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SURFACE WATER SUPPLY OF THE UNITED STATES

1907-8

PART XI. CALIFORNIA

PREPARED UNDER THE DIRECTION OF M. O. LEIGHTON

BY

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SURFACE WATER SUPPLY OF CALIFORNIA, 1907-8.

By W. B. Clapp and W. F. Martin.

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 public 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 in to 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	1892 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 some 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.	1896.
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 7.40 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.

$1\frac{1}{3}$ horsepower equals about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = 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 siutable 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 15, 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, $V=c\sqrt{Rs}$. 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

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

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.

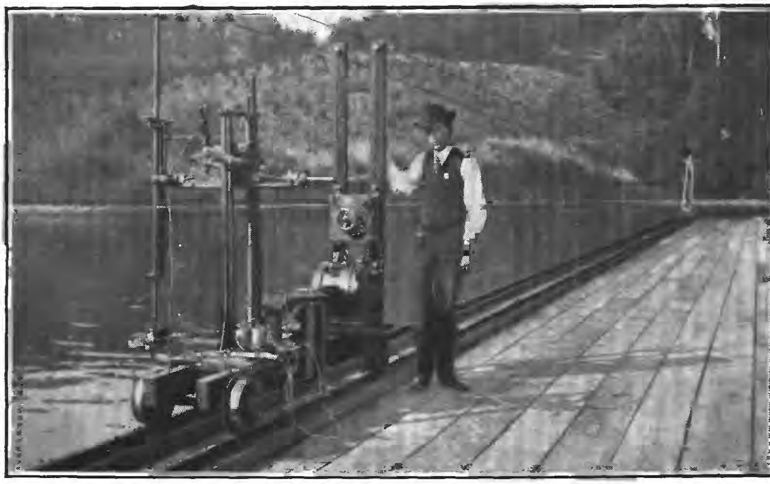
Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. They are located, as far as possible, at such points that the relation between gage height and discharge will always 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 expense 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 semipermanent 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 equally 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 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



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.

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 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.

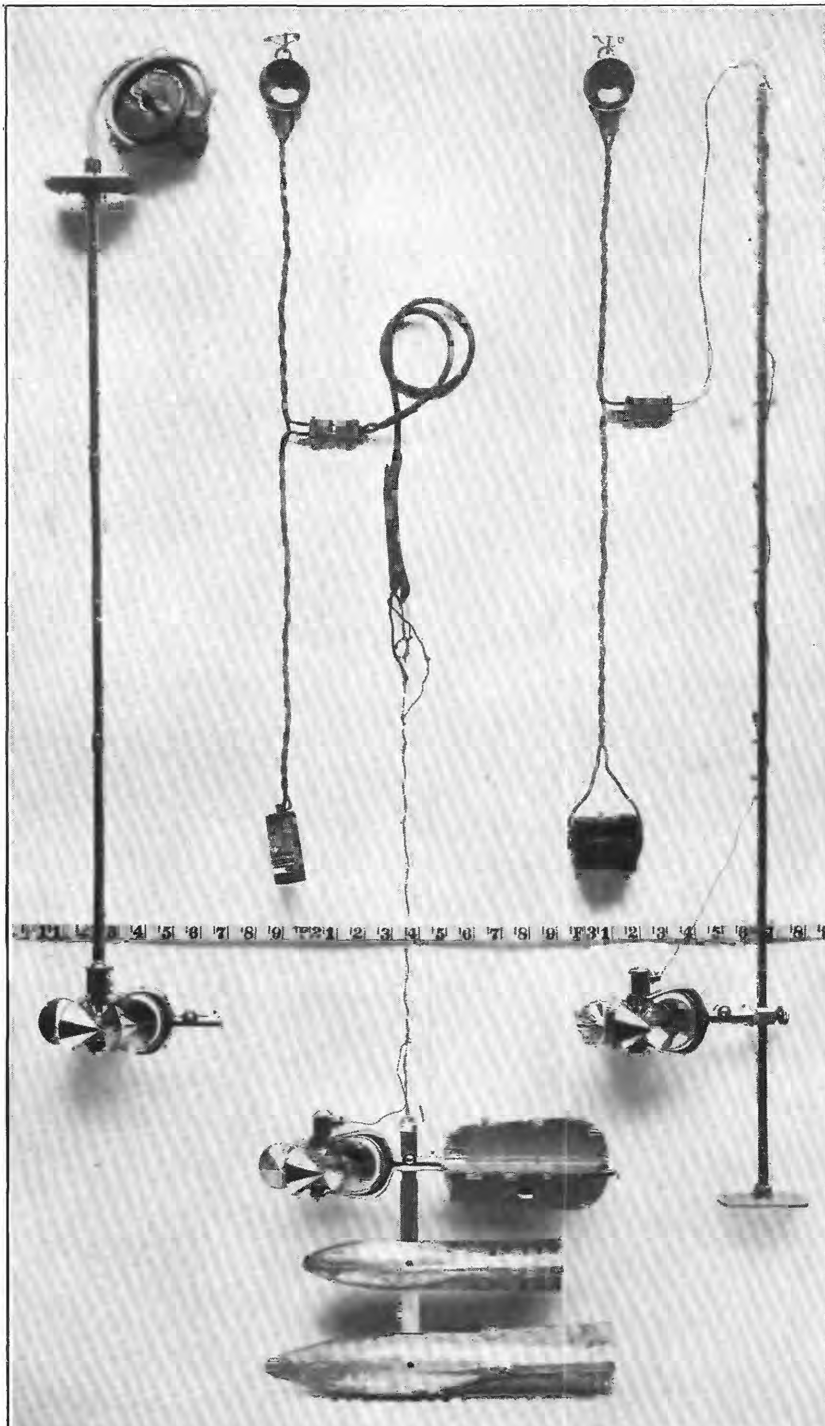
The two principal multiple-point methods in general use are the vertical velocity curve and 0.2 and 0.8 depth.

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



PRICE PENTA-RECORDING CURRENT METERS.

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. 19.) 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. (See fig. 1.) 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

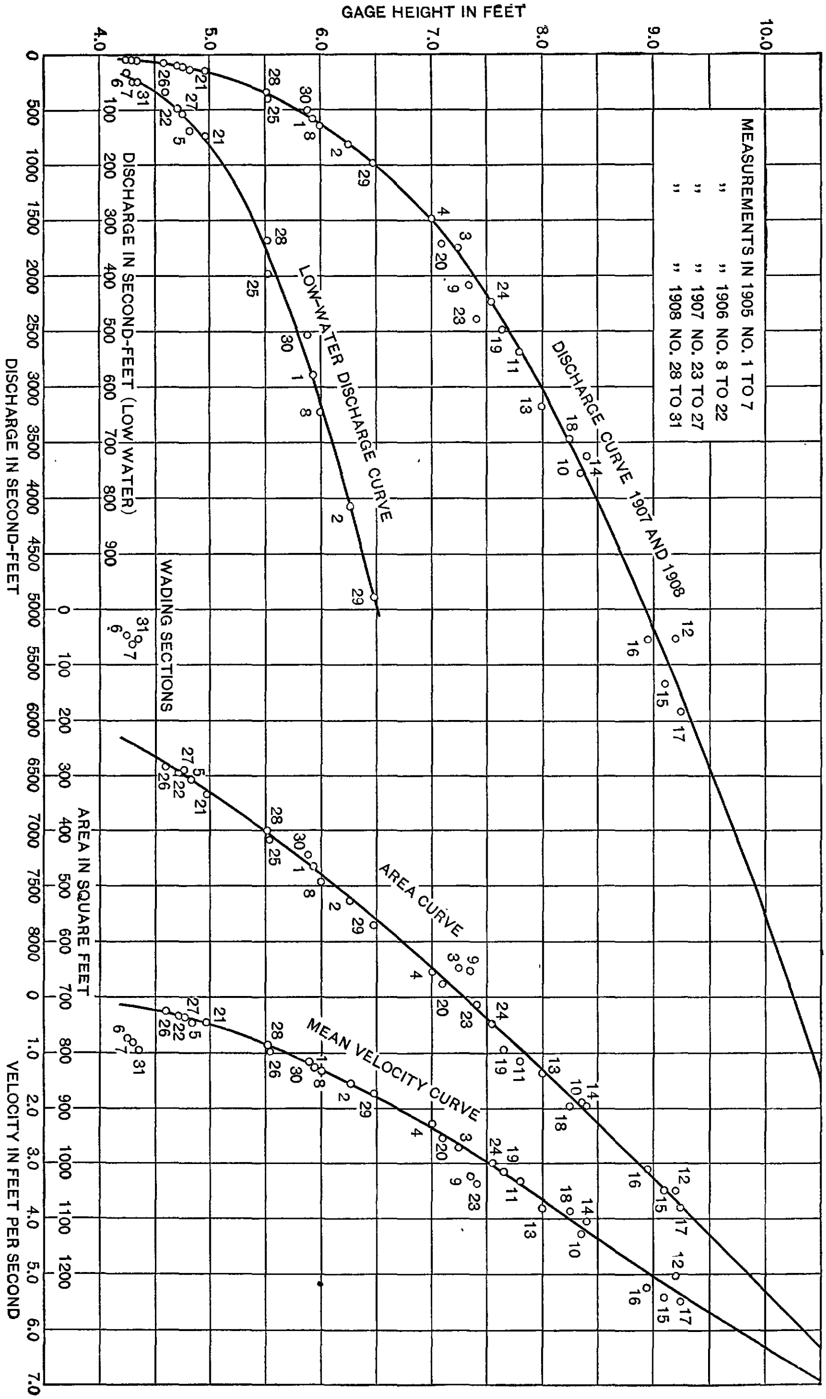


FIGURE 1.—Discharge, area, and mean-velocity curves for Kaweah River below Three Rivers, Cal.

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.

Class 2 is confined mainly to stations on rough mountainous streams with steep slope. 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 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.

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 semipermanent 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 given 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. These measurements are plotted and a mean or standard curve drawn among them. It is assumed that there is a different rating curve for every day of the year and that this rating is parallel to the standard curve with respect to their ordinates. On the day of a measurement the rating curve for that day passes through that measurement. For days between successive measurements it is assumed that the rate of change is uniform, and hence the ratings for the intervening days are equally spaced between the ratings passing through the two measurements. This method must be modified or abandoned altogether under special conditions. Personal judgment and a knowledge of the conditions involved can alone dictate the course to pursue in such cases. For illustrative example of a station of this type, showing the Bolster method of determining the daily discharge graphically, see Water-Supply Paper 249.

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 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 pe rcent; "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.

The hydrographic work of the United States Geological Survey in California is being carried on in cooperation with the State in accordance with acts of the state legislature, approved March 16, 1903, March 20, 1905, and March 11, 1907.

The act of March 16, 1903, which covered the period from July 1, 1903, to June 30, 1905, is in substance as follows:

> The state board of examiners are hereby empowered to enter into contracts with the Director of the United States Geological Survey for the purpose of making topographic maps to the extent of twenty thousand dollars; also for the purpose of gaging streams, surveying reservoir sites and canal locations, for the conservation and utilization of the flood and storm waters of the State, to the extent of fifteen thousand dollars * * *.

The acts of March 20, 1905, and March 11, 1907, are in substance the same as the previous acts, the appropriations being increased to $30,000 for topography and $20,000 for hydrography, and covering the four fiscal years July 1, 1905, to June 30, 1909.

Assistance has been rendered or records furnished by the following, to whom acknowledgment is due: Department of Engineering of the State of California, Nathaniel Ellery, state engineer; James N. Gillett, governor. Thanks are also due to Mr. D. W. Lewis, of Corcoran, Cal., for gage readings in Tulare Lake; to the Kern County Land Company, through A. K. Warren, engineer in charge of water measurements, for the record of Kern River; to the city of Santa Barbara for cooperation in gaging Santa Ynez River; to the Great Western Power Company, through Mr. M. A. Viele, chief engineer, for gage heights and stream measurements on Feather River and tributaries; to the Southern Pacific Company, through its chief engineer, William Hood, for river stage records of San Joaquin River at Herndon, Cal.; to the Los Angeles Aqueduct for cooperation in the Owens River drainage basin; and to the Southern California Mountain Water Company for cooperation on Cottonwood and Pine Valley creeks.

DIVISION OF WORK.

The field work in California, except in the Klamath River basin, was carried on under the direction of W. B. Clapp, assisted by W. F. Martin, W. V. Hardy, W. G. Steward, R. S. Hawley, W. A. Lamb, G. A. Shuey, R. B. Post, and A. T. Barrows. The ratings, computations, and special estimates were made by W. B. Clapp and W. F. Martin, assisted by W. A. Lamb and R. B. Post. The field work in the Klamath River basin was carried on under the direction of J. C. Stevens, assisted by C. E. Ellsworth, Howard Kimble, H. D. McGlashan, and L. F. Hendricks. The ratings and computations were made by F. F. Henshaw, G. C. Stevens, H. D. Padgett, and G. L. Parker. The manuscript was prepared for publication by F. F. Henshaw and R. C. Rice, and edited by Mrs. B. D. Wood.

LOWER COLORADO RIVER BASIN.[a]

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,

[a] For detailed description of Colorado River basin, see Water-Supply Paper 249.

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 Cavin, Fackler, 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	....	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	....	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	16,000
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.		
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. 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, Ariz.

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, the upper section, reading above 24 feet, being the original gage established in 1876. It is located at the railroad bridge, 600 feet above the cable section. 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 16	21.2	19,700	May 29	27.0	61,800
January 3	20.85	24,700	March 18	20.8	16,900	June 1	28.4	72,400
January 5	20.6	18,800	March 20	20.4	14,800	June 3	29.1	77,000
January 7	20.2	15,200	March 25	22.0	26,200	June 6	28.95	87,100
January 9	20.0	15,900	March 27	21.5	20,200	June 8	27.75	80,100
January 11	20.7	18,200	March 30	23.0	31,200	June 10	26.9	72,200
January 14	22.0	29,700	April 1	22.8	29,000	June 12	27.1	81,800
January 16	20.5	20,400	April 3	23.2	32,100	June 15	28.05	94,400
January 18	19.8	16,300	April 6	22.7	29,200	June 17	28.55	101,000
January 21	21.7	27,300	April 8	22.4	27,400	June 19	29.15	106,000
January 23	20.6	22,100	April 10	22.2	24,700	June 22	29.05	108,000
January 25	20.15	15,900	April 13	22.45	25,900	June 24	28.9	112,000
January 28	19.7	13,200	April 15	22.5	26,000	June 26	28.9	114,000
January 30	19.6	12,700	April 17	23.0	29,500	June 29	28.6	115,000
February 2	22.05	29,500	April 20	24.8	41,500	July 1	28.3	113,000
February 4	21.6	27,100	April 22	25.55	46,900	July 6	27.4	107,000
February 6	20.6	18,800	April 24	25.8	49,900	July 8	27.5	108,000
February 8	20.4	17,900	April 27	25.6	45,700	July 10	27.8	110,000
February 11	20.9	20,300	April 29	24.7	44,600	July 15	27.8	114,000
February 13	20.6	17,400	May 1	23.75	35,500	July 17	27.5	110,000
February 16	20.5	16,600	May 4	23.2	32,400	July 20	26.75	102,000
February 18	20.4	14,900	May 6	23.1	33,000	July 22	25.65	92,000
February 20	20.2	14,100	May 8	23.3	33,900	July 24	24.8	82,400
February 23	21.0	17,400	May 11	23.2	32,800	July 29	23.1	58,600
February 25	20.7	15,000	May 13	22.8	30,400	July 31	22.8	55,400
February 28	21.9	22,900	May 15	22.65	29,100	August 3	23.3	61,900
March 2	20.75	16,700	May 18	22.8	28,600	August 5	22.85	55,300
March 5	21.0	18,000	May 20	23.5	31,900	August 7	22.45	50,600
March 9	24.65	46,200	May 22	24.4	37,500	August 10	22.15	49,900
March 11	22.2	26,500	May 25	24.7	41,300	August 12	21.45	41,300
March 13	21.75	24,900	May 27	25.55	51,000	August 14	20.95	33,900

Discharge measurements of Colorado River at Yuma, Ariz., in 1907 and 1908—Cont'd.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sec.-ft.*
August 17	20.45	32,900	January 20	18.1	5,600	August 5	20.7	21,400
August 19	20.25	28,600	January 27	18.4	6,300	August 7	21.1	25,200
August 22	20.25	26,800	January 30	18.4	6,100	August 10	22.05	31,900
August 24	19.95	24,500	February 5	18.7	7,400	August 12	21.8	28,200
August 26	20.5	27,300	February 7	23.95	45,000	August 14	21.05	24,000
August 29	20.3	25,000	February 11	19.7	14,200	August 17	20.6	20,700
August 31	19.6	23,100	February 14	20.0	14,900	August 19	20.4	20,500
September 2	22.25	43,300	February 19	19.7	12,900	August 21	20.45	19,300
September 4	21.25	35,000	February 21	19.9	10,600	August 24	22.4	33,800
September 7	21.25	34,500	February 24	19.7	9,900	August 26	22.1	28,200
September 9	20.75	31,900	February 26	20.65	16,900	August 28	21.6	25,000
September 11	20.5	27,600	March 3	20.25	11,700	August 31	20.65	18,900
September 14	19.65	21,900	March 9	22.2	27,000	September 2	20.4	19,200
September 16	19.2	18,400	March 11	21.1	18,700	September 4	20.1	16,600
September 21	19.0	15,500	March 12	21.9	24,700	September 7	19.6	14,100
September 23	19.0	14,100	March 14	20.6	15,200	September 11	19.3	11,800
September 25	19.0	13,400	March 17	20.05	13,400	September 17	19.1	10,400
September 28	19.1	13,400	March 19	19.85	11,300	September 19	18.8	8,900
October 1	18.9	12,000	March 23	20.2	13,200	September 21	18.7	8,200
October 3	18.8	11,300	March 25	20.45	14,300	September 23	18.65	7,700
October 5	18.7	10,300	March 28	20.95	17,200	September 25	18.6	7,000
October 8	18.75	10,300	March 31	20.8	16,100	September 28	18.8	7,500
October 10	19.1	12,200	April 2	20.8	16,400	September 30	18.8	7,200
October 12	19.7	15,900	April 6	20.4	13,900	October 3	18.9	6,600
October 14	19.75	15,500	April 9	20.2	13,400	October 5	19.4	8,200
October 17	19.6	14,000	April 17	20.6	13,600	October 7	19.5	8,500
October 19	19.5	13,800	April 22	21.1	16,500	October 9	19.8	10,000
October 21	19.55	14,600	April 25	22.0	27,100	October 12	19.5	8,600
October 23	19.95	15,900	April 27	21.95	26,000	October 14	19.8	9,900
October 26	19.5	14,200	April 29	22.05	28,100	October 19	19.3	7,700
October 28	20.25	18,800	May 2	22.7	29,800	October 23	19.4	8,200
October 30	19.9	16,300	May 5	22.0	27,100	October 26	21.15	20,600
November 2	19.55	14,300	May 9	21.4	23,100	October 28	20.05	13,700
November 4	19.4	12,900	May 13	21.65	25,100	October 30	19.75	12,100
November 6	19.3	11,900	May 16	21.55	23,500	November 2	19.3	9,900
November 9	19.1	11,800	May 18	22.2	27,900	November 4	19.2	9,200
November 12	19.1	10,900	May 22	22.3	27,500	November 6	19.3	8,500
November 14	19.1	10,700	May 26	22.15	25,500	November 9	19.3	8,200
November 18	18.8	9,600	May 31	22.8	31,300	November 11	19.4	8,200
November 20	18.8	9,900	June 5	22.6	30,900	November 13	19.5	8,700
November 23	18.8	9,600	June 8	22.4	33,600	November 16	19.5	8,000
November 26	18.7	9,100	June 12	23.3	35,200	November 18	19.6	7,600
November 29	18.7	9,000	June 15	23.3	38,700	November 20	19.6	7,500
December 2	18.5	8,600	June 17	23.3	39,400	November 23	19.55	7,300
December 5	18.3	7,800	June 19	24.35	48,300	November 25	19.7	7,200
December 7	18.3	8,000	June 22	24.95	55,100	November 27	19.7	7,400
December 9	18.3	7,500	June 24	25.25	59,700	November 30	19.2	6,000
December 12	18.3	7,900	June 26	25.35	61,700	December 2	19.2	6,200
December 14	18.5	7,700	June 29	24.6	55,400	December 4	19.4	6,600
December 16	18.45	7,300	July 1	24.5	53,800	December 7	19.6	7,400
December 18	18.4	7,300	July 4	24.2	53,100	December 9	19.6	7,700
December 21	18.4	7,400	July 6	23.8	49,300	December 11	19.55	7,400
December 24	18.35	7,500	July 8	23.05	41,100	December 12	19.5	7,300
December 28	18.15	6,300	July 10	22.3	35,400	December 14	19.4	6,900
December 30	18.1	6,000	July 13	21.9	31,200	December 16	19.1	6,100
			July 15	21.5	29,800	December 17	19.4	7,300
1908.			July 17	21.2	28,800	December 19	27.1	72,500
January 2	18.0	5,800	July 20	21.0	25,600	December 20	27.3	68,900
January 5	18.2	6,400	July 22	20.7	24,600	December 22	21.5	25,400
January 8	18.6	7,400	July 24	20.7	24,100	December 23	23.1	37,200
January 11	18.4	6,900	July 27	20.55	21,600	December 26	20.6	19,400
January 13	18.3	6,700	July 29	20.1	19,300	December 28	19.8	14,800
January 16	18.2	5,900	July 31	20.2	18,900	December 30	19.2	11,200
January 18	18.1	5,600	August 3	20.85	22,700			

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	26.95	28.6	23.1	20.3	19.25	19.7	18.7	18.1
30	19.6	......	23.0	24.3	27.5	28.4	22.8	19.9	19.05	19.9	18.6	18.1
31	19.6	......	23.05	......	27.95	......	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	27,400	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	109,000	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	28,400	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	30,000	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	33,500	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	96,400	.428	.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	.028	.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.

DESCRIPTION.

Salton Sink originally formed a part of the Colorado Desert, which has an area of nearly 2,000 square miles, extends in a northwesterly direction almost 100 miles from the California-Mexico boundary line, and 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 prefectly 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. III, *A*). 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 "shoofly" 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.

SALTON SEA NEAR SALTON.

A record of gage heights was kept on Salton Sea from November, 1904, to February 26, 1906, 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. III, *B*). 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 2½ 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.

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 the 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.

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	73.4	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	75.6	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	74.2	......	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

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

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
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	−0.7	73.5
December	.2	0.8	April	5.6	33.9	October	− .4	73.1
			May	8.6	42.5	November	− .5	72.6
1905.			June	15.4	57.9	December	− .3	72.3
January	1.4	2.2	July	8.6	66.5			
February	1.6	3.8	August	2.9	69.4	1908.		
March	.8	4.6	September	.9	70.3	January	.0	72.3
April	1.2	5.8	October	1.2	71.5	February	− .1	72.2
May	1.0	6.8	November	− .2	71.3	March	− .2	72.0
June	2.2	9.0	December	1.2	72.5	April	− .4	71.6
July	4.4	13.4				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
			May	− .5	75.1	November	− .3	67.6
1906.			June	− .4	74.7	December	− .2	67.4
January	1.1	23.8	July	− .2	74.5			
February	1.8	25.6	August	− .3	74.2			

ALAMO AND NEW RIVERS NEAR BRAWLEY, CAL.

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.

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			

THE GREAT BASIN DRAINAGE.

GENERAL FEATURES.

The Great Basin drainage in California consists of all drainage from the eastern slope of the Sierra Nevada. It comprises all or a part of the drainage basins of Susan River and Honey Lake, Truckee River and Lake Tahoe, Carson River, Walker River, Mono Lake, and Owens River and Lake. Having no outlet to the ocean, the entire run-off from these basins is dissipated mainly through evaporation from the lakes and sinks in which the waters collect.

Investigations of flow have been made on the following streams in the Great Basin drainage in California: Susan River, Truckee River, Carson River, Walker River, tributaries of Mono Lake, Owens River and tributaries of Owens Lake, Mohave River.

Of these streams, the Truckee, Carson, and Walker discharge their waters outside of California, and are therefore not considered in this report.[a]

[a] See Water-Supply Paper 250.

HONEY LAKE BASIN.[a]

Honey Lake occupies a shallow depression in Honey Lake valley, in the southeastern part of Lassen County, Cal. It may be classed as a playa lake, as it is without outlet and becomes completely desiccated during seasons of unusual aridity. It is supplied principally by Susan River, which enters it from the northwest, but it receives also some tribute during the rainy season from Long Valley. The hot springs along its northern border also furnish considerable quantities of water. The area of the lake varies with the seasons as well as from year to year, as is common with all inclosed lakes. Its outline is indefinite, as its shores are usually low and marshy and in places form broad tule swamps. Its waters are quite strongly alkaline, unfit for human use, and are always of a greenish-yellow color, due to the impalpable mud held in suspension.

The following stations have been maintained in Susan River basin:

Susan River near Susanville, Cal. (1900 to 1905).
Willow Creek at Merrillville, Cal. (1904 to 1905).
Willow Creek near Standish, Cal. (1900 to 1905).

MONO LAKE BASIN.[b]

Lake Mono is situated in east-central California, within a few miles of the California-Nevada boundary. The thirty-eighth parallel and the one hundred and nineteenth meridian intersect in the center of the lake. It lies at the eastern base of the Sierra Nevada, and its drainage area forms one of the many independent hydrographic basins into which the vast region included between the Rocky Mountains and the Sierra Nevada, known as the Great Basin, is divided. The western rim of its drainage area, formed by the crest line of the Sierra Nevada, coincides for 36 miles with the western margin of the Great Basin.

Situated at the junction of two well-defined and strongly contrasted geographic provinces, the Mono basin partakes of leading characteristics of each. It is remarkable for its diversity of topography, its varied and striking contrasts of scenery, its wide range of climate, and corresponding variations of flora.

Lake Mono is 6,380 feet above the sea. The lowest pass in the serrate mountain crest along its western border is 3,000 feet above its surface. The highest peaks that overshadow it rise more than 6,000 feet above the level of the lake. The eastern portion of the basin partakes of the character of the arid region of interior drainage of which it forms a part, and includes valleys covered with sagebrush and rugged mountain slopes, which are but scantily clothed with

[a] Russell, I. C., Geological history of Lake Lahontan: Mon. U. S. Geol. Survey, vol. 11, 1885, pp. 55–56.
[b] Russell, I. C., Quaternary history of Mono Valley, Cal.: Eighth Ann. Rept. U. S. Geol. Survey, pt. 1, 1889, pp. 269–270, 287–288.

cedar and piñon. The tone of the landscape in this portion of the basin is gray and russet-brown, characteristic of the desert. Over its entire area no running water can be found during the greater part of the year, and the region is consequently silent and lifeless. To one reared under more humid skies this portion of the Mono basin would appear a veritable desert, but that it is not really a desert is shown by the fact that it produces nutritious bunch grass among the clumps of sagebrush in sufficient abundance to afford pasturage for a few cattle and horses.

The southwestern border of the basin includes magnificent mountains, that are clothed in favored places with forests of pine. The highest peaks reach far above the timber line and bear a varied and beautiful alpine flora. In the canyons that descend from the snow fields and miniature glaciers about the higher summits the rush of creeks and rills is heard throughout the year. The eastern and western portions of this single hydrographic basin are fragments of two distinct geographic provinces. One has the desolation and solitude of the Sahara, the other the rugged grandeur of the Pyrenees.

The lake derives the principal portion of its water supply from the creeks that descend the eastern slope of the Sierra and empty into it from the south and west. Supplementing the surface drainage are a number of springs, some of which are of considerable size.

The creeks tributary to Lake Mono are of clear, pellucid water, and flow through channels excavated for the most part in granite and metamorphosed sediments, but near their mouths they have eroded small gorges through lacustral marls and volcanic lapilli deposited during previous high-water stages of the lake. No chemical analyses of these waters have been made, but they have, without question, the normal purity of mountain streams. We may be sure, however, that like other streams they hold a small percentage of mineral matter in solution, which is left when evaporation takes place.

None of the springs of the basin are highly charged with mineral matter, but, on the contrary, some of the more copious are remarkable for their purity.

With the exception of a very small spring on the road between the town of Aurora and the valley of the same name, all springs of the basin are either in the bottom of the lake or quite near its shores, and they occur in greatest abundance near the base of the mountains. Only three of those that rise on the land have a temperature noticeably above the normal. The character of most of those rising in the bottom of the lake is uncertain. In some instances they reveal their presence in cold weather by the vapor to be seen on the lake surface above them, and are thus known to be thermal.

No gaging stations have been maintained on streams tributary to Mono Lake, but a few miscellaneous measurements were made in 1907. (See p. 332.)

OWENS RIVER BASIN.

DESCRIPTION.

Owens River basin is situated in the eastern part of California in Mono and Inyo counties, east of the main crest of the Sierra, which for a distance of about 140 miles forms the watershed between it and the basin of San Joaquin, Kings, and Kern rivers. It is south of Mono Lake basin and north of the arid region separating it from the Mohave Desert at the south. Its eastern limit is determined by the White Mountains at the north and the Inyo Mountains at the south. The length of the basin is about 120 miles; its width is about 20 miles at the south and 30 miles at the north, and its total area, including Owens Lake, comprises approximately 2,800 square miles, of which about 1,100 square miles are east of the river.

Owens River rises among the high peaks of the Sierra, east of Mount Lyell and directly opposite the headwaters of San Joaquin River, at an altitude of nearly 12,000 feet above sea level. It flows eastward into Long Valley, thence southwestward through Owens River canyon into Owens Valley, thence eastward and southward through the trough of the valley to Owens Lake, about 20 miles southeast of Mount Whitney and directly opposite the northern part of the Kern River basin. The total length of Owens River is about 125 miles—45 miles above the lower end of the canyon and 80 miles in Owens Valley.

Owens River has many tributaries. More than forty lateral streams, many of them, however, comparatively small, drain a part of the eastern slope of the Sierra and enter the main stream from the west. The principal tributaries, from north to south, are as follows: Rock, Pine, Horton, McGee, Birch, and Bishop creeks, opposite the San Joaquin basin; Coyote, Baker, Big Pine, Birch, Tinemaha, Taboose, Goodale, Division, Sawmill (Eightmile), Thibaut, Oak, Pine, and Symmes creeks, opposite Kings River basin; and Shepard, Bairs (Moffett), George, Hogback, Lone Pine, Tuttle, Richter, Cottonwood, and Ash creeks, opposite Kern River basin. No drainage enters Owens River from the east except during exceptionally heavy rainstorms, which are rare.

The basin is long and comparatively narrow and its topography is varied. It comprises a rough east-side mountain slope 5 or 6 miles wide, a valley floor about 6 miles wide, and a west-side slope ranging from 6 to 10 miles or more in width. The west-side area is made up of a very rugged and precipitous mountain slope 4 or 5 miles wide, and a sloping alluvial plain composed of delta-fan surfaces ranging from 1 to 5 miles in width and lying at the foot of the mountains and west of the western margin of the valley. Owens Valley is smooth and ranges in altitude from 3,600 feet at the south end to about 4,100 feet at the north end. The crest of the east-side range of mountains averages about 6,000 feet higher than the valley floor. The west-side plain consists of a porous granitic alluvium of considerable depth, and ranges in altitude from about 4,000 feet at the western valley margin to about 6,000 feet at the foot of the mountains. It has a fairly uniform slope of 400 to 600 feet to the mile. The eastern slope of the Sierra is very steep and rugged, and ranges in altitude from about 6,000 feet at the foot to 13,000 or 14,000 feet at the crest. The geologic formation is granitic.

The basin is rather poorly forested. The eastern slope is practically barren of vegetation, except in places a scanty desert growth. The western slope has a very slight soil covering and only a sparse timber growth, found chiefly along the water courses. All the western slope, a large part of the eastern slope, and the central part of Owens Valley are included in national forests.

The mean annual precipitation in Owens River basin is very light, especially on the valley floor and the eastern slope. The only records available are for the valley and indicate that the mean annual precipitation there is about 5 inches. On the Sierra slope the precipitation probably increases with increase of latitude and certainly increases with increase of altitude. On the higher parts of the slope it is probably 30 or 40 inches and possibly more; and it occurs almost entirely as snow, whose melting feeds the numerous streams that issue from this slope. These streams usually have their minimum flow in February and their maximum in July. Their combined maximum is about ten times their combined minimum. There is about the same ratio of disparity in the monthly extremes of precipitation, but the seasons are reversed.

Owens Valley is extensively cultivated and particularly adapted to stock raising. Numerous diversions are made for irrigation at different points on Owens River and tributaries, particularly in the upper part of the valley. Considerable water is also used for irrigating meadow lands in Long Valley north of Owens River canyon, but it is returned to the river above the head of Owens Valley.

Many excellent reservoir sites exist on the main stream and on the upper reaches of its tributaries.

The basin affords many opportunities for power development. The fall is so great and the minimum flow of the stream is so large and so reliably constant that many thousands of horsepower could be developed. It is estimated that a minimum of more than 100,000 horsepower could be obtained without storage, and this amount could be considerably more than doubled by utilizing all the possible storage. The Los Angeles Aqueduct, when completed, will have a capacity of 400 second-feet and a total fall of more than 3,000 feet from its intake in Owens Valley to its outfall in San Fernando Valley near the city, and will generate more than 100,000 horsepower. A full development of all the power opportunities in Owens River basin would probably yield more than 300,000 horsepower continuously.

Considered as a source of water supply, Owens River basin has other features of special interest. Nearly all the streams rise in glacial lakelets and marshes which are located at high altitudes near the crest of the Sierra, and serve to a certain extent as storage reservoirs in regulating the flow. The streams emerge from the mouths of their canyons upon the porous alluvial plain at the base of the Sierra, which is 1 to 5 miles in width and several hundred feet deep and across which they flow to the Owens River channel in the trough of the valley. This belt of débris is the source of a large and important loss, part of which appears in numerous springs throughout the valley. Perhaps stronger evidence of the great loss by seepage is afforded by the broad belt of wet and somewhat boggy land which extends over a large part of the trough of the basin. Undoubtedly large quantities of water can be obtained by sinking wells within this area. Several artesian wells which have been sunk in the vicinity of Independence yield a strong flow and give convincing evidence of an artesian belt in the valley. With a view to the greatest ultimate utilization of the valley's water supply, the city of Los Angeles is conducting special investigations to determine the depth to and fluctuations in the ground-water plane and the rate of evaporation from free water surface and saturated gravels near Independence; also to determine the amount of precipitation on the alluvial plain at the base of the Sierra between the 4,000 and 6,000 feet contours and the seepage losses of creeks crossing it.

The longest run-off record in Owens River basin extends back to 1903, when stations were established on the main stream and on Rock and Pine creeks near Round Valley, and Bishop Creek near Bishop. The wettest year since that time was 1906 or 1907, and the driest 1905. The total flow during the wettest year was nearly double that during the driest.

The following gaging stations have been maintained in this basin:

Owens River near Round Valley (1903 to 1908).
Owens River near Tinemaha (1906 to 1908).
Rock Creek near Round Valley (1903 to 1908).
Pine Creek near Round Valley (1903 to 1908).
Bishop Creek near Bishop (1903 to 1908).
Baker Creek near Big Pine (1908).
Big Pine Creek near Big Pine (1903 to 1908).
Birch Creek near Tinemaha (1907 to 1908).
Tinemaha Creek near Tinemaha (1907 to 1908).
Taboose Creek near Tibbetts (1906 to 1908).
Goodale Creek near Tibbetts (1906 to 1908).
Division Creek near Tibbetts (1906 to 1908).

Sawmill Creek near Independence (1906 to 1908).
Thibaut Creek near Independence (1908).
Oak Creek near Independence (1905 to 1908).
Independence Creek near Independence (1905 to 1908).
Shepard Creek near Thebe (1906 to 1908).
Bairs Creek near Thebe (1906 to 1908).
George Creek near Thebe (1906 to 1908).
Lone Pine Creek near Lone Pine (1906 to 1908).
Tuttle Creek near Lone Pine (1906 to 1908).
Cottonwood Creek near Olancha (1906 to 1908).
Ash Creek near Olancha (1906 to 1908).

In the fall of 1903 stations were established on five or six of the principal streams in Owens Valley and on numerous diversion canals used for irrigation. These stations were maintained two or three years to obtain general statistical data on the water supply of Owens Valley, and also for the purpose of determining the quantity of water used for irrigation at that time and the suitability of the valley for a reclamation project. After the city of Los Angeles had acquired its extensive holdings in the valley and had taken active steps to utilize the flow of Owens River and tributaries for a municipal water supply, many other stations were established at the request of and in cooperation with the city. Since that time all stations in Owens Valley have been maintained in cooperation with the city of Los Angeles, the city paying all field and maintenance expenses and the National Government furnishing and paying an engineer to do the work.

All stations in Owens Valley, except those on Owens River, are located near the western margin of the valley, and most of them are below the delta fans which extend eastward from the mouths of the canyons and are above all diversions. Almost without exception measurements are made from footbridges or by wading. The current is swift at almost every station and the channel is subject to more or less change.

OWENS RIVER NEAR ROUND VALLEY, CAL.

This station was established August 3, 1903, at the footbridge, 700 feet above the junction of Owens River and Rock Creek, and was destroyed March 19, 1907. A new station was established May 29, 1907, about 100 feet below the old one, but the new gage was not referred to the old datum.

Discharge measurements of Owens River near Round Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 25	G. R. Shuey	34	86	2.15	261
February 12	....do	34	84	2.17	254
March 12	....do	34	82	2.06	232
May 14	....do	19	77	....	350
August 4	Shuey and Post	21	101	3.25	709
August 8	R. B. Post	21	98	3.00	566
August 24	....do	21	79	2.61	369
September 7	....do	18	68	2.52	300
September 23	....do	18	62	2.40	260
October 5	....do	18	62	2.35	251
October 28	....do	20	71	2.50	278
November 17	....do	20	71	2.28	233
December 8	....do	20	66	2.26	243
1908.					
February 22	R. B. Post	21	65	2.20	228
March 29	....do	20	61	2.15	236
May 12	....do	32	76	2.2	222
June 18	....do	32	79	2.35	256
July 15	W. A. Lamb	34	84	2.38	267
August 4	....do	35	92	2.45	311
August 25	....do	33	80	2.15	240
September 17	....do	34	77	2.1	220
October 8	....do	33.5	73	1.95	198
October 23	Barrows and Lamb	33.5	76	2.00	200
November 7	....do	32	75	2.00	187

NOTE.—Beginning August 4, 1907, the gage heights refer to the new gage established May 29, 1907.

Daily gage height, in feet, of Owens River near Round Valley, Cal., for 1907 and 1908.

[T. E. Jones and Llewelyan Roberts, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907. [a]												
1	2.15	2.2	2.25			3.0	3.6	3.45	2.5	2.35	2.35	2.3
2	2.1	2.2	2.3			3.2	3.6	3.45	2.5	2.35	2.35	2.3
3	2.0	2.25	2.3			3.4	3.6	3.45	2.5	2.35	2.35	2.25
4	1.95	2.3	2.35			3.4	3.6	3.4	2.5	2.35	2.3	2.25
5	1.85	2.3	2.4			3.35	3.6	3.3	2.5	2.35	2.3	2.2
6	1.9	2.35	2.4			3.2	3.6	3.2	2.5	2.35	2.3	2.3
7	1.9	2.35	2.35			3.1	3.6	3.2	2.5	2.4	2.3	2.4
8	1.95	2.3	2.3			3.1	3.6	3.1	2.5	2.4	2.3	2.4
9	2.0	2.2	2.25			3.05	3.6	3.0	2.5	2.4	2.3	2.35
10	2.1	2.2	2.25			3.0	3.6	2.9	2.5	2.4	2.3	2.3
11	2.15	2.2	2.2			3.0	3.6	2.9	2.5	2.4	2.3	2.35
12	2.15	2.2	2.05			3.0	3.6	2.9	2.55	2.4	2.3	2.4
13	2.15	2.2	2.25			2.9	3.6	2.85	2.55	2.4	2.3	2.4
14	2.15	2.2	2.3			2.8	3.55	2.85	2.55	2.4	2.3	2.4
15	2.15	2.2	2.3			2.8	3.5	2.85	2.5	2.4	2.3	2.35
16	2.15	2.3	2.25			2.8	3.45	2.85	2.5	2.4	2.3	2.3
17	2.15	2.25	2.5			3.0	3.4	2.8	2.55	2.4	2.3	2.25
18	2.15	2.2	4.2			3.1	3.4	2.8	2.55	2.4	2.3	2.2
19	2.15	2.2	3.0			2.8	3.4	2.75	2.6	2.4	2.3	2.15
20	2.15	2.25	2.5			2.7	3.4	2.75	2.6	2.4	2.25	2.15
21	2.2	2.25	2.7			3.0	3.4	2.7	2.55	2.45	2.25	2.15
22	2.2	2.3	2.5			3.0	3.35	2.7	2.5	2.5	2.25	2.15
23	2.2	2.35	2.5			3.1	3.2	2.65	2.4	2.55	2.25	2.15
24	2.15	2.25	2.4			3.0	3.25	2.6	2.4	2.5	2.25	2.15
25	2.15	2.2	2.4			3.0	3.3	2.6	2.4	2.5	2.25	2.15
26	2.15	2.15	2.4			3.1	3.35	2.6	2.4	2.5	2.25	2.15
27	2.15	2.15	2.4			3.25	3.4	2.55	2.4	2.5	2.3	2.2
28	2.2	2.2	2.4			3.3	3.4	2.55	2.4	2.5	2.3	2.3
29	2.2		2.4		2.8	3.35	3.4	2.5	2.4	2.5	2.3	2.25
30	2.25		2.4		2.9	4.0	3.4	2.5	2.4	2.45	2.3	2.2
31	2.2		2.4		3.0		3.45	2.5		2.4		2.2

[a] Gage destroyed March 19, 1907. Gage heights March 21 to 31, inclusive, estimated by comparison with Rock and Pine creeks. New gage established May 29 about 100 feet below old station.

Daily gage height, in feet, of Owens River near Round Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.2	2.2	2.2	2.15	2.3	2.4	2.4	2.5	2.2	2.0	......	......
2	2.2	2.2	2.2	2.15	2.4	2.4	2.4	2.5	......	2.1	2.0	1.95
3	2.2	2.2	2.15	2.15	2.6	2.4	......	2.6	2.2	......	......	......
4	2.2	2.2	2.15	2.15	2.5	2.5	2.5	2.5	......	2.1	2.0	2.0
5	2.15	2.15	2.15	2.15	2.3	2.4	2.6	2.5	2.2	......	......	......
6	2.15	2.15	2.1	2.15	2.5	2.6	2.4	2.5	2.2	2.1	1.95	2.0
7	2.15	2.1	2.1	2.15	2.4	2.65	2.4	2.6	......	......	......	......
8	2.15	2.1	2.1	2.1	2.4	2.7	2.45	2.6	2.2	1.95	1.95	2.0
9	2.15	2.1	2.1	2.1	2.4	2.6	2.4	2.4	2.2	1.95	......	......
10	2.15	2.1	2.1	2.1	2.3	2.4	2.5	2.35	......	2.0	1.95	1.95
11	2.2	2.1	2.2	2.1	2.3	2.4	2.5	2.3	2.3	2.0	......	......
12	2.2	2.1	2.3	......	2.3	2.5	2.6	2.3	2.3	......	1.95	1.95
13	2.15	2.1	2.7	......	2.3	2.5	2.5	2.35	2.2	2.0	......	......
14	2.15	2.1	2.75	2.2	2.4	2.5	2.6	2.3	......	......	2.0	1.9
15	2.1	2.1	2.8	2.3	2.3	......	2.5	2.35	2.2	2.0	......	......
16	2.1	2.1	2.8	......	2.3	......	2.5	2.4	2.15	......	1.95	1.95
17	2.1	2.1	2.75	2.3	2.4	2.6	2.4	2.3	2.1	2.0	......	......
18	2.1	2.15	2.7	2.3	2.3	2.6	2.4	2.2	2.25	......	1.95	1.9
19	2.15	2.15	2.7	2.4	2.3	2.4	2.4	2.3	2.2	2.0	......	......
20	2.15	2.2	2.7	2.6	2.3	2.35	2.3	2.25	......	......	1.95	1.9
21	2.15	2.2	2.6	2.3	2.3	2.5	2.3	2.2	2.25	2.0	......	......
22	2.2	2.2	2.5	2.3	2.4	2.55	2.4	2.2	......	......	1.95	1.95
23	2.2	2.2	2.4	2.3	2.5	2.4	2.3	2.2	......	2.0	......	......
24	2.25	2.2	2.3	2.3	2.4	2.45	2.3	2.2	2.0	......	1.95	1.95
25	2.3	2.2	2.2	2.3	2.4	2.6	2.3	......	2.0	1.95	......	......
26	2.3	2.2	2.2	2.2	2.5	2.65	2.4	......	......	......	1.95	1.95
27	2.25	2.25	2.2	2.4	2.5	2.6	......	2.2	2.0	2.0	......	......
28	2.25	2.25	2.15	2.4	2.4	2.5	2.4	2.2	......	......	1.95	1.95
29	2.2	2.25	2.15	2.3	2.3	2.5	2.5	2.2	2.0	1.95	......	......
30	2.2	......	2.15	2.4	2.4	2.55	2.4	2.2	......	......	1.95	1.95
31	2.2	......	2.15	......	2.4	......	2.5	2.2	......	2.0	......	1.95

Rating tables for Owens River near Round Valley, Cal.

JANUARY 1, 1906, TO MARCH 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.*
1.60	132	2.30	297	3.00	512	3.70	750
1.70	152	2.40	326	3.10	545	3.80	785
1.80	172	2.50	355	3.20	578	3.90	821
1.90	194	2.60	385	3.30	612	4.00	857
2.00	218	2.70	416	3.40	646	4.10	893
2.10	244	2.80	448	3.50	680	4.20	930
2.20	270	2.90	480	3.60	715		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1903 to 1907, and is well defined between gage heights 1.7 feet and 2.8 feet.

MAY 29, 1907, TO DECEMBER 31, 1908.

1.90	174	2.50	307	3.10	617	3.60	932
2.00	191	2.60	342	3.20	679	3.70	997
2.10	210	2.70	386	3.30	741	3.80	1,062
2.20	231	2.80	441	3.40	804	3.90	1,127
2.30	253	2.90	498	3.50	868	4.00	1,192
2.40	278	3.00	557				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 21 discharge measurements made from August, 1907, to December 31, 1908. It is fairly well defined between gage heights 1.9 feet and 3.3 feet.

Monthly discharge of Owens River near Round Valley, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	284	183	247	15,200	A.
February	312	257	281	15,600	A.
March	929	231	341	21,000	B.
April	....	....	270	16,100	D.
May	....	....	438	26,900	D.
June	1,190	387	616	36,700	B.
July	932	710	856	52,600	B.
August	836	307	432	26,600	B.
September	342	278	305	18,100	B.
October	324	266	285	17,500	B.
November	266	242	252	15,000	B.
December	278	220	245	15,100	B.
The year	1,190	183	381	276,000	
1908.					
January	253	210	227	14,000	B.
February	242	210	223	12,800	B.
March	441	210	279	17,200	B.
April	342	210	242	14,400	B.
May	342	253	274	16,800	B.
June	386	266	313	18,600	B.
July	342	253	289	17,800	B.
August	342	231	264	16,200	B.
September	253	191	222	13,200	B.
October	210	182	192	11,800	B.
November	191	182	184	10,900	B.
December	191	174	182	11,200	B.
The year	441	174	241	175,000	

NOTE.—Monthly mean for April and May, 1907, estimated. Discharges interpolated for days in 1908 when gage was not read.

OWENS RIVER NEAR TINEMAHA, CAL.

This station was regularly established September 20, 1906, but the city of Los Angeles had made frequent measurements since the beginning of 1906. It is located at a basaltic knoll in the floor of the valley, known as Charlies Butte, about 7 miles south of Tinemaha. Measurements are made from a cable.

When the discharge exceeds 1,800 second-feet the left bank overflows and the station is inaccessible. At such times measurements are made from the county bridge near Citrus, about 12 miles below.

The bed of the stream is composed of sand and gravel and is subject to some change between high and low water.

The gage was washed out March 22, 1907, and a new one installed at the same datum on March 30, 1907.

Discharge measurements of Owens River near Tinemaha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 21	G. R. Shuey	82	227	2.62	497
February 7	do	82	234	2.72	544
February 20	do	83	223	2.55	505
March 6	do	83	276	3.47	704
March 30	do	84	234	2.85	536
April 12	do	84	167	1.85	345
April 20	do	64	120	1.33	221
May 3	do	58	98	.80	169
May 17	do	68	133	1.38	253
June 12	do	85	284	3.60	694
June 29	do	85	300	3.71	745
July 7	do	80	524	7.25	1,690
July 11	do	80	440		1,360
August 2	do	83	378	4.90	1,060
August 11	R. B. Post	83	284	3.79	748
August 15	do	83	260	3.29	649
August 31	do	79	167	2.25	381
September 12	do	68	149	1.82	327
September 25	do	63	138	1.55	264
October 21	do	82	223	2.56	463
October 30	do	84	280	3.50	652
November 12	do	84	214	2.92	476
November 25	do	83	226	2.72	481
December 4	do	83	220	2.69	439
1908.					
February 7	R. B. Post	85	270	3.27	677
Do	do	85	270	3.27	675
March 17	do	85	279	3.26	657
March 25	do	83	191	2.35	410
April 8	do	57	109	1.13	181
April 20	do	45	73	.70	115
April 29	do	40	51	.32	62
May 2	do	40	47	.24	52
May 16	do	40	45	.22	56
May 22	do	40	46	.20	58
June 2	do	40	53	.36	71
June 12	do	40	38	.06	54
June 26	do	40	41	.20	60
July 8	do	53	104	1.40	209
July 17	W. A. Lamb	69	122	1.65	275
July 29	do	58	90	.90	168
August 5	do	86	188	2.52	467
August 14	do	85	142	1.77	286
August 28	do	50	74	.80	131
September 20	do	85	106	1.35	224
September 28	do	85	127	1.60	270
October 9	do	83	121	1.52	256
October 24	Barrows and Lamb	86	188	2.13	436
November 5	A. T. Barrows	87	196	2.27	397
November 15	do	87	195	2.24	392
November 27	C. H. Lee	86	179	2.18	370

Daily gage height, in feet, of Owens River near Tinemaha, Cal., for 1907 and 1908.

[Ray Bowers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.7	3.05	2.3	2.9	0.9	2.0	4.5	5.0	2.2	1.6	3.3	2.7
2	2.65	3.0	2.25	2.9	.85	2.5	5.0	4.9	2.1	1.65	3.2	2.7
3	2.6	3.0	2.3	2.85	.8	2.9	5.6	4.8	2.05	1.7	3.15	2.7
4	2.5	2.95	2.35	2.7	.75	3.1	6.05	4.75	2.0	1.75	3.1	2.7
5	2.45	2.9	2.85	2.6	.85	3.6	6.5	4.8	1.95	1.8	3.05	2.75
6	2.5	2.95	3.45	2.5	1.0	3.9	6.9	4.85	1.9	1.9	3.0	2.8
7	2.55	3.0	3.3	2.4	1.15	3.95	7.25	4.65	1.85	2.05	3.0	2.9
8	2.6	3.0	3.05	2.2	1.25	3.9	7.35	4.45	1.8	2.1	3.0	3.1
9	2.7	3.0	2.8	2.1	1.3	3.8	7.3	4.2	1.75	2.2	3.0	3.05
10	2.8	2.9	2.65	2.0	1.3	3.7	7.2	4.0	1.75	2.25	3.0	3.05
11	2.85	2.8	2.5	1.9	1.35	3.6	6.75	3.75	1.8	2.2	2.95	3.2
12	2.95	2.7	2.4	1.8	1.3	3.6	6.65	3.7	1.8	2.15	2.9	3.15
13	3.0	2.6	2.35	1.7	1.3	3.55	6.6	3.5	1.85	2.1	2.9	3.0
14	2.95	2.5	2.35	1.6	1.3	3.55	5.9	3.4	1.9	2.15	2.9	3.0
15	2.9	2.4	2.4	1.7	1.3	3.5	5.8	3.3	1.8	2.2	2.85	2.9
16	2.85	2.3	2.35	1.75	1.25	3.5	5.7	3.25	1.7	2.3	2.8	2.85
17	2.8	2.4	2.45	1.65	1.4	3.4	5.6	3.2	1.65	2.4	2.8	2.8
18	2.75	2.55	3.0	1.55	1.45	3.3	5.5	3.25	1.6	2.5	2.8	2.8
19	2.7	2.45	4.0	1.4	1.55	3.3	5.4	3.3	1.6	2.6	2.8	2.8
20	2.7	2.55	4.9	1.3	1.7	3.1	5.2	3.2	1.6	2.6	2.8	2.75
21	2.7	2.6	6.0	1.25	1.8	3.05	5.0	3.1	1.6	2.6	2.8	2.75
22	2.6	2.6	*a* 5.6	1.2	1.85	3.0	4.9	3.0	1.6	2.7	2.8	2.75
23	2.5	2.65	*a* 5.2	1.15	1.9	3.0	4.8	2.9	1.6	2.85	2.75	2.7
24	2.5	2.6	*a* 4.8	1.1	1.9	3.15	4.75	2.85	1.55	3.05	2.75	2.7
25	2.55	2.55	*a* 4.4	1.0	1.85	3.3	4.9	2.7	1.55	3.3	2.75	2.7
26	2.6	2.5	*a* 4.1	.9	1.85	3.5	5.1	2.6	1.55	3.15	2.75	2.75
27	2.7	2.45	*a* 3.8	.8	1.85	3.65	5.3	2.55	1.55	3.4	2.75	2.75
28	2.8	2.4	*a* 3.5	.85	1.85	3.8	5.25	2.5	1.55	3.7	2.75	3.0
29	2.9	......	*a* 3.1	.9	1.9	3.9	5.2	2.4	1.55	3.6	2.75	2.95
30	3.0	......	2.85	.9	1.95	4.0	5.15	2.3	1.55	3.5	2.75	2.85
31	3.1	......	2.9	......	2.0	......	5.1	2.25	......	3.4	......	2.75
1908.												
1	2.75	2.95	2.8	1.55	.25	.3	.5	1.4	.6	1.55	2.25	2.25
2	2.7	3.1	2.75	1.45	.25	.25	.55	1.5	.6	1.55	2.25	2.3
3	2.7	3.3	2.7	1.35	.2	.25	.6	1.6	.55	1.4	2.25	2.4
4	2.7	3.45	2.6	1.3	.2	.3	.7	2.2	.5	1.5	2.3	2.5
5	2.7	3.55	2.6	1.25	.25	.25	.85	2.6	.45	1.55	2.25	2.55
6	2.7	3.4	2.6	1.2	.3	.2	1.0	3.0	.4	1.6	2.25	2.5
7	2.7	3.25	2.55	1.15	.2	.2	1.35	3.05	.5	1.6	2.25	2.45
8	2.7	3.1	2.55	1.15	.2	.2	1.4	2.8	.55	1.55	2.2	2.45
9	2.65	3.05	2.55	1.15	.2	.1	1.3	2.6	.6	1.55	2.25	2.4
10	2.65	3.1	2.55	1.2	.2	.1	1.4	2.45	.9	1.5	2.25	2.4
11	2.7	3.05	2.55	1.25	.2	.05	1.6	2.4	1.1	1.5	2.2	2.35
12	2.7	3.0	2.55	1.15	.2	.0	1.6	2.15	1.0	1.5	2.2	2.3
13	2.75	2.9	2.6	1.1	.2	− .05	1.7	2.0	1.1	1.55	2.25	2.3
14	2.8	2.8	2.6	1.05	.2	− .05	1.7	1.8	1.1	1.6	2.25	2.25
15	2.8	2.7	2.8	1.0	.25	− .05	1.75	1.65	1.15	1.6	2.25	2.25
16	2.8	2.7	3.0	.9	.25	− .05	1.8	1.55	1.2	1.65	2.25	2.2
17	2.75	2.7	3.25	.75	.2	+ .4	1.65	1.5	1.2	1.7	2.25	2.2
18	2.7	2.7	3.4	.75	.25	.5	1.4	1.35	1.25	1.7	2.2	2.15
19	2.7	2.7	3.4	.7	.25	.4	1.25	1.2	1.3	1.7	2.2	2.1
20	2.7	2.7	3.15	.8	.2	.3	1.1	1.05	1.35	1.8	2.2	2.0
21	2.7	2.7	2.9	.65	.2	.2	1.1	.9	1.35	1.9	2.2	2.05
22	2.7	2.8	2.7	.5	.2	.2	1.05	.9	1.3	2.0	2.25	2.1
23	2.8	3.2	2.5	.5	.2	.15	1.0	.85	1.3	2.05	2.25	2.2
24	3.0	3.1	2.4	.45	.2	.15	.9	.8	1.35	2.1	2.25	2.2
25	3.0	2.9	2.3	.4	.25	.2	.9	.75	1.4	2.1	2.2	2.2
26	3.0	2.85	2.2	.4	.3	.2	.8	.75	1.5	2.1	2.2	2.2
27	3.05	2.8	2.1	.35	.2	.2	.7	.8	1.6	2.1	2.2	2.25
28	3.1	2.75	1.95	.35	.2	.3	.75	.8	1.5	2.1	2.2	2.25
29	3.05	2.75	1.85	.3	.2	.3	.9	.8	1.5	2.15	2.25	2.3
30	3.0	......	1.75	.3	.2	.4	1.1	.7	1.55	2.2	2.25	2.3
31	3.0	......	1.65	......	.25	......	1.25	.6	......	2.2	......	2.3

a Estimated.

Rating tables for Owens River near Tinemaha, Cal.

FOR 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.*
0.70	159	2.00	355	3.30	631	5.20	1,131
.80	170	2.10	373	3.40	655	5.40	1,185
.90	181	2.20	391	3.50	680	5.60	1,239
1.00	194	2.30	410	3.60	705	5.80	1,293
1.10	208	2.40	430	3.70	731	6.00	1,347
1.20	222	2.50	451	3.80	757	6.20	1,401
1.30	238	2.60	472	3.90	783	6.40	1,455
1.40	254	2.70	494	4.00	809	6.60	1,509
1.50	270	2.80	516	4.20	861	6.80	1,563
1.60	286	2.90	538	4.40	915	7.00	1,617
1.70	302	3.00	561	4.60	969	7.20	1,672
1.80	319	3.10	584	4.80	1,023	7.40	1,728
1.90	337	3.20	607	5.00	1,077		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 24 discharge measurements made during 1907 and is fairly well defined.

FOR 1908.

0.00	40	1.00	159	2.00	346	3.00	592
.10	47	1.10	175	2.10	367	3.10	619
.20	56	1.20	191	2.20	390	3.20	646
.30	66	1.30	209	2.30	413	3.30	674
.40	77	1.40	227	2.40	437	3.40	702
.50	89	1.50	245	2.50	462	3.50	730
.60	102	1.60	264	2.60	487	3.60	758
.70	115	1.70	284	2.70	513		
.80	129	1.80	304	2.80	539		
.90	143	1.90	325	2.90	565		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 26 discharge measurements made during 1908 and is well defined.

Monthly discharge of Owens River near Tinemaha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	584	440	500	30,700	B.
February	572	410	493	27,400	B.
March	1,350	400	646	39,700	B.
April	538	170	315	18,700	B.
May	355	164	264	16,200	B.
June	809	355	660	39,300	B.
July	1,710	942	1,280	78,600	B.
August	1,080	400	698	42,900	B.
September	391	278	310	18,400	B.
October	731	286	460	28,300	B.
November	631	505	538	32,000	B.
December	607	494	527	32,400	B.
The year	1,710	164	558	405,000	
1903.					
January	619	500	539	33,100	B.
February	744	513	584	33,600	B.
March	702	274	485	29,800	C.
April	255	66	145	8,630	B.
May	66	56	58.1	3,570	B.
June	89	36	56.9	3,390	B.
July	304	89	188	11,600	B.
August	605	102	274	16,800	B.
September	264	77	173	10,300	B.
October	390	227	298	18,300	B.
November	413	390	397	23,600	B.
December	474	346	409	25,100	B.
The year	744	36	300	218,000	

ROCK CREEK NEAR ROUND VALLEY, CAL.

This station was established August 3, 1903, at the wagon bridge on the Bishop and Long Valley road, about two-thirds of a mile above the mouth of the creek.

Discharge measurements of Rock Creek near Round Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24	G. R. Shuey	14	20	1.75	44
February 11	do	13	17	1.50	36
March 12	do	11	13	1.23	23
April 23	do	15	19	1.60	42
May 15	do	14	22	1.85	54
May 30	do	14	29	2.40	84
July 3	do	14	38	3.10	132
July 24	do	14	36	2.90	122
August 4	Shuey and Post	14	34	2.80	107
August 8	R. B. Post	14	29	2.40	85
August 24	do	14	24	1.95	59
September 7	do	14	20	1.75	47
September 23	do	13	16	1.50	33
October 5	do	13	16	1.55	35
October 28	do	14	22	1.85	54
November 17	do	14	18	1.65	39
December 8	do	13	17	1.50	33
1908.					
February 22	R. B. Post	14	25	2.15	70
March 29	do	12	12	1.19	23
May 12	do	12	12	1.15	22
June 18	do	12	12	1.25	25
July 15	W. A. Lamb	14	19	1.43	40
August 4	do	15	27	2.00	73
August 26	do	13	17	1.25	33
September 17	do	14	18	1.46	35
October 7	do	14.5	16	1.39	29
October 22	A. T. Barrows	14	16	1.35	31
November 6	do	14.5	9.3	1.23	16
November 26	Barrows and Lee	14.5	15	1.30	25

Daily gage height, in feet, of Rock Creek near Round Valley, Cal., for 1907 and 1908.

[T. E. Jones and Llewelyan Roberts, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.6	1.6	1.45	1.55	1.65	3.0	3.9	2.8	1.7	1.55	1.75	1.5
2	1.6	1.6	1.5	1.5	1.65	3.2	3.8	2.8	1.7	1.55	1.75	1.5
3	1.55	1.6	1.5	1.5	1.7	3.2	3.8	2.8	1.7	1.55	1.7	1.4
4	1.55	1.55	1.8	1.5	1.7	3.2	3.8	2.7	1.75	1.55	1.7	1.45
5	1.5	1.55	2.1	1.45	1.75	3.1	3.8	2.6	1.75	1.55	1.7	1.4
6	1.5	1.55	2.0	1.4	1.75	3.0	3.8	2.6	1.75	1.55	1.65	1.7
7	1.55	1.55	1.6	1.35	1.8	2.9	3.85	2.6	1.75	1.5	1.65	1.8
8	1.6	1.6	1.55	1.3	1.85	2.8	3.85	2.55	1.75	1.5	1.6	1.75
9	1.65	1.6	1.5	1.35	1.9	2.6	3.85	2.5	1.75	1.5	1.6	1.7
10	1.65	1.65	1.5	1.4	1.9	2.5	3.9	2.4	1.7	1.4	1.65	1.65
11	1.7	1.65	1.5	1.4	1.9	2.5	3.9	2.35	1.7	1.4	1.65	1.65
12	1.7	1.6	1.2	1.45	1.95	2.5	3.9	2.3	1.7	1.35	1.6	1.6
13	1.7	1.6	1.2	1.45	2.0	2.3	3.9	2.25	1.65	1.35	1.6	1.6
14	1.7	1.6	1.25	1.5	2.1	2.2	3.9	2.25	1.65	1.4	1.6	1.6
15	1.7	1.6	1.4	1.5	2.1	2.0	3.85	2.3	1.6	1.5	1.65	1.5
16	1.7	1.6	1.4	1.5	2.1	2.0	3.8	2.3	1.6	1.7	1.65	1.45
17	1.7	1.55	1.8	1.5	2.15	1.9	3.8	2.4	1.65	1.7	1.65	1.4
18	1.75	1.55	2.1	1.5	2.2	1.8	3.8	2.35	1.65	1.65	1.65	1.4
19	1.75	1.5	1.9	1.5	2.2	2.0	3.6	2.3	1.7	1.6	1.65	1.35
20	1.7	1.5	1.8	1.5	2.3	2.0	3.4	2.25	1.7	1.7	1.7	1.35

Daily gage height, in feet, of Rock Creek near Round Valley, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	1.65	1.5	1.9	1.5	2.3	2.5	3.2	2.2	1.65	2.2	1.7	1.35
22	1.65	1.5	1.7	1.5	2.35	2.5	3.0	2.2	1.6	2.25	1.7	1.3
23	1.65	1.5	1.7	1.5	2.4	2.6	2.8	2.15	1.5	2.3	1.7	1.3
24	1.65	1.45	1.65	1.5	2.45	2.6	2.6	2.1	1.5	2.25	1.7	1.3
25	1.65	1.4	1.65	1.5	2.5	2.4	2.6	2.0	1.5	2.0	1.7	1.3
26	1.65	1.35	1.65	1.55	2.6	2.5	2.7	1.9	1.5	1.85	1.7	1.35
27	1.65	1.35	1.6	1.6	2.7	2.6	2.8	1.8	1.5	1.85	1.65	1.4
28	1.65	1.4	1.6	1.6	2.8	2.9	2.9	1.75	1.5	1.85	1.6	1.4
29	1.6		1.6	1.6	2.9	3.6	2.9	1.7	1.5	1.85	1.55	1.4
30	1.6		1.6	1.6	3.0	4.0	2.85	1.6	1.5	1.8	1.5	1.45
31	1.6		1.55		3.0		2.85	1.6		1.8		1.5
1908.												
1	1.5	1.5	1.4	1.2	1.5	1.3	1.8	1.7	1.2	1.4		
2	1.45	1.5	1.4	1.2	1.4	1.3	1.7	2.0		1.4	1.2	1.2
3	1.45	1.45	1.4	1.2	1.3	1.2		2.0	1.2			
4	1.45	1.4	1.4	1.2	1.4	1.2	1.75	1.9		1.35	1.15	1.3
5	1.45	1.35	1.4	1.2	1.15	1.3	1.8	1.9	1.25			
6	1.5	1.3	1.4	1.2	1.5	1.4	1.7	2.0	1.2	1.4	1.2	1.3
7	1.5	1.3	1.4	1.2	1.0	1.4	1.8	2.0				
8	1.5	1.25	1.4	1.15	1.3	1.4	1.9	1.9	1.2	1.4	1.2	1.25
9	1.5	1.25	1.4	1.15	1.2	1.4	1.85	2.0	1.2			
10	1.5	1.3	1.4	1.15	1.3	1.4	2.0	2.0			1.2	1.3
11	1.5	1.3	1.4	1.2	1.1	1.4	1.85	2.0	1.1	1.3		
12	1.4	1.3	1.4		1.1	1.3	2.0	1.9	1.15		1.2	1.3
13	1.35	1.35	1.4		1.2	1.5	1.9	2.1	1.2	1.0		
14	1.2	1.4	1.35	1.0	1.1	1.3	2.0	2.0			1.2	1.3
15	1.2	1.4	1.35	1.0	1.3	1.4	1.8	1.8	1.35	1.0		
16	1.15	1.4	1.35	1.0	1.2	1.45	1.7	1.9			1.15	1.25
17	1.15	1.4	1.4	1.0	1.3	1.5	1.7	1.8		1.3		
18	1.15	1.4	1.4	1.0	1.2	1.4	1.6	1.5	1.4		1.2	1.3
19	1.2	1.4	1.4	1.1	1.2	1.4	1.6	1.4	1.45	1.1		
20	1.2	1.35	1.35	1.1	1.3	1.4	1.5	1.3			1.2	1.3
21	1.2	1.35	1.3	1.1	1.3	1.5	1.4	1.2	1.5	1.2		
22	1.3	1.7	1.25	1.0	1.3	1.5	1.4	1.2			1.15	1.3
23	1.3	1.45	1.25	1.1	1.3	1.35	1.3	1.2	1.6			
24	1.3	1.45	1.2	1.2	1.4	1.4	1.2		1.7		1.15	1.3
25	1.35	1.4	1.15	1.2	1.3	1.5	1.3		1.7	1.25		
26	1.4	1.4	1.1	1.2	1.3	1.5	1.3				1.1	1.3
27	1.4	1.4	1.05	1.3	1.3	1.45		1.2	1.6	1.2		
28	1.4	1.4	1.2	1.3	1.3	1.4	1.4	1.3			1.15	1.3
29	1.4	1.4	1.2	1.3	1.2	1.4	1.5	1.3	1.5	1.1		
30	1.45		1.2	1.4	1.3	1.45	1.7				1.2	1.3
31	1.5		1.2		1.3		1.7	1.2		1.2		1.3

Rating tables for Rock Creek near Round Valley, Cal.

FOR 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	22	2.00	61	2.80	111	3.60	167
1.30	26	2.10	67	2.90	118	3.70	174
1.40	30	2.20	73	3.00	125	3.80	181
1.50	34	2.30	79	3.10	132	3.90	188
1.60	39	2.40	85	3.20	139	4.00	195
1.70	44	2.50	91	3.30	146		
1.80	49	2.60	97	3.40	153		
1.90	55	2.70	104	3.50	160		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 17 discharge measurements made during 1907. It is fairly well defined between gage heights 1.2 feet and 3.1 feet. Above gage height 2.6 feet the rating curve is a tangent, the difference being 7 per tenth.

Rating tables for Rock Creek near Round Valley, Cal.—Continued.

FOR 1908.

[The daily discharges were obtained by the indirect method for shifting channels.]

Monthly discharge of Rock Creek near Round Valley, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	46	34	41.1	2,530	C.
February	42	28	36.0	2,000	C.
March	67	22	40.7	2,500	C.
April	39	26	33.5	1,990	C.
May	125	42	72.6	4,460	C.
June	195	49	101	6,010	C.
July	188	97	157	9,650	C.
August	111	39	77.6	4,770	C.
September	46	34	40.9	2,430	C.
October	79	28	44.6	2,740	C.
November	46	34	41.9	2,490	C.
December	49	26	33.6	2,070	C.
The year	195	22	60.0	43,600	
1908.					
January	35	22	29	1,780	D.
February	45	24	30	1,730	D.
March	30	18	27	1,660	D.
April	30	17	22	1,310	D.
May	35	17	25	1,540	D.
June	35	23	30	1,790	D.
July	73	31	52	3,200	D.
August	80	31	53	3,260	D.
September	49	28	36	2,140	D.
October	31	17	25	1,540	D.
November	23	21	22	1,310	D.
December	26	23	26	1,600	D.
The year	80	17	31	22,900	

NOTE.—The daily discharges for 1908 were obtained by the indirect method for shifting channels.

PINE CREEK NEAR ROUND VALLEY, CAL.

This station was originally established August 3, 1903, at a point about 100 feet above the mouth of the creek, and 150 feet below the bridge on the road from Bishop to Long Valley. It was reestablished May 13, 1908, at a point about 300 feet above the bridge, and 550 feet from the mouth of the creek. Gage heights after that date are not comparable with any previous records.

Discharge measurements of Pine Creek near Round Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 13	G. R. Shuey	12	17	2.95	11
March 12	do	12	17	2.95	9.1
April 26	do	12	16	3.00	13
May 15	do	12	16	3.05	13
May 30	do	12	30	3.60	53
July 3	do	12	46	4.70	213
July 24	do	21	39	4.20	182
August 4	Shuey and Post	20	34	4.00	138
August 24	R. B. Post	18	22	3.48	52
September 7	do	17	20	3.30	41
September 23	do	19	14	3.05	22
October 5	do	16	13	2.98	18
November 17	do	14	11	2.89	13
1908.					
February 22	R. B. Post	9	14	3.02	17
March 29	do	7	10	2.69	5.9
May 13	do	7	10	3.48	4.4
June 18	do	8	13	3.87	20
July 15	Post and Lamb	10	19	4.19	50
August 3	W. A. Lamb	10	21	4.32	67
August 25	do	9	10	3.38	3.8
September 16	do	9	13	3.60	10
October 7	do	9	13	3.60	9.7
October 22	A. T. Barrows	9	12	3.51	6.6
November 6	do		12	3.49	5.6
November 26	Barrows and Lee	9	11.6	3.45	4.9

NOTE.—Beginning May 13, 1908, the gage heights refer to the new gage.

Daily gage height, in feet, of Pine Creek near Round Valley, Cal., for 1907 and 1908.

[T. E. Jones and Llewelyan Roberts, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.95	3.0	2.95	2.95	3.0	4.0	4.8	4.3	3.4	3.0	3.0	2.9
2	2.95	3.0	2.95	2.95	3.0	4.1	4.7	4.3	3.4	3.0	3.0	2.9
3	2.95	3.0	2.95	3.0	3.0	4.2	4.7	4.3	3.4	3.0	3.0	2.9
4	2.95	3.0	3.1	3.0	3.0	4.3	4.65	4.2	3.35	3.0	3.0	2.9
5	2.95	3.0	3.3	3.0	3.0	4.3	4.65	4.1	3.35	3.0	2.9	2.9
6	2.95	3.0	3.2	2.95	3.0	4.2	4.6	4.0	3.3	3.0	2.85	2.95
7	2.95	3.0	3.1	2.95	3.0	4.1	4.6	4.0	3.3	3.0	2.85	2.95
8	2.95	3.0	3.1	2.95	2.95	4.05	4.5	3.9	3.3	3.0	2.8	2.95
9	2.9	3.0	3.0	3.0	2.9	4.0	4.4	3.9	3.3	3.0	2.8	2.9
10	2.9	3.0	3.1	3.0	2.9	4.0	4.4	3.8	3.25	3.0	2.85	2.9
11	2.9	3.0	3.2	3.0	2.9	3.9	4.3	3.75	3.2	3.0	2.9	2.9
12	2.9	3.0	2.95	3.0	3.0	3.8	4.3	3.7	3.2	3.0	3.0	2.9
13	2.9	3.0	2.9	3.0	3.1	3.8	4.3	3.75	3.2	3.0	3.0	2.85
14	2.9	3.0	2.9	3.0	3.2	3.7	4.4	3.75	3.2	3.0	2.9	2.85
15	2.9	3.0	2.85	3.0	3.25	3.5	4.35	3.8	3.2	3.0	2.9	2.85
16	2.9	3.0	2.95	3.0	3.3	3.2	4.3	3.8	3.2	3.0	2.9	2.85
17	2.9	3.0	2.9	3.0	3.3	3.0	4.2	3.8	3.2	3.0	2.9	2.85
18	2.95	3.0	3.1	3.0	3.4	3.0	4.2	3.8	3.2	3.0	2.9	2.85
19	2.95	3.0	3.1	3.0	3.4	3.7	4.2	3.8	3.15	3.0	2.9	2.85
20	2.95	3.0	3.1	3.0	3.4	3.65	4.25	3.75	3.1	3.0	2.9	2.85
21	3.0	3.0	3.1	3.0	3.35	4.0	4.25	3.7	3.1	3.05	2.9	2.85
22	3.0	3.0	3.0	3.0	3.35	4.0	4.3	3.7	3.05	3.05	2.9	2.9
23	3.0	3.0	3.0	3.0	3.3	4.1	4.3	3.6	3.05	3.1	2.9	2.9
24	3.0	2.95	3.0	3.0	3.3	4.0	4.3	3.5	3.05	3.05	2.9	2.9
25	3.0	2.95	3.0	3.0	3.3	4.0	4.2	3.5	3.1	3.0	2.9	2.9
26	3.0	2.9	3.0	3.0	3.4	4.1	4.15	3.45	3.1	3.0	2.9	2.9
27	3.0	2.9	3.0	3.0	3.5	4.45	4.1	3.4	3.05	2.95	2.9	2.9
28	3.0	2.95	3.0	3.0	3.6	4.7	4.1	3.4	3.0	2.95	2.9	2.9
29	3.0		3.0	3.0	3.7	4.9	4.2	3.4	3.0	3.0	2.9	2.85
30	3.0		3.0	3.0	3.8	5.0	4.2	3.4	3.0	3.0	2.9	2.85
31	3.0		3.0		4.0		4.25	3.4		3.0		2.85

Daily gage height, in feet, of Pine Creek near Round Valley, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.9	2.75	2.7	2.8	2.3	3.4	3.9	4.4	3.4	3.7	......	......
2	2.9	2.75	2.7	2.75	2.4	3.4	3.95	4.4	......	3.7	3.5	3.4
3	2.9	2.75	2.7	2.7	[a] 2.4	3.4	4.0	4.4	3.4	......	......	......
4	2.9	2.75	2.75	2.7	[a] 2.4	3.5	4.0	4.4	......	3.65	3.45	3.4
5	2.9	2.75	2.75	2.7	[a] 2.4	3.4	4.2	4.3	3.4	......	......	......
6	2.9	2.75	2.7	2.7	[a] 2.4	3.6	4.3	4.3	3.4	3.5	3.45	3.4
7	2.85	2.7	2.7	2.7	[a] 2.4	3.6	4.3	4.4	......	......	......	......
8	2.85	2.7	2.7	2.7	[a] 2.3	3.7	4.3	4.5	3.4	3.5	3.45	3.4
9	2.8	2.7	2.7	2.65	[a] 2.3	3.6	4.3	4.45	3.4	......	......	......
10	2.8	2.7	2.7	2.65	[a] 2.3	3.8	4.4	4.4	......	......	3.45	3.4
11	2.8	2.7	2.7	2.6	[a] 2.3	3.8	4.45	4.5	3.4	3.5	......	......
12	2.8	2.7	2.7	[a] 2.5	[a] 2.3	3.75	4.5	4.3	3.4	......	3.45	3.4
13	2.8	2.7	2.7	[a] 2.35	3.2	3.8	4.6	4.4	3.4	3.5	......	......
14	2.8	2.7	2.7	2.2	3.4	3.7	4.6	4.4	......	......	3.5	3.4
15	2.8	2.7	2.65	2.2	3.4	3.8	4.5	4.1	3.5	3.5	......	......
16	2.8	2.7	2.65	2.1	3.3	3.85	4.6	4.0	3.6	......	3.45	3.4
17	2.85	2.7	2.65	2.1	3.2	3.9	4.5	3.9	......	3.6	......	......
18	2.85	2.75	2.65	2.5	3.1	3.8	4.4	3.8	3.5	......	3.4	3.4
19	2.85	2.8	2.65	2.6	3.2	3.9	4.4	3.75	3.5	3.5	......	......
20	2.85	2.8	2.65	2.3	3.4	3.9	4.3	3.7	......	......	3.45	3.4
21	2.8	2.85	2.65	2.3	3.6	3.95	4.1	3.7	3.6	3.65	......	......
22	2.85	3.05	2.7	2.3	3.3	3.9	4.2	3.7	......	......	3.45	3.4
23	2.85	3.0	2.75	2.3	3.4	3.8	4.15	3.7	3.7	......	......	......
24	2.9	3.0	2.75	2.5	3.3	3.9	4.0	3.65	3.7	......	3.45	3.4
25	2.9	2.9	2.7	2.5	3.4	3.95	4.0	[a] 3.4	3.7	3.5	......	......
26	2.9	2.85	2.75	2.5	3.3	4.0	4.2	[a] 3.45	......	......	3.45	3.4
27	2.9	2.8	2.75	2.6	3.3	3.9	[a] 4.2	3.5	3.7	3.55	......	......
28	2.85	2.75	2.8	2.5	3.4	3.9	4.2	3.5	......	......	3.4	3.45
29	2.85	2.7	2.8	2.5	3.4	3.9	4.3	3.45	3.7	3.5	......	......
30	2.8	......	2.8	2.5	3.3	3.9	4.3	[a] 3.4	......	......	3.4	3.4
31	2.8	......	2.8	......	3.4	......	4.4	3.4	......	3.5	......	......

[a] Estimated.

Monthly discharge of Pine Creek near Round Valley, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	12	9	10.4	640	C.
February	12	9	11.6	644	C.
March	27	8	13.4	824	C.
April	12	10	11.7	696	C.
May	105	9	28.3	1,740	C.
June	262	12	111	6,600	C.
July	230	159	193	11,900	C.
August	206	46	101	6,210	C.
September	46	19	30.8	1,830	C.
October	24	19	19.3	1,190	C.
November	19	11	15.3	910	C.
December	17	13	14.4	885	C.
The year	262	8	46.7	34,100	
1908.					
January	12	8.4	10.1	621	C.
February	20	5.8	8.2	472	C.
March	8.4	4.9	6.2	381	C.
April	8.4	1.0	3.6	214	C.
May	9	1.0	2.8	172	C.
June	31	4.0	17.5	1,040	C.
July	104	24	62.0	3,810	C.
August	90	4.0	42.0	2,580	C.
September	13	4.0	7.5	446	C.
October	13	6.0	7.7	474	C.
November	6	4.0	4.7	280	C.
December	5	4.0	4.0	246	C.
The year	104	1.0	14.7	10,700	

NOTE.—The daily discharges were obtained from several rating tables covering short periods of time.

BISHOP CREEK NEAR BISHOP, CAL.

This station was established August 10, 1903, at the wagon bridge on the Bishop road, about 4 miles southwest of Bishop and 2 miles below the mouth of Bishop Creek canyon. The North Hillside canal, South Hillside canal, and Powers canal are taken out above the station.

From May to August, 1907, the daily flow of the creek was obtained from readings on a 30-foot weir located about 3 miles above the mouth of the canyon and above all diversions. The filling of the basin above the weir during the high water of June, 1907, caused considerable velocity of approach, for which allowance was made in estimates from June 25 to July 31, 1907.

Discharge measurements of Bishop Creek and canals near Bishop, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height.	Discharge.		
			Creek.	Canals.	Total.
1907.		*Feet.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
January 25	G. R. Shuey	1.95	53	0	53
February 14	do	1.90	57	1.3	58
March 9	do	1.80	45	1.2	46
March 18	do	2.05	70	0	70
April 5	do	1.90	50	1.4	51
April 24	do	2.40	112	23	135
April 29	do	2.55	135	19	154
September 6	R. B. Post	2.30	89	16	105
September 22	do	2.10	56	16	72
October 4	do	1.87	43	28	71
October 28	do	1.90	44	11	55
November 16	do	1.95	49	6	55
December 9	do	1.58	37	10	47
1908.					
February 23	R. B. Post	2.00	73	0	73
March 26	do	2.10	70	10	80
May 13	do	2.10	72	12	84
June 19	do	2.30	97	9	106
July 15	Lamb and Post	2.95	184	36	220
August 3	W. A. Lamb	3.50	319	31	350
August 25	do	1.96	60	16	76
September 16	do	2.00	60	19	79
October 7	do	2.05	64	17	81
October 22	Lamb and Barrows	1.94	54	10	64
November 6	A. T. Barrows	2.09	72	3	75
November 25	Barrows and Lee	1.92	56	12	68

Daily gage height in feet, of Bishop Creek near Bishop, Cal., for 1907 and 1908.

[A. F. Kilpatrick and C. R. Beals, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.9	1.95	1.9	2.0	......	......	......	......	......	1.85	1.8	1.75
2	1.85	2.0	2.0	2.0	......	......	......	......	......	2.0	1.8	1.7
3	1.9	2.0	1.95	2.0	......	......	......	......	......	1.95	1.8	1.7
4	1.9	1.95	1.95	2.0	......	......	......	......	......	1.8	1.9	1.6
5	1.95	1.95	1.9	2.0	......	......	......	......	......	2.0	1.8	1.75
6	1.9	1.9	1.95	1.9	......	......	......	......	2.3	2.0	1.8	1.7
7	1.95	2.0	1.85	2.0	......	......	......	......	......	2.0	1.8	1.75
8	1.9	1.9	1.9	2.0	......	......	......	......	2.15	2.0	1.8	1.75
9	2.0	1.95	1.9	2.0	......	......	......	......	2.05	2.0	1.8	1.75
10	2.0	1.95	1.95	2.0	......	......	......	......	2.2	1.9	1.8	1.8
11	2.0	1.9	1.9	2.0	......	......	......	......	2.15	1.8	1.8	1.7
12	2.0	1.95	1.95	2.1	......	......	......	......	2.25	1.8	1.8	1.75
13	2.0	1.95	1.9	2.15	......	......	......	......	2.25	1.8	1.8	1.75
14	2.0	2.0	1.95	2.0	......	......	......	......	2.02	1.8	1.8	1.7
15	2.0	1.9	1.9	2.0	......	......	......	......	2.01	1.8	1.8	1.7
16	2.1	1.9	1.95	2.0	......	......	......	......	2.05	1.9	1.8	1.7
17	2.2	1.9	1.9	2.0	......	......	......	......	2.01	2.0	1.9	1.8
18	2.0	1.95	1.95	2.0	......	......	......	......	1.95	2.0	1.9	2.0
19	2.1	1.95	1.95	2.0	......	......	......	......	2.0	1.9	1.85	1.8
20	2.0	1.95	2.0	2.0	......	......	......	......	2.0	1.9	1.8	1.75
21	2.05	2.0	2.0	2.0	......	......	......	......	2.05	2.0	1.9	1.9
22	2.0	1.95	2.0	2.05	......	......	......	......	2.0	2.0	1.8	1.95
23	2.05	1.9	2.1	2.05	......	......	......	......	1.95	2.1	1.8	1.85
24	2.05	1.95	2.0	2.05	......	......	......	......	1.9	1.9	1.8	1.85
25	1.95	1.9	2.0	2.05	......	......	......	......	1.85	1.9	1.85	1.9
26	1.95	1.95	2.0	2.05	......	......	......	......	1.9	1.8	1.8	1.75
27	2.0	1.9	2.0	2.5	......	......	......	......	1.85	2.1	1.8	1.8
28	1.95	2.0	2.0	......	......	......	......	......	1.8	2.0	1.8	1.85
29	1.95	......	1.95	2.55	......	......	......	......	1.85	1.9	1.8	1.95
30	1.95	......	2.0	......	......	......	......	......	1.8	1.8	1.65	1.85
31	1.95	......	2.0	......	......	......	......	......	......	1.8	......	2.3
1908.												
1	2.1	2.0	1.95	2.0	2.2	2.3	2.8	2.7	2.25	2.05	1.95	1.8
2	2.15	1.95	1.95	2.0	2.4	2.25	2.5	3.5	2.2	2.0	1.95	1.85
3	2.3	2.0	1.85	1.95	2.5	2.15	2.55	3.6	2.0	2.05	1.95	1.8
4	2.1	2.0	2.1	1.9	2.3	1.9	2.6	3.7	2.15	2.0	1.85	1.75
5	1.95	1.9	1.9	1.95	2.4	1.9	2.8	3.7	2.1	2.05	1.95	1.8
6	1.95	1.9	1.95	2.1	2.3	1.95	2.8	3.5	2.1	2.0	2.0	1.7
7	1.85	1.9	2.2	2.0	2.2	2.1	3.1	2.9	2.1	2.1	1.95	1.9
8	1.8	1.8	2.4	1.9	2.3	2.0	3.1	2.9	2.3	1.95	1.9	1.85
9	1.9	2.0	2.3	1.9	2.35	2.1	3.1	2.9	2.3	2.1	1.9	1.8
10	1.7	1.9	2.1	2.0	2.1	2.1	2.85	3.1	2.2	1.95	2.0	1.8
11	1.95	1.9	2.0	1.95	2.0	2.2	2.9	2.8	2.3	1.8	1.95	1.8
12	1.9	1.85	2.3	1.9	2.0	2.2	3.0	2.8	2.1	1.9	1.95	1.8
13	1.95	1.8	2.1	1.95	2.0	2.4	3.1	2.2	2.2	1.9	1.9	1.7
14	1.85	1.9	2.0	1.9	2.1	2.4	3.1	2.1	1.9	2.0	1.95	1.85
15	2.0	2.3	2.0	1.95	2.0	2.4	2.95	2.2	2.3	2.0	1.85	1.75
16	1.7	1.85	2.0	1.9	1.9	2.2	2.3	2.3	2.0	1.9	1.9	1.7
17	1.85	1.8	2.0	2.0	1.9	2.3	2.4	2.2	2.1	2.0	1.9	1.8
18	1.85	1.85	1.9	1.85	2.1	2.15	2.3	2.3	2.15	2.0	1.95	1.85
19	1.85	2.0	1.85	1.95	2.0	2.25	2.5	2.3	2.2	1.95	1.9	1.8
20	1.85	2.0	1.95	2.1	2.0	2.2	2.5	2.1	2.1	2.0	1.95	1.8
21	1.75	2.1	1.9	2.1	2.1	2.25	2.5	2.1	2.1	1.9	1.8	1.8
22	1.9	2.0	2.0	2.0	2.15	2.3	2.5	2.2	1.95	1.9	1.8	1.8
23	1.8	2.0	1.95	2.0	1.9	2.5	2.8	2.2	2.15	2.0	2.2	1.75
24	1.85	1.9	1.95	1.9	2.1	2.4	2.7	2.3	2.25	1.95	1.95	1.85
25	2.0	2.2	2.0	1.95	2.0	2.6	2.6	2.0	2.2	1.9	1.9	1.7
26	1.85	1.95	2.0	1.85	2.1	2.5	2.5	2.3	2.0	2.0	1.8	1.8
27	1.9	1.85	2.1	1.9	2.15	2.8	2.5	2.2	2.0	2.0	1.8	1.9
28	2.15	1.9	1.9	1.85	2.1	2.7	2.8	2.2	2.0	1.95	1.7	1.95
29	1.95	1.8	1.9	2.1	2.3	2.7	2.7	2.0	2.0	2.0	1.8	1.85
30	2.0	......	1.9	2.2	2.3	2.7	2.6	2.1	1.9	1.95	1.8	1.9
31	2.3	......	2.0	......	2.2	......	2.7	2.1	......	2.0	......	1.7

NOTE.—No gage heights recorded from May 1 to September 5, 1907. Records of daily discharge were obtained from the weir.

Rating table for Bishop Creek near Bishop, Cal., 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.*
1.60	40	2.20	81	2.80	163	3.40	288
1.70	44	2.30	92	2.90	180	3.50	314
1.80	49	2.40	104	3.00	198	3.60	341
1.90	55	2.50	117	3.10	218	3.70	370
2.00	62	2.60	131	3.20	240	3.80	400
2.10	71	2.70	146	3.30	263		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 12 discharge measurements made during 1908. It is fairly well defined between gage heights 1.9 feet and 3.5 feet.

Monthly discharge of Bishop Creek near Bishop, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	76	48	56.4	3,470	C.
February	58	49	54.0	3,000	C.
March	66	49	55.4	3,410	C.
April	148	58	75.8	4,510	C.
May	195	101	131	8,060	B.
June	442	226	297	17,700	D.
July	418	302	354	21,800	D.
August	300	190	231	14,200	B.
September	160	41	83.7	4,980	B.
October	58	41	66.0	4,060	B.
November	42	38	49.4	2 940	B.
December	88	38	52.5	3,230	B.
The year	442	38	126	91,400	
1908.					
January	92	44	58.8	3,620	B.
February	92	49	58.6	3,370	B.
March	104	52	64.3	3,950	B.
April	71	52	59.7	3,550	B.
May	117	55	76.6	4,710	B.
June	163	55	94.5	5,620	B.
July	218	92	150.0	9,220	B.
August	370	62	143.0	8,790	B.
September	92	55	73.7	4,390	B.
October	71	49	60.4	3,710	B.
November	81	44	55.7	3,310	B.
December	58	44	49.4	3,040	B.
The year	370	44	78.7	57,300	

NOTE.—The monthly discharge for 1907 includes diversions above the station during February to April and September to December, inclusive. From May to August, inclusive, the estimate is made from readings on a 30-foot weir located about 3 miles above the mouth of the canyon above all diversions. Discharges over weir from June 9-24 and for the month of August, 1907, were interpolated. The monthly discharge for 1908 does not include diversions above gaging station.

BAKER CREEK NEAR BIG PINE, CAL.

This station was established February 20, 1908, at a point about 150 feet below the bridge on Mill road and about 3 miles west of the town of Big Pine.

No gage height observations were made prior to 1909.

Discharge measurements of Baker Creek near Big Pine, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	G. R. Shuey				16
May 2	do				28
May 25	do				41
June 10	do				37
July 6	do				24
December 9	R. B. Post				14
1908.					
February 20	R. B. Post	4.5	5.6	0.3	11
March 19	do	5	6.7	.41	14
May 14	do	5	7.3	.52	18
June 10	do	5	5.5	.00	10
July 17	W. A. Lamb	3.4	2.9	−.10	5.3
August 1	do	3.2	3.6	.00	8.6
August 13	do	.3	3.0	−.17	5.5
August 27	do	3.4	3.2	−.02	7.5
September 15	do	3.5	3.5	−.02	8.2
October 6	do	3	3.1	−.05	6.5
October 23	A. T. Barrows	3.5	4.3	.30	15
November 8	do	3.5	3.0	−.10	7.2
November 24	Barrows and Lee	4	4.5	−.05	8.1

BIG PINE CREEK NEAR BIG PINE, CAL.

This station was originally established December 5, 1903, at a point about 3 miles southwest of Big Pine where the creek issues from the foothills. It was established anew October 29, 1907, at a point about one-half mile east of the original station and about 2 miles southwest of Big Pine.

No record of gage heights was kept in 1907 or in the early part of 1908, but regular discharge measurements were made frequently.

Discharge measurements of Big Pine Creek near Big Pine, Cal., in 1907.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
		Sec.-ft.			*Sec.-ft.*
January 27	G. R. Shuey	18	July 6	G. R. Shuey	202
February 18	do	20	July 27	do	208
March 7	do	20	August 16	R. B. Post	120
March 28	do	21	August 26	do	98
April 8	do	23	September 8	do	55
April 21	do	51	September 24	do	31
May 2	do	47	October 29	do	30
May 17	do	54	November 15	do	24
June 11	do	83	December 9	do	20

Discharge measurements of Big Pine Creek and canals near Big Pine, Cal., in 1908.

Date.	Hydrographer.	Gage height.	Discharge.		
			Creek.	Canals.	Total.
		Feet.	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
February 19	R. B. Post	2.65	20	0	20
March 18	....do	2.75	23	0	23
May 11	....do	2.80	23	0	23
May 22	....do	2.76	22	0	22
June 10	....do	3.07	47	5	52
June 17	....do	3.16	47	6	53
July 7	....do	3.79	116	8	124
July 14	Post and Lamb	3.70	113	0	113
August 1	W. A. Lamb	4.10	166	14	180
August 13	....do	3.72	112	3	115
August 27	....do	3.33	67	8	75
September 15	....do	3.05	46	2	48
October 6	....do	2.70	21	1	22
October 24	Lamb and Barrows	2.51	13	0	13
November 8	A. T. Barrows	2.48	12	0	12
November 24	Barrows and Lee	2.48	12	0	12

Daily gage height, in feet, of Big Pine Creek near Big Pine, Cal., for 1908.

[Wesley Newman, observer.]

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1								2.5
2		2.95			3.4	2.7	2.6	
3		2.90						2.5
4					3.4		2.6	
5		2.8	3.8			2.7		2.5
6				3.8			2.6	
7		2.85	3.8		3.3	2.7		
8				3.9				2.5
9		3.05	3.85		3.4	2.7	2.5	
10				4.0				2.5
11		3.15	3.8		3.5		2.5	
12				3.7		2.6		2.6
13		3.25	3.85				2.5	
14					3.1	2.6		
15			4.0					2.6
16					2.9	2.6	2.4	
17		2.65	3.85	3.5				2.6
18					2.9		2.4	
19		2.7	3.9	3.4		2.6		2.6
20							2.4	
21		2.8	3.85	3.4	2.9	2.6		
22	2.75							2.6
23		2.85			2.9	2.6		
24	2.85			3.3			2.5	2.6
25		3.05			2.9			
26	2.95			3.3		2.6	2.5	2.6
27		3.25						
28	2.95			3.2	2.9	2.6	2.5	
29		3.05						2.5
30	3.00	3.00			2.8	2.6		
31				3.3				2.5

Rating table for Big Pine Creek near Big Pine, Cal., 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.*
2.40	10	2.90	32	3.40	74	3.90	137
2.50	13	3.00	39	3.50	85	4.00	151
2.60	17	3.10	47	3.60	97	4.10	166
2.70	21	3.20	55	3.70	110	4.20	181
2.80	26	3.30	64	3.80	123	4.30	196
						4.40	211

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during November, 1907, to December, 1908, and is well defined between gage heights 2.4 feet and 4.1 feet.

Monthly discharge of Big Pine Creek near Big Pine, Cal., for 1907 and 1908.

Month.	Discharge in second-feet. Maximum.	Minimum.	Mean.	Run-off (total in acre-feet).	Accuracy.
1907.					
January			18	1,110	D.
February			20	1,110	D.
March			20	1,230	D.
April			38	2,260	D.
May			56	3,440	D.
June			110	6,540	D.
July			202	12,400	D.
August			118	7,260	D.
September			46	2,740	D.
October			30	1,840	D.
November			24	1,430	D.
December			20	1,230	D.
The year			58	42,600	
1908.					
January			20.0	1,230	D.
February			20.0	1,150	D.
March			23.0	1,410	D.
April			25.0	1,490	D.
May	39	23	28.0	1,720	C.
June	64	21	39.0	2,320	B.
July	166	55	131	8,060	B.
August	166	55	100	6,150	B.
September	85	26	50.0	2,980	B.
October	21	17	18.0	1,110	B.
November	17	10	13.0	774	B.
December	17	13	15.0	922	B.
The year			40.0	29,300	

NOTE.—Daily discharges for 1907 were interpolated between the discharge measurements. The monthly discharges for 1908 do not include diversion above the station. The monthly discharges for January to April, inclusive, are estimated.

BIRCH CREEK NEAR TINEMAHA, CAL.

This station, originally established June 14, 1905, was reestablished December 7, 1906, at a point near Peterson's ranch house, about 1 mile west of Fish Springs schoolhouse, and about 8 miles south of Big Pine.

Discharge measurements of Birch Creek near Tinemaha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	5.5	4.2	0.40	4.7
February 26	do	5	3.9	.40	5.9
March 29	do	5	4.2	.33	7.3
April 10	do	4.5	3.4	.40	5.4
April 15	do	4.5	3.8	.50	8.2
May 17	do	5	5.2	.57	13
June 12	do	5.5	6.4	.70	22
July 11	do	6	7.6	.85	29
August 15	R. B. Post	5.2	5.2	.69	18
August 27	do	4.5	4.6	.60	16
September 9	do	4.5	4.2	.40	10
September 30	do	4.5	3.4	.28	4.4
October 30	do	4	3.0	.27	4.4
November 12	do	4	3.2	.25	5.0
November 25	do	4	3.1	.25	4.8
1908.					
February 18	R. B. Post	4.5	3.1	.23	4.7
March 9	do	4.5	3.1	.25	4.4
March 25	do	4.5	3.2	.29	5.4
April 7	do	4.5	3.1	.28	4.8
May 2	do	5	3.7	.35	8.0
May 21	do	4.5	3.3	.28	4.8
June 10	do	5	3.9	.34	7.5
June 29	do	5	4.6	.53	13
July 7	do	5	4.7	.60	15
July 14	Post and Lamb	5	5.4	.60	16
July 31	W. A. Lamb	5	5.6	.60	18
August 12	do	5	5.2	.60	15
August 25	do	5	2.8		6.8
September 14	do	5	4.2	.35	6.2
September 18	do	6	3.3		7.1
October 5	do	5	3.7	.25	5.1
October 7	do	3	1.5		5.1
October 21	Barrows and Lamb	5	3.3	.19	2.9
November 9	A. T. Barrows	5	3.4	.20	3.1
November 24	do	5	3.2	.21	2.9

Daily gage height, in feet, of Birch Creek near Tinemaha, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.5	0.4	0.35	0.35	0.55	0.8	0.8	0.9	0.4	0.25	0.25	0.2
2	.8	.4	.35	.35	.55	.8	.8	.95	.4	.25	.25	.25
3	.75	.4	.35	.35	.55	.8	1.0	.9	.4	.25	.3	.25
4	.4	.4	.45	.35	.55	.8	1.1	.8	.4	.25	.25	.2
5	.35	.4	.5	.35	.55	.8	1.0	.75	.4	.3	.25	.2
6	.35	.4	.4	.35	.5	.8	1.0	.75	.4	.3	.25	.3
7	.35	.4	.4	.4	.5	.75	.9	.75	.35	.3	.25	.3
8	.35	.45	.4	.4	.5	.7	.9	.75	.35	.3	.25	.3
9	.35	.4	.4	.4	.55	.6	.85	.75	.35	.25	.25	.3
10	.4	.4	.4	.4	.55	.7	.9	.7	.35	.25	.25	.3
11	.4	.4	.45	.45	.55	.7	.9	.7	.35	.25	.25	.25
12	.4	.4	.45	.5	.5	.6	.9	.65	.4	.25	.25	.25
13	.45	.4	.45	.5	.5	.55	.9	.6	.4	.25	.25	.25
14	.4	.4	.4	.5	.55	.6	.9	.7	.35	.25	.25	.25
15	.4	.4	.4	.45	.55	.55	.9	.7	.3	.3	.25	.25

Daily gage height, in feet, of Birch Creek near Tinemaha, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	0.45	0.4	0.4	0.45	0.6	0.55	0.85	0.7	0.3	0.4	0.25	0.25
17	.4	.4	.5	.45	.6	.55	.85	.7	.3	.4	.25	.25
18	.45	.4	.45	.5	.6	.55	.85	.8	.3	.35	.25	.2
19	.45	.4	.55	.5	.65	.6	.85	.8	.3	.3	.25	.2
20	.45	.4	.5	.5	.65	.7	.85	.7	.3	.3	.25	.2
21	.4	.5	.5	.5	.65	.7	.8	.7	.25	.3	.25	.25
22	.4	.4	.5	.5	.6	.6	.8	.7	.25	.35	.25	.25
23	.4	.4	.45	.5	.6	.6	.8	.6	.25	.4	.25	.2
24	.4	.4	.45	.55	.55	.6	.9	.6	.25	.3	.25	.25
25	.4	.4	.45	.55	.55	.6	.9	.6	.25	.3	.2	.2
26	.4	.4	.45	.55	.55	.7	.9	.55	.25	.3	.2	.25
27	.4	.4	.45	.5	.55	.8	.85	.5	.25	.25	.2	.25
28	.4	.4	.35	.55	.6	.9	.8	.5	.25	.25	.2	.25
29	.45	......	.35	.55	.6	1.0	.8	.45	.25	.25	.2	.25
30	.45	......	.3	.55	.7	.9	.8	.4	.25	.25	.2	.25
31	.4	......	.3	......	.7	......	.8	.4	......	.25	......	.25
1908.												
1	.25	.25	.3	.25	.4	.3	.55	.5	.35	.2	.2	.2
2	.25	.25	.35	.25	.35	.3	.6	.55	.35	.2	.2	.2
3	.25	.3	.3	.25	.35	.3	.6	.6	.4	.2	.2	.2
4	.25	.3	.3	.25	.3	.3	.6	.7	.4	.25	.2	.2
5	.25	.3	.3	.25	.3	.3	.6	.7	.4	.25	.2	.2
6	.25	.3	.3	.25	.3	.3	.6	.7	.4	.25	.2	.2
7	.25	.3	.3	.25	.3	.3	.6	.6	.4	.3	.2	.2
8	.25	.25	.25	.3	.3	.3	.6	.6	.4	.3	.2	.2
9	.25	.25	.25	.3	.3	.3	.6	.6	.4	.2	.2	.2
10	.25	.25	.25	.3	.3	.35	.6	.6	.4	.2	.2	.2
11	.25	.25	.25	.25	.25	.4	.6	.6	.4	.2	.2	.2
12	.25	.25	.25	.25	.25	.45	.6	.6	.3	.2	.2	.2
13	.25	.35	.25	.3	.25	.55	.6	.55	.3	.15	.2	.2
14	.25	.3	.3	.3	.25	.55	.55	.5	.3	.2	.2	.2
15	.25	.3	.3	.3	.25	.45	.55	.5	.3	.3	.2	.2
16	.25	.3	.3	.3	.25	.45	.5	.45	.3	.3	.2	.2
17	.25	.25	.3	.3	.25	.45	.5	.45	.3	.3	.2	.2
18	.25	.25	.3	.3	.25	.4	.5	.45	.3	.3	.2	.2
19	.25	.25	.3	.35	.25	.4	.5	.45	.3	.3	.2	.2
20	.25	.25	.3	.3	.25	.4	.5	.45	.25	.3	.2	.2
21	.25	.25	.3	.3	.25	.45	.5	.4	.25	.3	.2	.2
22	.25	.25	.3	.3	.25	.4	.5	.4	.25	.25	.2	.2
23	.3	.25	.3	.3	.25	.5	.5	.4	.25	.25	.2	.2
24	.3	.25	.3	.3	.25	.5	.6	.4	.25	.25	.2	.2
25	.35	.25	.3	.25	.25	.55	.6	.4	.25	.25	.2	.2
26	.35	.3	.3	.3	.3	.55	.5	.35	.3	.25	.2	.2
27	.3	.3	.25	.35	.3	.55	.6	.35	.3	.2	.2	.2
28	.3	.3	.25	.35	.35	.55	.6	.3	.3	.2	.2	.2
29	.3	.3	.25	.35	.35	.55	.6	.3	.3	.2	.2	.2
30	.3	......	.25	.3	.4	.55	.5	.3	.3	.2	.2	.2
31	.3	......	.25	......	.35	......	.5	.35	......	.2	......	.2

Monthly discharge of Birch Creek near Tinemaha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	26	5.2	7.6	467	C.
February	8.9	6	6.2	344	C.
March	11	4.6	8.2	504	C.
April	11	5.2	8.0	476	C.
May	20	8.9	12.5	769	C.
June	42	11	20.0	1,190	C.
July	50	26	32.0	1,970	C.
August	38	6	19.3	1,190	C.
September	6	4.3	5.0	298	C.
October	6	4.3	4.6	283	C.
November	4.6	4.2	4.3	256	C.
December	4.6	4.2	4.3	264	C.
The year	50	4.2	11.4	8,010	

Monthly discharge of Birch Creek near Tinemaha, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
January	7.1	4.8	5.2	320	C.
February	5.8	4.8	5.2	299	C.
March	7.1	3.9	5.5	338	C.
April	7.1	4.8	5.6	333	C.
May	8.4	4.8	5.7	350	C.
June	14	5.8	9.6	571	C.
July	16	12	14.3	879	C.
August	21	5.8	11.9	732	C.
September	8.4	4.8	6.5	387	C.
October	5.6	3.0	4.1	252	C.
November	3.0	3.0	3.0	179	C.
December	3.0	3.0	3.0	184	C.
The year	21	3.0	6.6	4,820	

NOTE.—The daily discharge was obtained from several rating tables covering short periods of time.

TINEMAHA CREEK NEAR TINEMAHA, CAL.

This station was established December 7, 1906, at a point near Peterson's ranch house, about 1 mile west of Fish Springs schoolhouse, and 8 miles south of Big Pine.

Discharge measurements of Tinemaha Creek near Tinemaha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	6	3.4	0.50	4.7
February 26	do	6	3.0	.43	3.4
March 29	do	6	3.2	.45	4
April 10	do	7	3.4	.45	4.2
April 15	do	7	4.8	.60	7.6
May 6	do	7.4	5.5	.63	9.4
May 17	do	7	4.8	.60	7.9
June 12	do	8	7.4	.85	19
July 11	do	9	12	1.40	40
August 15	R. B. Post	8	8.8	1.05	29
August 27	do	9	7	.80	20
September 9	do	6	4	.40	6.4
September 30	do	7	4.4	.38	6.5
October 30	do	7	4.6	.45	7.6
November 12	do	7	4.1	.38	6.4
November 25	do	6	2.9	.32	4.9
1908.					
February 18	R. B. Post	7.5	4.4	.61	6.3
March 9	do	7	3.0	.52	3.3
March 25	do	7	3.3	.52	4
April 7	do	7	3.4	.53	4.1
May 2	do	7	3.9	.59	6
May 21	do	6.5	3.3	.51	4.2
June 10	do	7	4.0	.55	6.0
June 29	do	7.5	7.8	.93	20
July 7	do	7.5	9.0	1.09	27
July 14	Post and Lamb	8.2	9.3	1.10	29
July 31	W. A. Lamb	8.5	8.4	1.02	24
August 12	do	8	7.5	.91	20
August 24	do	8	5.6	.76	12
September 14	do	8	6.3	.80	14
October 5	do	7	4.0	.60	6.2
October 21	Barrows and Lamb	8	3.9	.54	5
November 8	A. T. Barrows	7.5	4.0	.55	4.9
November 24	do	7.5	4.0	.51	5.1

Daily gage height, in feet, of Tinemaha Creek near Tinemaha, Cal., for 1907 and 1908.

[Enid M. Peterson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.4	0.5	0.4	0.35	0.65	0.8	1.15	1.1	0.5	0.35	0.35	0.35
2	.4	.5	.3	.35	.65	.85	1.3	1.2	.5	.35	.35	.35
3	.5	.5	.4	.35	.65	.85	1.6	1.2	.5	.35	.35	.35
4	.45	.5	.6	.35	.7	.9	1.9	1.1	.5	.35	.35	.35
5	.5	.45	.5	.35	.5	.95	1.8	1.1	.5	.3	.35	.35
6	.5	.5	.45	.35	.6	.85	1.6	1.1	.4	.3	.35	.35
7	.5	.45	.45	.35	.6	.9	1.6	1.0	.4	.3	.35	.35
8	.5	.45	.45	.35	.6	.85	1.5	1.0	.4	.3	.35	.35
9	.5	.5	.4	.35	.6	.8	1.5	1.0	.4	.3	.35	.35
10	.5	.5	.4	.35	.6	.8	1.4	.9	.4	.3	.35	.45
11	.5	.5	.4	.4	.6	.8	1.3	.9	.4	.3	.35	.35
12	.45	.5	.45	.4	.6	.8	1.3	.8	.4	.3	.35	.35
13	.5	.5	.5	.4	.6	.8	1.3	.8	.45	.3	.35	.4
14	.5	.45	.45	.5	.65	.8	1.4	.8	.45	.3	.35	.4
15	.5	.45	.4	.5	.65	.75	1.3	.8	.3	.3	.35	.35
16	.5	.4	.4	.5	.6	.75	1.2	.85	.4	.4	.35	.35
17	.5	.45	.5	.55	.6	.7	1.1	.9	.4	.4	.35	.35
18	.5	.45	.45	.55	.6	.7	1.2	1.0	.4	.4	.35	.35
19	.5	.45	.55	.55	.65	.7	1.2	1.0	.4	.35	.35	.35
20	.5	.45	.5	.55	.6	.75	1.2	.9	.4	.35	.35	.35
21	.5	.5	.5	.55	.65	.8	1.2	.8	.4	.35	.35	.35
22	.5	.5	.45	.6	.8	.8	1.2	.8	.4	.35	.35	.3
23	.45	.5	.5	.6	.75	.8	1.2	.75	.4	.4	.35	.35
24	.5	.45	.45	.6	.8	.8	1.2	.7	.4	.4	.35	.35
25	.5	.45	.45	.6	.75	.85	1.3	.7	.4	.4	.35	.3
26	.5	.45	.45	.6	.8	.9	1.3	.65	.35	.4	.35	.35
27	.5	.45	.45	.6	.75	1.1	1.3	.6	.35	.4	.35	.4
28	.6	.45	.45	.65	.8	1.1	1.25	.6	.35	.35	.35	.4
29	.55	......	.4	.65	.8	1.15	1.2	.6	.35	.35	.35	.4
30	.5	......	.4	.65	.8	1.15	1.2	.55	.35	.35	.35	.4
31	.5	......	.4	......	.8	......	1.2	.5	......	.35	......	.4
1908.												
1	.4	.4	.55	.55	.55	.55	.95	1.2	.6	.65	.55	.5
2	.3	.4	.55	.55	.6	.45	.95	1.15	.65	.6	.55	.45
3	.3	.35	.55	.55	.55	.45	.95	1.5	.7	.65	.55	.45
4	.35	.35	.5	.55	.55	.55	1.0	1.1	.75	.6	.5	.5
5	.35	.4	.5	.55	.55	.55	1.0	1.15	.75	.6	.5	.5
6	.35	.4	.5	.55	.6	.55	1.0	1.1	.7	.6	.5	.5
7	.35	.35	.5	.55	.55	.55	1.1	1.2	.8	.6	.5	.5
8	.35	.35	.5	.5	.55	.55	1.1	1.15	.8	.6	.5	.5
9	.35	.35	.55	.55	.55	.55	1.1	1.2	.8	.55	.5	.5
10	.35	.35	.5	.55	.6	.5	1.55	1.1	.8	.5	.5	.5
11	.35	.35	.5	.5	.55	.5	1.2	1.0	.75	.5	.5	.5
12	.35	.35	.5	.5	.55	.5	1.2	1.5	.75	.5	.5	.5
13	.35	.35	.5	.5	.55	.5	1.2	.95	.8	.55	.5	.5
14	.35	.35	.5	.55	.45	.55	1.3	.9	.75	.5	.5	.5
15	.35	.35	.55	.55	.45	.55	1.35	.9	.7	.5	.5	.5
16	.35	.35	.55	.5	.55	.55	1.3	.85	.65	.6	.5	.55
17	.35	.35	.5	.5	.45	.6	1.35	.8	.65	.5	.5	.55
18	.35	[a] .6	.55	.5	.45	.6	1.4	.8	.7	.5	.5	.55
19	.4	.6	.55	.5	.45	.65	1.4	.8	.75	.45	.45	.55
20	.4	.6	.55	.5	.55	.7	1.0	.8	.6	.45	.45	.55
21	.35	.6	.55	.5	.55	.7	1.1	.8	.7	.5	.45	.6
22	.4	.6	.55	.55	.45	.75	1.15	.85	.75	.5	.45	.6
23	.4	.6	.55	.5	.45	.75	1.1	.85	.7	.55	.5	.6
24	.4	.6	.55	.5	.55	.8	1.1	.8	.65	.55	.5	.6
25	.4	.6	.55	.55	.55	.8	1.15	.75	.65	.55	.5	.6
26	.5	.6	.55	.5	.55	.85	1.1	.75	.65	.55	.5	.6
27	.45	.6	.55	.55	.55	.85	1.1	.7	.6	.55	.5	.6
28	.45	.55	.55	.55	.45	.9	1.2	.7	.65	.55	.5	.55
29	.4	.55	.55	.55	.55	1.0	1.5	.65	.7	.55	.5	.55
30	.4	......	.55	.55	.55	.95	1.1	.6	.7	.55	.5	.55
31	.4	......	.55	......	.55	......	1.0	.6	......	.55	.5	.5

[a] Gage changed.

Monthly discharge of Tinemaha Creek near Tinemaha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	8	3	4.9	301	C.
February	5	4	4.4	244	C.
March	8	2	4.0	246	C.
April	10	2.5	5.3	315	C.
May	16	5	11.0	676	C.
June	30	12	18.0	1,070	C.
July	66	29	39.0	2,400	C.
August	33	9	20.0	1,230	C.
September	7.8	5	6.1	363	C.
October	6.5	4.5	5.4	332	C.
November	5.5	5.5	5.5	327	C.
December	7.8	4.5	5.7	350	C.
The year	66	2	10.8	7,850	
1908.					
January	9.0	4.5	6.0	369	C.
February	6.5	4.8	5.8	334	C.
March	4.8	3.6	4.4	270	C.
April	4.8	3.6	4.3	256	C.
May	6.1	2.8	4.4	270	C.
June	24	2.8	8.5	506	C.
July	52	22	32	1,970	C.
August	49	6.1	21	1,290	C.
September	14	6.1	9.8	583	C.
October	7.5	5	5.5	338	C.
November	5.5	4.5	5.0	298	C.
December	6	4.5	5.3	326	C.
The year	52	3.6	9.3	6,810	

NOTE.—The daily discharges for 1907 were obtained from several rating tables covering short periods of time. The daily discharges for 1908 were obtained by the indirect method for shifting channels.

TABOOSE CREEK NEAR TIBBETTS, CAL.

The original station was not regularly established until August 20, 1906, though discharge measurements had been made from the first of the year. It was located about 15 miles north of Independence, 2 miles northwest of Tibbetts railway station, and about one-half mile west of the crossing on the lower main highway. On February 25, 1907, the station was transferred from the lower road crossing to a point on the upper road crossing, 2 miles farther upstream and about 4 miles northwest of Tibbetts.

Discharge measurements of Taboose Creek near Tibbetts, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 4	G. R. Shuey	4	1.2	1.50	1.3
February 25	do	6	2.1	.20	2.1
March 29	do	6	3.5	.20	3.2
April 10	do	5	2.8	.20	4.8
April 15	do	6	4.6	.25	8.1
May 6	do	6	4.6	.24	7.0
June 13	do	7	6.0	.60	12
June 29	do	7	7.0	.65	19
July 11	do	6	9	.60	22
August 2	Shuey and Post	7	11	.60	26
August 11	R. B. Post	6	5	.48	11
August 27	do	6	4.4	.25	7.8
September 9	do	6	4.7	.15	7
September 30	do	6	3.4	.05	3.4
October 21	do	6	3.5	.08	3.7
November 5	do	5	4.1	.05	4.2
November 29	do	5.5	4.0	.00	3.3
December 12	do	5.5	3.8	.50	3.3
1908.					
February 15	R. B. Post	6	3.5	.43	2.4
March 10	do	6	3.2	.42	2.2
March 21	do	6	3.2	.43	2.4
April 9	do	4	2.3	.17	2.3
April 29	do	5	3.7	.22	3.7
May 2	do	7	4.5	.27	5.9
May 21	do	5	2.6	.20	3.1
June 17	do	6	4.4	.47	6.9
June 26	do	6	4.6	.48	7.0
July 8	do	7	6.1	.63	12
July 14	Lamb and Post	8	7.3	.63	12
July 31	W. A. Lamb	7	6.2	.59	11
August 12	do	7	5.3	.50	9.7
August 24	do	6	4.4	.40	5.2
September 4	do	6.5	4.2	.36	4.3
September 14	do	6	4.1	.39	5.2
October 5	do	6	3.8	.30	4.3
October 21	Barrows and Lamb	6	3.8	.31	4.5
November 9	A. T. Barrows	6	3.8	.28	3.8

Daily gage height, in feet, of Taboose Creek near Tibbetts, Cal., for 1907 and 1908.

[Ray Bowers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.6		0.2	0.2	0.8		0.7				0.1	
2		1.6						0.6	0.2			0.05
3	1.6			.2		1.0	.8					
4			.2		.8					0.1	.05	
5	1.6	1.55		.2		1.1	.9					
6			.2		.75			.55	.15			.05
7		1.55				1.0				.1		
8	1.6		.2	.2	.7						.05	
9		1.55				.9	.7	.5	.15			.05
10	1.6			.2	.75							
11			.2			.75	.6			.1	.05	
12	1.6	1.55		.25				.4				
13			.2		.75	.6	.6		.2			.5
14		1.5								.05		
15	1.6		.2	.25	.8		.6				.05	
16		1.5						.4	.15			.5
17	1.6			.25	.8	.55	.6					
18		1.5	.5							.05	.05	
19	1.6			.25		.5	.6	.4				
20		1.5	.35		.8				.1			.5
21						.5				.1		
22	1.6	1.5	.3	.75	.8		.45				.05	
23								.4	.1			.5
24	1.6			.8	.75	.55	.5					
25		.2	.25							.1	.05	

Daily gage height, in feet, of Taboose Creek near Tibbetts, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	1.6			0.8		0.6	0.55	0.35				
27		0.2	0.2		0.8				0.1			0.5
28						.65				0.1		
29	1.6		.2	.8	.85		.5	.3			0.05	
30									.1			.5
31	1.6				.9		.5					
1908.												
1					.3	.4						
2			.45							.35	.3	
3	.5	.45		.45			.5	.6				
4					.3				.4			.3
5						.3				.35		
6	.5		.45	.45			.6				.3	
7		.45						.6	.45			.35
8					.3	.4						
9			.45							.3	.3	
10	.5	.45		.2			.6	.6				
11					.25				.5			.4
12						.5				.3		
13	.5		.45	.2			.7				.3	
14		.45						.5	.5			.55
15					.25	.45						
16			.45							.3	.3	
17	.5	.45		.2			.6	.45				
18					.2				.45			.6
19						.5				.3		
20	.5		.45	.2			.55				.3	
21		.45						.4	.35			.3
22					.2	.45						
23			.45							.3	.3	
24	.5	.45		.2			.6	.45				
25					.3				.4			.3
26						.5				.3		
27	.5		.45	.25			.6				.3	
28		.45						.45	.4			.3
29					.4	.5						
30			.45							.3	.3	
31	.45							.4				

NOTE.—Beginning February 25, 1907, the gage heights refer to the gage at the new station 2 miles upstream and are not comparable with the old gage heights.

Monthly discharge of Taboose Creek near Tibbetts, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	2.3	2.3	2.3	141
February	6.2	1.4	2.3	128
March	14	6.2	7.3	449
April	24	6.2	12.0	714
May	28	20	23.0	1,410
June	36	14	21.0	1,250
July	28	12	18.0	1,110
August	18	8.5	12.0	738
September	6.2	4.3	5.0	298
October	4.3	3.6	4.2	258
November	4.3	3.6	3.6	214
December	3.6	2.9	3.2	197
The year	36	1.4	9.5	6,910

Monthly discharge of Taboose Creek near Tibbetts, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1908.				
January	3.0	2.4	3.0	184
February	2.4	2.3	2.3	132
March	2.3	2.2	2.3	141
April	5.2	2.5	3.1	184
May	7.2	3.1	4.9	301
June	8.0	4.5	6.0	357
July	14	8.0	10.9	670
August	11	5.7	8.2	504
September	8	5.0	6.4	381
October	5	4.0	4.5	277
November	4	4.0	4.0	238
December	10	4.0	5.5	338
The year	14	2.2	5.1	3,710

NOTE.—The daily discharges were obtained by the indirect method for shifting channels, and are approximate.

GOODALE CREEK NEAR TIBBETTS, CAL.

This station was established September 20, 1906, at the point where the stream leaves the foothills, about 13 miles north of Independence, 4 miles west of Tibbetts railway station, and one-fourth mile west of the upper road crossing.

Discharge measurements of Goodale Creek near Tibbetts, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	5	2.5	0.45	3.7
February 25	....do	4.7	2.8	.43	3.9
March 29	....do	4	2.4	.40	3.0
April 15	....do	5	3.3	.60	6.6
May 6	....do	5.5	3.6	.63	5.8
June 13	....do	6	4.2	.75	9.7
June 28	....do	6	5.2	.90	12
July 11	....do	6	6.7	1.10	18
August 2	Shuey and Post	6	6.0	1.05	15
August 11	R. B. Post	5	3.8	.80	8.9
August 27	....do	5	3.1	.65	6.7
September 9	....do	5	2.8	.50	4.8
September 30	....do	5	2.1	.45	3.1
October 21	....do	5	2.1	.45	3.2
November 5	....do	5	2.2	.41	3.4
November 29	....do	5	2.1	.40	2.6
December 12	....do	5	2.2	.39	2.8
1908.					
February 15	R. B. Post	5	2.6	.30	2.3
March 10	....do	5	2.5	.32	2.2
March 21	....do	5	2.6	.34	2.2
April 9	....do	5	2.5	.30	2.3
April 29	....do	5	3.0	.42	4.1
May 2	....do	5	3.2	.33	4.2
May 21	....do	5	2.5	.23	2.5
June 17	....do	5	3.2	.35	4.4
June 26	....do	5	3.4	.36	4.8
July 8	....do	5	4.2	.50	7.4
July 14	Post and Lamb	5.7	4.7	.50	8.1
August 12	W. A. Lamb	5	4.0	.34	5.0
August 24	....do	3.5	2.3	.26	4.0
September 4	....do	5	2.3	.16	2.5
September 14	....do	5	2.7	.22	3.7
October 5	....do	5.3	2.6	.20	3.3
October 21	Barrows and Lamb	5	2.7	.17	3.4
November 9	....do	5	2.6	.15	2.9

Daily gage height, in feet, of Goodale Creek near Tibbetts, Cal., for 1907 and 1908.

[Ray Bowers, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.5		0.45	0.4	0.7		0.9				0.4	
2		0.45						1.05	0.5			0.4
3	.5			.4		0.9	.95					
4			.45		.7					0.4	.4	
5	.5	.45		.4		.95	.95					
6			.45		.65			.95	.5			.4
7		.45				.9				.4		
8	.5		.45	.45	.6						.4	
9		.45					1.0	.95	.5			.4
10	.5			.5	.65	.8						
11			.4				1.1			.4	.4	
12	.5	.45		.55		.75		.8				
13			.4		.65		1.05		.5			.4
14		.5				.7				.4		
15	.5		.4	.6	.7		1.1				.4	
16		.5						.85	.5			.4
17	.5			.6	.7	.75	1.1					
18		.5	.6							.4	.4	
19	.5			.6		.8	1.1	.8				
20		.5	.5		.7				.5			.4
21						.8				.4		
22	.5	.5	.45	.65	.7		1.0				.4	
23								.75	.5			.4
24	.5			.7	.65	.85	.9					
25		.45	.4							.4	.4	
26	.5			.7		.85	.95	.7				
27		.45	.35		.7				.45			.4
28						.9				.4		
29	.45		.4	.7	.75		.95	.65			.4	
30									.45			.4
31	.45				.8		.95					
1908.												
1					.45	.35						
2			.35							.25	.15	
3	.4	.35		.35			.45	.4				
4					.3				.2			.2
5						.3				.2		
6	.4		.35	.35			.5				.15	
7		.35						.5	.2			.2
8					.3	.35						
9			.35							.25	.15	
10	.4	.35		.35			.5	.4				
11					.3				.3			.25
12						.4				.25		
13	.4		.35	.35			.5				.18	
14		.35						.3	.3			.3
15					.3	.4						
16			.35							.2	.18	
17	.4	.35		.35			.45	.25				
18					.25				.3			.3
19						.35				.18		
20	.4		.35	.4			.4				.15	
21		.35						.25	.25			.2
22					.3	.3						
23			.35							.2	.2	
24	.4	.35		.4			.4	.25				
25					.3				.3			.18
26						.4				.15		
27	.4		.35	.4			.4				.2	
28		.35						.2	.3			.18
29					.3	.45						
30			.35							.15	.2	
31	.35						.4	.2				

Monthly discharge of Goodale Creek near Tibbetts, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	4.0	3.4	3.9	240	D.
February	4.0	3.3	3.6	200	D.
March	5.4	3.4	3.3	203	D.
April	7.2	2.8	5.1	304	C.
May	9.2	5.4	7.0	430	C.
June	14	7.2	10.2	607	C.
July	18	12	15.1	928	C.
August	16	5.5	10.3	633	C.
September	4.0	3.4	3.9	232	C.
October	2.8	2.8	2.8	172	D.
November	2.8	2.8	2.8	167	D.
December	2.8	2.8	2.8	172	D.
The year	18	2.8	5.9	4,290	
1908.					
January	3.0	2.6	3.0	184	D.
February	2.6	2.2	2.6	150	D.
March	2.6	2.2	2.6	160	D.
April	3.0	2.2	2.7	161	D.
May	4.7	3.6	4.4	270	D.
June	7.4	4.7	5.8	345	D.
July	8.3	6.4	7.3	449	D.
August	8.3	3.2	5.0	307	D.
September	4.7	3.2	4.1	244	D.
October	3.4	3.3	3.3	203	D.
November	3.0	3.0	3.0	179	D.
December	3.0	3.0	3.0	184	D.
The year	8.3	2.2	3.9	2,840	

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

DIVISION CREEK NEAR INDEPENDENCE, CAL.

The original station was established January 10, 1906, at a point on the upper road crossing, about 1½ miles west of the Ricky ranch house and about 10 miles north of Independence.

A new station was established May 9, 1908, at a point about 200 feet above the intake of the power canal of the Los Angeles aqueduct. On July 29, 1908, a cloudburst made the creek overflow its banks and materially changed the cross section at the gaging station.

Discharge measurements of Division Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	G. R. Shuey	6	4.0	....	10
February 25	.....do	6	3.6	2.40	8.9
March 29	.....do	6.5	4.3	2.40	9
April 15	.....do	6.5	3.9	2.40	10
May 5	.....do	6.5	3.6	2.30	9
June 13	.....do	6	4.4	2.40	12
June 28	.....do	6	3.8	2.30	10
July 7	.....do	6	4.8	2.40	13
August 2	Shuey and Post	6	4.6	2.30	12
August 11	R. B. Post	6.5	4.6	2.26	9.4
August 27	.....do	6.5	4.4	2.30	10
September 9	.....do	6.5	4.6	2.30	9.8
September 25	.....do	6.5	4.4	2.29	8.8
October 9	.....do	6.5	4.6	2.26	9.5
November 5	.....do	6.5	4.3	2.21	10
November 29	.....do	6.5	4.4	2.20	8.5
December 12	.....do	6	3.7	2.39	7.6

Discharge measurements of Division Creek near Independence, Cal., in 1907 and 1908—Con.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 5	R. B. Post	5	3.9	1.01	7.2
March 13	do	5	3	.91	5.9
April 3	do	5	3	.90	5.5
April 13	do	5	3	.90	5.7
April 20	do	5	3	.88	5.7
May 6	do	6	5.1	.65	7.2
June 17	do	5	5.6	.70	7.3
July 14	Post and Lamb	5	5.2	.67	6.4
July 31	W. A. Lamb	5	2	.93	9.8
August 12	do	5.2	2.9	.86	7.7
August 24	do	5	2.9	.76	7.7
October 5	do	5	3.7	.68	7.3
October 20	Lamb and Barrows	5	4.5	.80	7.5
November 5	A. T. Barrows		4.3	.82	8.0

Daily gage height, in feet, of Division Creek near Independence, Cal., for 1908.

[G. G. Noble, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1					0.85	0.7				0.7	0.85	
2					.85		0.65				.85	
3					.85	.7		0.75	0.75		.85	
4					.85		.7	.9		.7	.85	0.8
5		1.0			.85	.7		.75			.85	
6					.85			.75	.75	.7	.85	.8
7		1.0				.7	.7	.75			.85	
8								.75	.75	.7	.85	
9					.7	.7					.85	
10		1.0			.7		.7	.75		.7	.85	.85
11		1.0				.7		.75	.85	.7	.85	
12					.7		.7	.75		.7	.85	
13						.7	.7	.75	.75	.7	.85	.8
14		1.0			.7			.75		.7	.85	
15						.7		.75	.75	.7	.85	
16		1.0			.7	.7	.7		.75	.7	.85	.8
17		1.0						.75		.7	.85	.8
18					.7		.7			.7	.85	
19		.95		0.85	.7	.7		.75		.75	.85	
20				.85	.7		.7			.8	.85	.8
21		1.0		.85	.7	.7		.75	.75	.8	.85	.8
22				.85		.7	.65			.8	.85	
23				.85	.7					.8	.8	
24				.85		.7	.7	.75	.8	.8	.8	
25				.85	.7					.85		.8
26		1.0		.85		.7		.75	.75	.85		
27				.85	.7		.7			.85		
28				.85	.7			.75	.75	.85		.8
29				.85		.7	[a].45			.85		
30				.85	.7	.65	.95	.75	.75	.85		.8
31					.7					.85		

[a] Channel changed during cloud-burst July 29.

Monthly discharge of Division Creek near Independence, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January			10.6	652	D.
February			10.8	600	D.
March			11.2	689	D.
April			10.1	601	D.
May			9.7	596	D.
June			11.1	660	D.
July			12.4	762	D.
August			10.1	621	D.
September			9.9	589	D.
October			10.0	615	D.
November			9.0	536	D.
December			7.7	474	D.
The year			10.2	7,400	
1908.					
January			[a] 7.0	430	D.
February	7.2	6.0	6.7	385	C.
March	5.9	5.9	5.9	363	C.
April	5.9	5.7	5.8	345	C.
May	7.2	5.7	7.0	430	C.
June	7.3	6.4	7.2	428	C.
July	10.0	6.4	7.2	443	C.
August	8.0	7.7	7.7	473	C.
September	7.7	7.5	7.7	458	C.
October	8.0	7.3	7.5	461	C.
November	8.0	7.5	7.7	458	C.
December	8.0	7.5	7.6	467	C.
The year	10.0	5.7	7.1	5,140	

[a] Estimated.

NOTE.—The daily discharges for 1907 were obtained by interpolation between measurements, those for 1908 by the indirect method for shifting channels.

SAWMILL CREEK NEAR INDEPENDENCE, CAL.[a]

This station was established September 20, 1906, at a point on the upper road crossing about 300 feet beyond the Eightmile ranch and about 8 miles north of Independence. The gage was destroyed in the early part of 1907, and was not replaced.

[a] This stream was called Eightmile Creek in the 1906 report.

The following discharge measurements were made during 1907 and 1908:

Discharge measurements of Sawmill (Eightmile) Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
1907.		*Sec.-ft.*	1908.		*Sec.-ft.*
April 10	G. R. Shuey	3.9	April 3	R. B. Post	4.6
May 5	do	6.0	May 1	do	3.9
June 13	do	12	June 17	do	3.1
August 27	R. B. Post	6.6	June 26	do	3.8
October 9	do	6.3	July 9	do	4.9
December 2	do	5.4	July 31	W. A. Lamb	5.9
			August 12	do	5.1
1908.			August 24	do	5.8
February 28	R. B. Post	3.9	September 14	do	3.5
March 21	do	4.0	November 5	A. T. Barrows	5.4

THIBAUT CREEK NEAR INDEPENDENCE, CAL.

A regular station was established on this creek February 13, 1908, at a point about 1 mile west of the county road between Independence and Big Pine and about 5 miles north of Independence. No gage record has been kept.

The following measurements were made during 1907 and 1908:

Discharge measurements of Thibaut Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 6	G. R. Shuey				1.7
May 24	do				1.7
June 28	do				1.2
August 31	R. B. Post				.9
December 2	do				.9
1908.					
February 13	R. B. Post	3	1.4	0.25	.8
April 3	do	3	1.4	.33	1.0
May 6	do	1	.3		.2
July 8	do	3	1.0	.29	.6
July 31	W A. Lamb	3	1.2	.29	.63
August 12	do	3	1.2	.40	.60

OAK CREEK NEAR INDEPENDENCE, CAL.

The original station was put in about 1 mile west of old Fort Independence on June 15, 1905. A new station was established October 1, 1906, at Bell's flour mill, about 3 miles northwest of Independence. This station was discontinued April 19, 1907, and replaced by another above and about three-fourths of a mile west of the mill, where the conditions were better.

Discharge measurements of Oak Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 21	G. R. Shuey	12	6	0.23	9.6
February 24	do	11	6.2	.23	12
March 19	do	12	6.6	.31	20
April 11	do	12	6.0	.29	15
April 19	do	14	13	.50	23
May 24	do	14	14	.58	28
June 14	do	13	14	.60	31
June 28	do	14.5	17	.80	54
July 10	do	15	17	.80	58
August 2	Shuey and Post	14	16	.76	52
August 15	R. B. Post	13	13	.63	32
August 31	do	14	12	.54	25
September 9	do	12	9.6	.45	18
October 9	do	14	9.8	.41	14
October 31	do	12	9.6	.40	14
November 19	do	12	9.4	.44	15
November 26	do	12.5	9.4	.40	12
1908.					
February 8	R. B. Post	12	7.6	.31	8.4
March 24	do	12	7.8	.35	9.9
April 11	do	13	8.6	.32	9.9
April 22	do	14	9.6	.43	15
May 4	do	14	9.6	.44	15
May 30	do	12	9.4	.44	16
June 11	do	13	11.0	.49	20
June 24	do	13	11.0	.53	23
July 1	do	13	11.0	.58	22
July 11	do	14	13.0	.63	30
July 28	W. A. Lamb	15	13.0	.60	28
August 11	do	14	12.0	.59	29
August 31	do	13	9.4	.37	13
September 22	do	13	9.2	.37	13
October 14	do	13	8.6	.34	12
October 26	A. T. Barrows	14	9.7	.32	13
November 2	do	14	9.4	.34	12
November 14	do	14	9.0	.32	11

Daily gage height, in feet, of Oak Creek near Independence, Cal., for 1907 and 1908.

[A. N. Bell, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.2	0.25	0.2	0.25	0.5							
2	.2	.25	.2	.25			0.8	0.7	0.55	0.45	0.4	0.4
3	.2	.25	.2	.25	.5	0.8	.9					
4	.2	.25	.2	.25		.8	1.0		.55	.45		.4
5	.2	.25	.2	.25			1.0	.7			.4	
6	.2	.25	.25	.25	.5	.75			.5			.4
7	.25	.25	.3	.25		.7		.6		.45	.4	
8	.25	.25	.25	.25	.5		.9		.5			.4
9	.25	.25	.25	.25		.65		.6		.4	.4	
10	.25	.25	.25	.25			.8					.4
11	.25	.25	.25	.3	.55		.8	.6	.45	.4	.4	
12	.25	.2	.25	.3						.4		
13	.25	.2	.25	.35	.5	.65	.85	.6			.4	.4
14	.25	.2	.25	.4			.85	.65	.45	.4		
15	.25	.2	.25	.4	.5	.6		.65			.4	.4
16	.25	.2	.25	.4			.8		.45	.4		
17	.25	.2	.3	.4	.55	.6	.8			.4	.4	.4
18	.25	.2	.3	.4	.6	.55			.45			
19	.25	.2	.35	.4			.8	.5		.4	.4	.4
20	.25	.2	.35	.4	.6				.45	.4		
21	.25	.2	.3			.7	.8	.5			.4	.4
22	.25	.2	.3	[a].55	.6	.7				.4		.4
23	.25	.2	.3				.7	.55	.45		.4	
24	.25	.2	.3	.55	.6	.6			.45			.4
25	.25	.2	.3		.6	.6	.7		.45	.45	.4	
26	.25	.2	.3					.55		.45		.4
27	.25	.2	.3	.6	.6	.8	.7		.45		.4	
28	.25	.2	.25		.6	.8		.55		.4		.4
29	.25		.25	.55			.7				.4	
30	.25		.25		.65	.9			.45	.4		.4
31	.25		.25		.7		.7	.55				

[a] New station.

Daily gage height, in feet, of Oak Creek near Independence, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	0.3					0.45			0.4		0.35	0.35
2		0.35	0.3	0.3	0.5	.45	0.6	0.6		0.4		
3	.3								.35			.3
4		.35		.35	.5		.65	.6		.4	.35	.3
5	.3		.35			.45						
6			.35	.35	.45		.65	.6	.4	.35	.35	.3
7	.3	.35			.4	.45						
8		.3		.35			.65	.6	.4	.35	.35	.3
9	.3				.4	.5						.3
10		.3	.3	.35			.65	.6	.4	.35	.35	
11	.3			.3		.5				.35		
12		.3	.3		.4		.65	.55	.45		.35	.3
13				.35		.55				.4	.3	
14	.3		.3	.35	.4	.55	.6		.5			.3
15		.3		.4				.55		.35	.3	
16	.3		.3		.4	.55	.6		.45		.3	.3
17		.3		.4	.4			.5	.4	.35		
18	.3		.3			.5	.6	.5		.35	.3	.3
19	.3	.3		.4	.4				.4			
20						.5	.6	.5		.35	.3	.3
21			.3	.4	.4	.55			.4			
22	.3	.35	.35				.6	.5		.35	.3	.3
23				.4	.4	.55		.5	.4			
24	.3	.3	.35		.45		.6		.4	.35	.3	.3
25				.4		.6		.45				
26		.3			.5		.6		.4	.35	.35	
27	.3		.35	.45				.45				.3
28					.5	.6	.6		.4		.35	
29	.35	.3	.35	.45				.4		.35		.3
30				.5		.6	.6	.4	.4		.35	
31	.35		.35				.6			.35		.3

Monthly discharge of Oak Creek near Independence, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	11	10	10.8	664	C.
February	11	10	10.4	578	C.
March	17	10	12.2	750	C.
April	31	11	18.8	1,120	C.
May	43	21	26.9	1,650	C.
June	62	31	42.2	2,510	C.
July	88	43	57.0	3,500	C.
August	43	21	32.8	2,020	C.
September	31	17	20.4	1,210	C.
October	17	13	14.5	892	C.
November	13	13	13.0	774	C.
December	13	13	13.0	799	C.
The year	88	10	22.7	16,500	
1908.					
January	11	8.6	10.0	615	C.
February	11	8.6	9.2	529	C.
March	11	8.6	9.3	572	C.
April	20	8.6	12.3	732	C.
May	20	13	15.8	972	C.
June	27	11	21.0	1,250	C.
July	31	27	29.0	1,780	C.
August	28	12	22.5	1,380	C.
September	20	12	15.5	922	C.
October	14.5	12.5	13.0	799	C.
November	12.5	10.4	11.6	690	C.
December	12.5	10.4	10.5	646	C.
The year	31	8.6	15.0	10,900	

NOTE.—From January 1 to April 20, 1907, records kept in flume. During the remainder of the year record kept at new station. Daily discharges for 1907 were obtained by indirect method for shifting channels. The daily discharges for 1908 were obtained from several rating tables covering short periods of time.

INDEPENDENCE CREEK NEAR INDEPENDENCE, CAL.[a]

The original station at the city waterworks, which was established June 15, 1905, was destroyed in June, 1906. On August 20, 1906, a new station was established at a point about 300 feet above the city waterworks and 1 mile west of Independence.

Discharge measurements of Independence Creek near Independence, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 24	G. R. Shuey	9	5.2	0.30	3.0
March 19	do	10	8.6	.60	10.0
April 16	do	10	11	.80	19
May 23	do	10.5	13	1.10	33
June 3	do	11	16	1.30	69
June 28	do	11	15	1.40	66
July 10	do	12	13	1.45	64
August 14	R. B. Post	10	8.6	1.00	25
August 30	do	10	7.0	.85	14
September 26	do	3.5	2.4	.60	5.3
October 19	do	4.5	3.1	.68	6.8
October 31	do	4.5	3.4	.77	8.4
November 11	do	4	2.8	.68	5.6
November 30	do	4	2.7	.64	4.7
1908.					
February 6	R. B. Post	4.5	2.2	.52	2.6
February 27	do	3.5	2.1	.54	2.7
March 14	do	3.5	2.2	.56	2.8
March 24	do	10	5.6	.63	5.4
April 10	do	9	4.5	.60	4.7
April 23	do	11	7.7	.82	11
May 1	do	10	9.3	1.00	18
May 9	do	10	8.5	.96	16
June 1	do	10	8.7	1.01	19
June 11	do	10	8.9	1.01	20
June 23	do	10	10.0	1.10	23
July 1	do	10	9.7	1.18	26
July 11	do	11	12	1.20	34
July 20	W. A. Lamb	12	11	1.08	27
July 28	do	12	11	1.08	28
August 6	do	12	11	1.10	30
August 22	do	12	7.6	.79	15
September 1	do	11	6.9	.71	11
September 21	do	10	6.2	.68	8.8
October 3	do	10	6.0	.67	9.4
October 14	do	10	5.6	.63	7.2
October 26	A. T. Barrows	11	6.4	.63	8.2
November 2	do	12	6.6	.64	8.0
November 11	do	12	6.2	.62	5.8

[a] This creek is called Little Pine Creek on the United States Geological Survey's topographic map of the Mount Whitney quadrangle, but is commonly known as Independence Creek.

Daily gage height, in feet, of Independence Creek near Independence, Cal., for 1907 and 1908.

[Le Roy Roeper, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.4	0.4	0.3	0.4			1.5		0.9	0.6		
2					0.9						0.7	0.7
3	.5	.4	.3	.5		1.1	1.5		1.0	.6		
4					.8			1.2			.7	.7
5	.4	.3	.35	.5	.8	1.3	1.7		1.0	.6		
6								1.3			.7	7
7		.4	.3	.4	.8	1.3	1.6		.9	.6		
8								1.1			.7	.7
9		.3	.3	.5	.9	1.2	1.5		1.0	.6		
10						1.3		1.1			.7	.7
11		.3	.35	.7	.95					.6		
12					.9	1.1		1.0			.7	.7
13	.5	.3	.3	.6			1.4		1.0	.6	.7	
14					.8	1.0		1.0			.7	.7
15	.4	.3	.4	.7			1.3		.9	.6		
16					1.0	1.2					.9	.7
17		.3		.8	1.1		1.3		1.0	.6		
18	.4							1.1			.7	.7
19		.3		.8	.9				.9	.7		
20	.4		.6					1.1			.7	.7
21		.3		.9	.8				.8	.7		
22	.4		.4					1.0			.7	.7
23		.35		.9	.9				.7	.7		
24	.5		.5					1.1			.7	.7
25		.4		.8	.9		1.4			.8		
26	.5		.5					1.0			.7	.7
27		.3		.9			1.3			.8		
28	.4		.4					1.2			.7	
29				.8		1.4	1.2	1.3		.8		.7
30	.4		.4								.7	
31	.5							1.2		.8		.7
1908.												
1		.6		.6		.9		1.1		.7		
2	.6		.5		1.0		1.2		.7		.65	.65
3		.6		.6		1.0		1.1		.7		
4	.6		.5		1.0		1.2		.65		.65	.6
5		.6		.6		1.0		1.1		.7		
6	.6		.5		1.0		1.2		.6		.65	.6
7		.5		.6		1.0		1.1		.7		
8	.6		.55		.95		1.1		.6		.6	.6
9		.5		.6		1.0		1.1		.7		
10	.6		.55		.9		1.1		.7		.6	.6
11		.5		.6		1.05		1.05		.7		
12	.6		.5		.9		1.1		.6		.6	.6
13		.5		.65		1.1		1.0		.7		
14	.6		.55		.9		1.1		.6		.6	.6
15		.5		.7		1.1		.95		.7		
16	.6		.6		.85		1.1		.6		.6	.6
17		.5		.7		1.1		.9		.7		
18	.6		.6		.85		1.1		.6		.6	.6
19		.5		.75		1.15		.9		.6		
20	.6		.6		.9		1.05		.6		.6	.6
21		.5				1.1		.85		.6		
22	.6		.6	.8	.9		1.0		.65		.6	.6
23		.5				1.1		.8		.6		
24	.6		.6	.8	.95		1.05		.7		.6	.6
25		.5				1.0		.8		.65		
26	.6		.6	.8	.9		1.1		.7		.6	.6
27		.5				1.0		.75		.65		
28	.6		.6	.85	1.0		1.1		.7		.6	.6
29		.5				1.1		.7		.65		
30	.6		.6	.9	1.0		1.1		.7		.6	.6
31								.7		.65		

Monthly discharge of Independence Creek near Independence, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	7	4.5	5.5	338	B.
February	4.5	3.0	3.5	194	B.
March	10	3	4.9	301	B.
April	25	4.5	14.9	887	B.
May	43	19	26.0	1,600	B.
June	93	33	62.0	3,690	C.
July	137	43	70.6	4,340	C.
August	53	25	35.8	2,200	C.
September	25	4.9	16.7	994	C.
October	11	4.6	6.6	406	C.
November	17	6.9	7.6	452	C.
December	6.9	6.9	6.9	424	C.
The year	137	3	21.8	15,800	
1908.					
January	4.3	4.3	4.3	264	C.
February	4.3	2.0	2.4	138	C.
March	4.3	2.0	3.4	209	C.
April	14	4.3	7.4	440	C.
May	19	12	15.7	965	C.
June	27	14	21.5	1,280	C.
July	35	22	29.0	1,780	C.
August	28	10	19.9	1,220	C.
September	10	6.1	8.3	494	C.
October	10	6.1	9.0	553	C.
November	8.2	6.1	6.6	393	C.
December	8.2	6.1	6.3	387	C.
The year	35	2	11.2	8,120	

NOTE.—Daily discharges for days without gage record were interpolated between measurements. The daily discharges were obtained from several rating tables covering short periods of time.

SHEPARD CREEK NEAR THEBE, CAL.[a]

No regular station has been maintained on this stream, but a sufficient number of measurements were made during 1907 and 1908 to justify a rough estimate of the monthly flow. All measurements were made at a point about 3 miles east of the mouth of the creek's canyon.

Discharge measurements of Shepard Creek near Thebe, Cal., in 1907 and 1908.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
1907.		*Sec.-ft.*	1908.		*Sec.-ft.*
January 30	G. R. Shuey	2.0	February 10	R. B. Post	1.0
February 24	do	2.7	February 29	do	1.6
March 22	do	3.8	March 11	do	1.3
April 16	do	9.7	April 4	do	0.7
May 4	do	9.1	April 17	do	1.4
May 20	do	13	April 30	do	6.3
June 5	do	31	May 8	do	6.3
June 15	do	20	May 15	do	5.4
June 27	do	30	June 8	do	8.2
July 9	do	39	June 23	do	11
July 31	do	36	July 3	do	24
August 12	R. B. Post	23	July 13	Post and Lamb	18
August 28	do	14	July 24	W. A. Lamb	17
September 11	do	3.3	August 9	do	34
September 27	do	3.3	August 17	do	18
October 17	do	6.1	September 2	do	6
November 4	do	4.9	October 1	do	8.5
November 24	do	4.6	October 20	Barrows and Lamb	4.7
December 14	do	2.7	November 3	do	3.0
			November 11	A. T. Barrows	2.5

[a] This station was referred to in the 1906 report (Water-Supply Paper 213) as Shepherds Creek near Independence.

Monthly discharge of Shepard Creek near Thebe, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January			2.0	123
February			2.4	133
March			3.4	209
April			8.1	482
May			14.0	861
June			26.0	1,550
July			37.0	2,280
August			21.0	1,290
September			4.7	280
October			5.1	314
November			4.7	280
December			2.9	178
The year			11.0	7,980
1908.				
January			[a] 1.3	80
February			[a] 1.3	75
March			[a] 1.3	80
April	6.4	0.7	2.6	155
May	7.0	5.4	6.2	381
June	22	7.1	13.4	797
July	28	17	22.0	1,350
August	34	6.7	21.0	1,290
September	18	6.0	9.6	571
October	8.5	3.6	5.7	350
November	3.4	2.5	2.6	155
December			[a] 2.0	123
The year			7.4	5,410

[a] Estimated.

NOTE.—Daily discharges for 1907 and April to November, 1908, were obtained by interpolation between the measurements. The monthly estimates of flow for 1907 and 1908 are only approximate.

BAIRS CREEK NEAR THEBE, CAL.[a]

No regular station has been maintained at this point, but during 1907 and 1908 enough measurements were made to justify a rough estimate of the monthly flow. All measurements were made at a point about 3 miles east of the mouth of the canyon.

Discharge measurements of Bairs (Moffett) Creek near Thebe, Cal., in 1907 and 1908.

Date.	Hydrographer.	Discharge.	Date.	Hydrographer.	Discharge.
1907.		*Sec.-ft.*	**1908.**		*Sec.-ft.*
March 22	G. R. Shuey	3.5	February 10	R. B. Post	0.0
April 16	do	7.2	April 17	do	.9
May 20	do	9.6	April 30	do	2.8
June 5	do	14	May 8	do	4.9
June 15	do	10	May 15	do	3.8
June 27	do	13	June 23	do	6.2
July 9	do	15	July 3	do	3.7
July 31	do	5.9	August 9	W. A. Lamb	8.2
August 12	R. B. Post	4.4	August 17	do	4.5
August 28	do	3.9	September 2	do	1.5
September 11	do	.6	October 1	do	2.9
October 17	do	1.8	November 12	A. T. Barrows	1.7
November 4	do	2.6			
November 24	do	1.6			
December 14	do	15			

[a] This station was referred to in the 1906 report (Water-Supply Paper 213) as Moffett Creek near Independence.

Monthly discharge of Bairs (Moffett) Creek near Thebe, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
1907.			1908.		
January	[a]1.0	61	January	[a]1.0	61
February	[a]1.0	56	February	[a].0	0
March	3.0	184	March	[a].0	0
April	7.0	417	April	1.2	71
May	9.6	590	May	3.0	184
June	12.2	726	June	4.0	238
July	11.7	719	July	4.5	277
August	4.4	270	August	4.0	246
September	1.1	65	September	1.6	95
October	1.7	104	October	[a]1.4	86
November	2.1	125	November	[a]1.2	71
December	1.5	92	December	[a]1.0	61
The year	4.7	3,410	The year	1.9	1,390

[a] Estimated.

NOTE.—Daily discharges, March to December, 1907, and April to September, 1908, were obtained by interpolation between measurements. The monthly estimates of flow are only approximate.

GEORGE CREEK NEAR THEBE, CAL.[a]

A gage has been placed on this creek at a point about 1 mile west of the road from Independence to Lone Pine, and all measurements during 1907 and 1908 were made there.

No gage record was kept during 1907 and 1908, but a rough estimate has been made of the monthly flow.

Discharge measurements of George Creek near Thebe, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. feet.*	*Feet.*	*Sec.-ft.*
February 24	G. R. Shuey	6.8	3.3	....	2.7
March 22	.....do	8	5.7	0.95	5.6
April 16	.....do	8.5	6.8	1.20	12
May 4	.....do	9	8	1.20	14
May 20	.....do	9	8.7	1.35	19
June 15	.....do	8	7.5	1.20	16
July 9	.....do	9	11	1.55	33
August 12	R. B. Post	8	7.3	1.20	14
August 28	.....do	8	6.2	1.05	8.7
September 11	.....do	8	5.1	.89	4.4
September 27	.....do	8	4.4	.79	2.0
October 19	.....do	8	6.4	1.01	6.8
November 4	.....do	8	5.7	.99	6.1
November 24	.....do	8	4.3	.82	2.8
December 14	.....do	8	4.1	.80	2.3
1908.					
February 10	R. B. Post	8	3.1	.68	1.5
February 29	.....do	8	3.8	.75	1.7
March 11	.....do	8	3.6	.75	1.8
April 4	.....do	8	4.2	.80	2.6
April 17	.....do	8	4.2	.82	2.8
April 30	.....do	8.5	7.6	1.18	14
May 8	.....do	8	6.3	1.03	8.6
May 15	.....do	6.5	5.7	.95	6.1
June 8	.....do	8.5	4.8	.85	6.8
June 23	.....do	9	6.3	1.09	12
July 3	.....do	9	8.1	1.20	19
July 13	Post and Lamb	8.5	7.1	1.15	18
July 24	W. A. Lamb	9	7.7	1.10	14
August 9	.....do	9	8.9	1.15	22
August 17	.....do	9	7.0	.95	11
September 2	.....do	9	5.4	.80	7.1
October 1	.....do	9	5.8	.87	8.7
October 20	Lamb and Barrows	8	4.3	.75	4.0
October 30	A. T. Barrows	4	3.4	....	5.8
November 3	Lamb and Barrows	8.5	4.8	.67	3.4
November 12	A. T. Barrows	9	4.5	.64	3.0

[a] This station was referred to in the 1906 report (Water-Supply Paper 213) as Georges Creek near Independence.

Monthly discharge of George Creek near Thebe, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
1907.			1908.		
January	2.0	123	January	2.7	166
February	2.5	139	February	1.9	109
March	5.0	307	March	2.2	135
April	11.0	655	April	5.3	315
May	17.0	1,040	May	8.0	492
June	19.0	1,130	June	11.0	655
July	28.0	1,720	July	18.0	1,110
August	13.0	799	August	14.0	861
September	4.0	238	September	8.1	482
October	5.2	320	October	6.0	369
November	3.8	226	November	3.2	190
December	2.3	141	December	3.0	184
The year	9.4	6,840	The year	7.0	5,070

NOTE.—Daily discharges were obtained by interpolation between the measurements. These monthly means are only approximate.

LONE PINE CREEK NEAR LONE PINE, CAL.

This station was established September 25, 1906, at a point about three-fourths of a mile west of the town of Lone Pine and about 500 feet above the division boxes on the creek.

Discharge measurements of Lone Pine Creek near Lone Pine, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	G. R. Shuey	7	4.2	1.67	5.6
February 23	do	7	4.5	1.70	6.9
March 21	do	7	5.2	1.80	9.6
April 16	do	6.5	7.1	2.05	21
May 21	do	7	8.8	2.30	32
June 5	do	7	11	2.60	46
June 27	do	8	14	2.85	69
July 9	do	7.5	13	2.80	74
July 30	do	6.5	11	2.60	54
August 12	R. B. Post	6	7.6	2.33	30
August 29	do	6.5	9.8	[a] 2.60	26
September 10	do	6.5	8.2	2.40	15
September 28	do	6.0	5.9	2.10	8.6
October 13	do	6	7.1	2.25	9.5
October 23	do	6	9	2.49	17
November 7	do	6	7.2	2.31	9.7
November 22	do	6	7.1	2.22	9.0
1908.					
February 1	R. B. Post	6	8	2.05	8.1
March 16	do	6	6.8	2.23	8.7
April 16	do	6	7.6	2.34	10
April 27	do	6	9.3	2.49	16
May 19	do	6	7.0	2.40	10
May 27	do	6.5	9.0	2.55	16
June 5	do	6	8.0	2.51	12
June 14	do	7.5	12	2.90	29
July 2	do	7.5	14	3.00	38
July 21	W. A. Lamb	8	15	3.00	39
August 7	do	10	20	3.40	73
August 18	do	6.5	12	2.85	29
September 7	do	7.5	13	3.00	32
September 10	do	8	16	3.20	49
September 23	do	7	11	2.62	19
October 18	do	7	9.4	2.45	10
October 28	A. T. Barrows	7	9.7	2.42	11
November 21	do	7.5	9	2.25	6.6

[a] Change in channel section.

Daily gage height, in feet, of Lone Pine Creek near Lone Pine, Cal., for 1907 and 1908.

[A. J. Gallaher, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.8		1.8	1.7			2.8				2.7	2.2
2		1.7				2.5			2.4	2.1		
3	1.8		1.8	1.7				2.6				
4		1.7					3.0				2.65	2.2
5	1.8		1.8	2.0		2.6			2.4	2.3		
6		1.7						2.6				
7	1.8		1.8	2.0			3.0				2.6	2.2
8		1.7				2.45			2.4	2.3		
9			1.8	2.0				2.5				
10	1.8	1.7					2.8				2.6	2.2
11			1.6	2.0		2.5			2.4	2.3		
12	1.8							2.4				
13	1.8		1.6	2.0			2.8				2.3	2.1
14		1.7				2.4			2.4	2.3		
15	1.8		1.8	2.0				2.4				
16							2.6				2.2	2.1
17	1.7	1.7	1.8	2.05		2.2			2.4	2.6		
18								2.4				
19	1.7	1.7	1.8	2.2			2.7				2.2	2.1
20	1.7					2.3			2.2	2.5		
21	1.7	1.7	1.8	2.15				2.4				
22							2.7				2.2	2.1
23	1.7	1.7	1.8	2.2		2.6			2.2	2.6		
24							2.7	2.3				
25	1.7	1.7	1.8	2.2			2.7				2.2	2.05
26						2.8			2.1	2.75		
27	1.7	1.7	1.8	2.2				2.2				
28							2.5				2.15	2.1
29	1.7		1.8	2.1		2.8		2.6	2.0	2.7		
30								2.8				
31	1.7		1.8				2.6					2.1
1908.												
1		2.05		2.3	2.55		3.0				2.45	2.25
2			2.1						2.6	2.6		
3	2.05					2.65		3.75				
4		2.0		2.3	2.65		3.05				2.35	2.25
5			2.1						2.6	2.5		
6	2.05					2.65		3.75				
7		2.0		2.25	2.65		3.1				2.35	2.25
8			2.1						3.0	2.5		
9	2.05					2.8		3.55				
10		2.05		2.3	2.7		3.15				2.35	2.25
11			2.15						3.0	2.45		
12	2.05					2.9		3.5				
13		2.1		2.3	2.65		3.2				2.35	2.3
14			2.15						2.8	2.45		
15	2.0					2.95		3.4				
16		2.1		2.4	2.6		3.2				2.3	2.3
17			2.2						2.65	2.45		
18	2.0					3.0		3.3				
19		2.1		2.4	2.5		3.1				2.25	2.25
20			2.2						2.6	2.45		
21	2.0					3.0		2.7				
22		2.35		2.45	2.45		3.0				2.25	2.15
23			2.25						2.6	2.45		
24	2.2					3.05		2.7				
25		2.2		2.5	2.5		3.0				2.2	2.15
26			2.25						2.8	2.45		
27	2.2					3.05		2.6				
28		2.1		2.5	2.55		3.0				2.25	2.15
29			2.25						2.75	2.45		
30						3.1		2.6				
31					2.65		3.0					2.15

Monthly discharge of Lone Pine Creek near Lone Pine, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	9.5	6.5	8.2	504	C.
February	6.5	6.5	6.5	361	C.
March	9.5	4.0	8.8	541	C.
April	27	6.5	19.5	1,160	C.
May			a 30.0	1,840	D.
June	65	27	45.6	2,710	C.
July	80	44	61.5	3,780	C.
August	51	26	39.5	2,430	C.
September	23	7.9	11.5	684	C.
October	38	8.1	19.6	1,210	C.
November	34	8.6	16.2	964	C.
December	8.9	8.1	8.5	523	C.
The year	80	4.0	23.0	16,700	
1908.					
January			a 8.0	492	D.
February	10	7.0	7.7	443	C.
March	9.5	7.5	8.2	504	C.
April	16	8.9	11.3	672	C.
May	22	13	17.4	1,070	C.
June	45	14	32.0	1,900	C.
July	54	38	44.0	2,700	C.
August	110	18	58.0	3,570	C.
September	54	16	24.0	1,430	C.
October	16	10	11.3	695	C.
November	10	6.5	7.6	452	C.
December	7.5	5.5	6.3	387	C.
The year	110	5.5	19.6	14,300	

a Estimated.

NOTE.—The daily discharges were obtained from several rating tables covering short periods of time.

TUTTLE CREEK NEAR LONE PINE, CAL.

Regular measurements were made on this creek during 1907 and 1908 near Lone Pine, at a point where the stream leaves the foothills and enters the valley. An incomplete gage height record was kept during 1907 and 1908, but it is of little value on account of continual changes at the gaging section.

Discharge measurements of Tuttle Creek near Lone Pine, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	G. R. Shuey	9	4.2	1.10	5.4
February 23	....do	9	4.7	1.02	6.4
March 21	....do	8	4.0	1.02	5.3
April 16	....do	8.5	4.2	1.00	5.7
May 21	....do	8	4.7	1.10	85
June 5	....do	9	6.4	1.25	12
June 27	....do	8	7.6	1.35	18
July 9	....do	8.5	9.9	1.55	28
July 30	....do	9	9.6	1.50	21
August 12	R. B. Post	8	7.2	1.33	14
August 29	....do	8	6.8	1.20	12
September 10	....do	8	5.6	1.12	8.4
September 28	....do	8	4.8	1.07	5.9
October 12	....do	8.5	5.2	1.10	6.1
October 23	....do	8.5	5.7	1.17	7.4
November 7	....do	8.5	5.3	1.14	6.8
November 22	....do	8	5.3	1.12	6.3

Discharge measurements of Tuttle Creek near Lone Pine, Cal., in 1907 and 1908—Con.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 1	R. B. Post	9.5	5.4	1.10	4.5
March 16	do	8.5	4.4	1.05	5.1
April 16	do	8	4.9	1.08	5.3
April 27	do	8	4.9	1.05	5.8
May 19	do	8.5	4.7	1.02	6.0
May 27	do	8.5	4.5	1.02	5.5
June 5	do	8.5	5.0	1.08	6.7
June 14	do	8.5	6.3	1.11	10
July 2	do	8	6.4	1.20	11
July 21	W. A. Lamb	8.5	7.4	1.20	15
August 7	do	8.5	8.4	1.32	21
August 18	do	8	7.0	1.19	14
September 7	do	8	6.2	1.11	10
September 23	do	8	6.0	1.10	10
October 18	do	8	5.4	1.10	8.2
October 28	A. T. Barrows	8	5.7	1.10	8.1
November 21	do	8	5.3	1.10	7.1

Daily gage height, in feet, of Tuttle Creek near Lone Pine, Cal., for 1907 and 1908.

[John Anton and A. J. Gallaher, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	1.2	1.2	1.2	1.0			1.4				1.2	1.1
2						1.2			1.2	1.0		
3	1.2	1.2	1.2	1.0				1.45				
4							1.5				1.25	1.1
5	1.2	1.2	1.2	1.0		1.25			1.2	1.2		
6								1.5				
7	1.2	1.2	1.2	1.0			1.5				1.25	1.1
8						1.25			1.2	1.1		
9	1.2	1.2	1.2	1.0				1.4				
10							1.55				1.2	1.1
11	1.2	1.2	1.2	1.0		1.2			1.1	1.1		
12								1.3				
13	1.2	1.2	1.2	1.0			1.5				1.2	1.05
14						1.3			1.2	1.1		
15	1.2	1.2	1.0	1.0				1.3				
16							1.25				1.1	1.1
17	1.2	1.2	1.0	1.0		1.4			1.2	1.25		
18								1.3				
19	1.1	1.2	1.0	1.2			1.3				1.1	1.1
20						1.2			1.1	1.1		
21	1.1	1.2	1.0	1.2				1.3				
22							1.3				1.1	1.1
23	1.1	1.2	1.0	1.2		1.8			1.1	1.2		
24								1.3				
25	1.1	1.2	1.0	1.2			1.3				1.1	1.05
26						1.7			1.1	1.25		
27	1.1	1.2	1.0	1.2			1.25	1.2				
28											1.05	1.1
29	1.1		1.0	1.2		1.5			1.1	1.2		
30								1.2				
31	1.1		1.0				1.5					1.1
1908.												
1		1.1		1.3	1.25		1.15				1.1	1.1
2			1.1						1.1	1.1		
3	1.05					1.1		1.25				
4		1.05		1.3	1.25		1.2				1.1	1.1
5			1.1						1.1	1.1		
6	1.05					1.15		1.3				
7		1.05		1.25	1.25		1.2				1.1	1.1
8			1.1						1.1	1.05		
9	1.05					1.15		1.3				
10		1.1		1.3	1.3		1.25				1.1	1.1

Daily gage height, in feet, of Tuttle Creek near Lone Pine, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11			1.15						1.5	1.1		
12	1.05					1.15		1.25				
13		1.1		1.3	1.25		1.3				1.1	1.1
14			1.15						1.15	1.1		
15	1.0					1.2		1.25				
16		1.1		1.4	1.2		1.2				1.1	1.1
17			1.2						1.1	1.1		
18	1.0					1.25		1.2				
19		1.1		1.4	1.0		1.15				1.1	1.1
20			1.2						1.1	1.1		
21	1.0					1.25		1.2				
22		1.25		1.15	1.0		1.15				1.1	1.05
23			1.25						1.1	1.1		
24	1.2					1.3		1.2				
25		1.2		1.2	1.05		1.1				1.1	1.05
26			1.25						1.15	1.1		
27	1.2					1.3		1.15				
28		1.1		1.2	1.1		1.1				1.1	1.05
29			1.25						1.1	1.1		
30						1.35		1.15				
31					1.1		1.1					1.05

Monthly discharge of Tuttle Creek near Lone Pine, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).
1907.			1908.		
January	7.4	455	January	5.0	307
February	8.5	472	February	4.5	259
March	7.4	455	March	5.0	307
April	7.3	434	April	5.5	327
May	[a]9.0	553	May	6.0	369
June	17.1	1,020	June	10.0	595
July	18.8	1,160	July	14.0	861
August	15.0	922	August	15.0	922
September	7.1	422	September	12.0	714
October	7.8	480	October	8.0	492
November	7.6	452	November	7.0	417
December	5.9	363	December	7.0	430
The year	9.9	7,190	The year	8.2	6,000

[a] Estimated.

NOTE.—The daily discharges were obtained by the indirect method for shifting channels. The monthly means are only approximate.

COTTONWOOD CREEK NEAR OLANCHA, CAL.

Cottonwood Creek discharges into Owens Lake. The original station on this creek was established September 25, 1906, at a point about one-fourth mile above the crossing of the Los Angeles aqueduct and about 15 miles south of Lone Pine. A new station was established September 9, 1908, at a point 100 feet above the head of the diversion pipe of the Los Angeles aqueduct.

Discharge measurements of Cottonwood Creek near Olancha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
January 31	G. R. Shuey	10.5	9.8	0.55	11
February 22	do	10.5	10	.60	11
April 17	do	11	19	1.35	51
May 21	do	10.5	30	2.20	144
June 4	do	11	30	2.30	157
June 19	do	11	24	1.70	89
June 25	do	11	23	1.70	84
July 30	do	10.5	18	1.20	40
August 13	R. B. Post	9	14	1.00	30
August 28	do	9	12	.87	19
September 11	do	9	10	.70	13
September 27	do	9	9.6	.56	9.7
October 13	do	9	14	.82	19
October 23	do	9	17	1.20	43
November 8	do	9	14	.89	24
November 23	do	9	12	.75	15
1908.					
January 31	R. B. Post	9	10	.77	12
March 4	do	11	13	.69	16
April 15	do	10	18	1.29	49
April 26	do	10	21	1.63	82
May 28	do	10	18	1.33	50
June 5	do	10	17	1.29	45
June 14	do	10	16	1.16	39
July 22	W. A. Lamb	12	13	.80	22
July 23	do	12	13	.80	20
August 8	do	10	13	.90	24
August 19	do	12	13	.80	19
September 9	do	10	10	1.86	16
September 24	do	10	12	2.05	21
October 19	do	11.5	11	1.90	18
October 29	A. T. Barrows	7	9.8	1.88	20
November 20	do	10	6.2	.48	7.6

Daily gage height, in feet, of Cottonwood Creek near Olancha, Cal., for 1907 and 1908.

[L. T. Waldorf, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.5	0.55					1.75	1.3	0.8	0.55		0.8
2			0.6	0.65								
3	.5	.55					1.75	1.4	.8	.5		.7
4				.65							1.2	
5	.5	.55	.6				1.75		.75	.8		.6
6				.65				1.2			.8	
7		.55	.6						.75			
8	.5							1.15		1.0		.9
9			.6	.9			1.7				.8	
10	.5	.55		1.3				1.1	.7	.9		.8
11						2.1	1.65		.7		.9	
12	.6	.55	.65							.8		.8
13				1.45		2.1	1.6	1.0	.7		.8	
14		.55	.65									
15	.5			1.3		2.1		1.0		.7	.7	.8
16		.6	.65				1.5					
17	.5			1.35				1.0	.6	1.4	.5	.7
18						1.7	1.5					
19	.5	.6	.7						.6	1.1	.5	.8
20				1.6		1.6	1.4	.95	.6			
21		.6	.75								.5	
22	.6					1.8		.9		1.0		.8
23		.6	.7	1.65			1.3					
24	.6	.6						.9	.6	1.25	.75	.75
25				1.85		1.7	1.3					
26	.6	.6	.65					.9	.55	1.2	.8	.75
27				1.9		1.8	1.3					
28		.6	.65					.85	.55	1.2	.8	
29	.6					1.8						.75
30			.65	1.8			1.2	.85			.8	
31	.55											.75

Daily gage height, in feet, of Cottonwood Creek near Olancha, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1		0.65					1.15				2.0	1.7
2			0.6			1.9	1.15				1.9	1.7
3							1.15				1.9	1.7
4		.65	.7					0.9			1.9	1.7
5			.75				1.1	1.05			1.85	1.7
6							1.1	.95			1.85	1.7
7							1.1	.9			1.9	1.7
8		.65	.7				1.1	.9			2.0	1.7
9							1.1	.9			2.0	1.7
10		.65			1.55		1.05	1.0			2.0	1.65
11					1.55		1.05	.9		1.75	2.0	1.6
12			.7			1.25	1.0	.9		1.75	1.9	1.6
13						1.2	1.0	.8		1.75	1.85	1.6
14		.65				1.2	1.0	.8		1.7	1.9	1.6
15			.7			1.2	1.0	.8		1.75	1.5	1.6
16						1.2	1.0	.8		1.9	1.5	1.6
17		.60				1.2	1.0	.75		1.9	1.4	1.6
18						1.2	1.0	.75		2.0	1.4	1.6
19			.95			1.2	1.05	.75		2.25	1.4	1.5
20						1.2	1.05	.75		2.2	1.5	1.5
21		.6				1.2	1.05	.7		2.45	1.5	1.5
22			1.1			1.1	1.0	.7		2.3	1.6	1.5
23						1.2	1.0	.7		2.1	1.6	1.5
24		.7				1.2	1.0	.65		2.05	1.6	1.5
25						1.1	1.0	.65		2.0	1.5	1.5
26			1.0			1.2	1.0	.6		1.9	1.7	1.5
27							1.0	.6		1.9	1.7	1.5
28		.6				1.09	1.05	.6		1.9	1.6	1.5
29			1.0			1.2	1.05	.6		1.9	1.7	1.5
30						1.2		.5		1.9	1.7	1.5
31					1.7			.6		2.0		1.5

Rating tables for Cottonwood Creek near Olancha, Cal.

FOR 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.*
0.50	9.4	1.00	27	1.50	65	2.00	120
.60	11	1.10	33	1.60	75	2.10	132
.70	13	1.20	40	1.70	85	2.20	144
.80	17	1.30	48	1.80	96	2.30	157
.90	21	1.40	56	1.90	108		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 16 discharge measurements made during 1907, and is well defined between gage heights 0.5 foot and 2.3 feet.

JANUARY 1 TO SEPTEMBER 8, 1908.

0.60	11	1.10	35	1.60	76	2.10	132
.70	15	1.20	42	1.70	86	2.20	145
.80	19	1.30	49	1.80	97	2.30	158
.90	24	1.40	57	1.90	108		
1.00	29	1.50	66	2.00	120		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 14 discharge measurements made during 1908, and is well defined between gage heights 0.8 foot and 1.7 feet.

Monthly discharge of Cottonwood Creek near Olancha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	11	9.4	10.0	615	B.
February	11	10	10.5	583	B.
March	15	11	12.0	738	B.
April	108	12	56.3	3,350	B.
May			*a* 115	7,070	D.
June			*a* 110	6,550	D.
July	90	44	67.1	4,130	B.
August	56	18	28.8	1,770	B.
September	17	10	12.5	744	B.
October	56	9.4	28.0	1,720	B.
November	40	9.4	18.6	1,110	B.
December	21	11	15.8	972	B.
The year			40.4	29,400	
1908.					
January			*a* 12.0	738	D.
February	15	11	12.5	719	B.
March	42	11	22.2	1,360	B.
April	81	29	58.1	3,460	B.
May	86	46	62.2	3,820	B.
June	108	35	48.5	2,890	B.
July	38	22	31.2	1,920	B.
August	32	7	18.7	1,150	B.
September			*a* 18.0	1,070	D.
October			*a* 19.0	1,170	D.
November	20	12.5	16.3	970	D.
December	15.5	13.5	14.4	885	D.
The year			27.8	20,200	

a Estimated.

NOTE.—Daily discharges for days having no gage height in 1907 were interpolated.

ASH CREEK NEAR OLANCHA, CAL.

Ash Creek discharges into Owens Lake. The gaging station was established April 15, 1907, at a point just above the forks of the creek near the mouth of the canyon, and about 16 miles south of Lone Pine.

Discharge measurements of Ash Creek near Olancha, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 22	G. R. Shuey	5	1.6	....	2.9
April 17	do	6	6.2	2.00	16
May 22	do	7	10	2.50	39
June 19	do	6	6.8	2.00	18
July 30	do	4.5	3.0	1.35	4.3
August 14	R. B. Post	4	2.8	1.30	3.9
August 29	do	4	2.6	1.28	3.9
September 11	do	4	2.4	1.21	2.6
September 27	do	5	2.4	1.18	2.1
October 13	do	5	3.2	1.32	3.6
November 8	do	5	3.8	1.59	5.4
November 23	do	5	3.3	1.46	4.1
1908.					
January 31	R. B. Post	5	3.1	1.35	4.1
March 4	do	5	3.8	1.51	4.8
April 15	do	6	5.9	1.87	10.0
April 26	do	6	7.1	2.10	15.0
May 28	do	6	6.5	1.91	11.0
June 4	do	6	6.2	1.85	11.0
June 14	do	5	4.4	1.68	7.0
July 22	W. A. Lamb	5	2.6	1.20	2.4
July 23	do	5	2.7	1.24	2.6
August 8	do	5	2.6	1.20	2.2
September 9	do	5	2.2	1.15	1.8
September 24	do	5	3.4	1.40	4.1
October 19	do	5	2.6	1.28	2.3
October 29	A. T. Barrows	5	2.6	1.25	2.5
November 20	do	5	2.8	1.26	2.4

Daily gage height, in feet, of Ash Creek near Olancha, Cal., for 1908.

[M. S. Watson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.35				1.9	1.4					
2			1.5	1.7								
3									1.2			
4		1.35	1.5			1.85						1.3
5				1.7			1.4					
6					1.85			1.2				
7												1.25
8		1.35	1.5			1.9						
9				1.75					1.3			1.3
10		1.35			1.9		1.4					
11						1.7						
12			1.5	1.9				1.2				
13					1.9				1.5			1.25
14		1.3										
15			1.5		1.95							1.3
16				1.85		1.6	1.3	1.2	1.2			
17		1.3						1.2				
18					2.0							1.3
19			1.7			1.55				1.3		
20											1.25	
21		1.3										
22			1.8		2.0							
23						1.55					1.25	
24		1.4										
25												
26			1.75		1.9							
27				2.1					1.3		1.25	
28		1.55				1.45						1.3
29			1.7							1.25		
30							1.2	1.2	1.3			
31	1.35											

Rating table for Ash Creek near Olancha, Cal., 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.*
1.00	0.8	1.40	4.0	1.80	9.2	2.10	15.0
1.10	1.5	1.50	5.1	1.90	10.9	2.20	17.3
1.20	2.2	1.60	6.3	2.00	12.8	2.30	20.0
1.30	3.1	1.70	7.7				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based upon fifteen discharge measurements made during 1908 and is well defined between gage heights 1.2 feet and 2.1 feet.

Monthly discharge of Ash Creek near Olancha, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January			2.5	154	D.
February			2.5	139	D.
March			2.5	154	D.
April			20.0	1,190	D.
May			39.4	2,420	B.
June			29.4	1,750	B.
July			5.5	338	B.
August			3.5	215	C.
September			2.5	149	D.
October			4.0	246	D.
November			4.5	268	D.
December			4.0	246	D.
The year			10.0	7,270	
1908.					
January			[a] 4.0	246	D.
February	5.7	3.1	3.7	213	C.
March	9.2	5.1	6.6	406	C.
April	15	7.7	10.9	649	C.
May	13	10	11.5	707	C.
June	11	4.6	7.3	434	C.
July	4	2.2	3.2	197	D.
August	2.2	2.2	2.2	135	D.
September	5.1	2 2	3.0	179	D.
October	3.1	2.6	3.0	184	D.
November	2.6	2.6	2.6	155	D.
December	3.1	2.6	3.0	184	C.
The year			5.1	3,690	

[a] Estimated.

NOTE.—The mean for April, 1907, is based upon the last 14 days of the month. Daily discharges from April 17 to August 31 were interpolated between measurements. The monthly means for balance of year are estimated.

MOHAVE RIVER BASIN.

DESCRIPTION.

Mohave River rises on the northern slope of the San Bernardino Mountains, and, flowing in a northerly direction, finally disappears in the sands of the Mohave Desert. This stream has few tributaries, the only ones of importance being West Fork and Deep Creek, which have their source in the higher elevations of the San Bernardino Mountains. The formation is of granite, with a good covering of soil. On the higher elevations there is a considerable growth of timber, which diminishes on the lower reaches, changing to a light growth of brush and grass and finally merging into the barren desert.

During the greater portion of the year the stream bed is dry below the junction of West Fork and Deep Creek, where the waters disappear in the sand and gravelly bed of the stream. Water again rises at a point lower down on the river above Victorville, where the gaging station was formerly located. Water is diverted above and below the gaging station, but is again returned to the river channel.

Several artesian wells have been sunk along the river above the gaging station, the water being used for irrigation. This stream does not discharge in any large quantity except during an extremely heavy rainfall in the winter months.

The precipitation throughout this basin is very light, with the possible exception of the higher elevation of the San Bernardino Mountains, where there is considerable fall of snow during the winter months, which melts in the early spring.

One station has been maintained in this basin, that on Mohave River at Victorville, Cal., 1899-1906. A list of miscellaneous measurements made in 1908 on streams discharging into Mohave Desert is given on page 335.

SOUTH PACIFIC OCEAN DRAINAGE.

GENERAL FEATURES.

The South Pacific Ocean drainage includes all streams south of San Francisco Bay that drain the western slope of the Coast Range and enter the Pacific, directly or indirectly. The region thus drained has an average width of nearly 50 miles and a total area of about 23,000 square miles. The minimum surface flow of the streams on the west side of the Coast Range is very small, and in many of them all the water disappears in the sand and gravel beds below the canyons. In the winter, however, they are torrential, and discharge large volumes of water. North of Santa Barbara the general course of the streams is northwestward; south of Santa Barbara, however, which is approximately opposite the intersection of the Coast Range by the Tehachapi Range, the general direction is southwestward.

Investigations of flow have been made on the following streams in the South Pacific Ocean drainage:

Cottonwood Creek (Tia Juana River).
Sweetwater River.
San Diego River.
Santa Ysabel Creek (Bernardo River).
San Luis Rey River.
Santa Margarita River.
Santa Ana River.
San Gabriel River.
Los Angeles River.
Malibu Creek.
Santa Clara River.
Ventura River.
Santa Ynez River.
Santa Maria River.
Salinas River.

TIA JUANA RIVER DRAINAGE BASIN.

DESCRIPTION.

Tia Juana River discharges into the Pacific Ocean below San Diego Bay near the Mexican boundary. Its principal tributary, Cottonwood Creek, rises in the Laguna Mountains of the Coast Range, and flows south and west for about 20 miles, where it is joined by Pine Valley Creek from the north; it then flows southwestward 12 miles to its junction with Tia Juana River at the Mexican boundary, about 22 miles east of the coast line. The total drainage area of Cottonwood Creek above its junction with Tia Juana River is approximately 340 square miles. It lies south of the Sweetwater and Otay river basins, and is the most southerly stream in San Diego County. Pine Valley Creek is its only important tributary.

The topography of the basin of Cottonwood Creek is rough throughout, although some valley areas are found above the 3,000-foot contour. Below this elevation the stream flows through a deep, narrow canyon, broken only by a short stretch of open country with comparatively light grade at the junction of Pine Valley Creek. Altitudes range from 600 feet above sea level, where the creek empties into Tia Juana River, to 5,000 feet on the Laguna Mountains.

The Cottonwood basin is very poorly forested. The timber consists of scattered oaks, cottonwoods, and alders, which are confined almost entirely to the small valleys along the stream and to the higher elevations. The mountain slopes are fairly well covered with brush.

The mean annual rainfall varies from 8 to 10 inches along the foothills and from 20 to 30 inches in the mountains.

The basin affords several good reservoir sites. The Barrett reservoir, located at the junction of Pine Valley Creek at an elevation of 1,500 feet; the Morena reservoir on Cottonwood Creek, at the lower end of Morena Valley, 8 miles above the Barrett reservoir; and Pine Valley reservoir on Pine Valley Creek, at the west end of Pine Valley. The Morena and Pine Valley reservoirs are at an elevation of 3,100 feet. All of these reservoirs have been surveyed. The Morena dam is now in course of construction and considerable preliminary work has been done at the Barrett dam, including the building of a low concrete dam to a height of about 20 feet above the bed of the stream. A conduit has been constructed to divert water from Cottonwood and Pine Valley creeks from above the Barrett dam to the lower Otay reservoir in the Otay River basin. This conduit has a capacity of about 60 second-feet, and will divert all the water from these creeks when their combined discharge does not exceed that amount. The city of San Diego receives its water supply from the lower Otay reservoir.

The following gaging stations have been maintained in this basin:

Cottonwood Creek near Jamul, Cal. (1906 to 1908).
Pine Valley Creek near Jamul, Cal. (1906 to 1908).

COTTONWOOD CREEK NEAR JAMUL, CAL.

This station, which was established December 14, 1905, chiefly to determine the amount of water available at the Barrett reservoir, is located near the Barrett dam site near the south line of sec. 15, T. 17 S., R. 3 E., San Bernardino meridian, and about 6 miles above the San Diego Campo road.

Pine Valley Creek enters Cottonwood Creek 1 mile above the gaging station, and Lyons Creek one-half mile above. The drainage area above the station, including that of Pine Valley Creek, is approximately 270 square miles.

Discharge measurements are made at the low concrete dam, back of which sand and gravel have been deposited to the level of its crest. At low stages the flow is restricted to a rectangular wooden flume through the wall of the dam, but at high stages the flow is over the entire length of the dam, which is 61 feet. Measurements are usually made by wading, except in high stages, when only float velocities can be obtained. The results obtained at this station are only fair.

Discharge measurements of Cottonwood Creek near Jamul, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 5	6	7.5	2.25	56	June 27	6	3.5	0.89	14
January 15	85	62	.60	171	December 6	6	3.6	.72	11
February 7	61	25	.38	50					
February 26	61	25	.48	59	1908.				
March 8	61	54	.80	191	January 17	6	4.2	.81	14
March 20	61	32	.60	89	January 27	6	7.2	1.95	52
April 12	61	32	.64	105	February 14	6	8	2.30	62
April 27	61	29	.51	72	February 23	6	10	1.97	43
April 28	61	28	.50	68	March 12	6	4.8	1.53	31
May 19	61	20	.37	34	March 21	6	3.6	1.12	20
May 29	61	23	.41	46	April 5	6	3.2	.91	17
June 11 [a]	53	15	.28	22	May 12	6	3.1	.73	11
June 16 [b]	57	16	....	27	November 18	3	1.1	....	1.6
June 20 [b]	28	10	1.08	19	December 22	6	2.7	....	4.3

[a] By Clapp and Hardy.

[b] By N. L. Hall.

Monthly discharge of Cottonwood Creek near Jamul, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	1,170	46	175	10,800	B.
February	116	36	66.9	3,720	B.
March	648	44	191	11,700	B.
April	306	64	111	4,600	B.
May	66	28	44.4	2,730	B.
June	49	9	23.2	1,380	B.
July	8.7	22	4.2	258	C.
August	2.5	.1	1.2	74	C.
September	2	.3	1.0	60	C.
October	16	2.2	7.5	461	C.
November	12	7.0	8.9	530	C.
December	12	7.6	9.8	603	C.
The year	1,170	.1	53.7	38,900	
1908.					
January	96	10	25.2	1,550	C.
February	155	28	58.4	3,360	C.
March	74	15	34.0	2,090	C.
April	31	10	15.6	928	C.
May	20	6.4	9.51	585	C.
June	6.6	.50	3.49	208	C.
July	.70	.02	.145	9	D.
August	.50	.05	.085	5	D.
September	.32	.07	.214	13	D.
October	6.3	.32	2.37	146	D.
November	5.0	3.6	4.31	256	C.
December	8.6	4.7	6.22	382	C.
The year	155	.02	13.3	9,530	

NOTE.—Discharges for the higher stages of 1907 were obtained by rating the Barrett dam as a weir. For intermediate stages the discharge for both years is based on a record of gage heights in a 6-foot flume through the dam, which was rated by measurements in 1907 and 1908. For the lowest stages of 1907 a quadrant weir was used.

PINE VALLEY CREEK NEAR JAMUL, CAL.

This station, which is located a short distance above the junction of Pine Valley Creek with Cottonwood Creek, was established in January, 1906, chiefly for the purpose of determining the relation between the flow of Pine Valley and Cottonwood creeks. The station was discontinued December 31, 1908.

Conditions for obtaining accurate discharge data are bad. On account of its isolated location only occasional gage readings were made during 1907 and none in 1908. All estimates of discharge are approximate only. No monthly discharges were computed for 1908.

Discharge measurements of Pine Valley Creek near Jamul, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 5	W. V. Hardy	32	11	4.45	27
January 15	do	45	22	4.60	55
February 7	do	45	14	4.30	31
February 27	do	47	17	4.30	39
March 8	do	46	26	4.58	90
March 20	do	47	19	4.32	38
April 11	do	47	21	4.35	51
April 27	do	46	15	4.20	30
May 19	do	25	9	3.95	17
May 29	do	35	9	3.90	13
June 11	Clapp and Hardy	14	5.8	3.75	14
June 16	N. L. Hall	23	6	3.77	10
December 16	W. V. Hardy	5	2	3.33	3.2
1908.					
January 16	W. V. Hardy	6	2.6	3.40	5.3
January 27	do	24	9	3.74	20
February 14	do	28	11	3.88	24
February 23	do	16	8.4	3.80	20
March 12	do	12	5.8		13
March 21	do	6	4.2		10
April 5	do	7	3.8		7.2
May 12	do	6	2.6		4.1
November 18	do	2	.80		.91
December 22	do	4	1.6		2.1

Monthly discharge of Pine Valley Creek near Jamul, Cal., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	124	19	49.3	3,030	C.
February	45	26	34.8	1,930	C.
March	119	36	62.4	3,840	C.
April	71	27	45.0	2,680	C.
May	30	12	19.8	1,220	C.
June	16	3	10.0	595	C.
July	3	1	2.0	123	D.
August	1.3	0	.6	37	D.
September	8	0	.3	18	D.
October	7	1.2	3.1	191	D.
November	3.5	2.8	3.0	179	D.
December	5.1	2.8	3.4	209	D.
The year	119	0	19.5	14,100	

NOTE.—Discharges from January to June, inclusive, were obtained by the indirect method for shifting channels. For the rest of the year discharges were interpolated by comparison with the discharge of Cottonwood Creek for the same dates.

SWEETWATER RIVER DRAINAGE BASIN.

DESCRIPTION.

Sweetwater River rises in the south and east slope of the Cuyamaca Mountains of the Coast Range, flows nearly due south for a distance of 15 miles, then turns to the west and southwest and discharges into San Diego Bay south of National City. Its length is 45 miles and its area comprises approximately 215 square miles, the greater part of which is in mountainous country. The basin is extremely narrow. It lies directly south of San Diego River and north of the Otay River and Cottonwood Creek basins.

The topography is not as rough as that of San Diego River basin, although the mountains and foothills extend to within 3 or 4 miles of the shore line of San Diego Bay, and the valley and mesa lands are not so extensive as along San Diego River. The basin is poorly forested. The timber is confined almost entirely to the immediate valleys of the streams and to the higher mountain areas. The mountain slopes have a fairly good covering of brush, but the lower foothills are almost bare, supporting only a sparse growth of low brush.

The mean annual rainfall varies from 10 to 15 feet along the foothill belt and from 20 to 40 inches in the mountains.

A considerable area lying between San Diego Bay and the foothills south from National City to the Mexican boundary is under a high state of cultivation. The greater part of this land is irrigated by water taken from Sweetwater River.

The celebrated Sweetwater masonry dam is located on Sweetwater River about 8 miles above its mouth at an elevation of 145 feet. There are two other reservoir sites on Sweetwater River, one a short distance above the Dehesa post-office and another 1 mile below Descanso, at an elevation of 3,340 feet above sea level.

During the extremely dry period from 1898 to 1904 there were years when no waters from Sweetwater River reached the reservoir. From 1899 to 1904 the reservoir was dry, and to tide over this period of drought pumping was resorted to. Wells were sunk in the reservoir site and pumps installed, by means of which water was delivered to the distribution system. Pumping operations were also extensively carried on in the valley along the river below the reservoir. It is probable that the construction of additional storage reservoirs on the upper reaches of the river would serve to tide over an extended dry period.

The following record of run-off has been kept at the Sweetwater reservoir by the San Diego Land and Town Company:

Estimated annual run-off at Sweetwater reservoir.

[Drainage area, 186 square miles.]

Year ending June 30—	Rainfall (inches).[a]	Run-off. Total in acre-feet.	Run-off. Acre-feet per square mile.	Run-off. Depth in inches on drainage area.
1888	16.00	7,048	37.9	0.71
1889	33.55	25,253	135.7	2.57
1890	38.65	20,532	110.4	2.07
1891	37.92	21,565	115.9	2.16
1892	24.58	6,198	33.3	.62
1893	26.16	16,261	87.4	1.63
1894	10.12	1,338	7.2	.13
1895	35.23	73,412	395.0	7.38
1896	16.41	1,321	7.1	.13
1897	23.88	6,891	37.0	.69
1898	18.03	4	.0	.00
1899	13.56	245	1.3	.02
1900	16.13	0	.0	.00
1901	24.82	861	4.6	.08
1902	20.25	0	.0	.00
1903	20.77	0	.0	.00
1904	14.94	0	.0	.00
1905	35.95	11,730	63.1	1.19
Mean, 18 years	23.72	10,703	57.5	1.07

[a] Taken as mean between Sweetwater dam and Cuyamaca.

The only gaging station maintained in this basin is on Sweetwater River near Descanso, 1906 to 1908.

SWEETWATER RIVER NEAR DESCANSO, CAL.

This station, which is located at the Ellis ranch, 1½ miles below Descanso post-office, near the east line of T. 17 S., R. 3 E., San Bernardino meridian, was established December 9, 1905, to determine the amount of water available for storage at the Guatay reservoir site and to ascertain the run-off in the upper reaches of the basin.

Measurements are made from a cable during high water and by wading during low and medium stages.

Guatay Creek enters the river from the east about 2 miles above the gaging station. A small diversion amounting only to a fraction of a second-foot is made above the gaging station for irrigation on the Ellis ranch. No change has been made in the datum of the gage.

Discharge measurements of Sweetwater River near Descanso, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.				
January 4	17	5.8	3.58	9.6
January 12	19	15	4.00	49
January 13	19	14	4.10	49
February 6	19	10	4.00	26
February 9	19	10	3.90	22
February 25	28	12	4.12	27
February 28	20	9	4.08	25
March 7	42	22	4.80	95
March 19	34	15	4.20	43
April 9	31	16	4.30	49
April 25	28	12	4.10	26
May 18	18	10	3.82	18
May 30	18	9	3.68	15
June 14	16	6.4	3.52	11
June 23	6	2	3.30	2.5
July 23 [a]	6	2	3.30	2.5
December 15	3	1.8	3.29	4.7
December 31	4	1.6	3.27	3.3
1908.				
January 15	10	4.2	3.41	5.9
January 26	10	6	3.50	10
January 27	10	5.2	3.41	7.9
January 28	15	7.8	3.60	13
February 11	12	7.8	3.50	12
February 11	14	8.2	3.52	12
February 11	14	9.8	3.60	17
February 12	17	16	3.82	36
February 22	14	6.4	3.49	9.8
February 24	14	7.8	3.50	12
March 3	16	6.2	3.52	9.4
March 4	16	8.4	3.73	18
March 11	16	5.6	3.50	9.1
March 20	16	3.4	3.42	4.2
March 22	16	3.4	3.43	4.3
April 3	16	3.8	3.44	4.7
April 13	16	3.2	3.44	3.7
April 28	10	3.0	3.33	4.0
May 7	10	3.6	3.32	4.9
May 13	10	3.6	3.32	5.0
May 27	6	1.6	3.16	1.8
June 13	5	1.2	3.1	1.1
July 7	2	.4	2.98	.36
November 16	2.5	1.0	3.11	.78
December 8	3	1.3	3.21	1.5
December 19	4	1.2	3.21	1.4

[a] By W. A. Lamb.

Daily gage height, in feet, of Sweetwater River near Descanso, Cal., for 1907 and 1908.

[Charles H. Ellis, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.55	4.1	4.05	......	4.0	3.65	3.38	3.26	3.24	3.25	3.25	3.2
2	3.6	4.1	4.0	4.35	4.0	3.65	3.38	3.26	3.24	3.25	3.25	3.2
3	3.55	4.1	4.0	4.8	4.0	3.6	3.38	3.26	3.24	3.25	3.25	3.25
4	3.6	4.05	4.05	4.4	4.0	3.6	3.38	3.26	3.24	3.25	3.2	3.25
5	3.6	4.0	5.1	4.4	4.05	3.65	3.36	3.26	3.24	3.25	3.2	3.25
6	3.75	4.0	4.85	4.3	4.05	3.7	3.35	3.26	3.24	3.3	3.2	3.4
7	3.8	3.95	4.8	4.3	4.0	3.7	3.35	3.28	3.24	3.3	3.2	3.35
8	3.8	3.9	4.85	4.3	3.95	3.7	3.35	......	3.23	3.25	3.2	3.3
9	3.9	3.95	4.7	4.3	3.95	3.65	3.36	......	3.23	3.25	3.2	3.3
10	4.9	3.9	4.65	4.3	3.95	3.6	3.38	......	3.23	3.25	3.2	3.4
11	4.15	3.85	4.65	4.25	4.0	3.55	3.38	3.25	3.23	3.25	3.2	3.35
12	4.0	3.85	4.6	4.25	3.95	3.6	3.37	3.25	3.23	3.25	3.2	3.3
13	4.1	3.85	4.5	4.2	3.9	3.65	3.37	3.25	3.23	3.25	3.2	3.3
14	4.45	3.85	4.45	4.2	3.9	3.55	3.37	3.25	3.23	3.6	3.25	3.3
15	4.25	3.85	4.4	4.2	3.9	3.5	3.37	3.25	3.23	3.5	3.25	3.3

Daily gage height, in feet, of Sweetwater River near Descanso, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	4.1	4.5	4.4	4.2	3.85	3.45	3.37	3.24	3.23	3.35	3.25	3.3
17	4.2	4.1	4.25	4.2	3.85	3.45	3.37	3.24	3.23	3.35	3.25	3.3
18	5.05	4.1	4.2	4.2	3.8	3.45	3.37	3.24	3.23	3.3	3.25	3.3
19	4.8	4.05	4.2	4.15	3.8	3.45	3.36	3.24	3.23	3.3	3.25	3.3
20	4.8	4.1	4.3	4.1	3.8	3.45	3.32	3.24	3.23	3.3	3.25	3.25
21	4.7	4.1	4.4	4.05	3.75	3.45	3.32	3.24	3.23	3.3	3.25	3.25
22	4.7	4.4	4.3	4.05	3.75	3.45	3.3	3.22	3.23	3.35	3.25	3.25
23	4.6	4.2	4.25	4.05	3.75	3.45	3.28	3.22	3.23	3.45	3.25	3.25
24	4.5	4.15	4.3	4.1	3.75	3.45	3.28	3.22	3.23	3.45	3.25	3.25
25	4.35	4.15	4.65	4.1	3.75	3.4	3.28	3.22	3.23	3.4	3.25	3.25
26	4.2	4.1	4.9	4.1	3.75	3.4	3.29	3.22	3.23	3.35	3.25	3.25
27	4.1	4.1	4.95	4.05	3.75	3.4	3.29	3.23	3.23	3.35	3.25	3.25
28	4.1	4.05	4.55	4.05	3.75	3.4	3.29	3.24	3.23	3.3	3.25	3.3
29	4.1	......	4.5	4.05	3.7	3.4	3.28	3.24	3.23	3.3	3.25	3.3
30	4.5	......	......	4.0	3.7	3.4	3.28	3.24	3.23	3.25	3.2	3.3
31	4.25	......	......	......	3.7	......	3.27	3.24	......	3.25	......	3.3
1908.												
1	3.25	3.45	3.55	3.5	3.25	3.15	3.05	3.0	3.1	3.1	3.1	3.1
2	3.25	3.4	3.5	3.45	3.4	3.15	......	3.0	......	3.1	3.1	3.15
3	3.25	3.9	3.5	3.45	3.5	3.15	......	3.0	......	3.1	3.1	3.2
4	3.25	3.8	3.8	3.45	3.35	3.15	......	3.0	......	3.1	3.1	3.2
5	3.25	3.6	3.85	3.45	3.3	3.15	......	3.0	......	3.1	3.1	......
6	3.25	3.5	3.8	3 45	3.3	3.15	......	......	3.1	3.1	3.1	......
7	3.25	3.4	3.7	3.5	3.3	3.15	3.0	......	......	3.1	3.1	......
8	3.25	3.4	3.6	3.5	3.3	3.15	3.0	......	......	3.1	3.1	3.2
9	3.25	3.6	3.55	3.45	3.3	3.1	3.0	......	......	3.1	3.1	3.2
10	3.25	3.6	3.5	3.45	3.3	3.1	3.0	3.0	3.7	3.1	3.1	3.2
11	3.2	3.6	3.5	3.45	3.3	3.1	3.0	......	......	3.1	3.1	3.2
12	3.2	3.7	3.45	3.45	3.35	3.1	3.0	......	......	3.1	3.1	3.2
13	3.25	3.6	3.45	3.45	3.3	3.1	3.0	......	......	3.1	3.1	3.2
14	3.5	3.55	3.45	3.45	3.3	3.1	3.0	......	......	3.1	3.1	3.2
15	3.4	3.55	3.45	3.4	3.25	3.1	3.0	......	......	3.15	3.1	3.2
16	3.3	3.55	3.45	3.4	3.25	3.1	3.0	......	......	3.2	3.1	3.25
17	3.25	3.55	3.45	3.35	3.25	3.1	3.0	3.05	......	3.15	3.1	3.25
18	3.25	3.5	3.45	3.35	3.25	3.1	3.0	......	......	3.15	3.1	3.2
19	3.25	3.5	3.45	3.3	3.25	3.1	3.0	......	......	3.15	3.1	3.2
20	3.25	3.5	3.45	3.3	3.2	3.1	3.0	......	......	3.1	3.1	3.2
21	3.25	3.5	3.45	3.3	3.2	3.1	3.0	......	......	3.1	3.1	3.2
22	3.25	3.5	3.45	3.65	3.2	3.05	3.0	......	......	3.1	......	3.2
23	3.4	3.5	3.45	3.65	3.2	3.05	3.0	......	3.15	3.1	......	3.2
24	3.45	3.5	3.45	3.55	3.2	3.05	3.0	3.05	3.2	3.1	......	3.2
25	3.55	......	3.5	3.45	3.2	3.05	3.0	......	......	3.1	......	3.2
26	3.5	......	3.75	3.4	3.2	3.05	3.0	......	......	3.1	3.15	3.2
27	3.45	3.4	3.7	3.4	3.2	3.05	3.0	......	......	3.1	3.15	3.2
28	3.6	3.45	3.6	3.3	3.15	3.05	3.0	......	......	3.1	3.15	3.2
29	3.55	3.6	3.6	3.25	3.15	3.05	3.0	......	......	3.1	3.15	3.2
30	3.45	......	3.55	3.25	3.15	3.05	3.0	......	......	3.1	3.1	3.2
31	3.45	......	3.5	......	3.15	......	3.0	3.1	......	3.1	......	3.2

Monthly discharge of Sweetwater River near Descanso, Cal., for 1907 and 1908.

[Drainage area, 40 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	134	9	56.7	1.42	1.64	3,490	B.
February	63	18	28.6	.715	.74	1,590	B.
March	123	24	65.0	1.62	1.87	4,000	B.
April	95	23	39.8	.995	1.11	2,370	B.
May	26	15	19.6	.490	.56	1,210	B.
June	15	6.5	9.8	.245	.27	583	B.
July	6.0	3.4	5.0	.125	.14	307	B.
August	3.7	2.3	2.9	.072	.08	178	B.
September	2.8	2.6	2.6	.065	.07	155	B.
October	12	3.0	4.5	.112	.13	277	B.
November	3.0	1.9	2.6	.065	.07	155	B.
December	6.5	1.9	3.8	.095	.11	234	B.
The year	134	1.9	20.1	.502	6.79	14,500	
1908.							
January	13	2.0	4.9	.122	.14	301	C.
February	34	6.0	13.8	.345	.37	794	C.
March	26	5.0	10.2	.255	.29	627	C.
April	16	3.0	5.4	.135	.15	321	C.
May	11	1.5	3.6	.090	.10	221	C.
June	1.5	.5	1.0	.025	.03	60	C.
July	.4	.4	.4	.010	.01	25	C.
August	1.0	.4	.5	.012	.01	31	C.
September	20	1.0	1.8	.045	.05	107	C.
October	2.0	1.0	1.0	.025	.03	61	C.
November	1.0	1.0	1.0	.025	.03	60	C.
December	1.5	1.0	1.5	.038	.04	92	C.
The year	34	.4	3.8	.094	1.25	2,700	

NOTE.—Discharges were obtained by the indirect method for shifting channels from January 1 to May 18, 1907. A rating table was used for remainder of year.
Daily discharges for 1908 were obtained by the indirect method for shifting channels.

SAN DIEGO RIVER DRAINAGE BASIN.

DESCRIPTION.

San Diego River rises in the Cuyamaca Mountains on the western slope of the Coast Range and flows in a southwesterly direction, discharging into Pacific Ocean through False Bay at the northern boundary of San Diego City. Its length is about 50 miles, half of which lies in the mountains above the town of Lakeside. The San Diego basin lies directly south of the Santa Ysabel basin and north of Sweetwater River basin.

The San Diego has several small tributaries, the most important being Coleman, Cedar, Boulder, South Fork, and Chocolate creeks, all of which enter from the east and south above Lakeside. San Vicente Creek, the only important tributary from the north, enters the river at Lakeside.

The upper part of the basin above Lakeside is extremely rough and rugged, but below Lakeside are numerous valleys and high mesa lands extending to the coast. Elevations throughout the basin range from 50 to 600 feet in the foothills and from 600 to 6,000 feet in the mountains. Cuyamaca Peak, the highest point in the basin, has an elevation of 6,028 feet. The formation is the loose granite that is typical of all river basins in San Diego County.

The San Diego basin is very poorly forested. The timber is confined almost entirely to the valley along the streams and to the higher mountain areas. The mountain slopes have a fairly good covering of brush, but the lower foothills are almost entirely bare, having only a scattering growth of low brush.

The mean annual rainfall varies from 10 to 15 inches along the foothill belt, and from 20 to 40 inches in the mountains.

Irrigation is carried on extensively in the valleys and on the mesa lands between Lakeside and San Diego, and additional areas might be irrigated if an adequate supply of water could be assured. Two storage reservoirs have been constructed: The Cuyamaca reservoir is situated on Boulder Creek, at an elevation of 4,600 feet above sea level, and has a capacity of 11,400 acre-feet with a 35-foot earthen dam. La Mesa reservoir is located in the foothills about 2 miles northwest of the town of La Mesa, at an elevation of 435 feet. The dam is of earth and rock, is 66 feet high, and has a storage capacity of about 1,500 acre-feet. La Mesa reservoir is filled by water diverted from San Diego River during the winter months.

The practicability of future development in this basin can be determined only by continuing stream-flow observations.

The only gaging station maintained in this basin is on the San Diego River near Lakeside, 1906 to 1908.

SAN DIEGO RIVER AND SAN DIEGO FLUME NEAR LAKESIDE, CAL.

This station, which is located about 1 mile above the railway station, at crossing of road from Lakeside to Padre Barona Valley, was established in December, 1905, to determine the amount of water available for further irrigation development.

Chocolate Creek enters the river from the south 7 miles above, and San Vicente Creek from the north 1 mile below the gaging station. The drainage area at this point is 208 square miles.

The San Diego flume diverts water from the river at a point one-half mile below the junction of Boulder Creek and about 15 miles above the gaging station. This flume diverts all the low flow of the river and a sufficient amount of the winter flow to fill La Mesa storage reservoir. The present capacity of the flume is about 16 second-feet. A daily record of the depth of water in the flume is kept by the San Diego Flume Company at the trestle crossing at Los Coches Creek, 3½ miles southeast of Lakeside, and has been furnished the United States Geological Survey. Discharge measurements have been made in the flume at this point, and estimated daily discharge is shown in addition to that of the river at Lakeside.

The conditions at the gaging station are extremely bad for procuring accurate estimates of discharge. The channel is wide and is composed of sand, which is constantly shifting and changing the position of the stream. Many measurements are necessary to procure reliable estimates of discharge. Results obtained at this station are approximate only. No change has been made in the datum of the gage.

Discharge measurements of San Diego River near Lakeside, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 3	52	23	3.65	39	January 3	4	1.2	3.20	1.0
January 8	54	29	3.80	82	January 14	4	1.2	3.22	1.2
January 10	57	61	4.10	234	January 18	4	1.2	3.23	1.4
January 18	62	135	4.60	667	January 24	21	8.4	3.36	13
January 19	57	74	4.20	419	January 24	21	12	3.40	23
January 20	57	61	4.00	303	January 25	30	16	3.50	30
February 4	57	42	3.75	105	January 28	55	42	3.60	105
February 11	57	33	3.60	74	February 10	62	52	3.80	133
February 23	59	49	3.90	152	February 15	53	38	3.60	84
March 4	59	33	3.62	81	February 22	53	23	3.50	44
March 5	63	72	4.15	335	February 26	45	22	3.45	39
March 5	63	96	4.35	623	March 3	56	24	3.50	40
March 5	66	98	4.50	576	March 4	61	32	3.60	62
March 11	61	56	3.85	187	March 5	63	46	3.80	132
March 18	60	45	3.75	116	March 13	62	20	3.48	30
March 23	63	77	3.95	268	March 20	48	16	3.45	26
April 1	63	64	3.90	189	March 25	35	10	3.38	14
April 13	60	46	3.80	145	April 1	41	15	3.41	19
April 24	60	38	3.65	91	April 6	41	13	3.40	17
May 3	60	29	3.60	62	April 12	21	4.5	3.34	4.5
May 17	48	23	3.54	33	April 17	8	3.2	3.35	3.9
May 25	48	18	3.48	26	April 25	27	13	3.45	21
May 31	42	14	3.49	20	April 28	14	4.3	3.31	4.8
June 8	40	14	3.50	23	May 5	38	12	3.45	16
June 13	43	19	3.52	30	May 13	18	4.1	3.38	5.2
July 22 [a]	3	.68	3.30	.62	May 26	2	.5	3.27	.5
December 1[illegible]	2	.6	3.16	.57	July 7	....	....	3.26	.2
December 19	3	.9	3.18	.66					
December 30	4	1.2	3.20	1.10					

[a] Made by W. A. Lamb.

Daily gage height, in feet, of San Diego River near Lakeside, Cal., for 1907 and 1908.

[J. H. Lucas and J. H. Beadle, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.8	3.95	3.65	3.95	3.65	3.5	3.30					3.1
2	3.85	3.8	3.65	4.0	3.6	3.5	3.28					3.1
3	3.65	3.75	3.6	4.1	3.6	3.5	3.27					3.1
4	3.6	3.75	3.6	4.0	3.6	3.5	3.28					3.1
5	3.6	3.7	4.4	4.0	3.65	3.5	3.26					3.1
6	3.95	3.7	4.1	4.0	3.65	3.5	3.28					3.1
7	3.9	3.65	4.1	3.95	3.7	3.5	3.3					3.15
8	3.8	3.6	4.1	3.9	3.65	3.55	3.3					3.15
9	3.8	3.6	4.0	3.9	3.6	3.5	3.28					3.15
10	4.1	3.6	3.9	3.85	3.6	3.5	3.27				3.15	3.10
11	4.4	3.55	3.85	3.85	3.6	3.5	3.26				3.1	3.15
12	3.95	3.5	3.9	3.85	3.6	3.5	3.28				3.1	3.15
13	3.8	3.5	3.9	3.8	3.6	3.5	3.28				3.1	3.15
14	3.9	3.55	3.8	3.75	3.6	3.5	3.28				3.05	3.15
15	4.0	3.5	3.8	3.75	3.55	3.45	3.28				3.05	3.15

Daily gage height, in feet, of San Diego River near Lakeside, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	3.95	3.55	3.85	3.8	3.55	3.45	3.28	......	......	......	3.05	3.15
17	3.95	4.0	3.8	3.8	3.55	3.45	3.29	......	......	......	3.1	3.15
18	5.0	3.8	3.7	3.75	3.5	3.4	3.3	......	......	......	3.1	3.15
19	4.2	3.75	3.75	3.7	3.5	3.4	3.29	......	......	......	3.1	3.2
20	4.0	3.7	3.7	3.7	3.5	3.4	3.29	......	......	......	3.1	3.15
21	4.0	3.65	4.0	3.7	3.5	3.4	3.3	......	......	......	3.1	3.15
22	3.95	3.7	3.95	3.7	3.5	3.4	3.29	......	......	......	3.1	3.15
23	3.9	3.7	3.9	3.65	3.5	3.4	3.28	......	......	......	3.1	3.15
24	3.8	3.65	3.85	3.65	3.5	3.4	3.3	......	......	......	3.1	3.2
25	3.8	3.6	3.8	3.7	3.5	3.4	3.3	......	......	......	3.1	3.2
26	3.75	3.7	4.8	3.65	3.5	3.35	3.28	......	......	......	3.1	3.2
27	3.7	3.7	4.4	3.7	3.5	3.35	3.29	......	......	......	3.1	3.2
28	3.7	3.65	4.1	3.6	3.5	3.3	3.29	......	......	......	3.1	3.2
29	3.7	......	3.95	3.65	3.5	3.3	3.28	......	......	......	3.1	3.2
30	3.8	......	3.9	3.7	3.5	3.3	3.28	......	......	......	3.1	3.2
31	3.7	......	3.95	......	3.5	......	3.27	......	......	......	......	3.2
1908.												
1	3.2	3.3	3.6	3.45	3.3	3.3	3.3	......	......	......	......	......
2	3.2	3.3	3.5	3.45	3.3	3.3	3.3	......	......	......	......	......
3	3.2	3.65	3.5	3.4	3.35	3.3	3.3	......	......	......	......	......
4	3.2	4.25	3.55	3.4	3.5	3.3	3.25	......	......	......	......	......
5	3.2	3.7	3.8	3.4	3.45	3.3	3.25	......	......	......	......	......
6	3.2	3.5	3.75	3.4	3.4	3.3	3.25	......	......	......	......	......
7	3.2	3.5	3.65	3.4	3.35	3.3	3.25	......	......	......	......	......
8	3.2	3.4	3.6	3.4	3.35	3.3	3.25	......	......	......	......	......
9	3.2	3.45	3.6	3.4	3.3	3.3	3.25	......	......	......	......	......
10	3.2	4.0	3.55	3.4	3.3	3.3	3.25	......	......	......	......	......
11	3.2	3.85	3.5	3.4	3.3	3.3	3.25	......	......	......	......	......
12	3.2	3.8	3.5	3.4	3.3	3.3	3.25	......	......	......	......	......
13	3.2	3.9	3.5	3.35	3.35	3.3	3.25	......	......	......	......	......
14	3.2	3.7	3.45	3.35	3.4	3.3	3.25	......	......	......	......	......
15	3.35	3.6	3.45	3.35	3.35	3.3	3.25	......	......	......	......	......
16	3.4	3.6	3.45	3.3	3.3	3.3	3.25	......	......	......	......	......
17	3.4	3.6	3.45	3.35	3.3	3.3	3.25	......	......	......	......	3.2
18	3.2	3.5	3.45	3.35	3.3	3.3	3.2	......	......	......	......	3.2
19	3.2	3.5	3.45	3.35	3.3	3.3	3.2	......	......	......	......	3.2
20	3.2	3.5	3.45	3.3	3.3	3.3	3.2	......	......	......	......	3.2
21	3.2	3.5	3.45	3.3	3.3	3.3	3.1	......	......	......	......	3.25
22	3.2	3.5	3.4	3.35	3.3	3.3	3.1	......	......	......	......	3.25
23	3.25	3.55	3.4	3.5	3.3	3.3	3.1	......	......	......	......	3.25
24	3.4	3.5	3.35	3.5	3.3	3.3	3.1	......	......	......	......	3.25
25	3.5	3.5	3.4	3.45	3.3	3.3	3.1	......	......	......	......	3.25
26	3.6	3.45	3.6	3.4	3.3	3.3	3.0	......	......	......	......	3.25
27	3.45	3.4	3.7	3.4	3.3	3.3	......	......	......	......	......	3.25
28	3.45	3.4	3.6	3.35	3.3	3.3	......	......	......	......	......	3.25
29	3.6	3.45	3.5	3.3	3.3	3.3	......	......	......	......	......	3.25
30	3.5	......	3.45	3.3	3.3	3.3	......	......	......	......	......	3.25
31	3.4	......	3.45	......	3.3	3.3	......	......	......	......	......	3.25

NOTE.—River dry August 1 to November 9, 1907, and July 27 to December 16, 1908.

Monthly discharge of San Diego River near Lakeside, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	1,050	27	183	11,300	C.
February	260	32	87.6	4,870	C.
March	940	60	242	14,900	C.
April	320	68	157	9,340	C.
May	83	23	45.4	2,790	C.
June	23	.6	15	893	D.
July	.6	.2	.44	27	D.
August	0	0	0	0	
September	0	0	0	0	
October	0	0	0	0	
November	.5	.1	.2	12	D.
December	1	.3	.6	37	D.
The year	1,050	0	60.9	44,200	
1908.					
January	100	1	15.5	953	C.
February	300	14	76	4,370	C.
March	130	12	44	2,700	C.
April	30	4	11.6	690	C.
May	25	.5	5	307	C.
June	.5	.2	.4	24	D.
July	.2	0	.1	6	D.
August	0	0	0	0	
September	0	0	0	0	
October	0	0	0	0	
November	0	0	0	0	
December	.2	0	.1	6	D.
The year	300	0	12.7	9,060	

NOTE.—Daily discharges were obtained by the indirect method for shifting channels. The above estimate does not include the water diverted by the San Diego Flume Company above the station.

Discharge measurements of San Diego flume near Lakeside, Cal., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 27	W. V. Hardy	5.9	3.9	0.66	9.6
November 13	do	5.9	3.0	.50	5.8
December 6	do	5.9	1.6	.27	1.8
December 18	do	5.9	1.6	.27	1.8

Daily gage height, in feet, of San Diego flume near Lakeside, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	0.64	0.21	0.33	0.54	0.71	0.88	0.62	0.65	0.67	0.61	0.43	0.50
2	.65	.17	.32	.55	.71	.78	.64	.62	.60	.61	.38	.30
3	.75	.17	.31	.52	.71	.70	.69	.60	.54	.64	.43	.42
4	.67	.17	.49	.53	.74	.67	.71	.57	.57	.61	.42	.32
5	.58	.24	.43	.53	.67	.53	.70	.57	.67	.59	.41	.52
6	.56	.22	.41	.50	.62	.55	.70	.58	.65	.58	.36	.31
7	.55	.21	.41	.52	.62	.55	.70	.56	.64	.60	.40	.56
8	.67	.23	.31	.52	.62	.61	.71	.55	.59	.57	.44	.55
9	.47	.24	.31	.50	.62	.65	.69	.52	.60	.52	.44	.25
10	.43	.23	.31	.50	.62	.60	.66	.55	.66	.54	.30	.15
11	.29	.24	.30	.50	.73	.62	.66	.61	.66	.54	.44	.18
12	.38	.24	.32	.58	.79	.65	.61	.62	.67	.53	.42	.24
13	.44	.39	.34	.58	.76	.73	.60	.66	.67	.51	.39	.15
14	.49	.47	.35	.55	.69	.88	.60	.65	.68	.52	.28	.16
15	.35	.46	.33	.54	.67	.60	.66	.65	.68	.64	.08	.38

Daily gage height, in feet, of San Diego flume near Lakeside, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	0.36	0.50	0.33	0.53	0.67	0.55	0.69	0.81	0.66	0.61	0.18	0.11
17	.38	.49	.33	.52	.66	.60	.69	.67	.67	.55	.25	.08
18	.25	.47	.35	.51	.67	.64	.66	.66	.67	.48	.12	.03
19	.27	.40	.33	.50	.67	.62	.62	.66	.68	.47	.21	.02
20	.30	.27	.35	.50	.65	.60	.65	67	.68	.49	.00	.26
21	.32	.27	.41	.50	.67	.64	.66	.69	.64	.39	.00	.29
22	.35	.30	.40	.65	.69	.67	.65	.65	.49	.46	.00	.41
23	.31	.27	.38	.71	.72	.65	.65	.60	.51	.55	.10	.25
24	.33	.44	.44	.71	.81	.65	.65	.58	.67	.49	.51	.25
25	.23	.54	.38	.71	.82	.62	.65	.57	.67	.52	.54	.38
26	.22	.52	.32	.71	.83	.64	.67	.59	.67	.54	.54	.00
27	.26	.45	.36	.71	.84	.64	.67	.65	.66	.51	.55	.24
28	.27	.33	.38	.71	.85	.62	.68	.66	.67	.52	.29	.38
29	.51	......	.38	.71	.88	.61	.65	.65	.62	.53	.42	.50
30	.42	......	.36	.71	.88	.62	.64	.67	.64	.34	.33	.64
31	.23	......	.48	......	.88	......	.65	.68	......	.36	......	.34
1908.												
1	.43	.71	.34	.44	.71	.59	.57	.62	.58	.55	.50	.47
2	.42	.71	.34	.45	.76	.53	.58	.62	.54	.59	.48	.44
3	.40	.79	.36	.45	.76	.53	.58	.64	.56	.59	.45	.33
4	.40	.49	.33	.55	.74	.52	.56	.60	.60	.57	.46	.10
5	.40	.56	.28	.53	.72	.51	.53	.56	.58	.56	.48	.27
6	.39	.58	.27	.53	.71	.52	.54	.58	.52	.54	.47	24
7	.31	.60	.27	.55	.70	.50	.54	.51	.50	.52	.44	.34
8	.29	.62	.27	.62	.69	.50	.56	.54	.51	.51	.42	.48
9	.30	.62	.26	.64	.68	.50	.59	.58	.56	.50	.43	.48
10	.30	.50	.26	.62	.68	.50	.60	.58	.58	.58	.45	.44
11	.40	.49	.31	.62	.68	.55	.61	.41	.52	.54	.51	.42
12	.42	.48	.43	.71	.71	.60	.59	.26	.52	.54	.51	.36
13	.50	.54	.43	.71	.73	.58	.59	.35	.46	.57	.50	.32
14	.50	.31	.43	.71	.70	.53	.60	.57	.51	.57	.49	.33
15	.48	.28	.42	.69	.68	.52	.60	.58	.56	.57	.49	.33
16	.49	.40	.41	.69	.66	.54	.61	.49	.60	.59	.49	.32
17	.54	.60	.41	.69	.65	.55	.62	.54	.61	.58	.48	.38
18	.52	.00	.42	.68	.61	.57	.58	.56	.61	.53	.50	.38
19	.46	.00	.42	.65	.57	.57	.55	.57	.62	.44	.52	.33
20	.48	.48	.45	.66	.51	.57	.50	.59	.55	.47	.50	.28
21	.55	.48	.41	.69	.57	.55	.50	.58	.54	.54	.45	.25
22	.57	.48	.42	.72	.53	.55	.59	.58	.52	.53	.45	.24
23	.60	.48	.41	.64	.54	.56	.60	.57	.61	.51	.47	.23
24	.66	.48	.40	.69	.49	.54	.58	.56	.66	.52	.48	.23
25	.71	.48	.39	.72	.50	.55	.59	.57	.52	.49	.32	.21
26	.71	.48	.45	.71	.58	.55	.42	.60	.64	.49	.33	.17
27	.71	.49	.46	.69	.61	.57	.54	.59	.64	.51	.47	.17
28	.71	.46	.39	.69	.61	.58	.56	.59	.64	.52	.48	.18
29	.68	.36	.41	.71	.58	.58	.55	.59	.62	.55	.49	.27
30	.71	......	.45	.70	.58	.57	.56	.59	.59	.56	.48	.29
31	.73	......	.45	......	.59	......	.61	.60	......	.55	......	.38

NOTE.—These gage-height records are kept by the San Diego Flume Company. Daily readings are made at 6.30 a. m., 12 m., and 5.30 p. m. in inches and have been reduced to feet.

Rating table for San Diego flume near Lakeside, Cal., 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	0.00	0.25	1.66	0.50	5.90	0.75	12.22
.05	.12	.30	2.30	.55	7.02	.80	13.70
.10	.30	.35	3.05	.60	8.20	.85	15.20
.15	.64	.40	3.90	.65	9.47	.90	16.70
.20	1.10	.45	4.85	.70	10.80		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during 1908 and 1909 and is well defined.

Monthly discharge of San Diego flume near Lakeside, Cal., for 1907 and 1908.

Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Accuracy.	Month.	Mean discharge (second-feet).	Run-off (total in acre-feet).	Accuracy.
1907.				1908.			
January	4.62	284	A.	January	6.38	392	A.
February	2.97	165	A.	February	6.02	326	A.
March	3.31	204	A.	March	3.58	220	A.
April	7.79	464	A.	April	9.27	552	A.
May	11.58	712	A.	May	9.29	571	A.
June	9.44	562	A.	June	6.94	413	A.
July	9.76	600	A.	July	7.95	489	A.
August	8.91	548	A.	August	7.20	443	A.
September	9.20	547	A.	September	7.50	446	A.
October	6.63	408	A.	October	6.76	416	A.
November	3.16	188	A.	November	5.22	311	A.
December	2.79	172	A.	December	2.65	163	A.
The year	6.68	4,854		The year	5.79	4,742	

NOTE.—This water is diverted from San Diego River. The discharge should be added to that at the Lakeside station for the total flow of the river.

BERNARDO RIVER DRAINAGE BASIN.

DESCRIPTION.

Bernardo River, or Santa Ysabel Creek, as it is known from its source to the San Pasqual Valley, rises in the Volcan Mountains on the western slope of the Coast Range and flows westward through San Pasqual Valley, below which it takes its true name, and empties into the Pacific Ocean midway between Oceanside and San Diego. Its length is 50 miles, and the maximum width of the drainage basin about 15 miles. The total drainage area is approximately 340 square miles. It lies south of San Luis Rey River and north of the San Diego River basin.

Numerous small tributaries enter Santa Ysabel Creek from its source to San Pasqual Valley, the most important being Black Canyon and Temescal creeks from the north and Santa Maria Creek from the south. Above the San Pasqual Valley the creek maintains a light flow throughout the year, but below that point the channel is dry during the summer months.

The upper part of the basin is rough, the surface being cut by many canyons. The lower part in the foothills is more rolling, with large areas of valley and high mesa land. The formation is a loose granite. The basin has very little timber, the principal cover being brush, grass, and a few scattered oaks.

The mean annual rainfall varies from 10 to 15 inches along the foothills and from 20 to 40 inches in the mountains.

No important amount of irrigation is carried on in this basin. A diversion is made in San Pasqual Valley to irrigate a small area along the river.

A good storage reservoir site exists on the main stream at Pamo Valley, below the junction of Temescal Creek with the Santa Ysabel. The dam site is about 4 miles above the gaging station.

No great amount of water power can be developed in this basin.

The only gaging station maintained in this basin is on Santa Ysabel Creek at the east or upper end of San Pasqual Valley.

SANTA YSABEL CREEK NEAR ESCONDIDO, CAL.

This station, which is located below the mouth of the narrow canyon at the upper end of the San Pasqual Valley, in sec. 31, T. 12 S., R. 1 E., San Bernardino meridian, was established in December, 1905, to determine the quantity of water available for storage.

Roden Canyon Creek and Temescal Creek, tributaries from the north, enter the Santa Ysabel 1½ and 5 miles, respectively, above the gaging station. Santa Maria Creek enters from the south 4 miles below the gaging station.

No diversions are made from the creek above the gaging station. A small diversion is made below the station for irrigation in San Pasqual Valley.

Measurements are made from a cable at high water and by wading at medium and low stages. The conditions for obtaining accurate discharge data at this station are extremely poor. The channel is composed of shifting sand which scours out at high stages of the stream and immediately fills in again as the flow decreases. Continual measurements of discharge are necessary to procure reliable estimates. All results from observations at this station are approximate only.

The datum of the gage remains unchanged.

Discharge measurements of Santa Ysabel Creek near Escondido, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 1	48	21	2.80	60	January 30	60	23	2.40	44
January 22	62	45	2.05	127	February 8	28	18	2.24	43
January 28	57	36	1.90	101	February 17	52	28	2.19	60
January 30	61	69	2.20	311	February 21	48	24	2.12	42
January 30	62	59	2 30	242	February 26 [b]	45	20	2.06	37
February 12	52	29	1.90	67	March 2	40	20	2.05	41
February 16	77	29	1.99	62	March 5	70	42	2.20	91
February 21	47	24	2.05	55	March 6	60	32	2.10	72
March 12	52	36	2.18	97	March 14	40	16	1.95	30
March 15	40	31	2.10	111	March 19	40	16	1.98	26
April 2	82	55	2.00	177	March 25	44	15	1.92	23
April 6	87	51	1.95	146	March 31	35	16	1.91	25
April 15	57	38	1.90	95	April 7	40	14	1.91	23
April 19	51	32	1.90	82	April 12	32	12	1.87	18
May 4	37	25	2.00	61	April 18	37	10	1.86	14
May 10	37	25	2.02	58	April 25	36	18	1.85	34
May 21	47	20	1.99	40	April 29	18	9.9	1.80	16
May 24	32	21	1.99	42	May 4	37	13	1.84	21
June 4	42	16	2.01	28	May 14	20	9.5	1.82	20
June 7	52	20	2.06	35	May 20	25	7.1	1.78	10
June 17	37	13	2.02	22	May 22	20	7.4	1.77	11
July 19 [a]	14	4.2	2.02	5.7	May 29	15	6.0	1.77	9.2
December 13	16	7.7	2.28	12	June 4	15	5.5	1.77	8.2
December 21	12	5.6	2.28	10	June 10	10	3.8	1.73	5.6
December 29	16	8.4	2.32	15	June 14	10	3.5	1.72	4.9
					July 6	1.5	.45	1.61	.31
1908.					November 11	3	1.2	1.70	1.8
January 4	14	6.6	2.30	11	November 26	8	3.3	1.77	5.6
January 13	14	6.4	2.30	10	December 3	16	5.4	1.80	8.1
January 18	16	6.4	2.27	10	December 11	8	2.8	1.78	3.8
January 23	16	8	2.30	14	December 16	10	2.9	1.83	4.8
January 29	65	34	2.50	71	December 24	7	3.0	1.80	5.4

[a] Measurement made by W. A. Lamb. [b] Measurement made by Clapp and Hardy.

Daily gage height, in feet, of Santa Ysabel Creek near Escondido, Cal., for 1907 and 1908.

[S. F. Potts, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.75	1.90	2.10	2.00	2.00	2.00	1.99	2.01	2.03	2.10	2.20	2.30
2	2.70	1.95	2.10	2.00	2.00	2.00	2.00	2.02	2.04	2.10	2.20	2.30
3	2.60	1.90	2.10	2.10	2.00	2.00	2.00	2.02	2.03	2.10	2.20	2.30
4	2.60	1.90	2.20	2.00	2.00	2.00	2.01	2.01	2.03	2.10	2.20	2.25
5	2.60	1.90	2.65	1.95	2.00	2.00	2.01	2.02	2.02	2.10	2.20	2.25
6	2.90	1.85	2.35	2.00	2.00	2.00	2.00	2.02	2.02	2.15	2.25	2.25
7	2.70	1.85	2.25	1.95	2.00	2.05	2.00	2.03	2.01	2.05	2.25	2.35
8	2.60	1.85	2.20	1.95	2.00	2.05	2.00	2.02	2.00	2.05	2.25	2.35
9	2.70	1.90	2.15	1.90	2.00	2.00	2.00	2.01	2.01	2.05	2.25	2.40
10	3.00	1.85	2.10	1.90	2.00	2.00	1.99	2.02	2.01	2.00	2.30	2.40
11	2.55	1.90	2.10	1.90	2.00	2.00	2.00	2.01	2.01	2.05	2.25	2.30
12	2.60	1.90	2.20	1.95	2.00	2.00	2.02	2.01	2.02	2.05	2.25	2.30
13	2.90	1.85	2.10	1.90	2.00	2.00	2.01	2.01	2.03	2.05	2.25	2.30
14	2.50	1.90	2.00	1.90	2.00	2.05	2.01	2.01	2.02	2.05	2.25	2.30
15	2.50	1.90	2.00	1.90	2.00	2.00	2.02	2.02	2.03	2.10	2.30	2.25
16	2.50	2.00	2.10	1.95	2.00	2.00	2.03	2.04	2.05	2.10	2.30	2.30
17	2.40	2.00	2.10	1.90	2.00	2.00	2.02	2.01	2.06	2.40	2.30	2.30
18	3.00	2.05	2.10	1.90	2.00	2.00	2.01	2.02	2.07	2.10	2.35	2.30
19	2.30	2.00	2.15	1.90	2.00	2.00	2.00	2.03	......	2.10	2.25	2.30
20	2.20	2.00	2.20	1.90	2.00	2.00	1.99	2.03	......	2.10	2.25	2.30
21	2.10	2.00	2.20	1.90	2.00	2.00	1.99	2.03	......	2.10	2.25	2.30
22	2.05	2.15	2.20	1.90	2.00	2.05	2.00	2.02	......	2.10	2.30	2.30
23	2.00	2.10	2.15	1.90	2.00	2.05	2.01	2.02	......	2.35	2.30	2.30
24	2.00	2.05	2.10	1.95	2.00	2.00	2.01	2.01	......	2.30	2.30	2.30
25	1.90	2.00	2.45	1.95	2.00	2.00	2.02	2.01	......	2.10	2.30	2.30

Daily gage height, in feet, of Santa Ysabel Creek near Escondido, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	1.90	2.05	2.10	1.90	2.00	2.00	2.02	2.02	2.07	2.10	2.30	2.30
27	1.90	2.15	2.25	1.90	2.00	2.00	2.03	2.04	2.05	2.15	2.30	2.30
28	1.90	2.15	2.10	2.00	2.00	2.00	2.03	2.02	2.05	2.20	2.25	2.30
29	1.90	......	2.05	2.00	2.00	2.00	2.03	2.04	2.09	2.20	2.30	2.30
30	2.25	......	2.00	2.00	2.00	2.00	2.02	2.04	2.09	2.20	2.30	2.30
31	1.85	......	2.00	......	2.00	......	2.01	2.02	......	2.20	......	2.30
1908.												
1	2.30	2.40	2.10	1.91	1.80	1.77	1.61	......	......	1.60	1.70	1.75
2	2.30	2.35	2.05	1.91	1.80	1.76	1.62	......	......	1.60	1.70	1.80
3	2.30	2.90	2.00	1.90	1.88	1.76	1.64	......	......	1.65	1.65	1.90
4	2.30	2.40	2.20	1.89	1.84	1.77	1.59	......	......	1.70	1.65	1.80
5	2.30	2.35	2.15	1.90	1.80	1.77	1.62	......	......	1.70	1.70	1.80
6	2.30	2.30	2.10	1.91	1.80	1.77	1.61	......	......	1.70	1.70	1.80
7	2.30	2.30	2.00	1.90	1.81	1.76	1.62	......	......	1.65	1.70	1.80
8	2.30	2.40	2.00	1.89	1.79	1.77	1.52	......	......	1.60	1.70	1.80
9	2.30	2.45	2.00	1.88	1.79	1.72	1.61	......	......	1.60	1.70	1.80
10	2.30	2.45	2.00	1.88	1.79	1.73	......	......	......	......	1.70	1.80
11	2.30	2.25	2.00	1.84	1.80	1.73	......	......	......	......	1.70	1.80
12	2.30	2.25	2.00	1.87	1.83	1.73	......	......	......	1.65	1.70	1.75
13	2.30	2.30	2.00	1.82	1.83	1.72	1.50	......	......	1.70	1.70	1.75
14	2.35	2.25	1.95	1.84	1.82	1.71	......	......	......	1.65	1.70	1.75
15	2.30	2.20	2.00	1.84	1.79	1.73	......	......	......	1.70	1.70	1.80
16	2.30	2.20	2.00	1.84	1.78	1.73	......	......	......	1.70	1.70	1.80
17	2.30	2.20	1.92	1.86	1.77	1.71	......	......	......	1.75	1.70	1.80
18	2.25	2.10	1.96	1.86	1.74	1.73	......	......	......	1.80	1.75	1.80
19	2.25	2.10	1.98	1.85	1.77	1.73	......	......	......	1.75	1.75	1.80
20	2.30	2.10	1.93	1.83	1.78	1.73	......	......	......	1.70	1.70	1.80
21	2.30	2.10	1.94	1.83	1.77	1.72	......	......	......	1.70	1.70	1.85
22	2.30	2.10	1.91	1.90	1.77	1.72	......	......	......	1.70	1.70	1.85
23	2.30	2.15	1.90	1.98	1.73	1.73	......	......	......	1.70	1.75	1.80
24	2.50	2.10	1.92	1.90	1.76	1.70	......	......	......	1.70	1.75	1.80
25	2.70	2.05	1.90	1.85	1.80	1.70	......	......	......	1.70	1.75	1.80
26	2.40	2.05	1.98	1.80	1.76	1.70	......	......	......	1.65	1.75	1.80
27	2.40	2.05	2.10	1.80	1.73	1.69	......	......	......	1.65	1.75	1.80
28	2.55	2.10	1.95	1.78	1.76	1.66	......	......	......	1.65	1.70	1.80
29	2.50	2.10	1.92	1.79	1.77	1.70	......	......	......	1.70	1.75	1.80
30	2.40	......	1.92	1.78	1.73	1.71	......	......	......	1.70	1.75	1.80
31	2.40	......	1.90	......	1.72	......	......	......	......	1.70	......	1.80

NOTE.—The creek was dry July 10 to 12, July 14 to September 30, and October 10 and 11, 1908.

Monthly discharge of Santa Ysabel Creek near Escondido, Cal., for 1907 and 1908.

[Drainage area, 128 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	500	40	155	1.21	1.40	9,530
February	110	50	72.4	.566	.59	4,020
March	290	50	138	1.08	1.24	8,480
April	200	67	108	.844	.94	6,430
May	65	33	49	.383	.44	3,010
June	35	16	24.6	.192	.21	1,460
July	15	5	8.6	.067	.08	529
August	5	5	5.0	.039	.04	307
September	6	5	5.5	.043	.05	327
October	15	6	8.1	.063	.07	498
November	12	9	10.2	.080	.09	607
December	15	10	12	.093	.11	738
The year	500	5	49.7	.388	5.26	35,900

Monthly discharge of Santa Ysabel Creek near Escondido, Cal., 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	136	10	25.6	.200	.23	1,570
February	146	37	54.1	.423	.46	3,110
March	82	20	37.7	.294	.34	2,320
April	44	12	20.9	.163	.18	1,240
May	25	5	13.7	.107	.12	842
June	9	1	5.06	.040	.04	301
July	1	0	.129	.0010	.001	8
August	0	0	.0	.00	.00	0
September	0	0	.0	.00	.00	0
October	2	0	.603	.0047	.005	37
November	5	1	2.74	.021	.02	163
December	17	2	5.65	.044	.05	347
The year	146	0	13.8	.108	1.45	9,940

NOTE.—Daily discharges were obtained by the indirect method for shifting channels. Values are approximate.

SAN LUIS REY RIVER DRAINAGE BASIN.

DESCRIPTION.

San Luis Rey River drains an area about 575 square miles in extent lying wholly in the northern part of San Diego County and extending from the crest of the Coast Range to the Pacific Ocean, a distance of 65 miles, with a maximum width of about 16 miles.

The river is formed by many small streams which have their sources in the higher elevations of the Coast Range and come together at the lower or west end of what is known as Warner's Valley. Below this point the river flows for a distance of 10 miles through a deep narrow canyon with a heavy grade, then over a sandy and gravelly bed with light grade for some 40 miles, finally discharging into the Pacific Ocean at Oceanside.

Altitudes within this basin range from 50 to 500 feet in the foothills in the vicinity of Oceanside and from 500 to 6,000 feet on the mountains. Palomar Mountain, the highest peak in the basin, has an elevation of 6,126 feet above sea level. The upper portion of the basin is more or less rolling, and several of the valleys are under cultivation and are used extensively for stock raising; the middle part, occupied by the river in its canyon, is rough; on the lower reaches the surface becomes less rugged, merging into the foothills, which extend to the coast. The rocks are granitic.

The basin is poorly forested. Some fairly good timber is found on the higher elevations, but the greater part of the cover is brush and grass with a scattered growth of oaks.

The mean annual precipitation in this basin probably ranges from 10 to 40 inches, gradually increasing with altitude. It occurs almost entirely as rain, snow appearing only occasionally on the high elevations.

Small areas are irrigated along the river, and water is diverted and used for irrigation and municipal supply at Escondido and vicinity. At the head of the rough canyon at the lower end of Warner's Valley is a good reservoir site. A dam constructed at this point would probably store all the normal flow of the river, but the small discharge of the stream at this point during extremely dry years makes doubtful the advisability of construction.

The stream affords little opportunity for power development. The total development with storage would probably not exceed 7,000 or 8,000 horsepower in years of normal stream flow. Within the period for which records are available the wettest year was 1906 and the driest 1904.

The only gaging station maintained in this basin is on the San Luis Rey River near Pala, Cal., 1904 to 1908.

SAN LUIS REY RIVER NEAR PALA, CAL.

This station, which is located at the road crossing to flour mill, 4 miles above Pala, was established October 9, 1903, to obtain general information regarding the flow of San Luis Rey River, the data being essential to the determination of the feasibility of storage, to the adjudication of water rights, and to further irrigation development.

No tributaries enter the river near the gaging station. Water is diverted from the river during the winter and spring months at a point in the rough canyon about 11 miles above the station to a storage reservoir, and is used during the summer period for irrigation and municipal supply at Escondido and the surrounding country.

Conditions for obtaining accurate discharge data are poor. The channel is wide, is composed of sand, gravel, and bowlders, and is subject to constant change. The current is swift at flood stages. The results from observations at this station are considered approximate only.

The datum of the gage was changed on November 13, 1906, the zero being lowered 4.66 feet.

Discharge measurements of San Luis Rey River near Pala, Cal., in 1907 and 1908.

[By W. V. Hardy.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1908.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 23....	62	55	7.50	193	February 1....	45	24	6.30	58
January 25....	62	49	7.40	169	February 3....	70	170	8.70	819
February 13...	60	39	6.43	78	February 4....	65	143	7.70	513
February 15...	60	35	6.40	76	February 4....	65	129	7.60	459
February 19...	62	51	6.62	110	February 4....	62	112	7.40	365
February 20...	62	45	6.57	105	February 5....	55	82	6.90	217
March 13......	60	64	7.32	183	February 5....	55	62	6.75	163
March 14......	60	54	7.18	141	February 6....	45	52	6.68	146
March 27......	65	163	7.95	593	February 19...	40	35	6.50	86
April 3........	65	87	7.82	330	February 29...	50	42	6.55	119
April 5........	65	87	7.70	282	March 8.......	50	34	6.42	87
April 16.......	47	55	6.70	135	March 16......	50	22	6.07	39
April 18.......	47	56	6.65	123	March 27......	50	36	6.40	90
May 6..........	54	47	6.39	105	April 11.......	30	11	5.75	16
May 8..........	54	42	6.30	82	April 23.......	50	28	6.30	71
May 23........	36	20	5.93	46	April 30.......	15	7.6	5.64	12
June 5.........	34	18	5.82	32	May 16........	32	13	5.81	21
June 18........	34	11	5.70	17	May 30........	15	6.5	5.58	9.5
July 24[a]......	6	2.2	5.40	3	June 3.........	15	7	5.63	12
December 11...	18	8	5.73	15	June 8.........	13	5.2	5.56	7.4
December 23...	13	6.1	5.60	9.9	July 12........	3.0	1.5	5.39	2.6
					November 5...	10.8	4.0	5.55	5.8
1908.					November 28..	8.8	3.8	5.50	5.3
January 7.....	14	6.8	5.62	12	December 15...	10.8	5.6	5.60	8.6
January 20....	14	6.8	5.61	12	December 28...	10	5.4	5.56	7.8
January 31....	50	29	6.40	73					

[a] Measurement made by W. A. Lamb.

Daily gage height, in feet, of San Luis Rey River near Pala, Cal., for 1907 and 1908.

[Louis S. Salmons, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.7	7.9	6.55	7.3	6.35	5.9	5.54	5.3	5.34	5.35	5.85	5.5
2	6.55	7.4	6.5	7.9	6.3	5.85	5.52	5.32	5.34	5.35	5.9	5.5
3	6.5	7.4	6.5	7.85	6.3	5.85	5.5	5.32	5.35	5.4	5.85	5.5
4	6.5	7.35	6.8	7.7	6.25	5.85	5.5	5.3	5.35	5.5	5.85	5.5
5	6.6	7.3	9.7	7.7	6.3	5.85	5.5	5.29	5.34	5.45	5.85	5.5
6	7.9	6.9	8.0	7.65	6.4	5.85	5.51	5.28	5.35	5.5	5.8	5.5
7	7.1	6.8	8.0	7.55	6.35	5.85	5.5	5.28	5.35	5.45	5.85	5.7
8	6.7	6.75	7.7	7.4	6.3	5.8	5.5	5.3	5.34	5.5	5.85	5.75
9	6.9	6.6	7.6	7.3	6.25	5.8	5.5	5.3	5.35	5.5	5.85	5.75
10	8.85	6.5	7.55	7.15	6.2	5.8	......	5.32	5.34	5.45	5.8	5.7
11	7.2	6.5	7.5	7.05	6.2	5.8	......	5.33	5.35	5.5	5.8	5.75
12	6.8	6.45	7.5	6.95	6.2	5.8	......	5.32	5.35	5.5	5.8	5.7
13	6.5	6.45	7.3	6.85	6.25	5.8	......	5.32	5.34	5.5	5.8	5.7
14	7.85	6.4	7.2	6.85	6.2	5.75	5.37	5.3	5.35	5.5	5.8	5.7
15	7.4	6.4	7.0	6.8	6.1	5.75	5.37	5.3	5.37	5.55	5.8	5.7
16	7.5	8.5	6.95	6.75	6.05	5.75	5.37	5.31	5.37	5.7	5.8	5.7
17	7.7	7.4	6.85	6.7	6.0	5.7	5.32	5.3	5.35	5.85	5.8	5.7
18	10.8	6.8	6.8	6.65	6.0	5.7	5.33	5.3	5.35	5.8	5.95	5.65
19	10.4	6.6	6.75	6.55	6.0	5.7	5.32	5.3	5.38	5.8	5.9	5.65
20	9.6	6.55	7.0	6.5	5.95	5.7	5.32	5.3	5.38	5.8	5.85	5.6
21	8.2	6.8	8.5	6.5	5.95	5.7	5.32	5.32	5.37	5.8	5.85	5.6
22	8.1	7.4	7.2	6.45	5.9	5.7	5.32	5.32	5.35	5.9	5.8	5.6
23	7.4	7.0	7.2	6.45	5.95	5.7	5.32	5.35	5.35	6.4	5.8	5.6
24	7.45	6.9	7.0	6.45	5.9	5.75	5.33	5.35	5.38	6.5	5.8	5.6
25	7.4	6.85	8.8	6.45	5.9	5.7	5.32	5.35	5.38	6.2	5.75	5.6
26	7.4	6.75	8.5	6.45	5.85	5.7	5.31	5.36	5.37	6.0	5.7	5.6
27	7.4	6.7	7.95	6.4	5.85	5.65	5.32	5.35	5.38	5.9	5.7	5.6
28	7.4	6.6	7.4	6.4	5.85	5.65	5.30	5.37	5.38	6.0	5.65	5.7
29	7.4	......	7.4	6.4	5.85	5.6	5.3	5.37	5.45	6.1	5.6	5.7
30	8.6	......	7.35	6.45	5.85	5.55	5.32	5.37	5.36	6.0	5.55	5.7
31	8.4	......	7.3	......	5.9	......	5.32	5.35	......	5.9	......	5.7
1908.												
1	5.7	6.3	6.45	5.95	5.6	5.6	5.4	5.35	......	5.35	5.5	5.5
2	5.65	6.3	6.35	5.9	5.65	5.65	5.4	......	......	5.35	5.5	5.5
3	5.65	7.75	6.2	5.9	5.8	5.65	5.4	......	......	5.35	5.5	5.65
4	5.65	7.55	6.6	5.9	5.8	5.6	5.45	......	......	5.35	5.5	5.85
5	5.6	6.8	6.75	5.85	5.8	5.6	5.45	......	......	5.35	5.55	5.7

Daily gage height, in feet, of San Luis Rey River near Pala, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	5.65	6.7	6.6	5.85	5.75	5.6	5.45	......	......	5.35	5.55	5.7
7	5.6	6.55	6.45	5.85	5.75	5.6	5.45	......	......	5.35	5.55	5.65
8	5.6	6.4	6.4	5.85	5.75	5.55	5.45	......	......	5.35	5.55	5.6
9	5.6	7.1	6.4	5.8	5.7	5.6	5.4	5.85	......	5.35	5.55	5.6
10	5.6	7.85	6.4	5.8	5.7	5.55	5.4	5.75	......	5.35	5.55	5.6
11	5.6	7.3	6.35	5.75	5.7	5.55	5.4	5.55	......	5.35	5.55	5.6
12	5.6	7.1	6.25	5.7	5.75	5.55	5.4	5.4	......	5.35	5.55	5.6
13	5.65	7.0	6.15	5.7	5.75	5.55	5.4	5.35	......	5.35	5.55	5.6
14	5.8	6.9	6.1	5.65	5.75	5.55	5.4	5.35	......	5.35	5.6	5.6
15	6.0	6.85	6.05	5.65	5.75	5.55	5.35	......	......	5.35	5.6	5.6
16	5.8	6.6	6.0	5.65	5.8	5.6	5.35	......	......	5.4	5.55	5.65
17	5.7	6.5	5.95	5.65	5.8	5.55	5.55	......	......	5.5	5.6	5.7
18	5.7	6.5	5.9	5.65	5.75	5.55	5.35	......	......	5.5	5.6	5.65
19	5.65	6.5	5.9	5.6	5.7	5.55	5.35	......	......	5.5	5.6	5.55
20	5.6	6.5	5.9	5.6	5.65	5.55	5.35	......	......	5.5	5.6	5.5
21	5.6	6.5	5.85	5.9	5.65	5.5	5.35	......	......	5.5	5.6	5.5
22	5.6	6.5	5.9	6.25	5.6	5.5	5.35	......	......	5.5	5.6	5.5
23	5.75	6.5	5.85	6.3	5.6	5.5	5.35	......	......	5.5	5.6	5.5
24	6.6	6.35	5.85	6.15	5.6	5.5	5.35	......	......	5.45	5.55	5.55
25	7.1	6.3	5.85	5.95	5.6	5.45	5.35	......	......	5.5	5.55	5.55
26	6.85	6.3	6.0	5.65	5.6	5.45	5.35	......	......	5.5	5.55	5.55
27	6.55	6.3	6.4	5.65	5.6	5.4	5.35	......	......	5.5	5.55	5.6
28	7.25	6.3	6.3	5.65	5.6	5.4	5.35	......	......	5.5	5.5	5.6
29	7.7	6.55	6.3	5.65	5.6	5.4	5.35	......	......	5.5	5.5	5.6
30	6.65	......	6.2	5.65	5.6	5.4	5.35	......	......	5.5	5.5	5.6
31	6.5	......	6.0	......	5.6	......	5.35	......	......	5.5	......	5.6

Monthly discharge of San Luis Rey River near Pala, Cal., for 1907 and 1908.

[Drainage area, 318 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	2,800	151	541	1.70	1.96	33,300	D.
February	910	79	154	.484	.50	8,550	C.
March	2,100	85	326	1.03	1.19	20,000	C.
April	410	98	167	.525	.59	9,940	C.
May	98	33	62.5	.197	.23	3,840	C.
June	40	8.0	22.8	.072	.08	1,360	B.
July	7.6	1.0	3.27	.010	.01	201	B.
August	2.4	.6	1.42	.0045	.01	87	B.
September	4.5	1.8	2.22	.0070	.01	132	B.
October	109	2.0	28.1	.088	.10	1,730	B.
November	47	8.0	27.8	.087	.10	1,650	B.
December	22	6.0	13.3	.042	.05	818	B.
The year	2,800	.6	112	.354	4.83	81,600	
1908.							
January	480	10	62.6	.197	.23	3,850	C.
February	544	60	175	.550	.59	10,100	C.
March	169	21	61.1	.192	.22	3,760	C.
April	71	10	21.3	.067	.07	1,270	C.
May	18	10	13.2	.041	.05	812	C.
June	12	4	7.4	.023	.03	440	C.
July	5	2	3.0	.0094	.01	184	C.
August	21	2	3.4	.011	.01	209	C.
September	2	2	2.0	.0063	.01	119	C.
October	5	2	3.5	.011	.01	215	C.
November	7	5	6.1	.019	.02	363	C.
December	12	5	8.6	.027	.03	529	C.
The year	544	2	30.6	.096	1.28	21,800	

NOTE.—Daily discharges for 1907 were obtained from rating tables covering short periods of time. For 1908 they were obtained by the indirect method for shifting channels and estimated on dates when gage was not read.

SANTA ANA RIVER DRAINAGE BASIN.

DESCRIPTION.

Of the three important streams—Santa Ana, San Gabriel, and Los Angeles rivers—that traverse the valley of southern California, the Santa Ana is the most important. Its drainage basin, lying south of the San Bernardino Mountains and the Sierra Madre and taking waters from their southern slopes, is the most eastern and comprises by far the largest area, including the northern part of Orange County, the northwestern part of Riverside County, and the southwestern part of San Bernardino County. Of the total drainage area, covering between 1,800 and 1,900 square miles, about two-thirds are in the valley, but only a few hundred yield much run-off.

The Santa Ana rises in the heart of the San Bernardino Mountains, about 30 miles east of Highland, and flows westward for about 25 miles to the mouth of its upper canyon; thence southwestward across San Bernardino Valley, through the lower canyon in the Santa Ana Mountains, and across the coastal plain to the Pacific Ocean at Newport Beach. Although the course of the stream measures about 100 miles, there is continuous surface flow from mountain to sea only during winter floods.

Many small streams from the southern slope of the San Bernardino Mountains and a few from the Sierra Madre west of the Cajon Pass flow toward the Santa Ana, but some of these discharge water to the main stream only in the flood seasons, the ordinary flow either being diverted or sinking into the sand and gravel of San Bernardino Valley. The principal tributaries are Bear, Alder, Mill, Lytle, and Chino creeks.

Altitudes in the Santa Ana drainage area range from a few feet above sea level on the coastal plain to 2,000 or 3,000 feet on the Santa Ana Mountains, 500 to 1,200 feet in the San Bernardino basin, and 2,000 to 11,000 feet on the southern slope of the San Bernardino Mountains. The more elevated regions are rough and rugged, and the mountain sides are incised by many canyons which are the result of active stream erosion. The rocks are granitic. The mesa and valley lands at the base of the mountains are composed of granitic gravel and sand of great depth. The higher mountain slopes support considerable timber; the lower slopes are as a rule covered with brush and grass.

The mean annual precipitation varies considerably in different parts of the Santa Ana basin. On the coastal plain west of the Santa Ana Range it averages 10 inches or more; eastward, in the San Bernardino Valley, it amounts to from 10 to 16 inches. On the mountain slopes it ranges from 20 inches at the base to 40 inches or more near the crest, and in Bear Valley north of the highest peaks, such as San Bernardino and San Gorgonio, it may be even 50 inches. Considerable snow falls in the region of these high peaks in winter and remains well into the summer, especially on the northern slopes, from which the headwaters of the Santa Ana come.

Irrigation in the valleys of the Santa Ana basin has attained a very high state of development. Probably no other stream of its size in the United States is made to serve greater or more varied uses. To begin with, a portion of the flow is regulated by artificial storage in the upper part of the basin, and the water passes successively through three hydro-electric plants before reaching the mouth of the canyon. On leaving the lower plant it is turned into high-level canals and used for municipal supply and irrigation about Redlands and Highland. The irrigation water that escapes through seepage to the body of ground water is recovered from springs and flowing wells, and from pumped wells, and is used for irrigation around San Bernardino and Riverside, the power for pumping being generated on the upper reaches of the stream. Bed-rock obstructions at Riverside Narrows, below the city of Riverside, force to the surface a part of the water in the gravel bed of the stream above this point, and this water, after being diverted for power development, is returned to the river above Corona. Only a few miles below it is again diverted and used for irrigation on the coastal plain in the vicinity of Santa Ana and Anaheim. The seepage water from irrigation is once more recovered by numerous pumping plants and flowing wells on the lower coastal plain west of Santa Ana. It is thus evident that the same water, in passing from mountain to sea, a distance of not more than 100 miles, may be used at least eight times for power and irrigation. In like manner the water in many of the tributaries may be used several times before reaching the main stream.

Further storage and power development are feasible on the upper Santa Ana, and with a full utilization of storage sites 25,000 or 30,000 horsepower at least could be obtained continuously.

The longest run-off record in the Santa Ana basin extends back to 1896. The wettest year since that time was 1907 and the driest 1899. The total flow during the wettest year was about ten times that during the driest.

The only gaging station maintained in the basin is on Santa Ana River near Mentone, 1896 to 1908.

SANTA ANA RIVER AND MENTONE POWER COMPANY'S CANAL NEAR MENTONE, CAL.

This station, which was established in June, 1896, at the road crossing opposite Warm Spring Canyon, about three-fourths of a mile below the head works of the Mentone Power Company's canal and 5 miles northeast of Mentone, has been maintained to obtain statistical information concerning the flow of the Santa Ana. The data show the amount and variation in flow of the water available for irrigation and power, and are useful in the adjudication of water rights. The station is about 2 miles below the mouth of Alder Creek.

Practically all the low-water flow is diverted above the station into the power canal, which returns it to the river bed below to be distributed to irrigation ditches. The flow in the canal is measured by a weir and is added to that at the station in order to obtain the total for the stream. The acquired water rights exceed the low-water flow.

Conditions for obtaining accurate discharge data are fair. The stream has a rocky bed and is subject to slight change. At high stages the current is very swift and it is difficult to get accurate gagings. The records are fairly satisfactory.

Discharge measurements of Santa Ana River near Mentone, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height of river.	Discharge.		
			River.	Mentone Power Company's canal.	Total for river.
1907.		*Feet.*	*Sec.-ft.*	*Sec.-ft.*	*Sec.-ft.*
January 10	W. F. Martin	3.82	284	76	360
February 27	do	3.95	379	76	455
March 12	do	4.1	501	76	577
March 26	do	4.65	872	72	944
April 29	W. B. Clapp	3.35	184	73	257
June 12	W. F. Martin	3.00	110	70	180
June 27	W. B. Clapp	2.75	79	70	149
July 30	W. F. Martin	2.52	59	69	128
August 22	do	2.15	16	69	85
September 18	W. B. Clapp	1.85	2.6	66	69
1908.					
January 29	W. F. Martin	3.0	126	0	126
February 20	do	2.64	77	78	155
May 15	W. B. Clapp	1.85	4	68	72

Daily gage height, in feet, of Santa Ana River near Mentone, Cal., for 1907 and 1908.

[Chas. Putnam, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.7	3.5	3.4	4.2	3.7	3.0	2.8	2.4	2.1	1.9	2.4	1.9
2	2.6	3.5	3.6	4.3	3.7	3.0	2.8	2.4	2.1	1.9	2.4	1.9
3	2.5	3.7	3.2	4.4	3.6	3.0	2.8	2.4	2.1	1.9	2.4	1.8
4	2.5	3.8	3.3	4.3	3.4	3.0	2.8	2.3	2.1	1.9	2.7	1.8
5	2.5	3.8	5.3	4.2	3.4	3.0	2.8	2.3	2.0	2.0	2.7	1.8
6	3.0	3.8	4.4	4.2	3.4	3.0	2.8	2.3	2.0	2.0	2.7	1.8
7	3.0	3.4	4.1	4.2	3.1	3.0	2.8	2.3	2.0	1.9	2.3	1.8
8	3.0	3.4	4.5	4.3	3.1	3.0	2.8	2.3	1.9	1.9	2.0	1.8
9	3.0	3.2	4.4	4.3	3.0	3.0	2.8	2.2	1.9	1.9	1.9	1.8
10	4.5	3.1	3.7	4.3	3.5	3.0	2.7	2.2	1.9	1.9	2.3	1.8
11	3.6	3.1	4.2	4.3	3.4	3.0	2.7	2.2	1.9	1.9	2.7	1.8
12	3.6	3.0	4.1	4.3	3.4	3.0	2.7	2.2	1.9	1.9	2.7	1.8
13	3.7	3.0	4.0	4.3	3.4	3.0	2.7	2.2	1.9	1.9	2.7	1.8
14	3.8	3.0	4.0	4.3	3.2	3.0	2.7	2.2	1.9	1.9	2.7	1.8
15	3.7	2.9	3.4	4.3	3.2	3.0	2.7	2.1	1.9	1.9	2.7	1.8

Daily gage height, in feet, of Santa Ana River near Mentone, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	3.8	2.9	3.4	4.3	3.0	3.0	2.7	2.1	1.9	2.2	2.7	1.8
17	3.8	3.1	3.4	3.7	3.0	2.9	2.7	2.1	1.8	2.1	2.7	1.8
18	4.0	3.0	3.5	3.6	3.0	2.8	2.6	2.1	1.8	2.1	2.7	1.7
19	3.9	2.9	4.1	3.8	3.6	2.8	2.6	2.1	1.8	2.1	2.6	1.7
20	3.6	2.9	4.4	4.3	3.6	2.8	2.6	2.0	3.1	2.0	2.6	1.7
21	3.6	3.6	6.0	4.2	3.6	2.8	2.6	2.1	1.9	2.0	2.6	1.7
22	3.6	4.4	4.9	4.1	3.2	2.8	2.5	2.1	1.9	1.9	2.6	1.7
23	3.6	4.4	4.8	3.7	3.2	2.8	2.5	2.1	1.9	2.0	2.5	1.7
24	3.6	4.1	4.6	3.6	3.2	2.8	2.5	2.1	1.9	2.5	2.5	1.7
25	3.0	4.0	4.8	3.6	3.1	2.8	2.5	2.1	1.9	2.2	1.9	1.7
26	2.9	4.0	4.7	3.6	3.1	2.8	2.5	2.1	1.9	2.1	1.9	1.7
27	2.9	4.0	4.7	3.7	3.2	2.8	2.5	2.1	1.9	2.1	1.9	1.7
28	2.9	3.4	4.5	3.7	3.1	2.7	2.5	2.1	1.9	2.4	1.9	1.7
29	2.9	......	4.4	3.4	3.1	2.7	2.4	2.1	1.9	2.4	1.9	1.7
30	3.4	......	4.3	3.7	3.0	2.8	2.4	2.1	1.9	2.4	1.9	1.7
31	3.0	......	4.2	......	3.0	......	2.4	2.1	......	2.4	......	1.7
1908.												
1	1.7	2.0	3.0	2.7	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8
2	1.7	2.9	2.9	2.6	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8
3	1.7	2.9	2.9	2.4	2.4	1.8	1.8	1.8	1.8	1.8	1.8	1.8
4	1.7	3.6	3.0	2.2	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8
5	1.7	2.8	3.0	2.1	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8
6	1.7	2.5	2.5	2.0	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8
7	1.7	2.3	2.4	2.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8
8	1.7	2.2	2.4	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8
9	1.7	2.1	2.1	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8
10	1.7	2.2	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
11	1.7	2.2	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
12	1.7	2.2	2.0	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
13	1.7	2.1	2.0	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
14	1.7	2.0	2.0	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
15	1.7	2.7	2.2	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
16	1.7	2.6	2.2	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
17	1.7	2.6	2.2	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
18	1.7	2.6	2.9	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
19	1.7	2.6	3.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
20	1.7	2.6	3.0	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
21	1.7	2.6	3.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
22	1.7	2.6	3.0	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
23	1.7	2.6	3.0	2.7	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
24	3.0	2.6	2.9	2.3	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
25	3.4	2.6.	2.9	2.3	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
26	2.8	2.6	2.3	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
27	2.4	2.7	2.4	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
28	3.0	2.7	2.4	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
29	3.2	3.3	2.6	2.2	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
30	3.0	......	2.7	2.1	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
31	3.0	......	2.7	......	1.8	......	1.8	1.8	......	1.8	......	1.8

Rating tables for Santa Ana River near Mentone, Cal.

JANUARY 1 TO APRIL 16, 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.*
2.50	10	3.40	155	4.30	625	5.20	1,300
2.60	18	3.50	181	4.40	700	5.30	1,375
2.70	27	3.60	210	4.50	775	5.40	1,450
2.80	38	3.70	241	4.60	850	5.50	1,525
2.90	52	3.80	275	4.70	925	5.60	1,600
3.00	69	3.90	330	4.80	1,000	5.70	1,675
3.10	88	4.00	400	4.90	1,075	5.80	1,750
3.20	108	4.10	475	5.00	1,150	5.90	1,825
3.30	131	4.20	550	5.10	1,225	6.00	1,900

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on four discharge measurements made during January to March, 1907, and is well defined between gage heights 3.8 feet and 4.7 feet. Above gage height 4 feet the rating curve is a tangent, the difference being 75 per tenth.

Rating tables for Santa Ana River near Mentone, Cal.—Continued.

APRIL 17 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.*
1.70	1	2.40	40	3.10	132	3.80	314
1.80	2	2.50	50	3.20	150	3.90	360
1.90	4	2.60	60	3.30	170	4.00	415
2.00	9	2.70	72	3.40	192	4.10	475
2.10	15	2.80	85	3.50	217	4.20	550
2.20	22	2.90	100	3.60	243	4.30	625
2.30	31	3.00	116	3.70	276		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during April to August, 1907, and is well defined between gage heights 2.0 feet and 3.5 feet. Above gage height 4.1 feet the rating curve is a tangent, the difference being 75 per tenth.

FOR 1908.

1.70	0	2.30	33	2.90	105	3.50	217
1.80	2	2.40	43	3.00	120	3.60	240
1.90	5	2.50	54	3.10	137	3.70	264
2.00	9	2.60	66	3.20	155	3.80	289
2.10	16	2.70	78	3.30	174	3.90	315
2.20	24	2.80	91	3.40	195	4.00	342

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1907 and 1908 and is well defined between gage heights 1.8 feet and 4 feet.

Daily discharge, in second-feet, of Mentone Power Company's canal near Mentone, Cal., for 1907 and 1908.

[Chas. Putnam, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	76	76	76	76	76	70	69	69	69	64	76	60
2	76	76	76	76	76	70	69	69	69	64	76	60
3	76	76	76	76	76	70	69	69	69	63	76	60
4	76	76	76	76	76	70	69	69	69	68	76	59
5	76	76	76	76	74	70	69	69	69	77	76	57
6	76	76	76	76	74	70	69	69	69	73	76	59
7	76	76	76	76	74	70	69	69	69	73	76	67
8	76	76	76	76	74	70	69	69	65	69	76	62
9	76	76	76	76	74	70	69	69	65	64	76	59
10	76	76	76	76	74	70	69	69	65	66	76	60
11	76	76	76	76	74	70	69	69	60	64	76	72
12	76	76	76	76	74	70	69	69	58	64	76	62
13	76	76	76	76	74	70	69	69	62	64	76	61
14	76	76	76	76	74	70	69	69	62	64	76	61
15	76	76	76	76	74	70	69	69	62	67	76	60
16	76	76	76	76	74	70	69	69	62	72	76	60
17	76	76	76	76	74	70	69	69	64	72	76	60
18	76	76	76	76	74	70	69	69	66	73	76	59
19	......	76	76	76	0	70	69	69	66	71	76	59
20	76	76	77	76	0	70	69	69	0	71	76	59
21	76	76	58	76	0	70	69	69	66	64	76	56
22	76	76	56	76	68	70	69	69	64	70	76	56
23	76	76	66	76	70	70	69	69	66	74	76	55
24	76	76	68	76	70	70	69	69	65	76	76	54
25	76	76	72	76	70	70	69	69	68	76	70	55
26	76	76	72	76	70	70	69	69	64	76	70	55
27	76	76	74	76	70	70	69	69	66	76	65	54
28	76	76	66	76	70	70	69	69	64	76	64	55
29	76	......	77	73	70	70	69	69	68	76	60	55
30	76	......	77	76	70	70	69	69	64	76	64	55
31	76	......	76	......	70	......	69	69	......	76	......	55

Daily discharge, in second-feet, of Mentone Power Company's canal near Mentone, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	55	64	78	77	77	67	60	60	59	58	65	40
2	55	0	78	77	77	62	57	61	60	59	48	38
3	55	0	78	77	77	62	57	56	60	60	45	56
4	55	0	78	77	77	62	56	62	60	60	41	56
5	53	76	78	77	77	62	57	62	58	59	40	50
6	53	78	76	77	77	60	57	63	59	45	40	47
7	53	78	78	77	77	60	58	66	59	45	40	41
8	53	78	78	77	77	58	61	52	59	53	40	43
9	53	78	77	77	76	57	63	66	59	48	39	43
10	53	76	77	74	77	57	63	62	59	66	39	43
11	53	76	76	74	74	62	66	66	59	61	40	41
12	53	78	74	77	77	65	68	60	59	59	40	41
13	55	78	76	77	76	62	68	68	59	62	37	41
14	63	76	77	74	73	62	64	68	59	66	39	40
15	63	78	77	77	71	58	66	68	59	66	38	40
16	61	78	77	77	73	57	64	64	59	63	40	40
17	61	78	77	77	72	56	64	62	59	62	38	40
18	61	78	0	77	66	56	64	59	60	64	40	37
19	61	78	0	77	66	53	59	63	59	54	38	36
20	55	78	0	74	64	56	59	63	58	46	37	36
21	55	78	0	77	66	56	56	58	58	46	37	40
22	57	78	0	77	64	56	58	59	56	52	38	41
23	57	78	0	77	61	56	61	62	56	45	38	41
24	70	78	0	77	63	56	63	62	75	52	49	41
25	72	78	0	77	61	57	67	61	55	48	39	40
26	70	78	74	77	63	60	63	61	49	48	39	41
27	76	78	74	77	64	64	61	61	44	50	40	39
28	0	78	77	77	62	64	64	61	43	53	41	38
29	0	78	77	77	61	64	69	60	42	57	38	38
30	0	......	77	77	67	62	69	60	44	62	41	37
31	0	......	77	......	71	......	68	60	......	61	......	38

Monthly discharge of Santa Ana River near Mentone, Cal., for 1907 and 1908.

[Drainage area, 182 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	851	86	239	1.31	1.51	14,700	B.
February	776	128	292	1.60	1.67	16,200	B.
March	1,960	184	681	3.74	4.31	41,900	B.
April	776	265	552	3.03	3.38	32,800	B.
May	352	186	236	1.30	1.50	14,500	B.
June	186	142	171	.940	1.05	10,200	B.
July	154	109	135	.742	.86	8,300	B.
August	109	78	90.2	.496	.57	5,550	B.
September	132	62	73.2	.402	.45	4,360	B.
October	126	68	84.2	.463	.53	5,180	B.
November	148	64	119	.654	.73	7,080	B.
December	74	55	60.4	.332	.38	3,710	B.
The year	1,960	55	228.	1.25	16.94	164,000	
1908.							
January	267	53	82.1	.451	.52	5,050	A.
February	252	73	135	.742	.80	7,760	A.
March	198	83	125	.687	.79	7,690	A.
April	155	79	98.9	.543	.61	5,880	A.
May	120	63	76.3	.419	.48	4,690	A.
June	69	55	61.6	.338	.38	3,670	A.
July	71	58	64.3	.353	.41	3,950	A.
August	70	54	63.8	.351	.40	3,920	A.
September	77	44	58.8	.323	.36	3,500	A.
October	68	47	57.8	.318	.37	3,550	A.
November	67	39	42.8	.235	.26	2,550	A.
December	58	38	43.4	.238	.27	2,670	A.
The year	267	38	75.8	.416	5.65	54,900	

NOTE.—These discharges include those of the Mentone Power Company's canal.

SEEPAGE MEASUREMENTS.

Measurements to determine the amount of return water from irrigated lands on the higher elevations above Colton, Cal., and between Slover Mountain and Riverside Narrows were continued in 1907 and 1908, and measurements were also made of diversion ditches and Santa Ana River below Riverside Narrows and above what is known as the Auburndale Bridge, which were made by Kingsbury Sanborn, of Riverside, Cal.

Natural flow, in second-feet, of return water to Santa Ana River, compared with developed water in San Bernardino above Colton, Cal., 1907.

[Measurements made by Kingsbury Sanborn, engineer Riverside Water Company.]

Date.	Location.	Developed.	Natural.	Total.
June 25	Barnhill pumping plant	1.70		1.70
September 18	do	1.30		1.30
June 21	Beam ditch		0.00	.00
September 28	do		.00	.00
June 21	Bloomington pumping plant	5.60		5.60
September 26	do	6.50		6.50
June 25	Citizens Water Co., pumping plant	4.00		4.00
September 26	do	2.00		2.00
June 20	City of San Bernardino, Sixth street pumping plant	4.00		4.00
September 28	do	2.30		2.30
June 25	City of Colton pumping plant (total)	4.50		4.50
September 18	do	4.50		4.50
June 25	City of Colton (water used for irrigating)	1.20		1.20
September 18	do	.00		.00
June 20	Camp Carlton ditch		4.40	4.40
September 25	do	3.10		3.10
June 22	Carr pumping plant	.00		.00
September 20	do	.00		.00
June 20	Daley ditch		.00	.00
September 25	do	.00		.00
June 19	Excelsior Land and Water Co	.65		.65
September 18	do	.65		.65
June 20	Grand Terrace pumping plant	.70		.70
September 20	do	.00		.00
June 20	Gage Canal, Palm avenue weir		50.10	50.10
September 20	do	33.20	.40	33.60
June 20	Gage Canal intake, Santa Ana River		.00	.00
September 20	do		.40	.40
June 21	Haws & Talmadge ditch		.08	.08
September 28	do	.00		.00
June 25	Hunter pumping plant	1.50		1.50
September 18	do	1.50		1.50
June 25	Johnson & Hubbard pumping plant	.40		.40
September 18	do	.00		.00
June 25	Lamb pumping plant	.00		.00
September 18	do	.00		.00
June 25	Lawson Well Co. pumping plant	.90		.90
September 18	do	.90		.90
June 20	Logsden & Farrell ditch	.00		.00
September 25	do	.00		.00
June 22	Lytle Creek Water and Improvement Co., pumping plant	.00		.00
September 20	do	.00		.00
June 19	Merryfield pumping plant	.70		.70
September 18	do	.70		.70
June 21	McKenzie ditch		.00	.00
September 28	do		.00	.00
June 19	Meeks & Daley ditch		22.30	22.30
October 3	do		17.10	17.10
June 25	McIntyre ditch		.00	.00
September 18	do		.00	.00
June 25	Orange Land and Water Co., pumping plant	.00		.00
September 26	do	.00	.00	.00
June 25	Riverside Highland Water Co., pumping plant	4.20		4.20
September 26	do	5.40		5.40
June 20	Riverside Highland Water Co., Santa Ana River	2.50	1.60	4.10
September 25	do	3.60		3.60
June 25	Rancheria pumping plant	2.00		2.00
September 26	do	2.00		2.00

Natural flow, in second feet, of return water to Santa Ana River, compared with developed water in San Bernardino above Colton, Cal., 1907—Continued.

Date.	Location.	Developed.	Natural.	Total.
June 21	Rabel ditch		0.60	0.60
September 28	do		1.00	1.00
June 19	Riverside Water Co., upper canal		63.00	63.00
September 26	do	16.00	30.00	46.00
June 27	Riverside Water Co., mill pumping plant	.00		.00
September 20	do	.00	.00	.00
June 19	Riverside Water Co., flume		.00	.00
September 20	do		.00	.00
June 27	Riverside Water Co., flume pump No. 1	.00		.00
September 20	do	.00		.00
June 27	Riverside Water Co., flume pump No. 2	.00		.00
September 20	do	.00		.00
June 19	Rosedale Water Co., pumping plant	.00		.00
September 26	do	.40		.40
June 19	Rogers pumping plant	.00		.00
September 18	do	2.20		2.20
June 21	Shay or Stout Dam ditch		2.60	2.60
September 28	do		1.30	1.30
June 20	Swamp ditch		2.20	2.20
September 21	do		1.00	1.00
June 19	West Riverside 350-inch Water Co. pumping plant		10.30	10.30
September 21	do	8.80		8.80
June 21	Whitlock ditch		.00	.00
September 20	do		.00	.00
June 25	Whiting ditch		.00	.00
September 25	do		.00	.00
June 20	Ward and Warren ditch		2.10	2.10
September 25	do		.00	.00

Return waters, in second-feet, in San Bernardino Valley below Slover Mountain and above Riverside Narrows, 1907.

[Measurements by Kingsbury Sanborn, engineer Riverside Water Company.]

Date.	Location.	Developed.	Natural.	Total.
June 24	Alvitrez ditch at headgate, east end of West Riverside Bridge		0.70	0.70
September 19	do		2.50	2.50
June 24	Cuttle's pumping plant	0.00		.00
September 20	do	2.50		2.50
June 24	California Orange Co., pumping plant	.00		.00
September 20	do	1.50		1.50
June 24	Evans Island and Jansen ditch, under west end of West Riverside Bridge		4.70	4.70
September 19	do		.00	00
June 19	Evans ditch near county line		.00	.00
September 20	do		.00	.00
June 19	Evans well ditch, Santa Ana street		.00	.00
September 23	do	.80		.80
June 24	Evans pipe line to China garden at headworks		1.40	1.40
September 19	do		.00	.00
June 24	Evans pumping plant 1,000 feet south of west end of West Riverside Bridge	.00		.00
September 19	do		.00	.00
June 24	Evans Jurupa pumping plant	.00		.00
September 19	do		.00	.00
June 24	Ferris Gallagher ditch near headworks		1.10	1.10
September 19	do		3.70	3.70
June 24	Gallagher ditch		1.60	1.60
September 19	do		.00	.00
June 22	Jurupa pumping plant to supply Rubidoux ditch	.00		.00
September 23	do	4.80		4.80
June 19	Lower canal, Riverside Water Co		11.70	11.70
September 23	do		.00	.00
June 24	Pond's pumping plant	2.50		2.50
September 23	do	1.50		1.50
June 19	Rubidoux ditch at measuring box		9.80	9.80
September 23	do	4.80	1.60	6.40
June 26	Riverside Power Co. canal at Pedley crossing		49.50	49.50
September 19	do		36.00	36.00
June 24	Rivino Land Co., pumping plant No. 1	1.35		1.35
September 23	do	1.00		1.00

Return waters, in second-feet, in San Bernardino Valley below Slover Mountain and above Riverside Narrows, 1907—Continued.

Date.	Location.	Developed.	Natural.	Total.
June 26	Rivino Land Co., pumping plant No. 2	2.30		2.30
September 23	do	.00		.00
June 19	Smith or Evans ditch, 1 mile below Riverside County line		5.70	5.70
September 20	do		.00	.00
June 24	Soquel ditch at intake		1.90	1.90
September 19	do		3.70	3.70
June 22	Spring Brook pumping plant at weir at end of main	.00		.00
September 24	do		.00	.00
June 22	Spanishtown pumping plant at weir at end of main	.00		.00
September 24	do	.00		.00
June 24	Zimmerman pipe line	.00	.00	.00
September 19	do	.00	.00	.00

Discharge measurements, in second-feet, of canals between Riverside Narrows and the Auburndale Bridge having their source in Santa Ana River, 1907.

Date.	Location.	Discharge.
June 26	Castile ditch near intake	0.00
September 27	do	.00
June 26	Durkee ditch at Auburndale road crossing	3.40
September 27	do	9.80
June 26	Fuller ditch	8.30
September 27	do	1.70
June 26	Gilliland ditch at Auburndale road crossing	1.10
September 27	do	.60
June 26	Newton ditch near intake	.00
September 27	do	.00
June 26	Newberry ditch at Auburndale road crossing	.00
September 27	do	.80
June 26	Roberts or Le Gay ditch near intake, Santa Ana River	.80
September 27	do	.00
June 26	Wilbur ditch at Rogers pipe trestle crossing, Santa Ana River	00
September 27	do	.00
June 26	Santa Ana River at Auburndale Bridge	78.00
September 27	do	57.70
June 26	Santa Ana River at Auburndale Bridge, including ditches	86.00
September 27	do	66.50

SAN GABRIEL RIVER DRAINAGE BASIN.

DESCRIPTION.

San Gabriel River is one of the three most important streams traversing the valley of southern California. Its drainage basin lies wholly in Los Angeles County west of the Santa Ana basin and east of the Los Angeles basin, and stretches from the crest of the Sierra Madre to the Pacific, a distance of about 50 miles. Its total drainage area is approximately 700 square miles, about one-third of which consists of mountain slopes, which contribute practically all of the run-off except in heavy storms. The remaining two-thirds is embraced in the San Gabriel Valley at the base of the mountains and in the coastal plain southeast of the city of Los Angeles.

The mountainous part of the basin is somewhat rectangular in shape. Its length east and west is about 25 miles, and its width about 10 miles. It lies on the southern slope of the Sierra Madre opposite the basins of Big and Little Rock creeks at the north and on the southern slope of the San Gabriel Range, through which the river breaks near Azusa and enters the San Gabriel Valley.

The main stream is formed by the junction of two principal forks, one from the north and east and the other from the west. Each of the branches receives many tributaries from the crests of the surrounding ranges. The headwaters come from the western slope of San Antonio Peak (Old Baldy), altitude 10,080 feet, and from the southern slope of other high peaks at the north, such as North Baldy and Islip mountains. The west fork drains the northern slope of Mount Wilson, the eastern and northern slopes of San Gabriel Peak, and a portion of the southern slopes of the main range to the north. It joins the main stream about 8 miles above the mouth of the canyon. The general course of the stream is southwestward. After leaving the mountains it traverses San Gabriel Valley in a wide wash of sand, gravel, and bowlders, then breaks through the range of foothills separating San Gabriel Valley from the coastal plain at a point called The Narrows, about 5 miles northwest of Whittier, and enters the coastal plain, across which it flows to its mouth in Alamitos Bay, a few miles east of Long Beach. The total length of the stream is about 65 or 70 miles.

The principal tributaries of San Gabriel River are Fish Fork and Cattle Creek from the east, and Iron and West forks from the west.

Altitudes in San Gabriel basin range from 20 to 200 feet on the Coastal Plain, from 200 to 900 feet in San Gabriel Valley, and from 1,000 to 10,000 feet in the mountains. The range of foothills near Whittier has an altitude of about 1,250 feet. The topography is rough and rugged in the mountains, especially in the upper part, where deep and narrow canyons exist. The geologic formation is granitic, with a light soil covering. The San Gabriel Valley is more or less rolling and is composed of granitic wash from the mountains.

The basin is rather poorly forested, having a sparse timber growth on the higher slopes and brush with some scattering timber on the middle and lower elevations.

The mean annual precipitation in this basin ranges from 15 to 20 inches in the valley area, and from 20 to 40 inches in the mountains. It occurs almost entirely as rain except on the higher peaks, where snow falls during the winter. On the northern slopes snow remains for several months.

The total summer flow of the stream is used for irrigation, and the same water may be put to use several times in its journey from mountain to sea. About 5 miles above the mouth of the canyon a power canal, with a capacity of 80 second-feet, takes water from the left bank of the stream and delivers it to irrigation canals below the wheels near the mouth of the canyon for irrigation in San Gabriel Valley. Some other small diversions are made in the spring months at and below the mouth of the canyon for the same purpose. Most of the excess water issuing from the canyon sinks into the sands and gravels of San Gabriel Valley to augment the underground basins, which are drawn upon for irrigating the lower part of the valley.

Above The Narrows at the lower end of the valley the underground flow is forced to the surface by a bed-rock obstruction, and this water, with additional water developed from many wells, is diverted through ditches for irrigating the higher parts of the coastal plain. The seepage loss from irrigation joins the body of underground water and is recovered from pumped and flowing wells in the lower coastal plain. Storage sites are practically lacking in this basin and opportunities for power development are not great. Probably not more than one-fifth as much power could be obtained in this basin as in the basin of the Santa Ana.

Run-off records in this basin extend back to 1896. The wettest year since that time was 1907 and the driest was 1899. The total flow during the wettest year was nearly 33 times that during the driest.

The only gaging station maintained in the basin is on San Gabriel River near Azusa, 1896 to 1908.

SAN GABRIEL RIVER AND POWER CANAL NEAR AZUSA, CAL.

This station, which is located just above the road crossing at the mouth of the canyon, about one-fourth mile above the Pacific Light and Power Company's power house and 2 miles north of Azusa, was established in 1896 to obtain general information for use in connection with power and irrigation development and in the adjudication of water rights. Estimates of flow were very unsatisfactory until after the completion of the power canal in 1898.

The station is well below all tributaries and is several miles below the power and irrigation diversion. The discharge in the canal is measured by a weir and is added to that at the station to obtain the total flow of the stream. The acquired water rights greatly exceed the low-water flow of the stream.

The channel is composed of gravel and bowlders and is subject to considerable change, especially above and below the measuring section; the current is very swift, and gagings at flood stages are difficult; and various temporary diversions for irrigation just above the station affect the discharge. The results are not very satisfactory.

Discharge measurements of San Gabriel River and power canal near Azusa, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height.	Discharge.		
			River.	Canal.	Total.
1907.		Feet.	Sec.-ft.	Sec.-ft.	Sec.-ft.
January 2	Clapp and Martin	3.03	169	76	245
January 9	W. F. Martin	4.88	1,110	76	1,190
January 19	do	4.3	706	76	782
February 7	do	4.8	1,020	76	1,100
February 28	do	4.2	618	76	694
March 5	do	7.4	5,980	76	6,060
Do	do	7.0	5,060	76	6,040
March 6	do	6.5	3,660	76	3,740
Do	do	6.4	3,310	76	3,390
March 8	do	6.0	2,590	76	2,670
Do	do	6.0	2,630	76	2,710
March 13	do	5.2	1,400	76	1,480
Do	do	5.15	1,350	76	1,430
March 27	do	6.3	2,020	76	2,100
Do	do	6.2	1,900	76	1,980
April 5	do	5.4	1,240	76	1,320
Do	do	5.4	1,290	76	1,370
April 15	do	5.0	893	76	969
April 30	W. B. Clapp	4.4	460	76	536
May 24	do	3.9	258	76	334
June 13	do	3.6	192	76	268
June 28	do	3.35	141	76	217
July 11	do	3.1	88	76	164
July 29	W. F. Martin	2.8	53	76	129
August 22	do	2.1	2.8	76	79
1908.					
January 27	W. F. Martin	3.8	271	76	347
February 3	do	5.6	1,885	76	1,961
February 19	do	3.35	127	76	203
April 14	W. B. Clapp	3.2	80	76	156
April 28	do	3.1	73	76	149
May 18	W. F. Martin	2.85	47	76	123
May 26	W. B. Clapp	2.55	31	76	107
June 13	do		4	76	80

Daily gage height, in feet, of San Gabriel River near Azusa, Cal., for 1907 and 1908.

[Jno. Woodward and A. W. Peake, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.											
1	3.2	4.2	4.2	5.7	4.3	3.7	2.8	2.6	2.2		2.1
2	3.1	4.2	4.1	5.7	4.2	3.7	3.0	2.6	2.1		2.0
3	2.9	4.6	4.1	5.7	4.2	3.7	3.2	2.5	2.1		
4	2.9	4.6	4.1	5.6	4.1	3.7	3.3	2.5	2.1		
5	2.2	4.7	7.6	5.5	4.1	3.7	3.2	2.5	2.0		
6	3.2	4.7	6.7	5.4	4.1	3.7	3.2	2.5	2.0		
7	3.6	4.5	6.2	5.3	4.0	3.7	3.2	2.5	2.0		
8	5.2	4.4	6.1	5.3	4.0	3.7	3.2	2.4			
9	5.5	4.3	6.1	5.2	4.0	3.65	3.1	2.4			
10	6.85	4.3	6.1	5.2	3.9	3.65	3.0	2.4			
11	5.7	4.2	6.0	5.2	3.9	3.65	3.0	2.4			
12	5.5	4.2	5.4	5.2	3.9	3.65	3.0	2.4			
13	5.2	4.1	5.3	5.2	3.85	3.6	2.9	2.3			
14	4.5	4.1	5.2	5.2	3.85	3.6	2.8	2.3			
15	4.6	4.1	5.1	5.2	3.85	3.6	2.8	2.2			
16	4.5	4.1	4.8	5.0	3.85	3.6	2.8	2.2		2.1	
17	4.5	4.9	4.7	5.0	3.85	3.55	2.8	2.2		2.2	
18	4.6	4.9	4.6	4.9	3.85	3.55	2.7	2.2		2.1	
19	4.5	4.6	4.6	4.8	3.8	3.55	2.7	2.2		2.0	
20	4.3	4.2	4.7	4.7	3.8	3.5	2.7	2.2		2.0	
21	4.1	4.2	6.1	4.7	3.8	3.5	2.7	2.1			
22	4.0	4.9	5.8	4.6	3.8	3.45	2.6	2.1			
23	4.0	4.6	5.3	4.6	3.8	3.45	2.6	2.1			
24	3.9	4.3	5.8	4.6	3.8	3.4	2.6	2.1		2.0	
25	4.1	4.3	6.0	4.6	3.8	3.4	2.6	2.1		2.1	

Daily gage height, in feet, of San Gabriel River near Azusa, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1907.											
26	4.2	4.2	6.5	4.5	3.8	3.4	2.6	2.1	......	2.0	......
27	4.1	4.2	6.0	4.5	3.8	3.35	2.6	2.1	......	2.3	......
28	4.1	4.2	6.0	4.4	3.75	3.35	2.6	2.1	......	2.5	......
29	4.3	......	6.0	4.4	3.75	3.3	2.6	2.1	......	2.4	......
30	4.5	......	6.0	4.4	3.75	3.3	2.6	2.1	......	2.2	......
31	4.4	......	5.8	......	3.75	......	2.6	2.2	......	2.1	......
1908.											
1	......	3.6	3.5	3.4	3.1	2.4	......	2.7	......	......	......
2	......	3.6	3.4	3.4	3.2	2.3	......	......	......	......	......
3	......	3.7	3.4	3.5	3.2	2.3	......	......	......	......	......
4	......	4.7	3.3	3.4	3.1	2.3	......	......	......	......	......
5	......	4.2	3.3	3.3	3.1	2.3	......	......	......	......	......
6	......	4.0	3.3	3.3	3.1	2.3	......	......	......	......	......
7	......	3.7	3.3	3.2	3.1	2.3	......	......	......	......	......
8	......	3.6	3.2	3.1	3.0	2.3	......	......	......	......	......
9	......	3.6	3.2	3.1	3.0	2.2	......	......	......	......	......
10	......	3.9	3.1	3.0	3.3	2.2	......	......	......	......	......
11	......	3.7	3.0	3.0	3.0	......	......	......	......	......	......
12	......	3.7	3.0	3.1	3.0	......	......	......	......	......	......
13	......	3.6	3.2	3.1	3.0	......	......	......	......	......	......
14	......	3.6	3.2	3.1	3.0	......	......	......	......	......	......
15	2.4	3.4	3.2	3.2	2.9	......	......	......	......	......	......
16	2.2	3.4	3.6	3.2	2.9	......	......	......	......	......	......
17	2.0	3.4	3.7	3.1	2.9	......	......	......	......	......	......
18	......	3.4	3.7	3.1	2.8	......	......	......	......	......	......
19	......	3.4	3.7	3.1	2.8	......	......	......	......	......	......
20	......	3.4	3.7	3.0	2.8	......	......	......	......	......	......
21	......	3.4	3.7	3.0	2.8	......	......	......	......	......	......
22	......	3.4	3.6	3.0	2.5	......	......	......	......	......	......
23	......	3.4	3.4	3.1	2.5	......	......	......	......	......	......
24	4.8	3.3	3.4	3.1	2.5	......	......	......	......	......	......
25	5.3	3.3	3.6	3.1	2.5	......	......	......	......	......	......
26	4.5	3.3	3.6	3.0	2.5	......	......	......	......	......	......
27	4.0	3.3	3.5	3.1	2.5	......	......	......	......	......	......
28	3.8	3.3	3.4	3.1	2.4	......	......	......	......	......	......
29	3.9	3.5	3.4	3.1	2.4	......	......	......	......	......	......
30	3.7	......	3.4	3.1	2.4	......	......	......	......	......	......
31	3.6	......	3.4	......	2.5	......	......	......	......	......	......

NOTE.—The river was dry on the days on which the gage was not read.

Rating tables for San Gabriel River near Azusa, Cal.

JANUARY 1 TO MARCH 13, 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.*
2.00	1	3.10	190	4.20	660	5.60	1,910
2.10	4	3.20	225	4.30	710	5.80	2,220
2.20	12	3.30	260	4.40	760	6.00	2,600
2.30	22	3.40	300	4.50	820	6.20	3,000
2.40	35	3.50	340	4.60	890	6.40	3,450
2.50	50	3.60	380	4.70	960	6.60	3,950
2.60	67	3.70	420	4.80	1,030	6.80	4,460
2.70	85	3.80	460	4.90	1,110	7.00	5,010
2.80	105	3.90	510	5.00	1,200	7.20	5,570
2.90	130	4.00	560	5.20	1,400	7.40	6,130
3.00	160	4.10	610	5.40	1,630	7.60	6,730

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on thirteen discharge measurements made during January to March, 1907, and is well defined between gage heights 3 feet and 7.5 feet.

Rating tables for San Gabriel River near Azusa, Cal.—Continued.

MARCH 14 TO 26, 1907.

[Indirect method for shifting channel used.]

MARCH 27 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.*
2.00	1	2.90	63	3.80	240	4.70	655
2.10	3	3.00	77	3.90	270	4.80	730
2.20	6	3.10	92	4.00	302	4.90	810
2.30	11	3.20	108	4.10	336	5.00	890
2.40	17	3.30	125	4.20	374	5.20	1,050
2.50	24	3.40	143	4.30	415	5.40	1,210
2.60	32	3.50	163	4.40	460	5.60	1,380
2.70	41	3.60	186	4.50	515	5.80	1,560
2.80	51	3.70	212	4.60	585	6.00	1,740

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twelve discharge measurements made during March to August, 1907, and is fairly well defined between gage heights 2 feet and 6.3 feet.

FOR 1908.

2.00	0	3.00	56	4.00	309	4.90	845
2.10	1	3.10	71	4.10	353	5.00	925
2.20	2	3.20	87	4.20	401	5.20	1,085
2.30	4	3.30	105	4.30	452	5.40	1,245
2.40	6	3.40	126	4.40	505	5.60	1,405
2.50	10	3.50	149	4.50	560	5.80	1,575
2.60	16	3.60	174	4.60	620	6.00	1,745
2.70	23	3.70	202	4.70	690	6.20	1,915
2.80	32	3.80	234	4.80	765	6.40	2,085
2.90	43	3.90	270				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nineteen discharge measurements made during 1907 and 1908, and is fairly well defined.

Daily discharge, in second-feet, of San Gabriel power canal near Azusa, Cal., for 1907 and 1908.

[John Woodward and A. W. Peake, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	76	76	76	76	76	76	76	76	76	51	76	54
2	76	76	76	76	76	76	76	76	76	50	76	54
3	76	76	76	76	76	76	76	76	76	50	76	53
4	76	76	76	76	76	76	76	76	76	50	71	54
5	76	76	76	76	76	76	76	76	76	58	69	54
6	76	76	76	76	76	76	76	76	76	63	66	54
7	76	76	76	76	76	76	76	76	72	60	65	76
8	76	76	76	76	76	76	76	76	67	56	66	76
9	76	76	76	76	76	76	76	76	59	54	67	67
10	76	76	00	76	76	76	76	76	59	50	76	63
11	76	76	76	76	76	76	76	76	57	50	73	66
12	76	76	76	76	76	76	76	76	57	50	66	62
13	76	76	76	76	76	76	76	76	57	50	64	58
14	76	76	76	76	76	76	76	76	57	50	63	57
15	76	76	76	76	76	76	76	76	57	66	62	57
16	76	76	76	76	76	76	76	76	57	76	61	57
17	76	76	00	76	76	76	76	76	57	76	58	57
18	76	76	76	76	76	76	76	76	57	75	59	57
19	76	76	76	76	76	76	76	76	57	70	59	57
20	76	76	76	76	76	76	76	76	56	67	61	57
21	76	76	76	76	76	76	76	76	53	61	61	56
22	76	76	76	76	76	76	76	76	51	66	61	55
23	76	76	76	76	76	76	76	76	50	76	61	55
24	76	76	76	76	76	76	76	76	50	76	58	54
25	76	76	76	76	76	76	76	76	50	76	57	54

Daily discharge, in second-feet, of San Gabriel power canal near Azusa, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	76	76	76	76	76	76	76	76	50	76	57	54
27	76	76	76	76	76	76	76	76	50	76	57	54
28	76	76	76	76	76	76	76	76	50	76	57	65
29	76	76	76	76	76	76	76	76	50	76	56	67
30	76	......	76	76	76	76	76	76	51	76	55	57
31	76	......	76	......	76	......	76	76	......	76	......	57
1908.												
1	56	76	76	76	76	76	48	37	29	30	32	34
2	54	76	76	76	76	76	47	42	29	31	32	57
3	54	76	76	76	76	76	45	43	28	38	32	80
4	52	76	76	76	76	76	44	42	26	36	32	80
5	52	76	76	76	76	76	45	40	26	35	32	81
6	51	76	76	76	76	76	43	40	26	34	31	67
7	51	76	76	76	76	76	43	39	26	32	32	56
8	50	76	76	76	76	76	42	39	28	30	32	47
9	50	76	76	76	76	76	42	37	29	30	32	47
10	50	76	76	76	27	76	42	42	32	29	32	44
11	50	76	76	76	76	76	42	41	30	29	33	44
12	48	76	76	76	76	76	42	39	28	30	33	43
13	49	76	76	76	76	76	42	38	27	32	33	43
14	76	76	76	76	76	76	41	37	26	32	33	43
15	76	76	76	76	76	76	40	37	26	32	33	41
16	66	76	76	76	76	76	39	37	26	34	33	41
17	58	76	76	76	76	76	39	35	27	40	33	43
18	56	76	76	76	76	76	39	34	28	40	33	40
19	56	76	76	76	76	76	39	34	27	39	33	40
20	56	76	76	76	76	76	38	32	26	39	33	40
21	54	76	76	76	76	76	37	32	28	38	33	40
22	54	76	76	76	76	76	37	31	28	36	33	40
23	65	76	76	76	76	76	36	30	26	34	33	40
24	76	76	76	76	76	56	36	30	62	34	33	40
25	76	76	76	76	76	54	36	30	54	34	33	40
26	76	76	76	76	76	53	36	30	39	32	33	40
27	76	76	76	76	76	52	36	30	36	33	36	40
28	76	76	76	76	76	51	36	29	33	32	35	39
29	76	......	76	76	76	50	35	29	32	32	34	39
30	76	......	76	76	76	49	34	29	31	32	34	39
31	76	......	76	......	76	......	33	29	......	32	......	39

NOTE.—These discharges were obtained by means of weirs.

Monthly discharge of San Gabriel River near Azusa, Cal., for 1907 and 1908.

[Drainage area, 222 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	4,670	88	949	4.27	4.92	58,400	C.
February	1,190	686	848	3.82	3.98	47,100	C.
March	6,810	686	1,880	8.47	9.76	116,000	C.
April	1,550	491	982	4.42	4.93	58,400	B.
May	491	302	350	1.58	1.82	21,500	B.
June	288	201	254	1.14	1.27	15,100	B.
July	201	108	136	.613	.71	8,360	B.
August	108	79	87.7	.395	.46	5,390	B.
September	82	50	60.2	.271	.30	3,580	B.
October	100	50	66.5	.300	.35	4,090	B.
November	79	55	63.9	.288	.32	3,800	B.
December	76	53	58.6	.264	.30	3,600	B.
The year	6,810	53	478	2.15	29.12	345,000	

Monthly discharge of San Gabriel River near Azusa, Cal., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	1,240	48	180	0.811	0.94	11,100	C.
February	766	181	260	1.17	1.26	15,000	C.
March	278	132	207	.932	1.07	12,700	C.
April	225	132	156	.703	.78	9,280	C.
May	163	82	117	.527	.61	7,190	C.
June	82	49	70.4	.317	.35	4,190	C.
July	89	34	41.6	.187	.22	2,560	C.
August	60	29	36.0	.162	.19	2,210	C.
September	62	26	30.6	.138	.15	1,820	C.
October	40	29	33.6	.151	.17	2,070	C.
November	36	31	32.9	.148	.17	1,960	C.
December	80	34	46.7	.210	.24	2,870	C.
The year	1,240	26	101	.455	6 15	73,000	

NOTE.—These discharges include the water in the river at the station and the water diverted through the power canal. During April and May, 1908, some water was diverted just above the station for irrigation. The quantity was variable, but probably averaged about 10 second-feet. This is not included in the above.

LOS ANGELES RIVER DRAINAGE BASIN.

DESCRIPTION.

Los Angeles River is formed by Tujunga, Pacoima, and other small creeks whose sources lie in the Sierra Madre northeast of the city of Los Angeles. These streams leave the mountains at a point about 25 miles above the city and enter the comparatively flat country of the San Fernando Valley, where, except at times of excessive flood, the waters disappear in the sand and gravel washes. At the lower end of this valley is a secondary range of hills, extending from east to west, and bed rock obstruction forces the waters to the surface to form what is known as Los Angeles River. Below this point the river flows through the flat country of the Los Angeles Valley and enters the Pacific near the town of Long Beach.

During the summer months the entire flow of Los Angeles River is diverted at a point about 5 miles above Los Angeles for the supply of the city, only a small amount of water passing this point except during flood periods.

DIVERSIONS FROM LOS ANGELES RIVER.

The amount of water diverted from Los Angeles River by the city of Los Angeles was measured during the summers of 1907 and 1908 in the 44-inch conduit and in the main-supply conduit. The supply is taken from the river near Burbank and includes the entire surface flow of the river at this point during the summer months. Some return seepage water again appears in the river channel near Huron street, Los Angeles, near which point the city has an underground gallery or tunnel for collecting an auxiliary supply, which is pumped into the reservoir and used in the general distributing system. The following table shows the results of the measurements:

Measurements of flow, in second-feet, of diversions from Los Angeles River by the city of Los Angeles.

Date.	44-inch conduit discharge.	Main-supply conduit discharge.	Total.	Date.	44-inch conduit discharge.	Main-supply conduit discharge.	Total.
1907.				1908.			
April 8	42.50	22.61	65.11	May 21	43.31	13.81	57.12
May 9	44.96	19.50	64.46	June 25	42.72	12.67	55.39
June 5	50.46	8.55	59.01	July 31	37.73	12.96	50.69
July 12	35.13	18.03	53.16	August 3	33.34	17.16	50.60
August 8	32.24	17.38	49.62	August 5	38.12	13.00	51.12
August 29	36.45	14.69	51.14	August 7	35.73	15.16	50.89
October 8	38.51	16.26	54.77	August 26	34.73	16.43	51.16
November 9	35.52	19.63	55.15	September 22	38.73	16.30	55.03
				October 23	40.24	14.65	54.89
1908.				November 20	35.54	21.78	57.32
April 29	44.44	12.30	56.74	December 30	36.91	22.98	59.89

SANTA YNEZ RIVER DRAINAGE BASIN.

DESCRIPTION.

Santa Ynez River is the only important stream lying wholly in Santa Barbara County. Its drainage basin lies north of the Santa Ynez Mountains, extending for a distance of about 80 miles parallel to the coast line, and comprising approximately 900 square miles. Four-fifths of this area is mountainous, including the north slope of the Santa Ynez and the south slope of the San Rafael mountains, and furnishes practically all of the run-off.

Santa Ynez River rises near the boundary line between Ventura and Santa Barbara counties, where the Santa Ynez and San Rafael mountain ranges merge, flows nearly due west, and enters the Pacific Ocean at Surf, about 8 miles north of Point Arguello light-house, where the coast line makes a sharp turn to the north.

Small tributaries are numerous, but the only one of importance is Mono Creek, which drains 120 square miles of the southern slope of the San Rafael Mountains, and joins the Santa Ynez River about 13 miles below its source.

Elevations in the Santa Ynez Mountains range from 3,000 to 4,000 feet; in the San Rafael Mountains they range from 4,000 to 6,000 feet, with a few high peaks, such as Mount Pinos, extending 8,826 feet above sea level. The rocks throughout the entire basin consist of shale, sandstone, and conglomerate.

The greater part of the drainage basin is included in a national forest and is sparsely covered with brush and small trees, only small areas on the higher elevations having any considerable growth of timber.

The mean annual precipitation in the area ranges from 20 to 30 inches, the increase being gradual from the lower to the higher altitudes, and is almost entirely rain, there being only a light snowfall on the higher elevations during the winter months.

Some small diversions for irrigation are made above Lompoc, and present water rights exceed the low-stage flow of the stream. The basin affords good storage sites. Several reservoirs have already been surveyed and their combined capacity far exceeds the mean annual run-off.

No important water-power development is possible in the Santa Ynez basin.

The following stations have been maintained in this basin:

Santa Ynez River near Santa Barbara (1903 to 1908).
Santa Ynez River near Lompoc (1906 to 1908).
Mono Creek near Santa Barbara (1903 to 1904).

SANTA YNEZ RIVER NEAR SANTA BARBARA, CAL.

This station, which is located at what is known as the Gibraltar dam site, about 3½ miles below the mouth of Mono Creek, in T. 5 N., R. 27 W., San Bernardino meridian, is maintained by the city of Santa Barbara through its board of water commissioners and Lee M. Hyde, engineer, to determine the quantity of water available for storage at the Gibraltar reservoir.

No important tributaries enter the river near the station and no diversions are made above. Water rights far exceed the mean low flow of the stream. The channel is fairly permanent and good results can be obtained if a reliable daily gage record is kept, but this is difficult owing to the isolated location of the station.

No changes have been made in the datum of the gage. No discharge measurements were made during 1907 and 1908.

Daily gage height, in feet, of Santa Ynez River near Santa Barbara, Cal., for 1907 and 1908.

Day.	1907.							1908.
	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.
1	2.52	3.6	2.9	3.95	1.81	2.05	1.91	......
2	2.52	3.55	2.87	3.85	......	......	......	......
3	2.5	4.0	2.8	3.8	......	2.0	1.92	......
4	2.49	4.25	9.5	3.65	......	......	......	1.95
5	2.48	4.2	8.0	3.6	1.81	......	......	......
6	2.7	4.2	7.0	3.5	......	1.98	1.92	......
7	3.6	4.15	5.2	3.6	......	1.98	......	1.94
8	9.3	4.1	4.1	3.4	1.82	......	......	......
9	10.4	3.95	4.05	3.35	......	......	2.3	1.93
10	7.0	3.9	4.0	3.3	......	1.97	......	......
11	5.8	3.85	4.0	3.3	......	......	2.15	1.93
12	5.0	3.8	3.75	3.25	......	1.98	......	......
13	4.5	3.75	3.7	3.15	......	......	......	1.92
14	4.1	3.7	3.65	3.1	......	1.98	2.12	2.17
15	4.3	3.75	3.65	3.05	......	......	......	2.12
16	4.2	3.8	3.6	3.0	......	1.97	......	......
17	5.25	3.8	3.55	2.97	......	1.97	2.1	2.09
18	4.3	3.55	3.5	2.95	......	......	......	......
19	4.3	3.2	7.45	2.94	......	1.96	2.08	......
20	4.3	2.95	6.3	2.92	......	......	......	2.06
21	4.3	2.95	5.85	2.9	1.83	......	......	......
22	4.3	3.7	5.5	2.85	......	......	......	......
23	4.3	3.5	5.3	2.81	......	1.94	2.08	2.04
24	4.3	3.3	5.0	2.8	2.01	......	......	......
25	4.3	3.2	7.0	2.76	1.99	......	2.06	6.40
26	4.3	3.1	5.45	2.72	2.3	......	......	5.00
27	4.3	2.97	4.7	2.69	3.42	1.92	2.05	5.00
28	4.2	2.93	4.6	2.66	2.4	......	2.0	4.00
29	4.1	......	4.4	2.63	......	1.91	2.0	3.01
30	4.0	......	4.3	2.61	2.21	1.9	......	2.78
31	3.55	......	4.2	......	......	......	1.98	2.61

Rating table for Santa Ynez River near Santa Barbara, Cal., for 1907 and 1908.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	1	3.00	156	4.40	1,065	6.80	4,230
1.90	2	3.10	186	4.60	1,285	7.00	4,520
2.00	3	3.20	223	4.80	1,510	7.20	4,810
2.10	6	3.30	265	5.00	1,750	7.40	5,100
2.20	12	3.40	315	5.20	1,990	7.60	5,390
2.30	22	3.50	370	5.40	2,250	7.80	5,680
2.40	35	3.60	430	5.60	2,510	8.00	5,970
2.50	49	3.70	495	5.80	2,790	9.00	7,420
2.60	65	3.80	565	6.00	3,070	10.00	8,870
2.70	83	3.90	635	6.20	3,360	11.00	10,320
2.80	104	4.00	710	6.40	3,650		
2.90	129	4.20	875	6.60	3,940		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and is fairly well defined between gage heights 1.8 feet and 9 feet. Above gage height 6 feet the rating curve is a tangent, the difference being 145 per tenth.

Monthly discharge of Santa Ynez River near Santa Barbara, Cal., for 1907.

[Drainage area, 207 square miles.]

Month.	Discharge in second-feet.				Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.		
January	9,450	49	1,470	7.10	90,400	B
February	920	142	490	2.37	27,200	B.
March	8,150	104	1,520	7.34	93,500	B.
April	670	65	237	1.14	14,100	B.
October	315	1	14.4	.07	885	B.
November	4	2	2.7	.013	161	B.
December	22	2	5.6	.027	344	B.
The period					227,000	

SANTA YNEZ RIVER NEAR LOMPOC, CAL.

This station, which was established November 10, 1906, to determine the amount of water available below the Gibraltar station, and to obtain data for the adjudication of water rights, was originally at wagon bridge, 1½ miles east of Lompoc. Early in January, 1907, the bridge was destroyed by heavy floods. A new bridge was built during the summer of 1907, and the station was reestablished September 25, 1907, at the same location.

No tributaries enter the stream in the vicinity of the station and no diversions have been made above since the station was established. The headworks of canals previously diverting water were destroyed by floods and have not been reconstructed. Acquired water rights exceed the low flow of the stream. The drainage area above the station is about 785 square miles.

The conditions at this station are extremely unfavorable for accuracy of measurements. The channel is wide and the stream at medium and low stages constantly shifts. Results obtained are approximate only. The datum of the gage has remained unchanged.

Discharge measurements of Santa Ynez River at Lompoc, Cal., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 10	R. S. Hawley	36	13	5.02	10
December 12	L. M. Hyde	107	144	5.88	259
1907.					
September 24	Clapp and Hyde	20	18	2.75	30
1908.					
January 28	L. M. Hyde	259	742	4.80	3,480
January 29	....do	221	421	3.85	1,490
March 10	W. F. Martin	272	225	3.28	418

Daily gage height, in feet, of Santa Ynez River near Lompoc, Cal., for 1906, 1907, and 1908.

[John Loynachan, observer.]

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1906.			1906.			1906.		
1	......	5.1	11	5.0	5.3	21	5.0	5.3
2	......	5.1	12	5.0	6.2	22	5.0	5.3
3	......	5.1	13	5.0	6.2	23	5.0	5.3
4	......	5.1	14	5.0	5.85	24	5.0	5.3
5	......	5.1	15	5.0	5.65	25	5.05	5.3
6	......	5.1	16	5.0	5.5	26	5.05	5.35
7	......	5.1	17	5.0	5.45	27	5.1	5.6
8	......	5.1	18	5.0	5.35	28	5.1	6.75
9	......	5.1	19	5.0	5.35	29	5.1	6.4
10	5.0	5.1	20	5.0	5.35	30	5.1	6.25
						31	......	6.15

Day.	Jan.	Sept.	Oct.	Nov.	Dec.	Day.	Jan.	Sept.	Oct.	Nov.	Dec.
1907.						1907.					
1	6.1	......	2.75	3.05	2.85	16	......	......	2.75	2.9	2.9
2	5.95	......	2.75	3.0	2.85	17	......	......	2.75	2.9	2.9
3	5.85	......	2.75	2.95	2.85	18	......	......	2.75	2.9	2.9
4	5.8	......	2.75	2.95	2.85	19	......	......	2.75	2.9	2.85
5	5.95	......	2.75	2.95	2.85	20	......	......	2.75	2.85	2.85
6	6.0	......	2.75	2.9	2.9	21	......	......	2.75	2.85	2.85
7	6.9	......	2.75	2.9	2.95	22	......	......	2.8	2.85	2.85
8	16.2	......	2.75	2.9	2.95	23	......	......	3.0	2.85	2.85
9	20.5	......	2.75	2.9	2.95	24	......	......	3.0	2.85	2.85
10	......	......	2.75	2.9	2.9	25	......	2.75	3.05	2.85	2.85
11	......	......	2.75	2.9	2.9	26	......	2.75	3.35	2.85	2.85
12	......	......	2.75	2.9	2.85	27	......	2.75	3.25	2.85	2.85
13	......	......	2.75	2.9	2.85	28	......	2.75	3.35	2.85	2.85
14	......	......	2.75	2.9	2.85	29	......	2.75	3.2	2.85	2.85
15	......	......	2.75	2.9	2.85	30	......	2.75	3.15	2.85	2.85
						31	......	......	3.05	......	2.85

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.85	3.6	3.7	3.15	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7
2	2.85	3.85	3.65	3.1	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7
3	2.85	5.35	3.65	3.1	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.8
4	2 85	5.0	3.6	3.1	3.1	2.9	2.9	2.7	2.7	2.7	2.7	2.7
5	2.85	4.1	3.6	3.1	3.1	2.9	2.9	2.7	2.7	2.7	2.7	2.9
6	2.85	4.0	3.55	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.9
7	2.85	3.8	3.55	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.85
8	2.85	3.8	3.55	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.8
9	2.85	4.7	3.5	3.05	3.05	2.9	2.9	2.7	2.7	2.7	2.7	2.8
10	2.85	4.7	3.4	3.1	3.05	2.9	2.85	2.7	2.7	2.7	2.7	3.05
11	2.85	4.2	3.3	3.1	3.0	2.9	2.85	2.7	2.7	2.7	2.7	2.8
12	2.85	4.1	3.25	3.1	3.0	2.9	2.85	2.7	2.7	2.7	2.7	2.85
13	2.85	4.0	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.75
14	3.0	3.9	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.75
15	3.0	3.8	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2 7
16	3.0	3.7	3.3	3.1	3.0	2.9	2.8	2.7	2.7	2.7	2.7	2.7
17	3.0	3.5	3.3	3.1	2.95	2.9	2.8	2.7	2.7	2.7	2.7	2.7
18	2.95	3.55	3.35	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
19	2.95	3.55	3.4	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.8
20	2.95	3.55	3.4	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.75
21	2.95	3.6	3.35	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.75
22	2.9	3.75	3.3	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.75
23	2.9	3.7	3.3	3.1	2.9	2.9	2.75	2.7	2.75	2.7	2.7	2.75
24	3.0	3.6	3.3	3.1	2.9	2.9	2.75	2.7	2.95	2.7	2.7	2.75
25	4.25	3.6	3.3	3.1	2.9	2.9	2.75	2.7	2.8	2.7	2.7	2.7
26	4.8	3.6	3.3	3.1	2.9	2.9	2.75	2.7	2.75	2.7	2.7	2.7
27	5.55	3.65	3.25	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
28	5.3	3.65	3.2	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
29	3.85	3.75	3.2	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
30	3.8	......	3.2	3.1	2.9	2.9	2.75	2.7	2.7	2.7	2.7	2.7
31	3.65	......	3.2	......	2.9	......	2.75	2.7	......	2.7	......	2.7

Rating tables for Santa Ynez River near Lompoc, Cal.

NOVEMBER 10, 1906, TO JANUARY 7, 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.*
5.00	8	5.50	114	6.00	320	6.50	750
5.10	23	5.60	146	6.10	380	6.60	870
5.20	42	5.70	182	6.20	450	6.70	1,010
5.30	64	5.80	224	6.30	540	6.80	1,170
5.40	88	5.90	270	6.40	640	6.90	1,330

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on two discharge measurements made during 1906 and the form of the 1907-8 curve and is not well defined.

SEPTEMBER 25, 1907, TO DECEMBER 31, 1908.

2.70	18	3.50	790	4.30	2,320	5.10	4,080
2.80	44	3.60	950	4.40	2,540	5.20	4,300
2.90	90	3.70	1,120	4.50	2,760	5.30	4,520
3.00	155	3.80	1,300	4.60	2,980	5.40	4,740
3.10	240	3.90	1,480	4.70	3,200	5.50	4,960
3.20	350	4.00	1,680	4.80	3,420	5.60	5,180
3.30	480	4.10	1,890	4.90	3,640	5.70	5,400
3.40	630	4.20	2,100	5.00	3,860		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on four discharge measurements made during 1907 and 1908 and is not well defined. Above gage height 4.2 feet the rating curve is a tangent, the difference being 220 per tenth.

Monthly discharge of Santa Ynez River near Lompoc, Cal., for 1906, 1907, and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1906.				
November 10-30	23	8	11.5	479
December	1,090	23	169	10,400
1907.				
January 1-7 [a]	1,330	224	442	6,140
October	555	30	114	7,010
November	197	67	90.5	5,390
December	122	67	76.8	4,720
1908.				
January	5,070	67	686	42,200
February	4,630	790	1,880	108,000
March	1,120	350	613	37,700
April	295	197	236	14,000
May	240	90	145	8,920
June	90	90	90	5,360
July	90	30	53.3	3,280
August	30	18	19.2	1,180
September	122	18	23.1	1,370
October	18	18	18	1,110
November	18	18	18	1,070
December	197	18	38.5	2,370
The year	5,070	18	318	227,000

[a] Discharges for January 8 and 9, estimated at approximately 42,000 and 62,000 second-feet, respectively, from an extension of the rating curve based on 1909 measurements.

NOTE.—Owing to shifting channel conditions and the small number of discharge measurements these are only approximate.

SALINAS RIVER DRAINAGE BASIN.[a]

DESCRIPTION.

The Salinas River basin lies almost wholly in Monterey and San Luis Obispo counties, and comprises an area about 4,780 square miles in extent, having a length of 150 miles northwest-southeast and a maximum width of about 45 miles.

The Salinas rises on the eastern slope of the Santa Lucia Range, near the southern end of the basin and flows northwestward, parallel to the coast, to its mouth, about 4 miles southwest of Castroville.

Topographically the Salinas basin is a long, narrow valley, walled in by steep mountain slopes which have been greatly eroded and dissected by stream action. At the northern end of the basin are the Gabilan Range and the Sierra de Salinas, separating it from the San Benito basin at the east and from Carmel River at the west; for the rest of its length it is flanked by parallel ridges on the west and by a broad mesa or elevated plain along the southeast, back of which are the crests of the Santa Lucia and Mount Diablo ranges respectively. The crest of the encircling mountains ranges in altitude from 2,500 to 4,000 feet above sea level. The rocks are sedimentary, resting on a basement complex of granite.

The forest cover in this basin is light and irregularly distributed. The valley has a few scattered trees and the eastern slopes are covered by grass, brush, and scrubby timber. On the higher elevations of the western slope there is considerable timber, most of which is included in a national forest reserve.

The mean annual precipitation is about 10 inches in the Salinas Valley, and increases with increase of altitude on the slopes. It is undoubtedly greatest on the west slope of the basin, where it probably ranges from 30 to 50 inches on the higher elevations and occurs almost entirely as rainfall.

The river has many tributaries, the most important of which, from north to south, are Arroyo Seco, San Antonio River, and Nacimiento River from the west and San Lorenzo and Estrella creeks from the east. The tributaries from the west are peculiar in that they lie west of secondary ranges parallel to the main range and flow southeastward for the greater part of their length, parallel but in a course directly opposite to the general course of Salinas River.

The streams of this basin are torrential and erratic, particularly the Salinas itself, which has a very heavy discharge in winter and no surface run-off in summer ordinarily except below Soledad. Some irrigation is carried on in the Salinas Valley, the water being obtained

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[a] For a detailed discussion of the water resources of Salinas Valley see Water-Supply Paper 89.

from flowing streams and by pumping, but further development is feasible and very much needed.

There are several storage reservoir sites of more or less value on the tributaries of the Salinas River, some of which have already been surveyed.

Very little power could be developed continuously in the Salinas basin without storage.

The following stations have been maintained in this basin:

Salinas River near Salinas (1900 to 1901).
Nacimiento River at Byron (February to April, 1901).
San Antonio River at Jolon (December to April, 1901).
San Lorenzo Creek near Kings City (1901 to 1903).
Arroyo Seco near Soledad (1901 to 1908).

ARROYO SECO NEAR SOLEDAD, CAL.

Arroyo Seco, the most northern of the chief tributaries of Salinas River rises at an altitude of about 6,000 feet and flows southeastward to the mouth of its canyon; thence northeastward across gravel wash to its junction with Salinas River near Soledad. The western part of its basin is well covered with underbrush and trees of medium size, and is included in a forest reserve.

The mean annual precipitation probably ranges from 30 to 50 inches in the upper part of the basin, and occurs chiefly as rainfall. Several reservoir sites of more or less value for storage have already been surveyed in this basin.

The gaging station, which was established early in 1901 at Pettitt's ranch about 15 miles south of Soledad, has been maintained to determine the quantity of water available for storage and irrigation.

Several canals, diverting water below the station for irrigation in Salinas Valley, head above the broad wash of gravel and sand into which the low-water flow sinks and disappears and from which the stream receives the name Arroyo Seco.

The channel shifts more or less during high water, and the current is very swift. Measurements made at such stages may be considerably in error. Otherwise, the records are very good.

Discharge measurements of Arroyo Seco near Soledad, Cal., in 1907 and 1908.

[By Charles Pettitt.]

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1907.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	123	182	6.22	386	May 12	120	147	5.77	215
January 9	136	583	10.20	3,190	May 28	70	56	5.55	147
January 11	135	507	9.55	2,840	June 25	44	51	5.32	60
January 13	127	304	7.88	1,240	July 29	44	36	5.08	31
January 17	130	378	8.35	1,600	August 11	41	29	5.00	23
January 25	128	274	7.40	957	October 15	42	33	5.01	25
January 28	133	458	9.12	2,260	October 26	81	70	5.70	200
March 4	123	188	6.62	502					
March 5	126	261	7.55	915	1908.				
March 10	129	361	8.55	1,820	January 25	123	249	6.82	640
March 12	129	333	8.08	1,400	January 26	127	343	7.72	1,130
March 18	138	521	10.10	3,160	January 28	123	220	6.58	540
March 19	140	777	12.00	5,200	February 2	132	511	9.08	2,080
March 20	138	563	10.10	3,230	February 3	127	355	7.75	1,220
March 22	130	450	8.88	2,230	February 9	125	281	7.00	772
March 25	138	660	11.10	4,180	March 9 [a]	121	154	5.82	202
April 7	126	262	7.00	728	July 12	40	27	4.78	3.6
May 5	120	156	5.85	229	October 12	24	10	4.80	3.2

[a] Measurement by W. F. Martin.

Daily gage height, in feet, of Arroyo Seco near Soledad, Cal., for 1907 and 1908.

[Mrs. Charles Pettitt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.6	7.55	6.15	7.8	5.95	5.5	5.25	5.05	5.0	5.0	5.2	5.1
2	6.3	7.45	6.15	7.6	5.9	5.5	5.25	5.05	5.0	5.0	5.2	5.15
3	6.3	7.5	6.1	7.45	5.9	5.5	5.25	5.05	5.0	5.0	5.2	5.15
4	6.05	7.3	6.8	7.3	5.9	5.5	5.2	5.05	5.0	5.0	5.15	5.15
5	6.25	7.25	7.9	7.25	5.85	5.5	5.2	5.05	5.0	5.0	5.15	5.15
6	6.1	7.1	7.4	7.1	5.85	5.5	5.2	5.0	5.0	4.95	5.15	5.15
7	6.1	7.0	7.0	7.0	5.8	5.5	5.2	5.0	5.0	4.95	5.15	6.5
8	7.1	6.9	6.85	6.9	5.8	5.5	5.2	5.0	5.0	4.95	5.15	5.45
9	10.10	6.85	7.4	6.8	5.8	5.45	5.2	5.0	5.0	5.0	5.1	5.4
10	10.10	6.7	8.6	6.75	5.8	5.45	5.2	4.9	5.0	5.0	5.1	5.5
11	9.70	6.6	8.4	6.7	5.8	5.45	5.2	5.0	4.95	5.0	5.1	5.7
12	8.5	6.6	8.1	6.6	5.75	5.45	5.2	5.0	4.95	5.0	5.1	5.7
13	7.9	6.5	7.75	6.55	5.75	5.5	5.2	5.0	4.95	5.0	5.1	5.5
14	7.9	6.5	7.5	6.5	5.75	5.5	5.15	4.95	4.95	5.0	5.1	5.4
15	7.55	6.4	7.35	6.5	5.7	5.45	5.15	4.95	4.95	5.0	5.15	5.4
16	7.8	6.4	7.3	6.4	5.7	5.45	5.15	4.95	4.95	5.05	5.15	5.45
17	8.4	6.4	7.9	6.4	5.7	5.4	5.15	4.95	4.95	5.1	5.15	5.45
18	7.7	6.4	9.35	6.3	5.65	5.4	5.1	4.95	4.95	5.1	5.15	5.45
19	7.5	6.3	11.85	6.3	5.65	5.4	5.1	4.95	4.95	5.1	5.15	5.4
20	7.25	6.3	10.20	6.25	5.65	5.4	5.1	4.95	4.95	5.05	5.15	5.4
21	7.15	6.5	9.25	6.2	5.6	5.35	5.1	4.95	4.95	5.05	5.15	5.35
22	7.1	6.5	8.90	6.15	5.6	5.35	5.1	4.95	4.95	5.05	5.15	5.3
23	7.05	6.4	12.00	6.1	5.65	5.35	5.1	4.95	4.95	5.1	5.1	5.3
24	7.1	6.4	11.60	6.1	5.65	5.35	5.1	4.9	4.95	5.1	5.1	5.3
25	7.5	6.4	11.20	6.1	5.6	5.3	5.1	4.9	4.95	5.15	5.1	5.25
26	7.3	6.4	10.8	6.05	5.6	5.3	5.1	4.9	4.95	5.7	5.15	5.25
27	7.25	6.2	9.6	6.05	5.6	5.3	5.1	4.9	5.0	5.6	5.15	5.25
28	9.1	6.2	9.1	6.0	5.55	5.3	5.1	4.95	5.0	5.4	5.15	5.25
29	8.4	....	8.6	6.0	5.55	5.3	5.1	4.95	5.0	5.3	5.1	5.25
30	8.0	....	8.3	5.95	5.55	5.25	5.1	4.95	5.0	5.25	5.1	5.7
31	7.7	....	7.9	....	5.5	....	5.05	5.0	....	5.25	....	5.75
1908.												
1	5.75	5.95	6.1	5.5	5.2	5.1	4.9	4.65	4.5	4.75	4.9	5.0
2	5.6	9.15	6.1	5.45	5.35	5.1	4.9	4.6	4.4	4.75	4.9	5.0
3	5.5	7.8	6.0	5.45	5.3	5.1	4.9	4.6	4.4	4.75	4.9	5.05
4	5.5	6.9	6.0	5.45	5.25	5.1	4.85	4.6	4.4	4.75	4.9	5.15
5	5.45	6.5	6.05	5.4	5.2	5.1	4.85	4.6	4.4	4.75	4.9	5.1

Daily gage height, in feet, of Arroyo Seco near Soledad, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	5.4	6.8	6.0	5.4	5.2	5.1	4.85	4.6	4.4	4.8	4.9	5.1
7	5.4	6.15	5.9	5.4	5.2	5.1	4.85	4.6	4.4	4.8	4.9	5.1
8	5.4	6.0	5.9	5.4	5.2	5.1	4.85	4.6	4.4	4.8	4.9	5.1
9	5.35	6.95	5.8	5.4	5.2	5.1	4.8	4.6	4.4	4.8	4.9	5.1
10	5.3	6.5	5.75	5.35	5.2	5.1	4.8	4.6	4.35	4.8	4.9	5.4
11	5.3	6.3	5.7	5.35	5.2	5.05	4.8	4.6	4.35	4.8	4.9	5.2
12	5.3	6.25	5.7	5.35	5.2	5.05	4.8	4.6	4.35	4.8	4.9	5.2
13	5.8	6.2	5.7	5.35	5.2	5.05	4.8	4.6	4.35	4.8	4.9	5.15
14	6.1	6.2	5.7	5.35	5.2	5.0	4.8	4.6	4.35	4.8	4.9	5.1
15	5.75	6.15	5.7	5.35	5.2	5.0	4.8	4.6	4.3	4.8	4.9	5.1
16	5.6	6.15	5.65	5.35	5.2	5.0	4.75	4.6	4.3	4.8	4.9	5.1
17	5.5	5.95	5.65	5.35	5.2	5.0	4.75	4.6	4.3	4.8	4.9	5.1
18	5.5	5.85	5.6	5.3	5.2	5.0	4.75	4.55	4.3	4.85	4.9	5.1
19	5.6	5.8	5.6	5.3	5.2	5.0	4.75	4.55	4.2	4.85	4.9	5.1
20	5.4	5.8	5.6	5.3	5.2	5.0	4.75	4.55	4.2	4.9	4.9	5.1
21	5.5	5.75	5.6	5.3	5.2	5.0	4.7	4.55	4.1	4.9	4.9	5.1
22	5.5	5.7	5.55	5.3	5.2	5.0	4.7	4.55	4.1	4.9	4.95	5.1
23	5.45	5.7	5.55	5.4	5.2	4.95	4.7	4.55	4.15	4.9	4.95	5.1
24	5.95	5.7	5.55	5.4	5.2	4.95	4.7	4.55	4.3	4.85	5.0	5.1
25	6.85	5.65	5.55	5.3	5.15	4.95	4.7	4.55	4.5	4.85	5.0	5.1
26	7.6	5.65	5.5	5.3	5.15	4.95	4.65	4.55	4.5	4.85	5.1	5.1
27	6.9	5.6	5.5	5.3	5.1	4.95	4.65	4.55	4.7	4.85	5.1	5.1
28	6.6	5.6	5.5	5.25	5.1	4.95	4.65	4.55	4.75	4.9	5.0	5.1
29	6.3	6.1	5.5	5.25	5.1	4.9	4.65	4.5	4.75	4.9	5.05	5.1
30	6.2	....	5.5	5.2	5.1	4.9	4.65	4.5	4.75	4.9	5.0	5.1
31	6.0	....	5.5	....	5.1	....	4.65	4.5	....	4.9	....	5.1

Rating table for Arroyo Seco near Soledad, Cal., 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.*
4.50	0.5	5.80	216	7.10	760	8.80	2,000
4.60	1	5.90	250	7.20	815	9.00	2,180
4.70	2	6.00	285	7.30	870	9.20	2,365
4.80	4	6.10	320	7.40	925	9.40	2,555
4.90	11	6.20	355	7.50	980	9.60	2,745
5.00	21	6.30	395	7.60	1,040	9.80	2,935
5.10	33	6.40	435	7.70	1,105	10.00	3,125
5.20	47	6.50	475	7.80	1,175	10.20	3,320
5.30	64	6.60	520	7.90	1,250	10.40	3,520
5.40	88	6.70	565	8.00	1,330	10.60	3,720
5.50	118	6.80	610	8.20	1,490	10.80	3,920
5.60	150	6.90	660	8.40	1,655	11.00	4,125
5.70	183	7.00	710	8.60	1,825	12.00	5,175

NOTE.—This table is not applicable for obstructed-channel conditions. It is based upon 34 discharge measurements made during 1907 and 1908 and is well defined between gage heights 4.8 feet and 12 feet. Above gage height 11 feet the rating curve is a tangent, the difference being 105 per tenth.

Monthly discharge of Arroyo Seco near Soledad, Cal., for 1907 and 1908.

[Drainage area, 215 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	3,220	302	1,150	5.35	6.17	70,700	A.
February	1,010	355	568	2.64	2.75	31,500	A.
March	5,180	320	1,910	8.88	10.24	117,000	A.
April	1,180	268	529	2.46	2.74	31,500	A.
May	268	118	188	.874	1.01	11,600	A.
June	118	55	94.3	.439	.49	5,610	A.
July	55	27	40.3	.186	.21	2,480	B.
August	27	11	18.3	.090	.10	1,130	B.
September	21	16	18.3	.090	.10	1,090	B.
October	183	16	39.0	.184	.21	2,400	B.
November	47	33	38.1	.177	.20	2,270	B.
December	475	33	99.6	.463	.53	6,120	B.
The year	5,180	11	391	1.82	24.75	283,000	
1908.							
January	1,040	64	228	1.06	1.22	14,000	A.
February	2,320	150	416	1.93	2.08	23,900	A.
March	320	118	187	.870	1.00	11,500	A.
April	118	47	77.3	.360	.40	4,600	B.
May	76	33	46.0	.214	.25	2,830	B.
June	33	11	23.9	.111	.12	1,420	B.
July	11	1.5	4.2	.020	.02	258	C.
August	1.5	.5	.9	.0042	.005	55	D.
September	3	0	.4	.0018	.002	24	D.
October	11	3	6.2	.029	.03	381	C.
November	33	11	14.7	.068	.08	875	B.
December	88	21	35.2	.164	.19	2,160	B.
The year	2,320	0	86.6	.403	5.40	62,000	

SAN FRANCISCO BAY DRAINAGE.

GENERAL FEATURES.

The great central valley of California, including an area of about 64,000 square miles in extent lying between the Coast Range on the west and the Sierra Nevada on the east, is drained by two trunk streams. From the north comes the Sacramento; from the south the San Joaquin; both discharge their waters into Suisun Bay, whence they find outlet through Carquinez Strait and San Pablo Bay into San Francisco Bay, passing finally through the Golden Gate into the Pacific Ocean.

SACRAMENTO RIVER BASIN.

DESCRIPTION.

The area drained by the Sacramento and its tributaries extends from Suisun Bay northward to Mount Shasta and from Trinity Mountains and the Coast Range eastward to the Sierra Nevada. On the south it merges into the San Joaquin drainage basin. In general outline it is roughly elliptical, with a length of about 230 miles and a width of about 150 miles. Its total area, including all tributaries, is approximately 27,100 square miles.

The Sacramento, the trunk stream of the basin, is the principal river in California. Rising in springs issuing from the western slope of Mount Shasta, the river flows almost due south for 370 miles and discharges into Suisun Bay about 50 miles by water above San Francisco. It is navigable as far north as Red Bluff, about 250 miles from its mouth.

The largest and most important tributaries of the Sacramento come from the east and include, in order from north to south, Pit River, Cow, Battle, Antelope, Mill, Deer, Chico, and Butte creeks and Feather and American rivers; from the west come Clear, Cottonwood, Thomes, Stony, Cache, and Puta creeks.

Considered as a whole, the basin is a region of rugged topography. Approximately 84 per cent of it is mountainous, and the other 16 per cent, comprising the gently sloping area along the lower reaches of the main stream, constitutes what is known as the Sacramento Valley.

The mountain ranges surrounding the basin belong to the Cordilleran system. The Sierra Nevada has an average width of approximately 70 miles from the rim of the valley to the crest of the range, which lies only a few miles west of the eastern boundary of the State. The range terminates in Warner Mountains in the northeastern part of the State, a region presenting evidence of recent volcanic action. Vast beds of lava cover the western slope of the range, and many cones, craters, ash deposits, and lakes exist in the vicinity of Mount Shasta and Lassen Peak, which are themselves the cones of extinct volcanoes. The Coast Range has an average width of approximately 35 miles from the rim of the valley to the crest, which lies inland from the shore and ranges in distance from 30 miles in the south to nearly 100 in the north, where the range takes the name Trinity Mountains. In Mount Shasta the Sierra Nevada and Coast Range merge into each other and also into the Cascade Range, which extends northward into Oregon.

The valley is in outline a long, narrow half ellipse, cut transversely, with its base opposite the mouth of the river. Its length north and south is approximately 150 miles, and its width varies from a few miles at the upper end near Red Bluff to 50 miles south of the city of Sacramento. The elevation of the valley ranges from 300 feet above sea level at Red Bluff to only a few feet at the mouth of the river. From the rim of the valley there is a slow rise in elevation across the zone of low-lying foothills, followed by a more rapid rise up the mountain side to the watershed on the summit of the encircling ranges. The eastern watershed ranges in elevation from 10,000 feet in the south to 6,000 or 7,000 in the north. The western watershed ranges from 4,000 in the south to 9,000 in the north, and the northern from 4,000 to 8,000 feet, exclusive of Mount Shasta, which has an elevation of 14,380 feet.

The valley portion of the Sacramento basin has very little natural timber, but the fringe of undulating foothills supports a growth of brush and scrubby timber which, though sparsely distributed along the lower elevations, becomes much denser with increase of altitude. Beyond the foothill region the mountain slopes on all sides are well timbered, except in the northeastern portion of the basin, where large areas are barren. Practically all the public land in the timbered section of the basin has been included in federal forest reserves.

The mean annual precipitation in the basin varies with the altitude, being least on the valley floor where it averages 22 inches, and increases gradually up the mountain slopes, near whose summits an occasional maximum of 100 inches is attained. In the northeastern part of the basin, however, the annual precipitation is comparatively light, even at considerable elevations. The year is divisible into a well-defined "rainy season," extending from November to April, and an equally well-defined "dry season," lasting from May to October. The greater part of the annual rainfall comes in the winter months, particularly in December and January, when about 18 and 20 per cent, respectively, of the mean annual rainfall is received. February and March each bring about 13 per cent and November 12 per cent, so that about 76 per cent of the mean annual rainfall is received in the period November to March, inclusive. During April, May, and October, 20 per cent more is received. The other four months are practically rainless. At the higher altitudes the precipitation appears chiefly in the form of snow during the late fall, winter, and early spring months. Ordinarily the snow melts slowly and does not completely disappear until late summer, thus prolonging and equalizing the stream flow. Occasionally the snow line extends below the 2,000-foot contour for short periods, thus giving rise to conditions which may result in disastrous floods in the valley if the temperature rises rapidly and is accompanied by heavy rain. Such a combination of conditions produces floods of greater or less severity in the winter or spring of almost every year. Ice does not form in any of the streams except in the high mountains far above the gaging stations, so that the stream-flow records in this basin are not affected by ice conditions.

The possibilities for irrigation in this basin are great. The Sacramento Valley probably furnishes the greatest field for development in the United States.

Existing development in irrigation has been achieved along the lines of individual and corporate private enterprise on a small scale.

Some water is diverted from practically all the streams entering the valley and applied to the irrigation of small scattered areas. Several irrigation districts have been formed at different times, but they have generally proved unsuccessful. The United States Reclamation Service has made preliminary investigations in the valley, and is now engaged in the construction of the Orland reclamation unit which will supply about 14,000 acres on the west side of Sacramento River.

The Sacramento basin contains many excellent storage sites, a number of which have already been surveyed by the Reclamation Service.

The possibilities for water-power development in the Sacramento basin are almost unlimited. Fully 50 per cent of all the available water power in the State exists in this basin, though its area is not more than 17 per cent that of the State. A number of the streams have a fall of 4,000 or 5,000 feet and an average minimum flow of several hundred second-feet. Without storage they are capable of developing a minimum of 2,000,000 horsepower, and with storage about 3,000,000 horsepower. The development at the present time is approximately 110,000 horsepower.

Large perennial springs are numerous in the northeastern part of the Sacramento basin, many of them discharging more than 100 second-feet and a few of them several hundred. Nearly all these springs have their sources in the lava beds covering this part of the basin. They are very effective in equalizing the mean monthly stream flow throughout the year and in maintaining a good minimum flow in the fall.

The streams of this basin have such heavy gradients as to make them generally unsuited for use in logging. Some logging, however, is done on Sacramento and Pit rivers.

The longest run-off record in this basin is that of Sacramento River, which runs back to 1895. The longest record of any of the tributaries extends back as far as 1901. The wettest year was 1904 and the driest was 1898. The greatest recorded flood flow, however, was in March, 1907. The total flow during the wettest year was about four times that of the driest. The mean average monthly flow is greatest in March and smallest in September, the ratio being about 1 to 13.

Investigations of flow have been made on Sacramento River and on the following tributaries:

Pit River.
McCloud River.
Cottonwood Creek.
Stony Creek.
Cache Creek.
Puta Creek.
Feather River.
Yuba River.
Bear River.
American River.

Gaging stations have been maintained on the main stream as follows:

Sacramento River at Jellys Ferry, near Red Bluff (1895 to 1902).
Sacramento River at Iron Canyon, near Red Bluff (1902 to 1908).

SACRAMENTO VALLEY.

Sacramento Valley, whose possibilities for general development through a comprehensive system of reclamation makes it by far the most important area in the basin, lies along the lower course of Sacramento River for a distance of about 150 miles northward from its mouth. Except for Marysville Buttes, in its center, the valley has a gentle and quite uniform slope, ranging from approximately 4 feet to the mile in the north to less than half a foot in the south. It is intensely fertile, has a semitropical climate and good transportation facilities, and lies near large centers of population. The valley as a whole suffers from an excess of water at one season and a deficiency at another. The problem of remedying these defects embraces three distinct phases—the preservation and improvement of navigation, the reclamation of swamp and overflowed lands, and the development of irrigation for all the higher lands. The general problem is undoubtedly the largest and most difficult in the field of hydraulic engineering in the West, but it seems only a question of time until it must be solved, because the interests involved are so important.

The valley suffers from frequent floods, which occur in winter or early spring. The worst floods in recent years occurred in 1904, 1907, and 1909. Each succeeding flood seems to cause more damage in proportion to the volume of water, due partly to the fact that there is more property to be damaged and partly to the effect of débris in the river channels. From 1849 to 1880 enormous quantities of débris arising from hydraulic mining were deposited in the upper courses of several of the streams on the eastern slope of the Sacramento basin. This mining débris, together with the large quantities of natural débris brought down by all the streams during flood, has resulted in elevating the stream beds and consequently the flood plane. The result is that all the streams now occupy ridges and have large overflow basins.

The lower course of Sacramento River for a distance of about 100 miles occupies a ridge from 5 to 20 feet higher than the troughs of the nearly parallel flood basins on each side, which are from 2 to 7 miles from the river. These big flood basins, Colusa and Yolo on the west side, and Butte, Sutter, and American on the east side, have a total area of approximately 900 square miles. They have a combined storage capacity equivalent to three days' continuous flood flow of all the streams discharging into the valley, and are, therefore, very powerful in affecting flood stages. When full, the combined capacity of these basins is sufficient to cover the entire valley to a depth of 1.38 feet.

The total area of the Sacramento Valley is about 4,250 square miles, divided approximately as follows: Two thousand five hundred and ten square miles of high lands not subject to overflow, but requiring irrigation for successful farming; 450 square miles of lower lands overflowed occasionally; 1,250 square miles of low lands overflowed periodically, and submerged for a considerable part of the year; and 38 square miles of perennial stream surface. It is thus seen that about 40 per cent of the valley suffers from floods and about 60 per cent from drought.

MAIN SACRAMENTO RIVER.

SACRAMENTO RIVER NEAR RED BLUFF, CAL.

This station, which is located at the lower end of Iron Canyon about 4 miles above Red Bluff and about 3 miles by river below the proposed Iron Canyon dam site, was established January 28, 1902, to take the place of a station at Jellys Ferry, about 12 miles above Red Bluff, which had been maintained since April 30, 1895.

The observations at this point furnish general statistical data concerning the flow of Sacramento River and are useful in connection with the maintenance of navigation below Red Bluff and in the consideration of reclamation problems in Sacramento Valley.

No important tributaries enter within several miles of the station, above or below. Antelope and Redbank creeks come in about 7 miles and Mill Creek about 16 miles below the station. Paines Creek enters about 3 miles and Battle and Cottonwood creeks about 10 miles above the station. Pit River enters about 40 miles above and Feather River about 100 miles below.

No diversions of any kind are made above the station, and it is believed that no appropriations of nor filings on water have been made.

The flow at the station is not affected by artificial storage. No change has been made in the gage datum since the station was established. The channel section is practically permanent and the station is well rated. The records are thoroughly reliable.

Discharge measurements of Sacramento River near Red Bluff, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 10	R. S. Hawley	546	7,640	8.95	35,200
February 23	do	548	7,700	9.10	36,100
March 7	do	542	6,880	7.65	28,800
April 2	W. G. Steward	555	8,060	10.20	37,400
April 24	do	540	6,210	6.70	21,200
May 5	do	528	5,520	5.10	16,400
May 14	do	527	5,310	4.70	14,900
June 20	W. F. Martin	523	4,480	3.47	10,200
September 10	W. A. Lamb	499	3,770	1.70	5,950
October 15	do	495	3,750	1.70	5,570
1908.					
February 27	W. A. Lamb	510	4,920	3.80	12,800
September 25	W. V. Hardy	497	3,430	1.20	4,230
December 18	W. F. Martin	493	3,760	1.70	6,270

Daily gage height, in feet, of Sacramento River near Red Bluff, Cal., for 1907 and 1908.

[Richard Groebe, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.85	15.45	8.5	......	5.4	3.95	2.8	2.0	1.7	1.6	1.9	1.85
2	4.55	21.2	7.5	10.2	5.4	3.9	2.7	2.0	1.8	1.6	1.95	1.85
3	4.8	20.4	7.0	10.2	5.25	3.8	2.7	2.0	1.8	1.6	1.95	1.85
4	14.45	23.1	6.5	9.7	5.2	3.85	2.7	1.95	1.8	1.6	1.9	1.9
5	10.85	18.35	6.9	10.3	5.1	3.7	2.65	1.95	1.8	1.6	1.85	2.1
6	6.95	16.3	7.8	11.15	5.05	3.6	2.6	1.95	1.8	1.6	1.85	2.2
7	5.5	13.95	7.6	11.7	5.0	3.7	2.55	1.95	1.8	1.6	1.85	3.7
8	5.3	11.7	7.1	10.8	4.9	3.6	2.5	1.95	1.75	1.6	1.85	3.5
9	5.9	9.6	7.9	10.2	4.8	3.5	2.5	1.95	1.7	1.6	1.8	2.7
10	5.95	8.95	9.7	9.9	4.85	3.35	2.5	1.95	1.7	1.6	1.8	2.7
11	5.25	8.1	9.75	9.8	5.25	3.95	2.5	1.95	1.7	1.65	1.8	4.9
12	4.7	7.35	9.3	9.55	5.15	7.45	2.4	1.95	1.7	1.65	1.8	3.25
13	4.3	6.9	8.1	9.3	4.85	6.75	2.3	1.95	1.7	1.7	1.8	3.3
14	4.3	6.4	7.3	9.3	4.7	4.6	2.3	1.9	1.7	1.7	1.8	3.45
15	4.15	6.1	6.8	9.15	4.6	4.0	2.3	1.9	1.7	1.7	1.8	2.9
16	3.85	5.85	6.6	8.8	4.6	3.8	2.3	1.9	1.7	1.7	1.8	2.7
17	4.1	6.0	10.0	8.4	4.55	3.7	2.25	1.85	1.7	1.7	1.8	2.5
18	4.1	6.3	21.4	7.9	4.5	3.6	2.25	1.85	1.7	1.65	1.8	2.4
19	3.9	5.85	26.05	7.7	4.9	3.5	2.25	1.8	1.7	1.7	1.8	2.3
20	3.8	5.7	28.7	7.6	5.2	3.4	2.2	1.8	1.65	1.7	1.85	3.3
21	3.75	5.6	22.85	7.0	4.7	3.4	2.2	1.8	1.65	1.7	1.85	2.7
22	3.75	6.35	18.4	7.0	4.4	3.3	2.2	1.8	1.65	1.7	1.85	2.4
23	3.75	8.85	21.65	6.9	4.45	3.2	2.15	1.8	1.65	1.7	1.85	2.5
24	3.8	7.65	16.8	6.7	4.2	3.15	2.15	1.8	1.65	1.7	1.85	2.55
25	4.5	13.1	14.3	6.4	4.15	3.0	2.1	1.75	1.65	1.8	1.85	2.6
26	5.2	10.8	13.25	6.4	4.1	3.0	2.1	1.75	1.6	1.8	1.85	10.6
27	5.35	9.0	12.15	6.25	4.05	3.0	2.1	1.75	1.6	1.8	1.85	8.0
28	10.7	8.0	10.5	6.0	4.0	2.9	2.1	1.75	1.6	1.85	1.85	4.4
29	12.15	......	......	5.8	4.0	2.9	2.05	1.75	1.6	1.9	1.85	4.0
30	10.55	......	......	5.6	3.95	2.8	2.05	1.7	1.6	2.1	1.85	4.65
31	9.9	......	......	......	3.9	......	2.05	1.7	......	2.15	......	7.35
1908.												
1	8.8	7.5	5.4	3.4	3.5	2.8	1.9	1.4	1.2	1.25	1.6	1.7
2	6.1	11.6	5.55	3.3	4.25	2.7	1.85	1.4	1.2	1.25	1.55	1.65
3	4.8	8.3	5.3	3.3	3.75	2.7	1.8	1.35	1.2	1.25	1.5	1.65
4	7.0	6.3	5.55	3.3	3.5	2.6	1.8	1.35	1.2	1.25	1.5	1.9
5	4.95	9.7	5.6	3.3	3.4	2.55	1.75	1.3	1.2	1.25	1.5	3.3
6	4.25	8.95	4.9	3.3	3.25	2.55	1.75	1.3	1.2	1.25	1.5	2.5
7	3.75	8.8	4.6	3.3	3.25	2.55	1.75	1.3	1.2	1.25	1.45	2.1
8	3.4	8.8	4.35	3.25	3.4	2.6	1.7	1.3	1.2	1.25	1.45	1.95
9	3.5	17.15	4.25	3.2	3.15	2.55	1.7	1.3	1.2	1.25	1.45	2.35
10	3.4	11.1	4.2	3.3	3.1	2.6	1.7	1.3	1.2	1.25	1.45	2.2

Daily gage height, in feet, of Sacramento River near Red Bluff, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11	3.3	8.15	4.2	3.5	3.1	2.6	1.65	1.3	1.2	1.25	1.45	2.0
12	3.2	6.7	4.3	3.7	3.15	2.55	1.65	1.3	1.2	1.25	1.45	1.9
13	3.4	5.9	4.4	3.85	3.0	2.5	1.6	1.3	1.2	1.3	1.45	1.85
14	11.35	5.35	4.6	3.9	2.95	2.4	1.6	1.3	1.2	1.3	1.45	1.85
15	6.6	4.95	4.7	3.9	3.5	2.4	1.6	1.25	1.25	2.7	1.5	1.85
16	5.4	4.75	5.05	4.15	3.2	2.4	1.6	1.25	1.2	1.8	1.5	1.8
17	4.7	4.5	5.2	4.05	3.05	2.3	1.55	1.25	1.3	1.5	1.45	1.75
18	4.8	4.35	5.2	3.8	3.1	2.2	1.55	1.25	1.3	1.5	1.45	1.7
19	7.75	4.2	5.0	3.7	5.05	2.1	1.5	1.25	1.3	1.5	1.5	1.65
20	11.5	4.0	4.7	3.95	3.8	2.1	1.5	1.25	1.3	1.5	1.5	1.6
21	9.4	3.9	4.5	4.1	3.6	2.35	1.5	1.25	1.3	1.5	2.35	1.6
22	7.55	3.8	4.3	4.05	3.5	2.2	1.5	1.25	1.3	1.45	3.2	1.6
23	6.4	3.7	4.2	4.1	3.4	2.1	1.45	1.25	1.25	1.45	3.3	1.7
24	10.0	3.7	4.15	4.4	3.3	2.1	1.45	1.25	1.2	1.45	2.7	2.0
25	7.9	3.7	4.25	4.4	3.2	2.0	1.45	1.25	1.2	1.4	2.2	2.0
26	6.45	3.7	4.25	4.1	3.25	2.0	1.4	1.25	1.2	1.4	2.15	1.8
27	5.6	3.85	4.05	3.8	3.15	1.9	1.4	1.25	1.2	1.45	1.95	1.75
28	5.1	4.0	3.9	3.7	3.05	1.9	1.4	1.25	1.25	1.45	1.8	1.8
29	4.6	4.2	3.7	3.6	3.0	1.9	1.4	1.25	1.25	1.45	1.75	1.8
30	4.3	....	3.6	3.55	2.9	1.9	1.4	1.2	1.25	1.7	1.75	1.8
31	4.05	....	3.5	....	2.8	....	1.4	1.2	....	1.95	....	1.75

Rating table for Sacramento River near Red Bluff, Cal., 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.*
0.90	3,980	2.70	8,600	5.00	16,620	15.00	68,200
1.00	4,200	2.80	8,910	5.20	17,390	16.00	75,100
1.10	4,420	2.90	9,220	5.40	18,170	17.00	82,200
1.20	4,650	3.00	9,540	5.60	18,970	18.00	89,700
1.30	4,880	3.10	9,860	5.80	19,780	19.00	97,600
1.40	5,110	3.20	10,190	6.00	20,600	20.00	105,900
1.50	5,350	3.30	10,520	6.20	21,440	21.00	114,600
1.60	5,590	3.40	10,860	6.40	22,290	22.00	123,700
1.70	5,840	3.50	11,200	6.60	23,150	23.00	133,200
1.80	6,090	3.60	11,540	6.80	24,020	24.00	143,100
1.90	6,350	3.70	11,890	7.00	24,900	25.00	153,500
2.00	6,610	3.80	12,240	8.00	29,400	26.00	164,500
2.10	6,880	3.90	12,590	9.00	34,100	27.00	176,000
2.20	7,150	4.00	12,940	10.00	39,000	28.00	187,500
2.30	7,430	4.20	13,660	11.00	44,200	29.00	199,500
2.40	7,710	4.40	14,380	12.00	49,700		
2.50	8,000	4.60	15,120	13.00	55,600		
2.60	8,300	4.80	15,860	14.00	61,700		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 58 discharge measurements made during 1902-1908 and is well defined between gage heights 1 foot and 21 feet. It is the same as the 1906 table between gage heights 10.5 and 20.3 feet. This curve averages all measurements made at this station and as the channel is permanent is applicable from 1902 to 1909.

Monthly discharge of Sacramento River near Red Bluff, Cal., for 1907 and 1908.

[Drainage area, 9,300 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	64,600	12,100	21,500	2.31	2.66	1,320,000	A.
February	134,000	19,000	45,400	4.88	5.08	2,520,000	A.
March	196,000	22,700	55,700	5.99	6.91	3,420,000	A.
April	48,000	19,000	32,200	3.46	3.86	1,920,000	A.
May	18,200	12,600	15,500	1.67	1.92	953,000	A.
June	26,900	8,910	12,200	1.31	1.46	726,000	A.
July	8,910	6,740	7,550	.812	.94	464,000	A.
August	6,610	5,840	6,260	.673	.78	385,000	A.
September	6,090	5,590	5,830	.627	.70	347,000	A.
October	7,020	5,590	5,870	.631	.73	361,000	A.
November	6,480	6,090	6,200	.667	.74	369,000	A.
December	42,100	6,220	11,600	1.25	1.44	713,000	A.
The year	196,000	5,590	18,800	2.02	27.22	13,500,000	
1908.							
January	47,000	10,200	21,000	2.26	2.61	1,290,000	A.
February	83,300	11,900	23,200	2.49	2.68	1,330,000	A.
March	19,000	11,200	15,000	1.61	1.86	922,000	A.
April	14,400	10,200	11,900	1.28	1.43	708,000	A.
May	16,800	8,910	10,700	1.15	1.33	658,000	A.
June	8,910	6,350	7,560	.813	.91	450,000	A.
July	6,350	5,110	5,570	.599	.69	342,000	A.
August	5,110	4,650	4,830	.519	.60	297,000	A.
September	4,880	4,650	4,710	.506	.56	280,000	A.
October	8,600	4,760	5,230	.562	.65	322,000	A.
November	10,500	5,230	6,060	.652	.73	361,000	A.
December	10,500	5,590	6,370	.685	.79	392,000	A.
The year	83,300	4,650	10,200	1.09	14.84	7,350,000	

PIT RIVER DRAINAGE BASIN.

DESCRIPTION.

The Pit River basin lies in the northeastern part of California, chiefly in Modoc, Lassen, and Shasta counties. Its area is about 5,980 square miles, exclusive of Goose Lake drainage, which, though topographically tributary to the Pit basin, has no discharging outlet. Physically the Pit basin is not tributary to the larger Sacramento basin, but is really its upper extension under a different name, having about 22 per cent of the total area of the Sacramento basin.

Pit River has its source in Warner Mountains at an elevation of 9,900 feet, and flows southwestward. Its length is about 180 miles, and it has a total fall of nearly 6,000 feet. It empties into Sacramento River, or rather the upper Sacramento empties into it, in the western part of Shasta County near Kennett, about 20 miles north of Redding.

The principal tributaries of Pit River are McCloud River, Squaw Creek, and Fall River from the north, and Burney, Hat, Beaver, Ash, and West Valley creeks from the south. McCloud and Fall rivers are the largest, having a minimum flow of 1,200 to 1,500 second-feet. Hat and Burney creeks also have a minimum flow of several hundred second-feet.

McCloud River drains an area comprising 649 square miles, lying just east of the upper Sacramento basin and including that part of the Pit basin which is fed directly from Mount Shasta. It has a length north and south of approximately 50 miles, and a width ranging from a few miles in the south to 20 miles or more in the north. The river rises in large springs in the lava formation southeast of Mount Shasta, but its main water supply comes directly from the southern and eastern slopes of Mount Shasta through Squaw, Mud, Cold, and Ash creeks, which are its chief tributaries. The river flows southward, has a length of about 60 miles and a fall of more than 4,000 feet. It discharges into Pit River about 4 miles east of the confluence of Sacramento and Pit rivers.

The greater portion of the Pit River basin exceeds 4,000 feet in elevation, and consists for the most part of barren lava beds in the north and numerous small, flat, marshy meadow valleys in the south. The area also contains many volcanic buttes and peaks, of which Mount Shasta in the north, with elevation of 14,380 feet above sea level, and Lassen Peak in the south, with elevation of 10,437 feet, are the most important. These are, however, on the Pit basin divide, and are common to the upper Sacramento and Feather basins, respectively.

About 50 per cent of the Pit basin is devoid of forestation, the timberless area lying chiefly in the northern and eastern parts. There are two well-forested areas in the basin—the one south of Pit River and north of Lassen Peak, and the other north of Pit River and South of Mount Shasta, extending from Fall River westward to the upper Sacramento and including the McCloud basin. All the public land in the forested areas is included in federal forest reserves.

The precipitation in Pit River region is very unevenly distributed. In the upper eastern part of the basin it is only about 10 inches annually and occurs largely as snow, which at moderate altitudes soon melts. In the western and northwestern parts, however, the mean annual precipitation amounts to 50 and even 75 inches, according to altitude, and occurs principally as rain except on the upper slopes of Mount Shasta, Lassen Peak, and other high peaks. In the McCloud basin it is seldom less than 40 inches and occasionally reaches 100 inches. Practically all the precipitation is confined to the "rainy season," from November to April of each year. There is not enough ice during the winter season to interfere with stream-flow records.

This basin affords little opportunity for irrigation. The valleys are many but are, as a rule, small and more or less swampy, and find use chiefly for meadow lands and for the growing of stock feed. Some of them are flooded artificially for the raising of wild hay, but such flooding can not be properly called irrigation. The uplands have a light soil covering and are used only for domestic pasturage and general stock-raising, which is carried on extensively.

The storage possibilities in Pit River basin are very great. Numerous reservoir sites on the upper reaches of the Pit and its tributaries have been surveyed by the United States Reclamation Service. A reservoir at the Big Valley site near Bieber would store more water than the river furnishes at this point. Warm Spring reservoir at Canby would also have a large storage capacity.

The possibilities for power development in this basin are also great, especially below Fall River Mills, which is about halfway between the source and mouth of Pit River. It is estimated that Fall River could develop more than 30,000 and McCloud River more than 200,000 horsepower continuously. Hat Creek could develop about 100,000 and Burney Creek about 10,000 continuously. Pit River and tributaries could develop about 1,000,000 horsepower continuously. About 50 per cent of this amount is commercially feasible of development, and only about 2 per cent has been developed.

Many perennial springs issue from crevices in the lava formation and some of them have a flow of several hundred second-feet. Fall River is fed from one or two large springs about 10 miles above its mouth, which discharge 1,500 second-feet. Hat and Burney creeks are fed largely from springs on the northern slope of Lassen Peak. McCloud River draws heavily from numerous large springs on the southern slope of Mount Shasta. Most of the smaller tributaries are also fed by springs.

The longest run-off record in this basin runs back to 1902. The wettest year in this period was 1904 and the driest was 1908. The total run-off during the wettest year was about twenty times greater than that during the driest year.

The following gaging stations have been maintained in this river basin:

Pit River near Canby (1904 to 1905).
Pit River near Bieber (1904 to 1908).
South Fork Pitt River near Ivy (1904 to 1905).
West Valley Creek near Likely (1904 to 1905).
Ash Creek at Adin (1904 to 1905).
McCloud River near Gregory (1902 to 1908).

PIT RIVER NEAR BIEBER, CAL.

This station, which is located about 12 miles south of Bieber, in the gorge near the dam site at the lower end of Big Valley, was established January 22, 1904, to determine the quantity of water available for storage in the proposed Big Valley reservoir, and it was discontinued September 30, 1908.

No large tributaries enter Pit River near the station. Ash Creek comes in from the east about 16 miles above, and Beaver Creek enters from the south at Pittville, about 12 miles below. Fall River, one of the chief tributaries, enters about 15 miles below the station.

No diversions are made immediately above the station. A large part of the flow of the stream, however, is undoubtedly lost by evaporation from the surface of the numerous swampy valleys through which the stream flows. Many of the valleys are flooded artificially during the summer season.

Many filings on water and applications for rights of way over public lands in this basin have been made. Most of the rights, however, have not been improved.

The stream is under no artificial control above or below the station that will affect the accuracy of the records. The channel conditions, however, are not the best. The bed is rocky and rough, though not subject to change, and the current is very sluggish at low stages. No change in the gage datum has been made. The records are fairly reliable.

Discharge measurements of Pit River near Bieber, Cal., for 1907.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	F. H. Holabird	180	595	4.30	646
January 31	do	220	1,080	6.80	3,360
February 6	do	220	1,010	6.50	2,780

Daily gage height, in feet, of Pit River near Bieber, Cal., for 1907 and 1908.

[F. H. Holabird, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.0	7.3	6.4	6.8	5.6	4.6	4.6	3.0	2.25	2.4	3.55	3.9
2	5.0	9.6	6.3	6.7	5.3	4.6	4.6	2.95	2.3	2.4	3.6	3.9
3	4.8	10.1	6.1	6.6	5.1	5.0	4.5	2.95	2.3	2.4	3.6	3.9
4	4.6	10.5	6.3	6.6	5.0	5.1	4.4	2.9	2.3	2.4	3.6	3.9
5	4.4	10.7	6.55	6.5	4.9	5.6	4.3	2.8	2.35	2.4	3.5	3.9
6	4.3	10.35	6.9	6.5	4.9	5.6	4.1	2.8	2.35	2.4	3.5	3.95
7	4.1	9.0	7.0	6.5	4.85	5.9	3.9	2.8	2.35	2.4	3.4	4.0
8	4.0	8.4	7.0	6.6	4.8	6.1	3.9	2.8	2.3	2.4	3.4	4.1
9	4.0	7.55	6.8	6.6	4.8	6.8	3.8	2.8	2.3	2.4	3.4	4.3
10	3.8	7.0	6.8	6.7	4.8	6.85	3.8	2.9	2.3	2.45	3.4	4.5
11	3.8	6.5	6.6	7.0	4.9	6.9	3.7	2.8	2.3	2.45	3.4	4.6
12	3.8	6.2	6.4	7.0	5.0	7.0	3.75	2.7	2.3	2.45	3.4	4.6
13	3.7	5.9	6.2	7.0	5.1	6.8	3.7	2.6	2.35	2.5	3.45	4.6
14	3.7	5.8	6.1	7.0	5.2	6.9	3.6	2.5	2.35	2.5	3.5	4.7
15	3.8	5.7	......	7.0	5.0	6.9	3.5	2.45	2.35	2.55	3.55	4.9
16	3.9	5.5	......	6.9	4.9	6.95	3.4	2.4	2.35	2.55	3.6	4.95
17	3.7	5.6	12.8	6.9	4.9	6.8	3.35	2.4	2.35	2.6	3.65	5.0
18	3.5	5.9	15.5	6.9	4.9	6.7	3.3	2.3	2.35	2.7	3.7	5.0
19	3.4	6.4	16.4	6.8	4.9	6.6	3.35	2.3	2.35	2.8	3.7	5.0
20	3.3	6.1	......	6.75	4.8	6.4	3.4	2.3	2.35	2.8	3.75	4.95
21	3.4	6.0	......	6.7	4.8	6.1	3.5	2.25	2.35	2.9	3.8	4.95
22	3.5	5.75	......	6.8	4.8	6.0	3.4	2.25	2.3	3.0	3.85	4.9
23	3.5	6.0	9.7	6.9	4.8	5.8	3.35	2.25	2.3	3.1	3.9	4.85
24	3.6	6.1	8.5	6.4	4.8	5.6	3.35	2.25	2.3	3.2	4.0	4.8
25	3.7	6.4	7.4	6.3	4.9	5.6	3.3	2.3	2.3	3.35	4.0	4.8
26	4.1	6.7	......	6.25	4.95	5.2	3.3	2.35	2.35	3.5	4.0	4.7
27	4.3	6.6	......	6.2	5.0	4.8	3.2	2.4	2.35	3.5	4.0	4.65
28	4.9	6.4	......	6.1	5.0	4.6	3.1	2.4	2.4	3.5	3.95	4.6
29	6.2	......	......	6.0	4.95	4.6	3.0	2.25	2.4	3.5	3.9	4.55
30	6.5	......	......	5.7	4.8	4.6	3.0	2.25	2.4	3.55	3.9	4.5
31	6.8	......	......	......	4.7	......	3.0	2.25	......	3.55	......	4.4

Daily gage height, in feet, of Pit River near Bieber, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.4	3.5	3.1	3.4	2.35	3.05	......	2.0	......	......	......	......
2	4.4	3.6	3.1	3.3	2.4	3.0	......	2.0	1.45	1.5	......	......
3	4.3	3.8	3.15	3.2	2.4	3.0	......	1.95	1.4	......	......	......
4	4.2	3.95	3.15	3.1	2.4	2.9	......	1.9	1.4	......	......	......
5	3.9	4.2	3.2	3.0	2.4	2.95	......	1.8	1.4	2.0	3.0	......
6	4.0	4.5	3.3	2.9	2.35	2.8	......	1.7	......	2.5	......	......
7	4.2	4.7	3.4	2.8	2.3	2.7	......	1.6	......	......	......	......
8	4.8	4.6	3.5	2.7	2.2	2.6	2.75	1.65	1.4	......	2.8	......
9	5.2	4.5	3.6	2.6	2.1	2.5	2.8	1.5	1.45	......	......	......
10	5.5	4.4	3 7	2.5	2.0	2.5	2.8	1.5	1.45	......	......	......
11	5.6	4.2	3.8	2.45	2.0	2.8	2.75	1.5	1.5	......	......	......
12	5.7	4.1	3.9	2.45	2.3	2.7	2.75	......	1.5	......	......	......
13	5.8	4.0	4.0	2.3	2.4	2.5	2.75	......	1.5	......	2.95	......
14	5.9	3.8	4.0	2.1	2.5	2.5	2.75	1.5	1.45	......	......	......
15	5.6	3.6	4.0	2.0	2.5	2.5	2.7	1.5	1.4	......	......	......
16	5.4	......	4.0	2.0	2.6	2.5	2.7	1.5	1.4	......	......	......
17	5.3	......	4.0	2.4	2.7	2.5	2.6	1.5	1.45	......	......	......
18	5.2	3.2	4.0	2.5	2.8	2.5	2.5	1.45	......	......	......	......
19	5.0	3.1	4.0	2.6	2.8	2.5	2.5	1.4	......	......	......	......
20	4.8	3.1	4.0	2.4	2.9	2.5	2.45	1.45	1.45	......	......	......
21	4.5	3.1	4.0	2.35	2.95	2.5	2.45	1.45	1.45	......	......	......
22	4.2	3.0	4.0	2.35	2.95	2.5	2.45	1.5	1.45	......	......	......
23	4.0	3.0	4.0	2.4	3.0	2.5	2.3	1.5	1.45	......	......	......
24	3.7	3.0	4.0	2.5	3.05	2.5	2.2	1.5	1.45	......	......	......
25	3.4	3.0	3.9	2.5	3.05	2.8	2.1	1.5	1.45	......	......	......
26	3.3	3.0	3.8	2.5	3.05	2.95	2.0	......	1.45	......	......	......
27	3.3	3.0	3.6	2.5	3.05	2.95	1.95	......	1.45	......	......	......
28	3.3	3.0	3.5	2.4	3.05	2.9	2.0	1.45	......	......	......	......
29	3.3	3.1	3.4	2.35	3.05	2.8	2.0	1.45	......	......	......	......
30	3.3	......	3.4	2.3	3.05	2.7	2.0	1.45	1.45	......	......	......
31	3.4	......	3.4	......	3.05	......	2.0	1.45	......	......	......	......

Rating table for Pit River near Bieber, Cal., for 1907 and 1908.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	4	3.00	120	4.50	755	7.00	3,520
1.50	6	3.10	135	4.60	825	7.20	3,840
1.60	9	3.20	154	4.70	900	7.40	4,160
1.70	13	3.30	177	4.80	980	7.60	4,480
1.80	18	3.40	205	4.90	1,060	7.80	4,820
1.90	23	3.50	240	5.00	1,140	8.00	5,180
2.00	29	3.60	276	5.20	1,320	9.00	7,140
2.10	35	3.70	316	5.40	1,500	10.00	9,600
2.20	41	3.80	356	5.60	1,700	11.00	12,400
2.30	49	3.90	400	5.80	1,900	12.00	15,200
2.40	57	4.00	450	6.00	2,120	13.00	18,000
2.50	66	4.10	500	6.20	2,360	14.00	20,800
2.60	76	4.20	560	6.40	2,630	15.00	23,600
2.70	86	4.30	620	6.60	2,920	16.00	26,400
2.80	96	4.40	685	6.80	3,220	17.00	29,200
2.90	108						

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on fifty-six discharge measurements made during 1906 and 1907, and is fairly well defined between gage heights 2.0 feet and 8.0 feet. Above gage height 10.0 feet the rating curve is a tangent, the difference being 280 per tenth. Above gage height 1.90 it is the same as the 1906 table.

Monthly discharge of Pit River near Bieber, Cal., for 1907 and 1908.

[Drainage area, 2,950 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	3,220	177	710	2.41	0.28	43,700	B.
February	11,600	1,600	4,190	1.42	1.48	233,000	B.
March	27,500	2,240	6,940	2.35	2.71	427,000	B.
April	3,520	1,800	2,970	1.01	1.13	177,000	B.
May	2,230	900	1,130	.383	.44	69,500	B.
June	3,520	825	2,160	.732	.82	129,000	B.
July	825	120	323	.109	.13	19,900	B.
August	120	45	71.7	.024	.03	4,410	B.
September	57	45	51.5	.017	.02	3,060	B.
October	258	57	113	.038	.04	6,950	B.
November	450	205	307	.104	.12	18,300	B.
December	1,140	400	799	.271	.31	49,100	B.
The year	27,500	45	1,650	.558	7.51	1,180,000	
1908.							
January	2,010	177	861	.292	.34	52,900	B.
February	900	120	339	.115	.12	19,500	B.
March	450	135	322	.109	.13	19,800	B.
April	205	29	77.6	.026	.029	4,620	B.
May	127	29	83.3	.028	.032	5,120	B.
June	127	66	85.6	.029	.032	5,090	B.
July	96	26	68.3	.023	.026	4,200	B.
August	29	5	9.3	.0032	.004	572	C.
September	6	4	4.8	.0016	.002	286	C.
The period						112,000	

McCLOUD RIVER NEAR GREGORY, CAL.

This station, which was established March 23, 1902, in cooperation with the McCloud River Electric Company, for the purpose of collecting general statistical data regarding the flow of the stream, is located at John's camp, near Hirze Mountain, by road about 14 miles east of Gregory post-office, which is on the upper Sacramento, just opposite Baird railroad station. The gaging station is 12 or 15 miles above the United States fishery at Baird post-office, near the mouth of the river. The station was discontinued June 30, 1908.

No important tributaries enter below the station, which is only about 15 miles above the mouth, and no diversions have been made either above or below. Filings on water for power development and applications for rights of way over public lands have been made, and conflicting rights are still unadjudicated. The flow is not affected by artificial conditions above or below the station.

The location and datum of the gage have not been changed.

The results at moderate stages are reasonably accurate. No discharge measurements were made during 1907 or 1908.

Daily gage height, in feet, of McCloud River near Gregory, Cal., for 1907 and 1908.

[F. P. Ackerson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.6	7.35	3.35	3.9	2.9	2.4	1.9	1.7	1.6	1.55	1.6	1.55
2	2.4	9.1	3.15	4.2	2.8	2.4	1.9	1.7	1.6	1.55	1.55	1.55
3	2.55	7.6	2.95	4.05	2.8	2.35	1.9	1.7	1.6	1.55	1.55	1.55
4	4.4	7.6	2.8	4.0	2.75	2.35	1.9	1.7	1.6	1.55	1.55	1.6
5	3.2	6.9	2.9	4.05	2.75	2.35	1.9	1.7	1.6	1.55	1.55	1.55
6	2.95	6.7	3.05	4.3	2.75	2.35	1.9	1.7	1.6	1.55	1.55	1.7
7	2.9	5.15	2.9	4.55	2.7	2.3	1.9	1.7	1.6	1.55	1.55	2.1
8	2.55	4.4	2.9	4.45	2.7	2.3	1.85	1.7	1.6	1.55	1.55	2.7
9	2.15	4.0	3.05	4.5	2.7	2.2	1.85	1.75	1.6	1.55	1.55	2.6
10	2.0	3.65	3.3	4.6	2.7	2.2	1.85	1.7	1.6	1.55	1.55	2.7
11	2.0	3.35	3.65	4.6	2.95	2.5	1.85	1.7	1.6	1.55	1.55	2.2
12	2.0	3.2	3.4	4.65	2.8	2.45	1.8	1.7	1.6	1.55	1.55	1.9
13	2.0	3.1	3.15	4.55	2.6	2.3	1.8	1.7	1.6	1.55	1.55	2.2
14	2.0	2.5	2.95	4.5	2.6	2.2	1.8	1.65	1.6	1.55	1.55	1.8
15	1.9	2.9	2.8	4.3	2.55	2.2	1.8	1.65	1.6	1.55	1.55	1.8
16	1.9	2.8	2.8	4.05	2.5	2.15	1.8	1.65	1.6	1.55	1.55	1.7
17	1.85	2.9	4.0	3.8	2.55	2.1	1.8	1.65	1.6	1.55	1.55	1.7
18	1.85	2.9	9.4	3.7	2.55	2.05	1.8	1.65	1.6	1.55	1.55	1.6
19	1.85	2.8	12.0	3.7	3.0	2.05	1.8	1.65	1.6	1.55	1.55	1.6
20	1.8	2.7	10.65	3.6	2.9	2.05	1.8	1.65	1.6	1.55	1.55	1.6
21	1.75	2.7	7.5	3.5	2.7	2.0	1.8	1.65	1.6	1.55	1.55	1.6
22	1.7	2.95	5.9	3.4	2.7	2.0	1.8	1.65	1.6	1.55	1.55	1.6
23	1.7	3.15	5.5	3.4	2.5	2.0	1.75	1.65	1.6	1.55	1.55	1.6
24	1.8	3.5	4.9	3.4	2.5	2.0	1.75	1.65	1.6	1.55	1.55	1.6
25	2.0	5.1	4.55	3.3	2.45	2.0	1.75	1.6	1.6	1.55	1.55	1.6
26	2.0	4.5	3.95	3.3	2.4	2.0	1.75	1.6	1.6	1.6	1.55	2.35
27	2.2	3.85	3.8	3.2	2.4	1.95	1.75	1.6	1.55	1.65	1.55	2.2
28	4.2	3.6	3.8	3.2	2.4	1.95	1.7	1.6	1.55	1.6	1.55	1.9
29	6.2	......	3.75	3.0	2.4	1.95	1.7	1.6	1.55	1.6	1.55	1.95
30	4.9	......	3.7	2.9	2.4	1.95	1.7	1.6	1.55	1.65	1.55	2.4
31	8.65	......	3.7	......	2.4	......	1.7	1.6	......	1.6	......	3.1
1908.												
1	3.0	2.1	2.7	2.2	2.5	2.0	......	......	......	......	......	......
2	2.6	2.1	2.75	2.1	2.5	2.0	......	......	......	......	......	......
3	2.3	2.1	2.65	2.1	2.4	2.0	......	......	......	......	......	......
4	2.4	2.15	2.4	2.2	2.4	1.9	......	......	......	......	......	......
5	2.25	2.35	2.3	2.2	2.3	1.95	......	......	......	......	......	......
6	2.1	3.5	2.2	2.2	2.25	1.95	......	......	......	......	......	......
7	1.9	4.25	2.2	2.2	2.35	1.95	......	......	......	......	......	......
8	1.9	3.75	2.1	2.15	2.3	1.95	......	......	......	......	......	......
9	1.9	4.1	2.1	2.2	2.3	1.9	......	......	......	......	......	......
10	1.9	3.6	2.25	2.3	2.2	1.9	......	......	......	......	......	......
11	1.85	3.1	2.4	2.4	2.1	1.9	......	......	......	......	......	......
12	1.85	2.8	2.45	2.5	2.1	1.9	......	......	1.2	......	......	......
13	1.95	2.55	2.45	2.6	2.1	1.9	......	......	1.2	......	......	......
14	2.95	2.4	2.5	2.65	2.3	1.9	......	......	1.2	......	......	......
15	2.8	2.4	2.65	2.8	2.2	1.9	......	......	1.2	......	......	......
16	2.35	2.3	2.85	2.9	2.2	1.9	......	......	1.2	......	......	......
17	2.2	2.2	3.05	2.8	2.1	1.8	......	......	1.3	......	......	......
18	2.55	2.15	2.95	2.6	2.25	1.8	......	......	1.3	......	......	......
19	3.4	2.1	2.75	2.7	2.3	1.8	......	......	1.35	......	......	......
20	4.95	2.1	2.6	2.85	2.2	1.85	......	......	1.35	......	......	......
21	4.6	2.1	2.6	2.8	2.2	1.8	......	......	1.3	......	......	......
22	3.2	2.1	2.6	2.75	2.2	1.8	......	......	1.3	......	......	......
23	2.75	2.05	2.6	2.8	2.15	1.75	......	......	1.3	......	......	......
24	2.75	2.0	2.6	2.8	2.15	1.7	......	......	1.3	......	......	......
25	2.6	2.0	2.55	2.8	2.2	1.7	......	......	1.3	......	......	......
26	2.5	2.05	2.55	2.7	2.15	1.7	......	......	1.3	......	......	......
27	2.4	2.2	2.4	2.6	2.15	1.7	......	......	1.3	......	......	......
28	2.25	2.35	2.4	2.5	2.1	1.6	......	......	1.3	......	......	......
29	2.2	2.5	2.3	2.5	2.1	1.6	......	......	1.3	......	......	......
30	2.1	......	2.3	2.5	2.1	1.6	......	......	1.3	......	......	......
31	2.05	......	2.25	......	2.0	......	......	......	......	......	......	......

Rating table for McCloud River near Gregory, Cal., for 1907 and 1908.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	1,178	2.90	2,578	4.60	5,410	6.60	10,350
1.30	1,228	3.00	2,700	4.70	5,625	6.80	10,920
1.40	1,282	3.10	2,825	4.80	5,840	7.00	11,500
1.50	1,340	3.20	2,955	4.90	6,060	7.20	12,100
1.60	1,402	3.30	3,090	5.00	6,280	7.40	12,710
1.70	1,468	3.40	3,230	5.10	6,500	7.60	13,330
1.80	1,538	3.50	3,380	5.20	6,730	7.80	13,960
1.90	1,612	3.60	3,535	5.30	6,960	8.00	14,600
2.00	1,690	3.70	3,695	5.40	7,200	8.20	15,260
2.10	1,772	3.80	3,860	5.50	7,440	8.40	15,930
2.20	1,858	3.90	4,030	5.60	7,680	8.60	16,610
2.30	1,948	4.00	4,210	5.70	7,930	8.80	17,300
2.40	2,042	4.10	4,395	5.80	8,180	9.00	18,000
2.50	2,140	4.20	4,585	5.90	8,440	10.00	21,700
2.60	2,242	4.30	4,785	6.00	8,700	11.00	25,700
2.70	2,349	4.40	4,990	6.20	9,240	12.00	30,000
2.80	2,461	4.50	5,200	6.40	9,790		

NOTE.—The table is not applicable for obstructed-channel conditions. It is based on seventeen discharge measurements made during 1902–1906, and is fairly well defined between gage heights 1.5 feet and 6.0 feet.

Below gage height 5.1 feet it is the same as the table for 1902 to 1906.

Monthly discharge of McCloud River near Gregory, Cal., for 1907 and 1908.

[Drainage area, 608 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	16,800	1,470	2,880	4.74	5.46	177,000	A.
February	18,400	2,140	5,510	9.06	9.43	306,000	A.
March	30,000	2,460	6,000	9.87	11.38	369,000	A.
April	5,520	2,580	4,100	6.74	7.52	244,000	A.
May	2,640	2,040	2,290	3.77	4.35	141,000	A.
June	2,140	1,650	1,840	3.03	3.38	109,000	A.
July	1,610	1,470	1,550	2.55	2.94	95,300	A.
August	1,500	1,400	1,440	2.37	2.73	88,500	A.
September	1,400	1,370	1,400	2.30	2.57	83,300	A.
October	1,440	1,370	1,380	2.27	2.62	84,800	A.
November	1,400	1,370	1,370	2.25	2.51	81,500	A.
December	2,820	1,370	1,660	2.73	3.15	102,000	A.
The year	30,000	1,370	2,620	4.31	58.04	1,880,000	
1908.							
January	6,170	1,580	2,300	3.78	4.36	141,000	A.
February	4,680	1,690	2,280	3.75	4.04	131,000	A.
March	2,760	1,770	2,150	3.54	4.08	132,000	A.
April	2,580	1,770	2,170	3.57	3.98	129,000	A.
May	2,140	1,690	1,880	3.09	3.56	116,000	A.
June	1,690	1,400	1,570	2.58	2.88	93,400	A.
The period						742,000	
September 12–30	1,260	1,180	1,220	2.01	1.42	46,000	A.

NOTE.—This station was discontinued June 30, 1908. September gage heights taken on account of extreme low-water conditions.

COTTONWOOD CREEK DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Cottonwood Creek lies west of Sacramento River and east of the Coast Range and just south of Clear Creek drainage basin.

Cottonwood Creek has three principal forks, called North, Middle, and South or Cold forks. North Fork rises in Bully Choop Mountain, which has an elevation of 7,073 feet above sea level. It is about 20 miles long, drains an area of 112 square miles, and has total fall about 4,200 feet. It unites with Middle Fork a short distance below Gas Point. Middle Fork is about 30 miles long, has a fall of 5,900 feet, and drains an area of 261 square miles. South Fork rises in Yallo Bally Mountains which reaches an elevation of about 6,000 feet, and unites with the main creek a few miles west of the town of Cottonwood. It is about 45 miles long, drains an area of 395 square miles, and has a fall of 4,600 feet. The main creek flows eastward and empties into the Sacramento about 5 miles east of the town of Cottonwood and opposite the mouth of Battle Creek. The total drainage area is 929 square miles.

The crest of the Coast Range, which forms the western boundary of the basin for a distance of about 50 miles, ranges in elevation from 6,000 to 8,000 feet above sea level. From the crest toward the east the basin slopes rapidly to the foothills around the northern end of the Sacramento Valley, and is regularly furrowed by numerous drainage ways. About two-thirds of the area is more than 1,000 feet above sea level.

This basin is very well timbered, but at the lower elevations the growth is more or less scrubby. The upper part of the basins of Middle and South forks is included in the Trinity National Forest.

The mean annual precipitation ranges from 25 inches in the lower part, where it occurs as rainfall, to more than 50 inches along the crest of the Coast Range, where much of it occurs as snow.

Some irrigation on a small scale is carried on in this basin, especially in the northern part along the North Fork, and there is opportunity for further development.

Storage is undoubtedly possible in the basin, but to what extent is not known. The same may be said regarding power development.

Only one gaging station has been maintained in the basin. This station is on the North Fork at Ono, 1907 to 1908.

NORTH FORK OF COTTONWOOD CREEK AT ONO, CAL.

This station was established October 27, 1907, at the highway bridge one-fourth mile west of Ono, for the purpose of determining the amount of water available above Ono for further irrigation development.

Several small ditches divert water from the creek above the gaging station. In September, 1908, they carried a total of 14 second-feet. Acquired water rights greatly exceed the low-water flow. The channel is somewhat rough and subject to slight change. At high stages the current is swift and is somewhat obstructed by the center bridge pier. The datum of the gage has not been changed.

The following miscellaneous discharge measurements were made of canals which divert water from Cottonwood Creek above the gaging station at Ono, Cal.:

Miscellaneous discharge measurements of canals diverting water from Cottonwood Creek.

Date.	Canal.	Locality.	Discharge.
1908.			*Sec.-ft.*
September 26..	Bee Creek Ditch Co	1 mile below intake	1.3
September 27..	Happy Valley Land and Water Co	1½ miles below intake	6.2
Do	Jerusalem	½ mile below intake	2.1
Do	Marina Gold Mining Co	¾ mile below intake	*a* 4.1

a This water is used for power development and is returned to creek channel.

Discharge measurements of North Fork of Cottonwood Creek at Ono, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 28	W. A. Lamb	26	15	4.45	13
1908.					
February 1	W. A. Lamb	88	101	5.45	246
February 20	do	90	112	5.31	212
March 12	do	90	98	5.30	206
April 22	do	48	62	5.10	124
September 26	W. V. Hardy	6	5.6	4.20	5.3
December 19	W. F. Martin	37	29	4.59	28

Daily gage height, in feet, of North Fork of Cottonwood Creek at Ono, Cal., for 1907 and 1908.

[F. J. Wheelock, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1907.				1907.				1907.			
1		4.4	4.4	11		4.4	4.95	21		4.4	4.8
2		4.5	4.4	12		4.4	5.15	22		4.45	4.8
3		4.4	4.4	13		4.4	5.2	23		4.45	4.8
4		4.4	4.5	14		4.4	4.95	24		4.4	4.8
5		4.4	4.5	15		4.4	4.9	25		4.4	4.85
6		4.4	4.55	16		4.4	4.8	26		4.4	6.4
7		4.4	5.15	17		4.4	4.8	27		4.4	5.45
8		4.4	4.8	18		4.4	4.8	28	4.4	4.4	5.25
9		4.4	4.7	19		4.4	5.15	29	4.4	4.4	5.2
10		4.4	5.5	20		4.4	4.95	30	4.4	4.4	5.3
								31	4.4		5.75

Daily gage height, in feet, of North Fork of Cottonwood Creek at Ono, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	5.35	5.45	5.4	5.2	5.1	4.75	4.4	4.1	4.0	4.2	4.4	4.5
2	5.3	6.1	5.3	5.2	5.2	4.7	4.4	4.1	4.05	4.2	4.4	4.5
3	5.25	5.6	5.3	5.15	5.1	4.7	4.35	4.1	4.05	4.2	4.4	4.5
4	5.3	5.5	5.3	5.15	5.1	4.7	4.35	4.1	4.1	4.2	4.4	4.7
5	5.2	5.65	5.3	5.15	5.05	4.7	4.35	4.1	4.1	4.2	4.4	4.7
6	5.15	5.95	5.3	5.15	5.05	4.7	4.35	4.1	4.1	4.2	4.4	4.6
7	5.1	5.95	5.3	5.1	5.05	4.7	4.35	4.1	4.1	4.2	4.4	4.6
8	5.1	6.05	5.3	5.1	5.0	4.65	4.35	4.1	4.1	4.2	4.4	4.6
9	5.1	7.05	5.25	5.1	5.0	4.65	4.3	4.1	4.1	4.2	4.4	4.85
10	5.1	6.15	5.25	5.1	5.0	4.6	4.25	4.1	4.1	4.2	4.4	4.7
11	5.1	5.85	5.25	5.1	5.0	4.6	4.3	4.1	4.1	4.3	4.4	4.65
12	5.1	5.7	5.3	5.15	5.0	4.6	4.3	4.1	4.1	4.3	4.4	4.6
13	5.35	5.6	5.3	5.15	5.0	4.6	4.3	4.1	4.1	4.3	4.4	4.6
14	5.35	5.55	5.3	5.15	5.0	4.6	4.3	4.2	4.15	4.55	4.4	4.6
15	5.25	5.5	5.3	5.2	5.0	4.55	4.3	4.2	4.15	4.6	4.4	4.6
16	5.2	5.5	5.35	5.2	5.0	4.55	4.3	4.1	4.2	4.5	4.4	4.6
17	5.2	5.45	5.4	5.2	5.0	4.55	4.25	4.05	4.4	4.4	4.4	4.55
18	5.75	5.4	5.4	5.15	5.0	4.5	4.25	4.05	4.3	4.4	4.4	4.55
19	5.6	5.4	5.4	5.15	5.0	4.55	4.2	4.0	4.3	4.4	4.4	4.55
20	5.9	5.3	5.3	5.15	5.0	4.55	4.2	4.0	4.3	4.4	4.6	4.55
21	5.7	5.3	5.3	5.1	4.95	4.55	4.2	4.0	4.25	4.4	4.6	4.55
22	5.55	5.3	5.3	5.2	4.9	4.55	4.2	4.0	4.2	4.4	4.7	4.55
23	5.5	5.3	5.3	5.3	4.9	4.5	4.15	4.0	4.2	4.4	4.65	4.6
24	6.55	5.3	5.3	5.25	4.9	4.5	4.2	4.0	4.2	4.4	4.6	4.55
25	5.75	5.3	5.3	5.25	4.9	4.5	4.1	4.0	4.2	4.4	4.75	4.55
26	5.6	5.35	5.3	5.2	4.85	4.5	4.1	4.0	4.2	4.4	4.6	4.55
27	5.5	5.4	5.25	5.15	4.8	4.5	4.1	4.0	4.2	4.4	4.5	4.55
28	5.5	5.4	5.25	5.1	4.7	4.4	4.1	4.05	4.2	4.4	4.5	4.55
29	5.4	5.4	5.2	5.1	4.7	4.4	4.1	4.0	4.2	4.4	4.5	4.55
30	5.4	....	5.2	5.1	4.75	4.4	4.1	4.0	4.2	4.55	4.5	4.55
31	5.4	....	5.2	....	4.75	....	4.1	4.0	....	4.5	....	4.55

Rating table for North Fork of Cottonwood Creek at Ono, Cal., 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.*
4.10	4	4.90	76	5.70	380	6.50	960
4.20	5	5.00	98	5.80	435	6.60	1,060
4.30	7	5.10	124	5.90	495	6.70	1,160
4.40	11	5.20	154	6.00	560	6.80	1,270
4.50	18	5.30	190	6.10	630	6.90	1,380
4.60	28	5.40	230	6.20	705	7.00	1,500
4.70	41	5.50	275	6.30	785	7.10	1,620
4.80	57	5.60	325	6.40	870		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during 1907 to 1909 and is well defined between gage heights 4.2 feet and 6.7 feet.

Monthly discharge of North Fork of Cottonwood Creek at Ono, Cal., for 1907 and 1908.

[Drainage area, 52 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.							
November	18	11	11.4	0.219	0.24	678	A.
December	870	11	125	2.40	2.68	7,690	A.
1908.							
January	1,010	124	254	4.88	5.63	15,600	A.
February	1,560	190	361	6.94	7.48	20,800	A.
March	230	154	189	3.63	4.18	11,600	A.
April	190	124	142	2.73	3.05	8,450	A.
May	154	41	91.2	1.75	2.02	5,610	A.
June	49	11	26.8	.515	.57	1,590	A.
July	11	4	6.5	.125	.14	400	A.
August	5	3	3.6	.069	.08	221	A.
September	11	3	4.8	.092	.10	286	A.
October	28	5	10.5	.202	.23	646	A.
November	49	11	17.2	.331	.37	1,020	A.
December	66	18	27.5	.529	.61	1,690	A.
The year	1,560	3	94.5	1.82	24.46	67,900	

NOTE.—Several small canals divert water from Cottonwood Creek above the gaging station. Discharge measurements made during September, 1908, show a total of 14 second-feet diverted.

STONY CREEK DRAINAGE BASIN.

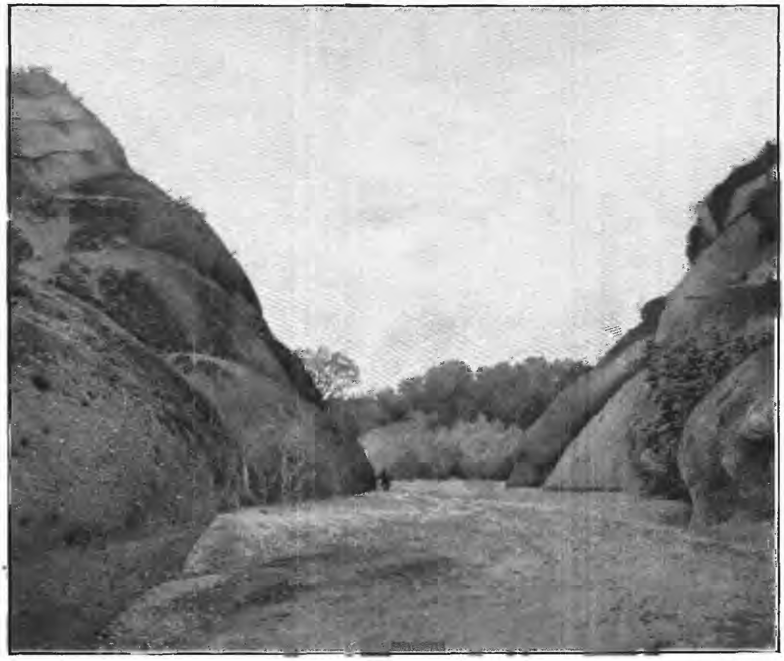
DESCRIPTION.

The Stony Creek drainage basin lies on the eastern slope of the Coast Range, north of the Cache Creek drainage basin, and south of the Thomes Creek basin, which lies between it and the Cottonwood basin on the north. The total drainage area of Stony Creek is about 828 square miles. Of this area about 600 square miles is embraced in an irregular parallelogram 10 to 15 miles in width and touching the crest of the range for a distance of 50 or 60 miles.

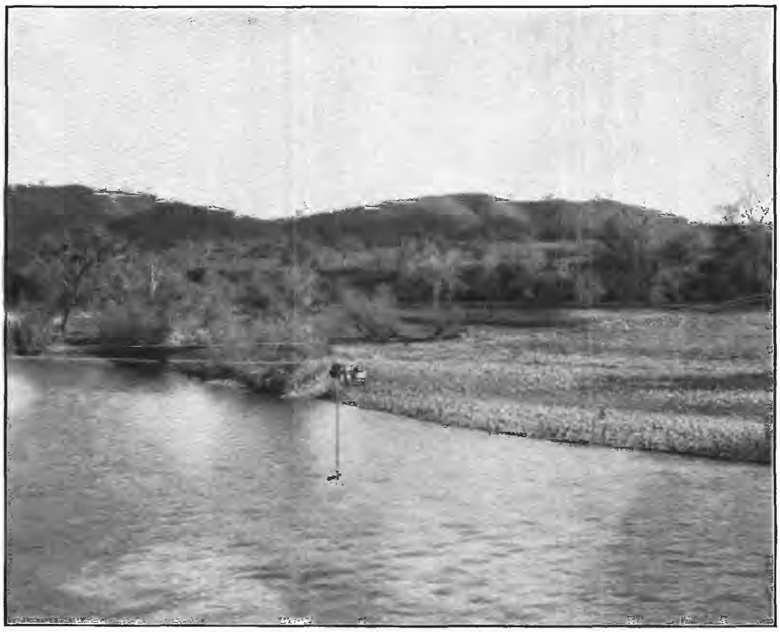
The creek rises in the south end of this area and flows northward along its eastern border for a distance of about 35 miles, then westward for about 15 miles, and finally southeastward to its junction with the Sacramento near St. John. The total length of the creek is about 90 miles, and its fall about 4,000 or 5,000 feet.

The principal tributaries of Stony Creek are Little Stony Creek from the south end of the area, Briscoe Creek from its middle, Grindstone Creek from its north end; and North Fork, which enters the main creek about 10 miles northwest of Orland.

The drainage basin of Stony Creek is somewhat peculiar topographically and geologically. The main stream lies wholly in sedimentary rock; the tributaries from the west come from the granitic crest of the range, and have heavy gradients. At various points in the basin the streams intersect conglomerate ridges of more or less hardness, which, because of their resistance to erosion, have produced



A. EAST PARK DAM SITE ON LITTLE STONY CREEK.



B. STONY CREEK GAGING STATION, NEAR FRUTO.

favorable sites for dams and reservoirs. The basin ranges in elevation from a few hundred feet in the valley to 6,000 feet or more at the summit of the range.

This basin is covered with a good forest growth of grass and dense brush at the lower elevations and heavy commercial timber on the mountain summits. About three-fourths of the upper basin is included in a national forest reserve.

The mean annual precipitation varies from 18 inches in the valley to 40 inches or more on the mountain summits, where more or less of it occurs as snowfall. The worst freshets occur during the winter.

For years Stony Creek has been used as a source of water for irrigation on a small scale in the northeastern part of Glenn County. The United States Reclamation Service now has under construction the Orland reclamation unit, which will furnish water to 14,000 acres around Orland. The water will be taken from Stony Creek by the aid of several dams for storage and diversion.

Storage possibilities in this basin are good. (See Pl. IV, *A*.) The most important reservoir sites on the main stream and its tributaries were surveyed several years ago by the Geological Survey. For the result of these surveys see Water-Supply Paper 86.

Without storage only a comparatively small quantity of power could be developed continuously in Stony Creek basin; but, with a comprehensive storage system, many thousand horsepower could be developed.

The run-off record on Stony Creek runs back to 1901. The wettest year since that time was 1907 and the driest 1908, or possibly 1901. Early in 1909, however, the maximum daily flow greatly exceeded all previous records. The total flow for the wettest year was a little more than double that for the driest.

Gaging stations have been maintained in this basin as follows:

Stony Creek near Fruto (1901 to 1908).
Little Stony Creek near Lodoga (1907 to 1908).

STONY CREEK NEAR FRUTO, CAL.

This station, which is located at Julian's ranch, about 7 miles northwest of Fruto, and 1¾ miles above the Mill Site dam site, which is in sec. 1, T. 21 N., R. 6 W., Mount Diablo base and meridian, was established January 30, 1901, to determine the quantity of water available for storage at the dam site below.

The only important tributary near the gaging station is Grindstone Creek, which has a drainage area of 173 square miles, and which enters from the west a short distance above the station. Still farther south of (above) the station, Salt, Elk, and Briscoe creeks enter. North Fork Stony Creek, which has a drainage area of about 90 square miles, enters about 12 miles below the station.

The channel is composed of gravel which shifts more or less during high water, when the current is very swift and the stream is several hundred feet wide. (See Pl. IV, *B*.) The gage datum has remained unchanged.

The records are fair except for very high stages. Estimates for flood flow are more or less approximate.

Discharge measurements of Stony Creek near Fruto, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
February 11	R. S. Hawley	143	333	6.35	1,430
April 26	W. G. Steward	138	274	5.95	895
June 12	L. F. Hendricks	134	156	5.05	274
August 1	T. H. Humphreys	78	64	4.30	27
September 12	W. A. Lamb	38	33	4.25	19
1908.					
January 2	W. A. Lamb	133	204	5.68	615
January 11	do	133	208	5.65	621
January 14	do	144	369	6.65	1,710
February 4	do	145	316	6.10	1,360
February 7	do	150	471	6.75	2,520
February 10	do	153	529	7.25	2,870
February 19	do	138	253	5.75	890
February 26	do	138	278	5.83	986
March 1	do	150	384	6.35	1,560
March 3	do	140	254	5.90	925
March 11	do	138	238	5.73	770
June 3	J. L. Rhead	67	99	4.78	225
June 6	do	90	104	4.71	164
June 10	do	82	115	4.70	166

Daily gage height, in feet, of Stony Creek near Fruto, Cal., for 1907 and 1908.

[W. H. Julian, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.8	9.85	6.0	7.35	5.6	5.2	4.6	4.2	4.2	4.3	4.3	4.4
2	4.8	12.4	5.9	7.2	5.6	5.1	4.6	4.2	4.2	4.3	4.3	4.4
3	4.8	11.35	5.8	7.1	5.6	5.1	4.5	4.2	4.2	4.3	4.3	4.4
4	9.45	11.0	5.7	7.0	5.5	5.1	4.5	4.2	4.2	4.3	4.3	4.4
5	6.35	10.0	7.6	6.9	5.5	5.1	4.5	4.2	4.2	4.3	4.3	4.4
6	6.1	9.3	7.4	7.15	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.8
7	6.0	8.6	6.75	7.25	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.6
8	6.35	8.2	6.5	7.2	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.5
9	9.15	7.4	7.15	7.05	5.5	5.1	4.4	4.2	4.2	4.3	4.3	4.5
10	9.0	6.75	6.75	6.9	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.5
11	7.1	6.5	6.5	6.8	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.2
12	6.3	6.4	6.4	6.7	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.1
13	5.8	6.3	6.3	6.6	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.6
14	5.55	6.3	6.2	6.5	5.4	5.1	4.4	4.2	4.2	4.3	4.4	5.2
15	5.4	6.2	6.1	6.6	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.1
16	5.4	6.1	6.0	6.5	5.4	5.0	4.4	4.2	4.2	4.3	4.4	5.0
17	5.6	6.2	9.45	6.5	5.3	4.9	4.3	4.2	4.2	4.3	4.4	5.0
18	5.55	6.1	14.25	6.5	5.3	4.9	4.3	4.2	4.2	4.3	4.4	4.9
19	5.65	6.1	13.15	6.5	5.4	4.9	4.3	4.2	4.2	4.3	4.4	4.9
20	6.0	6.0	11.8	6.4	5.4	4.9	4.3	4.2	4.2	4.3	4.4	5.2
21	6.65	6.0	9.8	6.4	5.4	4.9	4.3	4.2	4.2	4.3	4.4	5.1
22	6.8	6.25	7.75	6.3	5.4	4.9	4.3	4.2	4.2	4.3	4.4	5.0
23	6.8	6.4	11.55	6.3	5.3	4.8	4.3	4.2	4.3	4.3	4.4	4.9
24	6.7	6.3	8.7	6.2	5.3	4.8	4.3	4.2	4.3	4.3	4.4	4.9
25	6.7	6.2	8.15	6.1	5.3	4.8	4.3	4.2	4.3	4.3	4.4	4.8

Daily gage height, in feet, of Stony Creek near Fruto, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	6.8	6.35	7.75	6.0	5.3	4.7	4.3	4.2	4.3	4.3	4.4	7.5
27	8.15	6.1	7.45	5.9	5.3	4.7	4.3	4.2	4.3	4.3	4.4	6.85
28	7.65	6.0	7.25	5.8	5.2	4.7	4.3	4.2	4.3	4.3	4.4	6.4
29	7.2	......	7.25	5.7	5.2	4.7	4.3	4.2	4.3	4.3	4.4	6.5
30	6.85	......	7.35	5.6	5.2	4.6	4.3	4.2	4.3	4.3	4.4	7.65
31	7.6	......	7.35	......	5.2	......	4.3	4.2	......	4.3	......	7.0
1908.												
1	5.85	6.55	6.8	5.4	5.2	5.0	4.4	4.1	3.9	4.1	4.3	4.5
2	5.65	8.8	6.15	5.4	5.2	5.0	4.4	4.1	3.9	4.1	4.3	4.5
3	5.55	6.8	5.9	5.4	5.2	4.9	4.4	4.1	3.9	4.1	4.3	4.5
4	5.65	6.15	5.8	5.4	5.2	4.9	4.4	4.1	3.9	4.1	4.3	4.6
5	5.5	6.65	5.7	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.4
6	5.4	7.55	5.7	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.1
7	5.3	6.7	5.7	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.0
8	5.2	6.5	5.8	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.3	5.0
9	6.25	10.15	5.8	5.4	5.2	4.9	4.3	4.1	3.9	4.1	4.4	5.0
10	6.0	7.1	5.9	5.4	5.2	4.8	4.3	4.1	3.9	4.1	4.4	5.1
11	5.9	6.7	5.9	5.4	5.2	4.8	4.3	4.1	3.9	4.2	4.4	5.2
12	5.8	6.35	5.95	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	5.1
13	5.7	6.15	5.95	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	5.0
14	6.6	6.0	6.05	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	4.9
15	6.05	5.9	6.05	5.3	5.2	4.8	4.3	4.1	3.9	4.2	4.4	4.8
16	5.85	5.9	6.15	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.4	4.7
17	5.65	5.8	6.1	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.7
18	5.75	5.8	6.1	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.6
19	5.55	5.8	6.1	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.6
20	7.9	5.7	6.0	5.3	5.2	4.7	4.2	4.0	4.0	4.2	4.5	4.6
21	6.85	5.7	6.0	5.3	5.2	4.6	4.2	4.0	4.0	4.2	4.75	4.6
22	6.75	5.7	5.9	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.6	4.6
23	6.65	5.6	5.9	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.5	4.6
24	7.8	5.5	5.8	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.5	4.6
25	6.9	5.5	5.8	5.3	5.1	4.6	4.2	4.0	4.0	4.2	4.5	4.5
26	6.35	5.4	5.7	5.3	5.1	4.5	4.2	4.0	4.0	4.3	4.5	4.5
27	6.05	5.4	5.7	5.3	5.1	4.5	4.2	4.0	4.0	4.3	4.5	4.5
28	5.9	5.4	5.6	5.3	5.1	4.5	4.2	4.0	4.0	4.3	4.5	4.5
29	5.8	5.4	5.6	5.3	5.0	4.5	4.2	4.0	4.0	4.3	4.5	4.5
30	5.7	......	5.5	5.3	5.0	4.5	4.2	4.0	4.1	4.3	4.5	4.5
31	5.6	......	5.5	......	5.0	......	4.2	4.0	......	4.3	......	4.5

Rating tables for Stony Creek near Fruto, Cal.

MARCH 8, 1906, TO FEBRUARY 1, 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.*
4.80	380	5.90	1,150	7.00	2,390	8.20	3,980
4.90	430	6.00	1,250	7.10	2,515	8.40	4,280
5.00	480	6.10	1,355	7.20	2,640	8.60	4,600
5.10	530	6.20	1,460	7.30	2,765	8.80	4,930
5.20	580	6.30	1,570	7.40	2,890	9.00	5,270
5.30	640	6.40	1,680	7.50	3,020	9.20	5,630
5.40	705	6.50	1,790	7.60	3,150	9.40	6,000
5.50	780	6.60	1,905	7.70	3,280	9.60	6,400
5.60	865	6.70	2,020	7.80	3,410	9.80	6,800
5.70	955	6.80	2,140	7.90	3,550	10.00	7,280
5.80	1,050	6.90	2,265	8.00	3,690		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nine discharge measurements made during 1906 and three during 1904, and is well defined below gage height 6.4 feet.

Rating tables for Stony Creek near Fruto, Cal.—Continued.

FEBRUARY 2 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.*
4.20	15	5.60	580	7.00	2,160	8.80	4,860
4.30	30	5.70	660	7.10	2,300	9.00	5,200
4.40	50	5.80	750	7.20	2,440	9.20	5,570
4.50	80	5.90	850	7.30	2,580	9.40	5,970
4.60	110	6.00	950	7.40	2,720	9.60	6,390
4.70	140	6.10	1,060	7.50	2,860	9.80	6,820
4.80	175	6.20	1,170	7.60	3,000	10.00	7,280
4.90	215	6.30	1,280	7.70	3,140	11.00	10,200
5.00	255	6.40	1,400	7.80	3,280	12.00	14,300
5.10	300	6.50	1,520	7.90	3,420	13.00	19,300
5.20	350	6.60	1,640	8.00	3,570	14.00	25,000
5.30	400	6.70	1,770	8.20	3,880	15.00	31,200
5.40	450	6.80	1,900	8.40	4,200	16.00	37,800
5.50	510	6.90	2,030	8.60	4,520	17.00	44,700

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during February, 1907, to January, 1908, and is fairly well defined between gage heights 4.2 feet and 7 feet.

JANUARY 1 TO FEBRUARY 9, 1908.

[The indirect method for shifting channels used.]

FEBRUARY 10 TO DECEMBER 31, 1908.

3.90	3	4.90	245	5.90	990	6.90	2,360
4.00	10	5.00	285	6.00	1,110	7.00	2,510
4.10	20	5.10	335	6.10	1,240	7.10	2,660
4.20	35	5.20	385	6.20	1,370	7.20	2,810
4.30	55	5.30	440	6.30	1,510	7.30	2,960
4.40	78	5.40	500	6.40	1,650	7.40	3,120
4.50	105	5.50	575	6.50	1,790	7.50	3,280
4.60	135	5.60	660	6.60	1,930		
4.70	170	5.70	760	6.70	2,070		
4.80	205	5.80	870	6.80	2,210		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nine discharge measurements made during 1908 and the form of the previous curve at low stages, and is well defined between gage heights 5.5 feet and 7.5 feet.

Monthly discharge of Stony Creek near Fruto, Cal., for 1907 and 1908.

[Drainage area, 601[a] 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	6,100	380	2,020	3.36	3.87	124,000	C.
February	16,300	950	3,310	5.51	5.74	184,000	C.
March	26,500	660	4,430	7.37	8.50	272,000	C.
April	2,650	580	1,640	2.73	3.05	97,600	B.
May	580	350	450	.749	.86	27,700	B.
June	350	110	236	.393	.44	14,000	B.
July	110	30	47.1	.078	.09	2,900	B.
August	15	15	15	.025	.03	922	C.
September	30	15	19	.032	.04	1,130	C.
October	30	30	30	.050	.06	1,840	C.
November	50	30	44	.073	.08	2,620	C.
December	3,070	50	597	.993	1.14	36,700	B.
The year	26,500	15	1,070	1.78	23.90	765,000	

[a] Revised since the 1906 report.

Monthly discharge of Stony Creek near Fruto, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	3,600	310	1,140	1.90	2.19	70,100	B.
February	7,800	500	1,680	2.80	3.02	96,600	B.
March	2,210	575	993	1.65	1.90	61,100	B.
April	500	400	525	.874	.98	31,200	B.
May	385	285	364	.606	.70	22,400	B.
June	285	105	186	.309	.34	11,100	B.
July	78	35	47.6	.079	.09	2,930	C.
August	20	10	14.8	.025	.03	910	D.
September	20	3	6.83	.011	.01	406	D.
October	55	20	34	.057	.07	2,090	C.
November	187	55	88.2	.147	.16	5,250	C.
December	500	105	192	.379	.44	11,800	B.
The year	7,800	3	439	.736	9.93	316,000	

LITTLE STONY CREEK NEAR LODOGA, CAL.

This station was established by the United States Reclamation Service in March, 1907, for the purpose of determining the quantity of water available for storage in the East Park reservoir, is located at the East Park dam site (see Pl. IV, *A*), 3½ miles northwest of Lodoga, in sec. 3, T. 17 N., R. 6 W., Mount Diablo base and meridian, and is about 4 miles above the mouth of the creek. Records are furnished by the Reclamation Service.

Indian Creek enters Little Stony Creek from the east a short distance above the station. The channel is composed of clean rock, gravel, and sand, which shifts during high water. The current is swift at moderate and high stages.

The gage datum was changed in the fall of 1907. The records are only fair owing to changes in channel.

Discharge measurements of Little Stony Creek near Lodoga, Cal., in 1907 and 1908.

[By United States Reclamation Service engineers.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1907.	*Feet.*	*Sec.-feet.*	1907.	*Feet.*	*Sec.-feet.*	1907.	*Feet.*	*Sec.-feet.*
February 20	3.50	96	March 17	11.15	3,210	Do	5.6	698
March 5	4.25	314	Do	12.40	4,030	March 23	7.8	1,580
March 6	3.87	198	Do	12.50	3,930	March 24	6.65	1,050
March 7	3.80	156	March 18	13.10	3,940	June 11	3.20	28
March 8	3.70	149	Do	12.85	3,370	July 28	2.9	2.4
March 9	4.00	189	Do	12.00	2,860	November 27	2.8	1.0
Do	4.70	387	Do	12.30	2,700	December 8	3.1	15
Do	5.93	609	Do	12.40	3,290	December 27	3.46	76
Do	5.63	471	March 19	8.95	2,280			
March 10	4.40	275	Do	8.65	2,300	1908.		
Do	4.30	264	Do	8.5	2,080	February 1	3.94	171
March 11	4.15	222	Do	8.45	2,250	February 7	4.87	605
March 12	4.00	186	Do	8.6	2,330	Do	4.92	648
March 13	3.85	162	March 20	7.55	1,630	February 9[a]	5.87	1,260
March 14	3.75	145	Do	6.95	1,500	Do.[a]	6.50	1,810
March 15	3.70	132	Do	7.35	1,570	February 17	3.51	143
March 16	3.80	160	March 21	6.45	1,010	March 21	3.40	100
March 17	7.80	1,380	Do	6.15	906	June 2	2.65	8.4
Do	8.25	1,420	March 22	5.6	707			

[a] Measured by floats.

Daily gage height, in feet, of Little Stony Creek near Lodoga, Cal., for 1908

[Ora Gordon, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.1	4.0	4.3	3.2	3.0	2.7	2.5	2.4	2.3	......	......	2.3
2	3.5	4.3	3.9	3.2	3.0	2.7	2.5	2.4	2.3	......	......	2.3
3	3.4	4.2	3.8	3.2	2.9	2.7	2.5	2.4	2.3	......	......	2.3
4	3.4	4.2	3.7	3.1	2.9	2.7	2.5	2.4	2.3	......	......	2.3
5	3.4	5.6	3.6	3.1	2.9	2.7	2.4	2.4	2.3	......	......	3.0
6	3.3	5.7	3.5	3.1	2.9	2.7	2.4	2.4	2.3	......	......	2.8
7	3.3	5.0	3.5	3.1	2.9	2.7	2.4	2.4	2.3	......	......	2.7
8	3.3	4.6	3.4	3.0	2.9	2.7	2.4	2.4	2.3	......	......	2.7
9	3.5	6.3	3.4	3.0	2.9	2.6	2.4	2.4	2.3	......	......	3.2
10	3.3	4.8	3.4	3.0	2.9	2.6	2.4	2.4	2.3	......	......	3.2
11	3.3	4.3	3.4	3.0	2.9	2.6	2.4	2.4	2.3	......	......	3.0
12	3.3	4.0	3.4	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.9
13	3.3	3.9	3.4	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.8
14	3.7	3.8	3.5	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.8
15	3.5	3.7	3.5	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.8
16	3.5	3.7	3.5	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.7
17	3.5	3.5	3.5	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.7
18	3.6	3.5	3.5	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.7
19	3.6	3.5	3.5	3.0	2.9	2.6	2.4	2.4	2.3	......	......	2.7
20	4.3	3.5	3.4	3.0	2.9	2.6	2.4	2.4	2.2	......	......	2.7
21	4.1	3.4	3.4	3.0	2.9	2.6	2.4	2.4	2.1	......	......	2.7
22	4.1	3.4	3.4	3.0	2.9	2.6	2.4	2.4	2.1	......	2.0	2.7
23	3.9	3.4	3.4	3.0	2.9	2.6	2.4	2.4	......	......	2.1	2.7
24	4.5	3.4	3.4	3.0	2.9	2.5	2.4	2.4	......	......	2.1	2.7
25	4.1	3.4	3.4	3.0	2.9	2.5	2.4	2.4	......	......	2.1	2.7
26	3.9	3.4	3.3	3.0	2.9	2.5	2.4	2.4	......	......	2.4	2.7
27	3.8	3.5	3.3	3.0	2.9	2.5	2.4	2.4	......	......	2.4	2.7
28	3.7	3.5	3.2	3.0	2.9	2.5	2.4	2.4	......	......	2.4	2.7
29	3.6	3.5	3.2	3.0	2.9	2.5	2.4	2.4	......	......	2.3	2.7
30	3.6	......	3.2	3.0	2.9	2.5	2.4	2.4	......	......	2.3	2.7
31	3.6	......	3.2	......	2.8	......	2.4	2.4	......	......	......	2.7

NOTE.—The creek was dry and water standing in pools September 23 to November 21.

Rating table for Little Stony Creek near Lodoga, Cal., January 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.*
2.10	0.0	3.30	80	4.50	417	5.70	1,143
2.20	.5	3.40	97	4.60	465	5.80	1,219
2.30	1.5	3.50	116	4.70	515	5.90	1,298
2.40	3	3.60	136	4.80	568	6.00	1,380
2.50	5	3.70	157	4.90	623	6.10	1,462
2.60	8	3.80	180	5.00	680	6.20	1,546
2.70	13	3.90	204	5.10	740	6.30	1,630
2.80	20	4.00	230	5.20	802	6.40	1,714
2.90	28	4.10	259	5.30	866	6.50	1,800
3.00	38	4.20	292	5.40	932		
3.10	50	4.30	330	5.50	1,000		
3.20	64	4.40	372	5.60	1,070		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1908 and is fairly well defined between gage heights 2.65 feet and 6.5 feet. Above gage height 6.5 feet the rating curve is a tangent, the difference being 88 per tenth.

Monthly discharge of Little Stony Creek near Lodoga, Cal., for 1908.

[Drainage area, 102 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.	
January	417	80	155	1.52	1.75	9,530	C.
February	1,630	97	322	3.16	3.41	18,500	C.
March	330	64	113	1.11	1.28	6,950	C.
April	64	38	42.2	.414	.46	2,510	C.
May	38	20	28.4	.278	.32	1,750	C.
June	13	5	8.6	.084	.09	512	C.
July	5	3	3.3	.032	.04	203	D.
August	3	3	3.0	.029	.03	184	D.
September	1.5	0	1.0	.0098	.01	60	D.
October	0	0	0	.00	.00	0	
November	3	0	.4	.0039	.004	24	D.
December	64	1.5	17.8	.175	.20	1,090	C.
The year	1,630	0	57.9	.568	7.59	41,300	

CACHE CREEK DRAINAGE BASIN.

DESCRIPTION.

The Cache Creek drainage basin lies on the eastern slope of the Coast Range in Lake, Colusa, and Yolo counties, immediately south and west of the south end of the Stony Creek basin and north of the Puta Creek basin. The upper part of the basin, consisting of about 824 square miles, lies in the central part of Lake County, south of the divide separating the Eel River and Cache Creek basins. It is roughly rectangular in shape, and contains Clear Lake in its center. From Lake County the basin extends southeastward to the Sacramento Valley as a strip about 50 miles long and 10 miles wide. The total area of the basin is 1,290 square miles.

Cache Creek is the only known outlet of Clear Lake. The lake is very irregular in shape and has an area of 65 square miles and an elevation of 1,325 feet at mean level. Its length is 20 miles and its greatest width 7 miles. The upper part, or main lake, has a maximum depth of 35 feet, but the lower neck has a few small areas as much as 50 feet in depth. The drainage area tributary to the lake is about 417 square miles, chiefly toward the south and west. The principal creeks flowing into the lake are Scotts, Middle, and Clover from the west, and Doba, Kelsey, and Cole from the south. They are torrential during the rainy season, but are practically dry in the summer.

From the lake Cache Creek flows southeastward to Yolo basin and ultimately into Sacramento River through sloughs. Its total length is about 80 miles.

The largest and most important tributary of Cache Creek is the North Fork, which drains 250 square miles in the eastern part of

Lake County. The only other tributary of much importance is Bear Creek, which drains the western part of Colusa County. These creeks are very small in the summer, but rarely become dry. All the tributaries are torrential.

The upper part of the Cache Creek drainage basin in Lake County is mountainous and very rugged. Some of the peaks reach an altitude of 6,000 feet above sea level, and their slopes, as well as those of the lower ranges, are very steep. About 5 miles below the outlet the creek enters Cache Creek Canyon, in which it flows for 25 miles on an average grade of 35 feet to the mile. In some places the canyon walls are vertical cliffs 300 feet high. Below the canyon the creek enters Capay Valley, from 1 to 3 miles wide and 20 miles long, through which it winds for a distance of nearly 30 miles before entering the Sacramento Valley.

The forest covering in the Cache Creek drainage basin is very good. On the northern slope of the ranges around Clear Lake are fine belts of fir, oak, and pine. Elsewhere on the high ranges the vegetation consists of a dense growth of greasewood and chaparral. A strip along the northern edge of the basin is included in a national forest.

The mean annual precipitation ranges from 17 inches in the Sacramento Valley to 40 inches or more on the mountainous summits in Lake County, where much of it occurs as snowfall in the winter season.

Cache Creek furnishes exceptional opportunities for irrigation development in Yolo County. At the present time many ditches take water from the creek for irrigating land in the vicinity of Woodland and Yolo.

Good storage sites are also available in this basin. Clear Lake is a natural storage reservoir which is very powerful in regulating Cache Creek.[a]

The opportunities for water-power development on Cache Creek are excellent.

The upper part of this basin contains springs, a number of which, especially in the North Fork basin, have medicinal properties that attract hundreds of visitors during the summer. Bartlett Springs are probably the best known.

The longest run-off record in Cache Creek basin dates back to 1900. The wettest year since that date was 1904, and the driest 1908. The flow for the wettest year was more than three times as great as that for the driest. The following gaging stations have been maintained in this basin:

Cache Creek at Lower Lake (1901 to 1908).
Cache Creek near Yolo (1903 to 1908).

[a] For a detailed account of storage on Cache Creek see Water-Supply Paper 45.

CACHE CREEK AT LOWER LAKE, CAL.

This station, which was established January 1, 1901, to determine the outflow of Clear Lake, is located a short distance above the wagon bridge just below the outlet of Clear Lake and about 1 mile from Lower Lake.

No tributaries enter above the station except those which come into Clear Lake. Siegler Creek enters about 300 feet below the station, but it is very small except in flood flow of short periods. North Fork joins the main creek about 14 miles below the lake.

The flow at the station is regulated by Clear Lake, which diminishes the intensity of floods and prolongs the summer flow. The gage datum has remained unchanged during the life of the station.

The records are excellent. The section is practically constant, and the station has been well rated.

The following measurement was made September 20, 1907:

Width, 55 feet; area, 118 square feet; gage height, 345 feet; discharge, 158 second-feet.

Daily gage height, in feet, of Cache Creek at Lower Lake, Cal., for 1907 and 1908.

[J. R. Anderson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.9	5.25	6.2	11.5	9.0	6.4	5.35	4.45	3.7	3.6	3.2	3.05
2	3.85	5.55	6.2	11.4	8.9	6.35	5.35	4.4	3.65	3.3	3.15	3.0
3	3.9	5.9	6.15	11.3	8.75	6.3	5.25	4.4	3.65	3.3	3.15	3.0
4	4.2	6.0	6.15	11.2	8.6	6.25	5.25	4.35	3.65	3.25	3.15	3.1
5	4.2	6.1	6.35	11.15	8.4	6.2	5.2	4.35	3.65	3.25	3.15	3.0
6	4.2	6.2	6.25	11.1	8.4	6.15	5.2	4.3	3.65	3.25	3.15	3.2
7	4.2	6.2	6.25	11.0	8.35	6.2	5.25	4.3	3.65	3.25	3.15	3.2
8	4.25	6.25	6.3	10.95	8.3	6.2	5.1	4.25	3.6	3.2	3.1	3.1
9	4.5	6.3	6.5	10.9	8.25	6.05	5.05	4.25	3.6	3.2	3.15	3.1
10	4.5	6.25	6.5	10.8	8.25	6.0	5.05	4.2	3.6	3.2	3.15	3.25
11	4.45	6.25	6.7	10.7	8.5	6.0	5.0	4.15	3.6	3.2	3.1	3.2
12	4.6	6.25	6.55	10.6	8.3	5.95	4.95	4.1	3.6	3.25	3.1	3.2
13	4.45	6.2	6.6	10.5	8.2	5.9	4.95	4.1	3.55	3.2	3.2	3.2
14	4.6	6.2	6.6	10.4	8.0	5.85	4.9	4.1	3.55	3.2	3.1	3.25
15	4.5	6.2	6.6	10.3	7.9	5.8	4.9	4.05	3.55	3.2	3.1	3.3
16	4.5	6.2	6.65	10.2	7.8	5.8	4.85	4.05	3.5	3.2	3.15	3.3
17	4.6	6.2	7.9	10.15	7.75	5.75	4.85	4.05	3.5	3.2	3.0	3.3
18	4.7	6.2	8.9	10.3	7.5	5.75	4.8	4.0	3.5	3.2	3.1	3.3
19	4.7	6.2	9.7	10.2	7.4	5.7	4.8	4.0	3.45	3.2	3.15	3.4
20	4.65	6.15	10.1	10.1	7.3	5.7	4.75	4.0	3.45	3.2	3.1	3.3
21	4.65	6.15	10.45	10.05	7.2	5.75	4.75	3.95	3.45	3.2	3.0	3.3
22	4.65	6.2	10.5	10.0	7.0	5.6	4.7	3.9	3.45	3.2	3.0	3.3
23	4.6	6.15	11.25	9.9	6.9	5.6	4.7	3.9	3.4	3.2	3.0	3.35
24	4.7	6.1	11.55	9.8	6.85	5.55	4.65	3.9	3.4	3.15	3.0	3.3
25	4.75	6.3	11.75	9.6	6.7	5.5	4.65	3.85	3.4	3.1	3.0	3.35
26	4.8	6.2	11.75	9.4	6.8	5.5	4.6	3.85	3.4	3.15	2.95	3.5
27	4.9	6.2	11.75	9.4	6.6	5.45	4.55	3.8	3.45	3.2	2.95	3.5
28	4.9	6.2	11.7	9.3	6.5	5.45	4.55	3.8	3.5	3.2	2.95	3.5
29	4.9	......	11.65	9.2	6.5	5.4	4.5	3.8	3.35	3.2	2.95	3.4
30	4.95	......	11.6	9.1	6.5	5.4	4.5	3.75	3.35	3.2	3.0	3.6
31	5.15	......	11.55	......	6.4	......	4.45	3.75	......	3.2	......	3.7
1908.												
1	3.7	4.6	5.75	5.55	4.7	4.15	3.5	3.05	2.6	2.4	1.95	2.05
2	3.7	5.55	5.85	5.45	4.9	4.1	3.45	3.05	2.6	2.3	2.0	2.05
3	3.8	5.0	5.8	5.4	4.75	4.05	3.45	3.05	2.6	2.2	1.95	2.05
4	3.8	5.0	5.8	5.45	4.7	4.0	3.45	3.05	2.6	2.2	2.0	2.1
5	3.8	5.0	5.8	5.45	4.7	4.0	3.45	3.0	2.6	2.2	2.0	2.2

Daily gage height, in feet, of Cache Creek at Lower Lake, Cal., for 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
6	3.85	5.0	5.8	5.4	4.7	3.95	3.4	3.0	2.6	2.2	2.0	2.2
7	3.85	5.2	5.8	5.3	4.65	3.95	3.4	3.0	2.55	2.15	2.0	2.15
8	3.85	5.1	5.8	5.3	4.6	3.95	3.4	3.0	2.55	2.15	1.95	2.1
9	3.9	5.65	5.75	5.25	4.6	3.95	3.35	3.0	2.5	2.2	1.95	2.25
10	3.9	5.5	5.75	5.25	4.55	3.9	3.35	3.0	2.5	2.2	2.0	2.25
11	3.9	5.5	5.75	5.25	4.55	3.85	3.35	3.0	2.4	2.15	2.0	2.3
12	3.9	5.55	5.75	5.25	4.5	3.85	3.35	3.0	2.45	2.15	1.95	2.25
13	3.9	5.6	5.8	5.25	4.5	3.8	3.35	2.95	2.5	2.2	1.95	2.35
14	4.05	5.6	5.8	5.25	4.5	3.8	3.3	2.95	2.5	2.15	1.95	2.3
15	4.0	5.6	5.8	5.2	4.4	3.8	3.3	2.9	2.5	2.2	1.95	2.4
16	4.0	5.6	5.75	5.25	4.4	3.8	3.3	2.9	2.5	2.1	1.9	2.3
17	4.0	5.6	5.75	5.2	4.35	3.8	3.3	2.9	2.45	2.1	1.9	2.25
18	4.0	5.6	5.7	5.2	4.35	3.75	3.3	2.9	2.4	2.1	1.9	2.3
19	4.05	5.5	5.7	5.1	4.4	3.75	3.25	2.9	2.4	2.1	2.0	2.3
20	4.2	5.5	5.7	5.05	4.35	3.7	3.25	2.85	2.4	2.1	[a] 2.5	2.25
21	4.2	5.5	5.65	5.0	4.3	3.7	3.25	2.85	2.35	2.05	1.9	2.3
22	4.25	5.5	5.65	5.0	4.3	3.65	3.25	2.85	2.35	2.0	1.95	2.3
23	4.25	5.45	5.65	4.95	4.3	3.65	3.2	2.8	2.3	2.0	2.3	2.3
24	4.3	5.45	5.65	4.95	4.3	3.6	3.2	2.8	2.35	2.0	2.2	2.3
25	4.4	5.45	5.6	4.9	4.25	3.6	3.2	2.75	2.35	2.0	2.1	2.3
26	4.4	5.5	5.65	4.9	4.25	3.55	3.2	2.75	2.3	2.0	2.1	2.3
27	4.45	5.5	5.7	4.85	4.2	3.5	3.15	2.7	2.3	1.95	2.1	2.3
28	4.45	5.5	5.6	4.85	4.2	3.5	3.15	2.7	2.3	1.95	2.1	2.25
29	4.45	5.6	5.55	4.85	4.2	3.5	3.15	2.65	2.3	1.9	2.05	2.3
30	4.5	....	5.6	4.8	4.2	3.5	3.1	2.65	2.25	1.95	2.05	2.25
31	4.5	....	5.6	....	4.2	....	3.1	2.6	....	1.95	....	2.2

[a] High gage height due to heavy wind on lake.

Rating table for Cache Creek at Lower Lake, Cal., 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.*
1.90	5	3.20	128	4.50	395	6.60	999
2.00	6	3.30	145	4.60	419	6.80	1,063
2.10	8	3.40	164	4.70	444	7.00	1,127
2.20	12	3.50	183	4.80	469	7.20	1,191
2.30	18	3.60	202	4.90	494	7.40	1,257
2.40	27	3.70	222	5.00	520	7.60	1,324
2.50	37	3.80	242	5.20	575	7.80	1,392
2.60	48	3.90	262	5.40	631	8.00	1,460
2.70	59	4.00	282	5.60	690	9.00	1,840
2.80	71	4.10	303	5.80	750	10.00	2,260
2.90	84	4.20	325	6.00	810	11.00	2,760
3.00	97	4.30	348	6.20	872	12.00	3,300
3.10	112	4.40	371	6.40	935		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1905 to 1909, and the general form of previous curves, and is fairly well defined.

Monthly discharge of Cache Creek at Lower Lake, Cal., for 1907 and 1908.

[Drainage area, 500 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	561	252	404	0.808	0.93	24,800	A.
February	903	589	850	1.70	1.77	47,200	A.
March	3,160	856	1,790	3.58	4.13	110,000	A.
April	3,020	1,880	2,450	4.90	5.47	146,000	A.
May	1,840	935	1,360	2.72	3.14	83,600	A.
June	935	631	766	1.53	1.71	45,600	A.
July	617	383	467	.934	1.08	28,700	A.
August	383	232	298	.596	.69	18,300	A.
September	222	154	188	.376	.42	11,200	B.
October	202	112	132	.264	.30	8,120	B.
November	128	90	109	.218	.24	6,490	B.
December	222	97	142	.284	.33	8,730	B.
The year	3,160	90	746	1.49	20.21	539,000	
1908.							
January	395	222	300	.600	.69	18,400	B.
February	705	419	634	1.27	1.37	36,500	A.
March	765	675	726	1.45	1.67	44,600	A.
April	675	469	566	1.13	1.26	33,700	A.
May	494	325	383	.766	.88	23,600	A.
June	314	183	240	.480	.54	14,300	B.
July	183	112	145	.290	.33	8,920	B.
August	104	48	83.0	.166	.19	5,100	C.
September	48	15	32.0	.064	.07	1,900	C.
October	27	5.0	9.52	.019	.02	585	C.
November	[a] 37	5.0	7.68	.015	.02	457	C.
December	27	7.0	15.2	.030	.03	935	C.
The year	765	5.0	262	.523	7.07	189,000	

[a] Maximum caused by high wind on lake.

CACHE CREEK NEAR YOLO, CAL.

This station was established January 1, 1903, at the old wagon bridge on the road from Woodland to Yolo, about 1,000 feet above the railroad bridge, for the purpose of obtaining general statistical and comparative data regarding the flow of Cache Creek. The data are useful in connection with power and irrigation development and in studies of flood prevention in Sacramento Valley. In the fall of 1904 a new bridge was constructed, and the station was reestablished December 4.

No important tributaries enter within 12 or 15 miles of the station.

Many diversions are made from Cache Creek above the station, water being used for irrigation around Yolo and Woodland. The irrigating ditches usually take all the late summer flow. All available water in this basin has been filed upon, and all lands embraced within storage reservoirs are held in private ownership.

The gage datum has remained unchanged during the life of the station.

The records are good, considered as a whole. The bed of the stream is composed of earth, gravel, and sand, and is subject to some change. The banks are steep and well wooded, and their height has been increased by levees, which are overtopped at extremely high water. The current is swift at moderate and high stages. The creek is dry at the station almost every summer or fall.

Discharge measurements of Cache Creek near Yolo, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 12	R. S. Hawley	96	379	5.10	1,520
February 25	do	95	347	4.48	1,270
March 9	do	96	355	4.60	1,390
March 15	do	97	406	5.15	1,850
March 21	do	115	1,200	12.25	6,220
March 30	W. G. Steward	109	847	9.70	5,630
April 1	do	101	806	9.45	5,120
April 27	do	99	487	6.00	2,360
May 6	do	97	436	5.20	1,880
May 17	do	96	383	4.60	1,270
June 21	W. F. Martin	90	261	3.22	695
August 19	do	86	131	1.90	147
September 13	W. A. Lamb	44	59	1.39	55
October 4	do	43	54	1.32	38
October 14	do	36	46	1.19	18
October 29	do	90	119	1.50	91
1908.					
January 3	W. A. Lamb	90	230	3.00	626
January 29	do	91	251	3.35	828
February 6	do	99	564	6.32	2.910
February 11	do	100	512	5.85	2,400
February 17	do	95	323	4.33	1,280
February 25	do	90	275	3.90	975
March 4	do	97	387	4.75	1,640
March 10	do	95	311	4.15	1,210
April 5	do	90	249	3.30	791
April 23	do	90	210	2.85	580
June 23	W. B. Clapp	23	26	1.10	35

NOTE.—Creek dry from August 2 to December 31, 1908. The measurement on March 21, 1907, was made just after the big flood and was possibly affected by back-water from the Yolo basin.

Daily gage height, in feet, of Cache Creek near Yolo, Cal., for 1907 and 1908.

[Cornelia Bigelow, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.7	10.2	4.8	9.4	5.7	3.85	2.95	2.35	1.4	1.2	1.5	1.4
2	2.75	12.6	4.8	9.3	5.5	3.85	2.9	2.3	1.35	1.2	1.55	1.4
3	2.7	10.85	4.65	9.3	5.5	3.8	2.9	2.3	1.35	1.3	1.6	1.4
4	3.2	8.25	4.6	9.2	5.55	3.8	2.9	2.3	1.35	1.3	1.6	1.35
5	7.3	6.5	4.55	9.1	5.4	3.8	2.85	2.25	1.4	1.3	1.55	1.35
6	4.35	6.7	5.3	9.0	5.3	3.75	2.85	2.2	1.5	1.25	1.55	1.35
7	3.95	6.25	4.9	8.75	5.3	3.75	2.85	2.2	1.5	1.25	1.5	1.3
8	4.4	5.8	4.7	8.6	5.2	3.7	2.8	2.15	1.45	1.25	1.5	1.35
9	8.1	5.6	4.8	8.4	5.1	3.7	2.8	2.1	1.45	1.2	1.5	1.4
10	15.65	5.5	6.05	8.15	5.0	3.6	2.8	2.1	1.4	1.2	1.5	1.5
11	6.65	5.3	5.65	8.0	4.9	3.6	2.75	2.05	1.4	1.2	1.5	1.8
12	5.4	5.1	5.5	7.9	4.9	3.55	2.75	2.05	1.35	1.2	1.5	2.1
13	4.75	5.0	5.35	7.7	4.85	3.5	2.75	2.05	1.35	1.2	1.5	2.0
14	4.45	4.9	5.15	7.5	4.8	3.5	2.7	2.0	1.35	1.2	1.5	1.9
15	4.25	4.8	4.9	7.4	4.7	3.45	2.7	2.0	1.35	1.2	1.5	2.0
16	4.0	4.7	5.0	7.2	4.6	3.45	2.65	1.95	1.3	1.2	1.5	1.95
17	4.55	4.65	6.8	7.1	4.5	3.4	2.65	1.95	1.3	1.2	1.5	1.9
18	4.3	4.9	19.45	6.95	4.4	3.35	2.65	1.9	1.3	1.15	1.5	1.85
19	3.95	4.9	25.9	6.8	4.35	3.35	2.6	1.9	1.25	1.15	1.5	1.8
20	3.85	4.7	18.2	6.7	4.3	3.3	2.6	1.9	1.25	1.15	1.5	1.8
21	3.85	4.65	12.65	6.6	4.2	3.25	2.6	1.85	1.2	1.15	1.45	1.9
22	3.8	4.6	12.0	6.55	4.1	3.2	2.55	1.85	1.2	1.5	1.4	2.0
23	3.8	4.55	20.85	6.4	4.1	3.2	2.55	1.8	1.2	1.5	1.4	1.9
24	3.9	4.5	19.3	6.3	4.1	3.15	2.5	1.8	1.15	1.5	1.4	1.85
25	4.05	4.7	16.15	6.2	4.0	3.1	2.5	1.75	1.15	1.55	1.4	1.85

Daily gage height, in feet, of Cache Creek near Yolo, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	4.3	5.0	12.55	6.1	4.0	3.1	2.5	1.7	1.15	1.6	1.4	1.85
27	4.4	4.8	11.0	6.0	3.95	3.0	2.45	1.65	1.1	1.6	1.45	2.1
28	7.1	4.65	10.35	6.0	3.95	3.0	2.45	1.65	1.1	1.55	1.45	2.6
29	6.3		10.0	5.9	3.9	2.95	2.4	1.5	1.1	1.5	1.45	2.4
30	5.05		9.65	5.8	3.9	2.95	2.4	1.4	1.1	1.5	1.4	2.4
31	5.15		9.5		3.9		2.35	1.4		1.5		4.5
1908.												
1	4.45	3.65	7.4	3.4	2.55	1.75	.85	.5				
2	3.65	6.5	6.0	3.4	2.5	1.7	.85	.45				
3	3.2	10.2	5.05	3.35	2.55	1.7	.85					
4	3.0	6.7	4.75	3.35	2.5	1.6	.85					
5	3.05	5.5	4.5	3.3	2.45	1.5	.85					
6	3.7	6.2	4.3	3.3	2.5	1.4	.8					
7	2.5	5.5	4.25	3.3	2.4	1.4	.8					
8	2.45	5.25	4.2	3.25	2.35	1.3	.75					
9	2.45	8.75	4.2	3.2	2.3	1.3	.7					
10	2.7	7.7	4.15	3.2	2.3	1.5	.7					
11	2.6	5.9	4.15	3.15	2.25	1.4	.65					
12	2.5	5.3	4.15	3.15	2.2	1.35	.65					
13	2.45	4.95	4.15	3.1	2.2	1.3	.65					
14	2.8	4.7	4.2	3.1	2.2	1.3	.65					
15	3.3	4.6	4.2	3.05	2.15	1.25	.6					
16	3.05	4.45	4.15	3.05	2.15	1.4	.6					
17	2.85	4.3	4.15	3.0	2.15	1.35	.6					
18	2.7	4.25	4.1	3.0	2.15	1.3	.6					
19	3.05	4.2	4.0	2.95	2.1	1.25	.6					
20	3.25	4.1	3.9	2.95	2.2	1.25	.6					
21	4.65	4.0	3.85	2.9	2.2	1.2	.65					
22	4.05	3.95	3.8	2.9	2.1	1.15	.65					
23	3.8	3.9	3.8	2.9	2.0	1.05	.65					
24	3.85	3.85	3.75	2.85	1.95	0.9	.55					
25	4.65	3.9	3.65	2.85	1.9	0.9	.5					
26	4.0	3.9	3.6	2.85	1.9	0.9	.5					
27	3.75	3.85	3.55	2.8	1.9	.85	.55					
28	3.6	3.85	3.5	2.7	1.9	.85	.55					
29	3.45	4.15	3.5	2.65	1.85	.85	.5					
30	3.4		3.45	2.6	1.85	.85	.5					
31	3.2		3.45		1.75		.5					

NOTE.—The creek was dry, the water standing in pools, from August 2 to December 31, 1908. Gage heights from about March 19 to March 29, 1907, are probably affected by back water from the Yolo basin, which had been flooded by water from Sacramento River.

Rating tables for Cache Creek near Yolo, Cal.

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.*
1.10	10	2.70	430	4.60	1,380	11.00	6,540
1.20	20	2.80	470	4.80	1,500	12.00	7,390
1.30	35	2.90	510	5.00	1,640	13.00	8,240
1.40	50	3.00	550	5.20	1,780	14.00	9,090
1.50	70	3.10	590	5.40	1,920	15.00	9,940
1.60	95	3.20	635	5.60	2,060	16.00	10,790
1.70	120	3.30	680	5.80	2,210	17.00	11,640
1.80	145	3.40	725	6.00	2,370	18.00	12,490
1.90	170	3.50	775	6.20	2,530	19.00	13,340
2.00	200	3.60	825	5.40	2,690	20.00	14,190
2.10	230	3.70	875	5.60	2,850	21.00	15,040
2.20	260	3.80	925	6.80	3,010	22.00	15,890
2.30	290	3.90	980	7.00	3,170	23.00	16,740
2.40	325	4.00	1,035	8.00	3,990	24.00	17,590
2.50	360	4.20	1,145	9.00	4,840	25.00	18,440
2.60	395	4.40	1,260	10.00	5,690	26.00	19,290

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on sixteen discharge measurements made during 1907, and is well defined between gage heights 1.1 feet and 10.0 feet. Above gage height 8 feet the rating curve is a tangent, the difference being 85 per tenth.

Rating tables for Cache Creek near Yolo, Cal.—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.*
0.45	0	2.00	246	3.60	910	5.10	1,870
.50	1	2.10	280	3.70	960	5.20	1,945
.60	3	2.20	315	3.80	1,010	5.30	2,020
.70	5	2.30	352	3.90	1,062	5.40	2,100
.80	8	2.40	391	4.00	1,116	5.50	2,180
.90	13	2.50	431	4.10	1,176	5.60	2,260
1.00	22	2.60	471	4.20	1,238	5.70	2,340
1.10	35	2.70	513	4.30	1,300	5.80	2,420
1.20	50	2.80	555	4.40	1,365	5.90	2,500
1.30	66	2.90	597	4.50	1,435	6.00	2,580
1.40	84	3.00	639	4.60	1,505	7.00	3,380
1.50	104	3.10	681	4.70	1,575	8.00	4,200
1.60	127	3.20	725	4.80	1,645	9.00	5,040
1.70	153	3.30	770	4.90	1,720	10.00	5,900
1.80	182	3.40	815	5.00	1,795	11.00	6,780
1.90	213	3.50	862				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eleven discharge measurements made during 1908 and is well defined.

Monthly discharge of Cache Creek near Yolo, Cal., for 1907 and 1908.

[Drainage area, 1,230 [a] 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	10,500	430	1,750	1.42	1.64	108,000	C.
February	7,900	1,320	2,360	1.92	2.00	131,000	C.
March [b]	19,200	1,350	5,380	4.37	5.04	331,000	C.
April	5,180	2,210	3,580	2.91	3.25	213,000	B.
May	2,130	980	1,430	1.16	1.34	87,900	B.
June	953	530	747	.607	.68	44,400	B.
July	530	310	421	.342	.39	25,900	B.
August	310	50	189	.154	.18	11,600	B.
September	70	10	36.0	.029	.03	2,140	B.
October	95	15	40.1	.033	.04	2,470	B.
November	95	50	67.5	.055	.06	4,020	B.
December	1,320	35	188	.153	.18	1,160	B.
The year	19,200	10	1,350	1.10	14.83	963,000	
1908.							
January	1,540	411	792	.644	.74	48,700	A.
February	6,080	935	1,950	1.59	1.71	112,000	A.
March	3,710	838	1,270	1.03	1.19	78,100	A.
April	815	471	662	.538	.60	39,400	A.
May	451	167	310	.252	.29	19,100	A.
June	167	10	66.6	.054	.06	3,960	B.
July	10	1	4.48	.0036	.004	275	D.
August	1	0	.03	.00	.00	2	D.
September	0	0	.0	.00	.00	0	
October	0	0	.0	.00	.00	0	
November	9	0	.0	.00	.00	0	
December	0	9	.0	.00	.00	0	
The year	6,080	0	421	.343	4.59	302,000	

[a] Area revised since 1906 report.
[b] Discharges for the high-water period in March may be too large, as measurement made March 21 gave results 18 per cent smaller than the rating curve.

NOTE.—The creek was dry from August 2 to December 31, 1908.

PUTA CREEK DRAINAGE BASIN.

DESCRIPTION.

The Puta Creek drainage basin lies on the eastern slope of the Coast Range south of the Cache Creek basin and north of Napa Valley. It includes the southern part of Lake County, the northern half of Napa County, and small parts of Yolo and Solano counties. The basin is rather long from northwest to southeast and comparatively narrow, being about 20 miles wide at the north and less than 10 miles at the east. It has a total area of about 810 square miles.

Puta Creek rises in the northwestern corner of the basin in the St. Helena Range, and flows southeastward into the Yolo basin near Davis, and thence into Sacramento River through Cache Slough. The total length of the creek is about 80 miles. It has numerous tributaries which have a heavy flood discharge in the winter but are practically dry during the summer. The chief tributaries are Soda Creek from the north and Pope Creek from the west.

The topography of the Puta Creek basin is very rugged. Much of the upper basin is rough and precipitous. The underlying rock is an impervious slate and serpentine with only a thin soil covering. There is very little tilled land in the basin except below the foothills. Altitudes range from about 100 feet in the valley to about 5,000 feet on the mountain summits.

The lower parts of the basin are comparatively barren of timber, though they have a considerable growth of grass and brush which extends down as far as the foothills. Moderate elevations have scattering timber, and the mountain summits have a fairly heavy timber growth.

The mean annual precipitation varies widely in the different parts of the basin. Along the foothills it averages about 28 inches, in the central part about 40 inches, and along the crest of the divide, where some of it occurs as snowfall in the winter, about 65 inches. Helen Mine, on the northern slope of Mount St. Helena, receives almost 100 inches annually.

Below the foothills is a large area of rich irrigable land, which could be supplied with water from Puta Creek. Some of this land is already irrigated and has been proved to be susceptible of the highest state of cultivation.

At least two good reservoir sites exist on the main stream—one near Winters and the other near Guenoc.

Only a small amount of power could be developed continuously in the Puta Creek basin without storage, because of the torrential nature of the streams. By utilizing the storage sites, however, many thousands of horsepower could be developed.

The longest run-off record on Puta Creek dates back to 1904. The wettest year since that date was 1907 and the driest 1908. The total flow in the driest year was 30 per cent of that in the wettest.

A gaging station was maintained on Puta Creek near Guenoc from February 12, 1904, to July 31, 1906. The only station now maintained in the basin is that on Puta Creek at Winters, 1905 to 1908.

PUTA CREEK AT WINTERS, CAL.

This station, which is located about 450 feet below the railroad bridge and 800 feet southeast of the railroad station at Winters, was established September 26, 1905, to determine the amount of water available for storage in the proposed reservoir near Winters. The data are very valuable for irrigation and power projects and for use in connection with any plan for flood prevention in the Sacramento Valley.

No important tributaries enter the creek within several miles of the station.

No water is diverted above the station, but a small quantity is diverted at the station for irrigation by pumping. Recent filings have been made on water in this basin and all reservoir sites are embraced within lands held by private ownership.

The gage datum has remained unchanged during the life of the station.

The records are good except at very low stages, when, owing to the width of channel and its tendency to shift somewhat, gage heights are not of much value.

Discharge measurements of Puta Creek at Winters, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 9	R. S. Hawley	200	2,450	17.35	13,000
Do	do	200	2,500	17.70	13,200
Do	do	200	2,570	18.10	13,900
January 10	do	192	1,640	13.35	7,370
Do	do	200	1,850	14.40	8,150
Do	do	190	1,540	12.85	7,110
Do	do	189	1,420	12.20	6,290
February 12	do	176	294	6.80	802
February 26	do	174	236	6.50	619
March 12	do	175	471	7.90	1,820
March 19	do	214	3,290	22.15	22,500
Do	do	212	3,070	21.20	18,000
March 20	do	197	2,150	16.90	10,000
Do	do	194	1,910	15.60	8,130
March 28	do	179	1,060	8.85	3,260
April 28	W. G. Steward	56	123	5.30	386
May 7	do	51	109	5.05	281
May 23	do	50	99	4.75	201
June 22	W. F. Martin	47	77	4.28	85
July 8	do	47	70	4.10	54
August 20	do	46	58	3.90	21
September 14	W. A. Lamb	14	35	3.90	17
October 5	do	14	35	3.90	17
October 30	do	18	39	3.96	23
1908.					
January 4	W. A. Lamb	106	183	5.52	554
January 28	do	110	181	5.75	602
February 5	do	176	585	7.40	1,900
February 13	do	175	316	6.45	1,010
February 24	do	93	142	5.50	352
February 28	do	60	132	5.40	311
March 4	do	171	402	6.85	1,450
March 9	do	133	204	5.88	578
March 13	do	75	139	5.60	421
April 4	do	60	101	5.05	162
April 23	do	60	92	4.88	116
June 23	W. B. Clapp	28	18	4.35	19
December 22	W. F. Martin	58	82	4.68	64

Daily gage height, in feet, of Puta Creek at Winters, Cal., for 1907 and 1908.

[F. S. Wyatt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.25	15.5	6.3	7.5	5.2	4.5	4.2	3.95	3.9	3.95	3.95	4.0
2	......	16.3	......	7.15	5.15	4.5	4.2	3.95	3.9	3.95	3.95	4.0
3	5.85	11.5	6.25	7.05	5.1	4.5	4.15	3.95	3.9	3.95	3.95	4.0
4	11.9	9.95	6.2	7.5	5.1	4.45	4.15	3.95	3.9	3.95	3.95	4.0
5	9.0	8.8	6.2	7.4	5.1	4.45	4.15	3.95	3.9	3.95	3.95	4.0
6	7.25	8.2	8.0	7.3	5.1	4.4	4.15	3.95	3.9	3.95	3.95	4.0
7	7.75	7.8	7.1	7.1	5.05	4.4	4.15	3.9	......	3.9	3.95	4.1
8	7.55	7.5	6.7	6.95	5.05	4.4	4.1	3.95	3.9	3.9	3.95	4.1
9	14.3	7.2	6.6	6.75	5.0	4.4	4.1	3.9	3.9	3.9	3.95	4.2
10	14.95	7.1	8.15	6.55	5.0	4.4	4.1	3.9	3.9	3.9	3.95	4.2
11	9.7	6.9	7.85	6.4	4.95	4.4	4.1	3.9	3.85	3.9	3.95	4.3
12	8.35	6.8	8.05	6.25	4.95	4.4	4.05	3.9	3.9	3.9	3.95	5.0
13	8.0	6.7	7.4	6.15	4.9	4.45	4.05	3.9	3.9	3.9	3.95	4.6
14	7.4	6.6	7.1	6.05	4.9	4.5	4.0	3.9	3.9	3.9	3.95	4.55
15	7.65	6.5	6.95	6.05	4.85	4.5	4.0	3.9	3.9	3.9	3.95	4.55
16	7.1	6.45	7.5	5.95	4.85	4.4	4.0	3.9	3.9	3.9	3.95	4.65
17	8.05	6.4	15.3	5.85	4.8	4.5	4.0	3.9	3.9	3.9	3.95	4.45
18	7.9	6.35	21.6	5.7	4.8	4.45	4.0	3.9	3.9	3.9	3.95	4.55
19	7.2	6.3	23.65	5.6	4.75	4.45	4.0	3.9	3.9	3.9	4.0	4.45
20	7.1	6.25	16.15	5.7	4.75	4.4	4.0	3.9	3.9	3.9	3.95	4.4
21	......	6.2	12.35	5.55	4.75	4.4	4.0	3.9	3.9	3.9	3.95	4.4
22	6.85	......	11.9	5.5	4.75	4.4	4.0	3.9	3.9	3.9	3.95	4.4
23	6.8	6.8	26.6	5.5	4.75	4.4	4.0	3.9	3.9	3.9	4.0	4.4
24	6.75	6.5	15.6	5.45	4.75	4.4	4.0	3.9	3.9	3.9	4.0	4.35
25	6.8	6.4	14.75	5.4	4.7	4.35	4.0	3.9	3.9	3.9	3.95	4.3
26	7.0	6.7	11.4	5.4	4.7	4.3	3.95	3.9	3.9	3.95	4.0	4.6
27	7.2	6.4	10.0	5.35	4.65	4.25	3.95	3.9	3.9	3.95	4.0	4.6
28	14.35	6.3	9.15	5.3	4.65	4.25	3.95	3.9	3.9	3.95	4.0	5.1
29	9.95	......	8.35	5.3	4.6	4.2	3.95	3.9	3.9	3.95	4.0	4.75
30	8.4	......	7.85	5.25	4.55	4.2	3.95	3.85	3.95	3.95	4.0	4.65
31	7.8	......	7.7	......	4.55	......	3.95	3.85	......	3.95	......	8.35
1908.												
1	7.4	5.4	8.75	5.1	4.75	4.55	4.2	4.05	4.0	3.9	4.0	4.2
2	6.45	14.25	8.4	5.1	4.75	4.55	4.15	4.05	4.0	3.9	4.0	4.3
3	5.65	10.6	7.75	5.1	4.75	4.5	4.2	4.05	4.0	3.9	4.05	4.3
4	5.4	7.2	7.2	5.05	4.75	4.5	4.2	4.05	4.0	3.9	4.0	4.3
5	5.6	7.25	6.55	5.05	4.75	4.5	4.2	4.05	3.9	3.9	4.0	4.5
6	5.3	7.0	6.3	5.05	......	4.5	4.1	4.1	3.9	3.95	4.0	5.8
7	5.1	6.9	6.15	5.05	4.7	4.5	4.15	4.1	3.9	3.9	4.0	5.25
8	4.9	6.95	6.0	5.0	4.7	4.5	4.2	4.1	3.9	3.9	4.0	5.0
9	4.95	9.85	5.9	5.0	4.7	4.5	4.15	4.1	4.05	3.9	4.0	5.9
10	4.85	8.5	5.8	5.0	4.7	4.5	4.15	4.1	3.95	3.95	4.0	5.0
11	4.8	7.35	5.75	4.95	4.7	4.5	4.15	4.1	3.95	3.95	4.05	5.8
12	4.7	6.75	5.65	4.95	4.7	4.45	4.15	4.15	3.95	3.95	4.05	5.5
13	4.7	6.45	5.6	4.95	4.7	4.45	4.15	4.15	3.95	4.0	4.05	5.1
14	4.7	6.2	5.6	4.9	4.7	4.45	4.15	4.15	3.95	4.0	4.05	5.05
15	5.8	6.05	5.55	4.9	4.7	4.4	4.2	4.15	4.0	4.0	4.05	4.95
16	5.3	5.95	5.5	4.9	4.7	4.4	4.2	4.1	4.0	4.0	4.05	4.85
17	5.05	5.85	5.45	4.9	4.7	4.4	4.1	4.1	4.0	4.0	4.05	4.8
18	4.95	5.8	5.4	4.9	4.7	4.4	4.1	4.1	4.0	4.0	4.05	4.75
19	5.25	5.75	5.35	4.9	4.7	4.4	4.1	4.05	4.0	3.95	4.05	4.7
20	5.45	5.7	5.3	4.9	4.7	4.4	4.1	4.0	4.0	4.0	4.05	4.7
21	8.0	5.6	5.3	4.85	4.75	4.4	4.1	4.0	3.95	3.95	4.05	4.7
22	8.0	5.55	5.25	4.85	4.75	4.4	4.1	4.0	3.95	3.95	4.2	4.7
23	7.5	5.5	5.2	4.85	4.7	4.35	4.1	4.0	3.95	3.95	......	4.65
24	8.75	5.5	5.2	4.85	4.65	4.35	4.05	4.0	3.95	4.0	4.2	4.65
25	7.5	5.45	5.2	4.85	4.65	4.3	4.05	4.0	3.9	4.0	4.2	4.65
26	6.45	5.45	5.15	4.85	4.6	4.4	4.05	4.0	3.9	4.0	4.35	4.7
27	6.15	5.4	5.15	4.85	4.6	4.25	4.1	4.0	3.9	4.0	4.3	4.7
28	5.8	5.35	5.2	4.8	4.55	4.25	4.1	4.05	3.9	4.0	4.2	4.7
29	5.6	5.6	5.15	4.8	4.55	4.2	4.1	4.05	3.9	4.0	4.2	4.7
30	5.5	......	5.15	4.75	4.55	4.2	4.1	4.0	3.9	4.0	4.2	4.65
31	5.45	......	5.1	......	......	......	4.1	4.0	......	4.0	......	4.65

Rating tables for Puta Creek at Winters, Cal.

JANUARY 1 TO MARCH 19, 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.*
5.80	340	7.40	1,350	9.00	2,660	13.00	6,880
5.90	370	7.50	1,430	9.20	2,840	14.00	8,120
6.00	400	7.60	1,510	9.40	3,020	15.00	9,420
6.10	440	7.70	1,590	9.60	3,200	16.00	10,820
6.20	490	7.80	1,670	9.80	3,400	17.00	12,300
6.30	540	7.90	1,750	10.00	3,600	18.00	13,800
6.40	600	8.00	1,830	10.20	3,800	19.00	15,400
6.50	660	8.10	1,910	10.40	4,000	20.00	17,100
6.60	730	8.20	1,990	10.60	4,200	21.00	19,000
6.70	800	8.30	2,070	10.80	4,400	22.00	21,000
6.80	870	8.40	2,150	11.00	4,600	23.00	23,200
6.90	950	8.50	2,230	11.20	4,800	24.00	25,400
7.00	1,030	8.60	2,310	11.40	5,020	25.00	27,700
7.10	1,110	8.70	2,390	11.60	5,240	26.00	30,000
7.20	1,190	8.80	2,480	11.80	5,460		
7.30	1,270	8.90	2,570	12.00	5,680		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907, and is well defined between gage heights 5.8 feet and 18 feet.

MARCH 20 TO 27, 1907.

[The indirect method for shifting channels used.]

MARCH 28 TO DECEMBER 31, 1907.

3.90	15	5.00	270	6.10	820	7.40	1,800
4.00	32	5.10	304	6.20	880	7.60	1,980
4.10	50	5.20	340	6.30	950	7.80	2,180
4.20	70	5.30	380	6.40	1,020	8.00	2,380
4.30	90	5.40	430	6.50	1,090	8.20	2,580
4.40	110	5.50	480	6.60	1,160	8.40	2,800
4.50	131	5.60	530	6.70	1,230	8.60	3,020
4.60	154	5.70	580	6.80	1,300	8.80	3,240
4.70	180	5.80	640	6.90	1,380	9.00	3,480
4.80	208	5.90	700	7.00	1,460	9.20	3,720
4.90	238	6.00	760	7.20	1,620		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on ten discharge measurements made during March to October, 1907, and is well defined.

JANUARY 1 TO FEBRUARY 1, 1908.

4.70	185	5.80	670	6.90	1,430	8.00	2,370
4.80	215	5.90	730	7.00	1,515	8.10	2,460
4.90	250	6.00	790	7.10	1,600	8.20	2,550
5.00	285	6.10	855	7.20	1,685	8.30	2,640
5.10	320	6.20	920	7.30	1,770	8.40	2,730
5.20	360	6.30	985	7.40	1,855	8.50	2,820
5.30	405	6.40	1,050	7.50	1,940	8.60	2,910
5.40	450	6.50	1,120	7.60	2,025	8.70	3,000
5.50	500	6.60	1,195	7.70	2,110	8.80	3,090
5.60	555	6.70	1,270	7.80	2,195		
5.70	610	6.80	1,350	7.90	2,280		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during latter part of 1907 and early part of 1908, and is well defined.

FEBRUARY 2 TO DECEMBER 31, 1908.

3.90	3	5.20	225	6.50	1,090	8.60	2,910
4.00	4	5.30	270	6.60	1,175	8.80	3,090
4.10	6	5.40	320	6.70	1,260	9.00	3,270
4.20	10	5.50	370	6.80	1,345	9.20	3,450
4.30	16	5.60	420	6.90	1,430	9.40	3,630
4.40	25	5.70	480	7.00	1,515	9.60	3,810
4.50	36	5.80	540	7.20	1,685	9.80	3,990
4.60	50	5.90	610	7.40	1,855	10.00	4,170
4.70	67	6.00	690	7.60	2,025	11.00	5,140
4.80	90	6.10	770	7.80	2,195	12.00	6,160
4.90	120	6.20	850	8.00	2,370	13.00	7,220
5.00	150	6.30	930	8.20	2,550	14.00	8,320
5.10	185	6.40	1,010	8.40	2,730		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 11 discharge measurements made during February to December, 1908, and is well defined between gage heights 4.5 feet and 7.5 feet.

Monthly discharge of Puta Creek at Winters, Cal., for 1907 and 1908.

[Drainage area, 805 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	9,360	355	2,320	2.88	3.32	143,000	B.
February	11,300	490	1,860	2.31	2.40	103,000	B.
March	30,000	490	5,150	6.40	7.38	317,000	C.
April	1,890	360	919	1.14	1.27	54,700	B.
May	340	142	230	.286	.33	14,100	A.
June	131	70	110	.137	.15	6,550	A.
July	70	22	39.9	.050	.06	2,450	A.
August	22	10	16.3	.020	.02	1,000	A.
September	22	10	15.1	.019	.02	898	A.
October	22	15	17.7	.022	.03	1,090	A.
November	32	22	24.7	.031	.03	1,470	A.
December	2,740	32	197	.245	.28	12,100	A.
The year	30,000	10	908	1.13	15.29	657,000	
1908.							
January	3,040	185	808	1.00	1.15	49,700	B.
February	8,600	295	1,390	1.73	1.87	80,000	B.
March	3,040	185	662	.822	.95	40,700	B.
April	185	78	130	.161	.18	7,740	B.
May	78	43	64.7	.080	.09	3,980	B.
June	43	10	27.6	.034	.04	1,640	B.
July	10	5	7.32	.0091	.01	450	B.
August	8	4	5.35	.0066	.008	329	B.
September	5	3	3.55	.0044	.005	211	B.
October	4	3	3.61	.0045	.005	222	B.
November	20	4	6.73	.0084	.009	400	B.
December	610	10	138	.171	.20	8,480	B.
The year	8,600	3	271	.337	4.52	194,000	

FEATHER RIVER DRAINAGE BASIN.

DESCRIPTION.

Feather River heads on the crest of the Sierra and takes a general southerly course to its union with the Sacramento about 30 miles south of Marysville and about 15 miles northwest of Sacramento. Its total length is about 175 miles and its drainage area comprises approximately 6,590 square miles, lying on the western slope of the Sierra Nevada, south of the Pit River basin, and north of the American River basin.

From north to south the principal tributaries of Feather River are Indian Creek, Middle Fork, and Yuba and Bear rivers from the east, and Butt Creek and West Branch from the west. Many smaller or less important tributaries enter the main stream and the tributaries.

The basin is roughly triangular in shape, or rather more like a circular sector whose center is at the mouth of Feather River and arc along the crest of the Sierra from Lassen Peak at the north to Mount Lincoln at the northeast. The western leg of the sector is about 150 miles long, the southern leg 90, and the arc 180.

Feather River basin is naturally subdivided into three other comparatively large basins: Yuba River basin at the south, with a total drainage area of more than 1,300 square miles; Middle Fork basin in the center and at the east, with a total drainage area of about 1,340 square miles; and North Fork basin at the north and west, with a total drainage area of about 2,220 square miles. Yuba basin will be described in connection with the gaging station at Smartsville. Middle Fork basin is long but comparatively narrow except at its east end, where it broadens out and includes Sierra Valley, a large meadow valley at an altitude of 5,000 feet. Beckwith Pass, which opens into this valley from the east, is the lowest pass in the Sierra Nevada, and has an elevation of about 5,200 feet. Sierra Valley and the surrounding country are very dry in the summer. The greatest elevation in the Middle Fork basin is about 8,500 feet.

The drainage basin of the North Fork, here regarded as the main stream, includes the eastern part of Butte, the greater part of Plumas, and the southwestern corner of Lassen counties. The junction of North and Middle forks is in Butte County, about 6 miles northeast of Oroville. The length of North Fork basin does not exceed 75 miles, and its width in Plumas County is about 65 miles.

Above Prattville are two small basins of almost equal size, the eastern being drained by Hamilton Branch and the western by North Fork. The eastern basin ranges in elevation from 4,300 to 7,500 feet, has an area of 230 square miles, and includes the East Arm of Big Meadows and the large, level area called Mountain Meadows. The western basin has an area of 245 square miles, from 4,300 to 10,000 feet in altitude, and includes the West Arm of Big Meadows, and the higher elevations about Lassen Peak. Hamilton Branch and North Fork unite about 3 miles east of Prattville, at the lower end of Big Meadows.

Butt Creek joins North Fork from the west about 12 miles south of Prattville. It has a total drainage area of 74 square miles. Indian Creek enters North Fork from the east about 20 miles southwest of Prattville, and has a total drainage area of about 1,020 square miles.

The greater part of the Feather River drainage area is rough and mountainous and is well trenched by numerous stream channels which drain the slopes of the mountains. The rocks in the southern and eastern parts of the basin are principally granite, with a good soil covering. At the lower elevations some porous and deeply eroded slates and lavas are also found. The northern part of the basin is characterized by cones, craters, deposits of volcanic ash, and lakes, which indicate recent volcanic activity. The basin has a good covering of porous soil, which absorbs the moisture readily and serves to equalize the stream flow. The numerous meadows and valleys that exist in different parts of the area also help to maintain a steady flow during the dry season.

The Feather River drainage basin has a good forest cover, consisting for the most part of brush and scrubby timber on the lower elevations and commercial timber on the mountain sides, except around the summits of the highest peaks like Lassen. About two-thirds of the entire basin, 4,300 square miles in round numbers, is inclosed in national forest reserves, which include all the upper part of the basin except Sierra Valley on Middle Fork, the Meadows around Prattville on North Fork, and a few other very small valleys.

The mean annual precipitation in the Feather basin is about 30 inches in the foothill belt, and increases with elevation to the mountain summits. It ranges from 40 to 60 inches in the North and Middle Fork basins at the north and east, and from 40 to 75 inches at the Yuba basin at the south. In the winter much of it occurs as snowfall which does not disappear from the summits until summer.

Very little irrigation is practiced in the Feather basin. Some water is diverted for use in the small valleys and in the Sacramento Valley below the foothills, but only on a small scale. Considerable water is used for mining and power.

Opportunities for storage in this basin are excellent, especially on the North and Middle forks. Surveys of a large number of reservoir sites in this area have been made by the United States Reclamation Service and many others have been made by private companies.

The minimum flow of the streams in the Feather River basin is sufficient to develop more than half a million horsepower, and this amount could be almost doubled with storage. On North Fork alone about 300,000 horsepower could be developed at low water, and with storage half a million would be available. On Middle Fork only about 66,000 could be developed at low water, and on Yuba River only about 130,000. At the present time the Great Western Power Company is actively engaged in developing its holdings in the North Fork basin.

The basin has many large springs, especially in the lava districts, which supply a more or less steady flow throughout the year. In the North Fork basin, especially, are large perennial springs discharging 50 to 100 second-feet. One of the largest, Dotta Spring, about 3 miles east of Prattville, has a maximum discharge of 100 second-feet and a minimum of 70 second-feet. Many perennial springs are also found in the Yuba basin. The Feather basin also contains many small glacial lakes, chiefly in Yuba and North Fork basins.

The longest run-off record in the Feather basin goes back to 1902. The wettest year since that time was 1907, when a severe flood occurred, and the driest was 1908. The total flow in the driest year was about one-third of that in the wettest. Other historic floods of Feather River occurred in 1849, 1853, 1861, and 1881. At none of these, however, was the stage at Oroville so high as in March, 1907. This may have been due in part or entirely to the absence of mining débris which has been filling the channel at or below Oroville during recent years.

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

- North Fork of Feather River above Prattville (1905 to 1907).
- North Fork of Feather River below Prattville (1905 to 1908).
- North Fork of Feather River near Big Bend (1905 to 1908).
- Feather River at Oroville (1902 to 1908).
- Hamilton Branch near Prattville (1905 to 1907).
- Butt Creek near Butte Valley (1905 to 1908).
- Indian Creek near Crescent Mills (1905 to 1908).
- Yuba River near Smartsville (1903 to 1908).
- Bear River at Van Trent, above Wheatland (1904 to 1908).

NORTH FORK OF FEATHER RIVER ABOVE PRATTVILLE, CAL.

This station, which was established June 12, 1905, to determine the availability of the North Fork for power development, is located 3 miles east of Prattville and about 1,300 feet above the junction with Hamilton Branch. The drainage area above the station is 245 square miles. This station was discontinued July 1, 1907.

The channel has a shale bottom subject to slight change. At low water it is about 65 feet wide and 5 feet deep; at high water there is a diversion overflow around the station, leaving the main stream about 1½ miles above the point of measurement.

The following record has been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station from the date of its establishment:

Discharge measurements of North Fork of Feather River above Prattville, Cal., in 1905 and 1906.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
June 12	R. W. Armstrong	2.33	890	February 28	L. J. Bevan	1.82	669
June 22	W. E. Spear	1.79	620	April 12	do	2.77	1,046
July 1	do	1.48	520	May 15	do	3.83	1,524
July 15	R. W. Armstrong	1.23	407	July 7	do	2.48	929
July 28	W. E. Spear	1.09	399	August 8	do	1.34	502
August 15	L. J. Bevan	.99	370				
September 4	do	.90	345				
December 17	do	.80	330				

Daily gage height, in feet, of North Fork of Feather River above Prattville, Cal., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1						3.17	16		1.55	1.43			
2		2.76	1.81				17						
3							18					3.98	
4				2.50	3.88		19	1.00					
5	1.04						20						
6							21						
7							22						
8							23		2.25				
9		2.50	1.76				24						
10							25					3.12	
11					3.93		26	1.02					
12	1.02			3.53			27						
13							28						
14							29						2.55
15							30						
							31						

Rating tables for North Fork of Feather River above Prattville, Cal.

FOR 1905.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	325	1.20	425	1.60	550	1.90	660
.90	345	1.30	455	1.70	585	2.00	700
1.00	370	1.40	485	1.80	620	2.10	740
1.10	395	1.50	515				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1905 and is well defined.

FOR 1906 AND 1907.

0.80	350	1.70	620	2.60	975	3.50	1,370
.90	375	1.80	655	2.70	1,015	3.60	1,415
1.00	400	1.90	695	2.80	1,055	3.70	1,465
1.10	425	2.00	735	2.90	1,100	3.80	1,515
1.20	450	2.10	775	3.00	1,145	3.90	1,565
1.30	480	2.20	815	3.10	1,190	4.00	1,615
1.40	515	2.30	855	3.20	1,235	4.10	1,665
1.50	550	2.40	895	3.30	1,280	4.20	1,715
1.60	585	2.50	935	3.40	1,325		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during 1906 and the form of the 1905 curve at low water and is well defined above gage height 1.3 feet.

Monthly discharge of North Fork of Feather River above Prattville, Cal., for 1905 to 1907.

[Drainage area, 245 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.							
June 17-30	732	518	611	2.49	1.30	17,000	A.
July	515	385	436	1.78	2.05	26,800	A.
August	385	345	365	1.49	1.72	22,400	A.
September	358	329	341	1.39	1.55	20,300	A.
October	345	333	338	1.38	1.59	20,800	A.
November	339	329	332	1.36	1.52	19,800	A.
December	340	315	326	1.33	1.53	20,000	A.
The period						147,000	

Monthly discharge of North Fork of Feather River above Prattville, Cal., for 1905 to 1907—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1906.							
January	613	340	442	1.80	2.08	27,200	B.
February	695	448	553	2.26	2.35	30,700	B.
March	971	515	668	2.73	3.15	41,100	B.
April	1,060	655	923	3.77	4.21	54,900	B.
May	1,690	1,020	1,360	5.55	6.40	83,600	A.
June	1,460	963	1,200	4.90	5.47	71,400	A.
July	960	530	730	2.98	3.44	44,900	A.
August	530	440	471	1.92	2.21	29,000	B.
September	430	380	404	1.65	1.84	24,000	B.
October	390	365	373	1.52	1.75	22,900	B.
November	500	388	404	1.65	1.84	24,000	B.
December	951	385	522	2.13	2.46	32,100	B.
The year	1,690	340	671	2.74	37.20	486,000	
1907.							
January	585	375	425	1.73	1.99	26,100	B.
February	2,400	568	974	3.98	4.14	54,100	A.
March	3,900	515	1,350	5.51	6.35	83,000	C.
April	2,400	935	1,450	5.92	6.60	86,300	B.
May	1,700	1,200	1,490	6.08	7.01	91,600	A.
June	1,370	955	1,150	4.69	5.23	68,400	B.
The period	....	....	....	....	....	410,000	

NOTE.—These discharges were computed by the United States Geological Survey from data furnished by the Great Western Power Company. The daily discharge for days when there were no gage readings was estimated with the aid of a hydrograph, following the rise and fall at the station below Prattville, where daily observations were obtained most of the time. The sum of the monthly means for this station and the one on Hamilton Branch have been compared with those for the station below Prattville, and the ratios indicate that the values as a whole are good. Gage heights for 1905 and 1906 are given in Water-Supply Paper 213, pp. 129-130.

NORTH FORK OF FEATHER RIVER BELOW PRATTVILLE, CAL.

This station was established November 22, 1905, to determine the quantity of water available for storage and power development at the dam site. Previous to that date, however, the Great Western Power Company had installed a gage rod and maintained a daily record since June 13, 1905, making gagings by means of a boat. The station is located in the canyon at the proposed dam site of the Great Western Power Company, about 3 miles below the Meadow View bridge crossing on the Prattville-Greenville road, and about 5 miles southeast of Prattville. Gagings are made from a cable.

Butt Creek enters from the west about 5 miles below the station, and Indian Creek from the east about 15 miles below, and North Fork and Hamilton Branch unite about 5 miles above.

The Great Western Power Company probably owns all the water rights above this station.

Thin sheet ice is formed occasionally, but does not affect the records.

The gage datum has remained unchanged during the life of the station and the record is good. The bed is rocky and is not likely to change materially. The current is swift at high water, but has moderate velocity at other stages. At low water the stream is about 60 feet wide and has a maximum depth of 9 feet.

During the past two years this station has been maintained by the Great Western Power Company under the direction of Viele, Blackwell, and Buck, who have furnished the following data through L. J. Bevan, the company's hydrographer.

Discharge measurements of North Fork of Feather River below Prattville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Gage height.	Discharge.
1907.		*Feet.*	*Sec.-ft.*
January 22	L. J. Bevan	2.22	722
April 22	do	7.64	3,680
July 23	do	3.30	1,130
August 27	do	2.77	900
1908.			
August 17	L. J. Bevan	2.23	701

Daily gage height, in feet, of North Fork of Feather River below Prattville, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.20	4.20	4.25	5.60	7.25	6.80	4.40	3.10	2.65	2.45	2.55	2.35
2	2.90	6.50	4.05	5.55	7.10	6.85	4.25	3.05	2.65	2.45	2.55	2.35
3	2.80	8.35	3.95	5.50	7.10	6.85	4.20	3.05	2.65	2.45	2.50	2.35
4	2.50	9.45	3.90	5.45	7.50	6.80	4.15	3.05	2.65	2.45	2.45	2.40
5	2.40	9.30	4.00	5.50	7.00	6.70	4.10	3.00	2.65	2.45	2.40	2.45
6	2.50	9.10	4.05	5.55	6.95	6.50	4.05	3.00	2.65	2.45	2.40	2.55
7	2.50	8.10	3.85	5.70	6.95	6.50	4.00	3.00	2.65	2.40	2.35	3.20
8	2.50	6.80	3.68	5.80	6.85	6.30	3.90	3.00	2.65	2.40	2.35	3.25
9	2.50	5.60	3.70	5.80	6.90	6.00	3.85	2.95	2.60	2.40	2.35	3.20
10	2.50	5.18	3.70	5.85	7.00	5.75	3.80	2.95	2.60	2.40	2.40	3.20
11	2.50	4.85	3.65	6.50	7.25	6.30	3.75	2.95	2.60	2.40	2.40	3.45
12	2.50	4.60	3.45	7.25	7.25	7.25	3.70	2.90	2.55	2.40	2.35	3.25
13	2.45	4.40	3.35	7.65	7.30	7.05	3.65	2.90	2.55	2.40	2.35	3.25
14	2.45	4.22	3.30	a 8.55	6.85	6.90	3.60	2.90	2.55	2.60	2.35	3.00
15	2.40	4.15	3.40	9.50	6.85	6.80	3.60	2.85	2.55	2.55	2.35	2.80
16	2.35	4.15	4.50	8.85	6.90	6.70	3.55	2.85	2.55	2.55	2.30	2.70
17	2.30	4.10	8.40	8.15	7.00	6.60	3.50	2.85	2.55	2.50	2.30	2.65
18	a 2.27	4.25	13.00	a 8.00	7.00	6.50	3.45	2.80	2.55	2.45	2.40	2.55
19	2.25	4.25	16.00	7.90	7.20	6.40	3.45	2.80	2.55	2.40	2.40	2.50
20	2.26	4.25	14.60	8.25	7.50	6.30	3.40	2.80	2.50	2.40	2.35	2.40
21	2.30	4.25	12.00	7.90	7.40	6.20	3.35	2.75	2.50	2.40	2.30	2.40
22	2.30	4.35	8.50	7.64	7.30	6.10	3.30	2.75	2.50	2.45	2.30	2.47
23	2.34	4.40	6.40	7.60	7.20	6.00	3.25	2.75	2.45	2.45	2.35	2.55
24	2.35	4.50	6.30	7.70	7.10	4.95	3.25	2.75	2.45	2.45	2.35	2.57
25	2.35	4.80	6.30	7.85	7.05	4.85	3.20	2.75	2.45	2.40	2.35	2.57
26	2.40	4.75	6.25	7.50	7.00	4.80	3.20	2.75	2.40	2.45	2.35	3.10
27	2.45	4.43	6.10	7.40	6.90	4.70	3.15	2.75	2.40	2.50	2.30	4.05
28	2.55	4.20	6.00	7.40	6.80	4.70	3.15	2.70	2.45	2.50	2.30	4.00
29	2.73	....	5.90	7.55	6.70	4.60	3.15	2.70	2.45	2.50	2.30	3.00
33	2.80	....	5.75	7.40	6.65	4.30	3.10	2.70	2.45	2.60	2.25	2.25
31	3.25	....	5.70	....	6.60	....	3.10	2.70	....	2.70	....	2.30

a Estimated.

Daily gage height, in feet, of North Fork of Feather River below Prattville, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	2.27	2.45	2.18	3.46	4.17	....	2.56	*a* 2.05	1.99	1.93	2.07	1.99
2	2.57	2.10	2.24	3.42	4.44	....	2.58	....	1.95	1.93	2.02	2.00
3	2.43	2.23	2.48	3.52	4.38	....	2.54	....	1.96	1.93	2.00	2.03
4	2.48	2.50	2.38	3.70	4.13	....	2.50	....	1.98	1.93	1.98	2.30
5	2.48	2.45	2.39	3.86	3.92	....	2.49	....	1.98	1.93	1.98	2.30
6	2.45	2.47	2.33	3.88	3.85	3.38	2.47	*a* 2.04	1.98	1.92	1.96	2.28
7	2.44	2.51	2.34	3.68	3.96	3.40	2.44	....	1.99	1.92	1.95	2.15
8	2.45	2.50	2.34	3.51	4.16	3.45	2.40	....	1.96	1.93	1.98	2.12
9	2.43	2.43	2.40	3.52	3.91	3.42	2.37	....	1.95	1.93	1.98	2.08
10	2.42	2.42	2.45	3.60	3.75	3.40	2.40	....	1.95	1.93	1.98	2.02
11	2.45	2.43	2.50	3.71	3.76	3.42	2.36	*a* 2.03	1.94	1.95	1.97	1.93
12	2.45	2.40	2.60	3.84	3.95	3.44	2.36	....	1.95	1.95	1.97	1.98
13	2.50	2.35	2.66	4.02	3.84	3.45	2.33	....	1.98	1.94	1.96	1.96
14	2.77	2.34	2.84	4.14	3.88	3.50	2.30	....	1.98	1.97	1.96	1.96
15	2.91	2.33	3.03	4.25	4.24	3.54	2.27	....	1.96	2.58	1.95	1.88
16	2.91	2.32	3.26	4.36	4.33	3.45	2.25	*a* 2.07	2.02	2.46	1.95	1.87
17	2.89	2.35	3.57	4.34	4.22	3.32	2.22	....	2.03	2.18	1.94	1.86
18	2.97	2.30	3.95	4.33	4.20	3.20	2.18	....	2.00	2.10	1.94	1.83
19	3.15	2.29	4.14	4.23	4.31	3.08	2.18	....	1.98	2.07	1.94	1.83
20	3.30	2.30	4.17	4.38	4.23	3.02	2.16	....	1.98	2.05	2.05	1.84
21	3.32	2.30	4.15	4.58	4.00	3.08	2.13	*a* 2.00	1.95	2.02	2.40	1.83
22	3.37	2.32	4.17	4.62	3.90	3.11	2.14	....	1.94	1.99	2.46	1.85
23	3.32	2.37	4.18	4.50	3.89	2.98	2.11	....	1.93	1.98	2.50	1.86
24	3.38	2.41	4.21	4.32	3.92	2.86	2.10	....	1.93	1.98	2.35	1.86
25	3.17	2.46	4.41	4.33	4.00	2.77	2.10	....	1.93	1.98	2.23	1.86
26	3.02	2.53	4.33	4.25	4.07	2.73	....	....	1.93	1.98	2.10	1.86
27	2.90	2.70	4.11	4.15	4.02	2.68	....	....	1.84	1.97	2.02	....
28	2.77	2.73	3.88	4.13	3.87	2.65	....	....	1.94	1.97	2.00	....
29	2.64	2.58	3.72	4.16	3.89	2.61	*a* 2.07	2.00	1.93	1.99	1.99	....
30	2.60	....	3.70	4.11	3.96	2.58	....	2.00	1.93	2.14	1.99	....
31	2.52	....	3.58	....	....	....	....	2.00	....	2.13	....	....

a Estimated.

Rating table for North Fork of Feather River below Prattville, Cal., for 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.*
1.75	535	3.20	1,094	4.70	1,832	7.40	3,466
1.80	553	3.30	1,140	4.80	1,885	7.60	3,603
1.90	589	3.40	1,188	4.90	1,939	7.80	3,743
2.00	625	3.50	1,236	5.00	1,993	8.00	3,882
2.10	661	3.60	1,283	5.20	2,102	9.00	4,575
2.20	697	3.70	1,331	5.40	2,214	10.00	5,283
2.30	733	3.80	1,380	6.60	2,327	11.00	6,007
2.40	770	3.90	1,428	5.80	2,444	12.00	6,743
2.50	818	4.00	1,477	6.00	2,564	13.00	7,495
2.60	846	4.10	1,527	6.20	2,686	14.00	8,263
2.70	884	4.20	1,577	6.40	2,821	15.00	9,047
2.80	924	4.30	1,627	6.60	2,938	16.00	9,847
2.90	964	4.40	1,677	6.80	3,067	17.00	10,663
3.00	1,006	4.50	1,728	7.00	3,198		
3.10	1,049	4.60	1,780	7.20	3,331		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907 and is well defined between gage heights 1.9 feet and 7.7 feet.

Monthly discharge of North Fork of Feather River below Prattville, Cal., for 1907 and 1908.

[Drainage area, 506 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	1,120	715	814	1.61	1.86	50,100	A.
February	4,890	1,530	2,300	4.55	4.74	128,000	A.
March	9,850	1,140	2,800	5.53	6.38	172,000	A.
April	4,930	2,240	3,290	6.50	7.25	196,000	A.
May	3,530	2,940	3,230	6.38	7.36	199,000	A.
June	3,360	1,630	2,650	5.24	5.85	158,000	A.
July	1,680	1,050	1,280	2.53	2.92	78,700	A.
August	1,050	884	951	1.88	2.17	58,500	A.
September	865	770	826	1.63	1.82	49,200	A.
October	884	770	794	1.57	1.81	48,800	A.
November	827	715	758	1.50	1.67	45,100	A.
December	1,500	715	939	1.86	2.14	57,700	A.
The year	9,850	715	1,720	3.40	45.97	1,240,000	
1908.							
January	1,180	721	917	1.81	2.09	56,400	A.
February	1,880	660	809	1.60	1.73	46,500	A.
March	1,680	711	1,140	2.25	2.59	70,100	A.
April	1,790	1,200	1,500	2.96	3.30	89,300	A.
May	1,700	1,360	1,500	2.96	3.41	92,200	A.
June	1,400	839	1,110	2.19	2.44	66,000	A.
July	839	640	723	1.43	1.65	44,500	A.
August	650	625	635	1.25	1.44	39,000	C.
September	636	598	610	1.21	1.35	36,300	C.
October	840	595	632	1.25	1.44	38,900	A.
November	809	602	647	1.28	1.43	38,500	A.
December	733	562	612	1.21	1.40	37,600	A.
The year	1,880	562	903	1.78	24.27	655,000	

NOTE.—Values for 1908 are based on daily discharges computed for the Great Western Power Company. Practically the same rating table was used as for 1907.

NORTH FORK OF FEATHER RIVER NEAR BIG BEND, CAL.

This station, which was established June 13, 1905, to determine the availability of the North Fork for power development, is located about 300 feet above the head of Big Bend tunnel and about 20 miles north of Oroville.

No important tributaries enter for many miles above the station. West Branch enters from the west about 10 miles below the station by river, and Middle Fork comes in from the east about 20 miles below.

During 1908 the gage was changed several times, owing to construction work about the head of Big Bend tunnel.

The stream has a rock channel which is practically permanent. At low water the stream is about 85 feet wide and 19 feet deep and has a sluggish but uniform current.

The following record has been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station since its establishment.

Discharge measurements of North Fork of Feather River near Big Bend, Cal., in 1905 to 1908.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1907.		*Feet.*	*Sec.-ft.*
June 13	W. E. Spear	4.15	3,750	March 18[a]	L. J. Bevan	31.00	91,000
July 13	do	2.75	1,352	July 5	do	4.99	3,267
August 20	L. J. Bevan	2.14	1,048	August 13	do	3.18	1,750
September 16	do	2.07	1,003	August 21	do	2.96	1,654
October 22	do	2.15	1,038	October 9	do	2.66	1,364
December 5	do	2.25	1,101	1908.			
1906.				July 14	L. J. Bevan	[b] 1.82	1,418
February 2	L. J. Bevan	4.79	3,017	July 22	do	[b] 1.40	1,181
March 13	do	12.25	13,230	September 8	do	[b] 1.00	1,005
April 18	do	10.24	9,962	October 15	do	[b] 2.28	1,741
April 28	do	8.98	8,052				
June 6	do	9.55	8,655				
June 7	do	9.08	8,332				
July 13	do	4.73	3,081				
August 12	do	3.03	1,677				
October 11	do	2.44	1,269				

[a] Float measurement. [b] New gage since 1907.

Daily gage height, in feet, of North Fork of Feather River near Big Bend, Cal., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.85	12.60	8.50		10.90	9.20	5.50	3.60	2.95	2.70	3.28	2.85
2	5.35	20.95	8.50		10.65	9.30	5.40	3.55	2.95	2.72	3.18	2.86
3	5.25	19.85	8.00		10.60	9.20	5.30	3.50	2.95	2.72	3.25	2.85
4	6.00	17.50	8.00		10.30	9.10	5.20	3.45	2.95	2.72	3.02	2.95
5	6.35	16.50	8.50		10.20	8.70	5.05	3.35	2.95	2.72	2.92	3.00
6	5.65	15.50	8.50		9.95	8.50	5.00	3.30	2.95	2.72	2.90	3.50
7	5.15	13.00	8.00		9.80	8.30	4.90	3.30	2.95	2.75	2.90	6.30
8	4.85	11.50	7.50		9.80	8.20	4.80	3.25	2.90	2.75	2.90	5.45
9	4.70	10.50	8.50		9.80	7.70	4.70	3.20	2.85	2.75	2.90	4.60
10	4.85	9.00	8.00		10.00	7.60	4.60	3.20	2.80	2.80	2.86	5.35
11	4.70	9.00	7.50		10.70	9.60	4.55	3.20	2.80	2.87	2.90	6.15
12	4.55	8.50	7.00		10.45	8.60	4.45	3.15	2.80	2.90	2.94	4.70
13	4.45	8.00	6.50		9.95	8.50	4.35	3.15	2.77	2.87	2.85	4.82
14	4.30	7.50	6.10		9.60	8.30	4.20	3.15	2.77	2.85	2.85	4.58
15	4.35	8.05	6.55		9.50	7.70	4.15	3.10	2.75	2.82	2.82	4.12
16	4.15	8.50	6.60		9.40	7.30	4.15	3.05	2.75	2.80	2.85	3.98
17	4.10	9.00	13.00		9.10	6.90	4.10	3.05	2.77	2.80	2.90	3.68
18	4.10	9.05	31.00		9.70	6.80	4.05	3.05	2.80	2.80	2.95	3.58
19	4.00	8.50	[a]34.50		11.30	6.70	4.00	3.07	2.80	2.80	2.95	3.52
20	3.95	8.50	28.00		10.60	6.70	3.90	2.97	2.80	2.80	2.94	3.50
21	3.90	8.05	22.00	13.45	10.30	6.60	3.85	2.97	2.75	2.85	2.91	3.42
22	3.90	9.50	18.00	13.37	9.70	6.50	3.80	2.95	2.72	2.85	2.92	3.38
23	3.90	9.50	15.00	13.20	9.10	6.50	3.75	2.95	2.70	2.85	2.94	3.45
24	3.95	9.05	12.00		8.80	6.40	3.70	2.95	2.70	2.90	2.98	3.48
25	4.40	9.80	10.00		8.80	6.20	3.70	2.95	2.70	2.95	2.98	3.48
26	4.55	9.05	[b]9.80		8.70	6.10	3.65	2.95	2.70	3.05	2.98	6.10
27	4.90	8.50	[b]9.60		8.80	5.90	3.65	2.95	2.70	3.05	2.90	7.60
28	7.30	8.00	[b]9.40		8.80	5.95	3.65	2.95	2.70	3.05	2.94	6.85
29	8.05		[b]9.20		8.90	5.80	3.65	2.95	2.70	2.98	2.95	[b]6.60
30	7.50		[b]9.10	11.10	8.90	5.80	3.65	2.95	2.70	3.30	2.89	[b]6.55
31	8.65		[b]9.00		9.10		3.65	2.95		3.28		[b]6.50

[a] The highest crest stage of 36.0 feet occurred at 1 a. m. March 19.
[b] Estimated.

Rating table for North Fork of Feather River near Big Bend, Cal., for 1905 to 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.*
2.00	995	3.90	2,335	6.60	4,980	20.00	38,600
2.10	1,040	4.00	2,420	6.80	5,220	21.00	43,800
2.20	1,100	4.10	2,510	7.00	5,470	22.00	47,200
2.30	1,160	3.20	2,600	7.20	5,720	23.00	51,800
2.40	1,220	4.30	2,690	7.40	5,970	24.00	56,500
2.50	1,280	4.40	2,780	7.60	6,230	25.00	61,200
2.60	1,340	4.50	2,870	7.80	6,490	26.00	65,800
2.70	1,405	4.60	2,960	8.00	6,760	27.00	70,700
2.80	1,470	4.70	3,060	9.00	8,170	28.00	75,700
2.90	1,545	4.80	3,150	10.00	9,650	29.00	80,700
3.00	1,615	4.90	3,240	11.00	11,400	30.00	85,700
3.10	1,690	5.00	3,340	12.00	13,300	31.00	90,800
3.20	1,765	5.20	3,530	13.00	15,600	32.00	96,000
3.30	1,840	5.40	3,730	14.00	18,300	33.00	101,300
3.40	1,920	5.60	3,930	15.00	21,200	34.00	106,700
3.50	2,000	5.80	4,130	16.00	24,300	35.00	112,000
3.60	2,080	6.00	4,340	17.00	27,500	36.00	117,500
3.70	2,165	6.20	4,550	18.00	30,900		
3.80	2,250	6.40	4,760	19.00	34,600		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twenty discharge measurements made in 1905 to 1907 and is well defined between gage heights 2.0 feet and 13.0 feet, and fairly well above 13.0 feet.

Daily discharge, in second-feet, of North Fork of Feather River near Big Bend, Cal., for 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,730	3,010	3,530	4,550	5,540	4,815	2,290	1,030	980	980	1,540	......
2	3,480	3,060	3,480	4,285	5,535	4,815	2,280	1,020	980	980	1,180	......
3	2,910	3,430	3,340	4,130	5,280	4.760	2,250	1,020	970	980	1,180	......
4	2,960	3,340	3,530	4,390	......	4,180	2,250	1,009	970	980	1,190	......
5	2,870	3,290	3,480	4,705	5,040	4,080	2,210	1,009	970	990	1,130	......
6	2,690	3,240	2,915	......	4,815	4,080	2,120	1,000	980	990	1,088	......
7	2,360	3,340	2,825	5,040	4,760	4,180	2,080	998	1,006	990	1,096	1.580
8	2,380	3,480	2,825	4,650	......	4,080	2,080	998	1,006	980	1,096	......
9	2,870	3,730	2,825	4,695	4,815	3,980	2,040	994	980	980	1,088	......
10	2,650	3,530	2,915	4,925	4,705	3,880	......	994	980	980	1,088	......
11	2,560	3,390	3,010	5,535	4,705	3,980	......	1,000	970	980	1,088	......
12	2,600	3,200	3,010	5,915	4,760	4,080	......	1,006	970	980	1,096	......
13	3,100	3,200	3,195	6,490	4,705	4,080	......	1,006	970	980	1,096	......
14	5,250	2,830	3,290	6,690	5,535	......	......	1,070	970	990	1,088	......
15	4,500	2,830	3,565	6,830	5,410	4,080	......	1,060	980	2,510	1,088	......
16	4,140	2,740	5,785	7,690	5,505	3,880	......	1,060	960	1,830	1,088	......
17	3,630	2,740	6,425	4,925	5,160	3,980	......	1,030	1,040	1,400	1,096	......
18	3,730	2,640	6,190	6,425	5,285	3,880	......	1,060	1,050	1,300	1,088	......
19	4,280	2,550	6,555	6,165	5,285	3,780	......	1,050	1,030	1,220	1,060	......
20	5,230	2,400	6,425	6,040	5,535	3,580	......	1,060	1,006	1,180	1,182	......
21	5,940	2,460	6,165	6,830	5,535	3,580	......	990	1,006	1,130	1,540	1,175
22	6,100	2,420	6,100	6,830	5,160	3,480	1,170	980	1,006	1,130	2,650	......
23	5,340	2,560	6,165	6,690	5,280	3,290	1,170	980	980	1,100	2,370	1,165
24	5,400	2,560	6,000	6,105	5,100	3,105	......	980	980	1,100	2,060	1,172
25	4,760	2,460	6,425	6,040	5,160	2,915	......	980	970	1,100	1,683	1,165
26	4,290	2,740	6,330	5,980	5,220	2,735	......	980	970	1,088	1,427	1,096
27	3,880	2,640	6,285	5,785	5,160	2,465	1,098	980	980	1,088	1,290	1,233
28	3,630	3,430	4,695	5,535	5,040	......	1,010	980	980	1,085	1,240	1,047
29	3,400	3,480	5,345	5,405	4,980	......	1,020	980	980	1,040	......	1,126
30	3,200	......	4,925	5,535	5,040	2,380	1,008	980	980	1,580	......	1,100
31	2,960	......	4,705	......	4,925	......	1,025	980	......	1,560	......	1,119

NOTE.—These discharges were computed and furnished by the Great Western Power Company. Discharges have been interpolated for missing days in computing monthly means.

Monthly discharge of North Fork of Feather River near Big Bend, Cal., for 1905 to 1908.

[Drainage area, 1,940 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.							
July 13-31	1,440	1,120	1,280	0.660	0.47	48,200	A.
August	1,160	1,020	1,080	.557	.64	66,400	A.
September	1,190	1,010	1,030	.531	.59	61,300	A.
October	1,110	1,030	1,060	.546	.63	65,200	A.
November	1,320	1,080	1,120	.577	.64	66,600	A.
December	1,380	1,040	1,150	.593	.68	70,700	A.
The period						378,400	
1906.							
January	38,400	1,120	6,490	3.35	3.86	399,000	A.
February	9,350	2,870	5,150	2.65	2.76	286,000	A.
March	20,300	4,830	9,680	4.99	5.75	595,000	A.
April	13,200	7,320	9,910	5.11	5.70	590,000	A.
May	13,000	6,100	9,430	4.86	5.60	580,000	A.
June	11,800	3,720	7,570	3.90	4.35	450,000	A.
July	4,600	1,840	2,980	1.54	1.78	183,000	A.
August	1,800	1,360	1,540	.794	.92	94,700	A.
September	1,350	1,280	1,310	.675	.75	78,000	A.
October	1,270	1,220	1,240	.639	.74	76,200	A.
November	4,230	1,220	1,610	.830	.93	95,800	A.
December	22,400	1,250	4,070	2.10	2.42	250,000	A.
The year	38,400	1,120	5,080	2.62	35.56	3,680,000	
1907.							
January	7,660	2,340	3,510	1.81	2.09	216,000	A.
February	43,800	6,100	12,900	6.65	6.92	716,000	A.
March	109,000	4,440	18,300	9.43	10.87	1,130,000	B.
April			[a] 13,800	7.11	7.93	821,000	B.
May	12,000	7,750	9,330	4.81	5.54	574,000	A.
June	9,060	4,130	6,250	3.22	3.59	372,000	A.
July	3,830	2,120	2,700	1.39	1.60	166,000	A.
August	2,080	1,580	1,720	.887	1.02	106,000	A.
September	1,580	1,400	1,470	.758	.85	87,500	A.
October	1,840	1,400	1,520	.784	.90	93,500	A.
November	1,820	1,490	1,580	.814	.91	94,000	A.
December	6,240	1,500	2,980	1.54	1.78	183,000	A.
The year	109,000	1,400	6,340	3.27	44.00	4,560,000	
1908.							
January	6,100	2,360	3,770	1.94	2.24	232,000	A.
February	3,730	2,400	2,990	1.54	1.66	172,000	A.
March	6,560	2,820	4,590	2.37	2.73	282,000	A.
April	7,690	4,130	5,660	2.92	3.26	337,000	A.
May	5,540	4,705	5,130	2.64	3.04	315,000	A.
June	4,820	2,380	3,700	1.91	2.13	220,000	A.
July	2,290	1,010	1,590	.820	.95	97,800	A.
August	1,070	980	1,010	.521	.60	62,100	A.
September	1,050	960	987	.509	.57	58,700	A.
October	2,510	980	1,190	.613	.71	73,200	A.
November	2,650	1,060	1,310	.675	.75	78,000	A.
December	1,580	1,050	1,300	.670	.77	79,900	A.
The year	7,690	960	2,770	1.43	19.41	2,010,000	

[a] Estimated.

NOTE.—Discharges for 1905 to 1907 were computed by the United States Geological Survey from data furnished by the Great Western Power Company.

FEATHER RIVER AT OROVILLE, CAL.

This station, which was established January 1, 1902, to obtain data for use in studies of flood and reclamation problems in the Sacramento Valley, was originally placed at the Oroville highway bridge, and measurements were made from a boat about 500 feet above the bridge. In February, 1905, a cable was placed across the river about 1,000 feet above the bridge. In December, 1905, a staff gage was also placed near the cable on the left bank.

The station was completely destroyed by the flood of March, 1907, which took away the gage and the cable. A new gage, referred to the old datum, was put in on April 8, 1907, 1,000 feet above the highway bridge, and a new cable was placed across the river October 10, 1907, about 125 feet below the old one.

The station is about 6 miles below the junction of North and Middle forks, and about 30 miles above the mouth of Yuba River, which enters at Marysville. No other important tributaries enter near the station.

No diversions are made immediately above the station. All acquired water rights are probably for power development.

Conditions for obtaining accurate discharge measurements at high stages are poor, because the channel has a changeable bed and rough, rocky banks, and the current is very swift. At other stages the discharge data are fairly reliable, though the channel is subject to change and frequent gagings are necessary. At low water the stream is about 280 feet wide and from 10 to 15 feet deep, and the current is sluggish.

Discharge measurements of Feather River at Oroville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 9	R. S. Hawley	315	5,640	12.15	19,900
February 22	do	307	5,040	10.50	16,900
March 8	do	292	4,630	9.18	13,400
October 11	W. A. Lamb	290	2,880	6.00	1,630
October 24	do	285	2,790	6.02	1,650
1908.					
January 19	W. A. Lamb	295	3,730	8.73	8,400
February 2	do	295	3,620	8.30	7,340
February 21	do	290	3,240	7.02	3,810
April 6	do	295	3,680	8.62	7,980
April 13	do	295	4,060	9.80	11,700
April 21	do	295	4,150	10.10	13,000
September 23	W. V. Hardy	270	2,570	4.85	1,180
December 17	W. F. Martin	278	2,750	5.31	1,790

Daily gage height, in feet, of Feather River at Oroville, Cal., for 1907 and 1908.

[P. H. Bole, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.2	11.5	9.0	13.0	12.8	11.3	8.5	7.0	6.0	6.1	6.4	6.0
2	5.8	17.5	9.55	13.0	12.7	11.0	8.4	7.0	6.0	6.1	6.3	6.0
3	5.65	22.1	10.75	13.25	12.7	10.6	8.3	7.0	6.0	6.1	6.3	6.0
4	9.0	19.0	11.4	13.0	12.6	10.5	8.2	6.8	6.1	6.1	6.2	6.0
5	7.0	17.5	12.5	13.0	13.0	10.7	8.2	6.7	6.1	6.1	6.2	6.1
6	6.0	15.5	10.1	12.9	12.9	10.7	8.1	6.6	6.1	6.1	6.1	6.2
7	7.5	14.0	9.4	12.9	12.8	10.7	8.1	6.6	6.1	6.1	6.1	8.6
8	6.0	12.8	8.0	13.5	12.8	10.8	8.1	6.6	6.1	6.1	6.1	8.3
9	5.7	11.8	8.4	13.3	12.7	10.8	8.1	6.6	6.5	6.1	6.0	7.3
10	5.3	11.0	9.45	13.2	12.6	11.0	8.1	6.5	6.3	6.1	6.0	8.0
11	6.8	10.0	9.1	13.2	12.6	11.0	8.0	6.5	6.2	6.1	6.0	8.0
12	6.2	9.0	9.0	13.4	12.4	11.1	8.0	6.5	6.2	6.1	6.0	8.7
13	5.8	7.8	8.35	13.6	12.1	13.0	7.9	6.5	6.2	6.1	6.0	7.6
14	5.65	7.5	7.95	13.7	12.0	12.2	7.9	6.5	6.2	6.1	6.0	7.0
15	9.0	7.3	7.6	14.0	11.9	11.8	7.8	6.5	6.1	6.0	6.0	7.4
16	7.0	7.0	7.5	14.5	11.6	11.0	7.8	6.5	6.1	6.0	6.0	8.0
17	6.0	10.0	14.7	15.7	11.5	11.1	7.8	6.4	6.1	6.0	6.1	8.0
18	5.85	9.5	32.4	15.6	11.5	11.0	7.8	6.4	6.1	6.0	6.1	7.9
19	5.0	9.0	39.3	16.0	12.0	10.6	7.8	6.4	6.1	6.0	6.0	8.1
20	4.7	8.6	28.6	15.3	13.5	10.2	7.7	6.4	6.1	6.0	6.0	8.8
21	4.3	8.3	24.3	14.6	13.5	9.8	7.6	6.4	6.1	6.0	6.0	9.0
22	4.0	8.3	19.95	14.1	13.4	9.85	7.5	6.3	6.1	6.0	6.0	8.6
23	4.2	10.6	18.75	13.8	13.2	9.7	7.5	6.3	6.1	6.0	6.0	8.6
24	4.35	9.3	15.65	13.3	13.0	9.6	7.5	6.2	6.1	6.0	6.0	8.7
25	5.0	10.5	14.55	13.05	12.5	9.5	7.4	6.2	6.1	6.0	6.0	8.0
26	6.0	10.05	13.85	13.0	12.0	9.4	7.4	6.2	6.1	6.2	6.0	7.6
27	8.0	9.2	13.35	13.0	12.1	9.2	7.3	6.2	6.1	6.2	6.0	7.6
28	9.3	8.6	13.15	13.0	12.1	9.1	7.5	6.2	6.1	6.2	6.0	8.0
29	9.0	......	13.15	13.0	12.0	9.0	7.2	6.2	6.1	6.2	6.0	8.8
30	8.5	......	13.0	12.90	11.8	8.8	7.2	6.1	6.1	6.5	6.0	9.1
31	9.0	......	13.0	......	11.7	......	7.1	6.1	......	6.4	......	8.6
1908.												
1	7.6	9.0	8.0	8.0	9.0	8.1	6.5	5.6	4.9	4.9	5.3	5.3
2	7.0	10.5	7.9	8.0	8.8	8.0	6.4	5.6	4.9	4.9	5.2	5.3
3	7.0	11.0	7.8	7.9	8.6	8.0	6.3	5.6	4.9	4.9	5.1	5.5
4	6.8	10.4	7.7	7.7	8.5	8.1	6.1	5.5	4.9	4.9	5.1	5.9
5	6.5	9.0	7.7	7.6	8.4	8.1	6.0	5.5	4.9	4.9	5.0	7.2
6	6.0	8.5	7.5	7.8	8.4	8.2	6.0	5.5	4.9	4.9	5.0	6.4
7	6.0	8.0	7.4	8.0	8.4	7.9	6.0	5.5	4.9	4.9	5.0	6.1
8	6.2	7.9	7.5	8.0	8.3	7.9	6.0	5.4	4.9	4.9	5.0	5.8
9	6.4	7.9	7.5	8.3	8.3	7.8	6.0	5.3	4.9	4.9	5.0	5.8
10	6.8	7.8	7.5	8.4	8.3	7.7	5.9	5.2	4.9	4.9	5.0	5.7
11	6.9	7.8	7.5	8.5	8.3	7.7	5.9	5.0	4.9	4.9	5.0	5.6
12	7.0	7.7	7.5	8.7	8.4	7.6	5.9	5.0	4.9	4.9	4.9	5.5
13	7.2	7.5	7.5	9.0	8.5	7.6	5.9	5.0	4.9	4.9	4.9	5.5
14	10.3	7.4	8.1	9.5	8.5	7.5	5.8	5.0	4.9	4.9	4.9	5.5
15	8.4	7.4	8.6	10.0	8.5	7.5	5.8	5.0	4.9	7.6	4.9	5.3
16	8.0	7.3	8.8	10.5	8.6	7.5	5.8	5.0	4.9	6.6	4.9	5.2
17	7.9	7.2	9.0	10.0	8.7	7.5	5.8	5.0	4.9	5.8	4.9	5.3
18	7.9	7.1	9.4	9.8	8.8	7.5	5.7	5.0	4.9	5.5	4.9	5.2
19	8.5	7.0	9.6	9.5	8.9	7.6	5.7	5.0	4.9	5.3	4.9	5.1
20	10.5	7.0	9.5	9.4	8.9	7.6	5.7	5.0	4.9	5.2	5.1	5.0
21	11.0	7.1	9.0	9.6	9.0	7.6	5.7	5.0	4.9	5.1	6.0	4.9
22	10.0	7.2	9.0	9.8	9.0	7.5	5.7	5.0	4.9	5.1	7.2	5.0
23	9.5	7.2	8.9	10.0	9.0	7.4	5.6	5.0	4.9	5.1	6.9	5.2
24	9.1	7.3	8.9	9.7	9.1	7.4	5.6	5.0	4.9	5.1	6.4	5.5
25	9.0	7.3	8.8	9.5	9.2	7.3	5.6	5.0	4.9	5.1	5.9	5.3
26	8.7	7.5	8.7	9.2	9.0	7.2	5.6	5.0	4.9	5.1	5.6	5.3
27	9.0	7.6	8.6	9.0	8.8	7.0	5.5	5.0	4.9	5.0	5.5	5.3
28	8.6	7.8	8.6	9.0	8.7	6.9	5.5	4.9	4.9	5.0	5.4	5.3
29	8.0	8.0	8.5	9.0	8.5	6.7	5.5	4.9	4.9	5.0	5.4	5.2
30	7.7	......	8.3	9.1	8.4	6.6	5.5	4.9	4.9	6.0	5.3	5.2
31	7.5	......	8.1	......	8.3	......	5.5	4.9	......	5.6	......	5.2

NOTE.—The gage was washed out March 19, 1907, and a new gage installed at same datum April 8, 1907. Gage heights observed on the Geological Survey gage for March 11 to 18 are evidently in error. Gage heights for these periods have been estimated from readings on the Weather Bureau gage on Oroville bridge.

Rating tables for Feather River at Oroville, Cal.

JANUARY 1, 1906, TO MARCH 25, 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.*
4.00	3,960	5.70	5,900	7.80	9,080	16.00	42,000
4.10	4,070	5.80	6,020	8.00	9,450	17.00	47,500
4.20	4,180	5.90	6,140	8.20	9,830	18.00	53,500
4.30	4,290	6.00	6,260	8.40	10,220	19.00	59,500
4.40	4,400	6.10	6,390	8.60	10,630	20.00	65,500
4.50	4,510	6.20	6,520	8.80	11,100	21.00	71,700
4.60	4,620	6.30	6,650	9.00	11,600	22.00	78,000
4.70	4,730	6.40	6,780	9.20	12,100	23.00	84,300
4.80	4,840	6.50	6,910	9.40	12,620	24.00	90,600
4.90	4,950	6.60	7,050	9.60	13,160	25.00	96,900
5.00	5,060	6.70	7,190	9.80	13,700	26.00	103,200
5.10	5,180	6.80	7,330	10.00	14,260	27.00	109,500
5.20	5,300	6.90	7,480	11.00	17,600	28.00	115,800
5.30	5,420	7.00	7,640	12.00	21,500	29.00	122,100
4.40	5,540	7.20	8,000	13.00	26,000	30.00	128,400
4.50	5,660	7.40	8,360	14.00	31,000	31.00	134,700
5.60	5,780	7.60	8,720	15.00	36,500		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1906 and is well defined below gage height 17 feet. Above gage height 21 feet the curve is a tangent, the difference being 630 per tenth.

MARCH 26 TO DECEMBER 31, 1907.

6.00	1,650	7.40	4,900	8.80	8,940	10.20	13,870
6.10	1,850	7.50	5,160	8.90	9,260	10.30	14,250
6.20	2,060	7.60	5,430	9.00	9,590	10.40	14,630
6.30	2,270	7.70	5,700	9.10	9,920	10.50	15,020
6.40	2,490	7.80	5,970	9.20	10,260	10.60	15,410
6.50	2,710	7.90	6,250	9.30	10,600	10.70	15,800
6.60	2,940	8.00	6,530	9.40	10,950	10.80	16,200
6.70	3,170	8.10	6,820	9.50	11,300	10.90	16,600
6.80	3,410	8.20	7,110	9.60	11,660	11.00	17,000
6.90	3,650	8.30	7,400	9.70	12,020	12.00	21,300
7.00	3,890	8.40	7,700	9.80	12,380	13.00	26,000
7.10	4,140	8.50	8,000	9.90	12,750		
7.20	4,390	8.60	8,310	10.00	13,120		
7.30	4,640	8.70	8,620	10.10	13,490		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907 and is well defined. Above 13 feet it is the same as the 1906 table.

JANUARY 1 TO MAY 31, 1908.

5.50	770	6.90	3,540	8.30	7,160	9.70	11,500
5.60	930	7.00	3,770	8.40	7,440	9.80	11,850
5.70	1,090	7.10	4,010	8.50	7,730	9.90	12,200
5.80	1,270	7.20	4,250	8.60	8,020	10.00	12,560
5.90	1,450	7.30	4,500	8.70	8,310	10.10	12,920
6.00	1,640	7.40	4,750	8.80	8,610	10.20	13,290
6.10	1,830	7.50	5,000	8.90	8,910	10.30	13,660
6.20	2,030	7.60	5,260	9.00	9,210	10.40	14,030
6.30	2,230	7.70	5,520	9.10	9,520	10.50	14,410
6.40	2,440	7.80	5,790	9.20	9,840	10.60	14,790
6.50	2,650	7.90	6,060	9.30	10,160	10.70	15,170
6.60	2,870	8.00	6,330	9.40	10,490	10.80	15,560
6.70	3,090	8.10	6,600	9.50	10,820	10.90	15,950
6.80	3,310	8.20	6,880	9.60	11,160	11.00	16,340

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during October, 1907, to May, 1908, and is well defined.

Rating tables for Feather River at Oroville, Cal.—Continued.

JUNE 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.*
4.80	1,150	5.70	2,160	6.60	3,350	7.50	5,110
4.90	1,250	5.80	2,280	6.70	3,510	7.60	5,340
5.00	1,350	5.90	2,400	6.80	3,680	7.70	5,570
5.10	1,460	6.00	2,530	6.90	3,860	7.80	5,810
5.20	1,570	6.10	2,660	7.00	4,050	7.90	6,060
5.30	1,680	6.20	2,790	7.10	4,250	8.00	6,320
5.40	1,800	6.30	2,920	7.20	4,460	8.10	6,590
5.50	1,920	6.40	3,060	7.30	4,670	8.20	6,870
5.60	2,040	6.50	3,200	7.40	4,890		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during the latter part of 1908 and is well defined.

Monthly discharge of Feather River at Oroville, Cal., for 1907 and 1908.

[Drainage area, 3,640 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	12,400	3,960	7,130	1.96	2.26	438,000	B.
February	78,500	7,640	21,500	5.91	6.15	1,190,000	B.
March	187,000	8,540	36,900	10.1	11.64	2,270,000	C.
April	42,000	25,500	29,500	8.10	9.04	1,760,000	B.
May	28,600	17,000	23,400	6.43	7.41	1,440,000	B.
June	26,000	8,940	15,200	4.18	4.66	904,000	B.
July	8,000	4,140	6,000	1.65	1.90	369,000	C.
August	3,890	1,850	2,650	.728	.84	163,000	C.
September	2,710	1,650	1,900	.522	.58	113,000	C.
October	2,710	1,650	1,850	.508	.59	114,000	C.
November	2,490	1,650	1,780	.489	.55	106,000	C.
December	9,920	1,650	6,060	1.66	1.91	373,000	C.
The year	187,000	1,650	12,800	3.52	47.53	9,240,000	
1908.							
January	16,300	1,640	6,610	1.82	2.10	406,000	B.
February	16,300	3,770	6,380	1.75	1.89	367,000	B.
March	11,200	4,750	7,250	1.99	2.29	446,000	B.
April	14,400	5,260	9,210	2.53	2.82	548,000	B.
May	9,840	7,160	8,170	2.24	2.58	502,000	B.
June	6,870	3,350	5,310	1.46	1.63	316,000	B.
July	3,200	1,920	2,320	.637	.73	143,000	B.
August	2,040	1,250	1,510	.415	.48	92,800	C.
September	1,250	1,250	1,250	.343	.38	74,400	C.
October	5,340	1,250	1,650	.453	.52	101,000	C.
November	4,460	1,250	1,750	.481	.54	104,000	C.
December	4,460	1,250	1,910	.525	.61	117,000	C.
The year	16,300	1,250	4,440	1.22	16.57	3,220,000	

HAMILTON BRANCH NEAR PRATTVILLE, CAL.

This station, which was established June 12, 1905, to obtain data for studies of power available on North Fork of Feather River, is about 3 miles east of Prattville and 1¼ miles above the junction with North Fork. The drainage area above the station is 230 square miles.

The channel is straight and has a shale bottom subject to slight change. At low water the measuring section is about 70 feet wide and 4 feet deep.

This station was discontinued July 1, 1907.

The following record has been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station since its establishment.

Discharge measurements of Hamilton Branch near Prattville, Cal., in 1905 and 1906.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
June 12	R. W. Armstrong	3.08	394	January 19	L. J. Bevan	3.60	567
June 23	W. E. Spear	2.74	243	February 28	do	3.92	745
July 3	do	2.62	215	April 12	do	4.43	1,017
July 28	do	2.56	209	May 15	do	5.21	1,494
August 15	L. J. Bevan	2.56	211	July 7	do	3.19	439
September 4	do	2.55	210	August 8	do	2.77	294
December 17	do	2.40	177				

Daily gage height, in feet, of Hamilton Branch near Prattville, Cal., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1						4.33	16		3.60	3.35			
2		5.36	4.75				17						
3							18						
4				4.50	5.38		19	2.65					
5	2.99						20						
6							21						
7							22						
8							23		5.05				
9		4.62	4.64				24						
10							25					4.25	
11					5.42		26	2.69					
12	2.72			5.60			27						
13							28						
14							29						
15							30						
							31						

Rating table for Hamilton Branch near Prattville, Cal., from June 17, 1905, to June 30, 1907.

Gage height.	Discharge.	Gage height.	Discharge.	Gaga height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	168	3.30	454	4.20	881	5.10	1,423
2.50	194	3.40	493	4.30	936	5.20	1,488
2.60	220	3.50	534	4.40	992	5.30	1,553
2.70	249	3.60	577	4.50	1,050	5.40	1,619
2.80	280	3.70	624	4.60	1,109	5.50	1,685
2.90	312	3.80	672	4.70	1,170	5.60	1,753
3.00	346	3.90	722	4.80	1,232	5.70	1,820
3.10	381	4.00	774	4.90	1,295	5.80	1,888
3.20	417	4.10	827	5.00	1,359	5.90	1,957

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on thirteen discharge measurements made during 1905 and 1906, and is well defined between gage heights 2.4 feet and 5.2 feet.

Monthly discharge of Hamilton Branch near Prattville, Cal., for 1905 to 1907.

[Drainage area, 230 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.							
June 17-30	315	226	264	1.15	0.60	7,330	A.
July	237	210	219	.952	1.10	13,500	A.
August	217	207	211	.917	1.06	13,000	A.
September	207	194	202	.878	.98	12,000	A.
October	204	189	191	.830	.96	11,700	A.
November	188	176	182	.791	.88	10,800	A.
December	178	168	171	.743	.86	10,500	A.
The period						78,800	
1906.							
January	577	165	333	1.45	1.67	20,500	B.
February	774	417	575	2.50	2.60	31,900	A.
March	1,480	346	757	3.29	3.79	46,500	B.
April	1,360	707	1,030	4.48	5.00	61,300	B.
May	1,850	700	1,290	5.61	6.47	79,300	A.
June	1,110	534	846	3.68	4.11	50,300	A.
July	501	270	347	1.51	1.74	21,300	A.
August	271	240	254	1.10	1.27	15,600	A.
September	246	217	231	1.00	1.12	13,700	A.
October	216	197	212	.922	1.06	13,000	A.
November	226	212	218	.948	1.06	13,000	A.
December	843	217	343	1.49	1.72	21,100	A.
The year	1,850	165	572	2.33	31.61	388,000	
1907.							
January	534	194	288	1.25	1.44	17,700	A.
February	2,500	577	1,220	5.30	5.52	67,800	A.
March	4,100	468	1,340	5.83	6.72	82,400	B.
April	2,500	1,050	1,710	7.43	8.29	102,000	B.
May	1,890	908	1,460	6.35	7.32	89,800	B.
June	1,300	556	877	3.81	4.25	52,200	B.
The period						412,000	

NOTE.—These discharges were computed by the United States Geological Survey from data furnished by the Great Western Power Company. The daily discharges for days when there were no gage readings were estimated with the aid of a hydrograph, following the rate of rise and fall at the station below Prattville, where daily observations were obtained most of the time. The sum of the monthly means for this station and the one on North Fork above Prattville have been compared with those for the station below Prattville, and the ratios indicate that the values as a whole are good. Gage heights for 1905 and 1906 are given in Water-Supply Paper 213, p. 131.

BUTT CREEK AT BUTTE VALLEY, CAL.

Butt Creek rises in the extreme western part of Plumas County and flows eastward, discharging into North Fork of Feather River about 9 miles south of Prattville. The creek is about 25 miles long, and its drainage area comprises 74 square miles. It has an approximate fall of 3,000 feet, and is well adapted for power development.

The gaging station was established June 14, 1905, about 2 miles above the mouth of the creek and 100 feet below the foot bridge at the lower end of Butte Valley. The bottom of the channel is composed of coarse gravel and is not likely to change materially.

The following data have been furnished by Viele, Blackwell, and Buck for the Great Western Power Company, which has maintained the station since its establishment.

Discharge measurements of Butt Creek at Butte Valley, Cal., in 1905 to 1908.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1905.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
June 14	R. W. Armstrong	2.84	76	June 21	L. J. Bevan	3.54	179
July 18	do	2.51	42	July 24	do	2.68	57
August 19	do	2.39	35	August 30	W. V. Hardy	[a] 2.58	42
September 9	W. E. Spear	2.38	30				
				1907.			
1906.				July 22	L. J. Bevan	2.63	61
March 2	L. J. Bevan	3.16	136				
March 27	do	4.54	365	1908.			
April 10	do	4.75	426	August 18	L. J. Bevan	2.18	29.4

[a] Interpolated between readings of observer.

NOTE.—About 5 second-feet are diverted 6 miles above this station from Butt Creek into Yellow Creek watershed.

Daily gage height, in feet, of Butt Creek at Butte Valley, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.00	4.32	3.70	3.98	4.90	4.11	2.88	2.46	2.39	2.31	2.46	2.29
2	3.02	6.50	3.38	3.98	4.85	4.05	2.85	2.46	2.39	2.31	2.50	2.29
3	2.90	6.18	3.38	3.88	4.78	4.00	2.84	2.45	2.39	2.31	2.49	2.30
4	3.00	5.93	3.38	3.88	5.07	3.92	2.82	2.45	2.41	2.31	2.48	2.30
5	3.01	5.44	3.36	3.88	4.65	3.82	2.80	2.45	2.40	2.31	2.46	2.36
6	3.02	4.71	3.35	3.93	4.50	3.72	2.78	2.45	2.39	2.31	2.44	2.52
7	3.02	4.33	3.34	4.13	4.45	3.70	2.79	2.44	2.38	2.31	2.43	3.28
8	3.01	4.03	3.27	4.33	4.43	3.75	2.77	2.44	2.38	2.31	2.43	3.05
9	3.03	3.80	3.28	4.58	4.50	3.63	2.80	2.43	2.37	2.31	2.44	2.98
10	3.00	3.70	3.38	5.33	4.60	3.42	2.79	2.43	2.36	2.31	2.45	3.05
11	2.90	3.70	3.23	5.38	4.78	4.08	2.76	2.43	2.35	2.32	2.45	3.21
12	2.78	3.62	3.26	5.50	4.75	4.22	2.75	2.43	2.34	2.35	2.45	2.71
13	2.80	3.63	3.12	5.58	4.35	3.79	2.74	2.42	2.34	2.32	2.45	2.79
14	2.85	3.57	3.06	5.73	4.25	3.60	2.72	2.41	2.34	2.33	2.40	2.94
15	3.10	3.51	3.06	5.86	4.32	3.48	2.68	2.40	2.34	2.32	2.38	2.60
16	3.12	3.61	3.13	5.70	4.30	3.35	2.65	2.40	2.34	2.31	2.38	2.55
17	3.08	3.72	4.78	5.48	4.28	3.30	2.63	2.40	2.34	2.31	2.38	2.54
18	3.04	3.68	8.15	5.43	4.28	3.38	2.60	2.39	2.35	2.31	2.34	2.51
19	3.00	3.68	8.50	5.68	4.65	3.22	2.59	2.39	2.35	2.31	2.32	2.52
20	2.96	3.70	7.36	5.68	4.60	3.22	2.57	2.39	2.34	2.31	2.32	2.55
21	2.92	3.80	6.37	5.50	4.24	3.22	2.56	2.39	2.34	2.31	2.32	2.53
22	2.90	3.88	5.91	5.45	4.08	3.35	2.55	2.39	2.33	2.31	2.32	2.52
23	2.84	3.81	4.68	5.60	4.02	3.25	2.56	2.39	2.33	2.32	2.32	2.53
24	2.81	3.93	4.78	5.70	3.97	3.15	2.55	2.39	2.32	2.32	2.32	2.55
25	2.75	4.08	5.04	5.55	3.96	3.10	2.55	2.39	2.32	2.33	2.31	2.52
26	2.75	3.94	4.61	5.45	3.94	3.05	2.54	2.39	2.32	2.35	2.30	3.02
27	2.72	3.61	4.41	5.40	3.91	3.01	2.53	2.39	2.32	2.35	2.30	4.25
28	2.91	3.55	3.97	5.30	3.94	2.95	2.55	2.40	2.32	2.34	2.30	3.90
29	3.11	......	3.82	5.15	3.95	2.92	2.56	2.40	2.32	2.32	2.30	3.70
30	3.02	......	3.81	5.00	3.97	2.90	2.52	2.40	2.32	2.41	2.30	3.60
31	3.51	......	3.82	......	4.04	......	2.50	2.40	......	2.45	......	3.80
1908.												
1	3.02	2.53	2.71	3.00	3.28	2.95	2.33	2.07	2.10	2.10	2.13	2.13
2	2.90	2.64	2.91	3.00	3.36	2.92	2.31	2.04	2.10	2.10	2.12	2.15
3	2.80	2.83	2.86	3.07	3.26	2.86	2.29	2.01	2.10	2.10	2.11	2.18
4	2.68	2.69	2.82	3.12	3.15	2.84	2.29	2.00	2.09	2.10	2.10	2.30
5	2.70	2.69	2.70	3.21	3.12	2.82	2.28	2.00	2.09	2.10	2.10	2.32
6	2.75	2.68	2.74	3.30	3.12	2.82	2.28	2.00	2.09	2.09	2.10	2.25
7	2.72	2.67	2.75	3.15	3.14	2.82	2.27	2.00	2.12	2.09	2.10	2.20
8	2.70	2.70	2.73	3.12	3.15	2.80	2.26	2.00	2.11	2.10	2.10	2.19
9	2.65	2.66	2.70	3.31	3.12	2.75	2.24	2.10	2.10	2.10	2.10	2.18
10	2.62	2.62	2.65	3.45	3.15	2.74	2.24	2.10	2.16	2.10	2.10	2.17
11	2.61	2.65	2.70	3.62	3.11	2.73	2.23	2.10	2.16	2.10	2.10	2.19
12	2.58	2.58	2.75	3.77	3.16	2.74	2.24	2.10	2.17	2.10	2.10	2.20
13	2.64	2.55	2.80	3.80	3.16	2.71	2.25	2.10	2.18	2.10	2.10	2.21
14	2.91	2.62	2.85	3.72	3.16	2.68	2.21	2.10	2.18	2.15	2.10	2.20
15	2.81	2.58	2.95	3.80	3.36	2.66	2.18	2.10	2.19	2.53	2.10	2.19

Daily gage height, in feet, of Butt Creek at Butte Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
16	2.73	2.56	3.23	3.75	3.25	2.61	2.17	2.10	2.22	2.29	2.10	2.20
17	2.69	2.55	3.35	3.60	3.12	2.59	2.17	2.10	2.23	2.20	2.10	2.20
18	2.74	2.55	3.45	3.60	3.22	2.57	2.18	2.11	2.22	2.13	2.10	2.20
19	2.74	2.55	3.33	3.58	3.45	2.55	2.18	2.11	2.20	2.13	2.10	2.20
20	2.82	2.55	3.28	3.70	3.22	2.53	2.18	2.11	2.18	2.12	2.20	2.21
21	2.84	2.55	3.25	3.63	3.20	2.63	2.15	2.11	2.10	2.11	2.47	2.20
22	3.05	2.55	3.22	3.55	3.15	2.52	2.15	2.11	2.10	2.11	2.38	2.19
23	2.90	2.59	3.23	3.50	3.11	2.47	2.15	2.11	2.10	2.11	2.48	2.14
24	2.92	2.61	3.32	3.40	3.11	2.43	2.15	2.11	2.10	2.11	2.35	2.14
25	2.80	2.65	3.52	3.40	3.12	2.40	2.14	2.11	2.10	2.10	2.20	2.14
26	2.80	2.70	3.29	3.30	3.12	2.39	2.14	2.11	2.10	2.10	2.14	2.14
27	2.72	2.72	3.23	3.29	3.08	2.37	2.13	2.11	2.10	2.10	2.10	2.14
28	2.68	2.75	3.12	3.27	3.07	2.36	2.13	2.11	2.10	2.10	2.10	2.14
29	2.63	2.80	3.10	3.30	3.07	2.35	2.13	2.10	2.10	2.12	2.10	2.14
30	2.63	....	3.15	3.33	3.00	2.34	2.11	2.10	2.10	2.27	2.12	2.15
31	2.53	....	3.03	....	2.98	....	2.09	2.10	....	2.14	....	2.16

Rating tables for Butt Creek at Butte Valley, Cal.

JUNE 14, 1905, TO JANUARY 18, 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.*
2.30	28	3.60	201	4.90	453	6.40	832
2.40	33	3.70	218	5.00	475	8.60	889
2.50	41	3.80	236	5.10	497	6.80	948
2.60	50	3.90	254	5.20	520	7.00	1,010
2.70	61	4.00	272	5.30	544	7.20	1,074
2.80	73	4.10	290	5.40	568	7.40	1,140
2.90	87	4.20	308	5.50	592	7.60	1,206
3.00	101	4.30	326	5.60	617	7.80	1,272
3.10	117	4.40	346	5.70	643	8.00	1,338
3.20	133	4.50	366	5.80	669	8.20	1,404
3.30	150	4.60	387	5.90	695	8.40	1,470
3.40	167	4.70	409	6.00	722	8.60	1,536
3.50	184	4.80	431	6.20	776		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1905-6 and is well defined between gage heights 2.38 feet and 4.8 feet.

JANUARY 19, 1906, TO MARCH 18, 1907.

2.40	28	2.70	57	3.00	100	3.30	150
2.50	36	2.80	70	3.10	116	3.40	167
2.60	46	2.90	84	3.20	133		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on two discharge measurements made during 1906 and is well defined between gage heights 2.55 feet and 4.8 feet. Above gage height 3.4 feet the rating curve is the same as that for 1905.

MARCH 19, 1907, TO DECEMBER 31, 1908.

2.00	21	2.40	43	2.80	81	3.20	137
2.10	25	2.50	50	2.90	94	3.30	152
2.10	30	2.60	59	3.00	108	3.40	167
2.30	36	2.70	69	3.10	122		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on two discharge measurements made during 1907-8 and is fairly well defined between gage heights 2.1 feet and 4.8 feet. Above gage height 3.4 feet the rating curve is the same as that for 1905.

Monthly discharge of Butt Creek near Butte Valley, Cal., for 1905 to 1908.

[Drainage area, 73 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.							
June 14-30	79	61	69.2	0.948	0.60	2,330	B.
July	61	38	47.2	.647	.75	2,900	B.
August	38	32	33.6	.460	.53	2,070	B.
September	32	32	32.0	.438	.49	1,900	B.
October	32	32	32.0	.438	.50	1,970	A.
November	37	32	33.3	.456	.51	1,980	A.
December	71	42	58.8	.805	.93	3,620	A.
The period						16,800	
1906.							
January	1,240	57	221	3.03	3.49	13,600	A.
February	290	55	141	1.93	2.01	7,830	A.
March	722	124	287	3.93	4.53	17,600	A.
April	508	265	360	4.93	5.50	21,400	A.
May	431	211	320	4.38	5.05	19,700	A.
June	350	114	220	3.01	3.36	13,100	A.
July	121	47	69.3	.949	1.09	4,260	A.
August	47	44	45.9	.629	.73	2,820	A.
September	49	42	44.9	.615	.69	2,670	A.
October	62	40	42.6	.584	.67	2,620	A.
November	89	32	48.7	.667	.74	2,900	A.
December	352	30	90.2	1.24	1.43	5,550	A.
The year	1,240	30	158	2.16	29.29	114,000	
1907.							
January	186	60	95.1	1.30	1.50	5,850	A.
February	860	186	312	4.27	4.45	17,300	A.
March	1,500	110	367	5.03	5.80	22,600	A.
April	685	250	500	6.85	7.64	29,800	A.
May	490	256	343	4.70	5.42	21,100	A.
June	312	94	186	2.55	2.84	11,100	A.
July	91	50	67.1	.919	1.06	4,130	A.
August	47	42	43.8	.600	.69	2,690	A.
September	44	37	39.6	.542	.60	2,360	A.
October	46	37	37.9	.519	.60	2,330	A.
November	50	36	41.8	.573	.64	2,490	A.
December	317	35	97.8	1.34	1.54	6,010	A.
The year	1,500	35	178	2.43	32.78	128,000	
1908.							
January	115	57	76.5	1.05	1.21	4,700	A.
February	81	53	62.6	.858	.93	3,600	A.
March	187	64	113	1.55	1.79	6,950	A.
April	236	108	173	2.37	2.64	10,300	A.
May	176	105	132	1.81	2.09	8,120	A.
June	101	39	64.6	.885	.99	3,840	A.
July	38	25	30.4	.416	.48	1,870	A.
August	26	21	24.5	.336	.39	1,510	A.
September	32	25	26.7	.366	.41	1,590	A.
October	53	25	27.1	.371	.43	1,670	A.
November	49	25	28.2	.386	.43	1,680	A.
December	37	26	29.5	.404	.47	1,810	A.
The year	236	21	65.7	.900	12.26	47,600	

NOTE.—These discharges were computed by the United States Geological Survey from data furnished by the Great Western Power Company. Discharges were interpolated for days on which gage was not read.

INDIAN CREEK NEAR CRESCENT MILLS, CAL.

Indian Creek rises in the Sierra Divide and flows westward to its junction with North Fork of Feather River. The stream is about 50 miles long and its drainage area, comprising 1,025 square miles, is much greater than that of North Fork above the junction of the two streams. The basin is in the northeastern part of Plumas County, north of Middle Fork of Feather River and east of the upper part of North Fork. For about 45 miles it lies along the Sierra Divide, which separates it from Honey Lake drainage basin at the east. The principal tributaries are Squaw, Red, Clover, Little Grizzly, and Spanish creeks from the south and Light and Wolf creeks from the north.

Practically all of the Indian Creek basin has an altitude exceeding 5,000 feet, and much of it is a lava formation 6,000 to 7,000 feet in altitude. The entire basin is included in a national forest reserve, except a few small meadows, of which Indian and American valleys are the largest.

The mean annual precipitation is between 40 and 45 inches, and a large part of it occurs as snowfall. During the winter the streams freeze over occasionally.

The basin affords several good storage reservoir sites. Opportunities for power development are also good. With the available fall, the flow of the streams is sufficient to generate at least 20,000 horsepower continuously, and by utilizing storage 60,000 horsepower could be developed.

The longest run-off record covers only three years, of which 1907 was the wettest and 1908 the driest. The results in these probably represent extreme conditions. The total flow in 1907 was more than three times that in 1908.

The gaging station, which was established November 29, 1905, to determine the quantity of water available for storage, is located about 1¼ miles below Crescent Mills, on the Greenville-Taylorsville road, and about 2,000 feet below the Arlington Bridge.

This station is at the lower end of Indian Valley, above which point nearly all the important tributaries enter. Spanish Creek enters about 5 miles below the station.

The bed of the stream is practically permanent. At low water the stream is deep, and the current is very sluggish. No change has been made in the datum of the gage.

Daily gage height, in feet, of Indian Creek near Crescent Mills, Cal., for 1907 and 1908.

[Eugene Cook, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.6	6.05	5.0	7.65	7.55	5.6	3.2	1.9	1.35	1.5	1.8	1.7
2	3.3	9.15	5.15	8.15	7.45	5.7	3.1	1.8	1.35	1.5	1.8	1.7
3	3.4	10.2	5.15	8.1	7.35	5.7	3.0	1.75	1.4	1.5	1.8	1.7
4	4.3	9.55	5.2	7.75	7.25	5.6	2.9	1.7	1.45	1.55	1.8	1.8
5	4.4	9.3	5.15	7.6	7.0	5.4	2.8	1.7	1.5	1.55	1.75	2.0
6	3.5	8.8	5.45	7.2	6.85	5.2	2.7	1.65	1.5	1.5	1.75	2.5
7	3.25	7.9	5.35	7.4	6.75	5.05	2.65	1.6	1.5	1.5	1.75	3.5
8	3.15	7.0	5.05	7.9	6.65	5.05	2.6	1.55	1.45	1.45	1.75	3.3
9	3.1	6.4	4.9	8.3	6.7	4.8	2.6	1.5	1.45	1.45	1.7	2.8
10	3.05	6.05	5.15	8.85	6.75	4.6	2.5	1.45	1.4	1.45	1.7	3.3
11	2.95	5.8	5.0	9.6	6.9	4.75	2.45	1.45	1.4	1.45	1.7	3.7
12	2.85	5.7	5.0	10.2	7.05	5.4	2.4	1.45	1.35	1.6	1.7	3.1
13	2.8	5.5	4.7	10.25	6.9	5.35	2.3	1.45	1.35	1.75	1.7	3.1
14	2.8	5.3	4.5	10.4	6.6	5.15	2.2	1.45	1.4	1.7	1.7	2.8
15	2.75	5.2	4.4	11.6	6.3	4.85	2.2	1.4	1.4	1.65	1.7	2.6
16	2.75	5.2	4.45	11.5	6.35	4.7	2.15	1.35	1.4	1.6	1.7	2.5
17	2.7	5.3	7.1	10.55	6.4	4.5	2.1	1.3	1.4	1.55	1.75	2.35
18	2.7	5.4	17.0	9.95	6.4	4.3	2.1	1.3	1.4	1.55	1.8	2.25
19	2.65	5.4	a19.7	9.7	6.55	4.15	2.0	1.3	1.4	1.6	1.8	2.3
20	2.6	5.3	17.9	9.55	6.8	4.05	2.0	1.3	1.4	1.6	1.75	2.3
21	2.55	5.3	14.7	9.3	6.6	4.0	1.95	1.3	1.45	1.6	1.75	2.3
22	2.5	5.4	10.95	8.9	6.3	4.0	1.9	1.3	1.45	1.6	1.75	2.3
23	2.5	5.45	9.0	8.8	5.95	4.0	1.85	1.3	1.45	1.6	1.8	2.25
24	2.55	5.25	7.8	8.9	5.7	3.95	1.8	1.3	1.45	1.6	1.8	2.25
25	2.75	5.45	7.7	8.85	5.6	3.8	1.8	1.3	1.5	1.65	1.8	2.2
26	3.1	5.8	7.5	8.75	5.5	3.65	1.75	1.3	1.5	1.7	1.8	3.2
27	3.25	5.5	7.3	8.55	5.45	3.55	1.8	1.3	1.5	1.75	1.8	5.2
28	4.5	5.0	7.0	8.35	5.4	3.45	1.95	1.3	1.5	1.75	1.75	4.8
29	4.95	....	6.85	8.1	5.4	3.4	2.0	1.3	1.5	1.8	1.75	3.8
30	4.75	....	6.75	7.8	5.5	3.3	2.1	1.3	1.5	1.8	1.7	3.5
31	5.15	....	7.15	....	5.5	....	2.0	1.35	....	1.8	....	3.8
1908.												
1	3.5	2.8	3.4	4.4	3.95	3.4	1.75	.8	.8	1.0	1.4	1.5
2	3.3	2.75	3.35	4.15	4.05	3.35	1.7	.8	.8	1.0	1.4	1.5
3	3.0	2.9	3.35	4.05	4.05	3.3	1.5	.8	.8	.95	1.35	1.7
4	3.1	3.1	3.3	4.3	3.9	3.25	1.45	.8	.8	.95	1.35	1.9
5	2.9	3.0	3.2	4.55	3.7	3.15	1.45	.8	.8	1.0	1.3	2.35
6	2.65	3.0	3.15	4.8	3.6	3.05	1.45	.8	.8	1.0	1.3	2.1
7	2.55	3.1	3.05	4.9	3.65	3.0	1.6	.8	.8	1.0	1.3	1.9
8	2.65	3.25	3.0	4.45	3.7	2.95	1.55	.8	.8	1.0	1.3	1.8
9	3.0	3.35	3.0	4.35	3.7	2.9	1.5	.75	.8	1.0	1.3	1.8
10	2.85	3.3	3.05	4.7	3.6	2.8	1.45	.75	.8	1.0	1.3	1.7
11	2.75	3.15	3.25	4.9	3.65	2.8	1.45	.75	.8	1.0	1.3	1.65
12	2.7	3.0	3.45	5.2	3.85	2.7	1.45	.75	.8	1.0	1.3	1.6
13	2.9	2.8	3.8	5.4	3.95	2.7	1.4	.75	.8	1.0	1.3	1.6
14	3.3	2.7	4.2	5.5	3.95	2.8	1.4	.75	.8	1.0	1.3	1.6
15	3.5	2.7	4.7	5.45	4.0	2.9	1.4	.75	.8	1.2	1.3	1.6
16	3.4	2.7	5.3	5.45	4.1	2.8	1.4	.8	.85	1.6	1.3	1.55
17	3.25	2.65	5.7	5.3	3.9	2.6	1.4	.8	.9	1.55	1.3	1.5
18	3.35	2.65	6.0	5.0	3.8	2.45	1.35	.8	.95	1.45	1.3	1.45
19	3.4	2.6	6.2	4.85	4.2	2.35	1.35	.8	.95	1.4	1.3	1.45
20	3.65	2.55	5.8	4.9	4.5	2.35	1.3	.8	.95	1.35	1.5	1.45
21	3.95	2.5	5.55	5.0	4.35	2.35	1.25	.8	.95	1.3	1.7	1.45
22	4.25	2.5	5.5	4.95	4.2	2.2	1.2	.8	.95	1.3	1.9	1.5
23	4.15	2.5	5.3	4.7	4.1	2.25	1.15	.8	.95	1.3	2.1	1.55
24	4.05	2.5	5.3	4.5	4.0	2.15	1.05	.8	.95	1.3	1.95	1.6
25	3.9	2.6	5.5	4.35	3.9	1.95	.95	.8	.95	1.3	1.8	1.6
26	3.7	2.7	5.75	4.2	3.85	1.9	.9	.8	.95	1.3	1.7	1.65
27	3.5	2.9	5.3	4.1	3.7	1.85	.9	.8	.95	1.3	1.6	1.7
28	3.3	3.25	5.05	4.0	3.65	1.8	.85	.8	.95	1.3	1.5	1.7
29	3.1	3.5	4.7	4.0	3.6	1.8	.85	.8	.95	1.3	1.5	1.7
30	3.0	....	4.6	3.9	3.55	1.75	.85	.8	1.0	1.4	1.5	1.65
31	2.9	....	4.7	....	3.5	....	.85	.8	....	1.45	....	1.65

a Maximum gage height, 20.2 feet.

Rating table for Indian Creek near Crescent Mills, Cal., for 1906, 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.*
0.80	16	2.10	200	3.40	502	5.40	1,420
.90	25	2.20	219	3.50	530	5.60	1,540
1.00	35	2.30	238	3.60	560	5.80	1,660
1.10	46	2.40	258	3.70	595	6.00	1,800
1.20	58	2.50	278	3.80	630	6.20	1,940
1.30	71	2.60	299	3.90	665	6.40	2,080
1.40	84	2.70	321	4.00	700	6.60	2,220
1.50	98	2.80	345	4.20	785	6.80	2,360
1.60	113	2.90	369	4.40	880	7.00	2,500
1.70	129	3.00	395	4.60	980	8.00	3,200
1.80	146	3.10	421	4.80	1,080	9.00	3,900
1.90	164	3.20	448	5.00	1,180	10.00	4,600
2.00	182	3.30	475	5.20	1,300	11.00	5,300

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 14 discharge measurements made during 1905 and 1906 and is well defined below gage heights 6.2 feet. Above 7 feet the rating curve is a tangent, the difference being 70 per tenth.

Monthly discharge of Indian Creek near Crescent Mills, Cal., for 1907 and 1908.

[Drainage area, 740 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	1,270	278	504	0.681	0.79	31,000	A.
February	8,280	1,180	2,210	2.99	3.11	123,000	A.
March	11,400	880	2,930	3.96	4.56	180,000	B.
April	5,720	2,640	3,860	5.22	5.82	230,000	B.
May	2,880	1,420	2,110	2.85	3.29	130,000	A.
June	1,600	475	1,000	1.35	1.51	59,500	A.
July	448	137	241	.326	.38	14,800	A.
August	164	71	91.3	.123	.14	5,610	A.
September	98	77	88.9	.120	.13	5,290	A.
October	146	91	114	.154	.18	7,010	A.
November	146	129	139	.188	.21	8,270	A.
December	1,300	129	384	.519	.60	23,600	A.
The year	11,400	71	1,140	1.54	20.72	818,000	
1908.							
January	808	288	478	.646	.74	29,400	A.
February	530	278	363	.49	.53	20,900	A.
March	1,940	395	989	1.34	1.54	60,800	A.
April	1,480	665	1,030	1.39	1.55	61,300	A.
May	930	530	661	.893	1.03	40,600	A.
June	502	137	306	.414	.46	18,200	A.
July	137	20	72.4	.098	.11	4,450	A.
August	16	12	15.1	.02	.02	928	A.
September	35	16	22.7	.031	.03	1,350	A.
October	113	30	58.8	.08	.09	3,620	A.
November	200	71	94.4	.128	.14	5,620	A.
December	248	91	124	.168	.19	7,620	A.
The year	1,940	12	351	.476	6.43	255,000	

NOTE.—It has been assumed that channel conditions at this station are permanent, and the accuracy rated accordingly.

YUBA RIVER DRAINAGE BASIN.

DESCRIPTION.

Yuba River rises near the crest on the western slope of the high Sierra and flows southwestward to its junction with Feather River at Marysville. The total length of the stream is about 90 miles.

Its basin lies south of the Middle Fork of Feather River basin, west of the Truckee River basin and north of the American and Bear River basins, is chiefly in Yuba, Sierra, and Nevada counties, and is one of the principal subdivisions of the Feather River basin. It has an area of more than 1,300 square miles and is triangular in shape, the base of the triangle lying along the crest of the Sierra. Its extreme length from the mouth of the Yuba River to the crest of the Sierra is about 70 miles, and its greatest width is about 35 miles. The most important tributaries are Middle Fork of Yuba, South Fork of Yuba, and Deer Creek from the south, and North Fork of North Fork and Canyon Creek from the north.

The Yuba basin has a rugged and mountainous topography. From the edge of the Sacramento Valley it rises gently through the foothills and then more abruptly through rounded and broken mountains to the crest of the Sierra, which along the Yuba-Truckee divide has a mean elevation of about 8,000 feet and a few peaks exceeding 9,000 feet. The streams have cut deep canyons which head well up in the mountains. The lower western part of the basin is composed of slates and kindred rocks, much eroded; and the higher eastern part consists of granites and lavas. A stratum of serpentine traverses the basin parallel to the crest but at a considerable distance from it.

The soil is deep in most places and supports a hardy growth of brush and timber, especially along the sides of the canyons. The North Fork basin has at present the best forest cover, and that of South Fork the poorest, but this difference is the result of lumbering operations. All the upper part of the Yuba basin, more than 800 square miles, is now included in a national forest.

The mean annual precipitation ranges from 18 inches at Marysville to about 70 inches near the mountain crest. In the upper and central parts of the basin the precipitation ranges from 50 to 70 inches and occurs principally as snow, which remains on the ground all winter and well into the summer. The North and South Fork basins probably receive the greatest precipitation.

Irrigation development is almost entirely wanting in the Yuba River basin, but the main stream could be used, undoubtedly, for irrigating a part of the Sacramento Valley.

Storage sites in the Yuba River basin are not numerous, though considerable storage is feasible, particularly along the upper part of South Fork. Numerous small lakes near the headwaters of the South Fork are utilized as storage reservoirs. The stored water was originally used in hydraulic mining. At present this water is used for irrigation along the foothill fruit belt in the vicinity of Auburn and also for power development. The minimum flow of the streams is sufficient to develop about 125,000 horsepower without storage.

Perennial springs are found in different parts of Yuba River basin, particularly along the North Fork. In the South Fork basin at the higher elevations are many small glacial lakes, and here also are many rounded, denuded summits and glacial valleys.

The channel of Yuba River for many miles above its mouth has been filled with enormous quantities of mining débris—tailings from hydraulic mining between 1849 and 1880—variously estimated at between 71,000,000 and 700,000,000 cubic yards. The depth of this débris is about 7 feet at the mouth, about 26 feet at Dugnens Point, 11 miles above the mouth, and about 84 feet in The Narrows, 18 miles above the mouth. An attempt has been made to restrain this débris from moving downstream by building barrier dams, but it has not been successful.

The longest run-off record in the Yuba River basin dates from 1903. The wettest year since that time was 1907 and the driest 1908. The total flow in the wettest year was nearly three times that in the driest.

The only gaging station that has been maintained in the basin is on Yuba River near Smartsville, 1903 to 1908.

YUBA RIVER NEAR SMARTSVILLE, CAL.

This station, which is located 1 mile north of Smartsville at a point in the foothills called The Narrows, was established June 2, 1903, to obtain general statistical data regarding the flow of the river. The data are very valuable in connection with flood and reclamation problems of Sacramento Valley.

Deer Creek enters from the east about 1 mile above the station. Its drainage area is 88 square miles. South Fork of Yuba (draining 355 square miles) and North Fork of Yuba (draining 220 square miles) enter from the east about 8 and 15 miles, respectively, above the station. Dry Creek enters from the north about 7 miles below the station. Its drainage area is about 100 square miles.

No diversions are made immediately above the station. Extensive water rights have been acquired throughout this basin and practically the entire flow of the South Fork has been preempted by filings.

At the point of measurement the channel is straight for several hundred feet and is filled to a great depth with gravel and sand—tailings from hydraulic mining. The banks are high and rocky and not subject to overflow, and the current is swift at all stages. The bed of the stream is continually shifting, alternately filling and scouring, so that frequent discharge measurements are necessary. During recent years the bed has been lowering, and on August 1, 1906, the gage datum was lowered 10 feet.

Conditions for obtaining accurate discharge data are poor, owing to the shifting of the bed and the torrential nature of the stream. At high stages only float velocities can be taken.

Discharge measurements of Yuba River near Smartsville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 22	J. R. McKeel	160	570	10.10	2,030
February 5	....do	260	2,450	17.50	21,100
February 8	R. S. Hawley	252	1,720	15.40	10,800
February 11	J. R. McKeel	245	1,310	14.65	8,180
February 16	....do	245	1,090	14.20	6,370
February 27	....do	245	1,080	14.50	6,340
March 7	....do	245	1,160	14.60	6,750
March 12	....do	245	1,130	14.40	6,320
March 14	....do	245	986	14.00	5,000
March 22	....do	280	2,050	15.85	13,700
April 4	Hawley and Steward	283	1,470	13.80	9,520
April 8	J. R. McKeel	285	1,460	14.00	9,550
April 23	....do	285	1,710	15.00	14,500
April 27	....do	285	1,630	14.80	11,900
May 3	W. G. Steward	285	1,430	14.30	8,460
May 8	J. R. McKeel	280	1,390	13.80	7,330
May 16	....do	290	1,650	14.20	8,940
May 20	....do	290	1,840	14.95	10,900
May 26	....do	284	1,520	14.10	8,630
May 29	....do	288	1,670	14.65	10,500
June 6	....do	285	1,490	14.25	8,950
June 14	....do	145	1,080	13.0	5,440
June 20	....do	150	1,100	13.05	6,260
June 26	W. F. Martin	145	989	12.80	5,990
July 7	J. R. McKeel	138	841	11.50	4,180
July 13	....do	135	766	11.05	3,640
July 21	....do	134	608	10.00	2,100
July 28	....do	133	520	9.35	1,430
August 11	....do	130	424	8.7	711
September 1	....do	130	379	8.4	583
October 20	....do	130	360	8.20	468
October 22	W. A. Lamb	120	354	8.22	427
November 3	J. R. McKeel	130	372	8.30	531
November 16	....do	130	348	8.10	427
November 26	....do	130	362	8.20	476
December 2	....do	130	352	8.10	437
December 11	....do	135	688	10.50	2,790
December 23	....do	130	458	8.70	881
1908.					
January 3	J. R. McKeel	135	647	9.80	2,370
January 7	....do	135	577	9.40	1,670
January 16	....do	140	686	10.20	2,760
January 21	W. A. Lamb	160	1,170	13.10	8,440
January 27	J. R. McKeel	140	760	10.50	3,220
February 3	....do	140	834	11.40	4,050
February 11	....do	138	656	10.00	2,620
February 18	....do	137	562	9.50	1,680
February 24	....do	137	546	9.20	1,570
March 9	....do	135	633	9.80	2,420
March 14	....do	140	762	10.80	3,580
March 18	....do	140	890	11.80	5,100
March 23	....do	140	811	10.90	4,180
April 7	W. A. Lamb	140	738	10.50	3,130
April 18	....do	145	1,000	11.75	5,300
April 20	....do	160	1,220	12.90	8,410
May 17	J. R. McKeel	140	872	11.40	4,490
May 24	....do	140	1,000	12.05	6,100
June 7	....do	140	837	10.90	4,530
June 14	....do	140	814	10.50	4,320
June 21	....do	140	768	10.20	3,870
August 9	....do	125	320	6.80	363
August 23	....do	125	315	6.90	328
September 6	....do	125	297	6.80	286
September 13	....do	125	299	6.80	293
September 20	....do	125	302	6.85	303
November 1	....do	130	337	7.30	463
December 6	....do	130	537	8.40	1,520
December 15	....do	130	398	7.20	651
December 20	....do	130	378	7.00	567

Daily gage height, in feet, of Yuba River near Smartsville, Cal., for 1907 and 1908.

[J. R. McKeel, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	11.8	21.0	15.3	13.8	14.4	14.6	12.6	9.2	8.4	8.2	8.4	8.1
2	11.3	27.0	14.6	14.4	......	15.1	12.2	9.2	......	8.2	8.4	8.1
3	11.3	20.5	14.3	14.0	14.3	14.3	12.4	9.1	8.4	8.2	8.3	8.1
4	14.5	19.5	14.3	13.7	14.2	14.3	......	9.0	8.4	8.3	8.3	8.1
5	12.4	17.5	14.7	13.9	14.0	14.2	12.0	8.9	8.3	8.3	8.2	8.2
6	11.8	16.8	15.0	14.0	13.9	14.3	11.8	8.9	......	......	8.2	8.7
7	11.2	16.0	14.6	14.0	13.8	14.1	11.5	8.8	8.3	8.2	8.3	12.1
8	11.3	15.5	14.4	14.0	13.8	......	11.4	8.8	......	8.2	8.3	10.3
9	11.2	15.1	15.6	14.3	14.0	13.6	11.3	8.7	......	8.3	8.3	9.4
10	10.9	14.9	14.8	14.7	14.1	13.2	11.2	......	8.3	......	8.3	9.0
11	10.6	14.7	15.2	15.0	14.3	15.0	11.2	8.7	8.3	......	......	10.5
12	10.5	14.5	14.4	15.4	14.0	14.0	11.2	8.7	8.2	8.3	8.2	9.6
13	10.5	14.3	14.1	15.7	13.8	......	11.0	8.6	......	......	8.2	10.0
14	10.7	14.2	14.0	16.2	13.8	13.0	10.9	8.6	......	8.3	8.2	9.7
15	10.6	14.1	14.0	16.4	14.1	12.6	10.7	......	8.2	8.3	8.2	9.4
16	10.5	14.2	14.3	15.5	14.2	12.3	10.6	8.5	8.2	8.2	8.1	9.1
17	10.4	14.3	24.0	15.1	14.7	12.4	10.5	8.5	......	8.2	8.2	8.9
18	10.3	14.4	27.9	15.2	15.0	12.7	10.5	......	8.2	8.2	8.2	8.8
19	10.2	14.2	29.2	15.4	15.3	13.1	10.4	8.5	8.3	8.2	......	8.8
20	10.1	14.2	24.0	15.3	15.0	13.1	10.3	8.5	8.2	8.2	8.1	8.7
21	10.1	14.2	18.5	15.2	14.7	13.7	10.0	8.5	......	8.2	8.2	8.7
22	10.1	14.8	15.9	15.1	14.4	13.0	9.9	8.4	8.2	8.2	......	......
23	10.3	......	16.4	15.0	13.7	12.3	9.8	8.4	8.2	......	8.2	8.7
24	10.4	14.4	15.0	15.0	14.3	12.4	9.7	......	......	8.2	8.2	8.7
25	11.3	15.6	14.5	15.0	......	12.6	9.6	......	8.2	8.3	8.2	8.7
26	12.1	15.0	14.1	14.9	14.1	12.6	9.6	8.4	8.3	8.4	8.2	11.5
27	11.7	14.5	13.8	14.8	14.2	12.7	9.5	......	8.3	8.6	8.0	10.6
28	16.8	14.2	13.6	14.7	14.2	12.6	9.4	8.4	8.3	8.6	7.8	10.0
29	15.0	......	13.4	14.6	14.7	12.5	9.3	......	......	8.5	8.0	10.3
30	13.5	......	13.2	14.5	14.5	......	9.3	8.4	8.3	8.4	......	10.4
31	19.0	......	13.4	......	14.5	......	9.2	8.4	......	8.4	......	11.4
1908.												
1	10.1	10.1	10.3	10.0	12.3	11.2	8.2	7.0	......	6.8	7.3	7.1
2	10.1	10.5	10.9	10.1	12.7	10.8	8.2	......	6.9	......	7.3	7.1
3	9.8	11.4	10.7	10.3	12.0	10.0	8.1	6.9	......	6.8	7.2	7.5
4	10.1	10.5	10.2	10.6	11.0	9.9	8.0	6.9	6.8	......	7.2	8.3
5	9.7	10.4	10.2	......	11.1	10.2	......	6.9	......	6.8	7.1	9.8
6	9.5	10.4	10.0	10.8	11.3	10.5	7.9	6.9	6.8	......	......	8.4
7	9.4	10.2	9.9	10.5	12.2	10.9	7.8	6.9	......	6.8	7.0	7.9
8	9.4	10.1	......	10.2	......	10.8	7.8	6.8	......	......	......	7.7
9	9.5	10.4	9.8	10.5	10.9	10.8	7.7	......	6.8	6.8	7.0	7.8
10	9.4	10.2	10.0	11.0	10.8	10.7	7.7	6.8	......	......	......	7.5
11	9.4	10.0	10.1	11.6	10.7	10.6	7.6	6.9	6.8	6.8	7.0	7.4
12	9.6	9.9	10.3	11.9	10.8	10.6	......	6.9	......	......	......	7.3
13	9.9	9.8	10.5	12.3	10.7	10.5	7.5	6.9	6.8	......	7.0	7.3
14	12.1	9.8	10.8	12.0	11.0	10.4	7.5	......	......	6.8	......	7.3
15	10.8	9.7	11.1	11.6	11.5	10.0	7.5	6.9	6.8	10.2	7.1	7.2
16	10.4	9.6	11.5	11.3	11.2	9.9	7.4	......	6.9	8.4	7.1	7.1
17	10.2	9.6	11.6	11.2	11.4	9.7	7.4	6.9	6.9	7.8	......	7.1
18	10.1	9.5	11.8	11.6	12.0	9.5	7.3	......	......	7.4	7.1	7.0
19	10.4	9.5	11.6	12.2	13.0	9.4	......	6.9	6.9	7.4	......	7.0
20	12.2	9.4	11.3	12.9	12.0	9.3	7.2	......	6.9	7.3	7.1	7.0
21	13.0	9.4	......	12.6	11.9	10.2	7.2	6.9	......	7.3	7.7	7.0
22	12.9	9.3	11.0	12.2	11.8	9.2	7.2	......	......	7.2	8.3	7.2
23	11.8	......	10.9	11.7	11.8	9.0	7.1	6.9	6.8	7.2	8.6	7.1
24	12.1	9.2	10.8	11.4	12.1	8.9	7.1	......	6.8	7.2	8.0	7.6
25	11.3	9.3	10.9	11.3	12.2	8.8	7.1	6.9	6.8	......	7.6	7.3
26	10.8	9.5	11.0	11.6	12.0	8.7	......	......	......	7.1	7.3	7.2
27	10.5	9.4	10.8	11.7	11.7	8.6	7.1	......	6.8	......	......	......
28	10.3	9.6	10.5	12.0	11.8	8.5	7.1	6.9	6.8	7.1	7.1	......
29	10.2	10.0	......	12.0	11.7	8.4	7.0	......	......	......	......	7.1
30	10.0	......	10.4	12.0	11.6	8.3	7.0	6.9	......	7.3	7.0	7.1
31	9.8	......	10.3	......	......	......	7.0	......	......	7.4	......	7.1

Daily discharge, in second-feet, of Yuba River near Smartsville, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4,100	41,000	8,100	9,200	9,200	8,800	5,730	1,220	570	470	570	430
2	3,500	78,000	6,700	11,200	a 9,200	10,700	5,130	1,220	a 570	470	570	430
3	3,500	38,400	6,200	10,000	8,500	8,700	5,430	1,120	570	470	520	430
4	8,900	32,400	6,200	9,500	8,200	8,800	a 5,130	1,030	570	520	520	430
5	4,900	21,000	6,900	9,800	7,700	8,700	4,830	940	520	520	470	470
6	4,100	17,300	7,500	10,000	7,500	9,100	4,550	940	a 520	a 520	470	770
7	3,400	13,200	6,800	9,800	7,300	8,600	4,130	850	520	470	520	4,980
8	3,500	11,400	6,500	9,600	7,300	a 7,800	3,990	850	a 520	470	520	2,490
9	3,400	9,700	9,000	10,600	7,700	7,100	3,850	770	a 520	520	520	1,430
10	3,100	9,000	7,200	12,000	7,900	6,200	3,710	a 770	520	a 520	520	1,030
11	2,800	8,200	8,100	13,500	8,600	10,400	3,710	770	520	a 520	a 470	2,750
12	2,700	7,800	6,300	15,100	8,000	7,800	3,710	770	470	520	470	1,650
13	2,700	7,000	5,500	16,500	7,600	a 6,300	3,430	700	a 470	a 520	470	2,110
14	2,900	6,800	5,000	19,000	7,800	'5,400	3,290	700	a 470	520	470	1,760
15	2,800	6,400	6,000	20,700	8,700	4,900	3,010	a 700	470	520	470	1,430
16	2,700	6,400	6,600	16,000	8,900	4,700	2,880	630	470	470	430	1,120
17	2,600	6,500	56,000	14,400	10,300	4,500	2,750	630	a 470	470	470	940
18	2,500	6,600	85,000	15,000	11,400	4,700	2,750	a 630	470	470	470	850
19	2,400	6,200	100,000	16,000	12,300	5,100	2,620	630	520	470	a 430	850
20	2,300	6,200	60,000	15,600	11,400	6,000	2,490	630	470	470	430	770
21	2,300	6,100	27,000	15,400	10,300	6,000	2,110	630	a 470	470	470	770
22	2,300	7,200	14,000	15,000	9,400	7,300	1,990	570	470	470	a 470	a 770
23	2,500	a 6,700	16,500	14,500	7,700	5,800	1,870	570	470	a 470	470	770
24	2,600	6,300	11,000	14,500	9,200	5,300	1,760	a 570	a 470	470	470	770
25	3,500	8,900	9,900	14,500	a 8,900	5,500	1,650	a 570	470	520	470	770
26	4,500	7,500	8,900	13,300	8,600	5,700	1,650	570	520	570	470	4,130
27	4,000	6,300	8,400	12,000	8,500	5,700	1,540	a 570	520	700	400	2,880
28	17,700	6,000	8,000	11,300	7,800	5,800	1,430	570	520	700	350	2,110
29	10,400	......	7,700	10,600	8,500	5,700	1,320	a 570	a 520	630	400	2,490
30	6,700	......	7,500	9,800	8,400	5,500	1,320	570	520	570	a 400	2,620
31	29,400	......	8,000	......	8,600	......	1,220	570	......	570	......	3,990
1908.												
1	2,650	2,300	3,000	2,600	6,720	4,800	1,280	400	a 350	320	470	400
2	2,650	2,700	3,900	2,700	7,800	4,100	1,280	a 400	350	a 320	470	400
3	2,370	4,050	3,600	3,000	5,950	2,900	1,180	350	a 350	320	430	560
4	2,650	2,700	2,900	3,400	4,070	2,780	1,100	350	320	a 320	430	1,000
5	2,100	2,690	2,900	a 3,500	4,200	3,270	a 1,100	350	a 320	320	400	2,500
6	1,830	2,720	2,600	3,600	4,600	3,780	1,000	350	320	a 320	a 400	1,530
7	1,670	2,590	2,500	3,130	6,350	4,530	920	350	a 320	320	370	1,100
8	1,700	2,500	a 2,400	2,700	a 4,810	4,400	920	320	a 320	a 320	a 370	940
9	1,830	3,000	2,420	3,100	3,500	4,500	840	a 320	320	320	370	1,010
10	1,700	2,800	2,630	3,900	3,470	4,400	840	320	a 320	a 320	a 370	810
11	1,700	2,620	2,750	5,000	3,320	4,300	760	350	320	320	370	750
12	1,960	2,440	2,980	5,600	3,500	4,350	a 760	350	a 320	a 320	a 370	700
13	2,370	2,240	3,150	6,400	3,320	4,250	700	350	320	a 320	370	700
14	6,240	2,200	3,580	5,800	3,800	4,140	700	a 350	a 320	320	a 370	700
15	3,720	2,020	4,020	5,000	4,720	3,600	700	350	320	3,500	400	640
16	3,080	1,860	4,680	4,400	4,200	3,430	630	a 350	350	1,100	400	600
17	2,800	1,810	4,800	4,250	4,490	3,140	630	350	350	700	a 400	600
18	2,650	1,680	5,100	5,000	5,950	2,870	560	a 350	a 350	520	400	550
19	3,090	1,670	4,870	6,500	8,000	2,720	a 560	350	350	520	a 400	550
20	6,460	1,620	4,500	8,410	5,700	2,600	500	a 350	350	480	400	550
21	8,210	1,680	a 4,470	7,550	5,500	3,880	500	350	a 350	480	650	550
22	8,000	1,620	4,250	6,450	5,500	2,450	500	a 350	a 320	440	1,000	650
23	5,610	a 1,520	4,180	5,200	5,500	2,200	450	350	320	440	1,220	600
24	6,250	1,570	4,030	4,500	6,200	2,080	450	a 350	320	440	820	880
25	4,630	1,700	4,180	4,300	6,400	1,940	450	350	320	a 440	600	700
26	3,720	1,900	4,250	4,960	6,100	1,820	a 450	a 350	a 320	400	480	650
27	3,220	1,800	3,900	5,200	5,580	1,700	450	a 350	320	a 400	a 440	a 650
28	2,820	2,060	3,400	5,940	5,800	1,580	450	350	320	400	400	a 600
29	2,640	2,530	a 3,250	a 5,940	5,580	1,490	400	a 350	a 320	a 430	a 400	600
30	2,300	......	3,170	5,940	5,500	1,380	400	350	a 320	470	370	600
31	2,010	......	3,000	......	a 5,100	......	400	a 350	......	520	......	600

a Estimated.

NOTE.—The daily discharges from January 1 to June 30, 1907, were obtained by the indirect method for shifting channels; for the rest of the year a rating table was used.
Daily discharges for 1908 were computed by the indirect method for shifting channels.

Monthly discharge of Yuba River near Smartsville, Cal., for 1907 and 1908.

[Drainage area, 1,220 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	29,400	2,300	4,990	4.09	4.72	307,000	B.
February	78,000	6,000	14,100	11.6	12.08	783,000	B.
March	100,000	5,000	17,300	14.2	16.37	1,069,000	B.
April	20,700	9,200	13,100	10.7	11.94	780,000	B.
May	12,300	7,300	8,750	7.17	8.27	538,000	B.
June	10,700	4,500	6,750	5.53	6.17	402,000	B.
July	5,730	1,220	3,060	2.51	2.89	188,000	B.
August	1,220	570	736	.603	.70	45,300	B.
September	570	470	505	.414	.46	30,000	B.
October	700	470	517	.424	.49	31,800	B.
November	570	350	472	.387	.43	28,100	B.
December	4,980	430	1,590	1.30	1.50	97,800	B.
The year	100,000	350	5,990	4.91	66.00	4,290,000	
1908.							
January	8,210	1,670	3,380	2.77	3.19	208,000	C.
February	4,050	1,520	2,230	1.83	1.97	128,000	C.
March	5,100	2,400	3,590	2.94	3.39	221,000	C.
April	8,410	2,600	4,800	3.93	4.38	286,000	C.
May	8,000	3,320	5,200	4.26	4.91	320,000	C.
June	4,800	1,380	3,180	2.61	2.91	189,000	C.
July	1,280	400	705	.578	.67	43,300	C.
August	400	320	350	.287	.33	21,500	C.
September	350	320	329	.270	.30	19,600	C.
October	3,500	320	521	.427	.49	32,000	C.
November	1,000	370	478	.392	.44	28,400	C.
December	2,500	400	764	.626	.72	47,000	C.
The year	8,410	320	2,130	1.74	23.70	1,540,000	

BEAR RIVER DRAINAGE BASIN.

DESCRIPTION.

Bear River drains a narrow strip on the western slope of the Sierra below the 5,500-foot contour. The basin is about 60 miles long and not more than 10 miles wide, and lies south of Yuba River basin and north of American River basin. Its total area is less than 300 square miles.

The river rises in the extreme northeastern part of the basin near Emigrant Gap, and flows southwestward to its junction with Feather River about 15 miles south of Marysville. It is the boundary line between Nevada and Placer counties, and closely parallels the Bear-American divide, which is from 1 to 2 miles south of it. Its principal tributaries are Steep Hollow Creek, Greenhorn River, and Wolf Creek, all from the north.

The Bear River basin has very little forest cover, except on a small area in the upper part. The mean annual precipitation ranges from 21 inches in the valley to 52 inches at the source of the river, where much of it occurs as snow that soon disappears.

Very little, if any, irrigation is practiced in this basin.

Storage is not feasible, and the minimum flow of the streams is not sufficient to develop much power.

The longest run-off record extends back to 1904. The wettest year since that time was 1906, and the driest, 1908. The total flow in the wettest year was nearly five times that in the driest.

Only one gaging station has been maintained in this basin, that on Bear River at Van Trent (above Wheatland), 1904 to 1908.

BEAR RIVER AT VAN TRENT, CAL.[a]

This station, which is located about 800 feet below the bridge near the Dairy Farm mine, Van Trent post-office, and 8 miles above Wheatland, was established October 8, 1904, to obtain data regarding the flow of a deforested basin.

No important tributaries enter near the station. Wolf Creek enters from the north about 20 miles above, and has a drainage area of 76 square miles. Rock Creek is very small and enters about 1 mile below. No diversions are made immediately above the station.

The channel has a gravelly bed, and the current is swift at all stages. Only float velocities can be taken in flood. The gage datum has remained unchanged during the life of the station.

Conditions for obtaining accurate discharge data are poor, owing to the rough channel and torrential nature of the stream.

Discharge measurements of Bear River at Van Trent, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 7	R. S. Hawley	160	369	6.70	1,930
February 21	do	118	190	4.90	734
April 5	Steward and Hamilton	145	379	5.70	1,700
April 30	F. M. Hamilton	136	163	3.60	621
May 2	W. G. Steward	131	143	3.65	591
May 19	F. M. Hamilton	132	107	3.20	374
May 22	W. G. Steward	92	81	3.05	324
June 6	F. M. Hamilton	88	51	2.75	220
June 27	W. F. Martin	42	35	2.65	185
September 6	W. A. Lamb	47	32	1.80	40
October 21	do	45	28	1.75	35
1908.					
January 23	W. A. Lamb	135	213	4.00	902
April 9	do	49	53	2.70	223
April 18	do	60	62	2.85	315
September 21	W. V. Hardy	15	12	1.65	35
December 16	W. F. Martin	56	71	2.12	123

[a] Referred to in previous reports as "above Wheatland." Van Trent is a new post-office.

Daily gage height, in feet, of Bear River at Van Trent, Cal., for 1907 and 1908.

[Hermann Ernestus, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.4	10.75	6.9	6.4	3.7	3.0	2.6	1.9	1.8	1.8	2.1	2.1
2	5.0	17.75	6.1	6.2	3.6	2.9	2.5	1.9	1.8	1.8	2.2	1.9
3	4.8	10.5	5.5	5.9	3.5	2.8	2.5	1.9	1.7	1.8	2.1	1.9
4	6.15	9.7	5.3	5.6	3.5	2.8	2.6	1.9	1.8	1.8	2.0	1.9
5	6.8	8.2	6.1	6.0	3.5	2.8	2.4	1.8	1.8	1.8	2.2	2.4
6	5.5	7.3	6.5	5.7	3.4	2.8	2.4	1.8	1.8	1.8	2.0	2.4
7	5.2	6.8	5.6	5.5	3.4	2.9	2.4	1.8	1.8	1.7	2.1	4.15
8	5.85	6.5	5.4	5.4	3.4	2.9	2.3	1.8	1.7	1.8	2.0	3.3
9	5.4	6.1	5.8	5.3	3.3	2.9	2.3	1.8	1.7	1.9	2.0	2.7
10	5.3	5.6	6.8	5.3	3.3	2.7	2.3	1.8	1.7	1.8	2.1	2.5
11	5.1	5.4	7.0	5.2	3.3	3.2	2.2	1.7	1.7	1.8	1.9	3.75
12	4.9	5.4	6.3	5.2	3.4	3.4	2.2	1.7	1.7	1.8	2.1	2.9
13	4.9	5.3	5.6	5.1	3.4	3.4	2.2	1.7	1.7	1.8	1.9	3.0
14	5.3	5.3	5.2	5.55	3.2	3.3	2.2	1.7	1.7	1.8	1.9	2.8
15	5.1	5.2	4.9	6.3	3.2	3.1	2.1	1.7	1.8	1.8	1.9	2.7
16	5.0	5.1	4.9	5.1	3.1	3.0	2.2	1.7	1.8	1.8	1.9	2.8
17	5.2	5.3	13.95	4.8	3.1	2.9	2.2	1.7	1.7	1.8	2.0	2.7
18	5.4	5.3	12.75	4.5	3.1	2.9	2.2	1.7	1.7	1.8	1.9	2.6
19	5.1	5.0	17.8	4.4	3.2	2.8	2.1	1.7	1.8	1.9	1.9	2.5
20	4.9	4.9	13.6	4.3	3.2	2.9	2.1	1.7	1.8	1.9	2.0	3.1
21	4.8	4.8	9.6	4.2	3.2	2.8	2.1	1.7	1.8	1.8	2.0	2.7
22	4.9	6.0	8.8	4.2	3.1	3.2	2.1	1.7	1.7	1.8	1.9	2.6
23	4.9	5.4	13.2	4.1	3.1	2.9	2.1	2.0	1.7	1.8	1.9	2.5
24	5.0	5.0	9.7	4.1	3.2	2.8	2.1	1.9	1.7	1.8	1.9	2.4
25	5.7	7.3	9.4	4.0	3.1	2.8	2.1	1.9	1.8	1.9	1.9	2.5
26	6.0	5.9	8.1	3.9	3.1	2.8	2.1	1.9	1.8	2.0	1.9	3.8
27	5.6	5.3	7.3	3.9	3.0	2.7	2.1	1.8	1.8	2.1	2.0	5.15
28	9.5	5.1	6.9	3.8	3.0	2.7	2.0	1.8	1.8	2.1	2.0	3.5
29	7.3	......	6.5	3.8	3.0	2.6	2.0	1.8	1.9	2.1	1.9	3.2
30	6.1	......	6.3	3.7	2.9	2.7	2.0	1.8	1.8	2.1	1.9	3.0
31	7.5	......	6.4	......	3.0	......	1.9	1.9	......	2.2	......	6.5
1908.												
1	4.5	3.3	4.15	2.8	2.4	2.4	1.8	1.6	1.6	1.6	1.6	1.8
2	3.5	4.1	4.5	2.8	2.95	2.4	1.8	1.6	1.6	1.7	1.6	1.8
3	3.2	5.5	4.05	2.8	2.75	2.4	1.8	1.6	1.6	1.6	1.6	1.8
4	4.1	4.1	3.8	2.8	2.5	2.4	1.8	1.6	1.6	1.6	1.6	2.4
5	3.3	4.1	3.6	2.8	2.5	2.4	1.7	1.6	1.6	1.6	1.6	3.8
6	3.0	3.7	3.7	2.7	2.5	2.4	1.7	1.6	1.6	1.6	1.6	2.8
7	3.0	3.5	3.6	2.8	2.5	2.4	1.7	1.6	1.6	1.6	1.6	2.5
8	2.9	3.4	3.5	2.7	2.6	2.4	1.7	1.6	1.5	1.6	1.6	2.3
9	3.0	3.5	3.4	2.7	2.5	2.4	1.7	1.6	1.6	1.5	1.5	2.3
10	2.9	3.6	3.4	2.7	2.6	2.4	1.8	1.6	1.6	1.5	1.6	2.4
11	2.9	3.4	3.45	2.7	2.75	2.3	1.7	1.6	1.6	1.5	1.6	2.3
12	2.9	3.3	3.45	2.7	2.8	2.3	1.7	1.6	1.6	1.5	1.6	2.2
13	2.9	3.2	3.5	2.9	2.7	2.3	1.7	1.6	1.6	1.4	1.6	2.1
14	4.4	3.2	3.5	2.9	2.7	2.2	1.7	1.6	1.6	1.4	1.6	2.2
15	3.8	3.1	3.5	2.85	3.2	2.2	1.7	1.6	1.6	2.95	1.6	2.2
16	3.4	3.1	3.5	3.0	3.0	2.2	1.7	1.6	1.6	2.4	1.6	2.1
17	3.2	3.0	3.4	3.05	2.8	2.1	1.7	1.6	1.7	2.1	1.6	2.1
18	3.1	2.9	3.4	2.95	2.7	2.1	1.7	1.6	1.7	1.9	1.6	2.1
19	3.3	2.9	3.3	2.8	2.7	2.1	1.7	1.6	1.7	1.8	1.7	2.1
20	5.6	2.9	3.3	2.8	3.1	2.1	1.7	1.6	1.7	1.8	1.7	2.1
21	6.5	2.8	3.3	2.8	2.9	2.4	1.7	1.6	1.6	1.7	1.9	2.1
22	5.1	2.8	3.2	2.8	2.8	2.2	1.7	1.6	1.6	1.7	2.25	2.1
23	4.1	2.8	3.1	2.8	2.7	2.2	1.7	1.6	1.6	1.7	2.4	2.1
24	5.0	2.7	3.0	3.0	2.7	2.2	1.7	1.6	1.6	1.6	2.4	2.2
25	4.4	2.7	3.0	2.8	2.6	2.1	1.7	1.6	1.6	1.6	2.1	2.1
26	3.9	2.8	3.0	2.7	2.6	2.0	1.7	1.6	1.6	1.6	2.0	2.1
27	3.6	2.7	2.9	2.7	2.5	2.0	1.6	1.6	1.7	1.6	1.9	2.0
28	3.4	2.7	2.9	2.6	2.5	1.9	1.6	1.6	1.6	1.6	1.8	2.0
29	3.3	3.7	2.9	2.6	2.5	1.9	1.6	1.6	1.7	1.6	1.9	2.0
30	3.2	......	2.8	2.5	2.5	1.9	1.6	1.6	1.6	1.7	1.7	2.0
31	3.2	......	2.9	......	2.5	......	1.6	1.6	......	1.6	......	2.0

Rating tables for Bear River at Van Trent, Cal.

JANUARY 1 TO MARCH 25, 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.*
4.50	530	5.90	1,400	7.30	2,700	11.00	7,800
4.60	585	6.00	1,470	7.40	2,810	12.00	9,750
4.70	640	6.10	1,540	7.50	2,930	13.00	12,000
4.80	700	6.20	1,620	7.60	3,050	14.00	14,500
4.90	760	6.30	1,700	7.70	3,170	15.00	17,200
5.00	820	6.40	1,780	7.80	3,290	16.00	20,100
5.10	880	6.50	1,870	7.90	3,410	17.00	23,200
5.20	940	6.60	1,960	8.00	3,530	18.00	26,500
3.30	1,000	6.70	2,060	8.20	3,770	19.00	29,900
5.40	1,065	6.80	2,160	8.40	4,030	20.00	33,400
5.50	1,130	6.90	2,260	8.60	4,290	21.00	37,000
5.60	1,195	7.00	2,370	8.80	4,550	22.00	40,700
5.70	1,260	7.10	2,480	9.00	4,830	23.00	44,500
5.80	1,330	7.20	2,590	10.00	6,150		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twenty-four discharge measurements made during 1904 to 1907, and is well defined between gage heights 4.5 feet and 6.7 feet.

MARCH 26 TO DECEMBER 31, 1907.

1.70	35	2.90	275	4.10	800	5.60	1,700
1.80	40	3.00	310	4.20	850	5.80	1,840
1.90	45	3.10	345	4.30	905	6.00	1,980
2.00	50	3.20	385	4.40	960	6.20	2,125
2.10	60	3.30	435	4.50	1,015	6.40	2,275
2.20	75	3.40	465	4.60	1,070	6.60	2,430
2.30	95	3.50	510	4.70	1,130	6.80	2,590
2.40	120	3.60	555	4.80	1,190	7.00	2,750
2.50	150	3.70	600	4.90	1,250	8.00	3,650
2.60	180	3.80	650	5.00	1,310		
2.70	210	3.90	700	5.20	1,435		
2.80	240	4.00	750	5.40	1,565		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on nine discharge measurements made after March, 1907, and is well defined between gage heights 1.7 feet and 6 feet.

FOR 1908.

1.40	20	2.50	215	3.60	655	4.70	1,195
1.50	25	2.60	250	3.70	700	4.80	1,250
1.60	30	2.70	285	3.80	745	4.90	1,305
1.70	40	2.80	320	3.90	790	5.00	1,360
1.80	55	2.90	360	4.00	840	5.20	1,480
1.90	70	3.00	400	4.10	890	5.40	1,600
2.00	90	3.10	440	4.20	940	5.60	1,725
2.10	110	3.20	480	4.30	990	5.80	1,855
2.20	135	3.30	520	4.40	1,040	6.00	1,990
2.30	160	3.40	565	4.50	1,090	6.20	2,130
2.40	185	3.50	610	4.60	1,140	6.40	2,275

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during 1908, and is well defined between gage heights 1.5 feet and 4 feet.

Monthly discharge of Bear River at Van Trent, Cal., for 1907 and 1908.

[Drainage area, 263 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	5,480	700	1,300	4.94	5.70	79,900	C.
February	25,700	700	2,810	10.7	11.14	156,000	C.
March	25,800	760	4,450	16.9	19.48	274,000	C.
April	2,280	600	1,300	4.94	5.51	77,400	C.
May	600	275	404	1.54	1.78	24,800	B.
June	465	180	282	1.07	1.19	16,800	B.
July	180	45	84.7	.322	.37	5,210	B.
August	50	35	39.7	.151	.17	2,440	B.
September	45	35	38.0	.144	.16	2,260	B.
October	75	35	44.5	.169	.19	2,740	B.
November	75	45	51.0	.194	.22	3,030	B.
December	2,350	45	363	1.38	1.59	22,300	B.
The year	25,800	35	931	3.54	47.50	667,000	
1908.							
January	2,350	360	731	2.78	3.20	44,900	C.
February	1,660	285	535	2.03	2.19	30,800	C.
March	1,090	320	553	2.10	2.42	34,000	C.
April	420	215	316	1.20	1.34	18,800	C.
May	480	185	280	1.06	1.22	17,200	C.
June	185	70	142	.540	.60	8,450	C.
July	55	30	40.8	.155	.18	2,510	C.
August	30	30	30.0	.114	.13	1,840	C.
September	40	25	31.8	.121	.14	1,890	C.
October	380	20	52.1	.198	.23	3,200	C.
November	185	25	54.2	.206	.23	3,230	C.
December	745	55	145	.551	.64	8,920	C.
The year	2,350	20	243	.921	12.52	176,000	

AMERICAN RIVER DRAINAGE BASIN.

DESCRIPTION.

American River drains the area lying on the western slope of the Sierra, south of the Bear and Yuba River basins, west of Lake Tahoe and the Truckee River basin, and north of the Cosumnes and Mokelumne River basins. The area is triangular in shape, the base of the triangle following the crest of the Sierra for about 50 miles. The basin is about 80 miles long, and has a maximum width of 50 miles, and its total area is about 2,000 square miles.

American River is formed by the union of its three principal forks, which rise in the high Sierra at an altitude of 9,000 to 10,000 feet. It flows southwestward to its junction with the Sacramento just above the city of Sacramento, and has a total length of about 110 miles. North and Middle forks each have a length of about 60 miles, a total fall of nearly 8,000 feet, and a total drainage area of 349 and 640 square miles, respectively. South Fork has a length of about 60 miles, a total fall of nearly 9,000 feet, and a total drainage area of 861 square miles. North and Middle forks unite near Auburn, about 20 miles above the mouth of South Fork, which is only a few miles above Folsom. Each of the forks has many other forks, branches, and tributaries.

Almost half of the American drainage basin has an altitude exceeding 5,000 feet, and probably one-third of it ranges from 6,000 to 9,000 feet. The formation in the upper part is chiefly granite, which has yielded to glacial and erosional action to such an extent as to form many regular ridges and drainage channels.

The lower elevations of the basin have a poor forest cover, being barren, or, at most, sparsely timbered; but the higher elevations support a good growth of timber. All the upper part of the basin, amounting to considerably more than half of the total, is included in a federal forest reserve.

The mean annual precipitation varies from 21 inches in the Sacramento Valley to probably 60 inches near the summit of the Sierra, where it occurs as snow which does not disappear till summer. In the foothill region it ranges from 25 to 30 inches and in the central region from 45 to 55 inches. It is probably somewhat greater in the northern than in the southern part of the basin. At the higher altitudes there is much snow and ice during the winter.

Some water is diverted from the American for irrigation, particularly in the Sacramento Valley, but further development is possible.

Storage development on a big scale is not possible in the American basin, though considerable storage for power and mining is feasible, particularly on Middle and South forks.

The minimum flow of the streams in this basin, with the existing fall, is sufficient to develop about 100,000 horsepower without storage, of which about 40 per cent is on the South Fork and nearly 30 per cent on the Middle Fork.

The upper part of the American basin shows evidence of glaciation, which has left many small lakes, some of which have been dammed and used for storage in connection with mining.

The longest run-off record in this basin extends back to 1904. The wettest year since that time was 1907, and the driest, 1908. The total flow during the wettest year was nearly four times that during the driest.

The only gaging station that has been maintained in the basin is on American River near Fairoaks, 1904 to 1908.

AMERICAN RIVER NEAR FAIROAKS, CAL.

This station, which is located at the Fairoaks highway bridge about 1,000 feet north of the railroad station, was established November 3, 1904, to obtain data for use in connection with studies of flood problem in the Sacramento Valley. The old bridge was destroyed by flood in March, 1907, after which time measurements were made from a temporary bridge until the end of 1908. A new steel bridge was completed early in 1909, and measurements are now made from it.

No important tributaries enter American River above or below Fairoaks, except the South Fork, which joins the main stream about 3 miles above Folsom and about 10 miles above the station.

Some water is diverted for irrigation at points above the station, but the quantity is not known.

The position of the gage has been changed several times during the life of the station, but no change has been made in the datum.

The conditions for obtaining accurate discharge data are poor. The stream is torrential and has a changeable bed; the current is sluggish at low, and very swift at moderate, stages; the flow is disturbed by bars at low water and by concrete piers at other stages, and the channel conditions near the right bank are disturbed by a large eddy, which is very objectionable at all stages except the lowest.

Discharge measurements of American River near Fairoaks, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 5	R. S. Hawley	378	4,300	11.60	24,800
February 20	do	352	2,280	6.00	6,340
March 5	do	353	2,720	7.10	9,590
March 14	do	353	2,630	6.50	8,370
May 10	W. G. Steward	376	3,700	8.35	12,900
May 20	do	384	3,980	9.00	16,800
June 24	W. F. Martin	336	2,460	6.41	7,690
September 17	W. A. Lamb	180	923	2.50	412
November 2	do	320	1,430	2.70	736
1908.					
January 24	W. A. Lamb	361	2,560	5.70	7,260
February 14	do	325	1,580	3.40	1,660
March 16	do	355	2,250	4.95	5,380
April 11	do	360	2,260	4.95	5,680
Do	do	360	2,440	5.52	6,660
April 25	do	361	2,100	4.60	4,460
September 19	W. V. Hardy	64	64	1.50	149
October 6	do	65	72	1.63	176
December 15	W. F. Martin	271	1,350	2.21	694

Daily gage height, in feet, of American River near Fairoaks, Cal., for 1907 and 1908.

[M. J. Ferry, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.0	9.65	5.75	8.55	8.1	9.1	6.85	4.05	2.9	2.4	2.7	2.6
2	4.1	22.75	6.6	9.05	8.1	9.45	7.0	4.0	2.75	2.4	2.7	2.6
3	4.0	15.15	6.25	8.5	8.05	8.85	6.95	3.95	2.7	2.4	2.6	2.6
4	4.05	14.55	6.2	8.4	8.05	8.7	6.9	3.7	2.8	2.4	2.7	2.6
5	5.95	12.3	6.75	8.5	7.9	8.6	7.15	3.5	2.7	2.4	2.7	2.6
6	4.75	10.0	6.9	8.1	7.75	8.5	6.75	3.3	2.7	2.4	2.7	2.75
7	4.45	8.7	6.5	8.0	7.45	8.4	6.1	3.25	2.7	2.4	2.7	3.5
8	4.45	8.1	6.25	8.0	7.1	7.8	6.3	3.45	2.7	2.4	2.7	3.6
9	4.35	7.55	5.6	8.5	7.8	7.3	6.05	3.5	2.7	2.4	2.6	3.45
10	4.15	7.25	8.4	9.0	8.15	7.2	6.0	3.35	2.8	2.4	2.6	4.1
11	3.85	7.0	8.2	9.2	8.8	8.8	6.0	3.4	2.7	2.4	2.6	4.2
12	3.6	6.7	7.75	9.6	8.3	9.3	5.9	3.3	2.7	2.4	2.6	3.6
13	3.8	6.5	6.85	9.95	7.6	8.5	5.65	3.35	2.7	2.4	2.6	3.3
14	3.85	6.4	6.45	10.25	7.1	7.3	5.4	3.3	2.8	2.3	2.6	3.3
15	4.05	6.25	6.15	10.45	7.4	6.15	5.2	3.25	2.7	2.4	2.6	3.25

Daily gage height, in feet, of American River near Fairoaks, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	3.85	6.3	6.1	9.4	8.0	6.0	4.85	3.0	2.65	2.4	2.6	2.95
17	3.85	6.35	13.4	9.2	8.25	5.9	5.05	3.0	2.45	2.4	2.6	2.9
18	4.15	6.4	20.6	9.3	8.65	6.5	5.0	3.05	2.5	2.4	2.6	2.8
19	3.75	6.15	27.6	9.65	9.45	6.8	5.0	3.05	2.55	2.4	2.6	2.8
20	3.7	6.0	23.8	9.9	9.3	7.3	4.9	3.15	2.55	2.4	2.6	2.75
21	3.65	6.0	21.1	9.45	8.1	7.7	4.85	3.1	2.5	2.4	2.6	2.7
22	3.6	6.8	18.4	9.05	8.0	7.45	4.55	3.0	2.5	2.4	2.6	2.7
23	3.6	6.5	13.5	9.05	7.2	6.9	4.4	3.0	2.5	2.4	2.6	2.7
24	3.65	6.1	13.25	9.2	7.15	6.4	4.4	3.0	2.4	2.4	2.6	2.6
25	4.1	6.75	12.3	9.25	7.55	6.55	4.4	2.9	2.35	2.4	2.6	2.6
26	4.9	6.7	11.5	8.95	7.8	7.1	4.5	3.0	2.4	2.8	2.6	2.7
27	4.8	6.25	10.2	8.85	8.0	7.25	4.25	2.95	2.5	2.85	2.6	6.7
28	8.65	5.95	9.2	8.8	8.3	7.4	4.3	3.0	2.45	2.7	2.6	4.4
29	8.7	......	8.75	8.6	8.45	7.55	4.3	3.0	2.45	2.7	2.6	3.75
30	6.9	......	8.55	8.55	8.35	7.3	4.25	3.05	2.4	2.7	2.6	4.35
31	6.1	......	8.5	......	8.2	......	4.25	2.95	......	2.7	......	5.5
1908.												
1	4.2	3.5	4.05	4.0	5.6	4.4	3.3	2.0	1.4	1.5	1.9	2.3
2	3.5	3.8	4.3	4.0	5.55	4.45	3.25	2.0	1.5	1.5	1.9	2.3
3	3.5	4.65	4.6	3.8	5.8	4.15	3.25	2.0	1.5	1.5	1.9	2.6
4	3.55	4.7	4.3	4.0	4.8	4.15	3.25	2.0	1.4	1.5	1.8	2.9
5	3.5	4.4	4.0	4.2	4.75	4.05	3.2	1.9	1.5	1.5	1.8	3.5
6	3.3	3.8	3.95	4.2	4.9	4.15	3.1	1.95	1.4	1.5	1.8	3.8
7	3.25	3.7	3.8	4.2	4.75	4.05	3.1	1.9	1.4	1.5	1.8	3.5
8	3.3	3.6	3.8	4.0	4.7	4.35	3.0	1.9	1.5	1.5	1.8	3.15
9	3.2	3.7	3.8	4.0	4.6	4.35	2.95	1.8	1.5	1.5	1.7	2.85
10	3.2	3.7	3.7	4.0	4.5	4.55	2.95	1.8	1.5	1.5	1.6	2.8
11	3.2	3.6	3.8	5.2	4.25	4.4	2.9	1.7	1.4	1.5	1.6	2.6
12	3.65	3.5	3.8	6.0	4.6	4.55	2.95	1.7	1.4	1.5	1.6	2.5
13	3.8	3.5	3.95	5.65	4.6	4.35	2.85	1.7	1.5	1.5	1.5	2.3
14	4.0	3.5	4.4	6.1	4.5	4.35	2.7	1.7	1.5	1.6	1.5	2.2
15	3.7	3.45	4.6	5.75	5.25	4.25	2.7	1.6	1.5	1.8	1.4	2.15
16	3.55	3.4	5.05	5.75	5.05	4.15	2.65	1.6	1.5	3.75	1.4	2.2
17	3.5	3.4	5.0	5.0	4.9	4.1	2.6	1.6	1.5	2.9	1.4	2.1
18	3.5	3.4	5.0	5.0	4.95	3.9	2.5	1.6	1.4	2.6	1.4	2.0
19	3.5	3.35	5.0	5.4	5.1	3.8	2.5	1.6	1.5	2.6	1.4	1.9
20	3.9	3.3	4.95	6.05	5.0	3.7	2.4	1.5	1.5	2.5	1.4	1.8
21	5.5	3.3	4.85	5.9	5.2	4.2	2.3	1.5	1.5	2.3	2.9	1.75
22	5.55	3.25	4.75	5.5	5.35	3.8	2.3	1.5	1.5	2.2	3.2	1.6
23	5.9	3.2	4.6	5.15	5.2	3.7	2.2	1.5	1.5	2.1	3.0	......
24	5.75	3.1	4.5	4.8	5.25	3.5	2.2	1.5	1.5	2.1	3.0	......
25	5.0	3.2	5.0	4.65	5.5	3.6	2.2	1.5	1.5	2.0	2.9	......
26	4.45	3.3	4.8	4.8	5.4	3.6	2.2	1.5	1.5	2.0	2.8	......
27	4.1	3.4	4.5	4.7	5.55	3.45	2.1	1.5	1.5	2.0	2.6	......
28	4.0	3.55	4.3	5.5	5.1	3.4	2.0	1.5	1.5	2.0	2.5	......
29	3.7	4.0	4.3	5.4	5.05	3.4	2.0	1.5	1.5	2.0	2.4	......
30	3.7	......	4.3	5.55	5.1	3.2	2.0	1.4	1.5	2.0	2.3	......
31	3.55	......	4.1	......	4.95	......	2.0	1.5	......	1.9	......	......

NOTE.—Gage heights observed for December 23 to 31 are believed to be in error and have been discarded.

Rating tables for American River near Fairoaks, Cal.

JANUARY 1 TO MARCH 19, 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.*
0.80	100	2.50	1,080	4.40	3,460	11.00	23,300
.90	130	2.60	1,170	4.60	3,820	12.00	27,700
1.00	165	2.70	1,260	4.80	4,200	13.00	32,300
1.10	205	2.80	1,350	5.00	4,600	14.00	37,100
1.20	250	2.90	1,450	5.20	5,020	15.00	42,000
1.30	300	3.00	1,550	5.40	5,450	16.00	47,000
1.40	355	3.10	1,660	5.60	5,890	17.00	52,000
1.50	410	3.20	1,770	5.80	6,340	18.00	57,000
1.60	465	3.30	1,880	6.00	6,800	19.00	62,000
1.70	520	3.40	2,000	6.20	7,260	20.00	67,000
1.80	580	3.50	2,120	6.40	7,740	21.00	72,000
1.90	640	3.60	2,250	6.60	8,220	22.00	77,000
2.00	700	3.70	2,380	6.80	8,700	23.00	82,000
2.10	770	3.80	2,520	7.00	9,200	24.00	87,000
2.20	840	3.90	2,660	8.00	12,100	25.00	92,000
2.30	920	4.00	2,810	9.00	15,400	26.00	97,000
2.40	1,000	4.20	3,120	10.00	19,200	27.00	102,000

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1904 to March, 1907, and later high-water measurements, and is fairly well defined between gage heights 0.9 feet and 13.1 feet. Above gage height 15 feet the rating curve is a tangent, the difference being 500 per tenth.

MARCH 20, 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.-ft.*
1.40	100	2.40	640	3.40	1,640	4.80	4,080
1.50	130	2.50	720	3.50	1,770	5.00	4,500
1.60	160	2.60	800	3.60	1,910	5.20	4,960
1.70	200	2.70	890	3.70	2,060	5.40	5,420
1.80	240	2.80	980	3.80	2,220	5.60	5,880
1.90	290	2.90	1,080	3.90	2,390	5.80	6,340
2.00	350	3.00	1,180	4.00	2,560	6.00	6,800
2.10	420	3.10	1,290	4.20	2,920		
2.20	490	3.20	1,400	4.40	3,290		
2.30	560	3.30	1,520	4.60	3,680		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on ten discharge measurements made during 1907 to 1909, and is fairly well defined between gage heights 1.5 feet and 13.1 feet. Above gage height 6.0 feet the rating curve is the same as the preceding.

Monthly discharge of American River near Fairoaks, Cal., for 1907 and 1908.

[Drainage area, 1,910 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	14,400	2,250	4,150	2.17	2.50	255,000	A.
February	80,800	6,680	14,800	7.75	8.07	822,000	A.
March	105,000	6,220	24,700	12.9	14.87	1,520,000	B.
April	21,000	12,100	15,600	8.17	9.12	928,000	A.
May	17,000	9,470	12,200	6.39	7.37	750,000	A.
June	17,000	6,570	11,100	5.81	6.48	660,000	A.
July	9,600	3,010	5,510	2.88	3.32	339,000	A.
August	2,650	1,080	1,500	.785	.90	92,200	A.
September	1,080	600	813	.426	.48	48,400	B.
October	1,030	560	693	.363	.42	42,600	B.
November	890	800	821	.430	.48	48,900	B.
December	8,460	800	1,790	.937	1.08	110,000	A.
The year	105,000	560	7,810	4.08	55.09	5,620,000	

Monthly discharge of American River near Fairoaks, Cal., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	6,570	1,400	2,600	1.36	1.57	160,000	A.
February	3,880	1,290	1,960	1.03	1.11	113,000	A.
March	4,620	2,060	3,290	1.72	1.98	202,000	A.
April	7,030	2,220	4,490	2.35	2.62	267,000	A.
May	6,340	3,010	4,590	2.40	2.77	282,000	A.
June	3,580	1,400	2,600	1.36	1.52	155,000	A.
July	1,520	350	870	.455	.52	53,500	B.
August	350	100	200	.105	.12	12,300	B.
September	130	100	123	.064	.07	7,320	B.
October	2,140	130	384	.201	.23	23,600	B.
November	1,400	100	441	.231	.26	26,200	B.
December[a]	2,220	160	605	.317	.37	37,200	B.
The year	7,030	100	1,850	.966	13.14	1,340,000	

[a] Discharge estimated as 160 second-feet December 23 to 31.

SAN JOAQUIN RIVER BASIN.

DESCRIPTION.

The San Joaquin drainage basin is the southern lobe of the great central basin of California, and lies southeast of an imaginary line drawn from San Francisco Bay to Lake Tahoe. The rim of the basin is determined by the crest of the Sierra Nevada at the east, the Tehachapi Range at the south, and the Coast Range at the west. The basin is somewhat larger than the Sacramento basin, with which it merges at the north. It has a length of about 280 miles northwest-southeast and a width of about 125 miles. It is roughly rectangular in shape, and has a total area of about 32,700 square miles.

San Joaquin River rises in the high Sierra south of the Yosemite National Park, about halfway between the north and south ends of the basin, and flows southwestward to the trough of the San Joaquin Valley, whence it takes a northwestward course to its mouth. It has a total length of approximately 350 miles—125 miles in the mountains and 225 in the valley. It discharges into Suisun Bay, about 50 miles by water from San Francisco. It is navigable as far as Stockton, about 50 miles above its mouth.

All the important tributaries of San Joaquin drain parts of the western slope of the Sierra, take a course parallel to the upper San Joaquin—that is, southwestward, and enter from the east. In order from south to north they are Fresno, Chowchilla, Merced, Tuolumne, Stanislaus, Calaveras, and Mokelumne rivers. The principal streams from the Sierra south of the upper San Joaquin, in order from north to south, are Kings, Kaweah, Tule, and Kern rivers. These last-named streams, however, are not directly tributary to the San Joaquin, for they are lost in the Tulare Lake depression, which under normal conditions has no surface outlet to the San Joaquin. Kings River discharges partly into Tulare Lake and partly into the San Joaquin. Besides the North, Middle, and South forks the upper San Joaquin has many other smaller tributaries, like all other Sierra streams.

Topographically the San Joaquin basin comprises three parallel strips of country having marked physical differences—(1) the eastern slope of the Coast Range, having an average width of about 15 miles and a comparatively gentle slope incised by the action of short torrential, intermittent streams; (2) the western slope of the Sierra, having an average width of about 65 miles and a long steep slope deeply cut by many long perennial streams; and (3) the central plain, known as the San Joaquin Valley, having an average width of nearly 45 miles and a very light slope northwestward.

The eastern slope of the Coast Range has an area somewhat less than 4,000 square miles and is made up chiefly of sandstones, shales, and conglomerates. It ranges in elevation from a few hundred feet at the edge of the valley to a few thousand at the crest.

The Sierra slope has an area of about 16,000 square miles, or half the total area of the San Joaquin basin. This slope consists chiefly of granites and metamorphic sedimentary and igneous rocks. The altitude of the slope ranges from a few hundred feet in the foothills to more than 14,000 feet at the crest of the Sierra. Mount Whitney, the highest peak near the southern end of the range, has an elevation of 14,501 feet above sea level. The valleys, canyons, and water-falls of some of the principal streams, particularly Kings, Merced, and Tuolumne rivers, are famous for their beauty.

The lowland known as the San Joaquin Valley is a great structural trough which owes its present condition to fluvial erosion and transportation. It is about 250 miles long and 45 miles wide, and has an area of 11,500 square miles. It is divided into an east side and a west side plain by the trough axis, or line of lowest depression, which is everywhere much nearer the western than the eastern foothills. At some places the axis lines near the western hills; at others, the west side slopes are 15 or 18 miles wide, or about one-half as wide as the east side slopes. The west side slopes are steeper than those of the east. Gradients of less than 6 or 8 feet to the mile are unusual, and gradients of 20 or even 40 feet to the mile are common. On the east side the maximum grade is about 30 feet to the mile, while 5 feet or less is about the average.

The unsymmetrical form of the valley floor arises from the difference in the character of the streams tributary to each side. The east side streams being in every way more important than those from the west particularly with regard to volume and distribution of flow, build up flatter but more extensive deltas, or alluvial fans than are built by the smaller more erratic and torrential streams from the west.

The general slope of the valley is upward from north to south and from the central axis toward the hills on each side. The topography of the San Joaquin Valley is the result of a combination of alluvial fan surfaces which have their apexes at the mouths of the canyons of the tributary streams, and extend outward into the valley, coalescing laterally and terminally. The fans of Kings River on the east and Los Gatos Creek on the west have united, forming a delta-dam across the trough of the valley, which separates the Tulare basin on the south from the lower part of the main valley. Likewise Kern River has extended its delta to the McKittrick Hills, separating Buena Vista and Kern Lake basin at the south from the Tulare basin at the north.

Large areas in the northern end of San Joaquin Valley are inundated during the spring floods unless protected by artificial levees. The greater part of the flood waters come from the Sacramento system, but the most disastrous consequences result from the simultaneous flooding of the two systems. The alluvial fans are less pronounced at the north than at the south end, but they are, nevertheless, predominant along the valley borders.

Some parts of the San Joaquin basin have a good forest cover; others are practically barren. The upper reaches of the Coast Range have a light brush and timber cover, but the foothills are bare. The main valley is treeless except at a few places along water courses or irrigated areas. The foothills of the Sierra have a good covering of grass, brush, and scattering timber, which increases in density with elevation. Above the foothills zone there is a heavy timber growth which extends to an altitude of about 10,000 feet, above which contour there is little, if any, timber. The famous California big trees (*Sequoia gigantea*) occur on the Sierran slope of this basin. About 65 per cent of the Sierran slope is included in national forest reserves and parks.

The mean annual precipitation in the San Joaquin basin varies with elevation, latitude, and longitude. The southern part of the central valley is strictly arid, the rainfall there being less than 5 inches annually, but northward along the trough of the valley the rainfall gradually increases until, at the north end, it averages nearly 20 inches. The west-side slope has a light rainfall, which increases progressively northward. In the Sierra region the precipitation increases with elevation up to about 5,000 feet, and then decreases somewhat up to the summit. The same progressive increase from south to north that exists in the valley continues along the summit.

This is well shown by the total run-off from the northern and southern Sierra, which amounts to about 11,500,000 acre-feet annually. Of this amount, about 3,000,000 acre-feet are supplied by the streams south of the upper San Joaquin from about 7,500 square miles, and 8,500,000 acre-feet by the San Joaquin and tributaries to the north from about 5,100 square miles.

The precipitation occurs during the "rainy season," which begins in the late fall and ends in early spring. The snowfall is heavy in the higher mountain region and does not disappear until late summer. Much ice occurs in the higher altitudes, but does not interfere with stream measurements.

The San Joaquin Valley, like the Sacramento Valley to the north, offers great opportunities for irrigation development. Practically all the Sierra streams are now drawn upon for irrigation to a greater or less extent. For the fullest development of the valley, however, the surface supply will have to be augmented by waters drawn from underground sources.[a]

The basin affords many storage sites, some of them being very large. More or less storage is already utilized for power development in the Sierra.

The minimum flow of the streams is sufficient to generate about 600,000 horsepower without storage. This amount could be increased to about 1,500,000 horsepower with storage. The most important streams for power development are the upper San Joaquin, Kings, and Kern rivers, each of which could develop considerably more than 100,000 horsepower without storage. The development at the present time is about 115,000 horsepower.

Numerous small glacial lakes and smooth, bare domes and ridges bear testimony to the former presence of a great glacial ice sheet. Undoubtedly the famous Yosemite Valley owes its exquisite grandeur in part to glaciation. Small glaciers still protrude themselves from the summits of the highest peaks.

The longest run-off record in the San Joaquin basin dates back as far as 1893, when a gaging station was established on Kern River near Bakersfield. Yearly records have been kept on Kern River since 1894, and on Kings, Tuolumne, and Stanislaus rivers since 1896. The wettest year on record was 1907 for the streams north of upper San Joaquin River, and 1906 for those south of the San Joaquin. The driest year was 1898. The total flow of the wettest year on the different streams was from four to eight times that of the driest.

[a] Mendenhall, W. C., Preliminary report on the ground waters of the San Joaquin Valley: Water-Supply Paper U. S. Geol. Survey No. 222, 1908.

Investigations of flow have been made on San Joaquin River and on the following stream tributaries to it and to Tulare Lake:

Kern River.
Tule River.
Kaweah River.
Kings River.
Merced River.
Tuolumne River.
Stanislaus River.
Calaveras River.
Mokelumne River.
Cosumnes River.

Gaging stations have been maintained on the main stream as follows:

San Joaquin River near Pollasky (1907 to 1908).
San Joaquin River at Herndon (1879 to 1908).

MAIN SAN JOAQUIN RIVER.

SAN JOAQUIN RIVER NEAR POLLASKY, CAL.

This station, which is located at the Fort Miller ranch house, about 4 miles above the town of Pollasky, was established October 18, 1907, to obtain general statistical data regarding the flow of the river. The data are useful also in connection with irrigation and power development and for studies of flood problems in the San Joaquin Valley.

No important tributaries enter near the station and no diversions are made above except for water-power development, all such diverted water being returned to the river channel above the station. The entire flow of the stream is controlled by existing water rights, involving all irrigable lands tributary to San Joaquin River.

No change has been made in the gage datum.

Conditions for obtaining accurate discharge data are fair. At low stage the current is very sluggish, but at such times check measurements can be made from the bridge at Pollasky. The channel is subject to slight change which may somewhat affect the accuracy.

Discharge measurements of San Joaquin River near Pollasky, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 1 [a]	Clapp and Hardy	198	336		508
October 21	W. V. Hardy	220	720	3.80	541
1908.					
February 27	W. F. Martin			4.50	1,240
May 4	W. A. Lamb	237	1,380	6.65	3,710
June 13	W. F. Martin	238	1,380	6.98	4,000
July 30	W. V. Hardy	223	955	4.85	1,600
August 20	do	222	751	4.08	710
August 21	do	222	751	4.05	638
August 22	do	222	751	4.05	635
September 5	do	222	682	3.75	419
October 16	do	222	640	3.54	308
December 7	W. F. Martin	222	660	3.70	388

[a] Measurement made at concrete bridge at Pollasky, Cal.

Daily gage height, in feet, of San Joaquin River near Pollasky, Cal., for 1907 and 1908.

[George Hames and E. G. Davis, observers.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1907.				1907.				1907.			
1	......	4.1	3.5	11	......	3.8	5.4	21	3.8	3.6	3.9
2	......	4.1	3.5	12	......	3.75	4.25	22	3.8	3.65	3.85
3	......	4.0	3.5	13	......	3.75	4.2	23	3.9	3.65	3.85
4	......	4.0	3.5	14	......	3.7	4.15	24	3.9	3.6	3.85
5	......	3.85	3.55	15	......	3.7	4.1	25	4.0	3.6	3.85
6	......	3.85	3.75	16	......	3.7	4.1	26	3.95	3.6	3.9
7	......	3.85	4.5	17	......	3.7	4.0	27	4.1	3.6	3.9
8	......	3.85	3.95	18	3.8	3.65	3.9	28	4.3	3.6	3.95
9	......	3.85	4.0	19	3.8	3.65	3.9	29	4.3	3.6	4.1
10	......	3.8	4.2	20	3.8	3.6	3.9	30	4.2	3.6	4.5
								31	4.2	......	4.3

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.15	4.2	5.45	4.8	8.6	6.05	5.6	5.0	3.75	3.8	3.65	3.5
2	4.1	5.0	4.6	4.75	8.3	6.0	5.6	5.3	3.7	3.75	3.6	3.55
3	4.1	4.8	4.6	4.7	7.8	5.8	5.7	5.2	3.7	3.7	3.6	3.6
4	4.1	4.8	4.55	4.9	7.1	5.5	5.7	6.3	3.7	3.65	3.55	3.8
5	4.1	4.6	4.4	5.2	6.4	5.6	5.75	6.0	3.75	3.6	3.55	3.7
6	4.1	4.4	4.55	5.2	6.8	5.8	5.9	5.2	3.8	3.65	3.55	3.7
7	4.05	4.3	4.55	5.2	7.8	5.85	5.7	5.0	3.9	3.7	3.5	3.7
8	4.0	4.2	4.55	5.0	6.8	5.95	5.5	4.9	4.1	3.7	3.5	3.6
9	4.0	4.15	4.55	5.1	6.3	6.4	5.5	4.7	4.2	3.65	3.55	3.65
10	4.0	4.15	4.55	5.0	5.9	6.85	5.2	4.8	4.05	3.6	3.55	3.65
11	4.0	4.2	4.6	5.7	5.3	6.85	5.6	4.8	4.0	3.55	3.5	3.65
12	4.0	4.2	4.6	6.1	5.8	6.7	5.35	4.55	4.35	3.55	3.5	3.6
13	4.0	4.2	4.6	6.6	5.6	6.6	5.45	4.5	4.15	3.55	3.5	3.55
14	4.2	4.2	5.0	7.3	5.8	6.7	5.35	4.35	4.0	3.55	3.5	3.5
15	4.4	4.2	5.0	6.8	5.9	6.65	5.1	4.35	3.95	3.55	3.5	3.5
16	4.45	4.15	5.0	6.7	5.85	6.5	4.9	4.3	3.9	3.55	3.45	3.6
17	4.25	4.25	5.25	6.5	5.55	6.45	4.8	4.15	3.9	4.0	3.45	3.5
18	4.15	4.2	6.0	6.8	5.6	6.0	4.8	4.15	4.0	3.85	3.45	3.5
19	4.05	4.2	6.0	7.4	5.65	5.9	4.8	4.1	4.0	3.8	3.45	3.5
20	4.05	4.2	5.1	7.8	5.95	5.9	4.8	4.05	4.05	3.75	3.45	3.5
21	4.05	4.25	6.0	7.8	5.75	5.75	4.8	4.05	4.05	3.75	3.45	3.5
22	4.1	4.2	5.9	6.9	6.1	5.7	4.8	4.05	3.95	3.65	3.45	3.55
23	4.05	4.2	6.0	6.6	6.2	5.65	4.8	4.05	3.9	3.6	3.55	3.6
24	4.1	4.2	6.0	6.3	7.1	5.5	4.8	4.0	4.2	3.7	3.6	3.55
25	4.6	4.2	5.85	6.2	6.95	5.65	4.8	3.95	4.5	3.75	3.65	3.5
26	4.2	4.2	5.7	6.4	7.0	5.85	4.75	3.95	4.2	3.75	3.65	3.5
27	5.15	4.2	6.0	7.4	6.8	5.85	4.75	3.9	4.1	3.75	3.55	3.5
28	4.8	4.2	6.0	8.2	6.95	5.65	4.7	3.9	4.0	3.7	3.55	3.5
29	4.4	5.5	5.3	8.5	7.2	5.6	4.9	3.85	3.9	3.7	3.55	3.5
30	4.2	......	5.1	8.6	7.1	5.65	4.9	3.8	3.8	3.65	3.5	3.55
31	4.2	......	5.0	......	6.5	......	5.0	3.8	......	3.65	......	3.55

Rating table for San Joaquin River near Pollasky, Cal., 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.*
3.40	190	4.80	1,510	6.20	3,160	7.60	4,855
3.50	250	4.90	1,625	6.30	3,280	7.70	4,980
3.60	320	5.00	1,740	6.40	3,400	7.80	5,105
3.70	400	5.10	1,855	6.50	3,520	7.90	5,230
3.80	480	5.20	1,970	6.60	3,640	8.00	5,355
3.90	570	5.30	2,085	6.70	3,760	8.10	5,480
4.00	660	5.40	2,200	6.80	3,880	8.20	5,610
4.10	760	5.50	2,320	6.90	4,000	8.30	5,740
4.20	860	5.60	2,440	7.00	4,120	8.40	5,870
4.30	960	5.70	2,560	7.10	4,240	8.50	6,000
4.40	1,070	5.80	2,680	7.20	4,360	8.60	6,130
4.50	1,180	5.90	2,800	7.30	4,480		
4.60	1,290	6.00	2,920	7.40	4,605		
4.70	1,400	6.10	3,040	7.50	4,730		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eleven discharge measurements made during 1907 and 1908, and is fairly well defined between gage heights 3.5 and 7.0 feet.

Monthly discharge of San Joaquin River near Pollasky, Cal., for 1907 and 1908.

[Drainage area, 1,640 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.							
October 18-31			658	0.401	0.46	40,500	A.
November	760	320	441	.269	.30	26,200	A.
December	2,200	250	659	.402	.46	40,500	A.
1908.							
January	1,910	660	864	.527	.61	53,100	A.
February	2,320	810	1,010	.616	.66	58,100	A.
March	2,920	1,070	1,950	1.19	1.37	120,000	A.
April	6,130	1,400	3,350	2.04	2.28	199,000	A.
May	6,130	2,080	3,560	2.17	2.50	219,000	A.
June	3,940	2,320	2,960	1.80	2.01	176,000	A.
July	2,800	1,400	1,930	1.18	1.36	119,000	A.
August	3,280	480	1,190	.726	.84	73,200	A.
September	1,180	400	655	.399	.45	39,000	A.
October	660	285	388	.237	.27	23,900	A.
November	360	220	272	.166	.19	16,200	B.
December	480	250	301	.184	.21	18,500	A.
The year	6,130	220	1,540	.936	12.75	1,120,000	

SAN JOAQUIN RIVER AT HERNDON, CAL.

This station is at the Southern Pacific Railroad bridge, about 12 miles northwest of Fresno and 20 miles below Pollasky. In 1879 the engineering department of the Southern Pacific Company set a gage on the old trestle bridge, which was used for the regular gaging station established at the beginning of 1895. In 1899, the trestle was replaced by a steel bridge, to the center pier of which a new gage was placed at the datum of the old gage. Meter measurements were discontinued at the end of 1901, because of the continual change in the section due to shifting sand. Since that date only a gage record has been kept.

The following record has been furnished by William Hood, chief engineer of the Southern Pacific Company.

Daily gage height, in feet, of San Joaquin River at Herndon, Cal., for 1907 and 1908.

[Southern Pacific Railway Company, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.65	5.5	4.75	6.65	9.65	11.25	10.25	6.6	3.25	2.6	3.15	2.85
2	3.65	5.35	4.65	7.0	9.5	11.35	9.5	6.75	3.25	2.6	3.0	3.6
3	4.0	5.1	4.6	7.5	9.5	11.75	9.65	6.65	3.15	2.6	3.0	3.5
4	4.15	5.0	4.6	7.5	9.35	11.6	10.9	6.65	3.0	2.6	3.0	3.35
5	4.15	5.0	4.75	7.6	8.65	11.35	10.5	6.25	3.0	2.6	3.0	3.35
6	4.35	4.85	7.65	7.35	8.35	11.0	9.75	6.0	3.0	2.6	3.0	3.15
7	4.5	4.85	6.4	7.15	8.0	9.9	9.85	5.9	3.0	2.6	3.0	3.0
8	4.65	4.75	6.4	7.4	7.65	9.0	9.35	5.9	3.0	2.6	3.0	3.0
9	5.0	4.75	6.15	7.65	8.25	8.9	9.1	5.75	3.0	2.6	3.0	3.25
10	5.0	4.65	7.35	8.15	8.5	9.6	8.65	5.5	3.0	2.6	3.0	3.4
11	4.5	4.75	8.5	9.0	8.65	9.9	8.5	5.5	3.0	2.6	3.0	3.4
12	4.35	5.0	8.35	9.25	9.0	9.35	8.15	5.15	3.0	2.6	3.0	3.35
13	4.35	5.0	7.25	9.0	8.5	8.5	8.75	5.1	3.0	2.6	3.0	3.35
14	4.35	5.0	6.5	9.5	8.0	8.25	8.5	5.0	3.0	2.4	3.0	3.6
15	4.35	5.0	5.65	9.35	8.0	7.65	8.1	5.0	3.0	2.4	3.0	3.75
16	4.35	5.0	7.35	8.75	8.35	7.5	7.9	5.15	3.0	2.4	3.0	3.75
17	4.35	5.0	8.5	8.6	9.5	7.15	7.65	5.15	3.0	2.25	3.0	3.65
18	4.35	5.0	10.0	8.5	10.0	7.5	7.5	5.35	2.9	2.25	3.0	3.65
19	4.4	5.0	9.15	8.5	10.5	8.15	8.0	5.15	2.9	2.25	3.0	3.65
20	4.4	5.0	11.5	9.0	10.0	9.1	7.5	5.0	2.85	2.25	3.0	3.65
21	4.4	5.0	11.5	9.25	10.35	9.5	7.65	4.85	2.85	2.25	2.9	3.65
22	4.5	5.0	7.15	9.35	10.25	9.35	7.15	4.75	2.75	2.25	2.9	3.65
23	4.4	6.5	7.0	9.65	8.9	9.15	6.9	4.25	2.75	2.25	2.9	3.65
24	4.35	5.35	11.0	10.0	8.75	8.85	7.1	4.25	2.65	2.25	2.85	3.65
25	4.35	5.15	9.5	10.0	9.0	9.1	7.5	4.0	2.65	2.25	2.85	3.65
26	4.4	5.15	9.0	9.65	9.35	9.4	7.4	4.0	2.65	2.35	2.85	3.65
27	4.5	5.15	7.5	9.6	9.5	9.65	7.15	4.0	2.6	2.4	2.85	3.65
28	4.65	5.0	7.0	9.6	9.25	9.85	7.0	3.85	2.6	2.65	2.85	3.65
29	10.0	......	6.35	9.5	10.5	9.75	7.0	3.85	2.6	3.0	2.85	3.65
30	7.35	......	6.5	10.0	10.25	10.65	6.9	3.5	2.6	3.15	2.85	3.65
31	5.5	......	7.0	......	11.15	......	6.9	3.5	......	3.15	......	3.65
1908.												
1	3.7	3.75	4.25	4.0	8.0	6.6	4.7	3.5	2.85	2.6	2.5	2.35
2	3.75	3.75	4.25	4.0	8.0	6.25	4.7	3.5	2.75	2.6	2.5	2.35
3	3.75	3.75	4.25	4.0	7.5	6.1	4.7	4.15	2.75	2.6	2.5	2.35
4	3.75	3.75	3.9	4.0	7.35	6.0	5.0	5.25	2.7	2.6	2.5	2.35
5	3.75	3.75	3.75	4.0	6.7	5.7	5.0	5.5	2.7	2.5	2.5	2.35
6	3.75	3.75	3.75	4.35	5.75	5.6	5.15	5.25	2.7	2.5	2.5	2.35
7	3.75	3.75	3.75	4.25	5.7	5.25	5.15	5.1	2.6	2.5	2.5	2.35
8	3.75	3.75	3.7	4.1	5.7	5.15	5.15	4.7	2.6	2.5	2.5	2.35
9	3.75	3.75	3.6	4.0	5.75	6.15	5.1	4.5	2.9	2.5	2.5	2.35
10	3.75	4.0	3.6	4.0	5.75	6.25	5.1	4.5	2.85	2.5	2.4	2.35
11	3.75	4.0	3.7	5.15	5.5	6.25	5.1	4.15	2.75	2.5	2.4	2.35
12	3.75	3.7	3.7	5.6	5.4	6.35	4.75	4.0	2.75	2.5	2.4	2.35
13	3.7	3.7	3.7	6.0	5.25	6.35	4.7	4.0	2.75	2.5	2.4	2.35
14	3.7	3.7	4.1	6.15	5.0	6.5	4.7	4.0	2.7	2.5	2.4	2.35
15	3.75	3.7	4.35	6.25	5.15	6.7	4.4	4.0	2.7	2.5	2.35	2.35
16	3.75	3.7	4.75	6.4	5.0	6.7	4.35	4.0	2.7	2.5	2.35	2.35
17	3.75	3.6	5.35	6.25	5.0	6.6	4.15	4.0	2.7	2.6	2.35	2.35
18	3.7	3.6	5.6	6.0	5.0	6.15	4.0	3.7	2.6	2.6	2.35	2.35
19	3.7	3.6	5.7	5.75	5.0	6.0	4.0	3.6	2.6	2.6	2.35	2.35
20	3.6	3.6	5.7	5.6	5.0	5.5	4.0	3.6	2.6	2.7	2.35	2.35
21	3.6	3.6	5.25	6.4	5.0	5.15	3.75	3.5	2.6	2.6	2.35	2.35
22	3.6	3.6	5.5	6.35	5.35	5.0	3.75	3.5	2.6	2.6	2.35	2.35
23	3.6	3.6	5.0	6.35	5.35	4.75	3.75	3.5	2.6	2.6	2.35	2.35
24	3.6	3.5	5.25	6.15	6.25	4.75	3.7	3.5	2.6	2.6	2.35	2.35
25	3.6	3.5	5.35	6.1	6.5	5.0	3.7	3.35	2.6	2.6	2.35	2.35
26	3.75	3.5	5.35	6.0	6.75	5.0	3.7	3.25	2.7	2.5	2.35	2.35
27	3.75	3.5	5.25	6.0	6.7	5.0	3.6	3.25	2.75	2.5	2.35	2.35
28	3.75	3.5	5.0	6.6	6.7	5.15	3.6	3.1	2.7	2.5	2.35	2.35
29	3.75	3.6	4.6	7.7	6.7	5.25	3.6	3.0	2.7	2.5	2.35	2.35
30	3.75	......	4.5	8.0	6.5	5.4	3.5	3.0	2.7	2.5	2.35	2.35
31	3.75	......	4.15	......	6.5	......	3.5	3.0	......	2.5	......	2.35

TULARE LAKE BASIN.

DESCRIPTION.

The Tulare Lake basin is situated near the south end of the San Joaquin Valley and embraces that part of the valley determined by the Kings River delta at the north and the Kern River delta at the south. These rivers leave the foothills and enter the valley near Fresno and Bakersfield, respectively. Strictly speaking, they are tributaries of San Joaquin River, but in reality no water from Kern River has reached the San Joaquin in recent years. Only a part of Kings River enters the San Joaquin.

Below the foothills the Kings and Kern River channels roughly parallel each other in a southwestern direction. They are about 90 miles apart and their courses are approximately at right angles to the axis, or old trough, of the valley. During past centuries each of these streams has brought down an immense quantity of eroded material and deposited it in the valley along its course, the result of the deposition being the pronounced delta fans that extend completely across the valley as the Kings and Kern River ridges. The delta ridge formed by Kern River extends westward to the McKittrick hills and cuts off a small basin in the extreme south end of the San Joaquin Valley, which may be called Kern basin. This basin has several small lakes, of which Kern reservoir is the largest and occupies the lowest depression. Kern River drains into this basin.

North of the Kern and south of the Kings River ridge is another broad but shallow depression known as the Tulare Lake basin or the "valley of the tules." Its lowest area lies in the trough of the San Joaquin Valley and for several hundred years has been covered most of the time by a shallow fresh-water lake. The lake was originally a delta swamp and has always fluctuated in depth and extent, depending upon the season and the caprice of the delta rivers supplying it. Probably within the last hundred years the entire flow of Kern, Tule, and Kaweah rivers has entered this lake and a large part, if not all, of Kings River; but at the present time only the Kaweah and the Tule, south of Kings and north of Kern River, are wholly tributary to the Tulare basin. At high stages Kings River discharges in part into this basin, and sometimes overflow may reach it from the Kern basin at the south.

TULARE LAKE IN KINGS COUNTY, CAL.

Tulare Lake is a shallow body of water occupying the lowest depression in the Tulare basin. It is about 30 miles directly south of Fresno and 40 miles northwest of Bakersfield. The lake is roughly rectangular in shape, and its greatest length is from northwest to southeast. In November, 1907, when its margin was carefully determined, the lake had an area of about 274 square miles, a maximum depth of 12.4 feet, an average length of 20 miles, and a width of 13.5 miles; the water's edge was 3 miles from the town of Corcoran, and the water surface about 12 feet below. The lake reached its greatest height in the summer of 1907, when it had a maximum depth of nearly 14 feet.

For the twenty-five years preceding 1898 the lake level was steadily lowered, with only seasonal fluctuations. This lowering was in part brought about by the development of irrigation in Tulare basin, the water used for this purpose being diverted from the streams supplying the lake; but undoubtedly the chief factor in producing subsidence was light precipitation. During this entire period the precipitation was generally below the normal, particularly during the several years immediately preceding 1898, and in that year the lake bed became practically dry, and after partly refilling in 1901, it became completely dry in 1905. As the water receded a constantly increasing area of exceedingly fertile land was uncovered. From time to time this land was leveed on the lake side and cultivated, until, in the early spring of 1906, the entire lake bed was under cultivation.

On March 15, 1906, the first water reached the lake bed at the mouth of Kings River, and began spreading out over a large area of bottom land, upon which stood a crop of wheat almost matured. A few days later water from Kaweah and Tule rivers reached the lake. Then began a steady rise which rapidly submerged an increasingly large area of wheat fields. On June 1 the water was 7 feet deep, and covered about 200 square miles. On June 23, overflow water from Kern basin cut through the sand ridge to the south and flowed into the lake, which, for a few days afterwards, rose at the rate of 0.2 foot a day. On August 4 the water reached its greatest height for the year 1906, and the lake had an area of about 300 square miles and a maximum depth of 12.7 feet. The total rise of the lake in 1906 was 10.8 feet. From this date the lake level slowly subsided until December 9, after which a rise began which continued until July, 1907, when the lake attained a maximum depth of 14 feet. Since this date it has been gradually subsiding.

The lake bed resembles a large flat saucer. The flat, level area in the bottom has an elevation of approximately 180 feet above mean sea level and covers about 55 square miles. The lowest point on the crest of the delta ridge to the north is about 27 feet higher than the bottom of the lake. Natural overflow will not occur, therefore, until the lake has a maximum depth of nearly 30 feet and an area of nearly 1,000 square miles.

The lake receives practically all its water from Kings, Kaweah, and Tule rivers. Kings River furnishes the largest quantity. During flood periods about half of the total flow below all diversions enters the lake. Under normal conditions all the water of Tule River and nearly all that of Kaweah River is diverted for irrigation, and only a small quantity of water from these streams reaches the lake. The water from Kern River is stored in Kern basin except in years of great run-off. It is said that previous to 1906 no water had reached the lake from Kern River for twenty-five years. It thus appears that in years of great run-off, like 1906 and 1907, there will always be a large flow into the lake. Owing to variation in the inflow, therefore, and in the evaporation, which amounts to about 4.5 feet a year, it is probable that the lake will continue to fluctuate very much as in the past, though possibly never reaching very high stages.

The sudden reappearance of Tulare Lake has resulted in a financial loss of millions of dollars. Naturally great interest attaches to the probable behavior of the lake in the future, since permanent reclamation is ultimately hoped for. Whether the lake is destined to dry up or remain a body of water with great fluctuations, as in the past, or whether it is to fill and subside alternately, are questions of great importance.

During 1906 and a part of 1907, a record of the stage of the lake was kept by means of a government gage located near the entrance of Kings River near Lemoore, Cal., at the middle of sec. 4, T. 21 S., R. 20 E., Mount Diablo base and meridian. The record was kept by Mark Lovelace, of Lemoore, Cal. The zero of the gage is at an elevation of 175.1 feet above mean sea level, or 4 feet below the bottom of the lake (elevation 179.1 feet). On May 11, 1907, a gage was set near Corcoran, Cal., and after that date readings were made by D. W. Lewis, of Corcoran, Cal. All lake gage heights have been adjusted to refer to the gage datum near Lemoore, Cal.

Below is the gage record, showing the actual depth of the water on the lowest point of the lake bed, and the variations in level during the last three years.

Daily gage height, in feet, of Tulare Lake in Kings County, Cal., for 1906 to 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
1							10.1	12.4	12.1	11.4	10.9	10.6
2							10.2	12.6	12.0	11.4	10.9	10.6
3							10.3	12.6	12.0	11.4	10.9	10.6
4							10.4	12.6	12.0	11.4	10.9	10.6
5							10.5	12.6	11.9	11.3	10.9	10.6
6						7.6	10.6	12.6	11.9	11.3	10.9	10.6
7						7.7	10.7	12.7	11.8	11.3	10.9	10.6
8						7.8	10.8	12.7	11.8	11.3	10.8	10.6
9						7.9	10.9	12.7	11.8	11.3	10.8	10.6
10						8.0	11.0	12.6	11.7	11.3	10.8	10.6
11						8.0	11.1	12.6	11.7	11.2	10.8	10.6
12						8.1	11.2	12.6	11.7	11.2	10.8	10.6
13						8.1	11.4	12.6	11.7	11.2	10.8	10.6
14						8.2	11.5	12.5	11.7	11.2	10.8	10.6
15			0.0				11.6	12.4	11.6	11.2	10.8	10.6

Daily gage height, in feet, of Tulare Lake in Kings County, Cal., for 1906 to 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
16						8.4	11.6	12.4	11.6	11.1	10.8	10.6
17					6.2	8.5	11.7	12.4	11.6	11.1	10.8	10.7
18						8.6	11.7	12.4	11.6	11.1	10.8	10.7
19						8.7	11.8	12.3	11.6	11.1	10.8	10.7
20						8.8	11.8	12.3	11.6	11.1	10.7	10.7
21						8.8	11.9	12.3	11.6	11.0	10.7	10.7
22						9.0	12.0	12.2	11.5	11.0	10.7	10.7
23						9.1	12.0	12.2	11.5	11.0	10.7	10.7
24						9.2	12.0	12.2	11.5	11.0	10.7	10.7
25						9.3	12.0	12.2	11.5	11.0	10.7	10.7
26						9.4	12.1	12.2	11.5	11.0	10.7	10.7
27						9.6	12.1	12.2	11.5	11.0	10.6	10.7
28						9.8	12.1	12.1	11.5	11.0	10.6	10.8
29						9.9	12.2	12.1	11.4	10.9	10.6	10.8
30						10.0	12.2	12.1	11.4	10.9	10.6	10.8
31					7.3		12.3	12.1		10.9		10.8
1907.												
1	10.8	11.0	11.3									
2	10.8	11.0	11.3									
3	10.8	11.0	11.3		13.0			13.7				
4	10.8	11.0	11.4	12.6								
5	10.8	11.0	11.4			13.8						
6	10.8	11.0	11.4	12.6								
7	10.8	11.0	11.4									
8	10.8	11.0	11.4									
9	10.8	11.0	11.4									
10	10.9	11.0			13.5			13.5	12.9		12.4	
11	10.9	11.0			13.5					12.4		
12	10.9	11.0				13.9						
13	10.9	11.1		12.9								
14	10.9	11.1						13.4	12.8			
15	10.9	11.1										
16	10.9	11.1	11.7									
17	10.9	11.1			13.6							
18	10.9	11.1			13.6							
19	10.9	11.2		13.0								
20	10.9	11.2								12.4		
21	10.9	11.2				14.0			12.6			
22	10.9	11.2										
23	10.9	11.2	12.0									
24	10.9	11.2										
25	10.9	11.2			13.7							
26	10.9	11.2										
27	10.9	11.2		13.0								
28	10.9	11.3										
29	11.0											
30	11.0		12.4				13.8					
31	11.0				13.8					12.4		
1908.												
1										8.6		
2												
3												
4								9.9				8.3
5												
6												
7										8.5		
8												
9												
10												
11						11.4						
12												
13					11.9							
14						11.2						
15												
16								9.6				
17												
18												
19												
20												

Daily gage height, in feet, of Tulare Lake in Kings County, Cal., for 1906 to 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
21							10.4					
22												
23									8.6			
24												
25												
26												
27												
28												
29												
30						10.9						
31												

KERN RIVER DRAINAGE BASIN.

DESCRIPTION.

The Kern River basin, the largest and most southern of all the areas tributary to the San Joaquin Valley from the Sierra, also extends farther eastward than any of the other basins and differs from them in having its main axis north and south instead of east and west. It is long and comparatively narrow, and lies west of the main high Sierra divide, but it is east of the secondary parallel crest, called the Great Western Divide, which separates it from the basins of Kaweah and Tule rivers and southern foothill streams at the west. It is separated from Kings River basin at the north by a cross range about 15 miles in length, known as the Kings-Kern divide. To the east of this basin is the southern part of Owens Valley basin and the rough arid region south of Owens Lake and north of the Mohave Desert. The basin has a length of about 85 miles and a width of 25 to 30 miles. Its total drainage area above the valley rim is about 2,570 square miles.

Kern River has its source in numerous glacial lakes nestling in the shadow of many high peaks on the main Sierra divide, and on the Kings-Kern and the Great Western divides. A half dozen of these peaks exceed 14,000 feet in altitude, more than 50 exceed 13,000 feet, and many of the lakes are at an altitude of 11,000 feet or over. Mount Whitney, the highest mountain in the United States proper, has an altitude of 14,501 feet above sea level and overlooks the northern part of Kern basin from the east. The main stream flows directly southward for about 70 miles, then southwestward to the mouth of its canyon, a few miles northeast of Bakersfield, where it enters the southern end of the San Joaquin Valley. The total length of Kern River from its source to Bakersfield is about 140 miles.

The chief tributary of Kern River is South Fork. This stream heads in the main Sierra divide, 15 or 20 miles south of the headwaters of the main stream at an altitude of 11,000 feet, and flows directly southward for about 50 miles, then westward about 20 miles, to its junction with the main stream at Isabella. Above the point of confluence the two streams have about equal lengths and drainage areas, and are parallel to each other and to the marginal rims. Each receives many short tributaries from the east and the west. The most important ones, however, Big Arroyo and Rattlesnake creeks and Little Kern River from the west, and Gold Trout Creek from the east, enter the main stream above North Fork.

Altitudes in the Kern River basin range from a few hundred feet at the mouth of the river's lower canyon to 14,000 feet and more at the north end. The basin is divided into two lesser basins by a medial axial ridge, which extends northward from the junction of South Fork with the main stream to an intersection with the Sierra divide near Trail Peak and about 12 miles south of Mount Whitney.

The topography of the two basins is very different. The eastern basin is characterized by comparatively low, flat, and irregular hills, separated by many intervening meadows, large and small; it is drained by South Fork. The western basin is characterized by high glaciated peaks and ridges and by deep canyons; it is drained by the main stream, which flows through a narrow canyon for a great part of its length. The Kern River canyon proper is about 20 miles long, 1 mile wide at the top, and 1,500 to 2,000 feet deep. It begins at Junction Meadow, 7 miles west of Mount Whitney, at an altitude of 8,500 feet, and runs due south to Kern Lake. The bottom of the canyon has a width of several hundred feet and an average gradient of 100 feet to the mile. The main canyon is intersected by short cross canyons, chiefly from the west. Above the junction of Kern River and South Fork the canyons broaden out into valleys of considerable size, especially on South Fork. Below the valleys, however, the main stream enters a rough canyon, which it follows to its entrance into the San Joaquin Valley. The formation is granitic.

The greater part of the Kern basin has a forest cover. In the foothills region the covering consists of grass and brush. Between altitudes of 3,000 and 10,000 feet there is a covering of timber and accompanying underbrush. The region above the 10,000-foot contour, however, is practically devoid of all timber growth. The entire basin is included in federal forest reserves.

The mean annual precipitation is light in the Kern basin. This is due in part to the fact that the basin is in the southern region of the Sierra, which receives less rainfall than the central and northern regions, and in part to the important fact that it lies east of the Great Western Divide, which intercepts the moisture-laden winds. The precipitation is undoubtedly heaviest in the northern part of the basin, which is surrounded by many high peaks that have snow all the year, but no records exist as to the quantity. The central part of the basin probably has from 10 to 15 inches and the southern part less than 10 inches.

Some irrigation is done in the valleys about Kernville, particularly on the South Fork. Below the mouth of the lower canyon the total low-water flow is diverted for irrigation around Bakersfield in the San Joaquin Valley. Further development is undoubtedly possible by utilizing storage.

Many excellent reservoir sites exist on the South Fork, but the run-off is small. Reservoir sites also occur on some of the smaller tributaries of the main stream above South Fork.

As the fall of Kern River is very great and the minimum flow is furnished almost entirely from the higher altitudes, fine opportunities for power development are afforded. The minimum flow of the stream is capable of generating about 125,000 horsepower without storage. By utilizing the possible storage this amount could be increased to 200,000 horsepower.

The longest run-off record in this basin extends back to 1893. The wettest year since that time was 1906, and the driest 1898. The total flow during the wettest year was about seven and one-half times that during the driest.

The only gaging station maintained in this basin is on Kern River near Bakersfield, 1893 to 1908.

KERN RIVER NEAR BAKERSFIELD, CAL.

This station, which has been maintained by the Kern County Land Company to furnish a basis for the equitable division of the water of Kern River between different appropriators, is located at the mouth of the lower canyon, about 5 miles northeast of Bakersfield, at what is known as the "first point of measurement," in sec. 2, T. 29 S., R. 25 E. It was established September 29, 1893, by Walter James, chief engineer of the Kern County Land Company. The records furnish also statistical data regarding the run-off from a large area of the southern Sierra.

No tributaries enter below the station and only a few unimportant ones for 50 miles above.

Water diverted for power development above the station is returned to the river. Except for local irrigation in the valleys around Kernville no water is diverted for irrigation above the station. Below the point of measurement, however, the total flow of the river, except at flood stages, is diverted by the Kern County Land Company and the Miller & Lux interests, which own all the water rights on lower Kern River.

The stream flow records on Kern River are excellent. Regular current-meter measurements are made weekly, and an accurate cross-section is made from time to time with an engineer's level. An automatic water-stage register is used for obtaining gage heights.

The results are furnished to the Geological Survey by A. K. Warren, engineer in charge.

Daily discharge, in second-feet, of Kern River near Bakersfield, Cal., for 1907 and 1908.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1907.							1907.						
1	671	913	924	1,752	3,715	3,862	16	658	1,003	1,003	3,821	2,855	2,329
2	616	888	916	1,819	3,537	3,853	17	614	1,015	1,038	3,494	3,020	2,159
3	548	915	889	1,896	3,487	4,059	18	631	1,028	1,327	3,535	3,157	2,088
4	587	994	890	1,851	3,517	4,250	19	638	997	1,452	3,821	3,369	2,134
5	657	1,076	1,129	1,770	3,402	4,271	20	606	971	1,746	4,058	3,693	2,389
6	672	1,110	1,564	1,744	3,194	3,913	21	615	948	2,066	4,321	3,649	2,800
7	660	1,070	1,329	1,780	3,059	3,685	22	627	1,094	1,940	4,373	3,487	2,938
8	641	1,061	1,198	1,965	2,998	3,541	23	637	1,345	1,769	4,349	3,307	2,748
9	650	1,037	1,171	2,201	2,955	3,253	24	638	1,194	1,659	4,437	3,143	2,607
10	699	1,013	1,114	2,465	3,032	3,087	25	672	1,116	1,777	4,504	3,118	2,533
11	683	981	1,149	2,809	3,168	3,261	26	708	1,062	1,730	4,494	3,173	2,639
12	652	875	1,169	3,228	3,338	3,420	27	716	1,018	1,633	4,499	3,254	2,876
13	631	979	1,092	3,686	3,272	3,258	28	720	968	1,554	4,427	3,044	3,060
14	649	988	1,022	4,131	2,985	2,779	29	874	......	1,522	4,235	3,123	3,123
15	642	995	998	4,263	2,818	2,523	30	1,045	......	1,550	3,958	3,351	3,324
							31	966	......	1,661	......	3,590	......

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.										
1	851	964	2,015	1,200	825	593	284	378	340	310
2	777	921	2,080	1,119	826	632	272	359	325	313
3	762	903	2,003	1,069	830	656	309	362	318	316
4	745	886	1,765	1,003	838	761	303	354	317	327
5	732	898	1,576	912	829	832	296	353	314	335
6	761	922	1,442	918	852	1,077	285	350	306	338
7	761	958	1,427	941	852	908	286	341	299	348
8	719	1,002	1,477	953	836	827	308	327	296	336
9	716	998	1,348	1,022	806	723	343	306	291	307
10	754	1,004	1,244	1,116	786	672	411	299	291	295
11	706	1,054	1,198	1,162	763	666	371	284	299	287
12	719	1,278	1,163	1,211	763	632	422	279	302	279
13	752	1,418	1,160	1,239	852	576	524	297	311	249
14	801	1,592	1,154	1,245	862	551	458	304	324	334
15	865	1,606	1,120	1,233	796	503	406	313	338	294
16	1,068	1,565	1,112	1,191	739	477	410	317	343	299
17	1,242	1,454	1,058	1,132	657	454	387	334	325	301
18	1,367	1,421	1,032	1,079	582	433	371	396	297	290
19	1,386	1,450	1,002	1.003	494	396	344	427	279	272
20	1,362	1,550	1,011	934	555	379	320	413	270	264
21	1,356	1,625	1,002	895	593	367	306	391	265	269
22	1,407	1,635	974	910	545	371	294	374	287	291
23	1,442	1,611	1,012	878	530	359	285	361	291	298
24	1,454	1,467	1,099	847	494	357	330	360	313	285
25	1,493	1,396	1,100	859	475	340	330	373	328	278
26	1,576	1,418	1,286	876	468	319	453	376	314	283
27	1,475	1,485	1,294	901	464	307	511	366	293	290
28	1,321	1,639	1,198	886	474	298	501	369	296	286
29	1,219	1,850	1,161	853	506	302	449	363	306	288
30	1,158	2,023	1,237	817	602	283	402	358	304	290
31	1,064	....	1,291	....	604	272	....	349	....	292

Monthly discharge of Kern River near Bakersfield, Cal., for 1907 and 1908.

[Drainage area, 2,345 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	1,045	548	678	0.289	0.33	41,700
February	1,345	875	1,023	.436	.45	56,800
March	2,066	889	1,354	.577	.67	83,300
April	4,504	1,744	3,323	1.42	1.58	198,000
May	3,715	2,818	3,252	1.39	1.60	200,000
June	4,271	2,088	3,092	1.32	1.47	184,000
The period	4,504	548	2,120	.905	6.10	763,800
1908.						
March	1,576	706	1,058	.451	.52	65,100
April	2,023	886	1,333	.568	.63	79,300
May	2,080	1,002	1,292	.551	.64	79,400
June	1,245	817	1,013	.432	.48	60,300
July	862	464	681	.290	.33	41,900
August	1,077	272	527	.225	.26	32,400
September	524	272	366	.156	.17	21,800
October	427	279	349	.149	.17	21,500
November	343	265	306	.130	.14	18,200
December	348	249	298	.127	.15	18,300
The period	2,080	249	722	.257	3.49	438,200

NOTE.—No records of daily discharge were kept during the period from July, 1907, to February, 1908.

Mean monthly discharge, in second-feet, of Kern River near Bakersfield, Cal., from 1894 to 1906, inclusive.

[Furnished by the Kern County Land Company.]

Date.	1894.	1895.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	13-year monthly mean.
January	661	809	747	373	363	263	363	493	283	350	195	281	693	452
February	717	1,252	617	809	434	302	280	860	371	454	346	396	626	574
March	1,001	1,374	951	923	388	590	413	1,270	790	579	667	823	2,063	910
April	1,495	2,724	972	2,914	710	893	472	1,398	1,805	1,249	1,005	1,043	2,910	1,507
May	1,607	4,269	1,401	4,580	735	835	1,111	3,032	1,784	2,148	1,841	1,915	5,859	2,402
June	1,085	2,906	2,456	2,309	551	1,331	1,283	3,324	2,165	2,340	1,746	2,231	7,704	2,418
July	700	1,482	1,346	1,006	244	489	392	1,864	706	868	646	876	6,503	1,317
August	335	629	486	469	120	156	144	968	312	303	467	327	2,299	540
September	248	344	304	298	116	105	166	345	197	191	267	211	973	290
October	279	327	267	340	160	160	160	317	199	174	438	207	609	280
November	244	346	355	355	166	221	349	377	281	203	286	236	503	302
December	470	403	347	422	199	279	373	323	269	201	241	261	618	339
Yearly mean	737	1,413	854	1,234	348	468	459	1,216	763	755	679	735	2,625	945
Means to date, inclusive	737	1,075	1,001	1,059	917	838	788	841	832	825	811	805	945	

TULE RIVER DRAINAGE BASIN.

DESCRIPTION.

Tule River drains a small, somewhat rectangular area west of the Great Western Divide, which is a secondary crest of the Sierra lying parallel to and about 25 miles west of the main divide. The Tule

River basin is south of the Kaweah basin, west of the Kern basin, and north of the Deer Creek basin. Its length north and south averages about 25 miles, and its width averages about 15 miles. The total drainage area above the rim of the valley is about 370 square miles.

Tule River rises at an altitude of about 9,000 feet above sea level. The main stream is formed by the junction of North and Middle forks about 1 mile above Daunt post-office and about 15 miles northeast of Portersville. It takes a southwesterly course to the point where it leaves the foothills about 5 miles east of Portersville, and has a length of about 30 miles. South Fork joins the main stream about 8 miles below Daunt. The flood water passes westward through old channels in the river's alluvial fan to Tulare Lake, which it enters south of Corcoran.

Altitudes in the Tule basin range from 500 feet in the foothills to 10,000 feet along its eastern border. The western third is a typical foothill region with large, irregular hills of moderate altitude, separated by valleys. The eastern two-thirds is a typically eroded mountain region, which has a rather steep slope that has been characteristically carved by the action of primary and secondary stream systems. The formation is chiefly granitic.

The basin has a fairly good forest cover throughout. On the lower elevations the cover consists of grass, brush, and scattering timber; on the middle and higher elevations it is made up of good timber and accompanying underbrush. About two-thirds of the upper part of the basin is in a national forest.

The mean annual precipitation is about 8 inches in the valley below the foothills, 20 inches in the middle part of the basin, and 30 inches or more on the higher elevations where much of it occurs as snow.

Considerable irrigation is carried on in the small valleys above the point where the stream leaves the foothills. The total flow of the stream at moderate and low stages is diverted for irrigation in the vicinity of Portersville. Without storage further development is unlikely, but a small amount of storage is available.

The streams have plenty of fall, but the minimum flow is so small that only a few thousand horsepower could be developed continually without storage.

The longest run-off record in this basin extends back to 1901. The wettest year since that time was 1904, and the driest 1905, with 1908 a close second. The total flow during the wettest year was nearly five times that during the driest.

The only gaging station maintained in the basin is on Tule River near Portersville, 1901 to 1908.

TULE RIVER NEAR PORTERSVILLE, CAL.

This station, which is located 100 feet below the wagon bridge near McFarland's ranch, about 1 mile above the mouth of South Fork, and about 8 miles east of Portersville, was established April 8, 1901, to obtain general statistical information regarding the flow of Tule River. The data are valuable in connection with the reclamation of Tulare Lake and in planning future power and irrigation development.

South Fork unites with the main stream about 1 mile below the station. North and Middle forks join about 8 miles above.

A few small irrigation ditches divert water above the point of measurement. Below the station canals divert water for use chiefly in irrigating citrus fruits in the vicinity of Portersville. The acquired water rights exceed the minimum flow of the stream.

The gage datum has never been changed.

Conditions for obtaining discharge data are good. The channel is practically permanent and the velocity moderate. The records are thoroughly reliable.

Discharge measurements of Tule River near Portersville, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 26	W. F. Martin	78	189	3.45	582
June 3	do	75	158	3.08	391
August 9	W. A. Lamb	60	40	1.25	44
September 27	do	55	30	1.13	29
November 10	do	57	47	1.37	56
1908.					
February 24	W. F. Martin	70	118	2.54	220
May 8	W. A. Lamb	67	102	2.20	164
June 20	W. F. Martin	59	51	1.48	66
August 29	W. V. Hardy	18	11	0.72	6.4

Daily gage height, in feet, of Tule River near Portersville, Cal., for 1907 and 1908.

[Adah McFarland and R. W. McFarland, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.3	3.1	2.4	3.0	3.0	2.9	2.1	1.3	1.15	1.15	1.55	1.4
2	1.95	3.0	2.4	6.0	2.9	2.9	2.15	1.3	1.2	1.15	1.55	1.4
3	1.9	3.0	2.4	5.1	2.85	2.9	2.1	1.3	1.15	1.2	1.5	1.4
4	1.9	2.95	2.4	4.0	2.8	3.0	2.0	1.25	1.15	1.2	1.5	1.4
5	2.7	2.85	2.6	3.9	2.8	2.9	2.0	1.25	1.15	1.2	1.45	1.4
6	2.25	2.7	2.6	3.8	2.8	2.9	1.9	1.25	1.1	1.2	1.4	2.0
7	2.25	2.6	2.7	3.8	2.75	2.85	1.9	1.25	1.1	1.2	1.4	2.9
8	2.65	2.6	2.9	3.85	2.75	2.8	1.85	1.25	1.1	1.2	1.35	2.0
9	2.25	2.55	2.7	3.85	2.7	2.75	1.8	1.25	1.1	1.15	1.35	1.9
10	2.2	2.5	2.9	3.8	2.7	2.7	1.75	1.25	1.1	1.2	1.35	1.9
11	2.2	2.45	2.8	3.8	2.7	2.8	1.7	1.2	1.1	1.2	1.35	2.3
12	2.2	2.4	2.85	3.8	2.75	2.9	1.6	1.2	1.1	1.2	1.35	2.0
13	2.6	2.35	2.7	3.8	2.8	2.8	1.5	1.2	1.1	1.2	1.35	1.9
14	2.2	2.35	2.75	3.8	2.85	2.7	1.5	1.2	1.1	1.2	1.35	1.7
15	3.2	2.3	2.7	4.3	2.9	2.6	1.5	1.2	1.1	1.2	1.35	1.7
16	2.7	2.3	2.6	4.0	2.9	2.55	1.5	1.2	1.1	1.25	1.35	1.9
17	3.4	2.5	2.6	3.85	2.9	2.55	1.5	1.2	1.15	1.25	1.35	1.7
18	2.7	2.3	2.6	3.7	2.85	2.5	1.5	1.2	1.15	1.25	1.35	1.7
19	2.2	2.25	2.65	3.7	3.0	2.5	1.5	1.2	1.15	1.3	1.35	1.7
20	2.1	2.2	2.6	3.8	3.2	2.45	1.5	1.2	1.15	1.35	1.35	1.6

Daily gage height, in feet, of Tule River near Portersville, Cal., in 1907 and 1908—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	2.15	2.2	2.7	3.75	3.1	2.45	1.5	1.2	1.15	1.3	1.35	1.65
22	2.15	3.85	2.65	3.7	3.0	2.4	1.5	1.2	1.1	1.3	1.35	1.65
23	2.15	3.2	2.7	3.65	2.9	2.35	1.45	1.2	1.1	1.35	1.35	1.7
24	2.15	2.8	4.8	3.6	2.95	2.35	1.45	1.15	1.1	1.4	1.35	1.75
25	2.2	2.8	3.6	3.5	2.9	2.3	1.4	1.15	1.1	1.4	1.35	1.75
26	2.2	2.8	3.5	3.4	2.9	2.25	1.4	1.15	1.1	1.5	1.35	1.8
27	2.2	2.7	3.35	3.4	2.9	2.2	1.4	1.15	1.1	1.6	1.35	1.8
28	2.35	2.45	3.2	3.3	2.8	2.15	1.4	1.15	1.15	1.6	1.35	2.0
29	3.2	......	3.0	3.2	2.8	2.1	1.35	1.15	1.15	1.6	1.35	2.0
30	3.2	......	3.0	3.1	2.9	2.1	1.35	1.15	1.15	1.55	1.35	1.9
31	3.2	......	3.0	......	2.9	......	1.3	1.15	......	1.55	......	1.8
1908.												
1	1.75	1.8	3.1	2.15	2.3	2.0	1.2	.85	.75	1.05	1.15	1.3
2	1.7	2.6	3.0	2.1	2.3	1.95	1.2	.85	.7	1.0	1.15	1.3
3	1.65	3.1	3.0	2.1	2.3	1.95	1.15	.85	.75	1.05	1.15	1.3
4	1.75	2.6	3.0	2.1	2.25	1.95	1.1	.85	.7	1.05	1.15	1.3
5	1.7	2.2	3.5	2.1	2.25	1.9	1.1	.85	.8	1.05	1.15	1.4
6	1.6	1.9	3.1	2.1	2.2	1.85	1.1	.85	.8	1.05	1.15	1.35
7	1.7	1.85	2.7	2.1	2.2	1.85	1.05	.85	.85	1.0	1.15	1.3
8	1.7	1.85	2.4	2.1	2.2	1.8	1.05	.85	.85	1.0	1.15	1.3
9	1.7	3.5	2.3	2.1	2.15	1.8	1.05	.85	.9	1.0	1.15	1.3
10	1.6	3.1	2.35	2.1	2.1	1.75	1.0	.9	.9	1.0	1.1	1.3
11	1.6	2.7	2.4	2.1	2.1	1.7	1.0	.85	.9	1.0	1.1	1.3
12	1.6	2.4	2.5	2.25	2.4	1.7	1.0	.85	.9	1.0	1.1	1.3
13	1.7	2.2	2.6	2.35	2.35	1.65	1.0	.8	.9	1.0	1.1	1.3
14	1.75	2.1	2.65	2.35	2.3	1.65	.95	.8	.9	1.0	1.1	1.3
15	2.4	2.0	2.7	2.35	2.2	1.6	.95	.8	.95	1.0	1.1	1.3
16	2.2	2.0	3.1	2.3	2.15	1.6	.95	.8	.95	1.6	1.1	1.3
17	1.95	1.95	3.0	2.25	2.2	1.55	.95	.8	.95	1.5	1.1	1.35
18	1.9	1.95	2.95	2.25	2.2	1.55	.95	.8	.95	1.3	1.1	1.35
19	1.85	1.9	2.9	2.25	2.2	1.5	.9	.8	.95	1.3	1.1	1.3
20	1.85	1.9	2.8	2.2	2.2	1.5	.9	.8	.95	1.25	1.1	1.3
21	1.8	2.4	2.75	2.2	2.15	1.45	.9	.75	.95	1.2	1.1	1.3
22	1.8	4.6	2.7	2.4	2.1	1.45	.85	.75	.95	1.2	1.1	1.3
23	1.8	3.0	2.7	2.6	2.1	1.45	.85	.75	.95	1.2	1.2	1.3
24	2.5	2.55	2.65	2.3	2.05	1.4	.9	.8	1.1	1.2	1.6	1.3
25	2.7	2.55	2.6	2.3	2.1	1.4	.85	.8	1.4	1.15	1.35	1.3
26	2.25	2.6	2.6	2.3	2.1	1.4	.9	.75	1.2	1.15	1.3	1.3
27	2.0	2.6	2.5	2.3	2.05	1.35	.9	.75	1.15	1.15	1.3	1.3
28	1.95	2.6	2.4	2.35	2.0	1.3	.9	.7	1.1	1.15	1.25	1.3
29	1.9	3.2	2.3	2.4	2.05	1.2	.9	.8	1.1	1.15	1.25	1.3
30	1.85	......	2.2	2.35	2.05	1.2	.9	.75	1.05	1.15	1.25	1.3
31	1.8	......	2.2	......	2.0	......	.9	.75	......	1.15	......	1.3

Rating table for Tule River near Portersville, Cal., 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.*
0.70	6	1.80	100	2.90	345	4.00	840
.80	10	1.90	115	3.00	380	4.20	960
.90	15	2.00	132	3.10	420	4.40	1,090
1.00	21	2.10	150	3.20	460	4.60	1,230
1.10	28	2.20	170	3.30	500	4.80	1,370
1.20	36	2.30	190	3.40	540	5.00	1,510
1.30	45	2.40	210	3.50	580	5.20	1,660
1.40	55	2.50	235	3.60	630	5.40	1,820
1.50	65	2.60	260	3.70	680	5.60	1,980
1.60	76	2.70	285	3.80	730	5.80	2,140
1.70	87	2.80	315	3.90	780	6.00	2,300

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 to 1908 and is well defined. Above gage height 1.8 feet it is the same as the 1906 table.

Monthly discharge of Tule River near Portersville, Cal., for 1907 and 1908.

[Drainage area, 266 square miles.] [a]

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	540	115	232	0.872	1.00	14,300	A.
February	755	170	285	1.07	1.11	15,800	A.
March	1,370	210	354	1.33	1.53	21,800	A.
April	2,300	380	764	2.87	3.20	45,500	A.
May	460	285	338	1.27	1.46	20,800	A.
June	380	150	262	.985	1.10	15,600	A.
July	160	45	82.3	.309	.36	5,060	A.
August	45	32	36.7	.138	.16	2,260	A.
September	36	28	29.9	.112	.12	1,780	A.
October	76	32	46.0	.173	.20	2,830	A.
November	70	50	53.0	.199	.22	3,150	A.
December	345	55	106	.398	.46	6,520	A.
The year	2,300	28	216	.810	10.92	155,000	
1908.							
January	285	76	116	.436	.50	7,130	A.
February	1,230	100	264	.992	1.07	15,200	A.
March	580	170	296	1.11	1.28	18,200	A.
April	260	150	178	.669	.75	10,600	A.
May	210	132	164	.617	.71	10,100	A.
June	132	36	79.8	.300	.34	4,750	A.
July	36	12	20.0	.075	.09	1,230	A.
August	15	6	10.3	.039	.04	633	A.
September	55	6	18.5	.070	.08	1,100	A.
October	76	21	31.3	.118	.14	1,920	A.
November	76	28	34.1	.128	.14	2,030	A.
December	55	45	45.8	.172	.20	2,720	A.
The year	1,230	6	105	.394	5.34	75,600	

[a] Area revised since 1906 report.

KAWEAH RIVER DRAINAGE BASIN.

DESCRIPTION.

The Kaweah River basin lies on the western slope of the Sierra in the northern part of Tulare County, south and west of the Kings River basin, north of the Tule River basin, and west of the upper Kern River basin. In shape it roughly approximates a rectangular quadrilateral with sides about 26 miles in length. One corner is formed at the head of the alluvial delta fan below the foothills, and the opposite diagonal corner rests on Triple Divide Peak in the high Sierra, 15 or 20 miles west of the main crest. The east side of the quadrilateral rests on the Kaweah-Kern watershed, a secondary crest of the Sierra west of the main one and known as the Great Western Divide. The total area of the basin is about 715 square miles.

Kaweah River rises in numerous small lakes nestling among high peaks on or near the divide at an altitude of about 12,000 feet above sea level. The main stream is formed by the confluence of North, Middle, and South forks 10 or 15 miles above the head of its delta, and its course is southwestward throughout its length. Below the foothills it divides into several distributaries which cross the delta fan and enter Tulare Lake near Corcoran. Its total length above the delta is about 45 miles.

The Kaweah basin has a varied rolling topography, ranging in altitude from a few hundred feet in the foothills to more than 12,000 feet at the eastern border. There are many domes and ridges in the upper parts of the basin interspersed between numerous upland meadows and glacial lakelets. Only a small part of the area is high enough to have perpetual snow. Most of the streams have fairly well developed canyons with moderately steep slopes. The formation is granitic.

The basin is fairly well forested. The lower foothills are covered with grass, brush, and scrubby timber. By far the greater part of the area, however, has an excellent cover of timber and underbrush. The Sequoia National Park, situated almost wholly in Kaweah basin, contains the largest grove of big trees (*Sequoia gigantea*) in the Sierra. Practically all the area outside of the park is included in a national forest.

The mean annual precipitation ranges from 10 inches in the valley to 20 inches on the lower elevations and probably 40 inches in the upper part. On probably one-half the area it occurs chiefly as snow.

The opportunities for irrigation in the Kaweah basin are practically restricted to the valley delta below the foothills. Virtually the total flow at moderate and low stages is now diverted for irrigating land in Tulare County; but little further development seems possible without storage, and for this opportunities are not very favorable.

Some reservoir sites, however, could be developed. One of these sites is about 2 miles below Three Rivers post-office. Considerable storage can be effected in the upper parts of the basin by throwing low dams across the outlets of the larger lakes.

Opportunities for water-power development are very good. The streams have comparatively heavy gradients and a minimum flow sufficiently large to generate about 30,000 horsepower without storage. For a period of at least six months in the year more than 100,000 horsepower could be obtained.

The longest run-off record extends back to 1903. The wettest year since that time was 1906 and the driest 1908. The total flow during the wettest year was about four and one-half times that during the driest.

The only gaging station maintained in the basin is on Kaweah River below Three Rivers, 1903 to 1908.

KAWEAH RIVER BELOW THREE RIVERS, CAL.

This station, which is located about 1½ miles below Three Rivers post-office and about one-fourth mile back of J. O. Carter's ranch house, on the wagon road from Lemon Cove to Three Rivers, was established April 29, 1903, to obtain general statistical information regarding the flow of Kaweah River. The data are valuable also in connection with the reclamation of Tulare Lake and in planning future irrigation and power development. The station is about three-fourths of a mile below the confluence of North, Middle, and South forks.

No important tributaries enter below the point of measurement.

Some water is diverted above the station for power, particularly on Middle and East forks, but it is returned to the stream above Three Rivers. A few very small ditches divert water for local irrigation and domestic uses in the small valleys above Three Rivers. The acquired water rights on this stream probably exceed the low-water flow.

The gage datum has never been changed. The conditions for obtaining accurate discharge data are fairly good. The stream is confined to its channel except at very high stages, when the right bank overflows somewhat. The bed, though composed of fine gravel and sand, is not subject to much change. The current is somewhat sluggish at very low stages and rather swift at high stages, though not excessively so. A fair degree of confidence can be placed in the records. The discharge curve for this station for 1906 to 1908 is shown in figure 1, p. 25.

Discharge measurements of Kaweah River below Three Rivers, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 27	W. F. Martin	175	712	7.42	2,380
June 5	do	180	748	7.55	2,230
August 8	W. A. Lamb	150	414	5.53	395
September 26	do	145	281	4.60	67
November 9	do	148	288	4.77	106
1908.					
February 25	W. F. Martin	147	399	5.52	334
May 7	W. A. Lamb	163	570	6.48	978
June 19	W. F. Martin	155	443	5.89	505
August 27	W. V. Hardy	45	52	4.35	49

Daily gage height, in feet, of Kaweah River below Three Rivers, Cal., for 1907 and 1908.

[J. O. Carter, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.3	5.8	5.8	7.65	7.2	7.9	7.2	5.85	4.85	4.6	5.0	4.7
2	5.25	5.85	5.8	6.9	7.2	8.15	7.15	5.8	4.85	4.6	4.95	4.65
3	5.3	5.95	5.7	7.3	7.4	8.2	7.2	5.75	4.85	4.6	4.9	4.65
4	5.3	5.95	5.9	6.95	7.4	8.05	7.2	5.6	4.85	4.6	4.85	4.65
5	5.5	5.95	6.5	6.85	7.05	7.6	7.1	5.6	4.85	4.6	4.8	4.7
6	5.4	5.95	6.4	6.8	7.0	7.55	7.0	5.55	4.8	4.8	4.8	4.8
7	5.35	5.9	6.1	6.85	7.05	7.6	7.0	5.55	4.8	4.75	4.8	6.2
8	5.6	5.95	6.1	6.9	7.0	7.3	6.8	5.5	4.75	4.7	4.8	5.35
9	5.5	5.95	6.05	7.1	7.1	7.3	6.75	5.4	4.75	4.65	4.75	5.1
10	5.55	5.9	6.0	7.3	7.35	7.5	6.65	5.4	4.7	4.6	4.75	5.1
11	5.4	5.9	6.2	7.4	7.5	7.5	6.65	5.4	4.7	4.6	4.75	5.75
12	5.35	5.8	6.2	7.5	7.3	7.55	6.65	5.3	4.7	4.6	4.75	5.3
13	5.5	5.8	6.05	7.7	7.1	7.1	6.6	5.3	4.7	4.6	4.75	5.3
14	5.4	5.8	6.0	7.7	6.95	6.95	6.5	5.3	4.7	4.6	4.7	5.15
15	5.7	5.8	5.9	7.4	7.1	6.85	6.5	5.25	4.65	4.6	4.7	5.1
16	5.5	5.8	5.9	7.3	7.4	6.9	6.4	5.3	4.65	4.6	4.7	5.35
17	5.5	6.1	6.7	7.3	7.4	6.8	6.35	5.3	4.65	4.7	4.7	5.1
18	5.4	5.85	6.4	7.4	7.55	6.9	6.35	5.2	4.65	4.7	4.8	5.0
19	5.35	5.7	6.7	7.5	7.85	7.2	6.35	5.2	4.6	4.7	4.8	5.0
20	5.35	5.7	7.1	7.65	7.85	7.4	6.2	5.2	4.6	4.7	4.8	5.05
21	5.4	5.8	7.1	7.6	7.7	7.5	6.1	5.1	4.6	4.75	4.8	5.0
22	5.45	6.85	6.8	7.5	7.6	7.4	6.1	5.05	4.6	4.75	4.75	5.0
23	5.5	6.3	6.65	7.55	7.25	7.25	6.1	5.0	4.6	4.8	......	4.95
24	5.5	6.1	7.45	7.5	7.15	7.15	6.15	5.0	4.6	5.0	......	4.95
25	5.6	6.0	8.0	7.5	7.15	7.2	6.15	5.0	4.6	4.95	4.7	4.95
26	5.55	6.15	7.1	7.7	7.4	7.3	6.1	5.0	4.6	4.9	4.75	4.95
27	5.5	5.95	6.9	......	7.2	7.4	6.0	5.0	4.6	5.35	4.7	5.1
28	7.15	5.9	6.7	7.3	7.4	7.4	6.0	4.95	4.6	5.3	4.7	5.2
29	6.75	......	6.3	7.4	7.5	7.35	5.9	4.9	4.6	5.1	4.7	5.1
30	6.1	......	6.65	7.3	7.65	7.3	5.8	4.9	4.6	5.0	4.7	5.1
31	5.95	......	6.75	......	7.9	......	5.8	4.9	......	5.15	......	5.2
1908.												
1	5.15	5.15	5.75	5.7	7.1	6.1	5.5	5.3	4.3	4.55	4.5	4.65
2	5.1	5.1	5.7	5.65	6.85	6.1	5.5	5.3	4.3	4.5	4.55	4.7
3	5.0	5.55	5.6	5.65	6.8	6.0	5.45	5.2	4.3	4.5	4.5	4.8
4	5.05	5.9	5.5	5.65	6.5	5.85	5.45	4.95	4.3	4.5	4.55	4.75
5	5.0	5.4	5.5	5.8	6.35	5.85	5.4	4.9	4.3	4.5	4.55	4.9
6	5.0	5.35	5.6	5.9	6.4	5.8	5.3	4.8	4.3	4.5	4.5	4.8
7	5.0	5.3	5.5	5.8	6.5	5.95	5.3	4.8	4.4	4.5	4.5	4.75
8	5.0	5.25	5.6	5.7	6.65	6.2	5.3	4.7	4.55	4.45	4.5	4.75
9	5.0	5.45	5.6	5.75	6.2	6.2	5.2	4.7	4.5	4.45	4.5	4.7
10	5.0	5.45	5.65	5.9	6.0	6.3	5.25	4.65	4.45	4.4	4.5	4.7
11	5.0	5.35	5.7	6.2	6.0	6.3	5.2	4.6	4.7	4.4	4.5	4.7
12	5.0	5.4	5.75	6.3	6.15	6.3	5.2	4.6	4.6	4.4	4.5	4.65
13	5.0	5.2	5.85	6.4	6.05	6.3	5.2	4.6	4.5	4.4	4.5	4.65
14	5.1	5.3	6.0	6.4	6.0	6.2	5.1	4.5	4.5	4.4	4.5	4.65
15	5.45	5.35	6.1	6.3	6.0	6.15	5.1	4.5	4.4	4.6	4.5	4.65
16	5.25	5.35	6.35	6.25	6.0	6.1	5.0	4.5	4.4	5.35	4.5	4.65
17	5.2	5.4	6.4	6.25	5.95	6.0	4.95	4.5	4 4	5.1	4.5	4.6
18	5.1	5.25	6.3	6.35	6.1	5.9	4.9	4.5	4.4	5.55	4.45	4.55
19	5.1	5.3	6.3	6.45	6.25	5.9	4.9	4.4	4.4	5.2	4.45	4.6
20	5.1	5.25	6.3	6.5	6.1	5.9	4.85	4.4	4.4	4.8	4.45	4.6
21	5.1	5.35	6.3	6.55	6.25	5.85	4.8	4.4	4.4	4.75	4.45	4.65
22	5.05	5.9	6.3	6.35	6.2	5.8	4.75	4.4	4.4	4.65	4.5	4.6
23	5.05	5.5	6.3	6.25	6.3	5.75	4.75	4.4	4.4	4.8	4.7	4.6
24	5.55	5.45	6.25	6.2	6.4	5,8	4.8	4.4	5.25	4.8	4.9	4.6
25	5.65	5.5	6.3	6.2	6.65	5.7	4.8	4.35	5.65	4.8	4.8	4.6
26	5.45	5.65	6.2	6.45	6.6	5.7	4.8	4.35	5.0	4.7	4.8	4.6
27	5.3	5.65	6.0	6.55	6.45	5.7	4.8	4.35	5.0	4.7	4.7	4.6
28	5.25	5.7	5.9	6.85	6.4	5.7	4.8	4.35	4.7	4.7	4.7	4.6
29	5.25	6.1	5.8	6.9	6.5	5.6	4.8	4.35	4.6	4.65	4.65	4.6
30	5.2	......	5.75	6.9	6.6	5.5	4.8	4.35	4.6	4.6	4.65	4.6
31	5.15	......	5.65	......	6.2	......	4.8	4.35	......	4.6	......	4.6

Rating table for Kaweah River below Three Rivers, Cal., 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.*
4.20	35	5.70	446	7.20	1,730	8.70	4,470
4.30	42	5.80	503	7.30	1,870	8.80	4,700
4.40	51	5.90	564	7.40	2,010	8.90	4,930
4.50	62	6.00	628	7.50	2,160	9.00	5,160
4.60	75	6.10	695	7.60	2,320	9.10	5,400
4.70	91	6.20	765	7.70	2,480	9.20	5,640
4.80	110	6.30	839	7.80	2,650	9.30	5,880
4.90	132	6.40	917	7.90	2,830	9.40	6,120
5.00	156	6.50	999	8.00	3,010	9.50	6,370
5.10	184	6.60	1,085	8.10	3,200	9.60	6,620
5.20	216	6.70	1,175	8.20	3,400	9.70	6,870
5.30	254	6.80	1,270	8.30	3,600	9.80	7,130
5.40	296	6.90	1,370	8.40	3,810	9.90	7,390
5.50	342	7.00	1,480	8.50	4,030	10.00	7,650
5.60	392	7.10	1,600	8.60	4,250		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made 1903 to 1908 and is well defined.

Monthly discharge of Kaweah River below Three Rivers, Cal., for 1907 and 1908.

[Drainage area, 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	1,660	235	412	0.792	0.91	25,300	B.
February	1,320	446	600	1.15	1.20	33,300	B.
March	3,010	446	1,030	1.98	2.28	63,300	A.
April	2,480	1,270	1,960	3.77	4.21	117,000	A.
May	2,830	1,420	1,950	3.75	4.32	120,000	A.
June	3,400	1,270	2,030	3.90	4.35	121,000	A.
July	1,730	503	1,020	1.96	2.26	62,700	A.
August	533	132	261	.502	.58	16,000	B.
September	121	75	904	.174	.19	5,380	B.
October	275	75	112	.215	.25	6,890	B.
November	156	91	105	.202	.23	6,250	B.
December	765	83	197	.379	.44	12,100	B.
The year	3,400	75	814	1.56	21.22	589,000	
1908.							
January	419	156	206	.396	.46	12,700	B.
February	695	184	326	.627	.68	18,800	B.
March	917	342	598	1.15	1.33	36,800	B.
April	1,370	419	793	1.52	1.70	47,200	B.
May	1,600	596	886	1.70	1.96	54,500	B.
June	839	342	604	1.16	1.29	35,900	B.
July	342	100	185	.356	.41	11,400	B.
August	254	46	85.4	.164	.19	5,250	B.
September	419	42	81.5	.157	.18	4,850	B.
October	367	51	98.5	.189	.22	6,060	B.
November	132	56	71.6	.138	.15	4,260	B.
December	132	68	85.2	.164	.19	5,240	B.
The year	1,600	42	335	.643	8.76	243,000	

KINGS RIVER DRAINAGE BASIN.

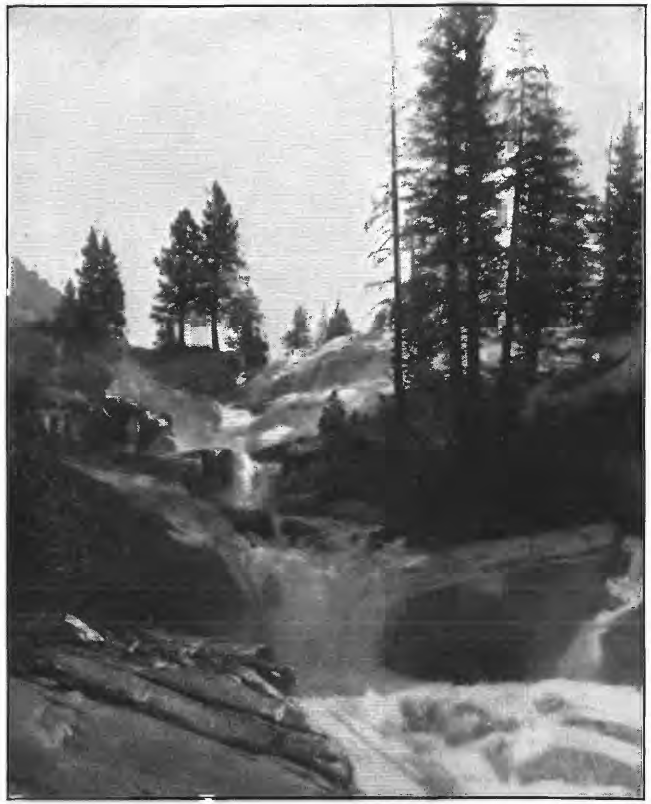
DESCRIPTION.

The Kings River basin lies on the western slope of the Sierra, south of the upper San Joaquin basin, and north of the Kaweah and upper Kern basins. For a distance of about 50 miles it touches the Sierra divide, which separates it from the central part of the Owens River basin at the east and contains many of the highest peaks in the Sierra. In shape and extent this basin is very much like the upper San Joaquin basin, which adjoins it at the north. It is roughly trapezoidal in shape, having a length of about 60 miles from valley rim to mountain crest, and ranging in width from about 15 miles at the west to about 45 miles at the east. Its total area above the valley border is about 1,840 square miles.

Kings River has its source in numerous glacial lakelets nestling at the foot of glaciers and perpetual snow banks which protrude from the summits of high peaks on and near the Sierra crest. The main stream is formed by the confluence of North, Middle, and South forks well up in the mountains. It takes a southwestward course to the mouth of its canyon, about 10 miles northeast of Sanger, whence it continues the same course across its delta fan to the trough of San Joaquin Valley about 6 miles west of Lemoore. From this point most of the low-water flow passes northwestward through Kings Slough to San Joaquin River about 3 miles north of Mendota, but most of the flood flow passes southward to Tulare Lake. The total length of the river from its source to the mouth of its canyon is about 85 miles. Besides the three forks and their tributaries, the other principal tributaries are Dinkey and Big creeks, from the north, and Mill Creek from the south.

The topography of the Kings River basin is very rough and irregular. At the head of this basin is the most rugged region in the Sierra. Many of the peaks are perpetually snow-capped; many others are sharp, bare, and precipitous. Altogether they produce some of the sublimest mountain scenery in the United States. Throughout the upper part of the basin there are, also, many charming lakes and beautiful meadows surrounded by lone peaks and domes. Nearly all the tributaries run through deep canyons cut through solid granite. The canyons of the three forks and of the main stream below their junction are long and narrow and 2,000 or 3,000 feet in depth. In some places they broaden out into narrow valleys with precipitous walls, like Kings River Canyon Valley on South Fork and Tehipite Valley on Middle Fork, which rival the famous Yosemite Valley in scenic grandeur. Altitudes in the basin range from 200 or 300 feet in the foothills to more than 14,000 feet at the eastern border. The formation is granitic.

A. POWER HOUSE OF THE STANISLAUS ELECTRIC POWER COMPANY, STANISLAUS RIVER.



B. FALLS ON BUBBS CREEK, TRIBUTARY TO KINGS RIVER.

The greater part of the Kings River basin is well forested. Above the 10,000-foot contour vegetation is very scanty; below this contour, however, there is a heavy covering of timber and underbrush. Extensive groves of big trees occur at many places in this basin. On the lower foothills the forest covering consists of brush, grass, and scattering small timber. Almost the entire basin above the valley rim lies in a national forest.

The mean annual precipitation varies with altitude. In the San Joaquin Valley it is 8 to 10 inches; in the foothills 20 to 30 inches; and on the higher elevations 50 to 60 inches. A large part of the basin has a high altitude and receives nearly all its precipitation in the form of snow, which never entirely disappears from the highest peaks.

Kings River offers magnificent opportunities for irrigation. Numerous canals, with a combined capacity of from 4,000 to 5,000 second-feet, now divert water from the river below the mouth of the canyon for use on the valley lands in Fresno, Kings, and Tulare counties, where the soil and climate are especially adapted to the raising of grapes and other fruits. During low water these canals take the total flow of the river.

Only a few storage reservoirs of much value exist in the Kings River basin. Several reservoir sites on the main stream and its tributaries have been surveyed and their availibility determined.[a]

A great deal of power could be developed in Kings River basin. The streams have very heavy gradients, and the minimum flow is sufficient to generate at least 125,000 horsepower without storage. This amount could be easily doubled by utilizing the potential storage. Middle and South forks afford the greatest opportunities for power. (See Pl. V, *B*.)

The longest run-off record in this basin extends back to 1895. The wettest year since that time was 1906, and the driest, 1898. The total flow of the wettest year was about five times that of the driest.

The only gaging station maintained in this basin is on Kings River near Sanger, 1895 to 1908.

KINGS RIVER NEAR SANGER, CAL.

This station, which is located just below a big bend in the river near the mouth of the canyon, about 15 miles northeast of Sanger and southwest of Red Mountain, was established September 3, 1895, to obtain general statistical data regarding the flow of Kings River. The data are useful also in considering irrigation, power, and storage developments, and in studying the flood and reclamation problems of Tulare Lake and lower San Joaquin River.

[a] See Water-Supply Paper U. S. Geol. Survey No. 58.

No tributaries enter below the station. Mill Creek enters from the south about 3 miles above the point of measurement. Big and Dinkey creeks enter from the north about 10 and 15 miles, respectively, above the station. The junction of the forks is 20 or 25 miles above.

No diversions are made immediately above the place of measurement. Many miles above, however, a small quantity of water is diverted from tributary streams into a flume used for transporting lumber from the mountains to Sanger. The total flow of the river at low and moderate stages is diverted into irrigation canals only a short distance below the station. The acquired water rights greatly exceed the low-water flow.

An automatic water-stage register is used for obtaining gage heights at this station because of the remarkable diurnal fluctuations of stage, especially during the spring and early summer when the snow is melting rapidly. It is not an unusaul thing to remove a weekly record sheet that has a notably regular sinusoidal curve traced across it, showing an hourly change and a daily range of nearly two feet. No change has ever been made in the gage datum.

The conditions for obtaining accurate discharge data at this station are very good. The stream is confined to its channel at all stages and the current is never too sluggish nor too swift. The channel has a gravel bottom, but there is very little change in it. This stream is well rated every year, so that full reliance can be placed in the records.

Discharge measurements of Kings River near Sanger, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 29	W. F. Martin	304	1,700	9.76	8,400
June 4	do	328	2,450	11.95	15,300
August 7	W. A. Lamb	230	944	7.22	2,870
August 31	do	165	508	5.30	794
September 25	do	140	372	4.75	382
November 8	do	140	356	4.70	384
1908.					
February 26	W. F. Martin	163	538	5.45	1,040
February 29	do	210	795	6.75	2,300
May 6	W. A. Lamb	293	1,230	8.09	4,350
June 18	W. F. Martin	210	819	7.05	2,520
August 25	W. V. Hardy	135	382	4.82	526
September 1	do	120	334	4.63	383
October 19	do	120	343	4.73	416
December 5	W. F. Martin	138	347	4.67	412

Daily gage height, in feet, of Kings River near Sanger, Cal., for 1907 and 1908.

[O. G. Williams, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.5	6.15	6.0	8.15	9.5	11.75	10.8	7.85	5.3	4.7	4.95	4.55
2	5.25	6.2	5.95	8.6	9.6	11.9	10.55	8.0	5.25	4.65	4.9	4.5
3	5.15	6.4	6.0	8.25	9.9	12.05	10.7	8.05	5.15	4.65	4.85	4.5
4	5.3	6.3	6.15	7.85	9.9	12.05	11.15	7.65	5.15	4.65	4.85	4.5
5	5.6	6.5	6.95	7.65	9.2	10.4	10.9	7.35	5.2	4.6	4.8	4.5
6	5.45	6.35	7.75	7.55	9.05	10.95	10.55	7.25	5.2	4.7	4.75	4.65
7	5.35	6.3	7.1	7.65	9.15	10.65	10.55	6.95	5.15	4.8	4.75	5.55
8	6.0	6.3	6.9	7.95	9.15	10.05	10.25	6.9	5.15	4.8	4.75	5.4
9	5.7	6.25	6.7	8.25	9.45	9.95	9.95	6.75	5.1	4.8	4.7	4.95
10	5.85	6.2	6.65	8.60	9.9	10.5	9.75	6.65	5.1	4.75	4.7	4.9
11	5.55	6.2	7.45	8.95	10.15	10.9	9.7	6.45	5.1	4.75	4.7	5.5
12	5.35	6.1	7.1	9.4	9.65	10.5	9.7	6.3	5.15	4.75	4.65	5.1
13	5.7	6.05	6.75	9.85	9.05	9.7	9.9	6.2	5.15	4.7	4.65	5.05
14	5.75	6.05	6.55	10.1	8.95	9.2	9.7	6.2	5.1	4.65	4.65	5.0
15	6.75	6.0	6.45	9.6	9.8	8.85	9.6	6.3	5.1	4.65	4.65	4.9
16	5.85	6.1	6.4	9.15	10.15	8.55	9.25	6.5	5.0	4.65	4.65	4.95
17	5.85	6.5	8.65	9.2	10.15	8.55	9.15	6.65	4.95	4.75	4.6	4.9
18	5.85	6.2	8.25	9.5	10.7	8.95	9.15	6.65	4.9	4.8	4.7	4.85
19	5.55	6.0	8.55	9.75	11.2	9.7	9.2	6.5	4.9	4.8	4.65	4.8
20	5.55	5.9	10.1	9.85	11.15	10.5	9.0	6.25	4.85	4.8	4.65	4.85
21	5.6	6.0	10.3	9.95	11.0	10.95	8.75	6.25	4.8	4.8	4.65	4.75
22	5.65	8.05	9.75	9.95	10.75	10.75	8.45	6.15	4.75	4.8	4.65	4.75
23	5.65	7.1	8.7	10.05	9.9	10.3	8.45	6.0	4.75	4.8	4.6	4.75
24	5.65	6.65	10.0	10.15	9.75	10.15	8.7	5.75	4.7	4.85	4.6	4.75
25	5.75	6.5	10.3	10.15	10.0	10.2	8.85	5.65	4.7	4.9	4.6	4.75
26	5.75	6.5	8.95	10.20	10.35	10.6	8.85	5.6	4.7	4.85	4.6	4.75
27	5.6	6.3	8.2	10.25	10.3	10.85	8.6	5.6	4.7	5.1	4.6	4.85
28	8.15	6.1	7.8	10.05	10.45	11.0	8.2	5.55	4.7	5.2	4.55	5.1
29	8.1	....	7.55	9.85	10.8	11.2	8.25	5.45	4.65	5.05	4.55	5.1
30	6.8	....	7.75	9.65	11.15	11.25	7.8	5.4	4.7	5.0	4.55	5.0
31	6.4	....	8.05	....	11.55	....	7.55	5.35	....	5.05	....	5.05
1908.												
1	5.05	5.0	5.9	5.9	9.25	7.25	6.4	6.4	4.6	4.8	4.55	4.5
2	4.95	5.0	5.9	5.85	9.05	7.15	6.45	7.15	4.6	4.75	4.5	4.5
3	4.95	5.3	5.65	5.85	8.2	6.85	6.5	7.65	4.6	4.7	4.5	4.65
4	4.95	5.8	5.55	5.9	7.7	6.6	6.55	6.75	4.6	4.65	4.5	4.65
5	4.9	5.35	....	5.9	7.6	6.6	6.6	6.8	4.6	4.65	4.5	4.7
6	4.85	5.2	....	6.0	7.9	6.65	6.6	6.4	4.65	4.65	4.5	4.75
7	4.85	5.1	5.5	6.15	8.25	6.75	6.55	6.15	4.7	4.65	4.5	4.65
8	4.85	5.1	5.45	6.05	7.8	7.15	6.45	5.85	4.85	4.6	4.45	4.6
9	4.85	5.4	5.45	6.1	7.35	7.4	6.3	5.8	5.0	4.55	4.45	4.6
10	4.85	5.55	5.5	6.15	7.0	7.55	6.2	5.8	4.85	4.55	4.45	4.6
11	4.85	5.3	5.55	6.5	6.95	7.75	6.15	5.7	5.15	4.5	4.45	4.55
12	4.85	5.2	5.65	7.25	7.0	7.85	6.2	5.55	5.3	4.5	4.45	4.5
13	4.9	5.15	5.75	7.7	6.85	7.9	6.3	5.4	5.1	4.5	4.45	4.45
14	5.0	5.2	6.0	7.95	6.75	7.85	6.2	5.3	4.95	4.45	4.4	4.45
15	5.15	5.15	6.25	7.65	6.9	7.6	6.0	5.2	4.85	4.45	4.4	4.5
16	5.0	5.1	6.65	7.55	6.85	7.55	5.85	5.1	4.75	4.7	4.4	4.45
17	5.0	5.15	6.8	7.3	6.65	7.3	5.65	5.05	4.75	4.85	4.4	4.45
18	5.0	5.1	6.75	7.6	6.7	7.0	5.6	5.0	4.75	4.85	4.4	4.45
19	4.95	5.05	6.85	8.15	7.0	6.85	5.7	4.95	4.7	4.75	4.4	4.4
20	4.9	5.1	6.85	8.25	6.95	6.6	5.7	4.95	4.7	4.75	4.4	4.4
21	4.9	5.1	6.9	8.3	7.05	6.8	5.65	4.95	4.65	4.7	4.35	4.45
22	4.9	5.2	6.8	7.85	7.2	6.75	5.65	4.95	4.65	4.7	4.4	4.45
23	4.9	5.25	6.8	7.5	7.6	6.6	5.65	4.85	4.6	4.7	4.5	4.45
24	5.45	5.15	6.8	7.3	8.05	6.65	5.65	4.85	4.9	4.7	4.65	4.4
25	5.8	5.2	6.9	7.4	8.4	6.75	5.55	4.8	5.55	4.7	4.6	4.4
26	5.6	5.4	6.8	7.85	8.25	6.8	5.5	4.8	5.6	4.7	4.6	4.4
27	5.3	....	6.45	8.35	7.95	6.75	5.5	4.75	5.3	4.7	4.6	4.4
28	5.2	....	6.2	8.95	7.85	6.6	5.65	4.75	5.15	4.65	4.5	4.4
29	5.15	6.9	6.15	9.2	8.25	6.55	5.7	4.7	5.0	4.65	4.5	4.4
30	5.1	....	6.05	9.2	8.3	6.4	5.7	4.7	4.85	4.65	4.5	4.4
31	5.05	....	5.9	....	7.7	....	5.7	4.65	....	4.6	....	4.4

Rating tables for Kings River near Sanger, Cal.

FOR 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.*
4.50	265	5.90	1,300	7.30	2,950	9.40	7,300
4.60	315	6.00	1,390	7.40	3,110	9.60	7,830
4.70	370	6.10	1,480	7.50	3,270	9.80	8,380
4.80	430	6.20	1,570	7.60	3,430	10.00	8,940
4.90	495	6.30	1,670	7.70	3,600	10.20	9,510
5.00	565	6.40	1,770	7.80	3,770	10.40	10,110
5.10	640	6.50	1,880	7.90	3,950	10.60	10,710
5.20	720	6.60	1,990	8.00	4,140	10.80	11,330
5.30	800	6.70	2,110	8.20	4,540	11.00	11,980
5.40	880	6.80	2,230	8.40	4,960	11.40	13,310
5.50	960	6.90	2,360	8.60	5,400	12.00	15,460
5.60	1,040	7.00	2,500	8.80	5,840		
5.70	1,120	7.10	2,650	9.00	6,300		
5.80	1,210	7.20	2,800	9.20	6,790		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1907 and previous measurements, and is well defined.

FOR 1908.

4.30	250	5.40	920	6.50	2,000	7.60	3,450
4.40	280	5.50	1,000	6.60	2,110	7.70	3,610
4.50	320	5.60	1,090	6.70	2,230	7.80	3,780
4.60	370	5.70	1,180	6.80	2,350	7.90	3,960
4.70	430	5.80	1,280	6.90	2,480	8.00	4,150
4.80	490	5.90	1,380	7.00	2,610	8.20	4,540
4.90	550	6.00	1,480	7.10	2,740	8.40	4,960
5.00	620	6.10	1,580	7.20	2,880	8.60	5,400
5.10	690	6.20	1,680	7.30	3,020	8.80	5,840
5.20	760	6.30	1,780	7.40	3,160	9.00	6,300
5.30	840	6.40	1,890	7.50	3,300	9.20	6,790

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

Monthly discharge of Kings River near Sanger, Cal., for 1907 and 1908.

[Drainage area, 1,740 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	4,440	680	1,360	0.782	0.90	83,600	A.
February	4,240	1,300	1,740	1.00	1.04	96,600	A.
March	9,810	1,340	4,110	2.36	2.72	253,000	A.
April	9,660	3,350	7,000	4.02	4.48	417,000	A.
May	13,800	6,180	9,200	5.29	6.10	566,000	A.
June	15,600	5,290	10,400	5.98	6.67	619,000	A.
July	12,500	3,350	7,560	4.34	5.00	465,000	A.
August	4,240	840	1,970	1.13	1.30	121,000	A.
September	800	342	554	.318	.35	33,000	A.
October	720	315	435	.250	.29	26,700	A.
November	530	290	363	.209	.23	21,600	A.
December	1,000	265	502	.289	.33	30,900	A.
The year	15,600	265	3,770	2.16	29.41	2,730,000	

Monthly discharge of Kings River near Sanger, Cal., for 1907 and 1908—Continued.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	1,280	520	650	0.374	0.43	40,000	A.
February	2,480	620	897	.516	.56	51,600	A.
March	2,480	960	1,670	.960	1.11	103,000	A.
April	6,790	1,330	3,210	1.84	2.05	191,000	A.
May	6,920	2,170	3,580	2.06	2.38	220,000	A.
June	3,960	1,890	2,680	1.54	1.72	159,000	A.
July	2,110	1,000	1,480	.851	.98	91,000	A.
August	3,530	400	1,080	.621	.72	66,400	A.
September	1,090	370	550	.316	.35	32,700	A.
October	520	300	405	.233	.27	24,900	A.
November	400	265	312	.179	.20	18,600	A.
December	460	280	323	.186	.21	19,900	A.
The year	6,920	265	1,400	.806	10.98	1,020,000	

MERCED RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Merced River lies on the western slope of the Sierra, north of the upper San Joaquin basin and south of the Tuolumne basin. It does not extend so far eastward as the other two basins, and it touches the Sierra divide in only one point—Mount Lyell (elevation, 13,090 feet)—which is common to the three basins. The mountainous part of the basin lies almost wholly in Mariposa County; the foothill and valley parts are in Merced County. The basin is somewhat rectangular in shape. It has a length of about 65 miles from the rim of the valley to the crest and a width of 20 to 25 miles. The total area of the basin above the valley border is about 1,200 square miles.

Merced River has its source in numerous small glacial lakes in the region about Mount Lyell and flows southwestward to its junction with the lower San Joaquin, about 5 miles northeast of Newman. It has a total length of about 135 miles, two-thirds of which is in the mountains. Its chief tributaries are Tenaya and Yosemite creeks from the north and Illilouette and Bridal Veil creeks and South Fork from the south.

The formation in this basin is chiefly granitic. The topography is very rough and much broken in the upper parts. The altitude ranges from a few hundred feet in the foothills to 13,000 feet around Mount Lyell. Within this basin is the famous Yosemite Valley, with its precipitous walls, bare granitic domes, and waterfalls of prodigious height. This valley, which averages less than a mile wide and is about 7 miles long, is a gorge cut chiefly by glacial action. From its floor the marginal cliffs rise almost vertically

2,000 to 3,000 feet, over which hung-up streams leap to the lower level as magnificent falls. The country around the valley rim is a rolling, glaciated region from 3,000 to 8,000 feet higher than the floor of the valley, which has an altitude of 4,000 feet. The valley opens westward into Merced Canyon.

The upper reaches of the basin above Yosemite Valley are largely devoid of forests, but the middle reaches are timbered. The growth extends well down on the lower elevations to the foothills, which are covered by scattering timber, brush, and grass. The Mariposa grove of big trees is situated in the South Fork basin. All the upper part of the basin, amounting to about 850 square miles, is included in national forest reserves.

The mean annual precipitation varies with altitude. It is from 10 to 15 inches in the San Joaquin Valley, about 25 inches in the foothills, and probably 60 inches on the higher elevations. It occurs almost entirely during the "rainy season." The snowfall is heavy during the winter and early spring and melts most rapidly in May and June, when, except on the higher peaks, the greater part of it disappears. The melting snow produces a regular annual rise in late spring and early summer. It is during this period that the splendid falls in Yosemite Valley attain their greatest beauty.

Opportunities for irrigation development are practically limited to the bottom lands in the foothills and parts of the San Joaquin Valley below. Present development utilizes almost the entire late summer flow of Merced River.

Considerable storage is feasible in the Merced basin above Yosemite Valley. Most of the reservoirs, however, would be very small.

Opportunities for power development are good. The minimum flow is small, but the fall is great. Without storage the minimum flow is sufficient to develop about 40,000 horsepower; with storage this amount could be increased to about 160,000 horsepower continuously.

The longest run-off record in the Merced basin extends back to 1901. The wettest year since that time was 1907 and the driest 1908. The total flow during the wettest year was more than four times that of the driest.

The following gaging stations have been maintained in the basin:

Merced River in Yosemite Valley (1904 to 1908).
Merced River above Merced Falls (1901 to 1908).
Tenaya Creek in Yosemite Valley (1904 to 1908).
Yosemite Creek in Yosemite Valley (1904 to 1908).

MERCED RIVER IN YOSEMITE VALLEY, CAL.

This station, which is located at the wagon bridge near the Sentinel Hotel, was established July 11, 1904, and has been maintained during only the summer season of each year to obtain data for comparing the flow over Vernal and Nevada falls, by means of which Merced River enters Yosemite Valley.

Tenaya Creek enters from the north about 1 mile and Illilouette Creek from the south about 2 miles above the station. Yosemite Creek enters from the north about one-half mile and Bridal Veil Creek from the south about 3 miles below the station.

No diversions are made above the station except for the small hydro-electric plant which supplies the valley with light and power. The diverted water returns to the river above the station.

No change has been made in the gage datum. The channel is straight and not subject to much change. The current is sluggish. A fair degree of confidence can be placed in the results at this station.

Discharge measurements of Merced River in Yosemite Valley in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 24	W. B. Clapp	95	668	6.80	1,760
November 8	C. W. Tucker	89	286	3.30	50
1907.					
May 1	C. W. Tucker	92	604	6.85	1,790
May 19	do	89	833	8.85	3,120
May 23	Martin and Tucker	93	707	6.90	1,820
May 25	W. F. Martin	93	735	7.34	2,200
May 31	C. W. Tucker	95	913	9.00	3,610
June 24	do	95	724	7.50	2,020
July 29	do	95	621	6.50	1,460
August 23	do	95	433	4.40	365
1908.					
August 4	Tucker and Hardy	94	427	4.20	336
August 16	W. V. Hardy	55	128	3.50	123
September 30	C. W. Tucker	53	114	3.20	49

Daily gage height, in feet, of Merced River in Yosemite Valley, Cal., for 1907 and 1908.

[C. W. Tucker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.6				6.9	8.8	8.6	6.3	3.9			
2					7.0	9.0	8.7	6.2	3.9			
3	3.6	4.1			7.2	9.1	8.6	6.1	3.9			
4			3.9		6.9	9.0	8.8	6.0	3.9			
5					6.7	8.6	9.0	5.8	3.9			
6			4.2		6.6	8.1	8.9	5.6	3.9		3.5	
7		4.2	4.1		6.8	7.7	8.8	5.4	3.9	3.4		3.3
8	3.6		4.0		6.4	7.5	8.4	5.3	3.9			
9					6.8	7.2	8.0	5.2	3.9			
10					7.3	7.4	7.9	5.0	3.9			
11	3.6				7.4	7.4	7.8	4.9	3.9			
12			4.0		7.3	7.6	7.7	4.9	3.9		3.4	
13					6.3	6.9	7.6	4.9	3.9			
14		4.1	3.9		6.2	6.5	7.4	4.9	3.9			
15					7.0	6.3	7.3	5.0	3.9			
16					7.5	6.4	7.2	4.9	3.8	3.4		3.8
17		4.1	5.8		7.9	6.5	7.0	4.9	3.7			
18			6.8		8.0	6.6	6.9	4.8	3.7			
19			7.3		8.9	7.2	6.9	4.8	3.7			
20		4.0	6.6		8.4	7.4	6.9	4.7	3.6			

Daily gage height, in feet, of Merced River in Yosemite Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21			5.6		8.0	7.6	6.8	4.6	3.6		3.1	3.7
22	3.6				7.8	7.7	6.6	4.5	3.5			
23		4.1			6.9	7.6		4.4	3.5			
24			4.9		7.2	7.5		4.4	3.5	3.5		
25					7.4	8.0		4.3	3.5			
26		4.1	4.7		7.4	8.1	6.7	4.3	3.5			
27	3.6				8.0	8.3	6.7	4.3	3.5			
28	4.1		4.5		8.1	8.4	6.8	4.2	3.4	3.9		
29	3.9		4.4		8.0	8.2	6.5	4.2	3.4			
30					8.4	8.8	6.4	4.0	3.4		3.1	
31	3.8		4.6		9.1		6.4	3.9				
1908.												
1						5.9	4.7	4.4				
2						5.7	4.7	4.4			3.0	
3					5.2	5.4	4.7	4.3				
4	3.7				5.3	5.3	4.7	4.2				3.1
5					5.5	5.2	4.8					
6					5.7	5.1	4.7					
7					5.3	5.2	4.7			3.0		
8					5.2	5.2	4.6					
9					5.2	5.4	4.5					
10					5.2	5.5	4.5					
11	3.6				5.1	5.6	4.4					
12					5.1	5.6	4.4					
13					5.0	5.7	4.3					
14					5.0	5.7	4.2				3.0	
15					5.0	5.7	4.2					
16					5.2	5.6	4.1			3.2		
17					5.4	5.6	4.1			3.2		
18					5.4	5.5	4.0					2.9
19					5.3	5.5	4.0				2.9	
20	3.6				5.1	5.4	4.0					
21					5.2	5.3	4.0					
22					5.2	5.3	3.9					
23					5.5	5.1	3.9					
24					5.9	5.1	3.9					
25					6.0	5.0	3.8					
26					6.1	4.9	3.8				3.0	
27					6.1	4.8	3.8			3.0		
28					6.3	4.8	3.8					3.0
29					6.5	4.8	3.8					
30					6.2	4.7	4.6					
31					6.0		4.5					

Rating table for Merced River in Yosemite Valley, Cal., 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.*
2.90	10	4.10	272	5.30	836	7.00	1,920
3.00	20	4.20	310	5.40	890	7.20	2,070
3.10	32	4.30	350	5.50	946	7.40	2,220
3.20	46	4.40	392	5.60	1,002	7.60	2,370
3.30	62	4.50	436	5.70	1,060	7.80	2,530
3.40	80	4.60	482	5.80	1,120	8.00	2,690
3.50	100	4.70	530	5.90	1,180	8.20	2,850
3.60	122	4.80	578	6.00	1,240	8.40	3,010
3.70	146	4.90	628	6.20	1,370	8.60	3,170
3.80	173	5.00	678	6.40	1,500	8.80	3,340
3.90	203	5.10	730	6.60	1,640	9.00	3,510
4.00	236	5.20	782	6.80	1,780	10.00	4,380

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1906 to 1908 and the form of the previous curve. Above gage height 3.3 feet, the table is fairly well defined; below gage height 3.3 feet it is approximate.

Monthly discharge of Merced River in Yosemite Valley, Cal., for 1906, 1907, and 1908.

[Drainage area, 236 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.	
1906.							
May 23-31	1,920	1,060	1,460	6.19	2.07	26,100	A.
June	4,380	1,240	3,140	13.3	14.84	187,000	A.
July	4,200	1,500	2,980	12.6	14.53	183,000	A.
August	1,370	350	790	3.35	3.86	48,600	A.
September	350	100	190	.805	.90	11,300	C.
October	122	46	80.1	.339	.39	4,930	C.
November	100	46	61.2	.259	.29	3,640	C.
December			71.7	.304	.35	4,410	D.
The period						469,000	
1907.							
January			153	.648	.75	9,410	C.
February			272	1.15	1.20	15,100	C.
March			576	2.44	2.81	35,400	C.
May	3,600	1,370	2,250	9.53	10.99	138,000	A.
June	3,600	1,440	2,480	10.5	11.71	148,000	A.
July	3,510	1,500	2,290	9.70	11.18	141,000	A.
August	1,440	203	664	2.81	3.24	40,800	A.
September	203	80	158	.670	.75	9,400	C.
October			116	.492	.57	7,130	D.
November			61.0	.258	.29	3,630	D.
December			127	.538	.62	7,810	D.
The period						556,000	
1908.							
January			130	.551	.64	7,990	D.
May	1,570	678	935	3.96	4.56	57,500	A.
June	1,180	530	851	3.61	4.03	50,600	A.
July	578	173	347	1.47	1.70	21,300	B.
October			33.0	.140	.16	2,030	D.
November			17.5	.074	.08	1,040	D.
December			30.7	.130	.15	1,890	D.
The period						142,000	

NOTE.—Discharges were interpolated December 12 to 31, 1906, and for the days when gage was not read, in March, 1907. For January, February, and October to December, 1907, and January and October to December, 1908, the mean of days when record was obtained was taken as the mean for the month. No allowance made for possible ice conditions during the winter months. Gage heights for 1906 are given in Water-Supply Paper 213, p. 162.

MERCED RIVER ABOVE MERCED FALLS, CAL.

This station, which is located about 1½ miles above Merced Falls, was established April 6, 1901, to obtain information regarding the flow of Merced River at the point where it emerges from its canyon.

No important tributaries enter for 25 miles above or below the station.

No important diversions are made above the station. The water used for power development returns to the river. Below Merced Falls, however, the combined capacity of irrigating canals in the vicinity of Snelling exceeds the low water flow. All acquired water rights above Merced Falls are for power or mining development.

The flow at the station is probably affected somewhat at times by artificial regulation at some of the power dams several miles above. It is not believed, however, that pondage from the dam at Merced

Falls has any appreciable effect at the station. The bed of the stream at the station is composed of gravel, and is subject to some change at high water. The velocity is also very great at flood stages.

The gage datum has never been changed.

At low and moderate stages the records have a fair degree of accuracy. At high stages, however, they are subject to considerable error, due mainly to inaccuracy in gaging at such stages and to shifting channel.

Discharge measurements of Merced River above Merced Falls, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
April 30	W. F. Martin	292	1,030	12.64	6,280
May 27	.....do	290	1,140	12.85	7,600
May 31	.....do	308	1,380	13.76	10,300
June 1	.....do	310	1,530	14.23	11,600
July 6	.....do	268	947	12.40	5,400
July 8	W. V. Hardy	265	993	12.40	5,560
July 9	.....do	265	914	12.12	4,960
July 10	.....do	218	801	11.75	4,350
July 11	.....do	213	766	11.57	3,760
July 15	.....do	210	727	11.44	3,550
July 17	.....do	193	660	11.22	3,080
July 20	.....do	180	622	10.90	2,540
July 22	.....do	175	595	10.75	2,340
July 23	.....do	170	550	10.50	1,990
July 29	W. A. Lamb	176	554	10.50	2,070
July 30	.....do	173	548	10.45	1,740
July 31	.....do	170	510	10.30	1,580
August 5	.....do	155	470	10.00	1,250
August 11	.....do	147	373	9.57	806
September 23	.....do	110	200	8.31	146
1908.					
March 2	W. F. Martin	165	441	10.00	1,230
May 2	W. A. Lamb	230	744	11.45	3,600
June 17	W. F. Martin	168	460	10.06	1,290
September 12	W. V. Hardy	102	177	8.16	102

Daily gage height, in feet, of Merced River above Merced Falls, Cal., for 1907 and 1908.

[C. Seigfeldt and C. Kelsey, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	9.9	10.6	10.15	11.75	12.5	13.95	12.65	10.35	8.7	8.25	8.6	8.2
2	9.55	11.5	10.0	12.0	12.55	14.15	12.4	10.35	8.75	8.2	8.6	8.2
3	9.4	12.05	10.0	11.95	12.75	14.1	12.45	10.2	8.7	8.2	8.55	8.2
4	9.35	11.55	10.25	11.55	12.6	14.1	12.8	10.1	8.75	8.15	8.5	8.2
5	10.25	11.5	11.55	11.4	12.1	13.85	12.75	9.95	8.65	8.3	8.5	8.5
6	9.85	11.1	11.85	11.3	11.95	13.6	12.25	9.95	8.7	8.2	8.4	9.4
7	9.6	10.85	11.65	11.25	11.95	13.1	12.1	9.85	8.7	8.2	8.4	8.75
8	11.0	10.65	11.1	11.35	11.95	12.5	12.15	9.85	8.6	8.25	8.4	8.65
9	10.45	10.6	10.9	11.6	12.4	12.35	11.95	9.75	8.6	8.1	8.4	9.35
10	10.65	10.6	12.55	11.85	12.75	12.8	11.7	9.65	8.6	8.2	8.35	8.95
11	10.2	10.45	13.9	12.0	12.95	13.1	11.55	9.55	8.6	8.2	8.4	8.8
12	9.9	10.4	12.7	12.35	12.45	12.85	11.55	9.45	8.6	8.2	8.4	8.8
13	9.6	10.3	11.85	12.6	11.9	12.15	11.6	9.4	8.6	8.2	8.4	8.7
14	10.0	10.2	11.25	12.9	11.8	11.5	11.4	9.35	8.6	8.2	8.3	8.75
15	10.2	10.1	11.0	12.6	12.3	11.3	11.25	9.4	8.6	8.2	8.3	8.7
16	10.1	10.1	10.85	12.25	12.9	11.25	11.2	9.45	8.55	8.1	8.3	8.7
17	10.05	10.3	15.2	12.25	13.0	11.2	11.1	9.45	8.5	8.2	8.25	8.7
18	10.05	10.25	14.8	12.55	13.45	11.3	11.1	9.45	8.45	8.15	8.25	8.6
19	9.85	10.0	18.0	12.85	13.75	12.05	11.1	9.45	8.4	8.15	8.3	8.6
20	9.75	9.95	16.05	13.05	13.45	12.55	11.0	9.25	8.4	8.2	8.3	8.6

Daily gage height, in feet, of Merced River above Merced Falls, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	9.8	9.9	14.8	13.0	13.25	12.8	10.85	9.2	8.35	8.15	8.2	8.6
22	9.95	11.55	13.95	13.0	13.05	12.75	10.75	9.1	8.35	8.2	8.2	8.6
23	9.95	10.7	13.55	13.0	12.45	12.3	10.65	9.05	8.3	8.3	8.25	8.6
24	10.0	10.55	16.55	13.05	12.1	12.05	10.75	9.0	8.25	8.3	8.2	8.6
25	10.45	10.45	15.6	12.9	12.45	12.5	10.8	8.9	8.2	8.3	8.2	8.6
26	10.6	10.7	13.65	13.0	12.8	12.5	10.7	8.9	8.25	8.4	8.2	8.6
27	10.25	10.3	12.75	12.95	12.85	12.7	10.65	8.85	8.2	8.4	8.2	8.6
28	15.6	10.25	12.3	12.9	13.1	12.8	10.65	8.85	8.25	8.65	8.2	8.6
29	12.7	......	11.95	12.85	13.3	12.4	10.6	8.8	8.25	8.7	8.2	8.8
30	11.4	......	11.85	12.6	13.45	13.05	10.45	8.8	8.3	8.7	8.2	8.9
31	10.75	......	11.85	......	13.85	......	10.3	8.7	......	8.6	......	9.15
1908.												
1	9.15	8.9	9.6	9.45	11.55	10.3	9.45	9.0	7.95	8.1	8.1	7.8
2	8.9	8.9	10.0	9.45	11.45	10.25	9.35	9.0	7.9	8.2	8.0	7.95
3	8.85	8.9	9.75	9.45	11.1	10.15	9.4	8.95	7.95	8.0	8.0	8.0
4	8.9	9.3	9.55	9.5	10.65	10.0	9.45	8.95	7.9	7.8	8.0	8.05
5	8.85	9.25	9.55	9.65	10.55	9.95	9.45	8.8	7.7	8.0	7.9	8.35
6	8.75	9.1	9.55	9.85	10.7	9.95	9.45	8.7	7.7	7.9	7.85	8.5
7	8.7	9.1	9.5	9.8	11.0	10.15	9.35	8.65	7.7	7.7	7.85	8.4
8	8.7	9.0	9.4	9.6	10.75	10.4	9.35	8.6	7.7	7.95	7.85	8.3
9	8.7	9.15	9.35	9.65	10.45	10.5	9.3	8.6	7.7	7.9	7.6	8.25
10	8.8	9.5	9.35	9.9	10.25	10.5	9.15	8.55	7.85	7.9	7.85	8.25
11	8.8	9.15	9.4	10.25	10.2	10.5	9.05	8.5	8.15	7.95	7.8	8.25
12	8.8	9.15	9.45	10.6	10.3	10.45	9.1	8.45	8.15	8.2	7.95	8.25
13	8.8	9.15	9.45	10.75	10.2	10.45	9.1	8.4	8.3	7.9	7.9	8.25
14	9.65	9.0	9.6	10.7	10.05	10.4	9.1	8.4	8.3	8.05	7.85	8.25
15	9.45	9.0	9.75	10.8	10.2	10.3	9.0	8.4	8.25	7.95	7.85	8.2
16	9.05	8.9	9.95	10.6	10.2	10.15	8.9	8.3	8.2	7.8	7.85	8.2
17	8.95	8.95	10.1	10.4	10.15	10.1	8.8	8.3	8.2	8.15	7.85	8.2
18	8.9	8.9	10.15	10.6	10.15	9.95	8.7	8.3	8.2	8.5	7.8	7.95
19	8.9	8.9	10.15	10.9	10.35	9.85	8.7	8.3	8.1	8.3	7.85	8.2
20	8.8	8.9	10.15	11.2	10.4	9.8	8.75	8.3	8.1	8.3	7.8	8.05
21	8.8	8.9	10.2	11.2	10.2	9.75	8.75	8.3	8.2	8.3	7.6	8.1
22	8.8	8.55	10.1	10.85	10.35	9.65	8.75	8.05	8.25	8.25	7.8	7.95
23	8.8	8.8	10.1	10.65	10.5	9.55	8.75	7.9	8.25	8.25	8.25	8.05
24	9.1	8.8	10.2	10.4	10.8	9.55	8.75	8.2	8.25	8.25	8.25	8.1
25	10.4	8.8	10.25	10.4	11.0	9.65	8.75	8.2	8.25	8.05	8.1	8.05
26	10.05	8.9	10.15	10.6	10.95	9.65	8.65	8.2	8.2	7.7	8.2	8.05
27	9.45	9.05	9.9	10.95	10.75	9.6	8.7	8.2	8.2	8.1	8.25	8.05
28	9.25	9.2	9.7	11.5	10.75	9.55	8.75	8.2	8.2	8.2	8.2	8.1
29	9.1	9.75	9.65	11.6	10.85	9.5	8.85	7.9	8.2	8.2	8.1	8.1
30	9.0	......	9.6	11.5	10.9	9.45	8.8	7.9	8.1	8.25	8.2	8.1
31	8.95	......	9.6	......	10.6	......	9.05	8.2	......	8.25	......	8.1

Rating tables for Merced River above Merced Falls, Cal.

FOR 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.*
8.00	50	9.30	655	10.60	1,970	12.80	6,490
8.10	75	9.40	720	10.70	2,110	13.00	7,020
8.20	105	9.50	790	10.80	2,260	13.20	7,600
8.30	140	9.60	860	10.90	2,420	13.40	8,200
8.40	180	9.70	940	11.00	2,600	13.60	8,800
8.50	220	9.80	1,030	11.20	2,970	13.80	9,420
8.60	260	9.90	1,130	11.40	3,350	14.00	10,100
8.70	305	10.00	1,230	11.60	3,740	15.00	13,840
8.80	355	10.10	1,340	11.80	4,160	16.00	17,800
8.90	415	10.20	1,450	12.00	4,600	17.00	22,300
9.00	475	10.30	1,570	12.20	5,040	18.00	27,500
9.10	535	10.40	1,700	12.40	5,520		
9.20	595	10.50	1,830	12.60	6,000		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on twenty discharge measurements made during 1907 and is well defined between gage heights 8.0 feet and 13.0 feet. The upper part of the table was determined by the weir formula for the dam at Merced Falls, 1½ miles below the station.

Rating tables for Merced River above Merced Falls, Cal.—Continued.

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.*
7.60	35	7.90	55	8.10	90	8.30	145
7.70	40	8.00	70	8.20	115	8.40	180
7.80	45						

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1907 and 1908 and is fairly well defined. Above 8.4 feet it is the same as the 1907 table.

Monthly discharge of Merced River above Merced Falls, Cal., for 1907 and 1908.

[Drainage area, 1,090 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	16,200	687	2,040	1.87	2.16	125,000	A.
February	4,710	1,130	2,100	1.93	2.01	117,000	A.
March	27,500	1,230	7,460	6.84	7.89	459,000	A.
April	7,160	3,060	5,490	5.04	5.62	327,000	A.
May	9,590	4,160	6,370	5.84	6.73	392,000	A.
June	10,600	2,970	6,330	5.81	6.48	377,000	A.
July	6,490	1,570	3,460	3.17	3.66	213,000	A.
August	1,640	305	792	.727	.84	48,700	A.
September	330	105	219	.201	.22	13,000	A.
October	305	75	135	.124	.14	8,300	A.
November	260	105	154	.141	.16	9,160	A.
December	720	105	308	.283	.33	18,900	A.
The year	27,500	75	2,910	2.66	36.24	2,110,000	
1908.							
January	1,700	305	517	.474	.55	31,800	A.
February	985	240	496	.455	.49	28,500	A.
March	1,510	687	1,040	.954	1.10	64,000	A.
April	3,740	755	1,870	1.72	1.92	111,000	A.
May	3,640	1,280	2,000	1.83	2.11	123,000	A.
June	1,830	755	1,270	1.17	1.30	75,600	A.
July	755	282	488	.448	.52	30,000	A.
August	475	55	203	.186	.21	12,500	A.
September	145	40	93.9	.086	.10	5,590	A.
October	220	40	94.3	.087	.10	5,800	A.
November	130	35	69.6	.064	.07	4,140	A.
December	220	45	105	.096	.11	6,460	A.
The year	3,740	35	687	.631	8.58	498,000	

TENAYA CREEK IN YOSEMITE VALLEY, CAL.

Tenaya Creek heads in small lakes above Tenaya Lake at an altitude of 10,000 feet, and flows southwestward to its junction with Merced River in the upper end of Yosemite Valley. For about 6 miles it flows through the beautiful Tenaya Canyon, which opens into the Yosemite Valley. From Tenaya Lake, through which it flows, to its mouth, a distance of about 10 miles, the creek has a fall of 4,000 feet.

Considerable storage capacity can be obtained at Tenaya Lake.

The gaging station is located at the wagon bridge below Mirror Lake and about 2 miles east of Yosemite post-office. It was established July 11, 1904, to obtain data for comparisons of flow with that of the station on Merced River at Yosemite and is maintained during only the summer season.

The gage datum has never been changed. Conditions for obtaining discharge data are very good, and the results are reliable.

Discharge measurements of Tenaya Creek in Yosemite Valley, Cal., in 1906, 1907, and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 11	C. W. Tucker	44	176	7.20	891
1907.					
May 7	C. W. Tucker	42	115	5.50	378
May 19	do	42	176	6.85	863
May 23	Martin and Tucker	45	138	5.83	475
May 25	W. F. Martin	45	145	6.03	530
June 4	C. W. Tucker	45	192	7.05	949
June 24	do	45	147	6.05	562
August 16	Clapp and Hardy	40	41	3.75	35
1908.					
August 4	W. V. Hardy	6	2.6	3.13	3.1

Daily gage height, in feet, of Tenaya Creek in Yosemite Valley, Cal., for 1907 and 1908.

[C. W. Tucker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1					5.7	6.9	5.9	4.5	3.4			3.2
2					5.7	6.9	6.0	4.4	3.4		3.3	
3			3.9		5.5	7.0	5.8	4.3	3.4			
4	3.6				5.4	7.1	6.0	4.2	3.4			
5					5.5	7.0	6.1	4.2	3.4			
6					5.4	6.4	6.0	4.1	3.3			
7					5.3	6.5	6.0	4.0	3.3			
8		4.2			5.2	6.4	5.9	4.0	3.3			3.4
9					5.4	6.1	5.9	3.9	3.3	3.2		
10	3.6				5.6	6.5	5.9	3.9	3.3			
11					5.5	6.3	5.8	3.8	3.2			
12					5.5	6.4	5.6	3.8	3.2		3.2	
13		4.0			5.4	5.6	5.5	3.8	3.2			
14					5.4	5.2	5.4	3.8	3.2			
15					5.7	5.1	5.4	3.9	3.2			
16					6.1	5.2	5.2	3.8	3.2			3.8
17					6.2	5.4	5.2	3.9	3.2	3.3		
18		4.1	6.7		6.4	5.5	5.1	3.9	3.2			
19					6.5	5.8	5.0	3.8	3.2		3.2	
20					6.2	6.0	5.0	3.7	3.1			3.6
21					6.0	6.3	4.9	3.7	3.1			
22			4.8		5.6	6.3	4.8	3.6	3.1			
23					5.8	6.1		3.6	3.1			
24					6.0	6.0		3.5	3.1			
25					6.0	6.1		3.5	3.1			
26					6.4	6.3	4.7	3.5	3.1			
27		4.0			6.5	6.4	4.7	3.4	3.1	3.7		
28					6.7	6.3	4.7	3.5	3.1			
29					6.7	6.2	4.6	3.5	3.1			3.8
30	4.0		4.3		6.9	6.5	4.6	3.5	3.1		3.2	
31					7.0		4.5	3.5				

Daily gage height, in feet, of Tenaya Creek in Yosemite Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1						4.2	3.7	3.3				
2						4.2	3.6	3.3				
3					4.4	4.3	3.6	3.3				3.0
4	3.7				4.6	4.4	3.6	3.2				
5					4.7	4.6	3.6					
6					4.8	4.5	3.6					
7					4.5	4.6	3.5				3.0	
8					4.5	4.7	3.5					
9					4.5	4.7	3.5					
10					4.6	4.7	3.5					
11					4.6	4.6	3.4					
12					4.4	4.7	3.4					
13	3.7				4.4	4.6	3.3			3.2		
14					4.3	4.6	3.3					
15					4.2	4.4	3.3					
16					4.3	4.3	3.3					3.0
17					4.3	4.3	3.2					
18					4.3	4.2	3.2					2.9
19					4.1	4.1	3.2					
20	3.7				4.2	4.1	3.2					
21					4.3	4.0	3.2					
22					4.3	4.0	3.1					
23					4.5	3.9	3.1			3.1	3.0	
24					4.4	3.8	3.1					
25					4.5	3.8	3.1					
26					4.6	3.7	3.1					
27					4.6	3.7	3.1					
28	5.7				4.6	3.7	3.1					
29					4.5	3.7	3.1					
30					4.3	3.7	3.6					
31					4.1		3.4					3.0

Rating tables for Tenaya Creek in Yosemite Valley, Cal.

JANUARY 1 TO JUNE 16, 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.*
5.50	293	6.20	480	6.90	722	7.60	1,035
5.60	317	6.30	512	7.00	760	7.70	1,080
5.70	342	6.40	544	7.10	800	7.80	1,125
5.80	368	6.50	578	7.20	840	7.90	1,175
5.90	395	6.60	612	7.30	882	8.00	1,225
6.00	422	6.70	648	7.40	946	8.10	1,275
6.10	450	6.80	684	7.50	990		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1906, and is well defined between gage heights 3.35 feet and 6.0 feet. Below 6.40 feet it is the same as the 1905 table.

JUNE 17, 1906, TO DECEMBER 31, 1908.

2.90	0.5	4.00	63	5.10	274	6.40	667
3.00	1.0	4.10	76	5.20	301	6.60	740
3.10	2.0	4.20	90	5.30	328	6.80	820
3.20	4.0	4.30	105	5.40	356	7.00	900
3.30	7.0	4.40	121	5.50	384	7.20	980
3.40	11	4.50	138	5.60	413	7.40	1,060
3.50	16	4.60	156	5.70	442	7.60	1,150
3.60	22	4.70	176	5.80	472	7.80	1,240
3.70	30	4.80	198	5.90	502		
3.80	40	4.90	222	6.00	533		
3.90	51	5.00	248	6.20	598		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on eight discharge measurements made during 1907 and 1908 and the general form of the previous curve. It is fairly well defined above gage height 3.1 feet.

Monthly discharge of Tenaya Creek in Yosemite Valley, Cal., for 1906, 1907, and 1908.

Drainage area, 47 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.	
1906.							
May 25-31	480	293	424	9.02	2.35	5,050	B.
June	1,280	317	764	16.3	18.19	45,500	B.
July	1,020	176	649	13.8	15.91	39,900	B.
August	156	11	70.3	1.48	1.71	4,320	B.
September	16	.5	2.62	.056	.06	156	C.
October	1.0	.5	.53	.011	.01	33	D.
November	4.0	1.0	1.27	.027	.03	76	C.
December 1-11	1.0	1.0	1.00	.021	.01	22	C.
The period						95,100	
1907.							
January			36	.766	.88	2,210	D.
February			73	1.55	1.61	4,050	D.
March			280	5.96	6.87	17,200	D.
May	900	301	516	10.9	12.57	31,700	B.
June	940	274	609	12.9	14.39	36,200	B.
July	565	138	338	7.19	8.29	20,800	B.
August	138	11	47.4	1.01	1.16	2,910	B.
September	11	2	4.93	.105	.12	293	C.
October			14	.298	.34	861	D.
November			5.0	.106	.12	298	D.
December			24	.511	.59	1,480	D.
The period						118,000	
1908.							
May	198	76	125	2.66	3.07	7,690	B.
June	176	30	100	2.13	2.38	5,950	B.
July	30	2	10.4	.221	.25	640	C.
August			6.0	.128	.15	369	D.
October			3.0	.064	.07	184	D.
November			1.0	.021	.02	60	D.
December			.9	.019	.02	55	D.
The period						14,900	

NOTE.—For January to March and October to December, 1907, and for August and October to December, 1908, the mean of days when record was obtained was taken as mean for month. No allowance was made for possible ice conditions during the winter months.

YOSEMITE CREEK IN YOSEMITE VALLEY, CAL.

Yosemite Creek rises in the northern part of Mariposa County, at an altitude of 9,600 feet, and flows southward through a rolling upland region to the brink of Yosemite Valley, whence it leaps 2,500 feet to the floor of the valley and enters Merced River nearly a mile below Yosemite post-office. Its total drainage area is about 44 square miles.

The gaging station, which is located at the wagon bridge below the falls, about one-half mile from Yosemite post-office, and is maintained during only the summer season, was established July 9, 1904, to obtain data for comparing the quantity of water passing over Yosemite Falls at different times, and thus determining the relative scenic magnificence of one of the most interesting features of the park. The falls are usually at their best in May or June.

Conditions for obtaining accurate discharge data are not very good. The stream bed is composed of granitic sand and fine gravel, and is subject to more or less change.

Discharge measurements of Yosemite Creek in Yosemite Valley, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1907.					
May 5	C. W. Tucker	37	129	7.65	353
May 21	do	37	170	8.70	622
May 23	Tucker and Martin	44	155	7.70	409
May 25	W. F. Martin	42	213	9.00	825
June 3	C. W. Tucker	43	226	9.85	710
June 25	do	42	129	7.55	349
August 6	do	35	64	6.10	69
August 16	Clapp and Hardy	23	16	5.90	34
1908.					
June 6	C. W. Tucker	37	78	6.50	115
August 4	Tucker and Hardy	7	2.8	5.40	3.7

Daily gage height, in feet, of Yosemite Creek in Yosemite Valley, Cal., for 1907 and 1908.

[C. W. Tucker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1			5.7		8.0	9.5	8.2	6.2	5.6			
2			5.6		8.5	9.7	8.3	6.3	5.6			
3	5.3				8.3	9.9	8.2	6.2	5.6		5.5	
4					8.0	9.8	8.7	6.2	5.6			
5					7.6	9.4	8.4	6.2	5.6			
6			5.7		7.4	8.6	8.4	6.1	5.6			
7		5.9			7.8	8.4	8.0	6.1	5.6			5.6
8					8.0	8.2	7.8	6.0	5.6			
9					7.8	7.9	7.6	6.0	5.6			
10					8.0	8.3	7.6	6.0	5.6			
11	5.3				8.3	8.2	7.4	5.9	5.6	5.3		
12			5.6		8.0	8.5	7.4	5.9	5.6		5.3	
13					7.4	7.6	7.2	5.9	5.6			
14			5.6		7.2	7.5	7.1	5.9	5.6			
15					7.8	7.3	7.0	6.0	5.5			
16					8.5	7.5	7.0	5.9	5.5			5.7
17			7.6		8.7	7.4	6.9	5.9	5.5			
18			8.5		9.0	7.5	6.8	5.9	5.5			
19			9.7		9.5	7.7	6.9	5.9	5.5			
20					9.0	8.0	6.9	5.8	5.5			
21		5.7	10.0		8.6	8.2	6.7	5.8	5.4		5.3	5.7
22	5.3				8.1	8.3	6.5	5.8	5.4			
23					7.7	7.9		5.7	5.4	5.3		
24					7.9	7.6		5.7	5.4			
25			11.0		9.0	7.9		5.7	5.4			
26					8.4	8.0	6.6	5.7	5.4			
27		5.7			8.5	8.2	6.6	5.6	5.4	5.8		
28					8.6	8.4	6.6	5.7	5.4	5.7		
29					8.6	8.3	6.6	5.7	5.4			
30					8.8	8.5	6.5	5.7	5.4		5.3	
31			6.3		9.9		6.3	5.7		5.6		5.7
1908.												
1						6.5	5.7	5.6				
2						6.6	5.7	5.5				
3					6.9	6.4	5.6	5.5				
4					7.0	6.4	5.6	5.4		5.4		
5	5.7				7.2	6.4	5.6					5.5
6					7.3	6.5	5.5					
7					7.0	6.5	5.5					
8					6.8	6.5	5.4					
9					6.8	6.6	5.4					
10					6.8	6.6	5.4				5.2	

Daily gage height, in feet, of Yosemite Creek in Yosemite Valley, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
11					6.7	6.7	5.4					
12	5.7				6.7	6.7	5.4					
13					6.6	6.8	5.4					
14					6.5	6.7	5.4					
15					6.6	6.6	5.4					
16					6.7	6.5	5.4			5.6		
17					6.6	6.4	5.4					
18					6.5	6.3	5.4					
19					6.5	6.3	5.4					
20					6.6	6.3	5.4			5.3		
21					6.6	6.2	5.4					
22					6.7	6.2	5.4					5.4
23					6.9	6.1	5.4					
24					7.0	6.1	5.4				5.3	
25					7.1	6.0	5.4					
26	5.7				7.0	6.0	5.4					
27					7.1	5.9	5.4					
28					7.2	5.9	5.4					
29					7.0	5.9	5.5	5.2				
30					6.8	5.8	5.9		5.2			
31					6.6		5.8			5.3		

TUOLUMNE RIVER DRAINAGE BASIN.

DESCRIPTION.

The drainage basin of Tuolumne River lies on the western slope of the Sierra, north of the Merced basin and south of the Stanislaus basin. For a distance of about 50 miles the Sierra divide separates this basin from Mono Lake and Walker River basins to the east. The Tuolumne basin is roughly trapezoidal in shape, ranging in average width from about 15 miles in the San Joaquin Valley to 30 miles near the eastern border. The length of the basin is about 105 miles, two-thirds of which is mountainous. The total area of the mountainous part of the drainage basin is about 1,680 square miles, and lies almost wholly in Tuolumne County.

Tuolumne River has its source in numerous glacial lakes nestling in the shadow of high peaks on or near the Sierra divide, and flows southwestward to its junction with the San Joaquin, 10 miles west of Modesto. Its principal headwaters come from the glacier and lakes on the northern slope of Mount Lyell to the north and east of the headwaters of Merced River. The course of the river is through beautiful upland meadows in its upper part, then through a canyon nearly 80 miles long, which has been cut out of solid granite. The upper part of this canyon, for a distance of about 25 miles, is from 3,000 to 4,000 feet deep, and is known as the Grand Canyon of the Tuolumne. At the lower end of the Grand Canyon is Hetch Hetchy Valley, which is smaller than Yosemite Valley, but in every other way resembles it very much. Finally, the river passes through the lower canyon into the San Joaquin Valley, which it enters near Lagrange. Its total length is about 150 miles.

Nearly all the tributaries of Tuolumne River enter from the north. In order from east to west, the principal ones are Return, Rancheria, Falls, and Cherry creeks, Clavey River, North Fork Tuolumne, and Woods Creek. Eleanor Creek is tributary to Cherry Creek. South Fork of Tuolumne River is tributary to the main stream from the south. Middle Fork is tributary to South Fork.

The Tuolumne basin is rough and rugged. The formation consists of granite, which at the higher altitudes is bare and glaciated and in places towers thousands of feet in vertical cliffs and domes.

Altitudes in this basin range from about 300 feet in the foothills to 12,000 and 13,000 feet along the crest of the Sierra divide. The upper part of the basin is practically devoid of forest cover. On the middle reaches, however, there is a heavy growth of coniferous timber, which becomes less dense with decrease of altitude. The forest cover in the foothill region consists of grass, brush, and scattering timber. About 1,200 square miles of the upper part of the basin is included in national park and forest.

The mean annual precipitation varies with altitude: In the San Joaquin Valley it is about 10 inches and in the foothill region about 30 inches; at the higher elevations it is probably 60 inches. On the upper half of the basin the precipitation occurs chiefly as snow, the greater part of which disappears in the spring; on the higher peaks much snow lasts until late summer. On the northern slope of Mount Lyell, at the head of this basin is one of the few glaciers still remaining in the Sierra.

The only opportunities for irrigation in the Tuolumne basin are in the San Joaquin Valley below the foothills. The Turlock and Modesto irrigation districts now divert water from Tuolumne River above La Grange for irrigating a large acreage in the valley on both sides of the river.

Excellent storage sites exist in the Tuolumne basin. Many glacial lakes throughout the upper reaches of the basin, especially in the northern part, afford exceptional opportunities for constructing storage reservoirs, and there are also a number of storage sites on the main river.

Tuolumne River has a heavy gradient, and the opportunities for power development are great. The minimum flow of the stream, however, is small and only about 35,000 horsepower could be developed continuously without storage. This amount could be increased to more than 300,000 horsepower by utilizing the storage possibilities.

The longest run-off record in the basin dates from 1895. The wettest year at the station since that time was 1907, and the driest 1898. The total flow during the wettest year was about four and one-half times that of the driest year. The flow in 1906 was nearly as great as in 1907, and 1908 was almost as dry as 1898. The high-water mark of the flood in 1862 indicates a greater maximum discharge than has occurred since 1895.

The following gaging stations have been maintained in this basin:

Tuolumne River at Lagrange (1895 to 1908).
Turlock canal near Lagrange (1899 to 1908).
Modesto canal near Lagrange (1903 to 1908).

TUOLUMNE RIVER AT LAGRANGE, CAL.

This station, which is located on the wagon bridge at Lagrange, about 2 miles below the Lagrange dam and headworks of Turlock and Modesto canals, and one-half mile below the powerhouse of the Lagrange Water and Power Company, was established August 29, 1895, to determine the value of the Tuolumne for irrigation and power development. The data obtained are also useful in studying the flood problem in the lower San Joaquin. Since April 1, 1908, the gage record has been kept at the dam and estimates of flow made by using it as a weir. (See Pl. VI, *A*.) At critically low stages, however, it is necessary to determine the flow from the station at the bridge below.

Woods Creek unites with the main stream from the north about 20 miles above Lagrange. No other tributaries of importance enter near the station.

Three important diversion systems take water from Tuolumne River above Lagrange: The Turlock and Modesto canals take water at Lagrange dam from the left and right banks, respectively, for irrigation in the San Joaquin Valley. The Lagrange Water and Power Company's canal takes water from the left bank about 17 miles above Lagrange. The diverted water is used chiefly for power development and all water so used is returned to the river below the dam and above the bridge gaging station on the river. No gage records have been kept on this canal, but from measurements of flow made at various times the mean daily flow has been estimated at a little less than 20 second-feet, or a total of 21,000 acre-feet for the year 1908. Water rights already acquired on this stream are considerably in excess of the low-water flow. It is practically impossible to determine the minimum flow of the stream very closely because of the diversions. During the late summer and fall the power and irrigation canals take the total flow and no water passes over the dam for several months at a time. Regular stations are maintained on the two irrigation canals, and enough gagings made on the power canal to make an estimate of its average flow; but enough water seeps around and through the dam and from the canals to affect appreciably the estimate of minimum flow. Then, too, a part of the water diverted by the power canal is returned to the river above the gaging station at Lagrange. The minimum flow may be affected, also, by pondage above the dam.

The gage datum at the bridge has never been changed. The datum at the dam, which is now being used as a weir, is the average crest level.

Conditions for obtaining accurate discharge data at Lagrange are very good, except for the changing conditions of control above described. Except for minimum flow, therefore, full reliance can be placed on the records at this station.

Discharge measurements of Tuolumne River at Lagrange, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1	W. F. Martin	347	2,450	8.40	8,460
May 28	do	348	2,680	9.10	11,200
May 31	do	349	2,970	9.85	14,600
August 1	W. A. Lamb	312	1,600	5.80	3,060
August 16	W. F. Martin	254	1,060	4.29	933
November 15	W. A. Lamb	220	882	3.53	228
1908.					
March 3	W. F. Martin	253	1,050	4.35	1,050
May 1	W. A. Lamb	314	1,720	6.15	5,370
Do	do	314	1,750	6.20	5,600
June 16	W. F. Martin	260	1,210	4.70	1,910
September 11	W. V. Hardy	33	25	[a]2.70	23
December 9	W. F. Martin	230	865	3.47	346

[a] Estimated.

Daily gage height, in feet, of Tuolumne River at Lagrange, Cal., for 1907 and 1908.

[Bert Clark, observer.]

Day.	Jan.	Feb.	Mar.	Apr.[a]	May.	June.	July.	Aug.	Sept.	Oct.	Nev.	Dec.
1907.												
1	5.9	6.25	6.0	8.4	8.5	10.0	8.9	6.05	2.75	2.5	3.9	3.5
2	5.55	8.7	6.0	8.4	8.45	10.4	8.6	5.95	2.8	2.5	3.85	3.5
3	5.5	8.1	5.9	8.4	8.5	10.35	8.9	5.9	2.8	2.65	3.8	3.5
4	5.4	8.2	6.15	8.4	8.35	10.3	9.25	5.6	2.8	2.7	3.8	3.55
5	6.0	7.95	7.4	8.4	8.05	9.95	9.3	5.25	2.8	2.6	3.7	3.5
6	5.6	7.35	7.05	8.4	7.85	9.6	8.55	5.25	2.8	2.6	3.7	3.5
7	5.5	7.0	6.85	8.4	7.9	9.05	8.4	5.25	2.8	2.6	3.7	4.3
8	6.6	6.8	6.45	8.4	7.8	8.5	8.3	5.2	2.8	3.1	3.7	4.2
9	6.05	6.6	6.5	8.4	8.1	8.5	8.25	[b]5.1	2.8	3.7	3.7	4.0
10	6.0	6.5	9.4	8.4	8.4	8.6	8.1	[b]5.0	2.8	3.6	3.65	3.9
11	5.7	6.5	8.0	8.4	8.5	9.1	8.0	[b]4.85	2.8	3.6	3.8	4.65
12	5.5	6.3	7.45	8.4	8.4	8.9	8.0	[b]4.7	2.8	3.3	3.7	4.2
13	6.2	6.1	7.0	8.5	7.9	8.1	7.95	[b]4.6	2.8	3.6	3.6	4.0
14	6.0	6.05	6.75	8.5	7.8	7.7	7.7	[b]4.5	2.8	3.65	3.55	4.05
15	6.0	6.05	6.55	8.5	8.0	7.35	7.5	[b]4.4	2.8	3.6	3.5	4.0
16	5.7	6.1	6.55	8.5	8.4	7.2	7.3	[b]4.3	2.8	3.5	3.5	3.95
17	5.8	6.25	11.2	8.5	8.7	7.15	7.2	4.2	2.8	3.4	3.6	4.0
18	5.7	6.15	13.5	8.5	9.05	7.15	7.2	4.2	2.6	3.45	3.6	3.95
19	5.5	5.95	15.75	8.5	9.3	7.75	7.2	4.2	2.6	3.1	3.7	3.85
20	5.4	5.9	13.0	8.6	9.3	8.2	7.2	3.85	2.6	3.5	3.65	3.8
21	5.4	5.85	11.5	8.6	8.95	8.45	7.0	3.6	2.6	3.5	3.5	3.85
22	5.6	7.7	10.5	8.6	8.75	8.7	6.75	3.45	2.6	3.6	3.5	3.8
23	5.5	6.9	9.8	8.6	8.25	8.2	6.6	3.35	2.55	3.6	3.5	3.8
24	5.55	6.55	10.65	8.6	8.05	7.9	6.7	3.2	2.5	3.6	3.5	3.85
25	5.8	6.5	10.65	8.6	8.4	7.9	6.8	3.05	2.5	3.6	3.5	3.8

[a] Gage out below 10 feet during April; gage heights obtained by measuring down to water surface from 10-foot mark.

[b] Estimated.

A. LAGRANGE DAM FROM LEFT BANK OF TUOLUMNE RIVER AT LAGRANGE.

B. CONCRETE-LINED CANAL AND TUNNEL PORTAL OF MAIN KLAMATH CANAL, NEAR KLAMATH FALLS, OREGON.

Daily gage height, in feet, of Tuolumne River at Lagrange, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	6.0	6.5	9.3	8.6	8.7	8.2	6.9	2.75	2.5	3.6	3.5	3.85
27	5.9	6.25	8.5	8.5	8.8	8.4	6.75	2.7	2.5	3.85	3.5	4.0
28	9.6	6.1	8.25	8.5	8.9	8.8	6.7	2.7	2.5	4.0	3.5	4.6
29	6.85	......	7.95	8.5	9.2	8.7	6.35	2.7	2.5	3.95	3.5	4.3
30	6.9	......	8.15	8.5	9.35	9.05	6.0	2.85	2.5	3.9	3.5	4.3
31	6.35	......	8.4	......	9.5	......	5.9	2.8	......	3.9	......	4.4
1908.												
1	4.4	3.9	4.3	......	......	......	......	......	......	3.0	2.6	3.4
2	4.3	3.9	4.3	......	......	......	......	......	......	3.0	2.95	3.4
3	4.2	4.0	4.3	......	......	......	......	......	......	2.9	3.1	3.4
4	4.2	4.25	4.15	......	......	......	......	......	......	2.7	a 3.3	3.45
5	4.15	3.85	4.1	......	......	......	......	......	......	2.7	3.5	3.65
6	4.0	3.8	4.1	......	......	......	......	......	......	2.75	a 3.4	......
7	4.0	3.85	4.1	......	......	......	......	......	......	2.75	a 3.3	......
8	4.0	3.8	4.0	......	......	......	......	......	......	2.75	a 3.2	......
9	4.0	4.1	4.0	......	......	......	......	......	......	2.75	3.2	......
10	4.05	4.25	4.05	......	......	......	......	......	......	2.8	3.2	......
11	3.95	4.2	4.1	......	......	......	......	......	......	2.8	3.2	......
12	3.95	4.0	4.3	......	......	......	......	......	......	2.7	3.2	......
13	3.95	3.9	4.4	......	......	......	......	......	......	2.7	3.1	......
14	4.7	3.8	4.55	......	......	......	......	......	......	2.7	a 3.1	......
15	4.6	3.7	4.8	......	......	......	......	......	......	2.85	3.05	......
16	4.35	3.7	5.0	......	......	......	......	......	......	4.5	3.1	......
17	4.3	3.7	5.1	......	......	......	......	......	......	3.9	3.2	......
18	4.15	3.75	4.95	......	......	......	......	......	......	3.7	3.2	......
19	4.05	3.8	4.8	......	......	......	......	......	......	3.55	3.2	......
20	4.0	3.75	4.9	......	......	......	......	......	......	3.45	3.3	......
21	4.0	3.7	4.95	......	......	......	......	......	......	3.45	a 3.4	......
22	4.05	3.7	4.5	......	......	......	......	......	......	3.4	3.6	......
23	4.05	3.6	4.6	......	......	......	......	......	......	3.35	3.5	......
24	4.6	3.6	4.65	......	......	......	......	......	......	3.35	3.5	......
25	5.1	3.6	4.5	......	......	......	......	......	2.85	3.35	3.5	......
26	4.75	3.65	4.3	......	......	......	......	......	3.1	3.35	a 3.4	......
27	4.3	3.95	4.2	......	......	......	......	......	2.7	3.4	3.35	......
28	4.25	4.05	4.05	......	......	......	......	......	3.1	3.4	3.3	......
29	4.2	4.65	4.0	......	......	......	......	......	3.1	3.35	3.3	......
30	4.1	......	4.0	......	......	......	......	......	a 3.05	3.3	3.3	......
31	4.0	......	4.0	......	......	......	......	......	......	a 2.8	......	......

a Estimated.

Daily gage height, in feet, of Tuolumne River at Lagrange dam, near Lagrange, Cal., for 1908.

[J. W. Simmons, observer.]

Day.	Apr.	May.	June.	July.	Dec.	Day.	Apr.	May.	June.	July.	Dec.
1	0.55	3.30	1.75	0.60	......	16	2.05	1.70	1.90	......	0.45
2	.35	3.20	1.70	.75	......	17	1.75	1.30	1.80	......	.50
3	.18	2.65	1.55	.50	......	18	1.70	1.28	1.50	......	.45
4	.35	2.20	1.20	.50	......	19	2.40	1.70	1.32	......	.40
5	.62	2.00	1.15	.50	......	20	2.90	1.85	1.15	......	.45
6	.90	2.25	1.40	.45	0.75	21	2.90	1.50	.92	......	.45
7	1.35	2.80	1.70	.40	.65	22	2.50	1.70	.80	......	.45
8	1.22	2.25	2.10	.25	......	23	2.30	1.55	.70	......	.45
9	1.18	1.70	2.30	.10	......	24	1.80	2.40	.98	......	.45
10	1.32	1.40	2.35	.00	.60	25	1.65	3.00	1.05	......	.40
11	1.50	1.35	2.30	.00	.60	26	1.60	2.90	1.00	......	.30
12	2.00	1.75	2.20	......	.55	27	2.05	2.50	.88	......	.30
13	2.40	1.65	2.20	......	.50	28	2.75	2.40	.75	......	.30
14	2.60	1.70	2.25	......	.50	29	3.00	2.70	.65	......	.10
15	2.45	1.80	2.00	......	.55	30	3.20	2.70	.60	......	.00
						31	......	2.20	......	......	.00

NOTE.—Record for January to March and September 25 to December 5, 1908, kept at the bridge station. From July 12 to September 24, 1908, all the water was diverted into the canals.

Rating tables for Tuolumne River at Lagrange, Cal.

JANUARY 1, 1906, TO MARCH 16, 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.*
5.40	1,300	6.40	3,080	7.40	5,570	8.40	8,700
5.50	1,440	6.50	3,300	7.50	5,850	8.50	9,040
5.60	1,580	6.60	3,530	7.60	6,140	8.60	9,390
5.70	1,750	6.70	3,760	7.70	6,440	8.70	9,740
5.80	1,910	6.80	4,000	7.80	6,750	8.80	10,090
5.90	2,080	6.90	4,250	7.90	7,070	8.90	10,450
6.00	2,260	7.00	4,500	8.00	7,390	9.00	10,810
6.10	2,450	7.10	4,760	8.10	7,710	9.20	11,570
6.20	2,650	7.20	5,020	8.20	8,030	9.40	12,330
6.30	2,860	7.30	5,290	8.30	8,360		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 18 discharge measurements made during 1906 and is well defined.

MARCH 17 TO DECEMBER 31, 1907.

2.50	0	4.00	640	5.50	2,490	8.00	8,000
2.60	2	4.10	750	5.60	2,645	8.20	8,540
2.70	6	4.20	860	5.70	2,805	8.40	9,120
2.80	12	4.30	970	5.80	2,970	8.60	9,720
2.90	21	4.40	1,080	5.90	3,140	8.80	10,360
3.00	35	4.50	1,190	6.00	3,320	9.00	11,000
3.10	55	4.60	1,305	6.20	3,690	10.00	14,500
3.20	85	4.70	1,420	6.40	4,100	11.00	18,600
3.30	125	4.80	1,540	6.60	4,540	12.00	23,200
3.40	175	4.90	1,665	6.80	5,010	13.00	29,000
3.50	235	5.00	1,790	7.00	5,500	14.00	36,200
3.60	300	5.10	1,920	7.20	6,000	15.00	44,800
3.70	370	5.20	2,055	7.40	6,500	16.00	54,000
3.80	450	5.30	2,195	7.60	7,000		
3.90	540	5.40	2,340	7.80	7,500		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1907 and previous high-water measurements and is well defined. The upper extension of curve is determined by applying the weir formula to simultaneous gage heights on the Lagrange dam.

JANUARY 1 TO DECEMBER 31, 1908.

2.60	10	3.30	230	4.00	810	4.70	1,860
2.70	20	3.40	290	4.10	930	4.80	2,050
2.80	40	3.50	360	4.20	1,060	4.90	2,250
2.90	60	3.60	430	4.30	1,200	5.00	2,460
3.00	90	3.70	510	4.40	1,350	5.10	2,680
3.10	130	3.80	600	4.50	1,510		
3.20	180	3.90	700	4.60	1,680		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1908 and is well defined.

Rating table for Tuolumne River at Lagrange dam, near Lagrange, Cal., 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.*
0.10	29	1.80	2,180	3.50	5,920	6.40	14,650
.20	81	1.90	2,370	3.60	6,180	6.60	15,360
.30	149	2.00	2,560	3.70	6,440	6.80	16,080
.40	229	2.10	2,750	3.80	6,700	7.00	16,800
.50	320	2.20	2,950	3.90	6,970	7.20	17,520
.60	421	2.30	3,160	4.00	7,240	7.40	18,240
.70	530	2.40	3,370	4.20	7,800	7.60	18,980
.80	648	2.50	3,580	4.40	8,360	7.80	19,740
.90	772	2.60	3,800	4.60	8,930	8.00	20,500
1.00	905	2.70	4,020	4.80	9,510	9.00	24,400
1.10	1,040	2.80	4,240	5.00	10,110	10.00	28,600
1.20	1,180	2.90	4,470	5.20	10,740	11.00	33,000
1.30	1,340	3.00	4,700	5.40	11,380	12.00	37,600
1.40	1,500	3.10	4,940	5.60	12,020	13.00	42,400
1.50	1,660	3.20	5,180	5.80	12,660	14.00	47,400
1.60	1,830	3.30	5,420	6.00	13,300	15.00	52,600
1.70	2,000	3.40	5,670	6.20	13,960	16.00	57,900

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 20 discharge measurements made during 1906 to 1908 and the weir formula $Q=905\ h^{\frac{3}{2}}$ and is fairly well defined.

Monthly discharge of Tuolumne River at Lagrange, Cal., for 1907 and 1908.

[Drainage area, 1,500 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	13,200	1,300	2,460	1.64	1.89	151,000	A.
February	9,910	2,470	4,240	2.83	2.95	235,000	A.
March	52,000	2,230	11,200	7.47	8.61	689,000	A.
April	10,700	9,230	9,810	6.54	7.30	584,000	A.
May	13,900	8,300	10,500	7.00	8.07	646,000	A.
June	17,300	6,960	11,200	7.47	8.33	666,000	A.
July	13,200	4,360	8,210	5.47	6.31	505,000	A.
August	4,630	754	2,140	1.43	1.65	132,000	A.
September	820	264	496	.331	.37	29,500	A.
October	640	[a] 55	304	.203	.23	18,700	A.
November	540	235	322	.215	.24	19,200	A.
December	1,400	235	634	.423	.49	39,000	A.
The year	52,000	[a] 55	5,130	3.42	46.44	3,710,000	
1908.							
January	2,680	756	1,180	.787	.91	72,600	A.
February	2,270	806	1,000	.667	.72	57,500	A.
March	3,380	1,380	2,120	1.41	1.63	130,000	A.
April	6,490	1,280	3,500	2.33	2.60	208,000	A.
May	6,720	2,560	4,100	2.73	3.15	252,000	A.
June	4,710	1,630	3,070	2.05	2.29	183,000	A.
July	1,820	548	1,020	.680	.78	62,700	A.
August	927	151	390	.260	.30	24,000	B.
September	153	80	[b] 116	.077	.09	6,900	B.
October	1,540	60	219	.146	.17	13,500	B.
November	470	[a] 50	218	.145	.16	13,000	B.
December	635	260	362	.241	.28	22,300	B.
The year	6,720	[a] 50	1,440	.960	13.08	1,050,000	

[a] Minima are affected by pondage at Lagrange dam.
[b] Mean based on 20-day record.

NOTE.—The daily discharges for 1907 include those of Modesto and Turlock canals. The daily discharges for 1908 include those of Turlock and Modesto canals and also the Lagrange Water and Power Company's canal. During April, May, June, a part of July, and a part of December, the Lagrange dam was used as a weir to give the flow of the river, the formula being determined by previous meter measurements at the station below.

MODESTO CANAL NEAR LAGRANGE, CAL.

The Modesto canal, which diverts water from the right bank of Tuolumne River, is owned by the Modesto Irrigation District. The water is taken through a concrete bulkhead at the end of Lagrange dam. (See Pl. V, *A*.) The diverted water is used for irrigating 81,200 acres of land around Modesto in Stanislaus County. The district has filed on 640 second-feet, but the maximum capacity of the canal at present is less than 600 second-feet.

The principal part of the construction work on this canal was done prior to 1892, but on account of litigation was not finished until April, 1903. A gage-height record has been kept since April 26, 1903, on which date a gage was installed in Indian Hill flume, near Lagrange, Cal. On July 12, 1904, the station was moved to the flume near the intake in order that more gage readings could be made and their fluctuations better interpreted. The gage is an iron staff in a concrete well about 50 feet below the waste gates. Measurements are made from a footbridge at a concrete section about 500 feet below the headworks.

Daily discharges of the Modesto canal have been included with those for Tuolumne River at Lagrange, Cal. The total run-off for the canal for 1907 was 146,000 acre-feet and for 1908 164,000 acre-feet.

Discharge measurements of Modesto canal near Lagrange, Cal., 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 30	W. F. Martin	21.9	83	2.90	538
Do	do	20.2	16	.55	43
Do	do	20.6	27	.92	102
Do	do	20.8	39	1.35	185
Do	do	21.0	46	1.70	257
Do	do	21.2	59	2.12	352
Do	do	21.8	73	2.56	476
1908.					
May 1	W. A. Lamb	22	95	3.05	583
June 16	W. F. Martin	22	96	3.11	576
Do	do	21	59	1.70	296
Do	do	21	40	1.02	152

Daily gage height, in feet, of Modesto canal near Lagrange, Cal., for 1907 and 1908.

[J. W. Simmons, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Dec.
1907.											
1		1.3		0.95	2.2	2.65	2.7	2.75	1.65	0.6	
2		1.3	0.8	.95	2.45	2.65	2.65	2.75	1.6		
3		1 0	1.15	1.5	2.6	2.65	2.7	2.75	1.55		
4		1.0	1.4	1.5	2.4	2.65	2.75	2.75	1.4		
5		1.0	1.4	1.5	2.2	2.65	2.75	2.75	1.4		
6		.4	.65	1.5	2.1	2.6	2.7	.5	1.6		
7		1.5	1.6	1.5	2.1	2.65	2.75	.45	1.6		
8		1.7	2.05	1.5	2.1	2.7	2.75	1.2	1.55		
9		1.9	1.7	1.5	2.2	2.7	2.75	1.2	1.4		
10		2.2	1.1	1.5	2.3	2.7	2.75	.6	1.4		

Daily gage height, in feet, of Modesto canal near Lagrange, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Dec.
1907.											
11		2.1	0.85	1.5	2.4	2.65	2.75	0.6	1.4		
12		2.15		1.55	2.45	2.6	2.75	.6	1.4		
13		2.4	.9	1.4	1.25	2.65	2.75	.6	1.4		
14		1.6	.9	1.4	.85	2.65	2.75	.6	1.4		
15	0.05	.75	1.45	1.4	2.0	2.7	2.75	1.0	1.35		
16	.05	.5	1.15	1.4	2.2	2.7	2.75	1.0	1.3		
17	.05	1.0	1.1	2.0	2.3	2.7	2.75	1.5	1.25		
18	1.0	1.1	.5	2.4	2.4	2.6	2.75	2.0	1.2		
19	1.0	1.75	.4	2.5	2.4	2.5	2.75	2.35	1.1		
20	1.05	1.75	.4	2.6	2.4	2.3	2.75	2.75	1.1		
21	1.05	1.75	.2	2.4	2.4	2.3	2.75	2.8	1.05		
22		1.0		1.1	1.2	2.3	2.6	2.85	1.0		
23	1.0	.95		1.5	1.1	2.3	2.5	2.85	.95		
24	1.0	.9		1.1	2.4	2.3	2.65	2.8	.95		
25	1.0	.9		2.2	2.5	2.4	2.65	2.7	.95		
26	1.05			2.3	2.55	2.6	2.65	2.8	.9		
27	1.0			2.25	2.55	2.65	2.65	2.5	.9		0.8
28	1.0			2.3	2.6	2.7	2.7	1.9	.9		.85
29	1.0			2.5	2.65	2.7	2.75	1.7	.85		.85
30	1.0			2.35	2.0	2.7	2.75	1.75	.9		.75
31	1.0				2.65		2.75	1.65			.8
1908.											
1	.75	.8	1.8	2.6	2.95	3.0	1.55	1.6	.4		
2	.8	.8	1.8	2.6	2.9	3.1	2.3	1.7	.4		
3	.8	.8	1.8	2.7	2.75	3.1	3.0	1.8	.4		
4	.8	1.0	1.9	2.8	2.7	3.1	2.7	1.8	.4		
5	.8	1.0	2.0	2.8	2.8	3.1	3.1	1.6	.35		
6	.8	1.5	2.1	2.45	2.4	3.05	3.1	1.5	.35		
7	.8	1.5	2.1	.45	2.95	3.1	3.1	1.4	.35		
8	.8	1.6	2.05	.6	3.0	3.1	3.1	1.3			
9	.3	1.4	2.05	.55	3.0	2.95	3.1	1.2			
10	.2	.8	2.05	1.1	3.0	3.05	2.95	1.15			
11	.9	1.35	2.1	1.8	2.05	3.05	2.5	1.1			
12	1.0	1.6	2.1	2.1	1.45	3.05	2.3	1.05			
13	1.3	1.6	2.1	2.3	1.4	3.0	2.5	1.0			
14	1.2	1.6	2.1	1.2	1.45	3.1	2.4	.95			
15		1.6	2.1	2.25	.7	3.05	2.0	.9			
16		1.6	2.1	2.5	1.7	2.9	1.8	.8			
17		1.4	2.15	2.6	2.5	3.1	1.65	.75			
18		1.25	2.15	2.7	2.75	3.05	1.55	.75			
19		1.25	2.15	2.8	2.8	3.1	1.5	.75			
20		1.4	2.1	2.8	2.9	3.05	1.5	.7			
21		1.4	2.1	2.5	3.0	3.1	1.5	.7			
22		1.4	2.2	2.85	3.0	3.1	1.5	.65			
23		1.4	2.3	2.85	3.0	3.1	1.5	.65			
24		1.4	2.3	2.9	3.0	1.7	1.5	.65			
25		1.6	2.4	2.85	3.0	2.7	1.5	.65			
26		1.6	2.4	3.0	2.6	3.1	1.4	.6			.8
27		1.65	2.35	3.0	3.05	3.1	1.35	.55			1.0
28	.35	1.65	2.45	3.0	3.05	3.1	1.5	.55			1.0
29		1.7	2.5	3.0	3.05	8.1	1.6	.5			1.15
30			2.5	3.0	3.1	3.1	1.5	.45			1.4
31			2.6		3.0		1.7	.45			1.5

NOTE.—The canal was dry on days when gage was not read.

Rating tables for Modesto canal near Lagrange, Cal.

FOR 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.*
0.20	2	1.00	117	1.80	280	2.60	475
.30	13	1.10	135	1.90	303	2.70	501
.40	25	1.20	154	2.00	327	2.80	527
.50	38	1.30	174	2.10	351	2.90	553
.60	52	1.40	194	2.20	375	3.00	580
.70	67	1.50	215	2.30	400		
.80	83	1.60	236	2.40	425		
.90	100	1.70	258	2.50	450		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made during 1907 and is well defined.

FOR 1908.

0.00	0	.90	136	1.80	309	2.70	499
.10	13	1.00	154	1.90	330	2.80	521
.20	26	1.10	172	2.00	351	2.90	543
.30	40	1.20	191	2.10	372	3.00	565
.40	55	1.30	210	2.20	393	3.10	587
.50	70	1.40	229	2.30	414	3.20	609
.60	86	1.50	248	2.40	435		
.70	102	1.60	268	2.50	456		
.80	119	1.70	288	2.60	477		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on four discharge measurements made during 1908 and is well defined.

Monthly discharge of Modesto Canal near Lagrange, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	126	0	49.9	3,070
February	425	0	173	9,610
March	339	0	80.8	4,970
April	475	108	272	16,200
May	488	135	377	23,200
June	501	400	472	28,100
July	514	475	505	31,100
August	540	52	310	19,100
September	247	91	165	9,820
October	52	0	1.68	103
November	0	0	0	0
December	91	0	13.6	836
The year	540	0	202	146,000
1908.				
January	210	0	56.4	3,470
February	288	119	224	12,900
March	477	309	384	23,600
April	565	62	431	25,600
May	587	102	483	29,700
June	587	288	568	33,800
July	587	219	368	22,600
August	309	62	153	9,410
September	55	0	12.1	720
October	0	0	0	0
November	0	0	0	0
December	248	0	35.0	2,150
The year	587	0	226	164,000

TURLOCK CANAL NEAR LAGRANGE, CAL.

The Turlock canal, which is owned by the Turlock irrigation district, diverts water through a short tunnel from the left bank of Tuolumne River. The headgates are only a few feet above Lagrange dam. The diverted water is used for irrigating 176,000 acres of fertile land in the vicinity of Turlock and Ceres in Stanislaus County. The district has filed on 1,500 second-feet, but the maximum capacity of the canal at present is somewhat less than 1,000 second-feet.

The first water was turned into the canal in small quantities in 1898 and was used for puddling. A record of the gage height has been kept from July, 1899, to the present time. The gage is a staff float in a concrete well a few feet below the waste gates. Measurements are made in a board flume about one-half mile below the gage well.

Daily discharges of the Turlock canal have been included with those for Tuolumne River at Lagrange. The total run-off for the canal in 1907 was 194,000 acre-feet and in 1908, 204,000 acre-feet.

Discharge measurements of Turlock canal near Lagrange, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 28	W. F. Martin	238	150	5.25	711
May 29	do	238	128	4.50	565
Do	do	238	115	3.98	477
Do	do	238	104	3.50	405
Do	do	238	88	2.92	318
Do	do	238	74	2.30	231
Do	do	238	58	1.75	153
Do	do	238	38	.95	64
1908.					
May 1	W. A. Lamb	24	150	5.4	716
June 16	W. F. Martin	24	157	5.69	748
September 11	W. V. Hardy	24	57	1.47	108

Daily gage height, in feet, of Turlock canal near Lagrange, Cal., for 1907 and 1908.

[H. T. Sackett, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1907.										
1			2.8		4.25	5.15	5.1	5.3	3.45	1.95
2			2.8		4.7	5.3	5.1	5.3	4.25	2.45
3			.2		4.8	5.4	5.1	5.3	3.7	2.5
4			.0		4.8	5.4	5.1	5.3	3.55	2.5
5			.0		5.0	5.4	5.1	5.3	3.55	2.35
6			.5		5.1	5.4	5.05	5.4	4.5	2.25
7			.5		5.1	5.4	5.1	5.4	3.8	2.25
8			1.0		5.2	5.35	5.1	5.4	3.6	2.2
9			1.0		5.2	5.4	5.1	5.4	3.55	
10			.0		5.25	5.4	5.1	5.4	3.4	
11			.6		5.3	5.4	5.1	5.4	3.3	
12		2.4	1.15		5.3	5.35	5.1	5.4	3.35	
13		3.6	1.15		5.3	5.3	5.1	5.4	3.4	
14		3.6	1.15		5.3	5.3	5.1	5.4	3.4	
15		3.6	1.15		5.3	5.0	5.1	5.4	3.2	
16		3.6	1.15	0.85	5.15	5.0	5.1	5.4	3.0	
17		2.1	1.15	1.7	5.1	4.7	5.2	5.4	2.85	
18		2.1		1.7	5.1	4.7	5.2	5.4	2.7	
19		2.1		2.15	5.15	4.7	5.2	5.4	2.6	
20		2.1		2.6	5.1	4.7	5.2	5.3	2.5	

Daily gage height, in feet, of Turlock canal near Lagrange, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1907.										
21	....	2.1	....	2.6	5.1	4.7	5.2	5.15	2.3	....
22	....	.6	....	3.0	5.1	4.7	5.2	5.05	2.2	....
23	....	.6	....	3.35	5.1	4.7	5.2	5.0	2.1	....
24	....	.6	....	3.35	....	4.7	5.3	4.85	2.05	....
25	....	2.8	....	3.35	....	4.7	5.3	4.45	2.0	....
26	....	2.8	....	3.8	....	4.7	5.3	4.05	2.0	....
27	....	2.8	....	3.8	....	5.0	5.3	3.8	2.05	....
28	....	2.8	....	3.8	5.1	5.0	5.3	4.25	2.0	....
29	....	....	....	4.25	....	5.0	5.3	4.4	1.9	....
30	....	....	....	4.25	5.0	5.1	5.3	4.3	2.0	....
31	....	....	....	....	5.15	....	5.3	4.05	....	....
1908.										
1	....	.2	2.2	4.7	5.4	5.5	5.7	3.6	.75	....
2	....	.2	2.2	5.0	5.4	5.45	5.7	3.65	.8	....
3	....	.2	2.2	5.2	5.35	5.45	5.7	4.5	.75	....
4	....	.2	2.2	5.4	5.4	5.45	5.75	4.35	.7	....
5	....	.2	2.2	5.5	5.35	5.6	5.7	3.4	.7	....
6	....	.2	2.2	5.55	5.4	5.6	5.75	3.05	.65	....
7	....	.2	2.2	4.0	5.4	5.6	5.65	2.85	.65	....
8	....	.2	2.2	5.65	5.35	6.0	5.6	2.6	.95	....
9	....	.2	2.2	5.7	5.35	6.0	5.5	2.4	.95	....
10	....	.2	2.2	5.7	5.45	6.0	4.95	2.3	1.3	....
11	....	.2	2.2	5.7	5.4	5.55	4.5	2.1	1.5	....
12	....	.2	2.2	5.8	5.5	5.5	4.6	2.1	1.3	....
13	....	.2	2.2	5.0	5.5	5.55	5.15	2.0	1.2	....
14	....	1.2	2.2	5.0	5.5	5.55	4.75	1.9	1.5	....
15	....	1.2	2.45	5.0	5.55	5.55	4.25	1.8	....	....
16	....	1.2	2.7	5.05	5.5	5.55	3.95	1.6	....	....
17	....	1.2	2.95	5.1	5.45	5.55	3.75	1.45	....	....
18	....	1.2	3.2	5.2	5.45	5.55	3.65	1.45	....	....
19	....	1.2	3.2	5.2	5.45	5.55	3.4	1.45	....	....
20	....	1.2	3.7	5.3	5.45	5.6	3.45	1.35	....	....
21	....	1.2	3.7	5.3	5.55	5.55	3.45	1.3	....	....
22	....	1.7	3.7	5.3	5.55	5.6	3.1	1.3	....	....
23	....	1.7	3.7	5.25	5.55	5.6	3.05	1.25	....	....
24	....	1.7	3.7	5.3	5.45	5.7	3.05	1.2	....	....
25	0.4	1.7	3.7	5.3	5.5	5.7	3.05	1.2	....	....
26	.4	1.7	3.95	5.3	5.5	5.7	2.8	1.1	....	....
27	.4	1.7	4.2	5.25	5.4	5.7	2.7	1.05	....	....
28	.2	2.2	4.45	5.3	5.5	5.7	3.2	1.0	....	....
29	.2	2.2	4.7	5.3	5.5	5.7	3.35	.9	....	....
30	.2	....	4.7	5.4	5.5	5.7	3.2	.9	....	....
31	.2	....	4.7	....	5.4	....	3.45	.8	....	....

NOTE.—The canal was dry on days when gage was not read.

Rating table for Turlock canal near Lagrange, Cal., 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.*
0.10	1	1.30	100	2.50	255	4.40	555
.20	7	1.40	111	2.60	269	4.60	589
.30	13	1.50	123	2.70	283	4.80	623
.40	19	1.60	135	2.80	298	5.00	657
.50	26	1.70	147	2.90	313	5.20	691
.60	33	1.80	160	3.00	328	5.40	725
.70	41	1.90	173	3.20	358	5.60	760
.80	50	2.00	186	3.40	390	5.80	796
.90	59	2.10	199	3.60	422	6.00	832
1.00	69	2.20	213	3.80	454		
1.10	79	2.30	227	4.00	487		
1.20	89	2.40	241	4.20	521		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eleven discharge measurements made in 1907 and 1908 and is well defined.

Monthly discharge of Turlock Canal near Lagrange, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	0	0	0	0
February	422	0	15.1	839
March	298	0	42.9	2,640
April	530	0	166	9,880
May	708	0	562	34,600
June	725	606	669	39,800
July	708	665	686	42,200
August	725	454	667	41,000
September	530	173	324	19,300
October	255	0	58.8	3,620
November	0	0	0	0
December	0	0	0	0
The year	725	0	266	194,000
1908.				
January	19	0	2.74	168
February	213	7	72.8	4,190
March	606	213	341	21,000
April	796	487	701	41,700
May	751	716	734	45,100
June	832	733	758	45,100
July	787	298	534	32,800
August	572	50	197	12,100
September	123	0	32	1,900
October	0	0	0	0
November	0	0	0	0
December	0	0	0	0
The year	832	0	281	204,000

LAGRANGE WATER AND POWER COMPANY'S CANAL NEAR LAGRANGE, CAL.

The Lagrange Water and Power Company's canal takes water from the south side of Tuolumne River at Indian Bar, about 17 miles above the town of Lagrange. This canal was built in the early days to supply water for hydraulic mining in the vicinity of Lagrange, and it is now locally known as the "old mining ditch." Recently it has been thoroughly repaired and is now used as a supply canal for the new hydro-electric plant which was installed in the latter part of 1907. The power house is situated on the bank of the river about half a mile above the town of Lagrange and is below the dam and headworks of the Turlock and Modesto irrigation canals.

The following measurements were made on the power canal during 1907 and 1908, but no regular station was maintained. Gage heights are depths of water in the flume.

Discharge measurements of Lagrange Water and Power Company's canal near Lagrange, Cal.

Date.	Hydrographer.	Gage height.	Discharge.
1907.		*Feet.*	*Sec.-ft.*
November 15	W. A. Lamb	0.90	12
1908.			
March 3 [a]	W. F. Martin	.92	11
May 1 [a]	W. A. Lamb	1.35	20
June 16 [b]	W. F. Martin	1.55	35
September 11 [b]	W. V. Hardy		26
December 9 [a]	W. F. Martin	2.24	48

[a] Measurement made in flume opposite dam.
[b] Measurement made in long flume a short distance above reservoir.

The mean daily flow of the canal for 1908, in second-feet, is estimated as follows: January, 10; February, 10; March, 11; April, 20; May, 31; June, 36; July, 35; August, 40; September, 31; October, 35; November, 40; December, 45. From May to September, inclusive, the estimate is fairly accurate, being based on daily gage readings.

STANISLAUS RIVER DRAINAGE BASIN.

DESCRIPTION.

Stanislaus River drains a long, narrow basin lying on the western slope of the Sierra, north of the Tuolumne basin, south of the Calaveras and Mokelumne basins, and west of the Walker River basin, from which it is separated for a distance of about 25 miles by the Sierra divide. The length of the basin from the valley rim to the crest of the divide is about 75 miles; its width averages about 12 miles in the foothills and less than 25 miles near the eastern border. North Fork above and the main stream below form the boundary between Calaveras and Tuolumne counties. The total drainage area above the valley is about 950 square miles.

Stanislaus River has its source in small glacial lakes and on high peaks of the Sierra divide, and flows southwestward to its junction with the lower San Joaquin about 15 miles west of Modesto. It has a total length of about 120 miles, of which about 80 miles is in the mountains and 40 miles in the valley. The main stream is formed by the confluence of its three principal forks heading well back in the mountains. Middle Fork, the largest and most important, unites with North Fork about 12 miles north of Sonora and 30 or 35 miles above the valley rim; South Fork joins the main stream about 8 miles below the junction of North and Middle forks.

The Stanislaus basin shows rough and broken topography. There are many high mountain peaks, more or less barren and precipitous. A few small narrow valleys exist in the upper part of the basin.

Middle Fork courses through a well-developed canyon, 30 or 40 miles long and from 1,500 to 2,000 feet deep. North and South forks also run through canyons from 500 to 1,000 feet deep. Altitudes within the basin range from a few hundred feet in the foothills to 11,000 feet and more at the crest of the divide. The rocks are granitic.

This basin has little timber above the 8,000-foot contour, except at places where glacial lakelets and moraines occur. In the middle reaches of the basin, however, is a great growth of timber. The North Fork basin contains the Calaveras grove of big trees (*Sequoia gigantea*), for which the Sierra is famous. This particular grove is the most northerly group of these trees in the Sierra. The forest cover of the foothill region consists of grass, brush, and scrubby timber. All the upper part of the basin, consisting of about 800 square miles, is included in national forests.

The mean annual precipitation varies with altitude. In the valley, near the border, it is about 15 inches or more, and on the higher elevations 50 or 60 inches. At the high altitudes it occurs chiefly as snow, which lasts well into the summer. The worst floods usually occur in the winter as a result of prolonged storms accompanied by comparatively high temperature.

Opportunities for irrigation in this basin are limited to the San Joaquin Valley, which is traversed by the lower courses of the river for about 40 miles. Water is now being diverted above Knights Ferry, and used for irrigation, chiefly in the vicinity of Oakdale. Further development, however, is feasible.

Some storage development has been effected in the Stanislaus basin, chiefly for mining and power uses. The opportunities for storage in this basin are not, however, very great.

Considerable power is available from the streams in this basin, chiefly Middle and North forks and the main stream below. Development has already been begun. (See Pl. V, *A*.) With the existing fall the minimum flow is sufficient to yield about 80,000 horsepower, and this amount could be increased by storage.

The longest run-off record on Stanislaus River extends back to 1896, with a break for the years 1901 and 1902. The wettest year since that date was 1907 and the driest 1898. The total flow during the wettest year was about eight times that during the driest year.

The only gaging station that has been maintained in this river basin is on Stanislaus River at Knights Ferry, 1895 to 1900, and 1903 to 1908. A gaging station is also being maintained on the Stanislaus Water Company's canal near Knights Ferry, which diverts water past the river station, in order to obtain the total yield of the basin.

STANISLAUS RIVER AT KNIGHTS FERRY, CAL.

A gaging station was first established on this river, May 3, 1895, at the railroad bridge one-half mile north of Oakdale. On July 30, 1898, a cable was placed about 1,000 feet below the railroad bridge, and the station was maintained at this point until February 16, 1901, when it was discontinued.

The present station, which is located at Knights Ferry, about 12 miles northeast of Oakdale, was established May 19, 1903, to obtain general statistical data regarding the flow of the river. The data are useful also in the consideration of irrigation and power projects, and in studying the flood problem on the lower San Joaquin.

No tributaries of importance enter below the station or for many miles above. South Fork joins the main stream about 25 miles above the station.

Numerous diversions from Stanislaus River are made for mining operations, but most of the water is returned to the river. Some water, however, is diverted from the South Fork and turned into the Tuolumne basin. Some water is also diverted from North Fork for use in the vicinity of Murphy and Angels.

The Stanislaus Water Company diverts water about 3 miles above Knights Ferry for power development and also for irrigating land between Knights Ferry and Stockton. The amount used for power is returned to the river through the power house, about 1,000 feet above the gaging station. The developed and acquired water rights probably exceed the low-water flow of the stream.

The conditions for obtaining accurate discharge data at this station are not the best, on account of excessive velocities at high stages and changing conditions of control at low and moderate stages. About 800 feet above the station there is an island which divides the stream into two channels, and a low dam spans each at the head of the island. On the right bank below one of these dams is a power house which operates with water taken from behind the dam, and also from the ditch heading about 3 miles above. The tail water returns to the river, and varies with the load at different hours of the day, thus affecting the gage height somewhat at low stages. The channel section at the station is also subject to slight change, and both banks overflow to some extent in high floods. The position of the gage has been changed, but the datum has remained constant.

Except for the conditions stated above, the records at this station are fairly reliable.

Discharge measurements of Stanislaus River at Knights Ferry, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 15	T. H. Prowse	166	602	7.97	1,710
January 29	do	217	1,060	10.22	5,080
February 3	do	250	1,410	11.22	7,460
March 11	do	225	1,260	10.72	6,110
April 9	do	218	1,240	11.20	6,590
April 23	do	278	1,300	11.60	8,080
May 2	W. F. Martin	230	1,180	11.42	7,620
May 17	T. H. Prowse	294	1,610	12.12	10,200
May 19	do	307	1,810	12.90	12,500
June 2	do	340	2,000	13.55	12,900
June 15	do	188	900	9.62	4,040
June 19	do	208	1,080	10.42	5,740
July 10	do	203	1,070	10.24	5,730
July 15	do	192	927	9.75	4,200
August 2	W. A. Lamb	165	616	8.50	2,180
August 14	T. H. Prowse	130	423	7.10	921
August 21	do	124	333	6.60	604
September 3	do	118	238	6.20	374
September 23	do	111	178	5.70	175
September 28	W. A. Lamb	115	201	5.90	243
November 4	T. H. Prowse	113	163	5.85	251
December 12	do	118	276	6.24	419
1908.					
February 4	T. H. Prowse	127	371	6.65	633
March 5	W. F. Martin	127	339	6.78	653
March 27	T. H. Prowse	138	483	7.55	1,210
April 21	do	191	839	9.73	3,950
April 29	W. A. Lamb	190	816	9.45	3,640
June 15	W. F. Martin	143	494	7.92	1,570
September 8	W. V. Hardy	38	37	5.30	70
October 10	do	39	38	5.30	77
November 26	T. H. Prowse	110	235	5.69	171

Daily gage height, in feet, of Stanislaus River at Knights Ferry, Cal., for 1907 and 1908.

[E. J. Coop, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7.4	8.6	8.2	11.15	11.3	12.8	11.2	8.4	6.2	5.7	5.9	5.6
2	7.05	12.55	8.55	11.35	11.45	13.15	10.95	8.35	6.2	5.7	5.85	5.6
3	6.9	11.05	8.3	11.05	11.35	12.9	10.9	8.2	6.2	5.7	5.85	5.6
4	6.95	11.35	8.65	10.9	11.1	12.95	11.0	8.0	6.2	5.7	5.85	5.6
5	7.65	10.8	9.4	10.85	10.7	12.7	11.3	7.9	6.45	5.7	5.85	5.6
6	7.2	9.95	9.2	10.65	10.6	12.25	10.7	7.9	6.4	5.7	5.85	5.6
7	7.2	9.55	8.9	10.6	10.65	11.8	10.55	7.9	6.35	5.7	5.85	6.1
8	8.4	9.25	8.65	10.7	10.6	10.9	10.55	7.8	6.2	5.65	5.75	6.5
9	8.3	9.1	8.75	11.15	11.05	10.9	10.55	7.6	6.1	5.65	5.75	6.1
10	7.9	8.9	14.0	11.4	11.6	11.25	10.3	7.5	6.1	5.65	5.75	6.0
11	7.4	8.8	10.8	11.5	11.8	11.75	10.2	7.35	6.1	5.65	5.75	6.6
12	7.2	8.7	10.1	11.9	11.15	11.9	10.2	7.2	6.1	5.65	5.75	6.3
13	7.3	8.6	9.45	12.25	10.6	10.6	10.15	7.15	6.1	5.65	5.75	6.1
14	8.15	8.55	9.1	12.75	10.5	10.05	9.9	7.15	6.1	5.65	5.7	6.05
15	8.0	8.5	8.85	12.25	11.0	9.8	9.65	7.15	6.05	5.65	5.65	6.05
16	7.4	8.5	8.85	11.7	11.9	9.7	9.4	7.2	6.05	5.65	5.65	6.0
17	7.8	8.75	14.5	11.7	11.85	9.6	9.35	7.15	5.95	5.65	5.65	6.0
18	7.6	8.55	17.35	11.85	12.35	9.85	9.2	7.1	5.9	5.7	5.65	5.9
19	7.25	8.3	25.30	12.15	12.6	10.4	9.4	7.05	5.9	5.7	5.7	5.9
20	7.1	8.25	19.1	12.15	11.75	11.0	9.4	6.85	5.85	5.7	5.7	5.9
21	7.1	8.35	15.6	11.8	11.6	11.3	9.2	6.6	5.8	5.7	5.65	5.9
22	7.1	10.85	14.55	11.85	11.6	11.45	8.9	6.6	5.8	5.8	5.65	5.9
23	7.0	9.5	14.15	12.0	10.75	11.0	8.85	6.6	5.8	5.8	5.65	5.85
24	7.3	8.85	13.8	12.1	10.75	10.45	8.5	6.55	5.75	5.8	5.65	5.8
25	7.5	8.9	14.2	11.85	11.4	10.5	9.1	6.5	5.7	5.85	5.6	5.8
26	7.35	8.8	12.75	11.9	11.5	10.9	9.0	6.45	5.7	5.95	5.65	5.8
27	7.4	8.55	11.8	11.9	11.7	11.2	8.9	6.45	5.75	6.05	5.65	6.75
28	10.95	8.35	11.4	11.9	11.85	11.6	8.9	6.4	5.75	6.0	5.65	6.95
29	10.1		11.1	11.85	12.1	11.9	8.8	6.3	5.7	6.0	5.65	6.55
30	8.95		11.0	11.4	12.3	11.85	8.65	6.3	5.7	6.0	5.6	6.35
31	8.4		11.0		12.7		8.5	6.2		5.9		7.0

Daily gage height, in feet, of Stanislaus River at Knights Ferry, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	6.6	6.2	7.25	7.1	9.25	7.9	6.7	6.0	5.3	5.3	5.4	5.4
2	6.4	6.2	7.3	7.0	9.45	7.9	6.65	5.9	5.3	5.3	5.4	5.4
3	6.3	6.35	7.3	7.0	8.95	7.8	6.75	6.0	5.3	5.3	5.35	5.4
4	6.4	6.4	7.0	7.3	8.5	7.5	6.7	5.9	5.3	5.3	5.3	5.5
5	6.2	6.45	6.9	7.7	8.35	7.5	6.75	5.8	5.3	5.3	5.3	5.9
6	6.15	6.3	6.95	7.7	8.55	7.6	6.65	5.8	5.3	5.3	5.35	5.95
7	6.1	6.3	6.7	7.85	8.9	7.7	6.6	5.8	5.3	5.3	5.3	5.7
8	6.1	6.3	6.6	7.55	8.65	8.05	6.55	5.85	5.3	5.3	5.3	5.7
9	6.1	7.5	6.7	7.6	8.2	8.0	6.4	5.7	5.3	5.3	5.35	5.65
10	6.2	7.0	6.85	8.05	7.95	8.2	6.4	5.6	5.35	5.3	5.35	5.65
11	6.1	6.65	6.85	8.7	7.9	7.95	6.45	5.6	5.3	5.3	5.35	5.6
12	6.0	6.45	7.0	9.1	8.15	8.1	6.4	5.6	5.3	5.3	5.35	5.55
13	6.0	6.4	7.1	9.2	8.05	8.1	6.4	5.6	5.3	5.3	5.35	5.55
14	7.6	6.4	7.3	9.5	8.0	8.1	6.35	5.6	5.3	5.3	5.35	5.6
15	6.8	6.3	7.5	9.1	7.95	8.0	6.3	5.45	5.3	5.3	5.4	5.6
16	6.45	6.2	7.7	8.8	7.85	7.8	6.2	5.5	5.3	5.6	5.4	5.5
17	6.4	6.2	7.8	8.45	7.85	7.6	6.15	5.45	5.3	6.1	5.35	5.5
18	6.3	6.2	7.9	8.8	7.75	7.5	5.9	5.5	5.3	5.7	5.35	5.4
19	6.3	6.2	7.8	9.3	8.2	7.35	5.9	5.5	5.3	5.6	5.35	5.45
20	6.25	6.2	7.9	9.55	8.2	7.4	5.9	5.4	5.3	5.45	5.35	5.45
21	6.3	6.15	7.95	9.5	7.95	7.1	5.95	5.45	5.3	5.4	5.35	5.5
22	6.45	6.15	7.85	9.1	8.0	7.0	5.95	5.45	5.3	5.5	5.4	5.5
23	6.7	6.2	7.7	8.65	8.35	7.15	5.95	5.4	5.3	5.4	5.4	5.5
24	6.7	6.1	7.9	8.2	8.4	7.1	5.9	5.3	5.3	5.4	5.85	5.55
25	7.4	6.15	8.1	8.3	8.8	7.0	5.9	5.3	5.3	5.35	5.8	5.4
26	6.6	6.2	7.9	8.35	8.85	7.0	5.9	5.25	5.35	5.3	5.7	5.5
27	6.5	6.45	7.55	8.85	8.6	7.0	5.9	5.25	5.55	5.4	5.6	5.5
28	6.4	6.7	7.35	9.3	8.5	6.9	5.9	5.3	5.3	5.35	5.5	5.5
29	6.4	7.5	7.25	9.4	8.65	6.7	5.9	5.3	5.3	5.4	5.4	5.45
30	6.3	....	7.25	9.35	8.7	6.7	5.95	5.25	5.3	5.4	5.4	5.45
31	6.25	....	7.3	....	8.3	....	6.2	5.3	....	5.4	....	5.5

Rating tables for Stanislaus River at Knights Ferry.

JANUARY 1 TO JULY 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.*
7.00	870	8.50	2,310	10.00	4,580	13.00	11,690
7.10	950	8.60	2,430	10.20	4,950	14.00	14,600
7.20	1,030	8.70	2,550	10.40	5,330	15.00	17,800
7.30	1,110	8.80	2,670	10.60	5,730	16.00	21,200
7.40	1,190	8.90	2,800	10.80	6,150	17.00	24,700
7.50	1,270	9.00	2,930	11.00	6,590	18.00	28,400
7.60	1,360	9.10	3,070	11.20	7,050	19.00	32,300
7.70	1,450	9.20	3,220	11.40	7,520	20.00	36,200
7.80	1,540	9.30	3,370	11,60	8,000	21.00	40,100
7.90	1,640	9.40	3,530	11.80	8,500	22.00	44,000
8.00	1,740	9.50	3,700	12.00	9,000	23.00	48,000
8.10	1,850	9.60	3,870	12.20	9,510	24.00	52,000
8.20	1,960	9.70	4,040	12.40	10,030	25.00	56,000
8.30	2,070	9.80	4,220	12.60	10,570	26.00	60,000
8.40	2,190	9.90	4,400	12.80	11,120		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1906 and 1907 and is fairly well defined between gage heights 7 feet and 13.5 feet. Above gage height 22 feet the rating curve is a tangent, the difference being 400 per tenth. Below 9 feet it is the same as the 1906 table.

Rating tables for Stanislaus River at Knights Ferry—Continued.

AUGUST 1, 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.-ft.*
5 20	50	6.30	415	7.40	1,110	8.50	2,230
5.30	70	6.40	470	7.50	1,190	8.60	2,350
5.40	95	6.50	525	7.60	1,280	8.70	2,480
5.50	120	6.60	580	7.70	1,370	8.80	2,610
5.60	145	6.70	640	7.80	1,470	8.90	2,740
5.70	175	6.80	700	7.90	1,570	9.00	2,880
5.80	205	6.90	760	8.00	1,670	9.20	3,160
5.90	240	7.00	820	8.10	1,780	9.40	3,460
6.00	280	7.10	890	8.20	1,890	9.60	3,760
6.10	320	7.20	960	8.30	2,000		
6.20	365	7.30	1,030	8.40	2,110		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on 17 discharge measurements made during 1907 and 1908 and is well defined. Above 9.5 feet it is the same as the 1906 table.

Monthly discharge of Stanislaus River at Knights Ferry, Cal., for 1907 and 1908.

[Drainage area, 935 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	6,520	820	1,640	1.75	2.02	101,000	B.
February	10,500	2,020	3,560	3.81	3.97	198,000	B.
March	57,200	1,980	10,400	11.12	12.82	640,000	B.
April	11,000	5,740	8,110	8.67	9.67	483,000	C.
May	10,900	5,590	7,690	8.22	9.48	473,000	C.
June	12,200	3,970	7,500	8.02	8.95	446,000	C.
July	7,380	2,420	4,370	4.67	5.38	269,000	C.
August	2,220	453	1,070	1.14	1.31	65,800	B.
September	585	263	378	.404	.45	22,500	B.
October	374	241	274	.293	.34	16,800	B.
November	278	166	206	.220	.25	12,300	B.
December	840	169	353	.378	.44	21,700	B.
The year	57,200	166	3,800	4.06	55.08	2,750,000	
1908.							
January	2,000	305	522	.558	.64	32,100	A.
February	1,220	345	518	.554	.60	29,800	A.
March	1,830	605	1,160	1.24	1.43	71,300	A.
April	3,770	897	2,390	2.56	2.86	142,000	A.
May	3,630	1,530	2,220	2.37	2.73	136,000	A.
June	2,010	728	1,360	1.45	1.62	80,900	A.
July	780	354	501	.536	.62	30,800	A.
August	361	116	208	.222	.26	12,800	A.
September	148	95	117	.125	.14	6,960	A.
October	334	83	126	.135	.16	7,750	A.
November	239	84	121	.129	.14	7,200	A.
December	277	102	155	.166	.19	9,530	A.
The year	3,770	83	783	.837	11.39	567,000	

NOTE.—Values are rated lower for April to July, 1907, because measurements in this period give discharges in excess of rating, probably due to excessively high surface velocity.

This estimate includes the flow of the power canal and Schell ditch. For the latter, a mean flow of 7 second-feet was assumed.

STANISLAUS WATER COMPANY'S CANAL AT KNIGHTS FERRY, CAL.

This canal diverts water from the right bank of Stanislaus River at a point about 3 miles above Knights Ferry. At some distance below the intake Schell ditch diverts a small quantity of water from the main canal for irrigation. The flow in the ditch is about 7 second-feet and is assumed to be constant. About one-half mile above Knights Ferry is another diversion from the main canal through a pressure pipe to the power house on the bank of the river, and the water thus diverted is used for power and then returned to the river about 1,000 feet above the gaging station.

This station, which is on the Oakdale road about one-half mile from Knights Ferry and about 200 feet below the point where the canal passes under the flume of Schell ditch, was established June 11, 1904, for the purpose of determining the amount of water diverted above the station on the river and used for irrigation. The station is on the main canal below all diversions.

Daily discharges of the canal have been included in those for Stanislaus River at Knights Ferry, Cal. The total run-off for the canal in 1907 was 34,200 acre-feet, and in 1908, 35,100 acre-feet.

The following measurements were made on Schell ditch, 200 feet below the intake, in 1908:

September 8, 6.6 second-feet.
October 10, 2.7 second-feet.

Discharge measurements of Stanislaus Water Company's canal at Knights Ferry, Cal., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 29	W. A. Lamb	9	21	2.85	72
June 15	W. F. Martin	8.7	25	3.40	102
September 8	W. V. Hardy	9	11	1.92	20
October 10	do	8	4.2	1.04	2.7

Daily gage height, in feet, of Stanislaus Water Company's canal at Knights Ferry, Cal., for 1907 and 1908.

[T. T. Burt, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	2.2	2.15	1.8		1.5	3.2	3.3	3.35	2.9	3.1	2.6	2.05
2	2.15	2.15	2.15		1.7	2.2	3.4	3.4	3.0	3.0	2.6	1.8
3	1.85	2.2	2.35		2.35	2.3	2.55	3.35	2.8	3.2	2.45	2.0
4	1.8	2.15	1.95		1.85	2.25	3.35	3.4	3.0	3.2	1.85	2.0
5	2.15	1.9	1.95		2.25	2.2	3.35	3.35	3.1	3.0	1.85	2.0
6	2.15	2.0	2.2		2.45	2.3	3.4	3.35	3.1	3.2	1.65	2.0
7	1.9	2.0	1.95		2.45	2.25	3.35	3.1	3.1	3.2	1.65	2.2
8	1.95	1.7	2.2		1.15	2.25	3.4	2.95	3.25	3.1	1.45	1.55
9	1.8	1.7	2.35			3.3	3.4	2.95	3.2	3.1	2.2	1.45
10	2.1	1.95	2.4	2.8		3.3	3.3	2.95	3.2	3.1	1.5	1.55
11	1.65	1.7	2.25	1.8	2.5	3.3	3.4		3.2	3.1	1.55	1.65
12	1.65	1.7	2.45	1.9	2.7	3.3	3.2		3.2	3.2	1.6	1.45
13	2.15	1.8	2.4	2.25	2.1	3.25	3.4		3.2	3.3	1.65	1.65
14	2.1	1.8	2.45	2.25	2.7	3.15	3.35		3.2	3.2	1.45	1.55
15	2.0	1.7	2.4	2.2	2.55	3.3	3.3		3.35	3.0	1.5	2.45
16	2.0	1.7	2.6	2.5	2.75	3.3	3.3	2.2	3.2	3.0	1.6	1.85
17	2.05	1.65	2.2	1.7	2.65	3.25	3.3	2.25	3.2	3.0	1.65	1.85
18	1.95		2.05	2.35	2.75	3.25	3.25	2.6	3.2	3.0	1.65	1.5
19	2.0		3.45	1.1	2.8	3.3	3.2	2.85	3.2	2.9	1.5	1.45
20	2.3				2.6	3.25	3.3	3.1	3.2	2.9	1.5	2.25

Daily gage height, in feet, of Stanislaus Water Company's canal at Knights Ferry, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
21	2.1	......	......	......	2.7	3.25	3.35	2.95	3.2	2.95	1.45	1.45
22	2.2	......	......	1.5	2.9	3.25	3.4	3.0	3.2	2.85	1.55	2.25
23	2.1	......	......	2.35	2.95	3.4	3.35	2.9	3.2	2.85	1.65	1.5
24	1.9	......	......	2.45	2.9	3.35	3.4	3.2	3.2	2.85	1.65	1.85
25	2.15	......	......	2.6	2.8	3.4	3.35	3.3	3.1	2.85	1.65	1.95
26	1.9	......	......	2.65	3.1	3.4	3.4	3.1	3.2	2.75	1.65	2.35
27	2.1	......	......	2.6	3.15	3.4	3.35	3.2	3.25	2.9	1.6	2.2
28	2.2	......	......	......	3.2	3.35	2.5	3.1	3.1	2.9	1.6	2.2
29	2.2	......	......	1.95	3.2	3.3	3.3	3.1	3.25	2.7	1.65	2.45
30	1.7	......	......	.75	3.2	3.4	3.4	3.2	3.15	2.6	1.65	1.45
31	2.05	......	......	......	3.2	......	3.35	3.1	......	2.6	......	1.45
1908.												
1	2.0	1.45	1.45	2.95	3.2	3.45	3.3	3.0	2.55	1.4	2.65	1.45
2	1.95	2.35	1.45	2.95	3.2	3.45	3.4	2.65	2.5	1.3	2.65	1.45
3	1.85	2.35	1.45	2.95	3.4	3.45	3.5	2.65	2.45	1.35	2.7	1.45
4	1.85	1.85	1.5	2.95	3.2	3.4	3.5	2.6	2.0	1.3	1.3	1.45
5	2.45	1.85	1.5	3.0	3.1	3.4	3.4	2.75	2.0	1.3	1.3	1.45
6	2.35	1.95	1.5	3.0	3.1	3.5	3.4	2.75	2.45	1.3	1.3	1.45
7	2.35	1.45	1.5	3.1	3.2	3.55	3.4	2.75	2.45	1.3	1.3	1.45
8	2.35	1.85	1.85	3.3	3.2	3.55	3.4	2.75	1.45	1.3	1.3	1.45
9	2.35	1.95	1.85	......	3.2	3.55	3.4	3.15	2.65	1.3	1.3	1.45
10	1.95	2.2	1.85	......	3.3	3.55	3.45	3.1	2.75	1.3	1.3	1.45
11	1.85	2.2	1.45	......	3.3	3.55	3.4	2.9	2.8	1.3	1.3	1.45
12	1.85	2.2	1.85	......	3.4	3.55	3.4	2.9	2.65	1.3	1.3	1.45
13	1.85	2.35	1.85	2.9	3.35	3.55	3.4	2.9	2.55	1.3	1.3	2.35
14	1.85	2.35	1.85	2.9	3.4	3.55	3.45	2.9	2.55	1.25	1.3	2.35
15	2.35	2.2	1.85	2.95	3.4	3.6	3.5	2.9	2.65	1.25	1.4	2.35
16	2.35	2.35	1.85	2.95	3.4	3.6	3.5	3.1	2.7	1.3	1.4	2.25
17	2.35	2.35	1.45	3.0	3.4	3.5	3.5	3.15	2.65	1.3	1.3	2.25
18	2.35	2.35	1.45	3.0	3.4	3.5	3.45	3.05	2.65	1.85	1.4	2.25
19	1.85	2.35	1.5	2.7	3.35	3.5	3.1	2.9	2.75	2.4	1.85	2.25
20	1.85	2.35	1.5	3.0	3.3	3.5	3.1	2.85	2.4	2.4	1.85	2.45
21	1.85	1.85	1.5	3.0	3.3	......	3.0	2.85	2.4	2.4	1.85	2.5
22	1.45	1.85	2.2	3.1	3.35	3.6	3.0	2.85	2.45	2.4	1.45	2.5
23	1.45	1.85	2.2	3.25	3.4	......	2.9	2.7	1.95	2.4	1.45	......
24	1.85	1.85	2.35	3.2	3.35	3.0	3.0	2.7	1.85	2.45	1.45	......
25	2.2	1.95	2.45	3.2	3.35	3.2	3.0	2.7	1.85	2.6	1.45	......
26	2.35	1.65	2.45	3.2	3.35	3.2	2.9	2.7	1.85	2.6	1.45	......
27	2.35	1.65	2.5	3.2	3.35	3.2	2.9	2.65	1.4	2.65	1.95	......
28	2.45	1.65	2.6	3.2	3.3	3.2	2.9	2.7	1.4	2.65	1.95	......
29	2.35	1.5	2.55	3.2	3.3	3.1	2.9	2.7	1.3	2.65	1.95	......
30	1.45	......	2.6	3.25	3.3	3.1	2.9	2.6	1.3	2.6	1.45	......
31	1.45	......	2.7	......	3.35	......	2.9	2.6	......	2.6	......	......

NOTE.—The canal was dry on days that have no gage record.

Rating table for Stanislaus Water Company's canal at Knights Ferry, Cal., 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.*
0.70	0	1.60	13	2.50	44	3.30	95
.80	.7	1.70	15	2.60	49	3.40	103
.90	1.5	1.80	17	2.70	54	3.50	111
1.00	2.5	1.90	20	2.80	60	3.60	119
1.10	4.0	2.00	23	2.90	67	3.70	127
1.20	5.5	2.10	27	3.00	74	3.80	135
1.30	7	2.20	31	3.10	81	3.90	143
1.40	9	2.30	35	3.20	88	4.00	151
1.50	11	2.40	39				

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on discharge measurements made during 1905-1908 and is fairly well defined.

Monthly discharge of Stanislaus Water Company's canal at Knights Ferry, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).
	Maximum.	Minimum.	Mean.	
1907.				
January	35	14	24.4	1,500
February	31	0	12.3	683
March	107	0	22.2	1,360
April	60	0	18.4	1,090
May	88	0	49.5	3,040
June	103	31	80.7	4,800
July	103	44	94.9	5,840
August	103	0	65.9	4,050
September	99	60	84.8	5,050
October	95	49	73.3	4,510
November	49	10	17.0	1,010
December	41	10	20.4	1,250
The year	107	0	47.0	34,200
1908.				
January	42	10	26.1	1,600
February	37	10	24.9	1,430
March	54	10	22.8	1,400
April	95	0	67.4	4,010
May	103	81	95.8	5,890
June	119	0	98.2	5,840
July	111	67	91.1	5,600
August	84	49	62.3	3,830
September	60	7	37.1	2,210
October	52	6	23.5	1,440
November	54	7	15.0	893
December	44	0	15.9	978
The year	119	0	48.3	35,100

CALAVERAS RIVER DRAINAGE BASIN.

DESCRIPTION.

Calaveras River drains a triangular, wedge-shaped area on the western slope of the Sierra, north of the Stanislaus basin and south of the Mokelumne basin. The basin has a width of from 12 to 16 miles in the foothills, and a length of about 45 miles from the rim of San Joaquin Valley to its apex in the mountains. Its total area above the border of San Joaquin Valley is about 500 square miles.

Calaveras River is formed by the confluence of North and South forks near San Andreas. The stream has its source in creeks at an altitude of 4,000 to 5,000 feet, and flows southwestward to its junction with the lower San Joaquin, a few miles west of Stockton. Its total length is about 80 miles, of which 35 miles are in the valley and 45 miles in the mountains.

This basin is almost wholly a foothill region. The hills are generally low, and are separated by small, irregular valleys here and there. The highest point in the basin is 6,000 feet in altitude, but only a very small part exceeds 4,000 feet. In the upper part of the basin the topography is more regular, and is characterized by rough, parallel ridges separated by canyons several hundred feet deep through which the small creeks flow. The formation has a granitic base.

In the lower foothills the forest cover consists of grass, brush, and scrubby timber, chiefly oak; but in the upper part of the basin there is a thick growth of timber. The Calaveras grove of big trees (*Sequoia gigantea*) is partly in this basin and partly in the Stanislaus basin to the south. This is the most northern grove of these gigantic trees in the Sierra.

The mean annual precipitation varies with altitude. It is about 15 inches in the valley, about 22 inches in the low foothills, and 35 or 40 inches in the upper part of the basin. The very little snow that falls in this basin quickly disappears.

Calaveras River is torrential in winter and dry for a few months during the summer. It is, therefore, not especially suitable for irrigation without storage. Some storage development on a small scale has already been accomplished, but further achievement is possible. Without storage very little power can be obtained, especially during the summer and fall.

The only gaging station which has been maintained in this basin is on the Calaveras River at Jenny Lind (1907 to 1908).

CALAVERAS RIVER AT JENNY LIND, CAL.

This station, which is located at the wagon bridge on the Milton road, about one-fourth mile from Jenny Lind post-office, was established December 1, 1906, by the United States Weather Bureau, and has been rated by the Geological Survey to obtain general statistical information regarding the flow of Calaveras River. The data are useful also in the development of irrigation and power projects and in studying the general flood problem in the lower San Joaquin; but they are of the greatest immediate value in devising protective measures against the flooding of the city of Stockton during the winter.

The station is well up in the foothills, and there are a few small intermittent tributaries below. Cosgrove, Slate, and Bear creeks enter about 5 miles above the station. North and South forks unite about 15 miles above.

No diversions are made immediately above the station. The acquired water rights are for mining and power operations.

The conditions for obtaining accurate discharge data are not very good. At low stages the stream at the station is about 100 feet wide and 2 feet deep, and the current is very sluggish. A considerable change in flow makes very little difference in the gage height, so that more or less error arises from the fact that the gage record is only to tenths of feet. At low stages measurements can be made at other sections by wading, thus eliminating inaccuracies from that source. At flood stages the current is very swift and the channel may change slightly. The upper part of the curve has been determined from slope and cross section. The gage datum has remained constant.

The records of flow are fairly reliable and satisfactory, except for the conditions stated above.

Discharge measurements of Calaveras River at Jenny Lind, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	W. G. Steward	130	424	1.70	576
September 30	W. A. Lamb	22	14	.19	26
November 4	do	24	17	.35	41
1908.					
January 8	W. A. Lamb	105	289	.63	85
April 14	do	44	36	.50	68
December 11	W. F. Martin	34	20	.30	40

NOTE.—River entirely dry from July 15 until after September 15, 1908.

Daily gage height, in feet, of Calaveras River at Jenny Lind, Cal., for 1907 and 1908.

[United States Weather Bureau, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Nov.	Dec.
1907.								
1	2.4	2.7	2.2	2.5	1.4	0.9		0.3
2	2.2	5.0	2.2	2.5	1.4	.9		.3
3	1.8	4.6	2.2	2.1	1.4	.9		.3
4	1.8	4.2	2.1	2.1	1.4	.9		.3
5	3.2	3.6	3.6	2.1	1.4	.9		.4
6	2.2	3.0	3.0	2.1	1.4	.9		.4
7	2.2	2.7	2.6	2.1	1.4	.9		.6
8	2.7	2.6	2.6	2.0	1.4	.9		.8
9	3.8	2.6	2.6	2.0	1.2	.9		.8
10	3.3	2.6	6.6	1.9	1.2	.9		.8
11	2.6	2.6	5.6	1.9	1.2	1.0		1.0
12	2.3	2.0	4.6	1.9	1.2	1.0		.9
13	2.3	2.0	4.6	1.9	1.2	1.0		1.0
14	3.0	2.0	3.2	1.9	1.0	1.0		1.0
15	3.3	1.8	2.8	2.1	1.0	1.0		.8
16	2.7	1.8	2.8	2.0	1.0	1.0		.6
17	2.5	1.9	6.6	1.8	1.0	1.0		.6
18	3.2	1.8	4.3	1.8	1.0	1.0		.6
19	3.2	1.8	11.4	1.7	1.0	.8		.6
20	2.4	1.8	5.0	1.7	1.0	.8		.7
21	2.4	1.8	5.0	1.7	1.0	.8		.6
22	2.3	4.8	5.0	1.6	1.0	.8		.6
23	2.2	3.2	5.0	1.6	1.1	.8		.6
24	2.2	2.3	5.0	1.5	1.0	.8		.6
25	2.2	3.2	5.0	1.5	1.0	.8		.6
26	2.2	2.4	4.0	1.5	1.0	.8		.6
27	2.2	2.4	3.3	1.5	1.0	.8		.7
28	2.4	2.2	3.0	1.5	1.0	.8		.7
29	3.1		3.0	1.4	1.0	.8		.9
30	3.3		2.5	1.4	.9	.8		.9
31	2.7		2.5		.9			1.1
1908.								
1	1.1	.9	1.0	.9	.5	.3	0.2	.2
2	1.1	.9	1.2	.9	.5	.3	.2	.2
3	1.1	1.0	2.0	.9	.4	.3	.2	.2
4	1.2	1.1	1.6	.9	.4	.3	.2	.2
5	1.0	1.1	1.5	.9	.4	.3	.2	.4
6	1.0	1.0	1.3	.9	.4	.3	.2	.9
7	1.0	.9	1.2	.8	.4	.3	.2	.9
8	1.0	.9	1.0	.8	.4	.3	.2	.9
9	1.0	2.2	1.0	.8	.4	.3	.2	.9
10	1.0	3.0	1.0	.8	.4	.3	.2	1.1

Daily gage height, in feet, of Calaveras River at Jenny Lind, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Nov.	Dec.
1908.								
11	1.0	1.4	0.9	0.8	0.4	0.3	0.2	01.0
12	1.0	1.4	.9	.8	.4	.3	.2	1.0
13	.7	1.2	.9	.8	.4	.3	.2	1.0
14	2.9	1.0	.9	.8	.4	.3	.2	.5
15	1.5	.9	.9	.5	.4	.3	.2	.5
16	1.5	.8	.9	.5	.4	.3	.2	.5
17	1.2	.8	.9	.5	.4	.3	.2	.5
18	1.2	.8	.9	.5	.4	.3	.2	.6
19	1.2	.8	.8	.5	.4	.3	.2	.5
20	1.2	.8	.8	.5	.4	.3	.2	.5
21	1.3	.8	.8	.5	.4	.3	.2	.5
22	1.3	.8	.8	.6	.4	.3	.2	.5
23	1.3	.7	.8	.6	.4	.3	.2	.5
24	1.8	.7	.9	.6	.4	.3	.2	.5
25	2.0	.7	.9	.5	.5	.3	.2	.5
26	1.4	.7	.9	.5	.5	.3	.2	.5
27	1.3	.7	.9	.5	.5	.3	.2	.5
28	1.2	.7	.9	.5	.5	.3	.2	.5
29	1.2	.8	.9	.5	.5	.3	.2	.5
30	1.0	....	.9	.5	.4	.3	.2	.5
31	.9	....	.9	....	.3	....	....	.5

NOTE.—The river was entirely dry from July 15 to some time after September 15, 1908.

Rating table for Calaveras River at Jenny Lind, Cal., for 1907 and 1908.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	18	1.30	380	2.60	1,500	4.80	4,720
.10	22	1.40	440	2.70	1,610	5.00	5,100
.20	28	1.50	500	2.80	1,730	5.20	5,500
.30	37	1.60	570	2.90	1,850	5.40	5,920
.40	50	1.70	640	3.00	1,980	5.60	6,360
.50	66	1.80	720	3.20	2,240	5.80	6,800
.60	86	1.90	810	3.40	2,510	6.00	7,250
.70	111	2.00	900	3.60	2,800	7.00	9,800
.80	141	2.10	990	3.80	3,100	8.00	12,750
.90	177	2.20	1,090	4.00	3,400	9.00	16,100
1.00	220	2.30	1,190	4.20	3,720	10.00	20,000
1.10	270	2.40	1,290	4.40	4,040	11.00	24,200
1.20	325	2.50	1,390	4.60	4,370	12.00	29,000

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on seven discharge measurements made in 1907 and 1908, and is fairly well defined between gage heights 0.2 foot and 1.7 feet. Above gage height 3 feet it is based on slope data.

Monthly discharge of Calaveras River at Jenny Lind, Cal., for 1907 and 1908.

[Drainage area, 395 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	3,100	720	1,540	3.90	4.50	94,700
February	5,100	720	1,750	4.43	4.61	97,200
March	26,100	990	4,030	10.2	11.76	248,000
April	1,390	440	778	1.97	2.20	46,300
May	440	177	293	.742	.86	18,000
June	220	141	174	.441	.49	10,400
December	270	37	115	.291	.34	7,070
The period						522,000
1908.						
January	1,850	111	380	.962	1.11	23,400
February	1,980	111	281	.711	.77	16,200
March	900	141	239	.605	.70	14,700
April	177	66	110	.278	.31	6,550
May	66	37	53.2	.135	.16	3,270
June	37	37	37.0	.094	.10	2,200
November	28	28	28	.071	.08	1,670
December	270	28	97	.246	.28	5,960
The period						74,000

NOTE.—These discharges are only fairly reliable as the gage height record is poor. Discharges of over 1,000 second-feet are only approximate on account of lack of high water measurements. The flow was small during the period of missing records, the river going entirely dry in midsummer.

MOKELUMNE RIVER DRAINAGE BASIN.

DESCRIPTION.

The Mokelumne River basin lies on the western slope of the Sierra, north of the Calaveras and Stanislaus river basins, and south of the Cosumnes and American River basins. For a distance of about 20 miles it touches the Sierra divide, which separates it from the Walker River basin on the east. Strictly speaking, the area drained by Cosumnes River and several other small tributaries which enter many miles west of the valley border, should be considered as a part of the Mokelumne basin; but this area is excluded from this description because it contributes nothing to the flow of Mokelumne River above the lower Sacramento and San Joaquin delta region. As thus limited, the Mokelumne basin is a long, narrow area, in profile very much like a long-necked circular bottle, with its mouth opening into the valley and its base resting on the crest of the Sierra. Its total length is about 75 miles half neck and half body. The neck averages about 3 miles in width and the body about 14 miles. The total area of the basin above the valley rim is about 640 square miles.

Mokelumne River has its source in glacial lakelets in Alpine County at an altitude of nearly 10,000 feet above sea level, and flows southwestward to its junction with the lower San Joaquin, about 25 miles northwest of Stockton. It has a total length of about 140 miles, of which approximately 90 miles are in the mountains. For the greater part of its course it forms the boundary between Amador County on the north and Calaveras County on the south. The principal branches are North, Middle, and South forks, which unite about 5 miles above Electra and nearly 40 miles above the rim of the valley, at the point where the basin begins to contract into the narrow neck characteristic of its lower part. Bear River is tributary to North Fork from the north.

The topography of this basin presents considerable variety. The lower, narrow part is a rolling, hilly region, sloping toward the river from each side and having large cultivated areas. Farther upstream the slopes become greater, and the river appears in a broad, shallow canyon that increases in depth on the main stream almost to its source. Above the confluence of the forks the topography is more pronounced and regular, and is characterized by parallel ridges separated by canyons. In the upper part of the basin there are small lakes and valleys surrounded by high peaks. Altitudes range from 200 feet in the foothills to 10,000 on the crest of the divide. The formation is granitic.

On the middle and higher elevations of the Mokelumne basin is a heavy timber growth. Grass, brush, and scattering oaks cover the lower reaches. All the upper part of the basin, amounting to about 400 square miles, is inclosed in national forests.

The mean annual precipitation varies with altitude. It is about 20 inches in the valley, 25 or 30 inches in the foothills, and 50 inches or more on the higher elevations, where most of it occurs as snow. Flood conditions in this basin during the winter and spring months are usually less severe than in adjacent basins, because of the fact that such a large percentage of the catchment area is at a high altitude and receives only snowfall.

Opportunities for irrigation in this basin are confined chiefly to the bottom lands in the foothills and to the valley lands below. Some attempts on a moderately large scale have been made to utilize the stream, but as a rule they have not been successful. Except for local development along the river the stream is little used for irrigation.

Some artificial storage exists in this basin, but not on a large scale. Further development is feasible, especially in the upper part of the basin.

The streams have steep gradients, and the minimum flow is sufficient to furnish considerable power without storage. An important amount has already been developed.

The longest run-off record in this basin dates back to 1904. The wettest year since that time was 1907 and the driest 1908. The total flow during the wettest year was nearly four times that during the driest.

The only gaging station maintained in this basin is on Mokelumne River near Clements, 1904 to 1908.

MOKELUMNE RIVER NEAR CLEMENTS, CAL.

This station, which is located at the highway bridge about 1 mile north of Clements, was established October 28, 1904, for the purpose of obtaining general statistical information regarding the flow of this river. The data are valuable also in constructing projects for irrigation and power and in studying the flood problem of the San Joaquin and Sacramento valleys.

No important tributaries enter for many miles above or below the station. The three forks unite about 30 miles above Clements, and Cosumnes River enters from the north about 30 miles below Clements.

Several ditches take water for use in mining and in power development in the Mokelumne basin, but most of the water is returned to the river. No diversions are made immediately above the station, except for local irrigation on the bottom lands adjacent to the river. In the upper part of the basin some water is probably diverted into contiguous basins. The acquired water rights on the lower part of the stream probably take the larger part, if not all, of the minimum flow.

The bed of the stream at the station is composed of sand and fine gravel and is subject to slight change. The gage datum has remained constant. The records at this station are fairly satisfactory.

During the extreme flood beginning March 19, 1907, the station was destroyed, and the gage heights for the high-water period, March 19 to April 10, 1907, have been estimated.

Discharge measurements of Mokelumne River near Clements, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 6	R. S. Hawley	253	1,270	9.40	3,760
February 19	do	255	681	6.87	1,680
March 6	do	255	778	7.24	2,140
March 13	do	255	851	7.53	2,380
October 2	W. A. Lamb	100	217	4.43	280
November 6	do	88	200	4.32	278
1908.					
April 16	W. A. Lamb	263	746	6.95	1,860
April 28	do	268	1,230	8.55	3,400
September 16	W. V. Hardy	85	133	3.74	143
October 8	do	79	110	3.56	122
December 12	W. F. Martin	82	148	3.95	210

Daily gage height, in feet, of Mokelumne River near Clements, Cal., for 1907 and 1908.

[Reba Gaskill, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.7	7.65	6.45	[a]10.4	9.55	12.45	11.0	6.65	4.4	4.3	4.25	4.25
2	5.75	13.55	6.65	[a]10.3	9.55	12.65	10.4	6.4	4.35	4.35	4.2	4.2
3	5.15	11.55	6.55	[a]10.2	9.8	12.35	10.55	6.3	4.35	4.4	4.25	4.05
4	6.15	12.1	6.85	[a]10.0	9.4	12.35	10.95	6.0	4.5	4.45	4.2	4.25
5	6.1	10.95	7.65	[a]9.9	8.6	12.15	10.85	5.8	4.5	4.55	4.25	4.25
6	5.35	9.45	7.25	[a]9.7	8.55	11.55	10.2	5.8	4.6	4.35	4.25	4.25
7	5.25	8.8	6.9	[a]9.6	8.15	11.2	10.05	5.7	4.3	4.25	4.35	4.45
8	6.45	8.3	6.8	[a]9.4	8.45	9.55	10.6	5.55	4.35	4.25	4.2	4.8
9	6.65	8.05	7.5	[a]9.3	9.25	9.8	10.15	5.55	4.1	4.35	4.35	4.3
10	5.75	7.95	9.7	9.1	10.25	10.3	9.85	5.5	4.2	4.35	4.25	4.3
11	5.20	7.7	9.0	9.5	10.15	11.5	9.7	5.25	4.25	4.35	4.15	4.95
12	4.95	7.55	8.0	9.85	9.55	9.85	9.75	5.25	4.1	4.25	4.25	4.8
13	5.1	7.3	7.55	10.35	8.6	9.05	9.4	5.15	4.1	4.25	4.35	4.25
14	6.55	7.15	7.25	10.95	8.45	8.35	8.9	5.15	4.3	4.2	4.25	4.45
15	5.6	7.05	7.05	10.8	9.25	7.9	8.55	5.0	4.2	4.25	4.35	4.55
16	5.1	7.0	7.15	10.05	10.0	7.8	8.25	5.0	4.2	4.35	4.15	4.3
17	5.3	7.25	13.6	9.85	10.65	7.9	8.2	5.05	4.25	4.35	4.25	4.3
18	5.4	7.05	17.0	9.95	11.45	8.25	8.1	4.9	4.25	4.3	4.25	4.4
19	5.3	6.85	21.0	10.6	11.5	9.35	8.1	4.9	4.25	4.35	4.15	4.2
20	4.9	6.8	[a]17.9	10.8	9.8	10.4	8.2	4.8	4.3	4.2	4.15	4.3
21	4.85	6.75	[a]15.9	10.15	10.05	10.9	7.9	4.7	4.25	4.25	4.15	4.25
22	4.9	6.85	[a]13.0	10.3	10.1	11.1	7.35	4.7	4.3	4.35	4.25	4.2
23	4.9	7.35	[a]13.3	10.6	9.5	9.9	7.35	4.5	4.25	4.25	4.25	4.2
24	4.95	7.1	[a]13.0	10.4	9.45	8.95	7.45	4.45	4.2	4.35	4.25	4.2
25	5.55	7.25	[a]11.6	10.3	9.35	9.15	7.65	4.55	4.3	4.45	3.95	4.25
26	5.9	7.05	[a]11.2	10.35	9.45	[a]10.0	7.4	4.4	4.2	4.5	4.25	4.2
27	5.5	6.8	[a]11.1	10.25	9.5	10.8	7.05	4.35	4.3	4.55	4.25	5.05
28	9.65	6.55	[a]11.0	10.2	11.0	11.25	7.3	4.5	4.3	4.35	4.25	5.3
29	8.75	....	[a]10.8	9.95	11.4	11.6	7.35	4.4	4.45	4.25	4.25	4.9
30	7.15	....	[a]10.7	9.65	11.7	11.6	7.05	4.4	4.2	4.25	4.25	4.6
31	6.9	....	[a]10.5	....	12.3	....	6.75	4.7	....	4.35	....	5.1
1908.												
1	4.9	4.35	5.0	5.2	8.0	6.55	4.8	3.5	3.45	3.65	3.8	3.85
2	4.6	4.4	5.1	5.15	8.0	6.6	4.8	3.6	3.65	3.75	3.65	3.8
3	4.5	4.6	5.3	5.1	7.1	6.3	4.65	3.5	3.65	3.6	3.6	3.9
4	4.75	4.7	5.3	5.15	6.75	6.2	4.5	3.6	3.7	3.65	3.65	3.85
5	4.55	4.5	4.8	5.55	6.6	6.15	4.45	3.6	3.8	3.55	3.6	4.25
6	4.55	4.45	4.6	6.0	7.0	6.55	4.35	3.55	3.75	3.65	3.65	4.3
7	4.45	4.4	4.6	5.85	7.55	6.55	4.35	3.5	3.45	3.55	3.65	3.75
8	4.4	4.35	4.15	5.55	7.0	6.65	4.3	3.4	3.4	3.45	3.55	3.95
9	4.4	5.45	4.1	5.3	6.6	6.75	4.15	3.45	3.65	3.6	3.5	4.1
10	4.4	4.85	4.2	5.9	6.4	6.85	4.1	3.3	3.65	3.5	3.65	3.95
11	4.2	4.7	4.35	6.5	7.0	6.85	3.95	3.5	3.55	3.55	3.6	3.85
12	4.2	4.6	4.85	7.2	6.6	6.75	3.95	[a]3.5	3.75	3.55	3.65	3.9
13	4.25	4.3	5.0	7.35	6.45	6.45	4.05	3.55	3.7	3.45	3.6	3.9
14	5.65	4.35	5.4	7.6	6.5	6.35	4.0	3.55	3.55	3.55	3.55	3.65
15	5.0	4.15	5.45	7.45	6.6	6.4	3.9	3.45	3.65	3.95	3.55	4.05
16	4.65	4.25	5.8	6.95	6.4	6.2	3.8	3.5	3.75	4.85	3.55	3.85
17	4.6	4.2	5.85	6.65	6.15	5.9	3.75	3.45	3.6	3.95	3.55	3.65
18	4.6	4.3	5.8	6.7	6.8	5.5	3.65	3.45	3.8	3.75	3.6	3.55
19	4.3	4.2	5.8	7.5	7.05	5.55	3.7	3.35	3.8	3.55	3.5	3.45
20	4.5	4.2	5.75	8.2	6.6	5.4	3.75	3.5	3.8	3.8	3.5	3.45
21	5.0	4.2	5.85	8.2	6.5	5.8	3.75	3.3	3.65	3.7	3.6	3.55
22	5.55	4.1	5.7	7.2	6.7	5.7	3.7	3.5	3.7	3.7	3.5	3.55
23	5.15	4.2	5.6	6.8	7.15	5.4	3.65	3.65	3.75	3.65	3.55	3.75
24	5.35	4.05	5.8	6.45	7.2	5.5	3.6	3.35	3.8	3.6	3.95	3.65
25	5.3	4.05	5.9	6.35	7.25	5.3	3.5	3.35	[a]3.7	3.65	3.85	3.55
26	5.25	4.15	5.8	6.5	7.3	5.15	3.35	3.55	3.75	3.5	3.65	3.35
27	4.9	4.25	5.55	7.0	7.2	5.2	3.4	3.55	3.55	3.55	3.55	3.5
28	4.75	4.5	5.25	8.1	7.3	4.95	3.6	3.55	3.45	3.6	3.5	3.35
29	4.65	5.2	5.25	7.8	7.4	4.85	3.6	3.6	3.7	3.6	3.6	3.65
30	4.5	....	5.25	8.35	7.2	4.8	3.4	3.6	3.7	3.45	3.55	3.5
31	4.5	....	5.35	....	6.95	....	3.5	3.35	....	3.55	....	3.5

[a] Estimated.

Rating tables for Mokelumne River near Clements, Cal.

FOR 1907.

Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.	Gage height.	Dis-charge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	150	5.50	885	7.00	1,885	10.00	4,340
4.10	185	5.60	945	7.20	2,025	11.00	5,310
4.20	220	5.70	1,005	7.40	2,170	12.00	6,310
4.30	260	5.80	1,065	7.60	2,320	13.00	7,310
4.40	305	5.90	1,130	7.80	2,470	14.00	8,310
4.50	350	6.00	1,195	8.00	2,620	15.00	9,310
4.60	400	6.10	1,260	8.20	2,780	16.00	10,310
4.70	450	6.20	1,325	8.40	2,940	17.00	11,310
4.80	500	6.30	1,395	8.60	3,100	18.00	12,310
4.90	550	6.40	1,465	8.80	3,260	19.00	13,310
5.00	605	6.50	1,535	9.00	3,440	20.00	14,310
5.10	660	6.60	1,605	9.20	3,620	21.00	15,310
5.20	715	6.70	1,675	9.40	3,800		
5.30	770	6.80	1,745	9.60	3,980		
5.40	825	6.90	1,815	9.80	4,160		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on six discharge measurements made during 1907 and previous high-water measurements, and is well defined between gage heights 4 feet and 9.5 feet. Above gage height 10.3 feet the rating curve is a tangent, the difference being 100 per tenth.

FOR 1908.

3.30	80	4.70	520	6.10	1,315	8.00	2,680
3.40	90	4.80	570	6.20	1,380	8.20	2,840
3.50	105	4.90	620	6.30	1,450	8.40	3,000
3.60	120	5.00	670	6.40	1,520	8.60	3,160
3.70	140	5.10	725	6.50	1,590	8.80	3,330
3.80	165	5.20	780	6.60	1,660	9.00	3,500
3.90	195	5.30	835	6.70	1,730	9.20	3,670
4.00	225	5.40	890	6.80	1,800	9.40	3,840
4.10	260	5.50	945	6.90	1,870	9.60	4,010
4.20	295	5.60	1,000	7.00	1,940	9.80	4,180
4.30	335	5.70	1,060	7.20	2,080	10.00	4,350
4.40	375	5.80	1,120	7.40	2,225		
4.50	420	5.90	1,185	7.60	2,375		
4.60	470	6.00	1,250	7.80	2,525		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on five discharge measurements made during 1907 and 1908 and on previous high-water measurements, and is fairly well defined between gage heights 3.4 feet and 8 feet.

Monthly discharge of Mokelumne River near Clements, Cal., for 1907 and 1908.

[Drainage area, 642 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	4,020	525	1,140	1.78	2.05	70,100	B.
February	7,860	1,570	2,780	4.33	4.51	154,000	B.
March	15,300	1,500	4,880	7.60	8.76	300,000	C.
April	5,260	3,530	4,430	6.90	7.70	264,000	C.
May	5,810	2,740	4,220	6.57	7.57	259,000	B.
June	6,960	2,470	4,720	7.35	8.20	281,000	B.
July	5,310	1,710	3,330	5.19	5.98	205,000	B.
August	1,640	282	703	1.10	1.27	43,200	B.
September	400	185	257	.400	.45	15,300	C.
October	375	220	276	.430	.50	17,000	C.
November	282	135	234	.364	.41	13,900	C.
December	770	167	328	.511	.59	20,200	C.
The year	15,300	135	2,270	3.54	47.99	1,640,000	

Monthly discharge of Mokelumne River near Clements, Cal., for 1907 and 1908—Cont'd.

Month.	Discharge in second-feet.				Run-off.		Accuracy.
	Maximum.	Minimum.	Mean.	Per square mile.	Depth in inches on drainage area.	Total in acre-feet.	
1908.							
January	1,030	295	537	0.836	0.96	33,000	B.
February	917	242	393	.612	.66	22,600	B.
March	1,180	260	817	1.27	1.46	50,200	B.
April	2,960	725	1,730	2.69	3.00	103,000	B.
May	2,680	1,350	1,900	2.96	3.41	117,000	B.
June	1,840	570	1,260	1.96	2.19	75,000	B.
July	570	85	229	.357	.41	14,100	B.
August	130	80	104	.162	.19	6,400	B.
September	165	97	135	.210	.23	8,030	B.
October	595	97	142	.221	.25	8,730	B.
November	210	105	124	.193	.22	7,380	B.
December	335	85	161	.251	.29	9,900	B.
The year	2,960	80	628	.977	13.27	455,000	

COSUMNES RIVER DRAINAGE BASIN.

DESCRIPTION.

The Cosumnes River basin lies on the western slope of the Sierra, north of the Mokelumne basin and south of the American basin. It does not reach the crest of the Sierra like these basins, but is wedged in between them. Its catchment area is somewhat elliptical in shape, or leaf-like, and has a length of about 55 miles and a width of 12 or 15 miles. Its total area above the valley rim is about 580 square miles.

Cosumnes River rises in the extreme eastern part of the basin at an altitude of 7,700 feet, and flows southwestward to its junction with the Mokelumne, about 6 miles east of Walnut Grove. Its total length is about 90 miles. The main stream is formed by the confluence of its three forks, about 45 miles above its mouth and 20 miles above the valley border.

This basin is characterized by many low hills and ridges separated by small irregular valleys. The upper part of the basin is more regular in aspect. The streams run in somewhat parallel and regular shallow canyons, which are separated by prominent ridges. The formation has a granitic base. Altitudes range from 200 feet in the foothills to 7,700 at the eastern border.

The forest cover in this basin consists of grass, brush, and scattering scrubby timber in the lower foothills. In the middle and upper parts of the basin there is a good timber growth. A small area of the upper basin is inclosed in a national forest.

The mean annual precipitation ranges from 20 inches in the valley to 35 or 40 inches at the higher elevations. The snowfall in this basin is comparatively light and soon disappears.

Very little irrigation, if any, is practiced in this area. Practically nothing is known concerning the opportunities for storage in this basin, but it is certain that some development is feasible.

The minimum flow of the stream is so small that but little power can be developed continually without storage.

The only gaging station in the basin is on Cosumnes River at Michigan Bar, 1907 to 1908.

COSUMNES RIVER AT MICHIGAN BAR, CAL.

This station, which is located at the Michigan Bar bridge, about 8 miles southwest of Latrobe, and not far from the Michigan Bar post-office, was established October 19, 1907, to obtain statistical information regarding the flow of Cosumnes River. The data are valuable in connection with the use of the river for irrigation and power development, and also in studying the flood problem of the Sacramento and San Joaquin valleys.

No tributaries enter below the station. Big Canyon Creek joins the main stream from the north about 6 miles above Michigan Bar, and the junction of the three forms is about 14 miles above.

Some water is diverted from the south side of the stream above the station and used for hydraulic mining near Michigan Bar. It is probable that all acquired water rights are for mining purposes.

The river bed is composed of sand and gravel and is subject to change. At low stages the current is very sluggish and at high stages very swift. The results are fairly satisfactory.

The monthly discharges for 1907 and 1908 include only the river at Michigan Bar bridge and take no account of the water diverted from the south side of the river above the station for hydraulic mining at Michigan Bar. No measurements have been made on the diversion ditch.

Discharge measurements of Cosumnes River at Michigan Bar, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 16	W. G. Steward	236	1,100	6.00	2,830
May 10	do	248	868	4.83	1,230
September 18	W. A. Lamb	72	228	3.13	41
October 9	do	40	26	3.18	58
1908.					
January 25	W. A. Lamb	250	738	4.55	886
February 15	do	236	535	3.90	229
April 10	do	223	547	3.90	294
September 18	W. V. Hardy			2.55	*a* 1
December 14	W. F. Martin	115	320	3.08	57.0

a Estimated.

Daily gage height, in feet, of Cosumnes River at Michigan Bar., Cal., for 1907 and 1908.

[C. B. Ruman, observer.]

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1907.				1907.				1907.			
1	......	3.3	3.25	11	......	3.2	4.15	21	3.2	3.3	3.6
2	......	3.3	3.25	12	......	3.25	3.8	22	3.2	3.3	3.6
3	......	3.3	3.25	13	......	3.25	3.7	23	3.2	3.7	3.6
4	......	3.3	3.25	14	......	3.25	3.7	24	3.2	3.3	3.5
5	......	3.3	3.2	15	......	3.25	3.6	25	3.3	3.3	3.45
6	......	3.3	3.35	16	......	3.2	3.6	26	3.4	3.3	3.5
7	......	3.3	3.75	17	......	3.2	3.6	27	3.4	3.25	4.15
8	......	3.25	3.95	18	......	3.2	3.5	28	3.45	3.25	4.05
9	......	3.3	3.75	19	......	3.2	3.4	29	3.4	3.25	3.95
10	......	3.25	3.55	20	3.2	3.3	3.6	30	3.3	3.2	3.8
								31	3.3	......	4.4

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.												
1	4.05	3.9	4.25	4.0	3.9	3.8	3.1	2.4	2.5	2.55	2.75	3.0
2	3.85	4.0	4.5	4.0	3.95	3.75	3.05	2.4	2.5	2.5	2.75	3.0
3	3.75	4.25	4.5	4.0	4.0	3.75	3.0	2.4	2.5	2.5	2.75	3.0
4	4.05	4.1	4.35	4.0	3.9	3.7	3.0	2.35	2.5	2.5	2.75	3.05
5	3.85	4.0	4.2	4.0	3.9	3.7	3.0	2.35	2.5	2.5	2.75	3.4
6	3.7	4.0	4.15	4.0	3.9	3.6	3.0	2.3	2.5	2.5	2.75	3.6
7	3.7	3.9	4.1	3.95	3.85	3.6	3.0	2.25	2.5	2.5	2.75	3.3
8	3.6	3.9	4.1	4.0	3.9	3.6	2.9	2.25	2.5	2.5	2.75	3.3
9	3.6	4.2	4.0	3.9	3.9	3.6	2.9	2.25	2.5	2.5	2.75	3.2
10	3.6	4.1	4.0	3.9	3.9	3.5	2.8	2.4	2.5	2.55	2.75	3.15
11	3.6	4.0	4.05	3.95	3.95	3.5	2.8	2.4	2.5	2.55	2.75	3.1
12	3.6	4.0	4.1	4.0	4.0	3.5	2.8	2.4	2.5	2.5	2.75	3.1
13	3.6	3.9	4.1	4.0	4.0	3.5	2.8	2.4	2.5	2.5	2.75	3.0
14	4.3	3.9	4.2	4.05	4.0	3.4	2.75	2.4	2.5	2.5	2.75	3.1
15	4.05	3.9	4.25	4.05	4.3	3.4	2.7	2.4	2.5	2.6	2.8	3.1
16	3.85	3.9	4.35	4.0	4.15	3.4	2.7	2.4	2.5	3.1	2.8	3.15
17	3.8	3.85	4.4	4.0	4.05	3.3	2.65	2.4	2.55	3.25	2.75	3.1
18	3.8	3.85	4.4	4.0	4.05	3.35	2.65	2.4	2.55	3.1	2.8	3.1
19	3.8	3.8	4.35	4.0	4.2	3.3	2.65	2.45	2.55	3.0	2.8	3.0
20	4.1	3.8	4.3	4.0	4.15	3.3	2.6	2.45	2.55	2.9	2.8	3.0
21	5.3	3.8	4.3	4.0	4.1	3.3	2.6	2.45	2.6	2.85	2.7	3.05
22	4.7	3.7	4.3	4.0	4.1	3.35	2.6	2.45	2.6	2.8	2.8	3.1
23	4.4	3.7	4.25	4.05	4.1	3.3	2.6	2.45	2.6	2.8	3.3	3.05
24	5.15	3.7	4.2	4.0	4.0	3.3	2.55	2.48	2.6	2.8	3.45	3.1
25	4.5	3.7	4.25	4.0	4.0	3.2	2.5	2.5	2.6	2.8	3.3	3.1
26	4.35	3.7	4.25	3.95	4.0	3.2	2.5	2.5	2.6	2.75	3.2	3.05
27	4.2	3.7	4.15	3.9	3.9	3.2	2.5	2.5	2.6	2.75	3.1	3.0
28	4.1	3.8	4.05	3.9	3.9	3.15	2.5	2.5	2.6	2.75	3.0	3.0
29	4.0	4.2	3.95	3.9	3.9	3.1	2.5	2.5	2.55	2.75	3.0	3.0
30	4.0	......	4.0	3.9	3.85	3.1	2.45	2.5	2.55	2.75	3.0	3.0
31	3.9	......	4.0	......	3.85	......	2.4	2.5	......	2.75	......	3.0

Rating table for Cosumnes River at Michigan Bar, Cal., 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.*
2.50	0	3.30	72	4.10	450	4.90	1,410
2.60	5	3.40	90	4.20	545	5.00	1,590
2.70	12	3.50	114	4.30	640	5.10	1,780
2.80	19	3.60	142	4.40	740	5.20	1,980
2.90	27	3.70	180	4.50	850	5.30	2,180
3.00	36	3.80	225	4.60	970		
3.10	46	3.90	285	4.70	1,100		
3.20	58	4.00	360	4.80	1,245		

NOTE.—This table is not applicable for obstructed-channel conditions. It is based on eight discharge measurements made during 1907 and 1908, and is fairly well defined.

Monthly discharge of Cosumnes River at Michigan Bar, Cal., for 1907 and 1908.

[Drainage area, 524 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.							
October 20-31			73.2	0.140	0.06	1,740	B.
November	72	58	67.1	.128	.14	3,990	B.
December	497	58	195	.372	.43	12,000	B.
1908.							
January	2,180	142	471	.899	1.04	29,000	B.
February	592	180	306	.584	.63	17,600	B.
March	850	322	552	1.05	1.21	33,900	B.
April	405	285	346	.660	.74	20,600	B.
May	640	255	359	.685	.79	22,100	B.
June	225	46	106	.202	.23	6,310	B.
July	46	0	15.5	.030	.03	953	B.
August	0	0	0	.000	.00	0	B.
September	5	0	1.7	.003	.003	101	B.
October	65	0	13.5	.026	.03	830	B.
November	102	12	27	.052	.06	1,610	B.
December	142	36	48.8	.093	.11	3,000	B.
The year	2,180	0	187	.357	4.87	136,000	

NOTE.—These discharges include only the river at Michigan Bar bridge and do not include water diverted above the station for hydraulic mining. No measurements have been made of the diversion ditch.

NORTH PACIFIC OCEAN DRAINAGE.

KLAMATH RIVER DRAINAGE BASIN.

DESCRIPTION.

Klamath River drains a territory lying east of the Cascade Range in south-central Oregon and south of the Siskiyou Mountains in California. The river rises in upper Klamath Lake, flows generally southward, and reaches the Pacific Ocean at Requa, on the coast of northern California. Only that part of the basin lying in Oregon has been studied in detail. The drainage from this portion of the area is collected in large lakes whose margins are wide shallow marsh lands covered with tules and aquatic plants. From upper Klamath Lake, which stands 4,141 feet above sea level, flows Link River, a stream 1¼ miles long, discharging into Lake Ewauna at an elevation of 4,080 feet. Klamath Falls, the principal city of this section, is located on Link River. From Lake Ewauna to the town of Keno Klamath River flows through a flat marshy country a distance of 20 miles. About 5 miles above Keno the river is connected with lower Klamath Lake by a channel known as Klamath Straits. During high stages water flows from Klamath River into lower Klamath Lake, and during low water the direction of the flow is reversed. About half a mile below Keno the river breaks over a rocky ledge, and here begins its precipitous fall of 100 to 200 feet per mile to its mouth. The drainage area above Keno, exclusive of lower Klamath Lake, is 3,150 square miles. The streams draining into upper Klamath Lake head about 6,000 feet above sea level. The elevation of Klamath Falls is 4,100 feet.

The principal tributaries of Klamath River are Sprague River, which drains the southwestern rim of the Great Basin divide in Oregon, and Anna River, which heads in a large spring supposed to be fed by the waters of Crater Lake. Williamson River, which drains the northern part of the Klamath Indian Reservation, is tributary to Sprague River. Lost River, although not a tributary of the Klamath, is usually considered with it, as a slough connects the two. Water formerly flowed in either direction, depending on which stream was higher, but the flow is now stopped by an artificial dike.

The mean annual rainfall at Klamath Falls, about 12 inches, is fairly representative for this section of the drainage area. A large part of this precipitation occurs as snow during the winter months. As nearly all the streams are spring fed and therefore rarely freeze, records of stream flow are little affected by ice.

Records of rainfall kept at three stations in this basin during 1907 and 1908 give results shown in the following table:

Precipitation at stations in drainage basin of Klamath River.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual.
1907.													
Keno, Oreg.	.....	.....	.....	.....	.....	0.58	1.57	3.05	0.61	0.85	1.35	4.43	.....
Steele Swamp, Cal.[a]	0.90	3.80	4.88	[b]0.90	2.25	2.92	.20	1.71	.72	2.13	1.06	1.98	23.45
Horsefly, Oreg.[c]	.90	4.95	3.45	.70	1.75	2.25	[b].20	1.10	1.72	1.27	.72	.30	19.31
1908.													
Keno, Oreg.	.66	.86	1.29	.95	1.97	.79	.03	.15	.18	4.18	1.43	.99	13.48
Steele Swamp, Cal.	.38	.36	1.24	.59	1.92	.44	.15	.42	.....	2.00	1.00	1.10	9.60
Horsefly, Oreg.	[b].50	[b].15	[b].65	.....	.....	.....	.....	.....	.....	2.00	.....	.....	.....

[a] On headwaters of Lost River above Clear Lake.
[b] Estimated from known snowfall or by comparison with adjacent stations.
[c] At Garber's ranch near gaging station on Miller Creek, within area proposed for use as storage reservoir by United States Reclamation Service.

Irrigation is practiced extensively in the upper part of the area, although dry-farming methods have been fairly successful. The agricultural products consist chiefly of forage crops for stock and cattle, the country being well adapted to stock raising. Grains, alfalfa, and the hardier vegetables and fruits are grown with some degree of success, but the climate is too rigorous for the intensive agriculture possible at lower altitudes.

Within the period covered by stream-flow records the lowest run-off was in 1905 and the highest in 1907.

The following gaging stations have been maintained in this basin:

- Sprague River at Yainax, Oreg. (1904).
- Link River at Klamath Falls, Oreg. (1904–1908).
- Klamath River at Keno, Oreg. (1904-1908).
- Sycan River near Silverlake, Oreg. (1905).
- Williamson River at Klamath Agency, Oreg. (1908).
- Lost River at Clear Lake, Cal. (1904–8).
- Lost River at Olene, Oreg. (1907–1908).
- Lost River near Merrill, Oreg. (1904–1908).
- Miller Creek at Horsefly, Oreg. (1904–1908).

Gage records have been obtained since 1904 on Upper Klamath Lake, Lower Klamath Lake, and Tule Lake, and during 1907 and 1908 three gages in Klamath River between upper and lower Klamath lakes were observed. Since 1905 records of evaporation have been kept at Keno.

UPPER KLAMATH LAKE NEAR KLAMATH FALLS, OREG.

Upper Klamath Lake is to be used by the United States Reclamation Service as a source of water supply to irrigate large areas of land. The main canal of the Klamath project (Pl. VI, *B*) has its intake at the lake.

A gage was installed on this lake near Klamath Falls, Oreg., May 28, 1904. The elevation of the zero of the gage is 4,136.13 feet. The daily records since February 16, 1906, are the mean daily heights obtained from a Frieze automatic water gage.

The winds have a marked effect on the level of the water surface of this lake. The water is lowered as much as 6 inches near the outlet when the wind blows from the south, and is raised as much over its normal level when the wind is in the opposite direction. Differences of a foot are frequently noticeable within a few hours. If the wind effect were eliminated the lake heights would show much more gradual changes than indicated by the accompanying records.

Daily gage height, in feet, of Upper Klamath Lake near Klamath Falls, Oreg., for 1907 and 1908.

[Ernest Jacobson and A. J. Santiman, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.15	5.35	6.20	7.05	6.92	6.60	5.85	5.20	4.80	4.85	4.90	4.98
2	5.15	5.50	6.30	7.00	6.90	6.60	5.80	5.25	4.80	4.80	4.90	4.98
3	5.15	5.55	6.70	6.90	7.00	6.58	5.85	5.20	4.80	4.77	5.00	5.20
4	5.15	5.65	6.60	6.60	6.95	6.50	5.85	5.15	4.80	4.75	5.00	5.40
5	5.20	5.90	6.45	6.80	6.85	6.55	5.88	5.15	4.80	4.75	5.02	5.00
6	5.40	6.05	6.35	6.85	6.80	6.60	5.70	5.12	4.82	4.75	5.02	5.10
7	5.40	6.20	6.35	7.05	6.85	6.55	5.75	5.10	4.85	4.75	5.00	5.00
8	5.40	6.30	6.35	7.08	6.85	6.40	5.75	5.15	4.85	4.85	5.00	5.05
9	5.40	6.40	6.40	7.03	6.70	6.30	5.70	5.15	4.85	4.75	4.95	5.05
10	5.40	6.50	6.30	7.05	6.70	6.25	5.68	5.05	4.85	4.55	4.80	5.00
11	5.40	6.50	6.40	7.08	6.78	6.20	5.68	5.10	4.87	4.55	4.80	5.10
12	5.40	6.50	6.45	7.09	6.90	6.25	5.70	5.05	4.90	4.60	4.90	5.00
13	5.40	6.55	6.35	7.09	6.80	6.28	5.60	5.05	4.90	4.68	4.95	5.30
14	5.40	6.55	6.30	7.15	6.78	6.30	5.60	5.05	4.85	4.66	4.90	5.40
15	5.40	6.55	6.30	7.15	6.75	6.30	5.55	5.05	....	4.68	4.90	5.35

Daily gage height, in feet, of Upper Klamath Lake near Klamath Falls, Oreg., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
16	5.40	6.55	6.30	7.10	6.75	6.25	5.55	5.05	....	4.68	4.95	5.35
17	5.40	6.50	5.70	7.13	6.72	6.25	5.55	4.85	....	4.67	4.90	5.35
18	5.40	6.55	6.25	7.10	6.48	6.25	5.55	4.85	....	4.66	5.10	5.35
19	5.40	6.55	6.05	7.08	6.63	6.20	5.55	4.85	....	4.70	5.10	5.30
20	5.40	6.55	5.95	7.07	6.63	6.20	5.45	4.85	....	4.72	5.15	5.30
21	5.40	6.50	6.35	7.10	6.65	6.25	5.38	4.85	4.72	4.72	5.10	5.30
22	5.40	6.55	6.00	7.15	6.68	6.20	5.35	4.85	4.72	4.70	5.00	5.25
23	5.40	6.45	6.25	7.20	6.62	6.11	5.35	4.85	4.70	4.70	5.00	5.25
24	5.40	6.15	6.80	7.20	6.65	6.10	5.32	4.95	4.68	4.75	4.90	5.25
25	5.40	6.10	6.90	7.15	6.60	6.08	5.37	4.98	4.70	4.70	4.90	5.20
26	5.40	6.25	7.00	7.15	6.65	6.05	5.38	5.00	4.70	4.75	4.80	5.65
27	5.40	6.40	7.05	7.20	6.65	5.98	5.30	4.95	4.80	4.90	4.90	5.60
28	5.40	6.25	7.00	6.95	6.65	6.00	5.27	4.95	4.95	4.95	4.95	5.70
29	5.35	....	6.90	7.00	6.60	5.95	5.25	4.95	4.85	4.90	4.98	5.70
30	5.35	....	6.95	6.95	6.58	5.85	5.23	4.95	4.80	4.90	5.00	5.50
31	5.35	....	....	....	6.60	....	5.20	4.85	....	4.92	....	5.60
1908.												
1	5.60	5.70	5.40	5.70	5.35	....	4.85	4.47	4.25	4.80	4.70	4.92
2	5.60	....	5.45	5.65	5.58	....	4.80	4.42	4.25	4.90	4.70	4.88
3	5.60	....	5.45	5.85	5.60	....	4.75	4.18	4.25	4.61	4.75	4.85
4	5.70	....	5.50	5.70	5.48	....	4.75	4.20	4.25	4.50	4.75	4.90
5	5.70	5.65	5.55	5.75	5.45	....	....	4.18	4.34	4.45	4.75	4.90
6	5.75	5.65	5.55	5.90	5.20	5.24	4.72	4.15	4.30	4.50	4.75	4.85
7	5.75	5.65	5.50	5.85	5.60	5.05	4.67	4.13	4.45	4.50	4.75	5.00
8	5.60	5.60	5.47	5.70	5.60	5.15	4.70	4.26	4.34	4.45	....	5.05
9	5.75	5.60	5.47	5.60	5.55	5.05	....	4.35	4.35	4.50	....	4.95
10	5.75	5.60	5.45	5.55	5.35	5.05	4.65	4.38	4.36	4.50	....	5.10
11	5.75	5.60	5.46	5.55	5.60	5.10	4.61	4.35	4.34	4.50	4.75	5.05
12	5.85	5.60	5.45	5.53	5.50	5.05	4.60	4.42	4.37	4.45	4.75	5.05
13	5.83	5.58	5.45	5.55	5.30	5.08	4.50	4.40	4.40	4.35	4.75	4.90
14	5.88	5.57	5.45	5.50	5.35	5.15	4.55	4.38	4.40	4.50	4.74	4.95
15	5.85	5.55	5.40	5.50	5.35	5.10	4.60	4.28	4.55	4.70	4.72	4.90
16	5.82	5.55	5.45	5.40	5.32	5.10	4.40	4.28	4.55	4.74	4.68	4.97
17	5.80	5.55	5.50	5.35	4.95	5.10	4.60	4.28	4.40	4.80	4.60	4.96
18	5.60	5.53	5.38	5.40	5.25	5.05	4.60	4.28	4.40	....	4.72	4.95
19	5.60	5.54	5.40	5.50	5.40	4.95	4.55	4.28	4.45	5.01	4.40	4.95
20	5.80	5.55	5.50	5.70	5.35	4.80	4.55	4.29	4.45	5.00	4.70	4.98
21	5.82	5.53	5.40	5.60	5.40	4.95	4.58	4.30	4.45	4.75	4.65	4.98
22	5.80	5.55	5.50	5.50	5.40	4.85	4.60	4.30	4.50	4.75	....	5.00
23	5.75	5.52	5.45	5.35	5.32	4.80	4.40	4.40	4.70	4.74	4.90	4.98
24	5.78	5.49	5.40	5.60	5.45	4.80	4.50	4.60	4.65	4.74	4.83	4.98
25	5.85	5.47	....	5.48	5.50	4.80	4.40	4.32	4.50	4.75	4.85	4.95
26	5.90	5.45	....	5.52	5.40	4.90	....	4.35	4.50	4.73	4.90	4.95
27	5.80	5.50	....	5.65	5.40	4.80	4.70	4.50	....	4.72	4.85	4.95
28	5.75	5.35	....	5.58	5.40	4.85	4.54	4.60	4.45	4.65	4.85	4.95
29	5.75	5.10	....	5.50	5.55	4.90	4.55	4.60	4.45	4.55	4.85	4.95
30	5.85	....	5.75	5.40	5.50	4.85	4.48	4.25	4.45	4.68	4.85	4.95
31	5.75	....	5.75	....	....	....	4.45	4.25	....	4.72	....	4.95

NOTE.—The breaks in the record were caused by the stopping of the automatic register, or the loss of record sheets.

LINK RIVER AT KLAMATH FALLS, OREG.

This station, which was established May 15, 1904, is located at the county bridge over Link River at Klamath Falls, 1¼ miles below the outlet of Upper Klamath Lake and immediately at the head of Lake Ewauna. The river has a fall of 70 feet in the 1¼ miles between the lakes, a portion of which is utilized for water power.

The records prior to June 6, 1908, especially the individual daily records, are not reliable. It is probable that for longer periods—a month or more—the total flow can be accepted as not greatly in error. This condition is accounted for by the effect of winds on the flow of water at this station. The gage until May 8, 1908, was located at the bridge at the upper end of Lake Ewauna. At the outlet of Upper Klamath Lake the river breaks over a rather shallow ledge. A strong wind upstream blows the water back from this outlet and at the same time increases the height of water on the gage by backing the water in Lake Ewauna. Thus we have diminished flow with increased gage height. So great is this wind effect that the river has been known to go entirely dry for a few hours at a time. When the wind is downstream the flow of Link River is greatly increased; but owing to the large surface of Lake Ewauna this increase in flow is not shown by the gage heights. In the long run these wind effects are no doubt compensatory, but little dependence can be placed in the published daily records prior to March 7, 1907. On the later date an anemometer was installed on the bridge and a ship's taffrail log was trailed in the water under the bridge. It was hoped that the daily reading from this log would afford some indication of the velocities with the anemometer records. Although the records obtained by this device were much more reliable during 1907 than previously, even they were not all that could be desired. It became evident that owing to the sudden changes of the wind complete data could not be obtained without automatic recording devices on both the log and anemometer. The method was effective, however, in reducing the probable error of the estimates from about 15 per cent to within less than 5 per cent. On June 6, 1908, a Friez gage was installed in the rapids where it could be affected only by change in flow, measurements being made at the bridge as formerly, and since that date the records are reliable. The data presented are made up in the following manner:

For January 1 to March 7, 1907, the old rating curve was used with the gage heights observed at the bridge. March 7, 1907, to June 6, 1908, the records of the anemometer and the taffrail log were used in determining the daily discharge. For the period following June 6, 1908, the permanent rating curve has been developed for the gage at the foot of the rapids, and discharges have been estimated in the usual manner, using the mean daily gage height taken from the register sheet.

Discharge measurements of Link River at Klamath Falls, Oreg., in 1907 and 1908.

GAGE AT BRIDGE.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 10	L. F. Hendricks	280	1,420	3.80	2,300
February 18	do	298	1,780	4.90	4,910
March 2	do	292	1,810	5.00	4,980
April 1	do	294	1,990	5.60	5,620
April 20	do	295	2,050	5.80	5,570
May 9	Stevens and Ellsworth	294	2,040	5.65	4,000
May 23	J. C. Stevens	298	1,950	5.30	4,220
June 13	C. E. Ellsworth	290	1,830	4.98	4,390
June 19	do	292	1,780	4.85	3,740
July 5	do	297	1,630	4.35	2,450
July 23	do	281	1,490	3.85	1,950
July 31	do	277	1,430	3.65	1,640
August 12	do	273	1,340	3.40	1,610
September 4	do	271	1,290	3.15	1,640
September 19	do	271	1,280	3.05	1,490
October 26	do	273	1,340	3.25	1,870
November 13	do	280	1,360	3.32	1,830
1908.					
February 17	C. E. Ellsworth	286	1,650	4.19	3,030
March 14	do	286	1,650	4.20	2,800
March 21	do	286	1,640	4.15	2,890
April 3	do	288	1,640	4.36	3,800
April 15	do	287	1,610	4.26	2,620
April 18	do	286	1,610	4.18	2,700
April 21	do	287	1,640	4.28	2,610
April 25	Ellsworth and Kimble	286	1,580	4.16	2,820
April 30	do	286	1,580	4.16	2,670
May 5	do	284	1,580	4.11	2,560
May 9	H. Kimble	283	1,550	4.02	2,620
May 13	do	284	1,570	4.07	2,680
May 18	do	282	1,550	4.03	2,170
May 21	do	283	1,550	4.04	2,980
May 25	do	282	1,520	3.94	2,530
May 30	do	276	1,520	3.87	2,910
June 4	do	277	1,490	3.76	2,290
June 13	do	277	1,470		2,000

FRIEZ GAGE.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1908.					
June 17	H. Kimble	277	1,430	1.85	2,110
June 23	do	276	1,410		1,710
June 29	do	275	1,380	1.65	1,760
July 1	do	275	1,360	1.57	1,620
July 7	do	272	1,330	1.42	1,570
July 9	do	271	1,330	1.44	1,530
July 13	do	271	1,300	1.70	1,920
July 18	do	269	1,270	1.33	1,330
July 22	do	268	1,280	1.30	1,390
July 28	do	267	1,220	1.19	1,210
August 14	do	265	1,160	1.20	1,250
September 1	do	264	1,130	.75	715
September 16	do	264	1,100	1.02	1,080
September 29	do	266	1,130	.92	936
October 13	do	268	1,190	1.20	1,180
October 26	do	272	1,340	1.59	1,760
October 31	do	272	1,310	1.60	1,720
November 13	do	274	1,340	1.65	1,870
December 7	do	276	1,370	1.64	1,830

Daily gage height, in feet, of Link River at Klamath Falls, Oreg., for 1907 and 1908.

[Ernest Jacobson, observer.]

GAGE AT BRIDGE.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	3.60	3.90	5.02	5.60	5.68	5.28	4.42	3.55	3.15	3.12	3.28	3.43
2	3.85	3.95	5.00	5.68	5.70	5.25	4.45	3.52	3.15	3.10	3.30	3.45
3	3.80	4.10	5.05	5.62	5.65	5.15	4.40	3.50	3.15	3.15	3.30	3.48
4	3.80	4.25	5.10	5.75	5.60	5.12	4.38	3.48	3.15	3.15	3.29	3.50
5	3.75	4.25	5.12	5.65	5.65	5.08	4.32	3.45	3.15	3.10	3.28	3.40
6	3.75	4.32	5.15	5.70	5.62	5.05	4.32	3.42	3.15	3.15	3.30	3.50
7	3.75	4.40	5.12	......	5.68	5.00	4.28	3.38	3.10	3.15	3.30	3.46
8	3.75	4.45	5.10	5.72	5.62	4.95	4.25	3.35	3.10	3.10	3.33	......
9	3.80	4.50	5.10	5.70	5.62	4.92	4.20	3.35	......	3.10	3.30	3.45
10	3.80	4.55	5.10	5.72	5.70	4.90	4.18	3.30	......	3.10	3.35	3.52
11	3.80	4.62	5.15	5.75	5.62	4.98	4.18	3.30	......	3.15	3.35	3.49
12	3.80	4.70	5.15	5.79	......	4.95	4.15	3.32	......	3.12	3.36	3.58
13	3.80	4.75	5.05	5.80	5.48	4.90	4.12	3.28	......	3.12	3.32	3.62
14	3.80	4.80	5.05	5.78	5.50	4.88	4.02	3.25	......	3.18	3.30	3.55
15	3.82	4.80	5.10	5.75	5.50	4.82	3.98	3.25	......	3.15	3.36	......
16	3.82	4.80	5.05	5.75	5.48	4.82	3.95	3.25	......	3.15	3.32	......
17	3.85	4.85	5.10	5.75	5.42	4.82	3.90	3.22	3.10	3.15	3.35	3.60
18	3.85	4.90	5.20	5.80	5.45	4.85	3.88	3.20	3.08	3.15	3.32	3.60
19	3.85	4.90	5.32	5.78	5.40	4.82	3.88	3.20	3.10	3.16	3.36	3.67
20	3.85	4.90	5.28	5.75	5.32	4.78	3.88	3.18	3.12	......	3.36	3.65
21	3.90	4.90	5.45	5.80	5.38	4.75	3.82	3.15	3.10	......	3.39	3.60
22	3.90	4.90	5.62	5.80	5.35	4.70	3.80	3.15	3.10	......	3.39	......
23	3.88	4.90	5.35	5.78	5.35	4.70	3.80	3.15	3.15	3.20	3.38	3.69
24	3.82	5.00	5.42	5.78	5.32	4.65	3.78	3.30	3.12	3.21	......	......
25	3.80	5.05	5.48	5.75	5.30	6.62	3.75	3.22	3.18	3.25	3.40	3.70
26	3.80	5.00	5.48	5.70	5.28	4.65	3.75	3.20	3.08	3.25	3.41	3.95
27	3.80	5.00	5.52	5.72	5.30	4.60	3.70	3.18	3.12	3.30	3.40	3.90
28	3.80	4.92	5.58	5.68	5.30	4.55	3.70	3.20	3.10	3.30	3.40	3.92
29	3.80	......	5.62	5.65	5.28	4.52	3.65	3.18	3.10	3.30	......	3.97
30	3.82	......	5.58	5.62	5.25	4.52	3.65	3.15	3.15	3.30	3.42	4.02
31	3.90	......	5.60	......	5.28	......	3.60	3.15	......	3.25	......	4.00
1908.												
1	4.00	4.40	......	4.22	4.25	3.84	3.37	2.90	2.50	2.58	3.19	3.37
2	4.01	4.50	4.22	4.25	4.14	3.76	3.38	......	2.52	......	3.26	3.38
3	4.05	4.40	4.20	4.35	......	3.77	3.38	2.79	2.60	2.51	3.20	3.40
4	......	4.34	4.20	4.24	4.09	3.75	......	2.82	2.60	2.59	3.17	3.44
5	4.00	4.34	4.22	......	4.11	3.75	3.25	2.78	2.47	2.55	3.20	3.43
6	4.04	4.50	4.20	4.24	4.22	3.74	3.25	2.80	......	2.58	3.18	3.43
7	4.10	4.31	4.21	4.27	4.12	3.80	3.25	2.77	2.45	2.58	......	3.42
8	4.18	4.50	......	4.21	4.06	......	3.23	2.72	2.39	2.72	......	3.53
9	4.12	......	4.20	4.24	4.04	3.74	3.20	......	2.43	2.68	......	3.44
10	4.08	4.24	......	4.25	4.06	3.72	3.18	2.77	2.46	2.75	3.24	3.42
11	4.10	4.25	4.20	4.26	4.05	3.68	3.11	2.70	2.46	......	......	3.40
12	......	4.24	4.20	......	4.06	3.71	3.17	2.72	2.44	......	3.23	3.34
13	4.11	4.26	4.18	4.35	4.04	3.74	3.15	2.62	2.43	2.75	3.25	3.47
14	4.12	4.25	4.20	4.27	4.01	3.65	3.12	......	2.43	......	3.25	3.41
15	4.14	......	4.20	4.22	4.04	3.68	3.06	2.68	2.46	......	3.27	3.40
16	4.10	4.30	4.19	4.28	4.05	3.66	3.08	......	2.43	3.01	3.25	3.4
17	4.15	4.22	4.22	4.30	4.10	3.60	3.07	2.70	2.44	......	......	3.48
18	4.20	4.24	4.14	4.20	4.03	3.66	3.05	......	2.47	......	3.28	3.48
19	......	4.20	4.19	4.18	3.98	3.56	3.05	2.68	2.48	3.16	3.50	3.50
20	4.20	4.22	4.22	4.29	4.01	3.85	......	2.63	......	3.20	3.34	3.50
21	4.20	4.20	4.15	4.24	4.02	3.47	3.02	......	......	......	3.30	......
22	4.20	4.20	4.20	4.18	3.96	3.52	2.98	2.67	2.45	3.11	3.30	3.48
23	4.25	......	4.18	4.18	3.95	3.53	2.99	......	2.45	3.11	3.32	......
24	4.22	4.22	4.40	4.22	4.03	3.50	2.99	2.62	2.46	3.14	3.35	3.48
25	4.22	4.25	4.18	4.16	3.96	3.47	2.91	2.53	......	3.23	3.35	3.50
26	......	4.30	4.25	4.16	3.88	3.40	......	2.56	2.48	......	3.34	3.48
27	4.25	4.20	......	4.15	3.85	3.40	2.95	2.57	2.53	......	3.35	......
28	4.22	4.25	4.15	4.17	3.96	3.40	......	2.54	2.53	3.33	3.36	......
29	4.21	......	4.25	4.16	3.85	3.41	......	2.48	2.53	3.30	......	3.46
30	......	......	4.22	4.21	3.80	3.41	2.88	......	2.51	3.16	3.25	......
31	4.19	......	4.20	......	3.83	......	2.90	2.49	......	3.18	......	3.50

Daily gage height, in feet, of Link River at Klamath Falls, Oreg., for 1907 and 1908—Continued.

GAGE AT FOOT OF RAPIDS.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1908.					1908.				
1	......	2.82	2.00	2.48	16	2.75	2.65	2.55	......
2	......	2.80	2.70	......	17	2.81	2.53	2.25	......
3	......	3.20	......	2.60	18	2.65	2.65	2.60	......
4	......	2.80	2.65	2.40	19	2.70	2.70	2.50	......
5	......	......	2.60	2.40	20	2.80	2.74	2.54	......
6	......	......	2.30	2.22	21	2.70	2.60	2.58	......
7	......	......	2.55	2.25	22	2.70	2.62	......	......
8	......	2.80	2.63	......	23	2.63	......	2.55	......
9	2.65	2.72	2.68	......	24	......	2.90	2.60	......
10	......	......	2.60	......	25	2.85	2.75	2.66	......
11	2.65	2.74	2.75	......	26	2.85	2.74	2.54	......
12	2.68	......	2.70	......	27	......	2.84	2.46	......
13	2.60	......	2.54	......	28	2.83	......	2.60	......
14	2.66	2.66	2.40	......	29	......	2.65	2.75	......
15	......	2.60	......	......	30	2.92	......	2.68	......
					31	2.90	......	2.45	......

FRIEZ AUTOMATIC GAGE.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1908.								1908.							
1	......	1.63	1.21	0.80	1.20	......	1.90	16	1.90	1.38	1.00	1.00	0.62	......	1.55
2	......	1.64	1.22	.77	1.30	1.55	1.95	17	1.86	1.40	1.01	.90	.70	......	1.70
3	......	1.58	1.16	.76	1.05	1.62	1.95	18	1.90	1.37	1.00	.90	......	......	1.70
4	......	1.62	1.16	.74	1.00	1.60	1.90	19	1.82	1.35	1.02	.95	1.95	......	1.70
5	......	1.58	1.15	.80	.96	1.62	1.79	20	1.52	1.30	1.02	.97	1.92	......	1.70
6	1.84	1.54	1.13	.80	.98	1.64	1.68	21	1.72	1.36	1.02	.96	1.52	1.60	1.72
7	1.84	1.46	1.10	.91	.96	1.64	1.70	22	1.68	1.30	1.03	.98	1.58	1.65	1.73
8	1.84	1.46	1.08	.86	.94	......	1.75	23	......	1.30	1.02	1.16	1.59	1.65	1.74
9	1.82	1.46	1.10	.86	1.00	......	1.65	24	......	1.30	1.10	1.10	1.60	1.65	1.73
10	1.80	1.46	1.08	.86	1.16	......	1.60	25	......	1.34	.90	1.00	1.62	1.60	1.72
11	1.80	1.42	1.06	.83	1.35	......	1.65	26	......	1.30	.87	.94	1.62	1.52	......
12	1.78	1.40	1.13	.87	1.30	......	1.75	27	1.78	1.26	.87	.93	1.60	1.54	......
13	1.77	1.36	1.16	.90	1.20	......	......	28	1.68	1.22	.85	.94	1.54	1.58	......
14	1.80	1.42	1.08	.89	.80	......	1.70	29	1.65	1.25	.98	.94	1.35	1.65	......
15	1.86	1.50	1.02	.94	.58	......	1.70	30	1.66	1.17	.80	.96	1.56	1.62	1.70
								31	......	1.14	.80	......	1.56	......	1.69

Rating tables for Link River at Klamath Falls, Oreg.

GAGE AT BRIDGE, MAY 15, 1904, 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.*
2.40	935	3.50	1,800	4.60	3,400	5.70	5,570
2.50	985	3.60	1,920	4.70	3,580	5.80	5,790
2.60	1,035	3.70	2,045	4.80	3,770	5.90	6,020
2.70	1,090	3.80	2,175	4.90	3,960	6.00	6,250
2.80	1,150	3.90	2,310	5.00	4,150	6.20	6,710
2.90	1,220	4.00	2,450	5.10	4,340	6.40	7,180
3.00	1,300	4.10	2,590	5.20	4,530	6.60	7,660
3.10	1,390	4.20	2,740	5.30	4,730	6.80	8,140
3.20	1,485	4.30	2,900	5.40	4,930		
3.30	1,585	4.40	3,060	5.50	5,140		
3.40	1,690	4.50	3,230	5.60	5,350		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1908 and is not well defined.

Rating tables for Link River at Klamath Falls, Oreg.—Continued.

FRIEZ AUTOMATIC GAGE, JUNE 6 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.*
0.60	625	1.00	994	1.40	1,474	1.80	2,036
.70	703	1.10	1,106	1.50	1,612	1.90	2,184
.80	792	1.20	1,224	1.60	1,750	2.00	2,332
.90	888	1.30	1,344	1.70	1,892		

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

Daily discharge, in second-feet, of Link River at Klamath Falls, Oreg., for 1908.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1		3,290	2,690	2,510	16	2,610	2,670	2,430	
2		3,170	2,670	2,530	17	2,590	2,560	2,380	
3		3,230	2,670	2,420	18	2,780	2,650	2,300	
4		3,450	2,720	2,260	19	2,670	2,860	2,520	
5		3,230	2,730	2,130	20	2,650	2,710	2,490	
6		3,410	2,620		21	2,760	2,690	2,750	
7	2,600	3,540	2,610		22	2,650	2,700	2,640	
8	2,610	3,250	2,970		23	2,650	2,640	2,580	
9	2,620	3,050	2,770		24	2,570	2,960	2,880	
10	2,530	2,870	2,600		25	2,700	3,000	2,900	
11	2,580	3,020	2,600		26	3,020	2,970	2,570	
12	2,630	3,050	2,750		27	3,100	3,180	2,550	
13	2,380	2,960	2,540		28	3,120	3,180	2,470	
14	2,530	3,020	2,230		29	2,970	3,000	2,620	
15	2,440	2,770	2,380		30	3,070	2,670	2,790	
					31	3,180		2,660	

NOTE.—These discharges were obtained from the gage heights at the bridge, taking into account also the readings of the taffrail log and the direction and force of the wind.

Monthly discharge of Link River at Klamath Falls, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	2,310	1,920	2,190	135,000	C.
February	4,240	2,310	3,530	196,000	C.
March	5,390	4,150	4,650	286,000	C.
April	5,790	5,350	5,630	335,000	C.
May	5,570	4,630	5,090	313,000	C.
June	7,710	3,260	4,020	239,000	C.
July	3,140	1,920	2,470	152,000	C.
August	1,860	1,440	1,570	96,500	C.
September	1,470	1,370	1,410	83,900	C.
October	1,580	1,390	1,460	89,800	C.
November	1,710	1,560	1,630	97,000	C.
December	2,480	1,690	1,970	121,000	C.
The year	7,710	1,370	2,970	2,140,000	
1908.					
January	2,820	2,450	2,660	164,000	C.
February	3,230	2,740	2,890	166,000	C.
March	3,180	2,380	2,730	168,000	B.
April	3,540	2,560	2,990	178,000	B.
May	2,970	2,230	2,620	161,000	B.
June	2,530	1,640	2,060	123,000	A.
July	1,810	1,150	1,470	90,400	A.
August	1,250	792	1,040	64,000	A.
September	1,180	739	900	53,600	A.
October	2,260	612	1,350	83,000	A.
November	1,820	1,640	1,770	105,000	A.
December	2,260	1,680	1,940	119,000	A.
The year	3,540	612	2,040	1,480,000	

NOTE.—Discharges for January 1, 1907, to March 6, 1908, are based on the gage heights at the bridge. From March 7 to June 5, 1908, the taffrail log readings are also taken into consideration. For June 6 to December 31 they are based on the Friez gage records.

Monthly discharge of Link River at Klamath Falls, Oreg., for 1907 and 1908—Continued.

GAGE AT BRIDGE.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1908.					
March	3,060	2,650	2,750	169,000	
April	2,980	2,660	2,790	166,000	
May	2,820	2,180	2,480	152,000	
June	2,240	1,690	1,970	117,000	
July	1,670	1,210	1,400	86,100	
August	1,220	975	1,080	66,400	
September	1,040	931	973	57,900	
October	1,620	990	1,280	78,700	
November	1,800	1,460	1,560	92,800	
December	1,840	1,630	1,750	108,000	

NOTE.—These discharges are based on gage readings at the bridge and are included only for comparative purposes. The records at the Friez gage are more reliable.

LOWER KLAMATH LAKE NEAR BROWNELL, CAL.

Lower Klamath Lake is connected with Klamath River by the Klamath Straits. The Southern Pacific Company has constructed a railroad through the marshes parallel to Klamath River. The embankment which crosses Klamath Straits is provided with gates whereby the surface flow can be regulated.

A gage was established in Lower Klamath Lake near Brownell, Cal., January 23, 1907. The elevation of the zero of the gage is 4,082.50 feet, and all gage heights have been referred to this datum. The normal area of the lake is 21,000 acres.

Daily gage height, in feet, of Lower Klamath Lake near Brownell, Cal., for 1907 and 1908.

[J. T. Jensen, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1		3.0	3.9	4.3	4.7	4.3	3.8	2.8	2.4	2.3	2.1	2.6
2		3.0	3.9	4.4	4.7	4.3	3.8	2.7	2.4	2.3	2.1	2.6
3		3.1	3.9	4.4	4.8	4.3	3.7	2.7	2.4	2.3	2.1	2.6
4		3.2	3.9	4.4	4.8	4.3	3.7	2.6	2.4	2.3	2.2	2.6
5		3.2	3.9	4.4	4.7	4.3	3.6	2.6	2.4	2.3	2.3	2.6
6		3.2	3.9	4.5	4.6	4.3	3.6	2.6	2.4	2.3	2.3	2.6
7		3.3	4.0	4.5	4.7	4.2	3.5	2.6	2.4	2.3	2.4	2.6
8		3.3	4.0	4.5	4.6	4.2	3.5	2.6	2.4	2.3	2.4	2.6
9		3.3	4.0	4.4	4.5	4.2	3.5	2.6	2.4	2.3	2.4	2.6
10		3.3	4.0	4.4	4.5	4.2	3.4	2.6	2.4	2.3	2.4	2.6
11		3.3	4.0	4.4	4.6	4.2	3.4	2.6	2.3	2.3	2.4	2.6
12		3.4	4.0	4.4	4.6	4.2	3.4	2.6	2.3	2.3	2.4	2.6
13		3.4	4.0	4.4	4.5	4.2	3.4	2.6	2.3	2.3	2.4	2.6
14		3.4	4.0	4.5	4.5	4.2	3.4	2.6	2.3	2.3	2.5	2.6
15		3.4	4.1	4.6	4.4	4.1	3.4	2.6	2.3	2.3	2.5	2.6
16		3.4	4.1	4.6	4.5	4.1	3.4	2.6	2.3	2.3	2.5	2.6
17		3.5	4.1	4.6	4.5	4.1	3.4	2.6	2.3	2.3	2.5	2.6
18		3.5	4.1	4.7	4.3	4.1	3.3	2.6	2.3	2.3	2.5	2.6
19		3.6	4.1	4.7	4.4	4.1	3.3	2.5	2.3	2.3	2.5	2.7
20		3.7	4.1	4.7	4.4	4.1	3.2	2.5	2.3	2.3	2.5	2.7
21		3.7	4.1	4.7	4.3	4.1	3.2	2.5	2.3	2.3	2.5	2.7
22		3.7	4.1	4.7	4.4	4.1	3.2	2.5	2.3	2.3	2.5	2.7
23	2.9	3.8	4.1	4.7	4.4	4.1	3.2	2.5	2.3	2.3	2.5	2.7
24	2.9	3.7	4.1	4.7	4.4	4.1	3.1	2.5	2.3	2.3	2.5	2.7
25	2.9	3.8	4.1	4.7	4.4	4.0	3.1	2.5	2.3	2.3	2.5	2.7

Daily gage height, in feet, of Lower Klamath Lake near Brownell, Cal., for 1907 and 1908—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	2.9	3.8	4.2	4.7	4.4	4.0	3.0	2.5	2.3	2.3	2.5	2.7
27	2.9	3.8	4.3	4.7	4.4	3.9	3.0	2.5	2.3	2.3	2.5	2.7
28	2.9	3.8	4.3	4.7	4.4	3.8	3.0	2.5	2.3	2.2	2.5	2.7
29	2.9	......	4.3	4.7	4.4	3.8	3.0	2.5	2.3	2.2	2.5	2.7
30	2.9	......	4.3	4.7	4.3	3.8	2.9	2.5	2.3	2.2	2.6	2.7
31	3.0	......	4.3	......	4.3	......	2.9	......	......	2.2	......	2.7
1908.												
1	2.8	3.2	3.3	3.3	3.2	3.1	......	2.1	1.7	1.6	2.1	2.4
2	2.8	3.2	3.3	3.3	3.2	3.1	......	2.1	1.7	1.6	2.1	2.4
3	2.8	3.2	3.3	3.3	3.2	3.1	2.5	2.1	1.7	1.6	2.1	2.4
4	2.8	3.3	3.3	3.3	3.2	3.1	2.5	2.1	1.7	1.7	2.2	2.4
5	2.8	3.3	3.4	3.3	3.2	3.0	2.5	2.0	1.7	1.7	2.2	2.4
6	2.8	3.3	3.4	3.3	3.2	3.0	2.5	2.0	1.7	1.7	2.2	2.3
7	2.8	3.4	3.4	3.3	3.2	3.0	2.5	2.0	1.7	1.7	2.2	2.2
8	2.8	3.4	3.4	3.3	3.2	3.0	2.5	1.9	1.7	1.7	2.2	2.2
9	2.8	3.4	3.4	3.3	3.2	3.0	2.5	1.9	1.7	1.7	2.2	2.2
10	2.8	3.4	3.4	3.3	3.2	3.0	2.4	1.9	1.6	1.7	2.2	2.2
11	2.8	3.4	3.4	3.3	3.2	3.0	2.4	1.9	1.6	1.8	2.2	2.3
12	2.9	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	1.8	2.3	2.3
13	2.9	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	1.9	2.3	2.4
14	3.0	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	1.9	2.3	2.5
15	3.0	3.4	3.4	3.3	3.1	2.9	2.4	1.9	1.6	2.0	2.3	2.5
16	3.0	3.4	3.4	3.2	3.1	2.9	2.3	1.9	1.6	2.0	2.3	2.5
17	3.0	3.4	3.4	3.0	3.1	2.9	2.3	1.9	1.6	2.0	2.3	2.5
18	3.1	3.4	3.4	3.1	3.1	2.9	2.3	1.9	1.6	2.1	2.3	2.5
19	3.1	3.4	3.3	3.1	3.1	2.8	2.2	1.9	1.6	2.1	2.2	2.5
20	3.1	3.4	3.3	3.1	3.1	2.8	2.2	1.9	1.6	2.1	2.2	2.5
21	3.1	3.4	3.3	3.1	3.1	2.8	2.2	1.8	1.6	2.1	2.2	2.5
22	3.1	3.4	3.3	3.0	3.1	2.8	2.2	1.8	1.6	2.1	2.2	2.5
23	3.1	3.4	3.3	3.0	3.1	......	2.2	1.8	1.7	2.1	2.2	2.5
24	3.1	3.4	3.3	3.1	3.1	......	2.2	1.8	1.7	2.1	2.2	2.5
25	3.1	3.4	3.3	3.2	3.1	......	2.1	1.8	1.7	2.1	2.3	2.5
26	3.1	3.4	3.3	3.2	3.1	......	2.1	1.8	1.7	2.1	2.4	2.5
27	3.1	3.4	3.3	3.2	3.1	......	2.1	1.8	1.7	2.1	2.4	2.5
28	3.1	3.3	3.3	3.2	3.1	......	2.1	1.8	1.7	2.1	2.4	2.5
29	3.2	3.3	3.3	3.2	3.1	......	2.1	1.8	1.6	2.1	2.4	2.5
30	3.2	......	3.3	3.2	3.1	......	2.1	1.7	1.6	2.1	2.4	2.5
31	3.2	......	3.3	......	3.1	......	2.1	1.7	......	2.1	......	2.5

KLAMATH RIVER GAGES.

The lands along the course of Klamath River through the bordering marshes from Klamath Falls to Keno, are grown up with tules and other aquatic plants. They will ultimately be drained and large areas of very fertile land thus be made suitable for agriculture. For the purpose of making a general study of the level of the water surface in this territory three gages were established:

Gage No. 1, located 4 miles below Klamath Falls, was established June 20, 1906. The elevation of the zero of the gage is 4,079.86 feet above sea level.

Gage No. 2, at Lee's ranch, 12 miles below Klamath Falls, was established December 19, 1906. The elevation of the zero of the gage is 4,075.04. As this gage is inaccessible during high water it has not been possible to obtain continuous records.

Gage No. 3, at Teeter's landing, 17 miles below Klamath Falls, was established December 19, 1906. The elevation of the zero of the gage is 4,079.44.

Daily gage height, in feet, of Klamath River 4 miles below Klamath Falls, Oreg., for 1907 and 1908.

[R. R. Brewbaker, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	5.8		6.8	7.35	7.5	7.0	6.4	5.55				
2	5.8		6.8	7.4					5.2		5.2	
3	5.8			7.4	7.4	7.0	6.4	5.5		5.1		5.4
4	5.8		9.0						5.15		5.2	
5			9.0	7.5	7.5		6.3	5.45		5.1		
6			9.0	7.5		7.0			5.15			5.5
7	5.8		9.0		7.5		6.25	5.4		5.1	5.25	
8	5.8		9.0	7.5		6.9	6.25					
9	5.8		9.9	7.5			6.2		5.15	5.1	5.25	5.4
10	5.8			7.5				5.35				
11			7.0		7.4	6.9	6.2		5.2	5.1	5.3	
12		6.2		7.5				5.35		5.1		5.5
13		6.3			7.35	6.85		5.35				
14	5.8	6.3		7.55	7.4				5.15	5.1	5.25	5.55
15	5.8	6.3			7.4	6.8	6.0					
16	5.8	6.3			7.35			5.3	5.1		5.3	5.55
17	5.8	6.2			7.3		5.95	5.25		5.1		
18	5.8	6.7		7.55	7.3		5.95		5.1		5.25	
19	5.8	6.7				6.8		5.25		5.1		
20	5.8	6.7		7.55	7.25		5.9		5.1		5.3	5.55
21	5.8	6.7			7.2				5.1	5.1		
22	5.8	6.8		7.6	7.2	6.65	5.8	5.15				
23	5.8	6.8					5.8				5.3	5.6
24	5.8			7.5	7.2	6.6		5.25	5.1	5.15		
25	5.8	9.0			7.15		5.75				5.35	
26	5.8	6.8		7.5		6.55	5.7			5.15		5.85
27	5.8		7.2				5.7	5.2	5.0		5.35	
28		6.8	7.3		7.1					5.2		5.8
29			7.3	7.5	7.1	6.5	5.65		5.0			
30			7.3		7.1		5.65	5.2			5.35	5.95
31			7.35				5.6	5.2		5.15		
1908.												
1		6.2	6.15			5.85	5.3	4.75		4.4		
2	5.9			6.15	6.1				4.4			
3		6.3	6.15			5.8	5.2	4.7		4.4	5.1	5.25
4	5.9			6.15	6.0							
5		6.25	6.15					4.7	4.35			5.3
6	5.95			6.15		5.7					5.1	
7			6.15		6.0		5.2		4.4	4.5		
8		6.4		6.15	6.0	5.75		4.65				
9	6.0		6.15				5.1					5.3
10		6.15			5.95			4.65	4.3	4.6	5.1	
11	5.95	6.2	6.15	6.15		5.7	5.1					
12					6.0				4.35	4.65		5.25
13	6.0					5.7	5.1	4.65				
14		6.2	6.1	6.1					4.35		5.15	
15	6.0	6.2			6.0	5.7	5.0	4.65				5.3
16			6.15					4.65		4.9		
17		6.2		6.2		5.6			4.4		5.2	
18	6.05		6.1	6.1	5.95		5.0					5.4
19		6.15						4.6	4.4			
20	6.05	6.15			5.95	5.8	5.0			5.0		
21			6.1	6.2							5.2	5.4
22		6.15				5.4		4.55	4.4			
23	6.15		6.1	6.15	5.9		4.95			5.0	5.25	
24						5.55		4.55	4.4			5.35
25	6.1	6.15		6.1	5.85							
26			6.1					4.5	4.4	5.0	5.2	5.35
27	6.15	6.15		6.0		5.4	4.86			5.05		
28			6.1		5.9	5.35					5.25	
29							4.8	4.45				
30	6.15			6.15	5.85							5.4
31			6.1					4.45				

Daily gage height, in feet, of Klamath River 12 miles below Klamath Falls, Oreg., for 1907 and 1908.

[Mrs. J. P. Lee and Arthur Sevits, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	10.5	10.8	11.7	12.1						10.0	10.1	10.3
2	10.6	10.9	11.7	12.1						10.0	10.1	10.3
3	10.7	11.0	11.7	12.2						10.0	10.1	10.3
4	10.8	11.0	11.7	12.2						10.0	10.1	10.3
5	10.7	11.1	11.7	12.2						10.0	10.1	10.3
6	10.7	11.1	11.	12.2						10.0	10.1	10.3
7	10.7	11.2	11.7							10.0	10.1	10.3
8	10.7	11.2	11.8							10.0	10.1	10.3
9	10.7	11.2	11.8							10.0	10.2	10.3
10	10.7	11.3	11.8							10.0	10.2	10.3
11	10.7	11.4	11.9							10.0	10.2	10.3
12	10.7	11.4	11.8							10.0	10.2	10.3
13	10.7	11.4	11.8							10.0	10.2	10.3
14	10.7	11.4	11.8							10.0	10.2	10.3
15	10.7	11.4	11.8							10.0	10.2	10.3
16	10.7	11.5	11.8							10.0	10.2	10.3
17	10.7	11.5	11.9							10.0	10.2	10.3
18	10.7	11.5	12.1							10.0	10.2	10.3
19	10.7	11.5	12.1							10.0	10.2	10.2
20	10.7	11.5	12.0							10.0	10.2	10.3
21	10.7	11.5	12.1							10.0	10.2	10.3
22	10.7	11.6	12.0							10.0	10.2	10.4
23	10.7	11.6	12.1							10.0	10.2	10.4
24	10.7	11.7	12.1							10.0	10.2	10.5
25	10.7	11.7	12.1							10.1	10.3	10.5
26	10.7	11.7	12.1							10.1	10.3	10.5
27	10.7	11.7	12.1							10.1	10.3	10.5
28	10.8	11.7	12.1							10.1	10.3	10.5
29	10.8		12.1							10.1	10.3	10.5
30	10.8		12.1							10.1	10.3	10.5
31	10.8		12.1							10.1		10.5
1908.												
1	10.7	11.2	11.1	11.2				9.8				
2	10.7	11.2	11.2	11.2								
3	10.8	11.2	11.2	11.2								
4	10.8	11.2	11.2	11.2			10.15					
5	10.9	11.2	11.2	11.2								
6	10.9	11.2	11.2	11.2		10.6			9.4			
7	10.9	11.2	11.2	11.2								
8	10.9	11.2	11.2	11.2				9.7				
9	10.9	11.2	11.2	11.2								
10	11.0	11.2	11.2	11.2			10.0					
11	11.0	11.2	11.2	11.2								
12	11.0	11.2	11.2	11.2								
13	11.0	11.2	11.2	11.2		10.55			9.5			
14	11.0	11.2	11.2	11.2								
15	11.0	11.2	11.2	11.2				9.6				
16	11.0	11.2	11.2	11.2								
17	11.1	11.2	11.2									
18	11.1	11.2	11.2				9.9					
19	11.1	11.2	11.2									
20	11.1	11.2	11.2			10.4						
21	11.1	11.2	11.2									
22	11.1	11.2	11.2					9.6				
23	11.1	11.1	11.2									
24	11.1	11.1	11.2		10.8							
25	11.1	11.1	11.2				9.8					
26	11.1	11.1	11.2									
27	11.1	11.1	11.2			10.3						
28	11.1	11.2	11.2									
29	11.1	11.2	11.2									
30	11.2		11.2		10.7			9.5				
31	11.2		11.2									

Daily gage height, in feet, of Klamath River 17 miles below Klamath Falls, Oreg., for 1907 and 1908.

[G. W. Kegg and Mrs. L. C. Ady, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.07	6.20	7.10	7.60	7.80	7.40	6.80	6.00	5.58	5.48	......	5.80
2	6.10	6.25	7.10	7.60	7.80	7.40	6.75	5.90	5.58	5.50	5.60	5.80
3	6.12	6.30	7.12	7.63	7.75	7.35	6.73	5.90	5.58	5.50	5.60	5.85
4	6.27	6.45	7.12	7.80	7.75	7.33	6.70	5.90	5.58	5.50	5.60	5.85
5	6.30	6.47	7.15	7.75	7.80	7.30	6.68	5.90	5.58	5.50	5.60	5.85
6	6.15	6.50	7.17	7.65	7.75	7.32	6.65	5.83	5.58	5.50	5.60	5.85
7	6.15	6.55	7.20	7.65	7.75	......	6.60	5.70	5.55	5.50	5.60	5.80
8	6.12	6.60	7.20	7.70	7.75	7.25	6.60	5.75	5.55	5.50	5.65	5.80
9	6.10	6.65	7.25	7.70	7.80	7.20	6.60	5.78	5.55	5.53	5.67	5.80
10	6.15	6.70	7.25	7.70	7.90	7.20	6.56	5.80	5.55	5.50	5.70	5.80
11	6.15	6.72	7.25	7.70	7.75	7.25	6.52	5.80	5.55	5.50	5.70	5.80
12	6.15	6.77	7.22	7.75	7.65	7.22	6.50	5.75	5.50	5.50	5.70	5.90
13	6.15	6.80	7.22	7.80	7.70	......	......	5.75	5.50	5.50	......	5.90
14	6.15	6.80	7.22	7.80	7.70	......	6.45	5.75	5.50	5.53	5.70	5.90
15	6.15	6.85	7.27	7.80	7.70	......	6.40	5.72	5.50	5.53	5.70	5.90
16	6.17	6.90	7.25	7.80	7.65	7.22	6.37	5.70	5.65	5.53	5.70	5.90
17	6.17	6.90	7.30	7.75	7.65	7.22	6.35	......	5.48	5.53	......	5.90
18	6.17	6.90	7.50	7.80	7.60	7.22	6.32	5.68	5.48	5.53	5.70	5.90
19	6.20	6.92	7.35	7.80	7.60	7.19	6.30	5.68	5.48	5.53	5.72	6.00
20	6.20	6.95	7.45	7.90	7.60	7.19	6.30	5.65	5.50	5.53	5.72	5.90
21	6.20	6.97	7.42	7.90	7.45	......	6.23	5.62	5.48	5.53	5.72	5.90
22	6.20	7.00	7.47	7.80	7.50	......	6.20	5.60	5.48	5.53	5.75	5.90
23	6.20	7.00	7.55	7.80	7.50	7.00	6.20	5.58	5.50	5.55	5.75	6.00
24	6.20	7.05	7.50	7.80	7.50	7.00	6.17	5.70	5.48	5.55	5.75	6.00
25	6.20	7.00	7.50	7.85	7.50	6.97	6.15	5.65	5.50	5.55	5.75	6.00
26	6.20	7.05	7.50	7.85	7.50	6.95	6.10	5.65	5.45	5.57	5.75	6.20
27	6.17	7.05	7.50	7.85	7.40	6.94	6.10	5.60	5.40	5.57	5.75	6.15
28	6.15	7.10	7.50	7.80	7.40	6.94	6.10	5.63	5.40	5.59	5.75	6.20
29	6.15	......	7.55	7.80	7.40	6.87	6.10	5.63	5.40	5.60	5.75	6.22
30	6.15	......	7.60	7.80	7.40	6.80	6.10	5.63	5.50	5.60	5.80	6.20
31	6.10	......	7.60	......	7.40	......	6.00	5.60	......	5.60	......	6.20
1908.												
1	6.20	......	6.51	6.50	......	......	5.75	......	4.95	4.98	......	......
2	6.20	6.58	......	6.50	......	......	5.74	......	4.95	5.05	......	......
3	6.20	6.59	6.53	6.50	......	......	5.72	......	4.92	5.08	......	......
4	6.20	6.60	6.52	6.50	6.41	......	5.70	......	4.96	4.98	......	......
5	6.22	......	6.52	......	6.41	6.14	5.70	......	4.95	5.00	......	......
6	6.30	......	6.52	......	......	6.12	5.69	......	4.96	5.00	5.54	......
7	6.31	6.55	6.52	......	......	6.10	5.68	......	4.90	5.01	5.55	......
8	......	......	6.52	6.50	......	6.18	5.67	......	4.88	5.05	5.55	......
9	......	6.55	6.51	6.50	......	6.10	5.64	......	4.85	5.02	......	......
10	6.31	6.55	6.51	6.51	......	6.10	5.62	......	4.85	5.05	......	......
11	6.32	......	6.51	6.51	......	6.09	5.59	......	4.87	5.06	......	......
12	6.32	......	6.50	6.51	......	6.08	......	......	4.88	5.10	......	......
13	6.32	6.57	6.50	6.51	6.42	6.06	......	......	4.89	5.35	......	......
14	......	6.58	6.50	6.51	6.42	6.02	......	......	4.85	5.36	......	......
15	6.37	6.58	6.49	6.51	......	6.00	......	5.15	4.85	5.38	......	......
16	6.37	6.52	6.49	6.51	6.41	......	......	5.10	4.86	5.39	......	......
17	6.40	6.52	......	6.51	......	......	......	5.10	4.88	5.40	......	......
18	6.40	6.53	......	6.51	6.41	......	......	5.10	4.89	5.41	......	......
19	6.46	......	6.49	6.52	6.41	5.98	......	5.10	4.89	5.45	......	......
20	6.46	6.53	6.49	6.52	......	5.90	......	5.05	4.90	5.50	......	......
21	6.47	6.55	6.50	6.53	......	......	......	5.05	4.92	5.48	......	......
22	6.47	6.55	6.49	......	6.40	5.90	......	5.05	4.95	5.46	......	......
23	6.48	6.55	6.49	......	......	5.90	......	5.05	4.96	5.48	......	......
24	6.50	6.53	......	......	......	5.90	......	5.00	4.95	5.50	......	......
25	6.50	6.53	......	6.47	......	5.90	......	4.96	4.95	5.50	......	......
26	6.50	6.52	......	6.45	......	......	......	5.00	4.92	5.50	......	......
27	6.50	......	......	......	6.40	5.80	......	4.80	4.95	5.50	......	......
28	6.50	......	6.47	......	6.40	5.78	......	4.85	4.95	5.50	......	......
29	......	......	......	6.44	......	5.76	......	4.90	4.96	5.50	......	......
30	......	......	......	......	......	5.76	......	4.95	4.98	5.50	......	......
31	......	......	6.50	......	......	......	......	4.95	......	5.50	......	......

KLAMATH RIVER AT KENO, OREG.

This station, which is located at the county bridge over Klamath River at the lower end of the lakes and marshes that form the headwaters of Klamath River, was established May 31, 1904, to obtain data for reclamation projects. The United States Reclamation Service is at present reclaiming lands for irrigation in two ways—by diverting waters from Klamath Lake and by draining the large swamp areas bordering this stream and the lakes which are tributary to it. Immediately below the station the river breaks over a rocky ledge with a fall of about 200 feet to the mile.

During the winter the river usually freezes over, but as the water is comparatively deep and the ice is not very thick the records have not been greatly affected by the ice. At low stages a growth of aquatic plants clogs the section and to some extent lessens the accuracy of the results. An additional source of error has resulted from the effect of wind on the wide expanse of water above the station. A strong upstream wind will blow the water back from the outlet and diminish the flow, but as the gage is located at the bridge, 1,000 feet above the gaging site, gage heights are not always affected to a corresponding degree. The datum of the gage has not been changed since it was installed.

Discharge measurements of Klamath River at Keno, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 19	L. F. Hendricks	432	3,970	13.55	3,240
March 13	do	435	4,110	13.80	3,760
April 2	do	445	4,260	14.10	4,550
April 16	do	450	4,360	14.25	4,880
May 23	J. C. Stevens	425	4,250	14.06	4,420
June 1	C. E. Ellsworth	440	4,150	13.90	4,230
June 15	do	435	3,960	13.65	3,650
June 29	do	435	3,870	13.45	3,160
July 22	do	420	3,640	12.90	2,240
July 29	do	410	3,560	12.75	1,970
August 19	do	410	3,370	12.40	1,540
September 2	do	405	3,380	12.30	1,450
September 21	do	401	3,320	12.20	1,240
October 3	do	403	3,370	12.25	1,350
October 25	do	403	3,370	12.30	1,430
November 4	do	408	3,420	12.37	1,470
November 14	do	410	3,430	12.40	1,520
1908.					
February 18	C. E. Ellsworth	427	3,770	13.20	2,690
March 6	do	427	3,790	13.17	2,580
April 1	do	430	3,750	13.15	2,520
April 17	do	427	3,770	13.19	2,560
May 5	Ellsworth and Kimble	421	3,670	13.02	2,400
May 22	H. Kimble	415	3,650	12.90	2,570
June 12	do	415	3,620	12.80	2,260
July 14	do	395	3,340	12.25	1,450
September 1	do	405	3,190	11.70	704
September 17	do	405	3,130	11.60	789
October 1	do	397	3,120	11.55	1,130
October 27	do	409	3,570	12.20	1,250
November 29	Kimble and McGlashan	413	3,660	12.38	1,460

Daily gage height, in feet, of Klamath River at Keno, Oreg., for 1907 and 1908.

[T. A. Grubb, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	12.70	12.90	13.70	14.10	14.30	13.92	13.40	12.65	12.35	12.22	12.40	12.50
2	12.70	13.00	13.70	14.10	14.30	13.90	13.37	12.60	12.30	12.25	12.33	12.50
3	12.70	13.10	13.70	14.10	14.30	13.88	13.35	12.55	12.30	12.21	12.44	12.50
4	12.70	13.10	13.70	14.30	14.30	13.86	13.32	12.54	12.30	12.20	12.37	12.50
5	12.70	13.20	13.80	14.20	14.30	13.84	13.30	12.52	12.27	12.20	12.38	12.50
6	12.70	13.20	13.80	14.20	14.30	13.81	13.25	12.50	12.25	12.20	12.39	12.52
7	12.70	13.30	13.80	14.20	14.30	13.80	13.23	12.49	12.25	12.22	12.39	12.38
8	12.70	13.30	13.80	14.20	14.30	13.79	13.21	12.48	12.25	12.23	12.39	12.50
9	12.80	13.40	13.80	14.30	14.30	13.77	13.20	12.47	12.25	12.23	12.39	12.50
10	12.80	13.40	13.80	14.30	14.20	13.75	13.18	12.47	12.25	12.25	12.40	12.50
11	12.80	13.40	13.80	14.30	14.20	13.73	13.16	12.45	12.25	12.25	12.40	12.50
12	12.80	13.40	13.80	14.30	14.10	13.73	13.15	12.45	12.24	12.25	12.40	12.60
13	12.80	13.40	13.80	14.30	14.20	13.73	13.13	12.43	12.24	12.25	12.40	12.60
14	12.80	13.50	13.80	14.30	14.20	13.71	13.10	12.42	12.23	12.25	12.40	12.60
15	12.80	13.50	13.80	14.20	14.20	13.69	13.05	12.41	12.23	12.25	12.40	12.60
16	12.80	13.50	13.80	14.30	14.20	13.66	13.02	12.40	12.23	12.25	12.40	12.60
17	12.80	13.50	13.90	14.30	14.20	13.64	13.00	12.40	12.23	12.25	12.40	12.63
18	12.80	13.50	14.10	14.30	14.20	13.62	12.98	12.39	12.23	12.25	12.40	12.63
19	12.80	13.50	14.00	14.40	14.10	13.60	12.95	12.39	12.22	12.30	12.40	12.64
20	12.80	13.60	14.00	14.40	14.10	13.58	12.92	12.37	12.22	12.30	12.42	12.65
21	12.80	13.60	14.00	14.30	14.10	13.56	12.91	12.35	12.20	12.30	12.43	12.65
22	12.80	13.60	14.00	14.30	14.10	13.55	12.90	12.33	12.20	12.30	12.46	12.66
23	12.80	13.60	14.00	14.30	14.00	13.54	12.87	12.30	12.20	12.30	12.48	12.69
24	12.80	13.60	14.00	14.30	14.00	13.53	12.85	12.30	12.20	12.30	12.48	12.73
25	12.80	13.70	14.00	14.30	13.98	13.53	12.82	12.31	12.17	12.30	12.49	12.78
26	12.80	13.70	14.00	14.30	13.96	13.51	12.80	12.31	12.15	12.30	12.49	12.90
27	12.80	13.70	14.00	14.30	13.95	13.50	12.78	12.31	12.15	12.30	12.49	12.90
28	12.90	13.70	14.00	14.30	13.94	13.47	12.76	12.31	12.15	12.36	12.49	12.89
29	12.90	....	14.10	14.30	13.93	13.45	12.75	12.32	12.17	12.37	12.50	12.90
30	12.90	....	14.10	14.30	13.93	13.42	12.72	12.32	12.20	12.30	12.50	12.90
31	12.90	....	14.10	....	13.93	....	12.70	12.34	....	12.30	....	12.90
1908.												
1	12.90	13.10	13.20	13.15	13.00	12.80	12.50	11.97	11.66	11.55	12.22	12.41
2	12.92	13.10	13.17	13.15	13.00	12.75	12.50	11.95	11.66	11.50	12.23	12.41
3	12.95	13.10	13.19	13.13	13.00	12.75	12.45	12.00	11.64	11.63	12.25	12.41
4	12.95	13.15	13.19	13.15	13.00	12.80	12.42	12.00	11.65	11.65	12.30	12.45
5	12.97	13.17	13.19	13.15	13.00	12.80	12.40	12.00	11.65	11.70	12.28	12.46
6	12.99	13.27	13.19	13.16	13.00	12.80	12.39	12.00	11.63	11.75	12.28	12.47
7	13.00	13.22	13.19	13.17	13.00	12.80	12.40	12.00	11.61	11.75	12.29	12.47
8	13.00	13.30	13.19	13.19	13.00	12.80	12.36	12.00	11.55	11.75	12.30	12.46
9	13.00	13.27	13.19	13.19	12.99	12.79	12.32	11.95	11.58	11.70	12.30	12.45
10	13.00	13.20	13.19	13.19	12.99	12.79	12.30	11.90	11.60	11.80	12.30	12.45
11	13.00	13.20	13.19	13.19	12.99	12.80	12.30	11.85	11.60	11.80	12.30	12.44
12	13.00	13.19	13.19	13.19	12.99	12.79	12.25	11.89	11.60	11.82	12.30	12.43
13	13.00	13.20	13.19	13.19	12.99	12.79	12.20	11.80	11.60	11.80	12.30	12.43
14	13.00	13.20	13.17	13.19	12.98	12.75	12.20	11.82	11.58	12.20	12.31	12.44
15	13.02	13.20	13.17	13.19	12.97	12.70	12.15	11.82	11.59	12.10	12.31	12.45
16	13.04	13.20	13.15	13.19	13.00	12.65	12.15	11.82	11.60	12.05	12.35	12.46
17	13.08	13.20	13.00	13.20	13.01	12.63	12.15	11.82	11.60	12.10	12.36	12.47
18	13.09	13.20	13.17	13.15	12.95	12.61	12.15	11.80	11.64	12.15	12.40	12.48
19	13.09	13.19	13.17	13.17	12.96	12.59	12.15	11.80	11.60	12.00	12.40	12.49
20	13.10	13.20	13.15	13.20	12.99	12.60	12.13	11.79	11.62	12.10	12.30	12.49
21	13.10	13.20	13.15	13.20	12.95	12.59	12.11	11.75	11.65	12.15	12.39	12.49
22	13.13	13.20	13.15	13.10	12.96	12.59	12.10	11.71	11.65	12.15	12.35	12.49
23	13.15	13.20	13.10	13.19	12.97	12.59	12.09	11.71	11.66	12.20	12.33	12.49
24	13.17	13.20	13.90	13.10	12.95	12.59	12.06	11.71	11.67	12.20	12.32	12.49
25	13.17	13.17	13.50	13.10	12.95	12.57	12.00	11.71	11.68	12.20	12.33	12.49
26	13.16	13.15	13.50	13.10	12.85	12.45	12.02	11.71	11.69	12.20	12.35	12.49
27	13.15	13.15	13.70	13.10	12.90	12.50	12.04	11.60	11.70	12.25	12.40	12.49
28	13.15	13.17	13.10	13.10	12.90	12.50	12.05	11.62	11.70	12.30	12.40	12.50
29	13.15	13.20	13.10	13.09	12.90	12.50	12.04	11.64	11.69	12.25	12.40	12.50
30	13.15	....	13.00	13.09	12.80	12.45	12.20	11.66	11.68	12.20	12.41	12.50
31	13.15	....	13.10	....	12.80	....	12.00	11.68	....	12.20	....	12.50

NOTE.—River frozen over from February 1 to 8, 1908; ice 4 inches thick.

Rating table for Klamath River at Keno, Oreg., 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.*
11.50	730	12.30	1,390	13.10	2,520	13.90	4,080
11.60	780	12.40	1,510	13.20	2,690	14.00	4,300
11.70	840	12.50	1,630	13.30	2,870	14.10	4,530
11.80	900	12.60	1,760	13.40	3,060	14.20	4,760
11.90	970	12.70	1,900	13.50	3,250	14.30	4,990
12.00	1,060	12.80	2,050	13.60	3,450	14.40	5,220
12.10	1,160	12.90	2,200	13.70	3,660		
12.20	1,270	13.00	2,360	13.80	3,870		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on twenty-four discharge measurements made during 1906 to 1908, and is fairly well defined.

Monthly discharge of Klamath River at Keno, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	2,200	1,900	2,030	125,000	B.
February	3,660	2,200	3,120	173,000	A.
March	4,530	3,660	4,070	250,000	A.
April	5,220	4,530	4,920	293,000	A.
May	4,990	4,150	4,630	285,000	A.
June	4,120	3,100	3,600	214,000	A.
July	3,060	1,900	2,430	149,000	A.
August	1,830	1,390	1,530	94,100	B.
September	1,450	1,220	1,310	78,000	B.
October	1,470	1,270	1,350	83,000	B.
November	1,630	1,430	1,540	91,600	B.
December	2,200	1,490	1,820	112,000	B.
The year	5,220	1,220	2,700	1,950,000	
1908.					
January	2,640	2,200	2,450	151,000	B.
February	2,870	2,520	2,670	154,000	B.
March	4,080	2,360	2,730	168,000	B.
April	2,690	2,500	2,610	155,000	B.
May	2,380	2,050	2,300	141,000	C.
June	2,050	1,570	1,870	111,000	C.
July	1,630	1,060	1,290	79,300	C.
August	1,060	780	925	56,900	C.
September	840	755	801	47,700	C.
October	1,390	730	1,070	65,800	B.
November	1,520	1,290	1,420	84,500	B.
December	1,630	1,520	1,590	97,800	B.
The year	4,080	730	1,810	1,310,000	

NOTE.—The open-channel rating table has been applied throughout the year; discharges for February, 1908, and possibly for short periods at other times, may be somewhat too large on account of ice.

WILLIAMSON RIVER NEAR KLAMATH AGENCY, OREG.

This station, which is located 13 miles northeast of the Klamath Agency at a point locally known as Rocky Ford, at the lower extremity of Klamath Marsh, was established March 26, 1908, in cooperation with the United States Indian Service. It is expected that a portion of the lands in the Klamath Reservation can be reclaimed by irrigation and also by the drainage of tributary swamp areas.

The nearest tributary is Spring Creek, 11 miles below the station. Owing to the inaccessibility of the station, continuous records have not been possible. During the winter months it is almost impossible to reach the station on account of snow.

On October 17, 1908, a Bristol self-registering gage was installed, and as this only required weekly visits by the observer, continuous records were obtained during the remainder of the year. Owing to the large storage capacity in Klamath Marsh the river is not subject to great fluctuations. It is probable that weekly observations will give sufficient data for an estimate of the flow.

The accuracy of the results is somewhat affected by the growth of aquatic plants in the river channel during the season, and a comparatively large number of measurements will be necessary in order to secure reliable results. The data herewith were obtained by usual methods, using a mean curve.

Discharge measurements of Williamson River near Klamath Agency, Oreg., in 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 26	C. E. Ellsworth	121	379	2.29	792
March 27	do	121	386	2.30	824
April 28	do	115	314	1.56	505
May 15	H. Kimble	100	270	1.33	351
June 19	do	95	236	.90	248
July 16	do	95	224	.82	162
September 26	do	80	166	.48	67
October 17	do	102	228	1.00	184
November 20	McGlashan and Kimble	100	241	1.09	278

Daily gage height, in feet, of Williamson River near Klamath Agency, Oreg., for 1908.

[Herbert Nelson, observer.]

Day.	Mar.	Apr.	Sept.	Oct.	Nov.	Dec.	Day.	Mar.	Apr.	Sept.	Oct.	Nov.	Dec.
1		2.27		0.50	1.05	1.04	16		1.86		0.90	1.04	0.90
2		2.26		.50	1.04	1.05	17		1.78		1.00	1.08	.85
3		2.24		.50	1.04	1.04	18		1.74		1.00	1.10	.80
4		2.20		.50	1.03	1.02	19		1.71		1.00	1.10	.98
5		2.18		.50	1.02	.95	20		1.70		1.00	1.08	1.06
6		2.16		.50	1.02	.91	21		1.69		1.00	1.07	1.06
7		2.14		.50	1.02	.94	22		1.65		1.00	1.09	1.05
8		2.14		.50	1.00	.99	23		1.64		1.00	1.11	1.04
9		2.12		.50	1.00	.91	24				1.01	1.13	1.03
10		2.08		.50	1.00	.90	25	2.32			1.01	1.15	1.02
11		2.05		.60	1.02	.87	26	2.30		0.50	1.01	1.09	1.03
12		2.02		.60	1.03	1.02	27	2.30		.50	1.02	1.06	1.03
13		1.96		.60	1.03	1.03	28	2.31	1.56	.50	1.02	1.04	1.03
14		1.92		.70	1.05	1.00	29	2.30		.50	1.01	1.06	1.03
15		1.90		.80	1.04	.96	30	2.30		.50	1.01	1.07	1.03
							31	2.28			1.03		

Rating table for Williamson River near Klamath Agency, Oreg., 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.*
0.50	72	1.00	239	1.50	450	2.00	674
.60	100	1.10	279	1.60	494	2.10	720
.70	130	1.20	320	1.70	539	2.20	766
.80	165	1.30	362	1.80	584	2.30	812
.90	201	1.40	406	1.90	629	2.40	858

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on nine discharge measurements made in 1908, and is fairly well defined.

Monthly discharge of Williamson River near Klamath Agency, Oreg., for 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
March 25-31	821	803	813	11,300	A.
April	798	464	621	37,000	B.
May			375	23,100	C.
June			201	12,000	C.
July			172	10,600	C.
August			130	7,990	C.
September			86	5,120	C.
October	251	72	166	10,200	B.
November	300	239	261	15,500	B.
December	263	165	235	14,400	B.
The period				147,000	

NOTE.—Discharges for May to September have been estimated from the gage heights taken at time of measurements.

LOST RIVER NEAR CLEAR LAKE, CAL.

This station, which was established September 1, 1904, is located 13 miles from Langell, Oreg., at the outlet of Clear Lake, 1 mile below the mouth of Willow Creek.

Clear Lake is the site of a reservoir, and a dam at the outlet is now being constructed by the United States Reclamation Service, where it is proposed to store the flood and winter flow of the stream for irrigation. The reservoir will hold three years' run-off.

In the winter months the stream is frequently frozen for weeks at a time, and for such periods the records are not reliable. Until construction work was begun on the dam it was almost impossible to procure gage observations with any degree of regularity. A Frieze automatic water register was established November 4, 1905, which required weekly visits by the observer, but as he was compelled to ride 12 miles to change the record sheets, it was not always possible for him to do so. Where missing records could be estimated with a reasonable degree of accuracy, it has been done.

The conditions at the station during low stages of the river are not conducive to accurate results. The channel is obstructed by the growth of weeds and aquatic plants, and a large number of measurements are required for reliable estimates of flow. At such times, however, the discharge is very low, so that the total run-off can be accepted with safety.

Discharge measurements of Lost River near Clear Lake, Cal., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Dis-charge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 30	Hendricks and Sticksel	130	196	7.25	444
January 31	.....do	130	208	7.30	497
February 6	L. F. Hendricks	163	522	9.80	2,230
February 10	.....do	146	371	8.50	1,170
March 6	.....do	140	271	7.80	782
April 12	.....do	150	395	8.70	1,280
April 24	.....do	130	195	7.20	491
May 13	Stevens and Ellsworth	125	117	6.60	235
June 4	C. E. Ellsworth	70	54	5.90	67
June 23	.....do	63	40	5.68	39
July 26	.....do	16	12	5.25	13
August 14	.....do	12	10	5.27	11
September 6	.....do	10	8.8	5.20	8.7
September 25	.....do	9	10	5.25	11
October 14	.....do	18	12	5.38	12
October 21	.....do	16	12	5.35	14
1908.					
February 21	C. E. Ellsworth	53	32	5.55	32
April 8	.....do	63	52	5.80	71
May 2	Kimble and Ellsworth	19	14	5.25	17
May 19	H. Kimble	30	28	5.70	36
June 25	.....do	7	6.6	4.84	5.2
July 25	.....do	8	8.2	5.00	7.1
September 3	.....do	10	5.8	4.80	2.5
October 8	.....do	6	12.4	5.20	8.6
October 23	.....do	6	12.8	5.24	11
November 25	Kimble and McGlashan	14	11 8	5.23	10.8

Daily gage height, in feet, of Lost River near Clear Lake, Cal., for 1907 and 1908.

[A. C. Duncan and R. M. Boller, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7.00	7.35	7.80	9.35	6.75		5.42	5.30	5.20			5.40
2	7.00	7.90	7.80	9.40	6.65		5.39	5.29				5.38
3	6.90	9.20	7.80	9.30	6.60	5.72	5.37	5.28			5.55	5.37
4	6.90	10.50	7.75	9.20	6.55	5.68	5.35	5.28				5.39
5	6.90	10.10	8.00	9.10	6.55	5.64	5.33					5.40
6	6.90	9.70	7.85	8.90		5.60	5.30		5.20			5.43
7	6.90	9.45	7.70	8.90		5.59	5.28		5.20			5.47
8	6.90	8.95	7.90	9.05		5.60	5.30		5.20			5.49
9	6.90	8.70	7.90	9.00		5.80	5.30		5.20			
10	6.90	8.50	7.85	8.85		5.70	5.30		5.20			
11	6.90	8.40	7.80	8.75		5.68	5.34	5.40	5.18			
12	6.90	8.25	7.65	8.70	6.60	5.70	5.40	5.38	5.16			
13	6.90	8.15	7.60	8.70	6.60		5.40	5.35	5.16	5.40		
14	6.80	8.05	7.50	8.65	6.60			5.33	5.16	5.40		
15	6.70	7.95	7.50	8.55	6.58			5.30	5.16	5.39		5.58
16	6.60	7.90	7.55	8.45	6.55	6.30		5.27		5.37		5.55
17	6.50	7.80	8.60	8.35	6.50	6.12		5.20		5.36	5.40	5.46
18	6.40	7.80	9.30	8.25	6.45	6.04		5.13		5.35		5.44
19	6.30	7.75	10.00	8.15	6.38	5.95				5.35		5.41
20	6.30	7.75	10.10	8.05	6.38	5.85				5.35		5.40
21	6.30	7.80	10.00	7.65	6.40	5.78	5.27		5.30	5.35		5.46
22	6.30	8.10	10.00	7.55	6.40	5.70	5.27		5.30			5.45
23	6.30	8.00	9.80	7.40	6.40	5.69	5.25		5.30			6.30
24	6.30	8.00	9.75	7.30	6.38	5.66	5.24		5.30		5.50	6.90
25	6.00	8.15	9.70	7.20	6.35	5.63	5.23	5.38	5.30			6.78

Daily gage height, in feet, of Lost River near Clear Lake, Cal., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
26	5.70	8.00	9.50	7.15	6.23	5.61	5.24	5.35	5.30			6.70
27	5.70	8.05	9.40	7.05	6.20	5.58	5.26	5.30	5.30			6.62
28	5.70	8.00	9.30	6.90	6.17	5.53	5.30	5.24	5.34			6.55
29	6.60		9.30	6.85	6.12	5.51	5.30	5.19				
30	7.50		9.60	6.85	6.08	5.50	5.32	5.18				
31	7.30		9.50		6.04		5.31	5.18				
1908.												
1				5.42	5.25	5.26	4.84	5.02	4.80		5.16	5.18
2		5.90		5.48	5.24	5.22	4.84	5.01	4.80		5.16	5.17
3				5.52	5.21	5.20	4.84		4.80		5.15	5.16
4				5.50	5.28	5.16	4.84		4.80	5.20	5.15	5.16
5				5.55	5.36	5.18	4.84		4.80	5.20	5.15	5.16
6					5.32	5.17			4.80	5.20	5.14	5.16
7					5.26	5.16				5.19	5.14	5.14
8			5.80	5.80	5.22					5.20	5.14	5.14
9		5.70	5.80	5.78	5.19			5.01		5.20		5.14
10		5.70	5.82	5.77				5.01		5.21		5.14
11		5.68	6.00	5.77				4.99		5.25		5.14
12		5.67	6.50	5.78				5.00		5.30		5.13
13		5.64	6.90	5.78		5.10		4.99	5.09	5.35		5.16
14	6.00	5.64	6.85	5.74		5.09		4.95	5.08	5.40		5.16
15	6.50	5.62	6.80	5.70		5.07			5.09	5.45	5.18	5.16
16	7.00	5.60	6.80	5.68		5.04			5.09	5.55	5.18	5.16
17	7.00	5.60	6.80	5.67	5.64	4.99			5.10	5.60	5.17	
18	6.90	5.59	6.80	5.69	5.69	4.98			5.11	5.60	5.16	
19	6.82	5.57	6.80	5.65	5.69	4.96			5.12	5.40	5.17	
20	6.88	5.56	6.80	5.61	5.69	4.94			5.16	5.25	5.22	5.16
21	6.88	5.55	6.75		5.70				5.21	5.24	5.25	5.16
22	6.65	5.55	6.75		5.70				5.22	5.20	5.26	5.16
23	6.60	5.55			5.70				5.20	5.14	5.29	5.16
24	6.65	5.55			5.70				5.19	5.14	5.26	5.16
25	6.50	5.58			5.44	4.84	4.95		5.19	5.14	5.25	5.16
26	6.50	5.80		5.54	5.34	4.82	4.98		5.20	5.14	5.22	5.16
27	6.30	5.95		5.56	5.26	4.81	5.01		5.20	5.13	5.22	5.18
28	6.30	6.05		5.48	5.20	4.84	5.01			5.13	5.22	5.20
29	6.18		5.65	5.39		4.84	5.01			5.14	5.18	5.23
30	6.20		5.65	5.32		4.84	5.02	4.80		5.15	5.18	5.26
31			5.50		5.29		5.02	4.80		5.16		5.29

Rating tables for Lost River near Clear Lake, Cal.

FOR 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.*
5.10	5	6.30	143	7.50	608	8.70	1,295
5.20	8	6.40	170	7.60	654	8.80	1,360
5.30	12	6.50	200	7.70	702	8.90	1,430
5.40	17	6.60	234	7.80	755	9.00	1,500
5.50	24	6.70	272	7.90	810	9.20	1,660
5.60	33	6.80	312	8.00	865	9.40	1,835
5.70	43	6.90	352	8.10	920	9.60	2,025
5.80	55	7.00	392	8.20	980	9.80	2,230
5.90	68	7.10	432	8.30	1,040	10.00	2,450
6.00	83	7.20	474	8.40	1,100	10.20	2,670
6.10	100	7.30	518	8.50	1,165	10.40	2,900
6.20	120	7.40	562	8.60	1,230	10.60	3,140

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on sixteen discharge measurements made during 1907, and is fairly well defined.

JANUARY 1, 1908, TO AUGUST 29, 1908.

4.80	4.5	5.40	24	6.00	98	6.60	252
4.90	5.7	5.50	31	6.10	118	6.70	286
5.00	7.5	5.60	40	6.20	140	6.80	320
5.10	10.4	5.70	52	6.30	164	6.90	356
5.20	14	5.80	66	6.40	191	7.00	392
5.30	18.5	5.90	81	6.50	220		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on five discharge measurements made during 1908 and earlier high-water measurements, and is fairly well defined.

Rating tables for Lost River near Clear Lake, Cal.—Continued.

AUGUST 30, 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.*
4.80	2.5	5.10	7.0	5.30	13	5.50	22
4.90	3.5	5.20	9.3	5.40	17	5.60	29
5.00	5.0						

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on four discharge measurements made during 1903 and is fairly well defined.

Monthly discharge of Lost River near Clear Lake, Cal., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	608	43	267	16,400	B.
February	3,020	540	1,140	63,300	A.
March	2,560	608	1,360	83,600	A.
April	1,840	332	1,070	63,700	A.
May	292	90	191	11,700	B.
June	143	24	54.9	3,270	B.
July	18	9	13.0	799	B.
August	17	6	11.9	732	B.
September	14	7	9.63	573	B.
October	24	14	16.8	1,030	B.
November	28	17	22.1	1,320	B.
December	352	16	84.6	5,200	B.
The year	3,020	6	353	252,000	
1908.					
January	392	98	205	12,600	B.
February	108	36	57.1	3,280	B.
March	356	31	177	10,900	B.
April	66	19.6	43.9	2,610	B.
May	52	13.6	28.9	1,780	B.
June	16.7	4.6	9.10	541	B.
July	8.1	5.0	6.08	374	B.
August	8.1	2.5	5.82	358	D.
September	10.0	2.5	6.48	386	B.
October	29	7.7	12.0	738	B.
November	12.6	7.9	9.13	543	B.
December	12.6	7.7	8.66	532	B.
The year	392	2.5	47.4	34,600	

LOST RIVER AT OLENE, OREG.

This station was originally established May 24, 1904, and was maintained until July 30 of that year, when the bridge at which measurements were made was destroyed and the station was discontinued. It was reestablished May 20, 1907, and the records have been continuous since that date. This station replaces the one at Merrill, simultaneous records being kept a sufficient length of time to make a comparison between the two. The difference of flow is largely accounted for by the inaccuracy of the data obtained at Merrill station. A slough connecting Lost River with Klamath River joins Lost River 5 miles below the Olene station and Klamath River 2 miles below Lake Ewauna. Through this slough it is proposed to divert part of the waters from Lost River into Klamath

River, and thus reclaim lands bordering Tule Lake. At present, however, the slough has been artificially closed and the flow has been shut off for several years. Before it was diked no water flowed except during high water, the direction depending upon whether Klamath or Lost River was the higher. There is a small amount of inflow below Olene. One spring was measured April 14, 1908, giving a discharge of 2.9 second-feet, and during the irrigating season there is probably some waste water from irrigation. Nuss Lake is situated half a mile from the left bank of Lost River and 1 mile below Olene. It has no surface outlet except at flood time, but it is possible that a little water passes underground from this lake to the river during the summer months.

The conditions at this station are favorable for good results. There is a riffle controlling the flow about 200 feet below the station, where measurements are made at extreme low water by wading, the velocity at the gaging site being too sluggish at such times for good results.

Discharge measurements of Lost River at Olene, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 20	Stevens and Ellsworth	126	419	5.20	349
May 31	C. E. Ellsworth	125	413	5.05	256
June 7	do	120	389	4.90	220
June 14	do	120	389	4.88	173
June 18	do	123	411	5.03	257
June 20	do	123	407	5.05	256
June 24	do	123	396	4.98	222
June 28	do	122	382	4.85	184
July 2	do	115	380	4.80	145
July 6	do	115	371	4.75	131
July 24	do	90	115	4.65	132
July 27	do	90	115	4.65	130
August 1	do	95	352	4.58	106
August 9	do	94	104	4.60	122
August 13	do	94	104	4.62	130
August 15	do	90	96	4.60	116
August 22	do	88	89	4.60	117
September 5	do	90	92	4.62	129
September 18	do	88	94	4.62	126
September 23	do	88	95	4.62	118
September 26	do	88	93	4.62	128
October 1	do	88	94	4.63	124
October 8	do	87	90	4.63	118
October 16	do	88	92	4.63	129
November 6	do	90	94	4.70	148
November 9	do	90	92	4.70	146
November 16	do	90	90	4.68	134
1908.					
February 15	C. E. Ellsworth	122	383	4.82	186
February 19	do	122	383	4.82	176
February 26	do	122	373	4.75	173
March 16	do	131	562	6.15	958
March 17	do	135	670	7.00	1,690
March 20	do	132	575	6.30	1,120
April 10	do	127	397	4.95	238
April 14	do	116	388	4.87	205
April 22	do	122	373	4.75	168
May 1	Ellsworth and Kimble	122	369	4.70	155
May 13	H. Kimble	120	364	4.65	127
June 11	do	110	359	4.60	112
June 27	do	90	359	4.60	122
July 23	do	90	348	4.50	125
September 5	do	90	348	4.50	108
October 24	do	93	359	4.60	97
November 23	Kimble and McGlashan	104	362	4.63	109

Daily gage height, in feet, of Lost River at Olene, Oreg., for 1907 and 1908.

[A. T. Wilson, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	......	......	......	......	......	5.15	4.80	4.55	4.60	4.62	4.70	4.65
2	......	......	......	......	......	5.15	4.80	4.55	4.60	4.62	4.70	4.65
3	......	......	......	......	......	5.15	4.80	4.55	4.60	4.62	4.70	4.65
4	......	......	......	......	......	5.15	4.80	4.55	4.60	4.62	4.70	4.65
5	......	......	......	......	......	5.10	4.80	4.55	4.60	4.62	4.70	4.65
6	......	......	......	......	......	5.05	4.75	4.55	4.60	4.62	4.70	4.65
7	......	......	......	......	......	4.55	4.75	4.55	4.60	4.63	4.70	4.65
8	......	......	......	......	......	4.80	4.75	4.55	4.60	4.64	4.70	4.65
9	......	......	......	......	......	4.80	4.75	4.60	4.60	4.64	4.70	4.65
10	......	......	......	......	......	4.70	4.75	4.60	4.60	4.64	4.70	4.65
11	......	......	......	......	......	4.60	4.75	4.60	4.60	4.64	4.70	4.65
12	......	......	......	......	......	4.60	4.75	4.60	4.60	4.64	4.70	4.65
13	......	......	......	......	......	4.80	4.70	4.58	4.60	4.64	4.70	4.65
14	......	......	......	......	......	4.85	4.70	4.55	4.60	4.64	4.70	4.65
15	......	......	......	......	......	4.90	4.70	4.55	4.60	4.64	4.70	4.65
16	......	......	......	......	......	5.00	4.70	4.50	4.60	4.64	4.70	4.65
17	......	......	......	......	......	5.00	4.70	4.50	4.60	4.64	4.70	4.65
18	......	......	......	......	......	4.98	4.70	4.50	4.60	4.64	4.70	4.65
19	......	......	......	......	5.20	5.05	4.70	4.50	4.60	4.64	4.70	4.65
20	......	......	......	......	5.20	5.05	4.70	4.50	4.60	4.65	4.70	4.65
21	......	......	......	......	5.20	5.05	4.70	4.60	4.60	4.65	4.70	4.65
22	......	......	......	......	5.20	5.05	4.60	4.60	4.60	4.65	4.70	4.70
23	......	......	......	......	5.25	5.05	4.60	4.60	4.60	4.65	4.70	4.70
24	......	......	......	......	5.22	5.00	4.60	4.60	4.60	4.65	4.70	4.72
25	......	......	......	......	5.25	4.95	4.60	4.60	4.62	4.65	4.70	4.88
26	......	......	......	......	5.25	4.95	4.60	4.60	4.62	4.65	4.68	4.52
27	......	......	......	......	5.25	4.90	4.60	4.60	4.62	4.70	4.65	5.90
28	......	......	......	......	5.22	4.90	4.60	4.60	4.62	4.70	4.65	5.88
29	......	......	......	......	5.22	4.85	4.60	4.60	4.62	4.70	4.65	5.65
30	......	......	......	......	5.15	4.85	4.60	4.60	4.62	4.70	4.65	5.60
31	......	......	......	......	5.15	......	4.60	4.60	......	4.70	......	5.52
1908.												
1	5.40	5.20	5.00	5.28	4.70	4.80	4.50	4.50	4.50	4.50	4.60	4.75
2	5.30	5.18	5.00	5.20	4.70	4.80	4.50	4.50	4.50	4.50	4.60	4.75
3	5.20	5.05	5.00	5.20	4.65	4.80	4.50	4.55	4.50	......	4.60	4.75
4	5.20	4.95	5.00	5.20	4.65	4.80	4.50	4.55	4.50	4.50	4.62	4.75
5	5.18	4.95	5.00	5.15	4.60	4.80	4.50	4.55	4.50	4.50	4.62	4.75
6	5.10	4.95	5.00	5.08	4.60	4.80	4.50	4.55	4.50	4.50	4.65	4.75
7	5.10	4.95	5.00	5.02	4.60	4.80	4.50	4.55	4.50	4.50	4.70	4.75
8	5.00	5.00	5.00	4.92	4.55	4.75	4.50	4.55	4.50	4.48	4.70	4.75
9	5.00	5.00	4.98	4.92	4.55	4.75	4.50	4.55	4.50	4.52	4.70	4.70
10	5.00	5.00	4.95	4.95	4.55	4.75	4.50	4.55	4.50	4.55	4.70	4.70
11	5.00	5.00	4.95	4.95	4.52	4.72	4.50	4.55	4.50	4.55	4.70	4.70
12	4.95	4.95	4.95	4.90	4.55	4.70	4.50	4.55	4.50	4.60	4.70	4.70
13	4.90	4.90	4.95	4.90	4.62	4.65	4.50	4.55	4.50	4.60	4.70	4.70
14	4.90	4.90	4.95	4.85	4.65	4.58	4.50	4.55	4.50	4.60	4.70	4.70
15	4.90	4.90	5.48	4.85	4.65	4.40	4.50	4.55	4.50	4.60	4.70	4.70
16	5.50	4.90	6.45	4.85	4.65	4.50	4.50	4.55	4.50	4.60	4.70	4.70
17	5.85	4.90	6.78	4.85	4.65	4.55	4.50	4.55	4.50	4.60	4.70	4.70
18	6.40	4.90	6.92	4.85	4.65	4.55	4.50	4.55	4.50	4.60	4.70	4.70
19	6.55	4.90	6.70	4.85	4.65	4.55	4.50	4.55	4.50	4.60	4.70	4.70
20	5.92	4.90	6.40	4.85	4.65	4.55	4.50	4.50	4.50	4.60	4.70	4.70
21	5.88	4.90	6.10	4.82	4.65	4.55	4.50	4.50	4.50	4.60	4.70	4.70
22	5.82	4.90	5.98	4.75	4.72	4.50	4.50	4.50	4.50	4.60	4.70	4.70
23	5.90	4.90	5.92	4.75	4.90	4.50	4.50	4.50	4.50	4.60	4.70	4.70
24	5.90	4.90	5.90	4.75	4.90	4.50	4.50	4.50	4.50	4.60	4.72	4.70
25	5.82	4.80	5.80	4.70	4.88	4.50	4.50	4.50	4.50	4.60	4.75	4.70
26	5.65	4.75	5.72	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
27	5.40	4.75	5.68	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
28	5.40	4.78	5.60	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
29	5.38	4.85	5.60	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
30	5.30	......	5.55	4.70	4.85	4.50	4.50	4.50	4.50	4.60	4.75	4.70
31	5.22	......	5.52	......	4.85	......	4.50	4.50	......	4.60	......	4.70

Rating table for Lost River at Olene, Oreg., 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.*
4.40	80	5.10	293	5.80	710	6.50	1,250
4.50	96	5.20	343	5.90	780	6.60	1,340
4.60	116	5.30	398	6.00	850	6.70	1,430
4.70	142	5.40	455	6.10	930	6.80	1,520
4.80	172	5.50	515	6.20	1,010	6.90	1,610
4.90	208	5.60	575	6.30	1,090	7.00	1,700
5.00	248	5.70	640	6.40	1,170		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on thirty-six discharge measurements made in 1907 and 1908, and is fairly well defined between gage heights 4.6 feet and 7.0 feet.

Monthly discharge of Lost River at Olene, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
May 19-31	370	318	350	9,020	B.
June	318	116	227	13,500	B.
July	172	116	142	8,730	B.
August	116	96	109	6,700	B.
September	121	116	117	6,960	B.
October	142	121	128	7,870	B.
November	142	129	140	8,330	B.
December	780	100	216	13,300	B.
The period				74,400	
1908.					
January	1,300	208	494	30,400	B.
February	343	157	221	12,700	B.
March	1,630	228	592	36,400	B.
April	387	142	214	12,700	B.
May	208	100	144	8,850	B.
June	172	93	126	7,500	B.
July	96	96	96.0	5,900	B.
August	106	96	101	6,210	B.
September	96	96	96.0	5,710	B.
October	116	93	110	6,760	B.
November	157	116	141	8,390	B.
December	157	142	146	8,980	B.
The year	1,630	93	207	150,000	

LOST RIVER NEAR MERRILL, OREG.

This station, which was established July 26, 1904, is located 4 miles northwest of Merrill and 7 miles above the junction of the river with Tule Lake.

The data obtained here are used in connection with general reclamation projects under way in this locality. It is expected that storage reservoirs on the headwaters of this stream will make a large portion of the annual flow available during the summer months, and at the same time lower the water surface in Tule Lake, and thereby expose a considerable area of agricultural lands on the northern border of the lake.

The records obtained at this station are fairly reliable when the water surface in the lake is low. When the lake gage registers 9 feet or more, water is backed up the river to the gaging station, and even at lower lake stages winds blowing up the lake produce the same effect.

The year 1907 was a wet year and the water surface in the lake remained above the critical point for a good portion of the year. It was necessary, therefore, to use a method similar to the indirect method for shifting channels to eliminate this backwater effect. This was only partially successful, and discharges after May 31 have been omitted, as the records at the Olene station show closely the amount of water passing this point. It was deemed advisable, therefore, to abandon this station entirely February 28, 1909, in favor of the station at Olene. A comparison of the records at the two stations since May 20, 1907, will reveal somewhat the inaccuracy of the data at Merrill, as there is little or no difference between the flow at the two points as far as can be ascertained from surface conditions. The years 1905 and 1906, however, were dry years and the records at the Merrill were not greatly affected by backwater.

Discharge measurements of Lost River near Merrill, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		*Feet.*	*Sq. feet.*	*Feet.*	*Sec.-ft.*
February 4	Hendricks and Sticksel	147	1,150	12.25	3,500
Do	do	148	1,230	12.75	3,950
February 7	J. Sticksel	228	3,540	16.90	7,430
February 8	do	226	3,260	16.50	7,240
February 9	do	218	2,920	15.00	5,520
Do	do	217	2,850	14.67	4,930
February 26	L. F. Hendricks	114	502	7.35	1,420
March 4	do	111	397	6.50	1,080
March 19	do	150	1,370	13.60	3,970
March 20	do	155	1,490	14.35	4,750
March 21	do	167	1,690	15.65	5,450
Do	do	169	1,740	15.90	5,550
March 22	do	170	1,780	16.05	5,470
March 23	do	162	1,620	15.10	4,980
Do	do	159	1,580	14.88	4,730
March 25	do	143	1,050	11.60	3,000
March 26	do	141	979	11.10	2,690
March 27	do	141	900	10.60	2,470
April 8	do	142	956	11.00	2,620
April 17	do	115	615	8.65	1,530
April 18	do	115	590	8.40	1,460
April 22	do	109	496	7.50	1,040
May 11	Stevens and Ellsworth	111	396	6.36	371
May 18	do	111	394	6.38	340
June 12	C. E. Ellsworth	110	367	6.15	189
June 26	do	110	343	6.10	228
July 2	do	110	349	6.05	255
1908.					
March 17	C. E. Ellsworth	114	492	7.27	1,280
April 9	do	105	250	5.05	200
May 4	Ellsworth and Kimble	105	236	4.82	139
August 21	H. Kimble	85	106	3.65	124
September 23	do	85	80	3.55	118
October 2	do	85	90	3.55	108
October 9	do	85	90	3.55	108
November 27	McGlashan and Kimble	89	91	3.48	117

Daily gage height, in feet, of Lost River near Merrill, Oreg., for 1907 and 1908.

[Clyde Bradley and Mrs. C. W. Lewis, observers.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	4.48	5.7	7.75	11.55	6.7	6.1	6.1	5.5	5.0	4.7	4.7	4.6
2	4.2	7.9	7.4	12.45	6.6	6.2	6.1	5.4	5.0	4.7	4.7	4.6
3	4.15	8.7	6.9	12.1	6.5	6.2	5.9	5.4	5.0	4.7	4.7	4.6
4	4.0	12.4	6.7	11.5	6.5	6.2	5.9	5.4	5.0	4.7	4.7	4.6
5	3.9	15.8	6.6	11.1	6.4	6.3	5.9	5.4	5.0	4.7	4.7	4.6
6	3.8	18.1	6.75	11.55	6.5	6.4	5.8	5.4	5.0	4.7	4.7	4.6
7	3.8	18.25	7.1	10.52	6.5	6.2	5.8	5.4	5.0	4.7	4.7	4.6
8	3.75	16.85	7.1	10.95	6.5	6.2	5.9	5.4	5.0	4.7	4.7	4.6
9	3.7	14.55	7.0	12.1	6.5	6.2	5.8	5.4	5.0	4.7	4.7	4.6
10	3.65	11.55	7.65	12.25	6.3	6.3	5.8	5.3	5.0	4.7	4.6	4.6
11	3.6	9.35	7.85	10.95	6.4	6.45	5.8	5.3	5.0	4.7	4.6	4.6
12	3.6	8.35	7.5	10.1	6.2	6.3	5.8	5.3	5.0	4.7	4.6	4.6
13	3.5	7.9	6.9	9.72	6.3	6.3	5.7	5.3	5.0	4.7	4.6	4.6
14	3.5	7.4	6.75	9.5	6.4	6.0	5.7	5.3	5.0	4.7	4.6	4.6
15	3.55	7.1	6.55	9.15	6.4	6.0	5.8	5.2	5.0	4.7	4.6	4.6
16	3.6	6.8	6.35	8.82	6.45	6.15	5.7	5.2	5.0	4.7	4.6	4.6
17	3.5	6.55	6.4	8.62	6.4	6.2	5.7	5.2	5.0	4.7	4.6	4.6
18	3.5	6.45	7.05	8.38	6.4	6.2	5.7	5.2	5.0	4.7	4.6	4.6
19	3.5	6.5	9.9	8.22	6.3	6.45	5.6	5.2	4.9	4.7	4.6	4.6
20	3.45	6.7	13.75	8.0	6.3	6.15	5.7	5.2	4.9	4.7	4.6	4.6
21	3.45	6.65	15.8	7.85	6.2	6.0	5.6	5.1	4.85	4.7	4.6	4.6
22	3.45	6.7	16.0	7.65	6.25	6.1	5.7	5.1	4.85	4.7	4.6	4.7
23	3.45	6.8	14.95	7.45	6.3	6.1	5.6	5.1	4.85	4.7	4.6	4.7
24	3.45	8.35	13.3	7.3	6.3	6.1	5.6	5.1	4.8	4.7	4.6	4.7
25	3.45	8.6	11.85	7.2	6.3	6.1	5.6	5.1	4.8	4.7	4.6	4.7
26	3.45	7.7	11.05	7.1	6.3	6.1	5.5	5.1	4.8	4.7	4.6	4.7
27	3.4	7.65	10.6	6.95	6.2	6.1	5.5	5.1	4.8	4.7	4.6	5.7
28	3.4	8.05	10.25	6.85	6.2	6.0	5.6	5.1	4.8	4.7	4.6	5.75
29	3.45	......	9.95	6.8	6.3	6.0	5.5	5.0	4.8	4.7	4.6	5.6
30	3.45	......	9.8	6.7	6.25	6.1	5.5	5.0	4.8	4.7	4.6	5.4
31	3.65	......	10.4	......	6.2	......	5.5	5.0	......	4.7	......	5.3
1908.												
1	5.2	5.1	5.0	5.3	5.0	4.6	4.2	3.9	3.6	3.6	3.5	3.5
2	5.1	5.0	5.0	5.3	4.9	4.4	4.2	3.8	3.6	3.6	3.5	3.5
3	5.0	5.0	5.0	5.2	4.7	4.4	4.2	3.8	3.6	3.5	3.5	3.5
4	5.0	5.0	5.0	5.2	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
5	5.0	5.0	5.0	5.2	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
6	5.0	5.0	5.0	5.1	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
7	4.9	5.0	5.0	5.0	4.8	4.5	4.2	3.8	3.6	3.5	3.5	3.5
8	4.9	5.0	5.0	5.0	4.7	4.5	4.1	3.8	3.6	3.5	3.5	3.5
9	4.9	5.0	5.0	5.0	4.7	4.5	4.1	3.8	3.6	3.5	3.5	3.5
10	4.9	5.0	5.0	5.0	4.65	4.5	4.1	3.8	3.6	3.5	3.5	3.5
11	4.9	4.8	5.0	5.0	4.6	4.5	4.0	3.8	3.6	3.5	3.5	3.5
12	4.9	4.9	5.0	5.0	4.7	4.5	4.1	3.8	3.6	3.5	3.5	3.5
13	4.9	4.9	5.0	5.0	4.7	4.5	4.1	3.7	3.6	3.5	3.5	3.5
14	4.8	4.9	5.0	5.0	4.7	4.5	4.2	3.7	3.6	3.5	3.5	3.5
15	4.8	4.9	5.1	5.0	4.7	4.5	3.9	3.7	3.6	3.6	3.5	3.5
16	4.9	4.9	5.8	5.1	4.7	4.5	4.0	3.7	3.6	3.5	3.5	3.5
17	5.45	4.9	7.4	5.1	4.8	4.4	4.0	3.7	3.6	3.6	3.5	3.5
18	6.0	4.9	7.7	5.1	5.0	4.3	4.0	3.7	3.6	3.5	3.5	3.5
19	6.2	4.9	7.5	5.0	4.9	4.3	4.0	3.7	3.6	3.5	3.5	3.5
20	6.1	4.9	6.9	5.0	4.9	4.4	3.9	3.7	3.6	3.5	3.5	3.5
21	5.9	4.9	6.5	5.0	4.7	4.3	3.9	3.7	3.6	3.5	3.5	3.5
22	5.7	4.9	6.2	4.9	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
23	5.7	4.9	6.0	4.9	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
24	5.7	4.9	6.0	4.9	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
25	5.6	4.9	5.8	4.8	4.8	4.3	3.9	3.7	3.6	3.5	3.5	3.5
26	5.5	4.9	5.6	4.8	4.7	4.3	3.9	3.7	3.6	3.5	3.5	3.5
27	5.3	4.9	5.5	4.7	4.7	4.2	3.9	3.7	3.6	3.5	3.5	3.5
28	5.2	4.9	5.5	4.8	4.8	4.2	3.8	3.6	3.6	3.5	3.5	3.5
29	5.2	5.2	5.5	4.8	4.7	4.3	3.8	3.6	3.6	3.5	3.5	3.5
30	5.1	......	5.4	4.9	4.6	4.3	3.8	3.6	3.6	3.5	3.5	3.5
31	5.1	......	5.3	......	4.6	......	3.9	3.6	......	3.5	......	3.5

Daily discharge, in second-feet, of Lost River near Merrill, Oreg., for 1907.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	444	824	1,490	2,800	600	16	180	1,180	856	1,560	360
2	330	1,560	1,380	3,260	540	17	150	1,100	856	1,450	330
3	345	1,870	1,180	3,080	495	18	150	1,060	1,050	1,380	330
4	300	3,680	1,110	2,770	480	19	150	1,080	2,080	1,310	300
5	270	6,300	1,080	2,570	435	20	135	1,140	4,030	1,210	300
6	240	9,000	1,110	2,800	450	21	135	1,130	5,620	1,140	270
7	240	9,200	1,210	2,290	450	22	135	1,140	5,780	1,080	270
8	225	7,250	1,210	2,500	420	23	135	1,180	4,870	984	300
9	210	5,160	1,140	3,080	420	24	135	1,140	3,740	920	300
10	195	3,210	1,340	3,160	360	25	135	1,830	2,970	872	285
11	180	2,140	1,410	2,470	360	26	135	1,490	2,570	824	270
12	180	1,740	1,280	2,120	300	27	120	1,470	2,330	760	240
13	150	1,560	1,080	1,950	330	28	120	1,620	2,160	696	240
14	150	1,380	984	1,830	360	29	135	....	2,050	664	270
15	165	1,280	920	1,700	360	30	135	....	1,990	600	255
						31	195	....	2,250	....	240

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

Monthly discharge of Lost River near Merrill, Oreg., for 1907.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
January	444	120	191	11,700	C.
February	9,200	824	2,600	144,000	B.
March	5,780	856	2,040	125,000	B.
April	3,260	600	1,790	107,000	B.
May	600	240	352	21,600	B.

NOTE.—Discharges have not been computed after May 31, 1907, as the records at Olene, which are much better than those at this station, show practically the same discharge as at Merrill.

TULE LAKE NEAR MERRILL, OREG.

This station was established May 17, 1904. It is located at J. F. Adams's ranch near the mouth of Lost River. The elevation of the zero of the gage has been taken as 4,048.21. When the station was established the gage was referenced to a bench mark on a juniper post near by. The bench mark at that time was 13.7 feet above the zero of the gage. On October 21, 1904, this elevation was verified. On May 11, 1907, the elevation of the same bench mark was found to be 12.87 feet above zero of the gage and was independently verified on June 11, 1907, and again on November 27, 1908. It appears, therefore, that some time between October, 1904, and May, 1907, gage was raised 0.83 foot. This was probably due to the action of ice in the lake, although nothing of this kind has been observed since that time. Just when it occurred it has been impossible to ascertain, and a graph of the heights has failed to reveal any critical points that would account for a sudden change. It is therefore likely that the gage was raised a little at a time during the winters of 1905–6 and 1906–7.

On account of this error the gage heights prior to May, 1907, should not be used for any refined studies.

Daily gage height, in feet, of Tule Lake near Merrill, Oreg., for 1907 and 1908.

[J. F. Adams, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	7.35	7.4	9.05	10.5	11.35							
2											9.7	
3								10.5				
4			9.1									
5										9.75		
6							10.95					
7									10.05			9.6
8	7.3			10.9	11.3	11.3						
9											9.7	
10		8.6						10.4				
11												
12			9.3							9.75		
13							10.85					
14									9.95			
15												
16	7.3			11.15	11.3	11.3					9.65	9.55
17								10.3				
18												
19		8.8								9.75		
20							10.75					
21			9.9						9.8			9.6
22				11.3								
23	7.35				11.3						9.6	
24						11.15		10.25				
25												
26										9.75		
27							10.65					
28		9.05							9.75			9.65
29												9.65
30				11.35		11.0					9.6	9.7
31	7.4		10.5		11.3			10.15				9.7
1908.												
1	9.7	9.9						8.7				
2	9.7				9.9							
3	9.75									7.75		
4	9.8			10.1			9.2					
5									8.1			7.5
6						9.6						
7			9.95								7.6	
8		9.9						8.6				
9					9.85							
10										7.7		
11	9.8			10.05			9.15					
12									8.0			7.5
13						9.45						
14			9.95								7.6	
15		9.9						8.45				
16					9.8							
17										7.65		
18	9.85			10.0			9.0					
19									7.85			7.4
20						9.35						
21			10.0								7.5	
22		9.9						8.2				
23					9.75							
24										7.65		
25	9.9			9.95			8.9					
26									7.8			7.35
27						9.25						7.35
28			10.1								7.5	7.35
29		9.95						8.1				7.35
30					9.7							7.35
31										7.6		7.35

MILLER CREEK NEAR LORELLA, OREG.

This station was established August 10, 1904. It is located at the lower end of Horsefly Valley, which is intended for use as a storage reservoir by the United States Reclamation Service in its general work in this locality. The gaging station is located in sec. 12, T. 39 S., R. 13 E., 9 miles northeast of Lorella.

During the winter months the river freezes over completely, and the data obtained at such periods are not reliable. As the total annual flow, however, is the important feature, a large error during such periods is admissible without affecting the desired results.

The conditions at the station during the open season are favorable for good results. A riffle controls the flow just below the station. The datum of the gage has not been altered since it was installed, and during a large portion of the time gage heights have been obtained by an automatic Friez gage.

The surface flow entirely disappears during the summer months.

Discharge measurements of Miller Creek near Lorella, Oreg., in 1907 and 1908.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1907.		Feet.	Sq. ft.	Feet.	Sec.-ft.
February 8	L. F. Hendricks	138	166	8.02	505
Do	do	135	125	7.70	332
April 13	do	136	170	7.95	466
April 25	do	80	47	7.00	80
May 14	Stevens and Ellsworth	83	43	6.75	57
June 6	C. E. Ellsworth	25	16	6.20	5.8
June 21	do	45	23	6.41	16
1908.					
February 22	C. E. Ellsworth	29	20	6.32	12
March 19	do	125	111	7.56	298
April 7	do	50	29	6.60	35
May 1	Ellsworth and Kimble	25	14	6.10	2.0
November 24	Kimble and McGlashan	27	11	6.09	1.5

Daily gage height, in feet, of Miller Creek near Lorella, Oreg., for 1907 and 1908.

[O. R. Stewart, observer.]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907.												
1	6.45	7.70	7.30	......	6.77	6.26	......	......	......	......	6.18	......
2	6.20	8.90	7.30	......	6.73	6.25	......	......	......	......	6.20	......
3	6.10	11.55	7.25	......	6.70	6.24	......	......	......	......	6.20	......
4	6.10	13.00	7.20	......	6.70	6.20	......	......	......	......	6.20	......
5	6.10	14.00	7.35	......	6.68	6.18	......	......	......	......	6.19	......
6	6.10	12.00	7.40	8.10	6.65	6.22	6.00	......	......	......	6.19	......
7	6.10	10.00	7.40	9.50	6.65	......	......	......	......	......	6.18	6.20
8	6.10	7.70	7.85	......	6.65	6.35	......	......	......	......	......	......
9	6.10	7.85	7.90	......	6.63	......	......	......	......	......	6.10	......
10	6.10	7.65	7.55	......	6.58	......	......	......	......	......	6.10	......
11	6.10	7.55	7.50	......	6.70	......	......	......	......	......	6.10	......
12	6.10	7.45	7.30	......	6.78	......	......	......	......	......	6.10	......
13	6.10	7.30	7.35	8.00	6.81	......	......	......	......	......	6.10	......
14	6.10	7.25	7.20	......	6.75	......	......	......	......	......	6.10	6.10
15	6.10	7.20	7.20	......	6.66	7.00	......	......	......	......	6.10	......

Daily gage height, in feet, of Miller Creek near Lorella, Oreg., for 1907 and 1908—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907												
16	6.10	7.20	7.20	......	6.58	......	......	......	......	......	6.10	......
17	6.10	7.35	8.00	......	6.50	......	......	......	......	......	6.12	......
18	6.10	7.50	9.80	......	6.50	......	......	......	......	......	6.11	......
19	6.10	7.40	10.15	......	6.58	......	......	......	......	......	6.11	......
20	6.10	7.35	9.80	7.10	6.62	......	......	......	......	......	6.11	......
21	6.10	7.30	9.40	7.10	6.65	......	......	......	......	......	6.11	6.40
22	6.10	8.00	9.00	7.10	6.75	6.30	......	......	......	......	6.16	......
23	6.20	7.80	8.70	7.05	6.70	......	......	......	......	......	6.20	8.00
24	6.20	7.40	8.30	7.00	......	......	......	......	......	......	......	8.00
25	6.30	7.80	7.90	7.00	6.70	......	......	......	......	......	......	7.60
26	6.30	7.85	7.60	6.95	6.65	......	5.70	......	......	6.12	......	7.15
27	6.30	7.70	7.75	6.90	6.57	......	......	......	......	6.15	......	7.15
28	6.30	7.40	7.65	6.88	6.49	......	......	......	......	6.20	......	7.05
29	6.65	......	7.95	6.85	6.42	6.10	......	......	......	6.17	......	......
30	7.20	......	8.50	6.80	6.35	......	......	......	......	6.20	6.10	......
31	7.95	......	8.40	......	6.29	......	......	......	......	6.20	......	......
1908.												
1	......	6.20	......	6.70	6.10	......	......	......	......	......	......	6.01
2	......	......	......	6.70	6.07	......	......	......	......	......	......	......
3	......	......	......	6.60	6.05	6.00	......	......	......	......	......	......
4	6.50	......	......	6.50	6.04	......	......	......	......	......	......	......
5	......	......	......	6.50	6.05	......	......	......	......	......	......	6.02
6	......	......	......	6.51	6.09	......	......	......	......	......	......	......
7	......	......	6.70	6.55	6.09	5.90	......	......	......	......	......	......
8	......	6.20	......	6.54	6.05	......	......	......	......	......	......	......
9	......	6.16	......	6.50	......	......	......	......	......	......	......	......
10	......	6.00	......	6.44	6.21	......	......	......	......	......	......	......
11	6.40	6.15	......	6.40	6.22	......	......	......	......	......	......	......
12	......	6.18	......	6.40	6.22	......	......	......	......	......	......	......
13	......	6.20	......	6.40	6.23	......	......	......	......	......	......	......
14	......	......	7.60	6.38	6.18	5.90	......	......	......	......	......	......
15	......	6.40	......	6.36	6.12	......	......	......	......	......	......	......
16	......	6.35	......	6.35	5.90	......	......	......	......	......	......	......
17	......	6.30	......	6.50	6.50	......	......	......	......	......	......	......
18	7.30	6.30	......	6.40	......	......	......	......	......	......	......	......
19	7.30	6.30	7.60	6.39	......	......	......	......	......	......	......	......
20	7.30	6.30	......	6.32	......	......	......	......	......	......	......	......
21	7.32	......	6.90	6.28	......	......	......	......	......	......	......	......
22	7.34	6.32	......	6.26	......	......	......	......	......	......	......	......
23	7.37	......	......	6.24	......	......	......	......	......	......	......	......
24	......	......	......	6.24	6.60	......	......	......	......	......	6.09	......
25	7.40	......	......	6.23	......	......	......	......	......	......	......	......
26	......	......	......	6.22	......	......	......	......	......	......	......	......
27	......	......	......	6.22	......	......	......	......	......	......	......	......
28	......	......	6.70	6.15	......	......	......	......	......	......	......	......
29	......	6.50	......	6.10	......	......	......	......	......	......	......	......
30	......	......	......	......	......	......	......	......	......	......	......	......
31	......	......	6.70	......	......	......	......	......	......	......	......	......

NOTE.—The creek was dry from about July 11 to October 25, 1907, and from July 1 to November 10, 1908. Creek frozen at gage December 15 to 28, 1907, and November 20 to December 31, 1908. It does not freeze except in very cold weather at low stages.

Rating table for Miller Creek near Lorella, Oreg., 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.*
5.90	0	7.20	138	8.50	775	10.60	2,490
6.00	0.3	7.30	170	8.60	835	10.80	2,690
6.10	1.7	7.40	206	8.70	900	11.00	2,900
6.20	5.0	7.50	246	8.80	965	11.20	3,120
6.30	10.0	7.60	290	8.90	1,035	11.40	3,360
6.40	16.6	7.70	337	9.00	1,110	11.60	3,600
6.50	25	7.80	387	9.20	1,260	11.80	3,840
6.60	35	7.90	437	9.40	1,415	12.00	4,080
6.70	46	8.00	490	9.60	1,575	13.00	5,310
6.80	59	8.10	545	9.80	1,745	14.00	6,730
6.90	73	8.20	600	10.00	1,920		
7.00	90	8.30	655	10.20	2,100		
7.10	112	8.40	715	10.40	2,290		

NOTE.—This table is not applicable for ice or obstructed-channel conditions. It is based on discharge measurements made during 1904 to 1908 and is well defined.

Monthly discharge of Miller Creek near Lorella, Oreg., for 1907 and 1908.

Month.	Discharge in second-feet.			Run-off (total in acre-feet).	Accuracy.
	Maximum.	Minimum.	Mean.		
1907.					
January	464	1.7	24.3	1,490	B.
February	6,730	138	1,020	56,600	A.
March	2,060	138	543	33,400	A.
April	1,500	59	448	26,700	B.
May	60	9.5	39.0	2,400	A.
June	90	1.5	26.6	1,580	B.
July	1.3	0	.17	10.4	C.
August	0	0	0	0	
September	0	0	0	0	
October	5.0	0	.80	49.2	C.
November	5.0	1.7	3.02	180	C.
December	490	1.7	71.9	4,420	B.
The year	6,730	0	181	127,000	
1908.					
January	206	16.6	95.4	5,870	B.
February	25	.3	10.1	581	C.
March	290	28	123	7,560	B.
April	46	1.7	17.5	1,040	B.
May	35	0	13.9	855	B.
June	7	0	.39	23	C.
July	0	0	0	0	
August	0	0	0	0	
September	0	0	0	0	
October	0	0	0	0	
November	....	0	.48	29	D.
December	....	....	.56	34	D.
The year	290	0	21.8	16,000	

NOTE.—Discharges for November and December estimated from comparison with Lost River at Clean Lake.

EVAPORATION STATION AT KENO, OREG.

This station was established August 1, 1904, to determine the evaporation from a water surface, and has been maintained continuously since that time. During the winter months, when ice interferes and when heavy upstream winds are blowing, it is impossible to obtain observations. The records are therefore somewhat irregular.

Evaporation is measured by means of a galvanized-iron pan, 3 feet square by 18 inches deep, floated in the river to within about 2 inches of the top of the pan. In the center of the pan is a needle point, to which the water surface can be adjusted with nicety. The observer has a galvanized-iron cup which holds a sufficient quantity of water to raise the water in the pan one-tenth of an inch. At each visit of the observer the water surface is adjusted to the point. At the time of the next observation, if no rain has occurred, it is only necessary to count the number of cupfuls required to fill the pan to the point again. This gives the evaporation in inches. A rain gage is also maintained in connection with the pan, and corrections are made if any rain has occurred between observations.

This method will determine directly the evaporation from the pan. The only source of error involved lies in the possibility that evaporation from this pan is not representative of the evaporation from a larger area. The method of course does not determine the rate of evaporation, but as the total quantity during a month or in the year is, as a rule, all that is required, it is believed that the errors are compensating and that the data are sufficiently accurate for all practical purposes.

Evaporation, in inches, from water surface at Keno, Oreg.

[T. A. Grubb, observer.]

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1907	....	....	....	....	[a]1.07	3.29	4.70	6.30	4.05	2.42	1.17	[b]0.90
1908	....	0.83	1.20	2.81	3.38	5.60	8.01	7.40	4.62	2.17	.89	[c].11

[a] May 23 to 31 only.
[b] Partial record, pan frozen from December 12, 1907, to February 10, 1908.
[c] Partial record, pan frozen at intervals.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements have been made on streams in California during 1907 and 1908. They are arranged in the same order of drainage basins as the regular stations:

THE GREAT BASIN IN CALIFORNIA.

Miscellaneous discharge measurements in Mono Lake drainage basin, 1907.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
July 22	Rush Creek	Mono Lake	Road crossing near lake	....	430
Do	Levining Creek	.....do	.....do	....	248

Miscellaneous discharge measurements in Owens River drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
1907.				*Feet.*	*Sec.-ft.*
July 24	Owens River	Owens Lake	Thompson ranch, Long Valley.		217
1908.					
May 18	do	do	Citrus, Cal		44
May 26	do	do	do		46
June 3	do	do	do		40
May 18	do	do	Alabama Hills		50
May 26	do	do	do		51
June 3	do	do	do		45
May 18	do	do	Mount Whitney bridge near Lone Pine, Cal.		53
May 27	do	do	do		54
June 3	do	do	do		49
July 23	do	do	do	4.0	146
August 7	do	do	do	5.7	436
August 9	do	do	do	5.95	483
August 18	do	do	do	4.45	220
September 10	do	do	do	3.52	80
September 25	do	do	do	4.26	180
October 18	do	do	do	4.75	255
October 28	do	do	do	5.3	355
November 21	do	do	do	5.5	381
1907.					
July 18	Hilton Creek	Owens River	Long Valley		44
Do	Convict Creek	do	do		188
July 19	Hot Creek	do	do		120
July 22	Magee Creek	do	do		141
July 23	Crooked Creek	do	do		15
March 12	Pine Creek	do	Mouth of canyon, Round Valley.		25
January 24	Horton Creek	do	Round Valley-Bishop road crossing.		11
March 11	do	do	do		2
1908.					
June 19	do	do	Round Valley-Bishop road crossing.		6.6
July 16	do	do	do		12
August 3	do	do	do		20
August 25	do	do	do		6.2
September 16	do	do	do		8.6
October 7	do	do	do		5.3
October 22	do	do	do		13
November 6	do	do	do		12
November 25	do	do	do		13
June 19	Magee Creek	do	Road crossing Round Valley		2
July 16	do	do	do		3.7
1907.					
March 8	Coyote Creek	Bishop Creek	At Butler ranch, ½ mile above junction with Bishop Creek.		0.3
April 29	do	do	do		16
February 8	Fish Springs	Owens River	At outlet of springs		25
January 27	Taboose Creek	do	Upper road crossing, 2 miles above regular gaging station.		3.4
1908.					
April 8	Seeley Springs	do	Outlet springs near Charlies Butte.		1.3
May 22	do	do	do		1.4
June 2	do	do	do		1.1
June 12	do	do	do		1.3
July 29	do	do	do		1.8
November 25	do	do	do		1.3
1907.					
February 19	Division Creek	do	Mouth of canyon, 3½ miles above regular gaging station.		13
Do	Black Rock Springs	do	Outlet springs near Independence.		27
1908.					
March 12	do	do	Outlet spings near Independence.		24

Miscellaneous discharge measurements in Owens River drainage basin, 1907 and 1908—Continued.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
1907.					
May 4	Symmes Creek	Owens River	2 miles west of county road near Independence.		2
May 23	do	do	do		9.8
June 15	do	do	do		13
July 10	do	do	do		15
August 14	do	do	do		1.8
August 30	do	do	do		1.1
1908.					
May 9	do	do	do		2.1
June 23	do	do	do		2.3
1907.					
May 21	Carroll Creek	Owens Lake	Road crossing on Lone Pine-Olancha road.		5.4
June 4	do	do	do		7.5
June 25	do	do	do		4.2
July 8	do	do	do		2
1908.					
May 28	do	do	do		1.4
1907.					
January 31	Cottonwood Creek	do	Below junction of South Fork.		13
September 28	do	do	At intake Los Angeles Aqueduct pipe line.		13
November 8	do	do	do		25
November 23	do	do	do		17

Discharge measurements of canals in Owens River drainage basin, 1907 and 1908.

Date.	Canal.	Diversion from—	Locality.	Discharge.
				Sec.-ft.
1907.				
April 13	Williams	Pine Creek	Williams ranch	5.0
April 30	Owens River	Owens River	Sec. 27, T. 6 S., R. 32 E., Mount Diablo meridian.	42
Do	Bishop Creek	do	Below waste gate, 3 miles above Bishop.	97
Do	Farmers	do	House of Robt. Love, 3 miles above Bishop.	29
May 13	McNally	do	Intake 3¾ miles north of Bishop, Cal.	61
May 1	Geo. Collins	do	Bridge 3 miles east of Bishop, Cal.	9.9
February 9	Big Pine	do	Near Center School	31
May 1	do	do	do	38
Do	Rawson	do	At county bridge 2½ miles east of Bishop.	36
May 11	Dell	do	In flume 3 miles below intake	26
January 22	Blake and Miller	Big Pine Creek	½ mile below head gate	50
May 16	do	do	do	12.2
1908.				
May 16	Stevens	Owens River	Citrus, Cal.	9.7
May 26	do	do	do	9.7
June 3	do	do	do	11
May 16	East Side	do	do	9.1
May 26	do	do	do	12
June 3	do	do	do	15

Miscellaneous discharge measurements of streams that discharge into the Mohave Desert, 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
October 13	Little Rock Creek	Mohave Desert	3 miles above Little Rock, in canyon.	1.1
October 14	Rock Creek	do	$1\frac{1}{2}$ miles above Shoemaker, in canyon.	6.5
Do	do	do	Road crossing below junction of Pallett Creek.	9.4
Do	Pallett Creek	Rock Creek	At road crossing near schoolhouse, above junction with Rock Creek.	1.8

NOTE.—The above measurements include all diverted water and represent total flow of streams. These creeks lie east of Palmdale, Los Angeles County, Cal.

SOUTH PACIFIC OCEAN DRAINAGE AREA.

Miscellaneous discharge measurements in San Luis Rey River drainage basin, 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
May 21	San Luis Rey River.	Sonth Pacific Ocean.	At proposed dam site, Warner's ranch in sec. 10, T. 11 S., R. 2 E., San Bernardino meridian.	5.2

Miscellaneous discharge measurements in Santa Margarita River drainage basin, 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
July 12	Temecula River	Santa Margarita River.	Old gaging station near Temecula, Cal.	[a] 2.6

[a] Gage height, 6.12 feet.

Miscellaneous discharge measurements in Santa Ana River drainage basin, 1907.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
September 18	Mill Creek	Santa Ana River	Below power plant No. 1, Edison Co.	[a] 33
September 19	Plunge Creek	do	Mouth of canyon, East Highland	[a] 3
Do	City Creek	do	Mouth of canyon, Highland	[a] 4.6
September 17	East Twin Creek	do	Mouth of canyon, near Arrowhead Hotel.	[a] 2.3
Do	Waterman Canyon, or West Twin Creek.	do	do	[a] 2.0
June 26	Mill Creek	do	Forest Home, above upper diversion, Edison Electric Co.	[a] 61
August 23	Chino Creek	do	Wagon bridge, Rincon road crossing	2.6
Do	Santa Ana River	Main stream	Wagon bridge, Rincon, Cal.	63

[a] Includes all diversions and represents total flow of creek.

Miscellaneous discharge measurements in Los Angeles River drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
1907.				*Sec.-ft.*
March 5	Los Angeles River.	Main stream	Seventh Street Bridge, Los Angeles, Cal.	3,200
April 17	Arroyo Seco	Los Angeles River.	Mouth of canyon, below junction Millard Canyon.	[a]40
May 14	do	do	do	[a]18
1908.				
April 17	do	do	do	[a]5
July 14	do	do	1 mile above junction Millard Canyon.	[a].3

[a] Includes all diverted water and represents total flow of stream.

SAN FRANCISCO BAY DRAINAGE AREA.

Miscellaneous discharge measurements in Sacramento River drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
Oct. 21, 1907[a]	Old Cow Creek	Cow Creek	Sec. 12, T. 32 N., R. 1 W., Mount Diablo meridian.	35.8
June 24, 1907[a]	South Fork Cow Creek.	do	Sec. 32, T. 32 N., R. 1 W., Mount Diablo meridian.	88.8
Oct. 21, 1907[a]	do	do	do	34.6
June 12, 1907	Stony Creek	Sacramento River	Near Rockville, above junction with Little Stony Creek.	157
June 3, 1908	do	do	do	106
June 9, 1908	do	do	do	82
Do	do	do	At Rockville	88
June 10, 1908	do	do	do	99
June 12, 1907	Little Stony Creek.	Stony Creek	Above Rockville and above junction with Stony Creek.	22
June 3, 1908	do	do	do	8.5
June 9, 1908	do	do	do	8.5
June 12, 1907	Briscoe Creek	do	1 mile above Elk Creek post-office	12
June 3, 1908	do	do	do	4.0
June 10, 1908	do	do	do	3.1
June 12, 1907	Elk Creek	do	Near Elk Creek post-office and above junction with Stony Creek.	7.7
June 3, 1908	do	do	do	1.8
June 10, 1908	do	do	do	.7
June 12, 1907	Salt Creek	do	2 miles below Elk Creek	2.4
June 3, 1908	do	do	do	.91
June 10, 1908	do	do	do	.25
June 12, 1907	Grindstone Creek	do	½ mile above junction with Stony Creek.	94
June 3, 1908	do	do	do	78
June 10, 1908	do	do	do	64

[a] These measurements were furnished by R. E. Johnson, C. E.

KLAMATH RIVER DRAINAGE BASIN.

Miscellaneous measurements in drainage basin of Klamath River proper, 1907.

Date.	Stream.	Tributary to—	Locality.	Discharge.
				Sec.-ft.
July 1, 1907	Klamath River	North Pacific Ocean	Words Bridge, sec. 28-29, T. 48 N., R. 4 W., Cal.	4,000
June 30, 1907	Fall Creek	Klamath River	0.8 mile above mouth, sec. 30, T. 48 N., R. 4 W., Cal.	59
July 3, 1907	Jenny Creek	do	Grieve's ranch, sec. 22 or 27, T. 40 S., R. 4 E., Oreg.	26
June 26, 1907	Shasta River	do	4 miles northeast Yreka, Cal., sec. 1, T. 45 N., R. 7 W.	250

Miscellaneous measurements in Upper Klamath Lake drainage basin, 1907 and 1908.

Date.	Stream—	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Aug. 6, 1907	Wood River	Upper Klamath Lake.	Fort Klamath, Oreg		295
Aug. 24, 1907	do	do	do		391
Sept. 16, 1907	do	do	do	8.40	338
Oct. 6, 1907	do	do	do	8.50	330
Mar. 3, 1908	do	do	do	8.50	318
Apr. 28, 1908	do	do	do	8.55	330
May 16, 1908	do	do	do	8.40	314
July 16, 1908	do	do	do	8.50	357
Sept. 26, 1908	do	do	do	8.30	279
Oct. 18, 1908	do	do	do	8.30	306
Aug. 7, 1907	Anna Creek	do	Sec. 16, T. 33 S., R. 7 E		62
May 15, 1908	do	do	do		62
Sept. 20, 1908	do	do	4 miles below Arants		45
Do	Anna Creek Spring.	Anna River	Arants		2.7
Aug. 6, 1907	Fort Creek	Wood River	Sec. 27, T. 33 S., R. 6 E		94
Apr. 28, 1908	do	do	2 miles southeast of Fort Klamath.	−2.31	115
July 16, 1908	do	do	do	−3.40	95
Sept 26, 1908	do	do	do	1.10	94
Oct. 18, 1908	do	do	do	1.10	95
Aug. 7, 1907	Crooked River	do	Klamath Agency, Oreg		41
Apr. 28, 1908	do	do	do	−[a]2.50	52
May 15, 1908	do	do	do	−[a]1.40	52
July 16, 1908	do	do	do	−[a]2.8	47
Sept. 25, 1908	do	do	do	.70	52
Oct. 17, 1908	do	do	do	.95	55
Aug. 7, 1907	Tecumseh Creek	Crooked River	½ mile north of Klamath Agency, Oreg.		20
Apr. 28, 1908	do	do	do		23
May 15, 1908	do	do	do		25
July 16, 1908	do	do	do		28
Sept. 25, 1908	do	do	do		29
Oct. 17, 1908	do	do	do		30
Aug. 7, 1907	Beetles Rest Springs.	Tecumseh Creek	do		25
Mar. 23, 1908	do	do	do		26
Apr. 27, 1908	do	do	do		25
Aug. 6, 1907	Sevenmile Creek	Upper Klamath Lake.	Sec. 28, T. 33 S., R. 6 E		94
Oct. 19, 1908	do	do	do		57
Aug. 6, 1907	Crane Creek	do	Sec. 29, T. 33 S., R. 6 E		11
Aug. 5, 1907	Threemile Creek	do	Sec. 11, T. 34 S., R. 6 E		[b]2
Do	Cherry Creek	do	Sec. 23, T. 34 S., R. 6 E		19
Aug. 3, 1907	Jones Creek	do	Sec. 9, T. 36 S., R. 6 E		7.7
Do	Moss Creek	do	Sec. 32, T. 36 S., R. 7 E		[b]1.0
Do	Rock Creek	do	Sec. 9, T. 37 S., R. 7 E		6.8
Aug. 4, 1907	Fourmile Creek	do	Sec. 4, T. 36 S., R. 5 E		2.3
Aug. 7, 1907	Williamson River	do	Chillaquin Bridge, above mouth of Sprague River.		513
Oct. 7, 1907	do	do	do		507
Oct. 20, 1908	do	do	do		692
Apr. 29, 1908	do	do	Below mouth of Sprague River.	3.88	2,000
Aug. 8, 1907	do	do	4 miles above mouth		985
Oct. 5, 1907	do	do	do	2.20	960
Sept. 27, 1908	Spring River	Williamson River	Strattons Camp	1.25	473
Oct. 7, 1907	Sprague River	do	5 miles below Yainax Agency, Oreg.	13.55	290
Oct. 21, 1908	do	do	do	13.5	315
May 21, 1908	Main Klamath project canal.	Upper Klamath Lake.	Klamath Falls, Oreg		66
Nov. 11, 1908	Moore Bros. power flume.	Link River	do		65
Nov. 21, 1908	do	do	do		65

[a] Below top of bridge plank marked with cross. [b] Estimated.

Miscellaneous measurements in lower Klamath Lake drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Aug. 20, 1907	Willow Creek	Lower Klamath Lake	Brownell, Cal		2.8
May 6, 1908	do	do	do		10
July 3, 1908	do	do	do		15
Nov. 8, 1908	do	do	do		13
Nov. 28, 1908	Fords Springs	Willow Creek	do		2.0
May 7, 1908	Sheepy Creek	Lower Klamath Lake	Near mouth, Dorris, Cal		32
July 4, 1908	do	do	do		34
Nov. 9, 1908	do	do	do		40
Aug. 20, 1907	Cottonwood Creek	do	Sec. 14, T. 47 N., R. 8 E., Cal.	1.85	13
May 6, 1908	do	do	J. F. ranch, Brownell, Cal		[a] 16
July 3, 1908	do	do	do		[a] 21
Nov. 8, 1908	do	do	do		[a] 14
Aug. 20, 1907	Slow Creek	do	Sec. 11, T. 47 N., R. 1 E		[b] 2.0
May 6, 1908	Dorris Creek	do	Dorris, Cal		8.0
July 2, 1908	do	do	do		7.6
Nov. 8, 1908	do	do	do		6.5

[a] Includes flow in two irrigating ditches.
[b] Estimated.

Miscellaneous measurements in Tule Lake drainage basin, 1907 and 1908.

Date.	Stream.	Tributary to—	Locality.	Gage height.	Discharge.
				Feet.	*Sec.-ft.*
Mar. 17, 1908	Lost River	Tule Lake	10 miles above Merrill		1,300
May 13, 1907	East Fork of Lost River.	Lost River	Sec. 3, T. 48 N., R. 7 E., Cal.		2.0
May 16, 1908	Olene Springs	do	Olene		2.9
Apr. 13, 1908	Tule Lake outlet		Scorpion Point, near Cornell, Cal.		[a] 14.4
Apr. 23, 1908	do		do		[a] 14.4
May 3, 1908	do		do		[a] 16.4
May 12, 1908	do		do		[a] 14.2
June 10, 1908	do		do		[a] 11.9
June 26, 1908	do		do		[a] 12.8
July 10, 1908	do		do		[a] 14.4
Dec. 7, 1908	do		do		[a] 33
Dec. 23, 1908	do		do		[a] 29

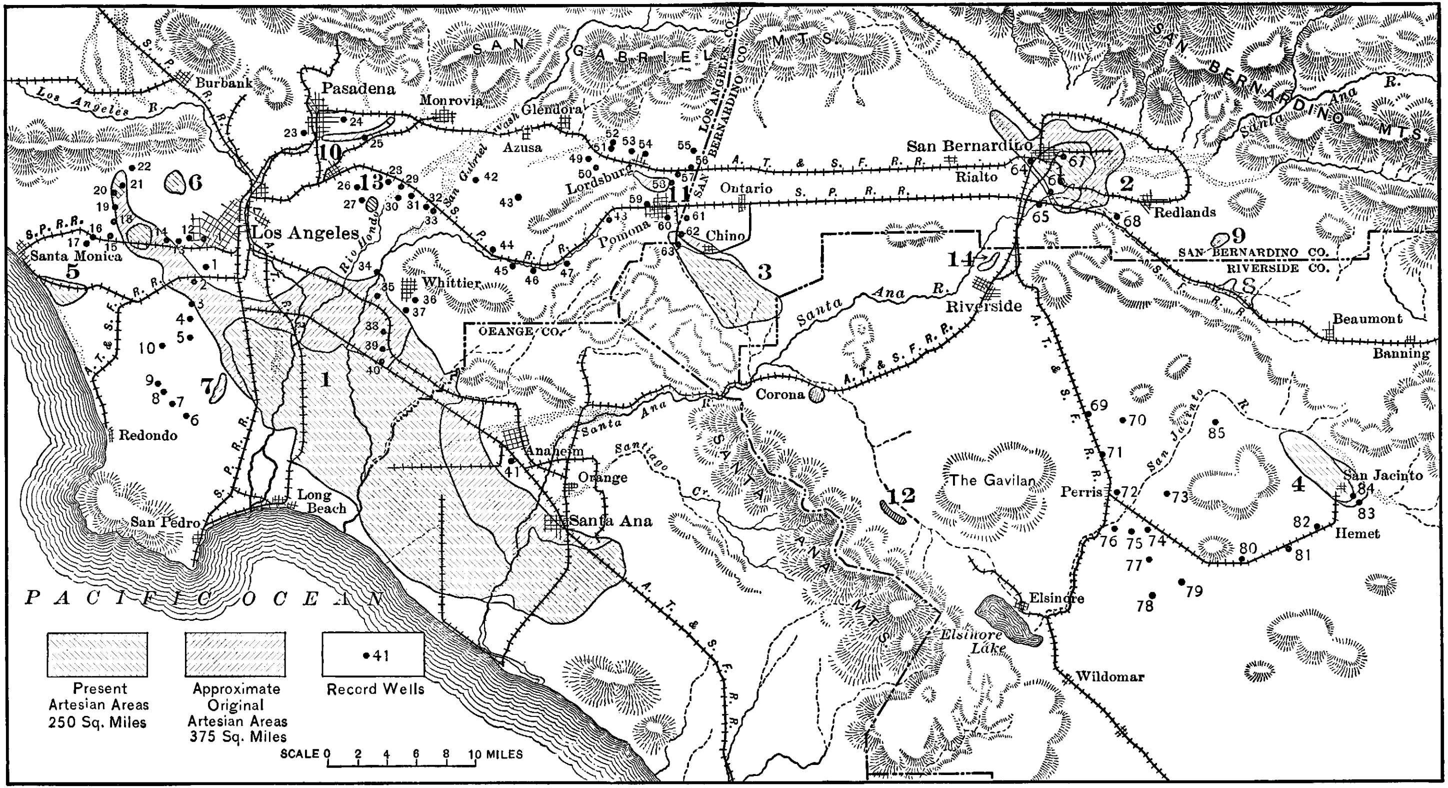
[a] During 1908 the Reclamation Service excavated two holes on the south shore of the lake, about 20 feet from the edge of the water. These holes were connected with the lake and these measurements show the amount of water flowing out through the lava beds.

FLUCTUATIONS IN GROUND-WATER LEVELS IN THE VALLEY OF SOUTHERN CALIFORNIA.

By W. C. MENDENHALL.

Water-Supply Paper 213 contains a chapter on the variations of water level in wells in southern California. In this chapter were assembled the results of measurements made during 1904, 1905, and 1906, as an incident in the study of the valuable ground waters of this part of the State, the use made of them, and the effects of this use on the permanence of the supply.

The chief purpose of these observations was to supply data for use in specific studies of conditions controlling the occurrence and distribution of the ground waters in definite areas in southern California, and the facts assembled have been used and will continue to be used



MAP OF VALLEY OF SOUTHERN CALIFORNIA, SHOWING LOCATION OF WELLS SELECTED TO SHOW GROUND-WATER CONDITIONS.

in generalized form for this original purpose. It has been thought best, however, to publish the details of such measurements in these annual progress reports, in order that they may thus be made available, at the earliest date possible, for engineers and for the courts in the suits constantly before them on questions involving ground as well as surface waters.

The measurements assembled here form a continuation of those published in Water-Supply Paper 213. They were made at irregular intervals during 1907 and 1908 on the same wells that were measured during the earlier period, except a few that had become inaccessible.

The rainfall in the winters of 1904–5, 1906–7, and 1907–8 was well above the average for southern California. In these periods, therefore, the ground-water levels should have shown a marked recovery from the low stages reached at the close of the dry decade beginning with 1893. During the first two of these seasons the recovery was disappointing, the excess rainfall apparently being nearly all required to saturate the thoroughly dry surface zone in the drainage basins, or else, because of a distribution of the storms that was not most advantageous, a large part of the excess that should have served to restore the underground reservoirs escaped to the sea in floods. But the cumulative effect of the continued wet winters became distinctly manifest during the season of 1906–7 in many of the important wells and was observed also during the succeeding winter. The improvement of course has not been uniform, because conditions have not been uniform, and, more important still, it has not been universal. A few unfavorably situated wells have exhibited practically continuous slow declines throughout this four-year period of favorable conditions. On the other hand, in some important sections the recovery has been very striking.

Because of the insufficiency of funds and the extension of ground-water studies over other fields, it has not been possible to make as many measurements in this region during 1907 and 1908 as during the earlier years, hence the details of the rise and fall of the ground-water plane are not shown, but only its general tendencies. The results, however, although insufficient to serve as a basis for a close study of the character of the fluctuations and their immediate relation to the various factors of direct control, such as floods, nevertheless indicate to each of the communities in which records wells have been selected, the essential facts of improvement or deterioration in conditions.

Plate VII shows the location of the wells whose records are given in the following pages. The numbers correspond to those on the map.

Variations of water level in wells in southern California.

1. R. Kidson, three-fourths mile northeast of Slauson.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 5	46	3
May 1	45	4
August 21	46	2
December 24	45	9
1908.		
April 29	46	1
June 26	46	4
October 20	47	5

2. Chinese Gardeners, one-half mile southwest of Slauson.

1907.		
February 5	23	8
May 1	22	½
August 21	24	10
December 24	23	1½
1908.		
April 29	23	3
June 26	25	1
October 20	24	10
December 17	24	8

3. Eliza Connelly, 1½ miles north of Sunnyside.

1907.		
February 5	22	7
May 1	22	7
August 21	23	10
1908.		
April 29	23	5
June 26	24	6
October 20	24	8
December 17	24	4

4. Mr. Till, 2½ miles south of Slauson.

1907.		
February 5	30	
May 1	29	4½
August 21	30	10
December 24	31	2
1908.		
April 29	31	2
June 26	31	9
October 20	32	3
December 17	32	3

5. J. P. Brockley, three-fourths mile north of Howard Summit.

1907.		
February 5	86	10
May 1	85	3
August 21	85	1
December 24	84	9
1908.		
April 29	84	8
June 26	87	
October 20	86	
December 17	86	10

6. F. H. Carrell, 1¼ miles southwest of Gardena.

Date of measurement.	Depth to water.	
	Ft.	*in.*
1907.		
February 5	26	1½
May 1	27	2
August 21	30	5½
December 24	26	10½
1908.		
April 29	29	½
June 26	30	6
October 20	28	8
December 17	27	4

7. A. B. Caldwell, one-fourth mile south of Moneta.

1907.		
February 5	24	4½
May 1	27	7
December 24	24	11½
1908.		
April 29	32	7
June 26	33	6
October 20	27	6
December 17	25	7

8. H. J. Harris, one-half mile north of Moneta.

1907.		
February 5	25	6½
May 1	29	1
August 21	34	
December 24	34	8
1908.		
April 29	33	
June 26	34	7
October 20	33	6
December 17	27	3

9. Stanley Bates, three-fourths mile northwest of Moneta.

1907.		
February 5	35	6
May 1	36	8
August 21	40	2
December 24	36	6
1908.		
April 29	40	1
June 26	43	½
October 20	38	11½
December 17	39	6

10. Post and Lockhart, 2 miles west of Howard Summit.

1907.		
May 1	38	4½
August 21	30	10½
December 24	30	9
1908.		
April 29	Pumping.	
June 26	37	8
October 20	Pumping.	
December 17	36	9

Variations of water level in wells in southern California—Continued.

11. William Bayley, Chester place, Los Angeles.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 6	71	½
May 2	70	6
August 22	70	1
December 23	70	2½
1908.		
April 30	70	6
June 27	70	10
October 21	71	7
December 18	71	11

12. Tony Bright, West Jefferson street, Los Angeles.

1907.		
May 2	49	3½
August 22	49	8½

13. Mrs. Showers, West Jefferson street, Los Angeles.

1907.		
February 6	34	2½
May 2	33	6
August 22	34	9

14. Artesian Land and Water Company, three-fourths mile north of Cienaga station.

1907.		
February 6	7	4½
May 2	7	4
August 22	8	6½
December 23	9	7
1908.		
April 30	7	
June 27	7	11
October 21	9	
December 18	8	6

15. Los Angeles County, Ivy station.

1907.		
February 6	11	7½
May 2	11	2½
August 22	12	5
December 23	12	10
1908.		
April 30	12	4
June 27	12	8
October 21	13	4
December 18	13	2

16. M. P. Kane, Palms.

1907.		
February 6	49	6½
May 2	50	8
August 22	50	2
December 23	50	3

17. F. P. Bojorquez, Palms.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 6	44	1
May 2	46	½
December 23	44	7½
1908.		
April 30	46	2
June 27	48	3
October 21	45	5
December 18	45	7

18. Jose Sesma, 1 mile north of Ivy station.

1907.		
February 6	44	5
May 2	44	2½
August 22	44	7½
1908.		
April 30	44	9
June 27	44	10
October 21	44	11
December 18	45	

19. J. H. Whitworth, 2 miles south of Sherman.

1907.		
February 6	6	11
May 2	7	
August 22	7	5½
1908.		
April 30	5	5
June 27	7	6
October 21	6	6
December 18	6	2

20. Hammel Decker, 1 mile south of Sherman.

1907.		
February 6	11	2
May 2	10	½
August 22	11	½
December 23	10	11
1908.		
April 30	10	8
June 27	11	2
October 21	12	
December 18	29	1

21. William Niles, three-fourths mile south of Sherman.

1907.		
February 6	5	3
May 2	6	5½
August 22	7	4
December 23	7	½
1908.		
April 30	3	2
June 27	3	11
October 21	3	2
December 18	2	6

Variations of water level in wells in southern California—Continued.

22. Los Angeles County, 1 mile east of Sherman.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
May 2	85	6½
August 22	83	1½
December 23	81	10
1908.		
April 30	86	2
June 27	89	7
October 21	95	
December 18		Dry.

23. Mr. Hurlbut, Pasadena.

1907.		
February 8	76	3½
May 3	74	10½
August 24	74	9
1908.		
April 28	72	2½
June 30	73	2
October 12	75	2
December 19	75	2

24. L. V. Harkness, 1½ miles southeast of Pasadena.

1907.		
February 8	122	5
May 3	120	11
August 24	120	4
December 28	118	1
1908.		
April 28	117	
June 30	119	1
October 12	118	6
December 19	118	1

25. Titus ranch, Sunny Slope station.

1907.		
February 8	11	4½
May 3	10	8
August 24	15	

26. John McClain estate, 1 mile south of San Gabriel.

1907.		
February 8	70	6
May 3	68	11
August 24	69	4
December 28	66	9½

27. F. E. Wilson, 2 miles south of San Gabriel.

1907.		
February 8	21	9
May 3	18	9
August 24	18	3
December 28	19	6
1908.		
April 28	18	6
June 30	19	3
October 12	19	3
December 19	19	7

28. G. B. Renfro, three-fourths mile southwest of Savannah.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 8	16	11
May 3	15	9½
August 24	16	6
December 28	16	2
1908.		
April 28	15	6
June 30	15	8
October 12	16	
December 19	15	5

29. J. A. Law, one-half mile west of El Monte.

1907.		
February 8	10	1½
May 3	8	5½
August 24	10	
December 28	9	6
1908.		
April 28	8	7
June 30	10	3
October 12	10	3
December 19	9	4

30. M. Ritter, El Monte.

1907.		
February 8	13	7
May 3	10	
August 24	9	9
December 28	10	8
1908.		
April 28	10	
June 30	10	2
October 12	12	5
December 19	12	10

31. Mrs. McClure, three-fourths mile south of El Monte.

1907.		
February 8	8	1
May 3	7	
August 24	8	6½
December 28	8	3
1908.		
April 28	8	
June 30	9	2
October 12	9	10
December 19	9	4

32. T. D. Andrews, 1½ miles southeast of El Monte.

1907.		
February 8	10	2½
May 3	7	8½
August 24	9	9
December 28	9	10½
1908.		
April 28	9	6
June 30	10	9
October 12	12	2
December 19	11	10

Variations of water level in wells in southern California—Continued.

33. Jackson Frees, 2 miles southeast of El Monte.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 8	15	6
May 3	13	1½
August 24	15	9½
December 28	16	1½
1908.		
April 28	15	5
June 30	17	1
October 12	18	4
December 19	17	9

34. E. Gurado, 3 miles southwest of Whittier.

1907.		
February 9	8	3½
May 4	8	1
August 22	8	10
December 27	8	9
1908.		
April 27	8	10
June 29	9	
October 19	9	3
December 24	8	11

35. Mrs. Mary Pheland, 2 miles southwest of Whittier.

1907.		
February 9	11	2
May 4	11	1
August 22	11	4
December 27	11	5½
1908.		
April 27	10	11
June 29	11	5
October 19	Well closed.	
December 24	Well closed.	

36. H. C. Baldwin, one-half mile southeast of Whittier.

1907.		
February 9	127	10½
May 4	127	4
August 22	127	7½

37. C. A. Landreth, 1 mile south of Whittier.

1907.		
February 9	30	1½
May 4	28	7
August 23	30	8
December 27	30	½
1908.		
April 27	29	3
June 29	29	8
December 24	29	5

38. J. W. Sharp, Santa Fe Springs.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 9	23	10
May 4	23	2½
August 23	24	
December 27	23	8
1908.		
April 27	23	6
June 29	24	2
October 19	24	9
December 24	24	1½

39. John H. Borden, 1½ miles north of Norwalk.

1907.		
February 9	4	3½
May 4	3	6½
August 23	4	1½
December 27	3	2½
1908.		
April 27	1	6
June 29	5	1
October 19	Casing cut off, datum destroyed.	
December 24		

40. Norwalk Builders' Association, Norwalk.

1907.		
February 9	12	1
May 4	14	1
August 23	14	10
December 27	12	5
1908.		
April 27	Pumping.	
June 29	14	3
October 19	13	4
December 24	12	11

41. J. B. Neff, 1½ miles south of Anaheim.

1907.		
January 1	49	1
February 1	47	8
March 1	45	11
April 1	42	9
May 1	39	11
May 31	39	5
June 16	38	10
June 30	39	1
July 27	40	5
September 3	40	
October 1	39	7
October 23	39	
November 7	38	10
November 28	38	10
December 31	38	6
1908.		
January 21	38	10
January 28	38	9
February 12	38	1
February 28	37	5
April 1	37	4
May 1	38	4
June 1	39	10
July 31	42	7
August 31	42	8
October 6	41	7
November 1	41	6
November 28	41	7

Variations of water level in wells in southern California—Continued.

42. Vineland district school, Vineland.

Date of measurement.	Depth to water. Ft.	in.
1907.		
February 12	78	10
May 16	64	
August 26	70	
December 30	76	5
1908.		
April 21	72	4
June 23	74	10
October 14	81	
December 27	83	1

43. G. F. Chamberlain, 2 miles southwest of Covina.

1907.		
February 12	103	7
May 16	94	6
August 26	89	6
December 30	91	5
1908.		
April 21	90	9
June 23	91	2½
October 14	95	1
December 27	96	9

44. H. Heinze, Puente.

1907.		
February 12	19	2
May 16	17	
August 26	20	9
December 30	21	1
1908.		
April 21	19	6
June 23	20	8
October 14	22	1
December 27	22	2

45. William Rowland, one-fourth mile south of Rowland.

1907.		
February 12	23	6
May 16	24	2
August 26	25	2
December 30	21	11
1908.		
April 21	23	6
June 23	25	4
October 14	23	5
December 27	22	6

46. B. Yorba, 1½ miles east of Rowland.

1907.		
February 12	28	2
May 16	28	8½
August 26	31	2
December 30	27	7
1908.		
April 21	29	2
June 23	31	5
October 14	30	9
December 27	29	5

47. F. Bowers, Lemon.

Date of measurement.	Depth to water. Ft.	in.
1907.		
February 12	17	
May 16	18	4
August 26	21	7
December 30	19	9
1908.		
April 21	19	8
June 23	20	3
October 14	23	1
December 27	20	6

48. S. E. Hicks, one-fourth mile west of Spadra.

1907.		
February 12	34	10
May 16	31	2½
August 26	34	6
December 30	32	6
1908.		
April 21	31	11
June 23	36	7
October 14	36	8
December 27	36	10

49. Sidney Deacon, 2 miles west of San Dimas.

1907.		
February 11	35	3½
May 15	39	6
August 26	43	3
December 30	46	9
1908.		
April 20	47	11
June 22	49	3
October 13	62	7
December 26	67	5

50. William Ferry, 1¼ miles southwest of San Dimas.

1907.		
February 11	202	1
May 15	207	2
August 26	202	4
December 30	202	1
1908.		
April 20	202	8
June 22	202	9
October 13	203	
December 26	203	4

51. Azusa Irrigation Company, San Dimas Wash.

1907.		
February 11	93	1½
1908.		
April 20	52	
June 22	53	7
October 13	56	11
December 26	59	9

Variations of water level in wells in southern California—Continued.

52. Emil Firth, San Dimas Wash.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 11	80	6
May 15	56	8
August 26	72	3
December 30	82	6
1908.		
April 20	86	9
June 22	86	5
October 13	91	10
December 26	94	9

53. Charles Alley, 1 mile northwest of Lordsburg.

1907.		
February 11	152	4
May 15	144	8
August 26	145	2
December 30	143	6
1908.		
April 20	140	5
June 22	142	2
October 13	153	6
December 26	147	7

54. Mr. Massey, three-fourths mile northeast of Lordsburg.

1907.		
February 11	196	3
May 15	191	1
August 26	183	7
December 30	163	6
1908.		
April 20	147	1
June 22	146	
October 13	151	3
December 26	152	6

55. Ontario Water Company, 1 mile north of Claremont.

1907.		
February 11	56	2
May 15	52	1
December 30	54	7
1908.		
April 20	55	10
June 22	57	6
October 13	Pumping.	
December 26	59	4

56. R. Bieley, Claremont.

1907.		
February 11	40	4½
May 15	23	5
August 26	7	2
December 30	7	10
1908.		
April 20	14	3
June 22	17	6
October 13	27	4
December 26	26	½

57. San Antonio Water Company, one-half mile southwest of Claremont.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 11	143	8
May 15	102	7
December 30	29	11½

58. Dr. A. R. Reed, 1½ miles northeast of Pomona.

1907.		
February 11	59	8½
May 15	52	9
August 26	46	7½
December 30	19	5
1908.		
April 20	10	7
June 22	10	9
October 13	14	10
December 26	11	2½

59. B. Linastruth, Pomona.

1907.		
February 11	95	5
May 15	93	7
August 26	93	4
December 30	91	6
1908.		
April 21	90	2
June 23	91	
October 13	Well closed, engine installed.	
December 26		

60. J. J. White, Pomona.

1907.		
February 11	63	5
May 15	65	4
August 26	63	5½
December 30	63	
1908.		
April 20	62	9
June 22	62	9
October 13	63	2
December 26	62	9

61. Mrs. Tieg, 1½ miles southeast of Pomona.

1907.		
February 11	91	6½
May 15	90	3½
August 26	91	7
December 30	90	
1908.		
April 20	92	7
June 22	Pumping.	
October 13	Pumping.	
December 26	91	4

Variations of water level in wells in southern California—Continued.

62. R. Riemers, 2½ miles southeast of Pomona.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 11	35	4
May 5	33	4
August 26	35	
December 30	35	11
1908.		
April 20	34	10
June 22	37	
October 13	37	1
December 26	36	

63. C. P. Brown, 2¼ miles southeast of Pomona.

1907.		
February 11	4	4
August 26	12	1
December 30	5	7
1908.		
April 20	12	
June 22	11	1
October 13	6	11
December 26	4	1

64. Mr. Haley, one-fourth mile west of San Bernardino.

1907.	*Feet.*
June 1	9.2
November	14.27

65. C. W. Rogers, 1 mile east of Colton.

1907.	
June 1	4.33
November	11.35

67. Riverside Water Company, Third and Waterman streets, San Bernardino.

Date of measurement.	Yield in miner's inches.
1907.	
June 1	Capped.
November	140.8

68. N. B. Hinkley estate, three-fourths mile west of Bryn Mawr.

Date of measurement.	Depth to water.
1907.	*Feet.*
June 1	67.1
November	71.3

69. Riverside County, 2½ miles south of Alessandro.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 13	51	3
May 17	61	8
August 30	52	
December 31	52	1
1908.		
April 22	52	
June 24	53	4
October 16	52	5
December 29	52	3

70. Well 4 miles northeast of Perris.

1907.		
February 13	30	4
May 17	30	4
August 30	30	7½
December 31	30	9
1908.		
April 22	30	4
June 24	31	2
October 16	32	6
December 29	31	7

71. C. Lossman, 2½ miles north of Perris.

1907.		
February 13	63	3½
May 17	67	9
August 30	63	11
December 31	64	
1908.		
April 22	64	1
June 24	Pumping.	
October 16	65	2
December 29	66	

72. Crawford Carter, Perris.

1907.		
February 13	32	
May 18	32	2½
1908.		
April 22	34	11
June 25	36	
October 15	37	5
December 28	37	3

73. Mrs. L. R. Harford, 3½ miles east of Perris.

1907.		
February 14	41	10½
May 18	40	4
August 31	40	9
December 31	43	1
1908.		
April 23	41	11
June 25	43	5
October 15	46	6
December 28	46	8½

Variations of water level in wells in southern California—Continued.

74. E. E. Waters, Ethanac.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 14	43	3
August 31	49	
December 31	47	11½
1908.		
April 23	39	1
June 25	45	7
October 15	46	3
December 28	45	4

75. Temescal Water Company, 1¼ miles west of Ethanac.

1907.		
February 14	29	2½
May 18	27	11
August 31	31	
December 31	31	11
1908.		
April 23	31	7
June 25	33	5
October 15	35	
December 28	35	3

76. Dr. Reese, 2¼ miles south of Perris.

1907.		
February 14	15	8½
May 18	15	9
December 31	16	7
1908.		
April 23	17	11
June 25	16	9
October 15	17	8
December 28	18	

77. William Newport, 4½ miles south of Perris.

1907.		
February 14	38	9
August 31	38	10
December 31	40	5
1908.		
April 23	39	6
June 25	40	6
October 15	42	8
December 28	43	7

78. William Newport, Menifee Valley.

1907.		
February 14	19	10½
May 18	18	3
August 30	19	8½
December 31	20	8
1908.		
April 23	19	7
June 25	20	5
October 15	21	6
December 28	21	11

79. H. H. Lindenberger, 4 miles southwest of Winchester.

Date of measurement.	Depth to water.	
1907.	*Ft.*	*in.*
February 14	13	6
May 18	11	
August 30	13	4
December 31	14	2
1908.		
April 23	Pumping.	
June 25	9	2
October 15	11	
December 28	Pumping slowly. 10	11

80. M. M. Patterson, Winchester.

1907.		
February 14	19	8
May 18	18	10
August 31	18	10
December 31	19	2
1908.		
April 23	18	8
June 25	19	2
October 15	19	7
December 28	19	7

81. Mrs. Maud F. Walker, 3 miles southwest of Hemet.

1907.		
February 14	9	3
August 30	9	8½
December 31	9	8½
1908.		
April 23	9	4
June 25	9	6
October 15	20	6
December 28	Not accessible.	

82. J. E. Garrigan, 1 mile west of Hemet.

1907.		
February 13	32	
May 18	32	6
August 31	32	6
December 31	31	10
1908.		
April 23	31	11
June 25	31	9
October 15	31	1
December 28	31	8

Variations of water level in wells in southern California—Continued.

83. Mrs. Ruby Hewitt, one-half mile east of Bowers.

Date of measurement.	Condition of water.
1907.	
August 30	Flowing.
December 31	Flowing.

84. J. Carmichael, Bowers.

Date of measurement.	Condition of water.
1907.	
February 13	Flowing.
May 18	Flowing.
August 30	([a])
December 31	([b])

85. K. D. Harger, Lakeview.

Date of measurement.	Depth to water. Ft.	Depth to water. in.
1907.		
February 13	29	4½
May 17	28	9
August 30	29	1
December 31	29	4
1908.		
April 22	28	10
June 24	28	10
October 16	29	1
December 29	29	½

[a] Flowing 1 miner's inch.

[b] Flowing as strong as in August.

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C.