	18,800	.084	.09	1,040,000	B.
March	68,700	14,800	24,100	.107	.12	1,480,000	B.
April	50,500	24,700	35,300	.157	.18	2,100,000	B.
May	68,800	28,600	37,900	.168	.19	2,330,000	B.
June	115,000	72,200	94,800	.421	.47	5,640,000	B.
July	114,000	52,400	96,500	.429	.49	5,930,000	B.
August	61,900	23,100	37,600	.167	.19	2,310,000	B.
September	43,300	13,100	23,200	.103	.12	1,380,000	B.
October	18,800	10,100	13,600	.060	.07	836,000	B.
November	16,300	8,800	10,800	.048	.05	643,000	B.
December	8,800	5,800	7,450	.033	.04	458,000	B.
The year	115,000	5,800	35,100	.156	2.12	25,500,000	
1908.							
January	7,400	5,600	6,320	0.028	0.03	389,000	B.
February	45,000	6,300	14,200	.063	.07	817,000	B.
March	33,000	10,100	16,100	.072	.08	990,000	B.
April	35,000	12,900	17,800	.079	.09	1,060,000	B.
May	33,700	23,000	27,200	.121	.14	1,670,000	B.
June	61,700	30,000	42,900	.191	.21	2,550,000	B.
July	53,800	18,900	32,600	.145	.17	2,000,000	B.
August	36,100	18,600	24,300	.108	.12	1,490,000	B.
September	19,300	7,000	11,400	.051	.06	678,000	B.
October	20,600	6,600	9,510	.042	.05	585,000	B.
November	10,200	6,000	8,090	.036	.04	481,000	B.
December	72,500	6,000	15,900	.071	.08	978,000	B.
The year	72,500	5,600	18,900	.084	1.14	13,700,000	

SALTON SEA NEAR SALTON, CAL.

Salton Sea originally formed a part of the Colorado Desert, which has an area of nearly 2,000 square miles and extends in a northwesterly direction almost 100 miles from the California-Mexico boundary line. It comprises two fertile valleys, one to the northwest of the sink, in Riverside County, known as the Coachella Valley, and the other to the southeast of the sink, in Imperial County, called the Imperial Valley. Salton Sea, which now partly fills the sink, lies between the two valleys and is partly in Riverside County and partly in Imperial County. The longest diameter of the sea has a northwest-southeast direction. On December 31, 1908, its surface was 206 feet below mean sea level, and it had a length of nearly 45 miles, a maximum width of about 15 miles, a minimum width of 9.5 miles, a maximum depth of 67.5 feet, and a superficial area of about 443 square miles. It is about 160 miles southeast of Los Angeles, 90 miles northwest of Yuma, and 50 miles north of Calexico.

A few thousand years ago, according to geologic evidence, what is now Salton Sea was a part of the Gulf of California, which then

extended about 200 miles farther northwest than at present. It is probable that the gulf waters then swept inland to the base, or nearly to the base, of San Jacinto Peak, although all evidence which would enable us to fix its exact limits has been obliterated by still more recent geologic events. At that time the mouth of Colorado River was in the vicinity of Yuma, 60 miles in an air line north of its present location. Presumably, then, as now, it was discharging annually enough silt to cover 1 square mile to a depth of 53 feet with dry earth, equivalent to 1 cubic mile each century, cut from the great canyons in the upper Colorado and the Gila Valley and carried to the Gulf. Running water will carry in suspension matter that quickly settles in still water, the settling process in this case being aided by the clarifying effect of the salt water.

As a result of these processes the Colorado delta was gradually extended southwestward toward the Cocopa Mountains, and when it reached them it had separated the old gulf into the present gulf and an inland sea. Delta growth, however, did not cease with the separation of the water body into two parts. Silt continued to be brought down the stream and to be deposited in its bed, along its banks, and in the still waters at its mouth. A stream, by this process of deposition along its channel, eventually builds the channel up until it is higher than the lands adjacent on either side. It is then in a condition of unstable equilibrium, and at some favorable time, as during an exceptional flood, it will break out of its immediate banks and establish itself in some more favorable course. By this process, oft repeated, it comes eventually to flow over all parts of its delta, building up each part in succession. By such a process the Colorado must have discharged alternately into the gulf and into the depression now known as the Salton Sink, meanwhile building up the delta dam that separates them until it reached a height of about 40 feet above sea level. During this process it is highly probable that water filled the Salton depression and evaporated from it many times, for it must have quickly disappeared whenever the erratic river changed its course to the gulf, for the run-off from the mountains that surround the sink is too slight to maintain a permanent water body in this region of intense evaporation. Meanwhile the original body of salt water that occupied the sink had been displaced by the volumes of fresh water poured into it from the river, and in the intermediate stages of the lake's existence, at least, its water was fresh or nearly fresh. A clear and definite indication of the last occupancy of this depression by a lake, presumably just before the river had shifted its course that it now follows to the gulf, may be seen in the remarkably well preserved old water line that rims the desert from Indio to the Cerro Prieto at a height of 40 feet above sea level. On the rocky points that projected into

the lake it is marked by a thick deposit of calcium carbonate, by slightly cut sea cliffs, and by a change in the profile of the rocky spurs at the water line. Where alluvial cones and the sandy floor of the desert formed the shore line beaches have been developed, and although of soft sand and easily eroded, they are even now well preserved, thus testifying to the recency of the action that produced them. Over the floor of the desert and along the sandy beaches are myriads of shells of fresh or brackish water mollusks [a] that lived in the lake.

There are some reasons for thinking that the lake at this latest stage was not perfectly fresh, that its waters were at least distinctly "hard." Its area when it stood at 40 feet above sea level was somewhat in excess of 2,100 square miles. The average flow of the Colorado has been determined as about 11,000,000 acre-feet per annum. The evaporation from a surface of the area of the old lake, under the conditions that prevail here, has never been determined, but is undoubtedly high. If it is as high as 8 feet per annum, it would nearly equal the average annual inflow from the Colorado; if it is but 7 feet per annum, the average inflow would exceed the evaporation by 2,000 second-feet, or somewhat less than 14 per cent of the inflow. In either event, the waters of the lake would be markedly more alkaline after a term of years than those of the Colorado. The calcium carbonate incrustations on the rocky points about the shores of the old lake are best explained by supposing that the lake waters contained large quantities of this salt, so that wherever they broke in spray and evaporated more rapidly than usual, the carbonate was deposited. This necessary excess of inflow over outflow at the period of maximum area of the lake, taken in connection with the thick calcium carbonate incrustations on the shores, indicates distinctly hard water. It may be assumed that other salts than calcium carbonate were also present in large amount, for the conditions that would lead to the abundance of one salt would also lead to an abundance of the others. The shells so thickly distributed over the desert floor, however, are not salt-water forms, but are identical with those now found living in the springs and occasional permanent streams about the desert borders. Many of these springs and streams are somewhat brackish, and the creatures flourish in them. It seems probable, then, that the lake waters also were rather alkaline, perhaps even brackish, at the time the lake attained its maximum area.

The period at which this lake disappeared can not be precisely fixed. The time units of geology are too large and too indefinite to translate satisfactorily into years, so that when we say that the disappearance of the lake is the most recent of geologic events we still

[a] Stearns, Robt. E. C., Remarks on fossil shells from the Colorado Desert: Am. Naturalist, vol. 13, pp. 141–154.

leave the mind groping for a definite human standard of time. The sandy beaches which mark the borders of the ancient lake are cut away, to be sure, where washes cross them from the mountains, but in sheltered places they are still perfect. Where they stretch across an embayment from one rocky point to another they are mere embankments of sand, old barrier beaches, with depressions behind them once occupied by shallow lagoons. In other areas, where they contour the alluvial cones, they are gullied and cut away where streams have flowed across them, but in other places are preserved unscarred. At one locality noted a low sea cliff that had been cut in alluvial-fan material was still preserved, although the loose sand and bowlders would slump in a few heavy storms.

In a region of abundant rainfall such ephemeral forms as these would be more nearly obliterated within fifty years after the lake had disappeared than they are now in the desert. In such a region the precipitation is twenty times that of the desert. It is the crudest of estimates—merely a guess in fact—to state that, reasoning from geologic evidence alone, it may be a thousand years since the lake disappeared, yet it puts in concrete form such a guess as the geologist is able to make, and this guess may be correct within a margin of error of 50 per cent.

When human records are studied some evidence on this point is found, but it is almost as uncertain as to time as that furnished by the physical features. The Indians in the Coachella Valley have distinct legends to the effect that at some time in the past the valley was occupied by a large body of water. Professor Blake records that they told him of a time when a great body of water existed in which were many fish, and of the manner in which that water disappeared "poco á poco"—little by little—until the lake became dry.

The Indians now living in the desert put this event as far back as the lives of four or five very old men, say four or five centuries ago at the most. There are, of course, no records and there is no known check on this assertion. Statements by Indians as to time, beyond the limits spanned by their own memories, are notoriously inaccurate. Furthermore, we do not know the means used to procure this statement. The native races are usually very prone to follow the suggestions contained in leading questions, and so to give the answer desired by the questioner. To obtain an entirely independent and unguided answer is one of the most delicate of tasks. Yet their statement has some value, and combining the evidence of the physical conditions and the Indian legends it may be said that it is probable that the lake disappeared and left the desert, as we have known it in historical time, from five hundred to one thousand years ago.

During the summer of 1891 the high water in the Colorado overflowed into Salton Sink to such an extent as to endanger the Southern

Pacific Railroad line at its lowest point. In the summer of 1905, after a succession of winter and spring floods in Gila River, followed by an exceptionally heavy summer flow in the Colorado, there was a repetition of flood conditions in the sink on a much larger scale.

The gravity of the situation on this latter date, however, was greatly augmented by the interference of man. For several years preceding a small quantity of water had been diverted from the Colorado below Yuma, Ariz., to be used by the settlers of the Imperial Valley for irrigation and domestic purposes. The first water was diverted in the United States and conveyed to the Imperial Valley, after passing through Mexican territory, by means of an old river channel which had been one of the Colorado's distributaries during the formation of its delta, and is now known as Alamo River. The increased demand for water and the silting up of the original canal heading above the boundary line necessitated the cutting of an additional channel from the river below the boundary to connect with the canal. It likewise silted up, and to supply the urgent need for water a canal was cut 4 miles below the original heading to connect Colorado and Alamo rivers. This canal was not provided with protective headworks and had a gradient much greater than that of the river, so that with the unusual and prolonged summer flood in 1905, it began cutting, until in July it was carrying 87 per cent of the total flow of the river. This large quantity of water flooded several hundred square miles about Calexico in the southern part of the Imperial Valley and caused serious loss both in the United States and in Mexico. These waters ultimately reached the Salton Sea, but in so doing they deepened and widened Alamo River into a great gorge and developed another drainage channel to the west through Imperial Valley in a second gorge now called New River (Pl. VI, *B*). Notwithstanding all attempts to control it the Colorado continued to pour its waters through Alamo and New rivers into Salton Sea until the early fall of 1906, when it was finally shut off by the Southern Pacific Company. It broke again, however, on December 7, but was closed about two months later.

The rise of Salton Sea began in November, 1904, and continued throughout 1905 and 1906 and until February, 1907. In the summer of 1905 it endangered the Southern Pacific tracks to such an extent as to require frequent shifting to higher ground by means of "shoo-fly" or spur tracks, which served temporarily until the latter part of the year when a high line about 40 miles in length was completed on the 200-foot contour below sea level. This line is still in use, though during the latter part of 1906 and the early part of 1907, the lower portion of it was seriously damaged by the action of waves. For use in the future, if required, another line has been located and graded

A. SALTON SEA NEAR SALTON STATION, SOUTHERN PACIFIC RAILROAD, 205 FEET BELOW SEA LEVEL, AUGUST 29, 1906.

B. NEW RIVER CUTTING BACK AND UNDERMINING ITS BANKS, CAUSING DESTRUCTION OF MANY ACRES OF FINE FARM LANDS.

on the 150-foot contour below sea level. In addition to the damage done to the railroad the sea has completely submerged the plant of the New Liverpool Salt Company, below Mecca, and also a few ranches in the vicinity of Mecca.

The gage record from November, 1904, to February 26, 1906, was kept by the New Liverpool Salt Company. Their datum is the lowest portion of the sink, or at least that portion which first filled with water, so that the gage record shows the actual depth of the water from time to time. On February 23, 1906, the Government put in a gage on the same datum about one-half mile west of Salton railway station, which is 3 miles southeast of the old Salton station (Pl. VI, *A*). This gage consisted of a series of five posts, 6 inches by 6 inches by 6 feet, set in the ground about 3 feet deep, and so placed that when the water covered one it would just reach the next one farther back. It was not a great while, however, until the waves completely destroyed this gage. In the meantime the Southern Pacific Company had graduated a bent on the trestle bridge across Salt Creek, about $2\frac{1}{2}$ miles east of Salton, using the company's datum, and arrangements were made to have the Southern Pacific agent at Salton furnish the record from this gage, corrections being made to reduce the original datum. The zero of the gage is 273.5 feet below mean sea level as determined from United States Geological Survey bench marks, or at an elevation of -280.3 according to the Southern Pacific Company.

There is some uncertainty as to the elevation of the lowest point of Salton Sink, and it is now believed that the depth below sea level has been overestimated in the past. From the record of the depth of the water as it filled the lowest portion of the basin, as kept by the New Liverpool Salt Company, it appears that the maximum depth of water was 17 feet on October 4, 1905 (according to the gage and as checked by soundings later), when on the same date the water surface just covered the United States Geological Survey bench mark a few feet from the old Salton railway station. As this bench mark is 256.5 feet below mean sea level, it would appear that the lowest point of the sink is 273.5 feet below mean sea level instead of 287 feet, which has been accepted heretofore. In 1891 Southern Pacific engineers reported the lowest point in the sink as -280.2, which corresponds to -273.4, United States Geological Survey.

Practically all the water that enters Salton Sea discharges through Alamo and New rivers, chiefly through the former. These rivers run through Imperial Valley and are the drainage channels for all the excess and waste water from the irrigation system and from the power plants.

There was a large inflow to the sea during July and parts of June and August, 1907. The approximate inflow to the sea as determined

by discharge measurements made during the first half of 1908 is as follows:

	Second-feet.
January	500
February	400
March	200
April	200
May	200
June	125

Total inflow January 1 to June 30, 1908, 97,700 acre-feet, or sufficient to cover the surface of the sea about 0.34 foot deep.

During 1908 the following measurements were made on Alamo and New rivers by H. R. Edwards, engineer for the New Liverpool Salt Company.

Discharge measurements of Alamo River near Brawley, Cal., in 1908.

[By H. R. Edwards.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*
January 7	6.6	632	March 9	5.9	300	April 28	5.0	115
January 8	6.5	519	March 11	5.3	152	April 30	5.5	188
January 10	6.4	573	March 13	5.0	100	May 2	5.6	181
January 13	6.6	542	March 14	5.3	190	May 4	5.4	174
January 15	6.2	416	March 16	5.2	141	May 6	5.8	214
January 17	6.2	379	March 18	4.8	88	May 8	5.8	242
January 20	6.2	374	March 22	5.5	105	May 10	5.1	102
January 23	6.2	383	March 23	5.1	117	June 21	6.0	394
January 26	6.4	428	March 24	5.6	186	June 22	5.5	254
January 27	6.6	438	March 25	5.8	253	June 23	5.3	168
January 29	6.6	496	March 27	5.5	198	June 24	5.5	220
January 31	6.5	411	March 29	5.7	254	June 26	6.2	417
February 2	6.5	395	March 31	5.0	93	June 27	5.9	331
February 4	7.3	697	April 5	5.8	258	June 28	5.9	307
February 6	6.8	585	April 7	5.0	96	June 29	5.7	268
February 10	5.9	270	April 9	4.4	52	June 30	5.5	222
February 12	6.1	357	April 11	4.6	65	July 1	5.7	274
February 14	5.4	142	April 13	4.9	90	July 2	5.2	163
February 23	4.2	39	April 15	5.0	107	July 3	5.2	155
February 25	6.0	312	April 17	5.2	122	July 4	6.4	520
February 27	5.8	256	April 19	5.9	275	July 6	6.7	589
February 29	5.9	309	April 20	6.1	355	July 7	6.1	401
March 2	6.0	412	April 22	6.1	377	July 8	5.6	228
March 4	6.1	337	April 24	6.4	432			
March 6	5.9	266	April 26	5.1	142			

Discharge measurements of New River near Brawley, Cal., in 1908.

[By H. R. Edwards.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
February 23		44	April 13		40
March 23		36	June 22		26
April 5		39			

Daily gage height, in feet, of Salton Sea near Salton, Cal., for 1907 and 1908.

[J. A. Jeffrey, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	72.6	75.4	76.0	75.9	.....	75.1	74.7	74.5	74.2	73.5	73.1	72.6
2	72.7	75.5	76.0	75.9	.....	75.1	74.7	74.5	74.2	73.4	73.1	72.6
3	72.8	75.6	76.0	75.9	.....	75.1	74.6	74.5	74.2	73.4	73.1	72.6
4	72.9	75.6	76.0	75.9	.....	75.1	74.6	74.5	74.2	73.3	73.0	72.5
5	72.9	75.7	76.0	75.9	.....	75.1	74.6	74.5	74.1	73.3	73.0	72.5
6	73.0	75.7	76.0	75.9	.....	75.1	74.6	74.5	74.1	73.3	73.0	72.5
7	73.0	75.8	76.0	75.9	.....	75.1	74.6	74.5	74.0	73.2	73.0	72.5
8	73.1	.....	76.0	75.9	.....	75.1	74.6	74.4	73.9	73.2	73.0	72.5
9	73.1	.....	76.0	75.9	.....	75.1	74.6	74.4	73.9	73.2	73.0	72.5
10	73.2	76.0	76.0	75.9	.....	75.0	74.6	74.4	73.8	73.2	73.0	72.5
11	73.4	76.0	76.0	75.9	.....	75.0	74.6	74.4	73.8	73.2	73.0	72.5
12	73.5	76.0	76.0	75.9	.....	75.0	74.6	74.4	73.8	73.1	72.9	72.5
13	73.6	76.0	76.0	75.8	.....	75.0	74.6	74.4	73.8	73.1	72.9	72.4
14	73.7	76.0	76.0	75.7	.....	75.0	74.6	74.4	73.8	73.1	72.9	72.4
15	73.8	76.0	76.0	75.7	75.4	75.0	74.6	74.4	73.8	73.1	72.9	72.4
16	73.9	76.0	76.0	75.7	75.4	75.0	74.6	74.4	73.7	73.1	72.9	72.4
17	74.0	76.0	76.0	75.7	75.4	75.0	74.6	74.4	73.7	73.1	72.9	72.4
18	74.1	76.0	76.0	.....	75.3	74.9	74.6	74.4	73.7	73.1	72.8	72.4
19	74.2	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.1	72.8	72.4
20	74.3	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.2	72.8	72.4
21	.....	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.2	72.8	72.4
22	.....	76.0	76.0	.....	75.2	74.9	74.6	74.3	73.6	73.2	72.7	72.4
23	.....	76.0	76.0	.....	75.1	74.9	74.6	74.3	73.6	73.2	72.7	72.4
24	.....	76.0	76.0	.....	75.1	74.8	74.6	74.3	73.6	73.2	72.7	72.4
25	74.9	76.0	76.0	.....	75.1	74.8	74.6	74.3	73.5	73.2	72.7	72.4
26	75.0	76.0	76.0	.....	75.1	74.8	74.6	74.3	73.5	73.2	72.7	72.4
27	75.2	76.0	76.0	.....	75.1	74.7	74.6	74.3	73.5	73.2	72.6	72.3
28	75.3	76.0	76.0	.....	75.1	74.7	74.5	74.2	73.5	73.2	72.6	72.3
29	75.3	.....	76.0	.....	75.1	74.7	74.5	74.2	73.5	73.2	72.6	72.3
30	75.3	.....	75.9	.....	75.1	74.7	74.5	74.2	73.5	73.1	72.6	72.3
31	75.3	.....	75.9	.....	75.1	.....	74.5	.....	.....	73.1	.....	72.3
1908.												
1	72.3	72.3	72.2	71.9	71.6	71.0	70.5	70.1	69.4	68.6	67.9	67.6
2	72.3	72.3	72.2	71.9	71.6	71.0	70.5	70.1	69.3	68.6	67.9	67.6
3	72.3	72.3	72.2	71.9	71.5	70.9	70.5	70.0	69.3	68.5	67.9	67.6
4	72.3	72.3	72.2	71.9	71.5	70.9	70.5	70.0	69.3	68.5	67.9	67.6
5	72.3	72.3	72.1	71.9	71.5	70.9	70.4	70.0	69.3	68.5	67.9	67.6
6	72.3	72.3	72.1	71.9	71.5	70.9	70.4	70.0	69.3	68.5	67.9	67.6
7	72.3	72.4	72.1	71.9	71.4	70.9	70.4	69.9	69.3	68.5	67.9	67.6
8	72.3	72.4	72.1	71.8	71.4	70.8	70.4	69.9	69.2	68.4	67.9	67.6
9	72.3	72.4	72.1	71.8	71.4	70.8	70.4	69.9	69.2	68.4	67.8	67.5
10	72.3	72.3	72.1	71.8	71.4	70.8	70.4	69.9	69.2	68.4	67.8	67.5
11	72.3	72.3	72.1	71.8	71.4	70.8	70.3	69.9	69.2	68.4	67.9	67.5
12	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.2	68.4	67.9	67.5
13	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.1	68.4	67.8	67.5
14	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.1	68.4	67.8	67.5
15	72.3	72.3	72.1	71.8	71.3	70.8	70.3	69.8	69.1	68.3	67.8	67.5
16	72.3	72.3	72.1	71.8	71.3	70.7	70.3	69.7	69.1	68.3	67.8	67.5
17	72.3	72.3	72.1	71.7	71.2	70.7	70.3	69.7	69.1	68.3	67.8	67.5
18	72.3	72.3	72.1	71.7	71.2	70.7	70.3	69.7	69.0	68.2	67.8	67.4
19	72.3	72.2	72.1	71.7	71.2	70.7	70.2	69.6	69.0	68.2	67.8	67.4
20	72.3	72.2	72.1	71.7	71.2	70.7	70.2	69.6	69.0	68.1	67.8	67.4
21	72.3	72.2	72.1	71.7	71.2	70.6	70.2	69.6	69.0	68.1	67.8	67.4
22	72.3	72.2	72.0	71.7	71.2	70.6	70.2	69.6	68.9	68.1	67.8	67.4
23	72.3	72.2	72.0	71.6	71.1	70.6	70.2	69.6	68.9	68.1	67.8	67.4
24	72.3	72.2	72.0	71.6	71.1	70.6	70.2	69.6	68.9	68.0	67.7	67.4
25	72.3	72.2	72.0	71.6	71.1	70.6	70.2	69.5	68.8	68.0	67.7	67.4
26	72.3	72.2	72.0	71.6	71.1	70.6	70.1	69.5	68.8	68.0	67.7	67.4
27	72.3	72.2	72.0	71.6	71.1	70.5	70.1	69.5	68.7	68.0	67.6	67.4
28	72.3	72.2	72.0	71.6	71.1	70.5	70.1	69.5	68.7	68.0	67.6	67.4
29	72.3	.....	72.0	71.6	71.1	70.5	70.1	69.4	68.7	67.9	67.6	67.4
30	72.3	.....	72.0	71.6	71.1	70.5	70.1	69.4	68.6	67.9	67.6	67.4
31	72.3	.....	72.0	.....	71.0	.....	70.0	69.4	.....	67.9	.....	67.4

Monthly rise of Salton Sea near Salton, Cal., for 1904–1908.

Month.	Monthly rise.	Total rise.	Month.	Monthly rise.	Total rise.	Month.	Monthly rise.	Total rise.
1904.	*Feet.*	*Feet.*	1906.	*Feet.*	*Feet.*	1907.	*Feet.*	*Feet.*
November	0.6		March	2.7	28.3	September	−.7	73.5
December	.2	0.8	April	5.6	33.9	October	−.4	73.1
1905.			May	8.6	42.5	November	−.5	72.6
January	1.4	2.2	June	15.4	57.9	December	−.3	72.3
February	1.6	3.8	July	8.6	66.5	1908.		
March	.8	4.6	August	2.9	69.4	January	.0	72.3
April	1.2	5.8	September	.9	70.3	February	−.1	72.2
May	1.0	6.8	October	1.2	71.5	March	−.2	72.0
June	2.2	9.0	November	−.2	71.3	April	−.4	71.6
July	4.4	13.4	December	1.2	72.5	May	−.6	71.0
August	2.2	15.6	1907.			June	−.5	70.5
September	1.2	16.8	January	2.8	75.3	July	−.5	70.0
October	1.4	18.2	February	.7	76.0	August	−.6	69.4
November	1.6	19.8	March	−.1	75.9	September	−.8	68.6
December	2.9	22.7	April	−.3	75.6	October	−.7	67.9
1906.			May	−.5	75.1	November	−.3	67.6
January	1.1	23.8	June	−.4	74.7	December	−.2	67.4
February	1.8	25.6	July	−.2	74.5			
			August	−.3	74.2			

DUCHESNE RIVER DRAINAGE BASIN.

DESCRIPTION.

Duchesne River rises in the high peaks of the Uinta and Wasatch mountains in northwestern Utah, flows for about 100 miles in a general southeasterly direction, and enters Green River at Ouray, Utah, about 3 miles above the mouth of White River. The stream has a total drainage area of 4,000 square miles. Altitudes range from 4,700 feet at the mouth of the river to more than 13,000 feet at the summits of the highest peaks.

The principal tributaries of the Duchesne are Strawberry River, Rock (East) Creek, Lake Fork, and Uinta River.

The drainage basin of the upper Duchesne proper is mountainous in character. The stream emerges from the mountains at the mouth of Rock Creek, at an elevation of about 6,000 feet. From the mouth of Strawberry River down to Lake Fork the valley of the Duchesne is about 2 miles in average width, and is bordered by sandstone bluffs approximately 200 feet high. The bluffs on the northern side of the river are capped by heavy deposits of coarse river gravel and cobblestones. The general course of the stream throughout this stretch and on down to the mouth of the Uinta is easterly. Along the lower course of the stream the plateaus on either side of the stream valley are comparatively low and can be easily reached by irrigation canals from the main stream.

Strawberry River, the main upper tributary of the Duchesne, drains an area of about 1,200 square miles. The stream rises in the Uinta Mountains, and enters the Duchesne at Theodore. Its flow is derived chiefly from melting snow, except during the late summer, when the flow comes from small springs well distributed over the entire drainage basin. The upper stream basin has numerous tributaries, particularly from the north and west. Among the most im-

portant may be mentioned Indian, Bryant's Fork, Mud, Horse, Sugar Springs, and Co-op. They are all short and fall rapidly until they reach Strawberry Valley, through which they flow sluggishly in well defined channels. The main stream traverses the valley from north to south and is very sluggish. Indian Creek drains a small portion of the southern slopes of the Uinta Mountains. Its basin comprises smooth, rolling hills, fairly well timbered with pine and aspen. The normal flow is derived chiefly from springs. The greater part of the precipitation is in the form of snow, which covers the ground for six or eight months of each year. As it has an average elevation of 7,500 feet, Strawberry Valley is not well suited for agricultural development, but is excellently adapted to grazing. At the mouth of the river, about 35 miles below Strawberry Valley, the elevation is about 5,500 feet, and the fall in that distance is, therefore, nearly 2,000 feet.

Rock Creek, Lake Fork, Uinta and its most important tributary, the Whiterocks, head in a series of small lakes in the Uinta Mountains. These lakes are fed by snow that exists the year round in the canyons and on the high slopes. All these streams drain areas mountainous and difficult of access in their upper portions, and all of them emerge from their canyons at an elevation of about 7,000 feet. Rock Creek continues its course in a narrow valley, but the others spread out so that their valleys are comparatively wide, and the adjoining benches comparatively low.

The drainage area of the Duchesne includes about 1,400 square miles of forest reserve, of which about 1,000 square miles may be classed as timbered land with an average stand of over 3,000 feet board measure to the acre. The principal species of timber are Engelmann spruce and lodgepole pine. The timbered land is distributed through the areas of the various tributaries about as follows: Upper Duchesne, 120 square miles; Rock Creek, 130 square miles; Strawberry River, 380 square miles; Lake Fork, 190 square miles; Uinta (above Whiterocks), 120 square miles; Whiterocks, 70 square miles.

Little information is avaliable as to the precipitation in this basin. In the plains portion of the area, the average rainfall is probably less than 10 inches, while the middle portion comprising considerably over one-half the area, probably averages between 10 and 15 inches. Only a small part in the high mountains has an annual precipitation in excess of 20 inches. At Fort Duchesne, at an elevation of 5,000 feet, a record extending over several years shows a mean annual rainfall of only 7 inches.

Very severe winters are experienced throughout this whole drainage basin. In the high mountains the snowfall is very heavy, and in many places the snow lies throughout the whole year. In the hills above an elevation of 7,000 feet there is very considerable snowfall, which usually forms in drifts in canyons, and not infrequently the snow lies for extended periods in the valleys and plateaus of the

more open country. All the streams in this drainage are usually covered with thick ice from about December 1 to April 1 of each year.

During the last three or four years this section, especially that included within the former limits of the Uinta Reservation, has undergone a great irrigation development. The United States Indian Service has constructed a series of canal systems diverting water from Lake Fork, the Uinta, and Whiterocks, and the Duchesne proper. Private enterprise has also taken hold, and although the private canal systems now in operation are small, eventually several hundred thousand acres of land below an elevation of 6,500 feet will be brought under irrigation. Practically no storage is used in connection with any of the irrigation systems now in operation or under construction, and excellent opportunities for additional development still remain.

The United States Reclamation Service is constructing a tunnel, with capacity of 500 second-feet, which will divert water from a 100,000-acre reservoir on the upper Strawberry across the divide to the headwaters of the Spanish Fork, there to be used for irrigation.

As the mountain drainage areas of all the main tributaries are studded with lakes, numerous reservoir sites can easily be found where water can be stored for the irrigation of the valley lands. It is believed that the entire flow from the drainage basin can be equalized by storage.

At the present time there are no water-power plants in this drainage basin, though with proper storage a development of 200,000 horsepower could be made. Very little water will be diverted for irrigation above an elevation of 6,500 feet, and as most of the reservoir sites are at an elevation of upward 8,000 feet, good opportunities for power development exist above irrigation diversions. Some of the streams have falls of from 100 to 150 feet or more per mile along these stretches.

At the present time the water in these streams is unused except for irrigation.

None of the records of stream flow in this basin extend back of 1899, and they are not continuous since that time. The driest year for which records are available was 1900, although 1902 was almost as low. The year of greatest average run-off was 1907.

DUCHESNE RIVER AT MYTON, UTAH.

This station, which was established October 26, 1899, and has been in operation every year, or portions thereof since that time, is located at the highway bridge at Myton, Utah, and was described in the earlier reports as the Price Road Bridge station. The object of the station is to determine the amount of water available for storage and irrigation.

The station is situated about 3 miles below the mouth of Lake Fork and about 15 miles above the mouth of the Uinta River, and the records show practically the entire run-off of the Duchesne basin above the mouth of Uinta River.

Within the last few years numerous ditches have been built by the United States Indian Service to divert water from this stream and its tributaries for irrigation on the Uinta Reservation. Water is also diverted for irrigation outside the limits of the reservation by several private parties.

Results at this station are affected by ice conditions for about four months during the winter season, and it is usually out of the question to apply open channel ratings for any portion of that time. The discharge has also been more or less affected by eddies about the wooden crib piers and by drift lodged against them.

The datum of the gage remained practically constant from the establishment of the station until June 6, 1909. (See Water-Supply Paper 269.)

Results at this station have been fairly good.

Discharge measurements of Duchesne River at Myton, Utah, 1905 to 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 13	H. S. Reed	95	366	5.22	330
March 14	do	95	363	5.20	317
April 19	do	105	394	5.41	443
1907.					
April 10	I. I. Price	102	598	6.04	814
April 25	do	104	665	7.10	1,870
May 14	do	107	728	7.90	2,880
May 29	do	107	806	8.35	3,910
June 12	do	108	851	8.82	4,650
June 29	do	109	981	9.90	7,340
July 19	do	106	874	8.50	3,930
August 15	do	104	678	6.75	1,490
September 2	do	104	666	6.52	1,330
September 14	do	104	628	6.10	844
September 16	Freeman, Fletcher, and Price	103	640	6.03	757
September 30	R. H. Fletcher	101	620	5.94	732
October 15	do	102	630	5.95	705
October 30	do	102	564	5.90	672
November 13	do	101	613	5.80	572
November 22[a]	do	101	602	5.68	497
December 9[a]	do	106	626	5.60	497
1908.					
March 18[b]	R. H. Fletcher	102	624	5.80	621
March 24	do	102	604	5.60	498
April 6	do	103	583	5.57	457
April 14	do	103	631	5.91	696
April 27	do	103	630	6.28	915
May 13	do	104	783	6.68	1,160
May 21	do	104	682	6.81	1,280
June 5	do	100	657	6.60	956
June 21	do	106	825	8.00	2,500
June 29	do	105	793	7.87	2,270
July 9	do	103	705	6.73	1,530
July 23	do	101	605	5.93	676
July 31	Freeman and Fletcher	106	683	6.39	1,000
August 6	R. H. Fletcher	101	639	6.25	965
August 17	do	100	626	5.93	737
August 25	do	100	586	5.93	717
September 10	do	101	589	5.70	555
September 15	do	101	601	5.77	634
September 30	do	101	595	5.75	616
October 9	do	101	611	5.90	704
October 17	do	101	608	6.03	764
October 29	do	101	584	5.80	629
November 11	do	100	575	5.65	554
November 19	do	100	571	5.62	508
December 3[a]	do	99	580	5.64	564
December 10[a]	do	99	581	5.50	559

[a] Ice conditions. [b] Ice out of stream.

Daily gage height, in feet, of Duchesne River at Myton, Utah, for 1905.

[H. Calvert, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.										
1		5.12	5.98	7.65	6.30			5.45	5.20	
2		5.14	6.02	8.10	7.20			5.50	5.20	
3		5.12	6.00	8.25	7.20			5.35	5.20	
4		5.12	6.00	8.55	6.95			5.30	5.20	
5		5.12	5.98	8.55	6.70			5.30	5.20	
6		5.12	5.92	8.40	6.20			5.30	5.20	
7		5.14	5.80	8.49	5.88			5.30	5.20	
8		5.15	5.80	8.70	5.85			5.30	5.20	
9		5.16	5.80	9.00	5.80			5.30	5.20	
10		5.33	5.80	8.35	5.80			5.30	5.20	
11		5.50	5.85	7.90	5.75			5.30	5.20	
12		5.38	5.80	8.05	5.74			5.30	5.20	
13	5.20	5.30	5.80	8.30	5.69			5.28	5.20	
14	5.20	5.30	5.80	8.45	5.65			5.28	5.20	
15	5.20	5.31	5.76	8.25	5.75			5.28	5.20	
16	5.20	5.36	5.74	8.00	5.85			5.28	5.20	
17	5.25	5.40	5.82	7.75	5.80			5.28	5.20	
18	5.25	5.40	5.95	7.35	5.70			5.28	5.20	
19	5.25	5.40	6.25	7.20	5.65			5.28	5.20	
20	5.28	5.40	6.50	7.45	5.60			5.25	5.22	
21	5.21	5.42	6.60	7.60	5.50			5.25	5.25	
22	5.20	5.48	6.85	7.41	5.50			5.25	5.30	
23	5.20	5.54	7.25	7.45				5.25	5.28	
24	5.20	5.62	7.05	7.20			5.15	5.25	5.25	
25	5.20	5.70	7.10	7.20			5.20	5.22	5.22	
26	5.20	5.78	7.02	7.20			5.10	5.20	5.20	
27	5.20	6.00	7.10	6.95			5.10	5.20	5.20	
28	5.15	5.95	7.25	6.75			5.00	5.20	5.20	
29	5.12	5.92	7.25	6.58			6.10	5.20		
30	5.12	5.90	7.19	6.50			6.10	5.20		
31	5.15		7.28					5.20		

NOTE.—Ice conditions prior to March 13 and after November 28, 1905. These records were omitted from the 1905 report through an oversight.

Daily gage height, in feet, of Duchesne River at Myton, Utah, for 1907 and 1908.

[H. G. Clarke and Alice Todd, observers.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]										
1			7.48	8.15	10.12	7.50	6.65	5.90	5.90	5.70
2			7.35	8.45	10.25	7.50	6.50	5.90	5.88	5.70
3			7.30	8.80	10.35	7.45	6.42	5.90	5.85	5.70
4			7.18	9.15	10.48	7.50	6.38	5.90	5.85	5.75
5			7.20	9.45	10.62	7.35	6.55	5.90	5.82	5.80
6			7.22	9.62	10.65	7.22	6.50	5.98	5.80	5.80
7			7.15	9.70	10.55	7.18	6.50	6.05	5.80	5.80
8			7.10	9.58	10.42	7.05	6.32	6.05	5.80	5.75
9			7.08	9.45	10.32	6.90	6.22	6.00	5.80	5.70
10		6.05	7.18	9.15	10.05	6.70	6.20	5.95	5.80	5.70
11		6.25	7.35	8.90	9.82	6.78	6.15	5.95	5.80	5.70
12		6.62	7.60	8.95	9.55	6.72	6.15	5.95	5.80	5.70
13		6.90	7.85	9.08	9.45	6.70	6.10	5.95	5.80	5.70
14		7.20	7.85	8.82	9.32	6.70	6.10	5.95	5.75	5.75
15		7.45	7.65	8.58	9.08	6.70	6.05	5.95	5.70	5.80
16		7.62	7.50	8.35	8.85	6.65	6.00	5.95	5.70	
17		7.65	7.65	8.25	8.58	6.65	6.00	5.92	5.70	
18		7.62	7.92	8.35	8.50	6.50	6.00	5.90	5.70	
19		7.52	8.25	8.60	8.50	6.55	5.95	5.90	5.70	
20		7.40	8.58	9.15	8.60	6.55	5.95	5.90	5.70	
21		7.10	8.98	9.50	8.70	6.50	5.95	5.90	5.70	
22		7.00	9.18	9.52	8.45	6.42	5.95	5.90	5.70	
23		6.90	9.40	9.40	8.20	6.40	5.95	5.90	5.70	
24		7.10	9.40	9.25	8.10	6.40	5.90	5.90	5.70	
25		7.30	9.25	9.05	8.20	6.40	5.90	5.95	5.70	

[a] See footnote at end of table, next page.

Daily gage height, in feet, of Duchesne River at Myton, Utah, for 1907 and 1908—Cont'd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.										
26	.....	7.28	9.05	9.15	8.30	6.52	5.90	5.90	5.70	.....
27	.....	7.30	8.72	9.40	8.05	6.50	5.90	5.90	5.70	.....
28	.....	7.52	8.45	9.72	8.00	6.55	5.90	5.90	5.70	.....
29	.....	7.58	8.28	9.88	7.82	6.52	5.90	5.90	5.70	.....
30	.....	7.55	8.10	10.00	7.70	65.5	5.90	5.90	5.70	.....
31	.....	.....	8.02	.....	7.52	6.52	.....	5.90	.....	.....
1908.										
1	.....	5.55	6.2	6.85	7.55	7.5	5.5	5.75	5.8	5.6
2	.....	5.5	6.25	6.8	7.35	6.75	5.5	5.75	5.85	5.6
3	.....	5.5	6.45	6.7	7.3	6.5	5.55	5.8	5.75	5.6
4	.....	5.5	6.75	6.6	7.2	6.25	5.5	6.0	5.75	5.65
5	.....	5.55	6.7	6.55	7.2	6.15	5.45	5.9	5.7	5.7
6	.....	5.55	6.65	6.55	7.15	6.2	5.45	5.85	5.7	5.6
7	.....	5.7	6.6	6.5	6.95	6.3	5.45	5.85	5.7	5.6
8	.....	5.7	6.8	6.55	6.85	6.2	5.5	5.85	5.7	5.5
9	.....	5.65	6.95	6.6	6.7	6.15	5.7	5.9	5.65	5.5
10	.....	5.65	6.9	6.95	6.65	6.05	5.7	5.9	5.65	5.55
11	.....	5.65	6.8	7.7	6.65	6.05	5.65	5.9	5.6	5.6
12	.....	5.7	6.7	8.6	6.55	6.05	5.65	5.95	5.6	5.6
13	.....	5.8	6.65	9.0	6.5	6.0	5.7	5.95	5.6	5.5
14	.....	5.9	6.55	9.15	6.45	6.15	5.8	5.9	5.6	5.5
15	.....	6.05	6.5	9.25	6.45	6.05	5.75	5.9	5.55	5.55
16	.....	6.1	6.45	9.0	6.4	5.95	5.65	6.0	5.5	5.5
17	.....	6.2	6.45	8.45	6.35	5.9	5.6	6.0	5.6	5.5
18	5.8	6.15	6.5	8.1	6.2	5.9	5.6	6.0	5.6	5.5
19	5.75	6.3	6.6	7.8	6.1	5.9	5.55	6.0	5.6	5.4
20	5.6	6.55	6.8	7.65	6.05	6.0	5.55	5.95	5.6	5.25
21	5.6	6.8	6.8	8.0	6.0	5.9	5.5	5.9	5.6	5.1
22	5.6	6.85	6.75	8.55	5.95	5.9	5.5	5.8	5.6	5.15
23	5.6	6.8	6.7	8.45	5.9	6.55	5.45	5.8	5.55	5.25
24	5.6	6.6	6.6	8.35	5.95	6.1	5.7	5.8	5.6	5.45
25	5.6	6.5	6.6	8.5	5.9	5.9	6.1	5.8	5.5	5.65
26	5.6	6.45	6.85	8.45	5.85	5.8	6.0	5.8	5.5	5.7
27	5.6	6.3	7.0	8.5	5.9	5.75	5.8	5.8	5.5	5.75
28	5.6	6.25	6.9	8.15	6.15	5.7	5.8	5.8	5.5	5.85
29	5.5	6.25	6.8	7.85	6.45	5.65	5.75	5.8	5.55	6.0
30	5.5	6.15	6.7	7.75	6.6	5.6	5.75	5.8	5.55	6.05
31	5.5	.....	6.75	.....	6.4	5.55	.....	5.8	.....	6.2

NOTE.—Ice conditions prior to March 10 and during December, 1907. River open March 18, 1908. Ice conditions during December, 1908.

Rating tables for Duchesne River at Myton, Utah.

1904 TO 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.00	219	5.90	760	6.80	1,650	7.70	2,880
5.10	264	6.00	840	6.90	1,770	7.80	3,040
5.20	313	6.10	920	7.00	1,890	7.90	3,205
5.30	366	6.20	1,005	7.10	2,020	8.00	3,375
5.40	423	6.30	1,100	7.20	2,150	8.20	3,715
5.50	484	6.40	1,200	7.30	2,290	8.40	4,070
5.60	548	6.50	1,305	7.40	2,430	8.60	4,430
5.70	615	6.60	1,415	7.50	2,575	8.80	4,790
5.80	685	6.70	1,530	7.60	2,725	9.00	5,150

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1906 and is fairly well defined between gage heights 5.3 feet and 8.2 feet.

Rating tables for Duchesne River at Myton, Utah—Continued.

1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.70	525	6.80	1,560	7.90	3,010	9.00	5,050
5.80	595	6.90	1,680	8.00	3,160	9.20	5,520
5.90	670	7.00	1,800	8.10	3,320	9.40	6,000
6.00	750	7.10	1,920	8.20	3,490	9.60	6,510
6.10	835	7.20	2,050	8.30	3,660	9.80	7,050
6.20	925	7.30	2,180	8.40	3,840	10.00	7,610
6.30	1,020	7.40	2,310	8.50	4,020	10.20	8,190
6.40	1,120	7.50	2,440	8.60	4,210	10.40	8,790
6.50	1,230	7.60	2,580	8.70	4,410	10.60	9,410
6.60	1,340	7.70	2,720	8.80	4,620	10.80	10,030
6.70	1,450	7.80	2,860	8.90	4,830		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 17 discharge measurements made during 1907 and is well defined.

MARCH 18 TO APRIL 19, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.50	430	5.80	620	6.00	770	6.20	940
5.60	485	5.90	690	6.10	850	6.30	1,030
5.70	550						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 4 discharge measurements made during March and April, 1908, and is well defined.

APRIL 20 TO JULY 6, 1908.

[Indirect method for shifting channels used.]

JULY 7 TO NOVEMBER 30, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.40	395	5.70	570	6.00	770	6.30	1,030
5.50	450	5.80	635	6.10	850	6.40	1,130
5.60	510	5.90	700	6.20	940	6.50	1,230

NOTE—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during July to November, 1908, and is well defined. Above gage height 6.5 feet it is the same as the 1907 table.

Daily discharge, in second-feet, of Duchesne River at Myton, Utah, from April 20 to July 6, 1908.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	815	1,240	2,000	16	.....	935	4,120	.....
2	.....	850	1,180	1,840	17	.....	935	2,100	.....
3	.....	1,020	1,070	1,840	18	.....	980	3,650	.....
4	.....	1,310	980	1,770	19	.....	1,070	2,250	.....
5	.....	1,250	950	1,840	20	1,240	1,280	2,050	.....
6	.....	1,190	950	1,850	21	1,500	1,280	2,500	.....
7	.....	1,130	850	.....	22	1,550	1,220	3,300	.....
8	.....	1,330	845	.....	23	1,480	1,150	3,140	.....
9	.....	1,490	940	.....	24	1,250	1,050	2,970	.....
10	.....	1,420	1,290	.....	25	1,140	1,050	3,200	.....
11	.....	1,300	2,170	.....	26	1,080	1,290	3,120	.....
12	.....	1,180	3,450	.....	27	930	1,450	3,180	.....
13	.....	1,130	4,170	.....	28	880	1,330	2,660	.....
14	.....	1,030	4,480	.....	29	870	1,220	2,250	.....
15	.....	985	4,670	.....	30	780	1,100	2,180	.....
					31	.....	1,140	.....	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Duchesne River at Myton, Utah, for 1905, 1907, and 1908.

[Drainage area, 2,750 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1905.[a]							
March 13–31	355	274	313	0.114	0.08	11,800	A.
April	840	274	448	.163	.18	26,700	A.
May	2,260	643	1,220	.444	.51	75,000	A.
June	5,150	1,300	3,100	1.13	1.26	184,000	A.
July 1–22	2,150	484	902	.328	.27	39,400	A.
September 24–30	920	219	455	.165	.04	6,320	A.
October	484	313	355	.129	.15	21,800	A.
November 1–28	366	313	319	.116	.09	17,700	A.
The period						383,000	
1907.							
April 10–30	2,650	794	2,060	.749	.58	85,800	A.
May	6,000	1,900	3,290	1.20	1.38	202,000	A.
June	7,610	3,400	5,390	1.96	2.19	321,000	A.
July	9,560	2,470	5,680	2.07	2.39	349,000	A.
August	2,440	1,120	1,560	.567	.65	95,900	A.
September	1,400	670	874	.318	.35	52,000	A.
October	792	670	693	.252	.29	42,600	A.
November	670	525	564	.205	.23	33,600	B.
December 1–15	595	525	551	.200	.11	16,400	B.
The period						1,200,000	
1908.							
March 18–31	620	430	490	.178	.09	13,600	A.
April	1,550	430	813	.296	.33	48,400	B.
May	1,490	815	1,160	.422	.49	71,300	B.
June	4,670	845	2,400	.873	.97	143,000	B.
July	2,000	668	1,230	.447	.52	75,600	A.
August	2,440	480	869	.316	.36	53,400	A.
September	850	422	539	.196	.22	32,100	A.
October	770	602	682	.248	.29	41,900	A.
November	668	450	522	.190	.21	31,100	A.
December[b]			527	.192	.22	32,400	D.
The period						543,000	

[a] Omitted from 1905 report. [b] Ice conditions during December, 1908, and discharge estimated.

STRAWBERRY RIVER IN STRAWBERRY VALLEY, UTAH.

This station, which was established May 12, 1903, and discontinued July 12, 1906, was originally located below the junction of Big and Little Strawberry rivers, above the mouth of Indian Creek. It was established below Indian Creek October 14, 1908, but no records of gage heights were obtained in 1908. Measurements are made from a cable whenever possible.

The records show the amount of water available for storage in Strawberry Valley for the use of the Reclamation Service. The water will be stored by a low dam and diverted through a tunnel 18,500 feet long into the drainage basin of Spanish Fork, a tributary of Utah Lake, for irrigation and power development. This tunnel is not yet finished and there are no diversions above the station. The river is frozen over nearly five months of the year.

Discharge measurements of Strawberry River in Strawberry Valley, Utah, 1908.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
August 26[a]	E. A. Porter	5.86	25.3
September 23[b]	La Rue and Lytle	5.95	31.3
October 14[c]	do	5.94	29.5

[a] By wading about 100 yards above cable. [b] By wading 10 feet above cable. [c] At cable.

STRAWBERRY RIVER AT THEODORE, UTAH.

This station, which was established June 10, 1908, is located at the west boundary of Theodore town site, along the wagon road to Heber, about 1¼ miles above the junction of the Strawberry with Duchesne River, about one-half mile upstream from the mouth of Indian Canyon, and about 18 miles below the mouth of Currant Creek. Discharge measurements are made by means of a car and cable. The drainage area above the station is nearly 1,200 square miles.

The records are important because they show the run-off of the lower Strawberry and the amount of water available for irrigation.

In connection with the Strawberry Valley project the United States Reclamation Service is building a tunnel 4 miles long, with a capacity of 500 second-feet, to convey water from a 100,000 acre-foot reservoir on Strawberry River across the divide to the Spanish Fork. This tunnel will not be completed for some time to come.

The flow of the stream is affected by ice for about four months during the winter season.

The chain gage is located about 50 feet downstream from the cable from which discharge measurements are made. The datum of the gage has remained constant since the station was established.

Very good results should be obtained at this station except at extremely high stages, when the stream overflows the left bank, rendering it impossible to make gagings.

Discharge measurements of Strawberry River at Theodore, Utah, in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 20[a]	R. H. Fletcher	41	251	.....	671
June 11	do	61	136	3.15	389
June 22	do	61	133	3.08	358
July 22	do	61	88	2.38	140
July 31	W. B. Freeman	59	90	2.52	160
August 7	R. H. Fletcher	60	90	2.48	178
August 16	do	60	87	2.40	131
August 26	do	60	76	2.27	98
September 8	do	61	92	2.52	169
September 16	do	60	80	2.32	118
September 28	do	60	78	2.38	135
October 8	do	59	77	2.41	134
October 16	do	60	83	2.39	136
October 27	do	60	80	2.38	136
November 10	do	59	76	2.35	128
November 18	do	56	73	2.25	115
December 9[b]	do	59	53	2.23	81

[a] Measured from bridge. [b] Wading measurement. Ice conditions.

Daily gage height, in feet, of Strawberry River at Theodore, Utah, for 1908.

[M. M. Smith, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.75	3.35	2.25	2.3	2.4	2.4	16	3.4	2.5	2.4	2.3	2.4	2.4	2.65
2	.....	2.7	3.05	2.25	2.3	2.4	2.5	17	3.45	2.5	2.35	2.3	2.4	2.4	2.8
3	.....	2.7	2.55	2.25	2.45	2.4	2.4	18	3.45	2.45	2.35	2.3	2.4	2.4	2.9
4	.....	2.7	2.5	2.25	2.45	2.4	2.65	19	3.3	2.4	2.4	2.3	2.4	2.4	2.8
5	.....	2.6	2.45	2.25	2.4	2.4	2.5	20	3.2	2.4	2.35	2.25	2.4	2.4	2.65
6	.....	2.6	2.55	2.25	2.4	2.4	2.5	21	3.1	2.4	2.35	2.25	2.4	2.4	2.7
7	.....	2.6	2.45	2.2	2.4	2.4	2.5	22	3.1	2.4	2.35	2.25	2.3	2.4	2.75
8	.....	2.6	2.4	2.35	2.4	2.4	2.4	23	3.05	2.4	2.35	2.25	2.35	2.3	3.0
9	.....	2.6	2.4	2.3	2.4	2.4	2.3	24	3.0	2.4	2.3	2.3	2.4	2.3	3.15
10	.....	2.55	2.4	2.3	2.4	2.4	2.75	25	3.0	2.35	2.3	2.6	2.4	2.35	3.2
11	3.2	2.5	2.4	2.45	2.35	2.3	2.55	26	2.9	2.35	2.3	2.5	2.35	2.4	3.2
12	3.3	2.5	2.4	2.45	2.35	2.4	2.6	27	2.9	2.55	2.3	2.4	2.35	2.45	3.2
13	3.3	2.5	2.5	2.4	2.35	2.4	2.6	28	2.85	2.6	2.3	2.35	2.4	2.4	3.2
14	3.3	2.5	2.5	2.35	2.35	2.35	2.55	29	2.8	2.6	2.25	2.4	2.4	2.35	3.25
15	3.3	2.5	2.4	2.35	2.35	2.4	2.7	30	2.8	2.55	2.25	2.35	2.4	2.35	3.3
								31	.....	3.2	2.25	.....	2.4	.....	3.3

NOTE.—Ice conditions during December.

Rating table for Strawberry River at Theodore, Utah, for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	95	2.60	190	3.00	328	3.40	497
2.30	116	2.70	220	3.10	368	3.50	519
2.40	139	2.80	253	3.20	410		
2.50	163	2.90	290	3.30	453		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 16 discharge measurements made during 1908 and is fairly well defined between gage heights 2.25 and 3.20 feet.

Monthly discharge of Strawberry River at Theodore, Utah, for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June 11-30	519	253	386	15,300	A.
July	410	128	179	11,000	A.
August	475	106	153	9,410	A.
September	190	95	123	7,320	A.
October	151	116	135	8,300	A.
November	151	116	136	8,090	A.
December	.....	.....	100	6,150	D.
The period	.....	.....	.....	65,600	

NOTE.—Ice conditions during December and discharge estimated.

LAKE FORK BELOW FORKS NEAR WHITEROCKS, UTAH.

This station was established on May 10, 1907, but a fragmentary record was maintained at the same place during 1904. It is located about 500 feet downstream from the junction of the East and West forks, on the old Indian trail from Spanish Fork to Whiterocks, Utah, about 30 miles west of White Rock.

Being above all present diversions, the station furnishes valuable data for determining the run-off and showing the amount of water available for irrigation below and storage above.

No important tributaries enter between this station and the mouth of the stream, and none on either branch for some distance above. The drainage area above the station is about 300 square miles.

The flow of this stream could doubtless be equalized at comparatively small expense by utilizing the storage facilities afforded by a number of the small lakes and reservoir sites found on both branches of the stream above the station. As both of the main tributaries have rapid fall, splendid opportunities for power development are presented above all irrigation diversions.

The winter flow of the stream for several months is affected by most severe ice conditions.

The chain gage established May 10, 1907, has no relation whatever to the 1904 gage. Still another chain gage and datum have been used since September 1, 1907. This gage is located about 100 feet upstream from the cable from which discharge measurements are made.

As the stream bed is rough and the current is swift at high and moderate stages, the results obtained at this station are only fair or approximate except at low stages, when they are fairly good.

Discharge measurements of Lake Fork below forks near Whiterocks, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 21	I. I. Price	70	210	3.05	1,090
June 8	....do	75	228	3.32	1,490
June 14	....do	75	194	2.98	1,080
July 13	W. G. Garvens	80	294	3.00	2,880
July 25	I. I. Price	80	216	2.48	1,660
August 31	....do	75	105	[b] 2.50	560
September 13	....do	65	83	2.10	329
September 17	W. B. Freeman	52	93	2.00	280
October 2	R. H. Fletcher	55	89	1.94	264
October 29	....do	71	112	1.75	203
November 11	....do	62	99	1.55	203
November 25[a]	....do	58	94	1.60	193
1908.					
March 23	R. H. Fletcher	52	81	1.35	234
April 3	....do	54	66	1.38	196
April 15	....do	61	81	1.64	262
April 26	....do	62	84	1.72	275
May 12	....do	65	112	2.12	500
May 20	....do	65	112	2.28	504
June 3	....do	60	109	2.19	529
June 20	....do	92	190	3.30	1,040
June 28	....do	100	230	3.73	1,960
July 8	....do	80	147	2.90	901
July 21	....do	65	109	2.18	529
July 28	W. B. Freeman	59	106	2.40	457
August 8	R. H. Fletcher	64	109	2.35	476
August 14	....do	69	119	2.45	581
August 27	....do	58	96	2.05	357
September 8	....do	56	85	1.75	318
September 17	....do	58	89	1.98	337
September 28	....do	58	98	2.05	377
October 7	....do	58	95	2.05	361
October 15	....do	60	99	2.13	403
October 26	....do	58	90	1.93	304
November 9	....do	56	84	1.75	287
November 17	....do	54	79	1.66	267
December 8	....do	53	83	1.55	272
December 21[a]	....do	40	97	2.88	248

[a] Ice conditions. [b] Reading from new gage. Old gage read 1.30 feet.

NOTE.—Above measurements made at various sections.

Daily gage height, in feet, of Lake Fork below forks near Whiterocks, Utah, for 1907 and 1908.

[Charles B. Elliott, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.										
1				2.60	4.75	1.85	2.55	.....	1.70	1.60
2				2.70	4.80	1.90	2.50	.....	1.70	1.60
3				2.95	5.00	1.80	2.40	.....	1.70	1.60
4				3.10	5.25	1.90	2.35	.....	1.70	1.60
5				3.25	4.90	1.75	2.50	.....	1.70	1.60
6				3.50	4.60	1.70	2.45	.....	1.65	1.60
7				3.55	4.30	1.65	.....	.....	1.65	1.65
8				3.40	4.00	1.60	.....	.....	1.65	1.70
9				3.45	4.00	1.60	.....	.....	1.65	1.72
10			2.00	3.15	3.00	1.55	.....	.....	1.60	1.68
11			2.00	3.00	3.00	1.45	.....	.....	1.55	1.68
12			2.10	3.00	3.00	1.40	.....	.....	1.55	1.55
13			2.20	3.15	2.95	1.35	2.10	.....	1.50	1.40
14			2.20	3.15	3.00	1.35	2.10	.....	1.50	1.35
15			2.20	3.00	2.85	1.40	2.05	.....	1.45	1.32
16			2.15	2.85	2.70	1.35	2.00	.....	1.50	1.32
17			2.15	2.80	2.50	1.30	2.00	.....	1.55	1.30
18			2.25	2.80	2.50	1.30	2.00	.....	1.60	1.52
19			2.40	3.00	2.50	1.25	1.95	.....	1.60	1.80
20			2.60	3.40	2.72	1.20	1.95	.....	1.60	2.20
21			2.85	3.75	2.75	1.20	1.95	.....	1.55	2.80
22			3.00	4.05	2.48	1.20	1.95	.....	1.40	3.00
23			3.10	3.95	2.35	1.15	1.90	.....	1.40	3.10
24			3.25	3.60	2.35	1.15	.....	.....	1.55	3.05
25			3.15	3.55	2.75	1.30	.....	.....	1.52	3.20
26			3.00	3.65	2.40	1.25	.....	.....	1.55	2.90
27			2.90	3.75	2.25	1.20	.....	.....	1.50	2.40
28			2.75	4.05	2.10	1.20	.....	1.80	1.50	2.10
29			2.70	4.30	2.00	1.20	.....	1.75	1.55	1.90
30			2.60	4.40	2.00	1.30	.....	1.75	1.60	1.90
31			2.55	.....	1.90	1.30	.....	1.68	.....	.....
1908.										
1				2.4	3.3	3.35	1.85	2.0	1.8	1.6
2				2.3	3.05	2.8	1.85	2 0	1.8	1.5
3		1.38	.....	2.2	3.0	2.6	1.85	2 0	1.8	1.65
4			.....	2.15	.....	2.6	1.8	.....	1.75	1.55
5			.....	.....	.....	.....	1.8	.....	1.8	1.5
6			.....	2.1	3.1	.....	1.8	2.05	1.8	1.5
7			.....	2.1	2.9	2.45	1.75	2.05	1.8	1.45
8			.....	2.15	2.85	2.3	1.9	2.1	1.75	1.45
9			.....	2.35	2.75	.....	2.1	2.1	1.75	1.45
10			.....	2.6	2.7	.....	2.0	2.1	1.75	1.5
11			2 15	.....	2.7	2.3	2.0	2.1	1.7	1.4
12			2.1	4.5	2.65	2.2	2.0	2.15	1.7	1.4
13			2.05	4.65	2.65	2.45	2.05	2.15	1 7	1 4
14			2.00	4.6	2.65	2.5	2.1	2 1	1.7	1 35
15		1.64	.....	4.6	2.7	2.35	2.05	2.1	1.6	1.35
16			1.9	4.1	2.6	2.25	2.0	2.1	1.6	1.3
17			1.9	3.55	2.45	2.15	2.0	2.0	1.6	1.3
18			2.0	3.3	2.35	2.15	1.9	2.1	1.65	1.3
19			2.2	3.2	2.3	2.35	1 9	2.1	1.65	1.35
20			2.25	3.35	.....	2.25	1.9	2.05	1.6	2.5
21			2.2	3.75	2.15	2.2	1.8	2.0	1.6	2 45
22			2.2	4.1	2.1	2.3	1.8	2 0	1.65	3.35
23	1.35	.....	2.15	3.85	2.1	2.4	1.8	2.0	1.6	3.4
24			2.1	.....	2.15	2.3	1 8	2.05	1.65	3.6
25		1.77	2.2	.....	2.05	2.25	2.3	1.95	1.7	3.55
26		1.72	2.5	4.0	2.1	.....	2.1	1.95	1.7	3.4
27			2.45	3.95	2.4	2.05	2.0	1.9	1.7	3.1
28			2.3	3.65	2.4	.....	2.0	1.9	1.7	2.95
29			2.25	3.6	3.05	1.9	2.0	1.9	1.6	2.5
30			2.4	3.4	2.85	1.9	2.0	1.85	1.6	2.4
31			2.5	.....	2.85	1.9	.....	1.85	.....	2.5

NOTE.—A new gage was installed on the opposite bank of the river August 31, 1907, on account of change in channel conditions during the June floods. Readings began on the new gage September 1, 1907. Ice conditions December 18 to 31, 1907.

Ice conditions during December, 1908.

Rating tables for Lake Fork below forks near Whiterocks, Utah.

1907.

[Daily discharges in 1907 determined by means of an approximate rating and indirect method for shifting channels.]

1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	195	2.20	444	3.10	1,080	4.00	2,220
1.40	214	2.30	493	3.20	1,180	4.10	2,380
1.50	235	2.40	548	3.30	1,285	4.20	2,545
1.60	257	2.50	610	3.40	1,400	4.30	2,715
1.70	281	2.60	675	3.50	1,520	4.40	2,890
1.80	307	2.70	745	3.60	1,650	4.50	3,070
1.90	336	2.80	820	3.70	1,785	4.60	3,255
2.00	367	2.90	900	3.80	1,925	4.70	3,445
2.10	402	3.00	985	3.90	2,070		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1908 and is fairly well defined.

Daily discharge, in second-feet, of Lake Fork below forks near Whiterocks, Utah, for 1907.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	760	7,500	890	610	265	210	190
2	.....	830	7,700	930	560	265	210	190
3	.....	1,040	8,300	860	480	265	210	190
4	.....	1,190	9,300	930	450	265	210	190
5	.....	1,390	8,200	820	560	260	210	190
6	.....	1,810	7,500	790	520	260	200	190
7	.....	1,920	6,600	765	520	260	200	200
8	.....	1,630	5,700	720	450	260	200	210
9	.....	1,720	5,750	720	380	260	200	210
10	450	1,250	2,700	700	380	255	190	210
11	450	1,080	2,750	640	380	255	185	210
12	490	1,080	2,800	610	320	255	185	185
13	540	1,250	2,740	590	320	250	180	160
14	540	1,250	2,880	590	320	250	180	155
15	540	1,080	2,480	610	300	250	170	150
16	520	950	2,110	590	285	240	180	150
17	520	900	1,680	560	285	240	185	150
18	560	900	1,680	560	285	240	190	150
19	640	1,080	1,680	530	270	240	190	150
20	760	1,800	2,160	510	270	240	190	150
21	950	2,800	2,230	510	270	235	185	150
22	1,080	3,880	1,650	510	270	235	160	150
23	1,190	3,740	1,440	490	255	235	160	150
24	1,390	2,840	1,440	490	255	230	185	150
25	1,250	2,830	2,230	560	255	230	180	150
26	1,080	3,240	1,520	530	255	230	185	150
27	990	3,720	1,290	510	255	230	180	150
28	870	4,800	1,120	510	260	230	180	150
29	830	5,760	1,020	510	260	220	185	150
30	760	6,200	1,020	560	260	220	190	150
31	730	.....	930	560	.....	210	.....	150

NOTE.—These discharges were obtained by the indirect method for shifting channels. Daily discharges estimated by comparisons with adjacent stations for days on which there are no gage records. Ice conditions December 18 to 31, 1907; discharge estimated.

Monthly discharge of Lake Fork below forks near Whiterocks, Utah, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
May 10–31	1,390	450	779	34,000	B.
June	6,200	760	2,160	129,000	C.
July	9,300	930	3,490	215,000	D.
August	930	490	634	39,000	C.
September	610	255	351	20,900	C.
October	265	210	245	15,100	D.
November	210	160	189	11,200	C.
December	210		169	10,400	D.
The period				475,000	
1908.					
March 15–31			200	6,740	D.
April			237	14,100	D.
May	610	336	422	25,900	C.
June	3,350	402	1,550	92,200	C.
July	1,280	384	721	44,300	C.
August	1,340	336	529	32,500	C.
September	493	294	351	20,900	B.
October	423	322	377	23,200	B.
November	307	257	280	16,700	B.
December	272	228	251	15,400	D.
The period				292,000	

NOTE.—Discharge estimated for periods September 7–12 and September 24 to October 27, 1907. Discharge estimated for period of ice conditions December 18–31, 1907.
Discharge March 15 to May 10, 1908, based on comparative hydrographs for stations in the Uinta River drainage.
Discharge estimated during the frozen period, December, 1908.

LAKE FORK NEAR MYTON, UTAH.

This station, which is located about 3 miles above Myton, Utah, was originally established July 3, 1900, and was known as the station on Lake Fork at mouth. It was discontinued at the end of the season of 1903, although several discharge measurements were made in 1904, and was reestablished June 13, 1907. On October 14, 1907, a cable equipment was installed about one-quarter mile above the gage.

As the station is only about one-half mile above the junction of the stream with Duchesne River, the records show the amount of water which Lake Fork contributes to the Duchesne, and in connection with the records obtained at the station on Lake Fork below the forks, which is about 20 miles upstream and above all present diversions, they indicate also the amount of water diverted for irrigation along the stream. No important tributaries enter between the two stations.

Several canal systems built by the United States Indian Service take water from this stream above the station for irrigation. Some private canal systems are proposed or in operation. As at all other stations in this basin, the stream is icebound for several months during the winter season.

The gage was in the same position and the same datum was used from 1900 to 1904, inclusive. During 1907 and 1908, three distinct gages and datums were used: From June 13 to 30, 1907, from August 18 to December 31, 1907, and during 1908.

The results obtained during 1908 have been very satisfactory, except for a few difficulties in the gage readings. Previous records are not so good.

Discharge measurements of Lake Fork near Myton, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.[a]	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 29[b]	I. I. Price	39.6	243	5.45	730
June 13[b]	do	39.6	276	6.30	1,190
June 29[b]	do	39.6	347	8.08	2,380
September 16[c]	Freeman and Price	72	180	2.50	230
September 30[c]	R. H. Fletcher	76	171	2.45	207
October 14[e]	do	66	146	2.40	176
October 31	do	66	141	2.28	185
November 9	do	64	133	2.20	172
November 23	do	64	117	2.12	130
December 10[c]	do	66	148	2.32	179
1908.					
March 24	R. H. Fletcher	64	125	3.48	133
April 6	do	64	115	3.44	117
April 14	do	65	128	3.65	150
April 27	do	65	133	3.78	176
May 13	do	65	159	4.25	261
May 22	do	65	169	4.25	300
June 4	do	65	161	4.25	270
June 20	do	69	318	6.44	1,460
June 28	do	68	286	6.13	1,220
July 8	do	66	210	5.03	609
July 23	do	65	149	4.05	243
July 31	Freeman and Fletcher	66	197	4.83	478
August 6	R. H. Fletcher	66	175	4.45	389
August 17	do	66	160	4.15	265
August 25	do	65	156	4.13	264
September 9	do	65	152	4.10	247
September 15	do	65	141	3.93	207
September 29	do	65	144	3.90	217
October 9	do	65	148	4.00	242
October 17	do	65	158	4.13	306
October 29	do	65	143	3.94	222
November 11	do	65	134	3.72	172
November 18	do	65	138	3.80	188
December 3[d]	do	65	133	3.77	181
December 10[d]	do	65	155	4.10	141

[a] Three gages were used, 1907–8, having no relation to each other. Measurements May 24 to June 29, 1907, refer to gage No. 1. Measurements September 16 to December 10, 1907, refer to gage No 2. Measurements for 1908 refer to gage No. 3.
[b] Measured from bridge
[c] Wading measurement.
[d] Ice conditions.
[e] Wading measurement at cable section.

Daily gage height, in feet, of Lake Fork near Myton, Utah, for 1907 and 1908.

[James McAfee, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]										
1					(b)		2.8	2.3		
2							2.8	2.3		
3							2.7	2.3		
4							2.7	2.3		
5							2.8	2.3		
6							2.8	2.4		
7							2.7	2.5		
8							2.7	2.4		
9							2.6	2.4	2.2	
10							2.6	2.4		2.32
11							2.5	2.4		
12							2.5	2.3		
13				6.3			2.5	2.3		
14				6.2			2.4	2.3		
15				6.0			2.4	2.3		
16				5.7			2.4	2.3		
17				6.0			2.4	2.3		
18				6.0		3.0	2.4	2.3		
19				6.5		3.0	2.4	2.3		
20				7.0		2.9	2.4	2.3		
21				7.5		2.8	2.3	2.3		
22				7.4		2.8	2.3	2.3		
23				7.0		2.8	2.3	2.2	2.12	
24				6.7		2.8	2.3	2.2		
25				6.8		2.8	2.3	2.2		
26				7.0		3.0	2.3	2.3		
27				7.5		2.8	2.3	2.3		
28				8.0		2.7	2.3	2.2		
29			5.45	8.2		2.7	2.3	2.2		
30				8.5		3.0	2.4	2.2		
31						3.0		2.2		
1908.[c]										
1		3.45	3.8	4.4	5.6	5.25	3.9	3.7	3.9	3.6
2		3.45	3.9	4.3	5.55	5.2	3.8	3.8	3.8	3.6
3		3.45	3.9	4.35	5.7	4.7	3.75	3.9	3.8	3.75
4		3.45	4.1	4.3	5.5	4.65	3.65	4.05	3.85	3.6
5		3.45	4.3	4.2	5.35	4.5	3.65	4.2	3.9	3.6
6		3.45	4.3	4.2	5.3	4.5	3.7	4.15	3.9	3.8
7		3.5	4.3	4.25	5.15	4.45	3.8	4.1	3.8	4.0
8		3.55	4.3	4.25	5.05	4.25	4.05	4.05	3.8	4.05
9		3.55	4.5	4.3	4.9	4.1	4.1	4.05	3.7	4.05
10		3.45	4.3	4.85	4.75	4.2	4.0	4.05	3.8	4.05
11		3.5	4.25	6.65	4.75	4.15	4.0	4.05	3.75	4.05
12		3.55	4.3	7.45	4.75	4.35	4.05	4.05	3.7	4.05
13		3.6	4.25	7.75	4.75	4.45	4.05	4.05	3.7	4.05
14		3.7	4.2	7.95	4.7	4.5	4.0	4.0	3.75	3.9
15		3.7	4.25	7.95	4.7	4.35	3.95	3.95	3.8	3.9
16		3.7	4.2	7.35	4.6	4.4	3.9	4.0	3.8	3.9
17		3.8	4.15	6.55	4.5	4.25	3.85	4.2	3.8	3.8
18		3.8	4.15	5.9	4.4	4.15	3.7	4.2	3.7	3.8
19		3.8	4.15	5.6	4.4	4.2	3.65	4.2	3.7	3.75
20		3.9	4.3	5.9	4.2	4.2	3.6	4.2	3.7	3.65
21		3.9	4.3	6.7	4.05	4.25	3.55	4.15	3.7	3.6
22		3.95	4.3	7.05	4.1	4.3	3.45	4.0	3.7	3.6
23		3.95	4.3	6.75	4.4	4.2	3.6	3.9	3.7	3.55
24	3.45	3.95	4.3	7.0	4.05	4.2	3.8	3.9	3.6	3.55
25	3.45	3.85	4.3	6.9	3.95	4.2	4.3	3.85	3.55	3.6
26	3.45	3.85	4.45	6.8	4.0	4.1	4.25	3.85	3.55	3.75
27	3.45	3.85	4.6	6.85	4.1	4.2	4.2	3.9	3.45	3.9
28	3.45	3.8	4.6	6.2	4.25	4.0	3.95	3.9	3.45	3.9
29	3.45	4.0	4.4	6.05	4.55	3.95	3.95	3.9	3.5	3.9
30	3.45	3.85	4.3	6.25	4.9	3.95	3.9	4.0	3.6	4.1
31	3.45		4.3		4.75	3.85		3.95		4.2

[a] Gage heights, August 18 to December 10, 1907, have no relation to gage heights for June, 1907.
[b] Bridge and gage washed out July 1, 1907.
[c] Gage heights, 1908, have no relation to gage heights for 1907. Ice conditions December 6 to 31, 1908.

Rating tables for Lake Fork near Myton, Utah.

JUNE 13 TO 30, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.70	860	6.50	1,310	7.30	1,830	8.10	2,400
5.80	910	6.60	1,370	7.40	1,900	8.20	2,470
5.90	965	6.70	1,430	7.50	1,970	8.30	2,540
6.00	1,020	6.80	1,490	7.60	2,040	8.40	2,615
6.10	1,075	6.90	1,555	7.70	2,110	8.50	2,690
6.20	1,130	7.00	1,620	7.80	2,180		
6.30	1,190	7.10	1,690	7.90	2,255		
6.40	1,250	7.20	1,760	8.00	2,330		

NOTE.—The above table is not applicable for obstructed-channel conditions. It is based on 3 discharge measurements made during May and June, 1907, and is only fairly defined.

AUGUST 18, 1907, TO DECEMBER 9, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	125	2.40	200	2.70	295	3.00	405
2.20	150	2.50	230	2.80	330		
2.30	175	2.60	260	2.90	365		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 7 discharge measurements made during September to November, 1907, and is not well defined.

1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	115	4.50	373	5.60	892	6.70	1,635
3.50	132	4.60	407	5.70	951	6.80	1,715
3.60	150	4.70	445	5.80	1,012	6.90	1,795
3.70	169	4.80	485	5.90	1,075	7.00	1,875
3.80	190	4.90	527	6.00	1,140	7.20	2,045
3.90	212	5.00	572	6.10	1,205	7.40	2,215
4.00	235	5.10	620	6.20	1,275	7.60	2,390
4.10	258	5.20	671	6.30	1,345	7.80	2,570
4.20	283	5.30	724	6.40	1,415	8.00	2,750
4.30	310	5.40	778	6.50	1,485		
4.40	340	5.50	834	6.60	1,560		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 24 discharge measurements made during 1908, and is well defined.

Monthly discharge of Lake Fork near Myton, Utah, for 1907 and 1908.

[Drainage area, 475 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
June 13–30	2,690	860	1,590	3.35	2.24	56,800	C.
August 18–31	405	295	354	.745	.39	9,830	C.
September	330	175	230	.484	.54	13,700	B.
October	230	150	176	.371	.43	10,800	B.
November	150	130	142	.299	.33	8,450	D.
December 1–9	180	150	163	.343	.12	2,910	D.
The period						102,000	
1908.							
March 24–31	124	124	124	.261	.08	1,970	A.
April	235	124	170	.358	.40	10,100	A.
May	407	190	302	.636	.73	18,600	A.
June	2,700	283	1,260	2.65	2.96	75,000	A.
July	951	224	476	1.00	1.15	29,300	A.
August	698	201	328	.691	.80	20,200	A.
September	301	124	208	.438	.49	12,400	A.
October	283	169	237	.499	.58	14,600	A.
November	212	124	173	.364	.41	10,300	A.
December	180	135	147	.309	.36	9,040	D.
The period						202,000	

NOTE.—Discharge estimated for November and December, 1907. Discharge estimated for the frozen period, December 6–31, 1908.

UINTA RIVER NEAR WHITEROCKS, UTAH.

This station was originally established in connection with the investigation for the water supply of the Uinta Reservation, on September 16, 1899, and the records were continued until the latter part of 1904. It was reestablished in the same locality on August 13, 1907.

The present station is located at the highway bridge on the government road up Uinta Canyon, usually known as the saw mill road. The bridge is about 10 miles northwest of the Indian agency at Whiterocks. Previous records were taken at points a short distance upstream from this bridge.

The data obtained show the amount of water available for storage and power development above and for irrigation below.

The station is situated about a mile below the mouth of Pole Creek. The Whiterocks comes in several miles below, but there are no other tributaries of any importance except some dry gulches which occasionally carry considerable flood water.

No water is diverted from the stream above the station, but the United States Indian Service has constructed a series of irrigation canals, which divert water at various points below. The upper reaches of this stream present excellent opportunities for storage and power development.

The results at the station are affected by ice during the winter season. Winter measurements are usually taken at riffles or open places in the channel.

The same gage was used from 1899 to 1904, inclusive. The gage established in August, 1907, was located a short distance upstream from the old gage, and at a different datum. The present chain gage has no determined relation to this last gage. It was established on October 22, 1907, and is located on the bridge about a mile downstream from the other gage.

As no one lives in the vicinity of the gage, it is read only when the hydrographer visits the station to take discharge measurements, and the discharge for intermediate days is estimated by comparison with the hydrographs of other streams in that locality.

As the stream bed is rough and the current swift at high and moderate stages, the discharge measurements, except at low stages, are apt to be considerably in error. The method of computing daily and monthly discharges makes them necessarily only rather approximate.

Discharge measurements of Uinta River near Whiterocks, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage. height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 13	I. I. Price	83	113	1.10	456
August 25	do	84.5	101	1.05	379
September 10	do	84.5	90	.90	301
October 9	R. H. Fletcher	68	86	.78	286
October 22	do	70	80	1.30	219
November 5	do	69	73	1.22	206
November 19	do	68	64	1.10	155
1908.					
March 30[a]	R. H. Fletcher	63	61	.98	123
April 10[a]	do	65	64	1.05	146
April 18	do	69	72	1.18	202
April 25	do	71	85	1.40	221
May 11	do	73	96	1.52	315
May 19	do	75	129	1.88	516
June 3	do	73	104	1.63	348
June 18	do	78	161	2.20	1,010
June 27	do	80	163	2.35	1,240
July 7	do	75	134	2.00	706
July 21	do	72	112	1.70	543
July 27	Freeman and Fletcher	72	125	1.90	544
August 13	R. H. Fletcher	75	115	1.82	468
August 22	do	75	122	1.85	479
August 28	do	73	105	1.60	329
September 3	do	71	98	1.45	298
September 18	do	71	94	1.48	316
September 25	do	75	117	1.85	448
October 5	do	72	101	1.50	333
October 13	do	72	97	1.50	323
October 23	do	71	95	1.45	294
November 7	do	70	81	1.30	241
November 14	do	70	83	1.28	240
November 24	do	70	77	1.20	213
December 7[b]	do	70	76	1.22	155
December 24[b]	do	81	206	3.10	237

[a] Some ice. [b] Ice conditions.

NOTE.—On October 9, 1907, station was moved 1 mile down stream to a bridge. New gage established at bridge on October 22, 1907.

Monthly discharge of Uinta River near Whiterocks, Utah, for 1907 and 1908.

[Drainage area, 218 square miles.]

Month.	Discharge in second-feet.		Run-off.	
	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1907.				
August 13-31	373	1.71	1.21	14,100
September	308	1.41	1.57	18,300
October	250	1.15	1.33	15,400
November	174	.798	.89	10,400
The period	.....	.....	.....	58,200
1908.				
March 15-31	146	.670	.42	4,920
April	172	.789	.88	10,200
May	348	1.60	1.84	21,400
June	910	4.17	4.65	54,100
July	636	2.92	3.37	39,100
August	444	2.04	2.35	27,300
September	327	1.50	1.67	19,500
October	325	1.49	1.72	20,000
November	236	1.08	1.20	14,000
December	202	.927	1.07	12,400
The period	.....	.....	.....	223,000

NOTE.—The above values are classed as C. The daily discharges were obtained from a hydrograph passing through the measurements and following the rates of rise and fall of other stream in the basin on which daily records were obtained.

UINTA RIVER AT FORT DUCHESNE, UTAH.

This station, which is located at the wooden highway bridge on the road to Vernal, one-fourth of a mile from Fort Duchesne, Utah, was originally established on September 4, 1899, and continued until the end of 1904. It was also maintained for a brief period during 1906, and on April 9, 1907, the station was reestablished.

The data obtained at this point show the amount of water contributed by this stream to Duchesne River, except the comparative small amount diverted for irrigation below, and in connection with the records of the stations above on the Whiterocks and the Uinta, they show the amount of water taken for irrigation by the numerous diversions both on the Uinta and Whiterocks above the station. The upper tributaries, above irrigation diversions, afford excellent opportunities for storage and power development.

The flow of the stream is affected by ice for about four months during the winter season, and the accuracy of the results is somewhat affected by eddies around the crib piers and by deposits of sediment brought down by Deep Creek during floods.

Practically the same datum was used for the gage up to and including 1906. The present chain gage, established April 9, 1907, has an entirely different datum. It is fastened to the bridge from which discharge measurements are made.

Discharge measurements of Uinta River at Fort Duchesne, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	Meeker and Price	81	297	6.44	181
April 24	I. I. Price	81	322	6.72	335
May 13	do	81	310	6.80	345
May 28	do	81	384	7.30	857
June 11	do	81	412	7.65	1,350
June 28	do	81	477	8.52	2,800
July 10	J. B. Cabanis	81	466	7.95	2,050
August 14	I. I. Price	81	367	6.76	408
September 3	do	81	340	6.62	305
September 19	R. H. Fletcher	79	329	6.43	218
October 10	do	79	333	6.42	202
October 23	do	80	322	6.35	173
November 6	do	80	281	6.34	150
November 20	do	80	254	6.35	142
December 5[a]	do	80	245	6.50	99
1908.					
March 26	R. H. Fletcher	80	227	6.32	139
April 1	do	78	217	6.28	108
April 11	do	80	219	6.37	137
April 23	do	80	239	6.60	244
May 2	do	80	230	6.50	189
May 16	do	80	250	6.56	223
June 5	do	80	261	6.58	214
June 15	do	80	478	8.30	2,360
June 25	do	80	417	7.48	872
July 9	do	80	372	6.83	317
July 25[b]	Freeman and Fletcher	68	66	6.40	106
August 11	R. H. Fletcher	80	348	6.61	228
August 18	do	80	351	6.65	244
August 24	do	80	369	6.85	339
August 31[b]	do	78	94	6.55	226
September 10[b]	do	80	94	6.62	246
September 21	do	70	73	6.42	139
September 30	do	80	344	6.78	302
October 10	do	80	348	6.76	295
October 19	do	80	350	6.82	338
October 30	do	80	343	6.75	293
November 5	do	80	339	6.70	262
November 13	do	80	326	6.62	236
November 23	do	77	77	6.51	197
December 2[a b]	do	75	85	6.78	226
December 17[a b]	do	56	77	6.95	177

[a] Ice conditions. [b] Wading measurement.

Daily gage height, in feet, of Uinta River at Fort Duchesne, Utah, for 1907 and 1908.

[Lucile Pierce, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]										
1	.....	.....	6.68	7.25	8.62	7.15	6.65	6.40	6.35	6.45
2	.....	.....	6.65	7.68	8.65	7.25	6.65	6.40	6.35	6.50
3	.....	.....	6.65	7.78	8.65	7.22	6.65	6.42	6.32	6.52
4	.....	.....	6.60	7.95	8.65	7.20	6.62	6.40	6.32	6.45
5	.....	.....	6.65	8.18	8.65	7.15	6.65	6.40	6.32	6.40
6	.....	.....	6.65	8.25	8.42	7.08	6.70	6.40	6.32	6.45
7	.....	.....	6.55	8.02	8.25	7.02	6.70	6.50	6.32	6.40
8	.....	.....	6.55	8.00	8.15	7.00	6.65	6.48	6.35	6.32
9	.....	6.42	6.48	7.60	8.10	6.98	6.55	6.40	6.32	6.32
10	.....	6.48	6.45	7.65	7.95	6.90	6.55	6.40	6.32	6.42
11	.....	6.62	6.52	7.62	7.85	6.90	6.55	6.40	6.32	6.45
12	.....	6.75	6.72	7.82	7.78	6.90	6.55	6.40	6.30	6.45
13	.....	6.80	6.80	7.72	7.75	6.85	6.52	6.40	6.30	6.45
14	.....	6.92	6.72	7.60	7.72	6.80	6.50	6.40	6.30	6.35
15	.....	7.00	6.68	7.50	7.65	6.82	6.50	6.40	6.35	6.25
16	.....	7.00	6.60	7.42	7.45	6.68	6.52	6.40	6.35	.....
17	.....	6.92	6.75	7.45	7.40	6.60	6.45	6.40	6.28	.....
18	.....	6.90	6.88	7.65	7.40	6.60	6.45	6.40	6.32	.....
19	.....	6.85	7.12	8.10	7.32	6.60	6.45	6.40	6.32	.....
20	.....	6.80	7.40	8.28	7.32	6.60	6.45	6.40	6.32	.....
21	.....	6.75	7.60	8.40	7.65	6.70	6.45	6.35	6.35	.....
22	.....	6.78	7.80	8.32	7.45	6.55	6.45	6.35	6.30	.....
23	.....	6.72	7.98	8.00	7.38	6.50	6.40	6.35	6.35	.....
24	.....	6.70	7.88	7.95	7.40	6.50	6.40	6.40	6.42	.....
25	.....	6.70	7.72	8.15	7.65	6.62	6.40	6.40	6.45	.....
26	.....	6.75	7.50	8.15	7.50	6.68	6.40	6.40	6.48	.....
27	.....	6.75	7.38	8.35	7.52	6.60	6.40	6.35	6.50	.....
28	.....	6.75	7.30	8.50	7.42	6.60	6.40	6.35	6.52	.....
29	.....	6.80	7.20	8.48	7.35	6.60	6.40	6.35	6.40	.....
30	.....	6.72	7.18	8.58	7.30	6.70	6.40	6.35	6.42	.....
31	.....	.....	7.15	.....	7.22	6.80	.....	6.35	.....	.....
1908.[b]										
1	.....	6.25	6.4	6.85	7.0	6.7	6.45	6.7	6.7	6.7
2	.....	6.25	6.5	6.7	7.0	6.7	6.45	6.65	6.7	6.7
3	.....	6.3	6.7	6.65	6.95	6.65	6.45	6.75	6.7	6.8
4	.....	6.3	6.8	6.6	6.95	6.55	6.4	6.75	6.6	6.8
5	.....	6.3	6.7	6.6	7.0	6.45	6.4	6.75	6.6	6.8
6	.....	6.3	6.65	6.6	6.9	6.5	6.4	6.7	6.7	6.7
7	.....	6.4	6.7	6.85	6.95	6.5	6.35	6.8	6.65	6.65
8	.....	6.35	6.8	6.85	6.85	6.4	6.3	6.7	6.65	6.75
9	.....	6.35	6.85	6.9	6.85	6.35	6.85	6.75	6.65	6.75
10	.....	6.3	6.8	7.55	6.85	6.4	6.6	6.8	6.65	6.75
11	.....	6.35	6.7	7.95	6.85	6.6	6.6	6.8	6.65	6.8
12	.....	6.35	6.7	8.3	6.8	6.6	6.55	6.75	6.65	6.8
13	.....	6.4	6.7	8.2	6.8	6.5	6.55	6.75	6.6	6.9
14	6.45	6.4	6.6	8.2	6.75	6.85	6.6	6.7	6.6	6.7
15	6.45	6.4	6.5	8.15	6.75	6.8	6.6	6.7	6.6	6.9
16	6.45	6.35	6.55	7.8	6.7	6.65	6.5	6.85	6.6	7.0
17	6.45	6.4	6.6	7.6	6.5	6.65	6.5	6.85	6.55	6.9
18	6.45	6.4	6.7	7.4	6.5	6.6	6.5	6.85	6.6	6.85
19	6.35	6.4	7.0	7.25	6.5	6.8	6.45	6.8	6.6	6.3
20	6.3	6.5	7.1	7.25	6.4	6.85	6.5	6.85	6.6	6.8
21	6.3	6.5	6.9	7.35	6.4	6.7	6.4	6.8	6.6	6.8
22	6.3	6.5	6.8	7.45	6.35	6.85	6.4	6.8	6.55	6.8
23	6.3	6.55	6.75	7.35	6.35	6.9	6.4	6.7	6.5	7.1
24	6.3	6.55	6.7	7.3	6.4	6.9	6.6	6.7	6.55	7.2
25	6.3	6.45	6.7	7.4	6.4	6.8	7.1	6.7	6.5	7.2
26	6.3	6.45	6.85	7.35	6.4	6.7	6.85	6.7	6.5	7.25
27	6.3	6.45	6.9	7.45	6.4	6.6	6.7	6.7	6.5	7.4
28	6.3	6.4	6.8	7.2	6.5	6.6	6.7	6.7	6.5	7.4
29	6.3	6.4	6.7	7.1	6.6	6.6	6.7	6.75	6.65	7.4
30	6.3	6.4	6.8	7.05	6.7	6.55	6.7	6.7	6.6	7.4
31	6.25	.....	7.0	.....	6.55	6.5	.....	6.7	.....	7.4

[a] Ice conditions November 24 to December 31, 1907.
[b] Ice conditions during December, 1908.

Rating tables for Uinta River at Fort Duchesne, Utah.

APRIL 9 TO JUNE 30, 1907, AND NOVEMBER 1 TO 23, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.30	135	6.90	450	7.50	1,125	8.10	2,075
6.40	160	7.00	535	7.60	1,270	8.20	2,260
6.50	200	7.10	635	7.70	1,420	8.30	2,455
6.60	250	7.20	750	7.80	1,575	8.40	2,660
6.70	310	7.30	870	7.90	1,735	8.50	2,870
6.80	375	7.40	995	8.00	1,900	8.60	3,080

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 8 discharge measurements made during above periods and is well defined.

JULY 1 TO OCTOBER 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.30	150	7.00	640	7.60	1,485	8.20	2,525
6.40	190	7.10	750	7.70	1,650	8.30	2,730
6.50	240	7.20	875	7.80	1,815	8.40	2,945
6.60	300	7.30	1,015	7.90	1,980	8.50	3,170
6.70	370	7.40	1,165	8.00	2,150	8.60	3,395
6.80	450	7.50	1,325	8.10	2,330	8.70	3,620
6.90	540						

NOTE.—The above table is not applicable for obstructed-channel conditions. It is based on 5 discharge measurements made during above period and form of previous curves and is well defined.

MARCH 14 TO MAY 31, AUGUST 28 TO SEPTEMBER 15, AND NOVEMBER 19 TO 30, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.20	88	6.50	194	6.80	375	7.00	535
6.30	118	6.60	246	6.90	450	7.10	635
6.40	153	6.70	306				

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during the above periods and is fairly well defined.

JUNE 1 TO 16, AUGUST 3 TO 27, AND SEPTEMBER 16 TO NOVEMBER 18, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.30	101	6.90	392	7.40	895	7.90	1,620
6.40	133	7.00	472	7.50	1,020	8.00	1,795
6.50	170	7.10	563	7.60	1,155	8.10	1,975
6.60	213	7.20	665	7.70	1,300	8.20	2,165
6.70	264	7.30	775	7.80	1,455	8.30	2,360
6.80	323						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during the above periods and is fairly well defined.

JUNE 17 TO AUGUST 2, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.30	76	6.70	238	7.10	515	7.40	795
6.40	106	6.80	295	7.20	600	7.50	900
6.50	143	6.90	360	7.30	695	7.60	1,010
6.60	187	7.00	435				

NOTE.—The above table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during the above period and is fairly well defined.

Monthly discharge of Uinta River at Fort Duchesne, Utah, for 1907 and 1908.

[Drainage area, 672 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
April 9–30	535	168	361	0.537	0.44	15,800	A.
May	1,870	180	635	.945	1.09	39,000	A.
June	3,040	810	1,860	2.77	3.09	111,000	A.
July	3,510	903	1,860	2.77	3.19	114,000	A.
August	945	240	487	.725	.84	29,900	A.
September	370	190	253	.376	.42	15,100	A.
October	240	170	188	.280	.32	11,600	A.
November	148	120	139	.207	.23	8,270	B.
December 1–15			102	.152	.08	3,030	D.
The period						348,000	
1908.							
March 14–31	174	103	134	.199	.13	4,940	B.
April	220	103	152	.226	.25	9,040	B.
May	635	153	342	.509	.59	21,000	A.
June	2,360	213	857	1.28	1.43	51,000	B.
July	435	91	242	.360	.42	14,900	B.
August	392	117	243	.362	.42	14,900	B.
September	563	118	216	.321	.36	12,800	B.
October	358	238	293	.436	.50	18,000	A.
November	276	192	228	.339	.38	13,600	B.
December			191	.284	.33	11,700	D.
The period						172,000	

NOTE.—Probable ice conditions November 24 to December 15, 1907, discharge estimated. Ice conditions during December, 1908, discharge estimated.

WHITEROCKS RIVER NEAR WHITEROCKS, UTAH.

This station, which is located at the mouth of the canyon at the foot of "Dugway" on the road from the plateau to the river bottom, about 10 miles above the Indian Agency at Whiterocks, was established April 18, 1899, and continued until the end of 1904. On April 11, 1907, it was reestablished at practically the same place. (See Pl. V, *B*.) Discharge measurements are made by means of a car and cable.

The information contained here is valuable in connection with general studies of run-off problems and to show the amount of water available for storage and power above and for irrigation below.

The station is below all important tributaries of the Whiterocks. The first diversion for irrigation is about 3 miles below the station. Excellent storage possibilities and opportunities for power development exist above all irrigation diversions.

Like other streams in this region, the river is icebound for several months in the winter.

The same gage and datum were used from the establishment of the station until the end of 1904. A new chain gage and datum were used from April 11, 1907, to May 8, 1908, and the present chain gage, at a still different datum, has been used since May 9, 1908.

Measurements are made from a cable about 100 feet downstream from the gage.

Owing to the remoteness of this gage from any dwelling, daily gage observations have not been made, and daily and monthly discharges have been obtained by comparing the relatively frequent discharge measurements with the hydrographs of other streams in that section.

As the stream bed is rather rough and the current is swift, measurements at high or medium stages are not very accurate. The daily and monthly discharge estimates, computed by the method outlined above, are necessarily only approximate.

Discharge measurements of Whiterocks River near Whiterocks, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11[a]	I. I. Price	38	51	2.90	134
April 27	do	38	58	3.00	146
May 11	do	39	54	3.00	145
May 26	do	50	88	4.10	454
June 3	do	55	108	4.62	702
June 10	do	54	94	4.30	516
June 25	do	58	134	5.32	1,030
July 2	do	75	174	5.60	1,320
July 9	J. B. Cabanis	55	131	4.75	936
July 16	do	55	93	4.10	479
July 23	I. I. Price	50	77	4.00	388
August 2	do	50	70	3.95	349
August 12	do	35	44	3.45	185
August 24	do	35	42	3.25	161
September 5	do	30	42	[b]3.40	144
September 18	Freeman and Fletcher	31	34	2.94	110
October 7	R. H. Fletcher	31	34	3.00	98
October 21	do	32	31	2.70	91
November 4	do	32	34	2.62	77
November 18	do	31	34	2.68	89
December 3[c]	do	31	32	2.55	80
1908.					
March 28[a]	R. H. Fletcher	28	27	2.66	58
April 9	do	30	28	2.65	61
April 17	do	30	35	2.70	88
April 24	do	31	40	3.02	128
May 9	do	40	60	[d]1.87	246
May 18	do	45	75	2.05	348
June 2	do	35	56	1.80	242
June 17	do	55	100	2.68	630
June 26	do	50	88	2.35	506
July 6	do	35	54	1.87	246
July 20	do	31	45	1.60	202
July 26[a]	Freeman and Fletcher	30	49	1.56	142
August 12	R. H. Fletcher	31	48	1.62	173
August 22	do	35	59	1.90	244
August 29	do	31	49	1.60	168
September 4	do	30	39	1.48	120
September 18	do	30	45	1.48	140
September 26	do	35	54	1.80	184
October 6	do	31	49	1.64	157
October 14	do	31	47	1.60	148
October 24	do	31	46	1.58	139
November 8	do	30	40	1.34	95
November 16[c]	do	30	40	1.48	88
November 28[c]	do	30	44	1.80	68
December 6[c]	do	30	37	1.32	94
December 19[c]	do	55	99	3.48	54

[a] Wading measurement.
[b] Backwater caused by fallen tree in stream below gage.
[c] Ice conditions.
[d] New gage. Old gage was washed out about May 4, 1908, and new gage was established May 10, 1908. The gage datum and locations are not the same.

Monthly discharge of Whiterocks River near Whiterocks, Utah, for 1907 and 1908.

[Drainage area, 114 square miles.]

Month.	Discharge in second-feet.		Run-off.	
	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1907.				
April 11–30	204	1.79	1.33	8,090
May	274	2.40	2.77	16,800
June	800	7.02	7.83	47,600
July	735	6.45	7.44	45,200
August	203	1.78	2.05	12,500
September	127	1.11	1.24	7,560
October	91.6	.804	.93	5,630
November	84.0	.737	.82	5,000
December 1–15	80.0	.702	.39	2,380
The period				151,000
1908.				
March 15–31	77.8	.682	.36	2,620
April	79.2	.695	.78	4,710
May	220	1.93	2.22	13,500
June	524	4.60	5.13	31,200
July	208	1.82	2.10	12,800
August	198	1.74	2.01	12,200
September	156	1.37	1.53	9,280
October	187	1.64	1.89	11,500
November	95.8	.840	.94	5,700
December	72.6	.637	.73	4,460
The period				108,000

NOTE.—The above values are classed as C.
The daily discharges were obtained from a hydrograph passing through the measurements following the rate of rise and fall of the other stream in the basin on which daily records were obtained.

PRICE RIVER NEAR HELPER, UTAH.

Price River rises in the Wasatch Mountains, in the southeastern part of Utah County, flows in a generally southeasterly direction and unites with Green River at a point about 14 miles above Greenriver, Utah. The main source of supply is the snow in the upper reaches of the basin, where elevations range from 8,000 to 9,000 feet. The region is extremely rough and rugged. The predominant rock is a loose and badly disintegrated sandstone. The soil is scanty and supports practically no vegetation except small groves of scrubby cedar and a few scattered pines. The original sparse underbrush and grass have been almost entirely tramped out by sheep and cattle.

The river is subject to floods in the spring and early summer, during which time it carries immense quantities of sediment. Gordon and Pleasant creeks, the principal tributaries, are both short, steep streams and enter from the west almost at right angles.

This gaging station, which was established February 21, 1904, is located on the upper side of the ford, about 3 miles south of Helper, Utah, and 350 feet west of the main line of the Denver and Rio Grande Railroad.

The datum of the original chain gage remained unchanged until washed out by high water April 11, 1907. It was replaced by a temporary gage June 23, 1907, and by a permanent gage July 16, 1907. All gage heights after June 22, 1907, are referred to a new datum 0.7 foot above the original datum. The bed of the stream is composed of fine gravel and sand and shifts slightly, especially during high water, and new rating curves are required each year. The records of discharge are considered fairly good.

Discharge measurements of Price River near Helper, Utah, in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 22	La Rue and Burridge	62	203	4.60	714
July 15	G. T. Burridge	60	143	3.45	224
August 2	do	52	115	3.30	137
August 27	do	47	96	3.15	100
1908.					
March 25	A. D. Williams	42	71	2.95	79.3
July 10	Hoyt and La Rue	40	82	2.78	48.0

Daily gage height, in feet, of Price River near Helper, Utah, for 1907 and 1908.

[John Tyron and Mrs. Rozina Farnsworth, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	3.3	3.3	3.5	3.9			4.1	3.3	3.2	2.9	2.9	2.8
2	3.3	3.3	3.5	4.0			4.0	3.3	3.1	2.9	2.9	2.8
3	3.3	3.3	3.5	4.0			4.0	3.6	3.1	2.9	2.9	2.8
4	3.3	3.5	3.6	4.1			3.9	3.3	3.1	2.9	2.9	2.8
5	3.3	3.5	3.6	4.2			3.9	3.3	3.1	2.9	2.9	2.8
6	3.3	3.5	3.6	4.2			3.8	3.3	3.2	2.9	2.9	2.8
7	3.3	3.5	3.6	4.2			3.8	3.3	3.1	2.9	2.9	2.8
8	3.3	3.3	3.6	4.4			3.8	3.2	3.1	2.9	2.9	2.8
9	3.3	3.3	3.6	4.4			3.7	3.2	3.1	2.9	2.9	2.8
10	3.3	3.6	3.6	4.5			3.6	3.2	3.1	2.9	2.9	2.8
11	3.3	3.6	3.6	4.7			3.6	3.1	2.9	2.9	2.8	2.8
12	3.3	3.5	3.4				3.5	3.1	2.9	2.9	2.8	2.8
13	3.3	3.5	3.4				3.6	3.1	2.9	2.9	2.8	2.8
14	3.3	3.5	3.3				3.5	3.1	2.9	2.9	2.8	2.8
15	3.3	3.5	3.3				3.4	3.1	2.9	2.9	2.8	2.8
16	3.3	3.5	3.3				3.5	3.1	2.9	2.9	2.8	2.8
17	3.3	3.5	3.3				3.5	3.1	2.9	2.9	2.8	2.8
18	3.3	3.5	3.3				3.5	3.1	2.9	2.9	2.8	2.8
19	3.3	3.5	3.4				3.5	3.1	2.9	2.9	2.8	2.8
20	3.3	3.5	3.7				3.5	3.1	2.9	2.9	2.8	2.8
21	3.3	3.5	4.0				3.4	3.0	2.9	2.9	2.8	2.8
22	3.3	3.5	4.0				3.4	2.9	2.9	2.9	2.8	2.9
23	3.3	3.4	4.0			4.6	3.4	3.0	2.9	2.9	2.8	2.9
24	3.3	3.6	4.0			4.3	3.4	3.1	2.9	2.9	2.8	2.9
25	3.3	3.5	3.9			4.3	3.4	4.5	2.9	2.9	2.8	2.9
26	3.3	3.5	3.9			4.3	3.4	3.5	2.9	2.9	2.8	2.9
27	3.6	3.5	3.9			4.2	3.4	3.4	2.9	2.9	2.8	2.9
28	3.6	3.5	3.9			4.2	3.5	3.4	2.9	2.9	2.8	2.8
29	3.6		3.8			4.1	3.4	3.1	2.9	2.9	2.8	2.8
30	3.6		3.7			4.1	3.4	3.6	2.9	2.9	2.8	2.8
31	3.4		3.8				3.3	3.5		2.9		2.8

[a] Gage washed out April 11, 1907, and new gage installed at different datum from previous gage June 23, 1907.

Daily gage height, in feet, of Price River near Helper, Utah, for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	2.8	2.7	2.7	2.9	3.7	3.5	2.9	2.9	2.8	2.7	2.8	2.7
2	2.8	2.7	2.7	2.8	3.5	3.5	2.9	2.9	2.5	2.7	2.8	2.7
3	2.8	2.7	2.7	2.8	3.6	3.4	2.9	2.8	2.5	2.7	2.8	2.7
4	2.8	2.7	2.7	2.95	3.4	3.4	2.9	2.8	2.5	2.8	2.8	2.7
5	2.8	2.7	2.7	3.0	3.4	3.4	2.8	2.8	2.4	2.9	2.8	2.7
6	2.8	2.7	2.7	3.0	3.4	3.4	2.7	2.8	2.4	2.8	2.7	2.7
7	2.8	2.7	2.7	3.9	3.4	3.4	2.7	2.7	2.4	2.8	2.7	2.7
8	2.8	2.7	2.7	3.0	3.5	3.4	2.7	2.7	2.4	2.7	2.7	2.7
9	2.8	2.7	2.7	3.0	3.5	3.4	2.8	2.7	2.4	2.7	2.7	2.7
10	2.8	2.7	2.7	3.0	3.5	3.5	2.8	2.7	2.4	2.7	2.7	2.65
11	2.7	2.7	2.7	3.9	3.5	3.5	2.7	2.7	2.4	2.7	2.7	2.6
12	2.7	2.7	2.7	3.8	3.6	3.4	2.7	2.8	2.4	2.7	2.6	2.6
13	2.7	2.8	2.7	3.9	3.5	3.4	2.7	4.2	2.4	2.7	2.6	2.7
14	2.7	2.9	2.7	3.8	3.5	3.4	2.7	3.1	2.4	2.7	2.6	2.7
15	2.7	2.9	4.8	3.7	3.5	3.4	2.7	2.7	2.4	2.6	2.7	2.7
16	2.7	2.8	4.8	3.7	3.5	3.4	2.7	2.7	2.8	2.6	2.7	2.7
17	2.7	2.7	4.5	3.8	3.6	3.4	2.7	2.8	2.4	2.7	2.7	2.7
18	2.7	2.7	3.0	3.8	3.7	3.4	2.6	2.8	2.8	2.6	2.8	2.7
19	2.7	2.7	3.0	3.8	3.6	3.2	2.6	2.8	2.4	2.6	2.8	2.7
20	2.7	2.7	3.9	3.6	3.6	3.2	2.6	2.7	2.4	2.6	2.8	2.7
21	2.7	2.8	3.8	3.7	3.5	3.1	2.6	2.7	2.5	2.6	2.7	2.6
22	2.7	2.8	3.9	3.6	3.5	3.0	2.6	2.7	2.4	2.6	2.7	2.6
23	2.7	2.8	3.9	3.6	3.5	3.1	2.6	2.7	2.4	2.6	2.7	2.6
24	2.7	2.8	3.9	3.6	3.5	3.1	2.6	2.7	2.4	2.6	2.7	2.6
25	2.7	2.8	3.0	3.8	3.6	3.0	2.6	2.7	2.4	2.6	2.7	2.6
26	2.7	2.7	4.2	3.8	3.7	3.0	2.6	2.6	2.7	2.7	2.7	2.6
27	2.8	2.7	3.0	3.7	3.7	3.0	3.0	2.5	2.8	2.7	2.7	2.6
28	2.7	2.7	3.9	3.8	3.5	3.0	2.75	2.5	2.8	2.7	2.7	2.6
29	2.7	2.7	3.9	3.8	3.5	3.0	3.5	2.5	2.6	2.7	2.7	2.6
30	2.7	.....	3.9	3.7	3.5	3.0	3.1	2.5	2.7	2.7	2.7	2.5
31	2.7	.....	3.9	.....	3.5	.....	3.1	2.4	.....	2.7	.....	2.5

[a] Slight ice conditions during January, February, and December, 1908.

Rating tables for Price River near Helper, Utah.

JANUARY 1, 1905, TO APRIL 11, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	18	3.70	78	4.10	182	4.50	354
3.40	30	3.80	98	4.20	219	4.60	404
3.50	44	3.90	122	4.30	260	4.70	455
3.60	60	4.00	150	4.40	305		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1906. It is well defined.

JUNE 23 TO DECEMBER 31, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	42	3.30	140	3.80	324	4.30	572
2.90	54	3.40	170	3.90	370	4.40	626
3.00	70	3.50	204	4.00	418	4.50	680
3.10	90	3.60	242	4.10	468	4.60	736
3.20	114	3.70	282	4.20	520		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 3 discharge measurements made during 1907 and the form of the average rating curve for this station. It is fairly well defined.

Rating tables for Price River near Helper, Utah—Continued.

1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	7	3.10	113	3.80	371	4.50	735
2.50	14	3.20	140	3.90	418	4.60	790
2.60	23	3.30	170	4.00	467	4.70	850
2.70	35	3.40	204	4.10	518	4.80	910
2.80	50	3.50	242	4.20	570		
2.90	68	3.60	283	4.30	625		
3.00	89	3.70	326	4.40	680		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 2 discharge measurements made during 1908 and the form of earlier curves, and is fairly well defined.

Monthly discharge of Price River near Helper, Utah, for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	60	18	23.8	1,460	D.
February	60	18	40.6	2,250	C.
March	150	18	72.0	4,430	C.
April 1–11	455	122	244	5,320	B.
June 23–30	736	468	554	8,790	B.
July	468	140	242	14,900	C.
August	680	54	141	8,670	A.
September	114	54	67.6	4,020	C.
October	54	54	54.0	3,320	C.
November	54	42	46.0	2,740	C.
December	54	42	44.3	2,720	C.
The period				58,600	
1908.					
January	50	35	40.3	2,480	C.
February	68	35	40.7	2,340	C.
March	910	35	248	15,200	B.
April	418	50	268	15,900	B.
May	326	204	256	15,700	B.
June	242	89	169	10,100	B.
July	242	23	50.9	3,130	A.
August	570	7	56.8	3,490	B.
September	50	7	17.5	1,040	D.
October	68	23	33.6	2,070	C.
November	50	23	37.8	2,250	C.
December	35	14	29.2	1,800	C.
The year	910	7	104	75,500	

NOTE.—No corrections made in discharge on account of ice conditions during 1908. Effect due to ice probably small.

GRAND RIVER DRAINAGE BASIN.

DESCRIPTION.

Grand River and its tributaries drain an area comprising approximately 26,000 square miles, of which 22,290 are in Colorado and the rest in eastern Utah. On the east and southeast the basin is limited by the high ranges of the Continental Divide, which separate it from the basins of Platte and Arkansas rivers; on the north by the White River and Book Cliffs plateaus; on the west by the canyon district of Green River.

Rising among the high peaks of the Rocky Mountains in the north-central portion of Colorado, the Grand flows in a southwesterly direction to its junction with Green River, traversing approximately 350 miles.

The tributaries include Fraser, Blue, Eagle, Williams Fork, Roaring Fork, Gunnison, and Dolores rivers, all of which enter from the south.

In most respects the Grand is a typical mountain stream, flowing throughout its course in a succession of deep canyons, with precipitous and ofttimes perpendicular walls, varying in height up to 3,000 feet above the water's edge, alternating with long, narrow, fertile valleys. The headwater region, comprising approximately 50 per cent of the basin, is extremely rugged, elevations ranging from 7,000 to 14,000 feet. Gradients are steep, stream channels are numerous, and tributaries are rapid, the fall varying from 20 to 150 feet. The intermediate or middle portion of the basin consists largely of broken and scarred plateaus of sedimentary origin. The lower drainage basin, that portion immediately east and west of the Colorado state line, is a dry, broken, much eroded region.

The rocks of the basin range from the granites and masses of igneous origin on the crest of the Continental Divide to the younger and less resistant sedimentaries of the plateau region. The soils of the upper basin, though shallow, generally contain considerable organic matter; those of the intermediate basin are largely decomposed and disintegrated sedimentary rocks; in the lower basin the soils consist of adobe clays and sandy loams, which grade imperceptibly from one to the other. The scant vegetation of the lower basin renders soil erosion large.

The precipitation ranges from 5 to 10 inches in the lower basin, 10 to 20 inches in the intermediate region, and 20 to 30 inches in the headwater region. By far the greater part of this is in the form of snow.

Notwithstanding heavy inroads, the forestation of the mountainous part of the basin, except in a few localities, is good—the equal of any in Colorado. The forest covering consists of spruce, quaking asp, cedar, and piñon. The intermediate basin is fairly well forested with quaking asp, cedar, and piñon. The forestation of the lower basin is poor, consisting of scattered pine, cedar, and piñon. The prevailing vegetation is sage brush, chico, and cactus pads.

The greater part of the timbered area in the Grand River basin above the Gunnison is included in the Arapahoe and Holy Cross National Forest. In these reserves in the Grand drainage basin there are about 1,400 square miles of merchantable timber land, 900 square miles of woodland, and about 800 square miles of burned area.

Extensive meadow lands are comprised within the upper basin. In the middle basin, or from the lower end of Gore Canyon to about Rifle, there are in contemplation about half a dozen small projects, which

will irrigate 30,000 to 35,000 acres. In the lower basin the Reclamation Service has under way the Grand Valley project, to cover an irrigable area of 60,000 to 70,000 acres. Under other schemes from 40,000 to 50,000 acres more will be irrigated. The Uncompahgre Valley project, which diverts water from the Gunnison, has finished structures capable of irrigating about 50,000 acres. The completed project will irrigate about 150,000 acres.

Natural storage within the basin is limited to a few high mountain lakes, of which Grand Lake is the largest. There are, however, reservoir sites along the Grand and its tributaries, which if utilized would make possible a development of 1,000,000 horsepower. The Kremmling reservoir site is by far the best in the drainage. It is located near the upper end of Gore Canyon, and with a 230-foot dam, water to the extent of about 2,200,000 acre-feet could be impounded. A standard-gage railroad now runs through this site.

Until recently the splendid power resources of this drainage basin have remained practically untouched. The estimated power which can be developed, including Dolores and Gunnison rivers, is as follows:

Minimum horsepower	540,000
Minimum horsepower (6 high months)	1,000,000
Horsepower from storage (6 months' period)	1,600,000

Of this amount less than 40,000 horsepower has so far been developed. With its numerous large tributaries, rising at high elevations, this stream affords more favorable opportunities for power development than any in Colorado.

Hot sulphur springs are located along the Grand River at two points—at Sulphur Springs, Colo., and at Glenwood Springs, Colo., and in both localities they increase the temperature of the river water. Their combined flow is probably less than 20 second-feet.

The years of maximum run-off in this drainage basin were 1897 and 1907; of the minimum run-off since records were begun—1902.

Fraser, Eagle, Williams, and Roaring forks and Gunnison River are described in connection with gaging stations now maintained. The importance of Dolores River entitles it to the following brief description, although measurements have been discontinued.

The Dolores rises in the La Plata and San Miguel mountains, whose highest peak, Mount Wilson, attains an elevation of over 14,000 feet. Its course is southwesterly for about 50 miles, when it turns and flows almost due northerly for nearly 100 miles, when it again turns to the west and enters Grand River about 15 miles west of the Colorado-Utah line. For the greater part of its course the river flows through deep canyons, and comparatively little irrigation is practiced along the stream itself. In the vicinity of Dolores, however, the valley broadens, and for about 40 miles has a width of one-half mile

to a mile. A considerable part of this area is cultivated. In the Paradox Valley, also, considerable land is cultivated, chiefly from small tributaries running into the main stream. By far the greater part of Dolores River water is used for irrigation in the San Juan drainage, being diverted by means of a tunnel and a great cut into the Montezuma Valley.

San Miguel River, the most important tributary of the Dolores, rises in San Miguel County, Colo., and drains an area immediately west of the headwaters of the Uncompahgre River, and enters the Dolores about 12 miles east of the Colorado-Utah line at an elevation of about 5,000 feet. The stream and its tributaries run for the most part in a northeasterly direction. Considerable land along the San Miguel has been irrigated and plans for increased development have been made. Probably 600 square miles of the Dolores River basin are covered with merchantable timber and as much more is woodland. The total area of this basin is about 4,500 square miles.

The mean annual run-off of Dolores River above the mouth of the San Miguel is nearly 400,000 acre-feet, while the San Miguel furnishes at least half that amount.

The basin contains several small storage reservoir sites, a few of which have been developed, both for power and irrigation. Theoretically, by utilizing storage it would be possible to develop from 75,000 to 100,000 horsepower in the Dolores drainage. The river has an average fall of over 20 feet per mile throughout almost its whole course, while a great stretch of the San Miguel averages over 50 feet to the mile. Several water-power plants are in operation along the upper San Miguel and its tributaries, the development aggregating nearly 10,000 horsepower, of which about 7,500 horsepower is developed at the Ames, the Howards Fork, and the Illium plants of the Telluride Power Company. One plant on Bridal Veil Creek is utilizing a head of 2,000 feet to develop 1,200 horsepower.

The following gaging stations have been maintained in the Grand River drainage basin:

North Fork of Grand River near Grand Lake Colo., 1904–1908.
Grand River near Granby, Colo., 1908.
Grand River at Sulphur Springs, Colo., 1904–1908.
Grand River near Kremmling, Colo., 1904–1908.
Grand River near Wolcott, Colo., 1906–1907.
Grand River at Glenwood Springs, Colo., 1899–1908.
Grand River near Palisades, Colo., 1902–1908.
Grand River near Grand Junction, Colo., 1895–1900.
North Inlet to Grand Lake at Grand Lake, Colo., 1905–1908.
Grand Lake Outlet at Grand Lake, Colo., 1904–1908.
Fraser River at Granby (Coulter), Colo., 1904–1908.
Williams Fork near Sulphur Springs, Colo., 1904–1908.
Troublesome River at Troublesome, Colo., 1904–1905.
Muddy River at Kremmling, Colo., 1904–1905.

Blue River near Kremmling, Colo., 1904–1908.
Tenmile Creek near Kokomo, Colo., 1904.
Tenmile Creek near Uneva Lake, Colo., 1903.
Eagle River near Eagle, Colo., 1905–1906.
Eagle River at Gypsum, Colo., 1907–1908.
Roaring Fork near Emma, Colo., 1908.
Roaring Fork at Glenwood Springs, Colo., 1906–1908.
Frying Pan River at Basalt, Colo., 1908.
Crystal River near Carbondale (Sewell), Colo., 1908.
Gunnison River near Iola, Colo., 1900–1903.
Gunnison River near Cimarron, Colo., 1903–1905.
Gunnison River at River Portal (east portal of Gunnison tunnel), Colo., 1905–1908.
Gunnison River near Cory, Colo., 1903–1905.
Gunnison River at Whitewater, Colo., 1897, 1902–1906.
Gunnison River near Grand Junction, Colo., 1895, 1897–1899.
Taylor River near Almont, Colo., 1905.
East River at Almont, Colo., 1905.
Cimarron Creek at Cimarron, Colo., 1903–1905.
North Fork of Gunnison River near Hotchkiss, Colo., 1903–1906.
Uncompahgre River near Colona, Colo., 1903–1906.
Uncompahgre River at Fort Crawford, Colo., 1895–99, 1908.
Uncompahgre River at Montrose, Colo., 1903–1908.
Uncompahgre River near Delta, Colo., 1903–1908.
Dolores River near Dolores, Colo., 1895–1903.
San Miguel River near Fall Creek, Colo., 1895–1899.

NORTH FORK OF GRAND RIVER NEAR GRAND LAKE, COLO.

This station, which was established July 29, 1904, to obtain data for use in connection with power development and for general run-off studies, is located at the highway bridge on the road between Grand Lake and Granby, and is about 3 miles southwest of Grand Lake post-office, Colo. The nearest railroad is the Denver, Northwestern and Pacific, at Granby, Colo., distant about 12 miles.

It is located about 2 miles above Grand Lake outlet, which is the most important tributary of the North Fork.

One large ditch above the station diverts water into the headwaters of the Cache la Poudre, in the South Platte drainage basin.

Winter records at this station are more satisfactory than at the other stations on the headwaters of the Grand, as near-by springs tend to keep the stream at the gaging station more or less open.

The location and datum of the staff gage, which is at the bridge, have remained unchanged during the maintenance of the station.

Fairly good results have been obtained at this station. Because of the sluggish condition of the stream at low stages, measurements taken at such times are not entirely satisfactory.

Discharge measurements of North Fork of Grand River near Grand Lake, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 23	C. L. Chatfield	60	171	5.40	706
July 20	do	55	115	4.70	344
August 13	do	40	82	4.10	136
October 2	Freeman and Stewart	39	65	3.73	61
November 26 [a]	J. B. Stewart	38	42	3.27	14
1908.					
January 29 [b]	J. B. Stewart	38	49	3.30	16
February 26 [b]	do	38	49	3.29	18.6
May 20	C. L. Chatfield	54	116	4.60	263
June 11	do	54	120	4.68	273
July 3	Hoyt and Freeman	50	101	4.45	219
July 27	C. L. Chatfield	40	81	3.98	92
August 17	do	40	79	4.00	98
September 17	do	44	79	3.63	36
October 22	do	44	76	3.50	20
November 23 [c]	do	38	53	3.40	23
December 21 [d]	do	32	53	4.10	15

[a] Measurement affected by ice conditions.
[b] Stream open at bridge but frozen over 20 feet below.
[c] Wading measurement.
[d] Measurement through ice.

Daily gage height, in feet, of North Fork of Grand River near Grand Lake, Colo., for 1907 and 1908.

[Harry W. Carr, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907. [a]												
1	3.40	3.35	3.35	3.58	3.80	4.48	6.00	4.42	3.78	3.70	3.55	3.25
2	3.40	3.35	3.35	3.62	3.85	4.80	6.00	4.40	3.80	3.65	3.60	3.30
3	3.40	3.35	3.35	3.65	3.78	4.80	5.95	4.35	3.75	3.65	3.55	3.35
4	3.40	3.35	3.35	3.68	3.90	4.90	6.00	4.55	3.72	3.70	3.58	3.20
5	3.40	3.38	3.35	3.70	3.90	5.20	6.00	4.48	3.70	3.70	3.55	3.20
6	3.40	3.32	3.35	3.70	3.90	5.25	5.90	4.42	3.70	3.70	3.52	3.20
7	3.40	3.30	3.35	3.62	3.92	5.10	5.95	4.32	3.70	3.80	3.50	3.20
8	3.40	3.30	3.35	3.60	3.92	5.08	5.80	4.22	3.70	3.80	3.50	3.20
9	3.40	3.30	3.35	3.70	4.00	5.08	5.78	4.20	3.70	3.72	3.50	3.20
10	3.40	3.30	3.35	3.85	4.08	4.95	5.62	4.15	3.68	3.70	3.52	3.28
11	3.40	3.30	3.35	4.10	4.22	4.98	5.35	4.15	3.62	3.70	3.52	3.30
12	3.40	3.30	3.35	4.05	4.50	5.20	5.25	4.15	3.60	3.65	3.40	3.28
13	3.40	3.30	3.35	4.25	4.40	5.45	5.15	4.10	3.60	3.65	3.52	3.30
14	3.40	3.30	3.35	4.32	4.15	5.70	5.20	4.08	3.92	3.60	3.35	3.30
15	3.40	3.40	3.35	4.45	4.12	5.75	5.02	4.00	3.78	3.60	3.38	3.30
16	3.40	3.35	3.35	4.40	4.10	5.80	4.90	3.95	3.72	3.60	3.30	3.25
17	3.40	3.35	3.35	4.25	4.22	5.78	4.82	3.90	3.70	3.60	3.30	3.25
18	3.40	3.35	3.35	4.15	4.48	5.80	4.75	3.95	3.65	3.60	3.30	3.38
19	3.40	3.35	3.35	3.95	4.55	5.90	4.60	4.00	3.65	3.60	3.30	3.25
20	3.40	3.35	3.42	3.90	4.82	5.85	4.58	3.98	3.62	3.60	3.28	3.25
21	3.40	3.35	3.48	3.82	5.02	5.50	4.58	3.90	3.60	3.58	3.25	3.25
22	3.40	3.35	3.52	3.88	5.10	5.45	4.60	3.85	3.60	3.55	3.22	3.25
23	3.35	3.35	3.58	3.95	5.05	5.75	4.62	3.80	3.55	3.55	3.30	3.25
24	3.35	3.35	3.75	3.95	5.05	5.85	4.60	3.80	3.55	3.55	3.30	3.25
25	3.35	3.35	3.75	3.90	4.90	5.85	4.58	3.90	3.52	3.55	3.25	3.25
26	3.35	3.35	3.72	3.98	4.68	5.85	4.65	3.90	3.68	3.55	3.30	3.25
27	3.35	3.38	3.75	4.08	4.62	5.85	4.90	3.88	3.72	3.55	3.30	3.25
28	3.35	3.35	3.68	4.10	4.58	5.90	4.80	3.82	3.65	3.55	3.30	3.28
29	3.35	.....	3.70	4.10	4.55	5.95	4.65	3.80	3.55	3.55	3.30	3.30
30	3.35	.....	3.62	3.92	4.52	6.00	4.55	3.80	3.65	3.55	3.30	3.30
31	3.35	.....	3.68	.....	4.50	.....	4.50	3.75	.....	3.55	.....	3.30

[a] Ice conditions probably prevailed during the greater part of January, February, and March and from about November 12 to December 31, 1907. In some cases morning readings were affected by ice and afternoon readings were used.

Daily gage height, in feet, of North Fork of Grand River near Grand Lake, Colo., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	3.3	3.4	3.3	3.35	3.9	4.4	4.5	4.15	3.7	3.6	3.4	3.6
2	3.35	3.4	3.45	3.45	4.0	4.35	4.5	4.0	3.7	3.6	3.45	3.95
3	3.3	3.3	3.6	3.4	4.1	4.4	4.5	4.0	3.7	3.6	3.45	3.4
4	3.3	3.3	3.3	3.4	4.0	4.65	4.5	3.95	3.7	3.6	3.5	3.4
5	3.3	3.3	3.3	3.4	3.9	4.7	4.6	3.95	3.7	3.6	3.4	.....
6	3.3	3.35	3.4	3.5	4.05	4.7	4.5	3.95	3.7	3.6	3.4	3.4
7	3.35	3.3	3.6	3.45	4.1	4.55	4.4	4.0	3.65	3.6	3.4	.....
8	3.3	3.3	3.55	3.55	4.3	4.5	4.4	3.9	3.65	3.6	3.4	3.4
9	3.3	3.35	3.5	3.6	4.2	4.5	4.4	3.85	3.65	3.55	3.4	.....
10	3.3	3.3	3.6	3.7	4.2	4.65	4.35	3.9	3.65	3.55	3.4	3.4
11	3.3	3.3	3.45	4.0	4.1	4.7	4.4	4.4	3.65	3.55	3.45	.....
12	3.3	3.3	3.5	4.05	4.1	4.95	4.35	4.4	3.65	3.55	3.45	3.4
13	3.3	3.35	3.3	4.1	4.05	4.7	4.3	4.25	3.75	3.55	3.95	3.4
14	3.3	3.35	3.3	4.15	4.0	4.85	4.3	4.1	3.8	3.55	4.05	.....
15	3.3	3.3	3.3	4.2	4.0	5.0	4.5	4.0	3.7	3.55	3.9	3.4
16	3.4	3.3	3.3	4.15	4.15	5.0	4.3	4.0	3.7	3.55	3.7	.....
17	3.3	3.35	3.3	4.1	4.2	5.0	4.3	3.95	3.65	3.55	3.75	3.35
18	3.3	3.35	3.3	4.1	4.3	4.85	4.2	3.9	3.6	3.55	3.75	.....
19	3.3	3.3	3.35	4.2	4.5	4.6	4.15	4.1	3.6	3.55	3.75	3.4
20	3.3	3.35	3.55	4.2	4.6	4.8	4.1	4.1	3.55	3.5	3.75	.....
21	3.3	3.35	3.5	4.2	4.4	4.95	4.1	4.1	3.55	3.5	3.8	4.1
22	3.3	3.4	3.4	4.3	4.3	5.0	4.05	4.1	3.55	3.45	3.5	.....
23	3.3	3.35	3.35	4.25	4.3	5.0	4.05	4.0	3.55	3.45	3.4	3.35
24	3.3	3.3	3.4	4.1	4.35	4.85	4.05	4.0	3.55	3.4	3.7	.....
25	3.3	3.3	3.35	4.05	4.35	4.85	4.0	3.9	3.55	3.4	3.8	3.35
26	3.3	3.3	3.35	3.9	4.35	4.85	4.0	3.85	3.55	3.4	3.5	.....
27	3.4	3.4	3.3	4.0	4.35	4.8	4.0	3.8	3.55	3.6	3.75	3.35
28	3.3	3.5	3.3	3.95	4.3	4.7	4.0	3.8	3.55	3.6	3.7	.....
29	3.3	3.3	3.5	3.9	4.3	4.6	4.0	3.8	3.6	3.5	3.5	3.35
30	3.3	.....	3.3	3.9	4.3	4.55	4.1	3.8	3.6	3.45	3.4	.....
31	3.3	.....	3.3	.....	4.3	.....	4.35	3.7	.....	3.4	.....	3.35

[a] Ice conditions probably prevailed during the greater part of January, February, and March and from about November 13 to December 31, 1908.

Rating tables for North Fork of Grand River near Grand Lake, Colo.

JANUARY 1, 1907, TO APRIL 10, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	10	4.00	105	4.70	347	5.40	702
3.30	16	4.10	130	4.80	390	5.30	767
3.40	24	4.20	160	4.90	434	5.60	834
3.50	33	4.30	194	5.00	479	5.70	902
3.60	43	4.40	230	5.10	528	5.80	970
3.70	55	4.50	267	5.20	582	5.90	1,040
3.80	69	4.60	306	5.30	640	6.00	1,110
3.90	85						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 5 discharge measurements made during 1907 and the form of previous curves. It is well defined.

APRIL 11 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.40	12	3.90	77	4.30	165	4.70	304
3.50	20	4.00	95	4.40	195	4.80	343
3.60	32	4.10	116	4.50	230	4.90	383
3.70	45	4.20	140	4.60	266	5.00	425
3.80	59						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1908 and the form of the 1907 curve and is well defined.

Monthly discharge of North Fork of Grand River near Grand Lake, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.[a]					
January	24	20	22.8	1,400	D.
February	24	16	19.1	1,060	D.
March	62	20	31.1	1,910	C.
April	248	41	104	6,190	A.
May	528	66	235	14,400	A.
June	1,110	260	764	45,500	A.
July	1,110	267	603	37,100	A.
August	286	62	132	8,120	A.
September	89	35	52.3	3,110	A.
October	69	38	46.6	2,870	A.
November	43	13	24.4	1,450	D.
December	22	10	13.9	855	D.
The year	1,110	10	171	124,000	
1908.[b]					
January	24	16	16.8	1,030	D.
February	33	16	18.9	1,090	D.
March	43	16	24.3	1,490	D.
April	165	20	87.7	5,220	A.
May	266	77	145	8,920	A.
June	425	179	319	19,000	A.
July	266	95	162	9,960	A.
August	195	45	96.3	5,920	A.
September	59	26	36.5	2,170	A.
October	32	12	24.6	1,510	B.
November	.....	.....	16.4	976	D.
December	.....	.....	15.2	935	D.
The year	.....	.....	80.2	58,200	

[a] The open channel rating was applied throughout 1907. The error in second-feet due to ice conditions is relatively small, but the percentage error may be great.

[b] The open channel rating was applied during January to March, 1908. See above footnote 1907. Ice conditions November 13 to December 31, 1908, and discharge estimated.

GRAND RIVER NEAR GRANBY, COLO.

This station was established June 10, 1908, by the Central Colorado Power Company, to obtain data for determining the flow of the South Fork in connection with storage and power development. It was taken over as a United States Geological Survey station on July 1, 1908. The gage is located at a highway bridge, which crosses the river about 4 miles from Granby on the road to Grand Lake. Measurements are made by means of a cable equipment located 300 feet downstream from the bridge.

It is about 4 miles below the junction of North and South forks, about the same distance above the mouth of Fraser River, and is above the mouth of Willow Creek. The drainage area is about 500 square miles.

No important diversions are made on the South Fork or on the main stream above the station. This stream affords excellent storage possibilities. Several filings for power development have been made above this station, but additional opportunities for filing no doubt exist. A small power plant is located on a tributary of the South Fork.

Thick ice covers the river for about four months each year, and anchor ice also occurs.

The location and datum of the gage have remained unchanged during the maintenance of the station.

Discharge measurements of Grand River near Granby, Colo., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 12	C. L. Chatfield	110	312	3.90	1,380
July 2	Hoyt and Freeman	102	225	3.00	732
July 26	C. L. Chatfield	95	146	2.30	304
August 16	do	100	172	2.50	419
September 16	do	90	113	1.75	147
October 20 [a]	W. H. Snelson, jr	85	88	1.50	105
October 21 [a]	C. L. Chatfield	85	94	1.50	84
October 23 [a]	do	85	96	1.47	82
November 22 [b]	do	60	42	1.55	72
December 20 [b]	do	35	38	2.10	51

[a] Wading measurement at cable section.
[b] Wading measurement below bridge. River frozen at cable.

Daily gage height, in feet, of Grand River near Granby, Colo., for 1908.

[J. P. Switzer, observer.]

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.05	2.8	1.9	1.6	1.5	1.7	16	3.85	2.85	2.5	1.8	1.5	1.45	2.1
2	.....	3.05	2.65	1.9	1.6	1.45	1.65	17	3.9	2.8	2.4	1.8	1.5	1.4	2.2
3	.....	3.05	2.6	1.85	1.6	1.45	1.8	18	3.8	2.65	2.4	1.65	1.5	1.4	2.15
4	.....	3.1	2.5	1.75	1.6	1.45	1.8	19	3.4	2.55	2.4	1.6	1.5	1.3	2.15
5	.....	3.1	2.4	1.7	1.6	1.45	1.8	20	3.45	2.5	2.4	1.6	1.5	1.3	2.15
6	.....	3.1	2.3	1.7	1.6	1.45	1.8	21	3.7	2.45	2.5	1.6	1.5	1.4	2.15
7	.....	3.05	2.3	1.7	1.6	1.45	1.6	22	3.95	2.4	2.6	1.6	1.5	1.4	2.2
8	.....	3.05	2.25	1.7	1.6	1.45	1.8	23	3.9	2.4	2.6	1.6	1.5	1.4	2.25
9	.....	3.0	2.1	1.7	1.6	1.45	1.75	24	3.75	2.4	2.6	1.55	1.5	1.35	2.3
10	3.4	3.0	2.1	1.7	1.6	1.45	1.8	25	3.75	2.3	2.45	1.5	1.5	1.55	2.3
11	3.5	2.95	2.5	1.7	1.6	1.4	1.9	26	3.65	2.3	2.3	1.55	1.5	1.55	2.2
12	3.85	2.95	2.9	1.7	1.55	1.35	1.9	27	3.7	2.3	2.2	1.6	1.5	1.3	2.2
13	3.7	2.9	2.8	1.7	1.5	1.4	1.95	28	3.5	2.3	2.2	1.6	1.45	1.55	2.25
14	3.65	2.9	2.7	1.8	1.5	1.4	1.85	29	3.35	2.3	2.1	1.6	1.45	1.6	2.3
15	3.8	2.95	2.6	1.8	1.5	1.5	2.15	30	3.3	2.55	2.0	1.6	1.5	1.7	2.2
								31	.....	2.8	1.95	.....	1.5	.....	2.25

NOTE.—Ice conditions November 21 to December 31.

Rating table for Grand River near Granby, Colo., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	54	2.00	207	2.70	515	3.40	995
1.40	70	2.10	240	2.80	575	3.50	1,070
1.50	88	2.20	276	2.90	640	3.60	1,150
1.60	108	2.30	316	3.00	710	3.70	1,230
1.70	130	2.40	359	3.10	780	3.80	1,310
1.80	153	2.50	406	3.20	850	3.90	1,390
1.90	178	2.60	458	3.30	920	4.00	1,475

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on eight discharge measurements made during 1908 and is well defined.

Monthly discharge of Grand River near Granby, Colo., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
June 10-30	1,430	920	1,200	50,000	A.
July	780	316	559	34,400	A.
August	640	192	380	23,400	A.
September	178	88	127	7,560	B.
October	108	79	94.8	5,830	B.
November	88	54	71.1	4,230	C.
December	70	50	55.6	3,420	C.
The period				129,000	

NOTE.—Ice conditions and discharge estimated November 21 to December 31.

GRAND RIVER AT SULPHUR SPRINGS, COLO.

This station was originally established July 27, 1904, at the highway bridge one-eighth mile below Sulphur Springs. On April 17, 1906, it was moved to the new highway bridge, about 1,000 feet above the old location, and a standard chain gage was installed. This gage has no determined relation to the old gage. The data obtained are used to check up the results at other stations on Grand River and its tributaries, and also to determine the flow of some of the smaller tributaries.

The Grand is joined by Fraser River about 10 miles above Sulphur Springs, and by Williams Fork a few miles below. The drainage area at the station is about 950 square miles.

A number of small private ditches divert water for meadow irrigation along the principal tributaries above the station and along the Grand. A number of large diversion ditches are located in the lower drainage basin. Filings for power development are numerous from source to mouth, but it is probable that a large amount of this water would still be available for appropriation for irrigation.

The river at the station freezes across for about four months each year, the ice sometimes reaching a depth of 2 feet. No artificial control is used.

On account of unfavorable measuring conditions during the winter months at the regular section, temporary gages have been maintained in a canyon one-quarter mile below, where the river is open and where measurements can be made by wading. A temporary gage was used from January 25 to March 17, 1908, and another, 200 feet nearer the regular station, from November 25 to December 20, 1908. From April 1 to 16, 1908, an old staff gage was read by the observer instead of the chain gage. Gage heights for this period have been adjusted to refer to the chain-gage datum. Beginning December 22, 1908, readings were resumed at the chain gage by gaging through a hole cut in the ice.

The accuracy of the results obtained at this station is affected to a certain extent by a bend in the river above the station, the bridge pier, and by ice conditions.

Discharge measurements of Grand River at Sulphur Springs, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	C. L. Chatfield	112	261	2.90	1,020
April 26	do	106	202	2.40	533
May 28	W. B. Freeman	131	397	3.98	2,120
June 21	C. L. Chatfield	289	773	5.85	4,640
July 18	do	132	395	4.10	1,890
August 10	do	111	231	2.60	710
September 30	Freeman and Stewart	107	145	1.87	259
1908.					
January 15 [a]	R. I. Meeker	45	40	.....	101
January 25 [a]	J. B. Stewart	44	65	.....	94
January 26 [a]	do	51	49	[b] 1.13	100
February 22 [a]	C. L. Chatfield	50	47	[b] 1.05	76
February 28 [a]	J. B. Stewart	60	63	[b] 1.05	89
March 17 [a]	C. L. Chatfield	65	77	[b] 1.35	161
April 17	do	104	210	2.45	569
May 25	do	112	298	3.31	1,140
June 13	do	121	447	4.47	2,170
July 4	Hoyt and Freeman	114	288	3.35	1,090
July 25	C. L. Chatfield	106	190	2.35	485
July 29	do	106	179	2.20	434
August 15	do	111	217	2.60	617
September 18	do	98	126	1.75	198
October 20	do	98	119	1.65	166
November 24 [c]	do	56	120	1.50	120
December 22 [a]	do	29	66	[d] 2.25	109

[a] Wading measurement in canyon. Frozen at regular section.
[b] Temporary gage one-fourth mile below regular section. Gage washed out during the measurement on March 17, 1908.
[c] Frozen at regular section. Wading 600 feet above bridge. Current full of slush ice.
[d] Temporary gage in canyon, about 200 feet above gage used January to March, 1908. Chain gage at regular section read 3.20 feet.

Daily gage height, in feet, of Grand River at Sulphur Springs, Colo., for 1907 and 1908.

[E. L. Chatfield, jr., observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov.	Dec.
1907.[a]												
1				2.00	2.62	3.65	6.05	3.48	2.18	1.98	1.68	.....
2				2.12	2.48	4.05	6.02	3.35	2.12	2.00	1.70	.....
3				2.45	2.48	4.95	5.95	3.18	2.00	2.05	1.78	.....
4				2.38	2.58	4.75	5.92	3.32	1.95	1.98	1.80	.....
5				2.18	2.52	5.30	5.82	3.35	2.00	2.05	1.82	.....
6				2.20	2.55	5.75	5.70	3.32	1.92	2.08	1.80	.....
7				2.00	2.62	5.55	5.62	3.18	1.90	2.00	1.80	.....
8				2.12	2.68	5.45	5.55	3.10	1.98	1.90	1.72	.....
9				2.37	2.62	5.38	5.45	2.58	1.92	1.82	1.68	.....
10				2.77	2.75	5.05	5.42	2.48	1.88	1.88	1.80	.....
11				3.07	3.00	5.05	5.38	2.38	1.82	1.82	1.80	.....
12				3.17	3.40	5.15	4.85	2.42	1.78	1.88	1.82	.....
13				3.07	3.40	5.85	4.75	2.60	1.75	1.82	.....	.....
14				3.07	3.20	5.95	5.20	2.58	1.78	1.82	.....	.....
15				3.42	3.12	6.00	4.75	2.50	1.82	1.85	.....	.....
16				3.52	3.10	6.22	4.32	2.45	1.78	1.90	.....	.....
17				3.12	3.18	6.00	4.20	2.42	1.80	1.92	.....	.....
18				3.07	3.20	6.05	4.00	2.42	1.78	1.92	.....	.....
19				3.82	3.50	6.28	3.85	2.40	1.75	1.98	.....	.....
20				3.27	4.45	6.05	3.90	2.35	1.68	2.08	.....	.....
21				2.37	4.50	5.85	3.78	2.38	1.65	2.12	.....	.....
22				2.42	4.85	5.90	3.82	2.42	1.68	2.02	.....	.....
23				2.47	4.75	5.75	3.72	2.22	1.62	2.10	.....	.....
24				2.42	5.22	5.55	3.72	2.18	1.65	2.18	.....	.....
25			2.68	2.37	4.75	6.05	3.78	2.18	1.60	2.28	.....	.....

[a] Ice conditions prevailed from about January 1 to March 24, and November 13 to December 31, 1907.

Daily gage height, in feet, of Grand River at Sulphur Springs, Colo., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26			2.55	2.44	4.55	5.05	3.88	2.12	1.82	2.08		
27			2.25	2.58	4.05	5.95	4.25	2.18	1.75	1.72		
28			2.02	2.82	4.05	5.85	4.08	2.18	1.85	1.58		
29			1.85	2.75	3.95	5.75	3.88	2.18	1.98	1.55		
30			1.80	2.68	3.95	5.95	3.80	2.20	1.92	1.70		
31			1.88		3.80		3.68	2.20		1.72		
1908.[a]												
1		1.1		2.4	2.4	3.2	3.4	2.9	2.0	1.75	1.6	2.0
2			1.0	2.45	2.35	3.25	3.4	2.7	1.95	1.7	1.6	2.0
3		1.05		2.3	2.45	3.5	3.3	2.6	1.9	1.7	1.55	2.1
4			1.05	2.2	2.5	3.95	3.3	2.5	1.8	1.75	1.6	2.1
5		1.0		2.25	2.4	4.0	3.3	2.4	1.8	1.75	1.55	2.15
6			1.1	2.25	2.3	4.0	3.25	2.3	1.8	1.7	1.5	2.1
7		1.0		2.2	2.3	3.95	3.2	2.3	1.8	1.7	1.5	2.2
8			1.05	2.25	2.75	3.8	3.15	2.25	1.75	1.7	1.5	2.3
9		1.05		2.25	2.9	3.6	3.1	2.2	1.8	1.7	1.5	2.4
10			1.05	2.3	2.85	3.95	3.05	2.2	1.85	1.7	1.5	2.4
11		1.0		2.3	2.65	4.35	3.0	2.3	1.8	1.6	1.55	2.35
12			1.1	2.35	2.6	4.8	3.0	2.9	1.8	1.6	1.5	2.4
13		1.0		2.35	2.55	4.5	3.0	2.8	1.9	1.7	1.4	2.3
14			1.2	2.4	2.55	4.4	3.05	2.7	1.9	1.6	1.55	2.3
15		.95		2.4	2.5	4.6	3.1	2.6	1.9	1.6	1.7	2.25
16			1.3	2.45	2.5	4.75	3.05	2.55	1.85	1.6	1.7	2.2
17		1.0	1.35	2.45	2.85	4.8	2.8	2.4	1.8	1.65	1.75	2.2
18				2.45	3.0	4.5	2.65	2.35	1.75	1.6	1.75	2.2
19		1.0	1.7	2.5	3.2	4.0	2.65	2.4	1.7	1.65	1.7	2.2
20				2.5	3.5	3.8	2.55	2.5	1.7	1.6	1.7	2.2
21		1.0	1.8	2.6	3.3	4.25	2.5	2.5	1.7	1.6	1.7	[b]
22		1.05		2.6	3.1	4.5	2.5	2.5	1.7	1.6	1.65	2.25
23		1.0	1.9	2.55	3.05	4.55	2.5	2.6	1.7	1.55	1.7	3.3
24				2.55	3.15	4.4	2.5	2.5	1.6	1.6	1.65	3.1
25		.95	2.0	2.6	3.25	4.3	2.4	2.4	1.65	1.7	2.4	2.9
26	1.15			2.5	3.25	4.15	2.3	2.3	1.7	1.6	2.35	3.0
27		.95	2.1	2.5	3.1	4.1	2.35	2.25	1.7	1.6	2.3	2.8
28	1.1	1.05		2.4	3.1	4.05	2.3	2.2	1.7	1.6	2.15	2.8
29		1.0	2.25	2.25	3.1	3.7	2.25	2.1	1.7	1.6	2.1	2.7
30	1.1			2.35	2.95	3.6	2.2	2.1	1.75	1.6	2.15	2.3
31			2.4		3.05		2.95	2.05		1.6		2.6

[a] Temporary gages in canyon used January 26–March 16 and November 25–December 20, 1908. Gage heights estimated March 19–31. Ice conditions prevailed at the regular gage from about January 1 to the middle of March and from about November 15 to Dec. 31, 1908.

[b] Ice jam at regular station.

Rating tables for Grand River at Sulphur Springs, Colo.

APRIL 17, 1906, TO JUNE 15, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	280	2.80	905	3.80	1,960	4.80	3,400
1.90	325	2.90	990	3.90	2,090	4.90	3,550
2.00	375	3.00	1,080	4.00	2,220	5.00	3,700
2.10	430	3.10	1,175	4.10	2,360	5.20	4,000
2.20	490	3.20	1,275	4.20	2,500	5.40	4,310
2.30	550	3.30	1,375	4.30	2,650	5.60	4,630
2.40	615	3.40	1,480	4.40	2,800	5.80	4,950
2.50	680	3.50	1,590	4.50	2,950	6.00	5,270
2.60	750	3.60	1,710	4.60	3,100	6.20	5,590
2.70	825	3.70	1,830	4.70	3,250		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on nine discharge measurements made during 1906–7.

JUNE 16 TO AUGUST 31, 1907.

[The indirect method for shifting channels used.]

Rating tables for Grand River at Sulphur Springs, Colo.—Continued.

SEPTEMBER 1 TO NOVEMBER 12, 1907, AND MARCH 18 TO NOVEMBER 14, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	92	2.40	528	3.40	1,211	4.40	2,159
1.50	119	2.50	586	3.50	1,290	4.50	2,270
1.60	150	2.60	648	3.60	1,373	4.60	2,385
1.70	185	2.70	712	3.70	1,459	4.70	2,505
1.80	226	2.80	778	3.80	1,548	4.80	2,631
1.90	271	2.90	846	3.90	1,642	4.90	2,763
2.00	320	3.00	916	4.00	1,740	5.00	2,900
2.10	370	3.10	987	4.10	1,841		
2.20	421	3.20	1,060	4.20	1,944		
2.30	473	3.30	1,134	4.30	2,050		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on thirteen discharge measurements made during period, July, 1907 to November, 1908, and is well defined.

JANUARY 26 TO MARCH 17, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.95	63	1.10	93	1.30	147	.....	.....
1.00	72	1.20	118	1.40	180	.....	.....

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during winter 1907–8 and is applicable to gage heights at temporary gage in canyon. It is fairly well defined.

NOVEMBER 25 TO DECEMBER 22, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	99	2.20	106	2.30	112	2.40	120
2.10	102						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on two discharge measurements made during winter 1908–9, and is applicable to gage heights at temporary gage in canyon. It is not well defined.

Daily discharge, in second-feet, of Grand River at Sulphur Springs, Colo., June 16 to August 31, 1907.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1	.....	4,670	1,340	11	.....	3,620	570	21	4,640	1,600	543
2	.....	4,630	1,240	12	.....	2,900	590	22	4,660	1,630	564
3	.....	4,530	1,100	13	.....	2,740	700	23	4,450	1,550	452
4	.....	4,440	1,220	14	.....	3,320	685	24	4,170	1,550	425
5	.....	4,300	1,240	15	.....	2,740	630	25	4,770	1,600	425
6	.....	4,140	1,220	16	5,540	2,170	592	26	4,770	1,700	391
7	.....	3,990	1,120	17	5,120	2,030	573	27	4,630	2,080	420
8	.....	3,890	1,040	18	5,130	1,830	575	28	4,400	1,900	418
9	.....	3,750	690	19	5,430	1,660	560	29	4,290	1,710	413
10	.....	3,680	630	20	5,000	1,710	530	30	4,570	1,630	420
								31	.....	1,520	420

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Grand River at Sulphur Springs, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off, (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
March 25-31	810	280	476	6,610	B.
April	1,990	375	863	51,400	B.
May	4,030	667	1,710	105,000	A.
June	5,430	1,770	4,390	261,000	B.
July	4,670	1,520	2,750	169,000	B.
August	1,340	391	701	43,100	B.
September	411	150	246	14,600	A.
October	443	134	288	17,700	A.
November 1-12	235	178	213	5,070	A.
The period	.....	.....	.....	673,000	
1908.					
January	.....	.....	99.2	6,100	C.
February	93	63	73.5	4,230	B.
March	528	72	198	12,200	B.
April	648	421	529	31,500	A.
May	1,290	473	805	49,500	A.
June	2,630	1,060	1,880	112,000	A.
July	1,210	421	819	50,400	A.
August	846	345	553	34,000	A.
September	320	150	220	13,100	A.
October	206	134	166	10,200	A.
November	150	92	125	7,440	C.
December	.....	.....	109	6,700	C.
The year	.....	.....	465	337,000	

NOTE.—Discharge estimated for periods, January 1-25, November 15-24, and December 23-31, 1908: ice conditions. See also footnotes to gage heights.

GRAND RIVER NEAR KREMMLING, COLO.

This station was established July 24, 1904. It is located at the upper end of Gore Canyon, about 3 miles southwest of Kremmling, Colo., near the Kremmling reservoir dam site, which is the largest in Colorado.

The records obtained at this station show the water available for storage and power development and are used also to determine probable run-off of some of the smaller tributaries between Kremmling and Sulphur Springs.

Blue River, the largest tributary above this station, empties into the Grand about 2 miles above. Other important tributaries between Kremmling and Sulphur Springs are Williams Fork, Troublesome, and Muddy rivers.

A number of private ditches divert water for meadow irrigation from both the main stream and its tributaries between Sulphur Springs and this station.

The river is frozen completely across at the station for about four months each year. During this period the records are affected by the surface ice and also by anchor ice forming in the riffle just below the gage.

On October 18, 1906, the present slope gage was established on the opposite side of the river from the old chain gage. The zero of

the slope gage is about 0.70 foot above the zero of the old gage. Measurements of discharge are made from a cable a few feet downstream from the gage.

Scouring during high stages and silting during low stages affect the accuracy of results. Data obtained are good at high and medium stages, but at low stages are not so accurate.

Discharge measurements of Grand River near Kremmling, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 19 [a]	R. I. Meeker	97	173	0.82	346
April 25	C. L. Chatfield	122	992	4.75	1,660
May 27	W. B. Freeman	138	1,850	9.85	4,960
June 19	C. L. Chatfield	160	2,680	15.40	9,500
July 16	do	140	1,840	9.95	4,870
August 9	do	124	1,230	4.35	1,580
September 28	W. B. Freeman	106	436	2.53	816
November 21 [b]	J. B. Stewart	101	205	.99	410
1908.					
January 21 [a]	J. B. Stewart	104	164	.68	304
January 22 [a]	do	104	146	.68	292
February 23 [a]	C. L. Chatfield	98	142	.96	268
March 2 [a]	J. B. Stewart	100	168	1.15	344
April 18	C. L. Chatfield	120	818	5.04	1,740
May 23	do	127	1,240	7.02	2,820
June 15	do	142	2,040	11.10	6,230
July 6	Hoyt and Freeman	127	1,450	6.98	2,740
July 23	C. L. Chatfield	92	1,110	4.10	1,280
August 20	do	115	1,000	4.10	1,410
September 19	do	105	254	1.60	545
October 24	do	105	250	1.50	472
November 25 [c]	do	100	167	.80	328
December 23 [d]	do	100	197	1.40	283

[a] Measurement through ice. [b] River filled with ice floats. [c] Floating ice. [d] Ice conditions.

Daily gage height, in feet, of Grand River near Kremmling, Colo., for 1907 and 1908.

[H. A. Howe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	0.89		0.78	2.28	5.14	8.77	14.78	6.98	3.50	2.62	1.80	0.45
2	1.16		.88	2.64	4.49	9.26	15.30	6.78	3.25	2.65	1.70	.35
3	1.90		.94	3.71	4.30	11.13	14.50	6.55	3.15	2.58	1.50	.30
4			1.02	3.70	4.37	11.49	14.10	6.70	2.90	2.45	1.50	.20
5			1.16	3.81	4.26	11.90	13.95	6.95	2.85	2.55	1.42	.15
6			1.26	3.46	4.49	13.05	13.78	6.25	2.92	2.65	1.32	.25
7			1.30	2.96	4.92	13.38	13.38	5.75	2.80	2.95	1.38	.45
8			1.30	2.69	4.88	13.38	12.95	5.50	2.78	3.40	1.50	.60
9			1.42	2.98	4.75	13.05	12.75	5.35	2.62	2.98	1.48	.60
10			1.14	4.01	4.99	12.44	12.80	5.18	2.50	2.78	1.30	.60
11			1.35	5.92	5.78	11.70	12.52	5.00	2.38	2.58	1.20	.58
12			1.00	6.20	7.04	12.40	11.15	4.72	2.20	2.42	.75	.58
13			1.24	5.92	7.60	13.47	10.78	4.60	2.12	2.35	.45	.48
14			.99	6.32	7.02	14.28	11.78	4.45	2.30	2.30	.25	.52
15			.90	6.96	6.54	14.92	11.15	4.68	2.55	2.30	.95	.32
16			.86	7.28	6.34	15.35	9.95	4.70	2.65	2.20	1.30	.38
17			1.11	6.84	6.81	15.49	9.40	4.45	2.35	2.10	1.30	.35
18		0.74	3.00	6.19	7.45	15.28	9.00	4.15	2.20	2.00	1.40	.28
19		.82	4.38	5.68	8.42	15.47	8.65	4.30	2.08	1.95	1.18	−.02
20		.77	5.79	4.62	9.84	15.38	8.35	4.25	1.98	1.90	.59	+.20
21		.86	5.85	4.65	11.26	14.62	8.65	4.35	1.90	1.80	1.00	.25
22		.92	6.50	4.70	12.30	13.95	8.62	4.05	1.85	1.80	.92	.40
23		1.19	4.76	4.65	12.80	13.85	8.10	4.00	1.80	1.78	.75	.30
24		1.12	3.96	4.69	12.62	14.25	8.10	3.70	1.80	1.70	.68	.55
25		1.18	4.36	4.75	12.18	14.45	8.40	3.50	1.78	1.80	.80	.85

[a] Ice conditions probably prevailed during January, February, and the first part of March, 1907; December 24–31, 1907.

Daily gage height, in feet, of Grand River near Kremmling, Colo., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	.....	1.11	4.82	4.46	11.06	14.82	8.88	3.78	2.10	1.80	1.00	1.10
27	.....	1.06	3.96	4.62	9.95	14.72	9.55	3.82	2.70	1.75	.70	.80
28	.....	.97	3.36	4.93	9.52	14.42	9.70	3.70	2.55	1.70	.62	.75
29	.....	.....	2.62	5.25	9.52	14.25	8.80	3.55	2.25	1.75	.58	.80
30	.....	.....	2.45	5.18	9.75	14.28	8.05	3.55	2.32	1.70	.55	.95
31	.....	.....	2.18	.....	9.31	.....	7.45	3.70	.....	1.60	.....	1.05
1908.[a]												
1	1.3	0.8	1.1	1.65	3.6	7.45	7.5	5.1	2.35	1.6	1.4	.65
2	1.2	.7	1.1	1.1	4.0	7.7	7.05	5.95	2.2	1.6	1.3	.4
3	1.15	.8	.95	1.1	4.9	7.9	7.0	4.55	2.1	1.6	1.05	.55
4	1.15	.8	1.0	1.8	5.5	9.0	6.95	4.2	2.0	1.6	1.1	.7
5	1.65	.85	1.1	1.7	4.85	9.3	7.0	3.7	1.95	1.55	1.15	1.15
6	1.85	.85	1.0	1.8	5.0	9.2	6.95	3.6	1.85	1.5	1.15	1.0
7	2.2	.9	.85	2.2	5.25	8.9	6.6	3.6	1.8	1.5	1.15	1.0
8	2.4	.9	.6	2.3	5.6	8.55	6.55	3.45	1.8	1.5	1.15	.7
9	2.15	.9	.8	2.3	6.3	8.55	6.35	3.2	1.75	1.4	1.15	.55
10	1.9	.9	.7	2.7	6.3	9.45	6.05	2.95	1.95	1.4	1.1	.65
11	1.85	.9	.8	3.1	5.7	10.45	6.1	3.35	2.15	1.4	1.25	.75
12	1.6	.95	.8	3.5	5.5	11.2	6.05	5.1	2.0	1.4	1.45	.65
13	1.55	.9	.95	3.85	5.4	10.9	5.95	4.95	2.05	1.3	1.15	.65
14	1.25	.9	1.55	4.15	5.1	10.65	5.95	4.85	2.3	1.25	.7	.9
15	1.05	1.0	1.75	4.8	4.9	10.9	6.1	4.3	2.2	1.2	.85	1.1
16	1.05	1.2	1.9	5.25	5.15	11.15	6.0	4.0	2.15	1.25	.9	1.2
17	.95	1.1	2.65	5.1	6.1	11.35	5.65	3.65	1.85	1.35	.8	.7
18	.9	1.05	2.15	4.95	6.6	10.75	5.25	3.75	1.7	1.4	.9	.85
19	.75	1.05	2.15	5.1	7.2	9.6	4.85	3.9	1.6	1.6	1.05	.6
20	.6	1.0	2.1	5.4	8.25	8.8	4.5	3.95	1.5	1.45	1.05	1.1
21	.7	1.1	1.3	5.6	7.9	9.2	4.25	4.3	1.45	1.25	1.0	1.05
22	.7	1.15	1.4	5.8	7.25	10.05	4.15	4.25	1.4	1.3	.95	.95
23	.7	1.0	1.45	6.1	7.1	10.2	4.2	4.35	1.3	1.15	1.05	1.2
24	.7	.95	1.65	5.6	7.2	9.9	4.2	4.2	1.3	1.3	.95	1.85
25	.9	1.1	1.9	5.0	7.9	9.7	4.15	3.8	1.45	1.5	.55	2.5
26	.8	1.05	2.0	4.4	7.65	9.3	3.8	3.55	1.5	1.45	.8	1.9
27	.8	1.1	2.3	4.1	7.3	9.3	3.7	3.45	1.6	1.1	.7	2.7
28	.7	1.1	2.1	4.1	7.2	9.25	3.6	3.25	1.6	1.1	.45	2.15
29	.75	1.0	1.9	3.7	6.65	8.2	3.6	3.0	1.6	1.35	.7	1.65
30	.8	.....	1.45	3.55	6.7	7.9	3.6	2.75	1.65	1.35	.95	1.55
31	.7	.....	1.1	.....	6.8	.....	4.65	2.55	.....	1.4	.....	1.3

[a] Ice conditions January 1 to March 20, and December 5 to 31, 1908.

Rating table for Grand River near Kremmling, Colo., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	170	1.40	490	2.80	890	5.40	1,940
.10	190	1.50	515	2.90	925	5.60	2,040
.20	210	1.60	540	3.00	960	5.80	2,140
.30	230	1.70	565	3.20	1,030	6.00	2,250
.40	250	1.80	590	3.40	1,100	7.00	2,825
.50	270	1.90	620	3.60	1,170	8.00	3,475
.60	290	2.00	650	3.80	1,240	9.00	4,220
.70	315	2.10	680	4.00	1,320	10.00	5,095
.80	340	2.20	710	4.20	1,400	11.00	6,120
.90	365	2.30	740	4.40	1,480	12.00	7,255
1.00	390	2.40	770	4.60	1,570	13.00	8,450
1.10	415	2.50	800	4.80	1,660	14.00	9,700
1.20	440	2.60	830	5.00	1,750	15.00	11,000
1.30	465	2.70	860	5.20	1,840	15.50	11,675

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1906–8 and is well defined, except at stages below about 1.5 feet.

Monthly discharge of Grand River near Kremmling, Colo., for 1907 and 1908.

[Drainage area, 2,380 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
February 18–28	438	325	384	.161	0.07	8,380	B.
March	2,520	335	874	.367	.42	53,700	A.
April	3,010	734	1,690	.710	.79	101,000	A.
May	8,210	1,420	3,680	1.55	1.79	226,000	A.
June	11,700	4,040	9,170	3.85	4.30	546,000	A.
July	11,400	3,120	6,220	2.61	3.01	382,000	A.
August	2,810	1,140	1,700	.714	.82	105,000	B.
September	1,140	585	784	.329	.37	46,700	A.
October	1,100	540	719	.302	.35	44,200	A.
November	590	220	407	.171	.19	24,200	B.
December	.....	.....	259	.109	.13	15,900	D.
The period	.....	.....	.....	.....	.....	1,550,000	
1908.							
January	.....	.....	304	.128	.15	18,700	D.
February	.....	.....	306	.129	.14	17,600	D.
March	740	.....	419	.176	.20	25,800	C.
April	2,300	415	1,290	.542	.60	76,800	A.
May	3,650	1,170	2,390	1.00	1.15	147,000	A.
June	6,510	3,120	4,720	1.98	2.21	281,000	A.
July	3,150	1,170	2,010	.845	.97	124,000	A.
August	2,220	815	1,310	.550	.63	80,600	A.
September	755	465	597	.251	.28	35,500	A.
October	540	415	488	.205	.24	30,000	B.
November	502	260	390	.164	.18	23,200	B.
December	.....	.....	303	.127	.15	18,600	D.
The year	6,510	.....	1,210	.508	6.90	879,000	

NOTE.—Ice conditions and discharge estimated for following periods, December 24–31, 1907; January 1 to March 20, 1908; and December 24–31, 1908.

Open-water rating applied to gage heights in February and March 1907, although there was probably ice in the river. The monthly means are probably not materially affected.

GRAND RIVER NEAR WOLCOTT, COLO.

This station, which was established May 27, 1906, and discontinued May 20, 1908, was located at the state bridge on the old stage road from Wolcott to Yampa. The Denver, Northwestern and Pacific Railroad now passes this bridge, the nearest station being McCoy.

The records at this station were used to check run-off data obtained at the station at Kremmling.

Piney River enters the Grand a few miles above and Rock Creek a few miles below the station. No important diversions are made between this and the Kremmling station. Between these two points the river has a fall of about 350 feet. Much of the power afforded by this fall has been filed upon.

Ice conditions are not as severe as at the Kremmling station.

The chain gage was located on the bridge and the datum remained the same during the maintenance of the station.

Results during high stages are good. Low-water measurements were made chiefly during the winter months and are not entirely satisfactory.

Discharge measurements of Grand River near Wolcott, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 7	W. B. Freeman	189	1,260	8.15	10,800
June 24	do	190	1,190	8.22	9,760
July 30	C. L. Chatfield	147	672	5.48	4,240
August 19	do	136	378	3.40	1,620
October 18	J. B. Stewart	83	268	2.30	763
November 21 [a]	do	78	216	1.57	294
1908.					
January 20 [b]	J. B. Stewart	73	252	[c] 1.50	381
March 1 [b]	do	68	199	1.38	334
June 14	C. L. Chatfield	199	989	6.85	6,560
July 6	Freeman and Hoyt	139	606	4.80	3,070

[a] Slush ice.
[b] Ice along edges.
[c] Reading at end of measurement, probably unaffected by ice. Mean gage height for measurement is doubtful.

NOTE.—Measurements for 1906 are given in Water-Supply Paper 211, p. 71.

Daily gage height, in feet, of Grand River near Wolcott, Colo., for 1907 and 1908.

[Edwin Crane, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907. [a]												
1	1.8	1.6	1.9	2.85	4.0	6.0	8.5	4.85	3.0	2.6	2.0	1.25
2	1.85	1.6	1.9	2.85	3.95	6.85	8.6	4.75	2.95	2.65	2.0	1.2
3	1.8	1.55	1.9	2.9	4.0	7.6	8.4	4.5	2.9	2.65	2.0	1.2
4	1.75	1.55	1.9	2.9	4.15	7.65	8.3	4.7	2.85	2.6	1.9	1.15
5	1.75	1.6	1.9	2.9	4.25	7.6	8.25	4.75	2.8	2.55	1.9	1.1
6	1.7	1.6	1.9	2.85	4.4	7.8	8.15	4.5	2.75	2.5	1.9	1.1
7	1.7	1.6	1.95	2.9	4.4	7.9	7.95	4.25	2.7	2.85	1.9	1.1
8	1.75	1.55	2.0	3.0	4.5	8.05	7.75	4.05	2.6	3.1	1.9	1.2
9	1.75	1.55	2.0	3.0	4.7	8.15	7.65	3.85	2.65	3.0	1.9	1.2
10	1.7	1.6	2.15	3.15	4.75	7.9	7.5	3.75	2.65	2.95	1.9	1.2
11	1.75	1.6	2.2	3.6	4.95	7.35	7.55	3.65	2.5	2.9	1.9	1.2
12	1.75	1.6	2.4	3.75	5.05	7.65	6.95	3.65	2.5	2.6	1.9	1.4
13	1.7	1.65	2.4	3.9	5.15	7.95	6.65	3.35	2.5	2.5	1.9	1.55
14	1.7	1.65	2.5	3.9	5.3	8.5	7.1	3.2	2.4	2.4	1.9	1.65
15	1.7	1.6	2.7	4.0	5.4	8.8	7.05	3.55	2.55	2.4	1.8	1.8
16	1.75	1.6	2.8	4.15	5.6	8.8	6.3	3.5	2.55	2.35	1.75	2.0
17	1.7	1.65	2.95	4.5	5.55	8.8	6.05	3.45	2.45	2.2	1.7	2.25
18	1.7	1.7	3.05	4.95	5.6	8.75	5.9	3.45	2.4	2.2	1.7	2.5
19	1.65	1.75	3.4	4.7	5.7	8.85	5.7	3.4	2.3	2.2	1.6	2.8
20	1.65	1.75	3.6	4.1	6.7	8.85	5.65	3.5	2.25	2.2	1.6	2.9
21	1.65	1.8	3.8	3.7	7.25	8.55	5.6	3.4	2.2	2.2	1.5	3.15
22	1.55	1.8	4.05	3.6	7.55	8.35	5.6	3.35	2.2	2.05	1.5	2.9
23	1.5	1.85	4.25	3.6	7.85	8.2	5.45	3.25	2.2	2.15	1.5	2.55
24	1.55	1.8	4.45	3.65	8.55	8.3	5.35	3.05	2.2	2.05	1.5	1.9
25	1.5	1.85	[b] 4.7	3.7	8.15	8.35	5.4	3.05	2.2	2.1	1.45	1.65
26	1.5	1.9	[b] 4.55	3.8	7.3	8.6	5.8	3.05	2.35	2.1	1.4	1.4
27	1.5	1.9	4.35	3.9	6.7	8.5	6.0	3.0	2.55	2.1	1.4	1.4
28	1.5	1.9	3.75	3.9	6.4	8.4	6.3	3.0	2.6	2.1	1.35	1.4
29	1.5	.....	3.3	4.0	6.4	8.3	5.75	3.05	2.45	2.0	1.3	1.4
30	1.5	.....	2.85	4.05	6.3	8.45	5.4	3.0	2.5	2.0	1.3	1.4
31	1.5	.....	2.85	.....	6.15	.....	4.95	3.0	.....	2.05	.....	1.4

[a] Ice conditions December 12 to 31, 1907.
[b] Rise caused by dam going out at Monarch.

Daily gage height, in feet, of Grand River near Wolcott, Colo., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1908.[a]						1908.[a]					
1	1.6	2.1	1.4	1.8	3.15	16	2.2	1.6	2.0	3.95	4.0
2	1.7	1.8	1.4	1.7	3.35	17	2.1	1.5	2.2	3.8	4.05
3	1.7	1.8	1.4	1.7	3.7	18	1.6	1.5	2.3	3.9	4.5
4	1.5	1.5	1.4	1.8	4.1	19	1.5	1.5	2.3	3.9	4.8
5	1.6	1.6	1.5	2.0	3.9	20	1.9	1.5	2.3	4.1	5.5
6	2.0	1.5	1.5	2.2	3.95	21	1.4	1.5	2.3	4.2	.....
7	2.2	1.5	1.6	2.4	4.1	22	1.6	1.4	2.3	4.25	.....
8	2.8	1.5	1.6	2.45	4.15	23	1.4	1.4	2.3	4.4	.....
9	2.4	1.4	1.6	2.4	4.3	24	1.4	1.5	2.1	4.1	.....
10	2.8	1.4	1.4	2.6	4.45	25	1.5	1.4	2.1	3.75	.....
11	2.9	1.5	1.5	2.8	4.35	26	1.5	1.4	2.1	3.5	.....
12	1.4	1.5	1.5	3.1	4.15	27	1.7	1.4	2.2	3.4	.....
13	1.6	1.5	1.5	3.4	4.1	28	1.6	1.4	1.9	3.3	.....
14	2.1	1.4	1.7	3.4	4.0	29	1.7	1.4	1.8	3.35	.....
15	1.4	1.4	1.9	3.7	3.85	30	1.9	.....	1.7	3.25	.....
						31	2.1	.....	1.8	.....	.....

[a] Partial ice conditions January 1 to February 5, 1908.

Rating table for Grand River near Wolcott, Colo., for 1906 to 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	215	2.20	669	3.40	1,623	5.20	3,737
1.10	237	2.30	733	3.50	1,713	5.40	4,036
1.20	260	2.40	800	3.60	1,807	5.60	4,348
1.30	285	2.50	870	3.70	1,905	5.80	4,673
1.40	313	2.60	943	3.80	2,007	6.00	5,010
1.50	343	2.70	1,021	3.90	2,112	6.20	5,366
1.60	375	2.80	1,102	4.00	2,220	6.40	5,744
1.70	410	2.90	1,186	4.20	2,442	6.60	6,138
1.80	450	3.00	1,273	4.40	2,672	6.80	6,546
1.90	495	3.10	1,359	4.60	2,913	7.00	6,970
2.00	555	3.20	1,446	4.80	3,173	8.00	9,610
2.10	608	3.30	1,534	5.00	3,450	9.00	12,800

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1906–1908 and is well defined, except below gage height 2.0 feet. This table supersedes all earlier rating tables.

Monthly discharge of Grand River near Wolcott, Colo., for 1906, 1907, and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1906.[a]					
May 27–31	7,790	6,340	6,960	69,000	A.
June	12,300	4,840	7,480	445,000	A.
July	5,370	1,860	3,440	212,000	A.
August	1,900	943	1,320	81,200	A.
September	2,010	733	1,200	71,400	A.
October	1,450	608	883	54,300	A.
November	800	410	553	32,900	B.
December	608	410	522	32,100	B.
The period	.....	.....	.....	998,000	

[a] The above monthly discharge for 1906 supersedes the values published in Water-Supply Paper 211.

Monthly discharge of Grand River near Wolcott, Colo., for 1906, 1907, and 1908—Cont'd.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.[a]					
January	472	343	397	24,400	D.
February	495	359	408	22,700	D.
March	3,040	495	1,300	79,900	A.
April	3,380	1,140	1,880	112,000	A.
May	11,300	2,170	4,870	299,000	A.
June	12,300	5,010	10,100	601,000	A.
July	11,500	3,380	6,700	412,000	A.
August	3,240	1,270	1,900	117,000	A.
September	1,270	669	896	53,300	A.
October	1,360	550	814	50,100	A.
November	550	285	425	25,300	C.
December			251	15,400	D.
The year			2,500	1,810,000	
1908 [b]					
January			353	21,700	D.
February			337	19,400	D.
March	733	313	491	30,200	C.
April	2,670	410	1,480	88,100	A.
May 1-20	4,190	1,400	2,390	94,800	A.
The period				254,000	

[a] Ice conditions December 12–31, 1907, and discharge estimated.
[b] Partial ice conditions January 1 to February 5, 1908, and discharge estimated.

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

This station was established May 12, 1899, discontinued July 17, and reestablished January 7, 1900. It is located at Glenwood Springs. The gage is of the float type and is placed on the right bank of the river about one-fourth of a mile above the state bridge. Discharge measurements are made from a cable underneath this bridge (Pl. X, *B*, p. 182). (See Water-Supply Paper 175, pp. 81–82, for a detailed description of the gages used to date.)

This may be considered a base station, as the records show the entire run-off of the basin above the mouth of Roaring Fork. Ice never forms at this station, as the hot water from the nearby springs keeps the water above the freezing point even in the most severe weather. The winter records are, therefore, of especial value, as they furnish a basis for estimating approximately the discharge of the streams at other stations in the basin during the ice period.

The station is about one-fourth mile above Roaring Fork, which is the third largest tributary of the Grand.

A few minor irrigation ditches are taken out between this and the Kremmling station, but do not, however, affect the discharge to any appreciable extent. The Shoshone plant of the Central Colorado Power Company, having a head of 170 feet, was practically completed in 1908. The tail water from this plant is returned to the river above the gaging station.

The position and datum of this gage have remained unchanged.

Results at this station are satisfactory. Conditions have always been permanent except during 1907 and 1908, when the débris from the Shoshone plant was deposited in the river bed, thereby changing the rating of the stream.

Discharge measurements of Grand River at Glenwood Springs, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 6	R. I. Meeker	185	490	3.75	1,020
June 6	W. B. Freeman	217	1,670	9.10	16,200
June 23	do	220	1,700	9.53	17,100
July 29	C. L. Chatfield	214	1,210	7.20	7,450
August 17	do	205	770	5.30	2,930
October 16	J. B. Stewart	190	643	4.77	1,380
November 13	do	185	467	[a]3.60	747
1908.					
February 12 [b]	J. B. Stewart	185	458	3.47	738
April 12	do	193	694	4.62	1,740
May 11	C. L. Chatfield			5.80	3,870
June 21	do	215	1,250	7.10	7,420
July 8	Hoyt and Freeman	211	1,000	5.93	4,170
July 20	Freeman and Chatfield	198	809	5.17	2,580
August 24	C. L. Chatfield	200	770	5.11	2,160
September 23	do	185	507	4.05	934
October 28	do	185	508	4.35	882
December 1	do	183	414	3.88	690

[a] Gage height somewhat uncertain, owing to gage being out of order. [b] River entirely open.

Daily gage height, in feet, of Grand River at Glenwood Springs, Colo., for 1907 and 1908.

[W. H. Richardson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.35	3.42	3.62	4.28	5.60	7.35	9.92	6.55	4.93	4.50	4.50	3.58
2	3.12	3.50	3.62	4.25	5.48	7.45	9.90	6.43	4.90	4.55	4.50	3.55
3	3.10	3.48	3.55	4.42	5.38	7.80	9.78	6.27	4.83	4.53	4.45	3.48
4	3.08	3.48	3.65	4.75	5.25	8.50	9.70	6.25	4.80	4.65	4.40	3.42
5	3.48	3.48	3.70	4.82	5.28	8.80	9.58	6.40	4.75	4.60	4.38	3.45
6	3.48	3.68	3.72	4.88	5.25	9.05	9.48	6.37	4.75	4.65	4.32	3.45
7	3.50	3.60	3.75	4.75	5.30	9.28	9.20	6.20	4.73	4.85	4.20	3.55
8	3.35	3.58	3.70	4.58	5.40	9.35	8.95	6.07	4.67	5.00	4.15	3.68
9	3.38	3.58	3.75	4.50	5.38	9.15	8.82	5.93	4.63	5.05	4.15	3.75
10	3.32	3.55	3.75	4.52	5.38	8.88	8.88	5.65	4.60	4.97	4.18	3.72
11	3.35	3.55	3.80	5.20	5.60	8.55	8.65	5.53	4.55	4.87	4.05	3.68
12	3.38	3.60	3.80	5.98	6.02	8.68	8.22	5.45	4.55	4.85	3.90	3.70
13	3.40	3.60	3.78	6.12	6.55	9.25	7.85	5.33	4.55	4.85	3.72	3.65
14	3.45	3.65	3.60	6.18	6.52	9.72	8.10	5.25	4.47	4.83	3.62	3.68
15	3.48	3.65	3.65	6.35	6.25	10.00	8.22	5.30	4.50	4.77	3.70	3.45
16	3.48	3.65	3.58	6.60	6.08	10.25	7.62	5.33	4.50	4.68	3.90	3.48
17	3.45	3.65	3.65	6.60	6.15	10.30	7.30	5.30	4.53	4.60	3.88	3.45
18	3.45	3.68	3.75	6.35	6.48	10.20	7.22	5.25	4.50	4.58	3.88	3.20
19	3.40	3.62	4.35	6.05	6.88	10.22	7.15	5.17	4.43	4.58	3.88	3.25
20	3.28	3.62	5.05	5.80	7.50	10.15	7.02	5.17	4.37	4.60	3.85	3.25
21	3.18	3.65	5.48	5.52	8.25	9.95	7.00	5.20	4.37	4.60	3.80	3.32
22	3.20	3.68	5.65	5.45	8.78	9.60	7.05	5.13	4.35	4.60	3.80	3.58
23	3.32	3.72	5.65	5.45	9.12	9.55	7.00	5.03	4.35	4.55	3.62	3.68
24	3.32	3.78	5.15	5.40	9.12	9.70	6.90	4.93	4.27	4.55	3.65	3.75
25	3.40	3.75	4.95	5.40	8.82	9.82	6.98	4.87	4.27	4.55	3.62	3.78
26	3.42	3.75	5.10	5.40	8.40	9.90	7.12	4.85	4.33	4.50	3.60	3.82
27	3.50	3.78	5.15	5.32	7.90	9.95	7.12	4.85	4.55	4.50	3.68	3.92
28	3.48	3.78	4.88	5.45	7.62	9.78	7.08	4.93	4.57	4.50	3.68	3.95
29	3.40	.....	4.65	5.52	7.60	9.72	7.17	4.87	4.57	4.50	3.65	3.82
30	3.40	.....	4.38	5.68	7.55	9.75	7.00	4.87	4.50	4.48	3.60	3.78
31	3.40	.....	4.30	.....	7.55	.....	6.85	4.90	.....	4.40	.....	3.68
1908.												
1	3.8	3.3	3.75	3.95	4.65	6.35	6.5	5.1	4.5	4.1	4.4	3.8
2	3.75	3.2	3.7	4.0	4.8	6.55	6.3	5.3	4.45	4.1	4.4	3.8
3	3.8	3.35	3.7	3.9	5.1	6.7	6.15	5.4	4.3	4.1	4.4	3.9
4	3.85	3.5	3.75	3.85	5.4	7.0	6.1	5.15	4.0	4.1	4.4	4.0
5	3.85	3.3	3.8	3.7	5.4	7.4	6.1	4.95	4.0	4.1	4.2	4.15

Daily gage height, in feet, of Grand River at Glenwood Springs, Colo., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	3.8	3.2	3.75	3.75	5.2	7.35	6.1	4.85	3.95	4.1	4.2	4.1
7	3.75	3.25	3.7	4.0	5.25	7.2	6.0	4.85	3.95	4.1	4.1	4.0
8	3.6	3.45	3.6	4.1	5.4	7.0	5.9	4.8	3.9	4.1	4.1	4.0
9	3.6	3.4	3.6	4.15	5.7	7.1	5.8	4.75	4.0	4.1	4.05	4.0
10	3.75	3.35	3.6	4.1	5.8	7.4	5.7	4.7	4.0	4.1	4.0	3.85
11	3.8	3.4	3.7	4.3	5.7	7.95	5.65	4.65	4.0	4.15	4.0	3.9
12	3.75	3.5	3.7	4.55	5.5	8.2	5.65	5.1	4.1	4.1	4.0	3.8
13	3.8	3.55	3.8	4.75	5.4	8.1	5.6	5.3	4.1	4.0	4.1	3.9
14	3.8	3.45	3.95	5.0	5.3	7.9	5.55	5.2	4.1	4.1	4.1	3.9
15	3.9	3.45	4.0	5.2	5.3	8.0	5.6	5.1	4.2	4.1	4.1	3.9
16	3.75	3.5	4.05	5.4	5.2	8.0	5.7	5.0	4.2	4.1	4.0	4.0
17	3.75	3.5	4.2	5.4	5.45	8.0	5.7	5.0	4.2	4.2	4.0	4.0
18	3.8	3.55	4.2	5.35	5.85	7.9	5.5	4.95	4.1	4.1	4.0	3.8
19	3.8	3.5	4.3	5.4	6.1	7.4	5.35	4.9	4.1	4.15	4.1	3.7
20	3.8	3.5	4.2	5.55	6.5	6.95	5.2	4.95	4.0	4.2	4.1	3.5
21	3.9	3.6	4.1	5.65	6.75	7.1	5.1	5.1	4.0	4.3	4.2	3.5
22	4.0	3.55	4.1	5.65	6.4	7.35	5.0	5.1	4.1	4.3	4.2	3.35
23	3.95	3.55	4.0	5.75	6.25	7.6	4.9	5.1	4.1	4.3	4.1	3.45
24	4.0	3.6	4.05	5.7	6.2	7.5	4.9	5.1	4.0	4.25	4.2	3.7
25	4.0	3.6	4.1	5.5	6.4	7.4	4.9	5.05	4.0	4.15	4.15	3.8
26	3.7	3.6	4.1	5.2	6.5	7.2	4.9	4.95	4.1	4.4	4.05	3.8
27	3.4	3.6	4.2	5.0	6.4	7.1	4.9	4.9	4.2	4.4	3.9	3.8
28	3.4	3.7	4.2	4.9	6.2	7.1	4.8	4.8	4.25	4.3	3.9	3.9
29	3.45	3.7	4.15	4.9	6.05	6.9	4.8	4.75	4.1	4.3	3.85	3.9
30	3.4	.....	3.95	4.8	5.95	6.6	4.8	4.65	4.05	4.4	3.7	3.9
31	3.4	.....	3.95	.....	6.1	.....	4.8	4.6	.....	4.4	.....	3.9

NOTE.—Owing to the swiftness of the current and the discharge of warm water from the springs the gage height at this point is not affected by ice conditions.

Rating tables for Grand River at Glenwood Springs, Colo.

JANUARY 1, 1906, TO SEPTEMBER 7, 1907, AND NOVEMBER 12, 1907, TO JULY 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	480	4.20	1,400	5.40	3,050	7.20	7,260
3.10	530	4.30	1,510	5.50	3,220	7.40	7,910
3.20	580	4.40	1,630	5.60	3,400	7.60	8,620
3.30	630	4.50	1,750	5.70	3,590	7.80	9,380
3.40	690	4.60	1,870	5.80	3,790	8.00	10,210
3.50	760	4.70	2,000	5.90	4,000	8.20	11,110
3.60	830	4.80	2,140	6.00	4,210	8.40	12,090
3.70	910	4.90	2,290	6.20	4,640	8.60	13,160
3.80	990	5.00	2,440	6.40	5,090	8.80	14,350
3.90	1,080	5.10	2,590	6.60	5,580	9.00	15,660
4.00	1,180	5.20	2,740	6.80	6,110	10.00	22,600
4.10	1,290	5.30	2,890	7.00	6,670	11.00	29,900

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1900 to 1908, and is well defined.

SEPTEMBER 8 TO NOVEMBER 11, 1907, AND AUGUST 1 TO 23, 1908.

[The indirect method for shifting channels used.]

AUGUST 24, 1908, TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	415	3.80	635	4.30	1,075	4.80	1,710
3.40	445	3.90	705	4.40	1,185	4.90	1,850
3.50	485	4.00	785	4.50	1,305	5.00	2,000
3.60	525	4.10	875	4.60	1,435	5.10	2,150
3.70	575	4.20	975	4.70	1,570		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during 1908 and 1909 and the form of the 1907 curve. It is fairly well defined.

Daily discharge, in second-feet, of Grand River at Glenwood Springs, Colo., for September 8 to November 11, 1907, and August 1 to 23, 1908.

Day.	1907.			Aug., 1908.	Day.	1907.			Aug., 1908.
	Sept.	Oct.	Nov.			Sept.	Oct.	Nov.	
1	.....	1,320	1,370	2,450	16	1,640	1,290	.....	2,050
2	.....	1,380	1,370	2,800	17	1,560	1,210	.....	2,050
3	.....	1,360	1,430	2,980	18	1,530	1,190	.....	2,000
4	.....	1,490	1,370	2,550	19	1,450	1,260	.....	1,950
5	.....	1,440	1,350	2,150	20	1,380	1,290	.....	2,000
6	.....	1,490	1,280	2,000	21	1,380	1,290	.....	2,150
7	.....	1,600	1,170	2,000	22	1,350	1,290	.....	2,150
8	1,850	1,790	1,220	1,930	23	1,350	1,230	.....	2,150
9	1,800	1,850	1,220	1,850	24	1,180	1,320	.....	.....
10	1,760	1,750	1,250	1,800	25	1,180	1,320	.....	.....
11	1,700	1,630	1,130	1,720	26	1,240	1,280	.....	.....
12	1,700	1,600	.....	2,270	27	1,480	1,280	.....	.....
13	1,700	1,480	.....	2,600	28	1,500	1,280	.....	.....
14	1,610	1,450	.....	2,430	29	1,500	1,370	.....	.....
15	1,640	1,380	.....	2,270	30	1,420	1,350	.....	.....
					31	.....	1,260	.....	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Grand River at Glenwood Springs, Colo., for 1907 and 1908.

[Drainage area, 4,520 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	760	520	674	0.149	0.17	41,400	B.
February	974	704	853	.189	.20	47,400	B.
March	3,500	795	1,550	.343	.40	95,300	A.
April	5,580	1,460	3,180	.704	.79	189,000	A.
May	16,500	2,820	6,820	1.51	1.74	419,000	A.
June	24,700	7,740	18,400	4.07	4.54	1,090,000	A.
July	22,000	6,250	11,400	2.52	2.90	701,000	A.
August	5,460	2,220	3,290	.728	.84	202,000	B.
September	2,340	1,180	1,670	.370	.41	99,400	B.
October	1,850	1,230	1,400	.310	.36	86,100	B.
November	1,430	830	1,070	.237	.26	63,700	B.
December	1,130	580	839	.186	.21	51,600	C.
The year	24,700	520	4,260	.943	12.82	3,090,000	
1908.							
January	1,180	690	954	.211	.24	58,700	A.
February	910	580	745	.165	.18	42,900	A.
March	1,510	830	1,130	.250	.29	69,500	B.
April	3,690	910	2,230	.493	.55	133,000	B.
May	5,980	1,940	3,790	.838	.97	233,000	A.
June	11,100	4,980	7,880	1.74	1.94	469,000	A.
July	5,330	2,140	3,280	.726	.84	202,000	B.
August	2,980	1,440	2,080	.460	.53	128,000	C.
September	1,300	705	884	.196	.22	52,600	B.
October	1,180	785	960	.212	.24	59,000	C.
November	1,180	575	885	.196	.22	52,700	B.
December	925	430	677	.150	.17	41,600	A.
The year	11,100	430	2,120	.469	6.39	1,540,000	

NOTE.—Indirect method for shifting channel used September 8 to November 11, 1907, and August 1 to 23, 1908. Change in conditions of flow during the latter period was caused by a deposit of sediment from construction operations at the Shoshone tunnel of the Central Colorado Power Company, about 10 miles above Glenwood.

GRAND RIVER AT PALISADES, COLO.

This station, which was established April 9, 1902, to obtain information concerning the amount of water available for irrigation in Grand River Valley, is located at the steel highway bridge 2 miles above Palisades.

The station is below all important tributaries except Gunnison and Dolores rivers.

Numerous large irrigation ditches divert water above and below this station. The proposed high-line canal of the United States Reclamation Service will take its water about 7 miles above Palisades. A water-power pumping plant just above the station pumps about 80 second-feet for irrigation. There are several similar plants in that vicinity and other important plants now in course of construction.

The river usually freezes over at the highway bridge a portion of the winter, but except for the interference of slush ice and an occasional thin ice cover the winter results are good.

No change has been made in the location or datum of the chain gage on the highway bridge during the maintenance of the station.

The section at the highway bridge is permanent, but measuring conditions are not very good, especially during very high water, when the current is very swift. All measurements in 1907 and 1908 were made from a suspension bridge at Palisades, 2 miles below the gage.

Flood measurements prior to 1906 at the upper bridge are less reliable than those at the suspension bridge.

Discharge measurements of Grand River at Palisades, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 8	R. I. Meeker	255	614	12.50	1,710
April 27	do	311	1,330	14.70	5,290
June 5	W. B. Freeman	391	3,030	19.85	23,400
June 21	do	419	3,400	20.78	26,100
July 27	C. L. Chatfield	321	2,120	17.50	14,100
August 16	do	307	1,150	14.35	4,760
October 15	J. B. Stewart	268	886	13.30	2,680
November 14	do	247	547	12.39	1,360
1908.					
February 11[a]	J. B. Stewart	233	522	12.70	1,280
April 11	do	267	833	13.24	2,690
July 7	W. B. Freeman	316	1,610	15.90	7,360
August 4	do	301	1,130	14.25	4,250
September 9	S. O. Harper	254	610	12.50	1,820

[a] The river was practically free from ice at the suspension bridge. Ice 1 foot thick at gage. Gage height to bottom of ice, 11.80 feet.

Daily gage height, in feet, of Grand River at Palisades, Colo., for 1907 and 1908.

[E. N. Purdy and J. J. Morrow, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	.....	.....	12.35	12.95	14.9	17.55	20.95	16.0	13.75	13.25	13.0	12.3
2	.....	.....	12.25	12.95	14.7	17.65	20.9	15.75	13.65	13.25	13.0	12.35
3	.....	.....	12.2	13.0	14.6	18.35	20.95	15.65	13.55	13.25	13.0	12.4
4	.....	.....	12.2	13.1	14.55	19.0	20.5	15.5	13.45	13.25	12.95	12.25
5	.....	.....	12.25	13.55	14.35	19.6	20.4	15.65	13.55	13.25	12.9	12.15
6	.....	.....	12.6	13.65	14.35	19.95	20.35	15.5	13.5	13.25	12.9	12.1
7	.....	.....	12.45	13.6	14.45	20.25	20.1	15.25	13.4	14.0	12.9	12.2
8	.....	.....	12.35	13.45	14.5	20.25	19.7	15.05	13.4	13.85	12.8	12.3
9	.....	.....	12.35	13.4	14.5	20.1	19.5	14.85	13.35	13.7	12.8	12.4
10	.....	.....	12.35	13.6	14.45	19.65	19.5	14.7	13.2	13.6	12.8	12.4
11	.....	.....	12.35	14.1	14.65	19.3	19.3	14.55	13.15	13.55	12.8	12.35
12	.....	.....	12.35	15.1	15.1	19.6	18.7	14.45	13.1	13.35	12.65	12.3
13	.....	.....	12.55	15.55	15.8	19.95	18.25	14.25	13.05	13.25	12.55	12.3
14	.....	.....	12.35	15.7	15.9	20.4	18.45	14.2	13.0	13.25	12.4	12.25
15	.....	12.25	12.25	16.1	15.7	20.8	18.55	14.2	13.1	13.3	12.4	12.25
16	.....	12.2	12.35	16.35	15.45	21.0	18.0	14.2	13.3	13.25	12.45	12.15
17	.....	12.2	12.25	16.35	15.45	21.0	17.4	14.2	13.3	13.25	12.6	12.15
18	.....	12.3	12.25	16.15	15.85	21.1	17.05	14.05	13.25	13.15	12.6	12.45
19	.....	12.3	12.5	15.8	16.5	20.95	16.95	14.05	13.15	13.1	12.6	13.0
20	.....	12.25	13.3	15.45	17.45	20.85	16.75	14.0	13.1	13.1	12.6	13.2
21	.....	12.25	13.95	15.0	18.45	20.65	16.6	14.1	13.05	13.1	12.55	13.2
22	.....	12.3	14.3	14.75	19.2	20.4	16.7	14.05	13.0	13.1	12.5	13.3
23	.....	12.4	14.5	14.6	19.65	20.4	16.6	13.95	12.95	13.0	12.4	13.25
24	.....	12.45	14.0	14.65	19.8	20.4	16.45	13.75	12.9	13.0	12.3	13.2
25	.....	12.35	13.65	14.65	19.35	20.35	16.4	13.9	12.95	13.05	12.35	13.2
26	.....	12.35	13.6	14.65	18.95	20.45	17.05	14.0	13.0	13.0	12.4	13.1
27	.....	12.35	13.75	14.7	18.35	20.35	17.35	13.85	13.0	13.0	12.4	13.0
28	.....	12.45	13.65	14.75	18.15	20.4	17.3	13.8	13.05	13.0	12.5	12.8
29	.....	.....	13.45	14.95	17.85	20.6	17.15	13.75	13.1	13.0	12.45	12.7
30	.....	.....	13.2	15.0	17.65	20.75	16.6	13.7	13.1	13.0	12.5	12.6
31	.....	.....	13.05	.....	17.6	.....	16.25	13.8	.....	13.0	.....	12.8
1908.[b]												
1	12.6	12.4	12.45	12.4	13.85	15.95	16.5	13.95	13.0	12.65	12.65	12.2
2	12.6	12.3	12.35	12.45	13.9	16.5	16.25	14.35	12.85	12.6	12.65	12.25
3	12.8	12.3	12.25	12.45	14.3	16.75	16.2	14.5	12.75	12.6	12.6	12.2
4	12.8	12.4	12.35	12.4	14.65	17.1	16.1	14.15	12.7	12.6	12.55	12.3
5	12.8	12.55	12.35	12.5	14.7	17.6	16.05	13.75	12.65	12.6	12.55	12.35
6	12.8	12.55	12.45	12.55	14.55	17.85	16.0	13.6	12.6	12.6	12.6	12.35
7	12.8	12.55	12.3	12.55	14.4	17.8	15.8	13.6	12.5	12.6	12.5	12.25
8	12.8	12.5	12.2	12.75	14.5	17.4	15.6	13.5	12.5	12.6	12.55	12.15
9	12.9	12.55	12.15	12.9	14.95	17.3	15.3	13.35	12.5	12.6	12.55	12.2
10	12.65	12.55	12.2	13.05	15.3	17.95	15.0	13.3	12.6	12.55	12.55	12.15
11	12.55	12.7	12.25	13.1	15.2	18.65	15.1	13.55	12.6	12.5	12.5	12.25
12	12.4	12.6	12.2	13.4	14.95	19.2	15.05	14.0	12.55	12.5	12.45	12.2
13	12.6	12.7	12.2	13.7	14.85	19.05	15.1	14.15	12.7	12.5	12.5	12.15
14	12.8	12.6	12.3	14.05	14.7	18.75	14.9	14.3	12.6	12.5	12.45	12.2
15	12.9	12.6	12.45	14.35	14.55	18.95	14.95	14.15	12.6	12.4	12.4	12.2
16	12.8	12.6	12.6	14.75	14.5	18.9	15.0	14.0	12.6	12.6	12.35	12.45
17	12.6	12.7	12.65	14.95	14.8	18.65	15.0	13.85	12.6	12.65	12.55	12.6
18	12.5	12.7	12.75	14.8	15.35	18.65	14.75	13.8	12.6	13.6	12.35	12.25
19	12.5	12.6	12.8	14.75	15.85	18.15	14.5	14.05	12.55	13.35	12.35	12.0
20	12.55	12.6	12.75	14.9	16.35	17.4	14.25	13.95	12.5	13.1	12.35	12.05
21	12.6	12.6	12.65	15.1	16.75	17.25	14.1	14.0	12.4	12.95	12.4	12.15
22	12.75	12.6	12.65	15.3	16.45	17.2	13.95	14.0	12.4	12.75	12.45	12.4
23	12.75	12.6	12.6	15.45	16.25	18.1	13.85	13.95	12.4	12.7	12.45	12.55
24	12.75	12.5	12.55	15.35	16.2	18.0	13.75	13.85	12.4	12.7	12.5	12.95
25	12.95	12.5	12.55	15.1	16.25	17.95	13.7	13.75	12.55	12.65	12.45	13.4
26	12.8	12.4	12.5	14.7	16.35	17.75	13.65	13.6	12.6	12.65	12.4	14.05
27	12.55	12.45	12.65	14.4	16.3	17.55	13.6	13.55	12.6	12.7	12.25	14.4
28	12.55	12.4	12.8	14.15	16.1	17.7	13.6	13.45	12.6	12.7	12.2	14.65
29	12.6	12.65	12.65	14.05	15.85	17.2	13.6	13.3	12.6	12.7	12.2	14.9
30	12.55	.....	12.45	13.95	15.7	16.85	14.4	13.1	12.6	12.7	12.2	14.7
31	12.5	.....	12.4	.....	15.7	.....	13.6	13.0	12.65	12.65	.....	14.75

[a] Ice conditions December 15 to 31, 1907.
[b] Ice conditions prevailed January 1 to February 27, 1908. River frozen over December 23 to 31, 1908.

Rating table for Grand River at Palisades, Colo., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
12.00	1,170	13.30	2,730	14.60	5,040	16.80	10,780
12.10	1,260	13.40	2,890	14.70	5,250	17.00	11,450
12.20	1,350	13.50	3,050	14.80	5,460	17.20	12,140
12.30	1,450	13.60	3,210	14.90	5,680	17.40	12,860
12.40	1,550	13.70	3,380	15.00	5,900	17.60	13,600
12.50	1,650	13.80	3,550	15.20	6,350	17.80	14,360
12.60	1,760	13.90	3,720	15.40	6,810	18.00	15,150
12.70	1,880	14.00	3,900	15.60	7,290	19.00	19,400
12.80	2,000	14.10	4,080	15.80	7,780	20.00	24,200
12.90	2,130	13.20	4,260	16.00	8,310	21.00	29,600
13.00	2,270	14.30	4,450	16.20	8,880	22.00	35,500
13.10	2,420	14.40	4,640	16.40	9,490		
13.20	2,570	14.50	4,840	16.60	10,130		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1902 to 1909, and is fairly well defined above gage heights 12.2 feet. In computing many of the earlier high-water measurements too high a coefficient was used in reducing surface to mean velocities. These measurements have been revised in drawing the above curve, which is probably the best curve for the entire period, 1902 to 1909.

Monthly discharge of Grand River near Palisades, Colo., for 1907 and 1908.

[Drainage area, 8,550 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
February 15–28	1,600	1,350	1,460	0.171	0.09	40,500	B.
March	4,840	1,350	2,240	.262	.30	138,000	B.
April	9,340	2,200	5,250	.614	.68	312,000	A.
May	23,200	4,540	10,500	1.23	1.42	646,000	A.
June	30,200	13,400	24,800	2.90	3.24	1,480,000	A.
July	29,300	9,030	17,000	1.99	2.29	1,040,000	A.
August	8,310	3,380	4,890	.572	.66	301,000	A.
September	3,460	2,130	2,600	.304	.34	155,000	B.
October	3,900	2,270	2,640	.309	.36	162,000	B.
November	2,270	1,450	1,820	.213	.24	108,000	B.
December [a]	1,550	1,260	1,370	.160	.18	84,200	C.
The period						4,470,000	
January [a]			1,300	.152	.18	79,900	C.
February [a]	1,820		1,320	.154	.17	75,900	C.
March	2,000	1,350	1,630	.191	.22	100,000	B.
April	6,930	1,550	3,900	.456	.51	232,000	A.
May	10,600	3,640	6,720	.786	.91	413,000	A.
June	20,300	8,180	14,600	1.71	1.91	869,000	A.
July	9,810	3,210	5,670	.663	.76	349,000	A.
August	4,840	2,270	3,550	.415	.48	218,000	A.
September	2,270	1,550	1,760	.206	.23	105,000	B.
October	3,210	1,550	1,890	.221	.25	116,000	B.
November	1,820	1,350	1,600	.187	.21	95,200	B.
December [b]	1,760	1,170	1,320	.154	.18	81,200	B.
The year	20,300	1,170	3,770	.441	6.01	2,730,000	

[a] Discharge estimated December 21, 1907, to February 10, 1908, following approximately the rate of rise and fall at Glenwood Springs. Values for February 11 to 27 are based on the gage heights allowing for ice as noted by the observer.

[b] Discharge estimated December 21–31; maximum and minimum are for December 1 to 20.

NORTH INLET TO GRAND LAKE AT GRAND LAKE, COLO.

Two streams, known as the North and East inlets, flow into Grand Lake, North Inlet being the larger.

The gaging station on the North Inlet, which was established August 3, 1905, to obtain information concerning the run-off from a high mountainous area and also for use in connection with power development, is located at the footbridge which crosses the stream about 100 yards north of the mouth and 300 yards east of the Grand Lake post-office.

The approximate elevation of this basin is 8,000 to 11,000 feet above sea-level, and the fall of the stream is very great.

No important tributaries enter above the station, which therefore gives results for the whole drainage area, measuring 36.5 square miles.

No water is diverted above the station. but filings have already been made for power development.

The stream is frozen over with thick ice for about four months. Gage readings during this period are therefore of little value.

No change has been made in the datum of the staff gage at the bridge during the maintenance of the station.

The accuracy of the records is affected by the roughness of the stream bed and by ice conditions. The records are fragmentary as the gage has not been read continuously.

Discharge measurements of North Inlet to Grand Lake at Grand Lake, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 24	C. L. Chatfield	60	140	3.78	488
July 22	do	56	106	3.13	284
August 12	do	52	63	2.53	109
October 2	Freeman and Stewart	44	35.8	2.06	21.2
November 26[a]	J. B. Stewart	6	4	4.32	3.3
1908.					
January 30[a]	J. B. Stewart	4	2.8	.....	6.5
February 26[a]	do	5	2.1	.....	3.1
May 20	C. L. Chatfield	49	79	2.80	151
June 11	do	52	94	3.00	204
July 3	Hoyt and Freeman	51	90	2.88	174
July 27	C. L. Chatfield	49	60	2.42	68
August 18	do	46	64	2.50	84
September 17	do	47	42	2.12	27
October 22	do	45	38	2.00	14
November 23[a]	do	7	5.2	2.40	7.7
December 21[a]	do	7	4	.....	6

[a] Ice conditions. Measurements by wading.

NOTE.—Discharge measurements made at this station in 1905 and 1906 are published in Water-Supply Papers 175, p. 75, and 211, p. 67, respectively.

Daily gage height, in feet, of North Inlet to Grand Lake at Grand Lake, Colo., for 1907 and 1908.

[J. Cairns and B. V. Glick, observers.]

Day.	Mar.	Apr.	July.	Aug.	Oct.	Day.	Mar.	Apr.	July.	Aug.	Oct.
1907.						1908.					
1		2.2			2.01	1					
2		2.3			2.01	2					
3		2.4			2.01	3			2.85		
4		2.4			2.01	4			2.95		
5		2.4		2.73	2.01	5			3.0		
6		2.4		2.73	2.02	6			2.95		
7		2.4		2.68	2.02	7			2.95		
8		2.4		2.63	2.02	8			2.85		
9		2.5		2.63	2.01	9			2.85		
10		2.5		2.63	2.01	10			2.8		
11		2.5		2.58	2.01	11			2.8		
12		2.5		2.53	2.01	12			2.8		
13		2.5		2.50	2.01	13			2.8		
14		2.55		2.50	2.01	14			2.85		
15		2.55		2.50	2.01	15			2.85		
16		2.6		2.45	2.01	16			2.8		
17	2.2	2.5		2.45	2.01	17			2.7		
18	2.25	2.45		2.40	2.01	18			2.6		
19	2.25	2.45		2.40	2.01	19			2.6		
20	2.25	2.45		2.40	2.01	20			2.55		
21	2.25	2.45		2.40	2.00	21			2.55		
22	2.25	2.45		2.35	2.00	22			2.5		
23	2.2	2.4		2.35	2.00	23					
24	2.3	2.35		2.30	2.00	24					
25	2.35	2.35		2.35	2.00	25					
26	2.3	2.4		2.35	2.00	26					
27	2.25	2.4		2.35	2.00	27			2.42		
28	2.2	2.3		2.30	2.00	28					
29	2.2	2.3		2.30	2.00	29					
30	2.2	2.25		2.30	2.00	30					
31	2.2				2.00	31					

Rating tables for North Inlet to Grand Lake at Grand Lake, Colo.

1905 TO 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	7	2.60	125	3.40	377
1.90	11	2.70	150	3.50	417
2.00	17	2.80	177	3.60	459
2.10	27	2.90	206	3.70	503
2.20	42	3.00	237	3.80	548
2.30	60	3.10	269	3.90	595
2.40	80	3.20	303	4.00	644
2.50	102	3.30	339		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1905 to 1907, and 1908, and is fairly well defined above gage height 2.0 feet.

1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	65	2.70	127	2.90	178
2.50	84	2.80	152	3.00	205
2.60	104				

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1908 and is well defined.

Monthly discharge of North Inlet to Grand Lake at Grand Lake, Colo., for 1905 to 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1905.					
August	60	17	33.9	2,080	D.
September	17	7	10.7	637	D.
October	14	7	8.2	504	D.
November	11	9	10.7	637	D.
December	11	7	7.6	467	D.
The period				4,320	
1906.					
May 3–31	321	51	194	11,200	B.
June	644	200	351	20,900	B.
July 1–22	317	155	259	11,300	B.
1907.					
March 17–31	70	42	49.9	1,480	B.
April	125	42	85.1	5,060	B.
August 5–30	158	60	95.5	4,920	A.
October	19	17	17.7	1,090	B.
December			4.0	246	D.
1908.					
January			5.5	338	D.
February			4.0	230	D.
July 3–27	205	69	134	6,640	A.

NOTE.—Ice conditions during December, 1907, January and February, 1908, and discharge estimated.

GRAND LAKE OUTLET AT GRAND LAKE, COLO.

This station, which was established July 31, 1904, is located at the west end of Grand Lake, about one-half mile south of Grand Lake post-office. Granby, about 15 miles distant, on the Denver, Northwestern and Pacific Railroad, is the nearest railroad point.

The records of the station show the storage possibilities of Grand Lake and the total run-off from the North and East inlets, and are valuable for use in connection with power development. The drainage area at the station is 62 square miles.

Shore ice forms at the station for about four months, but the stream does not freeze over because of the higher temperature of the water coming out of Grand Lake.

The location and datum of the staff gage have remained unchanged during the maintenance of the station.

During low stages, the rough bottom and sluggish character of the stream affect the accuracy of the results to a considerable extent.

Measurements have been made at various sections, but usually at a ford one-fourth mile downstream from the footbridge where the gage is located. There is a tag wire across the stream at the ford.

Discharge measurements of Grand Lake Outlet at Grand Lake, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 23	C. L. Chatfield	196	389	3.95	938
July 21	do	147	246	3.25	534
August 12	do	123	138	2.40	179
October 2	Freeman and Stewart	100	79	1.70	45
November 26	J. B. Stewart	28	14	1.35	5
1908.					
January 30	J. B. Stewart	28	12	1.30	7
February 26	do	14	12	1.25	6
May 20	C. L. Chatfield	125	147	2.68	240
June 11	do	125	187	3.05	389
July 3	Hoyt and Freeman	125	171	2.80	314
July 27	C. L. Chatfield	123	114	2.20	127
August 17	do	125	122	2.35	144
September 17	do	40	28	1.80	43
October 22	do	36	21	1.58	20
November 23	do	12	5.6	1.40	13.2
December 21	do	10	9.4	1.40	13

NOTE.—The above measurements were made by wading at various sections.

Daily gage height, in feet, of Grand Lake Outlet at Grand Lake, Colo., for 1907 and 1908.

[Mrs. Myrtle Westcott, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	1.40	1.30	1.30	1.55	1.70	2.30	4.15	2.82	1.95	1.72	1.55	1.20
2	1.40	1.35	1.30	1.55	1.70	2.42	4.18	2.70	1.95	1.70	1.50	1.20
3	1.40	1.40	1.35	1.55	1.70	2.68	4.15	2.65	1.92	1.70	1.50	1.20
4	1.38	1.42	1.35	1.58	1.65	2.72	4.00	2.78	1.90	1.65	1.50	1.20
5	1.35	1.42	1.32	1.60	1.65	2.88	4.15	2.85	1.85	1.68	1.45	1.15
6	1.35	1.40	1.30	1.65	1.70	3.22	4.12	2.70	1.85	1.68	1.45	1.15
7	1.35	1.40	1.32	1.62	1.70	3.15	4.02	2.60	1.85	1.80	1.45	1.15
8	1.35	1.40	1.35	1.62	1.70	3.08	4.05	2.55	1.82	1.82	1.45	1.15
9	1.35	1.40	1.35	1.62	1.70	3.00	3.95	2.50	1.80	1.88	1.45	1.15
10	1.35	1.40	1.35	1.65	1.70	2.88	3.82	2.48	1.80	1.88	1.45	1.15
11	1.35	1.40	1.35	1.72	1.78	2.88	3.68	2.45	1.78	1.85	1.45	1.15
12	1.35	1.40	1.38	1.80	1.88	3.15	3.52	2.38	1.75	1.82	1.40	1.15
13	1.35	1.40	1.40	1.82	1.95	3.42	3.48	2.32	1.72	1.88	1.40	1.15
14	1.35	1.38	1.40	1.90	1.95	3.68	3.62	2.28	1.70	1.82	1.40	1.15
15	1.35	1.40	1.40	1.95	1.95	3.78	3.52	2.25	1.70	1.80	1.35	1.15
16	1.35	1.35	1.38	2.00	1.95	3.88	3.30	2.25	1.75	1.72	1.35	1.15
17	1.30	1.35	1.40	2.00	1.95	3.82	3.20	2.25	1.70	1.72	1.35	1.15
18	1.30	1.35	1.35	1.95	2.02	3.95	3.18	2.20	1.70	1.68	1.35	1.15
19	1.30	1.35	1.35	1.90	2.22	4.15	3.10	2.15	1.65	1.68	1.35	1.15
20	1.30	1.35	1.42	1.85	2.50	3.95	3.15	2.15	1.65	1.65	1.32	1.15
21	1.30	1.35	1.45	1.80	2.80	3.85	3.22	2.15	1.65	1.62	1.30	1.15
22	1.30	1.32	1.48	1.80	3.08	3.70	3.20	2.10	1.65	1.62	1.30	1.15
23	1.30	1.30	1.50	1.78	3.08	3.90	3.22	2.08	1.65	1.62	1.30	1.15
24	1.30	1.30	1.50	1.75	3.02	3.98	3.05	2.05	1.65	1.62	1.30	1.15
25	1.30	1.30	1.55	1.75	2.90	4.15	3.05	2.05	1.68	1.55	1.25	1.20
26	1.30	1.30	1.60	1.75	2.70	4.15	3.18	2.05	1.68	1.55	1.25	1.20
27	1.30	1.30	1.60	1.75	2.55	3.98	3.62	2.05	1.68	1.55	1.25	1.20
28	1.30	1.30	1.65	1.75	2.45	3.98	3.58	2.05	1.72	1.58	1.25	1.20
29	1.30	.....	1.65	1.75	2.38	3.90	3.28	2.05	1.65	1.58	1.25	1.20
30	1.30	.....	1.60	1.75	2.35	4.12	3.05	2.00	1.68	1.55	1.22	1.20
31	1.30	.....	1.55	.....	2.28	.....	2.90	1.95	.....	1.55	.....	1.25
1908.[a]												
1	1.25	1.3	1.25	1.3	1.8	2.45	2.9	2.75	2.0	1.7	1.5	1.35
2	1.25	1.3	1.25	1.3	1.75	2.5	2.8	2.6	1.95	1.65	1.5	1.35
3	1.25	1.3	1.25	1.25	1.85	2.6	2.8	2.5	1.95	1.65	1.5	1.35
4	1.25	1.3	1.25	1.25	1.95	2.9	2.8	2.4	1.9	1.65	1.5	1.35
5	1.3	1.3	1.25	1.25	1.95	3.05	2.85	2.3	1.9	1.65	1.45	1.35

[a] Gage heights practically unaffected by ice conditions, 1907 and 1908.

Daily gage height, in feet, of Grand Lake Outlet at Grand Lake, Colo., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
6	1.3	1.3	1.25	1.25	1.9	3.0	2.8	2.25	1.85	1.65	1.45	1.35
7	1.3	1.3	1.25	1.25	1.95	2.9	2.8	2.2	1.8	1.65	1.45	1.35
8	1.3	1.3	1.25	1.3	2.0	2.8	2.8	2.2	1.8	1.65	1.45	1.35
9	1.25	1.3	1.25	1.3	2.2	2.7	2.8	2.15	1.8	1.65	1.45	1.35
10	1.25	1.3	1.25	1.35	2.2	2.9	2.8	2.1	1.8	1.65	1.45	1.35
11	1.25	1.3	1.25	1.4	2.1	3.1	2.75	2.3	1.85	1.6	1.45	1.35
12	1.25	1.3	1.25	1.4	2.1	3.4	2.75	2.65	1.8	1.6	1.45	1.35
13	1.25	1.25	1.25	1.5	2 0	3.25	2.75	2.65	1.8	1.6	1.4	1.35
14	1.25	1.25	1.25	1.6	2.0	3.2	2.7	2.6	1.85	1.55	1.4	1.35
15	1.25	1.25	1.25	1.7	1.95	3.35	2.7	2.5	1.85	1.55	1.4	1.35
16	1.3	1.25	1.25	1.9	1.95	3.4	2.65	2.4	1.8	1.55	1.4	1.35
17	1.3	1.25	1.25	2.0	2.1	3.5	2.6	2.4	1.8	1.55	1.4	1.4
18	1.3	1.25	1.25	2.05	2.25	3.4	2.5	2.3	1.8	1.55	1.4	1.4
19	1.25	1.25	1.25	2.1	2.4	3.0	2.45	2.3	1.75	1.55	1.4	1.4
20	1.25	1.25	1.3	2.1	2.7	2.95	2.4	2.35	1.75	1.55	1.4	1.4
21	1.3	1.25	1.3	2.1	2.7	3.25	2.3	2.5	1.75	1.55	1.4	1.4
22	1.3	1.25	1.25	2.15	2.55	3.55	2.3	2.7	1.7	1.55	1.4	1.4
23	1.3	1.25	1.25	2.2	2.4	3.6	2.25	2.8	1.7	1.55	1.4	1.4
24	1.3	1.25	1.25	2.15	2.3	3.4	2.3	2.6	1.7	1.55	1.4	1.4
25	1.3	1.25	1.25	2.1	2.4	3.3	2.25	2.5	1.65	1.55	1.4	1.4
26	1.3	1.25	1.25	2.0	2.4	3.3	2.25	2.4	1.65	1.55	1.4	1.4
27	1.3	1.25	1.25	2.0	2.3	3.3	2.2	2.4	1.65	1.5	1.35	1.4
28	1.3	1.25	1.25	1.9	2.3	3.1	2.2	2.2	1.65	1.5	1.35	1.4
29	1.3	1.25	1.3	1.85	2.2	3.0	2.2	2.15	1.7	1.5	1.35	1.4
30	1.3	.....	1.3	1.8	2.25	2.9	2.6	2.1	1.7	1.5	1.35	1.4
31	1.3	.....	1.3	.....	2.35	.....	2.9	2.1	.....	1.5	.....	1.4

[a] Gage heights practically unaffected by ice conditions, 1907 and 1908.

Rating tables for Grand Lake Outlet at Grand Lake, Colo.

1906 AND 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.15	3	2.00	84	2.90	379	3.80	835
1.20	4	2.10	106	3.00	420	3.90	890
1.30	7	2.20	131	3.10	465	4.00	945
1.40	11	2.30	159	3.20	515	4.10	1,000
1.50	16	2.40	190	3.30	565	4.20	1,055
1.60	23	2.50	224	3.40	615	4.30	1,110
1.70	33	2.60	260	3.50	670		
1.80	47	2.70	298	3.60	725		
1.90	64	2.80	338	3.70	780		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on ten discharge measurements made during 1906 and 1907, and is well defined.

JANUARY 1 TO OCTOBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	4.5	1.90	60	2.60	230	3.30	502
1.30	7.5	2.00	77	2.70	263	3.40	550
1.40	11	2.10	97	2.80	297	3.50	600
1.50	16	2.20	119	2.90	333	3.60	656
1.60	22	2.30	143	3.00	372		
1.70	32	2.40	170	3.10	413		
1.80	44	2.50	199	3.20	456		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on nine discharge measurements made during 1908 and form of preceding curves. It is well defined between gage height 1.25 feet and 3.05 feet.

Rating tables for Grand Lake Outlet at Grand Lake, Colo.—Continued.

NOVEMBER 1 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.35	11	1.45	15
1.40	13	1.50	18

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on two discharge measurements and form of preceding curve.

Monthly discharge of Grand Lake Outlet at Grand Lake, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	11	7	8.3	510	D.
February	12	7	9.4	522	D.
March	28	7	13.3	818	D.
April	84	20	42.9	2,550	C.
May	456	28	147	9,040	A.
June	1,030	159	685	40,800	A.
July	1,040	379	698	42,900	A.
August	358	74	175	10,800	A.
September	74	28	41.3	2,460	C.
October	61	20	34.9	2,150	C.
November	20	4.6	10.4	619	D.
December	5.5	3.0	3.4	209	D.
The year	1,040	3	156	113,000	
1908.					
January	7.5	6	6.87	422	B.
February	7.5	6	6.62	381	B.
March	7.5	6	6.24	384	C.
April	119	6	47.3	2,810	B.
May	263	38	119	7,320	A.
June	656	184	424	25,200	A.
July	333	119	231	14,200	A.
August	297	97	174	10,700	A.
September	77	27	44.0	2,620	B.
October	32	16	21.5	1,320	B.
November	18	11	13.9	827	B.
December	13	11	12.0	738	B.
The year	656	6	92.2	66,900	

FRASER RIVER AT GRANBY, COLO.

Fraser River rises among the peaks of the Front Range in southeastern Grand County and flows in a generally northwesterly direction to its junction with Grand River in the east-central part of Middle Park.

The gaging station, which was established July 28, 1904, to obtain data for use in determining the availability of the stream for power, storage, and irrigation, is located at the wagon bridge three-quarters of a mile southwest of Granby, about 4 miles above the mouth of Fraser River, in sec. 9, T. 1 N., R. 76 W., and is below all tributaries.

The drainage area is about 220 square miles.

Other than small irrigation ditches, there are no important diversions above the station. A small canal is taken out a few feet downstream from the measuring section. It is proposed to divert water by means of a tunnel from the headwaters of this river into the headwaters of South Boulder Creek, in the Platte drainage basin.

Thick ice covers the stream for about four months of the year; anchor ice also occurs. Each year in the low season a small temporary diversion dam is generally constructed about 50 feet below the station to divert the water into the canal below. This dam backs the water up on the gage, thus affecting the conditions of free flow.

Neither the location nor the datum of the staff gage at the highway bridge has been changed during the maintenance of the station.

Measuring conditions are rather poor. During high stages the measurements are affected by backwater and a boiling effect caused by the crib piers of the bridge. During low stages ice conditions and the temporary diversion dam interfere with good results.

Discharge measurements of Fraser River at Granby, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	C. L. Chatfield	55	110	5.05	242
June 22	do	59	197	6.35	1,000
July 19	do	60	148	5.42	431
August 11	do	56	116	4.90	188
October 11	Freeman and Stewart	53.5	93	4.64	97
November 25 [a]	J. B. Stewart	80	34	4.65	42
1908.					
January 27 [a]	J. B. Stewart	41	33	[b] 5.48	45
February 28 [a]	do	9	18	[c] 4.80	37
May 19	C. L. Chatfield	58	131	5.20	284
June 12	do	59	178	5.80	677
July 2	Hoyt and Freeman	58	139	5.32	328
July 26	C. L. Chatfield	65	112	4.90	165
August 15	do	42	88	4.90	121
September 16	do	39	80	4.60	78
October 20	do	38	73	4.50	46
November 22 [a]	do	40	56	4.70	57
December 22 [d]	do	23	25	.....	48

[a] Ice conditions.
[b] To water surface; to top of ice, 6.18; thickness of ice, 3.10.
[c] To water surface; to top of ice, 6.20; thickness of ice, 3.10.
[d] Measured below pumping station opposite Granby; river partly frozen.

NOTE.—These measurements were made at various sections.

Daily gage height, in feet, of Fraser River at Granby, Colo., for 1907 and 1908.

[J. N. Ostrander, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	.....	.....	.....	4.65	4.9	5.7	6.45	5.1	4.7	4.5	4.5	.....
2	.....	.....	.....	4.7	4.85	5.75	6.4	5.05	4.7	4.5	4.4	.....
3	.....	.....	.....	4.65	4.85	5.85	6.4	5.0	4.7	4.5	4.4	.....
4	.....	.....	.....	4.65	4.8	5.95	6.3	5.25	4.7	4.5	4.4	.....
5	.....	.....	.....	4.6	4.8	6.15	6.2	5.15	4.7	4.5	4.4	.....
6	.....	.....	.....	4.6	4.8	6.35	6.15	5.05	4.7	4.5	4.3	.....
7	.....	.....	.....	4.6	4.9	6.4	6.1	5.0	4.7	4.5	4.3	.....
8	.....	.....	.....	4.65	4.95	6.25	6.05	5.0	4.7	4.5	4.3	.....
9	.....	.....	.....	4.7	4.95	6.2	6.0	4.9	4.7	4.5	4.3	.....
10	.....	.....	.....	5.0	4.95	6.0	5.95	4.8	4.7	4.5	4.3	.....
11	.....	.....	.....	5.25	5.0	6.05	5.9	4.8	4.7	4.5	4.3	.....
12	.....	.....	.....	5.1	5.3	6.3	5.8	4.85	4.6	4.5	4.3	.....
13	.....	.....	.....	5.1	5.3	6.4	5.9	4.8	4.6	4.5	4.3	.....
14	.....	.....	.....	5.15	5.3	6.6	6.0	4.8	4.6	4.5	4.3	.....
15	.....	.....	.....	5.15	5.2	6.7	5.85	4.8	4.6	4.5	4.25	.....
16	.....	.....	.....	5.15	5.25	6.75	5.65	4.8	4.6	4.5	.....	.....
17	.....	.....	4.4	5.05	5.25	6.6	5.6	4.8	4.6	4.5	.....	.....
18	.....	.....	4.4	5.0	5.3	6.65	5.6	4.8	4.6	4.5	.....	.....
19	.....	.....	4.5	4.9	5.55	6.7	5.5	4.8	4.6	4.5	.....	.....
20	.....	.....	4.65	4.9	5.7	6.55	5.35	4.8	4.6	4.5	.....	.....
21	.....	.....	4.7	4.95	6.05	6.5	5.25	4.8	4.6	4.5	.....	.....
22	.....	.....	4.7	5.0	6.25	6.35	5.2	4.8	4.6	4.5	.....	.....
23	.....	.....	4.7	5.05	6.3	6.5	5.1	4.8	4.5	4.5	.....	.....
24	.....	.....	4.7	4.9	6.3	6.5	5.1	4.8	4.5	4.5	.....	.....
25	.....	.....	4.65	4.9	6.05	6.5	5.05	4.75	4.5	4.5	.....	.....
26	.....	.....	4.6	4.9	5.8	6.5	5.2	4.7	4.5	4.5	.....	.....
27	.....	.....	4.6	4.9	5.8	6.45	5.4	4.7	4.5	4.5	.....	.....
28	.....	.....	4.6	4.9	5.75	6.45	5.35	4.8	4.5	4.5	.....	.....
29	.....	.....	4.5	4.95	5.75	6.35	5.35	4.8	4.5	4.5	.....	.....
30	.....	.....	4.5	4.95	5.7	6.5	5.2	4.8	4.5	4.5	.....	.....
31	.....	.....	4.55	.....	5.8	.....	5.15	4.7	.....	4.5	.....	.....
1908.[b]												
1	5.5	.....	.....	4.5	4.6	5.3	5.4	5.3	4.7	4.6	4.5	4.95
2	5.5	.....	.....	4.5	4.6	5.4	5.4	5.15	4.7	4.6	4.5	5.0
3	5.5	.....	.....	4.5	4.6	5.5	5.4	5.1	4.7	4.6	4.5	5.1
4	5.5	.....	.....	4.5	4.65	5.5	5.35	5.0	4.6	4.6	4.5	5.1
5	5.5	.....	.....	4.5	4.7	5.5	5.3	4.9	4.6	4.6	4.55	5.1
6	5.4	.....	.....	4.5	4.7	5.6	5.3	5.1	4.6	4.6	4.55	5.15
7	5.4	.....	.....	4.6	4.8	5.6	5.2	5.15	4.55	4.6	4.55	5.15
8	5.4	.....	.....	4.6	4.9	5.6	5.15	5.0	4.55	4.6	4.55	5.25
9	5.4	.....	.....	4.6	4.9	5.6	5.1	4.9	4.5	4.6	4.55	5.25
10	5.4	.....	.....	4.6	4.85	5.7	5.1	4.9	4.6	4.6	4.55	5.25
11	5.5	.....	.....	4.7	4.8	5.9	5.1	4.95	4.6	4.6	4.55	5.25
12	5.5	.....	.....	4.7	4.8	6.0	5.05	5.15	4.6	4.6	4.5	5.4
13	5.5	.....	.....	4.7	4.8	6.1	5.0	5.2	4.6	4.6	4.5	5.25
14	5.5	.....	.....	4.7	4.8	6.1	5.0	5.2	4.55	4.6	4.5	5.3
15	5.5	.....	.....	4.7	4.8	6.0	5.0	4.9	4.5	4.6	4.5	5.1
16	5.5	.....	.....	4.7	4.8	5.85	5.0	4.9	4.5	4.6	4.5	5.1
17	5.5	.....	.....	4.7	4.9	5.8	5.0	4.9	4.5	4.6	4.5	5.1
18	5.5	.....	.....	4.7	4.95	5.75	5.0	5.0	4.5	4.6	4.5	5.3
19	5.5	.....	.....	4.7	5.1	5.6	5.0	5.1	4.5	4.6	4.5	5.4
20	5.5	.....	.....	4.7	5.2	5.6	5.0	5.1	4.45	4.6	4.5	5.45
21	5.5	.....	.....	4.7	5.1	5.6	5.0	5.1	4.45	4.5	4.5	5.5
22	5.5	.....	.....	4.7	5.2	5.6	5.0	5.0	4.4	4.5	4.7	5.35
23	5.5	.....	.....	4.7	5.2	5.7	4.9	5.0	4.4	4.55	4.7	5.3
24	5.5	.....	.....	4.7	5.3	5.6	4.95	5.0	4.4	4.55	4.8	5.3
25	5.5	.....	.....	4.7	5.3	5.6	5.0	4.9	4.4	4.5	4.8	5.4
26	.....	.....	.....	4.6	5.3	5.6	4.9	4.85	4.45	4.55	4.8	5.45
27	.....	.....	.....	4.6	5.2	5.6	4.85	4.8	4.5	4.55	4.8	5.55
28	.....	.....	.....	4.6	5.2	5.6	5.2	4.8	4.5	4.6	4.9	5.6
29	.....	.....	.....	4.6	5.2	5.5	5.25	4.8	4.6	4.55	4.9	5.6
30	.....	.....	.....	4.6	5.2	5.5	5.45	4.8	4.6	4.55	5.1	5.6
31	.....	.....	.....	.....	5.2	.....	5.45	4.8	.....	4.55	.....	5.6

[a] Ice condition November 16 to December 31, 1907.

[b] Ice conditions January 1 to March 31, 1908, and November 22 to December 31, 1908. Beginning July 24, 1908, conditions of flow affected by changes made in diversion weir below station.

Rating tables for Fraser River at Granby, Colo.

MARCH 17 TO JUNE 14, AND JULY 6 TO NOVEMBER 15, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.25	45	4.90	180	5.60	570	6.30	1,210
4.30	50	5.00	220	5.70	650	6.40	1,310
4.40	60	5.10	260	5.80	730	6.50	1,420
4.50	80	5.20	310	5.90	820	6.60	1,530
4.60	100	5.30	370	6.00	910		
4.70	120	5.40	430	6.10	1,000		
4.80	150	5.50	500	6.20	1,100		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1907 and form of the 1905 curve. It is well defined except at low stages.

JUNE 15 TO JULY 5, 1907.

[Indirect method for shifting channels used.]

APRIL 1 TO JULY 23, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	66	5.00	197	5.50	455	6.00	854
4.60	83	5.10	235	4.60	524	6.10	950
4.70	105	5.20	280	5.70	598		
4.80	132	5.30	332	5.80	677		
4.90	163	5.40	391	5.90	763		

NOTE.—The above table is not applicable for obstructed-channel conditions. It is based on four discharge measurements made during 1908 and the form of the 1907 curve. It is well defined between gage heights 4.9 feet and 6.1 feet.

JULY 24 TO NOVEMBER 21, 1908.

[Indirect method for shifting channels used.]

Daily discharge, in second-feet, of Fraser River at Granby, Colo., for June 15 to July 5, 1907.

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1	.....	1,280	11	.....	.....	21	1,190	.....
2	.....	1,240	12	.....	.....	22	1,050	.....
3	.....	1,260	13	.....	.....	23	1,180	.....
4	.....	1,170	14	.....	.....	24	1,190	.....
5	.....	1,090	15	1,610	.....	25	1,210	.....
6	.....	.....	16	1,630	.....	26	1,230	.....
7	.....	.....	17	1,440	.....	27	1,200	.....
8	.....	.....	18	1,450	.....	28	1,210	.....
9	.....	.....	19	1,470	.....	29	1,130	.....
10	.....	.....	20	1,280	.....	30	1,300	.....
						31	.....	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Daily discharge, in second-feet, of Fraser River at Granby, Colo., for July 24 to November 21, 1908.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1		160	86	70	46	16		122	60	56	46
2		120	86	70	46	17		122	60	56	46
3		110	86	70	46	18		153	60	56	46
4		87	70	70	46	19		186	60	56	46
5		80	70	64	50	20		190	53	51	46
6		110	70	64	50	21		190	53	46	46
7		120	62	64	50	22		157	50	46	
8		87	62	64	50	23		157	50	50	
9		70	60	64	50	24	190	160	50	50	
10		70	75	64	50	25	200	129	50	46	
11		80	75	64	50	26	165	115	52	50	
12		20	75	64	46	27	150	104	58	50	
13		140	78	56	46	28	140	107	58	55	
14		140	68	56	46	29	150	107	70	50	
15		120	61	56	46	30	210	107	70	50	
						31	210	107		50	

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Fraser River at Granby, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
March 17–31	120	60	96.7	2,880	C.
April	340	100	190	11,300	B.
May	1,210	150	494	30,400	A.
June	1,610	650	1,180	70,200	B.
July	1,280	240	680	41,800	A.
August	340	120	175	10,800	B.
September	120	80	102	6,070	B.
October	80	80	80.0	4,920	C.
November	80		49.7	2,960	D.
December			45.0	2,770	D.
The period				184,000	
1908.					
January			45.0	2,770	D.
February			37.6	2,160	D.
March			45.1	2,770	D.
April	105	66	90.6	5,390	C.
May	332	83	194	11,900	A.
June	950	332	580	34,500	A.
July	391	140	232	14,300	B.
August	190	70	123	7,560	C.
September	86	50	64.6	3,840	D.
October	70	46	57.4	3,530	D.
November			49.6	2,950	D.
December			52.3	3,210	D.
The year			131	95,000	

NOTE.—Ice conditions and discharge estimated for periods November 15 to December 31, 1907; January 1 to March 31, and November 22 to December 31, 1908. Discharge obtained by shifting-channel methods for June 15 to July 5, 1907, and July 24 to November 21, 1908.

WILLIAMS FORK NEAR SULPHUR SPRINGS, COLO.

Williams Fork rises in the Williams River Mountains and flows northwestward, joining Grand River in the central part of Middle Park.

The gaging station was established July 25, 1904, to obtain data for use in connection with the development of the stream for power, storage, and irrigation. It is located near the mouth of the stream, at the wagon bridge on the ranch of F. A. Field, about 9 miles west of Hot Sulphur Springs, Colo. The nearest railroad point is Parshall, a station on the Denver, Northwestern and Pacific Railroad.

The drainage area is about 200 square miles.

The station is below all tributaries. A number of irrigation ditches divert water above the station, and it is possible that in the future a tunnel will divert water from the headwaters of Williams Fork to the headwaters of Clear Creek in the Platte drainage basin. Some work has been done toward the construction of a reservoir and power plant a couple of miles downstream from the station.

Springs keep the ice from getting very thick at this station, but slush ice occurs frequently throughout the winter.

No change has been made in the location or in the datum of the staff gage at the bridge during the maintenance of the station.

Results are satisfactory. During low stages in the winter, the flow is constant, being nearly all from springs.

Discharge measurements of Williams Fork near Sulphur Springs, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 20[a]	R. I. Meeker	26	44	3.17	45
April 26	C. L. Chatfield	45	71	3.45	92
May 28	W. B. Freeman	50	106	4.08	342
June 21	C. L. Chatfield	64	154	4.70	860
July 18	do	51	112	4.15	373
August 10	do	48	80	3.65	144
September 30	Freeman and Stewart	45	67	3.42	75
November 24	J. B. Stewart	42	55	3.09	42
1908.					
January 24[b]	J. B. Stewart	34	47	3.12	40
February 29[b]	do	28	44	3.10	40
March 18[c]	C. L. Chatfield	38	37	3.19	51
April 17	do	47	79	3.65	131
May 22	do	49	94	3.92	230
June 14	do	54	131	4.50	614
July 4	Hoyt and Freeman	52	97	4.07	269
July 25	C. L. Chatfield	48	80	3.68	133
August 14	do	45	70	3.49	91
September 15	do	45	67	3.37	65
October 24	do	45	63	3.33	69
November 21	do	27	44	3.20	58
December 23[d]	do	24	31	4.60	51

[a] Fringe of ice along banks.
[b] Ice along edges. Right channel frozen solid, ice 1.7 feet thick.
[c] Wading measurement.
[d] Measurement through ice.

Daily gage height, in feet, of Williams Fork near Sulphur Springs, Colo., for 1907 and 1908.

[F. A. Field, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1	3.25	3.14	3.15	3.33	3.55	4.04	4.99	3.88	3.48	3.44	3.30	3.21
2	3.20	3.14	3.18	3.33	3.52	4.19	4.92	3.86	3.48	3.44	3.30	3.18
3	3.20	3.14	3.18	3.40	3.54	4.28	4.82	3.82	3.45	3.43	3.30	3.30
4	3.18	3.14	3.18	3.44	3.51	4.22	4.78	3.88	3.45	3.42	3.30	3.28
5	3.22	3.13	3.18	3.40	3.50	4.22	4.78	3.82	3.45	3.41	3.30	3.25
6	3.20	3.12	3.19	3.40	3.55	4.28	4.72	3.82	3.42	3.42	3.30	3.08
7	3.21	3.12	3.17	3.36	3.58	4.42	4.68	3.79	3.44	3.49	3.26	3.13
8	3.20	3.14	3.14	3.35	3.58	4.38	4.64	3.81	3.35	3.46	3.28	3.14
9	3.18	3.12	3.14	3.40	3.57	4.40	4.56	3.80	3.35	3.42	3.26	3.14
10	3.18	3.12	3.16	3.54	3.56	4.35	4.58	3.72	3.31	3.40	3.21	3.18
11	3.19	3.12	3.18	3.70	3.68	4.35	4.47	3.62	3.30	3.40	3.19	3.11
12	3.19	3.12	3.16	3.60	3.78	4.50	4.45	3.64	3.30	3.38	3.10	3.11
13	3.18	3.14	3.18	3.68	3.79	4.62	4.40	3.62	3.31	3.37	3.00	3.16
14	3.19	3.14	3.15	3.74	3.74	4.72	4.44	3.62	3.30	3.36	3.02	3.14
15	3.20	3.14	3.15	3.78	3.72	4.80	4.35	3.60	3.30	3.36	3.02	3.18
16	3.15	3.15	3.20	3.84	3.70	4.87	4.32	3.70	3.30	3.35	3.22	3.20
17	3.18	3.15	3.22	3.74	3.76	4.81	4.26	3.65	3.30	3.35	3.12	3.22
18	3.18	3.15	3.57	3.64	3.78	4.80	4.22	3.60	3.30	3.32	3.22	3.22
19	3.16	3.16	3.92	3.60	3.91	4.88	4.18	3.61	3.30	3.32	3.15	3.20
20	3.18	3.16	3.71	3.52	4.05	4.75	4.14	3.61	3.30	3.33	3.00	3.20
21	3.15	3.16	3.74	3.38	4.24	4.72	4.11	3.65	3.30	3.34	3.12	3.22
22	3.15	3.18	3.57	3.55	4.28	4.72	4.08	3.61	3.30	3.36	3.12	3.22
23	3.18	3.18	3.48	3.54	4.32	4.80	4.03	3.56	3.30	3.36	3.10	3.20
24	3.14	3.19	3.44	3.60	4.35	4.81	4.06	3.60	3.30	3.37	3.14	3.20
25	3.12	3.17	3.49	3.58	4.26	4.86	4.12	3.54	3.30	3.34	3.13	3.16
26	3.12	3.17	3.49	3.56	4.18	4.89	4.18	3.59	3.40	3.32	3.14	3.16
27	3.14	3.17	3.38	3.56	4.12	4.88	4.18	3.56	3.45	3.31	3.14	3.18
28	3.12	3.16	3.29	3.60	4.10	4.80	4.14	3.51	3.38	3.33	3.20	3.15
29	3.13	.....	3.32	3.59	4.15	4.86	4.04	3.50	3.36	3.32	3.27	3.15
30	3.10	.....	3.36	3.55	4.10	4.92	3.98	3.50	3.41	3.32	3.20	3.15
31	3.14	.....	3.25	.....	4.04	.....	3.93	3.50	.....	3.32	.....	3.15
1908.[b]												
1	3.2	3.1	3.1	3.1	3.5	4.05	4.2	3.6	3.4	3.4	3.3	3.2
2	3.2	3.1	3.05	3.05	3.6	4.05	4.2	3.6	3.35	3.3	3.2	3.15
3	3.15	3.1	3.1	3.15	3.75	4.1	4.1	3.55	3.3	3.3	3.2	3.2
4	3.2	3.1	3.1	3.15	3.65	4.25	4.1	3.5	3.3	3.3	3.2	3.3
5	3.2	3.1	3.1	3.2	3.6	4.25	4.1	3.5	3.3	3.35	3.2	3.2
6	3.15	3.1	3.1	3.2	3.6	4.25	4.0	3.5	3.3	3.3	3.15	3.25
7	3.15	3.1	3.0	3.2	3.6	4.2	4.0	3.5	3.3	3.3	3.15	3.2
8	3.15	3.1	3.0	3.2	3.7	4.15	4.0	3.5	3.3	3.3	3.1	3.3
9	3.15	3.1	3.1	3.35	3.8	4.2	3.95	3.5	3.3	3.3	3.2	3.35
10	3.2	3.1	3.1	3.4	3.75	4.4	4.0	3.5	3.3	3.3	3.2	3.3
11	3.2	3.1	3.1	3.5	3.7	4.5	4.0	3.5	3.3	3.3	3.2	3.2
12	3.2	3.1	3.1	3.55	3.7	4.6	4.0	3.6	3.3	3.3	3.2	3.25
13	3.2	3.1	3.15	3.55	3.65	4.5	3.95	3.6	3.4	3.3	3.3	3.3
14	3.15	3.05	3.2	3.6	3.65	4.55	3.95	3.55	3.35	3.25	3.25	3.25
15	3.15	3.05	3.2	3.7	3.6	4.6	3.95	3.5	3.3	3.2	3.25	3.25
16	3.15	3.1	3.25	3.7	3.7	4.6	3.95	3.5	3.3	3.25	3.25	3.2
17	3.15	3.1	3.2	3.7	3.85	4.65	3.85	3.5	3.3	3.3	3.25	3.2
18	3.15	3.1	3.2	3.7	3.85	4.55	3.8	3.5	3.3	3.3	3.25	3.2
19	3.15	3.1	3.15	3.65	3.9	4.35	3.75	3.5	3.3	3.3	3.2	3.2
20	3.15	3.1	3.15	3.6	4.05	4.35	3.7	3.6	3.3	3.4	3.2	3.3
21	3.15	3.1	3.1	3.65	3.95	4.45	3.7	3.6	3.25	3.4	3.2	3.45
22	3.15	3.05	3.2	3.7	3.95	4.6	3.7	3.6	3.25	3.3	3.2	3.95
23	3.1	3.05	3.15	3.7	3.95	4.5	3.7	3.65	3.25	3.3	3.15	3.95
24	3.1	3.1	3.1	3.55	3.85	4.45	3.7	3.6	3.25	3.3	3.1	3.9
25	3.1	3.1	3.1	3.45	4.05	4.45	3.7	3.6	3.3	3.3	3.2	4.0
26	3.1	3.1	3.15	3.45	4.0	4.4	3.6	3.6	3.3	3.2	3.2	3.9
27	3.1	3.05	3.1	3.45	3.95	4.4	3.6	3.6	3.3	3.15	3.2	3.8
28	3.15	3.1	3.15	3.45	3.95	4.4	3.6	3.6	3.3	3.2	3.2	3.5
29	3.1	3.1	3.1	3.45	3.9	4.25	3.55	3.55	3.35	3.3	3.15	3.5
30	3.1	.....	3.15	3.4	3.9	4.2	3.55	3.5	3.35	3.35	3.25	3.4
31	3.1	.....	3.15	.....	3.95	.....	3.65	3.45	.....	3.2	.....	3.25

[a] Discharge more or less affected by ice conditions from about January 1 to March 15, and about November 12 to December 31, 1907. Most of the gage heights during this period are afternoon readings.

[b] Discharge more or less affected by ice conditions from January 1 to about the end of March, and from about the 1st of November to December 31, 1908.

Rating tables for Williams Fork near Sulphur Springs, Colo.

1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	30	3.60	130	4.20	415	4.80	970
3.10	38	3.70	160	4.30	490	4.90	1,080
3.20	50	3.80	200	4.40	570	5.00	1,200
3.30	64	3.90	240	4.50	660		
3.40	82	4.00	290	4.60	760		
3.50	105	4.10	345	4.70	860		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1907, and is well defined below gage height 4.2 feet.

JANUARY 1 TO JUNE 17, 1908, AND OCTOBER 1 TO NOVEMBER 5, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	30	3.50	102	4.00	267	4.50	614
3.10	38	3.60	127	4.10	321	4.60	702
3.20	50	3.70	154	4.20	384	4.70	798
3.30	64	3.80	185	4.30	456		
3.40	82	3.90	221	4.40	533		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on seven discharge measurements made during above periods, and is well defined.

JUNE 18 TO SEPTEMBER 30, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	41	3.60	113	4.00	248	4.40	510
3.30	55	3.70	139	4.10	300	4.50	598
3.40	72	3.80	169	4.20	360	4.60	693
3.50	91	3.90	205	4.30	430		

NOTE.—The above table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during latter part of 1908 and the form of earlier curves. It is well defined.

NOVEMBER 6 TO DECEMBER 19, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	40	3.20	58	3.40	86	3.50	102
3.10	48	3.30	71				

NOTE.—The above table is applicable only for ice conditions. It is based on one discharge measurement made during the above period and is not well defined.

Monthly discharge of Williams Fork near Sulphur Springs, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907					
January	57	38	46.7	2,870	C.
February	49	40	43.6	2,420	C.
March	250	43	76.3	4,690	B.
April	216	69	120	7,140	A.
May	530	105	249	15,300	A.
June	1,100	312	786	46,800	A.
July	1,190	255	580	35,700	A.
August	232	105	154	9,470	A.
September	100	64	74.9	4,460	B.
October	103	66	77.8	4,780	B.
November	64	30	48.7	2,900	B.
December	64	36	47.8	2,940	C.
The year	1,190	30	192	139,000	
1908.					
January	50	38	44.0	2,710	B.
February	38	34	37.3	2,150	B.
March	57	30	41.5	2,550	B.
April	154	34	98.5	5,860	B.
May	293	102	190	11,700	A.
June	749	293	511	30,400	A.
July	360	102	207	12,700	A.
August	126	82	101	6,210	A.
September	72	48	56.4	3,360	B.
October	82	44	63.4	3,900	B.
November	71	48	57.4	3,420	C.
December	.....	.....	57.5	3,540	C.
The year	749	30	122	88,500	

NOTE.—Ice conditions and discharge estimated December 20–31, 1908. The open-channel rating was applied for all other periods of possible ice conditions 1907–8. In general the main channel of the stream is but little affected by ice due to warm spring water entering above the station.

BLUE RIVER NEAR KREMMLING, COLO.

Blue River rises among the peaks of the Continental Divide in the extreme southeastern part of Summit County and joins Grand River just above the point where the latter stream enters Gore Canyon.

This station, which was established July 21, 1904, to determine the availability of the stream for storage, power, and irrigation, was discontinued November 30, 1908. It was located at the state highway bridge on the road between Kremmling and Dillon, Colo. The nearest railroad point is Kremmling, on the Denver, Northwestern and Pacific Railway, about 16 miles distant.

The locality is below all important tributaries, although it is several miles above the mouth of the stream. The drainage area is about 700 square miles.

A number of small irrigation ditches divert water above the station. Numerous filings have been made for the rights above, but these do not call for all the available power. The present power development above the station amounts to about 2,000 horsepower.

During the winter months ice forms in the channel to such an extent as to make accurate gage readings and discharge measurements impossible.

The datum of the chain gage on the bridge remained practically unchanged during the maintenance of the station.

Because of the very rough channel and severe winter conditions results are not very satisfactory.

Discharge measurements of Blue River near Kremmling, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 16	C. L. Chatfield	137	231	3.00	664
June 20	do	164	476	4.30	2,600
July 17	do	161	382	3.62	1,730
August 9	do	154	277	3.05	946
September 29	Freeman and Stewart	121	149	2.47	271
November 22	J. B. Stewart	80	98	2.12	144
1908.					
January 23[a]	J. B. Stewart	55	73	1.70	164
March 3[b]	do	32	48	1.78	81
March 19[b]	C. L. Chatfield	48	73	2.40	136
July 3	Hoyt and Freeman	156	293	3.40	1,080
August 20	C. L. Chatfield	150	218	3.00	661
November 26[c]	do	73	85	2.05	136

[a] River frozen across. Ice 1.1 to 2.2 feet thick.
[b] Ice conditions. Wading measurement.
[c] Ice conditions.

Daily gage height, in feet, of Blue River near Kremmling, Colo., for 1907 and 1908.

[T. G. Marcott and Jessie Marcott, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1					2.55	3.10	4.75	3.45	2.72	2.42	2.28	2.15
2					2.55	3.15	4.65	3.42	2.72	2.48	2.28	2.10
3					2.58	3.68	4.60	3.35	2.68	2.50	2.22	2.00
4					2.58	3.60	4.40	3.38	2.60	2.52	2.25	2.05
5					2.60	3.65	4.45	3.22	2.62	2.42	2.30	2.10
6					2.60	3.82	4.40	3.15	2.65	2.52	2.28	2.18
7					2.60	3.75	4.40	3.00	2.62	2.60	2.30	2.22
8					2.58	3.70	4.50	3.05	2.65	2.60	2.28	2.30
9					2.65	3.70	4.45	3.08	2.62	2.55	2.25	2.25
10					2.68	3.70	4.50	3.10	2.55	2.50	2.25	2.25
11					2.85	3.80	4.25	3.05	2.50	2.48	2.20	.....
12					3.10	3.85	4.15	3.10	2.50	2.48	2.15	.....
13					3.00	4.30	4.05	3.02	2.50	2.48	2.15	.....
14					2.90	4.55	4.10	3.02	2.52	2.45	2.20	.....
15					2.85	4.65	3.75	3.05	2.62	2.45	2.20	.....
16					2.85	4.55	3.75	3.05	2.62	2.40	2.30	.....
17					3.00	4.65	3.60	3.00	2.52	2.35	2.30	.....
18					3.02	4.60	3.60	2.98	2.52	2.35	2.30	.....
19					3.15	4.85	3.55	3.00	2.50	2.32	2.20	.....
20					3.55	4.55	3.65	2.98	2.42	2.30	2.20	.....
21					3.80	4.25	3.60	2.98	2.40	2.30	2.18	.....
22					3.80	4.25	3.58	2.90	2.40	2.30	2.18	.....
23					3.78	4.50	3.55	2.82	2.40	2.25	2.15	.....
24					3.65	4.65	3.58	2.80	2.40	2.25	2.10	.....
25					3.65	4.60	3.70	2.80	2.40	2.22	2.20	.....
26					3.65	4.65	3.72	3.05	2.48	2.30	2.25	.....
27					3.35	4.60	3.82	2.90	2.55	2.30	2.20	.....
28				2.68	3.40	4.52	3.72	2.80	2.48	2.28	2.35	.....
29				2.75	3.45	4.50	3.65	2.70	2.40	2.28	2.20	.....
30				2.60	3.32	4.65	3.55	2.82	2.40	2.30	2.08	.....
31					3.15	.....	3.45	2.80	.....	2.30	.....	.....

[a] Ice conditions prevailed after about the middle of November, 1907.

Daily gage height, in feet, of Blue River near Kremmling, Colo., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	.....	2.6	.....	2.0	2.5	3.3	3.4	2.8	2.5	2.35	2.2	.....
2	.....	.....	2.5	.....	2.55	3.6	3.5	2.8	2.4	2.25	2.2	.....
3	.....	2.7	.....	.....	2.9	3.5	3.4	2.9	2.4	2.25	2.15	.....
4	.....	.....	2.6	2.1	2.7	3.7	3.45	2.8	2.4	2.3	2.15	.....
5	.....	2.7	.....	.....	2.7	3.7	3.4	2.7	2.4	2.3	2.15	.....
6	.....	.....	.....	2.2	2.6	3.75	3.35	2.7	2.4	2.35	2.1	.....
7	.....	.....	2.65	.....	2.75	3.3	3.3	2.75	2.4	2.35	2.0	.....
8	.....	2.5	.....	2.2	2.9	3.4	3.3	2.7	2.3	2.3	2.1	.....
9	.....	.....	2.55	.....	2.65	3.5	3.3	2.8	2.3	2.3	2.2	.....
10	.....	3.8	.....	.....	2.8	3.7	3.3	2.6	2.4	2.3	2.1	.....
11	.....	.....	2.7	2.4	2.8	4.0	3.35	3.0	2.4	2.2	2.1	.....
12	.....	3.3	.....	2.65	2.8	4.4	3.3	2.8	2.3	2.2	2.1	.....
13	.....	.....	.....	2.7	2.75	4.3	3.4	2.6	2.4	2.2	2.2	.....
14	.....	.....	2.7	2.5	2.75	4.0	3.2	2.7	2.5	2.3	2.2	.....
15	.....	2.9	.....	2.7	2.65	3.9	3.3	2.7	2.4	2.35	2.2	.....
16	.....	.....	2.7	2.75	2.7	3.8	3.4	2.7	2.3	2.35	2.15	.....
17	.....	2.4	.....	2.7	3.1	4.1	3.3	2.6	2.3	2.3	2.1	.....
18	.....	.....	2.65	2.9	3.1	3.9	3.3	2.6	2.4	2.2	2.1	.....
19	.....	2.35	2.4	2.7	3.3	3.8	3.0	2.7	2.35	2.2	2.1	.....
20	.....	.....	.....	2.65	3.45	3.6	3.1	2.7	2.3	2.15	2.15	.....
21	.....	.....	2.5	2.7	3.1	3.6	2.9	2.9	2.3	2.1	2.2	.....
22	2.7	2.4	.....	2.6	3.3	3.8	2.85	2.8	2.3	2.1	2.2	.....
23	2.55	.....	2.4	2.85	3.4	3.55	2.8	2.7	2.25	2.2	2.2	.....
24	.....	2.3	.....	2.7	3.1	3.5	2.8	2.7	2.3	2.2	2.15	.....
25	2.65	.....	2.45	2.6	3.35	3.3	2.75	2.6	2.3	2.25	2.2	.....
26	.....	2.4	.....	2.45	3.0	3.45	2.8	2.65	2.4	2.2	2.2	.....
27	.....	.....	.....	2.6	3.3	3.4	3.0	2.6	2.4	2.1	2.1	.....
28	.....	.....	2.35	2.35	3.0	3.3	2.8	2.6	2.3	2.2	2.0	.....
29	.....	2.45	.....	2.4	2.85	3.5	2.75	2.5	2.3	2.2	2.2	.....
30	.....	.....	.....	2.4	2.9	3.5	2.7	2.5	2.3	2.15	2.2	.....
31	.....	.....	.....	.....	3.1	.....	2.9	2.5	.....	2.2	.....	.....

[a] Ice conditions January 1 to March 31 and from about November 25 to December 31, 1908.

Rating tables for Blue River near Kremmling, Colo.

APRIL 28 TO JULY 31, 1907, AND APRIL 1 TO AUGUST 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	50	2.80	470	3.60	1,720	4.40	4,070
2.10	75	2.90	560	3.70	1,950	4.50	4,460
2.20	105	3.00	670	3.80	2,200	4.60	4,850
2.30	140	3.10	800	3.90	2,460	4.70	5,250
2.40	185	3.20	940	4.00	2,730	4.80	5,650
2.50	240	3.30	1,100	4.10	3,020	4.90	6,050
2.60	310	3.40	1,290	4.20	3,340		
2.70	390	3.50	1,500	4.30	3,690		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during the above periods and is not well defined.

AUGUST 1 TO DECEMBER 10, 1907, AND SEPTEMBER 1 TO NOVEMBER 30, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	65	2.40	260	2.80	600	3.20	1,160
2.10	95	2.50	330	2.90	710	3.30	1,360
2.20	140	2.60	410	3.00	840	3.40	1,590
2.30	195	2.70	500	3.10	990	3.50	1,850

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during the above periods and is not well defined.

Monthly discharge of Blue River near Kremmling, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.[a]					
May	2,200	275	919	56,500	B.
June	5,850	800	3,520	209,000	B.
July	5,450	1,400	2,850	175,000	B.
August	1,720	500	917	56,400	A.
September	520	260	360	21,400	B.
October	410	151	261	16,000	C.
November	228	89	156	9,280	C.
December			149	9,160	D.
The period				553,000	
1908.[b]					
January			161	9,900	D.
February			136	7,820	D.
March			117	7,190	D.
April	560	50	253	15,100	C.
May	1,400	240	649	39,900	C.
June	4,070	1,100	1,940	115,000	C.
July	1,500	390	916	56,300	C.
August	670	240	393	24,200	C.
September	330	168	232	13,800	C.
October	228	95	164	10,100	C.
November	140	65	117	6,960	D.
The period				306,000	

[a] Discharge estimated for December 11 to 31, 1907. Open-channel rating used for November and December 1 to 10, 1907.

[b] Ice conditions during January, February, and March, 1908, and discharge estimated. Discharge interpolated for days in April, 1908 that have no gage record. Open-channel rating used November, 1908.

EAGLE RIVER BASIN.

EAGLE RIVER NEAR EAGLE, COLO.

Eagle River rises in the Continental Divide, opposite the headwaters of the Arkansas, flows a little north of west for about 20 miles, and then takes a general westerly course to its junction with the Grand.

The gaging station was established March 12, 1905, and was discontinued February 10, 1907, in favor of the station at Gypsum. It was located at Rule's private road bridge, in T. 5 S., R. 85 W., 2½ miles below Eagle, Colo., and below mouth of Brush Creek. The record at this point shows practically the same discharge as the station at Gypsum, about 5 miles below, as no tributaries of any consequence enter between the two points.

Results obtained at this station were good for open-channel conditions. During the winter, as the river does not freeze over entirely, the results were fair.

Daily gage height, in feet, of Eagle River near Eagle, Colo., for 1907.

[Kenneth Rule, observer.]

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1	0.9	0.8	9	.9	.8	17	.7	.....	25	.8	.....
2	.9	.8	10	.9	.8	18	.7	.....	26	.8	.....
3	.8	.8	11	.9	.....	19	.8	.....	27	.8	.....
4	1.1	.9	12	.8	.....	20	.8	.....	28	.9	.....
5	1.0	1.1	13	.9	.....	21	.8	.....	29	.9	.....
6	1.0	.9	14	.9	.....	22	.8	.....	30	.9	.....
7	1.0	.9	15	.8	.....	23	.8	.....	31	.9	.....
8	1.0	.85	16	.7	.....	24	.8	.....			

Rating table for Eagle River near Eagle, Colo., for 1905 to 1907.

Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	183	1.00	230
.90	205	1.10	255

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1905–6, and is well defined.

Monthly discharge of Eagle River near Eagle, Colo., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	255	163	197	12,100	C.
February 1–10	255	183	198	3,930	C.

EAGLE RIVER AT GYPSUM, COLO.

This station, which was established February 7, 1907, to replace the station at Eagle, a few miles above, is located at the highway bridge one-fourth mile north of the Denver and Rio Grande Railroad station at Gypsum. It was abandoned December 31, 1909.

The station has been maintained to obtain data for use in connection with power and irrigation development.

Gypsum Creek, the only tributary of consequence, enters about one-eighth mile below the station. The drainage area above the mouth of Gypsum Creek is about 800 square miles.

A number of ditches divert water for irrigation, but such ditches are small, as the valley is generally narrow.

The stream is frozen along the edges during the winter, and some slush and anchor ice also forms, but the river usually remains open in midstream.

The location and datum of the chain gage on the highway bridge have remained the same during the maintenance of the station.

Channel conditions are permanent, but measurements are only fairly satisfactory because of the rough and rocky bottom. Winter records are affected by ice and are only fairly accurate.

Discharge measurements of Eagle River at Gypsum, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 7[a]	R. I. Meeker	80	141	2.50	158
April 28	do	96	229	3.50	579
June 8	W. B. Freeman	96	451	5.78	2,880
July 31	C. L. Chatfield	106	307	4.20	1,070
August 20	do	95	237	3.35	533
October 17	J. B. Stewart	86	194	2.80	230
November 15	do	81	166	2.51	168
1908.					
February 13[b]	J. B. Stewart	60	116	2.38	130
April 13	do	90	225	3.22	395
May 8	C. L. Chatfield			3.55	565
June 19	do	96	350	4.55	1,410
July 7	Hoyt and Freeman	96	293	4.15	959
July 21	C. L. Chatfield	95	230	3.30	428
August 22	do	95	221	3.28	452
September 21	do	84	158	2.70	188
October 26	do	85	157	2.60	178
November 29[a]	do	82	149	2.50	158

[a] No ice in channel. [b] Stream open except along edges.

Daily gage height, in feet, of Eagle River at Gypsum, Colo., for 1907 and 1908.

[J. F. Greenland, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.[a]												
1			2.4	2.9	3.5	4.2	6.2	4.15	3.4	3.1	2.8	2.5
2			2.5	2.95	3.4	4.35	6.1	3.95	3.25	3.1	2.8	2.5
3			2.4	2.95	3.35	4.82	6.05	3.9	3.2	3.1	2.8	2.5
4			2.45	2.95	3.35	5.55	6.0	3.85	3.1	3.1	2.8	2.4
5			2.5	3.0	3.35	5.65	6.0	4.0	3.15	3.1	2.8	2.4
6			2.5	3.0	3.35	5.7	5.8	3.9	3.2	3.1	2.8	2.45
7		2.5	2.45	2.95	3.35	5.6	5.7	3.8	3.2	3.3	2.8	2.5
8		2.4	2.45	3.0	3.35	5.65	5.8	3.75	3.15	3.2	2.8	2.4
9		2.35	2.45	3.2	3.35	5.6	5.75	3.75	3.1	3.15	2.8	2.4
10		2.5	2.5	3.2	3.35	5.3	5.7	3.7	3.05	3.1	2.8	2.4
11		2.45	2.45	3.55	3.55	5.3	5.55	3.6	3.0	3.1	2.7	2.4
12		2.5	2.45	3.7	3.9	5.65	5.35	3.5	3.0	3.1	2.3	2.4
13		2.5	2.4	3.8	3.95	5.82	5.45	3.4	3.0	3.05	2.45	2.4
14		2.5	2.4	3.85	3.85	6.0	5.6	3.35	3.0	3.0	2.55	2.4
15		2.45	2.35	4.0	3.75	6.25	5.2	3.3	3.05	3.0	2.56	2.15
16		2.45	2.4	4.15	3.7	6.3	5.05	3.3	3.2	3.0	2.55	2.1
17		2.45	2.5	4.0	3.85	6.25	4.85	3.2	3.15	2.9	2.5	2.1
18		2.5	2.5	4.15	3.9	6.15	4.7	3.25	3.1	2.9	2.5	2.05
19		2.55	2.7	3.95	4.05	6.25	4.6	3.35	3.1	2.9	2.5	2.0
20		2.5	3.0	3.7	4.85	5.95	4.6	3.3	3.0	2.9	2.5	2.3
21		2.55	3.05	3.35	5.5	5.75	4.6	3.3	3.0	2.8	2.4	2.45
22		2.55	3.1	3.4	5.5	6.1	4.55	3.3	3.0	2.8	2.4	2.5
23		2.55	2.95	3.35	5.5	5.85	4.45	3.25	2.9	2.8	2.4	2.5
24		2.55	2.95	3.4	5.4	5.9	4.4	3.25	2.9	2.8	2.5	2.5
25		2.5	2.95	3.45	5.2	6.15	4.55	3.3	2.9	2.8	2.5	2.5
26		2.5	2.95	3.35	4.8	6.0	5.1	3.4	3.0	2.8	2.5	2.5
27		2.5	2.95	3.4	4.45	6.1	5.05	3.2	3.1	2.8	2.5	2.5
28		2.5	2.85	3.45	4.4	6.05	4.7	3.2	3.1	2.8	2.5	2.5
29			2.85	3.45	4.4	6.05	4.4	3.2	3.1	2.8	2.5	2.5
30			2.8	3.5	4.5	6.15	4.3	3.25	3.1	2.8	2.5	2.4
31			2.8		4.3		4.2	3.45		2.8		2.4

[a] Probably occasional slight ice conditions November and December, 1907.

Daily gage height, in feet, of Eagle River at Gypsum, Colo., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.[a]												
1	2.5	2.8	2.3	2.5	3.15	4.25	4.35	3.4	3.0	2.7	2.5	2.4
2	2.5	2.75	2.3	2.5	3.3	4.3	4.3	3.35	2.9	2.7	2.5	2.4
3	2.5	2.55	2.3	2.4	3.6	4.7	4.25	3.2	2.9	2.7	2.5	2.4
4	2.5	2.5	2.3	2.4	3.45	5.35	4.15	3.1	2.8	2.6	2.5	2.5
5	2.55	2.45	2.3	2.45	3.4	5.1	4.05	3.1	2.8	2.6	2.5	2.5
6	2.6	2.45	2.3	2.5	3.4	5.25	4.0	3.1	2.8	2.6	2.5	2.45
7	2.6	2.45	2.2	2.55	3.45	4.8	4.0	3.1	2.75	2.6	2.5	2.4
8	2.6	2.45	2.2	2.65	3.6	4.5	3.9	3.1	2.75	2.6	2.5	2.4
9	2.6	2.45	2.2	2.7	3.9	4.85	4.05	3.0	2.8	2.55	2.5	2.4
10	2.6	2.4	2.25	2.8	3.7	5.35	4.1	3.0	2.8	2.55	2.5	2.45
11	2.75	2.4	2.3	2.9	3.7	5.7	3.95	3.25	2.8	2.5	2.5	2.45
12	3.05	2.4	2.3	3.1	3.65	5.75	3.95	3.5	2.8	2.5	2.5	2.5
13	3.0	2.4	2.3	3.2	3.6	5.4	3.95	3.35	2.8	2.5	2.5	2.4
14	2.95	2.4	2.3	3.3	3.6	5.55	3.95	3.3	2.8	2.5	2.4	2.4
15	2.75	2.4	2.35	3.5	3.5	5.5	4.05	3.25	2.8	2.5	2.4	2.4
16	2.8	2.4	2.4	3.6	3.5	5.3	3.95	3.15	2.8	2.5	2.35	2.45
17	2.85	2.4	2.45	3.6	3.6	5.6	3.25	3.1	(b)	2.5	2.4	2.4
18	2.85	2.4	2.45	3.5	4.45	5.4	3.05	3.15	(b)	2.55	2.45	2.25
19	2.95	2.4	2.45	3.7	4.5	4.6	3.3	3.2	(b)	2.7	2.45	2.15
20	2.85	2.4	2.45	3.8	4.4	4.6	3.3	3.2	(b)	2.65	2.45	2.1
21	2.6	2.45	2.45	3.9	4.4	4.9	3.35	3.25	2.7	2.65	2.45	2.1
22	2.55	2.45	2.4	3.9	4.3	5.5	3.25	3.25	2.7	2.65	2.45	2.15
23	2.55	2.45	2.4	4.0	4.3	5.45	3.2	3.25	2.6	2.6	2.5	2.3
24	2.55	2.45	2.5	3.9	4.4	5.25	3.2	3.2	2.6	2.6	2.5	2.7
25	2.55	2.4	2.5	3.9	4.25	5.25	3.2	3.1	2.6	2.6	2.5	3.1
26	2.55	2.3	2.5	3.6	4.15	5.05	3.1	3.0	2.65	2.6	2.4	3.05
27	2.55	2.3	2.5	3.25	4.0	5.05	3.1	3.0	2.7	2.55	2.35	3.05
28	2.5	2.3	2.5	3.2	4.0	4.9	3.1	3.0	2.65	2.5	2.4	3.1
29	2.5	2.3	2.5	3.05	3.7	4.5	3.1	3.0	2.65	2.55	2.4	3.1
30	2.5	.....	2.5	3.05	4.0	4.4	3.15	3.0	2.65	2.55	2.4	3.05
31	2.5	.....	2.5	.....	4.3	.....	3.35	2.95	.....	2.55	.....	3.05

[a] Ice conditions January 11–20 and December 22–31, 1908, and probably slight effect for short intervals at other times during the winter periods.
[b] Gage weight missing.

Rating table for Eagle River at Gypsum, Colo., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	60	3.00	307	4.00	890	5.00	1,900
2.10	75	3.10	346	4.10	970	5.20	2,145
2.20	92	3.20	389	4.20	1,055	5.40	2,395
2.30	111	3.30	438	4.30	1,145	5.60	2,655
2.40	132	3.40	491	4.40	1,240	5.80	2,925
2.50	155	3.50	548	4.50	1,340	6.00	3,210
2.60	181	3.60	609	4.60	1,445	6.20	3,505
2.70	209	3.70	674	4.70	1,555	6.30	3,660
2.80	239	3.80	743	4.80	1,665		
2.90	272	3.90	815	4.90	1,780		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1907–1909, and is well defined above gage height 2.3 feet.

Monthly discharge of Eagle River at Gypsum, Colo., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
February 7–28	168	122	153	6,680	A.
March	346	122	200	12,300	A.
April	1,010	272	540	32,100	A.
May	2,520	464	1,080	66,400	A.
June	3,660	1,060	2,890	172,000	A.
July	3,500	1,060	2,160	133,000	A.
August	1,010	389	562	34,600	A.
September	491	272	342	20,400	A.
October	438	239	299	18,400	A.
November	239	111	182	10,800	A.
December	155	60	131	8,060	C.
The year				515,000	
1908.					
January	181	155	170	10,500	C.
February	239	111	142	8,170	C.
March	155	92	128	7,870	A.
April	890	132	436	25,900	A.
May	1,340	368	806	49,600	A.
June	2,860	1,100	2,010	120,000	A.
July	1,190	326	675	41,500	A.
August	548	290	375	23,100	A.
September	307	181	226	13,400	A.
October	209	155	176	10,800	A.
November	155	122	146	8,690	A.
December	155	75	119	7,320	C.
The year	2,860	75	451	327,000	

NOTE.—Ice conditions and discharge estimated for January 11–20 and December 22–31, 1908. Open-channel rating applied for remainder of winter periods; effect from ice small. Discharge estimated for days in September, 1908, that have no gage record.

ROARING FORK BASIN.

DESCRIPTION.

Roaring Fork, which enters the Grand at Glenwood Springs, drains a large area lying chiefly in Pitkin County and reaching to the Continental Divide. It is one of the largest tributaries of the Grand. Frying Pan and Crystal rivers are its most important branches.

ROARING FORK NEAR EMMA, COLO.

This station is located on a steel highway bridge about 1½ miles below Emma, a station on the Aspen branch of the Denver and Rio Grande Railroad. It was established July 19, 1908, to obtain run-off data for the development of storage and power. (See Pl. VII, *A*.)

Frying Pan Creek joins Roaring Fork about 3 miles above the station, and Sopris Creek comes in above the station near Emma. The drainage area at the station is more than 500 square miles.

A few small ditches divert water above the station, principally for meadow irrigation. The only important power plant above the station is that at Aspen, Colo., which generates 1,000 horsepower.

The stream at this point is not so much affected by ice as at other stations in that vicinity, and open channel conditions are frequent. Slush ice is common.

A staff gage was used until August 27, 1908, at which time a chain gage was established on the bridge with a datum 0.10 foot above that of the staff gage. Gage heights are all referred to the datum of the chain gage.

A. FALLS ON ROARING FORK, COLORADO.

B. DIVERSION DAM OF ANIMAS POWER COMPANY, ON CASCADE CREEK ABOVE DURANGO, COLO.

Results at this station are satisfactory except when affected by ice conditions during very severe winters.

Discharge measurements of Roaring Fork near Emma, Colo., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 2[a]	C. L. Chatfield	93	200	.....	224
April 4[a]	....do	59	172	3.58	250
May 13[a]	....do	83	237	4.55	614
July 19[a]	Freeman and Chatfield	86	282	5.28	1,070
Do	....do	109	314	5.30	1,120
August 27	C. L. Chatfield	107	260	4.60	678
September 25	....do	100	172	3.95	372
October 29[b]	....do	90	164	3.80	319
December 2	....do	80	119	3.35	179

[a] Measurements made at bridge 1 mile below Basalt. [b] Open channel; slush ice.

NOTE.—All above measurement referred to the same gage.

Daily gage height, in feet, of Roaring Fork near Emma, Colo., for 1908.

[W. R. Hook, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.45	4.2	4.0	3 8	3.4	17	.....	4.75	3.95	3.9	3.6	3.6
2	.....	5.5	4.1	4.0	3.8	3.4	18	.....	4.85	3.9	3.9	3.65	3.5
3	.....	5.15	4.15	4.0	3.8	3.5	19	5.3	5.0	3.9	3.95	3.6	3.3
4	.....	4.95	4.1	4.0	3.75	3.6	20	5.25	5.0	3.9	3.95	3.6	3.3
5	.....	4.8	4.0	4.0	3.7	3.6	21	5.2	4.85	3.9	3.95	3.6	3.4
6	.....	4.8	4.0	3.95	3.7	3.6	22	5.1	4.8	3.9	3.9	3.6	3.55
7	.....	4.75	4.0	3.95	3.7	3.4	23	5.0	4.8	3.9	3.75	3.6	3.8
8	.....	4.65	3.9	3.9	3.7	3.4	24	5.0	4.7	3.8	3.85	3.6	3.6
9	.....	4.55	3.9	3.9	3.7	3.5	25	4.9	4.7	3.9	3.9	3.6	3.5
10	.....	4.5	4.05	3.85	3.7	3.6	26	4.85	4.65	4.05	3.85	3.5	3.6
11	.....	5.0	4.0	3.85	3.65	3.6	27	4.8	4.6	4.0	3.8	3.45	3.5
12	.....	5.25	3.95	3.85	3.65	3.4	28	4.85	4.5	4.0	3.85	3.5	3.75
13	.....	4.9	4.0	3.85	3.7	3.4	29	4.95	4.45	4.0	3.8	3.5	3.65
14	.....	5.05	4.0	3.8	3.55	3.4	30	4.85	4.4	4.05	.....	3.5	3.5
15	.....	4.9	4.0	3.8	3.65	3.6	31	5.3	4.3	.....	.....	.....	3.7
16	.....	4.75	4.0	3.85	3.55	3.6							

NOTE.—Slight ice conditions November 14 to December 31.

Rating table for Roaring Fork near Emma, Colo., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	176	3.90	357	4.50	603	5.10	967
3.40	200	4.00	393	4.60	652	5.20	1,044
3.50	225	4.10	431	4.70	705	5.30	1,124
3.60	254	4.20	471	4.80	763	5.40	1,206
3.70	287	4.30	512	4.90	826	5.50	1,289
3.80	321	4.40	556	5.00	894	5.60	1,373

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on nine discharge measurements made during 1908–9, and is well defined.

Monthly discharge of Roaring Fork near Emma, Colo., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 19–31	1,120	763	918	23,700	A.
August	1,290	512	790	48,600	A.
September	471	321	388	23,100	A.
October	393	304	332	20,400	A.
November	321	212	266	15,800	A.
December	321	176	234	14,400	A.
The period	.....	.....	.....	146,000	

NOTE.—Open-channel rating applied November and December; effect from ice immaterial.

ROARING FORK AT GLENWOOD SPRINGS, COLO.

This station, which was established April 6, 1906, to obtain run-off data, valuable because of the opportunities for storage and power development offered by the river, is located at the mouth of the stream on a single-span wooden road bridge, about 500 feet above the junction of Grand River and Roaring Fork, and about four blocks west of Grand avenue, Glenwood Springs.

A number of small irrigation ditches divert water from the main stream and tributaries. Three important power plants, located on Crystal River, Yule Creek, and Maroon and Castle creeks, develop about 2,100 horsepower. A number of smaller plants are also in operation in this drainage area.

Surface ice rarely forms solid across the river at this station, although slush and anchor ice are common. Extremely high stages of Grand River may affect the flow at this station to a small degree.

Neither the location nor the datum of the chain gage on the bridge has been changed during the maintenance of the station.

As the stream bed is very rough, conditions are unfavorable for accurate measurements. The channel is, however, fairly permanent, and the results are satisfactory.

Discharge measurements of Roaring Fork at Glenwood Springs, Colo., in 1904, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4					457
April 25					888
May 25					6,680
June 28					4,940
August 6					885
September 5					1,130
1907.					
February 6	R. I. Meeker	145	150	1.40	401
March 7	do	145	154	1.35	395
June 6	W. B. Freeman	169	760	5.10	5,730
June 22	do	169	794	5.26	5,830
July 28	C. L. Chatfield	166	609	4.20	3,750
August 18	do	155	382	2.50	1,530
October 16	J. B. Stewart	153	280	1.87	897
November 14[a]	do	149	209	1.41	466
1908.					
February 12[b]	J. B. Stewart	140	171	1.18	396
February 29	C. L. Chatfield	143	175	1.20	409
March 31	do	150	186	1.25	427
April 12	J. B. Stewart	154	292	1.95	947
May 11	C. L. Chatfield			2.58	1,580
June 21	do	167	601	4.10	3,680
July 8	Hoyt and Freeman	162	523	3.43	2,880
July 20	Freeman and Chatfield	156	409	2.70	1,750
August 24	C. L. Chatfield	155	302	2.10	1,090
September 23	do	149	185	1.40	442
October 28	do	148	189	1.45	502
December 1	do	143	166	1.20	465

[a] Some floating ice. [b] Fringe of ice along edges of river.

NOTE.—The measurements made in 1904 were not available for publication until the present time.

Daily gage height, in feet, of Roaring Fork at Glenwood Springs, Colo., for 1907 and 1908.

[Celia S. Linsley, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.38	1.35	1.32	1.65	2.30	3.50	6.28	3.75	2.28	1.90	1.65	1.30
2	1.30	1.38	1.30	1.68	2.30	3.80	6.52	3.60	2.20	1.88	1.62	1.35
3	1.25	1.42	1.30	1.78	2.20	4.60	6.18	3.60	2.18	1.82	1.60	1.35
4	1.38	1.45	1.35	1.85	2.20	4.60	6.18	3.60	2.15	1.85	1.58	1.28
5	1.45	1.45	1.35	1.92	2.15	5.10	6.20	3.58	2.18	1.80	1.55	1.30
6	1.45	1.38	1.35	1.95	2.10	5.15	6.20	3.35	2.15	1.80	1.55	1.32
7	1.35	1.32	1.35	1.85	2.20	5.20	6.05	3.38	2.10	2.05	1.55	1.35
8	1.35	1.25	1.32	1.82	2.20	5.10	6.00	3.35	2.10	1.95	1.58	1.35
9	1.40	1.32	1.30	1.95	2.20	5.10	5.68	3.22	2.05	1.90	1.50	1.30
10	1.35	1.32	1.32	2.25	2.30	4.65	5.65	3.08	1.98	1.90	1.50	1.32
11	1.35	1.28	1.35	2.68	2.50	5.00	5.20	3.10	2.00	1.85	1.45	1.35
12	1.30	1.30	1.38	2.90	2.80	5.15	5.10	2.98	1.98	1.85	1.42	1.35
13	1.35	1.32	1.32	3.10	2.80	5.60	5.00	2.95	1.92	1.85	1.32	1.35
14	1.38	1.32	1.30	3.28	2.60	5.80	5.35	2.90	1.98	1.85	1.40	1.30
15	1.35	1.28	1.32	3.35	2.60	6.05	5.05	2.85	2.12	1.80	1.42	1.20
16	1.35	1.32	1.35	3.42	2.60	6.10	4.65	2.88	2.30	1.87	1.58	1.30
17	1.35	1.30	1.32	3.18	2.75	6.20	4.45	2.78	2.18	1.75	1.48	1.22
18	1.35	1.38	1.58	2.95	2.95	6.10	4.48	2.65	2.10	1.81	1.50	1.12
19	1.35	1.32	1.65	2.78	3.50	6.20	4.35	2.75	2.08	1.82	1.50	1.15
20	1.28	1.32	1.92	2.58	4.00	5.70	4.30	2.72	2.00	1.75	1.50	1.20
21	1.22	1.35	1.98	2.50	4.65	5.60	4.38	2.65	2.00	1.70	1.42	1.30
22	1.25	1.38	2.00	2.42	4.80	5.35	4.30	2.52	1.98	1.69	1.40	1.34
23	1.30	1.42	1.88	2.45	5.00	5.48	4.20	2.42	1.90	1.70	1.30	1.40
24	1.30	1.38	1.82	2.40	4.60	5.85	4.08	2.30	1.85	1.71	1.30	1.36
25	1.38	1.32	1.80	2.40	4.40	6.10	4.52	2.28	1.80	1.75	1.34	1.36
26	1.40	1.35	1.88	2.38	3.95	6.05	4.85	2.45	1.90	1.70	1.40	1.35
27	1.38	1.38	1.80	2.40	3.90	6.10	4.78	2.32	1.90	1.70	1.32	1.32
28	1.35	1.35	1.78	2.42	3.80	5.88	4.42	2.30	1.90	1.69	1.35	1.30
29	1.40	.....	1.68	2.60	3.70	6.00	4.18	2.28	1.80	1.65	1.32	1.35
30	1.38	.....	1.65	2.60	3.70	6.30	4.08	2.25	1.90	1.65	1.30	1.20
31	1.35	.....	1.62	.....	3.60	.....	4.05	2.32	.....	1.65	.....	1.30
1908.												
1	1.3	1.1	1.25	1.2	2.2	3.4	3.95	2.5	1.5	1.55	1.5	1.2
2	1.2	1.2	1.25	1.25	2.35	3.6	3.75	2.6	1.5	1.5	1.45	1.15
3	1.3	1.25	1.25	1.3	2.5	3.55	3.75	2.55	1.6	1.5	1.45	1.25
4	1.25	1.25	1.3	1.4	2.4	4.5	3.85	2.4	1.5	1.5	1.4	1.3
5	1.3	1.15	1.4	1.5	2.4	4.0	4.0	2.2	1.5	1.5	1.4	1.25
6	1.25	1.1	1.35	1.5	2.4	4.1	3.7	2.1	1.5	1.5	1.4	1.2
7	1.2	1.2	1.3	1.5	2.5	4.0	3.65	2.1	1.45	1.5	1.4	1.1
8	1.2	1.2	1.2	1.55	2.6	3.7	3.6	2.05	1.5	1.5	1.4	1.2
9	1.3	1.2	1.3	1.6	2.9	4.3	3.45	1.95	1.5	1.45	1.4	1.2
10	1.3	1.25	1.3	1.65	2.7	4.8	3.35	2.1	1.45	1.45	1.4	1.2
11	1.2	1.15	1.3	1.8	2.6	4.9	3.45	2.35	1.45	1.4	1.4	1.2
12	1.2	1.2	1.3	1.95	2.5	5.4	3.35	2.65	1.5	1.45	1.4	1.2
13	1.2	1.15	1.3	2.2	2.45	5.5	3.25	2.5	1.5	1.45	1.3	1.2
14	1.3	1.1	1.3	2.4	2.3	5.45	3.2	2.45	1.5	1.45	1.3	1.3
15	1.4	1.15	1.4	2.55	2.3	5.05	3.25	2.35	1.5	1.45	1.25	1.35
16	1.2	1.2	1.4	2.7	2.35	4.9	3.15	2.2	1.5	1.5	1.25	1.4
17	1.2	1.25	1.6	2.6	2.9	4.9	3.05	2.2	1.5	1.5	1.25	1.3
18	1.3	1.2	1.6	2.5	3.1	4.8	2.85	2.3	1.45	1.55	1.25	1.15
19	1.25	1.1	1.5	2.6	3.6	4.5	2.75	2.4	1.45	1.55	1.25	1.0
20	1.3	1.2	1.45	2.75	3.8	4.25	2.6	2.4	1.4	1.6	1.25	1.0
21	1.3	1.2	1.4	2.8	3.4	3.95	2.5	2.4	1.45	1.5	1.25	1.2
22	1.35	1.2	1.4	2.8	3.3	4.2	2.5	2.25	1.45	1.5	1.25	1.2
23	1.25	1.25	1.4	2.9	3.2	4.45	2.4	2.2	1.5	1.5	1.25	1.25
24	1.3	1.25	1.45	2.7	3.25	4.8	2.3	2.15	1.4	1.5	1.3	1.25
25	1.3	1.3	1.5	2.45	3.1	4.85	2.2	2.1	1.5	1.5	1.3	1.15
26	1.3	1.3	1.5	2.4	3.0	4.7	2.2	2.0	1.5	1.5	1.3	1.2
27	1.3	1.25	1.5	2.35	3.0	4.8	2.2	1.95	1.6	1.5	1.3	1.2
28	1.3	1.25	1.45	2.3	2.9	4.75	2.2	1.95	1.6	1.5	1.25	1.1
29	1.25	1.2	1.3	2.15	2.75	4.3	2.3	1.9	1.55	1.45	1.25	1.1
30	1.2	.....	1.4	2.1	2.65	4.0	2.4	1.8	1.5	1.45	1.25	1.1
31	1.2	.....	1.35	.....	3.3	.....	2.4	1.65	.....	1.4	.....	1.15

NOTE.—Gage heights for the winter periods are probably more or less affected by ice conditions.

Rating tables for Roaring Fork at Glenwood Springs, Colo.

JANUARY 1 TO MARCH 17, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	250	1.30	330	1.40	410	1.50	490

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on two discharge measurements made during above period and the form of the following rating curve. It is fairly well defined.

MARCH 18 TO NOVEMBER 30, 1907, AND APRIL 11 TO NOVEMBER 10, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	300	2.40	1,395	3.60	2,890	4.80	4,920
1.30	375	2.50	1,505	3.70	3,040	4.90	5,110
1.40	455	2.60	1,620	3.80	3,190	5.00	5,300
1.50	540	2.70	1,740	3.90	3,350	5.20	5,700
1.60	625	2.80	1,860	4.00	3,510	5.40	6,110
1.70	715	2.90	1,980	4.10	3,680	5.60	6,530
1.80	805	3.00	2,100	4.20	3,850	5.80	6,950
1.90	900	3.10	2,225	4.30	4,020	6.00	7,380
2.00	995	3.20	2,350	4.40	4,195	6.20	7,820
2.10	1,090	3.30	2,480	4.50	4,370	6.40	8,270
2.20	1,190	3.40	2,615	4.60	4,550		
2.30	1,290	3.50	2,750	4.70	4,730		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 13 discharge measurements made during 1907 and 1908, and is well defined.

DECEMBER 1, 1907, TO APRIL 10, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	350	1.30	450	1.50	580	1.70	730
1.20	400	1.40	510	1.60	650		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during February to April, 1908, and is fairly well defined.

NOVEMBER 11 TO NOVEMBER 30, 1908.

[The indirect method for shifting channels used.]

DECEMBER 1 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	375	1.20	455	1.30	500	1.40	555
1.10	415						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on two discharge measurements made 1908–9 and form of the rating curve used December, 1907, to April 10, 1908. It is fairly well defined.

Daily discharge, in second-feet, of Roaring Fork, at Glenwood Springs, Colo., November 11 to 30, 1908.

Day.	Nov.	Day.	Nov.	Day.	Nov.
1		11	460	21	420
2		12	430	22	425
3		13	400	23	430
4		14	415	24	460
5		15	390	25	470
6		16	390	26	480
7		17	395	27	485
8		18	400	28	475
9		19	410	29	470
10		20	415	30	465
				31	

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Roaring Fork at Glenwood Springs, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	450	266	368	22,600	C.
February	450	290	367	20,400	B.
March	995	330	554	34,100	B.
April	2,640	670	1,490	88,700	B.
May	5,300	1,090	2,410	148,000	B.
June	8,040	2,750	6,270	373,000	A.
July	8,000	3,600	5,500	338,000	A.
August	3,120	1,240	1,980	122,000	A.
September	1,290	805	1,030	61,300	A.
October	1,040	670	802	49,300	A.
November	670	375	504	30,000	A.
December	486	360	453	27,900	B.
The year	8,040	266	1,810	1,320,000	
1908.					
January	510	400	433	26,600	A.
February	450	350	400	23,000	A.
March	650	400	500	30,700	A.
April	1,980	400	1,160	69,000	A.
May	3,190	1,190	1,870	115,000	A.
June	6,320	2,620	4,380	261,000	A.
July	3,510	1,190	2,170	133,000	A.
August	1,680	670	1,210	74,400	A.
September	625	455	534	31,800	A.
October	625	455	530	32,600	A.
November	540	390	447	26,600	C.
December	555	375	455	28,000	B.
The year	6,320	350	1,180	852,000	

NOTE.—Discharge for November 11–30, 1908, determined by indirect method for shifting channels.

FRYING PAN RIVER AT BASALT, COLO.

This station, which was established July 19, 1908, to obtain run-off data necessary for studies of storage and power possibilities, is located at the wooden highway bridge, about 100 yards from the Colorado Midland depot and about 75 yards downstream from a concrete arch bridge in the town of Basalt.

The station is near the mouth of the stream below all tributaries of importance, and the records show the total run-off from the drainage basin.

Diversions above are limited to ditches used for meadow irrigation. Power and storage possibilities are good.

Severe ice conditions prevail during the winter months, and gage readings are at times distorted by the backwater caused by the freezing of the river below. Slush ice is also a disturbing factor.

The location and datum of the staff gage at the bridge have remained unchanged during the maintenance of the station.

The accuracy of the measurements is affected by the roughness of the stream bed and the high current velocities during flood periods.

Discharge measurements of Frying Pan River at Basalt, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
December 19[a]	R. I. Meeker	54	166	.....	63
1908.					
February 13[b]	C. L. Chatfield	45	60	.....	55
March 2[b]	do	45	72	1.33	56
April 4	do	45.5	79	1.52	87
May 14	do	48.5	108	2.25	243
July 19	Freeman and Chatfield	59.8	122	2.40	318
August 27	C. L. Chatfield	46.5	90	1.80	133
September 25	do	46.5	75	1.46	65
October 29	do	45.5	75	1.40	76
December 2[c]	do	46	88	2.00	53

[a] Through ice 100 feet above concrete bridge. [b] Wading measurement. [c] Ice conditions.

Daily gage height, in feet, of Frying Pan River at Basalt, Colo., for 1908.

[J. G. Ould, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.35	1.75	1.55	1.5	1.6	16	.....	2.05	1.65	1.5	1.45	2.45
2	.....	2.35	1.75	1.55	1.5	2.0	17	.....	2.1	1.65	1 5	1.45	2.7
3	.....	2.15	1.7	1.55	1.5	2.05	18	.....	2.0	1.6	1 5	1.45	2.7
4	.....	2.05	1.7	1.55	1.4	1.6	19	2.4	2.05	1.6	1 5	1.45	2.9
5	.....	2.0	1.7	1.5	1 5	1.0	20	2.25	2.1	1.6	1.55	1.45	3.5
6	.....	2.0	1.7	1.5	1.5	1.0	21	2.25	2 0	1.55	1.5	1.45	3.75
7	.....	2.0	1.6	1.5	1.45	1.0	22	2.2	2 0	1.55	1.5	1.4	3.6
8	.....	2 0	1.6	1.5	1.45	1.5	23	2.1	2.0	1.5	1.5	1.4	3.1
9	.....	2.0	1.6	1.5	1.45	2 05	24	2 1	2.0	1.5	1 5	1.4	3.0
10	.....	2.0	1.65	1.5	1.5	2.1	25	2.1	2.0	1.5	1.5	1.4	2.9
11	.....	2.15	1.65	1.5	1.5	2.15	26	2.2	2.0	1.7	1 5	1.4	2 9
12	.....	2.35	1.6	1.5	1.4	2.05	27	2 1	2.0	1.6	1.5	1.4	3.25
13	.....	2 1	1.65	1.5	1.45	2.25	28	2.0	2.05	1.65	1.5	1 4	3.4
14	.....	2.15	1.7	1 5	1.45	2.25	29	2.15	1.95	1.6	1.4	1.4	3.4
15	.....	2.1	1.7	1.5	1.45	2.3	30	2.0	1.8	1.55	1.45	1.55	3.4
							31	2.15	1.75	.....	1.5	.....	3.45

NOTE.—Ice conditions November 30 to December 31.

Rating table for Frying Pan River at Basalt, Colo., for 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	68	1.70	118	2.00	187	2.30	272
1.50	83	1.80	139	2.10	214	2.40	302
1.60	99	1.90	162	2.20	242		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on seven discharge measurements made during 1908 and one in 1909, and is fairly well defined.

Monthly discharge of Frying Pan River at Basalt, Colo., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 19–31	302	187	230	5,930	A.
August	287	128	202	12,000	A.
September	128	83	105	6,250	A.
October	91	68	83.5	5,130	A.
November	83	60	74.0	4,400	A.
December			56.9	3,500	D.
The period				37,200	

NOTE.—Discharge estimated November 30 to December 31 because of ice conditions.

CRYSTAL RIVER NEAR CARBONDALE, COLO.

This station, which was established July 18, 1908, to obtain run-off data valuable because of the great power and storage possibilities on the stream, is located on a single-span highway bridge 150 feet above a section house, at a railroad point known as Sewell on the Redstone branch of the Denver and Rio Grande Railroad. It is about 5 miles above Carbondale. The drainage area of the river below the mouth of Thompson Creek is about 300 square miles.

No important tributaries enter below the station, but Thompson Creek comes in a short distance above.

Several irrigation ditches, with a combined maximum capacity of probably 100 second-feet, divert water above. The following ditches were diverting water above the station on July 18, 1908: Sweet ditch, estimated discharge, 15 second-feet; Grubb ditch, estimated discharge, 12 second-feet; Big Four ditch, estimated discharge, 8 second-feet.

The fall, run-off, and storage possibilities, however, make this essentially a power stream, especially on the upper reaches. Present power plants above the station generate about 1,150 horsepower.

Ice conditions are severe during the winter months and prevent using open channel methods of calculating the discharge.

No change has occurred in either location or datum of the staff gage at the bridge during the maintenance of the station.

Except as affected by ice, the results at this station are satisfactory.

Discharge measurements of Crystal River near Carbondale, Colo., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	C. L. Chatfield	51	180	3.00	463
July 18	Freeman and Chatfield	55	198	3.02	514
August 25	C. L. Chatfield	54	160	2.43	253
September 24	do	52	126	1.80	94
October 30	do	53	138	1.95	136
December 3	do	52	119	1.80	101

Daily gage height, in feet, of Crystal River near Carbondale, Colo., for 1908.

[Wm. Sutton and Matt Taylor, observers.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.05	2.15	2.0	1.95	1.7	16	.....	2.7	1.9	2.05	1.8	1.65
2	.....	3.2	2.1	1.9	1.95	1.7	17	.....	2.6	1.85	2.1	1.8	1.9
3	.....	2.85	2.1	1.9	2.0	1.7	18	3.0	2.8	1.85	2.15	1.8	1.7
4	.....	2.75	2.15	1.9	2.0	1.8	19	3.05	.....	1.9	2.15	1.75	1.6
5	.....	2.7	2.05	1.9	2.0	1.9	20	2.95	.....	1.8	2.1	1.7	1.85
6	.....	2.7	2.0	1.9	2.0	1.8	21	2.95	.....	1.8	2.1	1.7	1.9
7	.....	2.7	1.95	1.9	2.0	1.8	22	2.95	.....	1.8	2.1	1.7	2.0
8	.....	2.55	1.9	1.9	2.0	1.75	23	2.85	.....	1.8	2.0	1.7	2.1
9	.....	2.5	2.1	1.9	2.0	1.7	24	2.75	.....	1.8	2.0	1.75	2.15
10	.....	2.45	2.1	1.9	1.95	1.7	25	2.75	.....	2.0	2.0	1.85	2.2
11	.....	2.95	2.15	1.9	1.9	1.6	26	2.7	2.45	2.1	1.9	1.85	2.2
12	.....	2.85	2.1	1.9	1.9	1.6	27	2.8	2.45	2.0	1.9	1.8	2.0
13	.....	2.8	2.0	1.8	1.8	1.6	28	2.75	2.35	2.0	2.0	1.8	1.9
14	.....	2.85	1.95	1.8	1.8	1.5	29	2.75	2.25	2.0	2.05	1.8	1.85
15	.....	2.85	1.9	1.9	1.85	1.45	30	2.8	2.25	2.0	2.05	1.7	1.75
							31	2.85	2.15	.....	1.95	.....	1.7

Rating table for Crystal River near Carbondale, Colo., July 18 to December 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	50	1.90	121	2.40	245	2.90	451
1.50	61	2.00	141	2.50	278	3.00	503
1.60	73	2.10	164	2.60	315	3.10	559
1.70	87	2.20	189	2.70	357		
1.80	103	2.30	216	2.80	403		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on six discharge measurements made during 1908, and one in 1909, and is well defined between gage heights 1.7 feet and 3.0 feet.

Monthly discharge of Crystal River near Carbondale, Colo., for 1908.[a]

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
July 18–31	531	357	428	11,900	A.
August	617	176	342	21,000	A.
September	176	103	138	8,210	A.
October	176	103	135	8,300	A.
November	141	87	114	6,780	A.
December	189	56	107	6,580	B.
The period	.....	.....	.....	62,800	

[a] These estimates do not include ditch diversion above the gaging station. See description.

GUNNISON RIVER DRAINAGE BASIN.

DESCRIPTION.

Gunnison River is formed in Gunnison County, Colo., by the union of East and Taylor rivers, two streams that have their origin among the snow-covered peaks and on the slopes of the Continental Divide in the northeastern part of the county, descend through narrow mountain valleys, and unite about 12 miles above Gunnison.

From the junction of these rivers the Gunnison flows west and southwest to the point where it enters Grand River at Grand Junction, in the central part of Mesa County, Colo.

The upper course of the river lies through a broad, mountainous valley, but near the mouth of Lake Fork the valley narrows and the river enters Black Canyon of the Gunnison, through which it winds in a tortuous course for 56 miles between granite walls that rise precipitously 3,000 feet above the water's edge. (See Pl. VIII, *A*.) A short distance below the mouth of North Fork, the largest tributary of the river, the canyon walls break abruptly, and the valley is broad and fertile. Below Delta the river enters another narrow canyon, with walls averaging 800 feet in height, and this continues irregularly to Grand Junction, a few tracts of narrow bottom land lying between the channel and the canyon walls.

The soil of the lower valleys is chiefly adobe, and the higher mesas have large content of gravel and sand. Groves of quaking aspen, interspersed with large, open grazing plots, cover broad areas of this plateau region. Forests of pine and aspen occur on the top of the Grand Mesa, with piñon pines and cedars along the foothills. In the valleys chico and sagebrush form the controlling vegetation, except along the streams, which are bordered to some extent by cottonwood, willow, and undergrowth.

The chief tributaries of the Gunnison are Ohio, Tomichi, Lake Fork, and Cimarron creeks, and Smith, North Fork, and Uncompahgre rivers, North Fork being the largest.

North Fork rises in the Huntsman Hills, 20 miles south of Glenwood Springs, flows in a general south and southwesterly course, and unites with the Gunnison about 8 miles west of Hotchkiss. The drainage area is highly mountainous, except for a small portion which lies below Paonia, extreme points reaching an altitude of 13,000 feet. The mesa lands at the lower end of the valley stand 5,500 feet above sea level. The higher peaks are formed of granite rocks, but lower down sedimentary formations occupy at least 80 per cent of the area of the basin. The mountains are forested and the mesa lands are covered with sagebrush. All the tillable lands of the North Fork and its tributaries have been brought under cultivation, and irrigation is practiced to such an extent that the entire flow is needed for existing systems.

Uncompahgre River, the principal tributary of the Gunnison from the south, rises among the snowy peaks of the highly serrated Uncompahgre Mountains and flows a little west of north to its junction with the Gunnison at Delta. The basin embraces a mountainous plateau and valley area of 1,130 square miles, oblong in shape, the width increasing slightly at the lower end. The mountain area occupies but a small part of the basin, but contributes the perennial

waters of the stream. The plateau area is greatest in extent and borders the valley on both sides, the larger Uncompahgre Plateau lying to the southwest. Escarpments are conspicuous features of this plateau. The relief features are terraced mesas flanked by shale buttes and ridges, trenched by deep, narrow canyons. Uncompahgre Valley proper begins at a point near Eldredge siding, on the Denver and Rio Grande Railroad.

The other tributaries of the Gunnison need not here be described. Ohio, Tomichi, Lake Fork, and Cimarron creeks are perennial streams, but almost their entire volume is diverted for irrigation during the growing season, so that very little water reaches the Gunnison except at times of heavy storms or during spring floods.

Precipitation records for the Gunnison basin are meager. Those which exist show a range from 9 inches in the plateau region to about 25 inches in the mountains.

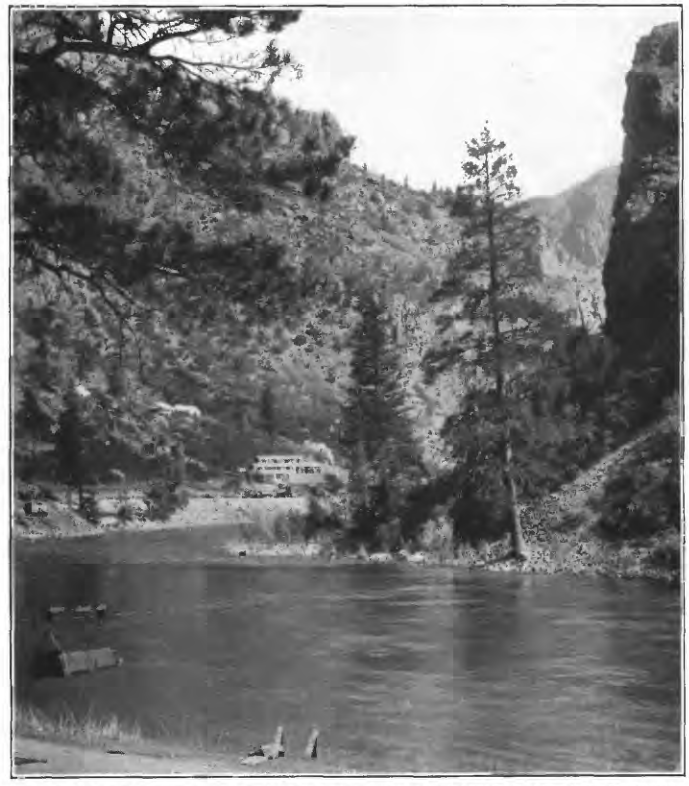
The run-off of the Gunnison drainage basin is protected to a large extent by four forest reserves, which have a total area of about 5,700 square miles, of which approximately 3,800 square miles are located within the basin. About 65 per cent of this area is in standing timber, the remainder being classified as sagebrush, barren and burned. Investigation of the headwaters of East River and other tributaries in Gunnison County several years ago showed that many of the hills had been almost entirely denuded of their timber, a discovery to which may be attributed the setting aside of the areas as forest reserves.

Along Gunnison River proper, above the mouth of Lake Fork, a number of ditches divert water for meadow irrigation, and irrigation is extensively practiced in the vicinity of delta. The largest irrigated area in the Gunnison drainage is the Uncompahgre Valley. In addition the lands being irrigated by large private ditches this valley contains about 150,000 acres, which are being reclaimed under the Uncompahgre project of the United States Reclamation Service. The greater part of the water for this land will be diverted from Gunnison River by means of the Gunnison tunnel, which has a capacity of about 1,300 second-feet. The present water rights consume the normal flow of Uncompahgre River, and the Uncompahgre Valley project will divert all the available water from Gunnison River during normal stages.

The country is not adapted for large reservoirs, the meadows having too much fall and the valleys being too narrow, so that construction would be expensive in proportion to reservoir capacity. However, a large number of small reservoirs exist on the Gunnison and its tributaries, which can be advantageously utilized for power.

Power plants at present in operation in this basin develop about 2,200 horsepower, and unutilized possibilities are very great. The

A. TORRENCE FALLS, GUNNISON RIVER CANYON, COLORADO.



B. GUNNISON RIVER FROM GAGING STATION, SHOWING EAST END OF GUNNISON TUNNEL, UNCOMPAHGRE PROJECT, COLORADO.

fall along some of the streams is heavy, averaging 50 to 150 feet to the mile. Along the Uncompahgre, from its source to the 8,000-foot contour, the fall is almost 300 feet to the mile. At the present time the waters in this basin are being used chiefly for domestic purposes and irrigation. By utilizing all the available storage it would theoretically be possible to develop about 200,000 horsepower. Along the South canal of the United States Reclamation Service, which receives the water from the Gunnison tunnel and carries it into Uncompaghre River, a series of drops will make possible the development of from 5,000 to 10,000 horsepower.

But two gaging stations were maintained previous to 1900, but since that year a number have been established and discontinued. The records, as a rule, cover about three-year periods, and show that 1904 was the driest and 1907 the wettest year. By comparison with other drainage basins adjacent to the Gunnison, however, it is evident that 1902 was a drier year than 1904.

GUNNISON RIVER AT RIVER PORTAL, COLO.[a]

This station, which was established April 7, 1905, to determine the water supply available for Gunnison tunnel for the United States Reclamation Service, replaced the station located at Cimarron, about 12 miles above. It is about 100 yards above the portal of Gunnison tunnel (Pl. VIII, *B*) and is about 21 miles northeast of Montrose. The data are valuable also because of the great power possibilities on the upper river.

The station is about 8 miles below the mouth of Crystal Creek, and is above North Fork and Uncompahgre River, the two most important tributaries.

A number of small ditches divert water for meadow irrigation above the station. The largest diversion along the river, and also in Colorado, is the recently completed Gunnison tunnel, with a capacity of about 1,300 second-feet, which diverts the water from the Gunnison into the Uncompahgre Valley, where it will be used for irrigation.[b]

Ice covers the river for about four months each year and attains a thickness of 1 to 2 feet. No winter records of discharge have been obtained.

Neither the location nor datum of the staff gage has been changed during the maintenance of the station. Discharge measurements are made from a cable a few feet downstream from the gage.

Fairly good results have been obtained at this station during the open seasons.

This station is maintained under the direction of the United States Reclamation Service.

[a] This station was referred to in previous reports as at east portal of Gunnison tunnel.
[b] The Gunnison tunnel and Uncompahgre project are described in the report of the United States Reclamation Service.

Discharge measurements of Gunnison River at River Portal, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 7	T. I. Phelps	.....	906	5.62	649
March 8	do	.....	880	5.50	576
March 14	do	.....	855	5.35	480
Do	do	.....	847	5.27	463
April 12	do	170	1,500	9.55	4,160
April 15	do	172	1,530	9.70	4,420
April 22	do	155	1,210	7.68	1,860
May 20	do	180	1,740	10.85	5,470
June 11	do	191	1,930	11.90	8,700
June 17	do	204	2,340	13.55	11,400
July 8	do	192	1,990	12.20	8,960
July 12	do	179	1,770	11.10	6,780
July 16	do	163	1,710	10.40	5,550
August 7	do	.....	1,280	8.25	2,880
August 23	do	.....	1,050	7.18	1,710
November 13	do	.....	704	5.10	429
1908.					
April 6	T. I. Phelps	148	939	6.32	1,330
April 18	do	160	1,260	8.48	2,980
April 28	do	153	1,090	7.23	2,170
June 17	do	183	1,700	11.00	6,630
July 22	do	149	996	6.80	1,460

Daily gage height, in feet, of Gunnison River at River Portal, Colo., for 1907 and 1908.

[T. I. Phelps, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.									
1	.....	6.30	7.88	9.80	13.45	8.60	7.25	6.20	6.00
2	.....	6.30	7.75	10.20	13.30	8.70	7.05	6.20	6.00
3	.....	6.60	7.75	11.70	12.90	9.05	6.90	6.20	5.95
4	.....	6.85	7.65	11.95	13.00	8.75	6.80	6.20	5.88
5	5.60	7.00	7.55	12.45	12.95	8.65	6.75	6.15	5.85
6	5.68	6.90	7.65	12.95	12.65	8.35	6.70	6.15	5.90
7	5.65	6.65	7.70	12.90	12.45	8.25	6.70	6.35	5.90
8	5.55	6.60	7.65	12.75	12.10	8.20	6.65	6.45	5.90
9	5.55	6.85	7.68	12.50	11.70	8.10	6.60	6.50	5.90
10	5.50	7.40	7.70	12.00	11.50	8.05	6.60	6.35	5.90
11	5.50	8.48	8.10	11.90	11.45	7.85	6.45	6.30	5.90
12	5.55	9.38	8.68	12.40	11.00	7.80	6.40	6.20	5.58
13	5.50	9.52	8.75	12.85	10.80	7.85	6.40	6.20	5.15
14	5.35	9.40	8.45	13.10	11.25	8.25	6.50	6.15	5.30
15	5.30	9.62	8.20	13.45	11.10	8.10	6.80	6.10	5.40
16	5.40	9.48	8.20	13.40	10.45	7.95	6.80	6.05	5.85
17	5.85	9.92	8.60	13.55	10.10	7.70	6.55	6.00	5.80
18	6.30	8.55	9.05	13.45	9.75	7.45	6.50	6.00	5.70
19	6.90	8.30	9.85	13.50	9.55	7.55	6.50	6.00	5.80
20	7.50	7.95	11.05	13.30	9.40	7.65	6.50	6.00	5.65
21	7.50	7.60	12.10	12.85	9.45	7.50	6.50	6.00	5.50
22	7.30	7.66	12.30	12.55	9.40	7.35	6.40	.....	5.30
23	7.00	7.69	12.55	12.50	9.30	7.15	6.30	.....	5.20
24	6.85	7.65	12.05	12.70	9.20	6.95	6.30	.....	.....
25	6.80	7.85	11.35	12.95	9.25	7.20	6.20	6.20	.....
26	6.85	7.88	10.85	13.15	9.75	7.20	6.25	6.10	.....
27	6.75	7.88	10.60	13.20	10.20	7.10	6.25	6.10	.....
28	6.60	7.92	10.40	13.05	9.70	7.20	6.25	6.10	.....
29	6.35	8.10	10.20	13.20	9.25	7.20	6.20	6.10	.....
30	6.20	7.98	10.15	13.40	8.95	7.30	6.20	6.05	.....
31	6.30	.....	10.05	.....	8.70	7.60	.....	6.00	.....

Daily gage height, in feet, of Gunnison River at River Portal, Colo., for 1907 and 1908—Con.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1908.									
1	.....	5.9	7.25	8.85	9.0	7.5	6.1	5.7	5.6
2	.....	6.0	7.55	9.05	8.65	8.0	6.0	5.7	5.6
3	.....	6.0	8.2	9.15	8.6	8.0	5.9	5.7	5.5
4	.....	6.2	7.9	9.55	.....	7.5	5.7	5.7	5.5
5	.....	6.25	7.55	9.7	8.5	7.3	5.6	5.6	5.5
6	.....	6.4	7.6	9.7	8.4	7.3	5.6	5.6	5.5
7	.....	6.3	7.7	9.4	8.2	7.0	5.6	5.6	5.5
8	.....	6.3	8.05	9.15	8.2	7.0	5.6	5.6	5.4
9	.....	6.3	8.45	9.25	8.0	6.8	5.7	5.6	5.4
10	.....	6.4	8.35	10.25	7.9	6.7	5.6	5.6	5.4
11	.....	6.75	7.95	11.1	8.0	7.3	5.6	5.6	5.4
12	.....	6.95	7.9	10.9	7.9	7.3	5.9	5.6	5.3
13	.....	7.3	7.7	10.8	7.85	7.1	.....	5.6	5.3
14	.....	7.85	7.7	11.0	7.75	.....	5.8	5.6	.....
15	.....	8.35	7.65	11.0	.....	6.9	5.8	5.6	.....
16	.....	8.45	7.6	10.8	7.95	6.8	5.8	5.6	.....
17	.....	8.4	7.9	11.1	7.75	7.1	5.7	5.6	.....
18	.....	8.5	8.25	10.7	7.5	7.1	5.7	5.6	.....
19	.....	8.35	8.7	9.85	7.2	7.4	5.6	5.6	.....
20	.....	8.2	9.2	9.25	7.05	7.2	5.6	5.7	.....
21	.....	8.25	8.85	9.45	6.95	7.1	5.6	5.7	.....
22	.....	8.5	8.9	9.7	6.82	6.9	.....	5.7	.....
23	.....	8.5	8.7	10.1	6.7	6.7	5.6	5.6	.....
24	.....	8.2	8.65	9.95	6.72	6.6	5.6	5.6	.....
25	.....	7.9	8.55	10.1	6.75	6.5	5.6	5.6	.....
26	.....	7.5	8.5	10.1	.....	6.5	5.7	5.5	.....
27	.....	7.25	8.5	.....	6.6	6.4	5.8	5.5	.....
28	.....	7.25	8.2	.....	6.6	6.4	5.8	5.5	.....
29	.....	7.2	7.95	.....	6.55	6.3	5.7	5.5	.....
30	.....	7.1	7.95	.....	6.6	6.2	5.7	5.5	.....
31	.....	.....	8.4	.....	6.8	6.1	.....	5.6	.....

Rating table for Gunnison River at River Portal, Colo., for 1907 and 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.10	395	6.30	1,090	7.50	2,080	9.40	4,035
5.20	435	6.40	1,165	7.60	2,170	9.60	4,270
5.30	480	6.50	1,240	7.70	2,260	9.80	4,540
5.40	525	6.60	1,315	7.80	2,350	10.00	4,850
5.50	575	6.70	1,395	7.90	2,445	10.20	5,170
5.60	630	6.80	1,475	8.00	2,540	10.40	5,510
5.70	685	6.90	1,555	8.20	2,730	10.60	5,860
5.80	745	7.00	1,640	8.40	2,930	10.80	6,230
5.90	810	7.10	1,725	8.60	3,140	11.00	6,620
6.00	880	7.20	1,810	8.80	3,360	12.00	8,830
6.10	950	7.30	1,900	9.00	3,580	13.00	11,280
6.20	1,020	7.40	1,990	9.20	3,805	14.00	13,880

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made in 1907 and 1908 and is fairly well defined. Owing to shifting conditions of flow it may not be strictly applicable at times during the above period.

Monthly discharge of Gunnison River at River Portal, Colo., for 1907 and 1908.

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Run-off (total in acre-feet).	Accuracy.
1907.					
March 5–31	2,080	480	1,060	56,800	B.
April	4,720	1,090	2,500	149,000	B.
May	10,200	2,120	4,400	271,000	B.
June	12,700	4,540	10,500	625,000	B.
July	12,400	3,250	6,620	407,000	A.
August	3,640	1,600	2,400	148,000	A.
September	1,860	1,020	1,310	78,000	B.
October	1,240	880	986	60,600	B.
November 1–23	880	415	703	32,100	B.
The period				1,830,000	
1908.					
April	3,030	810	1,940	115,000	C.
May	3,800	1,860	2,690	165,000	C.
June	6,830	3,420	4,880	290,000	B.
July	3,580	1,280	2,170	133,000	B.
August	2,540	950	1,630	100,000	C.
September	950	630	698	41,500	C.
October	685	575	634	39,000	C.
November 1–13	630	480	553	14,300	C.
The period				898,000	

UNCOMPAHGRE RIVER NEAR OURAY, COLO.

During January, February, and March, 1908, records of flow of Uncompahgre River were taken at the power plant of the Ouray Electric Power and Light Company, about 1 mile south of Ouray, Colo. These records were taken by Wheeler & Whinnerah, in the interests of the company, and they have furnished them to the United States Geological Survey for publication.

A dam built of plank, with a weir opening 10 feet wide, was used, and the depth of the water over the weir in inches was measured at a point about 6 feet back from the crest. The discharge data were computed practically on the basis of a standard Francis weir with end contractions.

Daily discharge, in second-feet, of Uncompahgre River near Ouray, Colo., for 1908.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	.....	12.2	a 13.4	11	15.4	14.5	15.1	21	15.1	13.1	.....
2	.....	14.3	14.5	12	a 14.6	14.3	13.9	22	a 15.1	13.9	.....
3	.....	13.5	12.8	13	13.9	13.1	19.6	23	15.1	15.8	.....
4	.....	13.9	17.1	14	a 13.6	12.8	21.3	24	14.5	13.5	.....
5	.....	14.9	13.3	15	13.3	12.9	a 30.8	25	a 14.0	12.8	.....
6	.....	13.9	12.8	16	13.1	a 12.9	40.4	26	a 13.4	15.4	.....
7	13.7	17.5	14.3	17	12.9	a 12.8	26.4	27	12.9	15.4	.....
8	a 15.0	17.1	14.7	18	a 13.4	12.8	.....	28	13.1	14.7	.....
9	16.2	13.1	12.6	19	13.9	13.5	.....	29	14.5	12.4	.....
10	a 15.8	14.1	14.3	20	13.5	12.8	.....	30	17.3	.....	.....
								31	15.1	.....	.....

a Interpolated.

Monthly discharge of Uncompahgre River near Ouray, Colo., for 1908.

[Drainage area, 45 square miles.]

Month.	Discharge in second-feet.		Run-off.	
	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
January 7–31	14.3	0.318	0.29	709
February	13.9	.309	.33	800
March 1–17	18.1	.402	.25	610

UNCOMPAHGRE RIVER AT FORT CRAWFORD, COLO.

This station, which was established October 2, 1907, to obtain information concerning the water supply above the principal diversions in the Uncompahgre Valley, replaces the station near Colona, which was established August 10, 1903. Its present location is at a highway bridge across Uncompahgre River about one-half mile west of Port Crawford, in sec. 36, T. 48 N., R. 9 W. Records were discontinued at the end of the season of 1908.

The station is located just below the mouth of Horsefly Creek. A number of large private irrigation ditches divert water above this station. Existing power plants generate about 1,800 horsepower. Opportunity for extended power development is found on the headwaters.

Thick ice forms along the edges of the river during the winter months. The channel remains open at the station, but slush ice affects the accuracy of the results at times. The channel scours during high stages and silts during periods of low water.

On June 21, 1908, the rod gage, which was established October 2, 1907, was washed out. On July 7, 1908, a temporary chain gage was installed. The zero of this gage was placed 1.95 feet below the zero of the rod gage. On July 23, 1908, a permanent rod gage was installed, the zero of which corresponds to 0.70 foot on the first rod gage, and to 2.65 feet on the chain gage. Gage readings for 1908 have been referred to the datum of the last gage.

Records during June and July, 1908, are unsatisfactory, because of the constant shifting of the channel.

This station was maintained under the supervision of the United States Reclamation Service.

Discharge measurements of Uncompahgre River at Fort Crawford, Colo., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 28	L. J. Foster	45	63	1.70	104
April 18	do	48	87	2.30	244
May 1	do	47	82	2.20	216
May 16	do	46	73	1.96	156
June 4	do	49	104	2.78	451
June 17	do	61	216	3.30	1,030
July 2	do	58	111	[a] 2.64	524
July 10	do	56.5	100	2.40	477
July 21	do	57	90	2.00	373
August 6	do	58	91	2.60	386
September 2	do	55	40	1.80	116
September 23	do	53	23	1.50	52

[a] Gage height referred to chain gage from existing reference points. Later reduced to rod gage. See note.

NOTE.—Gage heights of measurements at this station made prior to July 23, 1908, have been reduced to datum of gage established on that date.

Daily gage height, in feet, of Uncompahgre River at Fort Crawford, Colo., for 1908.

[Roy Humphrey, observer.]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.85	2.15	2.75	.....	2.8	2.0	1.6	1.8
2	.....	1.9	2.1	2.8	2.65	2.9	1.95	1.65	1.8
3	.....	1.9	2.2	2.75	.....	2.9	1.9	1.7	1.8
4	.....	1.9	2.35	2.85	.....	3.0	1.92	1.7	1.8
5	.....	1.95	2.3	2.9	.....	2.65	1.85	1.7	1.7
6	.....	1.9	2.3	2.8	.....	2.8	1.75	1.7	1.7
7	.....	1.95	2.4	2.7	[a] 2.7	2.7	1.65	1.7	1.7
8	.....	1.95	2.35	2.8	2.6	2.65	1.6	1.7	1.7
9	.....	2.0	2.3	2.85	2.45	2.5	1.55	1.7	1.7
10	.....	2.05	2.3	3.3	2.4	2.6	1.55	1.7	1.7
11	.....	2.1	2.4	3.9	2.6	2.95	1.6	1.7	1.7
12	.....	2.25	2.3	3.6	2.5	2.75	1.6	1.7	1.7
13	.....	2.25	2.4	3.3	2.6	2.65	1.6	1.7	1.7
14	.....	2.35	2.2	3.3	2.6	2.8	1.6	1.8	1.6
15	.....	2.5	2.15	3.3	2.65	2.85	1.6	1.8	1.6
16	.....	2.55	2.15	3.2	2.7	2.65	1.6	1.8	1.6
17	.....	2.5	2.15	3.0	2.75	2.9	1.6	1.8	1.5
18	.....	2.4	2.35	2.9	2.5	2.8	1.6	1.8	1.5
19	.....	2.4	2.65	2.9	2.2	2.75	1.6	1.8	1.5
20	.....	2.55	2.7	2.85	2.15	2.95	1.6	1.8	1.5
21	.....	2.6	2.8	[b]	2.05	2.65	1.6	1.9	1.5
22	.....	2.55	2.9	.....	2.05	2.65	1.6	1.9	1.5
23	.....	2.65	2.7	.....	[c] 2.0	2.6	1.6	1.9	1.5
24	.....	2.7	2.65	.....	1.95	2.5	1.6	1.9	1.5
25	.....	2.6	2.4	.....	1.9	2.5	1.65	1.9	1.5
26	.....	2.45	2.3	.....	1.95	2.5	1.65	1.9	1.5
27	.....	2.35	2.3	.....	1.85	2.5	1.6	1.9	1.4
28	1.7	2.35	2.35	.....	1.85	2.4	1.6	1.85	1.4
29	.....	2.4	2.45	.....	1.85	2.3	1.6	1.8	1.4
30	.....	1.9	2.6	.....	2.55	2.0	1.6	1.8	1.4
31	.....	.....	2.6	.....	2.65	2.0	.....	1.8	.....

[a] Temporary gage established. [b] Gage washed out. [c] Permanent gage established.

NOTE.—Gage heights from March 28 to July 22 have been reduced to datum of gage established July 23, 1908.

Rating table for Uncompahgre River at Fort Crawford, Colo., for March 28 to June 10 and August 1 to November 30, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	39	1.90	138	2.40	292	2.90	540
1.50	55	2.00	164	2.50	332	3.00	603
1.60	73	2.10	192	2.60	377	3.10	669
1.70	93	2.20	222	2.70	427	3.20	738
1.80	115	2.30	255	2.80	481	3.30	810

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on 8 discharge measurements made during 1908, and is well defined.

JUNE 11 TO JUNE 20 AND JULY 12 TO JULY 31, 1908.

[The indirect method for shifting channels used.]

Daily discharge, in second-feet, of Uncompahgre River at Fort Crawford, Colo., June 11 to June 20 and July 1 to July 31, 1908.

Day.	June.	July.	Day.	June.	July.	Day.	June.	July.
1		530	11	1,340	610	21		400
2		530	12	1,130	560	22		370
3		550	13	900	635	23		320
4		570	14	930	645	24		300
5		590	15	965	685	25		240
6		610	16	910	740	26		240
7		630	17	800	800	27		185
8		580	18	720	620	28		175
9		495	19	720	455	29		160
10		475	20	680	450	30		400
						31		425

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Uncompahgre River at Fort Crawford, Colo., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
April	427	126	253	15,100	A.
May	540	192	299	18,400	A.
June 1-20	1,340	427	712	28,200	C.
July	800	160	483	29,700	C.
August	603	164	414	25,500	A.
September	164	64	86.3	5,140	B.
October	138	73	110	6,760	B.
November	115	39	74.1	4,410	B.
The period				133,000	

NOTE.—Indirect method for shifting channel used for June 11-20 and July 2-31.

UNCOMPAHGRE RIVER AT MONTROSE, COLO.

This station, which was established April 22, 1903, to obtain for the United States Reclamation Service definite information concerning the amount of water carried by the Uncompahgre, is located at the iron highway bridge just west of Montrose and one-fourth mile west of the Denver and Rio Grande Railroad. The data are of value also in connection with power development.

24439—IRR 249—10——10

The station is about 2 miles above Happy Canyon Creek and is also above Cedar and Spring creeks. Large irrigation ditches divert water between this station and that at Fort Crawford. Existing water rights control the normal flow of this river for irrigation. Above these diversions, however, opportunities exist for storage and power development. Established plants generate about 1,800 horsepower. Open-channel conditions prevail at this station, although thick ice usually forms along the edges. Slush and anchor ice sometimes influence the accuracy of the results. The flow is controlled during the irrigation season by the large diversions above. The flow at this point will also be affected by the inflow from the south canal of the United States Reclamation Service when that is completed.

Neither the location nor the datum of the staff gage, which is 20 feet upstream from the bridge, has been changed during the maintenance of the station.

Results obtained are good except during winter periods and extreme low water.

This station is maintained under the supervision of the United States Reclamation Service.

Discharge measurements of Uncompahgre River at Montrose, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 9	E. F. Kriegsman	30	46	2.40	106
May 14	do	25	27	1.79	31
June 3	H. J. Kesner	34	70	3.32	345
June 17	Kriegsman and Kesner	54	135	4.40	841
July 1	H. J. Kesner	90	244	5.67	1,520
1908.					
May 6	L. J. Foster	24	29.7	2.01	44
June 18	do	46	97	3.47	428
June 26	do	55	136	4.42	728
July 17	do	29.3	53	2.77	169
August 7	do	30.5	58	2.94	194
September 3	do	27	28	1.98	31
September 10	do	16	12	1.50	5
September 24	do	23	24.8	1.83	12

Daily gage height, in feet, of Uncompahgre River at Montrose, Colo., for 1907 and 1908.

[Thomas Reeves, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.											
1	2.38	2.22	2.2	2.15	1.82	1.9	5.3	2.85	2.22	1.5	1.8
2	2.25	2.3	2.18	1.8	1.28	2.28	5.25	3.35	2.15	1.55	1.8
3	2.05	2.3	2.1	1.85	2.22	3.3	5.05	4.15	2.08	1.5	1.8
4	2.3	2.3	2.22	1.85	2.6	3.32	4.75	3.75	1.98	1.5	1.78
5	2.25	2.45	2.08	2.1	2.72	3.35	5.35	3.32	1.98	1.55	1.45
6	2.3	2.35	2.05	1.98	2.6	3.45	5.25	3.0	1.95	1.5	1.7
7	2.28	2.3	2.05	1.9	2.05	3.55	5.0	2.9	1.92	1.52	1.72
8	2.3	2.3	2.0	2.05	2.4	3.55	4.9	2.7	1.92	1.52	1.75
9	2.25	2.3	2.15	2.2	2.4	3.55	4.75	2.5	1.98	1.5	1.75
10	2.25	2.2	2.0	2.58	2.1	3.25	4.9	2.5	1.92	1.55	1.75
11	2.2	2.05	2.05	2.9	2.4	3.25	4.95	2.38	1.9	1.6	1.55
12	2.12	2.2	2.1	2.78	2.35	3.55	4.3	2.25	1.95	1.65	1.5
13	2.12	2.25	2.0	2.7	2.0	3.75	4.5	2.6	1.85	1.7	1.52
14	2.25	2.2	1.95	2.55	1.88	3.85	4.9	3.0	1.92	1.7	1.75
15	2.25	2.25	1.95	2.48	1.55	3.85	4.35	2.88	2.05	1.7	1.78
16	2.0	2.18	2.02	2.2	1.75	3.85	4.2	2.85	1.85	1.7	1.8
17	2.22	2.15	2.05	1.95	2.08	4.15	4.85	2.6	1.95	1.7	1.98
18	2.2	2.15	2.05	1.88	1.9	4.25	4.2	2.6	1.92	1.7	1.95
19	2.2	2.12	2.2	1.55	2.45	3.8	3.25	2.85	1.85	1.7	1.95
20	2.2	2.1	2.25	1.68	2.95	3.7	3.15	2.85	1.82	1.7	1.92
21	2.2	2.05	2.5	1.68	3.3	3.55	3.35	2.75	1.78	1.7	1.95
22	2.3	2.1	2.38	1.58	3.18	3.25	3.45	2.55	1.72	1.7	2.0
23	2.2	2.1	2.18	1.75	3.4	3.3	3.35	2.58	1.77	1.7	2.22
24	2.12	2.2	2.25	2.38	2.78	4.2	3.2	2.62	1.75	1.7	2.22
25	2.0	2.2	2.05	2.4	2.2	4.08	3.25	2.62	1.78	1.9	1.95
26	2.2	2.3	2.02	2.35	1.95	4.4	3.4	2.7	1.75	1.8	1.92
27	2.05	2.15	1.98	2.05	1.88	4.8	3.8	2.48	1.62	1.8	1.95
28	2.1	2.25	2.0	1.95	1.82	4.85	3.55	2.35	1.6	1.8	1.92
29	2.05	.....	1.88	1.9	1.82	5.25	3.45	2.2	1.55	1.78	1.9
30	2.22	.....	2.25	1.95	2.1	5.45	3.1	2.3	1.5	1.75	1.88
31	2.25	.....	2.15	.....	2.05	.....	2.95	2.25	.....	1.8	.....
1908.											
1	2.20	2.10	2.15	1.40	2.45	2.00	3.65	2.80	1.65	1.87	2.40
2	2.15	2.10	2.2	1.37	2.35	2.00	2.80	3.85	1.75	1.80	2.35
3	2.20	2.10	2.35	1.55	2.30	2.37	2.75	3.10	2.05	2.00	2.40
4	2.22	2.05	2.35	1.68	2.20	2.25	2.65	2.75	2.05	1.95	2.42
5	2.13	2.05	2.25	1.57	2.35	2.15	2.90	2.50	1.90	1.85	2.50
6	2.10	1.95	2.2	1.65	2.00	2.15	2.92	3.28	1.62	1.88	2.53
7	2.18	2.10	2.2	1.75	2.07	2.38	2.85	3.05	1.60	1.95	2.50
8	2.05	2.20	2.1	1.65	2.20	2.25	2.80	2.78	1.50	1.88	2.45
9	2.17	2.15	2.15	1.75	2.05	2.37	2.90	2.18	1.65	1.95	2.50
10	2.15	1.95	2.08	1.85	2.05	3.27	2.85	2.22	1.68	1.95	2.42
11	2.15	2.15	2.17	1.90	2.00	3.70	2.80	3.32	1.50	1.87	2.50
12	2.10	2.05	1.95	1.78	1.98	3.22	2.85	2.95	1.50	1.93	2.50
13	2.08	2.15	2.3	1.85	1.95	3.15	2.80	2.52	1.50	1.90	2.48
14	2.07	2.15	2.35	2.40	1.92	3.33	2.80	3.10	1.58	1.90	2.45
15	2.22	2.05	2.35	2.55	2.00	3.12	3.05	2.80	1.65	1.90	2.40
16	2.22	2.08	2.42	2.47	1.95	3.55	2.78	2.65	1.70	1.92	2.37
17	2.05	2.10	2.62	2.40	2.25	3.90	2.82	3.08	1.65	2.25	2.35
18	2.05	2.10	2.5	2.37	2.45	3.23	2.65	3.12	1.65	2.30	2.40
19	2.10	2.15	2.45	2.40	2.20	2.35	2.48	3.25	1.68	2.35	2.35
20	2.15	2.05	2.33	2.23	2.00	2.23	2.45	3.50	1.65	2.35	2.40
21	2.15	2.08	2.28	2.15	2.00	2.78	2.42	3.25	1.75	2.30	2.45
22	2.20	2.05	2.3	2.50	2.00	3.15	2.40	3.15	1.85	2.40	2.40
23	2.10	2.05	2.25	2.42	2.15	3.10	2.50	2.75	1.75	2.30	2.50
24	2.15	2.10	2.22	2.45	2.05	3.00	2.35	2.75	1.75	2.30	2.48
25	2.15	2.07	2.25	2.13	2.05	3.15	2.35	2.58	1.92	2.37	2.40
26	2.05	2.08	2.15	2.05	2.05	4.27	2.45	2.40	2.10	2.33	2.47
27	1.95	2.15	2.05	2.05	2.10	3.80	2.50	2.02	1.95	2.37	2.50
28	1.95	2.15	1.95	2.15	2.00	4.05	2.25	1.98	2.00	2.40	2.50
29	2.10	2.22	1.98	2.22	2.05	3.55	2.65	1.65	1.85	2.40	2.40
30	2.05	.....	1.92	2.30	1.92	3.65	2.50	1.75	1.95	2.40	2.35
31	2.05	.....	1.8	.....	2.40	.....	2.75	1.55	.....	2.40	.....

Rating tables for Uncompahgre River at Montrose, Colo.

JANUARY 1, 1907, TO JUNE 25, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	6	2.40	104	3.50	425	4.60	950
1.40	9	2.50	122	3.60	470	4.70	1,000
1.50	12	2.60	143	3.70	515	4.80	1,050
1.60	16	2.70	165	3.80	560	4.90	1,100
1.70	22	2.80	187	3.90	605	5.00	1,150
1.80	28	2.90	212	4.00	650	5.20	1,255
1.90	36	3.00	240	4.10	700	5.40	1,365
2.00	46	3.10	271	4.20	750	5.50	1,420
2.10	58	3.20	305	4.30	800		
2.20	72	3.30	342	4.40	850		
2.30	88	3.40	382	4.50	900		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 7 discharge measurements made during 1907 and 1908 and is well defined between gage heights 1.8 feet and 5.5 feet.

JUNE 26, 1908, TO NOVEMBER 30, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	5	2.20	60	2.90	196	3.60	402
1.60	6	2.30	75	3.00	222	3.70	437
1.70	8	2.40	90	3.10	249	3.80	472
1.80	11	2.50	107	3.20	277	3.90	510
1.90	20	2.60	127	3.30	306	4.00	548
2.00	32	2.70	148	3.40	338	4.10	588
2.10	45	2.80	170	3.50	370		

NOTE.—The above table is not applicable for ice or obstructed channel conditions. It is based on 6 discharge measurements made in 1908, and is well defined between gage heights 2.0 feet and 4.1 feet. Below 2.0 feet it is somewhat poorly defined.

Monthly discharge of Uncompahgre River at Montrose, Colo., for 1907 and 1908.

[Drainage area, 565 square miles.]

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1907.							
January	101	46	72.3	0.128	0.15	4,450	C.
February	113	52	75.1	.133	.14	4,170	C.
March	122	34	60.5	.107	.12	3,720	B.
April	212	14	69.4	.123	.14	4,130	B.
May	382	6	102	.181	.21	6,270	B.
June	1,390	36	569	1.01	1.13	33,900	A.
July	1,340	226	769	1.36	1.57	47,300	A.
August	725	72	195	.345	.40	12,000	A.
September	75	12	35.6	.063	.07	2,120	C.
October	36	12	20.2	.036	.04	1,240	D.
November	75	10	33.0	.058	.06	1,960	C.
The period						121,000	
1908.							
January	75	41	60.9	.108	.12	3,740	C.
February	75	41	57.8	.102	.11	3,320	C.
March	147	28	76.8	.136	.16	4,720	B.
April	132	8	60.7	.107	.12	3,610	B.
May	113	38	61.9	.110	.13	3,810	B.
June	661	46	269	.476	.53	16,000	B.
July	420	68	153	.271	.31	9,410	A.
August	491	5.5	178	.315	.36	10,900	A.
September	45	5	14.0	.025	.03	833	D.
October	90	11	50.7	.090	.10	3,120	C.
November	113	82	96.4	.171	.19	5,740	C.
The period						65,200	

UNCOMPAHGRE RIVER NEAR DELTA, COLO.

This station was established April 29, 1903, at a highway bridge one-fourth mile above the Denver and Rio Grande Railroad bridge. On November 17, 1903, it was removed to the Denver and Rio Grande Railroad bridge, one-fourth mile northwest of the Denver and Rio Grande depot. The vertical gage at this bridge was read until April 21, 1904, when an inclined gage was installed on the right bank near the bridge. The gage was read until November, 1906, when a staff gage was installed at the present location—the second highway bridge 2 miles south of Delta. Observations were not begun at this gage until April 21, 1907.

During normal stages the flow of the river at this point is nearly all seepage water from the irrigation ditches above. The station is important because it shows the seepage during low stages, and the storage possibility during high stages.

The station is located near the junction of the Uncompahgre with the Gunnison and is below all tributaries and diversions. During the irrigation season the ditches consume all the normal flow. Opportunities for power and storage development, however, are found on the headwaters of the river.

Results are probably not materially affected by ice conditions, as ice does not form very thick, except along the edges of the stream. Slush ice frequently occurs.

There is no determined relation between the datum of the last established gage and the several earlier gages, and the gage used from April 22, 1904 to November, 1906, is at a different datum from the previous gage.

Records obtained at this station are good except during extremely low stages.

This station is maintained under the supervision of the United States Reclamation Service.

Discharge measurements of Uncompahgre River near Delta, Colo., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 16	E. F. Kriegsman	47	97	2.39	259
May 10	do	15	28	1.38	10
June 5	H. J. Kesner	44	96	2.57	308
June 12	do	42	80	2.14	166
June 20	Kriegsman and Kesner	44	102	2.53	316
June 28	H. J. Kesner	49	138	3.15	527
July 5	do	49	180	3.93	1,040
August 30	L. J. Foster	43	81	2.00	130
October 16	do	27	56	1.75	63
1908.					
April 8	L. J. Foster	20	37	1.55	25.6
April 24	do	20	36	1.50	17.6
May 25	do			1.25	0
June 29	do	51	102	2.50	257
July 31	do	25	45	1.60	39
September 9	do	20	35	1.45	12.3

Daily gage height, in feet, of Uncompahgre River near Delta, Colo., for 1907 and 1908.

[W. J. Lance, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.											
1					1.35	1.4	4.05	2.05	2.0	1.75	1.95
2					1.4	1.4	4.05	2.0	2.0	1.75	1.9
3					1.4	1.75	3.7	2.8	1.85	1.7	2.15
4					1.3	2.75	3.75	2.6	1.7	1.7	2.1
5					1.3	2.5	3.75	2.45	1.7	1.7	2.1
6					1.3	2.75	4.0	2.4	1.7	1.7	2.05
7					1.3	2.75	3.85	2.25	1.7	2.15	2.1
8					1.3	2.8	3.65	2.2	1.7	2.15	2.15
9					1.3	2.7	3.45	2.0	1.7	1.8	2.0
10					1.3	2.7	3.4	2.0	1.7	1.75	1.95
11					1.3	2.75	3.45	1.8	1.7	1.7	1.85
12					1.35	2.5	3.3	1.8	1.7	1.75	1.75
13					1.6	2.55	3.25	2.15	1.6	1.75	1.75
14					1.5	2.55	3.25	2.55	1.6	1.7	1.8
15					1.4	2.55	3.45	2.35	1.8	1.7	1.85
16					1.4	2.65	3.0	2.2	1.95	1.85	2.0
17					1.35	2.75	2.65	2.0	2.0	1.9	2.3
18					1.3	2.85	2.2	1.95	1.8	1.9	2.2
19					1.65	2.7	1.9	2.3	1.8	1.85	1.95
20					1.85	2.65	2.0	2.65	1.8	1.8	2.05
21				1.7	2.2	2.5	2.1	2.55	1.8	1.85	2.0
22				1.4	2.6	2.4	2.0	2.4	1.8	1.9	1.95
23				1.5	2.7	2.15	2.1	2.1	1.7	1.8	2.15
24				1.5	2.6	2.3	2.1	2.1	1.7	1.8	2.5
25				1.5	2.4	2.75	2.25	2.5	1.75	1.95	2.25
26				1.45	2.0	3.2	2.35	2.6	1.8	1.9	2.15
27				1.4	1.75	3.3	2.7	2.0	1.85	1.8	2.05
28				1.4	1.6	3.45	2.65	2.0	1.85	1.75	2.0
29				1.45	1.6	3.55	2.4	2.0	1.8	1.75	2.0
30				1.35	1.6	3.80	2.25	2.0	1.7	1.8	2.15
31					1.45		2.05	2.0		1.8	
1908.[a]											
1	2.1	2.0	2.3	1.55	1.3	1.2	1.95	1.5	1.3	1.35	1.9
2	2.15	2.0	2.2	1.5	1.4	1.2	1.6	2.2	1.4	1.5	1.8
3	2.15	2.0	2.0	1.5	1.45	1.2	1.5	1.9	1.3	1.5	1.8
4	2.1	2.0	2.0	1.5	1.45	1.15	1.5	1.7	1.3	1.5	1.8
5	2.0	2.0	2.0	1.5	1.4	1.05	1.4	1.5	1.3	1.55	1.85
6	2.1	2.0	2.0	1.5	1.4	1.1	1.45	1.85	1.3	1.6	2.0
7	2.1	2.0	2.0	1.65	1.3	1.1	1.3	2.15	1.4	1.6	2.0
8	2.05	2.0	2.0	1.6	1.3	1.1	1.35	1.65	1.5	1.6	2.0
9	2.05	2.0	2.0	1.55	1.3	1.2	1.3	1.5	1.5	1.6	2.0
10	2.05	2.0	2.0	1.4	1.3	1.6	1.3	1.6	1.5	1.5	2.0
11	2.05	2.0	2.0	1.35	1.3	2.0	1.35	3.05	1.4	1.5	2.0
12	2.1	2.0	2.05	1.4	1.0	2.0	1.35	2.5	1.4	1.5	2.0
13	2.15	2.0	2.05	1.4	.95	1.65	1.35	1.8	1.5	1.5	2.0
14	2.2	2.0	2.05	1.4	1.1	1.75	1.3	2.25	1.5	1.5	2.0
15	2.15	2.0	2.0	1.4	1.3	1.9	1.5	2.15	1.5	1.5	2.0
16	2.1	2.0	2.0	1.6	1.3	2.0	1.4	1.95	1.5	1.55	1.9
17	2.3	1.9	2.05	1.5	1.3	2.15	1.35	2.0	1.5	1.65	1.95
18	2.3	2.0	2.1	1.2	1.3	1.95	1.3	2.5	1.5	1.8	2.0
19	2.3	2.0	2.1	1.2	1.3	1.55	1.3	2.55	1.5	2.55	2.1
20	2.3	2.0	2.0	1.35	1.3	1.45	1.3	2.6	1.5	2.0	2.2
21	2.3	2.0	1.95	1.2	1.3	1.45	1.3	2.7	1.5	2.0	2.1
22	2.2	2.0	1.9	1.3	1.3	1.4	1.3	2.6	1.5	2.0	2.0
23	2.2	2.0	1.9	1.45	1.3	1.5	1.3	2.45	1.5	1.9	2.0
24	2.15	2.0	1.9	1.55	1.25	1.45	1.3	2.3	1.5	1.9	2.1
25	2.15	2.05	1.9	1.4	1.25	1.45	1.3	2.1	1.5	1.9	2.0
26	2.0	2.05	1.9	1.4	1.3	2.6	1.3	1.95	1.6	1.9	2.0
27	2.0	2.05	1.8	1.3	1.2	2.75	1.3	1.7	1.6	1.85	2.0
28	2.0	2.25	1.8	1.2	1.2	2.3	1.3	1.55	1.5	1.8	2.0
29	2.0	2.25	1.7	1.25	1.2	2.2	1.45	1.4	1.45	1.8	2.0
30	2.0		1.6	1.3	1.2	2.1	1.3	1.4	1.4	1.8	1.85
31	2.0		1.6		1.2		1.35	1.35		1.9	

[a] For gage heights less than 1.3 feet during 1908 there was no flow.

NOTE.—The river was probably frozen during part, at least, of January and February.

Rating tables for Uncompahgre River near Delta, Colo.

1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	6	2.10	155	2.80	400	3.50	760
1.40	11	2.20	184	2.90	443	3.60	820
1.50	21	2.30	215	3.00	490	3.70	890
1.60	36	2.40	248	3.10	540	3.80	960
1.70	55	2.50	283	3.20	590	3.90	1,030
1.80	77	2.60	320	3.30	640	4.00	1,110
1.90	101	2.70	359	3.40	700	4.10	1,190
2.00	127						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on nine discharge measurements made during 1907, and is well defined.

1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.25	0	1.50	18	1.70	52	1.90	100
1.30	1	1.60	33	1.80	74	2.00	127
1.40	7						

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on thirteen discharge measurements made during 1907 and 1908 and is well defined. Above gage height 2.0 feet it is the same as the 1907 table.

Monthly discharge of Uncompahgre River near Delta, Colo., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
April 21-30	55	8	19.1	379	C.
May	359	6	66.5	4,090	B.
June	960	11	368	21,900	A.
July	1,150	101	526	32,300	A.
August	400	77	196	12,100	A.
September	127	36	72.5	4,310	A.
October	170	55	81.0	4,980	A.
November	283	66	140	8,330	A.
The period				88,400	
1908.					
January	215	127	162	9,960	D.
February	200	100	132	7,590	D.
March	215	33	119	7,320	B.
April	42	0	12.2	726	C.
May	12	0	2.0	123	D.
June	380	0	75.2	4,470	A.
July	114	1	9.0	533	C.
August	515	4	150	9,220	A.
September	33	1	14.1	839	C.
October	302	4	63.2	3,890	A.
November	184	74	122	7,260	A.
The period				51,900	

SAN JUAN RIVER DRAINAGE BASIN.

DESCRIPTION.

San Juan River rises among the snow masses that crown the high peaks of the San Juan Mountains in southwestern Colorado, flows southwestward into New Mexico, then swings to the west and northwest, passing from San Juan County, N. Mex., across the extreme southwestern corner of Colorado into San Juan County, Utah, in the southwestern part of which it unites with the Colorado.

For the first 75 miles of its course the San Juan is a typical mountain stream, but at Canyon Largo, N. Mex., where it turns westward, its character changes, and it occupies a broad, winding, sandy channel in an arid valley, bordered on each side by terraced mesas. Below the mouth of Mancos River the valley narrows and the river bottom is bounded by abrupt bluffs, broken and cut by dry water channels, and merging farther on into the walls of a deep, narrow, box canyon in which the river flows to its end.

The drainage area includes portions of four States and Territories. Its topography ranges in type from mountainous at the headwaters in Colorado to the types exemplified in the valleys, plateaus, and eroded mesas of Utah, New Mexico, and Arizona. Large areas of eruptive rocks occur in the highest portions of the basin, but the predominating formations are of sedimentary origin. The headwater streams are protected by fine forests of spruce and yellow pine and at lower elevations large areas of aspen. The lower basin is practically barren except for an extensive growth of sagebrush, scattered cedars, piñons, and range grasses.

The principal tributaries of the San Juan are Navajo, Piedra, Pine, Florida, Animas, and La Plata rivers, the Animas being the most important.

Animas River has its source in the region above Silverton, draining portions of the Needle and La Plata mountains, the former being the most rugged of the Rocky Mountain ranges. The river flows southward to the Colorado-New Mexico line and thence southwestward to the point where it joins the San Juan at Farmington, N. Mex. The upper portion of the basin, above Durango, is very mountainous and furnishes the greater part of the run-off (Pl. VII, *B*, p. 128). This region is generally well timbered with pine, spruce, and aspen, but large areas consist of naked granite peaks. Immediately above and below Durango the valley broadens and is bordered by mesas and bluffs cut by narrow canyons and covered with sagebrush and scattered pines and piñons; along the stream channels cottonwoods predominate. The rocks of this region are chiefly of sedimentary origin. The soils of the lower valleys consist of sandy loam and are very fertile.

La Plata River rises in the granite masses known as La Plata Mountains, about 25 miles northwest of Durango, Colo., and flows southward to its point of junction with the San Juan. Its drainage basin is a narrow strip parallel to and adjoining the Animas basin. The upper portion of the basin is a well-watered and forest-clad mountain region which merges southward into an arid mesa, plateau, and canyon country. La Plata Valley proper is a narrow, shallow depression from Hesperus down, bounded on both sides by high, broken tablelands and deeply eroded mountains. The lower mountain slopes are covered with piñon, scrub oak, and cedar; the lower valleys support heavy growths of sagebrush and chico; the upper mountain slopes were at one time heavily timbered with spruce and yellow and white pine, but these forests have been largely removed by lumbermen.

The other tributaries of the San Juan need not here be described. Those mentioned are perennial streams, but much of their water is diverted for irrigation and never reaches the main river. In addition to the perennial streams are many intermittent creeks throughout New Mexico, which contribute large volumes of water during heavy storms.

The altitudes in this drainage basin range from over 13,000 feet in the highest mountains to between 6,000 and 7,000 feet at the Colorado-New Mexico line. The San Juan at the mouth of the Animas has an elevation of about 5,300 feet; at its junction with Colorado River the elevation is about 3,500 feet.

Most of the timbered land in the San Juan drainage basin is included in the San Juan National Forest, which contains nearly 2,000 square miles of merchantable timber, 100 square miles of woodland, 300 square miles of sagebrush, and 200 square miles of barren and burnt area.

A small area in the high mountain drainage of this stream has an annual precipitation of over 25 inches, and over a considerable area the average exceeds 20 inches; but for the remainder of the area the average in Colorado seems to be about 15 inches, that in New Mexico about 10 inches, and in Utah about 15 inches.

Above an altitude of 7,500 feet the winters are severe and snowfalls are heavy. Below an elevation of 6,000 feet the winters are comparatively open and mild. The upper mountain streams flow under a thick ice cover, but in the more open country, in the vicinity of Aztec, it is rather unusual for the rivers to freeze over entirely, though much ice forms along the edges, and slush ice is often seen.

Much land along the valleys of San Juan, Animas, Pine, Florida, and La Plata rivers and the smaller tributaries in Colorado are now under cultivation, and also a few thousand acres of valley land in New Mex-

ico. Up to this time irrigation has largely been confined to the bottom land. The greatest opportunities for future development are in San Juan County, N. Mex., where exceptionally large areas, aggregating probably a million acres of fertile lands, are excellently adapted to irrigation. The rivers there are bordered by broad mesas and benches, sloping back for miles in many places, and easily reached by irrigation canals. The water supply is ample.

Numerous small lakes, high up in the mountains, tend to equalize the flow of some of the tributaries, and many large and small storage reservoir sites are available. Among others may be mentioned the Turley reservoir site, on San Juan River below the mouth of the Pine, which has a storage capacity of about one and a half million acre-feet.

Excellent opportunities for power development are presented. Theoretically, with proper storage, it will be possible to develop nearly 300,000 horsepower. Falls of 100 to 300 feet per mile are common on the upper reaches of the stream. The San Juan has an average fall of about 13 feet to the mile from the mouth of the Piedra to the mouth of the Mancos, a distance of about 115 miles, while the fall above the mouth of the Piedra is very much greater. The Animas has a fall of over 70 feet to the mile from Silverton to Durango, a distance of about 40 miles, and from Durango to its mouth the average fall is over 20 feet to the mile. Present developments are practically limited to two power plants on Animas River, of 6,000 and 1,000 horsepower. Several other plants are contemplated.

The largest deposits of lignite, bituminous, and coking coal in the West are to be found in this drainage area.

The following gaging stations have been maintained in the San Juan basin:

San Juan River near Arboles, Colo., 1895–1899.
San Juan River at Turley, N. Mex., 1907–8.
San Juan River near Farmington, N. Mex., 1904–1906.
Piedra River near Arboles, Colo., 1895–1899.
Los Pinos River at Ignacio, Colo., 1899–1903.
Animas River at Silverton, Colo., 1903.
Animas River at Durango, Colo., 1895–1905.
Animas River at Aztec, N. Mex., 1904, 1907–8.
Animas River near Farmington, N. Mex., 1904–5.
Florida River near Durango, Colo., 1899, 1901–1903.
La Plata River at Hesperus, Colo., 1904–1906.
La Plata River near La Plata, N. Mex., 1905–1908.
Mancos River at Mancos, Colo., 1898–1900.

SAN JUAN RIVER AT TURLEY, N. MEX.[a]

This station, which was established June 6, 1907, to obtain data necessary to determine the amount of water available for irrigation from this stream, was discontinued November 30, 1908. The data

[a] A new station was established December 9, 1908, at Blanco, N. Mex., to take the place of this station.

collected are also valuable for power purposes. It was located about one-fourth of a mile north of Turley post-office and about 18 miles east of the Denver and Rio Grande Railroad at Aztec, N. Mex.

The station was about 5 miles above the mouth of Canyon Largo, which is an intermittent stream draining a vast area and discharging during flood stages thousands of second-feet of water. The drainage area of the San Juan at Turley is about 4,700 square miles.

Irrigation is carried on extensively in a number of the tributary valleys above this station, the greatest development being along Pine River and Rio Piedra. A large canal, now under construction, will divert water from Pine River to irrigate land in Colorado. The diversions below the station are mainly small private ditches. Opportunities for power and irrigation enterprises are good.

The river seldom freezes over entirely, but ice usually forms along the edges and narrows the channel considerably. Slush ice is common during the winter months.

Neither the location nor the datum of the staff gage has been changed during the maintenance of the station.

The results obtained are considered fairly good.

Discharge measurements of San Juan River at Turley, N. Mex., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 6	V. L. Sullivan	192	1,240	7.60	7,750
September 7	do	180	574	4.55	1,960
December 13	do	158	254	2.60	314
1908.					
April 12	V. L. Sullivan	182	790	5.40	3,080

Daily gage height, in feet, of San Juan River at Turley, N. Mex., for 1907 and 1908.

[Jay Turley and A. C. Jaquez, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1							8.65	5.00		3.30	3.25	2.55
2							8.60	5.20	5.00	3.40	3.20	2.60
3							8.30	5.50	4.80	3.30	3.15	2.55
4							8.20	5.30	4.60	3.30	3.05	2.55
5							8.15	5.10	4.50	3.35	3.05	2.60
6						7.57	8.05	4.80	4.65	3.30	3.00	2.65
7						7.65	7.90	4.72	4.55	3.25	3.00	2.75
8						7.70	7.60	4.58	4.45	3.70	3.00	2.80
9						7.50	7.50	4.45	4.35	3.50	3.00	2.75
10						7.20	7.20	4.33	4.30	3.40	2.95	2.70
11						7.05	7.05	4.24	4.20	3.30	2.95	2.75
12						7.35	6.90	4.10	3.90	3.25	2.90	2.70
13						7.85	7.00	5.25	3.80	3.20	2.90	2.65
14						7.90	7.30	5.00	3.75	3.15	2.90	2.55
15						8.00	7.20	4.72	3.70	3.10	2.85	2.60
16						7.90	6.90	4.35	3.65	3.15	2.80	2.65
17						7.85	6.45	4.20	3.60	3.10	2.90	2.65
18						8.00	6.30	4.08	3.90	3.05	2.95	2.70
19						7.85	6.20	4.30	4.25	3.05	2.90	2.75
20						7.65	6.20	4.41	4.20	3.05	2.85	2.50

Daily gage height, in feet, of San Juan River at Turley, N. Mex., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	.....	.....	.....	.....	.....	7.40	6.15	4.60	4.10	3.00	2.80	2.55
22	.....	.....	.....	.....	.....	7.40	6.00	4.60	4.00	3.00	2.75	2.75
23	.....	.....	.....	.....	.....	7.20	5.93	4.32	3.85	3.00	2.65	2.85
24	.....	.....	.....	.....	.....	7.50	5.75	4.65	3.75	3.20	2.55	2.60
25	.....	.....	.....	.....	.....	7.70	6.80	4.45	3.70	3.30	2.70	2.70
26	.....	.....	.....	.....	.....	7.95	5.92	4.50	3.60	3.30	2.65	3.00
27	.....	.....	.....	.....	.....	8.05	5.78	4.44	3.55	3.20	2.70	2.90
28	.....	.....	.....	.....	.....	8.25	5.55	4.70	3.45	3.10	2.75	2.75
29	.....	.....	.....	.....	.....	8.40	5.40	.....	3.40	3.10	2.85	2.60
30	.....	.....	.....	.....	.....	8.55	5.28	.....	3.35	3.25	2.75	2.50
31	.....	.....	.....	.....	.....	.....	5.10	.....	.....	3.35	.....	2.60
1908.												
1	2.7	2.65	3.8	4.4	5.8	5.55	5.45	4.8	3.6	3.0	3.0	.....
2	2.85	2.75	3.3	4.45	6.0	6.0	5.2	8.8	3.7	3.05	2.9	.....
3	2.6	3.85	3.3	4.7	5.9	5.85	5.1	5.6	3.5	3.1	2.75	.....
4	2.65	5.1	3.3	4.8	5.65	6.1	5.0	5.28	3.6	3.1	2.85	.....
5	2.8	4.05	4.3	5.2	5.35	6.2	4.9	5.0	3.5	3.0	2.8	.....
6	2.7	3.25	4.6	5.25	5.1	6.2	5.0	4.8	3.4	2.9	2.9	.....
7	2.7	2.7	4.0	5.2	5.0	5.8	4.8	5.8	3.3	2.95	2.85	.....
8	2.8	2.65	3.7	5.3	5.0	5.7	4.85	4.8	3.1	3.0	2.95	.....
9	2.65	2.6	4.2	5.3	5.3	5.8	4.7	4.7	3.0	3.05	2.9	.....
10	2.75	2.7	3.5	5.35	5.3	6.4	4.65	4.3	3.0	3.05	3.0	.....
11	2.85	2.6	3.65	5.4	5.1	6.6	4.5	4.2	2.9	3.0	3.05	.....
12	2.9	2.55	3.95	5.4	5.0	5.8	4.5	4.0	2.9	3.05	2.95	.....
13	2.8	2.5	4.3	5.2	5.0	6.7	4.55	4.4	2.9	3.0	2.85	.....
14	2.7	2.45	4.5	5.4	4.9	6.6	4.6	4.8	2.9	3.0	2.7	.....
15	2.6	2.75	4.85	5.6	4.7	6.4	4.6	5.0	2.9	3.1	2.75	.....
16	2.65	2.95	4.95	6.2	4.7	6.8	4.7	5.4	2.8	.....	2.65	.....
17	2.65	3.85	5.25	6.1	5.3	6.0	4.6	5.4	2.95	3.0	2.6	.....
18	2.8	3.2	5.75	5.8	5.2	5.4	4.5	5.2	2.9	3.05	2.55	.....
19	2.95	3.15	5.6	5.65	6.15	5.3	4.4	5.4	3.0	3.1	2.4	.....
20	2.7	3.05	5.2	5.8	6.1	5.2	4.3	5.6	3.1	3.15	2.3	.....
21	2.75	2.8	5.0	5.9	5.9	5.6	4.32	6.05	3.0	3.2	2.25	.....
22	2.75	2.95	5.0	5.45	5.7	5.4	4.35	5.0	3.05	3.2	2.2	.....
23	2.7	3.8	4.7	5.55	5.55	5.7	4.2	4.9	3.0	3.1	2.25	.....
24	2.65	3.6	4.7	5.55	5.4	5.6	4.15	4.8	3.0	3.15	2.15	.....
25	2.75	3.5	4.8	5.3	5.25	5.4	4.25	4.5	2.95	3.15	2.1	.....
26	2.8	3.8	4.95	5.15	5.0	6.3	4.25	4.5	2.95	3.15	2.15	.....
27	2.7	3.85	5.05	5.0	5.0	6.6	4.25	4.4	3.0	3.1	2.25	.....
28	2.7	3.8	4.85	4.85	4.9	6.5	4.15	4.2	3.0	3.0	2.15	.....
29	2.75	3.8	4.65	4.8	4.8	5.7	4.38	4.0	3.0	3.05	2.1	.....
30	2.6	.....	4.5	4.75	4.75	5.5	4.4	4.0	3.05	3.0	2.05	.....
31	2.6	.....	4.3	.....	4.85	.....	4.6	3.95	.....	3.05	.....	.....

Rating table for San Juan River at Turley, N. Mex., for June 6, 1907, to November 30, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	100	3.30	760	4.60	1,990	6.60	5,250
2.10	130	3.40	840	4.70	2,110	6.80	5,680
2.20	160	3.50	920	4.80	2,230	7.00	6,150
2.30	195	3.60	1,000	4.90	2,350	7.20	6,650
2.40	235	3.70	1,090	5.00	2,480	7.40	7,170
2.50	280	3.80	1,180	5.20	2,750	7.60	7,720
2.60	330	3.90	1,270	5.40	3,050	7.80	8,310
2.70	380	4.00	1,360	5.60	3,350	8.00	8,910
2.80	430	4.10	1,460	5.80	3,680	8.20	9,510
2.90	490	4.20	1,560	6.00	4,040	8.40	10,120
3.00	550	4.30	1,660	6.20	4,420	8.60	10,740
3.10	620	4.40	1,770	6.40	4,830	8.80	11,360
3.20	690	4.50	1,880				

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during 1907 and 1908. These measurements lying between gage heights 2.5 feet and 8.0 feet are well distributed and form a good curve. They are insufficient in number, however, to indicate any possible change in conditions of flow.

Monthly discharge of San Juan River at Turley, N. Mex., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet)	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
June 6–30	10,600	6,280	8,150	404,000	A.
July	10,900	2,610	6,030	371,000	A.
August	3,200	1,440	2,080	128,000	A.
September	2,480	800	1,450	86,300	A.
October	1,090	550	711	43,700	A.
November	725	305	489	29,100	B.
December	550	280	367	22,600	B.
The period				1,080,000	
1908.					
January	520	330	395	24,300	B.
February	2,610	258	766	44,100	A.
March	3,600	760	1,920	118,000	A.
April	4,420	1,770	2,930	174,000	A.
May	4,320	2,110	2,910	179,000	A.
June	5,680	2,750	4,020	239,000	A.
July	3,120	1,510	1,990	122,000	A.
August	11,400	1,320	2,550	157,000	A.
September	1,090	430	627	37,300	A.
October	690	490	592	36,400	A.
November	585	115	337	20,100	B.
The period				1,150,000	

NOTE.—The above accuracy notes are based on the assumption of constant conditions of flow. See rating-table foot note.

Discharge estimated for days in August and September, 1907, that the gage record is missing.

SAN JUAN RIVER AT BLANCO, N. MEX.

This station was established December 9, 1908, and takes the place of the station at Turley, which was discontinued November 30, 1908. It is located at the new suspension bridge, which crosses the San Juan at Blanco about 4 miles below Turley post-office, 16 miles southeast of the Denver and Rio Grande Railroad, at Aztec, N. Mex., and one-half mile above the mouth of Canyon Largo.

The following discharge measurement was made by J. B. Stewart:

December 10, 1908:[a] Width, 194 feet; area, 194 square feet; gage height, 2.60 feet;[b] discharge, 157 second-feet.

Daily gage height, in feet, of San Juan River at Blanco, N. Mex., for 1908.

Day.	Dec.	Day.	Dec.	Day.	Dec.
1		11	2.6	21	2.75
2		12	2.4	22	2.8
3		13	2.4	23	3.0
4		14	2.4	24	3.0
5		15	2.7	25	2.85
6		16	3.0	26	2.8
7		17	2.4	27	2.7
8		18	3.0	28	2.7
9	2.6	19	2.8	29	2.6
10	2.6	20	2.8	30	2.7
				31	2.7

[a] Slush ice. [b] Chain gage.

ANIMAS RIVER AT AZTEC, N. MEX.

This station was originally established June 21, 1904, at a wooden-truss highway bridge about three-eighths of a mile west of Aztec, N. Mex. It was discontinued December 14, 1904, and reestablished at the same location on June 8, 1907. On September 13, 1908, it was moved to a new suspension bridge about half a mile above the old bridge, which was torn down on completion of the new bridge. The station is about one-third of a mile west of Aztec, on the main wagon road to Farmington and La Plata.

No change in the staff gage or gage datum occurred during the maintenance of the station at the old location. Beginning September 13, 1908, an inclined staff gage, installed a few feet downstream from the suspension bridge at an arbitrary datum, was read.

The records obtained at this point are valuable for irrigation and power projects, as the irrigable area in this basin is large and the fall of the river is heavy.

The station, although 20 miles above the mouth of the river, is below all important tributaries. The drainage area is about 1,300 square miles. Between Durango and Aztec many large ditches divert water for irrigation, and the discharge at this station does not represent the total run-off of the stream. Notwithstanding numerous existing water rights, an ample supply of water is available for future development.

Ice forms to a considerable depth along the edges during the greater part of the winter, but the river seldom freezes across. Slush ice occurs frequently during the winter months.

Results are good except during July, August, and September, 1908, when the shifting of the channel interfered with the accuracy of the data.

Discharge measurements of Animas River at Aztec, N. Mex., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec. ft.*
June 8	V. L. Sullivan	150	762	8.50	3,660
September 9	do	90	336	6.90	826
December 15	do	96	189	6.00	269
1908.					
April 13	Jay Turley	116	421	7.30	1,141
September 12	V. L. Sullivan	126	141	[a] 3.60	358
December 9 [b]	J. B. Stewart	82	108	[a] 3.30	181

[a] New gage at different datum. [b] Wading measurement.

Daily gage height, in feet, of Animas River at Aztec, N. Mex., for 1907 and 1908.

[J. M. Thomas, H. S. Wattles, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1							9.0	7.6	7.8	6.5	6.3	6.0
2							9.0	7.7	7.5	6.5	6.3	6.0
3							8.9	8.1	7.3	6.4	6.3	6.0
4							8.8	8.0	7.1	6.4	6.3	6.0
5							8.8	7.8	7.1	6.4	6.3	6.0
6							9.0	7.8	7.1	6.4	6.3	6.0
7							8.95	7.5	7.1	6.5	6.2	6.0
8						8.50	8.9	7.4	7.0	6.5	6.2	6.0
9							8.7	7.3	6.9	6.5	6.2	6.0
10							8.6	7.2	6.9	6.5	6.2	6.0
11							8.5	7.2	6.8	6.5	6.2	6.0
12							8.5	7.1	6.8	6.5	6.2	6.0
13							8.45	7.2	6.7	6.5	6.2	6.0
14						8.7	8.6	7.2	6.7	6.5	6.2	6.0
15						8.65	8.9	7.2	6.8	6.5	6.1	6.0
16						8.65	8.6	7.1	7.1	6.5	6.1	6.0
17						8.7	8.4	7.0	7.0	6.4	6.1	6.0
18						8.9	8.2	7.0	7.1	6.4	6.1	6.0
19						9.0	8.15	6.95	7.2	6.4	6.1	6.0
20						8.8	8.1	6.9	7.3	6.4	6.1	6.0
21						8.5	8.15	7.8	7.4	6.4	6.1	6.0
22						8.5	8.1	7.3	7.3	6.4	6.1	6.0
23						8.3	8.1	7.2	6.9	6.4	6.1	6.0
24						8.4	8.0	7.0	6.8	6.4	6.1	6.0
25						8.65	8.0	6.9	6.8	6.4	6.1	6.0
26						8.75	8.0	6.9	6.7	6.4	6.1	6.0
27						8.75	8.0	7.1	6.7	6.4	6.1	6.0
28						8.8	7.9	7.5	6.6	6.4	6.1	6.0
29						8.8	7.9	7.1	6.6	6.4	6.1	6.0
30						9.0	7.8	7.9	6.6	6.4	6.0	6.0
31							7.7	7.7		6.3		6.0
1908.												
1	6.0	6.2	6.3	7.2	7.1	8.0	8.5	7.3	6.3	3.5	3.5	3.4
2	6.0	6.2	6.3	7.2	7.5	8.1	8.2	6.8	6.2	3.5	3.5	3.4
3	6.0	6.3	6.3	7.1	7.6	8.0	7.9	6.7	6.1	3.5	3.5	3.45
4	6.0	6.3	6.3	7.1	7.6	7.9	7.6	6.9	6.0	3.5	3.5	3.45
5	6.0	6.4	6.5	7.2	7.5	8.0	7.4	7.0	6.0	3.6	3.5	3.5
6	6.0	6.4	6.5	7.2	7.7	8.1	7.4	6.8	5.9	3.5	3.5	3.45
7	6.0	6.3	6.4	7.3	7.6	8.2	7.4	7.0	5.9	3.5	3.5	3.4
8	6.0	6.2	6.4	7.3	7.5	8.4	7.3	6.8	5.8	3.5	3.5	3.35
9	6.0	6.2	6.5	7.2	7.6	8.4	7.2	6.9	5.7	3.45	3.5	3.3
10	6.0	6.2	6.5	7.3	7.6	8.5	7.3	6.7	5.6	3.4	3.5	3.4
11	6.0	6.2	6.3	7.2	7.5	8.3	7.3	6.6	5.6	3.4	3.5	3.4
12	6.0	6.0	6.4	7.2	7.6	8.6	7.3	6.6	5.6	3.4	3.4	3.4
13	6.0	6.0	6.7	7.3	7.6	8.4	7.2	6.7	3.6	3.4	3.4	3.4
14	6.0	6.0	7.0	7.3	7.7	8.6	7.2	6.7	3.6	3.4	3.4	3.4
15	6.0	6.0	7.0	7.3	7.8	8.5	7.2	6.9	3.6	3.4	3.4	3.6
16	6.0	6.0	7.2	7.4	7.7	8.6	7.1	7.0	3.5	3.4	3.4	4.0
17	6.0	6.0	7.5	7.5	7.8	8.7	7.3	7.1	3.5	3.4	3.4	4.2
18	6.3	6.0	7.4	7.5	8.0	8.5	7.2	7.3	3.5	3.4	3.4	3.9
19	6.5	6.0	7.6	7.5	8.1	8.4	7.3	7.4	3.5	3.6	3.4	3.5
20	6.4	6.0	7.8	7.6	8.3	8.2	6.8	7.5	3.5	3.7	3.4	3.4
21	6.3	6.0	7.7	7.8	8.5	8.3	6.9	7.4	3.5	3.7	3.4	3.4
22	6.3	6.0	7.7	7.7	8.3	8.4	6.7	7.3	3.5	3.7	3.4	3.4
23	6.3	6.1	7.8	7.6	8.0	8.4	6.6	7.2	3.5	3.6	3.4	3.4
24	6.3	6.2	7.5	7.5	7.9	8.5	6.5	7.1	3.5	3.6	3.4	3.4
25	6.3	6.3	7.6	7.5	7.9	8.4	6.4	6.9	3.5	3.6	3.4	3.4
26	6.3	6.3	7.7	7.4	7.8	8.4	6.4	6.8	3.5	3.6	3.4	3.4
27	6.3	6.3	7.6	7.4	7.7	8.5	6.5	6.7	3.7	3.6	3.4	3.4
28	6.3	6.2	7.5	7.3	7.6	8.4	6.7	6.7	3.7	3.5	3.4	3.4
29	6.2	6.2	7.4	7.2	7.5	8.4	6.6	6.6	3.7	3.5	3.4	3.4
30	6.2		7.3	7.2	7.7	8.5	6.8	6.5	3.6	3.5	3.4	3.4
31	6.2		7.3		8.0		6.6	6.4		3.5		3.4

NOTE.—New gage at different datum, September 13 to December 31, 1908.

Rating tables for Animas River at Aztec, N. Mex.

JUNE 14, 1907, TO JULY 4, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.00	270	6.80	720	7.60	1,570	8.40	3,340
6.10	310	6.90	800	7.70	1,720	8.50	3,660
6.20	350	7.00	880	7.80	1,890	8.60	4,000
6.30	400	7.10	970	7.90	2,080	8.70	4,360
6.40	450	7.20	1,070	8.00	2,290	8.80	4,730
6.50	510	7.30	1,180	8.10	2,520	8.90	5,110
6.60	570	7.40	1,300	8.20	2,770	9.00	5,500
6.70	640	7.50	1,430	8.30	3,040		

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during 1907 and 1908, and is fairly well defined.

JULY 5 TO SEPTEMBER 12, 1908.

[The indirect method for shifting channels used.]

SEPTEMBER 13 TO DECEMBER 31, 1908.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	180	3.60	350	3.90	532	4.10	657
3.40	235	3.70	410	4.00	594	4.20	721
3.50	292	3.80	471				

NOTE.—The above table is not applicable for ice or obstructed-channel conditions. It is based on seven discharge measurements made during 1908 and 1909, and is fairly well defined.

Daily discharge, in second-feet, of Animas River at Aztec, N. Mex., July 5 to September 12, 1908.

Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.	Day.	July.	Aug.	Sept.
1	.....	1,200	620	11	1,230	790	360	21	970	1,250	.....
2	.....	900	575	12	1,230	790	350	22	860	1,180	.....
3	.....	850	535	13	1,160	840	.....	23	810	1,120	.....
4	.....	955	495	14	1,160	840	.....	24	758	1,040	.....
5	.....	1,010	480	15	1,160	945	.....	25	705	937	.....
6	1,300	900	450	16	1,100	1,000	.....	26	705	880	.....
7	1,300	1,010	440	17	1,230	1,060	.....	27	753	822	.....
8	1,230	893	400	18	1,160	1,180	.....	28	852	822	.....
9	1,160	947	380	19	1,220	1,250	.....	29	800	772	.....
10	1,230	840	370	20	915	1,320	.....	30	908	720	.....
								31	800	670	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Animas River at Aztec, N. Mex., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
June 14–30	5,500	3,040	4,370	147,000	A.
July	5,500	1,720	3,540	218,000	A.
August	2,520	800	1,300	79,900	A.
September	1,890	570	903	53,700	A.
October	510	400	472	29,000	A.
November	400	270	337	20,100	A.
December	270	270	270	16,600	B.
The period	.....	.....	.....	564,000	

Monthly discharge of Animas River at Aztec, N. Mex., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January	510	270	329	20,200	A.
February	450	270	336	19,300	A.
March	1,890	400	1,020	62,700	A.
April	1,890	970	1,250	74,400	A.
May	3,660	970	1,880	116,000	A.
June	4,360	2,080	3,240	193,000	A.
July	3,660	705	1,230	75,600	D.
August	1,320	670	959	59,000	D.
September	620	292	377	22,400	C.
October	410	235	299	18,400	A.
November	292	235	256	15,200	A.
December	721	180	279	17,200	A.
The year	4,360	180	955	693,000	

NOTE.—Discharge for period July 5 to September 12, 1908, obtained by indirect method for shifting channel.

LA PLATA RIVER AT LA PLATA, N. MEX.

This station, which was established May 25, 1905, to obtain data for use by the United States Reclamation Service in connection with their proposed La Plata project, is located at a wooden, single span highway bridge, about 16 miles northwest of Aztec, N. Mex., and 1 mile south of La Plata post-office, in sec. 3, T. 31 N., R. 13 W. of New Mexico principal meridian. Being located below all the principal diversions, the station shows the amount of flood water available for storage and irrigation.

The station is below all tributaries and about 15 miles above the mouth of the La Plata. The drainage area is about 340 square miles.

Nearly all the normal flow of this stream is diverted for irrigation above the station, and there are a few small diversions below.

Ice conditions are not very severe, although thin ice frequently forms across the stream during the winter period. Thick ice often forms along the edges, and slush ice at times interferes with winter measurements.

On December 9, 1908, a chain gage was installed on the bridge and is read in place of the rod gage, as the latter does not record low stages. The datum remained unchanged.

Because of shifting conditions of channel and the uncertainty of some of the gage heights the results are not good.

Discharge measurements of La Plata River near La Plata, N. Mex., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 8	V. L. Sullivan	32	69	3.55	203
September 8	do	30	20	2.00	27
December 14	do	5	0.9	.60	0.7
1908.					
April 11	V. L. Sullivan	32	27	2.33	73
July 25	do	.....	.....	.60	[a] 0
December 8	J. B. Stewart	.....	.....	1.33	[b] 1.0
December 9	do	.....	.....	1.40	[b] 1.5

[a] River dry. [b] Discharge estimated.

Daily gage height, in feet, of La Plata River near La Plata, N. Mex., for 1907 and 1908.

[John Smith, Frank Williams, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1							3.0	1.0	2.6	1.0	0.7	0.6
2							3.0	2.0	2.4	.8	.7	.7
3							3.0	3.0	2.2	.8	.7	.7
4							2.8	1.0	2.2	.8	.7	.7
5							2.8	1.0	2.2	.7	.7	.7
6							2.6	1.0	2.2	.7	.7	.7
7						3.5	2.4	1.0	2.2	.7	.6	.7
8						3.5	2.4	1.0	2.2	.7	.6	.7
9						3.4	2.2	1.0	2.2	.7	.6	.7
10						3.4	2.0	1.0	2.0	.7	.6	.6
11						3.4	2.0	1.0	2.0	.7	.6	.6
12						3.3	1.6	1.0	2.0	.7	.6	.6
13						3.2	1.6	1.0	2.0	.7	.6	.6
14						3.2	1.5	1.0	2.0	.7	.6	.6
15						3.1	1.5	1.0	2.0	.7	.6	.5
16						3.1	1.3	1.0	2.0	.6	.6	.6
17						3.1	1.3	1.2	1.8	.6	.7	.5
18						2.8	1.3	1.2	1.8	.6	.7	.5
19						3.4	1.2	1.2	2.9	.6	.7	.5
20						3.6	1.2	1.2	2.2	.6	.6	.5
21						3.2	1.2	5.0	2.0	.6	.6	.5
22						3.2	1.0	3.0	1.8	.7	.6	.4
23						3.1	1.0	2.6	1.8	.7	.6	.4
24						3.1	1.0	2.2	1.6	.7	.6	.4
25						3.2	1.0	3.0	1.6	.7	.6	.4
26						3.2	4.5	2.6	1.6	.7	.6	.4
27						3.3	3.0	2.2	1.4	.7	.6	.5
28						3.2	2.4	2.2	1.2	.7	.6	.5
29						3.1	1.0	5.15	1.0	.7	.6	.5
30						3.1	1.0	3.3	1.0	.7	.6	.4
31							1.0	2.8		.7		.5
1908.												
1	0.5	0.7	1.3	1.8	1.5	1.4	0.7	6.6				
2	.5	.7	1.4	1.6	1.6	1.2	.6	.7				
3	.5	1.0	1.2	1 5	1.6	1.0	.6	.6				
4	.5	3.5	1.2	1.6	1.6	1.0	.6	.7				
5	.5	1.9	1.2	1.8	1.5	1.0	.6	.6				
6	.6	1.6	1.4	2.0	1.5	1.0	.6	3.2				
7	.6	1.4	1.4	1.9	1.5	1.0	.6	.6				
8	.5	1.4	1.2	2.0	1.5	1.0	.6	.6				1.33
9	.5	1.4	1.2	1.9	1.6	1.0	.6	.5				1.4
10	.5	1.6	1.0	1.9	1.6	1.2	.6	.5				1.4
11	.5	1.6	1.0	1.8	1.5	1.4	.6	.6				1.3
12	.5	1.4	1.8	1.9	1.4	1.2	.6	.6				1.3
13	.6	1.2	1.3	1.8	1.4	1.2	.5	.6				1.3
14	.6	1.2	1.4	1.9	1.3	1.2	.6	.6				1.4
15	.6	1.0	1.6	2.0	1.2	1.2	.6	.5				1.5
16	.6	1.2	1.8	2.2	1.2	1.0	.7	3.2				1.6
17	.6	1.2	1.8	2.4	1.2	1.0	.7	.8				1.5
18	.6	1.2	2.0	2.2	1.4	.8	.7	2.2				1.3
19	.6	1.2	2.0	2.2	1.6	.7	.6	2.0				1.4
20	.6	1.4	2.2	2.4	1.8	.7	.6	5.6				1.4
21	.6	1.4	2.4	2.0	1.6	.7	.6	2.4				1.4
22	.7	2.0	2.4	1.8	1.6	.7	2.6	1.8				1.3
23	.7	3.0	2.4	1.9	1.8	.7	.6	2.0				1.4
24	.7	2.5	2.2	1.6	1.5	.7	.6	2.0				1.4
25	.7	1.6	2.0	1.6	1.3	.7	.6	1.8				1.4
26	.7	1.8	1.8	1.5	1.2	.7	.6	1.6				1.4
27	.7	1.8	1.8	1.5	1.2	.7	.5	1.4				1.4
28	.7	1.4	2.0	1.4	1.2	.7	.5	1.0				1.4
29	.7	1.4	1.8	1.4	1.0	.7	3.0					1.4
30	.7		1.9	1.3	.9	.7	.5					1.3
31	.7		2.0		1.2		2.0					1.3

NOTE.—Gage out of water August 29 to December 8, 1908. During this period the average flow was about 1 second-foot per day. New gage established December 9, 1908.

LITTLE COLORADO RIVER DRAINAGE BASIN.

DESCRIPTION.

The country drained by Little Colorado River consists of a high plateau with an elevation over 4,000 feet above sea level, extending from the Continental Divide in northwestern New Mexico westward to the San Francisco Mountains in Arizona and from the Grand Canyon of the Colorado southward to the Mogollon Mesa. The greater part of this plateau is composed of rolling plains with a few feet of soil at the surface underlain by rock. Through this plateau the river winds northwestward to its junction with the great Colorado.

The run-off from approximately 6,000 square miles of the drainage area finds its way into the Little Colorado above the mouth of Rio Puerco, the largest tributary, which joins the main stream 2 miles above the town of Holbrook, Ariz. Both the Little Colorado and Rio Puerco are flashy streams, seldom clear even during low stages. They have shifting sandy bottoms, and where not confined in canyons the stream beds are wide with abrupt earth banks. The discharge fluctuates greatly, being insignificant in dry seasons. The floods are short and violent and carry large quantities of silt in suspension.

The following stations have been maintained in this river basin:

Little Colorado at St. Johns, Ariz., 1906–1908.
Little Colorado at Woodruff, Ariz., 1905–1908.
Little Colorado at Holbrook, Ariz., 1905–1908.
Silver Creek near Snowflake, Ariz., 1906–1908.
Silver Creek at Canyon Station, Ariz., 1906.
Woodruff ditch at Woodruff, Ariz., 1906.
Chevelon Fork near Winslow, Ariz., 1906–1908.
Clear Creek near Winslow, Ariz., 1906–1908.

LITTLE COLORADO RIVER AT ST. JOHNS, ARIZ.

This station, which was established April 18, 1906, to determine the amount of water available for irrigation, is located at the south end of the town of St. Johns, one-half mile above the dam and county bridge. The bed of the stream is clean, sandy, and shifting. Frequent measurements are necessary to properly determine the daily flow at this station. The results given in the following tables were furnished by the United States Reclamation Service:

Discharge measurements of Little Colorado River at St. Johns, Ariz., in 1907 and 1908.

[By W. D. Rencher.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*
January 5	4.65	67	February 27	4.94	92	April 26	4.60	69
January 10	4.75	80	March 6	4.91	75	April 30	4.56	69
January 16	4.66	54	March 13	5.00	87	May 6	4.30	51
January 22	4.53	36	March 19	5.11	127	May 30	4.27	49
January 29	4.66	40	March 23	6.40	430			
February 2	4.87	70	March 29	5.66	260	1908.		
February 8	4.92	89	April 1	5.60	259	July 21[a]	1.10	54
February 15	4.86	69	April 13	5.50	220			
February 21	4.84	68	April 19	5.10	150			

[a] River bed lately eroded 4 feet deeper.

Daily gage height, in feet, of Little Colorado River at St. Johns, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.61	4.73	4.94	6.20	4.58	4.14	3.87	4.18	4.85	3.23	3.70	3.94
2	4.50	4.81	4.94	6.27	4.55	4.07	3.90	4.24	4.57	3.23	3.70	3.94
3	4.60	4.77	4.93	5.77	4.45	4.04	3.90	4.54	4.80	3.22	3.83	3.94
4	4.72	4.77	4.94	5.82	4.36	4.04	3.90	4.25	5.40	3.22	3.81	3.95
5	4.65	4.76	4.94	5.78	4.32	3.99	3.89	4.27	4.45	3.22	3.80	3.95
6	4.67	4.83	4.92	5.45	4.29	3.97	3.89	4.20	5.50	3.21	3.80	3.95
7	4.68	4.88	4.95	5.65	4.26	3.94	3.86	4.17	5.40	3.20	3.80	3.95
8	4.68	4.92	5.02	5.75	4.22	3.92	3.83	4.23	5.00	3.19	3.80	3.94
9	4.68	4.86	5.04	5.73	4.19	3.90	3.81	4.34	4.52	3.18	3.80	3.93
10	4.73	4.88	5.02	5.75	4.16	3.90	3.80	4.25	4.11	3.18	3.80	3.93
11	4.71	4.85	4.96	5.72	4.14	3.90	3.79	4.20	3.97	3.18	3.80	3.92
12	4.73	4.82	4.99	6.70	4.11	3.90	3.78	4.38	3.99	3.16	3.88	3.92
13	4.70	4.82	4.98	5.60	4.10	3.89	3.77	4.35	3.79	3.16	3.91	3.91
14	4.69	4.82	4.90	5.70	4.09	3.88	3.78	4.20	3.68	3.16	3.83	3.90
15	4.70	4.85	4.93	5.46	4.11	3.87	3.77	4.17	3.68	3.16	3.80	3.91
16	4.68	4.88	4.93	5.35	4.11	3.86	3.77	4.08	3.55	3.18	3.80	3.90
17	4.68	4.87	4.96	5.27	4.09	3.85	3.78	4.45	3.73	3.20	3.80	3.90
18	4.67	4.90	4.97	5.18	4.08	3.84	3.77	4.42	3.70	3.22	3.84	3.91
19	4.64	4.91	5.05	5.12	4.04	3.84	3.77	4.22	3.53	3.22	3.96	3.92
20	4.64	4.86	5.30	5.10	4.03	3.84	3.77	4.45	3.46	3.22	3.94	3.94
21	4.66	4.84	5.65	5.08	4.02	4.43	3.79	6.10	3.41	3.22	3.93	3.95
22	4.62	4.85	6.05	5.07	4.01	4.42	3.83	5.65	3.39	3.22	3.91	3.94
23	4.53	4.85	6.37	5.03	3.99	4.36	4.25	5.14	3.36	3.30	3.90	3.88
24	4.55	4.94	6.20	4.95	3.97	4.26	4.05	4.84	3.34	4.12	3.90	3.85
25	4.57	4.97	6.13	4.83	3.94	4.22	4.62	5.72	3.31	4.08	3.90	3.85
26	4.61	4.95	6.07	4.68	3.93	4.21	5.00	5.98	3.29	4.00	3.90	3.85
27	4.64	4.95	5.97	4.58	3.93	4.14	4.62	6.58	3.27	3.94	3.92	3.85
28	4.60	4.94	5.85	4.52	4.02	3.98	4.43	5.35	3.25	3.88	4.00	3.85
29	4.60	.....	5.68	4.56	4.05	3.95	4.28	4.80	3.24	3.79	3.99	3.94
30	4.60	.....	5.63	4.56	4.25	3.91	4.16	5.55	3.24	3.76	3.94	4.00
31	4.62	.....	5.59	.....	4.27	.....	4.07	5.30	.....	3.75	.....	4.00
1908.												
1	3.94	4.10	4.41	4.50	3.51	3.31	3.22	0.97	1.13	0.75	0.77	0.85
2	3.92	4.10	4.40	4.53	3.45	3.30	3.22	2.15	.85	.75	.77	.85
3	4.00	4.10	4.38	4.50	3.45	3.29	3.22	1.52	.88	.75	.78	.90
4	4.03	4.24	4.44	4.50	3.42	3.28	3.21	2.45	.83	.75	.78	.90
5	4.00	4.38	4.50	4.53	3.40	3.28	3.20	1.60	.95	.75	.79	.92
6	4.02	4.32	5.15	4.80	3.40	3.28	3.20	.94	.90	.73	.80	.92
7	4.00	4.27	5.08	4.90	3.49	3.23	3.20	.89	.94	.72	.80	.90
8	4.02	4.22	4.78	4.80	3.55	3.17	3.20	.82	.95	.71	.80	.92
9	4.05	4.14	4.47	4.74	3.70	3.15	3.20	1.88	.99	.71	.80	.92
10	4.00	4.10	4.37	4.70	3.62	3.15	3.20	5.10	1.00	.70	.80	.90
11	3.97	4.05	4.31	4.64	3.51	3.15	3.20	1.60	1.00	.70	.80	.89
12	3.95	4.05	4.25	4.57	3.49	3.14	3.30	.92	1.10	.70	.80	.85
13	3.95	4.04	4.25	4.53	3.43	3.14	3.22	1.10	1.05	.70	.80	.85
14	3.95	4.02	4.20	4.52	3.39	3.16	3.40	1.28	.88	.70	.80	.85
15	3.96	4.01	4.31	4.50	3.34	3.19	3.35	1.00	.80	.70	.82	.89
16	4.00	4.02	4.75	4.44	3.32	3.18	4.98	1.05	.80	.70	.82	.86
17	4.03	4.05	5.15	4.38	3.32	3.18	8.75	.90	.87	.70	.81	.90
18	4.03	4.07	5.50	4.30	3.32	3.18	4.00	3.69	.80	.71	.82	.87
19	4.02	4.03	5.75	4.20	3.35	3.17	2.25	2.13	.80	.74	.82	.86
20	4.01	4.06	5.85	4.17	3.35	3.16	1.30	1.85	.80	.76	.83	.85
21	4.02	4.11	5.25	4.05	3.34	3.16	1.13	1.90	.80	.76	.85	.85
22	4.05	4.14	5.13	3.93	3.33	3.19	1.02	1.95	.80	.75	.85	.85
23	4.06	4.35	5.05	3.84	3.48	3.22	.93	1.40	.80	.75	.85	.85
24	4.02	4.88	5.01	3.86	3.41	3.21	2.25	.92	.81	.75	.87	.85
25	4.00	4.46	5.10	3.85	3.40	3.20	.94	1.18	.80	.75	.90	.85
26	4.00	4.37	5.14	3.78	3.39	3.22	.90	.90	.80	.75	.89	.85
27	4.00	4.35	5.20	3.72	3.38	3.22	1.29	.89	.77	.75	.91	.85
28	4.04	4.33	4.82	3.62	3.38	3.22	2.15	1.25	.75	.75	.88	.85
29	4.05	4.40	4.78	3.57	3.35	3.22	2.10	1.02	.75	.75	.86	.87
30	4.08	.....	4.73	3.56	3.32	3.22	1.02	1.00	.75	.75	.85	.86
31	4.10	.....	4.60	.....	3.32	.....	1.00	1.14	.....	.77	.....	.85

Daily discharge, in second-feet, of Little Colorado River at St. Johns, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	64	53	88	386	70	16	60	75	76	193	37
2	54	70	86	403	68	17	60	76	80	178	35
3	63	67	80	286	60	18	58	80	82	161	34
4	78	67	85	296	54	19	50	80	127	149	33
5	67	66	85	288	51	20	50	75	183	144	32
6	70	73	75	215	49	21	57	68	259	141	32
7	73	83	80	259	47	22	50	68	350	138	30
8	74	89	95	281	43	23	36	68	428	130	29
9	74	75	100	278	41	24	37	90	386	118	29
10	80	75	95	281	39	25	39	95	368	100	27
11	82	72	85	275	37	26	42	92	356	81	27
12	74	68	92	506	37	27	45	92	331	70	27
13	68	68	86	248	36	28	41	90	302	65	32
14	64	68	75	270	35	29	41	.....	265	69	33
15	64	69	76	218	37	30	41	.....	254	69	46
						31	43	.....	245	.....	48

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Little Colorado River at St. Johns, Ariz., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	82	36	58.0	3,570
February	95	53	75.4	4,190
March	428	75	173	10,600
April	[a] 554	65	210	12,500
May	70	27	39.8	2,450

[a] Maximum recorded discharge for the month, April 2, 1907.

LITTLE COLORADO RIVER AT WOODRUFF, ARIZ.

This station, which was established March 16, 1905, and was discontinued December 31, 1908, was located about 100 yards below the crossing of the Holbrook-Winslow wagon road and one-fourth mile below the Woodruff dam.

The station equipment, which was carried away by the flood of November 26 and 27, 1905, was replaced March 24, 1906. The object of the station was to determine the amount of water available for irrigation. The bed of the stream is sandy and shifting, and frequent measurements are required to determine the daily flow.

The results published in the following tables were furnished by the United States Reclamation Service.

Discharge measurements of Little Colorado River at Woodruff, Ariz., in 1907.

[By Newman, Wakefield, and Conner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 1	0.50	50	February 4	1.30	203	March 19	0.80	63
January 5	.70	74	February 7	1.20	161	March 26	1.00	174
January 7	1.80	170	February 7	1.20	176	April 2	1.50	266
January 10	4.90	1,010	February 13	1.00	66	April 9	1.50	260
January 13	1.70	164	February 18	1.00	63	April 16	.20	62
January 16	1.00	51	February 26	.80	67	April 23	.20	54
January 20	1.10	42	March 5	1.00	215	April 30	.20	44
February 1	2.60	457	March 12	.80	62			

NOTE.—No discharge measurements were made during the remainder of 1907 and 1908.

Daily gage height, in feet, of Little Colorado River at Woodruff, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.											
1	1.15	2.8	0.35	1.57	0.35	.....	0.8	3.95	0.1	1.75	0.3
2	.6	1.9	.3	1.45	.25	.....	1.5	3.1	.1	.85	.3
3	.5	1.4	.45	1.35	.15	.....	.9	2.5	.4	.6	.3
4	.4	1.3	.6	1.3	.10	.....	1.2	2.2	.3	.5	.3
5	.75	1.15	.8	1.4	.....	.....	.7	4.0	.5	.55	.3
6	.65	1.1	2.3	1.35	.....	.....	.....	3.05	.5	.45	.3
7	1.3	1.15	2.45	1.4	.....	.....	.....	1.45	.7	.4	.25
8	2.65	1.05	1.3	1.3	.....	.....	.....	1.55	.3	.5	.15
9	2.85	1.05	.9	1.25	.....	1.15	.....	1.8	.05	1.5	.1
10	4.0	1.0	.8	1.2	.....	.15	.....	1.65	.....	1.1	.1
11	2.95	.8	.7	1.15	.....	.....	.....	1.4	.....	.65	.25
12	2.4	.75	.6	1.2	.....	.....	.....	1.2	.....	.5	.2
13	1.4	.75	.5	1.1	.....	.....	.....	1.1	.....	.4	.....
14	1.3	.5	.5	1.1	.....	.....	2.27	2.2	.....	.4	.....
15	1.0	.35	.5	1.1	.....	.....	1.55	1.1	.....	.4	.....
16	1.0	.2	.45	1.1	.....	.....	.6	.9	.....	.5	.15
17	1.15	.25	.5	1.05	.....	.....	.4	.9	.....	.75	.25
18	1.25	.3	.4	.95	.....	.....	.3	.75	1.0	.95	.1
19	1.1	.6	.4	.9	.....	.....	.7	.8	1.7	1.9	.15
20	1.1	.55	.4	.6	.....	.....	1.05	.85	1.0	1.0	.1
21	1.0	.7	.4	.2	.....	.....	1.0	.65	.35	.55	.3
22	1.0	.5	.4	.15	.....	.....	2.35	.7	.2	.4	.1
23	.8	.4	7.65	.45	.....	.....	1.75	.55	1.9	.4	.1
24	.7	.35	2.95	.58	.....	.....	1.0	.45	6.0	.3	.....
25	.6	.55	2.15	.58	.....	.....	3.2	.4	3.65	.35	.....
26	.55	.7	1.75	.5	.....	.8	2.35	.4	1.6	.3	.25
27	.5	.6	1.7	.5	.....	.85	7.55	.35	1.15	.3	.2
28	.5	.45	1.75	.5	.....	1.6	4.0	.3	1.1	.3	.25
29	.5	.....	1.8	.45	.....	.6	3.45	.2	1.1	.3	.1
30	1.85	.....	1.75	.45	.15	.2	6.6	.45	.95	.3	.1
31	5.4	.....	1.6	.....	.....	.....	8.5	.....	.9	.....	.1
1908.											
1	.....	.....	.85	.90	.....	.....	1.65	1.65	.....	.....	.....
2	.....	.....	.70	.80	.....	.....	1.85	1.05	.....	.....	.....
3	.....	.....	.55	.80	.....	.....	2.40	3.60	.....	.....	.....
4	.....	4.50	.50	.75	.....	.....	3.65	1.95	.....	.....	1.45
5	.55	3.90	11.50	.60	.....	.....	4.95	1.50	.....	.....	.....
6	.45	1.75	5.75	.40	.....	.....	3.35	1.10	.....	.....	.....
7	.30	1.10	2.00	.40	.....	.....	2.22	.....	.....	.....	.....
8	.10	1.10	1.50	.40	.....	.....	7.00	.....	.....	.....	.....
9	.....	.90	1.40	.65	.....	.....	3.35	.....	.....	.....	.....
10	.....	.80	1.30	.80	.....	.....	3.05	.....	.....	.....	.....
11	.....	.70	1.30	.85	.....	.50	3.85	.....	.....	.....	.....
12	.....	.70	.50	.85	.....	.40	3.90	.....	.....	.....	.....
13	.15	.55	.....	.75	.....	.30	3.00	.....	.....	.....	.....
14	.15	.40	.....	.65	.....	.50	1.50	.....	.....	.....	.....
15	.30	.40	.....	.65	.....	.....	7.50	.....	.....	.....	.....
16	.10	.40	.....	.60	.....	3.65	.85	.....	.....	.....	11.50
17	.10	.40	.....	.65	.....	1.60	2.55	.....	.....	.....	6.15
18	.10	.45	.....	.60	.....	.55	6.95	.....	1.45	.....	4.90
19	.25	.55	.....	.55	.....	2.15	5.55	.....	.40	.....	.10
20	.30	.95	.90	.50	.....	2.05	3.75	.....	.....	.....	.10
21	.40	1.05	1.40	.40	.....	2.15	3.60	.....	.....	.....	.40
22	.25	1.85	1.50	.30	.....	1.20	1.90	.....	.....	.....	.65
23	.30	.64	1.65	.25	.....	.95	1.50	.....	.....	.....	.40
24	.30	2.50	1.40	.30	.....	.....	1.25	.....	.....	.....	.05
25	.30	1.65	1.40	.20	.....	.....	.95	.....	.....	.....	.....
26	.30	1.50	1.30	.15	.....	1.70	.55	.....	.....	.....	.....
27	.30	1.40	1.20	.05	.....	2.25	5.45	.....	.....	.....	.....
28	.30	1.05	1.20	.....	.....	2.90	6.15	.....	.....	.....	.....
29	.20	1.10	1.20	.....	.....	3.65	2.75	.....	.....	.....	.....
30	.20	.....	1.20	.....	.....	3.10	1.80	.....	.....	.....	.....
31	.10	.....	1.00	.....	.....	2.10	1.35	.....	.....	.....	.....

NOTE.—The water surface was below the gage for all missing days of 1907 and 1908.

Daily discharge, in second-feet, of Little Colorado River at Woodruff, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	55	515	45	285	30	16	51	55	62	62	.....
2	50	330	50	266	25	17	80	60	62	60	.....
3	40	220	80	260	20	18	95	63	62	58	.....
4	30	200	120	260	10	19	55	70	63	56	.....
5	74	150	175	265	.....	20	42	65	63	50	.....
6	60	160	550	260	.....	21	40	67	63	40	.....
7	170	168	485	265	.....	22	40	64	63	30	.....
8	385	150	225	260	.....	23	40	60	1,810	54	.....
9	425	125	130	260	.....	24	40	55	560	70	.....
10	790	115	100	240	.....	25	40	65	400	70	.....
11	495	80	70	200	.....	26	40	67	174	50	.....
12	350	66	62	200	.....	27	40	65	170	50	.....
13	115	66	62	150	.....	28	40	50	175	50	.....
14	100	65	62	140	.....	29	40	.....	180	44	.....
15	56	63	62	100	.....	30	310	.....	175	44	.....
						31	1,030	.....	160	.....	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Little Colorado River at Woodruff, Ariz., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	[a] 1,180	30	168	10,300
February	[a] 545	50	117	6,500
March	[a] 1,990	45	210	12,900
April	285	30	140	8,330

[a] Maximum recorded discharge for the month. These occurred on January 31, February 1, and March 23.

LITTLE COLORADO RIVER AT HOLBROOK, ARIZ.

This station, which was established March 17, 1905, to determine the amount of water available for irrigation, was discontinued December 31, 1908. It is located at the county bridge across Little Colorado River at Holbrook, Ariz.

The bed of the stream is sandy and shifting, and frequent discharge measurements are required to properly determine the daily flow.

The results presented in the following tables were furnished by the United States Reclamation Service:

Discharge measurements of Little Colorado River at Holbrook, Ariz., in 1907.

[By Conner and Wakefield.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 2	4.70	167	February 28	5.10	124	April 5	5.00	550
January 6	4.80	302	March 4	5.00	141	April 8	5.00	573
January 11	4.90	149	March 6	5.20	254	April 12	5.00	329
January 15	5.00	374	Do	5.90	960	April 15	5.00	320
January 20	4.80	206	March 11	4.80	217	April 19	5.00	329
January 25	4.70	91	March 15	4.80	136	April 22	5.00	294
February 3	5.10	371	Do	4.70	115	April 26	5.00	298
February 8	5.00	190	March 18	4.90	124	April 29	5.00	352
February 14	5.00	73	March 22	4.80	115	May 3	5.00	322
February 20	5.10	120	March 25	5.20	824	July 19	5.10	618
February 22	5.00	108	March 29	5.20	832	July 23	5.30	925
February 25	4.80	103	April 1	5.00	547			

NOTE.—No measurements made during the remainder of 1907 and 1908.

Daily gage height, in feet, of Little Colorado River at Holbrook, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.8	5.3	5.0	5.0	5.0	5.0	5.0	4.8	5.7	3.9	4.0	.....
2	4.8	5.3	5.0	5.0	4.9	4.75	4.75	5.8	5.45	3.8	4.0	.....
3	4.8	5.1	5.0	5.0	4.9	4.7	4.7	7.0	5.0	3.8	4.0	.....
4	4.8	5.1	5.0	5.0	4.9	4.6	4.6	6.6	5.0	3.8	4.0	.....
5	4.8	5.05	5.1	5.0	4.85	4.6	4.6	6.65	5.5	3.8	4.0	.....
6	4.8	5.0	5.65	5.0	4.8	4.6	4.6	5.0	5.0	4.75	4.0	.....
7	4.8	5.0	5.8	5.0	4.75	4.6	4.0	5.0	5.0	3.7	4.0	.....
8	5.0	5.0	5.65	5.0	4.7	4.6	4.0	4.9	5.0	3.7	5.0	.....
9	5.0	5.1	4.8	5.0	4.7	4.6	4.5	4.7	5.0	3.7	4.9	.....
10	5.6	5.15	4.8	5.1	4.7	4.6	4.9	4.6	4.9	3.65	4.5	.....
11	6.35	5.1	4.8	5.1	4.7	4.6	4.65	4.6	4.8	3.6	4.4	.....
12	5.3	5.1	4.8	5.0	4.6	4.6	4.45	4.6	4.6	3.6	4.4	.....
13	5.1	5.05	4.7	5.0	4.55	4.6	4.4	5.0	6.0	3.6	4.4	.....
14	5.0	5.0	4.7	5.0	4.45	4.6	4.2	5.0	5.0	3.6	4.4	.....
15	5.0	5.0	4.7	5.0	4.4	4.6	4.0	5.0	4.8	5.0	4.4	.....
16	5.0	5.0	4.7	5.0	4.4	4.6	4.0	5.0	4.8	5.0	4.4	.....
17	5.0	5.0	4.9	5.0	4.4	4.6	4.0	5.0	4.7	5.3	4.4	.....
18	5.0	5.0	4.9	5.0	4.4	4.6	4.0	5.0	4.7	5.05	5.0	.....
19	4.75	5.0	4.85	5.0	4.3	5.0	4.0	5.0	4.65	4.8	4.9	.....
20	4.8	5.1	4.8	5.0	4.3	4.9	5.0	5.0	4.6	4.55	4.8	.....
21	4.8	5.0	4.8	5.2	4.3	4.8	4.7	5.0	4.6	4.5	4.75	.....
22	4.8	5.0	4.8	5.15	4.3	4.7	4.65	5.0	4.5	4.0	5.0	.....
23	5.0	5.0	6.7	5.0	4.2	4.55	4.5	5.0	4.4	3.0	4.9	.....
24	5.0	4.9	5.7	5.0	4.2	4.45	4.4	5.0	4.3	8.0	4.8	.....
25	5.0	4.8	5.2	5.0	4.2	4.35	4.4	6.6	4.1	8.0	4.75	.....
26	5.0	4.8	5.1	5.0	4.2	4.2	5.0	6.0	4.05	7.0	4.65	.....
27	5.0	5.2	5.3	5.0	4.2	4.05	5.0	6.8	4.0	6.4	4.65	.....
28	5.0	5.1	5.3	5.0	4.2	4.0	4.9	6.0	4.0	6.0	4.5	.....
29	5.0	.....	5.2	5.0	4.2	4.0	4.8	6.0	4.0	5.0	4.45	.....
30	5.0	.....	5.2	5.0	4.6	4.0	4.8	6.0	4.0	4.0	4.4	.....
31	6.0	.....	5.1	.....	5.0	.....	4.8	.....	.....	4.0	.....	.....
1908.												
1	4.3	4.7	4.5	4.0	3.6	2.5	1.6	4.0	.....	4.7	3.8	3.3
2	4.55	4.7	4.4	4.0	3.8	2.45	1.6	5.0	.....	4.6	3.75	3.3
3	5.0	4.7	4.4	4.5	4.0	2.45	1.6	4.5	.....	4.6	3.7	3.6
4	4.8	4.7	4.4	5.0	3.9	2.45	1.6	4.5	.....	4.5	3.7	3.9
5	4.7	5.2	6.3	5.0	3.8	2.45	1.6	4.5	.....	4.5	3.65	4.0
6	4.6	5.4	5.3	5.0	3.7	2.45	1.6	4.5	.....	4.3	3.6	4.0
7	4.5	5.0	5.3	4.8	3.6	2.0	1.6	5.0	.....	4.15	3.55	4.0
8	4.4	5.0	4.9	4.8	3.6	2.0	1.6	7.0	.....	4.0	3.5	3.9
9	4.3	5.0	4.8	4.8	3.6	2.0	1.6	7.0	.....	4.0	3.45	3.9
10	4.2	5.0	4.8	5.05	3.6	1.9	1.6	7.0	.....	4.0	3.35	3.7
11	4.2	5.3	4.65	5.3	3.5	1.9	1.6	7.0	.....	4.5	3.2	3.6
12	4.2	5.5	4.5	5.0	3.4	1.9	1.6	5.0	.....	5.0	3.3	3.6
13	4.2	5.15	4.35	5.0	3.4	1.8	1.6	5.5	.....	5.4	3.3	3.6
14	4.2	5.6	4.2	4.8	3.4	1.6	1.6	5.5	.....	5.4	3.3	3.8
15	4.4	5.4	4.1	4.65	3.4	1.6	1.6	5.5	.....	5.0	3.25	4.7
16	4.4	5.4	4.3	4.5	3.4	1.6	1.6	5.6	.....	4.9	3.2	6.5
17	4.4	5.0	4.0	4.25	3.4	1.6	1.6	6.5	.....	4.8	3.15	5.5
18	4.4	5.0	4.3	4.35	3.4	1.6	4.5	7.0	.....	5.8	3.0	4.6
19	4.4	5.0	4.0	4.1	3.4	1.6	3.0	6.5	.....	5.8	3.0	4.4
20	4.4	5.0	4.0	4.0	3.4	1.6	3.4	4.5	4.8	5.4	3.0	4.3
21	4.4	5.0	4.0	4.0	3.4	1.6	3.8	4.0	4.8	5.0	3.0	4.1
22	4.6	7.3	4.0	4.0	3.4	1.6	4.4	4.0	4.8	4.9	3.0	4.0
23	4.8	7.1	4.0	4.0	3.4	1.6	5.2	.....	4.8	4.7	3.0	4.0
24	4.8	6.3	4.0	4.5	3.0	1.6	5.0	.....	4.2	4.4	3.0	3.9
25	4.8	5.3	4.0	4.0	3.0	1.6	3.9	.....	5.4	4.4	3.3	3.8
26	4.8	5.0	4.75	4.0	3.0	1.6	3.8	.....	5.2	4.4	3.3	3.8
27	4.8	4.8	5.3	3.9	3.0	1.6	3.8	.....	5.0	4.4	3.3	.....
28	4.8	4.6	5.0	3.8	2.9	1.6	3.8	.....	5.0	4.4	3.3	.....
29	4.8	4.6	4.0	3.8	2.9	1.6	3.8	.....	4.7	3.9	3.3	.....
30	4.8	.....	4.0	3.7	2.9	1.6	4.0	.....	4.7	3.8	3.3	.....
31	4.75	.....	4.0	.....	2.5	.....	5.0	.....	.....	3.8	.....	.....

Daily discharge, in second-feet, of Little Colorado River at Holbrook, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	Day.	Jan.	Feb.	Mar.	Apr.
1	160	380	120	547	16	370	85	115	320
2	167	380	125	550	17	360	90	124	325
3	210	374	130	550	18	350	95	124	325
4	240	370	141	550	19	250	100	122	329
5	270	280	220	550	20	206	119	121	330
6	302	190	607	550	21	200	110	118	340
7	300	190	900	560	22	180	108	115	294
8	300	190	600	573	23	180	106	1,800	290
9	300	190	300	550	24	150	105	1,200	295
10	400	190	250	540	25	110	103	824	295
11	700	180	217	460	26	91	103	800	298
12	600	170	200	321	27	90	300	840	300
13	500	130	180	320	28	90	123	840	320
14	400	73	160	320	29	100	.....	832	352
15	374	80	136	320	30	100	.....	800	350
					31	500	.....	700	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Little Colorado River at Holbrook, Ariz., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January	[a] 1,000	90	276	17,000
February	380	73	176	9,780
March	[a] 2,100	115	444	27,300
April	573	290	401	23,900

[a] Maximum recorded discharge for the month. These occurred on January 11 and March 23.

SILVER CREEK AT SNOWFLAKE, ARIZ.

This station, which was established May 4, 1906, to determine the amount of water available for irrigation, is located at the southeast end of the town of Snowflake, Ariz., and 2 miles below the dam of Snowflake and Taylor Irrigation Company. All water is shut off by the dam during the entire irrigation season, except when rains occur.

Owing to shifting conditions of channel, frequent measurements are required to properly determine the relation between discharge and stage.

The discharge measurements taken on Silver Creek near Snowflake in 1907 show no relation to the gage heights; hence it is impossible to make a rating table or curve of any value for interpolation.

The results published in the following tables are furnished by the United States Reclamation Service:

Discharge measurements of Silver Creek River at Snowflake, Ariz., in 1907.

[By Newman, Wakefield, and Conner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec-ft.*		*Feet.*	*Sec-ft.*		*Feet.*	*Sec-ft.*
January 4	2.80	15	February 26	1.12	43	March 21	2.00	6
January 9	2.90	25	Do	2.00	145	March 27	2.60	97
January 18	2.90	36	March 5	2.20	196	March 28	2.60	50
January 28	2.70	32	March 6	3.00	101	April 3	2.70	133
February 6	3.20	52	March 13	1.60	14	April 4	2.50	48
February 13	2.00	12	March 14	2.00	10	April 10	2.70	130
February 18	2.00	20	March 20	1.60	21	April 11	2.50	46
February 19	1.00	34						

NOTE.—Zero flow recorded April 17, 18, 24, 25, and May 1 and 2, 1907.

Daily gage height, in feet, of Silver Creek River at Snowflake, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.85	5.35	2.40	2.20	1.60	1.70	1.68	1.78	2.10	1.70	2.30	1.85
2	2.70	3.75	2.50	2.10	1.60	1.73	1.68	2.65	2.10	1.70	2.30	1.85
3	2.70	3.45	2.55	2.22	1.60	1.70	1.65	2.70	3.65	1.70	2.30	1.85
4	2.70	3.40	2.95	2.63	1.60	1.75	1.65	2.40	2.45	1.70	2.30	1.85
5	2.68	3.37	2.97	2.30	1.60	1.75	1.63	2.45	2.25	2.15	2.20	1.85
6	2.72	3.30	5.62	2.07	1.60	1.75	1.60	1.95	2.10	2.08	2.15	1.85
7	2.70	3.20	4.25	2.00	1.60	1.75	1.60	1.80	2.02	1.98	2.12	1.85
8	2.80	3.05	2.70	2.00	1.60	1.75	5.82	1.80	2.05	1.95	2.95	1.85
9	3.45	2.80	2.60	1.87	1.60	1.75	2.20	1.78	2.05	1.95	2.52	1.92
10	6.65	2.65	2.55	1.82	1.60	1.73	1.75	1.75	2.05	1.95	2.20	1.95
11	7.25	2.60	2.37	1.77	1.60	1.70	1.70	1.75	2.02	1.95	2.20	1.95
12	5.60	2.50	2.22	1.75	1.60	1.70	1.70	1.73	2.05	1.95	2.20	1.95
13	4.65	2.30	2.20	1.75	1.60	1.70	1.70	1.70	2.05	1.95	2.20	1.95
14	4.35	2.20	2.15	1.75	1.70	1.70	2.45	1.78	2.15	1.95	2.20	1.95
15	3.77	2.07	2.12	1.72	1.60	1.70	1.98	2.45	2.00	1.95	2.20	1.95
16	2.80	2.05	2.10	1.70	1.60	1.70	1.95	2.10	1.92	1.95	2.15	1.95
17	3.75	2.10	2.08	1.70	1.60	1.70	1.93	1.85	1.90	1.95	2.10	1.95
18	4.72	2.65	2.02	1.65	1.60	1.70	1.93	1.80	1.90	2.50	2.10	1.95
19	4.10	2.77	2.00	1.65	1.60	1.70	1.90	3.15	1.90	2.68	2.10	1.95
20	3.52	2.58	2.00	1.65	1.60	1.70	1.90	2.15	1.85	2.45	2.10	1.95
21	3.47	2.37	2.00	1.65	1.60	1.70	2.18	2.05	1.82	2.35	2.10	1.95
22	3.05	2.35	2.00	1.67	1.60	1.70	2.35	2.00	1.80	2.30	2.05	1.95
23	2.80	2.30	7.00	1.72	1.62	1.70	1.83	1.98	1.80	5.65	2.05	2.00
24	2.75	2.77	5.25	1.77	1.62	1.70	1.80	1.90	1.75	4.75	2.00	2.05
25	2.75	2.65	3.52	1.75	1.60	1.70	1.80	1.90	1.75	3.62	1.95	2.00
26	2.77	2.45	2.90	1.70	1.62	1.70	1.95	1.88	1.70	2.75	1.90	1.98
27	2.78	2.40	2.35	1.67	1.62	1.70	1.97	1.90	1.70	2.55	1.90	1.95
28	2.78	2.40	2.30	1.65	1.65	1.70	1.75	5.25	1.67	2.40	1.85	1.90
29	2.70	.....	2.30	1.62	2.50	1.70	1.70	2.30	1.67	2.32	1.85	1.88
30	2.90	.....	2.30	1.60	2.05	1.70	2.25	5.00	1.70	2.30	1.85	1.90
31	8.60	.....	2.30	.....	1.75	.....	2.00	2.85	.....	2.25	.....	1.90
1908.												
1	1.95	2.05	2.95	2.05	1.80	1.75	1.75	2.10	2.40	1.80	1.90	1.85
2	1.95	2.00	2.90	2.05	1.80	1.75	1.75	3.15	2.50	1.80	1.90	1.85
3	2.00	1.98	2.90	2.00	1.80	1.75	1.75	3.25	3.95	1.80	1.90	2.50
4	2.00	7.00	2.95	2.00	1.80	1.75	1.75	2.28	2.70	1.80	1.90	2.20
5	.....	5.08	.....	2.00	1.80	1.75	1.75	2.20	2.50	1.80	1.90	2.00
6	.....	4.72	6.60	2.00	1.80	1.75	1.75	2.25	2.25	1.80	1.90	2.00
7	.....	4.00	4.35	2.00	1.80	1.75	1.75	2.25	2.15	1.80	1.90	2.00
8	.....	3.40	3.35	2.00	1.80	1.75	1.75	3.88	2.10	1.80	1.90	2.00
9	.....	3.05	3.10	1.95	1.80	1.75	1.75	4.55	2.45	1.80	1.90	1.95
10	.....	2.75	2.75	1.95	1.80	1.75	1.75	5.68	2.65	1.80	1.90	1.95
11	.....	2.55	2.65	1.95	1.80	1.75	1.88	4.15	2.05	1.80	1.90	1.90
12	2.00	2.45	2.45	1.95	1.80	1.75	1.75	3.30	2.00	1.80	1.90	1.90
13	2.05	2.40	2.30	1.95	1.75	1.75	1.75	3.18	2.00	1.80	2.00	1.85
14	2.10	2.32	2.25	1.95	1.75	1.75	1.75	3.00	2.00	1.80	2.00	1.85
15	2.10	2.30	2.20	1.95	1.75	1.75	1.75	3.00	2.00	1.80	1.98	1.85
16	2.10	2.22	2.20	1.95	1.75	1.75	5.10	3.00	2.00	1.80	1.95	2.50
17	2.10	2.15	2.20	1.95	1.75	1.75	2.88	4.50	2.00	1.80	1.90	8.00
18	2.10	2.20	2.15	1.95	1.75	1.75	2.40	5.95	2.00	2.10	1.90	4.90
19	2.10	2.25	2.15	1.85	1.75	1.75	2.28	7.38	1.90	2.38	1.90	4.40
20	2.10	2.25	2.15	1.85	1.75	1.75	2.10	4.02	1.90	2.35	1.85	4.50
21	2.10	2.25	2.15	1.80	1.75	1.75	2.10	3.12	1.90	2.25	1.80	4.10
22	2.10	8.95	2.15	1.80	1.75	1.75	2.10	2.78	1.85	2.22	1.80	3.70
23	2.10	7.00	2.10	1.80	1.75	1.75	2.10	2.65	1.80	2.18	1.80	3.30
24	2.10	6.05	2.10	1.80	1.75	1.75	2.00	2.65	1.80	2.15	1.80	2.90
25	2.10	4.40	2.10	1.80	1.75	1.75	2.00	2.82	1.80	2.15	1.80	2.50
26	2.05	3.70	2.10	1.80	1.75	1.75	2.20	6.00	1.80	2.10	1.90	2.10
27	2.05	3.45	2.10	1.80	1.75	1.75	3.10	3.95	1.80	2.10	2.00	.....
28	2.10	3.20	2.10	1.80	1.75	1.75	2.90	3.00	1.80	1.58	2.00	.....
29	2.18	3.08	2.10	1.80	1.75	1.75	2.35	2.80	1.80	1.98	2.00	.....
30	2.10	.....	2.10	1.80	1.75	1.75	2.25	2.50	1.80	1.90	1.90	.....
31	2.10	.....	2.10	.....	1.75	.....	2.10	2.50	.....	1.90	.....	.....

CHEVELON FORK NEAR WINSLOW, ARIZ.

This station, which was established December 18, 1905, to determine the amount of water available for irrigation, was discontinued December 13, 1908. It was located above the mouth of the river, in sec. 34, T. 18 N., R. 17 E., 19 miles east of Winslow, Ariz.

Conditions of flow are changeable, requiring frequent measurements to properly determine the daily discharge.

The results published in the following tables were furnished by the United States Reclamation Service.

Discharge measurements of Chevelon Fork near Winslow, Ariz., in 1907.

[By Newman, Wakefield, and Conner.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 12	2.6	56	February 23	1.76	132	April 6	.....	149
January 19	1.7	35	March 2	1.76	151	April 13	.....	33
January 26	1.2	23	March 9	4.0	485	April 20	.....	18
February 2	3.2	567	March 16	1.5	99	April 27	.0	24
February 9	2.7	301	March 23	2.9	1,010	May 4	—.2	34
February 16	2.0	83	March 30	.....	128			

NOTE.—No measurements made after May 4, 1907.

Daily gage height, in feet, of Chevelon Fork near Winslow, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.4	3.4	1.4	.....	—0.2	—0.8	2.6	2.3	2.5	2.2	3.3	3.6
2	1.1	3.2	1.4	.....	— .2	— .8	2.6	2.3	2.5	2.2	3.2	3.4
3	1.2	3.0	1.4	.....	— .2	— .8	2.6	2.3	3.8	2.2	3.6	3.2
4	1.0	2.6	1.5	.....	— .2	— .8	2.6	2.3	3.6	2.3	3.6	3.2
5	1.5	2.6	2.0	.....	— .3	— .9	2.6	2.3	2.9	2.3	3.5	3.1
6	1.4	3.0	3.6	.....	— .3	— .9	2.6	2.3	2.8	2.3	3.4	3.1
7	1.2	3.0	4.1	.....	— .4	2.6	2.6	2.3	2.7	2.3	3.3	3.0
8	1.3	2.9	2.4	.....	— .4	2.6	2.6	2.5	2.6	2.3	3.1	2.9
9	1.3	2.5	2.0	.....	— .4	2.6	2.6	2.5	2.5	2.3	3.1	2.8
10	1.2	2.3	2.4	.....	— .5	2.6	2.6	2.3	2.3	2.3	3.0	2.8
11	2.0	2.2	2.2	.....	— .5	2.6	2.6	2.3	2.2	2.3	2.9	2.7
12	2.6	2.0	2.0	.....	— .5	2.6	2.6	2.3	2.2	2.3	2.8	2.6
13	2.6	1.8	2.0	.....	— .6	2.6	2.6	2.6	2.2	2.3	2.7	2.6
14	2.2	1.7	1.9	0.4	— .6	2.6	2.4	2.8	2.2	2.3	2.6	2.5
15	1.8	1.8	1.7	.3	— .6	2.6	2.4	2.9	2.2	2.3	2.8	2.5
16	2.0	2.0	1.5	.3	— .7	2.6	2.4	3.0	2.2	2.3	2.8	2.4
17	2.0	1.4	1.4	.3	— .7	2.6	2.4	2.9	2.2	2.3	2.9	2.4
18	1.9	1.2	1.3	.3	— .7	2.6	2.4	2.7	2.2	2.7	3.5	2.4
19	1.6	1.2	1.8	.3	— .7	2.6	2.4	2.6	2.2	2.6	3.0	2.3
20	1.5	1.2	2.0	.3	— .7	2.6	2.4	2.5	2.2	2.5	2.7	2.3
21	1.2	1.2	2.0	.2	— .7	2.6	2.4	2.7	2.2	2.5	2.6	2.2
22	1.2	1.2	1.9	.2	— .7	2.6	2.4	2.7	2.2	2.5	2.5	2.3
23	1.3	1.2	1.9	.2	— .7	2.6	3.5	2.6	2.2	3.7	2.5	2.3
24	1.2	4.2	13.4	.1	— .7	2.6	2.7	2.5	2.2	3.4	2.9	2.3
25	1.2	3.0	13.2	.1	— .7	2.6	2.5	2.4	2.2	5.2	3.4	2.3
26	1.2	2.2	.....	.0	— .7	2.6	2.3	2.4	2.2	4.8	3.4	2.3
27	1.1	1.8	.....	.0	— .7	2.6	2.3	2.4	2.2	4.2	3.3	2.3
28	1.1	1.5	.....	— .1	— .7	2.6	2.3	2.4	2.2	4.0	3.2	2.3
29	1.1	.....	.....	— .1	— .7	2.6	2.3	2.4	2.2	3.7	3.1	2.2
30	1.1	.....	.....	— .1	— .7	2.6	2.3	3.1	2.2	3.8	3.5	2.2
31	1.1	.....	.....	.....	— .7	.....	2.3	2.7	.....	3.4	.....	2.2

Daily gage height, in feet, of Chevelon Fork near Winslow, Ariz., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.2	2.3	5.5	6.1	6.7	7.6	5.5	4.5	4.3	5.0	3.8	3.6
2	2.2	2.3	5.5	6.1	6.7	7.7	6.2	4.5	4.0	5.0	3.8	3.6
3	2.3	2.3	5.2	6.0	6.8	7.7	6.8	4.3	3.8	5.0	3.8	3.0
4	2.2	2.3	5.0	6.1	6.9	7.7	6.9	4.3	4.2	5.0	3.8	3.4
5	2.3	4.1	19.0	5.2	7.0	7.7	4.9	4.4	4.4	4.9	3.8	3.6
6	2.3	5.0	17.8	5.8	7.0	7.8	4.8	4.2	4.6	4.9	3.8	3.6
7	2.3	4.7	14.1	6.2	6.4	7.6	4.8	4.3	4.6	4.9	3.8	3.7
8	2.3	4.5	11.2	6.4	6.1	6.6	4.8	4.4	4.8	4.8	3.8	3.8
9	2.3	4.3	9.0	6.6	6.2	6.6	4.7	4.5	4.4	4.8	3.8	3.7
10	2.3	4.2	8.4	6.6	6.5	6.7	4.7	4.5	4.5	4.8	3.8	3.7
11	2.3	4.0	7.3	6.7	6.6	6.7	4.5	4.5	4.6	4.8	3.8	3.7
12	2.3	3.9	6.6	6.7	6.7	6.7	4.4	4.6	4.6	4.8	3.8	3.7
13	2.3	3.8	6.2	6.8	6.8	6.8	4.4	4.7	4.8	4.8	3.8	.....
14	2.3	3.9	6.0	6.8	6.9	6.8	4.1	4.8	5.0	4.8	3.8	.....
15	2.3	4.0	5.8	6.9	7.0	6.6	4.4	4.9	5.0	4.8	3.8	.....
16	2.3	3.8	5.6	6.9	7.1	6.6	4.4	4.9	5.0	4.8	3.7	.....
17	2.3	3.7	5.4	7.0	7.2	6.6	4.6	4.2	5.0	4.8	3.7	.....
18	2.3	3.7	5.4	7.0	7.3	6.6	4.5	4.5	5.0	4.9	3.7	.....
19	2.3	3.6	5.6	7.0	7.4	6.6	4.5	4.7	5.0	4.4	3.7	.....
20	2.3	3.6	5.8	7.0	7.5	6.6	4.5	4.2	5.0	4.2	3.7	.....
21	2.3	3.6	6.1	7.0	7.5	6.8	4.5	3.4	5.0	4.2	3.7	.....
22	2.3	3.6	6.3	7.0	7.5	6.8	4.5	3.5	5.0	4.0	3.7	.....
23	2.3	3.6	6.5	7.0	7.4	6.8	4.5	3.8	5.0	4.0	3.7	.....
24	2.3	5.0	6.5	7.0	7.5	6.8	4.5	4.0	5.0	4.0	3.7	.....
25	2.3	5.1	6.6	7.0	7.5	6.8	4.5	4.0	5.0	4.0	3.7	.....
26	2.3	4.8	6.6	7.0	7.5	6.9	4.5	3.9	5.0	3.9	3.7	.....
27	2.3	4.8	6.6	7.0	7.5	6.8	4.4	4.0	5.0	3.9	3.7	.....
28	2.3	5.2	6.6	6.8	7.6	5.7	4.3	4.1	5.0	3.9	3.7	.....
29	2.3	5.5	6.6	6.8	7.6	5.6	4.4	4.0	5.0	3.9	3.7	.....
30	2.3	.....	6.6	6.8	7.6	5.4	4.5	4.0	5.0	3.9	3.7	.....
31	2.3	.....	6.2	.....	7.6	.....	4.5	4.2	.....	3.9	.....	.....

CLEAR CREEK NEAR WINSLOW, ARIZ.

This station, which was established June 13, 1906, to determine the quantity of water available for irrigation, is located 6 miles from Winslow and 3 miles above the Clear Creek Irrigation Company's dam and the county bridge. It is one-half mile above the pump house. The bed of the stream is strewn with large bowlders and is permanent.

The results given in the following tables were furnished by the United States Reclamation Service.

Discharge measurements of Clear Creek near Winslow, Ariz., in 1907.

[By R. M. Imel.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
February 2	8.00	1,510	February 23	5.04	552	March 2	5.04	583
February 20	6.00	843	February 25	8.04	1,750	March 9	6.80	1,110

Daily gage height, in feet, of Clear Creek near Winslow, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.2	8.0	5.6	4.6	2.6	2.0	2.0	3.8	2.6	2.3	2.3	2.3
2	3.9	8.0	4.6	6.3	2.5	2.0	2.0	3.6	2.6	2.3	2.3	2.3
3	3.6	6.6	4.2	8.8	2.4	2.0	2.0	3.4	2.8	2.3	2.3	2.3
4	3.4	6.3	4.0	7.4	2.3	2.0	2.0	3.2	3.2	2.6	2.3	2.3
5	3.4	6.0	4.3	6.4	2.4	2.0	2.0	3.2	3.3	2.6	2.3	2.3
6	3.8	6.4	6.5	6.2	2.4	2.0	2.0	3.1	3.2	2.4	2.3	2.3
7	3.5	6.8	10.3	5.8	2.3	2.0	2.0	3.1	3.2	2.3	2.3	2.3
8	3.5	6.8	7.9	5.5	2.2	2.0	2.0	3.0	3.1	2.3	2.3	2.3
9	3.4	6.5	6.7	5.4	2.2	2.0	2.0	3.0	2.8	2.3	2.3	2.3
10	3.4	6.1	5.8	5.4	2.2	2.0	2.0	2.8	2.3	2.3	2.3	2.3
11	3.4	5.7	5.2	5.1	2.2	2.0	2.0	2.6	2.2	2.3	2.3	2.3
12	4.7	5.5	4.7	4.9	2.2	2.0	2.0	2.5	2.2	2.3	2.3	2.3
13	5.3	5.2	4.6	4.6	2.2	2.0	2.0	2.5	2.2	2.3	2.3	2.3
14	5.0	5.0	4.5	4.3	2.2	2.0	2.0	2.5	2.2	2.3	2.3	2.3
15	4.5	4.8	4.2	4.0	2.2	2.0	2.0	2.5	2.3	2.4	2.3	2.3
16	4.2	4.7	3.9	3.8	2.2	2.0	2.0	2.5	2.3	2.3	2.3	2.3
17	4.0	4.7	3.8	3.6	2.2	2.0	2.0	2.5	2.3	2.2	2.3	2.4
18	3.8	4.8	3.8	3.4	2.2	2.0	2.0	2.5	2.3	2.2	2.3	2.4
19	3.7	7.7	4.5	3.2	2.2	2.0	2.0	2.5	2.3	2.3	2.3	2.4
20	3.7	6.7	5.8	3.0	2.2	2.0	2.0	2.6	2.3	2.3	2.3	2.4
21	3.6	6.0	6.6	3.0	2.1	2.0	3.0	2.6	2.3	2.3	2.3	2.4
22	3.6	5.8	7.8	3.0	2.1	2.0	2.2	2.6	2.3	2.3	2.3	2.3
23	3.5	13.7	9.2	3.0	2.1	2.0	2.1	2.6	2.3	2.3	2.3	2.3
24	3.5	16.0	10.0	2.9	2.1	2.0	2.0	2.6	2.3	2.3	2.3	2.3
25	3.4	10.0	7.9	2.8	2.1	2.0	2.0	2.6	2.3	2.3	2.3	2.3
26	3.3	8.4	7.1	2.7	2.1	2.0	2.0	2.6	2.3	2.3	2.3	2.3
27	3.4	7.2	6.4	2.6	2.0	2.0	2.0	2.6	2.3	2.3	2.3	2.3
28	3.4	6.4	5.7	2.6	2.0	2.0	2.0	2.6	2.3	2.3	2.3	2.3
29	3.4	.....	5.2	2.6	2.0	2.0	2.0	2.6	2.3	2.3	2.3	2.3
30	3.5	.....	5.1	2.6	2.0	2.0	2.0	2.6	2.3	2.3	2.3	2.3
31	3.6	.....	4.8	.....	2.0	.....	2.0	2.6	.....	2.3	.....	2.3
1908.												
1	2.4	2.3	6.6	4.6	4.2	2.3	2.0	2.4	3.4	2.2	2.1	2.1
2	2.4	2.3	6.0	4.6	4.1	2.3	2.0	2.4	3.4	2.2	2.1	2.1
3	2.4	2.3	5.5	4.6	4.0	2.3	2.0	2.6	3.4	2.2	2.1	2.1
4	2.4	2.3	5.2	4.7	3.9	2.3	2.0	2.5	3.3	2.2	2.1	2.1
5	2.3	2.3	20.0	5.8	3.8	2.3	2.0	2.5	3.3	2.2	2.1	2.1
6	2.3	2.3	13.6	5.7	3.8	2.3	2.0	2.5	3.3	2.2	2.1	2.1
7	2.3	2.3	9.4	5.3	3.7	2.3	2.0	2.4	3.3	2.2	2.1	2.1
8	2.3	5.3	8.0	5.1	4.0	2.3	2.0	2.4	3.3	2.2	2.1	2.1
9	2.3	5.2	6.4	4.9	4.8	2.3	2.0	2.4	3.3	2.2	2.1	2.1
10	2.3	4.9	5.9	4.7	4.5	2.3	2.0	2.4	3.3	2.2	2.1	2.1
11	2.3	4.7	5.4	4.6	4.2	2.3	2.0	2.4	3.2	2.2	2.1	2.1
12	2.3	4.6	5.0	4.5	4.2	2.3	2.8	2.3	3.2	2.2	2.1	2.1
13	2.3	4.2	4.8	4.4	4.2	2.3	3.0	2.3	3.1	2.2	2.1	.....
14	2.3	4.0	4.7	4.4	4.1	2.2	5.0	2.3	2.5	2.2	2.1	.....
15	2.3	4.0	4.8	4.4	4.0	2.2	3.4	2.3	2.2	2.2	2.1	.....
16	2.3	3.9	5.6	4.3	3.9	2.1	2.8	2.3	2.2	2.2	2.1	.....
17	2.3	3.8	6.2	4.3	3.6	2.0	2.7	2.3	2.2	2.2	2.1	.....
18	2.3	3.8	6.6	4.2	3.3	2.0	2.6	2.3	2.2	2.1	2.1	.....
19	2.3	3.8	6.6	4.2	2.9	2.0	2.6	2.3	2.2	2.1	2.1	.....
20	2.3	3.7	6.2	4.1	2.6	2.0	2.5	2.3	2.2	2.1	2.1	.....
21	2.3	3.7	5.7	4.1	2.4	2.2	2.5	2.3	2.2	2.1	2.1	.....
22	2.3	3.6	5.3	4.0	2.3	2.2	2.4	2.3	2.2	2.1	2.1	.....
23	2.4	3.7	5.1	4.0	2.3	2.1	2.4	3.5	2.2	2.1	2.1	.....
24	2.4	3.7	5.0	3.9	2.3	2.1	2.3	4.0	2.2	2.1	2.1	.....
25	2.4	5.0	4.7	3.9	2.3	2.1	2.3	3.9	2.2	2.1	2.1	.....
26	2.4	5.4	4.6	4.2	2.4	2.2	2.3	3.9	2.2	2.1	2.1	.....
27	2.3	5.2	4.6	4.8	2.4	2.3	2.3	3.6	2.2	2.1	2.1	.....
28	2.3	5.7	4.6	4.7	2.4	2.3	2.3	3.5	2.2	2.1	2.1	.....
29	2.3	6.4	4.6	4.5	2.4	2.0	2.3	3.5	2.2	2.1	2.1	.....
30	2.3	.....	4.6	4.3	2.3	2.0	2.3	3.4	2.2	2.1	2.1	.....
31	2.3	.....	4.6	.....	2.3	.....	2.3	3.4	.....	2.1	.....	.....

GILA RIVER DRAINAGE BASIN.

DESCRIPTION.

Gila River rises in western and southwestern New Mexico, receiving its waters from mountains having an elevation of from 7,000 to 8,000 feet. At the point where it crosses into Arizona it still has an elevation of 6,000 feet. From this place it flows between mountain ranges, falling rapidly, until at Florence, 180 miles away, it is about 1,500 feet above sea level. At a point about 15 miles above Florence the river emerges upon the plains, through which it winds for about 75 miles before receiving the waters of its principal tributary, the Salt. From the junction of the Salt the Gila continues west and southwest and enters the Colorado at Yuma, Ariz., near the southwest corner of the Territory.

The principal tributaries are San Pedro and Santa Cruz rivers from the south, and San Francisco, Salt,[a] Agua Fria, and Hassayampa rivers from the north.

San Francisco River rises in the southwestern part of Socorro County, N. Mex., and flows southwestward into Graham County, Ariz., where it unites with the Gila. The basin comprises about 2,600 square miles, of which 1,800 square miles are in New Mexico and 800 in Arizona.

San Pedro River rises in the northern part of the Mexican State of Sonora, flows northward for more than 100 miles, and empties into the Gila a few miles below the town of Dudleyville, 45 miles above Florence, Ariz. Rising in a country of very light snowfall, the river depends for the greater part of its water supply on the frequent showers of the rainy seasons. It flows over a sandy bed between high, steep banks, and during the dry season it shrinks to an insignificant stream of clear water which rises and sinks in the sand with the varying depth of bed rock.

The floods of the upper Gila and its tributaries are commonly short and violent, occurring during the months of January and February. A period of high water occurs also usually during the late summer or early fall. The season of low water occurs in June and July.

The drainage basin of the Gila includes 7,000 square miles of merchantable timber land, 11,000 square miles of woodland, of which the San Francisco basin has 1,000 square miles of timber land, 45,000 square miles of land upon which there is no timber, 1,300 square miles of scattered timber, and 300 square miles of open land.

The average annual precipitation over the greater part of the contributory drainage area of Gila and San Francisco rivers in New Mexico is between 10 and 15 inches rising above 20 inches in the high mountains of the headwater region.

---

[a] For description of Salt River, see p. 183.

The winters are mild, except in the mountainous sections, and very little ice forms on the rivers.

Irrigation development in New Mexico has been confined chiefly to the bottom lands along the main streams and their tributaries, but the total area irrigated comprises only a very few thousand acres. Excellent opportunities for irrigation exist along both the Gila and the San Francisco. The United States Reclamation Service has made surveys for an irrigation project in the vicinity of Alma, N. Mex. Another promising district is that popularly known as the Lordsburg flat, which extends from Lordsburg, N. Mex., northward to Gila River, a distance of over 20 miles, and comprises over a quarter of a million acres of almost unbroken and very fertile land, at an elevation a little above 4,000 feet. This land could be irrigated by the stored water of Gila River, although the expense of reaching it would be considerable.

Good storage sites exist at various places along San Francisco and Gila rivers, among which may be mentioned the reservoir site on the San Francisco near Alma, and that on the Gila near Redrock, N. Mex.

Because of the torrential character of the Gila, water-power development is not feasible except where stored water is used. The San Francisco being more of a mountain stream, presents better opportunities for the use of water power along its upper reaches. Most of the future water-power development along these streams will probably be in connection with irrigation projects. At present it is limited to one or two small plants on the San Francisco.

The following stations have been maintained in this river basin:

Gila River near Cliff, N. Mex., 1904–1907.
Gila River near Redrock, N. Mex., 1908.
Gila River at San Carlos, Ariz., 1899–1905.
Gila River near Buttes, Ariz., 1889–1890, and 1895–1899.
Gila River at Dome (Gila City), Ariz., 1903–1906.
San Francisco River at Alma, N. Mex., 1904–1907.
San Pedro River at Charleston, Ariz., 1904–1906.
San Pedro River near Dudleyville, Ariz., 1890.
Santa Cruz River near Nogales, Ariz., 1907.
Santa Cruz River and ditches at Tucson, Ariz., 1905–1907.
Salt River at Roosevelt, Ariz., 1901–1907.
Salt River at McDowell, Ariz., 1895–1898, 1900–1903.
Salt River below mouth of Cherry Creek, near Roosevelt, Ariz., 1906.
Salt River at Arizona Dam, Ariz., 1888–1891.
Tonto Creek at Roosevelt, Ariz., 1901–1904.
Verde River at McDowell, Ariz., 1889, 1895–1898, 1900–1908.

GILA RIVER NEAR CLIFF, N. MEX.

This station, which was established September 9, 1904, to determine the amount of water available for irrigation was located 9 miles below Cliff post-office, one-half mile below the mouth of Mancos River, and 40 miles from Silver City, N. Mex. It was discontinued December 31, 1907.

Conditions of flow are changeable, and hence frequent measurements are necessary to properly determine the daily discharge.

The results published in the following tables were furnished by the United States Reclamation Service.

Discharge measurements of Gila River near Cliff, N. Mex., in 1907.

[By Frank Asplind.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
October 23	4.50	161	October 26	5.00	374	October 28	4.85	265
October 24	4.90	337	October 27	4.90	312	October 29	4.80	237
October 25	5.10	433						

Daily gage height, in feet, of Gila River near Cliff, N. Mex., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.60	7.05	5.50	5.06	4.90	4.72	4.27	4.55	7.60	4.50	5.00	4.70
2	5.32	6.70	5.40	5.00	4.87	4.68	4.25	4.52	6.40	4.50	4.98	4.70
3	5.12	6.60	5.37	5.18	4.80	4.62	4.23	4.55	6.25	4.50	4.95	4.70
4	4.95	6.30	5.30	5.30	4.75	4.60	4.22	4.55	5.40	4.50	5.00	4.70
5	5.05	6.25	5.27	5.30	4.70	4.60	4.20	4.47	6.60	4.50	5.00	4.70
6	5.62	6.52	5.25	5.20	4.70	4.60	4.95	4.50	7.50	4.50	4.95	4.65
7	5.75	6.52	5.30	5.15	4.70	4.60	4.25	4.50	6.30	4.50	4.90	4.65
8	5.75	6.42	5.30	5.10	4.70	4.55	4.25	4.50	6.10	4.50	4.85	4.65
9	9.00	6.25	5.32	5.10	4.70	4.53	4.30	4.75	6.00	4.45	4.88	4.65
10	8.15	6.15	5.30	5.10	4.65	4.50	4.30	4.60	5.55	4.45	4.90	4.60
11	6.20	6.10	5.27	5.18	4.65	4.48	4.27	4.55	5.45	4.40	4.90	4.52
12	6.20	6.00	5.30	5.28	4.65	4.43	4.37	4.55	5.35	4.40	4.90	4.55
13	5.95	5.95	5.30	5.30	4.65	4.40	4.32	4.55	5.15	4.35	4.90	4.52
14	5.45	5.85	5.30	5.30	4.60	4.40	4.30	4.55	5.10	4.35	4.88	4.50
15	5.45	5.80	5.20	5.28	4.60	4.40	4.45	4.42	4.97	4.35	4.85	4.50
16	10.00	5.77	5.15	5.20	4.60	4.40	4.30	4.40	4.90	4.40	4.80	4.50
17	9.65	5.75	5.15	5.18	4.60	4.40	4.20	4.37	4.90	4.40	4.80	4.50
18	8.45	5.82	5.15	5.10	4.55	4.40	4.20	4.62	4.97	4.40	4.75	4.50
19	7.85	5.85	5.25	5.00	4.60	4.48	4.95	4.87	4.92	4.58	4.80	4.50
20	7.10	5.82	5.35	5.00	4.55	4.50	4.70	4.95	4.80	4.60	4.80	4.45
21	6.65	5.70	5.48	5.00	4.55	4.70	4.60	5.40	4.75	4.60	4.78	4.45
22	6.45	5.70	5.65	5.00	4.55	4.60	4.65	5.10	4.85	4.60	4.75	4.45
23	6.28	5.65	5.72	5.00	4.55	4.52	4.65	5.15	4.80	4.58	4.70	4.45
24	6.18	5.80	5.65	4.98	4.55	4.50	4.75	5.30	4.75	5.00	4.70	4.40
25	6.10	5.70	5.50	4.88	4.55	4.50	4.90	5.25	4.67	5.10	4.68	4.40
26	6.10	5.62	5.40	4.80	4.60	4.50	4.60	7.15	4.65	5.00	4.65	4.40
27	6.10	5.52	5.38	4.78	4.60	4.40	4.70	6.60	4.60	4.92	4.60	4.40
28	6.10	5.50	5.30	4.75	4.65	4.35	4.67	6.67	4.55	4.85	4.68	4.40
29	6.10	.....	5.22	4.80	4.80	4.32	4.62	7.20	4.55	4.80	4.65	4.40
30	6.22	.....	5.25	4.90	4.80	4.30	4.57	7.60	4.50	4.80	4.70	4.40
31	7.70	.....	5.12	.....	4.80	.....	4.63	8.82	.....	4.80	.....	4.40

GILA RIVER NEAR REDROCK, N. MEX.

This station, which was established May 14, 1908, to determine the amount of water available for irrigation and power enterprises, is located about 2 miles east of Redrock post-office and about 300 yards

above the Middle Box Canyon of the Gila. The two nearest railroad points are Silver City about 36 miles east of Redrock, and Lordsburg about 30 miles south.

Mangos River, an intermittent stream, the first large tributary upstream from the station, joins the Gila about 12 miles above. A number of large washes come into the river above and below the station, and during flood stages the run-off from these tributaries is very great. The drainage area at the station is about 3,500 square miles. A number of large irrigation ditches divert water above the station. Practically no power is developed in the headwaters of this basin, although opportunity for such development is good.

Except for fringe ice along the edges of the stream, ice conditions do not interfere with the accuracy of the results.

Neither the location nor the datum of the gage has been changed during the maintenance of the station.

Because of the few discharge measurements, the uncertainty of gage readings, and the constantly shifting channel, results are not good.

Discharge measurements of Gila River near Redrock, N. Mex., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 14 *a*	R. L. Cooper	91	107	0.40	208
November 16 *a*	do	110	95	.80	101
December 29 *a*	J. B. Stewart	116	77	1.15	129

a Wading measurements.

Daily gage height, in feet, of Gila River near Redrock, N. Mex., for 1908.

[J. L. Rutland, observer.]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.9	1.4	2.0	1.7	0.9	0.8	16	3.1	1.2	1.5	0.6	0.85	0.7
2	.9	1.3	2.4	1.4	.85	.75	17	3.1	1.2	2.6	1.15	.8	.9
3	.9	1.3	1.1	1.3	.85	.7	18	.9	1.6	1.9	.9	.7	.8
4	.9	1.2	1.6	1.3	.8	.7	19	.9	1.4	1.5	.85	.7	.75
5	.9	1.8	1.4	1.2	.75	.65	20	.85	1.3	1.3	.8	.65	.75
6	.9	1.6	1.3	1.15	1.3	.9	21	.8	1.5	1.3	.8	.6	.75
7	.9	1.4	1.3	1.1	1.0	.9	22	.8	1.3	1.6	.75	.6	.75
8	.9	1.3	3.0	.8	.95	.85	23	1.1	1.3	1.5	.9	.9	.7
9	.9	1.3	2.1	1.3	.85	.75	24	1.15	1.2	1.3	.85	.8	.7
10	.9	1.3	1.4	1.0	.8	.7	25	1.0	1.9	1.3	.8	.75	.95
11	.9	2.0	1.6	.8	.8	.7	26	1.5	1.6	1.45	.8	.7	.8
12	.9	1.5	1.3	.75	.75	.85	27	1.5	1.5	3.1	.75	1.5	.75
13	.9	1.3	1.9	.7	.7	.8	28	1.4	1.4	2.3	.7	1.4	.75
14	3.1	1.3	1.4	.7	1.5	.8	29	1.3	1.3	1.6	.7	1.0	.7
15	3.1	1.2	1.3	.6	.9	.7	30	1.2	1.3	1.4	1.1	.8	.7
							31	1.2	1.2	.....	.9	.....	.7

SAN FRANCISCO RIVER AT ALMA, N. MEX.

This station, which was established October 18, 1904, to determine the amount of water available for irrigation was located about

one-half mile south of Alma, N. Mex., and 85 miles northwest of Silver City. It was discontinued December 31, 1907.

Conditions of flow are changeable.

The results published herewith were furnished by the United States Reclamation Service.

Discharge measurements of San Francisco River at Alma, N. Mex., in 1907 and 1908.

[By Frank Asplind.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*
January 1	1.95	235	April 24	3.00	121	August 21	3.30	201
January 2	1.80	186	April 25	2.95	106	August 23	2.85	77.5
January 3	1.60	115	April 26	2.95	106	August 24	3.25	184
January 5	1.70	152	April 27	2.92	95	August 26	3.15	151
January 7	2.18	344	April 29	3.10	155	August 28	5.25	1,480
January 8 [a]	7.05	4,420	May 1	3.10	156	August 29	5.40	1,640
January 9	5.50	2,150	May 2	3.05	144	August 30 [a]	5.55	2,050
January 16 [a]	6.70	4,180	May 3	2.95	115	September 2	3.10	128
January 17	3.80	995	May 4	2.95	115	September 4	3.35	194
January 18	4.00	1,180	May 6	2.92	92.0	September 5	3.45	269
January 22	3.80	986	May 8	2.80	75.2	September 7	3.22	171
January 24	3.50	536	May 10	2.80	74.4	September 9	3.15	153
February 5	4.50	812	May 22	2.70	42.5	September 11	2.90	75.7
February 6	4.70	1,050	May 24	2.70	42.3	September 13	2.90	71.1
February 8	4.35	664	May 25	2.70	48.6	September 14	2.80	55.9
February 9	4.10	555	May 28	2.80	69.2	September 17	2.80	56.8
February 11	3.95	481	May 29	2.90	89.6	September 19	2.75	47.5
February 13	3.70	385	May 30	2.90	86.8	September 21	2.72	43.6
February 14	3.65	353	June 1	2.85	77.8	September 23	3.00	102
February 15	3.60	348	June 4	2.75	58.9	September 24	2.90	76.8
February 16	3.65	354	June 5	2.75	58.4	September 26	2.85	65.4
February 18	4.45	810	June 7	2.65	41.8	September 28	2.78	53.0
February 19	3.90	467	June 8	2.65	42.0	October 2	2.70	45
February 20	3.85	446	June 10	2.60	32.2	October 5	2.80	56
February 22	3.75	399	June 12	2.58	27.6	October 8	2.80	58
February 23	4.25	634	June 13	2.58	24.0	October 10	2.80	59
February 25	3.95	482	June 15	2.48	14.1	October 12	2.75	51
February 26	3.80	425	June 17	2.48	14.1	October 15	2.80	58
February 27	3.80	403	June 18	2.90	95.3	October 18	2.85	69
March 1	3.65	323	June 20	2.55	21.5	October 19	2.88	72
March 2	3.65	322	June 21	2.75	51.4	October 23	4.50	161
March 4	3.60	297	June 22	2.75	51.4	October 24	4.90	331
March 6	3.90	450	June 24	2.58	24.2	October 25	5.10	433
March 7	3.75	385	June 27	2.48	9.8	November 1	3.05	136
March 9	3.65	348	June 28	2.45	7.6	November 4	2.85	86
March 11	3.60	298	July 2	2.40	1.4	November 6	2.82	76
March 13	3.50	256	July 5	2.80	60.5	November 8	2.85	87
March 14	3.50	266	July 6	2.70	46.0	November 11	2.88	94
March 15	3.30	220	July 9	2.60	35.7	November 13	2.82	77
March 16	3.35	230	July 10	2.58	31.9	November 16	2.80	65
March 18	3.35	232	July 12	2.55	27.3	November 18	2.88	87
March 19	3.45	264	July 14	3.25	203	November 21	2.82	68
March 21	3.60	312	July 15	2.95	104	November 23	2.88	87
March 22	3.60	309	July 17	2.65	44.3	November 25	2.80	66
March 23	3.75	369	July 19	2.70	52.0	November 27	2.85	80
March 25	3.60	303	July 22	3.00	118	November 29	2.80	63
March 27	3.40	236	July 23	2.90	94.0	December 2	2.80	65
March 28	3.35	221	July 24	2.82	71.9	December 4	2.80	64
March 29	3.25	198	July 25	2.85	79.4	December 6	2.78	59
April 1	3.15	173	July 26	4.20	600	December 7	2.82	73
April 3	3.52	286	July 27	3.20	182	December 9	2.80	67
April 4	3.40	238	July 29	2.82	69.3	December 11	2.85	78
April 5	3.35	217	July 30	2.80	63.4	December 13	2.80	65
April 6	3.25	197	August 1	2.70	48.6	December 16	2.78	59
April 9	3.15	175	August 3	2.90	87.3	December 18	2.80	66
April 10	3.20	188	August 4	4.95	1,260	December 21	2.82	73
April 11	3.15	169	August 5	3.58	781	December 24	2.78	59
April 13	3.18	182	August 8	2.75	58.9	December 27	2.85	73
April 15	3.20	189	August 9	3.05	130	December 30	2.80	64
April 17	3.15	165	August 10	2.80	68.9			
April 18	3.10	160	August 12	2.70	51.0	1908.		
April 19	3.10	158	August 14	2.70	50.4	August 4	.....	570
April 20	3.05	141	August 16	2.62	39.9			
April 23	3.00	121	August 19	3.10	151			

[a] Float measurement.

Daily gage height, in feet, of San Francisco River at Alma, N. Mex., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.95	5.10	3.67	3.20	3.10	2.85	2.40	2.75	3.90	2.70	3.05	2.75
2	1.85	4.50	3.62	3.25	3.10	2.80	2.40	3.10	3.20	2.75	3.00	2.80
3	1.62	4.27	3.65	3.45	3.00	2.80	2.40	2.80	3.00	2.80	2.90	2.70
4	1.62	4.25	3.65	3.35	3.00	2.75	2.52	3.90	3.28	2.78	2.85	2.75
5	1.60	4.55	3.67	3.30	2.95	2.75	2.60	3.35	3.40	2.85	2.80	2.75
6	1.67	4.65	3.85	3.25	2.90	2.67	2.65	2.75	3.38	2.80	2.80	2.80
7	1.77	4.45	3.75	3.20	2.90	2.70	2.75	2.85	3.35	2.80	2.80	2.80
8	4.85	4.35	3.80	3.20	2.75	2.65	2.65	2.75	3.15	2.80	2.85	2.80
9	5.48	4.17	3.70	3.15	2.85	2.65	2.60	2.90	3.15	2.80	2.90	2.75
10	4.50	4.05	3.90	3.23	2.90	2.65	2.60	2.85	3.00	2.80	2.90	2.80
11	3.80	3.90	3.60	3.28	2.85	2.55	2.60	2.75	3.00	2.80	2.90	2.80
12	3.60	3.75	3.55	3.28	2.80	2.55	2.60	2.75	2.90	2.80	2.85	2.80
13	3.20	3.67	3.50	3.25	2.80	2.57	2.55	2.70	2.90	2.80	2.80	2.80
14	2.90	3.70	3.45	3.17	2.80	2.55	3.75	2.70	2.90	2.80	2.80	2.80
15	4.52	3.70	3.37	3.15	2.80	2.50	2.85	2.65	2.90	2.80	2.80	2.80
16	5.40	3.67	3.35	3.17	2.80	2.50	2.80	2.60	2.80	2.80	2.90	2.85
17	4.00	3.90	3.32	3.12	2.72	2.50	2.65	2.75	2.80	2.82	2.82	2.80
18	4.10	4.15	3.37	3.17	2.80	2.53	2.65	2.70	2.80	2.88	3.00	2.80
19	3.70	4.00	3.37	3.12	2.80	2.57	2.60	3.10	2.80	2.95	2.90	2.80
20	(a)	3.85	3.50	3.07	2.75	2.68	2.65	3.20	2.70	2.90	2.90	2.80
21	.....	3.90	3.65	3.00	2.75	2.80	2.70	3.25	2.85	2.82	2.90	2.80
22	.....	3.90	3.65	3.00	2.70	2.72	2.85	3.10	3.00	2.95	2.85	2.80
23	.....	4.20	3.75	3.10	2.72	2.63	2.90	2.85	2.95	3.25	2.80	2.80
24	(b)	4.05	3.75	3.00	2.70	2.60	2.90	2.90	2.90	3.45	2.80	2.80
25	.....	4.10	3.57	3.00	2.70	2.55	2.92	2.95	2.90	3.00	2.75	2.80
26	.....	3.85	3.47	3.00	2.70	2.50	3.90	3.35	2.80	3.00	2.72	2.80
27	3.60	3.65	3.42	2.98	2.70	2.45	3.15	3.10	2.80	2.98	2.85	2.80
28	3.62	3.67	3.37	2.92	2.77	2.45	2.95	3.65	2.78	3.00	2.85	2.80
29	3.65	.....	3.30	3.20	2.90	2.40	2.80	5.85	2.75	2.98	2.78	2.82
30	3.80	.....	3.20	3.15	2.90	2.40	2.80	5.55	2.70	2.85	2.75	2.80
31	5.30	.....	3.18	.....	2.97	.....	2.90	4.30	.....	2.95	.....	2.80

a Channel changed and covered with gravel. b New gage.

Daily discharge, in second-feet, of San Francisco River at Alma, N. Mex., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	225	1,400	360	180	150	80	1	60	465	50	135	60
2	190	800	340	195	150	70	1	160	180	60	120	70
3	120	660	350	270	120	70	1	70	120	70	90	50
4	120	640	350	230	120	60	18	620	205	65	80	60
5	115	850	360	210	105	60	35	240	250	80	70	60
6	140	925	440	195	90	45	40	60	240	70	70	70
7	170	770	390	180	90	50	60	80	230	70	70	70
8	2,690	700	413	180	60	40	40	60	165	70	80	70
9	2,080	600	370	165	80	40	35	95	165	70	90	60
10	1,380	540	465	188	90	40	35	80	120	70	90	70
11	1,000	465	330	202	80	20	35	60	120	70	90	70
12	900	390	310	202	70	20	35	60	90	70	80	70
13	710	360	290	195	70	27	20	50	90	70	70	70
14	575	370	270	172	70	20	400	50	90	70	70	70
15	1,460	370	240	165	70	15	80	40	90	70	70	70
16	2,720	360	230	172	70	15	70	35	70	70	90	80
17	1,100	465	220	158	55	15	40	60	70	75	75	70
18	1,150	590	240	172	70	17	40	50	70	85	120	70
19	940	515	240	158	70	23	35	150	70	105	90	70
20	.....	440	290	138	60	45	40	185	50	90	90	70
21	.....	465	350	120	60	70	50	190	80	75	90	70
22	.....	465	350	120	50	55	80	150	120	105	80	70
23	.....	615	390	150	55	37	90	80	105	210	70	70
24	.....	540	390	120	50	35	90	90	90	242	70	70
25	.....	565	320	120	50	20	97	105	90	120	60	70
26	.....	440	280	120	50	15	540	245	70	120	55	70
27	.....	350	260	112	50	8	165	150	70	112	80	70
28	.....	360	240	98	65	8	105	170	65	120	80	70
29	.....	.....	210	180	90	1	70	2,280	60	98	65	75
30	.....	.....	180	165	90	1	70	2,050	50	80	60	70
31	.....	.....	173	.....	112	.....	90	678	.....	105	.....	70

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of San Francisco River at Alma, N. Mex., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
January 1–19	[a] 5,200	115	936	35,300
February	[a] 1,600	350	572	31,800
March	465	173	311	19,100
April	270	98	168	10,000
May	150	50	79.4	4,880
June	80	1	34.1	2,030
July	[a] 970	1	80.9	4,970
August	[a] 3,200	35	273	16,800
September	[a] 515	50	125	7,440
October	[a] 465	50	91.5	5,630
November	135	55	81.7	4,860
December	80	50	68.5	4,210
The period	5,200	1	235	147,000

[a] Maximum recorded discharge for the month. These occurred on January 8, February 1, July 26, August 29, September 31, and October 24.

SANTA CRUZ RIVER NEAR NOGALES, ARIZ.

This station, which was established March 22, 1907, to determine the quantity of water available for irrigation, was located about 5 miles from Nogales, near Yerba Buena ranch. Conditions of flow are subject to change. It was discontinued November 30, 1907. The records given herewith were furnished by the United States Reclamation Service.

Discharge measurements of Santa Cruz River near Nogales, Ariz., in 1907.

[By Anderson and Reed.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*
March 22	2.77	12.8	March 25	2.76	8.8	November 3	3.05	143
March 23	2.80	22.4	March 26	3.15	7.6	November 26	3.40	144
March 24	2.80	8.8	April 3	3.70	4.9			

Daily gage height, in feet, of Santa Cruz River near Nogales, Ariz., for 1907.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.60	3.45	.....	3.75	2.80	2.75	3.10	3.05
2	.....	3.70	3.48	3.75	3.80	2.70	2.60	3.10	3.05
3	.....	3.70	3.45	3.75	3.80	2.60	2.30	3.10	3.05
4	.....	3.62	3.42	3.75	3.70	2.75	2.10	3.10	3.05
5	.....	3.65	3.50	3.80	3.80	2.70	3.35	3.10	3.05
6	.....	3.68	3.50	3.80	3.80	2.75	3.00	3.10	3.05
7	.....	3.58	3.50	3.85	3.80	2.80	3.10	3.05	3.00
8	.....	3.58	3.48	3.75	5.50	2.75	3.20	3.05	3.30
9	.....	3.58	3.46	3.90	2.65	2.60	4.60	3.05	3.35
10	.....	3.58	3.40	3.80	2.40	2.50	4.40	3.05	3.65
11	.....	3.62	3.45	3.60	2.40	2.50	5.10	3.05	3.60
12	.....	3.70	3.45	3.55	4.55	2.45	4.30	3.10	3.60
13	.....	3.66	3.45	3.60	3.00	2.45	3.20	3.10	3.55
14	.....	3.60	3.45	3.60	2.80	2.60	4.10	3.10	3.45
15	.....	3.80	3.45	.....	2.60	2.90	3.00	3.10	3.45
16	.....	3.82	3.48	3.80	2.55	2.70	2.90	3.40	3.45
17	.....	3.78	3.45	3.95	2.48	2.75	4.85	3.40	3.45
18	.....	.....	3.50	3.95	3.77	3.95	3.85	4.05	3.45
19	.....	3.75	3.50	3.90	2.70	3.10	3.95	.....	3.40
20	.....	3.75	3.55	3.95	2.60	3.00	3.90	4.00	3.40
21	.....	3.55	3.65	3.95	2.70	2.95	3.90	4.05	3.40
22	2.77	3.68	3.70	3.98	3.00	3.00	3.80	.....	3.40
23	2.80	3.70	3.70	3.98	3.00	5.25	3.20	3.85	3.40
24	2.80	3.70	3.70	3.98	3.35	4.50	3.10	3.70	3.40
25	2.76	3.72	3.70	3.98	3.25	3.50	3.00	3.50	3.40
26	3.15	3.72	3.70	3.80	3.30	3.20	3.00	3.45	3.40
27	3.50	3.70	3.68	3.75	3.00	3.80	2.90	3.40	3.40
28	3.40	3.80	3.72	3.70	2.95	3.40	2.95	3.35	3.35
29	3.55	.....	3.72	3.70	2.90	3.30	3.05	3.20	3.35
30	3.62	.....	3.75	3.70	2.85	3.10	3.10	3.20	3.35
31	3.40	.....	3.75	.....	2.85	3.00	.....	3.10	.....

SANTA CRUZ RIVER AND DITCHES AT TUCSON, ARIZ.

This station was established October 15, 1905, and discontinued November 12, 1907. It was located at Congress Street Bridge, Tucson, Ariz.

Manning and Farmers ditches divert practically the entire flow during the low period of Santa Cruz River. These ditches are taken out just above the gaging station, and their flow is determined by current-meter measurements, supplemented by daily records, kept by the ditch managers, of the amount of water contained in each. This water is used to irrigate lands on the north and south sides of Santa Cruz River in and about the vicinity of Tucson.

Conditions of flow are changeable.

The results published herewith were furnished by the United States Reclamation Service.

Discharge measurements of Santa Cruz River at Tucson, Ariz., in 1907.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
January 14	F. M. Jolly	0.46	16	August 15	L. B. Croasdale.	0.15	66
January 17	F. C. Kelton	4.40	4,010	August 16	do	.01	22
Do	do	3.30	3,330	August 19	do	.20	64
January 18	do	1.95	924	August 21	Croasdale and Callahan.	1.71	911
January 19	do	1.50	633				
February 11	W. L. Handy	.18	10	August 22	do	.78	365
March 4	do	.05	2	Do	do	.25	167
July 25	L. B. Croasdale.	2.36	1,410	August 30	do	.21	7
July 29	do	.20	17	September 4	L. B. Croasdale.	1.43	672
August 3	do	2.10	1,100	Do	Croasdale and Kelton.	1.15	588
Do	do	.99	537				
August 4	do	.01	38	September 5	L. B. Croasdale.	.01	93

Discharge measurements of Farmers ditch near Tucson, Ariz., in 1907.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
March 28	F. C. Kelton	9.40	[a] 4.6	July 14	L. B. Croasdale.	7.07	[c] 3.1
May 16	do	8.15	[b] 5.1	December 29	do	[d] 9.33	3.4
June 15	do	9.54	3.4				

[a] At flume crossing river. [b] 300 feet below head-gate. [c] 200 feet below head-gate. [d] New gage.

Discharge measurements of Manning ditch near Tucson, Ariz., in 1907.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
March 28 [a]	F. C. Kelton	8.84	10.7	July 6 [a]	L. B. Croasdale.	8.11	6.5
May 16 [a]	do	8.19	9.5	August 31 [d]	do	6.84	9.9
Do. [a]	do	8.19	9.0	September 1 [e]	do	6.84	10.0
Do. [b]	do	8.94	9.1	Do. [d]	do	6.85	8.3
Do. [b]	do	8.90	8.4	September 28 [d]	do	6.85	8.3
Do. [b]	do	8.88	6.0	November 3 [d]	do	7.02	10.1
Do. [c]	do	9.50	11.4	December 29 [d]	do	6.89	8.8
Do. [c]	do	9.45	11.4	Do. [d]	do	8.19	9.5
June 15 [a]	do	8.05	7.6				

[a] Measurement made at head-gate.
[b] Measurement made 1½ miles below head-gate.
[c] Measurement made 3½ miles below head-gate.
[d] Measurement made 100 feet south of Congress street.
[e] Measurement made at Hospital road flume.

Daily gage height, in feet, of Santa Cruz River at Tucson, Ariz., for 1907.

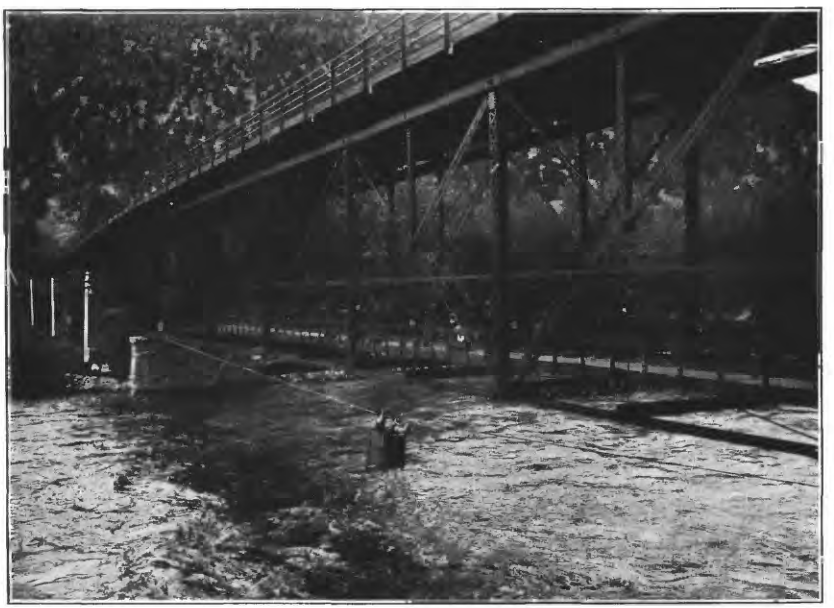
Day.	Jan.	Feb.	July.	Aug.	Sept.	Oct.	Nov.	Day.	Jan.	Feb.	July.	Aug.	Sept.	Oct.	Nov.
1	0.7	0.4	.....	−0.40	−0.37	.....	−0.27	16	0.85	0.15	.....	−0.04	−0.26	−0.26	.....
2	.5	.4	.....	.....	− .37	.....	− .27	17	3.8	.15	.....	− .26	− .26	.00	.....
3	.5	.4	.....	1.50	.46	.....	− .25	18	1.95	.15	.....	− .40	.00	.25	.....
4	.5	.4	.....	− .05	1.40	.....	− .25	19	1.5	.15	.....	.48	− .28	− .04	.....
5	.5	.3	.....	− .14	− .06	.....	− .25	20	1.5	.1	.....	.43	− .28	− .18	.....
6	.55	.3	.....	− .19	.18	.....	− .25	21	.7	.1	.....	1.56	− .28	− .23	.....
7	.55	.3	.....	− .20	.25	.....	− .25	22	.5	.1	.....	.51	.....	− .30	.....
8	.55	.3	.....	− .24	− .11	.....	− .25	23	.5	.1	.....	.18	.....	− .30	.....
9	.55	.2	.....	− .30	− .24	.....	− .25	24	.5	.1	.....	.50	.....	− .13	.....
10	1.25	.2	.....	− .31	− .28	.....	− .25	25	.5	.1	2.36	.05	.....	− .23	.....
11	.6	.18	.....	.....	.19	.....	− .20	26	.5	.05	.....	− .02	.....	− .27	.....
12	.5	.18	.....	.....	− .13	.....	− .40	27	.5	.05	.....	.16	.....	− .27	.....
13	.5	.18	.....	.....	− .28	−0.26	.....	28	.5	.05	− .20	.53	.....	− .27	.....
14	.5	.18	.....	.....	− .28	− .26	.....	29	.5	.....	− .20	.02	.....	− .27	.....
15	.5	.15	.....	.17	− .18	− .26	.....	30	.5	.....	− .20	− .31	.....	− .27	.....
								31	.5	.....	− .30	.....	.....	− .20	.....

NOTE.—The river was dry March 1 to July 22, August 2, 11–14, 31, September 22 to October 12, and November 12 to December 31.

A. FLOOD PASSING OVER ROOSEVELT DAM, SALT RIVER PROJECT, ARIZONA.

B. TRANSMISSION LINE THROUGH SALT RIVER VALLEY, ARIZONA; POWER DEVELOPED AT ROOSEVELT DAM.

A. GRANITE REEF DAM, SHOWING BOTH INTAKES, SALT RIVER PROJECT, ARIZONA.



B. MEASURING SECTION ON GRAND RIVER AT GLENWOOD SPRINGS, COLO.

SALT RIVER DRAINAGE BASIN.

DESCRIPTION.

Salt River, though considered a tributary of the Gila, is in fact larger both in catchment area and in discharge. It receives the drainage from central Arizona, its principal tributary, the Verde, flowing southeasterly and south from the mountains and tablelands south of Colorado River. The Verde Valley is situated in Yavapai County, Ariz., on the headwaters of the stream, and extends from a canyon above Camp Verde to a point about 10 miles below the fort. About a mile below the junction of the Verde and 30 miles above Phoenix the Salt enters upon the plains of the Gila Valley.

The Salt River project of the United States Reclamation Service involves the construction of a dam 240 feet high for the storage of 1,100,000 acre-feet of water, and of power plants for pumping water for irrigation in the lower valley. In addition to this it is estimated that by developing the flow available along Salt River and using it for pumping, nearly 60,000 acres can be added to the irrigated district in Salt River valley. The power developed along the river will be transmitted to substations properly located and there distributed at a lower voltage to pumping stations so situated as to furnish water for irrigation. Views of the Roosevelt dam, the Granite Reef dam, and the transmission lines are shown in Plates IX, *A;* X, *A;* and IX, *B*. The Reclamation Service reports the project as 83.5 per cent completed (December, 1909).

SALT RIVER AT ROOSEVELT, ARIZ.

This station, which was established February 7, 1901, to determine the amount of water available for irrigation and was discontinued December 9, 1907, was located at the town of Roosevelt—the United States Reclamation Service construction camp for the Salt River dam and reservoir, and is about 12 miles west of Livingston, Ariz.

During the flood of December 3 to 5, 1906 (Pl. IX, *A*), the gage rod which had been in use since the construction of the dam was begun, was carried away. From December 3 to 15, 1906, the readings were taken on the upper gage about 1,000 feet above the dam. A new rod was established at the same location as the one carried away on December 17, 1906, with the zero at the same elevation as the old gage.

Conditions of flow are changeable, requiring frequent measurements to properly determine the daily discharge.

The results published herewith are furnished by the United States Reclamation Service.

Discharge measurements of Salt River at Roosevelt, Ariz., in 1907.

[By McDonald, Blades, and others.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 3	3.20	892	April 9	4.30	2,210	July 13	2.05	275
January 7	4.60	4,560	April 10	4.40	2,440	July 15	2.00	294
January 8	4.95	4,830	April 11	4.50	2,510	July 16	2.05	299
January 9	5.55	5,380	April 12	4.50	2,520	July 17	2.05	285
January 10	6.70	9,030	April 13	4.50	2,550	July 18	2.00	277
January 11	6.05	8,100	April 15	4.40	2,370	July 19	2.00	265
January 12	5.12	5,270	April 16	4.30	2,200	July 20	2.00	262
January 14	4.25	2,580	April 17	4.20	2,000	July 22	2.22	367
January 15	3.80	2,110	April 18	4.00	1,870	July 23	2.18	352
January 16	3.60	1,890	April 19	3.90	1,780	July 24	3.70	2,100
January 17	5.00	3,540	April 20	3.80	1,570	July 25	2.95	946
January 18	4.65	2,850	April 22	3.80	1,550	July 26	2.60	657
January 19	4.30	3,040	April 23	3.70	1,440	July 27	2.50	568
January 21	4.10	2,830	April 24	3.60	1,380	July 29	2.35	452
January 22	3.80	2,320	April 25	3.50	1,220	July 30	2.22	385
January 23	3.70	1,990	April 26	3.40	1,130	July 31	2.28	382
January 24	3.50	1,880	April 27	3.30	1,060	August 1	2.52	574
January 25	3.40	1,690	April 29	3.30	1,010	August 2	3.08	875
January 26	3.35	1,620	April 30	3.30	1,080	August 3	3.35	1,460
January 28	3.30	1,540	May 1	3.40	1,120	August 5	3.02	984
January 29	3.30	1,530	May 2	3.40	1,150	August 6	2.80	778
January 31	5.50	5,870	May 3	3.30	1,070	August 7	2.58	601
February 1	5.65	6,410	May 4	3.30	1,000	August 8	2.45	517
February 2	5.05	3,830	May 7	3.10	881	August 9	2.38	456
February 4	4.25	2,960	May 8	3.05	828	August 10	2.32	398
February 5	4.10	2,700	May 9	3.00	794	August 11	2.22	372
February 6	4.10	2,630	May 10	3.00	754	August 13	2.20	368
February 7	4.17	2,810	May 11	3.00	740	August 14	2.18	354
February 8	4.20	2,790	May 13	2.90	727	August 15	2.20	341
February 9	4.15	2,880	May 14	2.90	698	August 16	2.25	376
February 11	3.90	2,390	May 15	2.90	682	August 17	2.50	610
February 12	3.80	2,150	May 16	2.85	680	August 19	2.42	538
February 13	3.75	2,020	May 17	2.85	676	August 20	3.00	1,080
February 14	3.65	1,820	May 18	2.80	656	August 21	2.85	778
February 15	3.60	1,720	May 20	2.80	623	August 22	3.15	1,140
February 16	3.50	1,680	May 21	2.75	616	August 23	3.45	1,360
February 18	3.60	1,750	May 22	2.70	581	August 24	3.35	1,200
February 19	4.47	2,200	May 23	2.70	578	August 26	3.00	901
February 20	3.80	2,030	May 24	2.75	586	August 27	3.02	907
February 21	3.70	1,890	May 25	2.75	597	August 28	3.32	1,010
February 23	3.70	1,890	May 27	2.80	649	August 29	3.80	1,340
February 25	4.40	3,050	May 28	2.80	627	August 30	4.42	2,800
February 26	4.20	2,610	May 29	2.85	672	August 31	5.58	5,740
February 27	4.10	2,320	May 30	2.90	704	September 2	4.15	2,070
February 28	4.00	2,200	May 31	2.95	728	September 3	3.85	1,630
March 1	4.00	2,120	June 1	2.95	715	September 4	5.10	3,600
March 2	3.90	2,090	June 3	2.80	639	September 5	4.32	2,570
March 4	4.36	2,010	June 4	2.70	560	September 6	3.90	1,630
March 5	4.75	3,950	June 5	2.65	548	September 7	3.75	1,590
March 6	8.95	15,900	June 6	2.65	527	September 9	3.62	1,390
March 7	6.30	7,250	June 7	2.65	572	September 10	3.48	1,210
March 8	5.40	4,460	June 8	2.70	585	September 17	3.10	823
March 9	4.80	3,670	June 10	2.68	604	September 18	3.10	673
March 11	4.40	2,790	June 11	2.60	588	September 19	3.00	695
March 12	4.20	2,390	June 12	2.58	552	September 20	3.00	650
March 13	4.10	2,260	June 13	2.52	528	September 21	3.00	577
March 14	4.10	2,170	June 14	2.50	499	September 23	2.90	547
March 15	4.10	2,010	June 15	2.50	491	September 24	2.90	516
March 16	4.00	1,890	June 17	2.45	480	September 25	2.90	519
March 18	3.90	1,720	June 18	2.45	484	September 26	2.90	514
March 19	4.00	1,910	June 19	2.40	469	September 27	2.90	457
March 20	4.10	2,140	June 20	2.40	465	September 28	2.80	445
March 21	4.35	2,590	June 21	2.50	551	September 29	2.80	416
March 22	5.30	5,180	June 22	2.50	551	October 1	2.80	420
March 23	7.70	10,300	June 24	2.42	462	October 2	2.80	411
March 25	5.40	5,860	June 27	2.30	388	October 3	2.80	407
March 26	5.05	4,700	June 28	2.25	374	October 4	2.80	426
March 27	4.85	3,790	June 29	2.20	350	October 5	3.80	416
March 28	4.50	3,140	July 1	2.15	336	October 7	2.80	420
March 29	4.50	2,780	July 2	2.10	334	October 8	2.85	477
March 30	4.30	2,360	July 3	2.10	330	October 9	2.80	382
April 1	4.10	1,970	July 5	2.15	306	October 10	2.75	421
April 2	4.20	2,410	July 6	2.22	370	October 11	2.75	436
April 3	4.20	2,220	July 8	2.12	368	October 12	2.75	431
April 4	4.50	2,950	July 9	2.10	290	October 14	2.70	387
April 5	4.50	2,860	July 10	2.10	319	October 15	2.70	388
April 6	4.40	2,410	July 11	2.10	318	October 16	2.70	385
April 8	4.30	2,200	July 12	2.10	291	October 17	2.68	356

Discharge measurements of Salt River at Roosevelt, Ariz., in 1907—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
October 18	4.45	2,570	November 2	3.40	1,170	November 21	3.45	1,050
October 18	5.50	4,830	November 4	3.40	1,160	November 22	3.42	1,020
October 19	4.00	1,890	November 5	3.25	923	November 23	3.35	879
October 21	3.50	1,380	November 6	3.20	806	November 26	3.22	715
October 22	3.30	1,190	November 7	3.20	744	November 27	3.20	695
October 23	3.30	1,010	November 9	3.20	682	November 29	3.20	692
October 24	4.70	3,510	November 11	3.25	727	November 30	3.20	690
October 24	5.30	4,520	November 12	3.28	759	December 2	3.15	637
October 25	6.50	8,740	November 13	3.35	943	December 4	3.10	588
October 26	4.95	3,450	November 14	3.35	849	December 5	3.10	594
October 28	4.00	1,780	November 15	3.35	845	December 6	3.05	535
October 29	3.80	1,570	November 16	3.30	790	December 7	3.00	536
October 30	3.60	1,280	November 18	3.45	1,050	December 9	3.00	521
October 31	3.40	1,130	November 19	3.40	994			
November 1	3.35	1,150	November 20	3.50	1,200			

Daily gage height, in feet, of Salt River at Roosevelt, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.75	4.00	4.10	3.40	2.92	2.15	2.52	4.86	2.80	3.32	3.20
2	.....	5.00	3.90	4.20	3.40	2.88	2.10	3.07	4.15	2.80	3.40	3.15
3	3.20	4.60	3.85	4.20	3.30	2.73	2.10	3.35	3.85	2.80	3.50	3.15
4	.....	4.25	3.85	4.60	3.25	2.70	2.10	4.80	5.10	2.80	3.40	3.10
5	.....	4.10	5.10	4.50	3.18	2.70	2.15	3.02	4.32	2.80	3.30	3.10
6	.....	4.12	8.40	4.40	3.10	2.60	2.22	2.80	3.90	2.80	3.25	3.02
7	4.90	4.22	6.15	4.35	3.10	2.65	2.18	2.58	3.75	2.80	3.20	3.00
8	5.00	4.20	5.30	4.30	3.05	2.70	2.13	2.45	3.68	2.85	3.18	3.00
9	5.80	4.12	4.70	4.30	3.00	2.69	2.10	2.38	3.62	2.80	3.15	3.00
10	6.70	4.00	4.50	4.40	3.00	2.67	2.10	2.32	3.47	2.75	3.20	.....
11	5.90	3.90	4.35	4.50	3.00	2.60	2.10	2.28	3.30	2.75	3.25	.....
12	5.02	3.80	4.25	4.50	2.95	2.58	2.10	2.22	3.20	2.75	3.34	.....
13	4.95	3.72	4.10	4.50	2.90	2.53	2.05	2.20	3.20	2.75	3.38	.....
14	4.15	3.62	4.10	4.45	2.90	2.50	2.00	2.18	3.15	2.70	3.35	.....
15	3.75	3.55	4.05	4.40	2.90	2.50	2.00	2.22	3.18	2.70	3.35	.....
16	3.55	3.50	4.00	4.30	2.85	2.48	2.05	2.25	3.20	2.70	3.30	.....
17	4.90	3.55	3.95	4.15	2.85	2.45	2.05	2.50	3.10	2.68	3.30	.....
18	4.45	3.60	3.90	4.00	2.80	2.45	2.00	2.95	3.10	5.10	3.40	.....
19	4.30	3.90	4.00	3.90	2.80	2.40	2.00	2.42	3.00	4.00	3.40	.....
20	4.20	3.83	4.15	3.80	2.80	2.40	2.00	3.00	3.00	3.35	3.50	.....
21	4.05	3.70	4.38	3.78	2.75	2.50	2.12	2.85	3.00	3.40	3.48	.....
22	3.80	3.70	5.55	3.75	2.70	2.50	2.22	3.15	2.95	3.25	3.38	.....
23	3.70	3.70	7.70	3.70	2.70	2.47	2.18	3.45	2.90	3.30	3.32	.....
24	3.50	4.40	6.00	3.60	2.75	2.42	3.70	3.35	2.90	5.00	3.30	.....
25	3.40	4.40	5.35	3.50	2.75	2.40	2.95	3.25	2.90	6.60	3.30	.....
26	3.35	4.20	5.15	3.40	2.85	2.30	2.60	3.00	2.90	4.70	3.22	.....
27	3.30	4.10	4.85	3.30	2.80	2.30	2.50	3.02	2.90	4.38	3.20	.....
28	3.30	4.00	4.55	3.30	2.80	2.25	2.42	3.32	2.80	3.95	3.20	.....
29	3.30	.....	4.45	3.25	2.85	2.20	2.35	3.80	2.80	3.75	3.20	.....
30	3.55	.....	4.30	3.30	2.90	2.17	2.22	6.65	2.80	3.55	3.20	.....
31	6.35	.....	4.02	.....	2.95	.....	2.27	5.58	.....	3.38	.....	.....

Daily discharge, in second-feet, of Salt River at Roosevelt, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	6,600	2,120	1,970	1,120	715	336	574	3,350	420	1,130	670
2	.....	3,670	2,040	2,410	1,150	674	334	875	2,070	411	1,170	637
3	892	3,250	1,860	2,220	1,070	639	330	1,460	1,630	407	1,260	630
4	.....	2,960	1,860	3,010	1,000	560	320	4,300	3,600	426	1,160	587
5	.....	2,700	4,740	2,860	940	548	306	984	2,579	416	936	594
6	.....	2,630	14,200	2,410	881	527	370	778	1,630	420	808	535
7	5,120	2,970	7,010	2,300	881	572	368	601	1,590	430	744	526
8	4,830	2,790	4,390	2,200	828	585	368	517	1,490	477	676	521
9	6,520	2,800	3,410	2,210	794	595	290	456	1,390	382	670	520
10	9,030	2,640	2,940	2,440	754	604	319	398	1,210	422	700	.....
11	7,550	2,400	2,750	2,510	740	588	318	390	1,020	436	726	.....
12	4,930	2,150	2,430	2,520	734	552	291	372	930	431	830	.....
13	4,420	1,980	2,260	2,550	627	528	292	368	930	430	942	.....
14	2,180	1,820	2,170	2,460	698	499	294	354	880	387	850	.....
15	2,100	1,740	2,010	2,370	682	491	294	341	900	388	845	.....
16	1,890	1,680	1,890	2,200	680	485	299	376	930	385	790	.....
17	3,280	1,720	1,830	1,940	676	480	285	610	823	356	800	.....
18	2,440	1,750	1,790	1,870	656	484	277	910	673	3,350	1,040	.....
19	3,040	2,200	1,910	1,780	640	460	265	538	695	1,890	994	.....
20	2,930	2,030	2,200	1,570	623	465	262	1,080	650	1,380	1,200	.....
21	2,830	1,890	2,620	1,550	616	552	320	778	576	1,440	1,050	.....
22	2,320	1,890	5,580	1,490	581	551	367	1,140	562	1,190	1,020	.....
23	1,990	1,890	10,300	1,440	578	520	352	1,360	547	1,010	879	.....
24	1,880	3,050	6,300	1,380	586	462	2,100	1,200	515	4,030	860	.....
25	1,690	3,050	5,720	1,220	597	440	946	1,080	519	8,740	840	.....
26	1,620	2,610	4,700	1,130	670	400	657	901	513	3,020	715	.....
27	1,540	2,320	3,790	1,060	649	388	568	907	457	2,340	695	.....
28	1,540	2,200	3,140	1,010	627	374	510	1,010	445	1,720	692	.....
29	1,530	.....	2,780	970	672	350	452	1,340	416	1,500	690	.....
30	1,910	.....	2,360	1,080	704	340	385	8,560	416	1,220	680	.....
31	8,730	.....	1,950	.....	728	.....	382	5,740	.....	1,130	.....	.....

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Salt River at Roosevelt, Ariz., for 1907.

[Drainage area, 5,760 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
January (26 days)	a 11,600	892	3,410	0.592	0.57	176,000
February	a 6,950	1,680	2,550	.443	.46	142,000
March	a 17,000	1,790	3,710	.644	.74	228,000
April	a 3,410	970	1,940	.337	.38	115,000
May	1,150	578	748	.130	.15	46,000
June	715	340	514	.089	.10	30,600
July	a 2,550	262	428	.074	.09	26,300
August	a 11,100	341	1,300	.226	.26	79,900
September	3,600	416	1,130	.196	.22	67,200
October	a 9,700	356	1,320	.229	.26	81,200
November	1,260	670	880	.153	.17	52,400
December 1–9	670	520	580	.101	.03	10,400
The period	.....	.....	.....	.....	.....	1,060,000

a Maximum discharge recorded for the month. These occurred on January 31, February 1, March 6, April 4, May 24, August 30, and October 25.

SALT RIVER AT McDOWELL, ARIZ.

This station, which was established April 20, 1897, to determine the amount of water available for irrigation, is located one-third mile above the junction of Salt and Verde rivers, 30 miles northeast of

Phoenix, 15 miles northeast of Mesa, and 1¾ miles above the Arizona canal diversion dam.

The bed of the river at this point is sandy and shifting, and frequent measurements are required to properly determine the daily discharge.

The results published herewith were furnished by the United States Reclamation Service.

Discharge measurements of Salt River at McDowell, Ariz., in 1907 and 1908.

[By W. Richins.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*
January 2	6.50	5,350	June 27	2.55	450	December 10	3.10	600
January 4	5.80	3,210	June 29	2.45	377	December 13	3.10	597
January 8	6.60	5,630	July 2	2.30	341	December 17	3.05	569
January 10	7.75	9,690	July 6	2.20	299	December 20	3.00	476
January 12	6.85	6,200	July 9	2.25	348	December 24	3.00	448
January 15	5.55	2,850	July 11	2.20	308	December 27	3.00	443
January 18	6.00	3,530	July 13	2.20	314	December 31	3.00	415
January 22	5.75	2,650	July 16	2.15	305			
January 25	5.50	2,100	July 18	2.15	309	1908.		
January 29	5.30	1,760	July 20	2.10	304	January 3	3.00	426
January 31	6.58	5,030	July 23	2.30	408	January 7	3.05	493
February 2	6.85	5,520	July 25	3.60	1,250	January 10	3.00	428
February 6	6.00	3,150	July 27	2.95	685	January 14	2.95	400
February 8	6.10	3,310	July 30	2.65	492	January 17	3.00	399
February 12	5.80	2,820	August 1	2.55	470	January 21	2.95	405
February 15	5.50	2,200	August 3	3.50	1,120	January 24	2.95	392
February 19	5.60	2,450	August 5	3.40	974	January 28	2.95	383
February 22	5.60	2,660	August 8	3.00	635	January 31	2.95	394
February 26	6.00	3,330	August 10	2.80	514	February 4	12.00	29,800
February 28	5.65	2,870	August 13	2.60	446	February 6	5.92	6,010
March 6	10.25	18,300	August 15	2.45	393	February 8	5.50	2,620
March 7	8.05	9,270	August 17	2.50	396	February 11	5.10	2,030
March 9	6.55	4,470	August 20	2.80	551	February 13	5.15	2,110
March 12	6.00	3,340	August 22	3.20	806	February 15	5.10	1,730
March 15	5.90	2,740	August 24	3.90	1,330	February 18	5.50	2,360
March 19	5.70	3,300	August 27	3.40	883	February 20	5.55	2,400
March 22	6.40	3,950	August 29	4.15	1,700	February 22	5.15	1,850
March 23	8.20	10,500	August 31	7.30	7,390	February 25	5.80	3,880
March 25	7.15	6,710	September 3	5.05	2,030	February 27	5.40	2,640
March 27	6.30	4,470	September 4	5.05	2,090	March 3	5.40	2,730
March 29	6.00	3,570	September 6	5.00	2,020	March 5	5.35	2,600
April 2	5.45	2,880	September 10	4.20	1,390	March 7	6.85	8,980
April 5	5.80	3,830	September 12	3.75	1,120	March 9	5.65	4,440
April 9	5.50	3,170	September 14	3.50	831	March 11	5.35	3,340
April 11	5.50	3,270	September 17	3.45	819	March 13	5.10	2,570
April 13	5.50	3,150	September 19	3.20	671	March 17	5.30	2,740
April 15	5.40	3,080	September 21	3.05	638	March 20	5.75	3,870
April 17	5.15	2,800	September 24	2.85	529	March 24	5.50	3,180
April 19	4.95	2,230	September 26	2.75	493	March 27	5.25	2,580
April 23	4.60	1,760	October 1	2.60	409	March 31	5.00	2,130
April 26	4.35	1,370	October 3	2.55	395	April 3	4.60	1,640
April 30	4.10	1,220	October 5	2.55	397	April 7	4.70	1,880
May 2	4.10	1,280	October 9	2.65	472	April 10	4.70	2,090
May 4	4.00	1,240	October 11	2.60	456	April 14	4.40	1,660
May 7	3.70	1,000	October 15	2.50	347	April 17	4.40	1,570
May 9	3.60	960	October 17	2.50	360	April 21	4.20	1,360
May 11	3.55	922	October 19	5.20	2,870	April 24	4.35	1,580
May 13	3.45	840	October 22	3.55	1,070	April 28	4.30	1,500
May 15	3.40	783	October 24	3.50	1,040	May 1	4.10	1,230
May 17	3.35	820	October 25	6.75	7,180	May 5	4.10	1,190
May 21	3.25	742	October 29	4.65	1,620	May 8	4.15	1,260
May 23	3.15	653	October 31	4.20	1,200	May 12	3.95	1,080
May 25	3.20	698	November 2	4.05	1,150	May 15	3.80	948
May 28	3.20	703	November 5	4.00	1,150	May 19	3.60	845
May 31	3.30	858	November 7	3.25	1,020	May 22	3.50	790
June 4	3.15	716	November 9	3.70	955	May 26	3.50	807
June 6	3.05	653	November 12	3.70	983	May 29	3.30	655
June 8	3.00	635	November 15	3.75	1,020	June 3	3.15	621
June 11	3.00	628	November 19	3.70	1,010	June 5	3.10	579
June 13	2.90	534	November 21	3.75	1,080	June 9	3.05	523
June 15	2.85	523	November 23	3.60	949	June 12	2.90	461
June 18	2.75	494	November 26	3.40	830	June 15	2.85	427
June 20	2.70	491	November 29	3.30	749	June 17	2.85	434
June 22	2.80	524	December 3	3.20	676	June 19	2.85	440
June 25	2.70	503	December 6	3.20	661	June 23	2.70	387

Discharge measurements of Salt River at McDowell, Ariz., in 1907 and 1908—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*
June 25	2.65	345	September 4	6.00	2,860	November 10	3.95	600
June 30	2.55	271	September 8	4.90	1,350	November 13	3.45	356
July 3	2.50	268	September 11	4.70	1,060	November 17	4.85	1,300
July 7	2.40	230	September 15	4.30	828	November 20	3.60	455
July 10	2.35	214	September 18	4.15	758	November 24	3.40	382
July 14	2.85	489	September 22	3.95	578	November 27	3.40	344
July 17	3.50	868	September 25	3.85	498	December 1	3.50	372
July 21	3.80	1,060	September 29	3.90	565	December 4	4.15	812
July 22	3.40	796	October 2	3.75	473	December 8	3.70	490
July 24	3.25	700	October 6	3.65	384	December 11	3.55	396
July 28	5.50	2,860	October 9	3.65	387	December 15	3.65	502
July 31	4.00	956	October 13	3.55	355	December 16	12.40	[b] 1,300
August 4	3.85	936	October 16	3.50	320	December 17	13.00	35,000
August 7	4.20	1,100	October 20	3.75	501	December 19	7.15	9,710
August 14	4.20	1,090	October 23	3.65	409	December 22	6.05	4,250
August 17	4.65	1,400	October 27	3.55	376	December 24	6.00	4,340
August 21	6.00	3,760	October 30	3.50	370	December 29	3.45	450
August 25	5.75	2,480	November 4	3.45	342	December 31	3.55	554
August 28	6.00	3,010	November 6	3.45	336			
September 1	6.05	3,120	November 7	2.95	[a] 125			

[a] Shut gate at Roosevelt caused drop in river. [b] Gaging was influenced by high water in Verde.

Daily gage height, in feet, of Salt River at McDowell, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.05	7.62	5.65	5.52	4.05	3.35	2.35	2.60	5.85	2.58	4.10	3.28
2	6.45	6.80	5.65	5.52	4.10	3.30	2.30	3.15	5.45	2.55	4.05	3.25
3	6.05	6.50	5.70	5.50	4.08	3.22	2.30	3.35	5.15	2.55	4.10	3.20
4	5.75	6.30	5.75	5.62	4.00	3.15	2.30	4.00	5.52	2.55	4.08	3.20
5	5.50	6.08	5.82	5.78	3.90	3.08	2.25	3.65	5.57	2.55	3.98	3.20
6	5.60	6.00	10.35	5.52	3.78	3.05	2.20	3.38	4.92	2.55	3.88	3.20
7	6.30	6.05	7.95	5.50	3.70	3.02	2.20	3.15	4.77	2.55	3.82	3.15
8	6.60	6.15	7.12	5.50	3.65	3.00	2.20	2.98	4.60	2.60	3.75	3.15
9	6.55	6.15	6.55	5.50	3.60	3.05	2.22	2.85	4.40	2.65	3.70	3.15
10	7.80	5.90	6.45	5.52	3.60	3.05	2.20	2.78	4.15	2.62	3.70	3.10
11	7.40	5.88	6.30	5.50	3.55	3.00	2.22	2.69	3.90	2.60	3.70	3.10
12	6.78	5.80	5.98	5.48	3.50	2.98	2.20	2.60	3.72	2.60	3.72	3.10
13	6.15	5.68	6.05	5.50	3.45	2.90	2.20	2.58	3.58	2.58	3.82	3.10
14	5.82	5.58	6.98	5.45	3.40	2.88	2.18	2.52	3.50	2.55	3.75	3.10
15	5.55	5.50	5.90	5.40	3.40	2.85	2.15	2.45	3.50	2.50	3.75	3.08
16	5.50	5.40	5.85	5.25	3.40	2.82	2.12	2.50	3.50	2.50	3.70	3.05
17	5.75	5.40	5.72	5.18	3.35	2.80	2.12	2.50	3.40	2.50	3.68	3.05
18	5.98	5.42	5.70	5.05	3.35	2.75	2.12	2.70	3.27	3.85	3.65	3.05
19	5.90	5.55	5.80	4.95	3.30	2.70	2.10	2.72	3.18	5.00	3.68	3.05
20	6.00	5.72	6.00	4.80	3.25	2.68	2.10	3.25	3.12	4.25	3.78	3.00
21	5.90	5.68	6.25	4.74	3.22	2.68	2.10	3.42	3.02	3.95	3.75	3.00
22	5.72	5.62	6.40	4.68	3.20	2.80	2.08	3.15	2.95	3.50	3.70	3.00
23	5.60	5.55	8.60	4.60	3.15	2.75	2.32	3.80	2.90	3.50	3.60	3.00
24	5.58	5.92	7.80	4.48	3.18	2.70	2.65	3.82	2.85	4.30	3.52	3.00
25	5.50	6.10	7.15	4.40	3.20	2.68	3.58	4.01	2.87	6.55	3.48	2.95
26	5.32	5.98	6.55	4.32	3.20	2.58	3.15	3.95	2.75	5.75	3.40	2.95
27	5.30	5.80	6.30	4.22	3.20	2.52	2.92	3.48	2.70	5.20	3.35	3.00
28	5.30	5.62	6.12	4.14	3.20	2.48	2.86	3.72	2.65	4.98	3.30	3.00
29	5.30	.....	6.02	4.05	3.22	2.42	2.80	4.58	2.62	4.60	3.30	3.00
30	5.30	.....	5.82	4.05	3.28	2.38	2.62	5.58	2.60	4.40	3.30	3.00
31	6.55	.....	5.65	.....	3.30	.....	2.80	7.15	.....	4.20	.....	3.00

Daily gage height, in feet, of Salt River at McDowell, Ariz., for 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.00	2.90	5.35	4.88	4.10	3.20	2.52	4.38	5.98	3.80	3.45	3.50
2	3.00	2.90	5.38	4.70	4.10	3.18	2.50	4.03	5.68	3.75	3.45	3.45
3	3.00	2.98	5.35	4.60	4.10	3.15	2.50	4.05	5.85	3.70	3.45	3.55
4	3.00	12.22	5.22	4.60	4.10	3.15	2.45	3.88	6.00	3.70	3.45	4.18
5	3.00	8.60	6.12	4.70	4.10	3.10	2.40	4.12	5.78	3.65	3.45	4.02
6	3.02	5.85	8.95	4.80	4.05	3.10	2.40	4.20	5.40	3.65	3.32	3.85
7	3.05	5.70	6.62	4.75	4.02	3.10	2.38	4.18	5.10	3.65	2.95	3.75
8	3.00	5.52	6.02	4.75	4.10	3.08	2.35	4.38	4.95	3.62	2.95	3.70
9	3.00	5.45	5.68	4.72	4.17	3.05	2.35	4.70	4.75	3.65	3.50	3.65
10	3.00	5.32	5.48	4.72	4.10	3.02	2.48	4.70	4.62	3.60	3.98	3.60
11	3.00	5.10	5.30	4.62	4.00	2.95	2.68	4.18	4.70	3.60	3.58	3.55
12	3.00	5.02	5.15	4.55	3.92	2.90	2.55	4.00	4.58	3.55	3.45	3.50
13	3.00	5.18	5.12	4.42	3.88	2.90	2.70	4.08	4.45	3.55	3.45	3.50
14	2.95	5.22	5.00	4.42	3.85	2.90	2.85	4.12	4.40	3.50	3.45	3.50
15	2.95	5.10	5.05	4.40	3.78	2.88	2.98	3.85	4.30	3.50	3.15	3.95
16	2.98	5.30	5.12	4.40	3.72	2.85	3.30	5.08	4.22	3.50	2.80	12.25
17	3.00	5.48	5.32	4.40	3.65	2.85	3.90	4.68	4.20	3.50	4.58	13.65
18	2.95	5.60	5.55	4.35	3.62	2.85	3.98	6.05	4.15	3.45	3.50	9.45
19	2.95	5.95	5.60	4.30	3.58	2.85	4.60	6.35	4.10	3.55	3.45	7.18
20	2.95	5.65	5.75	4.25	3.52	2.80	4.45	6.25	4.05	3.75	3.52	6.40
21	2.95	5.15	5.72	4.20	3.50	2.80	3.70	6.05	4.00	3.70	3.15	6.15
22	2.95	5.12	5.65	4.25	3.50	2.72	3.48	6.60	3.92	3.68	3.70	6.08
23	2.95	5.85	5.55	4.32	3.55	2.70	3.35	6.30	3.90	3.62	3.40	6.00
24	2.95	6.30	5.50	4.35	3.55	2.70	3.22	5.88	3.90	3.60	3.40	6.02
25	2.95	5.82	5.30	4.35	3.50	2.65	3.68	5.70	3.85	3.60	3.40	6.02
26	2.95	5.60	5.20	4.35	3.48	2.65	4.20	5.95	3.85	3.60	3.40	5.92
27	2.95	5.40	5.35	4.35	3.42	2.60	3.98	5.98	3.90	3.55	3.40	5.75
28	2.95	5.35	5.45	4.30	3.32	2.60	5.88	5.95	3.95	3.50	3.50	4.00
29	2.95	5.35	5.30	4.22	3.30	2.58	4.92	5.92	3.88	3.50	3.55	3.45
30	2.95	.....	5.18	4.18	3.25	2.55	4.32	6.10	3.85	3.50	3.55	3.25
31	2.95	.....	5.00	.....	3.20	.....	3.95	6.20	.....	3.50	.....	3.42

Daily discharge, in second-feet, of Salt River at McDowell, Ariz., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6,750	8,860	2,760	2,900	1,250	860	350	500	3,150	400	1,150	730
2	5,200	5,350	2,760	3,070	1,280	820	341	830	2,450	395	1,120	710
3	3,940	4,440	2,840	2,890	1,270	780	340	1,040	2,130	395	1,150	676
4	3,130	3,900	2,900	3,180	1,240	716	340	1,420	2,750	395	1,140	670
5	2,630	3,320	3,000	3,740	1,160	690	320	1,140	2,870	397	1,090	670
6	2,850	3,150	18,600	2,970	1,080	653	300	960	1,950	397	1,020	661
7	4,600	3,230	8,880	3,070	1,000	640	310	740	1,880	400	1,010	650
8	5,630	3,260	6,170	3,140	980	635	310	630	1,670	440	970	640
9	5,540	3,490	4,470	3,170	960	635	340	540	1,530	472	955	630
10	9,870	2,910	4,260	3,340	960	635	320	510	1,360	460	960	600
11	8,290	2,900	3,940	3,270	922	628	320	470	1,210	456	970	600
12	6,000	2,820	3,300	3,120	890	620	320	440	1,100	440	990	600
13	4,130	2,540	3,380	3,150	840	534	314	430	910	410	1,060	600
14	3,340	2,340	3,010	3,120	800	630	310	410	831	380	1,020	600
15	2,850	2,200	2,740	3,080	783	523	305	393	830	347	1,020	580
16	2,690	2,110	2,570	2,880	800	510	305	396	820	350	990	570
17	3,190	2,140	2,370	2,800	820	500	305	396	780	360	980	569
18	3,500	2,200	2,330	2,470	820	494	305	440	740	1,350	960	550
19	3,160	2,400	2,430	2,230	785	490	304	500	670	2,620	1,000	530
20	3,400	2,640	2,840	2,090	760	490	304	760	660	1,650	1,090	476
21	3,020	2,580	3,460	1,980	750	500	304	880	640	1,400	1,080	470
22	2,620	2,540	3,950	1,880	690	524	308	770	590	1,040	1,030	460
23	2,340	2,430	11,900	1,760	653	510	410	1,220	560	1,040	949	450
24	2,290	3,080	8,950	1,590	670	505	630	1,260	530	1,580	900	448
25	2,100	3,780	6,710	1,470	698	500	1,230	1,350	530	6,700	880	440
26	1,880	3,320	5,000	1,360	700	470	860	1,270	493	3,900	830	440
27	1,820	3,040	4,470	1,290	700	450	680	930	480	2,330	780	443
28	1,790	2,820	3,920	1,250	703	420	620	1,270	450	1,950	770	440
29	1,760	.....	3,600	1,200	750	375	580	2,230	430	1,600	760	430
30	1,900	.....	3,380	1,200	800	360	490	3,500	410	1,390	749	420
31	5,030	.....	3,120	.....	858	.....	570	7,100	.....	1,200	.....	415

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Daily discharge, in second-feet, of Salt River at McDowell, Ariz., for 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	426	370	2,640	1,960	1,230	630	270	1,240	3,000	500	350	372
2	426	370	2,700	1,750	1,220	625	270	1,020	2,450	473	342	360
3	426	400	2,700	1,700	1,210	621	268	1,050	2,650	470	340	420
4	426	30,900	2,500	1,680	1,190	610	250	940	2,860	460	340	812
5	426	16,900	3,950	1,830	1,190	579	240	1,100	2,500	400	336	700
6	460	6,000	23,500	1,940	1,170	570	240	1,130	1,920	384	300	590
7	493	3,800	7,500	1,930	1,160	560	230	1,100	1,570	385	125	540
8	428	2,700	5,600	1,980	1,260	540	220	1,230	1,410	380	125	490
9	428	2,490	4,450	2,050	1,270	523	214	1,470	1,180	387	490	470
10	428	2,290	3,850	2,100	1,210	506	260	1,470	1,030	370	600	430
11	428	2,030	3,300	1,960	1,130	480	360	1,080	1,060	370	460	396
12	420	1,970	2,840	1,860	1,080	461	300	950	980	355	360	390
13	410	2,130	2,570	1,700	1,030	450	370	1,010	900	350	356	410
14	400	2,010	2,410	1,670	1,000	440	460	1,030	880	330	350	410
15	400	1,730	2,470	1,630	948	427	530	840	828	330	210	690
16	400	1,930	2,510	1,600	910	430	730	1,780	790	320	80	11,300
17	400	2,240	2,790	1,570	878	434	1,100	1,400	780	320	1,070	35,000
18	400	2,480	3,190	1,520	864	436	1,160	3,270	758	300	400	18,800
19	400	3,200	3,440	1,470	845	440	1,600	4,100	740	390	370	9,710
20	400	2,540	3,870	1,420	820	420	1,480	4,120	660	501	420	6,000
21	405	2,150	3,960	1,360	700	410	1,000	3,820	620	460	250	4,700
22	400	1,600	3,680	1,440	790	390	800	5,440	560	440	530	4,250
23	400	3,400	3,200	1,520	800	387	760	3,920	540	410	390	4,200
24	392	4,800	3,180	1,580	800	370	680	2,600	530	400	382	4,340
25	390	4,000	2,800	1,580	800	345	1,000	2,410	498	400	370	4,100
26	390	3,000	2,590	1,580	800	330	1,360	2,880	500	390	360	3,700
27	385	2,640	2,740	1,570	740	310	1,260	2,930	540	376	344	3,100
28	383	2,640	2,860	1,500	690	300	3,500	2,910	590	370	390	840
29	385	2,640	2,580	1,410	665	385	2,500	2,900	560	370	410	450
30	390	.....	2,350	1,320	640	271	1,300	3,280	530	370	400	360
31	394	.....	2,130	.....	630	.....	930	3,470	.....	370	.....	470

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Salt River at McDowell, Ariz., for 1907 and 1908.

[Drainage area, 6,260 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1907.						
January	[a] 10,200	1,760	3,780	0.604	0.70	232,000
February	[a] 9,980	2,110	3,210	.513	.53	178,000
March	[a] 19,500	2,330	4,640	.741	.85	285,000
April	3,740	1,200	2,490	.398	.44	148,000
May	1,280	653	883	.141	.16	54,300
June	860	360	570	.091	.10	33,900
July	1,230	300	421	.067	.08	25,900
August	[a] 9,200	393	1,120	.179	.21	68,900
September	[a] 3,500	410	1,180	.188	.21	70,200
October	[a] 9,400	347	1,180	.188	.22	72,600
November	1,150	749	979	.156	.17	58,300
December	730	415	554	.088	.10	34,100
The year	19,500	300	1,750	.280	3.79	1,260,000

[a] See footnote at end of table, next page.

Monthly discharge of Salt River at McDowell, Ariz., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1908.						
January	493	383	411	0.066	0.08	25,300
February	[a] 47,300	370	3,980	.636	.69	229,000
March	[a] 24,200	2,130	3,900	.623	.72	240,000
April	2,100	1,320	1,670	.267	.30	99,400
May	[a] 1,300	630	957	.153	.18	58,800
June	630	271	456	.073	.08	27,100
July	[a] 7,700	214	827	.132	.15	50,800
August	[a] 5,720	840	2,190	.350	.40	135,000
September	[a] 3,150	498	1,150	.184	.21	68,400
October	501	300	391	.062	.07	24,000
November	[a] 1,300	80	375	.060	.07	22,300
December	[a] 40,000	360	3,840	.613	.71	236,000
The year	47,300	80	1,680	.268	3.66	1,220,000

[a] Maximum discharge recorded for the month. These occurred in 1907 on January 10, February 1, March 6, August 31, September 1, and October 25, and in 1908 on February 4, March 6, May 8, July 28, August 22, September 1, November 17, and December 17.

VERDE RIVER AT McDOWELL, ARIZ.

This station, which was established April 20, 1897, to determine the quantity of water in the Verde available for irrigation, is located 30 miles northeast of Phoenix, 15 miles northeast of Mesa, 2⅛ miles above the Arizona canal diversion dam, and three-fourths mile above the mouth of the river.

As the bed of the stream at this point is sandy and shifting, frequent measurements are required to properly determine the daily discharge.

The results published herewith were furnished by the United States Reclamation Service.

Discharge measurements of Verde River at McDowell, Ariz., in 1907 and 1908.

[By W. Richins.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*
January 2	5.70	2,610	February 28	2.90	1,610	April 19	2.50	403
January 4	4.30	1,650	March 6	14.6	33,100	April 23	2.45	327
January 8	4.20	1,690	March 7	9.00	11,200	April 26	2.40	293
January 10	5.95	3,710	March 9	5.50	5,140	April 30	2.40	331
January 12	7.75	6,730	March 12	4.25	2,680	May 2	2.35	292
January 15	4.40	1,940	March 15	3.40	1,520	May 4	2.40	321
January 18	3.50	1,130	March 19	2.95	896	May 7	2.30	257
January 22	3.40	1,210	March 22	3.35	1,260	May 9	2.30	271
January 25	3.35	1,180	March 23	6.80	7,150	May 11	2.30	245
January 29	3.25	1,230	March 25	5.44	2,510	May 13	2.25	224
January 31	8.9	12,500	March 27	3.70	1,600	May 15	2.25	232
February 2	6.75	5,000	March 29	3.60	1,510	May 17	2.30	266
February 6	5.45	3,360	April 2	3.40	1,060	May 21	2.30	247
February 8	5.00	3,380	April 5	4.25	2,180	May 23	2.25	226
February 12	3.10	1,530	April 9	3.30	1,060	May 25	2.20	208
February 15	2.70	1,100	April 11	3.05	788	May 28	2.20	227
February 19	4.30	2,830	April 13	2.90	639	May 31	2.35	274
February 22	2.75	1,340	April 15	2.75	551	June 4	2.30	248
February 26	3.70	2,310	April 17	2.60	462	June 6	2.25	218

Discharge measurements of Verde River at McDowell, Ariz., in 1907 and 1908—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*
June 8	2.20	213	November 15	2.90	366	June 3	3.35	139
June 11	2.20	212	November 19	3.00	380	June 5	3.40	179
June 13	2.25	226	November 21	3.05	393	June 9	3.35	163
June 15	2.20	197	November 23	3.00	370	June 12	3.35	156
June 18	2.20	198	November 26	2.95	330	June 15	3.30	151
June 20	2.20	211	November 29	2.95	319	June 17	3.25	136
June 22	2.20	191	December 3	2.95	315	June 19	3.30	140
June 25	2.15	179	December 6	2.95	350	June 23	3.25	131
June 27	2.15	186	December 10	2.95	322	June 26	3.25	123
June 29	2.10	173	December 13	2.95	306	June 30	3.20	110
July 2	2.10	175	December 17	2.95	331	July 3	3.25	123
July 6	2.10	192	December 20	3.00	346	July 7	3.20	98
July 9	2.05	165	December 24	2.95	326	July 10	3.25	118
July 11	2.05	167	December 27	2.95	309	July 14	3.30	130
July 13	2.10	210	December 31	2.95	315	July 17	3.85	380
July 16	2.30	241				July 21	4.40	480
July 18	2.15	196	1908.			July 22	4.20	376
July 20	2.00	144	January 3	3.00	358	July 24	4.00	325
July 23	2.15	166	January 7	3.00	353	July 28	7.10	3,860
July 25	2.60	426	January 10	2.95	299	July 31	5.20	1,180
July 27	2.50	320	January 14	3.00	313	August 4	4.80	690
July 30	2.40	275	January 17	2.95	296	August 7	6.00	2,230
August 1	2.50	280	January 21	2.95	293	August 14	5.10	992
August 3	2.75	566	January 24	2.95	292	August 17	4.65	638
August 6	3.50	830	January 28	2.95	285	August 21	5.75	1,290
August 8	2.90	487	January 31	3.00	336	August 25	4.40	471
August 10	2.70	338	February 4	9.10	14,400	August 28	4.80	703
August 13	2.45	236	February 6	5.40	3,590	September 1	4.25	364
August 15	2.35	239	February 8	4.10	1,430	September 4	4.20	364
August 17	2.25	200	February 11	3.95	1,080	September 8	4.15	317
August 20	2.60	316	February 13	4.00	1,260	September 11	5.20	893
August 22	2.40	280	February 15	3.85	795	September 15	4.40	395
August 24	2.50	320	February 18	3.90	970	September 18	4.20	291
August 27	2.55	288	February 20	3.90	959	September 22	4.15	230
August 29	2.50	267	February 22	3.80	808	September 25	4.60	469
August 31	2.60	355	February 25	4.80	1,910	September 29	4.10	223
September 2	2.90	438	February 27	4.20	1,350	October 2	4.10	220
September 4	3.00	449	March 3	4.50	1,550	October 6	4.10	210
September 6	3.90	1,220	March 5	4.15	1,160	October 9	4.10	207
September 10	3.30	563	March 7	6.35	4,370	October 13	4.10	187
September 12	2.90	422	March 9	4.70	1,540	October 16	4.05	175
September 14	2.75	352	March 11	4.30	962	October 20	4.70	498
September 17	2.85	362	March 13	4.05	784	October 23	4.50	306
September 19	2.55	275	March 17	4.35	1,010	October 27	4.45	295
September 21	2.50	244	March 20	4.35	1,000	October 30	4.40	261
September 24	2.40	192	March 24	3.95	519	November 4	4.40	268
September 26	2.50	225	March 27	3.85	478	November 6	4.40	269
October 1	2.40	193	March 31	3.75	405	November 10	4.45	274
October 3	2.45	207	April 3	3.75	408	November 13	4.45	286
October 5	2.55	297	April 7	3.65	346	November 17	4.45	276
October 9	3.05	552	April 10	3.55	302	November 20	4.45	283
October 11	2.85	327	April 14	3.50	266	November 24	4.50	307
October 15	2.90	424	April 17	3.45	253	November 27	4.50	282
October 17	3.05	462	April 21	3.40	196	December 1	4.65	327
October 19	4.20	1,650	April 24	3.55	316	December 4	5.10	592
October 22	3.30	590	April 28	3.55	311	December 8	5.10	587
October 24	3.80	993	May 1	3.50	255	December 11	4.85	355
October 25	4.30	1,560	May 5	3.50	259	December 15	4.95	453
October 29	3.50	702	May 8	5.60	2,030	December 16	19.20	[a]60,000
October 31	3.15	468	May 12	4.25	507	December 17	10.30	12,000
November 2	3.20	557	May 15	3.90	333	December 19	6.25	3,400
November 5	3.05	451	May 19	3.70	233	December 22	5.15	1,310
November 7	2.95	368	May 22	3.10	210	December 24	5.00	905
November 9	2.90	364	May 26	3.50	192	December 29	4.55	595
November 12	2.85	321	May 29	3.40	169	December 31	4.45	507

[a] Float velocity.

Daily gage height, in feet, of Verde River at McDowell, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.30	8.65	3.05	3.45	2.40	2.35	2.10	2.40	3.07	2.40	3.02	2.95
2	5.35	6.50	3.50	3.42	2.35	2.32	2.10	2.28	2.90	2.40	3.20	2.95
3	4.45	5.60	4.37	4.85	2.38	2.28	2.10	2.85	2.80	2.45	3.15	2.95
4	4.25	5.40	4.70	4.28	2.40	2.28	2.08	4.50	2.90	2.48	3.05	2.95
5	4.20	5.20	6.10	4.22	2.35	2.28	2.05	3.70	3.45	2.55	3.05	2.95
6	4.30	5.25	13.35	4.05	2.30	2.28	2.10	3.40	3.90	2.75	3.00	2.95
7	4.30	5.30	9.05	3.75	2.30	2.25	2.10	3.10	3.65	2.95	2.95	2.95
8	4.25	4.75	6.40	3.50	2.32	2.20	2.10	2.90	3.48	3.18	2.95	2.95
9	4.60	4.00	5.25	3.30	2.30	2.30	2.05	2.80	3.32	3.05	2.90	2.95
10	5.90	3.50	4.45	3.12	2.32	2.25	2.05	2.68	3.22	2.88	2.90	2.95
11	6.95	3.28	5.05	3.02	2.30	2.20	2.05	2.56	3.00	2.82	2.90	2.95
12	7.62	3.08	4.12	2.98	2.28	2.25	2.10	2.45	2.87	2.75	2.85	2.95
13	6.10	2.88	3.85	2.90	2.25	2.25	2.10	2.42	2.77	2.78	2.85	2.95
14	4.95	2.75	3.45	2.84	2.25	2.25	2.12	2.38	2.75	2.82	2.85	2.95
15	4.25	2.70	3.38	2.78	2.25	2.20	2.15	2.35	3.20	2.95	2.90	2.95
16	3.90	2.62	3.20	2.68	2.25	2.20	2.25	2.30	3.00	2.88	2.90	2.95
17	3.60	2.68	3.20	2.60	2.28	2.20	2.18	2.25	2.80	3.02	2.90	2.95
18	3.50	2.60	3.00	2.55	2.25	2.20	2.15	2.20	2.57	3.38	2.95	2.95
19	3.70	4.50	2.95	2.50	2.25	2.20	2.08	2.35	2.52	4.15	3.00	2.95
20	3.60	3.45	3.05	2.50	2.25	2.20	2.00	2.52	2.57	3.75	3.00	3.00
21	3.42	2.95	3.20	2.48	2.28	2.20	2.08	2.40	2.50	3.45	3.05	2.95
22	3.45	2.70	3.32	2.45	2.25	2.20	2.12	2.38	2.45	3.28	3.00	2.95
23	3.32	4.02	6.70	2.45	2.25	2.18	2.18	2.55	2.40	3.20	3.00	2.95
24	3.35	6.75	5.60	2.45	2.22	2.15	2.10	2.50	2.40	3.90	2.98	2.95
25	3.35	4.70	4.35	2.40	2.20	2.15	2.65	2.58	2.40	4.40	2.95	2.95
26	3.25	3.50	3.85	2.40	2.20	2.15	2.60	2.62	2.45	4.30	2.95	2.95
27	3.20	2.95	3.70	2.40	2.20	2.15	2.48	2.52	2.40	3.90	2.95	2.95
28	3.28	2.85	3.80	2.38	2.22	2.12	2.44	2.42	2.45	3.65	2.95	2.95
29	3.30	.....	3.60	2.35	2.30	2.10	2.40	2.50	2.45	3.45	2.95	2.95
30	3.48	.....	3.50	2.40	2.35	2.10	2.38	3.32	2.45	3.25	2.95	2.95
31	9.80	.....	3.50	.....	2.35	.....	2.32	2.62	.....	3.12	.....	2.95
1908.												
1	2.95	3.00	4.45	3.75	3.50	3.35	3.20	4.85	4.22	4.10	4.40	4.62
2	2.95	3.00	4.75	3.75	3.50	3.35	3.25	4.68	4.28	4.10	4.40	4.60
3	3.00	3.12	4.45	3.75	3.50	3.35	3.20	4.40	4.22	4.10	4.40	4.75
4	2.95	9.10	4.30	3.70	3.48	3.38	3.20	4.78	4.20	4.10	4.40	5.30
5	2.95	7.90	4.52	3.70	3.50	3.40	3.20	5.37	4.20	4.10	4.40	5.30
6	3.00	5.30	8.35	3.70	3.58	3.35	3.20	6.30	4.20	4.10	4.40	5.25
7	3.00	4.50	5.95	3.65	5.95	3.35	3.20	5.85	4.15	4.10	4.40	5.20
8	3.00	4.05	5.35	3.60	5.58	3.35	3.20	5.48	4.18	4.10	4.40	5.05
9	2.98	4.10	4.75	3.58	5.10	3.35	3.25	5.32	4.40	4.10	4.42	4.90
10	2.95	4.10	4.55	3.55	4.65	3.35	3.25	4.85	4.60	4.10	4.45	4.88
11	2.95	3.95	4.32	3.55	4.28	3.35	3.40	4.98	5.10	4.10	4.45	4.85
12	2.95	3.90	4.18	3.50	4.25	3.35	3.30	4.98	4.80	4.10	4.45	4.80
13	2.98	4.00	4.02	3.50	4.12	3.35	3.25	4.98	4.60	4.10	4.45	4.80
14	3.00	3.90	3.95	3.50	3.98	3.30	3.30	5.20	4.48	4.10	4.50	4.80
15	2.98	3.85	4.05	3.45	3.90	3.30	3.62	4.82	4.35	4.08	4.50	5.32
16	2.95	3.95	4.18	3.45	3.85	3.30	3.65	4.30	4.28	4.05	4.45	17.65
17	2.95	4.00	4.38	3.45	3.80	3.25	3.85	4.58	4.22	4.10	4.45	11.25
18	2.95	3.92	4.48	3.45	3.72	3.30	3.92	4.68	4.20	4.60	4.45	7.65
19	2.95	3.95	4.48	3.40	3.68	3.30	5.00	4.68	4.20	4.75	4.48	6.12
20	2.95	3.85	4.35	3.40	3.60	3.30	4.50	4.50	4.20	4.68	4.45	5.60
21	2.95	3.82	4.30	3.40	3.60	3.30	4.35	5.42	4.18	4.60	4.50	5.35
22	2.95	3.75	4.15	3.40	3.60	3.28	4.18	5.15	4.15	4.55	4.50	5.15
23	2.95	4.75	3.98	3.50	3.55	3.25	4.05	5.30	4.10	4.50	4.50	5.02
24	2.95	5.60	3.92	3.55	3.50	3.25	3.98	5.30	4.15	4.45	4.50	4.98
25	2.95	4.70	3.85	3.60	3.50	3.25	4.22	4.40	4.52	4.40	4.50	4.88
26	2.95	4.12	3.85	3.60	3.50	3.25	3.38	4.65	4.20	4.42	4.50	4.78
27	2.98	4.20	3.85	3.58	3.50	3.25	5.02	4.88	4.20	4.45	4.50	4.68
28	2.95	4.30	3.80	3.55	3.45	3.25	6.15	4.72	4.18	4.45	4.55	4.60
29	2.95	4.30	3.75	3.52	3.40	3.22	5.20	4.55	4.10	4.42	4.60	4.58
30	2.98	.....	3.75	3.50	3.40	3.20	5.70	4.45	4.10	4.40	4.60	4.50
31	3.00	.....	3.75	.....	3.40	.....	5.15	4.30	.....	4.40	.....	4.45

Daily discharge, in second-feet, of Verde River at McDowell, Ariz., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3,550	10,200	1,630	1,150	330	270	173	280	370	193	430	315
2	2,090	4,500	2,000	1,060	292	260	173	200	438	193	557	315
3	1,760	3,150	3,080	3,100	300	248	173	640	350	207	510	315
4	1,570	3,000	3,550	2,220	321	240	173	2,100	390	230	450	330
5	1,560	2,810	5,670	2,170	290	230	170	1,040	740	297	450	340
6	1,730	2,860	32,200	1,940	257	220	192	740	1,220	380	420	350
7	1,800	3,370	11,400	1,530	260	220	190	570	920	410	368	340
8	1,750	2,910	6,350	1,260	270	213	170	487	730	690	368	330
9	1,920	2,080	4,760	1,060	271	240	165	410	570	552	364	330
10	3,630	1,640	3,360	860	270	220	165	340	510	390	364	322
11	5,260	1,530	4,100	760	245	212	167	270	420	310	364	320
12	6,450	1,500	2,490	710	240	220	200	240	410	290	321	310
13	4,130	1,300	1,990	639	224	226	210	230	360	310	321	306
14	2,490	1,140	1,570	610	230	220	220	230	352	350	321	310
15	1,730	1,100	1,500	570	232	197	230	239	600	400	366	320
16	1,390	920	1,380	510	230	197	241	220	450	350	366	330
17	1,160	880	1,230	462	260	198	230	206	330	430	366	331
18	1,130	610	980	430	240	198	196	460	280	730	370	330
19	1,400	3,120	896	403	230	200	170	210	270	1,570	380	340
20	1,320	1,780	980	400	230	211	144	280	270	980	380	346
21	1,240	1,370	1,130	370	240	200	150	280	244	680	393	326
22	1,260	1,280	1,240	330	230	191	160	280	220	580	370	326
23	1,180	3,020	7,120	327	226	185	170	300	192	580	370	326
24	1,180	8,040	4,620	320	220	178	170	320	200	1,120	350	326
25	1,180	4,000	2,420	300	208	180	470	300	200	1,730	330	320
26	1,180	2,020	1,790	293	210	180	420	310	220	1,560	325	310
27	1,200	1,690	1,600	390	220	186	320	280	200	1,100	325	309
28	1,220	1,510	1,770	340	230	180	300	230	220	820	320	310
29	1,230	.....	1,510	300	240	173	280	267	220	640	319	312
30	1,420	.....	1,230	330	270	173	270	1,020	220	510	318	315
31	15,200	.....	1,230	.....	274	.....	270	360	.....	460	.....	315
1908.												
1	300	336	1,500	405	255	140	110	690	364	221	264	327
2	300	336	2,200	407	255	140	125	580	380	220	265	310
3	358	400	1,550	408	255	139	120	440	370	218	267	350
4	300	14,400	1,280	405	250	150	110	640	364	215	268	800
5	300	9,800	1,600	400	259	179	110	1,400	360	212	268	800
6	350	3,400	11,000	400	280	163	100	2,600	350	210	269	740
7	353	2,000	3,500	346	2,410	163	98	2,230	310	209	270	680
8	350	1,430	2,450	320	2,030	163	100	1,420	317	208	270	500
9	330	1,400	1,540	310	1,360	163	115	1,330	450	207	270	450
10	299	1,200	1,330	302	850	163	118	780	560	202	274	420
11	300	1,080	962	300	550	163	170	860	880	197	278	400
12	300	1,000	880	270	507	163	130	860	620	192	282	380
13	310	1,260	780	270	430	163	120	860	510	187	286	380
14	313	1,000	720	266	360	151	130	992	400	185	280	380
15	310	795	784	260	333	151	270	740	380	180	280	840
16	300	1,000	880	255	310	151	300	420	340	175	280	51,600
17	296	1,100	1,010	253	290	140	380	600	310	200	276	17,000
18	295	970	1,170	250	250	150	400	650	291	450	280	5,600
19	295	1,000	1,160	200	233	150	1,020	650	290	520	280	3,400
20	295	959	1,000	200	210	150	650	570	290	495	283	2,200
21	293	900	970	196	210	150	480	1,080	250	410	290	1,700
22	293	808	760	200	210	140	376	920	230	360	295	1,310
23	293	810	570	280	200	131	350	1,000	210	306	300	1,000
24	292	3,000	519	316	200	130	325	1,000	230	290	307	905
25	290	1,910	480	330	195	130	400	471	430	270	300	820
26	290	1,300	480	330	192	123	200	590	260	280	290	750
27	300	1,350	478	320	190	120	1,020	750	260	295	282	680
28	285	1,130	470	311	180	120	2,350	703	240	290	290	620
29	285	1,130	420	270	169	120	1,200	570	223	280	300	600
30	290	.....	410	255	160	110	1,780	500	223	261	300	540
31	336	.....	405	.....	160	.....	1,180	380	.....	262	.....	507

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Verde River at McDowell, Ariz., for 1907 and 1908.

[Drainage area, 6,000 square miles.]

Month.	Discharge in second-feet.				Run-off.	
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.
1907.						
January	a 18,000	1,130	2,430	0.405	0.47	149,000
February	a 11,300	610	2,620	.437	.46	146,000
March	a 38,200	896	3,770	.628	.72	232,000
April	3,100	293	838	.140	.16	49,900
May	330	208	251	.042	.05	15,400
June	270	173	209	.035	.04	12,400
July	470	144	217	.036	.04	13,300
August	2,100	200	430	.072	.08	26,400
September	1,220	192	404	.067	.08	24,000
October	1,730	193	614	.102	.12	37,800
November	557	318	375	.062	.07	22,300
December	350	306	323	.054	.06	19,900
The year	38,200	144	1,040	173	2.34	748,000
1908.						
January	358	285	306	.051	.06	18,800
February	a 15,600	336	1,970	.328	.35	113,000
March	a 13,000	405	1,400	.233	.27	86,100
April	408	196	301	.050	.06	17,900
May	a 2,600	160	443	.074	.09	27,200
June	179	110	146	.024	.03	8,690
July	a 3,860	98	463	.077	.09	28,500
August	a 2,800	380	880	.147	.17	54,100
September	a 893	210	356	.059	.07	21,200
October	a 600	175	265	.044	.05	16,300
November	307	264	281	.047	.05	16,700
December	a 60,000	310	3,130	.522	.60	192,000
The year	60,000	98	828	.138	1.89	600,000

a Maximum discharge recorded during the month. These occurred in 1907 on January 31, February 1, March 6; and in 1908 on February 4, March 6, May 7, July 28, August 6, September 11, October 19, and December 16.

MISCELLANEOUS MEASUREMENTS IN GREEN RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in Green River drainage basin during 1908:

Measurements in Green River basin, 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
July 28, 1908	East Fork of Lake Fork.	Duchesne River	Above forks near Whiterocks, Utah.	.....	289
July 29, 1908	West Fork of Lake Fork.	do	At lakes, 12 miles above forks near Whiterocks, Utah.	a 2.20	252
July 30, 1908	Rock Creek	do	Below Stillwater Lake, Wasatch County, Utah.	.....	258

a At gage used in 1904, see Water-Supply Paper 133, p. 124.

MISCELLANEOUS MEASUREMENTS IN GRAND RIVER DRAINAGE BASIN.

The following miscellaneous discharge measurements were made in Grand River drainage basin during 1906, 1907, and 1908:

Miscellaneous measurements in Green River basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Nov. 30, 1908	Grand River	Colorado River	Dotsero, Colo		429
Oct. 2, 1907	East Inlet Grand Lake.	Grand Lake	Grand Lake, Colo		14.5
July 3, 1908	do	do	do	[a] 4.0	116
Aug. 19, 1908	Willow Creek	Grand River	At mouth, near Granby, Colo.	[b] 3.20	33
Sept. 18, 1908	do	do	do	[b] 2.95	14
June 20, 1907	Williams Fork	do	Above South Fork	3.0	[c] 1,070
July 18, 1907	do	do	do	1.4	93
Oct. 13, 1907	do	do	do	.8	25
June 20, 1907	do	do	Below South Fork	4.0	[c] 1,720
July 20, 1907	do	do	do	1.4	262
Oct. 12, 1907	do	do	do	.4	50
June 20, 1907	South Fork of Williams Fork.	Williams Fork		4.5	[c] 548
July 20, 1907	do	do		2.4	103
Oct. 13, 1907	do	do		1.6	19
June 20, 1907	Bobtail Creek	do		3.0	[c] 880
July 17, 1907	do	do		1.2	60
Oct. 11, 1907	do	do		.7	9
June 20, 1907	Steelman Creek	do		2.5	[c] 335
July 17, 1907	do	do		1.0	30
Oct. 12, 1907	do	do		.4	5
June 20, 1907	McQueary Creek	do		1.5	[c] 75
July 18, 1907	do	do		.5	15
Oct. 12, 1907	do	do		.2	2
Nov. 20, 1907	Snake Creek	Blue River	6 miles above junction with Blue River, near Dillon, Colo.		21.5
Feb. 12, 1908	do	do	do		11.1
Apr. 15, 1908	do	do	do		33.8
Apr. 17, 1908	do	do	do		21.9
Aug. 21, 1908	do	do	do		70
Nov. 22, 1907	Straight Creek	do	4 miles above mouth, near Dillon, Colo.		4.1
July 22, 1908	Piney River	Grand River	At mouth, near Radium, Colo.		[d] 35
Apr. 5, 1906 [e]	Gypsum Creek	Eagle River	Gypsum, Colo		44
May 3, 1906 [e]	do	do	do		44
June 16, 1906 [e]	do	do	do		50
May 28, 1906 [e]	do	do	do		37
June 8, 1907	do	do	do		[d] 20
Aug. 20, 1907	do	do	do		[d] 18
July 21, 1908	do	do	do		[d] 4
Aug. 22, 1908	do	do	do		[d] 10
Sept. 22, 1908	do	do	do		[d] 24
Oct. 26, 1908	do	do	do		45
Nov. 29, 1908	do	do	do		40
July 20, 1908	No Name Creek	Grand River	3 miles above Glenwood Springs, Colo.		[d] 4
Dec. 19, 1907	Roaring Fork	do	Above Frying Pan River near Basalt, Colo.		159
Feb. 13, 1908	do	do	do		137
Aug. 27, 1908	Sopris Creek	Roaring Fork	Emma, Colo		[d] 6
Sept. 25, 1908	do	do	do		[f] 14.9
Oct. 29, 1908	do	do	do		[d] 15
Dec. 2, 1908	do	do	do		[d] 10
Dec. 20, 1907	Crystal River	do	Carbondale, Colo		93
Feb. 12, 1908	do	do	1 mile west of Carbondale, Colo.		100
Feb. 29, 1908	do	do	do	.30	90
Apr. 1, 1908	do	do	do	.35	120
Apr. 4, 1908	do	do	do	.45	124
Mar. 29, 1908	Yule Creek	Crystal River	Marble, Colo		6

[a] Below head of spike in overhanging pine tree on right bank 200 feet above mouth.
[b] Nail in upstream end of center cross beam of wooden road bridge ½ mile above mouth, taken as elevation 9.00 feet.
[c] Discharge estimated from high-water marks by Kutter's formula, discharges and dates approximate.
[d] Discharge estimated.
[e] Not published in Water-Supply Paper 211.
[f] Float measurement.

Miscellaneous measurements in Green River basin—Continued.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Dec. 3, 1908	Nettle Creek	Crystal River	Sewell, near Carbondale, Colo.		[a] 3
July 18, 1908	Thompson Creek	do	do	.57	6.6
Aug. 25, 1908	do	do	do	.68	10.2
Sept. 24, 1908	do	do	do		[a] .5
Oct. 30, 1908	do	do	do	.60	11.2
Dec. 3, 1908	do	do	do		[a] 8.0
July 18, 1908	Thompsons ditch	Thompson Creek	do		[a] 1.5
July 18, 1908	Sewells ditch	Diverts from Thompson Creek.	do		[a] 1.0
July 18, 1908	Pioneer ditch	do	do		[b] 13.8
Aug. 25, 1908	do	do	do		[a] 0.15
Sept. 24, 1908	do	do	do		[b] 6.2
Oct. 30, 1908	do	do	do		[a] 0.75
July 18, 1908	Sweet ditch	Diverts from Crystal River.	do		[b] 15
Aug. 25, 1908	do	do	do		[b] 15.9
Sept. 24, 1908	do	do	do		[b] 8.0
Oct. 30, 1908	do	do	do		[a] 1.2
Dec. 3, 1908	do	do	do		0
July 18, 1908	Big Four ditch	do	do		[a] 8
Aug. 25, 1908	do	do	do		7.6
Sept. 24, 1908	do	do	do		3.6
Oct. 30, 1908	do	do	do		1.8
July 18, 1908	Grubb ditch	do	do		[a] 12
Aug. 25, 1908	do	do	do		[b] 12.8
Sept. 24, 1908	do	do	do		[b] 16
Oct. 30, 1908	do	do	do		[a] 1.5
Dec. 3, 1908	do	do	do		[a] 1.5

[a] Discharge estimated. [b] Float measurement.

NOTE.—The measurements of Williams Fork and its tributaries were made by A. L. Fellows and H. F. Fellows in connection with an investigation of water supply for the Intermountain Water Company.

MISCELLANEOUS MEASUREMENTS IN VIRGIN RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in Virgin River drainage basin during 1908:

Miscellaneous measurements of Muddy River in Virgin River basin.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
May 20, 1908	Muddy River	Virgin River	Near Moapa, Nev.	1.70	46.0
June 2, 1908	do	do	do	1.60	40.5
Oct. 10, 1908	do	do	do	1.50	44.8
Dec. 4, 1908	do	do	do	1.67	53.8

NOTE.—The gage heights were taken at the gaging station on Muddy River near Moapa, Nev.

INDEX.

○