Water-Supply and Irrigation Paper No. 84 Series P, Hydrographic Progress Reports, 22

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

CHARLES D. WALCOTT, DIRECTOR

REPORT

OF

PROGRESS OF STREAM MEASUREMENTS

FOR

THE CALENDAR YEAR 1902

BY

F. H. NEWELL

PART III.—WESTERN MISSISSIPPI AND WESTERN GULF DRAINAGE

WASHINGTON
GOVERNMENT PRINTING OFFICE
1903

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ILLUSTRATIONS.

LETTER OF TRANSMITTAL.

DEPARMENT OF THE INTERIOR,
UNITED STATES GEOLOGICAL SURVEY,
DIVISION OF HYDROGRAPHY,
Washington, D. C., June 29, 1903.

SIR: I have the honor to transmit herewith Water-Supply Paper No. 84, which is Part III of the Report of Progress of Stream Measurements for 1902. This paper contains the data which has been received during 1902 from that portion of the territory west of the Mississippi River which drains either into the Mississippi River or the western Gulf of Mexico. This paper will be followed by Water-Supply Paper No. 85, which will contain the data from the remainder of the Western States, and will also complete the Progress Report of Stream Measurements for 1902.

These papers contain, for the various gaging stations, the original data as collected and the results obtained from the discussion of these data, also such other information as is of interest in hydrographic studies.

Very respectfully,

F. H. NEWELL,
Hydrographer in Charge.

Hon. CHARLES D. WALCOTT,
Director United States Geological Survey.

PROGRESS REPORT OF STREAM MEASUREMENTS FOR THE CALENDAR YEAR 1902.

PART III.

By F. H. NEWELL.

INTRODUCTION.

This paper contains the data collected in the territory which drains from the West either into the Gulf of Mexico or the Mississippi River, and for convenience in arrangement the material has been grouped under these two headings. This paper with Water-Supply Paper No. 85 make up the Progress Report of Stream Measurements for the territory west of the Mississippi River. The report for the territory east of the Mississippi River is contained in Water-Supply Papers Nos. 82 and 83. The material in each of these papers consists of both the original data as collected at the various river stations and the results obtained from the discussion of these data; also brief descriptions and facts regarding such other subjects as are allied to hydrographic studies.

For convenience in arrangement the data under the two main parts of this paper have been grouped by drainage areas and these have been arranged geographically from North to South.

In collecting hydrographic data the Geological Survey has received the hearty cooperation of various individuals, corporations, and States, as mentioned hereafter. This cooperation has made possible the publication of many valuable records which could not otherwise have been obtained.

A brief historical sketch of the stream measurements made by the Geological Survey is published on pages 11 to 15 of Water-Supply Paper No. 75.

On figs. 1 and 2 the full dots show the relative location of the stations at which the U. S. Geological Survey is collecting hydrographic data. The section west of the shaded line comprises those States which are

covered by the national irrigation act of June 17, 1902 (Stat. L., vol. 32, pp. 388–390), and the cross-lined areas show the location of the irrigation projects which are now under investigation.

The results of the stream measurements made during the past years

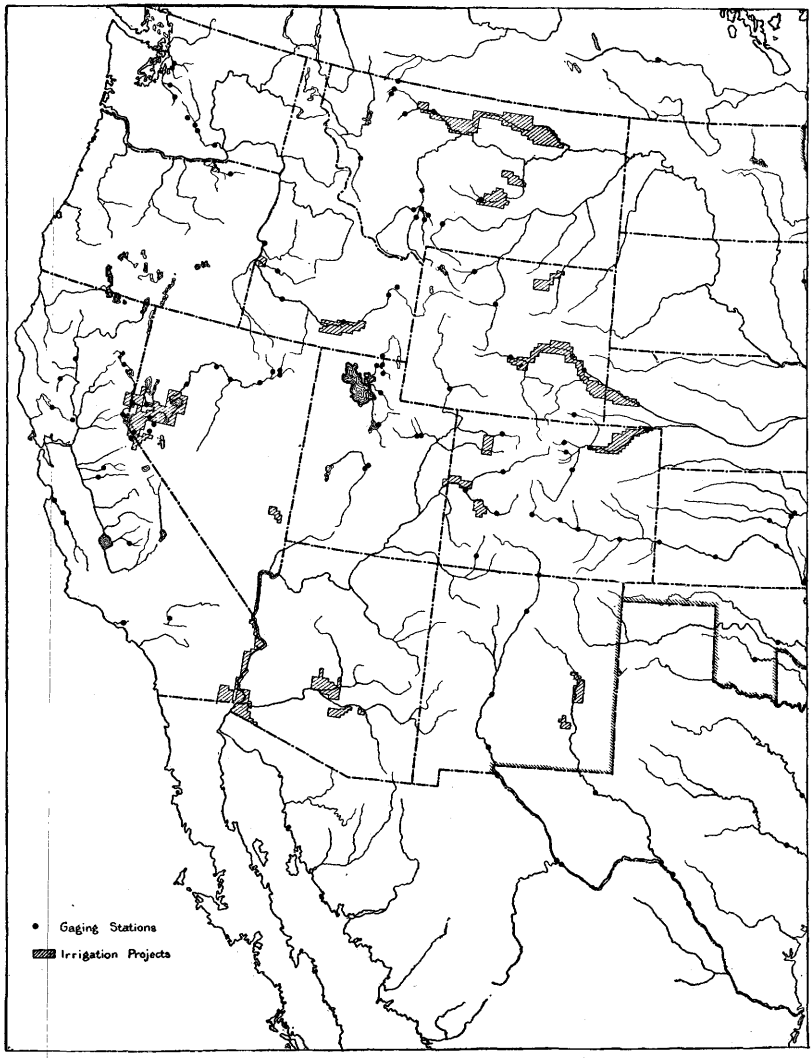

FIG. 1.—Location of river stations and principal irrigation projects in western half of United States, 1902–3.

by the U. S. Geological Survey can be found in the following publications, which may be consulted at the public libraries in most cities:

1893. Bulletin No. 131.
1894. Bulletin No. 131.
1895. Bulletin No. 140.

1896. Water-Supply Paper No. 11; Part IV of the Eighteenth Annual Report.
1897. Water-Supply Papers Nos. 15 and 16; Part IV of the Nineteenth Annual Report.
1898. Water-Supply Papers Nos. 27 and 28; Part IV of the Twentieth Annual Report.

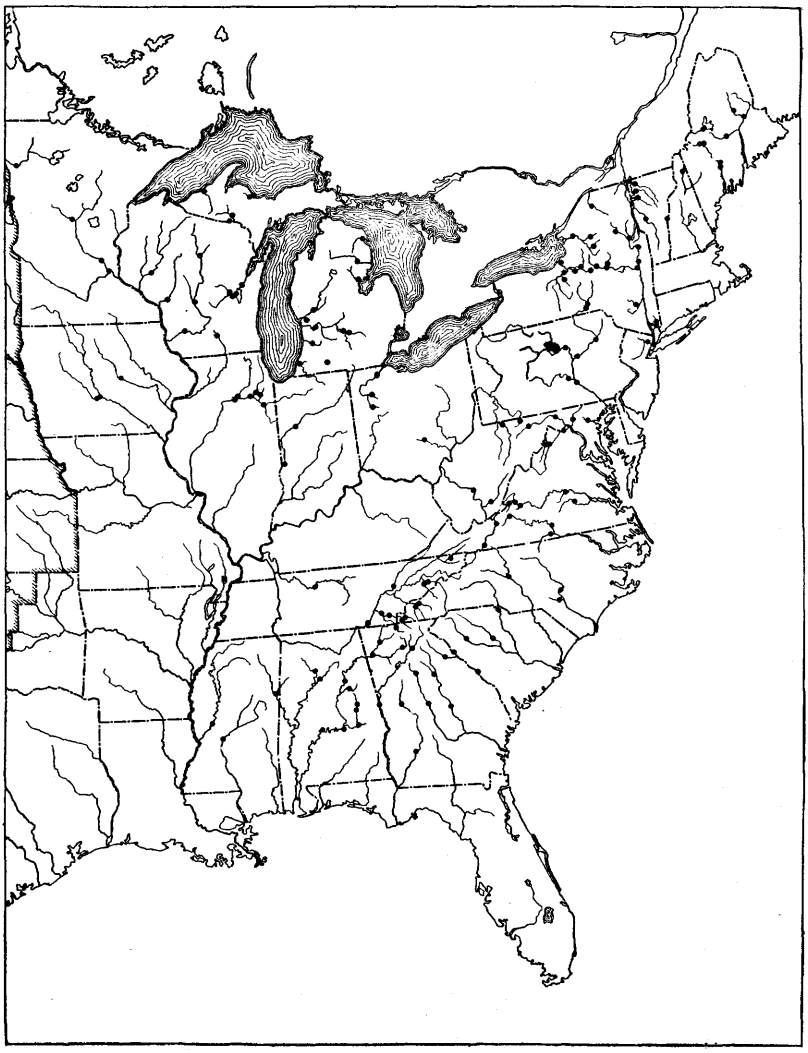

FIG. 2.—Location of river stations in eastern half of United States, 1902-3.

1899. Water-Supply Papers Nos. 35 to 39, inclusive; Part IV of the Twenty-first Annual Report.
1900. Water-Supply Papers Nos. 47 to 52, inclusive; Part IV of the Twenty-second Annual Report.
1901. Water-Supply Papers Nos. 65, 66, and 75.
1902. Water-Supply Papers Nos. 82 and 85, inclusive.

ACKNOWLEDGMENTS.

Most of the measurements presented in this paper have been obtained through local hydrographers and engineers. Acknowledgment is due to each of these persons, and thanks are extended to other persons and corporations who have assisted local hydrographers or who have cooperated in any way, either by furnishing records or by assisting in transportation.

The following list, arranged alphabetically by States, gives the names of the resident hydrographers and others who have assisted in furnishing and preparing the data contained in this report:

Colorado.—Resident hydrographer, A. L. Fellows, assisted by M. C. Hinderlider. Acknowledgments are also due to the following individuals and corporations for assistance rendered and data furnished: Hon. A. J. McCune, State engineer of Colorado; Hon. J. J. Armstrong, E. R. Chew, and A. F. Reeves, superintendents of irrigation; L. H. Dickson and T. J. Burrows, water commissioners; also to other water commissioners who have given assistance from time to time.

Transportation has been furnished by the Denver and Rio Grande, Atchison, Topeka and Santa Fe, Colorado and Southern, Union Pacific, and Rio Grande Southern railroads.

Special assistance was rendered by the officers of the Arkansas Valley Beet and Irrigated Land Company, at Lamar, and C. A. Jones, at Forks Creek.

Kansas.—Resident hydrographer, W. G. Russell. Acknowledgments are also due to the Chicago, Rock Island and Pacific; Missouri, Kansas and Texas; Atchison, Topeka and Santa Fe, and Union Pacific railways for transportation furnished resident hydrographer in Kansas, Oklahoma, and Indian Territory.

Montana.—Resident hydrographer, J. S. Baker, assisted by H. B. Waters. Acknowledgments are also due to Arthur P. Stover, who furnished the results of a number of measurements on the West Gallatin River, near Salesville, Mont., and on Middle Creek, near Bozeman, Mont.

Nebraska.—Resident hydrographer, J. C. Stevens. Acknowledgments are also due to the following individuals and corporations for assistance rendered and data furnished:

Adna Dobson, C. E., State engineer, secretary of the State board of irrigation; B. E. Forbes, assistant secretary State board of irrigation; H. O. Smith, Lexington, Nebr., under secretary State board of irrigation; Robert H. Willis, C. E., Bridgeport, Nebr., under assistant State board of irrigation. The Burlington and Missouri River, and Fremont, Elkhorn and Missouri Valley Railroad Companies have also rendered valuable assistance.

New Mexico.—Acknowledgments are due to W. W. Follett, consulting engineer International (Water) Boundary Commission, for the data at stations upon the Rio Grande River both in New Mexico and Texas.

Oklahoma.—Resident hydrographer, W. G. Russell.

South Dakota.—Resident hydrographer, J. C. Stevens, assisted by Prof. A. B. Crane, Brookings, S. Dak.

Texas.—Resident hydrographer, Thomas U. Taylor.

Wyoming.—Resident hydrographer, A. J. Parshall. Acknowledgments are also due to the following individuals and corporations for assistance rendered and data furnished:

To H. G. Burt, president of Union Pacific Railroad Company; to G. W. Holdrege, general manager Burlington and Missouri River Railroad in Nebraska; to

Frank Trumbull, president of the Colorado and Southern Railway Company: and to George F. Bidwell, general manager of Fremont, Elkhorn and Missouri Valley Railroad for free transportation over their lines.

Acknowledgments are also due to John C. Hoyt, George L. Warner, H. G. Stokes, and Frank H. Brundage, for computations on and the arrangement of data of this report.

WESTERN MISSISSIPPI RIVER DRAINAGE.

For convenience in arrangement, the stations from which the Geological Survey has obtained data during 1902, and which are located on rivers tributary either directly or indirectly to the Mississippi River from the West, have been grouped under Missouri, Platte, Kansas, Arkansas, and Red River drainage basins. These are arranged in the report in this order.

MISSOURI RIVER DRAINAGE BASIN.

The Missouri River is formed by the junction of the Jefferson, Madison, and Gallatin rivers at Three Forks, Mont. Of its tributaries, the Marais des Cygnes River rises in the eastern part of Kansas, flows east, and, as Osage River, enters the Missouri below Jefferson City, Mo. The Big Sioux River drains the extreme eastern part of South Dakota and flows south into the Missouri at Sioux City, Iowa. The Niobrara River drains the extreme northern part of Nebraska and flows east into the Missouri at Niobrara, Nebr. The Yellowstone River has its source in a lake of the same name in Yellowstone National Park, from which it takes a general northeasterly course and flows into the Missouri near the Montana-North Dakota boundary. Its principal tributaries are the Powder River, of which Clear Creek and Piney Creek in Wyoming are small tributaries near its headwaters, and the Big Horn, which drains northeastern Wyoming, and of which the Shoshone is a tributary. The Milk River rises on the divide in the northwestern part of Montana, flows northeast into Canada and then, with a general easterly course, flows back into Montana, emptying into the Missouri in the northeastern part of the State. The Musselshell River rises in Meagher County, in south central Montana, flows east, then north into the Missouri, about 100 miles above the mouth of Milk River. The Marias River rises on the divide in the northwestern part of Montana and flows east into the Missouri. Two Medicine Creek is a tributary near its headwaters. West Gallatin River, the longest fork of the Gallatin, rises in Yellowstone Park and flows north to its junction at Three Forks, Mont., with the Madison and Jefferson Rivers. Middle Creek is a small tributary of the East Gallatin River. The Madison River rises in Yellowstone Park and flows north parallel to the West Gallatin. The Jefferson River is

formed by the Beaverhead and Big Hole rivers. Its tributaries drain extreme southwestern Montana. The following is a list of the stations in the Missouri River drainage basin:

Marais des Cygnes River at Ottawa, Kans.
Big Sioux River near Watertown, S. Dak.
Niobrara River at Niobrara, Nebr.
Niobrara River at Valentine, Nebr.
Clear Creek at Buffalo, Wyo.
Piney Creek at Kearney, Wyo.
Shoshone River at Cody, Wyo.
Big Horn River near Thermopolis, Wyo.
Yellowstone River near Livingston, Mont.
Milk River at Malta, Mont.
Milk River at Havre, Mont.
Musselshell River at Shawmut, Mont.
Marias River near Shelby, Mont.
Two Medicine Creek at Midvale, Mont.
Missouri River at Cascade, Mont.
Missouri River at Townsend, Mont.
Gallatin River at Logan, Mont.
West Gallatin River near Salesville, Mont.
Middle Creek near Bozeman, Mont.
Madison River near Norris, near Redbluff, Mont.
Jefferson River at Sappington, Mont.

MARAIS DES CYGNES RIVER AT OTTAWA, KANS.

This station was established August 26, 1902, by W. G. Russell, and is located on the highway bridge near the center of the town of Ottawa, Kans. The gage is of the usual wire type, with the scale bar graduated to feet and tenths, and spiked to the bridge floor. The initial point for sounding is on the right bank. The channel both above and below the station is straight and the current quite swift. Both the right and left banks are high and the bed of the stream is rocky. The gage is read daily by W. H. Blacksten.

The following discharge measurements were made during 1902:

August 26: Gage height, 3.60 feet; discharge, 2,080 second-feet.
September 25: Gage height, 5.40 feet; discharge, 3,390 second-feet.
November 22: Gage height, 2.20 feet; discharge, 417 second-feet.

Daily gage height, in feet, of Marais des Cygnes River at Ottawa, Kans.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						1902.					
1		13.50	4.00	1.90	2.50	17		1.80	2.20	2.70	2.30
2		9.15	2.60	1.90	2.30	18		1.80	2.10	2.40	2.20
3		3.20	2.40	1.90	2.50	19		1.70	2.10	2.40	2.10
4		2.40	13.70	2.00	4.70	20		1.80	2.00	2.30	4.80
5		2.20	22.25	2.40	3.00	21		1.80	2.00	2.20	11.60
6		6.30	22.30	2.40	2.40	22		2.90	2.00	2.20	7.60
7		15.90	16.20	2.20	2.30	23		7.00	2.00	2.20	3.50
8		9.60	3.30	2.10	2.20	24		12.75	2.00	2.20	2.90
9		2.90	2.80	2.00	2.20	25		7.20	2.00	2.40	2.50
10		2.30	2.60	2.00	2.20	26	3.60	3.50	2.00	2.40	2.40
11		2.10	2.50	2.00	2.10	27	2.80	2.70	1.90	2.30	2.40
12		2.10	2.40	1.90	2.30	28	2.50	2.40	1.90	2.20	2.30
13		2.00	2.40	2.00	2.30	29	2.30	2.20	1.90	2.10	2.30
14		2.00	2.30	2.00	2.30	30	2.20	4.50	1.90	2.10	2.20
15		1.90	2.20	3.70	2.20	31	7.45		1.90		2.20
16		1.90	2.20	3.40	2.20						

BIG SIOUX RIVER NEAR WATERTOWN, S. DAK.

Big Sioux River rises in Grant County, S. Dak., about 30 miles north of Watertown. Its principal headwaters drain lands constituting part of the Sisseton and Wahpeton Indian Reservation. Its general course is southeast, and it empties into Missouri River near Sioux City, Iowa. The river is of interest on account of its water powers, a number of which have been developed, principally at Flandreau, Dell Rapids, and Sioux Falls, S. Dak., and at Akron, Iowa.

Lake Poinsett, which lies almost wholly in Hamlin County, S. Dak., has its outlet in Big Sioux River near Dempster, a short distance above Estelline. Immediately below the outlet of the lake a dam has been constructed on the Big Sioux to maintain the level of the lake within certain limits.

The gaging station was established by O. V. P. Stout, the gage being put in September 15, 1900, by George W. Carpenter, county surveyor for Codington County. It is located on the farm of L. E. Spicer, about 4 miles above Watertown. The gage consists of an inclined rod securely fastened on the right bank of the stream. The observer is L. E. Spicer. During 1902 the following discharge measurements were made by A. B. Crane.

May 24: Gage height, 1.42 feet; discharge, 22 second-feet.
July 15: Gage height, 0.76 foot; discharge 2.3 second-feet.
November 15: Gage height 0.82 foot; discharge, 2.7 second-feet.

Daily gage height, in feet, of Big Sioux River at Watertown, S. Dak.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.							
1		1.15	0.88	0.70	0.91		
2							0.80
3		1.15		.70	.90	0.70	
4			.88				.80
5				.70		.70	
6		1.15	.88		.80		
7							.80
8		1.15	.85	.70	.73		
9						.73	.80
10		1.13		.70	.70		
11			.83				
12				.70		.70	.80
13		1.00	.80		.70		
14					.70	.70	.80
15		.90	.75	.72			
16					.70		.80
17		.85		.80		.69	
18			.75				.83
19				.80	.68	.69	
20		.83	.73				
21					.68	.68	.84
22		.83	.73	.83			
23					.70		.84
24		.85		.80		.68	
25	1.30		.70				.85
26				.80	.72	.78	
27	1.25	1.00	.70				
28					.73	.80	.85
29		.95	.70	.80			(a)
30	1.15				.72		
31						.80	

(a) Observations discontinued November 28 on account of ice.

NIOBRARA RIVER AT NIOBRARA, NEBR.

This station was established May 11, 1902, by J. C. Stevens. It is located at the wooden highway bridge 1 mile southwest of the city of Niobrara. The gage is of the usual wire type, graduated to feet and half-tenths. It is read daily by Miner Thompson, who lives near by. The measurements are taken from the bridge. The initial point of soundings is on the east end of the bridge on the upstream side. The channel is straight for a considerable distance both above and below the station. The banks are low, but not liable to overflow. The bed of the stream is sandy and shifting. The main channel seems to be changing from the right to the left bank. The zero-mark of the gage is 6.8 feet east of the face of the fourth floor beam from the west end of the bridge. From the index on the wire to the bottom of the sash weight is 19 feet. When the gage reads zero the water is

12.49 feet below the top of the face plate on the south pier at the west end of the bridge.

Discharge measurements of Niobrara River at Niobrara, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
May 11	J. C. Stevens	2.55	1,637
July 6	do	2.85	2,021
July 25	do	2.00	1,401
August 21	do	2.10	1,106
September 28	do	1.90	2,201

Daily gage height, in feet, of Niobrara River at Niobrara, Nebr.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1902.						
1	.....	2.60	2.70	2.70	2.60	2.40
2	.....	2.50	2.90	2.65	2.50	2.40
3	.....	2.50	2.95	2.65	2.50	2.40
4	.....	2.55	2.90	2.60	2.50	2.30
5	.....	2.70	2.50	2.60	2.45	2.30
6	.....	2.60	2.80	2.55	2.45	2.30
7	.....	2.60	2.70	2.55	2.50	2.25
8	.....	2.55	2.70	2.55	2.45	2.20
9	.....	2.70	2.75	2.60	2.40	2.20
10	.....	2.60	2.67	2.60	2.45	2.20
11	2.55	2.50	2.60	2.70	2.40	2.10
12	2.57	2.75	2.60	2.60	2.35	2.10
13	2.57	2.60	2.60	2.55	2.40	2.10
14	2.70	2.60	2.65	2.50	2.35	2.10
15	2.70	2.60	2.60	2.70	2.30	2.05
16	2.75	2.65	2.60	2.70	2.20	2.00
17	2.57	2.75	2.60	2.75	2.30	2.10
18	2.67	2.70	2.60	2.80	2.20	1.90
19	2.80	2.65	2.65	2.85	2.20	1.90
20	2.90	2.65	2.60	2.75	2.50	2.00
21	3.00	2.75	2.60	2.70	2.90	2.00
22	2.90	2.80	2.60	2.80	2.80	1.90
23	2.57	2.80	2.55	2.70	2.80	1.90
24	2.45	2.60	2.60	2.60	2.60	1.90
25	2.40	2.60	2.65	2.75	2.60	1.90
26	2.50	2.70	2.75	2.90	2.50	(a)
27	2.50	2.85	2.70	2.75	2.50	.....
28	2.60	2.70	2.70	2.65	2.50	.....
29	2.55	2.80	2.70	2.60	2.45	.....
30	2.50	2.75	2.70	2.55	2.40	.....
31	2.45	.....	2.70	2.60	.....	.....

[a] Observations discontinued October 25, on account of ice.

NIOBRARA RIVER AT VALENTINE, NEBR.

A gaging station was established July 22, 1897, by O. V. P. Stout, and was known as the Fort Niobrara station. It was about three-quarters of a mile southwest from Fort Niobrara and about 3 miles east of Valentine, Nebr. The original gage was an oak rod 2 by 4 inches, graduated to tenths of a foot, and fastened in a vertical position by lag screws to a plumb post in the trestle bent which serves as the west pier of the military bridge near Fort Niobrara. The zero of the gage was 9.08 feet below the top of the short cap, at the shoe of the north truss at the west end of the bridge; it was also 8.09 feet below the top of the north end of the long pile cap, below the cap above noted; and also 9.17 feet lower than the top of the west side of the iron cap of the north cylinder of the center pier of the bridge. This station was afterwards discontinued, but was resumed on April 26, 1899, when a rod was located 195 feet downstream from the wagon bridge near Fort Niobrara. The rod was solidly bedded on cross-ties and well fastened with bridge spikes. It was a new 3 by 4 inch oak rod 10 feet long, and was placed on the left bank of the stream. Bench mark No. 1 was the top of a large spike driven in the top of a 2 by 4 inch timber which was set 4 feet in the ground and 12 feet west of the rod, and was 5.63 feet above gage datum. Bench mark No. 2 was the top of the short cap at shoe of truss at west end of the bridge, downstream side, and was 9.98 feet above the zero of the gage. Bench mark No. 3 was the top of the plate of the center pier of the bridge, downstream side, and was 10.03 feet above gage datum. Thomas Dillon, mail carrier between Valentine and Fort Niobrara, was the observer. On June 26, 1901, it was reestablished at the Borman bridge, which is about 3 miles upstream from the military bridge. The gage is of the wire and weight type, gage heights being marked by staples on the bridge rail. The zero of the gage is 12 feet below the top of the bridge floor.

Discharge measurements of Niobrara River at Valentine, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
March 22	J. C. Stevens	1.66	971
April 12	do	1.50	784
June 15	do	1.30	585
July 4	do	1.60	800
July 20	do	1.40	727
August 20	do	1.40	681
September 26	do	1.55	733
November 13	do	1.60	764

Daily gage height, in feet, of Niobrara River at Valentine, Nebr.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.										
1	.....	1.58	1.63	1.50	3.10	1.31	1.40	1.43	1.58	1.55
2	.....	1.61	1.65	1.42	1.95	1.32	1.38	1.47	1.64	1.46
3	.....	1.64	1.60	1.44	1.73	1.38	1.30	1.42	1.53	1.16
4	.....	1.70	1.58	1.45	1.56	1.31	1.27	1.44	1.50	1.40
5	.....	1.68	1.65	1.54	1.58	1.42	1.28	1.47	1.57	1.48
6	.....	1.75	1.53	1.55	1.38	1.38	1.30	1.45	1.55	1.55
7	.....	1.50	1.47	1.44	1.25	1.31	1.27	1.44	1.54	(a)
8	.....	1.58	1.56	1.58	1.90	1.43	1.41	1.45	1.58	.....
9	(a)	1.54	1.60	1.42	1.38	1.48	1.28	1.46	1.54	.....
10	1.78	1.55	1.54	1.40	1.32	1.40	1.26	1.51	1.52	.....
11	1.80	1.44	1.52	1.42	1.32	1.24	1.33	1.53	1.50	.....
12	1.75	1.54	1.64	1.50	1.36	1.20	1.32	1.55	1.56	.....
13	1.79	1.58	1.57	1.48	1.27	1.36	1.29	1.52	1.60	.....
14	1.67	1.60	1.55	1.40	1.32	1.38	1.37	1.49	1.58	.....
15	1.65	1.54	1.63	1.28	1.26	1.39	1.33	1.48	1.56	.....
16	1.40	1.64	1.47	1.42	1.25	1.38	1.35	1.55	1.62	.....
17	1.33	1.72	1.52	1.47	1.26	1.44	1.34	1.52	1.56	.....
18	1.60	1.66	1.49	1.34	1.40	1.37	1.45	1.48	1.61	.....
19	1.95	1.58	1.83	1.52	1.42	1.38	1.40	1.50	1.54	.....
20	1.85	1.56	1.78	1.47	1.40	1.34	1.48	1.49	1.57	.....
21	2.05	1.47	1.51	1.36	1.34	1.45	1.45	1.48	1.50	.....
22	1.66	1.74	1.45	1.80	1.32	1.43	1.47	1.51	1.56	.....
23	1.75	1.69	1.51	1.32	1.37	1.34	1.33	1.55	1.52	.....
24	1.98	1.52	1.46	1.36	1.41	1.43	1.37	1.50	1.53	.....
25	1.90	1.80	1.44	1.33	1.32	1.62	1.48	1.51	1.60	.....
26	1.96	1.75	1.42	1.34	1.38	1.45	1.59	1.56	1.51	.....
27	1.93	1.54	1.48	1.37	1.35	1.31	1.53	1.53	1.56	.....
28	1.89	1.72	1.37	1.46	1.32	1.38	1.45	1.52	1.53	.....
29	1.83	1.58	1.40	1.95	1.34	1.40	1.57	1.51	1.46	.....
30	1.97	1.65	1.33	2.10	1.45	1.43	1.42	1.54	1.48	.....
31	1.85	.....	1.42	.....	1.36	1.52	.....	1.50	.....	.....

a Ice interfered with observations from January 1 to March 9 and from December 6 to 31.

Rating table for Niobrara River at Valentine, Nebr., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	475	1.3	580	1.6	865	1.9	1,330
1.1	490	1.4	655	1.7	1,000	2.0	1,525
1.2	525	1.5	750	1.8	1,155		

Estimated monthly discharge of the Niobrara River at Valentine, Nebr.

[Drainage area, 6,070 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March, 22 days			1,169	51,011	0.19	0.16
April	1,155	700	896	53,310	.15	.17
May	1,240	615	802	49,305	.13	.15
June	1,740	580	740	44,030	.12	.13
July	4,260	580	805	49,490	.13	.15
August	865	525	653	40,145	.11	.13
September	865	550	649	38,614	.11	.12
October	805	655	745	45,805	.12	.14
November	930	700	807	48,015	.13	.15

CLEAR CREEK AT BUFFALO, WYO.

This station was established October 24, 1902, by Jeremiah Ahern. It is located at the highway bridge in the town of Buffalo, Johnson County, Wyo. The gage is a plain staff graduated to feet and tenths, spiked to the pier at the northwest end of the bridge. The initial point for sounding is on the left bank. Measurements are made from the bridge. The channel is straight both above and below the station. Both banks are high and rocky. The bed of the stream is also rocky. The gage is read daily by P. A. Gatchell. The bench mark is U. S. G. S. B. M. at the court-house, marked "SHER 4635." Elevation 4,635.033 feet. The elevation of the gage as determined from this bench mark is 4,605.766 feet.

Daily gage height, in feet, of Clear Creek at Buffalo, Wyo.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1902.			1902.			1902.			1902.		
1		0.90	9		1.00	17	0.70	1.00	25	0.85	0.80
2		.90	10		.80	18	.68	1.00	26	.90	.80
3		.80	11		.80	19	.70	.90	27	1.00	.75
4		.80	12		.90	20	.80	.85	28	1.00	.90
5		.80	13		.90	21	.70	.90	29	1.20	1.20
6		.80	14		.90	22	.70	.85	30	1.00	1.30
7		.90	15		1.10	23	.70	.85	31		1.50
8		.90	16	0.65	1.60	24	.80	.85			

PINEY CREEK AT KEARNEY, WYO.

This station was established September 6, 1902, by Jeremiah Ahern. It is located at the highway bridge at Kearney, Johnson County, Wyo., which is on the stage route between Sheridan and Buffalo, 24 miles from Sheridan. The gage is a vertical staff graduated to feet and tenths and spiked to the abutment of the bridge. It is read daily by R. D. Noyce. The initial point for sounding is on the right bank. Discharge measurements are taken from the bridge. The channel is straight for 600 feet above and 200 feet below the station. The left bank is high, and liable to overflow at extreme high water. The right bank is high and does not overflow. The bed of the stream is gravel. The bench mark is the U. S. G. S. bench mark at Geier's Ranch, about 600 feet from the gage. It is marked "SHER 4662." Elevation 4,661.767 feet. The elevation of the zero of the gage as referred to this bench mark is 4,645.963 feet.

The following discharge measurement was made in 1902, by J. Ahern.

September 6: Gage height, 1.41 feet; discharge, 21 second-feet.

Daily gage height, in feet, of Piney Creek at Kearney, Wyo.

Day.	Sept.	Oct.	Day.	Sept.	Oct.	Day.	Sept.	Oct.	Day.	Sept.	Oct.
1902.			1902.			1902.			1902.		
1	.....	1.47	9	1.43	1.41	17	1.48	1.39	25	1.42	1.44
2	.....	1.43	10	1.43	1.40	18	1.49	1.39	26	1.47	.....
3	.....	1.43	11	1.43	1.41	19	1.48	1.38	27	1.60	.....
4	.....	1.42	12	1.43	1.40	20	1.47	1.59	28	1.43	.....
5	.....	1.41	13	1.43	1.39	21	1.48	1.39	29	1.50	.....
6	.....	1.41	14	1.43	1.40	22	1.46	1.40	30	1.40	.....
7	1.45	1.40	15	1.43	1.40	23	1.45	1.55			
8	1.43	1.42	16	1.48	1.40	24	1.43	1.46			

SHOSHONE RIVER AT CODY, WYO.

This station was established April 26, 1902, by A. J. Parshall. It is located at the wagon bridge 1 mile northwest of Cody, Wyo. The gage is a plain staff graduated to one-half tenths and is fastened to the bridge, from which discharge measurements are made. The initial point for sounding is on the left bank. The channel is straight both above and below the station. The current is swift. The right bank is low and subject to overflow. The left bank is high and does not overflow. The bed of the stream is gravel and rock. The bench mark is a bolt in the bridge sleeper 1.15 feet above the 12-foot mark on the gage. It is indicated by a cross. The observer is W. J. Kissick, who reads the gage twice daily.

During 1902 the following discharge measurements were made by A. J. Parshall:

April 26: Gage height, 2.40 feet; discharge, 538 second-feet.
June 7: Gage height, 4.80 feet; discharge, 4,352 second-feet.
July 17: Gage height, 4.10 feet; discharge, 2,812 second-feet.
July 31: Gage height, 3.65 feet; discharge, 2,039 second-feet.
December 8: Gage height, 2.00 feet; discharge, 270 second-feet.

Daily gage height, in feet, of Shoshone River at Cody, Wyo.

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1902.						
1	2.75	5.50	4.15	4.00	2.50	2.50
2	3.00	5.00	4.45	4.00	2.50	2.50
3	2.55	4.50	4.65	4.00	2.50	2.50
4	2.50	4.50	4.45	3.45	2.50	2.50
5	2.50	5.00	4.00	3.40	2.50	2.50
6	2.60	5.00	4.05	3.50	2.50	2.50
7	3.00	4.80	4.00	3.45	2.50	2.50
8	3.55	5.60	4.00	3.50	2.50	2.50
9	4.00	6.00	4.00	3.50	2.50	2.50
10	4.20	6.60	4.05	3.15	2.50	2.50
11	4.40	6.60	4.20	3.00	2.50	2.50
12	4.15	6.30	4.50	3.00	2.50	2.50
13	4.30	6.30	4.50	3.00	2.50	2.50
14	4.50	6.00	4.45	3.00	2.50	2.50
15	4.90	5.40	4.45	3.00	2.50	2.50
16	4.50	5.00	4.25	3.00	2.50	2.50
17	4.35	5.00	4.25	3.00	2.50	2.50
18	4.40	5.00	4.25	3.00	2.50	2.50
19	4.10	4.70	4.35	3.00	2.50	2.50
20	3.65	4.50	4.00	3.00	2.50	2.50
21	3.50	5.00	4.00	3.00	2.50	2.50
22	3.50	4.90	4.10	3.00	2.50	2.50
23	3.50	5.25	4.10	3.00	2.50	2.50
24	3.50	5.25	4.00	3.00	2.50	2.50
25	3.50	5.25	4.00	3.00	2.50	2.50
26	3.90	5.25	4.00	3.00	2.50	2.50
27	4.75	5.00	4.00	3.00	2.50	2.50
28	5.25	4.85	4.10	3.00	2.50	2.50
29	5.25	4.50	4.20	3.00	2.50	2.50
30	5.50	4.50	4.00	3.00	2.50	2.50
31	5.75	.....	4.00	2.50	.....	2.50

Rating table for Shoshone River at Cody, Wyo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.5	30	2.8	860	4.1	2,920	5.4	5,585
1.6	70	2.9	960	4.2	3,125	5.5	5,790
1.7	110	3.0	1,070	4.3	3,330	5.6	5,995
1.8	160	3.1	1,190	4.4	3,535	5.7	6,200
1.9	210	3.2	1,320	4.5	3,740	5.8	6,405
2.0	270	3.3	1,460	4.6	3,945	5.9	6,610
2.1	335	3.4	1,610	4.7	4,150	6.0	6,815
2.2	400	3.5	1,770	4.8	4,355	6.1	7,020
2.3	470	3.6	1,940	4.9	4,560	6.2	7,225
2.4	540	3.7	2,120	5.0	4,765	6.3	7,430
2.5	615	3.8	2,310	5.1	4,970	6.4	7,635
2.6	690	3.9	2,510	5.2	5,175	6.5	7,840
2.7	770	4.0	2,715	5.3	5,380		

Estimated monthly discharge of Shoshone River at Cody, Wyo.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
May	6,300	615	2,752	168,904
June	8,045	3,740	5,246	311,632
July	4,045	2,715	2,755	169,112
August	2,715	615	1,346	82,762
September	615	615	615	37,749
October	615	615	615	37,749

BIGHORN RIVER NEAR THERMOPOLIS, WYO.

This station, which was established by A. J. Parshall on May 28, 1900, was located about a half mile northeast of Thermopolis, at the ferry crossing the river. The gage, which consists of a horizontal rod extending out over the water, is fastened to a post set firmly in the bank. On the horizontal stick is attached the wire gage by means of which the heights of the river are recorded. The bench mark was the head of a nail in a stick driven in the ground 1 foot south of the post to which the gage rod is fastened and 2.58 feet below the top of the gage frame. The bench mark has been destroyed. A new gage, whose relative heights are the same as those of the gage of 1901, was painted on a pier on the right bank in 1903. This gage is reached only by the

water when it is at a height of 3 feet above datum. It will enable the observer to read heights of high water more accurately than can be done upon the gage rod which is in the center of the stream and is exposed to the force of the current, causing a rise and fall of several inches on the rod. Discharge measurements were first made from a ferryboat, but, beginning with 1902, they have been made from the bridge which was recently erected. The channel is straight above and below the station. Both banks are high and not subject to overflow. The bed of the stream is of gravel and shifts during extreme high water. In 1901 a gage was painted upon one of the lower piers of the new State bridge over the river, 400 or 500 feet upstream from the former station. The relative heights on the rod remained as before, the same bench mark being used. During 1902 the following discharge measurements were made by A. J. Parshall:

June 11: Gage height, 4.70 feet; discharge, 9,080 second-feet.
June 14: Gage height, 4.40 feet; discharge, 8,391 second-feet.
June 16: Gage height, 3.60 feet; discharge, 6,334 second-feet.

Daily gage height, in feet, of Bighorn River near Thermopolis, Wyo.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1902.					1902.				
1	2.40	2.80	2.70	0.90	17	3.40	1.50	2.10	0.70
2	2.60	2.80	2.60	.80	18	3.40	1.50	2.10	.60
3	2.70	2.70	2.60	.80	19	3.30	1.50	2.00	.60
4	2.70	2.60	2.60	.80	20	2.90	1.40	1.90	.60
5	2.60	2.50	2.50	.70	21	2.40	1.40	1.80	.60
6	2.40	2.30	2.50	.70	22	2.50	1.40	1.70	.50
7	3.40	2.10	2.40	.60	23	2.40	1.30	1.60	.50
8	3.70	2.00	2.30	.60	24	2.30	1.30	1.60	1.00
9	4.20	2.00	2.30	.90	25	2.20	1.40	1.50	1.00
10	4.20	1.90	2.20	1.00	26	2.30	2.50	1.40	.90
11	4.70	1.80	2.20	1.20	27	2.20	3.00	1.20	.90
12	5.00	1.80	2.30	1.00	28	2.10	3.00	1.10	.80
13	4.60	1.70	2.30	.90	29	2.30	3.00	1.00	.60
14	4.40	1.70	2.20	.80	30	2.40	2.90	.90	.50
15	4.00	1.60	2.10	.80	31	.....	2.80	.90	.....
16	3.60	1.50	2.10	.70					

YELLOWSTONE RIVER NEAR LIVINGSTON, MONT.

The gaging station is located at the highway bridge over the Yellowstone River, 5 miles south of Livingston, Mont., at the mouth of the canyon. It was established May 2, 1897, a vertical rod fastened to the face of the pier being first used. A wire gage was afterwards established. Length of cable 18.30 feet; pulley distance, 0.58 foot. The bench mark is the head of the 2-inch nut on the center pin at the foot of the end diagonal of the truss, east pier, upper side, and is 13.44 feet above datum.

A new bench mark was determined in 1899. It was the top of the end plate of the bridge at the upper side of the east end, at an elevation of 14.20 feet above zero of gage. On January 1, 1903, the gage (and the datum) were lowered 3.00 feet, making all subsequent readings 3 feet greater. The elevation of bench mark also reads 17.20 feet, instead of 14.20 feet. The slope of the water surface at the gaging station was found to be 0.146 feet in 200 feet on August 29, 1899. The left bank is high and will not overflow. The right bank is low, and during floods a part of the water escapes through a slough on that side, and has to be measured separately. The observer is Thomas S. Carter, rancher.

During 1902 the following discharge measurements were made by H. B. Waters:

May 1: Gage height, —0.82 foot; discharge, 1,604 second-feet.
July 16: Gage height, 2.90 feet; discharge, 8,359 second-feet.
August 23: Gage height, 0.23 foot; discharge, 3,081 second-feet.

Daily gage height, in feet, of Yellowstone River near Livingston, Mont.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	−1.30	(a)	−1.20	−1.20	−0.75	5.15	3.50	1.52	−0.05	−0.65	−1.05	−1.30
2	−1.30	(a)	−1.15	−1.15	− .80	4.20	3.50	1.42	− .10	− .70	−1.05	−1.30
3	−1.00	−1.60	−1.20	−1.15	− .80	3.70	3.77	1.32	− .10	− .70	−1.10	−1.40
4	− .90	−1.50	−1.20	−1.15	− .80	3.60	3.57	1.20	− .15	− .70	−1.10	−1.40
5	−1.00	−1.40	−1.25	−1.15	− .75	3.90	3.50	1.15	− .20	− .75	−1.25	−1.30
6	−1.10	−1.40	−1.20	−1.10	− .75	3.90	3.30	1.05	− .20	− .75	−1.30	−1.40
7	−1.00	−1.40	−1.20	−1.10	− .45	3.90	3.20	1.00	− .25	− .75	−1.20	(a)
8	−1.00	−1.40	−1.20	−1.10	− .15	4.25	3.05	.95	− .25	− .80	−1.05	−1.60
9	−1.00	(a)	−1.25	−1.15	.75	5.20	2.92	.90	− .30	− .80	−1.05	−1.30
10	−1.00	−1.20	−1.20	−1.15	1.38	5.90	2.90	.85	− .30	− .80	−1.05	−1.30
11	−1.10	−1.10	−1.20	−1.12	1.73	6.05	2.90	.80	− .35	− .80	−1.00	−1.40
12	(a)	−1.10	−1.20	−1.12	1.98	5.80	2.97	.80	− .40	− .80	−1.00	−1.40
13	−1.30	−1.10	−1.20	−1.15	2.70	5.50	3.00	.80	− .45	− .85	−1.00	−1.30
14	−1.30	−1.20	−1.30	−1.15	3.03	5.85	3.00	.75	− .45	− .85	−1.00	(a)
15	−1.20	−1.20	−1.25	−1.15	3.65	4.65	2.90	.75	− .50	− .85	−1.05	−1.60
16	−1.30	−1.00	−1.20	−1.10	3.28	4.32	2.80	.70	− .50	− .90	−1.10	−1.70
17	−1.30	− .90	−1.20	−1.05	3.35	4.07	2.77	.70	− .50	− .90	−1.10	−1.60
18	−1.10	−1.00	−1.20	− .95	2.88	4.00	2.62	.70	− .50	− .90	−1.10	−1.60
19	−1.15	−1.00	−1.20	− .80	2.43	3.85	2.45	.65	− .50	− .95	−1.15	−1.50
20	−1.20	−1.20	−1.20	− .35	1.93	3.67	2.35	.60	− .55	− .95	−1.15	−1.40
21	−1.30	−1.20	−1.20	− .60	1.78	3.77	2.30	.50	− .55	− .95	−1.25	−1.40
22	−1.20	−1.20	−1.20	− .90	1.50	3.90	2.28	.40	− .60	− .95	−1.35	−1.40
23	−1.50	−1.20	−1.20	− .60	1.43	4.05	2.20	.35	− .60	−1.00	−1.30	−1.30
24	(a)	−1.20	−1.20	− .70	1.55	4.13	2.15	.30	− .60	−1.00	−1.25	−1.40
25	(a)	−1.20	−1.20	− .80	2.13	4.00	2.10	.25	− .60	−1.00	−1.20	−1.20
26	(a)	−1.20	−1.15	− .90	2.68	4.03	2.02	.20	− .65	−1.00	−1.30	−1.10
27	(a)	−1.20	−1.15	− .90	3.58	3.85	1.92	.15	− .65	−1.00	−1.35	−1.30
28	(a)	−1.20	−1.20	− .90	4.25	3.90	1.80	.10	− .65	−1.00	−1.35	(a)
29	(a)	.....	−1.35	− .85	4.55	3.55	1.75	.05	− .65	−1.00	−1.35	−1.50
30	(a)	.....	−1.35	− .80	5.10	3.60	1.70	.00	− .65	−1.00	−1.45	−1.50
31	a−1.60	.....	−1.30	.....	5.40	.....	1.62	.00	.....	−1.05	.....	−1.50

a River frozen at gage.

Rating table for Yellowstone River near Livingston, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
−1.6	1,000	0.4	3,445	2.4	7,375	4.4	11,350
−1.4	1,135	.6	3,840	2.6	7,765	4.6	11,750
−1.2	1,280	.8	4,225	2.8	8,155	4.8	12,150
−1.0	1,440	1.0	4,620	3.0	8,545	5.0	12,550
− .8	1,640	1.2	5,010	3.2	8,950	5.2	12,950
− .6	1,825	1.4	5,395	3.4	9,350	5.4	13,350
− .4	2,070	1.6	5,790	3.6	9,750	5.6	13,750
− .2	2,350	1.8	6,195	3.8	10,150	5.8	14,150
.0	2,680	2.0	6,590	4.0	10,550	6.0	14,550
.2	3,050	2.2	6,985	4.2	10,950	6.2	14,950

Estimated monthly discharge of Yellowstone River near Livingston, Mont.

[Drainage area, 3,580 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean		Second-feet per square mile.	Depth in inches.
1902.						
January	1,550	1,000	1,242	76,368	0.35	0.40
February	1,550	1,000	1,254	69,644	.35	.36
March	1,317	1,170	1,268	77,966	.35	.40
April	2,137	1,280	1,479	88,007	.41	.46
May	13,350	1,640	6,392	393,029	1.79	2.06
June	14,650	9,650	11,230	668,231	3.14	3.50
July	10,050	5,790	7,899	485,691	2.21	2.55
August	5,590	2,680	3,974	244,352	1.11	1.28
September	2,592	1,770	2,053	122,162	.57	.64
October	1,770	1,397	1,564	96,167	.44	.51
November	1,440	1,135	1,309	77,891	.37	.41
December	1,355	960	1,129	69,420	.32	.37
The year	14,650	960	3,402	2,468,928	.95	12.94

MILK RIVER AT MALTA, MONT.

This station was established July 31, 1902, by C. T. Prall. It is located at the highway bridge on the main road one-fourth mile east of Malta, Mont. The gage is of the usual wire type, with the scaleboard graduated to feet and tenths and nailed to the lower

side of the bridge. The length of the gage wire from the pointer to the end of the weight is 28.7 feet. The distance from the zero on the rod to the outside edge of the pulley is 0.5 of a foot. The gage is read twice daily by H. Caselberg. The initial point for sounding is on the right bank. The channel is straight for 700 feet above the station and 250 feet below the station. The banks are not liable to overflow. The bed of the stream is rocky and sandy. The bench mark is a 20-penny wire nail driven just below the gage rod at a gage reading of 5 feet.

Discharge measurements of Milk River at Malta, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
July 31	C. T. Prall	2.50	525
August 21	do	1.80	259
September 10	do	1.40	166
September 25	F. E. Weymouth	1.50	165
October 6	John T. Whistler	1.85	271
October 11	F. E. Weymouth	1.65	198
October 17	Cyrus C. Babb	1.67	174
October 24	John T. Whistler	1.60	171
October 31	George Drummond	1.70	257
November 7	John T. Whistler	1.70	210

Daily gage height, in feet, of Milk River at Malta, Mont.

Day.	Aug.	Sept.	Oct.	Nov.	Day.	Aug.	Sept.	Oct.	Nov.
1902.					1902.				
1	2.30	1.80	1.70	1.60	17	1.70	1.30	1.60	.....
2	2.40	1.70	1.70	1.60	18	1.80	1.30	1.60	.....
3	2.30	1.70	1.70	1.60	19	1.80	1.30	1.60	.....
4	2.20	1.70	1.70	1.60	20	1.70	1.30	1.60	.....
5	2.10	1.70	1.70	1.60	21	1.70	1.30	1.60	.....
6	2.10	1.70	1.70	1.60	22	1.80	1.30	1.60	.....
7	2.10	1.70	1.70	1.60	23	1.70	1.30	1.60	.....
8	2.10	1.60	1.70	1.70	24	1.80	1.30	1.60	.....
9	2.10	1.50	1.70	.....	25	1.80	1.30	1.60	.....
10	2.00	1.50	1.80	.....	26	1.80	1.40	1.60	.....
11	1.95	1.50	1.80	.....	27	1.80	1.40	1.60	.....
12	1.90	1.40	1.60	.....	28	1.70	1.30	1.60	.....
13	1.90	1.30	1.60	.....	29	1.70	1.30	1.60	.....
14	1.90	1.30	1.60	.....	30	1.70	1.40	1.60	.....
15	1.90	1.30	1.60	.....	31	1.70	.....	1.60	.....
16	1.70	1.30	1.60	.....					

Rating table for Milk River at Malta, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	32	2.4	485	4.2	1,187	6.0	1,889
0.8	47	2.6	563	4.4	1,265	6.2	1,967
1.0	68	2.8	641	4.6	1,343	6.4	2,045
1.2	93	3.0	719	4.8	1,421	6.6	2,123
1.4	127	3.2	797	5.0	1,499	6.8	2,201
1.6	173	3.4	875	5.2	1,577	7.0	2,279
1.8	251	3.6	953	5.4	1,655		
2.0	329	3.8	1,031	5.6	1,733		
2.2	407	4.0	1,109	5.8	1,811		

Estimated monthly discharge of Milk River at Malta, Mont.

[Drainage area, 6,744 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
August	485	212	294	18,056	0.04	0.05
September	251	109	143	8,509	.02	.02
October	251	173	189	11,620	.03	.03
November 1 to 8	.....	.....	178	2,822	.03	.01

MILK RIVER AT HAVRE, MONT.

The present station is located at Havre, Mont., and was established by Cyrus C. Babb, May 15, 1898. Measurements of discharge are made from a car and cable of 200-foot span swung across the river a short distance above the gage. The river is subject to violent floods of short duration, and the bed of the river being composed of gravels and clay is liable to change after each freshet.

Discharge measurements of Milk River at Havre, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 11	J. S. Baker	3.50	249
April 19	L. H. Ling	3.10	214
May 19	do	4.00	362
May 22	do	4.90	1,013
May 23	do	7.35	3,363
May 24	do	8.88	5,179
May 27	do	6.60	2,503
July 10	do	7.00	2,341
July 31	do	4.70	573
August 8	do	4.10	387
August 26	do	4.20	427
August 30	do	3.90	269
September 11	do	3.60	192
September 17	do	3.80	240
September 23	do	3.90	226
September 30	do	4.00	229
October 6	do	3.90	206
October 16	do	3.90	208
October 29	do	3.90	206
November 4	L. V. Branch	3.77	205

Daily gage height, in feet, of Milk River at Havre, Mont.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1			4.20	2.80	3.10	4.30	4.60	4.70	3.90	4.00	3.90	
2			4.20	2.80	3.20	4.30	4.60	4.60	3.90	3.90	4.00	
3			4.20	2.80	3.20	6.40	5.00	4.30	3.90	3.90	4.00	(a)
4		(a)	4.00	3.60	3.10	7.40	6.50	4.20	3.80	3.90	3.80	
5			3.90	3.50	3.10	8.40	7.50	4.20	3.80	3.90	3.80	
6			3.40	3.40	3.00	8.00	8.00	4.10	3.80	3.90	3.80	
7			3.20	3.10	3.00	8.00	12.10	4.10	3.80	3.90	3.80	
8			3.20	3.10	3.00	6.00	10.50	4.10	3.80	3.90	(a)	(a)
9	a3.00		3.20	3.10	3.10	5.50	8.00	4.10	3.80	3.80		
10			3.60	3.10	3.10	5.40	7.00	4.10	3.60	3.80		
11			4.30	3.50	3.20	5.20	6.40	4.10	3.60	3.80		
12			4.00	3.70	3.20	5.00	6.00	4.10	3.60	3.90		
13			3.40	3.70	3.20	5.00	6.20	4.10	3.60	3.90	(a)	(a)
14			3.20	3.60	3.20	4.90	6.20	4.10	3.60	3.90		
15		(a)	3.20	3.50	3.20	4.80	6.00	4.10	3.60	3.90		
16			3.20	3.50	3.30	5.20	6.00	4.00	3.80	3.90		
17			3.20	3.30	3.40	5.20	5.50	4.00	3.80	3.90		
18	a3.00		3.20	3.20	4.00	5.20	5.20	4.00	3.70	3.90	(a)	(a)
19		3.30	3.20	3.10	4.00	5.20	5.00	4.00	3.60	3.90		
20		3.60	3.20	3.00	4.10	5.20	5.20	4.00	3.60	3.90		
21		3.30	3.20	2.90	4.10	5.20	5.20	4.00	3.60	3.90		
22		3.30	3.20	2.90	5.10	5.20	5.00	4.00	3.80	3.90		
23		3.10	3.20	3.00	7.80	5.10	5.20	3.90	3.90	3.90	(a)	(a)
24		3.10	3.40	3.00	10.50	5.10	5.20	3.90	3.90	3.90		
25	a3.00	3.10	3.50	3.00	11.00	5.00	5.20	4.00	4.00	3.90		
26		3.10	3.60	3.00	7.30	4.90	5.00	4.20	4.00	3.90		
27		3.40	3.60	2.90	6.60	4.80	4.90	4.10	3.90	3.90		
28		3.40	3.50	2.90	5.60	4.80	4.90	4.00	3.90	3.90	(a)	(a)
29			3.20	2.90	5.00	4.60	4.80	4.00	3.90	3.90		
30	a3.00		2.90	3.00	4.50	4.60	4.70	3.90	4.00	3.90		
31			2.90		4.50		4.70	3.90		3.90		

a Frozen at gage.

Rating table for Milk River at Havre, Mont., for 1902.

FROM JANUARY 1 TO MAY 22.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.6	145	5.0	989	7.4	3,442	9.8	6,259
2.8	161	5.2	1,178	7.6	3,677	10.0	6,494
3.0	180	5.4	1,368	7.8	3,912	10.2	6,729
3.2	200	5.6	1,557	8.0	4,147	10.4	6,964
3.4	222	5.8	1,746	8.2	4,381	10.6	7,199
3.6	250	6.0	1,935	8.4	4,616	10.8	7,433
3.8	288	6.2	2,124	8.6	4,851	11.0	7,668
4.0	335	6.4	2,314	8.8	5,086	11.5	8,255
4.2	412	6.6	2,503	9.0	5,320	12.0	8,842
4.4	519	6.8	2,738	9.2	5,555	12.5	9,429
4.6	630	7.0	2,973	9.4	5,790		
4.8	800	7.2	3,207	9.6	6,025		

Rating table for Milk River at Havre, Mont., for 1902—Continued.

FROM MAY 23 TO DECEMBER 31.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.6	100	3.0	122	3.4	157	3.8	212
2.8	109	3.2	138	3.6	180	4.0	300

[a] Above 4 feet the table is the same as for the fore part of the year.

Estimated monthly discharge of Milk River at Havre, Mont.

[Drainage area 7,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	180	180	180	11,068	0.02	0.02
February	----------	----------	[a]208	11,552	.03	.03
March	465	170	249	15,310	.03	.03
April	268	161	196	11,663	.03	.03
May	7,668	180	1,085	66,714	.15	.17
June	4,616	465	1,479	88,007	.20	.22
July	8,960	630	2,045	125,742	.28	.32
August	710	310	377	23,181	.05	.06
September	335	250	297	17,673	.04	.04
October	335	288	309	18,999	.04	.04
November	----------	----------	[a]300	17,851	.04	.04
December	----------	----------	[a]300	18,466	.04	.04
The year	8,960	161	586	426,226	.08	1.04

[a] Frozen; estimated.

MUSSELSHELL RIVER AT SHAWMUT, MONT.

This station was established August 12, 1902, by S. B. Dobbins. It is located about 200 yards west of Shawmut post-office, which is at the home ranch of the Blooming Land and Cattle Company. The gage is a vertical pole, graduated to feet and tenths, and nailed to a stump which overhangs the river. The observer is Dwight Crawford, who reads the gage daily. No bench marks have been established. The barometric elevation at this station is 3,900 feet.

Daily gage height, in feet, of Musselshell River at Shawmut, Mont.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						1902.					
1		0.60	1.00	1.10	1.10	17	0.70	0.70	1.10	1.20	1.20
2		.60	1.00	1.10	1.10	18	.70	.70	1.10	1.20	1.20
3		.60	1.00	1.10	1.10	19	.70	.70	1.10	1.10	1.20
4		.60	1.00	1.20	1.10	20	.70	.80	1.10	1.10	1.20
5		.60	1.00	1.00	1.20	21	.70	.70	1.10	1.00	1.20
6		.50	1.00	1.80	1.20	22	.70	.70	1.10	1.00	1.20
7		.50	1.00	1.10	1.20	23	.70	.70	1.10	1.10	1.20
8		.50	1.00	1.20	1.20	24	.70	.70	1.10	1.20	1.30
9		.50	1.00	1.20	1.20	25	.60	.70	1.10	1.20	1.30
10		.70	1.00	1.20	1.20	26	.60	.70	1.10	1.20	1.30
11		.70	1.10	1.20	1.20	27	.80	.70	1.10	1.20	1.30
12	0.60	.70	1.10	1.20	1.20	28	.70	.80	1.10	1.20	1.40
13	.50	.70	1.10	1.20	1.20	29	.60	.90	1.10	1.20	1.40
14	.50	.70	1.10	1.20	1.20	30	.60	.90	1.20	1.10	1.40
15	.50	.70	1.10	1.20	1.20	31	.60		1.20		1.40
16	.60	.70	1.10	1.20	1.20						

MARIAS RIVER NEAR SHELBY, MONT.

This station was established April 4, 1902, by J. S. Baker. It is located on the highway bridge 7 miles south of Shelby, Mont. The gage is of the usual wire type. The scaleboard is spiked to the downstream face of the bridge and is graduated to feet and tenths. It is read daily by William Mead, who lives about one-half mile southwest of the gage. The right bank is low and liable to overflow. The left bank is high and confined by a row of piles and a plank wall. The bed of the stream is composed of sand and gravel. Above the station the channel is curved. Below the station it is straight. The initial point for sounding is on the left bank at the east edge of the east pier on the lower side of the bridge. Bench mark No. 1 is a rivet head in the footplate at the foot of the batter post on the top of the southeast pier of the bridge. It is marked with black paint, B. M. 17.54. Its elevation above the zero of the gage is 17.54 feet. B. M. No. 2 is a spike in the southwest side of a cottonwood stump 25 feet southeast of the southeast pier. It is marked B. M. 11.27. Its elevation above the zero of the gage is 11.27 feet.

Discharge measurements of Marias River near Shelby, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 4	J. S. Baker	2.05	358
April 4	do	2.05	357
July 8	L. V. Branch	5.95	5,664
July 23	do	3.68	1,658
July 29	C. T. Prall	3.40	1,295
August 15	C. C. Babb	2.80	780
September 19	C. T. Prall	2.40	547
November 3	L. V. Branch	2.16	299

Daily gage height, in feet, of Marias River near Shelby, Mont.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1	.....	2.70	6.50	4.10	3.10	2.40	2.20	2.20	2.30
2	.....	2.70	6.40	5.00	3.10	2.30	2.20	2.20	2.30
3	.....	2.90	6.20	6.40	3.00	2.20	2.20	2.20	2.30
4	2.50	2.70	5.50	11.50	3.00	2.30	2.20	2.20	2.30
5	2.60	2.60	5.20	11.00	3.00	2.40	2.20	2.20	2.30
6	2.40	2.50	5.00	8.50	2.90	2.40	2.20	2.10	2.30
7	2.10	2.60	4.90	6.80	2.80	2.40	2.20	2.20	2.30
8	2.10	2.90	4.80	6.10	2.70	2.30	2.20	2.20	2.30
9	2.00	3.00	4.50	5.60	2.80	2.20	2.20	2.10	2.30
10	2.10	3.30	4.80	5.30	3.00	2.10	2.20	2.20	2.30
11	2.10	3.30	5.10	5.10	2.80	2.20	2.20	2.20	2.30
12	2.10	3.90	5.10	4.90	2.70	2.20	2.20	2.30	2.50
13	2.10	3.90	4.90	4.50	2.50	2.20	2.20	2.70	2.60
14	2.10	3.90	4.60	4.50	2.50	2.20	2.20	2.60	2.60
15	2.20	4.40	4.50	4.50	2.50	2.20	2.20	2.60	2.50
16	1.90	5.70	4.40	4.40	2.40	2.30	2.20	2.50	2.60
17	2.00	5.40	4.50	4.40	2.40	2.20	2.20	2.60	2.50
18	2.00	5.10	4.40	4.10	2.50	2.20	2.20	2.50	2.50
19	2.00	5.10	4.20	4.10	2.20	2.30	2.20	2.50	2.50
20	2.00	4.90	4.20	4.00	2.10	2.20	2.20	2.50	2.60
21	2.50	9.90	4.10	4.00	2.10	2.20	2.20	2.40	2.60
22	2.70	14.50	4.00	3.90	2.30	2.50	2.20	2.50	2.50
23	2.60	9.20	4.10	3.80	2.00	2.40	2.20	2.50	2.50
24	2.50	9.40	3.90	3.60	2.40	2.20	2.20	2.50	2.50
25	2.40	9.00	4.10	3.50	2.60	2.30	2.20	2.40	2.50
26	2.30	6.40	4.10	3.60	2.70	2.20	2.20	2.40	2.60
27	2.40	6.00	4.40	3.60	2.50	2.20	2.20	2.30	2.60
28	2.40	6.50	4.30	3.70	2.50	2.20	2.20	2.30	2.60
29	2.40	6.60	4.20	3.50	2.30	2.30	2.20	2.30	2.40
30	2.60	7.00	4.30	3.30	2.20	2.30	2.20	2.30	2.30
31	.....	6.60	.....	3.30	2.10	.....	2.20	.....	2.30

Rating table for Marias River near Shelby, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	144	3.8	1,871	6.6	6,809	9.4	11,737
1.2	168	4.0	2,223	6.8	7,161	9.6	12,089
1.4	192	4.2	2,575	7.0	7,513	9.8	12,441
1.6	227	4.4	2,927	7.2	7,865	10.0	12,793
1.8	273	4.6	3,279	7.4	8,217	10.2	13,145
2.0	333	4.8	3,631	7.6	8,569	10.4	13,497
2.2	425	5.0	3,983	7.8	8,921	10.6	13,849
2.4	540	5.2	4,355	8.0	9,273	10.8	14,201
2.6	660	5.4	4,707	8.2	9,625	11.0	14,553
2.8	780	5.6	5,059	8.4	9,977	11.2	14,905
3.0	935	5.8	5,401	8.6	10,329	11.4	15,257
3.2	1,105	6.0	5,753	8.8	10,681	11.6	15,609
3.4	1,285	6.2	6,105	9.0	11,033	11.8	15,961
3.6	1,520	6.4	6,457	9.2	11,385	12.0	16,313

Estimated monthly discharge of Marias River near Shelby, Mont.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April 4 to 30	----------	----------	468	25,063	0.18	0.18
May	5,235	600	4,764	292,927	1.83	2.11
June	6,633	2,047	3,469	206,420	1.33	1.48
July	16,313	1,190	3,980	244,721	1.52	1.75
August	1,402	333	654	40,213	.25	.29
September	600	373	463	27,550	.18	.20
October	480	425	425	26,132	.16	.18
November	720	373	518	30,823	.20	.22
December	660	480	563	34,617	.22	.25

TWO MEDICINE CREEK AT MIDVALE, MONT.

This station was established September 17, 1902, by C. C. Babb. It is located 200 yards above the Great Northern Railroad bridge 1 mile from the railroad station at Midvale, Mont. The gage is inclined and graduated so as to give readings of vertical feet and tenths. It is fastened to a tree and stake. The initial point for sounding is on the left bank. The channel is straight for 700 feet above and 300 feet

below the station. The banks are high and rocky. Bench mark No. 1 is a nail in a rock 13.5 feet below the rod. Its elevation is 2.03 feet above the zero of the gage. Bench mark No. 2 is a nail driven in a spruce tree 40 yards north of the rod. Its elevation is 32 feet above the zero of the gage.

The following discharge measurements were made during 1902:

October 15: Gage height, 0.45 foot; discharge, 34 second-feet.
October 15: Gage height, 0.54 foot; discharge, 47 second-feet.

Daily gage height, in feet, of Two Medicine Creek at Midvale, Mont.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.					1902.				
1		0.50	0.35	0.70	17		0.45	1.50	0.80
2		.50	.35	.60	18	0.45	.45	1.20	.80
3		.50	.35	.60	19	.50	.45	1.00	.80
4		.50	.30	.60	20	.45	.45	1.00	.80
5		.50	.30	.60	21	.45	.40	.90	.80
6		.45	.30	.60	22	.45	.40	.90	.80
7		.45	.30	.60	23	.40	.40	.80	.80
8		.45	.30	.60	24	.40	.35	.80	.80
9		.45	.30	.70	25	.40	.35	.80	.90
10		.45	.35	.70	26	.45	.35	.70	1.00
11		.50	.40	.80	27	.50	.35	.70	1.00
12		.50	.55	.80	28	.50	.35	.70	1.20
13		.45	.70	.80	29	.50	.35	.70	1.20
14		.45	.90	.80	30	.50	.35	.70	1.20
15		.45	1.20	.80	31		.35		1.20
16		.45	1.50	.80					

MISSOURI RIVER AT CASCADE, MONT.

This station was established July 1, 1902, by W. W. Schlecht. It is located at the highway bridge in the town of Cascade, Mont., about one-fourth of a mile from the railroad. The gage is of the usual wire type, and the scaleboard is graduated to feet and tenths and is fastened to one of the eyebars of the bridge. It is read daily by H. W. Ludwig. The initial point for sounding is on the abutment of the right approach to the bridge. The channel is straight for about 600 feet above the station and 300 feet below. About 300 feet below the station there is an island, on either side of which the river is rapid. There is about 1 foot fall at this point. The right bank is low and liable to overflow. The left bank is high and not liable to overflow. The bed of the stream is rocky near the piers and muddy along the banks. The bridge has two spans. The central pier is protected by an ice and drift breaker, which extends about 125 feet upstream. No bench marks have been established.

The following measurements were made during 1902 by W. W. Schlecht and L. V. Branch:

July 21: Gage height, 5.06 feet; discharge, 5,537 second-feet.
September 9: Gage height, 3.67 feet; discharge, 1,891 second-feet.
November 6: Gage height, 4.18 feet; discharge, 3,131 second-feet.

Daily gage height, in feet, of Missouri River at Cascade, Mont.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.						
1	.....	4.20	3.67	3.90	4.20	3.95
2	.....	4.15	3.55	3.95	4.20	4.00
3	.....	4.05	3.77	4.00	4.20	4.20
4	.....	3.90	3.87	4.05	4.20	4.50
5	.....	3.87	3.85	4.07	4.20	4.50
6	.....	3.75	3.75	4.05	4.18	4.50
7	.....	3.62	3.70	4.00	4.17	.....
8	.....	3.60	3.65	4.00	4.20	.....
9	.....	3.60	3.70	4.00	4.20	.....
10	.....	3.60	3.67	4.05	4.20	.....
11	.....	3.60	3.62	4.05	4.25	.....
12	.....	3.60	3.60	4.10	4.32	.....
13	.....	3.60	3.60	4.10	4.45	.....
14	.....	3.60	3.60	4.15	4.50	.....
15	.....	3.60	3.60	4.10	4.50	.....
16	.....	3.55	5.60	4.10	4.55	.....
17	5.35	3.50	3.65	4.10	4.55	.....
18	5.30	3.45	3.65	4.10	4.60	.....
19	5.22	3.55	3.70	4.10	4.57	.....
20	5.12	3.50	3.70	4.15	4.55	.....
21	5.00	3.72	3.70	4.15	4.50	.....
22	5.00	3.92	3.70	4.15	4.45	.....
23	4.90	3.90	3.70	4.10	4.20	.....
24	4.80	3.90	3.70	4.10	4.50	.....
25	4.70	3.87	3.70	4.10	4.00	.....
26	4.65	3.85	3.65	4.10	4.00	.....
27	4.60	3.85	3.62	4.10	4.00	.....
28	4.50	3.85	3.60	4.18	4.00	.....
29	4.40	3.82	3.65	4.20	4.00	.....
30	4.30	3.75	3.72	4.20	4.00	.....
31	4.30	3.70	.....	4.20	.....	.....

MISSOURI RIVER AT TOWNSEND, MONT.

The gaging station was established in 1891 by the Missouri River Commission, and readings have been made continuously since that time by an observer employed by the Commission. The locality is 2,504 miles above the mouth of the river. The following description of the gage, its location, and bench marks is from Lieut. J. C. Sanford, secretary of the Missouri River Commission:

A standard wire cable gage was erected by the Missouri River Commission October 1, 1891, on a county road bridge, located about 300 feet below the Northern Pacific Railroad bridge across the Missouri River near Townsend, Mont. Its zero is set at an approximate elevation of 3,700 feet above sea level as determined from a primary line of levels, run under the direction of the Commission in 1890, from Three Forks to Fort Benton, Mont., and starting from a bench mark of the Northern Pacific Railroad at Gallatin, Mont. (See Annual Report of Chief of Engineers, 1891.)

Reference bench mark is B. M. 10 (Townsend), described as "located on the right bank of the Missouri River, about one-half mile north of Townsend Railroad station, about one-half mile from river, measured in a perpendicular direction to track, and about three-fourths mile south of railroad bridge over the Missouri

River. It is about 60 feet west of a point on the track, 30 feet north of railroad bridge No. 392, and about 7 feet west of railroad fence. Compass reading to milepost 1121 is 318°. Marked by stone and pipe; elevation, 3,795.991 feet. This elevation is erroneous, but is the elevation from which the gage is set.

The tabulated records of the Townsend gage are reductions to the St. Louis directrix datum obtained by subtracting 400.063 feet from the daily means of the gage readings. The gage reads from 3,785 to 3,799 feet.

Lieutenant Sanford states that since the establishment of the gage level lines have been completed connecting all of the upper river gages with the datum of the Missouri River Commission. Precise levels have been run up to Sioux City, Iowa, and above that checked Y lines have been run under the direction of Capt. H. F. Hodges, Corps of Engineers, United States Army, and of the Missouri River Commission. The elevations of the zeros of the other Montana gages read during 1890 are as follows:

Elevations of river gages in Montana.

Locality.	Above mouth.	Elevation of gage zero.	Locality.	Above mouth.	Elevation of gage zero.
	Miles.	*Feet.*		*Miles.*	*Feet.*
Great Falls	2,333.3	2,897.165	Toston	2,519.8	3,477.230
Craig	2,415.7	3,028.575	Gallahers Ferry	2,546.4	3,613.069
Stubbs Ferry	2,463.8	3,207.674	Gallatin Ferry	2,546.7	3,614.783

The area drained at this point is approximately 15,000 square miles, comprising, as above stated, the inflow from the Gallatin, the Madison, and the Jefferson rivers. This gage at Townsend is the highest of a series of twenty or more gages maintained permanently by the Missouri River Commission. Descriptions of these gages are given in the annual report of the Missouri River Commission, contained in the Annual Report of the Chief of Engineers, United States Army; that for 1891, on page 3819; for 1892, on page 3271, and for 1893, on page 2316. The distance of this point above Sioux City is 1,703 miles, and above Fort Benton, the next gage below maintained by the Corps of Engineers, 219 miles. In the report of the Chief of Engineers, United States Army, for 1893, page 2320, it is stated that there is under way an "examination of Missouri River from Three Forks to Canyon Ferry, Mont., with a view of determining at what points, if any, use might be made of water power for manufacturing and other purposes without unreasonably impairing the navigability. This part of the river was surveyed and mapped in 1890 under the direction of the Missouri River Commission. For the present work it is proposed to examine the maps of this survey and select such points as seem suitable to personally examine the localities, and by additional field work to get the necessary data for a report."

The gaging station on the upper Missouri River in the vicinity of Craig, referred to in previous reports, was abandoned in June, 1892, owing to the expense of maintenance and the fact that the Missouri River Commission had a gage at Townsend, Mont.

The results are furnished to the Geological Survey by the Corps of Engineers, United States Army.

Discharge measurements of Missouri River at Townsend, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 14	H. B. Waters	88.75	2,840
July 14	do	89.82	6,547
August 28	do	88.52	2,350

GALLATIN RIVER AT LOGAN, MONT.

This station was established on August 24, 1893, by F. H. Newell, at the railroad pump house immediately below the Northern Pacific main line bridge crossing Gallatin River at Logan, Mont. The gage was a vertical rod fastened to the cribwork box sunk in the river for the protection of the inlet pipe of the pump. The bench marks consist of nails driven into the angle of the pier of the bridge facing the gage, these being placed at the elevation of the 7, 8, 9, and 10 foot marks, and designated by corresponding figures. At the bridge itself measurements of volume can not well be made, as the stream is divided into four channels, being very swift in two of these, and obstructed by piles, snags, and sand in the others. Above the bridge, however, is a broad, straight course, where measurements can be made by means of a boat and cable.

On March 10, 1894, the gage rod was washed out, together with the crib to which it was attached, no discharge measurements having been made while it was in place.

On November 16, 1894, a new gage was established by Arthur P. Davis under the northeast corner of the Northern Pacific bridge above mentioned. This gage consisted of timbers partly inclined and partly vertical, the lower inclined portion being graduated from 0.60 foot up to 7.10 feet, and the vertical portion from 7 feet up to 12.10 feet. Bench mark No. 1 is on the head of a bridge spike, in the top of the pile stump to which the lower end of the inclined gage is fastened. Elevation 1.62 feet above zero of gage. Bench mark No. 2 is the head of a bridge spike driven horizontally into the first pier east of the river. It is driven into the north end, and is marked "B. M." Its elevation is 9.32 feet above the zero of the gage. The measurements were made by means of a cable across the river 100 yards above the bridge.

On September 16, 1896, a wire gage was placed in the east span of the railroad bridge and fastened to the guard rail on the upper side. The distance from the outside edge of the pulley to the end of the rod is 1 foot; from the end of the weight to the index marker 18.40 feet. Bench mark 1 is the top of the northeast corner of the iron plate at foot of diagonal end member of truss, east end, upper side,

and is 13.70 feet above datum. Bench mark 2 is a spike in pile stump, described and called "Bench mark No. 1," in the description of the 1894 gage. Discharge measurements are made from the cable across the river 300 feet above the railroad bridge. The section is a good one, the channel being straight for some distance above and below the cable. The bed is gravelly. The observer is James Martin. The following measurements were made in 1902:

Discharge measurements of Gallatin River at Logan, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 15	H. B. Waters	0.91	486
May 3	do	1.30	715
Do	do	1.30	720
May 28	do	4.23	4,018
July 14	do	1.66	986
August 29	do	.56	394

Daily gage height, in feet, of Gallatin River at Logan, Mont.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	.....	(a)	a1.05	1.30	.....	4.40	.....	0.80	0.60	1.10	1.10	1.40
2	.....	.....	1.05	1.30	.....	4.30	.....	.70	.60	1.10	1.10	1.20
3	.....	.....	1.05	1.30	.....	3.75	.....	.60	.60	1.10	1.10	1.20
4	(a)	.....	1.05	1.30	1.30	3.55	.....	.60	.60	1.10	1.10	1.30
5	1.00	.....	1.05	1.30	1.20	3.25	.....	.60	.60	1.10	1.10	1.40
6	1.00	.....	1.05	1.30	1.20	3.35	.....	.50	.60	1.10	1.20	1.30
7	1.00	.....	1.05	1.30	1.30	3.35	.....	.50	.60	1.10	1.10	1.30
8	1.00	(a)	1.04	1.30	1.40	4.15	.....	.50	.60	1.10	1.20	1.30
9	1.00	.....	1.40	1.30	1.60	4.10	.....	.50	.60	1.10	1.20	1.20
10	1.00	.....	1.40	1.30	1.60	4.30	.....	.60	.60	1.10	1.20	1.20
11	a1.00	.....	1.40	1.30	1.80	4.40	.....	.60	.60	1.10	1.30	1.20
12	1.00	.....	1.30	1.30	2.40	4.15	.....	.60	.60	1.10	1.40	1.10
13	1.00	.....	1.30	.....	2.55	4.35	.....	.60	.60	1.10	1.30	1.00
14	1.00	.....	1.30	.....	2.60	4.40	1.70	.60	.50	1.10	1.20	1.20
15	1.00	(a)	1.30	.....	3.35	2.95	1.50	.70	.30	1.10	1.20	1.40
16	1.00	1.10	1.30	.....	3.45	2.55	1.40	.70	.20	1.10	1.20	1.60
17	1.00	1.10	1.30	.....	3.50	2.50	1.30	.70	.30	1.10	1.20	2.50
18	1.00	1.10	1.30	.....	3.50	2.45	1.30	.80	.30	1.10	1.20	2.45
19	.....	1.10	1.30	.....	3.40	2.50	1.30	.80	.20	1.10	1.30	2.85
20	.....	1.10	1.30	.....	3.40	2.30	1.20	.70	.20	1.10	1.20	2.90
21	.....	1.10	1.30	.....	3.35	2.10	1.10	.70	.20	1.10	1.10	3.10
22	.....	1.10	1.30	.....	3.30	2.30	1.10	.70	.20	1.10	1.20	3.40
23	(a)	1.05	1.30	.....	3.35	2.40	1.00	.70	.20	1.10	1.30	3.60
24	.....	1.05	1.30	.....	3.30	2.40	.90	.70	.20	1.10	1.40	3.35
25	.....	1.05	1.30	.....	3.10	2.30	.80	.60	.10	1.10	1.40	3.30
26	.....	1.05	1.30	.....	3.10	2.44	.80	.70	.10	1.10	1.40	3.30
27	.....	1.05	1.30	.....	3.45	2.10	.80	.60	.10	1.10	1.40	2.40
28	.....	1.05	1.30	.....	3.80	2.20	.90	.60	1.10	1.10	1.40	2.10
29	.....	.....	1.30	.....	3.90	.....	.80	.60	1.10	1.10	1.40	2.10
30	.....	.....	1.30	.....	4.05	.....	.80	.60	1.10	1.10	1.40	2.60
31	.....	.....	1.30	.....	4.25	.....	.70	.60	.....	1.10	.....	2.80

a Frozen at gage.

Rating table for Gallatin River at Logan, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	356	1.4	780	2.6	1,965	3.8	3,520
.4	370	1.6	940	2.8	2,200	4.0	3,830
.6	400	1.8	1,120	3.0	2,440	4.2	4,125
.8	450	2.0	1,315	3.2	2,700	4.4	4,430
1.0	530	2.2	1,520	3.4	2,960		
1.2	650	2.4	1,735	3.6	3,240		

Estimated monthly discharge of Gallatin River at Logan, Mont.

[Drainage area, 1,805 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January 5 to 18	----------	----------	530	14,717	0.29	0.15
February 16 to 28	----------	----------	576	14,856	.32	.15
March	780	560	678	41,693	.38	.44
April 1 to 12	----------	----------	710	16,899	.39	.18
May 4 to 31	----------	----------	2,328	129,291	1.29	1.34
June 1 to 28	----------	----------	2,775	154,136	1.54	1.60
July 14 to 31	----------	----------	599	21,398	.33	.22
August	450	382	410	25,206	.23	.27
September	590	356	399	23,742	.22	.25
October	590	590	590	36,278	.33	.38
November	780	590	679	40,383	.38	.42
December	3,240	530	1,465	90,079	.81	.93

WEST GALLATIN RIVER NEAR SALESVILLE, MONT.

The Salesville station, which has been maintained for a number of years, was established near Williams's ranch, about 16 miles southwest of Bozeman and near a highway bridge crossing the stream about 5 miles south of Salesville. A gage rod was erected in July, 1895, and observations were begun on August 1 by Ira T. Williams, a ranchman living about 600 feet away. The gage is spiked to a tree and is not liable to be washed out. The bench mark consists of a 6-inch spike driven in the top of a stump 5 feet north of the gage post. It is 6.71 feet above the zero of the gage, as lowered 5 feet

from the original position. A second bench mark consists of a 6-inch spike driven into the east bridge abutment. This is 9.26 feet above the zero of the gage. The initial point for soundings is on the right bank. In flood the water flows behind the bridge abutments on the right bank, but at other times is confined within the channel. The bed of the stream is composed of bowlders and is not liable to change. The velocity is great, rendering discharge measurements somewhat difficult. The channel is nearly straight, with slight curves both above and below. Two canals are taken out above this station, the West Gallatin Company carrying about 125 second-feet between July 1 and September 15, and the Kleinschmidt carrying about 50 second-feet between July 1 and August 15. In September, 1896, a wire gage was placed on the bridge, the pulley being fastened to the end of the rod opposite the 0.15-foot mark. The distance of the end of the weight to the index marker is 15.50 feet. The two gages were made to read the same.

The bench mark for the wire gage is the head of the southwest bolt in the rim of the southeast cylindrical pier. Its elevation is 13.70 feet above datum. The observer is Ira T. Williams, Salesville, Mont.

Discharge measurements of West Gallatin River near Salesville, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 28	H. B. Waters	2.83	373
June 3	A. P. Stover	5.30	2,629
Do	do	5.30	2,606
June 9	do	6.12	4,361
June 14	do	6.30	4,768
June 24	do	5.05	2,778
Do	do	5.05	2,779
July 10	do	4.25	1,074
July 17	H. B. Waters	4.14	1,348
August 13	A. P. Stover	3.30	627
September 4	H. B. Waters	2.80	433

Daily gage height, in feet, of West Gallatin River near Salesville, Mont.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.80	2.80	2.70	2.70	3.00	6.40	4.50	3.60	3.00	2.90	2.90	2.90
2	2.80	2.80	2.70	2.70	3.00	5.55	4.60	3.50	2.95	2.90	2.90	2.90
3	2.80	2.90	2.70	2.70	2.90	5.30	4.65	3.40	2.90	2.90	2.90	2.90
4	2.80	3.00	2.70	2.70	2.90	5.20	4.50	3.40	2.90	2.90	2.90	2.90
5	2.80	3.25	2.70	2.70	2.90	5.20	4.40	3.40	2.80	2.90	2.90	2.90
6	2.80	3.30	2.70	2.70	3.00	5.20	4.40	3.30	2.80	2.90	2.90	2.90
7	2.80	3.30	2.70	2.70	3.20	5.50	4.30	3.30	2.80	2.90	2.90	2.90
8	2.80	3.20	2.70	2.70	3.30	6.35	4.25	3.30	2.70	2.90	2.90	2.90
9	2.80	3.20	2.70	2.70	3.60	6.50	4.20	3.30	2.70	2.90	2.90	2.70
10	2.80	3.20	2.70	2.70	3.87	6.40	4.20	3.20	2.70	2.90	2.90	2.70
11	2.80	3.00	2.70	2.70	4.00	6.40	4.20	3.20	2.70	2.90	2.90	2.70
12	2.80	3.00	2.70	2.70	4.15	6.10	4.20	3.10	2.70	2.90	2.90	2.70
13	2.80	3.00	2.70	2.80	4.45	6.10	4.25	3.20	2.70	2.90	2.90	2.70
14	2.80	2.90	2.70	2.80	4.75	6.05	4.25	3.20	2.70	2.90	2.90	2.70
15	2.80	2.80	2.70	2.70	5.25	5.75	4.30	3.20	2.90	2.90	2.90	2.70
16	2.80	2.80	2.70	2.70	4.90	5.20	4.30	3.20	2.80	2.90	2.90	2.70
17	2.80	2.80	2.70	2.70	4.75	5.10	4.30	3.20	2.80	2.90	2.90	2.60
18	2.80	2.70	2.70	2.70	4.55	5.10	3.80	3.10	2.90	2.90	2.90	2.55
19	2.70	2.70	2.70	2.70	4.40	5.00	4.10	3.10	2.90	2.90	2.90	2.80
20	2.70	2.70	2.70	3.00	4.15	4.80	4.10	3.10	2.90	2.90	2.90	2.80
21	2.70	2.70	2.70	3.00	3.95	4.80	3.90	3.10	2.90	2.90	2.90	2.90
22	2.70	2.70	2.70	2.90	4.00	4.85	3.90	3.10	2.80	2.90	2.90	2.90
23	2.70	2.70	2.70	2.90	4.20	5.00	3.90	3.10	2.90	2.90	2.90	2.90
24	2.70	2.70	2.78	2.90	4.45	5.05	3.90	3.00	2.90	2.90	2.90	2.90
25	2.70	2.70	2.75	2.90	4.45	5.00	3.90	3.00	2.90	2.90	2.80	2.90
26	2.70	2.70	2.78	2.90	4.80	5.10	3.90	3.00	2.90	2.90	2.70	2.90
27	2.70	2.70	2.73	2.90	5.15	4.90	3.90	3.00	2.90	2.90	2.60	2.90
28	2.80	2.70	2.75	2.90	5.95	4.80	3.90	3.00	2.90	2.90	2.70	2.90
29	2.80	------	2.75	2.90	6.25	4.50	3.70	3.00	2.90	2.90	2.90	2.90
30	2.80	------	2.70	2.90	6.55	4.50	3.70	3.00	2.90	2.90	2.90	2.70
31	2.80	------	2.70	------	6.65	------	3.70	3.00	------	2.90	------	2.70

Rating table for West Gallatin River near Salesville, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.6	300	3.8	930	5.0	2,285	6.2	4,550
2.8	400	4.0	1,060	5.2	2,605	6.4	5,000
3.0	500	4.2	1,215	5.4	2,950	6.6	5,450
3.2	600	4.4	1,415	5.6	3,310		
3.4	700	4.6	1,665	5.8	3,690		
3.6	810	4.8	1,960	6.0	4,100		

Estimated monthly discharge of West Gallatin River near Salesville, Mont.

[Drainage area, 860 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	400	360	388	23,881	0.45	0.52
February	650	360	449	24,962	.52	.54
March	400	360	365	22,413	.42	.48
April	500	360	399	23,742	.46	.51
May	5,565	450	1,697	104,370	1.97	2.27
June	5,225	1,530	3,025	180,030	3.52	3.93
July	1,735	870	1,192	73,269	1.39	1.60
August	810	500	591	36,327	.69	.80
September	500	360	422	25,081	.49	.55
October	450	450	450	27,669	.52	.60
November	450	300	437	26,023	.51	.57
December	450	270	407	25,031	.47	.54
The year	5,565	270	818	592,798	.95	12.91

MIDDLE CREEK NEAR BOZEMAN, MONT.

The station, established on August 3, 1895, is located 9 miles south of Bozeman and one-eighth of a mile above the old sawmill dam in the creek canyon. Discharge measurements are made from a wire cable placed across the stream in 1898. The gage is about 200 feet below the cable, and consists of a horizontal frame supporting a wire gage. Bench mark No. 1 consists of a spike driven horizontally into a stump 5 feet high about 80 feet east of the gage rod. The middle of this spike is at an elevation of 7.03 feet above gage datum. Bench mark No. 2 consists of an 8-inch bridge spike driven horizontally into a charred stump about 25 feet northeast of the gage, with an elevation of 3.58 feet. Bench mark No. 3 consists of a large rock 93 feet east of the gage, marked "B. M." in black paint, and is 4.84 feet above gage datum. The initial point for sounding is on the left bank. The water moves swiftly on one side; the left bank is low and liable to overflow. The bed of the stream is of gravel and is liable to change. Gage heights were not taken in 1897 and 1901, owing to the impossibility of securing an observer at moderate expense.

A new gage and three new bench marks were established at this station on May 8, 1902. Bench mark No. 1 is the top of a bowlder 56 feet southeast of the deadman of the east end of the cable. It is marked in red paint B. M., U. S. G. S., 8.41; elevation 8.41 feet above

the zero of the gage. Bench mark No. 2 is the top of a bowlder 68 feet southeast of the deadman, marked in red paint B. M., U. S. G. S., 9.26; elevation 9.26 feet above zero of the gage. Bench mark No. 3 is a large bowlder on the hillside 150 feet northeast of the deadman, marked B. M., U. S. G. S., 20.43; elevation 20.43 above the zero of the gage. The relation of the gage zeros has not been determined.

Discharge measurements of Middle Creek near Bozeman, Mont.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
May 7	J. S. Baker	1.02	55
Do	do	1.08	62
Do	do	1.12	67
June 4	A. P. Stover	1.45	156
Do	do	1.45	158
June 19	do	1.40	136
July 9	do	1.25	96
July 17	H. B. Waters	1.30	125
August 12	A. P. Stover	1.00	59
September 11	H. B. Waters	.81	41

Daily gage height, in feet, of Middle Creek near Bozeman, Mont.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1902.							1902.						
1			1.50	1.10	0.90	0.85	17	1.50	1.60	1.35	1.00	0.80	
2		1.60	1.50	1.10	.90	.85	18	1.40	1.50	1.30	1.00	.80	
3		1.50	1.50		.85	.85	19	1.30	1.50	1.25	.90	.80	
4		1.40	1.45	1.10	.85		20	1.30	1.45		.90	.80	
5		1.40	1.45	1.50	.85		21	1.30	1.50	1.25	.90		
6		1.40		1.50	.80		22	1.30		1.25	.90	.80	
7		1.50	1.40	1.50			23	1.30	1.60	1.25	.90	.80	
8			1.35	1.50	.80		24	1.40	1.60	1.25		.80	
9		1.60	1.35	1.00	.80		25	1.40	1.65	1.25	.90	.85	
10		1.80	1.35		.80		26	1.50	1.60	1.20	.90	.85	
11		1.90	1.35	1.00	.80		27	1.60	1.60		.90	.85	
12		1.80	1.35	1.00	.80		28	1.70	1.50	1.15	.90		
13		1.70		1.00	.80		29	1.70		1.10	.90	.85	
14	(a)	1.80	1.30	1.00			30	1.70	1.50	1.10	.90	.85	
15	1.60		1.30	1.00	.80		31	1.80		1.10			
16	1.50	1.70	1.35	1.00	.80								

(a) Observer did not read gage on Sundays.

Rating table for Middle Creek near Bozeman, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	49	1.1	72	1.4	136	1.7	271
.9	53	1.2	88	1 5	181	1.8	316
1.0	60	1.3	107	1.6	226	1.9	361

Estimated monthly discharge of Middle Creek near Bozeman, Mont.[a]

[Drainage area, 55 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1898.						
April 18 to 30	----------	----------	195	5,018	3.55	1.72
May	466	118	270	16,610	4.91	5.66
June	956	153	429	25,521	7.80	8.70
July	298	88	172	10,586	3.13	3.61
August	77	57	65	3,989	1.18	1.36
September	57	48	53	3,178	.96	1.07
October 1 to 21	----------	----------	52	2,255	.95	.78
1899.						
May 7 to 31	----------	----------	164	8,150	2.98	2.77
June	760	232	504	29,982	9.16	10.22
July	564	153	334	20,559	6.07	7.00
August	153	66	104	6,383	1.89	2.18
September	77	48	57	3,414	1.04	1.16
October	66	48	49	2,987	.89	1.03
1902.						
May 15 to 31	----------	----------	180	6,069	3.27	2.07
June	361	122	221	13,150	4.02	4.49
July	181	72	116	7,133	2.11	2.43
August	181	53	74	4,564	1.35	1.56
September	53	49	50	2,975	.91	1.02

[a] The results for 1898 and 1899, as previously published, were in error.

MADISON RIVER NEAR REDBLUFF, MONT.

This station is located at the ranch of the observer, Mrs. S. A. Black, 4 miles below the Redbluff iron county bridge over the Madison, and about 1½ miles below the mouth of Cherry Creek. It is also about 3 miles below the location of the old Redbluff station, described in Bulletin No. 131, on page 18. It was established May 2, 1897, at which time the one at Threeforks was discontinued. The vertical gage is fastened to a post set firmly into the bed of the river, and braced with cross-pieces from the bank. Discharge measurements are made from the iron bridge above. Cherry Creek is measured at the same time, as it enters between the gage and the bridge. The initial point for soundings is at the left abutment of the bridge. The banks are high and do not overflow. The bed of the stream is rocky and the current is quite swift. The following are the discharge measurements made during 1902 by H. B. Waters:

April 29: Gage height, 1.40 feet; discharge, 1,485 second-feet.
July 18: Gage height, 1.74 feet; discharge, 2,403 second-feet.
July 18: Gage height, 1.74 feet; discharge, 2,426 second-feet.
September 4: Gage height, 1.31 feet; discharge, 1,424 second-feet.

Daily gage height, in feet, of Madison River near Redbluff, Mont.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1	(a)	1.00	1.40	3.00	1.95	1.40	1.30	1.30	1.30
2		1.00	1.40	3.00	2.00	1.40	1.30	1.30	1.30
3	(a)	1.20	1.40	2.75	2.00	1.40	1.30	1.30	1.30
4		1.20	1.40	2.51	2.10	1.35	1.30	1.30	1.30
5		1.20	1.40	2.50	2.00	1.30	1.30	1.30	1.30
6		1.30	1.43	2.45	2.00	1.30	1.30	1.30	1.30
7		1.90	1.45	2.35	1.95	1.30	1.30	1.30	1.30
8		1.30	1.50	2.35	1.90	1.30	1.30	1.30	1.30
9		1.30	1.50	2.55	1.80	1.30	1.30	1.30	(a)
10		1.30	1.50	2.85	1.80	1.30	1.30	1.30	
11	(a)	1.30	1.60	2.95	1.80	1.30	1.30	1.30	
12		1.30	1.70	2.95	1.80	1.30	1.30	1.30	
13		1.30	1.80	2.90	1.80	1.30	1.30	1.30	
14		1.30	1.90	2.90	1.80	1.30	1.30	1.30	
15		1.30	2.05	2.80	1.80	1.30	1.30	1.30	
16		1.30	2.20	2.60	1.80	1.30	1.30	1.30	
17	(a)	1.30	2.20	2.35	1.75	1.30	1.30	1.30	
18		1.35	2.20	2.25	1.70	1.30	1.30	1.30	
19		1.35	2.17	2.10	1.70	1.30	1.30	1.30	
20		1.40	2.10	2.20	1.70	1.30	1.30	1.30	
21		1.40	2.01	1.90	1.70	1.30	1.30	1.30	
22	(a)	1.40	1.90	1.90	1.60	1.30	1.30	1.30	
23	1.00	1.40	1.90	1.95	1.55	1.30	1.30	1.30	
24	1.00	1.40	1.90	2.00	1.50	1.20	1.30	1.30	
25	1.00	1.50	2.00	2.00	1.50	1.20	1.30	1.30	
26	1.00	1.50	2.15	2.10	1.50	1.20	1.30	1.30	
27	1.00	1.50	2.40	2.00	1.50	1.20	1.30	1.30	
28	1.00	1.50	2.60	1.90	1.50	1.20	1.30	1.30	
29	1.00	1.50	2.70	1.90	1.45	1.20	1.30	1.30	
30	1.00	1.40	2.85	1.90	1.40	1.20	1.30	1.30	
31	1.00		3.00		1.40	1.30		1.30	

a River frozen at gage January 1 to March 23, and November 9 to December 31.

Rating table for Madison River near Redbluff, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	910	1.6	2,075	2.2	3,745	2.8	5.540
1.1	1,025	1.7	2,325	2.3	4,035	2.9	5,840
1.2	1,175	1.8	2,600	2.4	4,345	3.0	6,140
1.3	1,360	1.9	2,880	2.5	4,655	3.1	6,440
1.4	1,570	2.0	3,160	2.6	4,935		
1.5	1,815	2.1	3,450	2.7	5,230		

Estimated monthly discharge of Madison River near Redbluff, Mont.

[Drainage area, 2,085 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March 23 to 31	----------	----------	910	16,245	0.44	0.15
April	2,075	910	1,436	85,448	.69	.77
May	6,140	1,570	3,001	184,524	1.44	1.66
June	6,440	2,880	4,336	258,010	2.08	2.32
July	3,450	1,570	2,435	149,722	1.17	1.35
August	1,570	1,175	1,361	83,685	.65	.75
September	1,360	1,360	1,360	80,926	.65	.73
October	1,360	1,360	1,360	83,623	.65	.75
November 1 to 8	----------	----------	1,360	21,580	.65	.19

JEFFERSON RIVER AT SAPPINGTON, MONT.

The station on this river is located at Sappington, 7 miles above Willow Creek, and was established by Arthur P. Davis November 13, 1894. The wire gage is fastened to the guard rail on the upper side of the Northern Pacific Railway bridge, 1 mile north of the railroad station. Bench mark No. 1 consists of a 6-inch wire nail driven horizontally in the east side of the blocking which forms the south abutment of the railroad bridge and is 6.90 feet above gage datum. Bench mark No. 2 is a 6-inch wire nail in a telegraph pole, about 30 feet south and east of the south abutment of the bridge, and is at an elevation of 7 feet on the gage. Bench mark No. 3 is the head of the northwest bolt fastening the switch standard to the cross-tie, 30 feet east of the bridge. Its elevation is 15.67 feet. On November 3, 1897, the rod was lowered eight-tenths of a foot, the subsequent years being adjusted to the new datum, but the balance of 1897 was corrected to agree with old datum. Discharge measurements are made

from a cable and car installed a short distance above the bridge. The following measurements were made during 1902 by H. B. Waters:

April 16: Gage height, 2.10 feet; discharge, 1,181 second-feet.
May 27: Gage height, 4.90 feet; discharge, 5,940 second-feet.
July 15: Gage height, 2.99 feet; discharge, 2,534 second-feet.
August 1: Gage height, 2.03 feet; discharge, 1,137 second-feet.
August 29: Gage height, 1.67 feet; discharge, 663 second-feet.

Daily gage height, in feet, of Jefferson River at Sappington, Mont.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	(a)	3.20	.....	1.80	3.20	6.50	3.20	2.15	1.60	1.80	2.10	2.40
2	.....	.....	.....	1.85	3.20	6.50	3.20	2.00	1.60	1.80	2.10	2.40
3	.....	.....	.....	2.00	3.20	6.30	3.20	2.00	1.40	1.80	2.10	2.40
4	.....	.....	.....	2.00	3.20	5.90	3.55	1.90	1.55	1.80	2.15	2.50
5	b 3.50	.....	.....	2.10	3.10	5.35	3.90	1.80	1.60	1.85	2.20	2.50
6	.....	.....	.....	2.20	3.00	5.10	4.20	1.80	1.60	1.90	2.20	2.50
7	.....	.....	.....	2.10	2.90	4.70	4.10	1.45	1.65	1.90	2.20	2.50
8	.....	3.30	.....	2.20	2.90	4.55	3.85	1.35	1.70	1.90	2.20	2.50
9	.....	.....	.....	2.10	3.25	4.60	3.60	1.45	1.70	1.90	2.20	2.50
10	.....	.....	.....	2.20	3.55	4.60	3.55	1.60	1.70	1.90	2.20	2.50
11	b 3.20	.....	.....	2.25	3.85	4.70	3.30	1.50	1.65	1.90	2.25	2.50
12	.....	.....	.....	2.10	4.05	5.10	3.20	1.50	1.60	1.90	2.30	2.50
13	.....	.....	.....	2.00	4.10	5.10	3.15	1.65	1.60	2.00	2.30	2.50
14	.....	.....	.....	2.20	4.30	5.10	3.00	1.70	1.60	2.00	2.35	2.50
15	.....	3.40	.....	1.95	4.65	5.10	2.95	1.70	1.60	2.00	2.40	2.50
16	.....	.....	.....	2.00	5.20	4.95	2.75	1.70	1.60	2.00	2.40	2.40
17	.....	.....	.....	2.10	5.50	4.70	2.70	1.70	1.60	2.00	2.40	2.30
18	.....	.....	.....	2.10	5.40	4.10	2.65	1.80	1.65	2.00	2.40	2.30
19	.....	.....	.....	2.20	5.10	3.80	2.65	1.80	1.70	2.00	2.50	2.30
20	.....	.....	.....	2.40	5.00	3.55	2.80	1.90	1.70	2.00	2.50	2.30
21	.....	.....	.....	3.20	5.00	3.45	2.70	1.85	1.70	2.00	2.45	2.30
22	.....	3.40	.....	3.55	4.80	3.30	2.65	1.80	1.70	2.00	2.40	2.30
23	.....	.....	.....	3.60	4.60	3.20	2.50	1.70	1.70	2.00	2.30	2.30
24	.....	.....	.....	3.60	4.75	3.20	2.50	1.70	1.70	2.00	2.30	2.30
25	3.40	.....	.....	3.60	4.80	3.20	2.40	1.70	1.70	2.10	2.30	2.40
26	.....	.....	.....	3.35	4.80	3.15	2.35	1.70	1.70	2.10	2.30	2.40
27	.....	.....	.....	3.30	4.85	3.10	2.20	1.70	1.75	2.10	2.30	2.40
28	.....	.....	.....	3.30	5.15	3.10	2.20	1.70	1.80	2.10	2.30	2.40
29	.....	.....	.....	3.30	5.60	3.10	2.20	1.70	1.80	2.10	2.30	2.40
30	.....	.....	2.00	3.20	6.25	3.20	2.10	1.60	1.80	2.10	2.30	2.40
31	.....	.....	1.90	.....	6.60	.....	2.10	1.60	.....	2.10	.....	2.40

a Weekly observations during January, February, and March. b Ice at gage.

Rating table for Jefferson River at Sappington, Mont., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.4	510	2.8	2,230	4.2	4,640	5.6	7,305
1.6	685	3.0	2,550	4.4	5,000	5.8	7,695
1.8	875	3.2	2,870	4.6	5,365	6.0	8,085
2.0	1,090	3.4	3,205	4.8	5,750	6.2	8,475
2.2	1,335	3.6	3,550	5.0	6,140	6.4	8,865
2.4	1,610	3.8	3,905	5.2	6,525	6.6	9,255
2.6	1,915	4.0	4,270	5.4	6,915		

Estimated monthly discharge of Jefferson River at Sappington, Mont.

[Drainage area, 8,984 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	3,550	875	1,875	111,570	0.21	0.23
May	9,255	2,390	5,028	309,160	.56	.65
June	9,060	2,710	5,081	302,340	.57	.64
July	4,640	1,210	2,502	153,842	.28	.32
August	1,150	485	801	49,252	.09	.10
September	875	645	739	43,974	.08	.09
October	1,210	875	1,059	65,115	.12	.14
November	1,755	1,210	1,460	86,876	.16	.18
December	1,755	1,470	1,630	100,225	.18	.21

Miscellaneous measurements in Missouri River drainage basin.

[Made by B. E. Forbes, J. C. Stevens, Adna Dobson, A. B. Crane, and H. B. Waters.]

NEBRASKA.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
August 9	Long Pine Creek	Long Pine	49.7
March 22	Minnechaduza Creek	Valentine	38.1
April 11	do	Sec. 29, T. 35, R. 30 W	14.9
Do	do	Sec. 2, T. 34, R. 30 W	17.3
Do	do	Sec. 8, T. 34, R. 29 W	26.0
Do	do	Sec. 30, T. 34, R. 38 W	33.8
April 12	do	Valentine	38.3
June 5	do	do	23.1
July 4	do	do	27.4
July 20	do	do	22.7
August 20	do	do	25.8
March 22	Niobrara River	Fort Niobrara	1,226
April 12	do	do	877
June 3	do	W. line sec. 26, T. 29, R. 46 W.	25.4
June 15	do	Fort Niobrara	588
July 4	do	do	714
July 20	do	do	705
June 2	White River	Sec. 34, T. 32, R. 52 W	64.9
August 20	do	Sec. 25, T. 32, R. 52 W	10.4
November 8	Big Sioux	Sioux Falls, S. Dak	46.4

Miscellaneous measurements in Missouri River drainage basin—Continued.

MONTANA.

Date.	Stream.	Locality.	Gage height.	Discharge.
1902.			*Feet.*	*Second-feet.*
August 28	Crow Creek	Radersburg	1.85	18.14
Do	do	do	1.85	18.89

PLATTE RIVER DRAINAGE BASIN.

The Platte River, one of the largest tributaries of the Missouri, is formed by the junction of the North and South Platte rivers in Lincoln County, Nebr., and flows east into the Missouri River 18 miles south of Omaha, Nebr. The principal tributaries of the Platte in Nebraska are the Elkhorn and the Loup rivers. The Elkhorn River rises in the northern part of Nebraska and flows southeast into the Platte about 35 miles above its mouth. The North, Middle, and South Loup rivers, with their tributaries, drain north central Nebraska and join the Platte River near Columbus, Nebr.

The North Platte River rises in northern Colorado, flows north into Wyoming and then east into Nebraska. The Sweetwater and the Laramie rivers are its principal tributaries. The Sweetwater joins it from the west in south central Wyoming. The Laramie River rises in the northern part of Colorado and flows north into the North Platte in eastern Wyoming. The Little Laramie is a small tributary of the Laramie River in southern Wyoming.

The South Platte River rises in central Colorado, flows north, then east to its junction with the North Platte River. Its tributaries are mostly small creeks. Big Thompson Creek joins it 8 miles south of Greeley, Colo. St. Vrain Creek joins it about 15 miles south of Greeley. Clear Creek joins it about 3 miles north of Denver, and Bear Creek 8 miles south of Denver.

The following list includes the stations in the Platte River drainage basin:

Elkhorn River near Arlington, Nebr.
Elkhorn River near Norfolk, Nebr.
Loup River at Columbus, Nebr.
Platte River near Columbus, Nebr.
Platte River near Lexington, Nebr.
North Platte River at North Platte, Nebr.
North Platte River at Bridgeport, Nebr.
North Platte River at Mitchell, Nebr.
North Platte River at Guernsey, Wyo.
Little Laramie River at Mays Ranch, near Hatton, Wyo.
Sweetwater River near Splitrock, Wyo.

South Platte River at Bigspring, Nebr.
South Platte River at Julesburg, Colo.
Middle Crow Creek near Hecla, Wyo.
South Platte River at Kersey, Colo.
Big Thompson Creek near Arkins, Colo.
St. Vrain Creek at Lyons, Colo.
Clear Creek at Forkscreek, Colo.
South Platte River at Denver, Colo.
Bear Creek near Morrison, Colo.
South Platte River at South Platte, Colo.

ELKHORN RIVER NEAR ARLINGTON, NEBR.

The station at Arlington, Nebr., was established by Glenn E. Smith April 28, 1899, and is located at the wagon bridge 1 mile west of the town of Arlington. The original rod was fastened to cross-ties, which are solidly bedded in the river bank. It consisted of a new oak stake 3 by 4 inches and 12 feet long. It was placed 200 feet downstream from the bridge on the west bank of the river. Bench mark No. 1 is a large spike driven in a pile 50 feet upstream from the rod, and is 6.36 feet above gage datum. Bench mark No. 2 is a large spike driven in a piling 20 feet back and 10 feet upstream from the rod, and is 9.12 feet above gage datum. Bench mark No. 3 is a vertical spike driven into a small leaning tree 5 feet downstream from the rod, and is 7.43 feet above gage datum. On May 10, 1899, the rod was washed out; on May 29 it was replaced by an oak rod 2 by 6 inches and 16 feet long. This rod was placed on the same bank as the first rod, but was set 25 feet farther upstream. The gage datum was not changed. Mike Hammang, a farmer living about 300 yards from the gage rod, is the observer.

Discharge measurements of Elkhorn River near Arlington, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
March 19	J. C. Stevens and B. E. Forbes	1.85	771
April 14	J. C. Stevens	2.15	920
Do	do	2.15	928
June 17	do	1.85	743
July 7	do	6.29	4,363
July 29	do	3.57	1,402
August 23	do	3.75	1,388
September 10	do	2.10	805
Do	do	2.10	796
October 4	J. C. Stevens and Ferd Bonstedt	4.79	2,676
Do	do	4.78	2,661

Daily gage height, in feet, of Elkhorn River near Arlington, Nebr.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.										
1	.....	2.24	3.20	1.90	1.80	4.95	3.47	4.20	2.88	2.01
2	.....	2.39	3.23	1.88	1.99	4.15	3.12	5.15	2.86	2.10
3	.....	2.51	3.30	1.82	2.20	3.37	2.80	5.07	2.76	(a)
4	.....	2.73	3.12	1.72	2.85	3.00	2.64	4.80	2.75	.....
5	.....	2.89	2.71	1.82	3.57	2.75	2.52	4.73	2.72	.....
6	.....	2.83	2.44	1.88	5.80	2.56	2.40	4.60	2.67	.....
7	.....	2.75	2.31	1.75	6.17	2.35	2.24	4.39	2.63	.....
8	.....	2.67	2.23	1.74	5.90	2.21	2.20	4.26	2.58	.....
9	(a)	2.62	2.15	1.99	8.16	2.14	2.17	4.17	2.60	.....
10	3.74	2.50	2.14	2.85	9.10	2.00	2.00	4.06	2.58	.....
11	3.34	2.39	2.08	2.76	8.78	1.95	1.97	4.01	2.56	.....
12	3.17	2.32	2.00	2.60	7.65	1.82	1.94	4.54	2.62	.....
13	3.19	2.21	2.01	2.31	7.66	1.88	1.90	5.14	2.87	.....
14	3.36	2.12	2.02	2.14	7.41	1.81	1.80	5.10	3.30	.....
15	3.37	2.13	1.98	2.10	6.10	2.25	1.76	4.71	3.16	.....
16	3.02	2.12	1.88	1.93	5.85	4.97	1.72	4.28	2.88	.....
17	3.33	2.07	1.87	1.82	5.52	5.50	1.68	4.02	2.76	.....
18	(a)	1.98	1.82	1.91	6.11	4.29	1.61	3.86	2.64	.....
19	(a)	1.96	1.77	2.27	7.11	3.59	1.55	3.72	2.58	.....
20	2.25	1.91	1.75	2.44	7.15	3.03	1.54	3.65	2.55	.....
21	2.32	1.84	1.80	2.15	6.92	2.70	2.06	3.49	2.47	.....
22	2.71	1.80	1.85	1.92	6.50	3.80	2.60	3.42	2.50	.....
23	2.57	1.77	1.93	1.81	5.69	3.44	3.25	3.39	2.47	.....
24	2.42	1.79	1.98	1.75	4.71	3.90	3.59	3.29	2.46	.....
25	2.35	1.75	2.00	1.72	4.06	4.18	3.58	3.22	2.36	.....
26	2.36	1.82	1.95	1.61	4.30	4.57	3.40	3.16	2.32	.....
27	2.28	1.92	1.89	1.60	4.22	5.18	3.45	3.06	2.28	.....
28	2.22	1.95	1.92	1.58	3.86	5.23	3.57	2.96	2.26	.....
29	2.23	2.11	1.90	1.70	3.51	5.06	3.46	2.95	2.24	.....
30	2.21	2.65	1.94	1.74	3.12	5.57	3.92	2.91	2.14	.....
31	2.18	.....	1.90	.....	3.66	3.90	.....	2.82	.....	.....

a Operations discontinued from January 1 to March 10, and from December 3 to 31, on account of ice.

Rating table for Elkhorn River near Arlington, Nebr., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.4	238	2.0	740	3.6	1,706	5.2	3,398
.6	276	2.2	833	3.8	1,882	5.4	3,656
.8	322	2.4	932	4.0	2,067	5.6	3,925
1.0	375	2.6	1,037	4.2	2,263	5.8	4,203
1.2	435	2.8	1,149	4.4	2,469	6.0	4,494
1.4	501	3.0	1,268	4.6	2,686	6.2	4,797
1.6	574	3.2	1,393	4.8	2,913		
1.8	654	3.4	1,542	5.0	3,150		

a This table was applied indirectly according to the method outlined on p. 323 of Nineteenth Ann. Rept., U. S. Geol. Surv., pt. 4.

Estimated monthly discharge of the Elkhorn River near Arlington, Nebr.

[Drainage area, 5,980 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March, 18 days	----------	----------	1,251	44,664	0.21	0.14
April	1,342	731	974	57,950	.16	.18
May	1,640	718	931	57,240	.16	.18
June	1,220	465	781	46,465	.13	.14
July	9,568	585	3,633	223,350	.61	.69
August	3,114	471	1,453	89,341	.29	.33
September	1,846	530	1,001	59,560	.17	.19
October	3,199	1,161	2,034	125,050	.34	.39
November	1,463	804	1,051	62,530	.18	.19

ELKHORN RIVER NEAR NORFOLK, NEBR.

The gaging station established July 16, 1896, is located about 2 miles south of Norfolk, Nebr., near the line of Thirteenth street extended. The gage is on the left bank of the river. It consists of an inclined oak piece, 2 by 4 inches, 12 feet long, resting on beveled blocks which rest in turn on horizontally bedded cross-ties. All are firmly fastened together by lag screws. The zero of the gage is 8.21 feet below a small spike driven horizontally into a tree near the root, about 20 feet back, and downstream from the gage. Also, the zero of the gage is 3.96 feet below the head of a lag screw which is placed vertically in the horizontal trunk of a large living willow tree which overhangs the stream about 15 feet below the gage. Bench mark 3 is a standard 4-foot iron pipe of the United States Geological Survey, located 35 feet west and 7 feet north of the top of the gage, and 15.5 feet west of the ash tree on which is bench mark 1. Its elevation is 10.70 feet above the zero of the gage. The observer is Harold Taft, a farmer boy, whose home is about 300 yards from the gage. The river bed at the station is composed of sand and mud.

Discharge measurements of Elkhorn River near Norfolk, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902		*Feet.*	*Second-feet.*
March 21	J. C. Stevens	2.39	570
April 13	do	2.22	534
May 12	do	2.16	483
June 16	do	2.54	551
July 3	do	4.36	1,376
July 26	do	2.45	475
August 22	do	1.78	296
September 29	do	5.65	2,497
November 14	do	2.34	502

Daily gage height, in feet, of Elkhorn River near Norfolk, Nebr.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1	.....	2.95	2.55	2.50	1.90	1.90	2.35	5.92	2.88
2	.....	3.25	2.60	2.35	3.11	1.90	2.70	5.76	2.71
3	.....	3.45	2.60	2.20	4.48	1.85	2.50	5.52	2.69
4	.....	3.20	2.55	2.10	4.00	1.85	2.40	5.35	2.65
5	.....	3.20	2.55	2.95	3.55	1.83	2.10	4.73	2.65
6	.....	2.97	2.50	3.07	3.05	1.81	1.90	4.60	2.59
7	.....	2.90	2.50	2.50	2.90	1.80	1.95	4.39	2.58
8	.....	2.85	2.45	2.55	2.72	1.79	1.97	4.26	2.58
9	(a)	2.80	2.40	2.50	2.80	1.77	1.95	4.17	2.47
10	2.55	2.70	2.30	2.40	2.85	1.75	1.99	4.06	2.47
11	2.60	2.50	2.25	2.35	2.85	1.75	2.00	4.01	2.43
12	2.62	2.32	2.20	2.20	2.90	1.73	2.01	4.26	2.30
13	2.75	2.20	2.20	2.10	2.90	1.70	2.00	4.10	2.21
14	2.72	2.15	2.15	2.40	3.40	1.68	1.98	3.88	2.10
15	2.72	2.15	2.10	2.40	4.00	1.65	1.93	3.66	2.15
16	(a)	2.12	2.15	2.70	3.85	1.70	1.90	3.41	2.03
17	(a)	2.13	2.20	2.80	3.55	1.70	1.85	3.01	1.99
18	(a)	2.15	2.30	2.75	3.85	1.73	1.85	2.97	1.97
19	(a)	2.13	2.60	2.70	3.00	1.75	1.84	3.72	1.97
20	2.65	2.10	2.80	2.61	3.40	1.75	2.00	3.65	2.03
21	2.52	2.15	2.85	2.50	3.25	1.78	2.35	3.49	2.03
22	2.45	2.10	2.80	2.30	3.05	1.80	2.45	3.42	2.09
23	2.42	2.10	2.75	2.22	2.90	1.85	2.37	3.39	2.13
24	2.38	2.01	2.75	2.12	2.85	2.00	2.65	3.29	a1.12
25	2.40	2.00	2.70	1.95	2.60	2.63	2.83	3.22	a1.22
26	2.40	2.20	2.60	1.85	2.49	2.78	3.10	3.16	a1.26
27	2.40	2.35	2.61	1.82	2.40	2.90	3.47	3.06	.....
28	2.45	2.35	2.61	1.80	2.00	3.00	4.89	2.96	.....
29	2.38	2.45	2.60	1.75	2.19	2.60	5.69	2.95	.....
30	2.35	2.50	2.55	1.75	2.10	2.10	5.94	2.91	.....
31	2.30	.....	2.55	.....	2.00	2.10	.....	2.82	.....

a Observations discontinued from Jan. 1 to Mar. 9 and from Nov. 27 to Dec. 31 on account of ice.

Rating table for Elkhorn River near Norfolk, Nebr., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	140	2.4	493	4.0	1,324	5.6	2,480
1.0	162	2.6	575	4.2	1,444	5.8	2,660
1.2	192	2.8	668	4.4	1,570	6.0	2,840
1.4	227	3.0	763	4.6	1,704	6.2	3,020
1.6	270	3.2	860	4.8	1,843	6.4	3,200
1.8	319	3.4	971	5.0	1,987	6.6	3,380
2.0	370	3.6	1,087	5.2	2,135	6.8	3,560
2.2	425	3.8	1,205	5.4	2,300		

[a] This table was applied indirectly according to the method outlined on page 323 of Nineteenth Ann. Rept. U. S. Geol. Surv., pt. 4.

Estimated monthly discharge of the Elkhorn River near Norfolk, Nebr.

[Drainage area, 2,474 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March, 18 days	----------	----------	591	21,100	0.24	0.16
April	1,028	444	651	38,730	.26	.29
May	773	471	616	37,870	.25	.29
June	840	259	490	29,154	.20	.22
July	1,462	287	710	43,650	.29	.33
August	729	263	354	21,764	.14	.16
September	2,750	319	642	38,200	.26	.29
October	2,597	668	1,265	77,770	.51	.59
November 1 to 23	----------	----------	482	21,990	.19	.16

LOUP RIVER AT COLUMBUS, NEBR.

Observations at this station were begun October 13, 1894.

This station is located near the iron bridge of the Union Pacific Railway, just west of Columbus, Nebr. The observer is David J. Mowery, who lives in Columbus. The gage is 50 yards from the bridge, and is of oak, 3 by 6 inches, 12 feet long, fastened by lag screws to a pile, which forms part of the training works above the bridge. The rod is vertical. The 12-foot mark on the rod is 7 feet below a point 2 feet east of the third panel point of the north truss of the east span, counting the end of the span as the first panel point. Bench mark 2 is the regulation 4-foot iron post of the United States Geological Survey, placed 72 feet east of gage rod. Its elevation is 13.27 feet above zero of gage. Gagings are made from a cable which spans the stream about 50 yards above the bridge.

Discharge measurements of Loup River at Columbus, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 8	Frank Dobson	5.79	6,826
April 13	do	4.76	2,532
May 11	do	4.81	2,203
May 22	J. C. Stevens	5.56	4,039
June 1	do	4.85	2,585
July 11	do	5.59	6,586
August 10	do	6.10	7,685
August 26	do	5.55	6,901
September 11	do	4.48	2,514
October 5	J. C. Stevens and Ferd Bonstedt	5.05	3,156

Daily gage height, in feet, of Loup River at Columbus, Nebr.[a]

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1	.....	4.65	4.80	4.85	6.00	4.80	5.40	5.00	4.79
2	.....	4.60	4.80	4.95	6.60	4.70	5.10	5.00	4.80
3	.....	4.55	4.80	5.00	6.80	4.60	4.60	5.00	4.80
4	.....	4.50	4.85	5.40	6.10	4.60	4.55	5.00	4.85
5	.....	4.60	4.90	5.80	6.10	4.55	4.50	4.92	4.85
6	.....	4.80	5.00	5.90	6.05	4.50	4.50	4.95	4.85
7	.....	4.70	5.10	5.95	6.10	4.45	4.50	4.95	4.90
8	5.79	4.70	5.00	5.00	6.00	4.40	4.45	4.90	4.95
9	5.79	4.70	4.95	4.90	5.90	5.00	4.45	4.80	4.95
10	5.00	4.70	4.90	4.85	6.45	6.10	4.45	4.80	4.95
11	4.70	4.70	4.80	4.70	5.59	4.90	4.48	5.00	4.80
12	4.60	4.73	4.80	4.65	5.25	4.70	4.45	5.60	4.70
13	4.70	4.76	4.90	4.65	5.00	4.65	4.40	5.50	4.65
14	4.80	4.75	5.10	4.60	5.50	4.62	4.40	5.40	4.65
15	4.80	4.75	5.30	4.60	5.25	4.60	4.35	5.30	4.65
16	4.80	4.70	5.30	4.70	5.10	4.60	4.30	5.20	4.60
17	4.70	4.70	5.30	4.65	5.05	4.60	4.20	5.10	4.65
18	4.70	4.70	5.70	4.65	5.10	5.00	4.40	5.00	4.70
19	4.60	4.70	5.90	5.00	5.10	5.55	4.50	4.90	4.75
20	4.60	4.70	6.10	5.40	5.00	5.50	4.65	4.90	4.80
21	4.64	4.70	5.56	5.00	4.90	5.50	4.80	4.90	4.80
22	4.65	4.75	5.55	4.95	4.80	5.40	5.80	4.90	4.80
23	4.68	4.80	5.50	4.70	4.75	5.40	6.10	4.90	4.81
24	4.70	4.80	5.40	4.80	4.70	5.30	5.10	4.90	4.85
25	4.80	4.80	5.36	4.70	4.80	5.50	5.10	4.90	4.85
26	4.90	4.85	5.15	4.60	4.85	5.55	5.10	4.90	4.85
27	4.95	5.15	5.00	4.80	4.80	5.45	5.40	4.90	4.85
28	4.97	5.10	4.95	4.80	4.85	5.50	5.20	4.85	4.85
29	5.00	5.00	4.90	5.00	4.85	5.59	5.10	4.85	4.85
30	4.80	4.90	4.85	5.00	4.85	5.80	5.05	4.80	.....
31	4.70	.....	4.85	.....	4.80	5.95	.....	4.80	.....

[a] Observations discontinued from January 1 to March 8, and from November 29 to December 31, on account of ice.

Rating table for Loup River at Columbus, Nebr., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.8	1,140	4.6	2,040	5.4	4,101	6.2	6,760
3.9	1,175	4.7	2,265	5.5	4,402	6.3	7,134
4.0	1,225	4.8	2,500	5.6	4,712	6.4	7,517
4.1	1,300	4.9	2,743	5.7	5,031	6.6	8,311
4.2	1,400	5.0	2,995	5.8	5,358	6.8	9,149
4.3	1,510	5.1	3,258	5.9	5,694	7.0	10,025
4.4	1,660	5.2	3,530	6.0	6,040	7.2	10,941
4.5	1,825	5.3	3,811	6.1	6,396		

[a] This table was applied indirectly according to the method outlined on page 323, 19th Ann. Rept., U. S. Geol. Surv., pt. iv.

Estimated monthly discharge of the Loup River at Columbus, Nebr.

[Drainage area, 13,542 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March, 24 days	----------	----------	3,343	159,156	0.25	0.22
April	3,206	1,976	2,409	143,385	.18	.20
May	7,443	2,203	3,226	198,334	.24	.28
June	5,936	2,211	3,250	193,375	.24	.27
July	10,895	3,394	5,669	348,530	.42	.48
August	8,152	2,463	4,767	293,115	.35	.40
September	6,909	1,693	3,218	191,487	.24	.27
October	4,712	2,500	3,011	185,116	.22	.25
November, 29 days	2,869	2,040	2,501	143,859	.19	.20

PLATTE RIVER NEAR COLUMBUS, NEBR.

This station was established in 1895, and is located on the left bank of the main channel of the river, 75 feet above the Meridian bridge south of Columbus. It is about 4 miles above the mouth of the Loup River. The gage consists of an inclined oak timber fastened to cross-ties which are embedded in the bank of the river. The channel is straight both above and below the gage. The bench mark is a standard 4-foot iron post of the United States Geological Survey, and is located 44.5 feet east of the gage, 60 feet north of the north end of the north bridge truss, and 10 feet west of a cottonwood tree 6 inches in diameter. Its elevation is 7.06 feet above gage datum.

The initial point for soundings is the north end of the upstream side of the bridge.

David J. Mowery, who lives in Columbus, is the observer.

Discharge measurements of Platte River near Columbus, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 8	Frank Dobson	3.39	5,664
April 13	do	2.22	996
May 11	do	2.37	1,695
May 22	J. C. Stevens	3.85	8,447
June 1	do	3.39	5,852
July 11	do	3.55	6,992
August 10	do	1.31	350
August 26	do	1.60	546
September 11	do	.50	5
October 5	J. C. Stevens and Ferd Bonstedt	2.50	1,989

Daily gage height, in feet, of Platte River near Columbus, Nebr.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1		2.80	2.30	3.38	3.40	1.90	1.10	1.95	1.80
2		2.60	2.25	3.39	3.60	1.80	1.10	2.00	1.90
3		2.40	2.20	3.39	3.60	1.70	1.10	2.20	1.95
4		2.30	2.40	3.40	4.00	1.50	1.00	2.40	2.00
5		2.35	2.50	3.55	4.10	1.35	1.00	2.50	2.00
6		2.10	2.65	3.90	4.10	1.20	1.00	2.75	2.00
7	(a)	2.15	2.75	3.80	4.00	1.10	1.10	2.75	2.00
8	3.39	2.15	2.85	3.85	4.00	1.05	1.00	2.50	1.95
9	3.38	2.20	2.85	3.70	3.90	1.00	.90	2.30	1.90
10	3.30	2.20	2.86	3.65	3.75	1.30	.80	2.30	1.90
11	3.00	2.20	2.87	3.50	3.50	1.10	.50	2.40	1.80
12	2.90	2.21	2.90	3.40	3.40	1.00	.45	2.80	1.70
13	2.80	2.22	2.90	3.20	3.20	.90	.40	3.00	1.70
14	2.80	2.20	3.00	3.20	3.21	1.10	.40	3.20	1.80
15	2.80	2.20	3.20	3.05	3.00	1.20	.30	3.30	2.00
16	2.80	2.15	3.35	3.25	2.89	1.10	.20	3.00	2.00
17	2.70	2.15	3.45	3.40	2.80	1.00	.20	2.95	2.10
18	2.40	2.10	4.00	3.55	2.80	1.00	.20	2.90	2.10
19	2.30	2.10	4.30	3.55	3.05	1.00	.40	2.60	2.05
20	2.20	2.15	4.20	3.50	3.38	1.00	.65	2.50	2.05
21	2.20	2.10	3.85	3.50	3.00	1.40	.70	2.40	2.10
22	2.10	2.05	3.84	3.50	2.90	2.20	1.00	2.30	2.10
23	2.10	1.95	3.82	3.40	2.80	2.00	1.85	2.20	2.10
24	2.50	1.97	3.80	3.40	2.70	1.90	1.85	2.10	2.10
25	2.70	2.00	3.75	3.40	2.60	1.60	1.85	2.05	2.05
26	3.00	2.10	3.70	3.40	2.50	1.20	1.90	2.05	2.05
27	3.10	2.09	3.60	3.40	2.40	1.30	1.95	2.00	2.00
28	3.10	2.10	3.50	3.42	2.30	1.30	1.95	1.95	1.95
29	3.10	2.15	3.39	3.40	2.20	1.30	1.90	1.85	1.95
30	3.00	2.25	3.38	3.40	2.10	1.30	1.85	1.85	(a)
31	2.90	.....	3.38	.....	2.05	1.20	.....	1.85	.....

a Observations discontinued from January 1 to March 8 and from November 29 to December 31 on account of ice.

Rating table for Platte River near Columbus, Nebr., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	190	2.0	825	3.0	3,100	4.0	9,150
1.1	220	2.1	925	3.1	3,500	4.2	11,250
1.2	250	2.2	1,025	3.2	4,000	4.4	13,550
1.3	285	3.3	1,150	3.3	4,500	4.6	16,400
1.4	340	2.4	1,275	3.4	5,000	4.8	19,700
1.5	400	2.5	1,400	3.5	5,500	5.0	23,700
1.6	475	2.6	1,676	3.6	6,050	5.2	28,400
1.7	550	2.7	1,984	3.7	6,700	5.4	33,700
1.8	635	2.8	2,324	3.8	7,400	------	------
1.9	725	2.9	2.696	3.9	8,200	------	------

[a] This table was applied indirectly according to the method outlined on page 323, 19th Ann. Rept. U. S. Geol. Surv., Pt. IV.

Estimated monthly discharge of the Platte River near Columbus, Nebr.

[Drainage area 56,867 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March 9 to 31	------	------	2,817	134,098	0.050	0.045
April	2,398	825	1,076	64,022	.019	.021
May	13,800	1,212	5,462	335,845	.096	.111
June	9,950	4,150	6,426	382,347	.113	.126
July	11,140	995	5,267	323,805	.093	.107
August	1,150	190	404	24,837	.007	.008
September	975	0	337	20,051	.006	.007
October	5,000	690	1,798	110,554	.032	.037
November	925	635	796	47,365	.014	.016

PLATTE RIVER NEAR LEXINGTON, NEBR.

This station was established April 2, 1902, by H. O. Smith. It is located on the highway bridge, 2½ miles south of Lexington, Nebr. The gage is of the usual wire type, the scaleboard being graduated to feet and half-tenths. It is protected by a box and securely fastened to the upstream hand rail of the bridge, about 100 feet from the north end. It is read daily by Charles Freeman, a farmer living near by. The channel is straight both above and below the station.

The banks are low, but do not overflow. The bed of the stream is sandy and shifting. Bench mark No. 1 is a hub on the west side of the bridge approach. Its elevation is 2,391.90 feet above sea level. Bench mark No. 2 is the top of the east end of the first cap at the north end of bridge. Its elevation is 2,393.31 feet above sea level. The elevation of the water surface, or the end of the weight, when the gage reads zero, is 2,385.65 feet.

Discharge measurements of Platte River near Lexington, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 8	H. O. Smith and B. E. Forbes	.....	2,293
May 2	H. O. Smith	2.85	2,693
May 22	do	3.38	7,764
June 3	do	3.00	3,038
June 18	do	3.25	6,555
July 5	do	2.98	4,993
July 19	do	2.30	1,002
July 29	do	2.25	185
August 2	do	2.00	0
August 23	do	1.20	0
September 25	do	2.85	2,829
November 8	do	2.70	1,127

Daily gage height, in feet, of Platte River near Lexington, Nebr.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1	.....	2.95	3.25	.....	2.35	1.70	2.45	2.70	2.80
2	.....	2.85	2.95	.....	2.00	1.60	2.55	2.60	2.70
3	.....	2.80	2.90	.....	1.95	1.50	2.55	2.65	2.30
4	.....	2.75	3.00	.....	1.80	1.45	2.50	2.45	2.35
5	.....	2.85	2.90	3.00	1.80	1.40	2.50	2.60	2.25
6	.....	2.80	2.90	3.00	1.70	1.40	2.40	2.60	2.25
7	.....	2.90	2.55	2.90	1.65	1.35	2.45	2.75	2.25
8	.....	2.90	2.75	3.05	1.60	1.30	2.55	2.70	2.15
9	.....	2.70	3.15	2.70	1.85	1.20	2.50	(a)	2.25
10	.....	2.75	.....	3.00	1.65	1.15	2.45	.....	2.30
11	.....	2.75	3.00	2.90	1.60	1.10	2.70	.....	2.30
12	.....	2.75	3.05	3.00	1.50	1.10	2.75	.....	2.35
13	.....	2.90	3.40	3.05	1.45	1.10	2.75	.....	2.30
14	.....	3.10	3.35	2.65	1.40	1.05	2.70	.....	2.45
15	2.70	3.40	3.15	2.80	1.40	1.00	2.65	.....	2.50
16	2.65	3.40	3.30	2.50	1.35	1.00	2.65	.....	2.40
17	2.65	3.95	3.00	2.50	1.30	1.00	2.60	.....	2.50
18	2.60	3.70	3.25	2.35	1.30	0.95	2.65	.....	2.50
19	2.70	3.60	3.25	2.30	1.25	0.95	2.65	.....	2.60
20	2.75	3.40	3.25	2.25	1.20	0.90	2.80	.....	2.70

(a) Book stolen containing records from November 9.

Daily gage height, in feet, of Platte River near Lexington, Nebr.—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
21	2.70	3.20	3.10	2.25	1.20	1.60	2.70	.....	2.65
22	2.60	3.35	3.35	2.15	1.20	2.10	2.60	.....	2.60
23	2.60	3.40	3.20	2.10	1.25	2.05	2.60	.....	2.70
24	2.75	3.30	3.40	2.05	1.30	2.25	2.60	.....	2.70
25	2.65	3.20	3.40	2.00	1.40	2.85	2.60	.....	2.80
26	2.60	3.20	3.10	2.40	1.45	2.35	2.60	.....	2.70
27	2.90	3.25	3.10	2.40	1.35	2.70	2.65	.....	2.80
28	2.70	3.30	(a)	2.35	1.30	2.70	2.80	.....	2.85
29	2.75	3.40	.....	2.15	1.25	2.40	2.65	.....	2.85
30	2.80	3.35	.....	2.40	2.15	2.45	2.70	.....	3.00
31	.....	3.30	.....	2.30	2.00	.....	2.70	.....	3.00

[a] Gage down; bridge being repaired.

Rating table for Platte River near Lexington, Nebr., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.1	160	2.6	1,680	3.1	5,140	3.6	10,240
2.2	390	2.7	2,220	3.2	6,060	3.7	11,520
2.3	640	2.8	2,820	3.3	7,000	3.8	12,860
2.4	920	2.9	3,500	3.4	8,020	3.9	14,240
2.5	1,260	3.0	4,290	3.5	9,060	4.0	15,680

[a] This table was applied indirectly, according to the method outlined on p. 323, 19th An. Rept., U. S. Geol. Surv., Pt. IV.

Estimated monthly discharge of the Platte River near Lexington, Nebr.

[Drainage area, 53,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April 15 to 30	.....	.....	2,208	70,072	0.041	0.024
May	14,672	1,950	5,490	337,550	.103	.119
June, 26 days	.....	.....	5,135	264,813	.096	.092
July	5,692	0	2,234	137,350	.042	.048
August	565	0	27	1,660	.001	.001
September	2,780	0	302	17,968	.006	.007
October	1,896	640	1,191	73,232	.022	.025
December	4,290	275	1,678	103,160	.031	.036

NORTH PLATTE RIVER AT NORTH PLATTE, NEBR.

The lowest gaging station on this river is located at the wagon bridge just north of North Platte, Nebr., and was established October 5, 1894. It is 3.5 miles above the junction with the South Platte River. The bridge is a long, low, pile bridge, having 93 spans of approximately 20 feet each, crossing the main channel of the river. North of this, at a distance of about 440 feet, is another bridge crossing a smaller branch or slough, and having six spans of about 20 feet each. The water, except in times of flood, does not pass under all of the spans of the long bridge. Usually the greater part flows under two or three of the spans, spreading out in shallow pools or streamlets under others. Beneath the greater number of spans is a dry, sandy bed at ordinary stages. The initial point for soundings is on the right bank and consists of a mark on the railing on the upstream side of the bridge. The channel is nearly straight for about 500 feet both above and below the station. The banks are low, but are rarely, if ever, overflowed.

The observations of river height are made at the Union Pacific Railroad bridge, about 2 miles below the wagon-road bridge. The railroad bridge is 3 miles above the junction of the North and South Platte rivers. The gage is vertical, marked to tenths of a foot, and is fastened by screws to the piling under the bridge. The top of the east rail directly over the gage is 12 feet above the zero. The gage rod is read twice each day by H. E. Dress, the railroad bridge watchman.

Discharge measurements of North Platte River at North Platte, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 9	H. O. Smith and B. E. Forbes	2.20	1,804
May 6	H. O. Smith	2.65	3,723
May 20	do	3.15	7,136
June 3	do	2.50	3,039
June 19	do	3.00	6,610
July 3	do	2.70	4,991
July 17	do	1.65	1,343
July 28	do	1.70	678
August 9	do	1.00	55
August 18	do	1.00	49
August 23	do	1.00	94
September 6	do	1.00	20
September 24	do	2.30	1,817
November 29	do	2.40	822

Rating table for North Platte River at North Platte, Nebr.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.5	15	1.5	565	2.5	2,950	3.5	11,100
.6	30	1.6	670	2.6	3,440	3.6	12,700
.7	50	1.7	800	2.7	4,050	3.7	14,300
.8	75	1.8	950	2.8	4,700	3.8	16,000
.9	100	1.9	1,120	2.9	5,450	3.9	17,700
1.0	150	2.0	1,320	3.0	6,100	4.0	19,400
1.1	210	2.1	1,560	3.1	6,900		
1.2	280	2.2	1,800	3.2	7,800		
1.3	370	2.3	2,150	3.3	8,800		
1.4	465	2.4	2,520	3.4	9,900		

[a] This table was applied indirectly according to the method outlined on p. 323, 19th An. Rept. U. S. Geol. Surv., Part IV.

Daily gage height, in feet, of North Platte River at North Platte, Nebr.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.										
1	.....	2.00	2.70	2.60	2.80	1.50	1.10	1.90	2.00	2.20
2	.....	2.25	2.70	2.60	2.80	1.35	1.05	1.90	2.00	2.25
3	.....	2.30	2.60	2.50	2.70	1.20	1.00	1.90	2.00	2.30
4	.....	2.40	2.60	2.50	2.60	1.10	1.00	1.95	2.00	2.30
5	.....	2.40	2.70	2.45	2.50	1.10	1.00	2.00	2.00	2.30
6	.....	2.40	2.65	2.65	2.50	1.15	1.00	1.95	2.00	2.30
7	.....	2.25	2.60	2.95	2.50	1.00	1.00	1.90	2.00	(a)
8	.....	2.20	2.60	2.90	2.40	1.00	1.00	1.85	2.00	.....
9	.....	2.20	2.60	3.00	2.50	1.00	1.00	1.75	2.00	.....
10	.....	2.15	2.60	2.90	2.35	1.05	.95	1.70	2.00	.....
11	.....	2.10	2.60	2.75	2.30	1.00	1.00	2.05	2.00	.....
12	.....	2.00	2.75	3.05	2.20	.90	1.10	2.00	2.00	.....
13	.....	2.05	2.90	2.95	2.10	.90	1.15	2.00	2.00	.....
14	.....	2.15	2.90	3.00	2.00	1.05	1.10	2.00	2.00	.....
15	(a)	2.30	3.00	3.00	2.00	1.05	1.20	2.00	2.10	.....
16	1.80	2.40	3.40	3.00	1.75	1.00	1.15	2.00	2.10	.....
17	2.05	2.40	3.20	2.95	1.50	.90	1.10	2.00	2.10	.....
18	2.20	2.35	3.05	3.00	1.60	1.00	1.20	1.95	2.10	.....
19	2.20	2.40	3.10	3.00	1.70	1.10	1.15	1.90	2.10	.....
20	2.25	2.40	3.15	3.00	1.70	1.10	1.10	1.90	2.10	.....
21	2.30	2.40	3.15	2.90	1.70	1.00	1.20	2.00	2.05	.....
22	2.30	2.55	3.10	2.90	1.60	1.00	1.55	2.00	2.00	.....
23	2.35	2.60	3.10	2.90	1.60	1.00	2.25	2.00	2.05	.....
24	2.55	2.60	3.10	2.80	1.50	1.05	2.30	2.00	2.10	.....
25	2.60	2.60	3.10	2.65	1.40	1.10	2.15	2.00	2.10	.....
26	2.65	2.50	3.05	2.60	1.40	1.00	1.95	2.00	2.20	.....
27	2.50	2.60	3.00	2.60	1.45	1.00	1.95	2.00	2.60	.....
28	2.45	2.60	2.90	2.50	1.65	1.10	2.00	2.00	2.50	.....
29	2.30	2.60	2.90	2.50	1.80	1.20	2.00	1.90	2.40	.....
30	2.05	2.60	2.90	2.70	1.65	1.10	1.90	1.90	2.20	.....
31	2.00	.....	2.80	.....	1.50	1.10	.....	2.00	.....	.....

[a] River frozen.

Estimated monthly discharge of the North Platte River at North Platte, Nebr.

[Drainage area 28,517 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1901.						
March	9,900	1,320	3,260	200,425	0.110	0.130
April	4,700	1,560	2,408	143,276	.080	.090
May	14,300	2,150	7,680	472,232	.270	.310
June	17,700	4,050	9,733	579,108	.340	.380
July	4,050	75	1,508	92,712	.050	.060
August	800	50	346	21,275	.010	.010
September	1,320	565	1,068	63,546	.040	.040
October	1,320	670	1,121	68,919	.040	.050
November	1,800	1,320	1,576	93,772	.060	.070
1902.						
March 16 to 31	.....	.....	2,257	71,627	.079	.047
April	3,440	1,800	2,443	145,359	.086	.096
May	9,900	3,440	5,450	335,066	.191	.220
June	6,900	2,950	5,139	305,790	.180	.201
July	6,100	370	2,229	137,039	.078	.090
August	370	30	102	6,271	.004	.005
September	1,800	100	481	28,620	.017	.019
October	1,120	670	1,035	63,642	.036	.042
November	1,560	800	1,104	65,688	.039	.044

NORTH PLATTE RIVER AT BRIDGEPORT, NEBR.

This station was established May 4, 1902, by R. H. Willis. It is located at the wagon bridge, one-half mile due north from Bridgeport, Nebr. The gage is of the usual wire type, the scaleboard being graduated to half-tenths of feet. It is inclosed in a wooden box securely fastened to the railing of the bridge. When the gage reads zero the water is 9 feet below the floor of the bridge at the gage. The gage is read daily by Frank Churchill, a schoolboy who lives one-half mile away. The discharge measurements are made from the bridge, and the initial point for sounding is on the right bank at the south end of the west railing of the bridge. The channel widens both above and below the station. The banks are low, but not liable to overflow. The bed of the stream is sandy and shifting. The bench mark is the top of the floor of the bridge at the gage. Its elevation is 9 feet above the surface of the water when the gage reads zero.

The following discharge measurements were made by R. H. Willis and Frank Dobson in 1902:

May 20: Gage height, 6.00 feet; discharge, 5,414 second-feet.
June 3: Gage height, 5.80 feet; discharge, 4,515 second-feet.
June 10: Gage height, 5.17 feet; discharge, 2,050 second-feet.
June 14: Gage height, 5.97 feet; discharge, 5,433 second-feet.
June 21: Gage height, 5.71 feet; discharge, 5,120 second-feet.
July 19: Gage height, 5.00 feet; discharge, 787 second-feet.
July 26: Gage height, 4.87 feet; discharge, 619 second-feet.
August 8: Gage height, 4.68 feet; discharge, 190 second-feet.
August 28: Gage height, 4.49 feet; discharge, 37 second-feet.
September 22: Gage height, 5.08 feet; discharge, 634 second-feet.

Daily gage height, in feet, of North Platte River at Bridgeport, Nebr.

Day.	May.	June.	July	Aug.	Sept.	Oct.	Nov.
1902.							
1	.....	5.41	5.60	4.85	4.50	4.79	5.02
2	.....	5.61	5.56	4.75	4.46	4.75	4.95
3	.....	5.79	5.76	4.80	4.45	4.80	4.98
4	5.50	5.93	5.40	4.78	4.44	4.80	4.88
5	5.70	6.04	5.43	4.80	4.40	4.84	4.96
6	5.60	5.99	5.32	4.79	4.40	4.82	5.00
7	5.56	6.10	5.33	4.80	4.40	4.80	(a)
8	5.60	5.93	5.35	.....	4.40	4.82	.....
9	5.68	5.89	5.27	4.75	4.48	4.85	.....
10	.....	5.90	5.16	4.72	4.40	4.85	.....
11	.....	5.93	5.19	4.72	4.40	4.91	.....
12	5.76	5.92	5.10	4.70	4.40	4.95	.....
13	.....	5.89	5.02	4.67	4.40	4.90	.....
14	5.80	6.00	5.04	5.05	4.38	4.91	.....
15	5.89	6.04	5.00	4.75	4.41	4.94	.....
16	5.86	6.00	5.20	4.68	4.40	4.95	.....
17	5.91	6.00	5.04	4.70	4.40	4.92	.....
18	5.99	5.85	5.01	4.65	4.40	4.95	.....
19	5.95	5.82	5.00	4.62	.....	4.91	.....
20	6.00	5.82	4.89	4.61	4.46	4.92	.....
21	6.04	5.75	4.86	4.60	.....	.....	.....
22	6.10	5.68	4.80	4.59	4.95	4.94	.....
23	6.04	5.58	4.75	4.60	4.88	4.95	.....
24	6.04	5.48	4.77	4.62	4.78	4.95	.....
25	5.96	5.47	4.86	4.52	4.77	4.94	.....
26	5.86	5.26	4.90	4.52	4.95	4.95	.....
27	5.65	5.46	4.94	4.56	4.85	4.90	.....
28	5.56	5.60	4.79	4.60	4.82	4.91	5.00
29	5.41	5.87	4.76	.....	4.82	4.95	.....
30	5.45	5.85	4.85	.....	4.79	4.94	.....
31	5.41	.....	4.90	.....	.....	4.91	.....

(a) Observations discontinued November 6 to December 31 on account of ice.

Rating table for North Platte River at Bridgeport, Nebr., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.4	10	4.9	560	5.4	2,120	5.9	4,820
4.5	50	5.0	790	5.5	2,610	6.0	5,450
4.6	110	5.1	1,060	5.6	3,120	6.1	6,200
4.7	210	5.2	1,380	5.7	3,660		
4.8	350	5.3	1,710	5.8	4,230		

Estimated monthly discharge of the North Platte River at Bridgeport, Nebr.

[Drainage area, 23,190 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
May, 25 days	----------	----------	4,149	255,050	0.179	0.206
June	6,200	1,580	4,267	253,900	.184	.205
July	4,000	290	1,200	73,780	.052	.060
August, 27 days	----------	----------	244	15,000	.011	.013
September, 28 days	----------	----------	162	9,640	.007	.008
October, 30 days	----------	----------	559	34,372	.024	.028

NORTH PLATTE RIVER AT MITCHELL, NEBR.

This station was established by O. V. P. Stout on June 3, 1901. It replaces the station at Gering, Nebr., which was discontinued, as the narrower channel at Mitchell seemed favorable to increased accuracy of gagings, and, being nearer the Wyoming line, it serves better as a State-line gaging station.

The gage consists of a sash weight hung from a wire carrying an index reading on a horizontal rod nailed to the bridge rail. The zero of the gage is 8 feet below the bridge floor at the gage. It is also 6.73, 6.79, and 6.79 feet below the tops of the upstream ends of the bridge. The observer is G. D. Aughinbaugh, a barber at Mitchell, about one-half mile from the bridge.

On April 4, 1902, a temporary gage rod was set whose zero mark was 3.79 lower than the old rod of 1901. On May 3, 1902, a new permanent gage was put in whose zero mark was 1.0 foot lower than the old rod of 1901, in order to avoid negative gage heights. Hence, between April 4 and May 3, 1902, 2.79 feet were subtracted from the gage heights reported by the observer. To make the gage heights reported during 1901 comparable with those of 1902, 1.0 foot must be added.

Discharge measurements of North Platte River at Mitchell, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet*	*Sec.-feet.*
April 4	Frank Dobson	1.56	917
May 3	do	2.22	2,649
May 28	do	2.46	3,698
June 12	do	3.15	6,425
June 19	do	3.00	4,937
June 27	do	2.42	3,257
July 16	do	1.58	1,014
July 24	do	1.30	630
August 2	do	1.05	349
August 19	do	.85	102
September 2	do	.82	30
October 25	R. H. Willis	.96	363

Daily gage height, in feet, of North Platte River at Mitchell, Nebr.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	.....	2.26	2.79	2.30	1.21	0.82	0.86	0.95
2	.....	2.36	2.91	2.65	1.23	.82	.86	.94
3	(a)	2.22	3.05	2.22	1.19	.83	.87	.94
4	1.56	2.42	3.17	2.05	1.13	.83	.87	.93
5	1.56	2.27	3.25	1.89	1.14	.82	.87	.94
6	1.56	2.32	3.27	1.91	1.14	.82	.87	1.08
7	1.31	2.43	3.05	1.90	1.00	.82	.93	1.09
8	1.21	2.47	3.05	1.91	1.03	.83	.....	1.08
9	1.31	2.48	3.02	1.90	1.04	.83	.....	1.08
10	1.27	2.65	3.17	1.85	1.00	.82	.....	1.11
11	1.27	2.75	3.11	1.76	.98	.82	.....	1.09
12	1.41	2.70	3.16	1.69	.95	.82	.89	1.10
13	1.51	2.80	3.14	1.69	.90	.82	.93	1.10
14	1.61	2.95	3.14	1.76	.93	.83	.93	1.10
15	1.71	3.01	3.19	1.61	.90	.83	.91	1.10
16	1.91	3.07	3.10	1.60	.87	.83	.93	1.14
17	1.81	3.14	3.05	1.54	.86	.83	.92	1.10
18	1.81	3.14	3.01	1.46	.85	.83	.91	1.75
19	1.86	3.19	3.03	1.41	.85	.82	.93	1.15
20	1.86	3.19	2.99	1.38	.85	.84	.93	1.18
21	1.91	3.02	2.94	1.37	.84	.85	.94	1.17
22	1.86	3.27	2.76	1.37	.84	.88	.96	1.16
23	1.86	3.19	2.64	1.39	.84	.89	.97	.....
24	2.26	3.15	2.51	1.33	.84	.85	.97	.....
25	2.21	3.05	2.32	1.28	.84	.84	.98	.....
26	2.41	2.90	2.21	1.31	.84	.85	.99	.....
27	2.41	2.70	2.30	1.29	.84	.84	.98	.....
28	2.51	2.52	2.20	1.25	.84	.87	.99	.....
29	2.46	2.49	2.53	1.46	.83	.86	1.00	.....
30	2.36	2.39	2.39	1.50	.83	.86	.99	.....
31	.....	2.20	.....	1.31	.83	.....	.97	.....

a Observations discontinued from January 1 to April 4 and from November 22 to December 31 on account of ice.

Rating table for North Platte River at Mitchell, Nebr., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.0	99	1.2	1,650	2.4	4,595	3.6	9,920
.2	235	1.4	2,020	2.6	5,290	3.8	11,022
.4	455	1.6	2,455	2.8	6,100	4.0	12,120
.6	720	1.8	2,910	3.0	7,015	.....	.....
.8	1,005	2.0	3,415	3.2	7,940	.....	.....
1.0	1,310	2.2	3,980	3.4	8,900	.....	.....

[a] This table was applied indirectly, according to the method outlined, p. 323, 19th An. U. S. Geol. Surv., Pt. IV.

Estimated monthly discharge of the North Platte River at Mitchell, Nebr.

[Drainage area, 24,400 square miles.]

Month.	Discharge (second-feet).			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April 4 to 30	.....	.....	1,603	85,846	0.066	0.067
May	6,373	2,649	4,346	267,200	.178	.205
June	6,877	2,934	4,915	292,420	.201	.224
July	3,777	612	1,308	80,420	.054	.062
August	559	44	207	12,728	.008	.009
September	124	30	69	4,105	.003	.003
October, 24 days	.....	.....	299	14,233	.012	.011
November 1 to 22	.....	.....	563	24,567	.023	.019

NORTH PLATTE RIVER AT GUERNSEY, WYO.

This station was established June 14, 1900, by A. J. Parshall. It is located at the county bridge about a half mile northwest of Guernsey. The bridge has eight piers, the sides are planked, and there is uniform flow under each span. The rod consists of a 4-inch by 4-inch by 12-foot scantling firmly attached to one of the piers of the bridge. As the station was to be a temporary one, a metallic tape, divided into feet and tenths, was securely fastened to the rod. The bench mark is a spike driven into a sleeper of the bridge 1 foot from the rod and at an elevation of 10.04 feet above the zero. The channel is straight for a distance above and below the station. Both banks are high and do not overflow at high stages. The bed of the stream is sandy, but probably does not shift much.

It was found that considerable inconvenience was caused by sand accumulating about the rod as the high water subsided. With the opening of the season of 1902 a new rod was placed about 200 feet

above the first location. It was fastened to one of the piers of the railroad bridge, and was placed 1 foot lower in the water.

Measurements are still made from the county bridge, which, while it does not furnish a perfect location for measurements, is the best yet found on the river in Wyoming.

Discharge measurements of North Platte River at Guernsey, Wyo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 28	A. J. Parshall	0.90	1,099
April 4	do	.65	748
April 15	do	1.50	1,696
April 29	do	2.10	3,025
May 22	do	3.80	7,379
September 5	do	— .30	173
October 9	do	.20	437

Daily gage height, in feet, of North Platte River at Guernsey, Wyo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1	0.90	2.20	3.80	1.60	0.50	—0.20	0.20	0.30	0.40
2	.90	2.40	3.80	1.60	.50	— .20	.20	.30	.40
3	.65	2.40	3.80	1.60	.50	— .30	.20	.30	.40
4	.65	2.40	4.00	1.60	.50	— .30	.20	.30	.40
5	.65	2.60	4.00	1.80	.40	— .30	.20	.30	.40
6	.80	2.60	4.00	1.60	.40	— .25	.20	.30	.40
7	.80	2.80	4.00	1.20	.40	— .30	.20	.30	.40
8	.90	2.80	4.00	1.60	.40	— .30	.20	.30	.40
9	1.00	2.80	4.00	1.20	.20	— .30	.20	.30	.40
10	1.00	3.00	3.80	1.20	.40	— .30	.20	.30	.40
11	1.00	3.00	3.80	1.20	.40	— .30	.20	.30	.40
12	1.05	3.20	4.00	1.20	.20	— .20	.20	.30	.30
13	1.25	3.20	4.00	1.00	.20	— .20	.20	.30	.30
14	1.40	3.20	3.80	1.00	.20	— .30	.20	.30	.30
15	1.60	3.20	3.80	1.00	.20	— .20	.20	.30	.30
16	1.60	4.10	3.80	1.00	.00	— .20	.20	.30	.60
17	1.60	3.80	3.40	.80	.00	— .30	.20	.30	.60
18	1.50	4.00	3.40	.80	.00	— .30	.20	.30	.60
19	1.60	3.80	3.40	.80	.00	— .30	.20	.40	.60
20	1.60	3.80	3.00	1.00	.00	— .20	.20	.40	.60
21	1.60	3.80	3.00	1.00	.00	— .20	.20	.40	.70
22	1.90	3.80	3.00	1.00	.00	— .30	.20	.40	.70
23	2.00	3.80	2.60	.80	.00	— .30	.20	.40	.70
24	2.20	3.60	2.60	.80	— .10	— .30	.20	.40	.75
25	2.20	3.00	2.60	.70	— .10	— .30	.20	.40	.70
26	2.40	2.80	2.00	1.20	— .20	— .30	.20	.40	.70
27	2.20	2.60	2.00	1.20	— .20	— .30	.20	.40	.70
28	2.20	2.60	2.00	1.20	— .20	— .30	.20	.40	.80
29	2.20	2.60	2.00	1.20	— .20	— .30	.30	.40	.80
30	2.20	3.00	2.00	.80	— .20	.20	.30	.40	.80
31	.....	3.00	.....	.80	— .20	.....	.30	.....	.80

Rating table for North Platte River at Guernsey, Wyo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
—0.7	15	0.5	625	1.7	2,135	2.9	5,050
— .6	50	.6	700	1.8	2,335	3.0	5,305
— .5	90	.7	780	1.9	2,550	3.1	5,560
— .4	130	.8	870	2.0	2,780	3.2	5,820
— .3	175	.9	970	2.1	3,030	3.3	6,080
— .2	220	1.0	1,080	2.2	3,280	3.4	6,340
— .1	270	1.1	1,200	2.3	3,530	3.5	6,600
.0	320	1.2	1,330	2.4	3,780	3.6	6,860
.1	375	1.3	1,470	2.5	4,030	3.7	7,120
.2	430	1.4	1,620	2.6	4,285	3.8	7,380
.3	490	1.5	1,780	2.7	4,540	3.9	7,640
.4	555	1.6	1,950	2.8	4,795	4.0	7,900

Estimated monthly discharge of North Platte River at Guernsey, Wyo.

[Drainage area, 16,243 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	3,780	740	1,885	111,949	0.12	0.13
May	8,160	3,280	5,556	341,015	.34	.39
June	7,900	2,780	6,131	364,181	.38	.42
July	2,335	780	1,304	80,061	.08	.09
August	625	220	400	24,552	.02	.02
September	430	175	196	11,662	.01	.01
October	490	430	436	26,750	.03	.03
November	555	490	516	30,650	.03	.03
December	870	490	663	40,689	.04	.05

LITTLE LARAMIE RIVER NEAR HATTON, WYO.

This station was established in 1902 by B. P. Fleming. It is located at an old bridge 25 miles northwest of Laramie, Wyo. The gage is a plain staff graduated to feet and tenths and secured to the bridge. It is read twice daily by J. M. May, a ranchman, who lives about 75 yards from the gage. The initial point for soundings is a nail driven in the bridge stringer at the left bank. The channel is straight above the station and curved below. The water is quite swift. The right bank is liable to overflow. The left bank is high and rocky. There is an old channel at the right of the station in which there is flow at

high water. The bed of the stream is rocky and very rough. The bench mark is on a rock on the left bank of the stream near the gage. It is marked B. M. U. S. G. S. Its elevation above the zero of the gage has not been determined.

During 1902 the following discharge measurements were made by B. P. Fleming:

July 5: Gage height, 1.05 feet; discharge, 159 second-feet.
August 21: Gage height, 0.47 foot; discharge, 30 second-feet.
October 14: Gage height, 0.68 foot; discharge, 51 second-feet.

Daily gage height, in feet, of Little Laramie River near Hatton, Wyo.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Day.	July.	Aug.	Sept.	Oct.	Nov.
1902.											
1	.....	0.60	0.30	0.70	0.55	17	1.00	0.40	0.30	0.60	0.55
2	.....	.60	.30	.70	.55	18	1.15	.40	.30	.60	.60
3	.....	.60	.30	.70	.45	19	1.00	.35	.30	.60	.65
4	.....	.50	.30	.70	.45	20	.95	.30	.30	.60	.65
5	.....	.50	.30	.70	.45	21	.90	.35	1.20	.60	.70
6	1.00	.50	.30	.60	.45	22	.80	.30	1.25	.60	.65
7	1.00	.55	.20	.60	.45	23	.80	.30	1.00	.60	.65
8	.90	.55	.20	.60	.60	24	.80	.30	.80	.60	.60
9	.90	.55	.20	.60	.60	25	.80	.30	.80	.60	.65
10	.90	.40	.30	.60	.60	26	.80	.30	.80	.60	.60
11	.80	.45	.30	.70	.55	27	.80	.30	.80	.60	.55
12	.80	.55	.30	.70	.50	28	.75	.30	.70	.60	.55
13	.85	.50	.30	.70	.45	29	.65	.30	.75	.60	.60
14	.90	.50	.30	.70	.45	30	.60	.35	.70	.60	.60
15	.85	.55	.30	.70	.55	31	.65	.30	.....	.55	.....
16	.85	.45	.30	.60	.50						

Rating table for Little Laramie River near Hatton, Wyo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	2.5	0.4	24.5	0.7	54.5	1.0	133
.2	9.5	.5	32.5	.8	72.5	1.1	188
.3	16.5	.6	41.5	.9	96	1.2	248

Estimated monthly discharge of Little Laramie River near Hatton, Wyo.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
July 6–31	.....	.....	91	4,695
August	42	16	27	1,660
September	278	10	48	2,856
October	54	42	46	2,828
November	54	28	38	2,265

SWEETWATER RIVER AT DEVILS GATE, NEAR SPLITROCK, WYO.

This station was established in October, 1902, by W. W. Schlecht. It is located about one-fourth mile above Devils Gate and is reached by a team from Rawlins or from Casper, Wyo. The gage is of the usual wire type, with the scale board graduated to feet and tenths. It is read twice daily by Tom Sun, jr., a rancher who lives about 300 yards from the gage. The gagings are made temporarily from a foot bridge at Tom Sun's house. It is intended later to establish a cable at this point.

One discharge measurement made by W. W. Schlecht on October 4, 1902, gives gage height 4.02 feet; discharge, 14.5 second-feet.

Daily gage height, in feet, of Sweetwater River at Devils Gate, Wyo.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.											
1	4.05	.....	4.20	12	4.07	4.11	4.50	23	4.09	4.10	4.50
2	4.00	.....	4.40	13	4.06	4.11	4.50	24	4.09	4.05	4.55
3	4.02	.....	4.40	14	4.05	4.19	4.50	25	4.10	4.15	4.60
4	4.03	.....	4.40	15	4.04	4.14	4.40	26	.....	4.15	4.55
5	4.03	.....	4.40	16	4.03	4.00	4.40	27	.....	4.15	4.45
6	4.03	.....	4.50	17	4.06	4.05	4.40	28	.....	4.20	4.40
7	4.02	.....	4.40	18	4.07	4.00	4.40	29	.....	4.20	4.38
8	4.01	.....	4.45	19	4.05	4.05	4.45	30	.....	4.20	4.45
9	4.02	4.08	4.50	20	4.04	4.05	4.40	31	.....	.....	4.50
10	4.01	4.05	4.50	21	4.09	4.00	4.60				
11	4.03	4.10	4.50	22	4.09	4.10	4.50				

SOUTH PLATTE RIVER AT BIGSPRING, NEBR.

This station was established September 5, 1902, by J. C. Stevens. It is located on the highway bridge one-fourth mile south of Bigspring, Nebr. The gage is of the usual wire type, graduated to feet and tenths, and bolted to the girder of the bridge. It is read daily by Victor Root, a schoolboy, who lives near by. The measurements are made from the bridge, and the initial point for soundings is on the upstream side of the north end of the bridge. There is a short bend above the station and below the station the river is straight. The banks are not liable to overflow. The bed is sandy and shifting. The bench mark is a United States Geological Survey bench mark (marked "U. S. Geological Survey B. M. Elevation above sea, 3,370 feet"), located about 200 feet north of the Union Pacific depot, on the west side of the street. Its elevation is 3,370 feet above sea level. The elevation of the floor of the bridge over the zero mark of the gage is 3,373.95 feet. When the gage reads zero the surface of the water is 9.1 feet below the floor of the bridge over zero mark on the rod and 3,364.85 below bench mark described above.

Gage heights were taken of the water surface when there was no surface flow by digging in the sand.

Discharge measurements of South Platte River at Bigspring, Nebr.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
September 5	J. C. Stevens	1.00	0
September 23	H. O. Smith	1.65	173

Daily gage height, in feet, of South Platte River at Bigspring, Nebr.

Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.	Day.	Sept.	Oct.	Nov.
1902.											
1	.....	1.80	1.45	12	1.00	1.35	1.35	23	1.65	1.35	1.30
2	.....	1.80	1.45	13	1.00	1.35	1.30	24	1.50	1.25	1.30
3	.....	1.80	1.45	14	1.00	1.35	1.30	25	2.00	1.25	1.30
4	.....	1.80	1.45	15	1.00	1.30	1.30	26	2.40	1.20	1.35
5	1.00	1.60	1.40	16	1.00	1.35	1.30	27	2.15	1.25	1.35
6	1.05	1.60	1.30	17	1.10	1.35	1.30	28	1.90	1.25	1.30
7	1.00	1.60	1.25	18	1.10	1.25	1.30	29	1.80	1.25	1.45
8	1.00	1.50	1.25	19	1.15	1.25	1.30	30	1.80	1.25	(a)
9	1.00	1.50	1.25	20	1.20	1.25	1.35	31	.....	1.35	.....
10	1.00	1.50	1.25	21	Pools.	1.20	1.30				
11	1.00	1.35	1.25	22	2.00	1.30	1.30				

a Observations were discontinued November 29.

SOUTH PLATTE RIVER AT JULESBURG, COLO.

This station was established April 2, 1902, by John E. Field, at the wagon bridge crossing the South Platte River, about 1 mile southeast of Julesburg, Colo., a station at the junction of the main line and Denver branch of the Union Pacific Railroad. As this is the last station on the South Platte River in Colorado, and is also below all irrigation ditches in Colorado taking water from the South Platte, with the exception of one, it is of considerable importance for securing data relative to the flow of return waters as well as the natural flow in the main channel. However, the conditions at this station are not as desirable as they should be, owing to the great width of the channel and the general instability of the bed of the stream, features characteristic of the whole course of the South Platte River through this part of the State. The channel at this point is about one-half mile wide, and at low stages of the river it is badly broken up by islands, causing the stream to flow in several different channels. The banks are low, but do not overflow. The bed of the river is dry during the greater part of the year and is shifting and unstable, being composed entirely of sand and gravel.

Measurements are usually made by wading, but may be made from the wagon bridge at high-water stages. The observations are taken once daily by Lloyd Jenkins, who lives in Julesburg. The gage rod consists of a 2 by 4 inch timber 7 feet long, spiked in a vertical position to a piling on the downstream side of the bridge, about 150 feet from the north end. No bench mark has been established, but the rod is securely spiked to the piling and any change in the position of the rod is hardly possible. The initial point for sounding is the left or north bank.

The following discharge measurements were made during 1902 by J. E. Field, S. G. Lees, and R. W. Hawley:

April 2: Gage height, 1.30 feet; discharge, 35 second-feet.
October 10: Gage height, 1.58 feet; discharge, 133 second-feet.
November 8: Gage height, 1.15 feet; discharge, 31 second-feet.

Daily gage height, in feet, of South Platte River at Julesburg, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.									
1	1.30	1.20	1.20	1.10	0.75	0.75	2.30	1.15	1.40
2	1.30	1.25	1.10	1.10	.75	.75	2.20	1.15	1.40
3	1.30	1.25	1.05	1.50	.75	.75	2.00	1.15	1.40
4	1.30	1.25	1.05	1.25	.80	.75	1.80	1.15	1.55
5	1.25	1.20	1.05	1.15	.80	.75	1.75	1.15	1.75
6	1.25	1.20	1.15	1.15	.80	.75	1.70	1.15	1.90
7	1.25	1.20	1.15	1.15	.75	.75	1.70	1.15	2.00
8	1.20	1.15	1.15	1.00	.75	.75	1.70	1.15	2.20
9	1.20	1.15	1.00	1.00	.75	.75	1.65	1.15	2.45
10	1.20	1.15	1.00	1.00	.75	.75	1.55	1.15	2.50
11	1.20	1.15	1.00	.90	.75	.75	1.50	1.15	2.50
12	1.20	1.30	1.60	.90	.75	.75	1.45	1.15	2.50
13	1.20	1.20	1.35	.90	.75	.75	1.40	1.15	2.60
14	1.45	1.20	1.25	.80	.75	.75	1.40	1.20	2.60
15	1.40	1.30	1.25	.80	.75	.75	1.35	1.20	2.60
16	1.30	1.25	1.20	.80	.75	.75	1.30	1.20	2.60
17	1.30	1.20	1.20	.80	.75	.75	1.25	1.20	2.60
18	1.25	1.15	1.10	.80	.70	.75	1.20	1.20	2.60
19	1.20	1.20	1.10	.80	.70	.75	1.20	1.20	2.70
20	1.20	1.30	1.10	.80	.70	.75	1.20	1.20	.....
21	1.25	1.20	1.10	.80	.80	1.20	1.20	1.20	2.75
22	1.30	1.15	1.00	.80	.80	1.90	1.25	1.20	2.80
23	1.40	1.15	1.00	.80	.80	1.90	1.25	1.20	2.80
24	1.30	1.10	.95	.80	.80	2.00	1.25	1.20	2.85
25	1.30	1.10	.95	.85	.80	2.00	1.20	1.20	2.90
26	1.25	1.25	.90	.85	80	2.10	1.20	1.25	(a)
27	1.20	1.25	1.00	1.75	.80	2.20	1.20	1.30	.....
28	1.20	1.25	1.10	1.00	.80	2.30	1.20	1.40	.....
29	1.20	1.20	1.10	.80	.75	2.30	1.20	1.40	.....
30	1.20	1.25	1.10	.80	.75	2.30	1.15	1.40	.....
31	.....	1.25	.....	.75	.75	.....	1.15	.....	.....

a Frozen.

Rating table for South Platte River at Julesburg, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	4	1.4	75	2.0	407	2.6	953
.9	9	1.5	105	2.1	488	2.7	1,058
1.0	15	1.6	144	2.2	573	2.8	1,167
1.1	23	1.7	195	2.3	662	2.9	1,280
1.2	35	1.8	258	2.4	755		
1.3	52	1.9	330	2.5	852		

Estimated monthly discharge of South Platte River at Julesburg, Colo.

[Drainage area, 20,598 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	89	35	46	2,737	0.0022	0.0025
May	52	23	37	2,275	.0017	.0020
June	144	9	28	1,666	.0014	.0016
July	225	2	19	1,168	.0010	.0012
August	4	0	3	184	.0001	.0001
September	662	2	153	9,104	.0074	.0083
October	662	28	129	7,932	.0063	.0073
November	75	28	37	2,202	.0018	.0020
December 1–25			761	37,736	.0369	.0343

MIDDLE CROW CREEK NEAR HECLA, WYO.

This station was established March 24, 1902, by A. J. Parshall. It is located 4 miles northwest of Hecla, Wyo., on a footbridge. The gage is attached to the timber of the bridge, and is graduated to hundredths of a foot. It is read twice daily by Hugh W. McGee. The initial point for sounding is on the left bank. The channel is straight above the station and curved below. The right bank is low and subject to overflow. The left bank is high and does not overflow. The bed of the stream is sandy. The bench mark is a notch cut in a tree 6 feet east of the gage. Its elevation is 4.1 feet above the zero of the gage.

Discharge measurements of Middle Crow Creek near Hecla, Wyo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 24	A. J. Parshall	0.80	3
April 20	do	2.20	17
May 7	do	2.40	28
May 14	do	2.50	31
May 20	do	2.20	25
June 1	do	1.05	8

Daily gage height, in feet, of Middle Crow Creek near Hecla, Wyo.

Day.	April.	May.	June.	July.	Day.	April.	May.	June.	July.
1902.					1902.				
1	0.80	2.45	1.15	0.73	17	1.00	1.80	0.55	0.40
2	.80	2.35	1.05	.73	18	1.35	1.80	.55	.48
3	.80	2.50	.90	.65	19	1.75	2.05	.55	.68
4	.80	2.50	.90	.60	20	2.10	2.10	.55	.67
5	.80	2.45	.85	.50	21	2.30	1.70	.60	.63
6	.80	2.35	.85	.50	22	1.65	1.57	.55	.50
7	.90	2.35	.87	.48	23	1.25	1.50	.50	.50
8	.95	2.38	.82	.45	24	1.35	1.43	.45	.43
9	1.05	2.30	.75	.45	25	1.40	1.32	.32	.40
10	1.15	2.35	.70	.45	26	1.40	1.35	.30	.40
11	1.25	2.40	.60	.48	27	1.55	1.62	.35	.40
12	1.40	2.35	.60	.43	28	1.85	1.70	.70	.45
13	1.40	2.27	.58	.40	29	1.90	1.40	1.12	.40
14	1.35	2.40	.55	.40	30	2.40	1.35	.90	.35
15	1.25	2.40	.58	.40	31	.....	1.20	.....	.30
16	1.05	2.10	.60	.40					

Rating table for Middle Crow Creek near Hecla, Wyo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
.0	.....	0.7	4.5	1.4	13.5	2.1	24.0
0.1	0.5	.8	5.5	1.5	15.0	2.2	25.5
.2	1.0	.9	6.5	1.6	16.5	2.3	27.0
.3	1.5	1.0	7.5	1.7	18.0	2.4	28.5
.4	2.0	1.1	9.0	1.8	19.5	2.5	30.0
.5	2.5	1.2	10.5	1.9	21.0	2.6	31.5
.6	3.5	1.3	12.0	2.0	22.5	2.7	33.0

Estimated monthly discharge of Middle Crow Creek near Hecla, Wyo.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
April	28.5	5.5	12.6	750
May	30.0	10.5	22.4	1,375
June	9.8	1.5	4.4	263
July	4.8	1.5	2.6	161

SOUTH PLATTE RIVER AT KERSEY, COLO.

This station was established April 27, 1901, at Kersey, a station on the Union Pacific Railroad, about 6 miles east of Greeley, at a bridge 1½ miles north of the railroad station itself. This station was intended to take the place of the one previously maintained at Orchard, Colo. This point was selected on account of the regularity of the channel and the fact that there was a wagon bridge crossing the river from which gagings could be made at high water. It is of particular value owing to the fact that the point is just below all the important tributaries of the South Platte, which derive their supply from the mountain region. It is also at about the point where water could be used to the best advantage for storage in reservoirs along South Platte River in northeastern Colorado. The observer is Edward K. Plumb, who lives near the bridge and reads the rod daily. The gage rod consists of a vertical 2 by 6 inch timber, 8 feet long, marked in feet and tenths and spiked to the downstream side of the third pile of the bridge from its south end. The initial point for soundings is the right bank, downstream side, the bridge being marked every 10 feet. The right bank is high and not liable to overflow, but the left is low and water spreads over a considerable distance at high stages.

The following discharge measurements were made during 1902 by J. E. Field and R. W. Hawley:

January 3: Gage height, 2.65 feet; discharge, 634 second-feet.
February 28: Gage height, 2.70 feet; discharge, 700 second-feet.
April 2: Gage height, 1.85 feet; discharge, 328 second-feet.
August 15: Gage height, 1.30 feet; discharge, 62 second-feet.
November 2: Gage height, 1.65 feet; discharge, 188 second-feet.

Daily gage height, in feet, of South Platte River at Kersey, Colo.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.85	3.50	2.70	1.85	1.10	1.60	2.50	1.30	1.30	2.00	1.75	2.30
2	2.85	3.50	2.65	1.85	1.10	1.50	1.60	1.30	1.40	2.00	1.80	2.30
3	2.85	3.50	2.65	1.85	1.10	1.50	1.50	1.30	1.40	2.00	1.80	2.30
4	2.85	3.50	2.65	1.85	1.50	1.40	1.50	1.30	1.40	2.00	1.80	2.30
5	2.75	3.20	2.65	1.85	1.75	1.40	1.40	1.30	1.40	2.00	1.80	2.30
6	2.75	2.90	2.60	1.75	1.50	1.40	1.40	1.30	1.40	2.00	1.80	2.30
7	2.70	2.70	2.60	1.75	1.20	1.40	1.40	1.30	1.40	2.00	1.80	2.30
8	2.70	2.65	2.60	1.60	1.20	1.40	1.50	1.30	1.40	1.95	1.80	2.30
9	2.65	2.60	2.60	1.60	1.20	1.40	1.60	1.30	1.40	1.95	1.80	2.30
10	2.60	2.60	2.55	1.55	1.20	1.40	1.60	1.30	1.40	1.95	1.80	2.30
11	2.60	2.60	2.55	1.50	1.30	1.40	1.80	1.30	1.40	1.95	1.80	2.30
12	2.60	2.70	2.50	1.45	1.30	1.40	1.60	1.30	1.40	1.95	1.80	2.30
13	2.55	2.75	2.50	1.40	1.30	1.40	1.50	1.30	1.40	1.90	1.80	2.30
14	2.55	2.90	2.40	1.35	1.30	1.40	1.40	1.30	1.40	1.80	1.80	2.35
15	2.50	2.80	2.30	1.30	1.30	1.35	1.40	1.30	1.40	1.75	1.80	2.35
16	2.50	2.80	2.30	1.25	1.30	1.30	1.30	1.30	1.40	1.75	1.80	2.40
17	2.50	2.80	2.25	1.25	1.30	1.30	1.30	1.30	1.40	1.65	1.80	2.45
18	2.50	2.80	2.25	1.25	1.30	1.30	1.30	1.30	1.40	1.60	1.90	2.50
19	2.50	2.80	2.25	1.20	1.30	1.30	1.30	1.30	1.40	1.60	2.00	2.50
20	2.50	2.80	2.20	1.20	1.40	1.30	1.30	1.30	1.40	1.60	2.20	2.50
21	2.60	2.80	2.15	1.20	1.40	1.30	1.30	1.30	1.40	1.65	2.40	2.50
22	2.60	2.80	2.10	1.10	1.40	1.30	1.30	1.30	4.50	1.65	2.40	2.60
23	2.60	2.80	2.00	1.10	1.40	1.30	1.30	1.30	4.00	1.70	2.35	2.60
24	2.65	2.75	2.00	1.10	1.40	1.30	1.30	1.30	3.50	1.70	2.30	2.60
25	2.85	2.75	2.00	1.10	1.40	1.30	1.30	1.40	2.40	1.70	2.30	2.55
26	3.50	2.70	2.00	1.10	1.40	1.35	1.30	1.40	2.00	1.70	2.30	2.55
27	3.50	2.70	2.00	1.10	1.40	1.35	1.30	1.40	2.00	1.70	2.30	2.55
28	3.50	2.70	1.90	1.10	1.45	1.35	1.30	1.40	2.20	1.70	2.30	2.50
29	3.50	.....	1.90	1.10	1.50	1.35	1.30	1.40	2.10	1.70	2.30	2.45
30	3.50	.....	1.90	1.10	1.50	3.75	1.30	1.40	2.00	1.70	2.30	2.40
31	3.50	.....	1.90	.....	1.60	.....	1.30	1.30	.....	1.75	.....	2.40

Rating table for South Platte River at Kersey, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet*	*Second-feet.*
0.2	2	1.4	105	2.6	637	3.8	1,965
.4	4	1.6	170	2.8	770	4.0	2,261
.6	8	1.8	243	3.0	935	4.2	2,557
.8	14	2.0	325	3.2	1,139	4.4	2,853
1.0	29	2.2	423	3.4	1,386		
1.2	59	2.4	527	3.6	1,669		

Estimated monthly discharge of South Platte River at Kersey, Colo.

[Drainage area, 9,470 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches
1902.						
January	1,524	580	836	51,404	0.0883	0.101
February	1,524	637	862	47,873	.0910	.095
March	700	282	486	29,883	.0513	.059
April	262	42	122	7,259	.0129	.014
May	224	42	96	5,903	.0111	.013
June	1,891	80	158	9,402	.0167	.019
July	580	80	124	7,624	.0131	.015
August	105	80	85	5,226	.0090	.010
September	2,631	80	363	21,600	.0383	.043
October	325	170	249	15,310	.0263	.030
November	527	224	334	19,874	.0353	.039
December	637	475	532	32,711	.0562	.065
The year	2,631	42	354	254,069	.0375	.503

BIG THOMPSON CREEK NEAR ARKINS, COLO.

This stream drains the country immediately north of that drained by the headwaters of St. Vrain Creek, and is one of the largest tributaries of South Platte River, into which it empties about 4 miles above the town of Evans. Little Thompson Creek is an important tributary of Big Thompson Creek, and the country drained by these two streams makes up irrigation district No. 4. The junction of these creeks is near the lower end of the district, a short distance above the point where their combined waters enter the South Platte.

Records of the flow of this stream were begun in April, 1888. The station was established at its present location on April 1, 1899. The only diversion above the gaging station is Handy ditch, a record of the gage heights of which is kept by the water commissioner of that district, J. M. Wolaver, who also kept the records of Big Thompson Creek at this point during the year 1900. It is necessary to include the discharge of Handy ditch in order to obtain the total run-off of the basin. The rod is a vertical 2-inch by 4-inch timber fastened to the downstream side of the right-hand end of the wagon bridge on the ranch of John Chasteen. The bench mark is 25 feet south of the gage, and is a nail in the root of a cottonwood stump, the head of the nail being 9.35 feet above the zero of the gage. The channel of the stream is lined with bowlders and is very rough, but, not being

likely to change, it furnishes a good point for obtaining accurate measurements. A permanent station could be located here to advantage. Like the other tributaries of the South Platte, nearly all of the normal flow of Big Thompson and Little Thompson creeks is used for irrigation, and during the high-water stages the greater part of the volume is diverted into large reservoirs, from which it is used to advantage later in the season.

The following discharge measurements were made during 1902 by J. E. Field and M. C. Hinderlider:

August 30: Gage height, 0.75 feet; 86 second-feet.
November 14: Gage height, 0.42 feet; 28 second-feet.

Daily gage height, in feet, of Big Thompson Creek near Arkins, Colo.[a]

Day.	May.	June.	July.	Aug.	Sept.	Oct.
1902.						
1	.....	2.10	1.40	0.80	0.60	0.80
2	.....	2.00	1.20	.80	.60	1.10
3	.....	1.80	1.30	.80	.60	.90
4	.....	2.00	1.30	.90	.60	1.00
5	.....	2.20	1.20	.90	.50	.80
6	.....	2.00	1.10	.80	.50	.80
7	.....	2.00	1.00	.80	.50	.70
8	.....	2.20	1.00	.80	.50	.70
9	.....	2.20	.90	.80	.50	.70
10	.....	2.30	1.00	.70	.50	.70
11	.....	2.20	1.00	.70	.50	.80
12	.....	2.00	1.00	.70	.50	1.00
13	.....	1.90	1.00	.70	.50	.90
14	.....	1.90	1.00	.80	.50	.90
15	.....	2.00	1.00	.80	.50	.80
16	.....	1.90	1.00	.70	.40	.80
17	.....	1.80	1.00	.70	.40	.70
18	.....	1.70	1.60	.70	.40	.80
19	.....	1.60	1.40	.70	.40	.70
20	.....	1.60	1.10	.70	.50	.70
21	.....	1.60	1.00	.60	1.00	.70
22	.....	1.60	1.00	.60	1.20	.60
23	.....	1.50	1.00	.70	1.10	.60
24	.....	1.60	1.00	.70	.90	.60
25	0.90	1.60	.90	.70	.80	.60
26	1.20	1.60	1.00	.60	1.10	.50
27	1.50	1.50	.90	.60	1.00	.50
28	2.00	1.60	.80	.60	.90	.60
29	1.60	1.70	.80	.60	.90	.60
30	2.00	1.50	.80	.70	.80	.50
31	2.10	.....	.80	.60	.....	.50

[a] To secure total discharge of Big Thompson Creek in figuring run-off, etc., add number of second-feet flowing in Handy Ditch for corresponding dates.

Rating table for Big Thompson Creek near Arkins, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	1	0.8	96	1.4	271	2.0	539
.3	12	.9	118	1.5	310	2.1	593
.4	26	1.0	143	1.6	350	2.2	650
.5	41	1.1	172	1.7	393	2.3	710
.6	58	1.2	203	1.8	439		
.7	76	1.3	236	1.9	486		

Estimated monthly discharge of Big Thompson Creek near Arkins, Colo.[a]

[Drainage area, 305 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	35	20	29	1,726	0.10	0.11
May	659	80	299	18,385	.98	1.13
June	773	310	505	30,050	1.66	1.85
July	385	108	182	11,191	.60	.69
August	130	67	90	5,534	.30	.35
September	238	34	89	5,296	.29	.32
October	198	46	98	6,026	.32	.37

[a] The discharge of Handy Ditch is included.

ST. VRAIN CREEK AT LYONS, COLO.

The town of Lyons is situated between the north and south forks of St. Vrain Creek, the forks uniting at a point about 1 mile east of the center of the town. Records of the flow of the creek at or near Lyons have been kept since April, 1888, except during the years 1893 and 1894, but the station was not put in its present condition until May 5, 1899, since which date records have been kept throughout each irrigation season. The present station is located one-half mile southeast of Lyons, Colo., below the junction of the north and south forks of St. Vrain Creek. The supply ditch takes water out on the left side of the stream above the gage. To obtain the total run-off of the drainage basin of the creek at this station, the amount of water in the ditch must be added to the discharge of the creek. The gage is an inclined 2 by 4 inch timber, graduated to vertical tenths of a foot,

the space between the marks being 0.134 of a foot. It is fastened to posts driven into the ground. The right bank of the stream is low and liable to overflow. The left bank is a railroad embankment and is not liable to overflow. Measurements are usually made by wading, but at high water they can be made from a wagon bridge 400 feet below the gage. The bench mark is a spike driven into the root of a large cottonwood tree, 150 feet north of the gage rod. The head of the spike is 6.51 feet above gage datum. The observer during 1902 was L. H. Dickson, commissioner of the St. Vrain water district, who read the gage during the irrigation season.

During 1902 the following discharge measurements were made by J. E. Field and M. C. Hinderlider:

July 28: Gage height, 2.50 feet; discharge, 91 second-feet.
August 30: Gage height, 2.05 feet; discharge, 31 second-feet.
November 8: Gage height, 2.08 feet; discharge, 40 second-feet.

Daily gage height, in feet, of St. Vrain Creek at Lyons, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	1.60	2.35	3.35	2.72	2.32	2.18	2.45	2.05
2	1.60	2.40	3.15	2.70	2.30	2.10	2.50	2.03
3	1.70	2.50	3.10	2.75	2.45	2.10	2.50	2.03
4	1.82	2.50	3.28	2.67	2.50	2.10	2.50	2.03
5	1.80	2.55	3.32	2.70	2.42	2.05	2.50	2.03
6	1.85	2.55	3.30	2.60	2.45	2.02	2.50	2.03
7	1.90	2.58	3.35	2.50	2.30	2.00	2.40	.....
8	2.00	2.70	3.45	2.45	2.35	2.00	2.35	.....
9	2.10	2.80	3.55	2.51	2.25	2.00	2.30	.....
10	2.00	2.90	3.45	2.58	2.20	2.00	2.30	.....
11	1.80	3.10	3.35	2.56	2.18	2.00	2.40	.....
12	1.80	3.20	3.35	2.51	2.18	2.03	2.35	.....
13	1.85	3.20	3.30	2.47	2.18	2.00	2.35	.....
14	1.90	3.25	3.30	2.50	2.20	2.00	2.35	.....
15	1.80	3.35	3.38	2.53	2.20	1.95	2.30	.....
16	1.85	3.22	3.25	2.54	2.20	1.95	2.25	.....
17	1.95	3.18	3.22	2.64	2.30	1.95	2.25	.....
18	2.00	3.10	3.15	2.80	2.20	1.95	2.22	.....
19	2.10	2.90	3.20	2.80	2.15	1.95	2.20	.....
20	2.15	2.85	3.20	2.60	2.12	1.95	2.15	.....
21	2.25	2.70	2.95	2.52	2.10	2.30	2.12	.....
22	2.10	2.60	2.95	2.50	2.10	3.00	2.15	.....
23	2.05	2.55	2.92	2.48	2.15	2.95	2.10	.....
24	2.07	2.55	2.98	2.43	2.18	2.55	2.20	.....
25	2.05	2.60	2.92	2.48	2.18	2.55	2.20	.....
26	2.07	3.00	2.95	2.50	2.08	2.60	2.10	.....
27	2.05	3.20	2.92	2.52	2.18	2.40	2.10	.....
28	2.15	3.20	2.95	2.45	2.10	2.40	2.10	.....
29	2.25	3.10	3.00	2.32	2.10	2.55	2.08	.....
30	2.25	3.30	2.78	2.50	2.05	2.50	2.05	.....
31	.....	3.50	.....	2.25	2.25	.....	2.05	.....

Daily gage height, in feet, of Supply ditch at Lyons, Colo.[a]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	0.21	0.25	1.30	0.65	0.55	0.25	0.40	0.40
2	.21	.25	1.35	.60	.25	.25	.40	.40
3	.23	.25	.92	.65	.25	.25	.50	.40
4	.25	.25	.50	.70	.25	.25	.50	.25
5	.25	.25	.68	.25	.25	.25	.50	.25
6	.25	.25	.72	.25	.25	.25	.50	.25
7	.25	.20	.70	.25	.25	.20	.50	.25
8	.25	.20	.75	.25	.25	.20	.40	.25
9	.25	.25	.85	.25	.35	.20	.40	.25
10	.41	.25	.85	.25	.45	.20	.40	.25
11	.25	.45	.70	.38	.45	.25	.40	.25
12	.25	.45	.55	.48	.45	.25	.40	.25
13	.25	.70	.50	.45	.45	.25	.40	.25
14	.25	.70	.50	.45	.35	.25	.40	.25
15	.25	.80	.82	.25	.25	.25	.40	.25
16	.25	.80	.80	.25	.25	.25	.40	.25
17	.25	.80	.75	.25	.25	.25	.40	.25
18	.25	.80	.75	.25	.25	.25	.40	.25
19	.25	.80	.75	.25	.25	.25	.40	.25
20	.25	.50	.70	.25	.25	.25	.40	.....
21	.25	.50	.70	.25	.25	.25	.40	.....
22	.25	.50	.70	.40	.25	.25	.50	.....
23	.25	.45	.55	.40	.25	.60	.20	.....
24	.25	.45	.50	.40	.25	.60	.20	.....
25	.25	.45	.50	.25	.25	.50	.40	.....
26	.25	.20	.50	.25	.40	.40	.40	.....
27	.25	.60	.40	.25	.45	.40	.40	.....
28	.25	.80	.30	.40	.40	.40	.40	.....
29	.25	.80	.25	.55	.40	.40	.40	.....
30	.25	.80	.25	.68	.40	.40	.40	.....
31	.....	1.20	.....	.50	.45	.....	.40	.....

[a] The daily flow of Supply ditch to be added to St. Vrain Creek at gaging station to give total discharge of St. Vrain Creek used in working up run-off, etc.

Rating table for St. Vrain Creek at Lyons, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.1	1	1.8	18	2.5	91	3.2	280
1.2	2	1.9	24	2.6	109	3.3	321
1.3	3	2.0	31	2.7	130	3.4	365
1.4	4	2.1	39	2.8	153	3.5	413
1.5	6	2.2	48	2.9	180	3.6	463
1.6	9	2.3	59	3.0	211	3.7	514
1.7	13	2.4	74	3.1	245	3.8	569

Estimated monthly discharge of St. Vrain Creek at Lyons, Colo.[a]

[Drainage area, 209 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	57	12	34	2,023	0.16	0.18
May	500	70	215	13,220	1.03	1.19
June	485	152	312	18,565	1.49	1.66
July	167	69	112	6,887	.54	.62
August	95	43	59	3,628	.28	.32
September	329	31	74	4,403	.35	.39
October	107	42	69	4,243	.33	.38
November 1–19	----------	----------	84	3,165	.40	.28

[a] This includes the flow of the supply ditch.

CLEAR CREEK AT FORKSCREEK, COLO.

The gaging station is located at the Forkscreek railroad station on the Colorado and Southern Railway, in Clear Creek canyon, just below the junction of the North and South Forks of Clear Creek. It was established May 29, 1899, and has been continued through the irrigation seasons of 1899, 1900, 1901, and 1902. The gage consists of a weight fastened to a wire running over a pulley fastened to the wall at the railway station. Bench mark No. 1 is a point on the timber to which the pulley is attached, and is 13.58 feet above gage datum. Bench mark No. 2 is a granite point 49.5 feet east of the first bench mark, and is 15.46 feet above gage datum. In May, 1902, a trussed foot bridge 43 feet long was placed across the creek at right angles to the direction of the current just below the railway bridge and about 300 feet below the forks of the creek. This bridge is located over the most desirable cross section of the stream, and where satisfactory measurements can be made. It is possible to secure fairly good results by means of measurements made at two bridges above the forks. At low water the stream is gaged by wading. The stream flows rapidly through this part of the canyon, the channel being rocky and the fall great. Both banks are high and rocky. The observer is C. A. Jones.

The following discharge measurements were made during 1902 by S. G. Lees and M. C. Hinderlider:

June 14: Gage height, 2.90 feet; discharge, 655 second-feet.
September 10: Gage height, 1.50 feet; discharge, 60 second-feet.
September 20: Gage height, 1.60 feet; discharge, 55 second-feet.
October 15: Gage height, 1.80 feet; discharge, 82 second-feet.

Daily gage height, in feet, of Clear Creek at Forkscreek, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.							
1	.....	2.10	3.05	2.60	1.90	1.60	1.80
2	.....	2.20	2.95	2.60	1.90	1.70	1.80
3	.....	2.40	2.95	2.55	1.90	1.70	1.80
4	.....	2.40	2.95	2.50	1.90	1.60	1.80
5	.....	2.30	3.00	2.50	1.90	1.60	1.75
6	.....	2.55	3.00	2.45	1.90	1.50	1.70
7	.....	2.60	3.00	2.40	1.90	1.50	1.70
8	.....	2.65	3.05	2.30	1.90	1.50	1.70
9	.....	2.65	3.15	2.30	1.80	1.50	1.70
10	.....	2.70	3.15	2.30	1.85	1.50	1.70
11	.....	2.75	3.30	2.25	1.90	1.55	1.70
12	.....	2.75	3.05	2.30	1.90	1.60	1.70
13	1.65	2.70	2.95	2.20	1.90	1.60	1.60
14	1.65	2.77	2.95	2.15	1.90	1.55	1.70
15	1.65	2.80	2.95	2.15	1.80	1.65	1.70
16	1.75	2.90	2.90	2.35	1.80	1.60	1.70
17	1.70	2.90	2.85	2.40	1.80	1.55	1.70
18	1.75	2.70	2.78	2.40	1.80	1.55	1.60
19	1.80	2.75	2.75	2.30	1.75	1.60	1.60
20	.....	2.65	2.75	2.30	1.70	1.65	1.60
21	.....	2.70	2.75	2.20	1.60	2.05	1.60
22	.....	2.55	2.70	2.10	1.60	1.90	1.60
23	.....	2.55	2.70	2.10	1.65	1.75	1.60
24	.....	2.40	2.65	2.10	1.80	1.75	1.60
25	.....	2.55	2.65	2.10	1.80	1.80	1.60
26	.....	2.70	2.60	2.10	1.80	1.75	1.60
27	1.60	2.95	2.70	2.10	1.80	1.70	1.60
28	1.70	2.75	2.75	2.05	1.70	1.70	1.60
29	1.75	2.80	2.75	2.00	1.70	1.90	1.50
30	2.05	2.80	2.60	2.00	1.70	1.80	.....
31	.....	2.90	.....	2.00	1.65	.....	.....

Rating table for Clear Creek at Forkscreek, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.3	20	2.2	179	3.1	480	4.0	946
1.4	32	2.3	205	3.2	522	4.1	1,003
1.5	44	2.4	235	3.3	566	4.2	1,060
1.6	58	2.5	267	3.4	614	4.3	1,117
1.7	75	2.6	299	3.5	665	4.4	1,174
1.8	93	2.7	332	3.6	719	4.5	1,231
1.9	112	2.8	367	3.7	775	4.6	1,288
2.0	133	2.9	403	3.8	832	4.7	1,345
2.1	155	3.0	441	3.9	889	4.8	1,402

Estimated monthly discharge of Clear Creek at Forkscreek, Colo.

[Drainage area, 345 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April 13–19, 27–30	----------	----------	81	1,766	0.23	0.09
May	422	155	315	19,369	.91	1.05
June	566	299	398	23,683	1.15	1.28
July	299	133	199	12,236	.58	.67
August	112	58	94	5,780	.27	.31
September	144	44	69	4,106	.20	.22
October 1–29	----------	----------	70	4,026	.20	.22

SOUTH PLATTE RIVER AT DENVER, COLO.

In the spring of 1895 a river station was established at the Twenty-third Street Viaduct in the city of Denver, but observations were discontinued on June 18, as the location was found to be unfavorable for accurate measurements, and the water had fallen below the gage. In July a station was established at the Fifteenth Street Bridge and observations were begun, these being made in the morning and in the afternoon. Stream measurements are made from the lower side of the bridge. The original gage consisted of two 6 by 2 inch timbers spiked together, inclined and graduated to vertical tenths of a foot. The space between the marks was 0.156 foot. The timbers were fastened to posts driven into the bank. The bench mark is 107 feet southwest from the gage and is a cross mark on top of the east abutment of the Fifteenth Street Bridge on the north corner. It is marked B. M. and is 6.15 feet above the 9-foot mark of the gage rod.

Another inclined gage rod reading the same as the one on the right bank was placed on the left side in August, 1898. It consisted of a 4 by 4 inch by 12-foot timber fastened to posts driven into the left bank and graduated to vertical feet and tenths.

This rod was washed out by the high water of June, 1900, which also removed the sand bar in front of the rod on the right-hand side, making it available at low-water stages, and since that time the readings have been taken from the latter rod.

The initial point for soundings is on the right bank at the post of the iron railing. The channel is straight for about 1,000 feet above and below and the water moves with moderate velocity. The bed of the stream is sandy and shifting. This point is immediately below the

mouth of Cherry Creek, which enters between the Fourteenth Street and Fifteenth Street bridges. The stream at this point is confined between artificial embankments of furnace slag.

May 15, 1901, a T-rail was placed on the site of the latter rod, which was stolen. The rail was embedded in an inclined position in the slag bank. The zero of the rod is 12 feet below the top of the capstone of the southeast abutment of the Sixteenth Street Viaduct 100 feet northeast of the rod. All readings were taken from this rod from May 15, 1901, to June 9, 1903, when the rod was again stolen. On June 10, 1903, a vertical 4 by 4 inch timber was placed at the same point and fastened to a cottonwood tree. The zero of the rod was placed at the same elevation as the zero of the old gage. The observer is J. A. Banning, water commissioner.

Discharge measurements of South Platte River at Denver, Colo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Sec.-feet.*
April 1	J. E. Field	1.10	107
May 15	do	1.65	241
May 29	do	2.22	557
June 10	S. G. Lees	1.00	74
June 11	do	.98	62
June 12	do	1.05	68
June 13	do	1.85	163
June 16	do	1.00	63
July 16[a]	do	1.09	18
July 22	do	1.13	32
September 9	M. C. Hinderlider	1.10	22
September 12	do	1.00	16
October 14	do	1.30	63
October 28	R. W. Hawley	1.19	48
October 29	do	1.12	42

[a] Channel changed.

Daily gage height, in feet, of South Platte River at Denver, Colo.

Day.	Apr.	Oct.	Nov.	Dec.	Day.	Apr.	Oct.	Nov.	Dec.
1902.					1902.				
1	1.10	.....	1.20	.....	17	1.05	1.30	.....	1.10
2	1.09	.....	1.20	.....	18	1.00	1.30	.....	1.05
3	1.10	.....	1.20	.....	19	1.04	1.20	.....	1.03
4	1.02	.....	1.20	.....	20	.....	1.30	.....	1.20
5	1.04	.....	1.10	.....	21	.....	1.30	.....	1.40
6	1.16	1.22	1.10	.....	22	.....	1.30	.....	1.13
7	1.00	1.24	1.00	.....	23	.....	1.30	.....	1.20
8	.95	1.24	1.00	1.40	24	.....	1.20	.....	1.20
9	1.02	1.21	1.20	1.25	25	.....	1.20	.....	1.35
10	1.05	.....	1.10	1.20	26	.....	1.20	.....	1.30
11	1.02	.....	1.00	1.30	27	.....	1.20	.....	1.45
12	1.07	.....	1.00	1.12	28	.....	1.20	.....	1.45
13	1.08	.....	1.00	1.20	29	.....	1.20	.....	1.15
14	1.08	1.30	1.00	1.20	30	.....	1.20	.....	1.10
15	1.08	1.25	1.20	1.15	31	.....	1.20	.....	1.10
16	1.07	1.30	.....	1.10					

Rating table for South Platte River at Denver, Colo., for 1902.

JANUARY 1 TO JUNE 30, 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	2	0.9	48	1.2	106	1.5	187
.7	16	1.0	64	1.3	130	1.6	224
.8	32	1.1	83	1.4	156	1.7	270

JULY 1 TO DECEMBER 31, 1902.

0.8	2	1.2	56	1.6	221	2.0	435
.9	6	1.3	90	1.7	270	2.1	491
1.0	13	1.4	131	1.8	323	2.2	547
1.1	30	1.5	174	1.9	379		

Estimated monthly discharge of South Platte River at Denver, Colo.

[Drainage area, 3,840 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April 1–19	.....	.....	74	2,789	0.019	0.013
October 6–31	.....	.....	71	3,661	.018	.017
November 1–15	.....	.....	32	952	.008	.004
December 8–31	.....	.....	61	3,046	.016	.015

BEAR CREEK NEAR MORRISON, COLO.

Bear Creek is one of the smaller tributaries of the South Platte, heading in the vicinity of Mount Evans, about 30 miles southwest of Denver, and entering the main stream about 8 miles above that city. Although usually of small volume, the stream drains a considerable portion of very mountainous country, which is subject to more or less violent cloudbursts, so that floods sometimes come down this creek, causing great destruction to property and even loss of life. All of the normal flow of the stream is used for irrigation, and it is only during high-water stages that a large amount of water passes through it. Records of its flow have been kept for a portion of each irrigation season since April, 1888, with the exception of the years 1892, 1893, and 1894. The present station was established April 1, 1899. It is located just above the town of Morrison. The gage rod, which is a 2-inch by 6-inch timber placed vertically and marked in feet and tenths, is fastened to the upper side of the dam which diverts water into the mains of the Denver Union Water Company. The bench mark is the top of a granite bowlder about 100 feet above the rod on the left-hand side of the stream, and it is 10.33 feet above the gage datum. As in previous years, the station was maintained through cooperation with the Denver Union Water Company. The observer is S. Hebrew, an employee of the Denver Union Water Company.

Observations at this station were discontinued in March, 1902, sufficient data having been secured since its establishment in 1888.

Daily gage height, in feet, of Bear Creek near Morrison, Colo.

Day.	Feb.	Day.	Feb.	Day.	Feb.	Day.	Feb.
1902.		1902.		1902.		1902.	
1	0.75	8	0.95	15	1.15	22	1.15
2	.75	9	.95	16	1.25	23	1.15
3	.80	10	1.05	17	1.20	24	1.25
4	.75	11	1.05	18	1.25	25	1.30
5	.85	12	1.05	19	1.35	26	1.35
6	.85	13	.95	20	1.25	27	1.45
7	.90	14	.92	21	1.20	28	1.45

SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station is located at the junction of the North and South forks of the South Platte River at the town of South Platte, on the Colorado and Southern Railroad, about 9 miles above the mouth of the canyon. The station was established March 28, 1902, by John E. Field, at the wagon bridge crossing the main stream about 150 feet below the junction of the two forks. This station is of special importance, its location being above the diverting gates of all irrigating

ditches and also above the intake of the Denver Union Water Company, which derives the greater part of its supply of water from the South Platte River a few miles below this station. The location of the Cheesman Storage Reservoir on the South Fork, 20 miles above this station, and the contemplated installation of large power plants on the two forks above, also add to the importance of this station as a point from which to secure data. Bridges across either fork above the main station allow of measurements being made on these streams, thereby checking all gagings on the main stream below.

The gagings on the main stream are made at high water from a wooden wagon bridge 76 feet long, and at low water by wading. The channel at this point is composed of bowlders and gravel and is reasonably stable. The right bank is the mountain side, rising directly from the bed of the stream at a slope of about 45 degrees. The left bank is low and covered with trees, and liable to overflow at very high water. The gage rod consists of a 2 by 4 inch timber 7 feet long, spiked in a vertical position to the upstream face of the timber pier in the middle of the river; the bench mark, which is a nail driven into the cap timber of the pier just above the rod, is 10.15 feet above the zero of the rod. Observations have been made twice daily during the irrigating season since the establishment of the station. The observer during the summer of 1902 was John B. Sevan. This station is located only about 200 feet from the Colorado and Southern Railway station, and is easily accessible from Denver.

Discharge measurements of South Platte River at South Platte, Colo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 28	J. E. Field	1.85	145
May 2	do	2.00	208
June 13	S. G. Lees	1.87	167
July 17	do	1.00	53
Do	do	1.04	60
August 12	do	1.00	53
August 25	J. E. Field	1.55	122
September 7	M. C. Hinderlider	1.20	69
September 8	J. E. Field	1.20	69
September 13	M. C. Hinderlider	1.25	79
September 23	do	1.45	108
October 17	S. G. Lees	1.20	60
October 27	R. W. Hawley	1.18	57

Daily gage height, in feet, of South Platte River at South Platte, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	1.72	1.11	2.50	1.55	1.00	1.20	1.20	0.95
2	1.72	1.56	2.15	1.50	1.00	1.20	1.30	.95
3	1.60	2.00	1.56	1.50	1.00	1.20	1.20	.97
4	1.55	1.55	1.56	1.50	.56	1.25	1.10	.97
5	1.55	1.55	1.56	1.40	1.25	1.20	1.10	.97
6	1.72	1.55	1.55	1.35	1.60	1.30	1.20	.85
7	1.82	1.55	1.56	1.30	1.30	1.30	1.10	.85
8	2.12	1.56	1.55	1.30	1.20	1.30	1.10	.90
9	3.30	1.11	1.56	1.30	1.10	1.40	1.10	.95
10	2.80	1.55	1.10	1.40	1.10	1.30	1.00	1.02
11	2.95	1.65	1.57	1.25	1.10	1.30	1.00	1.02
12	2.40	2.15	1.10	1.35	1.00	1.22	1.20	.....
13	2.80	2.15	1.50	1.35	1.05	1.25	1.20	.....
14	2.90	2.15	1.45	1.25	1.00	1.30	1.10	.....
15	2.85	2.15	1.50	1.15	1.15	1.30	1.10	.....
16	2.45	2.15	1.50	1.00	1.30	1.30	1.10	.....
17	2.25	2.15	1.45	1.35	1.40	1.20	1.10	.....
18	2.20	2.10	1.45	1.40	1.40	1.20	1.10	.....
19	2.20	2.05	1.45	1.40	1.40	1.20	1.00	.....
20	2.30	1.55	1.45	1.35	1.40	1.30	1.00	.....
21	2.30	1.10	1.80	1.25	1.40	1.40	1.00	.....
22	3.25	1.90	1.75	1.20	1.60	1.60	1.00	.....
23	2.00	1.85	1.60	1.25	1.60	1.35	.95	.....
24	1.90	1.80	1.60	1.20	1.20	1.25	.90	.....
25	1.90	1.75	1.55	1.20	1.20	1.15	.90	.....
26	1.90	1.45	1.50	1.20	1.40	1.10	1.02	.....
27	1.90	2.25	1.55	1.20	1.40	1.10	1.02	.....
28	1.90	2.40	1.50	1.15	1.40	1.15	.95	.....
29	1.82	2.65	1.85	1.15	1.35	1.20	.98	.....
30	1.90	2.55	1.65	1.10	1.20	1.20	1.02	.....
31	.....	2.45	.....	1.00	1.25	.....	1.02	.....

Rating table for South Platte River at South Platte, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	5	1.0	55	1.8	160	2.6	348
.3	8	1.1	65	1.9	178	2.7	380
.4	12	1.2	75	2.0	197	2.8	414
.5	18	1.3	86	2.1	218	2.9	449
.6	24	1.4	98	2.2	240	3.0	485
.7	30	1.5	112	2.3	264	3.1	521
.8	36	1.6	127	2.4	290	3.2	557
.9	45	1.7	143	2.5	318	3.3	593

Estimated monthly discharge of South Platte River at South Platte, Colo.

[Drainage area, 2,612 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	593	119	260	15,471	0.100	0.112
May	364	65	180	11,068	.069	.080
June	318	65	127	7,557	.049	.055
July	119	55	85	5,226	.033	.038
August	127	21	81	4,980	.031	.036
September	127	65	82	4,879	.031	.035
October	86	45	61	3,750	.023	.027
November 1–11	.....	.....	49	1,069	.019	.020

Miscellaneous measurements in Platte River drainage basin.

[Made by H. O. Smith, B. E. Forbes, J. C. Stevens, Frank Dobson, Adna Dobson, R. H. Willis.]

NEBRASKA.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
July 5	Buffalo Creek	Sec. 33, T. 9, R. 18	6.4
Do	do	Sec. 30, T. 10, R. 20	2.0
March 25	Calamus	Burwell	411
March 21	Elkhorn River, North Fork.	Norfolk	118
April 13	do	do	150
May 12	do	do	116
June 16	do	do	137
July 26	do	do	168
August 22	do	do	170
September 29	do	do	242
November 14	do	do	118
March 25	Loup, North	Burwell	1,088
March 23	do	St. Paul	1,186
Do	Loup, Middle	do	1,538
September 7	Platte River	Kearney	Dry.
August 26	Platte River, North	Sec. 3, T. 23, R. 58 W., State line.	31
August 28	do	do	31
September 8	do	do	8
September 22	do	do	630

Miscellaneous measurements in Platte River drainage basin—Continued.

NEBRASKA—Continued.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
April 9	Platte River, South	North Platte	Dry.
May 20	do	do	207
July 7	Salt Creek	Lincoln	[a]5,438
July 10	do	do	[a]10,136
October 1	do	do	92
August 18	Spring Creek	Sec. 30, T. 10, R. 21 W	1.0
April 23	do	Sec. 36, T. 14, R. 47 W	2.4
May 7	do	Sec. 30, T. 15, R. 37 W	2.5
September 7	Wood River	Sec. 12, T. 9, R. 16 W	27.3
July 17	Blue Creek	Sec. 6, T. 16, R. 42 W	90
August 18	do	Sec. 19, T. 16, R. 42 W	50
July 22	Lawrence Fork	Sec. 36, T. 19, R. 52 W	1.4
Do	do	Sec. 11, T. 18, R. 52 W	1.6
July 29	do	Sec. 1, T. 18, R. 52 W	2.9
July 31	do	Sec. 15, T. 18, R. 52 W	2.2
August 18	Lonergan Creek	Sec. 19, T. 15, R. 39 W	2.5
August 19	Sand Creek	Sec. 14, T. 15, R. 40 W	1.3
May 7	White Tail Creek	S. line sec. 36, T. 15, R. 38 W.	24.7
Do	do	N. line sec. 36, T. 15, R. 38 W.	36.0
Do	do	NE. ¼ sec. 26, T. 15, R. 38 W.	33.0
April 13	Lodge Pole	Sec. 36, T. 14, R. 47 W	4.0
April 25	do	Sec. 35, T. 15, R. 55 W	12.0
June 2	do	Kimball	5.6
July 2	do	Sec. 25, T. 15, R. 56 W	7.5
Do	do	Sec. 31, T. 15, R. 56 W	10.5

[a] Flood.

Miscellaneous measurements in the Platte drainage.

[Made by A. J. Parshall and W. P. Edwards.]

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
September 11	North Platte River	Saratoga	108
September 12	do	At mouth of Brush Creek	63
September 14	do	Fort Steele	80
September 24	do	do	175
September 26	do	Big Bend	238
September 29	do	North of Seminole Mountains.	393
October 1	do	South of Seminole Mountains.	362
September 12	Brush Creek, Carbon County, Wyo.	At mouth	3.6
Do	Grand Encampment Creek, Carbon County, Wyo.	Near mouth	35
September 13	Cow Creek, Carbon County, Wyo.	do	.61
September 14	Pass Creek, Carbon County, Wyo.	do	.46
September 29	Medicine Bow River, Carbon County, Wyo.	do	40
January 1	South Fork, Crow Creek	Granite Canyon, Laramie County, Wyo.	1.23
January 8	Clear Creek (tributary Crow Creek).	Reis Springs, Laramie County, Wyo.	.10
Do	do	Corlett, Laramie County, Wyo.	.12
Do	North Fork, Clear Creek (tributary Crow Creek).	do	.14
January 15	Middle Crow	Simmons, Laramie County, Wyo.	3.75
March 12	do	At dam site, Laramie County, Wyo.	3.14
July 8	Bear Creek	Morrison	18
July 9	North Turkey Creek	Near Conifer	3
Do	Elk Creek	Winston	5
Do	Deer Park Creek	Bailey	4
Do	North Fork South Platte	do	70
July 10	Halls Gulch	Webster	14
Do	Jefferson Creek	Jefferson	16
Do	Michigan Creek	Como	6
Do	Tarryall Creek	Near Como	11
Do	Middle Fork South Platte River.	Fairplay	39
July 11	Fourmile Creek	Near Fairplay	4
Do	South Fork South Platte River.	Near Buffalo Springs	28

KANSAS RIVER DRAINAGE BASIN.

The drainage basin of the Kansas River lies between those of the Platte and Arkansas rivers, being entirely within the region of the Great Plains, and principally within the arid or semiarid area. It has no mountain tributaries, but depends entirely for its water supply upon the water which, falling within or near the basin, percolates slowly to the drainage channels. The catchment area extends from eastern Colorado to the Missouri River, a distance from east to west of 485 miles. Its extreme width is about 200 miles. The main stream of the Kansas River is formed at Junction, Kans., by the Republican and Smoky Hill rivers, and flows east into the Missouri at Kansas City. The Republican is its principal tributary and drains southern Nebraska and northern Kansas by means of many small tributary creeks. The Solomon, Saline, and Smoky Hill rivers drain the plains of northwestern Kansas. The Blue River is a small tributary in northeastern Kansas, flowing south into the Kansas River, near Manhattan, Kans. The following is a list of the stations in the Kansas River drainage basin:

Kansas River at Lecompton, Kans.
Blue River near Manhattan, Kans.
Republican River at Junction, Kans.
Republican River and the Mill Race near Superior, Nebr.
Solomon River at Niles, Kans.
Saline River near Salina, Kans.
Smoky Hill River at Ellsworth, Kans.

KANSAS RIVER AT LECOMPTON, KANS.

The gaging station at Lecompton was established April 16, 1899, at the new wagon bridge. On June 24, 1900, a new gage was established, the old gage having been broken. The present gage, a pine board 1 inch by 1 inch by 10 feet long, graduated to feet and tenths, is spiked on top of the old gage, and is at the same elevation. On October 26, 1900, a bench mark was established on top of the bottom flange of the iron strut connecting the two iron cylinders at the south end of the highway bridge over the river. The bench mark is at the west end of the strut, next to the cylinder. Its elevation is 12.19 feet above the zero of the gage. The observer is A. D. McAdow.

Discharge measurements of Kansas River at Lecompton, Kans.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 28	W. G. Russell	3.00	1,340
May 28	do	7.00	14,314
June 9	do	8.25	17,182
June 21	do	6.50	13,147
July 12	do	16.35	72,173
July 30	do	6.15	12,879
August 27	do	7.70	17,720

Daily gage height, in feet, of Kansas River at Lecompton, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.10	2.20	2.00	3.40	2.90	7.25	10.95	8.00	14.45	7.60	5.60	5.80
2	2.10	2.20	2.00	3.40	2.90	7.50	11.30	7.55	12.85	7.50	5.60	5.80
3	2.10	2.20	2.00	3.35	2.90	7.00	11.75	7.10	11.35	9.35	5.60	5.75
4	2.10	2.20	1.90	3.30	2.90	6.60	11.95	6.55	9.90	11.20	5.60	5.70
5	2.10	2.20	1.90	3.20	2.90	7.20	12.20	5.50	8.95	13.05	5.60	5.70
6	2.10	2.20	1.80	3.20	3.05	7.70	12.50	5.30	8.50	12.40	5.60	5.70
7	2.20	2.20	2.20	3.20	3.35	9.00	12.85	4.90	7.90	10.20	5.60	5.70
8	2.30	2.20	2.65	3.20	3.65	8.50	13.20	4.70	7.45	9.90	5.60	5.70
9	2.40	2.20	2.85	3.20	3.80	7.95	13.80	4.60	6.90	9.55	5.60	5.65
10	2.40	2.20	3.15	3.10	3.75	9.50	14.60	4.90	6.60	8.70	5.60	5.60
11	2.40	2.20	3.40	3.10	3.70	9.60	15.30	5.40	6.10	7.65	5.50	5.60
12	2.40	2.20	3.35	3.10	3.75	9.20	16.30	4.95	5.20	7.65	5.55	5.55
13	2.40	2.20	3.20	3.10	3.95	8.50	16.85	4.90	4.70	8.20	5.70	5.50
14	2.40	2.10	3.00	3.10	4.25	7.80	17.40	4.85	4.30	9.75	5.90	5.50
15	2.35	2.10	3.00	3.10	4.50	7.50	17.60	4.80	4.30	9.30	6.00	5.50
16	2.30	2.10	3.50	3.10	4.90	7.25	16.65	4.80	4.30	8.55	6.00	5.40
17	2.30	2.10	3.50	3.10	4.90	6.90	15.55	4.70	4.25	7.90	6.10	5.40
18	2.30	2.10	3.40	3.05	4.70	6.70	13.50	4.65	4.20	7.35	6.40	5.50
19	2.30	2.10	3.40	3.00	4.95	6.50	11.50	4.60	4.15	6.90	6.65	5.90
20	2.30	2.00	3.40	3.00	5.40	6.45	12.80	4.50	4.10	6.45	6.50	6.60
21	2.30	2.00	3.30	3.00	5.70	6.65	10.60	5.15	4.10	6.05	6.40	7.00
22	2.30	2.00	3.30	3.00	6.20	8.80	8.60	5.55	4.30	6.00	6.20	7.25
23	2.30	2.10	3.50	3.00	6.70	8.45	7.00	6.75	5.80	5.90	6.20	7.40
24	2.30	2.10	3.50	3.00	7.10	7.70	7.30	6.60	6.20	5.70	6.20	7.35
25	2.30	2.10	3.40	3.00	7.75	7.15	7.05	6.50	6.40	5.60	6.15	7.25
26	2.30	2.00	3.40	3.00	8.40	6.70	7.00	6.85	6.65	5.60	6.10	7.20
27	2.30	2.00	3.30	3.00	9.45	6.35	7.00	7.75	6.90	5.60	6.05	7.10
28	2.30	2.00	3.30	3.00	9.25	6.00	6.80	8.00	8.30	5.50	6.00	7.00
29	2.30	.....	3.30	5.00	7.60	9.00	6.35	8.20	8.80	5.40	6.00	7.00
30	2.30	.....	3.30	2.95	5.65	10.70	6.10	8.85	7.90	5.40	5.80	7.00
31	2.20	.....	3.30	.....	5.55	.....	7.15	12.85	.....	5.40	.....	6.90

Rating table for Kansas River at Lecompton, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	275	4.6	6,710	7.2	15,200	9.8	24,300
2.2	625	4.8	7,300	7.4	15,900	10.0	25,000
2.4	1,000	5.0	7,900	7.6	16,600	10.5	27,500
2.6	1,425	5.2	8,510	7.8	17,300	11.0	30,000
2.8	1,885	5.4	9,130	8.0	18,000	11.5	32,750
3.0	2,375	5.6	9,770	8.2	18,700	12.0	35,500
3.2	2,890	5.8	10,430	8.4	19,400	12.5	38,625
3.4	3,415	6.0	11,110	8.6	20,100	13.0	41,750
3.6	3,940	6.2	11,790	8.8	20,800	13.5	45,375
3.8	4,465	6.4	12,470	9.0	21,500	14.0	49,000
4.0	5,000	6.6	13,150	9.2	22,200	15.0	58,000
4.2	5,550	6.8	13,830	9.4	22,900	16.0	67,000
4.4	6,120	7.0	14,510	9.6	23,600	17.0	76,000

Estimated monthly discharge of Kansas River at Lecompton, Kans.

[Drainage area, 58,550 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	1,000	445	767	47,161	0.01	0.01
February	625	275	492	27,324	.01	.01
March	3,675	100	2,460	151,259	.04	.05
April	3,415	2,250	2,653	157,864	.05	.06
May	23,075	2,125	8,435	518,648	.14	.16
June	28,500	11,110	17,131	1,019,365	.29	.32
July	81,400	11,450	38,291	2,354,422	.65	.75
August	40,812	6,415	11,941	734,223	.20	.23
September	53,050	5,270	14,990	891,977	.26	.29
October	42,112	9,130	17,734	1,090,421	.30	.35
November	13,320	9,450	10,830	644,430	.18	.20
December	15,900	9,130	11,785	724,631	.20	.23
The year	81,400	100	11,459	8,361,725	.20	2.66

BLUE RIVER NEAR MANHATTAN, KANS.

The gaging station, established April 12, 1895, is at the county bridge 4 miles north of Manhattan. The gage rod consists of three sections, the lower being an ash stick driven into the bottom of the river and bolted to an overhanging cottonwood tree, 30 feet east of the

bridge. The other two sections of the rod are bolted to the south bridge pier. The bench mark is a cross cut in the capstone of the south bridge pier immediately above the upper gage, and is 32.135 feet above gage datum.

The observer is C. M. Matter.

Discharge measurements of Blue River near Manhattan, Kans.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 14	W. G. Russell	4.10	534
April 29	do	3.80	381
May 20	do	5.00	852
June 10	do	18.05	17,623
June 26	do	6.70	1,903
July 9	do	25.15	31,273
July 14[a]	do	26.85	31,060

[a] Backwater from Kansas River probably caused low discharge on July 14.

Daily gage height, in feet, of Blue River near Manhattan, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	4.20	(a)	a4.80	4.00	3.80	5.50	22.00	11.50	24.50	10.10	6.50	6.00
2	4.00	(a)	4.90	4.10	3.80	5.30	21.50	10.90	20.90	8.10	6.40	6.00
3	3.80	a3.80	5.00	4.10	3.80	5.20	19.30	10.00	17.90	7.60	9.90	5.90
4	3.80	(a)	4.70	4.10	4.80	5.10	18.70	9.40	13.10	13.10	8.80	6.20
5	3.90	a4.10	.....	4.20	4.10	5.00	18.60	8.80	9.40	15.60	7.30	6.20
6	4.00	(a)	.....	4.20	3.90	7.20	14.20	7.90	8.60	14.30	6.90	6.10
7	4.00	(a)	4.80	4.20	3.90	6.80	9.70	7.80	8.20	12.30	6.50	6.00
8	3.90	a4.20	4.60	4.20	3.90	13.00	19.40	7.60	7.90	11.30	6.40	5.80
9	3.90	(a)	4.60	4.20	3.90	16.00	25.00	7.50	7.40	9.70	6.30	5.80
10	3.80	(a)	4.50	4.10	3.90	18.50	29.00	7.30	7.10	9.00	6.20	5.70
11	4.00	a4.20	4.40	4.00	4.00	18.00	31.50	7.00	7.10	8.40	6.20	5.70
12	3.90	(a)	4.30	4.00	4.00	14.00	31.20	6.90	6.90	8.80	6.20	5.60
13	3.90	(a)	4.30	4.00	3.80	12.10	30.00	6.90	6.60	19.30	6.10	5.60
14	3.90	a4.30	4.10	4.00	4.80	11.60	28.50	6.80	6.50	16.20	6.70	5.50
15	3.90	(a)	4.10	4.00	4.60	13.70	18.70	6.70	6.50	12.30	7.60	5.40
16	3.90	a4.40	4.10	4.00	4.60	12.60	12.80	6.50	6.30	11.20	7.60	5.30
17	3.90	(a)	4.00	4.00	5.30	10.50	11.20	6.60	6.30	9.20	7.00	5.80
18	3.90	(a)	4.10	4.00	4.70	10.30	10.70	6.50	6.20	8.80	6.60	7.00
19	4.00	a4.40	4.20	4.00	5.30	10.60	11.20	6.50	6.10	8.30	6.50	a8.00
20	4.00	(a)	4.20	4.00	5.20	13.50	14.80	7.90	6.10	8.00	6.40	8.20
21	4.00	(a)	4.20	3.90	4.90	15.50	13.20	8.20	6.00	7.80	6.40	7.70
22	4.00	a4.50	4.10	3.90	10.20	12.00	12.50	7.90	6.10	7.60	6.30	7.90
23	4.00	(a)	4.20	3.90	10.10	9.00	13.60	8.10	6.50	7.40	6.20	7.30
24	4.10	(a)	4.20	3.90	10.30	8.70	13.40	8.40	7.60	7.20	6.10	6.90
25	4.00	a4.70	4.10	3.90	18.00	7.50	14.80	8.20	10.70	7.10	6.10	6.70
26	a4.00	(a)	4.20	3.90	14.10	6.80	15.30	8.10	10.90	7.00	6.10	a7.60
27	a3.90	a5.00	4.10	3.90	8.80	6.40	11.30	10.40	10.60	6.90	6.20	a7.60
28	(a)	a4.80	4.00	3.80	7.80	13.50	11.50	11.20	9.10	6.80	6.20	a7.60
29	a3.90	.....	4.00	3.80	6.40	11.80	11.60	11.30	8.10	6.80	6.10	a7.60
30	(a)	.....	4.00	3.80	6.00	11.60	11.70	15.00	9.30	6.60	6.10	a7.60
31	a4.00	.....	4.00	.....	5.70	.....	11.80	23.30	.....	6.50	.....	a7.50

a Frozen.

Rating table for Blue River near Manhattan, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.0	140	6.8	2,006	10.6	5,468	15.0	11,760
3.2	204	7.0	2,150	10.8	5,684	15.5	12,710
3.4	268	7.2	2,306	11.0	5,900	16.0	13,670
3.6	336	7.4	2,462	11.2	6,124	16.5	14,630
3.8	408	7.6	2,624	11.4	6,348	17.0	15,590
4.0	480	7.8	2,792	11.6	6,576	17.5	16,550
4.2	560	8.0	2,960	11.8	6,808	18.0	17,510
4.4	640	8.2	3,136	12.0	7,040	18.5	18,470
4.6	726	8.4	3,312	12.2	7,280	19.0	19,430
4.8	818	8.6	3,492	12.4	7,520	19.5	20,390
5.0	910	8.8	3,676	12.6	7,764	20.0	21,350
5.2	1,014	9.0	3,860	12.8	8,012	21.0	23,270
5.4	1,118	9.2	4,052	13.0	8,260	22.0	25,190
5.6	1,228	9.4	4,244	13.2	8,560	23.0	27,110
5.8	1,344	9.6	4,440	13.4	8,860	24.0	29,030
6.0	1,460	9.8	4,640	13.6	9,186	25.0	30,950
6.2	1,592	10.0	4,840	13.8	9,538		
6.4	1,724	10.2	5,048	14.0	9,890		
6.6	1,862	10.4	5,256	14.5	10,820		

Estimated monthly discharge of Blue River near Manhattan, Kans.

[Drainage area, 9,490 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	560	408	461	28,346	0.05	0.06
February	910	408	619	34,378	.07	.07
March	910	480	618	37,983	.07	.08
April	560	408	483	28,740	.05	.06
May	17,510	408	2,157	132,629	.23	.27
June	17,510	910	6,298	374,757	.66	.74
July	43,430	4,540	16,866	1,037,050	1.78	2.05
August	27,686	1,790	4,329	266,180	.46	.53
September	29,990	1,460	5,011	298,175	.53	.59
October	20,006	1,790	5,071	311,804	.53	.61
November	4,740	1,526	1,945	115,735	.20	.22
December	3,136	1,066	1,897	116,642	.20	.23
The year	43,430	408	3,813	2,782,419	.40	5.51

REPUBLICAN RIVER AT JUNCTION, KANS.

The gaging station at this point, established by Arthur P. Davis, April 26, 1895, is located at the wagon bridge at the north end of Washington street just above the mouth of the river. The gage consists of two oak timbers bolted to a post and to a cottonwood tree. One bench mark consists of a 60-penny spike driven into the base of the abutment of the bridge at an elevation of 10.67 feet on the rod; the second bench mark is the top of a stone in the base of the bridge abutment 18 feet south of the gage and at an elevation of 14.51 feet above gage datum. The right bank is high, but the left is low and may overflow at high water. The bed of the stream is sandy and liable to change.

On October 23, 1900, a new bench mark was established, at an elevation of 12.35 feet above the zero of the old gage. It is a spike driven in the west side of a cottonwood tree 18 inches in diameter and 10 feet west of the bridge. The spike is about 2 feet above the ground. The observer is J. H. Rathert.

Discharge measurements of Republican River at Junction, Kans.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 13	W. G. Russell	4.00	846
April 29	do	3.65	556
May 19	do	5.10	2,047
June 5	do	4.80	1,777
June 16	do	5.10	2,180
June 25	do	4.80	1,740
July 7	do	7.55	7,713
July 8	do	10.25	16,601
July 15	do	6.65	5,306
September 27	do	8.50	10,207

Daily gage height, in feet, of Republican River at Junction, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.80	3.90	4.60	4.35	3.60	5.50	9.67	5.75	7.30	5.00	3.50	3.45
2	3.80	3.90	4.20	4.30	3.55	5.30	8.50	5.00	5.60	4.65	3.50	3.45
3	3.85	3.90	4.20	4.10	3.55	5.10	8.20	5.35	5.00	4.60	3.95	3.40
4	3.85	3.90	4.30	4.00	4.63	6.10	9.30	4.80	4.20	6.60	3.95	3.40
5	3.80	3.90	4.40	4.00	4.00	4.80	7.80	4.55	3.85	5.35	3.60	3.35
6	3.80	3.90	4.50	3.90	3.80	5.30	7.25	4.25	3.45	5.30	3.50	3.10
7	3.75	3.90	4.60	3.90	3.75	5.90	7.10	4.20	3.40	5.15	3.45	3.10
8	3.75	3.90	4.50	3.80	3.70	7.50	10.60	4.10	3.30	5.10	3.40	3.00
9	3.75	3.90	4.30	3.85	3.65	6.85	10.40	3.85	3.25	4.60	3.45	3.00
10	3.80	3.90	4.20	3.80	3.65	6.40	11.20	6.10	3.20	4.20	3.45	3.20
11	3.90	3.90	4.00	3.80	3.55	5.85	12.30	3.80	3.20	4.00	3.45	3.20
12	3.90	3.90	4.00	3.85	3.55	5.10	12.70	3.60	3.10	4.90	3.45	3.20
13	3.80	3.90	4.00	3.80	3.95	7.40	10.10	3.50	2.90	4.90	3.40	3.20
14	3.80	3.90	3.90	3.75	4.95	5.45	7.60	3.40	2.90	6.70	3.50	3.18
15	3.85	3.90	3.90	3.70	4.70	6.20	6.60	4.50	2.90	4.90	3.65	3.08
16	3.90	3.90	3.85	3.72	4.00	5.20	6.20	3.35	2.85	4.80	3.70	3.12
17	3.90	3.90	3.85	3.72	4.40	4.80	5.75	3.25	2.65	4.40	3.60	3.25
18	3.90	3.90	3.80	3.70	4.20	5.50	5.40	3.10	2.80	4.20	3.60	3.30
19	3.90	3.90	3.80	3.70	4.50	5.40	5.00	3.50	2.75	4.00	3.50	3.30
20	3.90	3.90	3.75	3.60	5.40	5.60	4.80	3.60	2.75	3.85	3.50	3.35
21	4.00	3.90	3.70	3.60	6.10	6.20	4.70	7.60	2.70	3.90	3.50	3.65
22	4.00	3.90	3.90	3.70	6.40	5.30	5.30	4.70	2.70	3.85	3.45	3.38
23	4.10	3.90	3.90	3.65	6.55	5.00	4.75	3.90	3.35	3.80	3.40	3.35
24	4.00	3.90	3.85	3.60	6.60	4.90	4.40	3.90	3.65	3.75	3.50	3.30
25	3.90	4.00	3.80	3.60	6.65	4.80	4.20	3.80	5.10	3.65	3.50	3.28
26	3.90	4.00	3.90	3.65	7.60	4.60	4.20	3.50	8.20	3.60	3.40	3.28
27	3.90	4.10	3.90	3.65	6.70	4.40	4.00	5.85	8.50	3.55	3.40	3.30
28	3.90	4.55	3.85	3.65	5.60	5.23	4.20	5.10	5.90	3.55	3.45	3.65
29	3.90	.....	3.85	3.62	5.70	7.60	8.20	6.65	5.70	3.50	3.45	3.42
30	3.90	.....	3.90	3.65	5.60	7.80	8.40	6.95	5.50	3.50	3.40	3.55
31	3.90	.....	4.10	.....	5.90	.....	7.50	8.90	.....	3.45	.....	3.48

Rating table for Republican River at Junction, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.2	20	4.6	1,480	7.0	6,000	9.4	13,200
2.4	30	4.8	1,720	7.2	6,600	9.6	13,800
2.6	70	5.0	1,960	7.4	7,200	9.8	14,400
2.8	140	5.2	2,210	7.6	7,800	10.0	15,000
3.0	220	5.4	2,520	7.8	8,400	10.2	15,600
3.2	300	5.6	2,840	8.0	9,000	10.4	16,200
3.4	400	5.8	3,200	8.2	9,600	10.6	16,800
3.6	510	6.0	3,600	8.4	10,200	10.8	17,400
3.8	630	6.2	4,000	8.6	10,800	11.0	18,000
4.0	840	6.4	4,400	8.8	11,400	11.5	19,500
4.2	1,050	6.6	4,900	9.0	12,000	12.0	21,000
4.4	1,260	6.8	5,400	9.2	12,600	13.0	24,000

Estimated monthly discharge of Republican River at Junction, Kans.

[Drainage area 25,837 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	945	600	710	43,656	0.03	0.03
February	1,425	735	775	43,041	.03	.03
March	1,480	570	887	54,539	.03	.03
April	1,207	510	654	38,916	.03	.03
May	7,800	482	2,128	130,846	.08	.09
June	8,400	1,260	3,338	198,625	.13	.15
July	23,100	840	7,887	484,953	.30	.35
August	11,700	260	2,046	125,804	.08	.09
September	10,500	88	1,646	97,944	.06	.07
October	5,150	427	1,436	88,296	.06	.07
November	787	400	471	28,026	.02	.02
December	2,443	220	422	25,944	.02	.02
The year	23,100	88	1,867	1,360,590	.07	.98

REPUBLICAN RIVER AND THE MILL RACE NEAR SUPERIOR, NEBR.

This station was established June 20, 1896, about one mile west of Superior, Nebr. The old gage rod was first placed just above the highway bridge, which is itself 75 yards above the dam which diverts water into the mill race.

This gage consists of an oak piece 2 by 4 inches, 10 feet long. The face is inclined 30 degrees to the horizontal, and the footmarks are placed 2 feet apart to correspond to this inclination. The rod is fastened to cross-ties which are bedded in the bank of the river. The location is on the outside of an easy bend in the river. The bed of the river is of mud and sand. The top of the rim of the upstream cylinder of the north pier is 15.42 feet above the zero of the gage. Bench mark 2 is the standard 4-foot iron pipe of the United States Geological Survey. It is 83 feet north of the upstream cylinder of the north pier of the bridge and is 10 feet west of the line of the upstream truss of the bridge. It is 1 foot inside a wire fence. The top of the pipe is 4 inches above the ground and the elevation is 4.88 feet above gage datum.

In the spring of 1898 two other gages were established. The first gage was placed in the river a few feet upstream from the crest of the dam, the zero being at the same elevation as the crest. The second is

in the mill race, which is crossed by a wagon bridge about 50 yards below its head. Discharge measurements of the river are made from the highway bridge, thus determining at once the discharge through the mill race and from the dam. The discharge from the mill race is measured and is deducted from the total discharge of the river to give the amount passing over the dam. The bench mark for this river gage is bench mark No. 2 of the old gage described above. Its elevation is 4.92 feet above the datum of the gage at the dam. The gage of the mill race reads 2 feet higher than that of the river gage, so that its zero is 6.92 feet below the same bench mark.

It was found, however, that the discharge of the mill race was regulated more or less by the mill below, so that there was no relation whatever between the gage height and the discharge. To remedy this difficulty the observer records the depth of water in midstream at the wagon bridge and immediately thereafter notes number of seconds required for a float to pass over a 50-foot range in midstream. The ratios of the time to the depth was found to bear a constant rela tion to the discharge.

During 1899 Glenn E. Smith made an examination of a portion of the upper Republican River. On September 6, 1899, at Oxford, Nebr., the river channel was dry and was reported to have been in this condition for ten days. At Orleans, about 12 miles below, there was an estimated discharge of 0.3 second-foot—this small amount coming from Sappa River, which enters at this point.

Discharge measurements of Republican River near Superior, Nebr.[a]

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 16	Frank Dobson	0.75	625
April 5	J. C. Stevens	.70	638
May 24	Frank Dobson	1.30	1,499
July 8	J. C. Stevens	(b)	12,494
July 30	do	1.25	1,562
August 12	do	.73	553
September 19	do	.39	154

[a] These discharges include that flowing in the mill race.
[b] Water out of banks on both sides and over top of gage rod.

Discharge measurements of mill race near Superior, Nebr.[a]

Date.	Hydrographer	Discharge.	Date.	Hydrographer.	Discharge.
1902.		*Sec.-feet.*	1902.		*Sec.-feet.*
March 16	Frank Dobson	22	July 30	J. C. Stevens	119
April 5	J. C. Stevens	54	August 12	do	54
May 24	Frank Dobson	35	September 19	do	3

[a] Gage heights are not observed, but depth of water in midstream and the time required for a float to pass over a 50-foot range in midstream, the ratios of which are used instead of gage heights.

Daily gage height, in feet, of Republican River near Superior, Nebr.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.									
1	.....	0.80	0.56	1.10	1.98	1.42	0.70	1.00	0.60
2	.....	.80	.50	1.00	2.32	1.20	.68	.98	.60
3	.....	.71	.70	1.05	2.05	1.05	.65	1.05	.59
4	.....	.73	.46	1.32	1.30	1.18	.61	1.19	.55
5	.....	.70	.49	.95	2.40	.95	.60	1.35	.56
6	.....	.70	.53	1.95	(b)	.92	.58	1.00	.63
7	.....	.62	.90	1.90	(b)	.90	.52	.98	.60
8	(a)	.56	1.02	1.92	(b)	.82	.53	.90	.61
9	0.90	.55	1.15	1.48	(b)	.80	.45	.89	.62
10	.85	.58	.85	1.30	3.50	.70	.42	.82	.70
11	.80	.68	.75	1.42	2.55	.81	.48	.88	.71
12	.80	.78	.69	1.00	1.88	.70	.40	1.05	.73
13	.80	.68	.86	.95	1.92	.62	.32	1.45	.74
14	.83	.60	.80	.88	1.72	.80	.31	1.00	.78
15	.75	.60	.78	1.05	1.42	.78	.40	.85	.71
16	.75	.62	.70	.82	1.30	.65	.41	.82	.78
17	.70	.68	.70	.70	1.15	.60	.32	.99	.74
18	.85	.65	.75	.85	1.68	.55	.48	.90	.79
19	.80	.62	1.85	1.38	1.80	.52	.34	.91	.75
20	.64	.70	1.69	1.20	1.10	.51	.35	.83	.74
21	.60	.65	1.53	1.20	1.05	.50	.40	.78	.71
22	.75	.63	1.42	1.08	1.00	.52	1.85	.70	.71
23	.78	.67	1.20	.95	.92	.68	3.60	.71	.67
24	.75	.65	1.30	.90	1.02	.50	2.32	.72	.80
25	.68	.62	1.56	.82	1.08	.50	1.86	.70	.80
26	.80	.58	1.95	.76	(b)	.50	1.78	.73	.70
27	.81	.60	1.95	.68	3.25	.60	1.35	.75	.90
28	.97	.56	1.65	.65	3.00	.58	1.10	.75	.70
29	.52	.56	1.75	.78	1.60	.59	1.05	.72	.80
30	.83	.52	1.25	1.10	1.20	.67	1.02	.71	(a)
31	.81	.....	1.20	.....	1.70	.62	.....	.72	.....

[a] Observations discontinued from Jan. 1 to Mar. 9 and during December on account of ice.
[b] Flood; water over top of gage.

Rating table for Republican River near Superior, Nebr., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.1	45	1.0	850	1.9	2,780	2.8	6,155
.2	95	1.1	1,010	2.0	3,075	2.9	6,630
.3	150	1.2	1,190	2.1	3,390	3.0	7,125
.4	215	1.3	1,390	2.2	3,725	3.1	7,650
.5	285	1.4	1,610	2.3	4,080	3.2	8,195
.6	360	1.5	1,840	2.4	4,455	3.3	8,760
.7	460	1.6	2,085	2.5	4,850	3.4	9,345
.8	570	1.7	2,340	2.6	5,265	3.5	9,950
.9	690	1.8	2,505	2.7	5,700	3.6	10,575

[a] This table was applied indirectly according to the method outlined on page 323, Nineteenth Annual Report United States Geological Survey, Part IV, and gives the discharge over the dam, exclusive of that flowing in the mill race.

Estimated monthly discharge of Republican River near Superior, Nebr.

[Drainage area, 22,347 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
March 9 to 31	----------	----------	675	29,453	0.03	0.02
April	740	390	555	33,020	.02	.02
May	2,810	335	1,269	78,020	.06	.07
June	3,235	320	1,372	81,640	.06	.07
July	12,490	970	[a] 3,080	[a] 189,360	[a] .14	[a] .16
August	1,920	330	674	41,440	.03	.03
September	10,875	155	1,175	69,910	.05	.06
October	1,995	520	937	57,610	.04	.05
November	970	460	622	37,010	.03	.03

[a] Exclusive of four days' flood discharge.

SOLOMON RIVER AT NILES, KANS.

The station at Niles was established May 5, 1897, and is located at a bridge one-half mile west of the town and 7 miles above the mouth of the river. The rod of the wire gage is spiked to the floor of the bridge. The bench mark is the uppermost of three nails driven into a cottonwood tree 18 inches in diameter, on the north side of the river and 25 feet east of the bridge, at an elevation of 24.96 feet above gage

datum. The channel is straight for about 100 feet above and below the section. The current is sluggish; the right bank is high, and the left bank overflows only at very high stages. The bed of the stream is muddy.

The observer is J. J. Little.

Discharge measurements of Solomon River at Niles, Kans.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 30	W. G. Russell	4.50	72
June 5	do	7.20	409
June 26	do	7.80	555
July 3	do	27.30	6,561
October 1	do	29.10	8,623

Daily gage height, in feet, of Solomon River at Niles, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	.....	(a)	(a)	4.60	4.60	9.10	26.10	14.50	8.40	29.10	8.70	7.40
2	.....	(a)	5.10	5.50	4.80	7.70	27.60	10.00	9.00	28.50	8.60	7.40
3	.....	a 5.00	5.00	5.30	4.70	6.60	27.30	10.00	9.70	14.70	8.80	7.30
4	a 4.90	(a)	4.20	5.20	4.70	10.70	25.80	7.90	9.10	13.50	9.10	7.30
5	(a)	a 5.30	4.30	5.10	4.60	7.60	21.70	7.70	7.50	13.90	8.60	7.20
6	a 5.00	(a)	4.20	4.90	4.50	7.10	17.60	7.30	6.80	16.90	8.40	7.20
7	(a)	(a)	5.70	4.80	4.60	9.80	13.40	7.00	6.40	17.30	8.30	7.20
8	(a)	a 5.10	5.90	4.70	4.50	16.00	14.30	6.70	6.80	18.10	8.20	7.20
9	(a)	(a)	5.70	4.60	4.50	14.50	17.10	6.70	6.80	16.00	8.20	6.90
10	a 5.00	a 5.00	5.30	4.70	4.50	11.00	21.30	14.50	6.20	14.20	8.10	7.00
11	(a)	(a)	5.30	4.90	4.60	10.40	22.10	14.00	5.80	12.30	8.10	6.60
12	(a)	a 5.10	5.20	4.90	4.70	9.40	21.40	11.70	5.50	11.30	8.10	7.20
13	a 4.90	(a)	5.20	4.80	4.80	8.20	20.30	9.50	5.50	14.30	8.10	7.00
14	(a)	(a)	5.00	4.70	4.60	12.40	10.80	10.30	5.60	17.30	8.10	7.00
15	a 5.00	a 5.20	4.90	4.90	4.60	7.80	9.20	10.70	5.60	16.80	8.10	6.70
16	(a)	(a)	4.80	4.90	4.70	7.40	8.80	8.70	5.50	16.40	8.10	6.90
17	a 4.90	(a)	4.80	4.70	4.60	8.80	8.00	7.70	5.60	14.40	7.80	7.50
18	(a)	a 5.40	5.00	4.80	4.60	11.00	7.50	7.30	5.60	12.20	7.80	6.70
19	a 5.20	(a)	4.70	4.90	4.20	12.40	7.30	7.00	5.40	14.40	7.80	7.10
20	(a)	a 5.00	4.70	4.90	4.70	8.70	7.00	6.50	5.30	10.50	7.80	7.40
21	(a)	(a)	4.70	4.60	4.60	12.50	6.80	7.70	5.30	10.30	7.70	7.10
22	a 5.50	a 5.10	4.80	4.70	5.60	14.60	6.90	8.60	5.40	10.00	7.70	6.90
23	(a)	(a)	5.00	4.80	5.80	12.10	6.70	8.00	5.30	9.80	7.60	6.90
24	a 5.00	a 5.30	4.90	4.70	7.80	11.30	6.30	7.70	11.30	9.60	7.50	6.90
25	(a)	(a)	4.90	4.80	7.60	9.50	6.60	8.60	18.20	9.60	7.50	6.60
26	a 5.20	a 5.40	5.00	4.80	7.10	8.40	6.50	7.90	22.00	9.30	7.50	7.10
27	(a)	(a)	4.90	4.80	11.30	7.10	6.30	8.10	22.70	9.30	7.40	7.10
28	a 5.00	a 5.20	4.80	4.80	11.00	7.00	6.20	10.10	24.00	9.30	7.40	7.10
29	(a)	.....	5.00	4.40	9.10	20.00	6.60	8.40	25.60	9.10	7.40	6.90
30	(a)	.....	4.70	4.60	10.60	25.30	17.90	7.20	27.60	8.80	7.40	6.90
31	a 5.00	.....	4.80	.....	8.40	.....	20.20	8.20	.....	8.70	.....	7.10

a Frozen.

Rating table for Solomon River at Niles, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
4.0	22	7.4	470	10.8	1,285	14.5	2,375
4.2	38	7.6	512	11.0	1,337	15.0	2,550
4.4	54	7.8	556	11.2	1,389	16.0	2,900
4.6	70	8.0	600	11.4	1,441	17.0	3,250
4.8	86	8.2	646	11.6	1,493	18.0	3,600
5.0	102	8.4	692	11.8	1,547	19.0	3,950
5.2	122	8.6	738	12.0	1,604	20.0	4,300
5.4	142	8.8	784	12.2	1,663	21.0	4,650
5.6	162	9.0	830	12.4	1,722	22.0	5,000
5.8	192	9.2	880	12.6	1,782	23.0	5,350
6.0	222	9.4	930	12.8	1,841	24.0	5,700
6.2	252	9.6	980	13.0	1,900	25.0	6,050
6.4	282	9.8	1,030	13.2	1,960	26.0	6,400
6.6	316	10.0	1,080	13.4	2,020	27.0	6,800
6.8	352	10.2	1,130	13.6	2,080	28.0	7,220
7.0	390	10.4	1,181	13.8	2,140	29.0	7,730
7.2	430	10.6	1,233	14.0	2,200	30.0	8,300

Estimated monthly discharge of Solomon River at Niles, Kans.

[Drainage area, 6,815 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	152	94	106	6,517	0.02	0.02
February	142	102	119	6,608	.02	.02
March	207	38	101	6,210	.02	.02
April	152	54	89	5,296	.01	.01
May	1,415	38	285	17,524	.04	.05
June	6,155	316	1,392	82,830	.20	.22
July	7,040	252	2,492	153,227	.37	.43
August	2,375	299	847	52,080	.12	.14
September	7,040	132	1,392	82,830	.20	22
October	7,780	761	2,263	139,145	.33	38
November	855	470	601	35,764	.09	.10
December	490	316	402	24,718	.06	.07
The year	7,780	38	841	612,749	.12	1.68

SALINE RIVER NEAR SALINA, KANS.

The station, established May 4, 1897, is located at a bridge 4.5 miles northeast of Salina, near the mouth of the river. The rod of the wire gage is spiked to the floor of the bridge. Bench mark No. 1 is a nail in an elm tree 2 feet in diameter on the north side of the river and 6 feet west of the bridge. Its elevation is 22.90 feet above gage datum. Bench mark No. 2 is six nails driven into a 16-inch box-elder tree on the north side of the river and 35 east of the bridge. Its elevation is 22.90 feet above gage datum. The channel is straight for a short distance above and below the station. Both banks are high and not liable to overflow. The bed of the stream is sand and mud. The observer is Charley Tressin.

Discharge measurements of Saline River near Salina, Kans.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 6	W. G. Russell	4.00	22
April 30	do	3.30	23
May 11	do	3.20	24
June 2	do	4.70	116
June 11	do	6.80	326
July 2	do	17.40	2,017
July 23	do	4.80	131
September 30	do	24.50	3,822
October 2	do	21.10	2,664
November 29	do	6.10	231

Daily gage height, in feet, of Saline River near Salina, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.70	(a)	4.10	3.60	3.40	5.70	15.80	6.10	9.00	24.50	7.20	6.10
2	3.70	a4.10	4.30	3.50	3.40	4.60	18.20	5.50	13.50	20.90	7.20	6.10
3	3.80	(a)	4.30	3.60	3.30	4.20	20.20	5.20	12.00	10.80	7.70	6.10
4	3.90	a4.00	3.80	3.50	3.20	4.30	20.30	5.00	8.60	15.30	7.60	6.00
5	4.20	(a)	3.80	3.50	3.40	9.10	10.50	5.00	7.50	15.70	7.20	6.10
6	4.00	a4.00	3.60	3.40	3.40	12.00	8.90	4.80	6.60	15.00	7.00	6.00
7	4.00	(a)	3.70	3.60	3.30	15.80	7.90	4.70	6.20	16.10	6.90	5.70
8	4.10	a4.10	3.90	3.40	3.30	16.90	14.50	4.60	5.90	16.90	6.70	5.50
9	4.10	a4.10	3.90	3.40	3.40	13.90	9.50	5.70	5.70	15.00	6.80	5.80
10	4.20	(a)	3.70	3.50	3.30	8.40	16.10	5.20	5.50	11.60	6.70	5.70
11	4.00	a4.20	3.60	3.40	3.20	6.80	10.80	7.20	5.30	10.70	6.70	5.50
12	4.00	(a)	3.90	3.40	3.10	8.20	7.40	9.50	5.20	10.00	6.60	5.80
13	4.10	a4.10	3.60	3.50	3.30	7.30	6.60	12.00	5.00	9.60	6.70	5.95
14	4.20	(a)	3.60	3.50	3.10	7.20	6.60	7.40	5.00	10.70	6.70	6.35

a Frozen.

Daily gage height, in feet, of Saline River near Salina, Kans.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
15	4.00	a4.10	3.60	3.40	3.10	12.10	6.00	6.20	4.90	15.20	6.60	6.25
16	4.20	a4.20	3.60	3.40	3.20	12.50	5.70	5.50	4.90	17.10	6.60	6.20
17	4.20	(a)	3.70	3.50	3.20	13.50	5.40	5.00	4.90	16.00	6.60	6.30
18	4.20	a4.20	3.60	3.40	3.10	14.40	5.30	4.70	4.80	10.80	6.40	6.20
19	4.30	(a)	3.40	3.40	3.10	11.00	5.10	5.20	4.80	9.60	6.40	5.90
20	4.50	(a)	3.60	3.30	3.20	8.40	5.10	5.10	4.80	9.10	6.40	5.60
21	4.00	a3.90	3.50	3.40	3.50	14.90	4.80	5.30	4.70	8.70	6.30	5.80
22	4.00	a3.60	3.40	3.50	4.00	14.50	4.90	6.20	5.00	8.40	6.30	5.90
23	4.00	3.80	3.50	3.40	4.00	12.70	4.80	10.00	12.00	8.20	6.30	6.05
24	4.00	3.60	3.50	3.30	3.50	7.90	4.80	14.40	17.80	8.10	6.30	5.95
25	4.10	3.60	3.60	3.30	7.20	7.50	4.70	14.00	17.50	7.90	6.20	5.90
26	a4.20	3.80	3.60	3.50	7.50	6.80	4.90	15.40	18.00	7.80	6.30	6.10
27	(a)	3.90	3.60	3.40	6.70	6.30	4.80	16.70	19.60	7.70	6.20	6.35
28	a4.30	3.80	3.60	3.20	7.00	6.30	4.90	17.00	21.40	7.50	6.20	5.85
29	(a)	.....	3.60	3.30	9.70	13.10	4.70	10.00	23.40	7.40	6.10	5.70
30	a4.00	.....	3.60	3.10	7.20	13.70	7.50	7.50	24.50	7.30	6.10	5.60
31	a4.10	.....	3.60	.....	5.80	.....	6.40	6.90	.....	7.20	.....	5.65

a Frozen.

Rating table for Saline River near Salina, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
3.2	28	6.8	320	10.4	796	14.0	1,370
3.4	34	7.0	340	10.6	824	14.5	1,460
3.6	41	7.2	364	10.8	852	15.0	1,550
3.8	50	7.4	388	11.0	880	15.5	1,640
4.0	60	7.6	412	11.2	910	16.0	1,730
4.2	70	7.8	436	11.4	940	16.5	1,820
4.4	80	8.0	460	11.6	970	17.0	1,910
4.6	100	8.2	488	11.8	1,000	17.5	2,000
4.8	120	8.4	516	12.0	1,030	18.0	2,090
5.0	140	8.6	544	12.2	1,064	18.5	2,180
5.2	160	8.8	572	12.4	1,098	19.0	2,270
5.4	180	9.0	600	12.6	1,132	19.5	2,360
5.6	200	9.2	628	12.8	1,166	20.0	2,450
5.8	220	9.4	656	13.0	1,200	20.5	2,545
6.0	240	9.6	684	13.2	1,234	21.0	2,640
6.2	260	9.8	712	13.4	1,268	22.0	2,860
6.4	280	10.0	740	13.6	1,302	23.0	3,170
6.6	300	10.2	768	13.8	1,336	24.0	3,620

Estimated monthly discharge of Saline River near Salina, Kans.

(Drainage area, 3,311 square miles.)

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	90	45	64	3,935	0.019	0.022
February	70	41	60	3,332	.018	.019
March	75	34	45	2,767	.014	.016
April	41	25	35	2,083	.011	.012
May	698	25	112	6,886	.034	.039
June	1,892	70	792	47,127	.239	.267
July	2,507	110	621	38,184	.188	.217
August	1,910	100	512	31,482	.155	.179
September	3,920	110	874	52,007	.264	.295
October	3,920	364	1,089	66,960	.329	.379
November	424	250	305	18,159	.092	.103
December	275	190	234	14,388	.071	.082
The year	3,920	25	395	287,310	.120	1.630

SMOKY HILL RIVER AT ELLSWORTH, KANS.

The gaging station, established April 17, 1895, is located at the highway bridge on Douglass avenue, Ellsworth, Kans. The gage is an inclined ash timber spiked to a post driven in the bed of the river and bolted to an iron post on the bridge pier. The bench mark is a nail driven into the base of a large box-elder tree near the southeast corner of the bridge, 90 feet from the gage, and its elevation is 13.07 feet above the zero of the gage. A slope gage is spiked to the St. Louis and San Francisco Railroad bridge 2,536 feet upstream, and is referred to the same datum. The channel is nearly straight above and below the gage, and the bed is sandy and shifting. The observer is Thomas Coyne.

Discharge measurements of Smoky Hill River at Ellsworth, Kans.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
March 27	W. G. Russell	1.00	20
June 23	do	6.20	2,830
June 24	do	4.50	1,530
August 18	do	1.40	96
August 28	do	3.50	651

Daily gage height, in feet, of Smoky Hill River at Ellsworth, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	a1.20	a0.80	1.50	0.95	0.75	1.30	5.20	2.90	3.00	3.60	1.80	1.25
2	a1.20	a .80	1.40	.95	.75	1.20	4.60	2.75	2.80	3.40	1.85	1.25
3	a1.20	a .80	1.30	.90	.75	1.20	4.30	2.60	2.70	3.60	1.85	1.20
4	a1.20	a .80	1.20	.90	.75	2.20	3.90	2.50	2.60	4.10	1.80	1.20
5	a .90	a .80	1.10	.90	.75	1.70	3.40	2.30	2.40	4.20	1.80	1.20
6	a .90	a .80	1.10	.90	.75	1.50	3.00	2.10	2.30	4.00	1.75	1.20
7	a .90	a .80	1.00	.90	.70	1.30	2.80	2.00	2.20	3.80	1.70	1.20
8	a .90	a .80	1.00	.85	.70	1.25	3.80	2.25	2.00	3.50	1.60	1.15
9	a .90	a .85	1.00	.85	.70	1.20	3.40	2.20	1.90	3.30	1.60	1.15
10	a .90	a .85	.95	.85	.70	1.20	3.00	1.95	1.85	3.10	1.55	1.15
11	a .90	a .85	.95	.85	.70	1.15	6.70	1.80	1.80	2.90	1.50	1.15
12	a .90	a .90	.95	.80	.70	1.10	5.80	1.80	1.70	2.70	1.60	1.10
13	a .90	a .90	.90	.80	.70	3.00	5.00	1.75	1.70	2.50	1.65	1.10
14	a .90	a .90	.90	.80	.85	2.00	4.50	2.20	1.65	2.80	1.70	1.10
15	a .85	a .90	.90	.80	.80	1.70	3.50	2.00	1.60	3.00	1.65	1.20
16	a .85	a .95	.90	.80	.80	2.50	2.70	1.80	1.60	2.60	1.65	1.20
17	a .85	a .95	.85	.80	.75	2.30	2.50	1.60	1.55	2.60	1.65	1.20
18	a .85	a1.10	.85	.80	.80	2.10	2.20	1.40	1.50	2.50	1.60	1.20
19	.85	a1.20	.85	.80	.85	2.10	2.00	1.30	1.50	2.35	1.60	1.30
20	.85	a1.20	.85	.75	.85	8.75	1.90	1.25	1.50	2.30	1.60	1.40
21	.85	a1.30	.90	.75	1.60	5.50	1.80	3.80	1.50	2.20	1.55	1.40
22	.80	a1.50	.90	.85	2.20	4.90	1.80	6.50	1.65	2.20	1.55	1.30
23	.80	1.10	.90	.85	2.20	6.00	1.70	8.30	3.00	2.15	1.50	(a)
24	.80	1.20	.95	.85	2.00	4.50	1.65	12.00	12.60	2.10	1.50	(a)
25	a .80	1.20	.95	.80	1.80	3.80	3.00	6.50	9.00	2.00	1.45	1.40
26	a .80	1.30	2.15	.80	3.05	3.50	2.60	5.00	7.80	2.00	1.40	(a)
27	a .80	1.50	1.00	.80	1.70	3.20	2.40	4.20	6.20	2.00	1.35	(a)
28	a .80	1.50	1.00	.80	1.50	3.00	2.20	3.50	5.20	1.95	1.30	(a)
29	a .80	.....	.95	.80	1.50	5.40	2.00	3.30	4.60	1.90	1.25	(a)
30	a .80	.....	.95	.80	1.50	5.00	3.40	3.10	3.90	1.85	1.25	(a)
31	a .80	.....	.95	.....	1.45	.....	3.20	3.80	.....	1.85	.....	(a)

a River frozen.

Rating table for Smoky Hill River at Ellsworth, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	9	2.6	485	4.6	1,670	6.6	3,190
0.8	17	2.8	575	4.8	1,810	6.8	3,345
1.0	25	3.0	675	5.0	1,950	7.0	3,500
1.2	55	3.2	780	5.2	2,105	8.0	4,275
1.4	85	3.4	900	5.4	2,260	9.0	5,050
1.6	125	3.6	1,020	5.6	2,415	10.0	5,825
1.8	175	3.8	1,140	5.8	2,570	11.0	6,600
2.0	235	4.0	1,260	6.0	2,725	12.0	7,375
2.2	310	4.2	1,390	6.2	2,880		
2.4	395	4.4	1,530	6.4	3,035		

Estimated monthly discharge of Smoky Hill River at Ellsworth, Kans.

[Drainage area, 7,980 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	55	17	24	1,475	0.003	0.003
February	100	17	38	2,110	.005	.005
March	290	19	39	2,398	.005	.006
April	23	15	18	1,071	.002	.002
May	700	13	87	5,349	.011	.013
June	4,856	40	821	48,853	.103	.115
July	3,267	137	891	54,785	.112	.129
August	7,375	62	1,021	62,779	.128	.148
September	7,840	100	1,033	61,468	.130	.144
October	1,390	187	588	36,155	.074	.085
November	187	62	125	7,438	.016	.017
December	85	40	64	3,935	.008	.009
The year	7,840	13	396	287,816	.050	.676

Miscellaneous measurements in Kansas River drainage basin in Nebraska.

[Made by J. C. Stevens, B. E. Forbes, H. O. Smith, Frank Dobson.]

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
April 5	Blue River	Seward	50
April 18	do	Crete	143
Do	do	do	132
September 16	do	Wymore	234
July 2	Crooked Creek	Sec. 1, T. 1, R. 11 W.	a 175
June 10	Center Creek	Sec. 36, T. 2, R. 15 W.	7.6
Do	do	Sec. 7, T. 1, R. 15 W.	7.7
April 25	Frenchman River	Culbertson	92
June 13	do	Enders	60
September 18	do	Culbertson	66
June 10	Lost Creek	Sec. 10, T. 1, R. 15 W.	0.7
April 25	Republican	Culbertson	204
April 26	do	Ives	39
Do	do	Stratton	85
Do	do	Haigler	52
April 27	do	Oxford	255

Miscellaneous measurements in Kansas River drainage basin in Nebraska—Continued.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
April 27	Republican	McCook	137
June 10	do	Franklin	743
June 12	do	Benkleman	35
September 17	do	Oxford	37
Do	do	McCook	29
Do	do	Benkleman	45
September 18	do	Culbertson	41
June 12	Republican, South Fork	State Line	32.8
September 17	do	Benkleman	31.6
April 26	Rock Creek	Ives	9.9

[a] Flood.

ARKANSAS RIVER DRAINAGE BASIN.

The Arkansas River rises in the central part of Colorado, flows south for about 70 miles, then east for 50 miles, increased by many small mountain streams. At Canyon, Colo., it emerges from the Rocky Mountain front and takes a general easterly direction across the great plains of Colorado, where most of the water is diverted for irrigation. It flows east across Kansas to the center of the State, thence southeast through Indian Territory and Arkansas into the Mississippi River, about 25 miles north of Greenville, Miss. Throughout the mountainous area above Canyon the discharge increases, but as soon as the river emerges onto the Great Plains the water is gradually diverted by lines of canals, so that by the time the Kansas line is reached the river is usually dry during the summer. Among its tributaries the Neosho (called the Grand in Indian Territory) and the Verdigris rivers drain southeastern Kansas and flow south in nearly parallel courses, joining the Arkansas about 3 miles apart, west of Tahlequah, Ind. T. The Walnut River is a small tributary from the north, flowing into the Arkansas at Arkansas City, Kans. The north fork of the Canadian River rises in the northeastern part of New Mexico, and flows east through Oklahoma and Indian Territory into the Canadian River about 40 miles above its mouth. The following is a list of the stations in the Arkansas River drainage basin:

Canadian River (North Fork) near Elreno, Okla.
Neosho River at Iola, Kans.
Verdigris River near Liberty, Kans.
Walnut River at Arkansas City, Kans.
Arkansas River at Arkansas City, Kans.

Arkansas River at Hutchinson, Kans.
Arkansas River at Dodge City, Kans.
Arkansas River at Syracuse, Kans.
Arkansas River at Barton, Colo.
Arkansas River near Rockyford, Colo.
Arkansas River near Nepesta, Colo.
Arkansas River at Pueblo, Colo.
Arkansas River near Canyon, Colo.
Arkansas River at Salida, Colo.

CANADIAN RIVER (NORTH FORK) NEAR ELRENO, OKLA.

This station was established October 27, 1902, by W. G. Russell, and is located at the highway bridge, 2 miles north of Elreno, Okla. The gage is of the usual wire type, with a scale board graduated to feet and tenths, and nailed to the railing of the bridge. The bench mark is the top of a steel cylinder on the north side of the bridge. Its elevation is 11.3 feet above the zero of the gage. The initial point for sounding is on the right bank. The channel both above and below the station is straight for about 200 feet; the right bank is high and the left bank is low; both banks are liable to overflow. The bed of the stream is sandy, and somewhat shifting. The observer is G. G. Sudermann, who reads the gage once daily.

The following discharge measurement was made in 1902:

October 27: Gage height, 2.00 feet; discharge, 23 second-feet.

Daily gage height, in feet, of Canadian River (North Fork), near Elreno, Okla.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.				1902.			
1	.....	2.00	2.60	12	.....	2.10	2.50	23	.....	2.50	2.60
2	.....	2.20	2.50	13	.....	2.30	2.50	24	.....	3.00	2.60
3	.....	2.10	2.40	14	.....	2.20	2.80	25	.....	2.80	2.70
4	.....	2.10	2.40	15	.....	2.20	2.80	26	.....	2.60	2.80
5	.....	2.10	2.40	16	.....	2.20	2.70	27	2.00	2.50	2.80
6	.....	2.10	2.50	17	.....	2.30	2.70	28	2.00	2.50	2.80
7	.....	2.10	2.50	18	.....	2.30	2.70	29	2.00	2.50	2.40
8	.....	2.10	2.50	19	.....	2.30	2.60	30	2.00	2.50	2.40
9	.....	2.10	2.50	20	.....	2.30	2.60	31	2.00	.....	2.60
10	.....	2.10	2.50	21	.....	3.45	2.60				
11	.....	2.10	2.50	22	.....	2.80	2.60				

NEOSHO RIVER AT IOLA, KANS.

The station was established in July, 1895, and is located at the highway bridge 1 mile west of the city of Iola, Kans. The gage is fastened to the head gates of the flume about 90 feet above the bridge. The bench mark is the heads of three large nails driven into the crosspiece of the flume, and is 13.30 feet above the datum of the gage.

The observer is Thomas J. Staley.

The following discharge measurements were made by W. G. Russell during 1902:

April 26: Gage height, 3.00 feet; discharge, 512 second-feet.
May 29: Gage height, 12.00 feet; discharge, 15,216 second-feet.
June 19: Gage height, 4.50 feet; discharge, 1,312 second-feet.
July 29: Gage height, 7.70 feet; discharge, 6,995 second-feet.
August 25: Gage height, 16.50 feet; discharge, 25,246 second-feet.

Daily gage height, in feet, of Neosho River at Iola, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.00	2.70	3.15	2.90	4.00	8.00	4.50	5.15	13.50	4.65	3.35	3.60
2	2.00	2.70	4.00	2.90	3.50	7.50	4.50	4.25	12.10	4.00	3.30	3.65
3	2.10	2.70	3.50	2.90	3.50	5.75	4.50	3.00	10.50	4.50	3.35	4.85
4	2.20	2.70	3.60	2.90	3.30	5.50	4.50	2.85	6.25	10.00	3.30	5.70
5	2.30	2.70	3.00	2.90	3.30	13.00	4.50	2.80	5.25	14.25	3.15	4.50
6	2.30	2.70	3.00	2.90	6.10	15.25	4.50	2.65	6.15	11.75	3.00	3.95
7	2.50	2.70	3.00	2.90	5.25	16.75	4.50	2.50	7.35	11.75	3.00	3.90
8	2.50	2.70	3.00	2.85	3.50	17.90	5.00	2.50	8.40	10.75	3.00	3.65
9	2.50	2.70	3.00	2.80	3.00	17.90	5.00	2.40	6.75	8.75	3.00	3.50
10	2.50	2.70	3.00	2.80	3.00	20.50	5.00	2.40	5.90	6.65	3.00	3.50
11	2.50	2.80	2.90	2.80	2.90	21.25	4.70	2.40	5.25	6.10	3.00	3.50
12	2.50	2.80	3.00	2.80	2.80	15.50	4.70	2.40	4.40	6.20	3.00	3.50
13	2.50	2.80	3.10	2.80	2.80	5.55	4.50	2.40	3.50	5.50	3.00	3.50
14	2.50	2.80	3.00	2.80	2.80	5.00	4.50	2.40	3.40	5.40	5.00	3.60
15	2.50	2.80	2.80	2.80	2.80	5.00	4.25	2.90	3.40	5.30	5.00	4.50
16	2.50	3.00	2.80	2.80	4.25	5.00	4.00	2.90	3.40	5.20	4.50	4.65
17	2.50	3.00	2.90	2.80	6.55	5.00	4.00	2.50	3.00	5.50	4.30	3.85
18	2.50	3.00	2.90	2.80	5.20	4.50	4.00	2.50	3.00	5.50	4.30	3.90
19	2.50	3.00	2.70	2.80	4.25	4.50	4.50	3.00	3.10	5.20	4.20	4.00
20	2.60	3.00	2.70	2.80	3.25	11.50	6.00	5.85	3.20	5.40	4.20	7.25
21	2.60	3.00	3.00	2.80	4.50	15.50	5.00	9.75	3.50	5.50	4.00	8.00
22	2.70	3.00	3.00	2.80	11.50	15.00	4.00	11.50	6.00	4.75	3.80	7.00
23	2.70	3.00	2.80	2.80	12.00	10.50	4.00	13.50	8.50	4.50	3.80	6.50
24	2.70	3.00	2.80	3.00	12.75	8.25	4.00	16.25	8.50	4.25	3.70	6.00
25	2.75	3.00	2.90	4.00	12.35	7.65	3.50	16.25	12.25	4.20	3.70	5.00
26	2.70	3.15	2.90	3.00	13.50	5.50	3.50	15.25	7.75	4.50	3.70	4.65
27	2.70	3.60	2.90	3.00	12.50	5.00	3.50	15.25	6.00	4.00	3.60	4.50
28	2.70	3.60	3.00	6.50	12.60	4.50	4.00	14.15	5.00	4.00	3.60	4.50
29	2.70	.....	3.00	5.75	12.00	4.50	7.55	7.50	5.00	3.65	3.60	4.20
30	2.70	.....	2.80	4.25	9.00	4.50	6.00	5.25	4.90	3.50	3.60	4.00
31	2.70	.....	2.80	.....	6.25	.....	5.40	12.25	.....	3.40	.....	3.90

Rating table for Neosho River at Iola, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	190	4.8	2,360	7.6	6,780	11.0	13,100
2.2	260	5.0	2,600	7.8	7,140	11.5	14,150
2.4	330	5.2	2,900	8.0	7,500	12.0	15,200
2.6	400	5.4	3,200	8.2	7,860	12.5	16,300
2.8	490	5.6	3,500	8.4	8,220	13.0	17,400
3.0	580	5.8	3,800	8.6	8,580	13.5	18,500
3.2	700	6.0	4,100	8.8	8,940	14.0	19,600
3.4	850	6.2	4,420	9.0	9,300	15.0	21,800
3.6	1,000	6.4	4,740	9.2	9,660	16.0	24,000
3.8	1,200	6.6	5,060	9.4	10,020	17.0	26,200
4.0	1,400	6.8	5,380	9.6	10,380	18.0	28,400
4.2	1,640	7.0	5,700	9.8	10,740	19.0	30,600
4.4	1,880	7.2	6,060	10.0	11,100	20.0	32,800
4.6	2,120	7.4	6,420	10.5	12,100	21.0	35,000

Estimated monthly discharge of Neosho River at Iola, Kans.

[Drainage area, 3,670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	467	190	370	22,750	0.10	0.12
February	1,000	445	549	30,470	.15	.16
March	1,400	445	601	36,954	.16	.18
April	4,900	490	836	49,745	.23	.26
May	18,500	490	5,585	343,408	1.52	1.75
June	35,550	2,000	11,694	695,841	3.19	3.56
July	6,690	925	2,169	133,367	.59	.68
August	24,550	330	6,382	392,414	1.74	2.01
September	18,500	580	4,962	295,259	1.35	1.51
October	20,150	850	4,689	288,315	1.28	1.48
November	2,600	580	1,119	66,585	.30	.33
December	7,500	925	2,227	136,933	.61	.70
The year	35,550	190	3,432	2,492,041	.94	12.74

VERDIGRIS RIVER NEAR LIBERTY, KANS.

The station was established in August, 1895, and is located at a wagon bridge about 250 feet below McTaggart's mill dam, about 3 miles southwest of the town of Liberty, Kans. The gage is a vertical

timber fastened to the floor of the mill. Bench mark No. 1 is the heads of three large nails in the flume, and is at an elevation of 12.46 feet above the zero of the gage. Bench mark No. 2 is the head of a spike in the root of a cottonwood tree 40 feet south of the gage, and is at an elevation of 10.98 feet above gage datum. The bed is rocky, composed of gravel and subject to very little change. In 1900 a new bench mark was established, consisting of 3 nails driven horizontally into a root on the river side of a cottonwood tree 40 feet south of the gage, the nails being 8 inches below a sandstone rock which protrudes from a hollow in the tree. Its elevation is 11.88 feet above the zero of the old gage.

The observer is C. Fienen.

During 1902 the following discharge measurements were made by W. G. Russell:

April 27: Gage height, 3.10 feet; discharge, 284 second-feet.
May 30: Gage height, 5.50 feet; discharge, 1,822 second-feet.
June 20: Gage height, 9.75 feet; discharge, 6,192 second-feet.
August 24: Gage height, 8.70 feet; discharge, 5,136 second-feet.

Daily gage height, in feet, of Verdigris River near Liberty, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.00	1.90	3.85	3.00	2.60	5.20	5.70	3.60	14.25	4.80	3.20	3.80
2	2.00	1.90	3.75	2.90	3.30	8.35	5.30	3.25	14.00	4.60	3.25	4.15
3	2.00	1.90	3.70	2.90	4.25	7.25	4.45	3.05	7.00	4.65	3.50	6.20
4	2.00	1.90	3.45	2.90	3.30	11.90	4.05	2.80	4.65	6.80	4.10	5.90
5	2.00	1.90	2.80	2.90	5.25	26.25	3.75	2.65	4.20	15.20	5.30	5.35
6	2.00	1.90	2.70	2.90	6.95	31.75	3.55	2.60	7.90	16.85	4.30	4.65
7	2.00	1.90	2.60	2.80	9.45	33.37	3.35	2.50	10.75	11.05	3.95	4.25
8	2.00	1.90	2.55	2.70	6.20	32.10	6.40	2.50	7.50	6.10	3.85	4.10
9	2.00	1.90	2.50	2.70	5.00	29.50	9.40	2.70	4.75	5.40	3.80	4.00
10	2.00	1.90	2.40	2.70	4.05	13.25	6.10	3.10	3.75	4.95	3.70	4.00
11	2.00	1.90	2.40	2.65	3.60	6.25	5.80	2.95	3.60	4.75	3.55	4.00
12	1.90	1.90	2.50	2.65	3.35	5.40	4.35	2.95	3.40	4.55	3.45	4.00
13	1.90	1.90	2.40	2.60	3.25	4.90	4.10	2.75	3.35	4.40	8.20	4.00
14	1.90	1.90	2.40	2.60	3.05	4.70	3.85	2.60	3.30	4.25	12.70	4.85
15	1.90	1.90	2.40	2.60	3.05	6.65	3.65	2.60	3.15	4.10	14.20	11.25
16	1.90	1.90	2.80	2.60	3.15	8.30	3.45	2.50	3.00	4.05	7.90	10.10
17	1.90	1.90	2.75	2.65	2.90	4.90	3.30	2.40	3.05	3.95	5.80	6.40
18	1.90	1.90	2.70	2.65	2.75	5.35	3.20	2.40	3.05	3.75	5.00	5.40
19	1.90	1.90	2.60	2.60	2.80	10.65	4.30	2.30	3.00	3.65	4.65	5.40
20	1.90	1.90	2.50	2.60	2.90	12.05	4.05	2.25	3.50	3.60	4.50	7.05
21	1.90	1.90	2.50	2.60	3.40	14.10	5.35	2.70	4.75	3.60	4.40	10.75
22	1.90	1.90	2.50	2.55	13.30	15.05	4.40	3.45	5.25	3.60	4.35	8.45
23	1.90	1.90	2.60	2.55	22.70	14.90	3.90	3.65	5.40	3.55	4.25	6.10
24	1.90	2.25	3.55	2.65	28.05	9.10	3.95	7.90	13.00	3.45	4.45	5.45
25	1.90	2.75	3.40	3.60	28.67	5.15	3.45	10.00	20.75	3.40	4.65	5.10
26	1.90	5.60	3.35	3.90	25.25	4.70	3.00	11.95	17.90	3.30	4.55	4.75
27	1.90	5.05	3.55	3.10	22.30	4.40	2.90	8.25	7.00	3.25	4.40	4.55
28	1.90	4.70	3.70	2.85	19.00	4.20	2.90	5.40	5.75	3.20	4.30	4.30
29	1.90	.....	3.50	2.65	9.10	4.75	2.95	4.70	5.15	3.20	3.95	4.30
30	1.90	.....	3.25	2.60	5.40	6.05	3.80	3.70	5.00	3.20	3.85	4.30
31	1.90	.....	3.15	.....	5.00	.....	3.80	8.20	.....	3.20	.....	4.30

Rating table for Verdigris River near Liberty, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.2	2	5.2	1,520	9.2	4,375	18.0	12,300
1.4	5	5.4	1,650	9.4	4,525	19.0	13,500
1.6	10	5.6	1,780	9.6	4,680	20.0	14,700
1.8	27	5.8	1,920	9.8	4,840	21.0	15,900
2.0	55	6.0	2,060	10.0	5,000	22.0	17,150
2.2	90	6.2	2,200	10.2	5,160	23.0	18,500
2.4	140	6.4	2,340	10.4	5,320	24.0	19,900
2.6	205	6.6	2,480	10.6	5,480	25.0	21,300
2.8	280	6.8	2,620	10.8	5,640	26.0	22,700
3.0	368	7.0	2,760	11.0	5,801	27.0	24,100
3.2	464	7.2	2,901	11.2	5,963	28.0	25,500
3.4	560	7.4	3,043	11.4	6,126	29.0	26,900
3.6	660	7.6	3,188	11.6	6,290	30.0	28,300
3.8	760	7.8	3,334	11.8	6,454	31.0	29,700
4.0	860	8.0	3,480	12.0	6,619	32.0	31,100
4.2	960	8.2	3,626	13.0	7,458	33.0	32,500
4.4	1,060	8.4	3,775	14.0	8,300	34.0	33,950
4.6	1,164	8.6	3,925	15.0	9,150	35.0	35,450
4.8	1,280	8.8	4,075	16.0	10,100	36.0	36,950
5.0	1,400	9.0	4,225	17.0	11,150		

Estimated monthly discharge of Verdigris River near Liberty, Kans.

[Drainage area, 3,067 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	55	40	45	2,767	0.01	0.01
February	1,780	40	204	11,330	.07	.07
March	785	140	357	21,951	.12	.14
April	810	187	268	15,947	.09	.10
May	26,438	205	5,395	331,718	1.76	2.03
June	33,018	960	7,893	469,666	2.57	2.87
July	4,525	320	1,050	64,562	.34	.39
August	6,577	100	1,051	64,623	.34	.39
September	15,650	368	2,935	174,645	.96	1.07
October	11,080	464	1,706	104,898	.56	.65
November	8,470	464	1,598	95,088	.52	.58
December	6,433	685	1,852	113,875	.60	.69
The year	33,018	40	2,030	1,471,070	.66	8.99

WALNUT RIVER AT ARKANSAS CITY, KANS.

This station was established September 21, 1902, by W. G. Russell, and is located on the Madison avenue highway bridge one-half mile east of Arkansas City, Kans. The gage is of the usual wire type, with the scaleboard graduated to feet and tenths; it is read daily by D. T. Burton. The bench mark is the lower edge of the fifth rivet from the top in the upper row on the fourth section of the west side of the south pier. The initial point for sounding is on the right bank. The channel both above and below the station is straight, and the river is sluggish; both the right and left bank are high; the bed of the stream is sandy and shifting.

The following discharge measurements were made during 1902 by W. G. Russell:

September 24: Gage height, 10.15 feet; discharge, 3,899 second-feet.
October 20: Gage height, 4.90 feet; discharge, 182 second-feet.

Daily gage height, in feet, of Walnut River at Arkansas City, Kans.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.														
1	.....	5.30	5.05	4.45	12	.....	4.45	4.60	4.45	23	.....	4.10	4.20	5.90
2	.....	5.65	5.00	4.40	13	.....	4.40	4.70	4.40	24	10.30	4.20	4.30	6.15
3	.....	6.10	4.45	4.30	14	.....	4.30	4.60	4.65	25	10.40	4.00	4.40	6.20
4	.....	5.65	4.60	4.40	15	.....	4.40	4.40	5.25	26	7.30	4.30	4.30	6.60
5	.....	8.75	5.00	4.30	16	.....	4.10	4.30	5.40	27	6.40	4.20	4.30	5.75
6	.....	9.45	5.10	4.30	17	.....	4.10	4.40	5.50	28	6.10	4.00	4.20	5.70
7	.....	6.55	5.05	4.40	18	.....	4.00	4.50	5.60	29	6.00	4.10	4.30	5.65
8	.....	6.00	5.10	4.40	19	.....	4.20	4.60	5.60	30	4.40	4.05	4.40	5.60
9	.....	5.20	5.20	4.30	20	.....	4.10	4.50	5.55	31	.....	4.30	.....	5.70
10	.....	5.10	5.10	4.30	21	.....	4.30	4.40	5.70					
11	.....	5.00	5.00	4.40	22	.....	4.20	4.45	5.80					

ARKANSAS RIVER AT ARKANSAS CITY, KANS.

This station was established September 23, 1902, by W. G. Russell. It is located on the Chestnut avenue highway bridge, one-half mile west of Arkansas City, Kans. The gage is a painted staff graduated to feet and tenths, spiked to the west side of the south pile of the second bent on Chestnut avenue. The bench mark is the top of the cap on the pile which carries the gage. Its elevation is 17.2 feet above zero of the gage. The initial point for sounding is on the left bank. The channel is straight for about 200 feet both above and below the station; both banks are low and liable to overflow; the bed of the river is sandy and shifting. The observer is D. T. Burton, who reads the gage daily.

The following discharge measurements were made during 1902:

September 23: Gage height, 4.70 feet; discharge, 1,008 second-feet.
October 20: Gage height, 3.80 feet; discharge, 218 second-feet.

Daily gage height, in feet, of Arkansas River at Arkansas City, Kans.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1902.					1902.				
1	.....	4.10	4.40	3.40	17	.....	4.00	3.50	3.70
2	.....	4.30	4.10	3.40	18	.....	3.20	3.60	3.80
3	.....	4.40	3.70	3.50	19	.....	3.00	3.70	3.70
4	.....	4.45	3.80	3.40	20	.....	3.20	3.70	3.70
5	.....	4.50	3.60	3.30	21	.....	3.10	3.60	3.60
6	.....	4.55	3.30	3.40	22	.....	3.30	3.50	3.35
7	.....	4.50	3.40	3.45	23	4.70	3.40	3.60	3.25
8	.....	4.45	3.45	3.45	24	4.30	3.55	3.50	3.20
9	.....	4.55	3.65	3.50	25	4.20	4.10	3.40	3.10
10	.....	4.30	3.60	3.40	26	4.10	4.00	3.50	3.00
11	.....	4.55	3.50	3.45	27	4.10	4.10	3.60	2.70
12	.....	4.40	3.60	3.40	28	4.10	4.20	3.50	2.80
13	.....	4.20	3.70	3.40	29	4.00	4.10	3.40	2.75
14	.....	4.30	3.60	3.50	30	4.05	4.10	3.30	2.65
15	.....	4.10	3.40	3.60	31	.....	4.20	.....	2.65
16	.....	4.15	3.60	3.70					

ARKANSAS RIVER AT HUTCHINSON, KANS.

The Arkansas River, after crossing the Kansas and Colorado State line, is not systematically measured until Hutchinson, in about the center of the State, is reached. The station here was established May 13, 1895, and is located at the wagon bridge at the south end of Main street. The gage consists of an oak timber spiked to a pile a few feet above the bridge. Bench mark No. 1 is the upper crosspiece of the pier guard, with an elevation of 8.35 feet above zero of the gage. Bench mark No. 2 is the top of the iron doorsill of the first brick building next to the river, and its elevation is 8.12 feet above gage datum. The channel is straight for some distance above and below the bridge; the bed is sandy and very shifting, necessitating frequent discharge measurements and soundings. At time of low water the stream subdivides into a number of threads. Measurements of discharge are made from the bridge at times of high water, and at low water they can be made by wading.

The observer is Daniel Lauer.

Discharge measurements made on Arkansas River at Hutchinson, Kans.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 25	W. G. Russell	1.10	39
May 31	do	1.50	155
June 3	do	4.15	5,057
June 4	do	3.75	3,824
June 18	do	2.05	550
July 18	do	2.55	1,066
August 23	do	2.40	1,117
November 25	do	1.20	95

Daily gage height, in feet, of Arkansas River at Hutchinson, Kans.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.20	1.20	2.00	1.25	1.00	4.42	2.15	1.80	1.70	2.30	1.30	1.10
2	1.20	2.00	2.00	1.25	1.00	4.60	2.40	1.60	1.70	2.10	1.30	1.10
3	1.25	(a)	2.00	1.25	1.00	4.12	2.40	1.60	1.60	2.00	1.30	1.10
4	1.25	2.00	2.00	1.20	1.10	3.72	2.40	1.55	1.50	1.95	1.30	1.10
5	1.25	2.00	1.80	1.20	1.10	3.57	2.15	1.50	1.55	1.85	1.30	1.10
6	1.20	2.00	1.60	1.20	1.10	3.05	2.05	1.45	1.60	1.75	1.25	1.10
7	1.20	(a)	1.50	1.20	1.10	2.82	2.05	1.40	1.65	1.70	1.25	1.10
8	1.15	2.00	1.40	1.20	1.05	2.70	2.00	1.40	1.45	1.65	1.25	1.20
9	1.10	1.20	1.35	1.20	1.05	2.62	1.95	1.40	1.45	1.65	1.20	1.30
10	1.05	(a)	1.30	1.20	1.05	2.52	1.95	1.40	1.40	1.65	1.20	1.30
11	1.00	1.20	1.30	1.20	1.05	2.45	1.90	1.90	1.40	1.60	1.20	1.30
12	1.10	1.20	1.25	1.15	1.00	2.40	1.85	2.45	1.35	1.50	1.20	1.30
13	1.10	.....	1.25	1.15	1.00	2.32	2.10	2.20	1.35	1.50	1.25	1.30
14	1.05	1.20	1.20	1.15	1.20	2.22	2.50	2.10	1.35	1.50	1.30	1.30
15	1.05	.....	1.15	1.15	1.30	2.10	2.55	2.00	1.30	1.45	1.25	1.30
16	1.00	1.20	1.10	1.15	1.20	2.00	2.60	1.95	1.30	1.45	1.20	1.30
17	1.00	(a)	1.10	1.15	1.25	1.95	2.60	1.85	1.30	1.40	1.20	1.30
18	1.00	1.20	1.10	1.15	1.20	2.15	2.50	1.80	1.25	1.35	1.20	1.30
19	1.00	(a)	1.10	1.15	1.15	2.20	2.15	1.75	1.25	1.35	1.20	1.30
20	1.00	1.20	1.10	1.15	1.15	2.20	1.95	1.75	1.20	1.35	1.20	1.40
21	1.25	(a)	1.10	1.10	1.30	2.25	1.70	2.45	1.25	1.35	1.20	a1.50
22	1.25	1.20	1.15	1.10	1.75	2.30	1.70	2.50	1.25	1.35	1.20	a1.50
23	1.25	2.00	1.20	1.10	2.00	2.25	1.70	2.35	1.35	1.30	1.20	a1.50
24	1.25	2.00	1.20	1.05	2.00	2.45	1.70	2.40	1.30	1.30	1.20	a1.50
25	1.20	2.00	1.20	1.05	1.70	2.50	1.75	2.50	1.25	1.30	1.20	a1.50
26	1.20	2.00	1.25	1.05	1.55	2.40	1.75	2.40	1.25	1.30	1.20	a1.50
27	(a)	2.00	1.30	1.05	1.40	2.30	1.80	2.35	1.25	1.30	1.10	a1.50
28	1.20	2.00	1.30	1.00	1.50	2.25	1.90	2.25	2.00	1.30	1.10	1.50
29	1.20	.....	1.30	1.00	1.45	2.25	2.00	2.10	2.15	1.30	1.10	1.46
30	(a)	.....	1.30	1.00	1.50	2.15	2.00	2.00	2.30	1.30	1.10	1.40
31	1.20	.....	1.30	.....	3.90	.....	1.90	1.80	.....	1.30	.....	1.40

a Frozen.

Rating table for Arkansas River at Hutchinson, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.8	20	1.8	325	2.8	1,640	3.8	4,080
.9	30	1.9	400	2.9	1,820	3.9	4,340
1.0	40	2.0	475	3.0	2,000	4.0	4,600
1.1	60	2.1	600	3.1	2,260	4.1	4,860
1.2	80	2.2	725	3.2	2,520	4.2	5,120
1.3	100	2.3	850	3.3	2,780	4.3	5,380
1.4	125	2.4	975	3.4	3,040	4.4	5,640
1.5	150	2.5	1,100	3.5	3,300	4.5	5,900
1.6	200	2.6	1,280	3.6	3,560	4.6	6,160
1.7	250	2.7	1,460	3.7	3,820		

Estimated monthly discharge of Arkansas River at Hutchinson, Kans.

[Drainage area, 34,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	90	40	69	4,243	0.002	0.002
February	475	80	263	14,606	.008	.008
March	475	60	148	9,100	.004	.005
April	90	40	68	4,046	.002	.002
May	4,340	40	254	15,618	.008	.009
June	6,160	438	1,583	94,195	.047	.052
July	1,280	288	605	37,190	.018	.021
August	1,100	125	510	31,359	.015	.017
September	850	80	184	10,949	.005	.006
October	850	100	208	12,789	.006	.007
November	100	60	83	4,939	.002	.003
December	150	60	106	6,518	.003	.004
The year	6,160	40	340	245,552	.010	.136

ARKANSAS RIVER AT DODGE, KANS.

This station was established November 28, 1902, by W. G. Russell, and is located one-fourth mile south of Dodge, on the highway bridge. The gage is a plain staff graduated to feet and tenths, and nailed to the upstream pile of the twelfth bent at the north end of the bridge. The initial point for sounding is on the left bank. The channel both above and below the station is straight for about 100 feet; both banks are low and liable to overflow; the bed of the stream is sandy and shifting. The observer is Alexander Alter, who reads the gage once each day.

The following discharge measurement was made in 1902:

November 28: Gage height, 1.55 feet; discharge, 45 second-feet.

Daily gage height, in feet, of Arkansas River at Dodge, Kans.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1902.											
1		1.45	9		1.55	17		1.25	25		1.56
2		1.55	10		1.35	18		1.25	26		1.65
3		2.00	11		1.65	19		1.25	27		1.65
4		1.35	12		1.25	20		1.15	28	1.55	1.45
5		1.35	13		1.45	21		1.45	29	1.10	1.65
6		1.25	14		1.65	22		1.55	30	1.45	1.65
7		1.50	15		1.00	23		1.45	31		1.55
8		1.65	16		1.00	24		1.55			

ARKANSAS RIVER AT SYRACUSE, KANS.

This station, established August 21, 1902, by W. G. Russell, is located on the highway bridge 1 mile south of Syracuse, Kans. The gage is a plain staff graduated to feet and tenths, fastened to the east pile of the bent 283 feet south of the north end of the bridge. The initial point for sounding is on the left bank. The channel above and below the station is straight and the water is sluggish. The right bank is low and liable to overflow; the left bank is high, and the bed of the stream is sandy and shifting. The bench mark is on the top of the east end of the first sill at the north end of the bridge. Its elevation is 13.45 feet above the zero of the gage. The gage is read daily by Clyde S. Welborn.

The following discharge measurements were made during 1902:

August 21: Gage height, 2.05 feet; discharge, 99 second-feet.
August 30: Gage height, 3.00 feet; discharge, 909 second-feet.
November 9: Gage height, 1.80 feet; discharge, 42 second-feet.
November 26: Gage height, 1.60 feet; discharge, 19 second-feet.

Daily gage height, in feet, of Arkansas River at Syracuse, Kans.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.					
1	.....	2.70	1.75	1.70	1.80
2	.....	2.70	1.75	1.70	1.70
3	.....	2.65	1.80	1.70	1.70
4	.....	2.55	2.00	1.70	1.80
5	.....	2.50	2.00	1.70	1.70
6	.....	2.50	1.95	1.70	1.70
7	.....	2.45	1.95	1.70	1.80
8	.....	2.45	1.90	1.70	1.80
9	.....	2.40	1.90	1.80	1.90
10	.....	2.35	1.85	1.80	1.80
11	.....	2.30	1.80	1.80	1.80
12	.....	2.25	1.80	1.80	1.80
13	.....	2.15	1.80	1.80	1.80
14	.....	2.05	1.80	1.80	1.80
15	.....	1.95	1.80	1.80	1.80
16	.....	1.95	1.80	(a)	1.80
17	.....	1.95	1.80	.....	1.80
18	.....	1.90	1.80	.....	1.80
19	.....	1.90	1.80	.....	1.80
20	.....	1.90	1.80	.....	1.80
21	2.05	1.90	1.80	.....	1.90
22	2.05	1.85	1.75	.....	2.00
23	2.00	1.85	1.75	.....	2.00
24	2.00	1.85	1.75	.....	2.00
25	1.90	1.80	1.75	.....	2.00
26	2.05	1.80	1.70	1.60	2.00
27	3.05	1.80	1.70	1.80	1.90
28	3.85	1.75	1.70	1.70	2.00
29	3.45	1.75	1.70	1.80	2.10
30	3.00	1.75	1.70	1.80	2.00
31	2.85	.....	1.70	.....	2.00

(a) No observer.

Rating table for Arkansas River at Syracuse, Kans., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.6	20	2.2	190	2.8	680	3.4	1,315
1.7	30	2.3	250	2.9	780	3.5	1,430
1.8	40	2.4	330	3.0	880	3.6	1,545
1.9	60	2.5	410	3.1	980	3.7	1,660
2.0	80	2.6	500	3.2	1,090	3.8	1,775
2.1	130	2.7	590	3.3	1,200	3.9	1,890

Estimated monthly discharge of Arkansas River at Syracuse, Kans.

[Drainage area, 24,960 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
August 21 to 31	.....	.....	[a] 571	[a] 12,459	[a] 0.023	[a] 0.009
September	590	35	197	11,722	.008	.009
October	80	30	43	2,644	.002	.002
November	.....	.....	[b] 34	[c] 2,023	[c] .001	[c] .002
December	130	30	54	3,320	.002	.003

[a] 11 days. [b] 20 days. [c] 30 days.

ARKANSAS RIVER AT BARTON, COLO.

This station was established May 2, 1901, at the railroad bridge one-half mile east of Barton or Byron, which is the name of the railroad station on the Atchison, Topeka and Santa Fe Railway. Throughout this region the bed of the stream is broad and sandy, and the channel is shifting. This point was selected as the most available place for determining, approximately, the discharge of the Arkansas at a point near the Colorado-Kansas line. The rod consists of a vertical 2 by 4 inch piece of timber 7 feet long, nailed to a pile on the downstream side of the railroad bridge at the lowest point in the channel. No bench mark was established, but the rod was spiked at the foot marks to the pile. The channel is extremely shifting, and there may be at times many different channels. The initial point for soundings is the right bank. The observer was Harry Hunt, postmaster at Barton.

The observations at this station were discontinued in May, 1902, for the reason that the channel had changed and the conditions were unfavorable for securing reliable data.

Daily gage height, in feet, of Arkansas River at Barton, Colo.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1902.						1902.					
1.....	1.15	1.30	0.90	0.30	0.10	17.....	1.30	1.50	0.20	0.20	.....
2.....	1.20	1.30	.80	.30	.15	18.....	1.20	1.50	.30	.20	.....
3.....	1.20	1.40	.80	.20	.15	19.....	1.20	1.40	.35	.25	.....
4.....	1.30	1.50	.70	.10	.....	20.....	1.15	1.40	.35	.25	.....
5.....	1.30	1.50	.70	.10	.....	21.....	1.15	1.40	.35	.20	.....
6.....	1.30	1.50	.50	.05	.....	22.....	1.10	1.30	.35	.20	.....
7.....	1.40	1.50	.40	.05	.....	23.....	1.10	1.30	.45	.20	.....
8.....	1.40	1.50	.40	.05	.....	24.....	1.10	1.20	.50	.10	.....
9.....	1.50	1.50	.40	.05	.....	25.....	1.10	1.00	.40	.10	.....
10.....	1.50	1.60	.40	.05	.....	26.....	1.00	1.00	.30	.05	.....
11.....	1.50	1.70	.30	.05	.....	27.....	1.00	1.00	.25	.05	.....
12.....	1.60	1.70	.30	.20	.....	28.....	1.00	.90	.30	.05	.....
13.....	1.50	1.70	.30	.30	.....	29.....	1.10	.....	.30	.05	.....
14.....	1.40	1.70	.20	.35	.....	30.....	1.10	.....	.35	.10	.....
15.....	1.40	1.60	.20	.35	.....	31.....	1.20	.....	.30	.....	.....
16.....	1.30	1.60	.20	.30	.....						

ARKANSAS RIVER NEAR ROCKYFORD, COLO.

The old station was located 2 miles northeast of Rockyford, Colo., and was established May 3, 1897. The gage consisted of a vertical 1 by 3 inch timber notched in tenths and securely nailed to the pile protection to the abutment of the wagon bridge at the left side of the stream, upper side of the bridge. The initial point for soundings was on the left bank at the water's edge. Both banks are high and liable to overflow only at very high water. The channel is straight for about 300 feet above and below the station. The bed is sandy and shifting. This station was abandoned April 7, 1900.

A new station was established by R. W. Hawley on April 19, 1901, at a point 3½ miles northwest from Rockyford station on the Atchison, Topeka and Santa Fe Railway. A steel cable was stretched across the river and supplied with a car, and an inclined timber gage rod was bolted into the shale on the north side of the river and marked. The bench mark consists of a cut in a tree at the initial point level with a 10-foot mark on the rod. The records were kept through the courtesy of the American Beet Sugar Company, Fred Chappell, agriculturist, taking the reading. The channel is fairly favorable for good results, being at what is known as the old ford. The bottom is of shale and usually free from sand, although filled in to a certain extent at some stages. Gagings may be made either by means of the cable and car or by wading. The point is of especial importance, owing to the fact that it is one of the few places on the Arkansas River where the channel is at all permanent.

Daily gage height, in feet, of Arkansas River near Rockyford, Colo.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1902.				1902.			
1	1.80	2.00	2.00	17	1.50	2.00	2.50
2	1.70	2.20	2.20	18	1.50	2.00	2.00
3	1.80	2.50	2.00	19	1.50	2.00	2.00
4	1.80	2.50	1.80	20	1.60	2.00	1.80
5	1.80	2.50	2.20	21	1.50	2.00	2.20
6	1.90	2.40	2.00	22	1.60	2.00	2.20
7	1.90	2.30	2.00	23	1.60	1.90	1.80
8	1.90	2.20	1.80	24	1.50	1.80	2.20
9	1.80	2.40	2.00	25	1.50	2.20	2.00
10	1.70	2.60	1.80	26	1.60	2.00	1.80
11	1.70	2.60	2.20	27	1.60	2.20	2.20
12	1.50	2.50	2.30	28	1.60	2.00	1.80
13	1.60	2.70	2.20	29	1.60	.....	1.80
14	1.50	2.40	2.00	30	1.90	.....	2.20
15	1.50	2.50	2.20	31	1.90	.....	2.00
16	1.50	2.00	2.50				

Rating table for Arkansas River near Rockyford, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet*	*Second-feet.*	*Feet.*	*Second-fcet.*
—0.2	25	1.2	181	2.6	1,665	4.0	4,420
.0	32	1.4	238	2.8	2,035	4.2	4,820
.2	43	1.6	343	3.0	2,424	4.4	5,220
.4	56	1.8	510	3.2	2,820	4.6	5,620
.6	73	2.0	735	3.4	3,220	4.8	6,020
.8	101	2.2	1,009	3.6	3,620		
1.0	137	2.4	1,321	3.8	4,020		

Estimated monthly discharge of Arkansas River near Rockyford, Colo.

[Drainage area, 11,440 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	616	282	402	24,718	0.035	0.04
February	1,848	510	1,081	60,036	.094	.10
March	1,489	510	828	50,896	.072	.08

ARKANSAS RIVER NEAR NEPESTA, COLO.

The original station, established September 8, 1897, is located 1,000 feet north of Nepesta, Colo., at a wagon bridge, 200 feet below the Atchison, Topeka and Santa Fe Railroad. The gage consists of a vertical timber graduated to feet and tenths, securely fastened to the upstream cylinder of the bridge, on the left side of the river. The channel above and below the station is straight for several hundred feet, while the bed is sandy and shifting, and the results, therefore, are not altogether satisfactory for the purpose of making a rating table. This station was maintained by the Great Plains Water Company until December, 1900. May 1, 1901, another station was established by A. L. Fellows, assisted by C. W. Beach, at the dam and head gate of the Oxford Farmers' Canal, 1½ miles west of Nepesta. The station consists of the dam crossing the river at the head gate forming a weir, and a gage rod, consisting of a 2 by 6 inch timber, 8 feet long, fastened to an oak pile at the south end of the dam; the location being marked by spikes driven into the pile at each foot mark. The rod is graduated to feet and tenths vertically. At low stages the stream may be measured by wading, but at high stages it is necessary to use the wagon bridge at Nepesta, making the necessary allowances for inflow between the two points; this can readily be done, as the distance is only about a mile. The observer is Z. Swallow, head gate keeper of the Oxford Farmers' Canal. The station will prove of particular value, as it is near the head of irrigation district No. 17, one of the most important on the Arkansas River.

The table of the discharge of the Oxford Farmers' Canal has been furnished by their secretary, F. M. Weiland. Readings were taken only on those days when the river gage read zero.

During 1902 the following discharge measurements were made by C W. Beach:

May 23: Gage height, 0.50 feet; discharge, 234 second-feet.
June 28: Gage height, 0.60 feet; discharge, 127[a] second-feet.

Daily gage height, in feet, of Arkansas River near Nepesta, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
1	0.58	.....	0.92	.....	.....	0.72	0.51	0.52
2	.61	.....	.91	.....	.....	.59	.59	.....
3	.61	0.27	.98	.....	.....	.53	.61	.....
4	.55	.62	1.05	.....	.....	.51	.61	.....
5	.54	.79	1.02	0.20	.....	.42	.59	.....
6	.63	.80	.95	.20	4.75	.39	.51	.....
7	.61	.67	.98	.59	1.55	.41	.50	.....
8	.52	.75	.95	.57	.62	.39	.49	.....

[a] Water fell 0.05 during gaging.

Daily gage height, in feet, of Arkansas River near Nepesta, Colo.—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1902.								
9	0.57	0.87	0.93	0.44	0.53	.....	0.50	.....
10	.60	.80	.85	.72	.42	.....	.51	.....
11	.59	.85	.85	1.42	.....	.....	.49	.....
12	.55	1.20	.87	1.60	.52	.....	.51	.....
13	.62	1.17	.83	.44	.50	.....	.50	.....
14	.64	1.16	.87	.41	.61	0.39	.51	.....
15	.59	1.22	.86	.39	.49	.....	.50	.....
16	.51	1.16	.87	.19	.50	.....	.50	.....
17	.49	1.21	.79	.60	.51	.....	.49	.....
18	.49	1.19	.75	1.90	.39	.....	.52	.....
19	.42	1.12	.69	1.30	.19	.....	.51	.....
20	.48	1.02	.68	.50	.....	.....	.50	.....
21	.22	.78	.64	.20	.....	.52	.50	.....
22	.27	.65	.59	.....	.....	.59	.52	.....
23	.36	.64	.61	.....	.20	.61	.52	.....
24	.36	.72	.53	.....	.44	.56	.51	.....
25	.....	.75	.56	.....	.51	.50	.50	.....
26	.....	.73	.51	.....	1.10	.49	.52	.....
27	.....	2.65	.51	.55	1.40	.48	.50	.....
28	.17	2.65	1.25	.51	1.12	.49	.50	.....
29	.17	1.72	1.73	.25	.75	.59	.50	.....
30	.17	1.22	.25	.....	.59	.59	.50	.....
31	.....	1.05	.....	.....	2.00	.....	.52	.....

Discharge of Oxford Farmers' Canal.

Date.	River gage.	Second-feet in Oxford Farmers' Canal.	Date.	River gage.	Second-feet in Oxford Farmers' Canal.
July 1	0.00	75	August 11	0.00	80
July 2	0.00	53	August 20	0.00	14
July 3	0.00	14	August 21	0.00	14
July 4	0.00	14	August 22	0.00	14
July 22	0.00	14	September 9	0.00	30
July 23	0.00	14	September 10	0.00	14
July 24	0.00	14	September 11	0.00	14
July 25	0.00	8	September 12	0.00	18
July 26	0.00	6	September 13	0.00	20
July 30	0.00	14	September 15	0.00	14
July 31	0.00	14	September 16	0.00	14
August 1	0.00	6	September 17	0.00	14
August 2	0.00	6	September 18	0.00	14
August 3	0.00	6	September 19	0.00	14
August 4	0.00	14	September 20	0.00	14
August 5	0.00	14			

April 25, 26, and 27 gage rod read zero, but no flow in canal recorded.

Rating table for Arkansas River near Nepesta, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.2	21	1.6	2,067	3.0	5,202	4.4	8,400
.4	61	1.8	2,506	3.2	5,658	4.6	8,860
.6	200	2.0	2,949	3.4	6,114	4.8	9,324
.8	465	2.2	3,396	3.6	6,570	5.0	9,788
1.0	815	2.4	3,844	3.8	7,026		
1.2	1,217	2.6	4,296	4.0	7,482		
1.4	1,635	2.8	4,748	4.2	7,940		

Estimated monthly discharge of Arkansas River near Nepesta, Colo.[a]

[Drainage area 9,130 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	244	0	119	7,081	0.013	0.015
May	4,409	0	936	57,552	.103	.119
June	2,352	28	566	33,679	.062	.069
July	2,727	0	312	19,184	.034	.039
August	9,208	0	643	39,537	.070	.081
September	348	0	87	5,177	.010	.011
October	211	108	129	7,932	.013	.015

[a] These figures do not include the flow of Oxford Farmers' Canal.

ARKANSAS RIVER AT PUEBLO, COLO.

This station was established in September, 1894, by A. P. Davis. Originally there were two gage rods. The main gage was located at the Santa Fe Avenue Bridge and consisted of a vertical 6 by 6 inch timber, and a 1 by 6 inch scale bolted to the abutment of the Denver and Rio Grande Railroad bridge on the left-hand side of the river, graduated to tenths of a foot. There was also a short vertical rod for extreme low water spiked to a pile about 20 feet out in the stream, reading the same as the main gage. The 12-foot mark of this gage was opposite the top of the large capstone. The rod at Victoria Avenue Bridge consisted of inclined 4 by 4 inch timbers fastened to posts set in the right bank of the stream, graduated to vertical tenths of a foot, the space between the marks being 0.242 of a foot. This rod was placed in June, 1895, for the purpose of noting the change in the slope of the water surface. The rods were read until July 10, 1898, when on account of the shifting of the bed of the river they were abandoned and a new gage was installed on the east side of the Main Street Bridge. From this bridge all the discharge measurements were made until the season of 1902.

The channel at this point is excellent, and it would be of very great value to the entire division to have a permanent station of concrete established here. The channel, which is of bowlders and gravel, is confined by high masonry walls, so that there is little change, except that it fills during low water and scours out during high water. The flow of the stream is rapid, but not too swift for accurate measurements. This station is an important one, being located near the head of the principal irrigation portion of the valley, only one ditch of importance being taken out above it in the Pueblo district, although considerable water is used in the ditches in the neighborhood of Canyon, which is in another water district. It is upon the gagings made at this point that the water superintendents and commissioners depend for distribution of water to ditches below.

Readings were made at Main street bridge until March 3, 1900, when owing to the scouring of the channel it became necessary to replace the gage by one about 60 feet below the south end of the Union avenue bridge. This gage was a 2 by 6 inch vertical timber, bolted like the former rod to the masonry wall and graduated to feet and tenths. On June 13, 1900, this rod was connected with a bench mark on the coping at the northwest corner of the Union avenue bridge, which was found to be 19.79 feet above the zero of the rod. In March, 1902, another rod exactly similar to the one last mentioned was bolted in a vertical position to the masonry wall on the right-hand side of the river about 30 feet above the south end of the Union avenue bridge. All gage heights up to July 14, 1902, were taken from the rod just below the Union avenue bridge. After July 14, 1902, the readings were taken from the rod above the bridge, the graduations on the former rod being too dim to be read at low water. A difference of 0.2 of a foot existed between the two rods when the new one was set, the new rod reading 0.2 of a foot higher than the old one. In all the discharge measurements made during 1902 the gage height was taken from the new rod above the Union avenue bridge. The observer during 1902 was T. J. Burrows, water commissioner of the Pueblo water district.

Discharge measurements of Arkansas River at Pueblo, Colo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 25	J. E. Field	1.80	220
May 18	C. W. Beach	3.30	1,323
July 7	do	1.80	193
July 15	J. E. Field	1.60	130
August 24	M. C. Hinderlider	2.20	358
September 1	C. W. Beach	2.17	341
September 21	do	2.05	212

Daily gage height, in feet, of Arkansas River at Pueblo, Colo.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.20	4.20	2.10	1.80	2.00	2.65	1.90	1.30	2.20	2.00	2.10	2.05
2	2.20	3.70	2.10	1.80	2.00	2.60	2.20	1.40	1.90	2.00	2.10	2.10
3	2.20	3.70	2.00	1.80	2.10	2.62	2.05	1.75	2.00	2.10	2.10	2.10
4	2.30	3.50	2.00	1.80	2.30	2.80	2.05	1.80	2.00	2.10	2.10	2.20
5	2.30	3.50	1.90	1.80	2.60	2.70	2.05	8.10	2.00	2.10	2.10	2.10
6	2.20	3.50	2.00	1.80	2.60	2.70	1.80	3.00	2.00	2.10	2.10	2.10
7	2.25	3.50	2.10	1.80	2.87	2.70	1.70	2.70	2.00	2.00	2.10	2.20
8	2.25	3.70	2.00	2.00	2.95	2.70	1.70	2.30	2.00	2.00	2.10	2.20
9	2.10	3.70	2.00	2.00	2.65	2.70	1.70	2.30	2.00	2.00	2.10	2.10
10	2.10	3.50	2.05	2.00	3.00	2.55	3.35	2.30	1.90	2.00	2.10	2.10
11	2.10	3.70	2.00	2.00	3.40	2.50	2.05	2.00	1.90	2.00	2.10	2.10
12	2.15	3.80	2.00	2.00	3.40	2.70	1.70	2.00	1.90	2.00	2.00	2.10
13	2.10	3.70	2.00	2.00	3.40	2.67	1.70	2.00	2.00	2.00	2.30	2.10
14	2.10	3.40	2.00	2.00	3.40	2.65	2.00	2.00	1.90	2.00	2.00	2.10
15	2.10	3.25	2.00	2.00	3.40	2.65	1.60	1.90	2.00	2.10	2.00	2.10
16	2.10	2.20	2.00	2.00	3.40	2.60	1.60	1.90	2.00	2.10	2.00	2.10
17	2.10	2.70	2.00	1.95	3.40	2.65	2.02	1.90	2.00	2.20	2.00	2.20
18	2.30	2.20	1.90	1.90	3.40	2.50	2.30	1.90	2.00	2.20	2.00	2.20
19	2.30	2.15	1.95	1.80	3.30	2.35	2.30	1.90	2.00	2.20	2.00	2.20
20	2.20	2.10	2.00	1.80	3.05	2.30	2.20	1.80	2.00	2.20	2.00	2.10
21	2.10	2.10	2.00	1.80	2.85	2.40	2.30	1.80	2.25	2.20	2.20	2.10
22	2.05	2.10	2.00	2.00	2.60	2.30	2.10	2.35	2.15	2.20	2.20	2.20
23	2.00	1.95	2.00	2.00	2.40	2.20	2.10	2.25	2.10	2.20	2.10	2.20
24	2.10	1.80	2.00	1.90	2.30	2.20	2.00	2.30	2.10	2.20	2.10	2.20
25	2.10	1.70	2.00	1.80	2.20	2.10	1.85	2.10	2.10	2.20	2.20	2.20
26	2.15	2.10	1.90	1.90	2.40	2.00	1.80	2.30	2.10	2.20	2.15	2.20
27	2.15	2.10	1.90	2.10	2.75	1.90	1.70	3.45	1.90	2.10	2.10	2.20
28	2.20	2.10	1.90	2.00	3.20	2.20	2.20	2.10	1.90	2.10	2.10	2.20
29	2.20	.....	1.90	2.00	2.75	2.35	1.60	1.90	2.00	2.10	2.10	2.20
30	2.20	.....	1.90	2.00	2.70	2.00	1.50	2.00	2.00	2.10	2.10	2.20
31	2.20	.....	1.80	.....	2.70	.....	1.30	2.25	.....	2.10	.....	2.10

Rating table for Arkansas River at Pueblo, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	20	3.0	985	5.0	3,523	7.0	6,538
1.2	43	3.2	1,205	5.2	3,811	7.2	6,855
1.4	80	3.4	1,443	5.4	4,103	7.4	4,176
1.6	129	3.6	1,687	5.6	4,398	7.6	7,501
1.8	190	3.8	1,931	5.8	4,696	7.8	7,829
2.0	265	4.0	2,175	6.0	4,996	8.0	8,157
2.2	360	4.2	2,425	6.2	5,300	8.2	8,485
2.4	481	4.4	2,685	6.4	5,605	8.4	8,813
2.6	625	4.6	2,957	6.6	5,913		
2.8	791	4.8	3,238	6.8	6,224		

Estimated monthly discharge of Arkansas River at Pueblo, Colo.

[Drainage area, 4,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	417	265	343	21,090	0.075	0.086
February	2,425	158	1,070	59,425	.231	.241
March	310	190	258	15,863	.056	.065
April	310	190	234	13,924	.051	.057
May	1,443	265	876	53,863	.190	.219
June	791	225	543	32,311	.116	.129
July	1,382	60	277	17,032	.060	.069
August	8,321	60	613	37,692	.133	.153
September	360	225	271	16,126	.059	.066
October	360	265	311	19,123	.068	.078
November	417	265	307	18,268	.067	.075
December	360	287	333	20,475	.072	.083
The year	8,321	60	453	325,192	.098	1.321

ARKANSAS RIVER NEAR CANYON, COLO.

This station is located at the Hot Springs Hotel, 1½ miles west of Canyon and a short distance below the mouth of Grape Creek. Observations at this point were begun on April 17, 1889, the station being established here by Robert Robertson. The record has been maintained since that time, with occasional breaks due to absence or change of observer. The station is of special importance, being located at the mouth of the canyon and at a point practically above all of the irrigation ditches, except the Canyon City ditch (sometimes called the North Side ditch) and the South Canyon ditch (sometimes called the South Side ditch), both of which head above the station. During the irrigation season each of these ditches carries from 25 to 60 cubic feet of water per second, according to the needs of the irrigators, and their discharge should be added to the discharge at the station in order to obtain the total run-off at the mouth of the canyon. This site was used in 1888 for a gaging station by the State engineer of Colorado, and is highly favorable for obtaining accurate measurement. The channel of the river is straight for several hundred yards, both above and below, and the current, though swift, is not too great at high water nor too sluggish at low stages for satisfactory results. The banks on both sides are high and are not overflowed. The cross

section is regular and has not been subject to notable changes, except on the right bank, near the gage, where a sand bar has formed at times of low water.

The gage rod established by Mr. Robertson was of 2 by 6 inch timber, inclined, and attached to the crib of an old bridge on the south or right-hand side of the river, almost directly in front of the hotel. There were two bench marks: No. 1, on the top of a log of the crib; elevation, 10.01 feet above the datum; No. 2, in the cleft of a red bowlder at the foot of a charred stump 50 feet downstream and on the same side of the river; elevation, 9.60 feet. On April 13, 1891, the station was inspected by Frank Tweedy, and a third bench mark was established, this being a bedded rock 40 feet from the north end of the cable, toward Hot Springs Hotel and 10 feet from the river bank. It is marked "B. M. No. 3, U. S. G. S.," and is 15.98 feet above the zero of the gage. The present observer is Dr. J. L. Prentiss.

The measurements were at first made from a car suspended from a cable stretched across the river, the bridge from which measurements were originally made by the State engineer having been destroyed. Later a new suspension bridge was constructed in front of the hotel, necessitating the removal and replacement of the gage, and subsequent measurements were made from this bridge, which, having a clear span, offers no obstruction to the current. On October 4, 1895, it was found that the top of the gage had been broken off, necessitating its renewal for readings during high water. The channel was found to be filled with sand and gravel in front of the gage, requiring considerable work in order to make the water flow to the rod. It was decided, therefore, to put in a new gage where the stream could not deposit material. A point was chosen about 100 feet below the bridge, on the left bank, and a crib was built, anchored in place by rocks and bolts, the lower end of the gage being fastened to it. The upper end of the inclined portion was attached to a juniper tree. On December 27, 1895, the station was inspected, and it was found that readings had been made from the old rod, which, at the stage of water prevailing, recorded about 0.40 of a foot above the new rod on the opposite side of the river. When the water is high and extends with unbroken surface from bank to bank the readings are the same, but at low water the observations on the old rod are misleading, owing to the accumulation of sand and gravel in front of it.

On August 26, 1902, owing to the shifting of the channel a new rod, consisting of 4 by 4-inch timber, was placed in an inclined position on the north or left bank of the river at the site of the previous rod just below the north end of the suspension bridge. The rod on this date read practically the same as the old rod. The bench mark is the top point of a granite boulder embedded in the earth 60 feet east of the south end of the bridge, and about 10 feet from the south bank of the river. The zero of the rod is 16.055 feet below the bench mark.

The following discharge measurements were made during 1902 by J. E. Field and M. C. Hinderlider:

April 21: Gage height, 2.20 feet; discharge, 323 second-feet.
July 26: Gage height, 1.60 feet; discharge, 165 second-feet.
August 26: Gage height, 2.00 feet; discharge, 226 second-feet.

Daily gage height, in feet, of Arkansas River near Canyon, Colo.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.30	2.20	2.30	2.40	2.35	3.05	2.30	1.58	2.20	2.10	2.30	2.30
2	2.30	2.30	2.30	2.40	2.40	3.00	2.30	1.90	2.15	2.20	2.25	2.40
3	2.30	2.30	2.30	2.40	2.50	2.95	2.30	1.90	2.05	2.20	2.20	2.40
4	2.30	2.30	2.30	2.40	2.60	2.90	2.10	2.00	2.00	2.20	2.20	2.40
5	2.20	2.30	2.30	2.50	2.75	2.90	1.88	2.40	2.00	2.25	2.20	2.30
6	2.20	2.30	2.30	2.45	2.90	2.90	1.80	2.75	2.00	2.30	2.20	2.30
7	2.20	2.30	2.30	2.40	3.00	2.85	2.05	2.05	2.00	2.20	2.20	2.30
8	2.20	2.30	2.30	2.30	3.15	2.75	2.00	1.78	1.95	2.20	2.10	2.30
9	2.20	2.30	2.30	2.20	3.25	2.90	2.25	1.70	1.90	2.20	2.10	2.30
10	2.20	2.30	2.30	2.20	3.50	2.90	1.88	1.62	1.90	2.20	2.10	2.30
11	2.20	2.30	2.30	2.10	3.60	2.90	1.80	1.60	1.90	2.25	2.10	2.20
12	2.30	2.30	2.30	2.10	3.75	2.90	1.72	1.70	1.90	2.25	2.10	2.20
13	2.30	2.30	2.30	2.00	3.70	2.80	1.68	1.65	1.90	2.20	2.10	2.20
14	2.30	2.30	2.30	2.00	3.70	2.80	1.62	1.70	1.90	2.20	2.20	2.35
15	2.30	2.30	2.30	2.00	3.60	2.80	1.60	1.75	1.90	2.20	2.20	2.40
16	2.30	2.30	2.30	2.00	3.75	2.80	1.58	1.80	1.90	2.30	2.20	2.45
17	2.30	2.30	2.30	1.95	3.55	2.70	1.85	1.80	1.90	2.35	2.30	2.50
18	2.30	2.30	2.30	1.88	3.50	2.70	1.90	1.80	1.90	2.30	2.30	2.40
19	2.20	2.30	2.30	1.95	3.40	2.60	1.85	1.80	1.90	2.30	2.20	2.35
20	2.20	2.30	2.30	2.10	3.20	2.55	2.40	1.80	1.90	2.30	2.20	2.30
21	2.20	2.30	2.30	2.10	2.90	2.50	2.40	2.35	2.10	2.30	2.20	2.30
22	2.20	2.30	2.30	2.15	2.70	2.35	2.25	2.45	2.20	2.30	2.30	2.40
23	2.20	2.30	2.40	2.10	2.65	2.20	2.25	2.00	2.20	2.30	2.35	2.40
24	2.20	2.30	2.40	2.00	2.55	2.05	1.95	1.90	2.15	2.20	2.30	2.50
25	2.20	2.30	2.40	2.00	2.50	2.10	1.65	1.95	2.15	2.20	2.20	2.50
26	2.20	2.30	2.40	2.00	2.60	2.35	1.55	2.30	2.10	2.20	2.20	2.45
27	2.20	2.30	2.40	2.10	3.15	2.50	1.58	3.00	2.05	2.20	2.20	2.40
28	2.20	2.30	2.40	2.10	3.35	2.50	1.50	2.65	2.00	2.30	2.20	2.35
29	2.20	.....	2.40	2.20	3.00	2.45	1.42	2.40	2.00	2.25	2.20	2.20
30	2.20	.....	2.40	2.25	3.00	2.40	1.40	2.35	2.05	2.20	2.30	2.10
31	2.20	.....	2.40	.....	3.00	.....	1.40	2.25	.....	2.20	.....	2.15

Rating table for Arkansas River near Canyon, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	62	1.7	185	2.4	360	3.1	716
1.1	78	1.8	206	2.5	393	3.2	791
1.2	94	1.9	228	2.6	432	3.3	872
1.3	110	2.0	252	2.7	476	3.4	957
1.4	128	2.1	277	2.8	527	3.5	1,046
1.5	146	2.2	303	2.9	584	3.6	1,139
1.6	165	2.3	331	3.0	647	3.7	1,236

Estimated monthly discharge of Arkansas River near Canyon, Colo.

[Drainage area, 3,060 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	331	303	317	19,492	0.104	0.12
February	331	303	325	18,050	.106	.11
March	360	331	337	20,721	.110	.13
April	393	228	294	17,494	.096	.11
May	1,286	345	757	46,546	.250	.29
June	681	264	481	28,622	.157	.18
July	360	128	229	14,081	.075	.09
August	647	161	270	16,602	.090	.10
September	303	228	254	15,114	.083	.09
October	345	277	313	19,246	.102	.12
November	345	277	294	17,494	.100	.11
December	393	277	342	21,029	.112	.13
The year	1,286	128	351	254,491	.115	1.58

ARKANSAS RIVER AT SALIDA, COLO.

This station is located at the footbridge near the railroad shops at Salida, Colo. It was originally established by the Denver and Rio Grande Railroad April 11, 1895. The original gage rod was a vertical timber fastened to the north side of the footbridge. Considerable difficulty was experienced by its being knocked out by ice and by logs during high water, and a new inclined gage rod was put in place during the spring of 1901 by J. E. Field, consisting of a 6 by 6 inch oak timber fastened to the north trestle of the bridge, the graduations being extended by marks on the trestle above the timber. On July 31, 1901, the gage was lowered and set farther out into the stream.

Another gage was established at this station on August 27, 1902, the zero of which is 1.10 feet below the zero of the old gage. The gage heights from this date are taken on the new rod.

The measurements are all made from the suspension footbridge back of the Denver and Rio Grande Railroad.

The banks are high and do not overflow. The bed of the stream consists of sand, gravel, and boulders. Two large boulders interfere to a great extent with the accuracy of the results. As the station is an important one, these boulders should be removed, so as to improve the character of the channel, and thus render the results of measurements more reliable. The stream is very swift at this point, but the channel is straight, and the discharge can readily be measured from

the footbridge. Little water is used above Salida, and none is used below that place until Canyon is reached. The observer is William Furniss. The gage heights have been sent to the local forecast official of the Weather Bureau at Denver, who has had them published in the morning papers.

Discharge measurements of Arkansas River at Salida, Colo.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
April 11	J. E. Field	0.55	273
April 12	do	.55	286
May 5	do	1.40	.706
May 19	do	1.80	1,144
May 12	M. C. Hinderlider	2.20	1,804
July 26	do	.30	224

Daily gage height, in feet, of Arkansas River at Salida, Colo.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1902.							
1	0.10	0.75	1.45	0.80	0.20	1.20	1.10
2	.10	.85	1.50	.70	.25	1.30	1.10
3	.10	.95	1.35	.55	.30	1.20	1.20
4	.10	1.10	1.30	.45	.30	1.05	1.20
5	.15	1.10	1.30	.40	.35	1.00	1.20
6	.25	1.30	1.30	.35	.40	1.00	1.20
7	.30	1.55	1.30	.30	.40	1.00	1.20
8	.30	1.60	1.30	.30	.30	1.00	1.20
9	.30	1.60	1.20	.25	.20	1.00	1.20
10	.25	1.70	1.20	.20	.20	1.00	1.20
11	.20	1.80	1.20	.20	.20	1.00	1.20
12	.20	1.85	1.20	.20	.20	1.00	1.20
13	.20	2.00	1.10	.20	.20	1.00	1.15
14	.20	2.05	1.10	.20	.10	1.00	1.10
15	.20	2.10	1.05	.20	.10	1.00	1.10
16	.10	2.10	1.00	.15	.10	1.00	1.00
17	.10	2.00	1.00	.10	.10	.90	1.00
18	.10	2.00	.90	.10	.10	.85	.95
19	.20	1.75	.75	.50	.15	.80	1.00
20	.35	1.55	.70	.60	.40	.80	1.05
21	.45	1.15	.70	.55	.60	.80	1.00
22	.35	.95	.65	.50	.55	1.15	1.00
23	.30	.90	.60	.40	.35	1.25	1.05
24	.30	.90	.55	.30	.30	1.20	1.10
25	.30	.95	.50	.25	.30	1.15	1.10
26	.35	1.20	.50	.15	.30	1.10	1.10
27	.45	1.50	.70	.10	[a]1.30	1.05	1.05
28	.50	1.45	.70	.10	1.25	1.10	1.00
29	.50	1.45	.80	.10	1.20	1.10	.90
30	.60	1.60	.80	.10	1.20	1.10	.90
31	.....	1.40	.....	.20	1.20	.....	.90

[a] New rod placed on this date. Old rod read 0.2 foot; new rod read 1.30 feet. The heights from this time on are read from the new rod.

Rating table for Arkansas River at Salida, Colo., for 1902.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
—0.3	140	.5	268	1.3	622	2.1	1,615
— .2	150	.6	293	1.4	702	2.2	1,799
— .1	162	.7	320	1.5	798	2.3	1,991
.0	175	.8	353	1.6	906	2.4	2,188
.1	190	.9	393	1.7	1,024	2.5	2,388
.2	206	1.0	441	1.8	1,150		
.3	224	1.1	494	1.9	1,287		
.4	245	1.2	554	2.0	1,442		

[a] This table is referred to the old gage. In using it 1.10 feet were subtracted from all gage heights after August 26.

Estimated monthly discharge of Arkansas River at Salida, Colo.

[Drainage area, 1,160 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
April	293	190	219	13,031	0.19	0.21
May	1,615	336	852	52,387	.73	.84
June	798	268	467	27,788	.40	.45
July	353	190	229	14,081	.20	.23
August	293	190	217	13,343	.19	.22
September	206	140	168	9,997	.14	.16
October	190	150	174	10,699	.15	.17

Miscellaneous measurements in the Arkansas River drainage basin for 1902.

[Made by W. P. Edwards.]

Date.	Stream.	Locality.	Discharge.
			Second-feet.
July 11	Trout Creek	Newell	4
July 12	Chalk Creek	Mount Princeton	17

RED RIVER DRAINAGE BASIN.

The headwaters of the Red River include several forks, all of which have their sources in northern Texas. Red River takes a general easterly direction along the northern boundary of Texas, and then turns toward the southeast and flows through a low, swampy region in Louisiana into the Mississippi, not far from the southern boundary of Mississippi. The Washita River rises in northern Texas, crosses southern Oklakoma, and flows into the Red River in the southern part of Indian Territory, about 10 miles from Denison, Tex.

The Sulphur Fork of the Red River has its headwaters in Hunt and Fannin counties, flows eastward, forming the boundary between Delta, Red River, and Bowie counties on the north, and Hopkins, Franklin, Titus, Morris, and Cass counties on the south, and empties into the Red River in Arkansas about 7 miles north of the boundary line between that State and Louisiana. The flow of this river is very unreliable, changing with the rainfall. If the summer is at all dry it ceases to flow altogether, but there always remains enough water standing in pools to water stock. During or immediately after protracted or unusually heavy rains, the river becomes very wide and deep, floods its bottoms, and often occasions considerable loss of stock and damage to planters and the railroads.

The Big Cypress River has its headwaters in Franklin and Titus counties, flows in a generally easterly direction, and empties into the Red River. The flow of the river is unreliable, varying with the rainfall. In the summer it ceases to flow, becoming dry, except in those places where the water stands in holes. After long or heavy rains the stream is liable to overflow its banks.

The Washita River at Anadarko is the only regular station in the Red River drainage basin.

WASHITA RIVER AT ANADARKO, OKLA.

This station, established October 25, 1902, by W. G. Russell, is located at the highway bridge, one-half mile north of the Anadarko railroad depot. The gage is of the usual wire type, with the scale-board graduated to feet and tenths, and spiked to the hand rail of the bridge. The initial point for sounding is on the right bank. The channel both above and below the station is straight for 200 feet; the right bank is high, and the left bank is low; both banks are liable to overflow; the bed of the stream is sandy and constant. The observer is James H. Dunlap, who reads the gage once each day.

The following discharge measurement was made in 1902:

October 25: Gage height, 2.50 feet; discharge, 171 second-feet.

Daily gage height, in feet, of Washita River at Anadarko, Okla.

Day.	Oct.	Nov.	Dec.	Day.	Oct.	Nov.	Dec.
1902.				1902.			
1		2.50	4.00	17		2.60	7.20
2		2.70	3.80	18		2.60	6.10
3		2.70	3.70	19		2.60	4.30
4		4.30	3.60	20		2.60	3.90
5		4.85	3.50	21		2.70	3.70
6		4.50	3.40	22		2.80	3.60
7		3.50	3.40	23		7.40	3.50
8		3.20	3.30	24		9.20	3.40
9		3.00	3.20	25		7.60	3.30
10		2.80	3.20	26	2.50	6.70	3.20
11		2.70	3.20	27	2.50	5.40	3.10
12		2.70	3.10	28	2.50	4.80	3.10
13		2.70	3.10	29	2.50	4.60	3.10
14		2.70	3.10	30	2.50	4.20	3.10
15		2.70	3.30	31	2.50		3.10
16		2.60	5.60				

Miscellaneous measurements in the Red River drainage basin.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
December 23	Sulphur Fork	St. Louis Southwestern Railroad bridge, near Naples, Tex.	[a] 3,097
December 24	Big Cypress	St. Louis Southwestern Railroad bridge, near Pittsburg, Tex.	[b] 101
November 17	Ouachita	Camden, Ark	2,477
November 15	Red	Garland, Ark	18,627

[a] Water 6 feet (approximately) above normal winter level.
[b] Water 2 feet (approximately) above normal winter level.

WESTERN GULF DRAINAGE.

Those stations from which the United States Geological Survey has obtained data during 1902, and which are located on rivers which drain into that portion of the Gulf of Mexico west of the Mississippi River, have been grouped into the following drainage basins: Sabine, Neches, Trinity, Brazos, Colorado (of Texas), Guadalupe, and Rio Grande.

SABINE RIVER DRAINAGE BASIN.

The Sabine River has its headwaters in Collin and Hunt counties, flows in a southeasterly direction to the State line, then south, forming the boundary between Texas and Louisiana, and empties into Sabine Lake, an arm of the Gulf, near Orange, Tex. When measured on

December 25, 1902, the river was swollen by the rains of the previous two months. At the time the measurement was taken the river was 150 feet wide and had a maximum depth of 19 feet, which was said, by those residing near by, to be about 3 feet above normal. The banks are steep and the river is deep in the whole cross section. The drainage area of the Sabine above Orange, Tex., is 10,400 square miles. The principal tributary of the Sabine is the Big Sandy River, which rises in the northern part of Wood County, flows southeast through Wood and Upshur counties, and empties into the Sabine River near the town of Big Sandy. The stream has a reliable flow throughout the entire year. Its flow as measured December 25, 1902, was considerably in excess of the least flow of the stream, because there had been a protracted rainy period before the measurement was taken. There were at one time three mills on this stream, all of which are now abandoned or destroyed. The Seagore mill was situated about 100 yards below the crossing of the county road where the measurement was made. A dam, made by driving piling and filling in with stone, was used to store the water and give a greater fall. The fall obtained was 6 feet. The plant fell into decay and was finally washed away by floods. Almost all traces of the mill are now gone. Three miles farther upstream is the Silas Smith mill site, and still farther upstream the Kay mill site. Each of these mills has shared the same fate.

Miscellaneous measurements in the Sabine drainage basin.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
December 25	Sabine River	At St. Louis Southwestern Railroad crossing.	1,150
Do	Big Sandy River	At county road crossing, 2 miles northeast of Big Sandy.	188

NECHES RIVER DRAINAGE BASIN.

The Neches River rises in Van Zandt County and flows through the heavily wooded section of east Texas and finally empties into Sabine Lake near Beaumont. Its drainage area above Beaumont is 10,200 square miles. Its largest tributary is the Angelina, but it receives many smaller streams in its course, and on account of its flowing through a timbered section the flow of these tributaries, although small, is reliable, and many of them support small water-power plants. These plants are located in Van Zandt, Henderson, Angelina, San Augustine, Houston, and Tyler counties and are to be taken up and described later in a special report by T. U. Taylor on "The Water

Power and Water Supply of Texas." When measured on September 10, 1902, the water was what is termed in east Texas clear water, but it had the leaf-stain color and gave a chromine color to white objects beneath the surface. Near Grapeland, in Houston County, the San Pedro has its head and almost at its inception has sufficient water to support the water-power plant of Ferguson & Weisinger, where a 12-foot overshot wheel operates a gristmill and cotton gin of 50 saws.

In its lower sections the Neches becomes more sluggish in its flow, has deep water, and partakes of the bayou characteristics nearer the Gulf. Near Beaumont the water from Lake Sabine sometimes impregnates it with salt water.

The principal tributary of the Neches is the Angelina, which rises in Smith County, flows in a southeastwardly direction, and empties into the Neches near Townbluff. It was measured December 27, 1902, after protracted rains, at the crossing of the Houston East and West Texas Railroad, about 9 miles north of Lufkin, Tex., by Edward C. H. Bantel. The flow at that time was considerably above the average. This is considered a reliable stream, and is said to never go dry at this point. It is subject to floods which inundate extensive bottom lands, and cause considerable damage.

Miscellaneous measurements in the Neches drainage.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
September 10	Neches	International and Great Northern Railroad bridge.	26
December 27	Angelina	North of Lufkin	1,361

TRINITY RIVER DRAINAGE BASIN.

The Trinity River rises in a network of small streams in the counties of Montague, Wise, and Parker, but their combined capacity at Dallas is not sufficient to keep the bottom or bed of the stream moist. The United States Geological Survey maintained a station at Dallas for a time, but it was abandoned on account of the small discharge. Below Dallas the Trinity flows through a wooded country, and consequently it is not subject to the sudden floods with their quick run-offs.

TRINITY RIVER AT RIVERSIDE, TEX.

The drainage area of the Trinity River above Riverside, Tex., is 16,000 square miles. A gaging station was established on the Trinity at Riverside, Tex., in December, 1902, by T. U. Taylor. The zero

of the gage is 66 feet below the top of the ties (or base of rail) in the north arm of the draw span of the International and Great Northern Railroad bridge. The elevation of the top of the pivot pier above gage datum is 56.5 feet, and that of the top of the channel of the lower chord of the arms of the draw span of the bridge is 62.9 feet. The gage consists of a tagged plumbers' chain to which is attached a lead weight in the form of a frustum of a cone. The bottom of the lead weight is marked 66, and every foot above this is marked with a brass tag giving its distance in feet above the bottom of the weight. The observer at Riverside is G. W. Higdon, who is in charge of the pumping plant of the International and Great Northern Railroad. In reading the gage it is only necessary to let the lead weight touch the water and then read off the distance the mark or point is from the upper end or zero mark of the chain.

The following measurements were made during 1902 on the Trinity and its tributaries:

September 10: At Riverside, gage height, 6 feet; discharge, 160 second-feet.
September 11: Near Oakwood, discharge, 120 second-feet.
September 11: Elkhart River, 4 miles northwest of Grapeland; discharge, 4 second-feet.

BRAZOS RIVER DRAINAGE BASIN.

This river has its source in the Staked Plains region of western Texas, and has a general southeasterly course, emptying into the Gulf of Mexico south of the mouth of Trinity River. Its drainage basin is entirely within the State of Texas.

Under the direction of Thomas U. Taylor the United States Geological Survey is maintaining stations in this basin at Waco and Richmond, Tex.

BRAZOS RIVER AT WACO, TEX.

On September 14, 1898, a gage was established on the southwest bank of Brazos River at Waco. It consists of an inclined iron bar, 3 inches by 1 inch, reading from 0 to 4.3 feet, bolted to a hard-pine stick 16 feet long, embedded in cement in the sloping limestone of the bank, flush with the surface, on which are painted the graduations above 4.3 feet. The gage is inclined to the horizontal at an angle whose sine is $\frac{5}{29}$. Three bench marks have been established. The first is on the lowest water table on the southwest pier of the suspension bridge, and is marked "U. S. G. S. 44.33 B. M." The hydrant at the corner of First and Austin streets is at an elevation (by gage) of 43.32 feet, while the top of the rail of the San Antonio and Aransas Pass Railroad a few feet from the hydrant is at an elevation of 41.12 feet. The bed of the river is shifting sand, and nearly every freshet modifies the cross section, so that at the same gage heights the river

sometimes flows in one and sometimes in two channels under the suspension bridge from which the measurements are made.

At high water the gage reading is obtained by measuring to the water surface from the top rail of the stiffening truss of the suspension bridge at a certain point when there is no load upon the bridge, and by taking this distance from 47.8 feet.

In the early part of 1902 a new camel-back truss bridge of one span was erected across the Brazos at Waco a few hundred feet above the suspension bridge. This new bridge crosses the river at an angle of 76 degrees. It has a footway on the east or downstream side that affords excellent facilities for measuring the flow of the stream, and there are no midstream piers to render measurements troublesome or doubtful. On the north pier of the new bridge a gage has been marked off to agree with the United States Geological Survey gage at the suspension bridge. The top of the cement floor of the new bridge at the southeast batter brace is at an elevation of 45.4 feet with respect to the United States Geological Survey gage. High-water gage heights can be read directly from the gage on the north pier, or the distance of the water surface can be measured from the cement floor and this subtracted from 45.4 feet will give the height of the river referred to the gage.

The Brazos reached in 1902 the lowest stage in its recorded history. In the latter part of 1901, from December 28 to 31, the gage reached the low mark of 2.3 feet, and several measurements were taken at this stage of the river to determine what was thought at that time to be the least discharge of the Brazos. An average discharge of 70 second-feet was then found. The river stood for seven days in January at this height and then fell to 2.2 feet, and then, in the latter part of January, it fell to 2.1 feet. During the first part of February the gage stood at 2.2 feet, but on the 19th of February again dropped to 2.1 feet. It remained at this height until March 7, when it dropped to 2 feet, the lowest mark since 1898, and the lowest mark ever reached on the gage. On March 8, 1902, the flow was measured by Thomas U. Taylor at a point 200 yards above the new bridge, at a section where the stream is only 24 feet wide. The average depth was 7 inches, and there was a mean velocity of 1.36 feet per second. This gave a discharge of 19 second-feet. This stage of the river continued until the afternoon of March 11.

Discharge measurements of Brazos River at Waco, Tex.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 14	C. N. Campbell	2.29	56
January 22	do	2.18	47
March 8	T. U. Taylor	1.98	20
July 25	do	21.00	70,500
July 30	do	16.00	26,700
July 31	do	14.00	20,800
August 1	do	11.80	13,800
August 5	do	6.70	4,200
September 5	do	4.90	1,730
September 6	do	4.30	1,230
December 17	do	3.71	892
December 20	do	3.68	863

Daily gage height, in feet, of Brazos River at Waco, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.30	2.20	2.10	4.60	2.75	5.90	4.40	11.65	3.20	4.85	2.55	5.80
2	2.30	2.20	2.10	4.60	2.70	7.00	4.15	9.25	3.15	5.55	2.50	7.65
3	2.30	2.20	2.10	4.20	2.60	8.60	3.70	8.25	3.10	6.10	3.55	6.45
4	2.30	2.20	2.10	3.90	2.60	7.50	3.50	7.20	4.40	6.10	3.70	6.20
5	2.30	2.20	2.10	3.60	2.80	8.75	4.05	6.70	4.55	6.90	3.30	6.20
6	2.30	2.20	2.10	3.40	3.00	7.40	5.30	6.40	4.40	5.85	8.80	5.60
7	2.30	2.20	2.05	3.85	3.20	6.20	5.50	6.20	5.55	5.20	7.60	5.00
8	2.20	2.20	2.00	3.50	3.40	5.75	4.75	5.75	5.20	4.80	7.10	4.80
9	2.20	2.20	2.00	4.60	4.90	5.30	4.30	5.35	4.60	4.75	5.90	4.75
10	2.20	2.20	2.00	4.40	7.50	4.95	3.95	5.05	6.70	4.50	5.70	4.65
11	2.20	2.30	2.20	4.00	6.95	4.55	3.50	4.85	7.20	4.30	5.30	4.50
12	2.20	2.30	3.70	3.85	5.95	4.45	3.40	4.65	6.00	4.00	5.30	4.40
13	2.20	2.30	3.75	5.25	5.45	4.35	3.75	4.50	5.35	3.75	5.35	4.40
14	2.20	2.20	3.20	4.90	5.15	4.10	3.80	4.40	5.10	3.60	7.70	4.35
15	2.20	2.20	4.80	3.90	5.65	3.85	5.10	4.40	4.90	3.40	5.70	4.30
16	2.20	2.20	7.00	3.65	5.75	3.70	5.10	4.30	4.75	3.30	7.80	3.80
17	2.20	2.20	5.80	5.00	4.90	3.90	5.90	4.20	4.55	3.20	10.30	3.65
18	2.10	2.20	5.35	4.00	4.40	4.10	4.65	3.85	4.30	3.10	8.80	3.70
19	2.10	2.15	5.20	4.10	8.95	3.70	4.60	3.70	4.00	3.10	5.95	3.70
20	2.10	2.10	5.10	3.90	12.15	3.50	4.60	4.30	3.85	3.00	5.80	3.60
21	2.10	2.10	5.05	3.60	7.75	3.35	4.75	4.05	3.75	3.10	9.35	3.60
22	2.20	2.10	4.50	4.15	7.25	3.30	7.05	3.75	3.70	3.85	7.05	3.50
23	2.20	2.10	4.45	3.90	8.50	3.30	11.40	3.70	3.65	3.45	6.70	3.50
24	2.20	2.10	3.95	3.65	10.80	3.40	11.60	3.70	3.45	3.60	6.40	3.50
25	2.10	2.10	3.80	3.50	10.45	3.15	15.50	3.60	3.40	3.60	14.75	3.50
26	2.20	2.10	3.55	3.40	9.75	3.10	32.10	3.55	3.35	3.50	8.65	3.50
27	2.20	2.10	3.45	4.25	8.35	4.90	31.35	3.35	3.45	3.15	6.80	3.50
28	2.20	2.10	3.80	3.40	8.05	5.10	27.05	3.30	6.15	3.05	6.20	3.50
29	2.20	.....	3.70	3.15	8.20	4.80	22.65	3.20	5.60	3.00	6.15	3.40
30	2.20	.....	5.00	3.10	7.70	4.80	17.30	3.20	5.05	3.00	6.05	3.40
31	2.20	.....	4.60	.....	6.90	.....	13.80	.....	.....	2.85	.....	3.40

Rating table for Brazos River at Waco, Tex., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
2.0	20	4.6	1,490	7.2	4,800	11.0	12,285
2.2	80	4.8	1,650	7.4	5,135	11.5	13,450
2.4	160	5.0	1,820	7.6	5,475	12.0	14,660
2.6	250	5.2	2,010	7.8	5,825	12.5	15,980
2.8	350	5.4	2,220	8.0	6,180	13.0	17,400
3.0	450	5.6	2,450	8.2	6,540	13.5	18,850
3.2	550	5.8	2,700	8.4	6,910	14.0	20,300
3.4	670	6.0	2,975	8.6	7,285	14.5	21,800
3.6	795	6.2	3,265	8.8	7,665	15.0	23,300
3.8	925	6.4	3,555	9.0	8,055	15.5	24,800
4.0	1,055	6.6	3,855	9.5	9,050	16.0	26,300
4.2	1,195	6.8	4,155	10.0	10,085	16.5	27,800
4.4	1,340	7.0	4,470	10.5	11,160	17.0	29,300

Estimated monthly discharge of Brazos River at Waco, Tex.

[Drainage area, 30,750 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
January	120	50	84	5,165	0.0027	0.003
February	120	50	74	4,110	.0024	.003
March	4,470	20	995	61,180	.0324	.037
April	2,062	500	1,062	63,193	.0345	.038
May	15,032	250	4,280	263,167	.1392	.160
June	7,570	500	2,123	126,327	.0690	.077
July	74,600	670	12,528	770,317	.4074	.470
August	13,810	550	2,354	144,742	.0766	.088
September	4,800	500	1,609	95,742	.0523	.058
October	4,310	375	1,230	75,630	.0400	.046
November	22,550	200	4,491	267,233	.1460	.162
December	5,562	670	1,494	91,862	.0486	.056
The year	74,600	20	2,694	1,968,668	.0876	1.19

BRAZOS RIVER AT RICHMOND, TEX.

The drainage area of the Brazos River above Richmond, Tex., is 44,000 square miles.

In the latter part of December, 1902, T. U. Taylor established a gaging station at Richmond, Tex., on the Brazos River. The gage consists of a tagged plumber's chain marked every foot with brass tags. The chain is 50 feet long, the bottom of the lead weight being the 50-foot mark. The zero of the gage is 50 feet below the top of the guard rail in the mid-span of the bridge of the Southern Pacific Railroad. The observer is W. B. Ransom, a local druggist, and observations were commenced on January 1, 1903.

Above and at Waco the river rises rapidly, and when it gets above the gage height of 30 feet overflows the bottom lands below the town. When the floods spread out over the bottom lands as they do from Waco to Richmond, the river stays up longer in its lower stretches than it does in the upper sections, as the the backwater in the bottoms and the lowlands serve as storage reservoirs and are drained slowly as the river recedes. At Hearne and below the river in 1899 was several miles in width. Its maximum height at Richmond occurred on July 7, 1899, when it stood 4 feet below the top of the guard rail, or at a gage height of 46 feet. The water was out over the bottoms above, and in Richmond it covered the tracks of the Southern Pacific Railroad.

The following measurements were made at Richmond in 1902:

August 2: Gage height, 28.1; discharge, 48,400 second-feet.
August 6: Gage height, 31.9; discharge, 60,470 second-feet.
August 19: Gage height, 7.1; discharge, 5,800 second-feet.

LITTLE RIVER AND ITS TRIBUTARIES.

The Sulphur Fork of the Lampasas rises in the town of Lampasas in two springs, the Hancock and the Hanna, with a joint flow as determined on August 18, 1902, by T. U. Taylor of 9 second-feet. Of this amount the Hancock had 7.6 second-feet and the Hanna 1.4. This is probably the least flow of the springs. These springs are fully described in Water Supply Paper No. 50, page 335. The Lampasas, the Salado, and the Leon unite southeast of Belton, in Bell County, at the "Three Forks," forming the Little River. The Salado rises in the village of Salado, 9 miles south of Belton, from springs that bear a striking resemblance to those of the Edwards formation. The measurement at Salado on December 19, 1902, can be regarded as the minimum flow, as there had been no rains for many months. The Salado has a reliable flow of 13 second-feet at its head and it is slightly reenforced lower down. At one time there were eleven different power plants in operation along this short stream, but at present there are

only three in active operation. Summer's mill, 2 miles above the "Three Forks," derives its power from a 10-foot dam. Dulaney's mill, 1 mile farther up the stream, derives its power from a dam 8 feet high, while Stinnett's flour mill, 6 miles farther up, gets an 18-foot head by means of a mill race 1 mile long. Below the "Three Forks" the river is known as Little River. It has two reliable streams in the Lampasas and Salado to feed it, and its flow is reliable, but probably on account of danger from overflows no attempts have been made to utilize its energy in power plants. Three irrigation plants have been located on the Little River within the last year in the neighborhood of Cameron.

San Gabriel River.—The San Gabriel River rises in Burnett County, and flows easterly through Williamson County, and joins Little River 10 miles north of Rockdale. Its waters are used for irrigation and power purposes near Georgetown and Taylor.

Miscellaneous measurements in Little River Basin.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
December 18	Salado	Dulaney's Mill	29
December 19	do	Salado	1?
August 18	Sulphur Fork of Lampasas	Lampasas	9
February 15	San Gabriel	Jonah	34

COLORADO RIVER (OF TEXAS) DRAINAGE BASIN.

The Colorado River rises in the extreme western portion of the State, within a few miles of the eastern boundary of New Mexico, and flows in a general southeasterly direction, emptying into the Gulf of Mexico in Matagorda County. The drainage area above Austin is 37,000 square miles, and above Columbus it is 40,000 square miles, and it extends into the corner of New Mexico. Its main tributaries are the Concho, the San Saba, and the Llano. The Concho has a reliable flow above its junction with the Colorado, and if the stream below the junction were to receive its name from the one that contributed the most water the river below the junction would be known as the Concho instead of the Colorado. The Concho furnishes water for irrigation and water power, and supports in Irion and Tom Green counties some excellent irrigation systems, described in Water Supply Paper No. 71. The San Saba and the Llano rivers are described in the same paper.

The Colorado at Austin emerges from a canyon. From Austin to the Gulf it traverses a rather flat country, and its waters are utilized for many power plants, and during the season of 1902 60,000 acres of rice were sowed in the counties of Colorado, Wharton, and Matagorda, under canals that obtained their water from the Colorado.

Under the direction of Thomas U. Taylor, the United States Geological Survey is maintaining gaging stations in this basin at Columbus and Austin, Tex. During 1902 miscellaneous measurements were made by Mr. Taylor at several other places, as stated hereafter.

COLORADO RIVER AT COLUMBUS, TEX.

A gaging station was established at Columbus, Tex., on the Colorado River, in December, 1902. The zero of the gage is 50 feet below the top of the downstream pier on the west side of the river. A gage has been marked off by the county officers on this pier, but the observer for the United States Geological Survey uses a tagged chain, with lead weight for a sounder. The flood of 1900 was the highest known at Columbus, and it reached the gage height of 38.6 feet.

The following measurements were made on the Colorado at Columbus in 1902:

August 2: Gage height, 32.0 feet; discharge, 36,000 second-feet.
August 4: Gage height, 13.4 feet; discharge, 6,800 second-feet.
August 7: Gage height, 12.6 feet; discharge, 4,300 second-feet.
December 27: Gage height, 3.5 feet; discharge, 1,200 second-feet.

COLORADO RIVER AT AUSTIN, TEX.

Gage heights were first taken on the crest of the Austin dam on August 13, 1895, and were continued from that date until the failure of the dam occurred in April, 1900. The first discharge measurement was made on December 21, 1897. In February, 1899, the gage was placed on the Congress Avenue Bridge south of the city. This gage consists of a plain staff attached to a bath house. The observer is W. Peterson. The bench mark is on the first flange above the cribwork of the north pier of the highway bridge. Its height is 4.78 feet above the zero of the gage. Measurements of discharge are made in a narrow place in the river about one-fourth mile above this point. The flood of April 7, 1900, carried away the great masonry dam at Austin. This flood was general over southwest Texas, but its only disaster was limited to the demolition of that structure. A full discussion of this failure will be found in Water Supply Paper No. 40.

Prior to the flood of April 7, 1900, the discharge of the river at the station below the dam was at low stages absolutely under the control of the turbines at the power house at the dam; and measurements made opposite the city, at the station between the two bridges, did not give

the unobstructed flow of the river. Since the destruction of the dam, measurements have been made at the station a fourth of a mile above the highway bridge on Congress avenue.

Discharge measurements of Colorado River at Austin, Tex.

Date.	Hydrographer.	Gage height.	Discharge.
1902.		*Feet.*	*Second-feet.*
January 20	C. N. Campbell	2.10	497
February 17	do	1.99	471
March 15	do	2.50	962
April 9	do	1.70	376
June 20	T. W. Taylor	1.40	252
June 21	do	1.32	186
Do	do	1.32	215
June 23	do	1.34	211
June 28	A. A. Cother	1.20	180
June 30	do	1.19	176
October 24	T. W. Taylor	1.55	293
October 25	do	1.50	282
October 28	A. A. Cother	1.45	286
October 30	do	1.40	293
November 4	do	4.10	3,600
November 5	do	3.20	1,717
November 6	do	2.60	1,216
November 11	do	2.40	1,100
November 17	do	6.80	13,917
November 18	do	6.20	11,650
November 21	do	3.10	1,686
November 22	do	8.40	20,083
November 24	do	9.80	26,246
November 25	do	7.40	16,613
November 27	do	6.50	12,845
December 2	do	4.00	2,793

Daily gage height, in feet, of Colorado River at Austin, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.85	1.90	1.83	1.90	1.95	3.25	2.85	10.10	1.55	2.50	1.40	3.15
2	1.85	1.90	1.80	2.00	1.85	5.15	2.25	8.60	1.60	2.40	1.40	3.70
3	1.85	1.90	1.80	1.90	1.75	4.00	4.60	5.80	1.60	4.35	1.50	4.85
4	1.85	1.95	1.75	1.80	1.85	3.45	5.60	4.50	1.90	5.00	4.15	4.35
5	1.85	2.00	1.70	1.73	1.95	2.90	4.05	4.00	3.45	4.05	3.10	3.70
6	1.85	2.00	1.70	1.73	1.85	2.75	3.15	3.55	3.80	3.65	2.70	3.30
7	1.85	1.95	1.70	1.70	1.95	2.45	2.75	3.20	3.00	3.45	3.25	3.05
8	1.85	1.98	1.70	2.05	1.95	2.35	2.50	3.05	3.45	2.90	3.30	2.95
9	1.90	2.00	1.70	1.75	3.20	2.20	2.35	3.00	3.50	2.55	2.85	2.75
10	1.90	2.00	1.70	1.70	3.70	2.15	2.20	3.05	5.30	2.35	2.55	2.65
11	1.90	2.00	1.80	1.60	3.25	2.05	2.15	2.60	4.15	2.20	2.40	2.60
12	1.90	2.00	1.80	1.53	2.90	2.00	1.95	2.50	3.45	2.10	2.30	2.50
13	1.95	2.00	4.00	3.10	2.65	1.85	1.80	2.55	3.15	1.95	2.35	2.50
14	1.95	1.90	3.10	4.15	2.45	1.70	2.65	2.70	2.85	1.90	3.15	2.42
15	1.95	2.00	2.60	5.10	2.35	1.60	2.35	2.55	2.06	1.80	2.45	2.35
16	1.98	2.00	2.05	6.15	2.20	1.60	2.20	2.40	2.45	1.75	2.15	2.30
17	2.00	1.95	3.20	4.85	2.15	1.63	2.25	2.20	2.35	1.70	4.70	2.25
18	2.00	1.95	2.90	4.20	2.15	1.60	2.05	2.10	2.20	1.70	5.30	2.25
19	2.00	1.95	2.70	3.30	5.25	1.50	3.15	2.00	2.10	1.60	4.15	2.00
20	2.10	1.90	2.50	3.15	8.05	1.43	2.40	2.00	2.05	1.60	3.30	2.00
21	2.10	1.90	2.38	2.95	8.85	1.40	2.25	1.90	2.00	1.60	3.00	2.15
22	2.00	1.90	2.30	2.75	5.95	1.38	2.10	1.92	1.90	1.60	5.75	2.10
23	2.00	1.90	2.23	2.60	4.35	1.35	2.15	1.82	2.35	1.55	9.85	2.10
24	2.00	1.88	2.20	2.50	3.90	1.30	2.25	1.72	2.70	1.55	10.90	2.05
25	1.95	1.85	2.10	2.40	3.40	1.30	5.70	1.70	2.40	1.50	7.40	2.00
26	1.93	1.85	2.15	2.33	3.15	1.30	9.10	1.70	3.05	1.45	8.15	1.95
27	1.90	1.85	2.00	2.30	2.95	1.30	11.10	1.67	2.95	1.45	6.75	1.95
28	1.90	1.85	1.93	2.20	3.10	1.20	11.85	1.65	2.80	1.42	4.90	1.90
29	1.90	.....	1.85	2.10	3.20	1.30	10.65	1.60	3.25	1.40	4.20	1.90
30	1.90	.....	1.80	2.00	3.00	2.05	10.35	1.60	2.90	1.40	3.55	1.90
31	1.90	.....	1.80	.....	2.85	.....	10.65	1.55	.....	1.40	.....	1.95

Rating table for Colorado River at Austin, Tex., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.2	180	3.6	2,480	6.0	10,850	8.4	20,450
1.4	240	3.8	2,890	6.2	11,650	8.6	21,250
1.6	320	4.0	3,340	6.4	12,450	8.8	22,050
1.8	410	4.2	3,865	6.6	13,250	9.0	22,850
2.0	520	4.4	4,490	6.8	14,050	9.2	23,650
2.2	650	4.6	5,250	7.0	14,850	9.4	24,450
2.4	820	4.8	6,050	7.2	15,650	9.6	25,250
2.6	1,020	5.0	6,850	7.4	16,450	9.8	26,050
2.8	1,240	5.2	7,650	7.6	17,250	10.0	26,850
3.0	1,490	5.4	8,450	7.8	18,050		
3.2	1,780	5.6	9,250	8.0	18,850		
3.4	2,110	5.8	10,050	8.2	19,650		

Estimated monthly discharge of Colorado River at Austin, Tex.

[Drainage area, 37,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	580	435	480	29,494	0.01	0.01
February	520	435	483	26,836	.01	.01
March	3,340	360	732	45,025	.02	.02
April	11,450	300	1,711	101,827	.05	.06
May	22,250	385	3,052	187,652	.08	.09
June	7,450	180	883	52,552	.02	.02
July	31,250	410	7,148	439,517	.19	.22
August	27,250	300	2,827	173,841	.08	.09
September	2,890	300	1,503	89,460	.04	.04
October	6,850	240	1,019	62,684	.03	.03
November	30,450	240	5,623	334,594	.15	.17
December	6,250	460	1,230	75,626	.03	.03
The year	31,250	180	2,224	1,619,108	.06	.79

Miscellaneous measurements on Colorado River.

Date.	Locality.	Discharge.
1902.		*Sec.-feet.*
June 19	Marble Falls	219
June 27	do	145
August 17	Ballinger	.104

BARTON SPRINGS NEAR AUSTIN, TEX.

These springs are about 2 miles from the court-house at Austin. There are at present two distinct groups of springs that unite one-fourth mile below the stone bridge and form the main channel. The flow of these springs has responded to the rainfall on the Edwards Plateau with unfailing regularity. The Walsh spring on the south side of the stream which formerly ran a mill was dry for several years, but in 1900, a year of heavy rainfall, it revived and continued flowing for about a year, but during the whole of 1902 no water issued from this spring. The following measurements have been made of the flow of the springs:

Miscellaneous measurements of Barton Springs.

Date.	Hydrographer.	Discharge.
		Sec.-feet.
1894	C. C. Babb	17
1895	do	25
March, 1898	T. U. Taylor	20
May, 1898	do	30
August, 1900	do	69
December, 1900	do	33
June, 1902	do	19
August, 1902	do	19

LLANO RIVER, TEXAS.

The Llano River rises in Sutton County and flows east to its junction with the Colorado. Just below Junction City, in Kimble County, the North and South forks unite and form the main Llano.

The main Llano River is joined by the Johnson Fork of the Llano below Junction City. The water in this fork is almost exhausted, before it reaches the main Llano, by several small irrigation plants that derive their waters from it. The measurement of August 13, 1902, on the South Llano was stated by the mill owner and operator just south of the town to be at the lowest stage, and this is highly probable, as no rains of any account had fallen for some time. While the South Llano is much shorter than the North Llano, yet the North Llano on the same date was not flowing at their junction. The South Llano could easily supply sufficient water for an irrigation system of 6,000 acres, and the land that could be brought under ditch is rich and well placed for easy irrigation.

The capacity of the Llanos has not been developed to much extent either for power or irrigation purposes. Power plants are located at Junction City, 2 miles above the town of Llano, and at Llano. Its use for irrigation purposes is confined to the county of Kimble.

There are more individual irrigation plants in Kimble County fed by the Llano and its tributaries than in any other county in Texas, as can be seen by referring to Water Supply Paper 71. There are four water-power plants on the Llanos, but only three are in active operation at present. At Junction City, a dam about one foot high, constructed of logs and loose rocks, deflects part of the flow of the South Llano into a ditch whose bed is on the same level with that of the river. The ditch is 10 feet wide, 4 feet deep, and about 3 furlongs in length. The ditch follows the foothills to the fore bay or flume

100 feet long, 6 feet wide, and 6 feet deep. The power is developed by a 30-inch Leffel turbine, and is used to run a gristmill, a cotton gin of 70 saws, and to supply a tank 80 feet above the level of the water in the ditch. The tank is used as a part of the waterworks for the town of Junction. The water emerges from the turbine and flows back under the flume for about 60 feet, when it turns sharply to the east and is conducted back to the river. In addition to the power developed, there is a plan on foot to install an irrigation system of 6,000 acres. The main canal will be taken out of the river above Junction and will follow the foothills west of town and then cross the North Llano by an invert, and irrigate lands on the north side of the main Llano east of the town.

While there are many localities on the Llano between Junction and the town of Llano where power plants could be developed, yet no attempts have been made to construct additional plants except near the town of Llano. At Llano there are conditions for a good water-power plant. Just north of the town a small plant is at present used in running the waterworks, the electric-light plant, and the flour mill. The dam is constructed partly of stone and partly of wood. It is built on a turtleback formation of granite that would afford an excellent foundation for a masonry dam. All the necessary factors for a successful power plant—the foundation, the water, the finest stone in the world, and good railroad facilities—are here in abundance and only await capital.

Miscellaneous measurements on the Llano and its tributaries.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
June 26	Llano	Above Llano	55
August 13	Johnson Fork	1 mile above Segovia	11
Do	South Llano	One-fourth mile below Junction City.	94
August 14	Bear Creek	Morales farm	3

SAN SABA RIVER, TEXAS.

The San Saba River rises in two springs near Fort McKavett, in the western part of Menard County, and flows in an easterly direction for over 100 miles to its junction with the Colorado. Between Fort McKavett and Menardville the river is fed by many springs, some of which are utilized in small irrigation systems before their waters join those of the San Saba. The largest of these springs is known as the

Wilkinson spring, and is situated above Menardville, on the farm of W. J. Wilkinson. It forms the headwaters of Clear Creek. This stream is only about 3 miles long. Its waters are only partially utilized for irrigation purposes, but it would easily irrigate 1,500 to 2,000 acres. A resident of thirty years states that the flow of this stream is greater in the summer than in the winter. However, the variation is rather slight, so that its capacity for irrigation or power purposes would not be subject to large fluctuations.

Four miles above Menardville the Noyes ditch, 9 miles long, is taken out of the San Saba and deflects most of the normal flow. This ditch feeds an irrigation system both above and below the town of Menardville. Above Menardville the water of the San Saba is used for the irrigation systems of Byers and Striegler and for the Noyes system, which lies above and below Menardville. The Sieker and the Kitchen ditches, 2 and 5 miles, respectively, below Menardville, are taken from the San Saba. For a full description of these irrigation systems see Water Supply Paper No. 71.

Twelve miles below Menardville the river enters the canyons, which it traverses for 50 miles. The canyons finally widen into rich valleys at a point known as "The Narrows," 17 miles above the town of San Saba, opposite the ranch of Hilliard Doran. The measurement made on June 24 can be relied upon as the least flow of the San Saba, as no rain of any consequence had fallen on its drainage area for nearly two years. While the flow at Fort McKavett is more than this, and while Clear Creek and the smaller streams swell this flow above Menardville to double this amount, the irrigation systems in Menard County practically take all the water out of the river. When this measurement of 25 second-feet was made at "The Narrows" the river was reported as not flowing above the mouth of Brady Creek. Twelve miles above San Saba the Sloan spring emerges from the foothills of the Edwards plateau. It has a capacity of 9 second-feet, and its waters are utilized in one of the most effective irrigation systems in Texas.

So far the waters of the San Saba have not been used for power purposes on the main stream, but in its course there are many excellent sites for dams that would make practical use of the waste potential energy.

Miscellaneous measurements on the San Saba and its tributaries.

Date.	Stream.	Locality.	Discharge.
1902.			*Sec.-feet.*
August 14	San Saba	1 mile below Fort McKavett.	26
Do	Clear Creek	9 miles above Menardville.	25
August 15	San Saba	North of Menardville court-house.	8
Do	Noyes Ditch	Near M. E. Church, Menardville.	28
June 24	San Saba	Doran's ranch	25
June 25	do	1 mile below Doran's ranch.	28
Do	do	Barnetts Ford, above San Saba.	28
June 24	Mill Creek	San Saba	8

GUADALUPE RIVER DRAINAGE BASIN.

The Guadalupe River rises in the southern central part of Texas, flows southeast, and empties into San Antonio Bay. During the summer of 1902 its discharge was the least in its observed history, causing much loss above New Braunfels, where half a dozen power plants were forced to shut down or to run on short time. The flow at this time was so low that special efforts were made to obtain measurements at several points along its course. The results of these measurements are shown in the accompanying table.

Under the direction of Thomas U. Taylor, the U. S. Geological Survey is maintaining a station in this basin near Cuero, Tex.

GUADALUPE RIVER NEAR CUERO, TEX.

This station was established by Thomas U. Taylor December 26, 1902. It is located at the dam of Carl Buchel's power house, 3 miles north of Cuero, Tex. The gage is a plain staff graduated to feet and tenths. It is mounted on the wall of the power house near the dam, and is read twice daily by Carl Buchel. The initial point for sounding is on the left bank. The channel is straight for about one-fourth of a mile above and 400 feet below the station. The right bank is low and liable to overflow; the left bank is high and rocky. The bed of the stream is of clay. The bench mark is on the crest of the dam. Its elevation is the same as the zero of the gage.

The Guadalupe, while the best water-power stream in Texas, has a drainage area above Cuero of only 5,100 square miles. Its efficiency is due almost entirely to the canal at New Braunfels. Below New Braunfels the largest tributary is the San Marcos River.

Miscellaneous measurements in the Guadalupe River drainage basin.

Date.	Stream.	Station.	Discharge.
1902.			*Sec.-feet.*
August 29	Gaudalupe	Comfort	7
August 28	do	Near Walhalla	11
Do	do	6 miles above New Braunfels.	9
August 26	do	North of New Braunfels, near cemetery crossing.	13
August 27	do	One-fourth mile above International and Great Northern R. R. bridge.	342
August 30	do	Below Erskine Falls	355
February 22	Comal	Landa Mill Race and Comal Spring Creek.	333
August 26	do	do	318
August 12	Johnsons Fork	On Kerrville and Junction City road crossing.	9
February 22	San Marcos	Prairie Lea	149
September 9	do	Westerfield Ford	150
March 12	San Antonio	San Antonio	7
October 21	do	Hot Wells	34

RIO GRANDE DRAINAGE BASIN.

The Rio Grande rises in southern Colorado, in the Rocky Mountains, flows south through New Mexico and thence southeast, forming the boundary between Texas and Mexico. Pecos River, which rises in northern New Mexico and flows south across eastern New Mexico and western Texas, is its principal tributary from the north. The Conchos River is its principal tributary from the Mexican side. The determination of the amount of water in the Rio Grande is of importance, both on account of its use in irrigation and from its bearing upon interstate and international distribution of water. The New Mexico and Texas stations are maintained by the International (Water) Boundary Commission, and the data are furnished by W. W. Follett, consulting engineer for the Commission. On account of the shifting character of the river beds at the international (water) boundary stations, no rating tables have been prepared. The estimated monthly discharges are from daily discharges, computed directly from the discharge measurements. The following list includes the stations in the Rio Grande drainage basin:

Rio Grande at Eagle Pass, Tex.
Las Moras Creek.
San Felipe Creek.
Rio Grande below mouth of Devils River, Texas.
Devils River at Devilsriver, Tex.

Pecos River at Moorhead, Tex.
Pecos River, Margueretta flume, and West Valley ditch, near Pecos, Tex.
Rio Grande at Langtry, Tex.
Rio Grande below Presidio, Tex.
Rio Grande above Presidio, Tex.
Rio Grande near Fort Hancock, Tex.
Rio Grande near El Paso, Tex.
Rio Grande near San Marcial, N. Mex.
Rio Grande at water tank; Buckman, near Rio Grande, N. Mex.
Rio Grande at Embudo, N. Mex.
Rio Grande near Cenicero, Colo.
Rio Grande near Del Norte, Colo.

RIO GRANDE AT EAGLE PASS, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is a half mile above the highway bridge between Eagle Pass and Ciudad Porfirio Diaz, Mexico, and about 540 miles below El Paso, Tex. During 1902 the following measurements of discharge were made by O. B. Powell, D. Griggs, and R. F. Dowe:

Discharge measurements of the Rio Grande at Eagle Pass, Tex.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 3	2.3	2,041	March 29	1.8	1,495
January 7	2.3	1,945	April 1	1.7	1,437
January 10	2.5	2,253	April 4	1.7	1,314
January 13	2.5	2,304	April 8	1.7	1,270
January 17	2.4	2,152	April 12	1.7	1,347
January 25	2.2	1,888	April 15	2.75	2,976
January 28	2.2	1,848	April 19	2.0	1,633
January 31	2.2	1,828	April 23	1.7	1,377
February 4	2.2	1,965	April 26	1.7	1,325
February 8	2.2	2,017	April 29	1.7	1,319
February 11	2.2	2,054	May 3	1.6	1,261
February 15	2.2	1,957	May 5	4.65	8,742
February 18	2.2	2,034	May 10	2.2	1,624
February 22	2.1	1,916	May 13	2.0	1,849
February 25	2.1	1,954	May 17	1.9	1,428
March 1	2.0	1,901	May 19	8.0	[a] 34,300
March 8	1.9	1,826	May 21	2.95	2,609
March 11	1.9	1,600	May 23	2.3	2,118
March 15	1.9	1,550	May 26	2.1	1,959
March 18	1.8	1,478	May 30	1.9	1,707
March 22	1.8	1,415	June 3	2.0	1,721
March 25	1.8	1,431	June 7	1.8	1,498

[a] Partly estimated.

Discharge measurements of the Rio Grande at Eagle Pass, Tex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
June 10	1.7	1,326	September 26	3.15	4,423
June 14	2.2	1,960	September 29	2.9	3,890
June 17	1.9	1,517	October 1	2.9	3,826
June 21	2.2	2,207	October 3	3.05	4,183
June 24	2.0	1,544	October 6	3.5	5,157
June 28	1.9	1,462	October 8	2.9	3,743
July 1	1.8	1,369	October 10	2.6	3,130
July 2	3.7	4,248	October 13	3.0	4,085
July 7	1.8	1,360	October 15	2.9	3,356
July 10	2.0	1,592	October 17	2.6	3,019
July 12	2.9	3,027	October 20	2.5	2,460
July 15	4.75	7,906	October 22	2.4	2,335
July 17	3.6	4,122	October 25	2.3	2,270
July 19	3.3	3,552	October 27	2.3	2,263
July 22	3.55	4,495	October 29	2.2	2,078
July 24	4.5	7,404	October 31	2.2	2,084
July 26	7.5	[a] 22,980	November 3	2.8	3,175
July 28	6.4	16,676	November 5	2.5	2,671
July 30	6.4	17,283	November 7	3.0	3,920
August 2	4.85	9,819	November 10	2.4	2,428
August 4	4.3	7,741	November 12	2.2	2,279
August 7	3.5	4,987	November 14	2.1	2,086
August 9	3.55	5,210	November 17	2.1	1,969
August 11	3.0	3,915	November 19	2.1	1,963
August 15	5.2	9,600	November 21	2.55	2,632
August 19	4.1	6,050	November 23	2.1	2,035
August 21	3.9	5,574	November 26	2.1	2,056
August 23	3.9	5,523	December 4	2.1	2,257
August 26	4.4	7,388	December 6	2.1	2,354
August 28	4.7	8,305	December 9	2.2	2,542
August 30	4.0	6,166	December 11	2.2	2,582
September 2	5.9	14,448	December 13	2.2	2,559
September 4	5.0	8,649	December 16	2.2	2,572
September 9	7.05	25,740	December 18	2.1	2,420
September 10	8.7	30,902	December 20	2.2	2,557
September 13	7.7	25,612	December 23	2.2	2,494
September 18	4.6	8,884	December 26	2.1	2,419
September 20	4.1	8,046	December 29	2.1	2,402
September 22	4.85	10,644	December 31	2.1	2,398
September 24	3.5	5,542			

[a] Partly estimated.

Daily gage height, in feet, of the Rio Grande at Eagle Pass, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.30	2.20	2.00	1.70	1.70	2.15	1.80	5.35	5.25	2.90	2.20	4.50
2	2.30	2.20	2.00	1.70	1.70	2.10	3.65	4.90	5.75	3.00	2.65	3.80
3	2.30	2.20	2.00	1.70	1.60	2.05	2.35	4.55	5.10	3.10	2.80	2.35
4	2.30	2.20	2.00	1.70	3.95	1.95	1.95	4.25	4.95	3.20	2.55	2.10
5	2.30	2.20	1.90	1.70	4.70	1.90	1.85	4.20	5.30	3.00	2.50	2.10
6	2.30	2.20	1.90	1.70	3.15	1.80	1.80	3.90	5.90	3.40	2.65	2.10
7	2.30	2.20	1.90	1.70	2.75	1.80	1.75	3.55	5.90	3.15	2.95	2.75
8	2.30	2.20	1.90	1.70	2.45	1.80	1.70	3.80	6.25	2.85	2.75	3.40
9	2.45	2.20	1.90	1.70	2.35	1.75	1.95	3.70	7.25	2.65	2.55	2.25
10	2.50	2.20	1.90	1.70	2.15	1.70	1.95	3.35	8.60	2.55	2.40	2.20
11	2.50	2.20	1.90	1.70	2.00	1.70	2.30	3.05	8.90	2.45	2.30	2.20
12	2.50	2.20	1.90	1.70	2.00	1.70	2.90	3.00	8.00	2.50	2.20	2.20
13	2.50	2.20	1.90	1.70	2.00	1.90	2.75	2.95	7.60	3.00	2.20	2.20
14	2.50	2.20	1.90	1.85	2.00	2.25	4.45	3.20	6.95	2.90	2.10	2.20
15	2.50	2.20	1.90	2.40	1.90	2.05	4.60	5.15	6.00	2.85	2.10	2.20
16	2.45	2.20	1.90	2.45	1.90	2.00	3.80	4.35	5.35	2.75	2.15	2.20
17	2.40	2.20	1.80	2.15	1.90	1.90	3.55	4.05	4.90	2.65	2.20	2.20
18	2.40	2.20	1.80	2.00	4.45	2.20	3.30	3.95	4.60	2.55	2.10	2.10
19	2.40	2.20	1.80	2.00	7.35	2.00	3.30	4.10	4.40	2.50	2.10	2.15
20	2.30	2.20	1.80	1.85	3.75	1.90	3.30	4.10	4.00	2.50	2.10	2.20
21	2.30	2.10	1.80	1.80	2.75	2.20	3.20	3.85	3.85	2.50	2.40	2.20
22	2.30	2.10	1.80	1.80	2.35	2.30	3.35	3.65	4.85	2.45	2.10	2.20
23	2.30	2.10	1.80	1.75	2.30	2.25	3.30	3.85	4.35	2.40	2.10	2.15
24	2.30	2.10	1.80	1.70	2.25	2.00	4.05	3.75	3.50	2.40	2.10	2.15
25	2.20	2.10	1.80	1.70	2.20	1.90	5.00	3.90	3.30	2.30	2.25	2.20
26	2.20	2.10	1.80	1.70	2.10	1.90	7.40	4.25	3.15	2.30	2.20	2.15
27	2.20	2.10	1.80	1.70	2.10	2.00	6.45	4.85	2.95	2.30	2.00	2.10
28	2.20	2.00	1.90	1.70	2.00	1.90	6.30	4.65	2.90	2.30	2.20	2.10
29	2.20	.....	1.80	1.70	1.95	1.85	6.40	4.25	2.90	2.20	2.15	2.10
30	2.20	.....	1.80	1.70	1.90	1.80	6.35	4.00	2.90	2.20	2.15	2.10
31	2.20	.....	1.80	.....	2.30	.....	5.80	4.55	.....	2.20	.....	2.10

Estimated monthly discharge of the Rio Grande at Eagle Pass, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	2,300	1,830	2,052	126,189
February	2,050	1,830	1,973	109,587
March	1,900	1,420	1,606	98,737
April	2,260	1,270	1,448	86,182
May	29,200	1,260	3,382	207,967
June	2,330	1,330	1,648	98,063
July	22,400	1,270	6,094	374,717
August	12,140	3,800	6,539	402,070
September	32,000	3,890	12,868	765,719
October	4,920	2,080	3,070	188,787
November	3,800	1,930	2,385	141,937
December	8,400	2,260	2,904	178,532
The year	32,000	1,260	3,831	2,778,487

LAS MORAS CREEK, TEXAS.

Las Moras Creek, which rises in the town of Brackettville, Kinney County, Tex., and empties into the Rio Grande about 25 miles above Eagle Pass, has had a variable record since measurements have been made upon it. In December, 1895, C. C. Babb found a total discharge of 21 second-feet. In June, 1898, the "Brackett flood" occurred, as described in Water-Supply Paper No. 50, page 344, and Las Moras showed an increased flow up to the latter part of 1901. The flow was measured by T. U. Taylor in June, 1899, when it had a discharge of 60 second-feet at Mulligan's bend, one-fourth mile below the courthouse; in ———, 1900, when a flow of 51 second-feet was found at the same section; in December, 1901, when a flow of —— second-feet was obtained, and in 1902 two checked measurements on September 2 and 3 each gave a discharge of only 11 second-feet.

SAN FELIPE CREEK, TEXAS.

San Felipe Creek has its source in four large springs. These springs are all above the Southern Pacific Railroad bridge, 1 mile east of Del Rio, at distances from 200 yards to 2 miles. Measurements have been made on the San Felipe since December, 1895, when C. C. Babb found a joint discharge on the creek and of Madre ditch (which includes the total flow of the springs) to be 99 second-feet. The following measurements have since been made by and under the direction of T. U. Taylor: In June, 1899, a joint flow of 84 second-feet; September, 1900, a joint flow of 149 second-feet; in December, 1901, a flow of 150 second-feet, and in September, 1902, a flow of 115 second-feet were obtained. The variation in the flow is caused by an increased rainfall in the Edwards Plateau to the north of Del Rio. An increased flow is found in all of the outlets of the underground waters of the plateau which stretches from the Southern Pacific Railroad north to the Texas Pacific Railroad. The crest of increased flow follows the increased rainfall in the highlands to the north.

RIO GRANDE BELOW MOUTH OF DEVILS RIVER, TEXAS.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is alongside the Southern Pacific Railway track, about a half mile below the mouth of Devils River and about 480 miles below El Paso.

Discharge measurements of the Rio Grande near Devilsriver, Tex.

[Made by James P. Hague, J. D. Dillard, and A. L. Wilcox.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 6	3.5	2,152	July 8	3.55	1,765
January 10	3.9	2,944	July 12	4.3	3,204
January 14	3.8	2,591	July 15	5.75	6,495
January 19	3.7	2,147	July 20	4.7	3,875
January 23	3.5	2,107	July 24	6.8	9,735
January 26	3.5	1,955	July 29	9.1	15,560
January 30	3.5	1,865	August 2	6.5	8,779
February 5	3.5	1,943	August 6	5.3	4,998
February 10	3.5	2,034	August 11	4.85	4,106
February 13	3.5	2,048	August 15	6.85	10,000
February 17	3.5	2,071	August 19	5.6	6,038
February 20	3.5	2,172	August 23	5.7	6,357
February 24	3.5	2,037	August 28	6.3	8,205
March 2	3.4	1,826	September 1	7.15	10,467
March 5	3.3	1,697	September 5	8.7	14,587
March 9	3.3	1,592	September 9	11.75	29,431
March 12	3.3	1,716	September 13	9.65	19,549
March 16	3.3	1,672	September 17	6.35	10,064
March 20	3.2	1,579	September 19	6.1	8,864
March 24	3.25	1,622	September 23	5.35	5,602
March 28	3.1	1,496	September 27	4.85	4,133
April 3	3.1	1,438	October 2	4.7	3,748
April 8	3.1	1,405	October 6	5.0	4,497
April 11	3.1	1,379	October 10	4.4	2,889
April 14	4.6	4,393	October 14	4.65	3,393
April 19	3.25	1,488	October 18	4.35	2,856
April 26	3.1	1,253	October 22	4.2	2,491
May 1	3.1	1,243	October 25	4.15	2,451
May 6	3.4	1,671	October 30	4.05	2,226
May 10	3.2	1,379	November 2	4.75	3,795
May 16	3.3	1,558	November 6	4.85	3,847
May 20	3.95	2,654	November 10	4.1	2,353
May 24	3.4	1,600	November 14	3.95	2,117
May 29	3.3	1,426	November 18	3.9	2,025
June 3	3.4	1,620	November 22	3.9	2,027
June 7	3.3	1,398	November 26	3.9	2,095
June 11	3.3	1,471	December 2	3.9	2,052
June 15	3.5	1,807	December 8	4.0	2,168
June 19	3.4	1,662	December 13	3.95	2,112
June 24	3.35	1,556	December 18	3.9	2,074
June 28	3.4	1,502	December 23	3.9	2,051
July 3	3.4	1,497	December 30	3.9	2,041

Daily gage height, in feet, of the Rio Grande near Devilsriver, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	3.60	3.50	3.50	3.10	3.10	3.80	6.25	6.85	7.35	4.70	4.35	3.90
2	3.60	3.50	3.40	3.10	3.10	3.50	3.75	6.45	7.25	4.70	4.60	3.90
3	3.60	3.50	3.50	3.10	3.10	3.40	3.40	6.20	7.25	5.10	4.35	3.85
4	3.60	3.50	3.45	3.10	4.80	3.40	3.35	5.95	7.30	4.80	4.35	3.80
5	3.55	3.50	3.30	3.10	3.75	3.30	3.30	5.65	8.65	5.00	4.30	3.95
6	3.50	3.50	3.30	3.10	3.55	3.30	3.30	5.25	8.00	4.95	4.85	4.05
7	3.50	3.50	3.30	3.10	3.60	3.30	3.30	5.90	8.60	4.65	4.55	4.05
8	3.50	3.50	3.30	3.10	3.35	3.30	3.50	5.50	9.70	4.45	4.35	4.00
9	3.90	3.50	3.30	3.10	3.20	3.30	3.40	4.95	11.65	4.40	4.20	3.90
10	3.85	3.50	3.30	3.10	3.20	3.30	4.05	4.75	12.75	4.40	4.10	4.00
11	3.80	3.50	3.30	3.10	3.10	3.35	4.40	4.70	10.90	4.35	4.05	4.00
12	3.80	3.50	3.30	3.10	3.10	3.60	4.20	4.60	10.40	4.75	4.00	4.00
13	3.80	3.50	3.30	3.40	3.10	3.75	5.35	4.50	9.50	4.75	3.90	3.90
14	3.80	3.50	3.30	4.10	3.10	3.65	6.60	7.50	8.45	4.65	3.90	3.90
15	3.70	3.50	3.30	3.70	3.10	3.50	5.60	6.85	7.30	4.55	3.90	3.90
16	3.70	3.50	3.30	3.50	3.20	3.50	5.15	6.00	6.65	4.45	3.90	3.90
17	3.70	3.50	3.30	3.40	3.20	3.50	4.80	6.00	6.35	4.40	3.90	3.90
18	3.70	3.50	3.30	3.40	10.00	3.50	4.85	5.95	6.05	4.35	3.90	3.90
19	3.70	3.50	3.20	3.30	5.60	3.40	4.75	5.60	5.95	4.30	3.90	3.95
20	3.60	3.50	3.20	3.15	3.95	3.90	4.70	5.85	5.50	4.30	3.90	3.90
21	3.60	3.50	3.20	3.10	3.75	3.95	4.95	5.65	6.10	4.20	3.90	3.90
22	3.60	3.50	3.20	3.10	3.45	3.80	4.85	5.65	6.55	4.20	3.90	3.90
23	3.50	3.50	3.20	3.10	3.40	3.50	5.65	5.70	5.30	4.15	3.95	3.90
24	3.50	3.50	3.25	3.10	3.40	3.40	6.50	5.60	5.00	4.10	4.20	3.90
25	3.50	3.50	3.20	3.10	3.65	3.40	10.15	5.95	4.80	4.10	3.95	3.90
26	3.50	3.50	3.10	3.10	3.50	3.40	9.55	6.75	4.90	4.00	3.90	3.90
27	3.50	3.50	3.10	3.10	3.40	3.40	8.00	6.95	4.85	4.05	4.05	3.90
28	3.50	3.50	3.10	3.10	3.40	3.40	8.40	6.20	4.70	4.10	3.90	3.90
29	3.50	.....	3.10	3.10	3.30	3.35	9.20	5.90	4.70	4.10	3.90	3.90
30	3.50	.....	3.10	3.10	4.20	3.30	8.05	6.30	4.70	4.10	3.90	3.90
31	3.50	.....	3.10	.....	4.20	.....	7.55	7.25	.....	4.10	.....	3.90

Estimated monthly discharge of the Rio Grande near Devilsriver, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	2,940	1,860	2,246	138,129
February	2,170	1,880	2,022	112,304
March	1,940	1,500	1,646	101,217
April	3,270	1,250	1,535	91,359
May	23,000	1,240	2,656	163,339
June	2,650	1,400	1,755	104,450
July	18,700	1,360	6,372	391,795
August	12,200	3,460	7,071	434,797
September	35,500	3,700	12,122	721,329
October	4,770	2,150	3,037	186,744
November	3,850	2,030	2,400	142,790
December	2,250	1,930	2,080	127,914
The year	35,500	1,240	3,745	2,716,167

DEVILS RIVER AT DEVILSRIVER, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is opposite the Southern Pacific Railway station at Devilsriver. The river is about 50 miles in length, has a perennial flow, and during flood periods is subject to great fluctuations.

Discharge measurements of Devils River at Devilsriver, Tex.

[Made by James P. Hague, J. D. Dillard, and A. L. Wilcox.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 5	2.0	497	July 2	2.0	425
January 11	2.1	488	July 11	2.0	431
January 18	2.0	495	July 19	2.0	418
January 22	2.0	489	July 28	2.1	466
January 29	2.0	472	August 5	2.0	415
February 6	2.0	490	August 14	2.0	431
February 9	2.0	453	August 20	2.0	408
February 16	2.0	474	August 28	2.0	406
February 23	2.0	505	September 4	2.25	543
March 1	2.0	497	September 12	2.2	447
March 8	2.0	503	September 16	2.2	445
March 17	2.0	493	September 18	2.2	428
March 23	2.0	490	September 26	2.15	492
March 29	2.0	486	October 5	2.15	443
April 4	2.0	479	October 13	2.15	435
April 8	2.0	475	October 21	2.1	421
April 15	2.0	487	October 29	2.1	419
April 25	1.9	438	November 5	2.15	429
May 5	2.3	656	November 13	2.15	432
May 9	2.0	446	November 22	2.15	414
May 19	4.0	2,479	November 26	2.1	392
May 23	2.4	742	December 2	2.25	499
May 28	2.2	582	December 8	2.15	428
June 2	2.2	536	December 13	2.1	402
June 14	2.1	483	December 18	2.1	415
June 23	2.05	470	December 23	2.05	389
June 27	2.0	448	December 30	2.05	386

Daily gage height, in feet, of Devils River at Devilsriver, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.00	2.00	2.00	2.00	1.90	2.20	2.00	2.00	2.00	2.10	2.10	2.20
2	2.00	2.00	2.00	2.00	1.90	2.20	2.00	2.00	2.00	2.20	2.40	2.30
3	2.00	2.00	2.00	2.00	1.90	2.20	2.00	2.00	2.00	2.35	2.35	2.20
4	2.00	2.00	2.00	2.00	3.00	2.20	2.00	2.00	2.25	2.25	2.25	2.15
5	2.00	2.00	2.00	2.00	2.40	2.20	2.00	2.00	2.05	2.15	2.15	2.15
6	2.00	2.00	2.00	2.00	2.20	2.20	2.00	2.00	2.00	2.15	2.15	2.15
7	2.00	2.00	2.00	2.00	2.10	2.20	2.00	2.00	3.80	2.15	2.15	2.15
8	2.00	2.00	2.00	2.00	2.00	2.20	2.00	2.00	2.25	2.10	2.15	2.15
9	2.00	2.00	2.00	2.00	2.00	2.20	2.00	2.00	2.20	2.10	2.15	2.15
10	2.00	2.00	2.00	2.00	2.00	2.20	2.00	2.00	2.20	2.10	2.15	2.15
11	2.05	2.00	2.00	2.00	2.00	2.20	2.00	2.00	2.20	2.10	2.15	2.15
12	2.10	2.00	2.00	2.00	2.00	2.10	2.00	2.00	2.20	2.10	2.15	2.10
13	2.10	2.00	2.00	2.20	2.00	2.10	2.00	2.00	2.10	2.10	2.15	2.10
14	2.10	2.00	2.00	2.10	2.00	2.10	2.00	2.00	2.20	2.10	2.15	2.10
15	2.10	2.00	2.00	2.00	2.00	2.10	2.00	2.00	2.20	2.10	2.15	2.10
16	2.10	2.00	2.00	2.00	2.00	2.10	2.00	2.00	2.20	2.10	2.15	2.10
17	2.10	2.00	2.00	2.00	2.00	2.10	2.00	2.00	2.20	2.10	2.15	2.05
18	2.00	2.00	2.00	1.90	5.95	2.10	2.00	2.00	2.20	2.10	2.15	2.10
19	2.00	2.00	2.00	1.90	4.05	2.10	2.00	2.00	2.20	2.10	2.15	2.10
20	2.00	2.00	2.00	1.90	2.95	2.10	2.00	2.00	2.20	2.10	2.15	2.10
21	2.00	2.00	2.00	1.90	2.65	2.10	2.00	2.00	2.20	2.10	2.15	2.10
22	2.00	2.00	2.00	1.90	2.45	2.00	2.00	2.00	2.20	2.10	2.15	2.05
23	2.00	2.00	2.00	1.90	2.40	2.00	2.00	2.00	2.20	2.10	2.15	2.05
24	2.00	2.00	2.00	1.90	2.40	2.00	2.00	2.00	2.20	2.10	2.15	2.05
25	2.00	2.00	2.00	1.90	2.25	2.00	2.00	2.00	2.20	2.10	2.15	2.05
26	2.00	2.00	2.00	1.90	2.20	2.00	2.00	2.00	2.15	2.10	2.10	2.05
27	2.00	2.00	2.00	1.90	2.20	2.00	2.60	2.00	2.15	2.10	2.10	2.05
28	2.00	2.00	2.00	1.90	2.20	2.00	2.15	2.00	2.15	2.10	2.10	2.05
29	2.00	.....	2.00	1.90	2.20	2.00	2.05	2.00	2.15	2.10	2.10	2.05
30	2.00	.....	2.00	1.90	2.20	2.00	2.00	2.00	2.15	2.10	2.10	2.05
31	2.00	.....	2.00	.....	2.20	.....	2.00	2.00	.....	2.10	.....	2.05

Estimated monthly discharge of Devils River at Devilsriver, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	500	470	488	29,990
February	500	450	480	26,638
March	500	490	494	30,367
April	590	440	469	27,907
May	5,380	440	815	50,102
June	560	435	491	29,207
July	880	420	443	27,213
August	430	405	414	25,458
September	2,200	405	510	30,367
October	530	420	433	26,618
November	660	390	436	29,514
December	535	380	414	25,438
The year	5,380	380	491	355,219

PECOS RIVER NEAR MOORHEAD, TEX.

This station was established by the International (Water) Boundary Commission in April, 1900. It is near Moorhead, immediately above the high bridge of the Southern Pacific Railway.

Discharge measurements of Pecos River near Moorhead, Tex.

[Made by James P. Hague, J. D. Dillard, and A. L. Wilcox.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 4	1.4	608	June 4	0.7	231
January 8	2.1	967	June 8	.7	231
January 13	2.1	943	June 12	.7	240
January 16	1.9	842	June 17	1.5	543
January 25	1.6	581	June 20	1.1	351
January 28	1.6	536	June 25	1.7	642
February 1	1.6	499	June 29	1.2	394
February 8	1.4	502	July 4	.9	282
February 12	1.65	636	July 9	.8	253
February 15	1.6	612	July 13	.7	237
February 19	1.6	609	July 17	1.7	594
February 22	1.7	638	July 21	2.35	1,067
March 4	1.3	487	July 25	2.9	1,531
March 7	1.3	487	July 30	3.6	2,036
March 11	1.3	457	August 3	4.2	2,763
March 14	1.2	426	August 7	2.45	1,202
March 19	1.2	362	August 12	1.8	729
March 22	1.2	360	August 16	1.9	784
March 26	1.15	344	August 21	2.0	851
March 30	1.1	370	August 25	1.6	579
April 1	1.1	378	August 29	1.3	465
April 6	1.0	343	September 2	1.2	374
April 10	.9	298	September 6	2.05	885
April 13	1.85	718	September 10	1.55	602
April 20	.9	311	September 14	1.85	742
April 25	.9	277	September 18	1.6	630
April 30	.9	250	September 20	1.55	565
May 3	1.4	460	September 25	1.35	477
May 7	1.35	430	September 30	1.3	431
May 11	.9	249	October 4	1.45	464
May 17	.8	235	October 8	1.3	420
May 21	1.1	322	October 12	1.3	423
May 25	.9	255	October 16	1.3	429
May 30	.8	231	October 20	1.3	416

Discharge measurements of Pecos River near Moorhead, Tex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
October 24	1.25	421	November 28	1.3	392
October 28	1.2	404	December 3	1.3	365
November 3	1.5	521	December 7	1.3	375
November 7	1.3	440	December 11	1.55	507
November 11	1.25	423	December 16	1.4	398
November 15	1.3	420	December 22	1.4	420
November 20	1.25	412	December 27	1.4	410

Daily gage height, in feet, of Pecos River near Moorhead, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.40	1.60	1.60	1.10	0.90	1.05	1.25	3.85	1.20	1.20	1.20	1.30
2	1.40	1.30	1.40	1.10	.90	.90	1.10	3.95	1.25	1.25	1.20	1.30
3	1.40	1.30	1.30	1.10	1.20	.80	1.10	4.20	1.80	1.85	1.45	1.30
4	1.40	1.30	1.30	1.00	.90	.70	.90	4.30	1.45	1.40	1.45	1.30
5	1.30	1.30	1.30	1.00	.90	.70	.90	3.35	4.05	1.40	1.35	1.30
6	1.30	1.20	1.30	1.00	1.35	.70	.90	2.70	2.15	1.40	1.30	1.30
7	1.30	1.30	1.30	1.00	1.40	.70	.85	2.40	1.85	1.30	1.30	1.30
8	1.95	1.40	1.30	1.00	1.15	.70	.80	2.25	1.80	1.30	1.30	1.30
9	2.05	1.40	1.30	1.00	1.10	.70	.80	2.05	1.65	1.30	1.35	1.35
10	2.00	1.40	1.30	.90	1.00	.70	.80	1.95	1.75	1.20	1.40	1.55
11	2.00	1.40	1.30	.90	.90	.70	.75	1.85	1.90	1.20	1.30	1.50
12	2.20	1.60	1.30	.90	.90	.70	.70	1.80	2.05	1.30	1.30	1.60
13	2.10	1.65	1.30	2.20	.90	.80	.70	1.80	2.05	1.30	1.30	1.50
14	2.10	1.60	1.20	3.25	.90	.70	.70	1.90	1.85	1.30	1.30	1.50
15	2.10	1.60	1.20	1.60	.90	.60	.75	1.85	1.65	1.20	1.30	1.50
16	1.90	1.60	1.20	1.70	.90	.70	.80	2.00	1.60	1.30	1.20	1.40
17	1.80	1.60	1.20	1.30	.85	1.50	2.00	2.55	1.70	1.30	1.20	1.40
18	1.80	1.60	1.20	1.10	10.40	1.30	2.90	2.50	2.30	1.30	1.20	1.40
19	1.80	1.60	1.20	1.10	1.35	1.10	2.90	2.25	1.75	1.30	1.25	1.40
20	1.60	1.60	1.20	.90	1.10	1.05	2.50	2.15	1.55	1.30	1.30	1.40
21	1.60	1.60	1.20	.90	1.10	1.00	2.30	2.00	1.50	1.30	1.30	1.40
22	1.60	1.70	1.20	.90	1.10	.95	2.30	1.90	1.50	1.30	1.40	1.40
23	1.60	1.70	1.20	.90	1.00	.80	2.30	1.85	1.40	1.30	1.30	1.40
24	1.60	1.70	1.20	.90	.90	1.55	2.50	1.65	1.45	1.20	1.30	1.40
25	1.60	1.60	1.20	.90	.90	1.60	3.00	1.55	1.40	1.20	1.30	1.40
26	1.60	1.60	1.15	.90	.90	1.35	3.35	1.50	1.35	1.20	1.30	1.40
27	1.60	1.60	1.15	.90	.90	1.20	3.50	1.40	1.30	1.20	1.30	1.40
28	1.60	1.60	1.15	.90	.90	1.05	3.50	1.35	1.30	1.20	1.30	1.40
29	1.60	.....	1.15	.90	.80	1.20	3.55	1.30	1.30	1.20	1.30	1.40
30	1.60	.....	1.10	.90	.80	1.05	3.60	1.25	1.30	1.20	1.30	1.40
31	1.60	.....	1.10	.....	1.20	.....	3.75	1.20	.....	1.20	.....	1.40

Estimated monthly discharge of Pecos River near Moorhead, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	1,000	450	675	41,514
February	640	430	559	31,041
March	610	340	421	25,884
April	1,760	250	411	24,466
May	11,100	230	640	39,342
June	590	210	319	18,952
July	2,160	235	885	54,387
August	2,880	425	1,074	66,020
September	2,370	375	678	40,334
October	740	405	430	26,420
November	500	390	425	25,269
December	535	365	414	25,478
The year	11,100	210	578	419,107

PECOS RIVER, MARGUERETTA FLUME, AND WEST VALLEY DITCH, NEAR PECOS, TEX.

The summer flow of Pecos River is largely dependent upon numerous springs, which occur in the limestone country in the vicinity of Roswell and below. Owing to the numerous diversions for irrigating purposes, however, the river would be dry in the summer where it crosses into Texas were it not for the waters which are gradually returning to the river through seepage. This water, unfortunately, is impregnated to a considerable extent with alkali, which renders it undesirable for irrigating purposes.

The station on the Pecos River was established January 1, 1898, by Thomas U. Taylor, and is located about 6 miles above Pecos, Tex., at the flume of the Margueretta Canal Company. This canal diverts the water from the Pecos River 3 miles above the flume from the west side of the river. The main canal flows for 3 miles on the west side of the river and then is taken by the flume across the Pecos River to the east side. However, before it reaches the flume the West Valley canal is taken out of the main canal and is made to carry water to the alfalfa farms on the west side of the river. The gage consists of a graduated strip of wood attached to one of the vertical bents of the flume on the upper side of the same. The bench mark is on the top of the west abutment or pier on the north side, and its elevation is

20.70 feet above the datum of the gage. The channel at this point is nearly straight, the water at low stages rather sluggish, the banks high, and the bottom sandy. The gage heights on the flume are obtained by measuring the depths of the water in the flume at the west end. The zero of this gage is at the bottom of the flume. The gages of the river have no connection with each other except that they are geographically at the same place on the river and have the same observer, Willard H. Dennis, who reads both gages. For the years 1901 and 1902 Mr. Dennis has also taken the measurements of the flow of the Pecos, the flume, and the ditch at this station. The measurements are made above the flume by wading, a wire being stretched across the river and tagged every 4 feet. A full description of the canals and ditches in this section is given on page 62 of Water-Supply Paper No. 13.

Discharge measurements of Pecos River and Margueretta flume near Pecos, Tex.

Date.	Gage height Pecos River.	Pecos River discharge.	Margueretta flume discharge.
1902.	*Feet.*	*Second-feet.*	*Second-feet.*
September 29	2.00	119	.....
October 3	2.00	109	115
October 6	2.40	153	106
October 10	2.20	132	117
October 14	2.00	103	132
October 18	2.10	127	123
October 21	2.15	120	126
October 24	2.00	107	.....
October 27	2.30	162	130
November 3	1.90	97	126
December 3	3.60	390	82
December 4	3.30	306	87
December 6	2.80	221	99

Discharge of West Valley ditch near Pecos, Tex.

Date.	Discharge.	Date.	Discharge.	Date.	Discharge.
1902.	*Sec.-feet.*	1902.	*Sec.-feet.*	1902.	*Sec.-feet.*
March 24	10	June 16	16	October 6	6
March 31	10	June 23	14	October 10	9
April 8	10	June 29	14	October 13	14
April 14	14	July 6	10	October 14	13
April 21	16	August 24	16	October 18	15
April 28	14	August 31	10	October 19	12
May 5	16	September 7	16	October 21	11
May 12	14	September 14	16	October 26	7
May 18	16	September 21	14	October 27	8
May 26	16	September 28	14	November 2	7
June 2	18	October 3	14	November 3	7
June 9	14	October 5	9		

Daily gage height, in feet, of Pecos River near Pecos, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	4.90	2.80	2.60	0.90	0.40	0.50	1.10	4.45	2.00	2.00	1.90	2.60
2	5.10	2.80	2.70	.90	.40	.50	1.10	3.85	2.00	2.00	1.95	3.45
3	5.00	2.70	2.70	.85	.40	.50	1.10	3.65	2.00	2.10	2.00	3.65
4	5.00	3.30	2.70	.85	.40	.50	2.00	3.55	2.00	2.10	2.00	3.35
5	4.95	3.50	2.65	.85	.40	.50	1.65	3.20	3.15	2.30	2.00	3.30
6	5.00	3.50	2.60	.90	.40	.50	1.35	3.05	3.30	2.45	2.00	2.75
7	4.90	3.55	2.55	.90	.40	3.65	1.10	4.00	2.90	2.20	2.00	2.80
8	4.30	3.55	2.45	.80	.40	3.55	1.10	4.20	2.75	2.10	2.00	2.80
9	4.00	3.50	2.40	.65	.40	4.75	1.10	3.55	3.15	2.10	2.05	2.75
10	3.95	3.45	2.40	.55	.40	6.50	1.75	4.00	3.35	2.15	2.10	2.80
11	3.85	2.95	2.35	.50	.40	5.25	5.30	5.05	3.15	2.15	2.10	2.75
12	3.45	3.00	2.30	.50	.40	3.10	9.50	7.65	3.10	2.10	2.10	2.60
13	3.15	3.70	2.30	.50	.50	1.95	12.00	5.15	2.90	2.10	2.10	2.65
14	3.00	4.05	2.30	.50	.55	1.50	7.70	4.25	2.80	2.05	2.00	2.70
15	2.95	4.05	2.25	.50	.65	1.15	6.00	3.75	2.45	2.10	2.00	2.70
16	2.90	3.90	2.20	.50	.80	1.05	5.10	3.55	2.10	2.10	2.00	2.70
17	2.80	3.90	2.20	.40	.70	1.00	4.55	3.40	2.05	2.10	2.00	2.70
18	2.80	3.80	2.05	.40	.70	5.50	3.95	3.35	2.00	2.10	2.00	2.70
19	2.80	3.45	1.85	.40	.70	6.55	3.85	3.25	2.05	2.25	2.00	2.70
20	2.75	3.10	1.65	.40	.65	3.70	6.45	3.05	2.10	2.30	2.00	2.70
21	2.70	3.10	1.50	.40	.50	2.85	8.70	2.90	2.45	2.10	2.00	2.60
22	2.70	3.05	1.50	.40	.50	2.50	8.50	2.70	2.50	2.10	2.00	2.60
23	2.70	2.95	1.50	.40	.50	1.75	11.70	2.55	2.40	2.10	2.00	2.60
24	2.70	2.90	1.55	.40	.50	1.50	13.90	2.50	2.60	2.00	2.10	2.60
25	2.70	2.85	1.50	.40	.50	1.30	12.35	2.50	2.70	2.30	2.15	2.60
26	2.70	2.80	1.50	.40	.50	1.15	9.40	2.35	2.60	2.30	2.00	2.60
27	2.70	2.70	1.50	.40	.50	1.10	7.95	2.30	2.40	2.30	2.00	2.70
28	2.70	2.60	1.40	.40	.50	1.10	7.70	2.20	2.15	2.30	2.00	2.70
29	2.70	.....	1.30	.40	.50	1.10	7.35	2.15	2.00	2.15	2.15	2.70
30	2.70	.....	1.25	.40	.50	1.10	6.85	2.05	2.00	2.05	2.40	2.75
31	2.70	.....	1.05	.....	.50	.....	5.90	2.00	.....	2.00	.....	3.00

Daily gage height, in feet, of Margueretta flume near Pecos, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	2.95	2.52	2.50	2.00	1.75	1.85	1.90	0.00	2.30	2.15	2.20	2.15
2	3.00	2.50	2.50	1.95	1.85	1.95	1.75	.00	2.30	2.25	2.30	2.15
3	3.00	2.50	2.60	1.85	2.00	1.50	1.75	.60	2.30	2.35	2.25	1.95
4	3.00	2.65	2.60	1.85	1.85	1.45	2.05	1.25	2.15	2.20	2.30	2.05
5	3.05	2.60	2.60	1.60	1.70	1.62	2.20	1.55	1.60	2.40	2.35	2.15
6	3.10	2.55	2.60	1.60	1.65	1.65	1.65	1.90	3.00	2.30	2.30	2.10
7	3.00	2.55	2.60	1.55	1.70	2.50	1.30	2.30	1.85	2.00	2.30	2.05
8	2.78	2.55	2.58	1.50	1.70	2.50	1.30	2.85	1.10	2.00	2.30	2.10
9	2.85	1.40	2.55	1.50	1.70	2.55	1.95	.85	1.25	2.10	2.25	2.15
10	2.85	1.40	2.60	1.40	1.55	1.75	1.80	.95	1.35	2.10	2.20	2.20
11	2.85	1.25	2.52	1.65	1.50	1.95	1.45	3.00	1.15	2.05	2.20	2.20
12	2.75	1.35	2.42	2.10	1.60	2.30	1.90	.....	1.50	2.05	2.20	2.20
13	2.80	1.72	2.50	2.25	1.60	2.32	3.20	3.00	1.40	2.10	2.20	2.20
14	2.78	2.60	2.45	2.20	1.60	2.32	2.50	3.00	.80	2.10	2.15	2.20
15	2.78	2.50	2.25	2.00	1.75	1.78	1.10	2.90	1.00	2.10	2.15	2.30
16	2.80	2.40	2.25	1.75	2.10	1.50	.60	2.80	1.70	2.10	2.10	2.25
17	2.80	2.40	2.40	1.75	2.05	1.60	.15	2.25	1.70	2.20	2.10	2.20
18	2.90	2.40	2.40	1.80	2.00	2.25	.00	2.25	1.50	2.20	2.10	2.20
19	2.85	2.35	2.40	1.80	1.85	2.40	.00	2.15	2.65	2.10	2.10	2.20
20	2.80	2.20	2.35	1.90	1.60	2.50	1.15	1.65	2.10	2.10	2.10	2.20
21	2.80	2.20	2.48	1.90	1.50	2.45	2.05	2.35	1.80	2.30	2.15	2.20
22	2.85	2.20	2.40	1.70	1.60	2.20	3.10	2.15	1.80	2.30	2.20	2.30
23	2.80	2.20	2.40	1.40	1.60	2.30	3.35	1.60	1.85	2.30	2.20	2.30
24	2.80	2.10	1.85	1.35	1.75	2.20	3.65	1.50	2.10	2.40	2.20	2.30
25	2.75	2.30	1.90	1.45	2.00	2.05	3.50	1.50	2.20	2.45	2.20	2.30
26	2.75	2.40	2.00	1.65	1.95	1.85	3.10	1.50	2.05	2.35	2.20	2.20
27	2.75	2.50	2.00	1.65	1.70	1.75	2.30	1.60	2.10	2.35	2.15	2.30
28	2.75	2.40	2.05	1.75	1.65	1.68	2.50	2.05	2.10	2.40	2.15	2.30
29	2.75	.....	2.10	1.60	1.60	1.65	2.00	2.20	2.10	2.30	2.20	2.30
30	2.75	.....	1.80	1.65	1.45	1.90	.55	2.25	2.05	2.30	2.00	2.30
31	2.72	.....	1.90	.....	1.55	.....	.00	2.30	.....	2.30	.....	2.30

Rating table for Pecos River near Pecos, Tex., for 1902. [a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.7	77	3.0	240	4.3	574	8.0	2,022
1.8	83	3.1	260	4.4	606	8.5	2,222
1.9	90	3.2	280	4.5	640	9.0	2,422
2.0	98	3.3	302	4.6	674	9.5	2,622
2.1	107	3.4	324	4.7	710	10.0	2,822
2.2	117	3.5	348	4.8	746	10.5	3,022
2.3	128	3.6	372	4.9	784	11.0	3,222
2.4	140	3.7	398	5.0	822	11.5	3,422
2.5	154	3.8	425	5.5	1,022	12.0	3,622
2.6	170	3.9	453	6.0	1,222	12.5	3,822
2.7	186	4.0	482	6.5	1,422	13.0	4,022
2.8	204	4.1	512	7.0	1,622	13.5	4,222
2.9	222	4.2	542	7.5	1,822		

[a] This is made up from measurements of the river only; does not include ditch or flume.

Estimated monthly discharge of Pecos River near Pecos, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	862	185	381	23,427
February	497	170	304	16,88[illegible]
March 1 to 19 [a]			144	5,482
June 7 to 13 and 18 to 23 [a]			577	14,87[illegible]
July 10 to 31 [a]			1,881	82,080
August	1,882	98	383	23,550
September	313	98	167	9,937
October	147	98	112	6,887
November	140	90	102	6,069
December	385	170	205	12,59[illegible]

[a] As no discharge measurements have been made at low water, discharges for gage heights of less than 1.7 feet can not be computed. Gage height of 1.7 feet corresponds to a discharge of 77 second-feet. For periods not covered by above table discharges were less than 77 second-feet. See table of gage heights.

RIO GRANDE AT LANGTRY, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is located one-half mile south of Langtry station, on the Southern Pacific Railway, and is about 440 miles below El Paso, Tex., at the eastern end of the canyon section of the Rio Grande, and a short distance to the west of the mouth of Pecos River, one of the principal tributaries of the Rio Grande.

Discharge measurements of the Rio Grande at Langtry, Tex.

[Made by Jas. P. Hague and J. D. Dillard.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 3	0.9	806	February 14	0.95	542
January 7	.9	684	February 18	1.0	577
January 9	.9	592	February 21	.9	512
January 12	.9	649	February 25	.9	515
January 17	1.0	589	February 28	.9	531
January 20	1.0	651	March 3	.8	484
January 24	.9	554	March 6	.8	460
January 27	1.0	636	March 10	.8	458
January 31	.95	563	March 13	.8	454
February 3	1.0	571	March 15	.8	447
February 7	1.0	563	March 18	.75	409
February 11	.95	550	March 21	.75	424

Discharge measurements of the Rio Grande at Langtry, Tex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
March 25	.7	391	August 8	2.95	3,060
March 27	.7	403	August 13	2.3	2,043
March 31	.65	370	August 18	3.95	5,066
April 2	.65	362	August 22	4.0	5,263
April 5	.65	373	August 26	5.9	9,328
April 9	.65	361	August 30	5.45	8,268
April 12	.65	368	September 3	5.15	7,843
April 17	1.0	591	September 7	7.95	14,979
April 21	.7	378	September 11	10.65	23,471
April 24	.65	318	September 20	3.8	4,749
April 28	.65	304	September 24	3.1	3,261
May 2	.6	283	September 28	2.6	2,360
May 5	1.35	845	September 30	2.7	2,532
May 8	.65	310	October 3	2.75	2,523
May 12	.6	286	October 7	2.35	1,957
May 15	1.1	656	October 11	2.8	2,661
May 18	2.2	1,899	October 15	2.35	2,011
May 22	.75	362	October 19	2.0	1,540
May 26	.7	329	October 23	1.8	1,317
May 31	1.7	1,189	October 27	1.7	1,202
June 5	.75	358	October 31	1.65	1,142
June 9	.7	305	November 4	1.7	1,222
June 13	1.35	797	November 8	1.8	1,324
June 17	1.0	501	November 12	1.5	1,032
June 21	1.8	1,269	November 16	1.4	939
June 26	.7	316	November 20	1.35	868
July 1	1.9	1,360	November 24	1.35	863
July 5	.85	382	November 28	1.3	815
July 10	2.95	3,067	December 1	1.3	779
July 14	5.0	6,696	December 5	1.9	1,434
July 18	2.35	2,125	December 10	1.35	839
July 22	3.0	2,997	December 15	1.35	831
July 26	8.0	12,962	December 20	1.4	893
July 31	5.45	7,599	December 26	1.35	845
August 4	3.4	3,902			

Daily gage height, in feet, of the Rio Grande at Langtry, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	0.90	0.90	0.90	0.65	0.65	1.00	1.65	4.75	5.90	2.80	2.55	1.30
2	.90	1.00	.80	.65	.60	.85	.90	3.80	5.80	3.10	1.95	1.30
3	.90	1.00	.80	.65	.60	.80	1.00	3.40	5.45	3.40	2.15	1.60
4	.90	1.00	.80	.65	.70	.80	.90	3.25	6.40	3.20	1.95	1.70
5	.90	1.00	.80	.65	1.55	.75	.85	2.90	7.00	3.40	2.85	1.80
6	.90	1.00	.80	.65	.80	.75	.90	3.70	7.85	2.65	2.55	1.60
7	.90	1.00	.80	.65	.65	.70	1.10	3.70	8.10	2.40	2.00	1.60
8	.90	1.00	.80	.65	.65	.70	1.20	2.80	10.40	2.20	1.80	1.55
9	.90	1.00	.80	.65	.65	.70	2.20	2.65	14.65	2.20	1.65	1.50
10	.90	1.00	.80	.65	.65	1.00	3.05	2.50	12.95	2.10	1.55	1.35
11	.90	.95	.80	.65	.65	1.35	2.80	2.50	10.65	2.75	1.50	1.35
12	.90	.95	.80	.65	.60	1.70	2.90	2.45	10.05	2.70	1.50	1.30
13	.90	.95	.80	2.95	.60	1.40	7.00	4.65	8.85	2.60	1.45	1.30
14	1.10	.95	.80	1.00	.75	1.25	4.80	6.25	7.25	2.55	1.45	1.30
15	1.10	.95	.80	2.15	1.10	1.20	3.90	5.65	6.40	2.30	1.40	1.30
16	1.10	.90	.80	2.05	.95	1.10	3.50	5.25	5.70	2.20	1.40	1.40
17	1.00	.90	.80	1.40	.80	1.10	2.55	4.40	5.05	2.15	1.40	1.40
18	1.00	1.00	.75	.80	2.45	1.45	2.45	3.95	4.35	2.05	1.40	1.40
19	1.00	.90	.75	.80	1.15	1.80	2.95	3.95	4.05	2.00	1.40	1.40
20	1.00	.90	.75	.80	.85	1.80	2.60	4.05	3.95	1.95	1.40	1.40
21	1.00	.90	.75	.80	.80	1.80	3.20	3.95	6.25	1.90	1.35	1.40
22	1.00	.90	.75	.75	.75	1.10	2.90	3.90	5.05	1.85	1.35	1.40
23	1.00	.90	.70	.70	.75	1.00	4.35	3.75	3.55	1.80	1.35	1.40
24	.95	.90	.70	.65	1.30	.85	4.00	4.45	3.05	1.80	1.35	1.40
25	.90	.90	.70	.65	.80	.75	10.45	5.10	2.95	1.75	1.40	1.40
26	.95	.90	.70	.65	.75	.70	7.60	5.90	2.90	1.75	1.70	1.40
27	1.00	.90	.70	.65	.75	.70	7.45	5.15	2.75	1.70	1.40	1.40
28	1.00	.90	.70	.65	.75	.70	7.75	4.60	2.65	1.70	1.30	1.35
29	1.00	.....	.70	.65	1.60	.70	8.10	4.55	2.70	1.70	1.30	1.35
30	1.00	.....	.65	.65	1.60	4.10	5.80	5.60	2.70	1.65	1.30	1.35
31	.90	.....	.65	.....	1.60	.....	5.45	6.40	.....	1.60	.....	1.35

Estimated monthly discharge of the Rio Grande at Langtry, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	820	550	663	40,760
February	580	510	542	30,089
March	530	370	435	26,717
April	3,380	305	611	36,367
May	2,250	285	544	33,451
June	5,170	305	745	44,301
July	20,800	380	4,964	305,216
August	10,550	2,250	5,672	348,734
September	38,200	2,440	11,160	664,048
October	3,900	1,080	1,948	119,782
November	2,740	815	1,190	70,809
December	1,330	780	917	56,379
The year	38,200	285	2,449	1,776,633

RIO GRANDE BELOW PRESIDIO, TEX.

This station was established April 8, 1900, by the International (Water) Boundary Commission. It is 6 miles below Presidio, also below the mouth of Conchos River, and about 215 miles below El Paso. It is at the western end of the canyon section of the Rio Grande. The discharge at this station, minus the discharge at the station above Presidio, Tex., gives the discharge of the Conchos, except at rare intervals when some rain water enters the Rio Grande from the north.

Discharge measurements of the Rio Grande below Presidio, Tex. [a]

[Made by S. D. Church and J. P. Hague.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
March 3	4.2	98	June 11	4.7	26
March 6	4.2	85	June 13	5.2	74
March 10	4.1	77	June 16	4.7	30
March 12	4.0	58	June 20	4.5	15
March 14	3.9	52	July 2	8.55	2,275
March 17	3.9	51	July 4	5.0	170
March 19	3.9	48	July 7	7.3	517
March 21	3.8	41	July 9	8.9	3,086
March 24	3.8	35	July 14	8.05	2,156
March 26	3.7	30	July 16	8.2	2,265
March 28	3.7	32	July 18	7.65	1,473
April 2	3.7	32	July 21	9.4	4,883
April 4	3.7	32	July 22	11.0	9,539
April 7	3.7	29	July 24	12.15	13,706
April 9	3.6	26	July 26	12.2	14,352
April 11	3.6	25	July 28	11.4	10,579
April 14	3.6	22	July 30	9.6	5,313
April 16	3.6	23	August 1	8.9	3,601
April 18	3.6	22	August 4	7.6	1,854
April 21	3.5	20	August 6	8.3	1,909
April 23	3.5	21	August 8	7.7	1,528
April 25	3.5	20	August 10	8.3	1,794
May 5	3.4	13	August 12	10.8	7,030
May 7	3.4	12	August 14	10.2	5,999
May 9	3.4	11	August 16	10.25	6,082
May 12	3.4	10	August 18	9.75	4,971
May 20	3.5	8	August 20	9.85	5,426
June 6	3.9	7	August 22	9.8	5,416
June 9	6.85	405	August 24	11.3	8,831

[a] No measurements for January and February, 1902. Daily flow computed from gage record.

Discharge measurements of the Rio Grande below Presidio, Tex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
August 26	10.0	5,776	October 20	6.2	906
August 28	11.4	10,361	October 23	6.05	845
August 30	11.45	10,522	October 25	6.0	815
September 1	10.15	5,781	October 27	5.8	721
September 4	12.85	15,932	October 30	6.05	834
September 8	16.75	32,962	November 1	5.7	711
September 9	13.7	23,771	November 4	5.65	697
September 11	12.5	17,686	November 7	5.4	587
September 15	10.5	7,169	November 10	5.4	588
September 17	8.3	3,669	November 13	5.2	532
September 19	8.2	3,396	November 16	5.15	485
September 20	7.7	2,652	November 19	5.1	451
September 22	7.5	2,125	November 22	5.05	446
September 24	7.5	2,125	November 25	5.0	420
September 25	7.5	2,157	November 28	5.0	413
September 27	7.3	1,933	December 1	6.5	974
September 29	7.15	1,742	December 6	5.4	542
October 1	7.1	1,617	December 9	5.2	498
October 3	6.85	1,438	December 12	5.2	492
October 6	6.65	1,245	December 15	5.35	574
October 8	7.6	2,230	December 18	5.3	530
October 10	7.2	1,963	December 21	5.25	481
October 13	6.8	1,758	December 24	5.05	401
October 15	6.6	1,080	December 27	5.05	415
October 17	6.4	1,010	December 30	5.05	404

Daily gage height, in feet, of the Rio Grande below Presidio, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	5.00	4.80	4.20	3.70	3.45	3.90	4.75	8.70	10.60	7.10	5.80	6.75
2	4.95	4.75	4.20	3.70	3.40	3.90	8.15	8.20	10.20	8.15	6.65	5.35
3	4.90	4.65	4.20	3.70	3.40	3.90	5.50	7.90	11.10	6.85	7.25	5.25
4	4.80	4.60	4.20	3.70	3.40	3.90	5.00	7.65	12.85	6.80	5.80	5.10
5	4.90	4.60	4.20	3.70	3.40	3.90	5.00	7.70	14.25	6.80	5.65	5.15
6	5.15	4.60	4.20	3.70	3.40	3.90	6.60	8.45	16.50	6.65	5.50	5.35
7	5.40	4.70	4.20	3.70	3.40	3.90	7.45	7.55	17.95	7.45	5.45	5.25
8	5.35	4.65	4.15	3.70	3.40	5.60	8.40	7.70	16.65	7.65	5.40	5.20
9	5.25	4.55	4.10	3.60	3.40	7.40	9.10	7.50	14.00	7.45	5.40	5.20
10	5.15	4.45	4.10	3.60	3.40	5.30	11.60	8.40	12.90	7.25	5.40	5.20
11	5.10	4.40	4.10	3.60	3.40	4.70	12.20	11.50	12.65	7.10	5.30	5.20
12	5.10	4.40	4.00	3.60	3.40	4.70	10.30	11.40	12.45	6.90	5.30	5.20
13	5.10	4.35	3.90	3.60	3.40	5.20	9.15	10.40	12.15	6.80	5.15	5.15
14	5.00	4.30	3.90	3.60	4.35	5.10	8.05	10.30	11.05	6.70	5.20	5.20

Daily gage height, in feet, of the Rio Grande below Presidio, Tex.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
15	5.00	4.30	3.90	3.60	3.80	4.85	7.70	10.10	10.55	6.60	5.20	5.35
16	4.90	4.30	3.90	3.60	3.60	4.70	8.20	10.20	9.35	6.50	5.15	5.40
17	4.80	4.30	3.90	3.60	3.60	4.80	7.80	9.70	8.50	6.40	5.10	5.30
18	4.90	4.30	3.90	3.60	3.50	4.55	7.65	9.90	8.30	6.30	5.10	5.30
19	5.15	4.30	3.90	3.50	3.50	4.55	7.40	9.90	8.15	6.20	5.10	5.30
20	5.15	4.30	3.90	3.50	3.50	4.90	9.30	9.85	7.75	6.20	5.10	5.20
21	5.00	4.30	3.80	3.50	3.50	4.40	9.40	10.00	7.60	6.20	5.10	5.25
22	5.00	4.25	3.80	3.50	3.50	4.40	12.25	9.95	7.50	6.10	5.05	5.10
23	4.90	4.20	3.80	3.50	3.50	4.40	12.60	10.80	7.60	6.05	5.00	5.10
24	4.80	4.20	3.80	3.50	3.50	4.40	12.10	11.40	7.50	6.00	5.00	5.05
25	5.10	4.20	3.80	3.50	5.55	4.40	12.10	11.40	7.45	6.00	5.00	5.05
26	5.30	4.20	3.70	3.50	4.00	4.40	12.75	10.20	7.50	5.90	5.00	5.05
27	5.30	4.20	3.70	3.50	3.90	4.40	12.00	10.80	7.35	5.80	5.00	5.05
28	5.20	4.20	3.70	3.50	3.90	4.40	11.50	11.50	7.25	5.80	5.00	5.05
29	5.15	.....	3.70	3.50	3.90	4.30	10.50	11.55	7.15	5.80	5.00	5.05
30	5.00	.....	3.70	3.50	3.90	4.30	9.60	11.40	7.10	6.00	5.00	5.05
31	4.90	.....	3.70	.....	3.90	.....	8.95	11.30	.....	5.85	.....	5.00

Estimated monthly discharge of the Rio Grande below Presidio, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	350	220	259	15,907
February	220	100	141	7,835
March	100	30	59	3,610
April	30	20	24	1,448
May	15	10	11	674
June	625	10	48	2,866
July	17,100	40	5,918	363,888
August	10,900	1,300	5,702	350,618
September	45,000	1,680	10,755	639,947
October	3,320	720	1,305	80,212
November	2,000	415	590	35,098
December	1,070	380	493	30,317
The year	45,000	10	2,109	1,532,420

RIO GRANDE ABOVE PRESIDIO, TEX.

This station was established April 4, 1900, by the International (Water) Boundary Commission. It is 7 miles above Presidio and above the mouth of Conchos River, one of the principal tributaries of the Rio Grande, and is about 200 miles below El Paso. Its location is far enough above the mouth of Conchos River to be free from the effects of backwater from that stream.

Discharge measurements of the Rio Grande above Presidio, Tex.[a]

[Made by J. P. Hague.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
July 5	1.4	53	August 11	5.5	1,254
July 10	4.0	857	August 13	2.65	188
July 12	4.1	943	August 15	2.4	165
July 15	2.55	289	September 2	2.0	107
July 17	1.95	143	September 5	3.45	635
July 19	1.55	61	September 8	2.1	186
July 23	7.3	2,683	September 10	2.0	99
July 25	5.6	1,326	October 12	.7	15
July 29	2.15	193	November 3	1.5	60
July 31	1.75	62	November 5	1.0	13
August 2	.9	14	November 8	.8	9

[a] No measurements made at this station during January, February, and December, 1902. Daily flow computed from gage record. River was dry during May and June, 1902.

Daily gage height, in feet, of the Rio Grande above Presidio, Tex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.20	1.30	.....	.....	.....	.....	.....	1.60	3.55	.....	0.90	2.30
2	1.20	1.30	.....	.....	.....	.....	3.05	0.95	3.55	.....	3.55	0.70
3	1.10	1.25	.....	.....	.....	.....	0.75	.....	4.85	.....	1.75	0.30
4	1.00	1.20	.....	.....	.....	.....	1.95	.....	4.95	.....	1.20	.....
5	1.10	1.20	.....	.....	.....	1.20	1.40	.....	3.40	1.65	1.00	.....
6	1.35	1.30	.....	.....	.....	.....	.....	.....	4.35	0.75	0.90	.....
7	1.60	1.40	.....	.....	.....	.....	.....	.....	3.65	.....	1.05	.....
8	1.50	1.40	.....	.....	.....	0.55	.....	.....	2.15	.....	0.85	.....
9	1.50	1.30	.....	.....	.....	.....	.....	.....	2.00	.....	0.25	.....
10	1.40	1.25	.....	.....	.....	.....	4.05	1.20	1.90	.....	.....	.....
11	1.40	1.20	.....	.....	.....	.....	6.45	5.50	0.80	.....	.....	.....
12	1.40	1.10	.....	.....	.....	.....	3.90	5.20	.....	0.60	.....	.....
13	1.40	0.90	.....	.....	.....	.....	2.75	2.50	.....	.....	.....	.....
14	1.30	0.70	.....	.....	.....	.....	2.30	3.10	.....	.....	.....	.....
15	1.30	0.50	.....	.....	.....	.....	2.55	2.20	.....	.....	.....	.....
16	1.20	0.30	.....	.....	.....	.....	2.15	1.15	.....	.....	.....	.....
17	1.10	(a)	.....	.....	.....	.....	1.85	.....	.....	.....	.....	.....
18	1.30	.....	.....	.....	.....	.....	1.50	.....	.....	.....	.....	.....
19	1.50	.....	.....	.....	.....	.....	1.50	.....	.....	.....	.....	.....
20	1.50	.....	.....	.....	.....	.....	3.20	.....	.....	.....	.....	.....
21	1.40	.....	.....	.....	.....	.....	5.25	.....	.....	.....	.....	.....
22	1.40	.....	.....	.....	.....	.....	4.80	.....	.....	.....	.....	.....
23	1.30	.....	.....	.....	.....	.....	7.40	.....	.....	.....	.....	.....
24	1.20	.....	.....	.....	.....	.....	6.55	.....	.....	.....	.....	.....
25	1.50	.....	.....	.....	.....	.....	5.70	.....	.....	.....	.....	.....
26	1.65	.....	.....	.....	.....	.....	3.70	.....	.....	.....	.....	.....
27	1.70	.....	.....	.....	.....	.....	2.80	.....	.....	.....	.....	.....
28	1.60	.....	.....	.....	.....	.....	2.60	.....	.....	.....	.....	.....
29	1.60	.....	.....	.....	.....	.....	2.30	.....	.....	.....	.....	.....
30	1.50	.....	.....	.....	.....	.....	2.25	.....	.....	.....	.....	.....
31	1.40	.....	.....	.....	.....	.....	1.75	.....	.....	.....	.....	.....

[a] On days for which there are no gage heights the river was dry.

Estimated monthly discharge of the Rio Grande River above Presidio, Tex.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	130	40	77	4,741
February	70	0	29	1,607
March	0	0	0	0
April	0	0	0	0
May	0	0	0	0
June	60	0	3	159
July	2,740	0	568	34,929
August	1,250	0	102	6,288
September	1,080	0	205	12,198
October	70	0	3	198
November	670	0	28	1,676
December	240	0	8	496
The year	2,740	0	85	62,292

RIO GRANDE NEAR FORT HANCOCK, TEX.

This station was established by the International (Water) Boundary Commission March 27, 1900. It is 1½ miles southeast of Fort Hancock, on the Southern Pacific Railway, in the El Paso Valley, and is about 55 miles below El Paso.

Discharge measurements of the Rio Grande near Fort Hancock, Tex.[a]

[Made by A. L. Wilcox and F. W. Carpenter.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
July 21	2.5	6	September 4	4.5	249
July 23	3.0	18	September 6	3.4	81
July 24	2.4	5	September 9	3.2	72
August 30	6.3	808	September 12	2.1	8
September 1	7.0	1,034	October 7	2.5	16

[a] No measurements made at this station during months of January and February.

Daily flow computed from gage heights.
River was dry during March, April, May, and June, 1902.
No measurements were made at this station during November and December, 1902. River was dry.

Daily gage height, in feet, of the Rio Grande near Fort Hancock, Tex.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	4.80	5.30	.....	.....	.....	.....	.....	.....	6.90	3.35	.....	.....
2	4.90	5.50	.....	.....	.....	.....	.....	.....	5.85	3.05	.....	.....
3	5.00	5.60	.....	.....	.....	.....	.....	.....	5.20	2.70	.....	.....
4	5.10	5.50	.....	.....	.....	.....	.....	.....	4.60	3.65	.....	.....
5	5.10	5.40	.....	.....	.....	.....	.....	.....	4.00	3.90	.....	.....
6	5.10	5.30	.....	.....	.....	.....	.....	.....	3.35	2.90	.....	.....
7	5.20	5.30	.....	.....	.....	.....	.....	.....	3.30	2.35	.....	.....
8	5.30	5.20	.....	.....	.....	.....	.....	.....	3.20	2.00	.....	.....
9	5.30	5.10	.....	.....	.....	.....	.....	.....	3.15	.....	.....	.....
10	5.40	5.20	.....	.....	.....	.....	.....	.....	2.75	.....	.....	.....
11	5.50	5.20	.....	.....	.....	.....	.....	.....	2.40	.....	.....	.....
12	5.50	5.20	.....	.....	.....	.....	.....	.....	2.10	.....	.....	.....
13	5.60	5.30	.....	.....	.....	.....	4.30	.....	2.00	.....	.....	.....
14	5.70	5.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	5.70	5.30	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	5.80	5.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
17	5.80	4.95	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	5.70	4.75	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	5.70	4.55	.....	.....	.....	.....	.....	.....	2.45	.....	.....	.....
20	5.50	4.35	.....	.....	.....	.....	5.40	.....	2.40	.....	.....	.....
21	5.80	4.00	.....	.....	.....	.....	2.15	.....	2.10	.....	.....	.....
22	5.75	3.75	.....	.....	.....	.....	4.40	.....	.....	.....	.....	.....
23	5.80	.....	.....	.....	.....	.....	3.50	.....	.....	.....	.....	.....
24	5.70	.....	.....	.....	.....	.....	2.40	.....	.....	.....	.....	.....
25	5.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	5.60	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	5.60	.....	.....	.....	.....	.....	3.40	.....	.....	.....	.....	.....
28	5.60	.....	.....	.....	.....	.....	2.60	.....	.....	.....	.....	.....
29	5.60	.....	.....	.....	.....	.....	.....	.....	5.15	.....	.....	.....
30	5.50	.....	.....	.....	.....	.....	.....	5.00	4.05	.....	.....	.....
31	5.40	.....	.....	.....	.....	.....	.....	7.30	.....	.....	.....	.....

[a] On the days for which no gage heights are given the river was dry.

Estimated monthly discharge of the Rio Grande near Fort Hancock, Tex. [a]

Month.[a]	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1902.				
January	160	40	112	6,883
February	120	0	57	3,154
July	460	0	26	1,587
August 30 and 31	1,090	0	47	2,916
September	1,000	0	122	7,240
October	165	0	17	1,061
The year	1,090	0	32	22,841

[a] For the months for which no figures are given the river was dry.

RIO GRANDE NEAR EL PASO, TEX.

This station was located at the pumping house of the smelter company, 3 miles north of El Paso, Tex. The bed of the stream here is composed of mud, constantly shifting and changing. May 1, 1897, the station was placed under the charge of W. W. Follett, consulting engineer, International (Water) Boundary Commission, and by him removed 1 mile farther up the river to Courchesne's limekiln. The river heights were measured at the masonry pump foundation pier, 150 feet above the kiln. The top of the downstream chisel draft on this pier was assumed to be at a gage height of 15.0 feet, and the distance of the surface of the water below it was measured with a carefully graduated rod. This pier was torn down in October, 1902, and an inclined wooden gage established some 60 feet upstream. This is a 2 by 4 bolted to 1¼-inch steel bars set with cement in holes drilled in solid rock. The graduations are notches cut in the scantling. The B. M. is a one-half-inch iron bolt set in solid rock at the head of the gage. Its top is 13.00 feet above gage datum. The left bank of the river is formed by the loose rock fill of the Atchison, Topeka and Santa Fe Railroad embankment, and will not overflow. The right bank, however, is not so good, being made ground and subject to overflow. The bottom of the river here has also proven unstable, scouring on a rise and filling on a falling river. It is probably the best site for a station in the vicinity of El Paso, however, as the entire river bed is constantly shifting for many miles above and below. On account of this shifting character of the stream, the only accurate method of estimating the daily discharges is by taking a large number of measurements, which was done in 1902 by T. M. Courchesne, J. P. Hague, A. L. Wilcox, F. W. Carpenter, and I. H. Huggett.

Discharge measurements of the Rio Grande near El Paso, Tex. [a]

[Made by T. M. Courchesne, Jas. P. Hague, A. L. Wilcox, and F. W. Carpenter, and I. H. Huggett.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 30	6.3	145	May 2	5.85	64
February 1	6.4	165	May 5	5.4	19
April 18	6.75	262	May 7	5.2	5
April 21	7.0	301	June 3	6.05	134
April 22	6.6	195	June 4 [b]	5.4	17
April 24	6.6	200	August 27	9.0	1,578
April 26	7.3	465	August 28	6.3	937
April 28	7.3	441	August 29	9.8	2,050
April 30	6.3	145	August 31	9.0	1,190

[a] No measurement for March. Water too shallow.
[b] River dry the remainder of month, throughout July, and until August 27.

Discharge measurements of the Rio Grande near El Paso, Tex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
September 2	7.5	645	October 4	5.6	52
September 5	6.2	160	October 6	5.5	47
September 8	5.6	73	October 8	5.35	37
September 10	5.4	23	October 10	5.3	29
September 13	5.1	5	October 15	4.9	8
September 27	7.9	653	October 17	4.85	4
September 28	7.1	369	December 22	5.9	117
September 30	6.4	171	December 24	5.6	80
October 2	6.0	101	December 26	5.2	34
October 3	5.9	85	December 29	4.7	4

No measurements for November.

Daily gage height, in feet, of the Rio Grande near El Paso, Tex.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	6.30	6.40	4.90	4.90	5.90	.....	.....	.....	8.10	6.15	.....	5.30
2	6.30	6.40	4.90	4.90	5.80	.....	.....	.....	7.50	6.00	.....	5.30
3	6.30	6.30	4.90	4.90	5.75	6.05	.....	.....	7.00	5.95	.....	5.25
4	6.30	6.30	4.90	4.90	5.45	5.25	.....	.....	6.40	5.65	.....	5.20
5	6.30	6.30	4.90	4.90	5.35	5.00	.....	.....	6.20	5.50	.....	5.30
6	6.30	6.20	4.90	4.90	5.20	.....	.....	.....	6.00	5.45	.....	5.40
7	6.30	6.20	4.90	4.90	5.20	.....	.....	.....	5.80	5.40	.....	5.35
8	6.30	6.20	4.90	4.90	5.20	.....	.....	.....	5.60	5.40	.....	5.25
9	6.30	6.10	4.90	4.90	5.20	.....	.....	.....	5.50	5.35	.....	5.20
10	6.30	6.00	4.90	4.90	5.20	.....	.....	.....	5.40	5.30	.....	5.10
11	6.30	6.00	4.90	4.90	5.20	.....	.....	.....	5.30	5.30	.....	5.00
12	6.30	6.00	4.90	4.90	5.10	.....	5.05	.....	5.20	5.20	.....	4.90
13	6.30	6.00	4.90	4.90	.....	.....	.....	.....	5.10	5.20	.....	4.75
14	6.30	6.05	4.90	4.90	.....	.....	.....	.....	.....	5.15	.....	4.70
15	6.30	6.20	4.90	4.90	.....	.....	.....	.....	.....	4.95	.....	4.70
16	6.30	6.30	4.90	4.90	.....	.....	.....	.....	.....	4.90	.....	.....
17	6.30	6.25	4.90	4.90	.....	.....	.....	.....	.....	4.90	.....	.....
18	6.30	6.20	4.90	6.80	.....	.....	.....	.....	.....	4.90	.....	.....
19	6.30	6.20	4.90	6.90	.....	.....	.....	.....	.....	.....	.....	.....
20	6.30	6.20	4.90	6.90	.....	.....	.....	.....	.....	.....	.....	.....
21	6.30	6.10	4.90	6.95	.....	.....	.....	.....	.....	.....	.....	5.30
22	6.30	5.95	4.90	6.65	.....	.....	.....	.....	.....	.....	.....	5.90
23	6.30	5.75	4.90	6.60	.....	.....	.....	.....	.....	.....	.....	5.65
24	6.30	5.50	4.90	6.55	.....	.....	.....	.....	.....	.....	.....	5.45
25	6.30	5.30	4.90	6.80	.....	.....	.....	.....	.....	.....	.....	5.35
26	6.30	5.05	4.90	7.30	.....	.....	.....	.....	7.60	.....	5.30	5.15
27	6.30	5.00	4.90	7.50	.....	.....	.....	6.30	7.85	.....	5.30	5.05
28	6.30	5.00	4.90	7.25	.....	.....	.....	7.75	7.10	.....	5.30	4.95
29	6.30	.....	4.90	6.70	.....	.....	.....	9.95	6.55	.....	5.30	4.75
30	6.30	.....	4.90	6.30	.....	.....	.....	9.40	6.35	.....	5.30	4.70
31	6.30	.....	4.90	.....	.....	.....	.....	9.05	.....	.....	.....	4.70

[a] On the days for which no gage heights are given the river was dry.

Estimated monthly discharge of the Rio Grande near El Paso, Tex.

[Drainage area, 30,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	140	130	135	8,291	0.0045	0.0052
February	160	30	104	5,772	.0035	.0036
March	20	10	10	635	.0003	.0003
April	540	10	133	7,904	.0044	.0049
May	75	0	9	526	.0003	.0003
June	135	0	5	307	.0002	.0002
July	10	0	0	20	.0000	.0000
August	2,140	0	236	14,499	.0079	.0091
September	860	0	156	9,313	.0052	.0058
October	115	0	23	1,428	.0008	.0009
November	30	0	5	298	.0002	.0002
December	115	0	29	1,775	.0010	.0012
The year	2,140	0	70	50,768	.0024	.0317

RIO GRANDE NEAR SAN MARCIAL, N. MEX.

This station is located about one-half mile south of San Marcial, N. Mex., at the bridge of the Atchison, Topeka and Santa Fe Railroad. The original gage was established by Arthur P. Davis on January 29, 1895. The observer was Bert Halseth, San Marcial, N. Mex., whose house is about one-half mile distant. The gage was of hard pine timber, 9 by 5 inches by 25 feet, anchored and bolted to the east end of the second pier from the south. It was inclined and painted white. The distance between the footmarks was 1.6 feet. The 13-foot mark was level with the extension of the pier, to which the gage was anchored. The 15-foot mark was level with the top of the capstone on which the bridge truss rests. Measurements were made from the same bridge. On August 8, 1889, a station was established near San Marcial, and a measurement was made which gave a discharge of 19 second-feet. Soon after this date, however, the river gage was destroyed and the locality was abandoned until 1895.

In 1896 the inclined gage was carried away and a wire gage was put in its place. The wire gage is attached to the guard rail of the bridge, south span, lower side. Bench mark No. 1 is the top of the capstone on which the bridge truss rests, and is at an elevation of 15 feet above gage datum; bench mark No. 2 is the top of the extension of the pier to which the old vertical gage was fastened, and is at an elevation of 13 feet above gage datum. The wire gage has been abandoned and the gage heights are now measured with a graduated rod from the deck of th bridge but using the old gage datum. The channel is

sandy and shifting. A number of bridge piers interfere with the current to a certain extent, but not with the observed gage heights. They sometimes affect the discharge measurements.

Discharge measurements of the Rio Grande near San Marcial, N. Mex.

[Made by W. W. Sentman and J. R. Nisbet.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 1	7.2	389	April 24	8.3	1,441
January 3	7.15	348	April 26	7.9	763
January 6	7.3	469	April 28	7.7	575
January 27	7.4	238	April 30	7.9	583
January 30	7.3	291	May 2	7.7	378
February 3	7.4	383	May 8	7.4	221
February 5	7.4	425	May 10	7.5	250
February 7	7.45	331	May 12	7.6	281
February 10	7.6	340	May 14	7.7	298
February 12	7.4	358	May 16	8.1	906
February 14	7.4	266	May 20	7.8	470
February 17	7.5	296	May 22	7.5	325
February 20	7.4	279	May 24	7.4	232
February 22	7.4	294	May 26	7.1	105
February 24	7.4	298	May 28	6.6	33
February 28	7.4	222	May 29	8.2	1,473
March 4	7.3	218	May 31	7.7	773
March 6	7.3	195	June 3	7.4	451
March 8	7.3	178	June 5	7.4	363
March 10	7.1	157	June 7	7.2	191
March 12	6.9	84	June 9	7.1	119
March 15	6.5	49	June 12 [a]	6.7	42
March 17	6.8	88	August 12	7.35	198
March 19	7.1	132	August 14	6.9	51
March 21	7.0	84	August 16	7.5	243
March 27	7.1	113	August 18	7.25	82
March 29	7.2	113	August 27	8.25	2,385
March 31	7.1	115	August 31	6.6	321
April 2	7.0	99	September 2	6.5	89
April 4	6.9	69	September 4	5.4	29
April 7	6.4	23	September 6	5.0	10
April 9	5.8	2	September 23	8.4	2,418
April 12	8.1	841	September 26	6.3	497
April 14	8.3	1,275	September 28	5.9	142
April 16	8.3	1,307	October 3	5.2	25
April 18	8.3	1,157	October 6	4.9	19
April 22	8.2	912	October 9	5.0	17

[a] River dry the balance of the month and during July.

Discharge measurements of the Rio Grande near San Marcial, N. Mex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
October 12	4.9	14	November 30	6.0	156
October 15	4.8	7	December 3	6.0	104
October 30	4.9	12	December 6	6.1	134
November 2	5.0	13	December 9	6.2	142
November 4	5.0	18	December 14	6.3	151
November 7	5.1	17	December 17	6.7	244
November 10	5.1	18	December 20	6.3	80
November 13	5.2	31	December 22	5.9	60
November 16	6.4	202	December 25	6.5	289
November 20	6.0	117	December 28	6.4	258
November 24	5.9	122	December 31	6.25	186
November 28	5.95	158			

Daily gage height, in feet, of the Rio Grande near San Marcial, N. Mex.[a]

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	7.25	7.35	7.35	7 10	7.80	7.50	.....	.....	6.35	5.35	5.00	6.00
2	7.15	7.30	7.50	7.00	7.65	7.40	.....	.....	6.40	5.70	5.00	6.00
3	7.25	7.35	7.45	6.90	7.60	7.35	.....	.....	5.70	5.25	5.00	6.00
4	7.35	7.45	7.35	6.85	7.55	7.40	.....	.....	5.45	5.05	5.00	5.60
5	7.35	7.40	7.35	6.70	7.35	7.40	.....	.....	5.15	5.00	5.00	5.70
6	7.30	7.50	7.30	6.55	7.45	7.30	.....	.....	5.05	4.90	5.00	6.15
7	7.30	7.45	7.30	6.40	7.40	7.20	.....	.....	.....	4.80	5.10	6.15
8	7.30	7.55	7.30	6.20	7.40	7.20	.....	.....	.....	5.15	5.10	6.15
9	7.15	7.50	7.20	5.80	7.65	7.15	.....	.....	.....	5.10	5.10	6.20
10	7.05	7.60	7.20	.....	7.55	7.05	.....	.....	.....	5.00	5.10	6.25
11	7.10	7.40	7.05	.....	7.50	6.85	.....	.....	.....	4.95	5.10	6.30
12	7.10	7.45	6.90	8.20	7.60	6.70	.....	7.00	.....	4.90	5.10	6.30
13	7.35	7.35	6.80	8.20	7.70	6.55	.....	7.05	.....	4.90	5.20	6.30
14	7.40	7.40	6.70	8.35	7.70	.....	.....	7.80	.....	4.90	5.20	6.30
15	7.40	7.40	6.50	8.35	7.75	.....	.....	8.50	.....	4.80	5.80	6.50
16	7.35	7.50	6.50	8.40	8.50	.....	.....	7.55	.....	4.80	6.30	6.90
17	7.40	7.50	6.95	8.25	8.05	.....	.....	7.25	.....	.....	6.20	6.70
18	7.40	7.55	7.10	8.30	7.80	.....	.....	7.20	.....	.....	6.05	6.60
19	7.30	7.50	7.20	8.00	7.80	.....	.....	6.90	.....	.....	6.00	6.40
20	7.35	7.45	7.20	8.15	7.75	.....	.....	6.65	.....	.....	6.00	6.30
21	7.30	7.35	7.10	8.20	7.65	.....	.....	.....	.....	.....	5.95	5.95
22	7.30	7.40	6.95	8.30	7.55	.....	.....	.....	6.20	.....	5.90	5.95
23	7.35	7.40	6.75	8.45	7.45	.....	.....	.....	8.45	.....	5.90	6.45
24	7.35	7.45	6.60	8.30	7.35	.....	.....	7.25	7.85	4.80	5.85	6.55
25	7.40	7.40	6.60	8.10	7.15	.....	.....	9.05	6.70	4.80	5.80	6.50
26	7.30	7.40	6.65	7.90	7.00	.....	.....	11.10	6.25	4.80	5.70	6.40
27	7.40	7.40	7.20	7.90	6.95	.....	.....	8.45	6.15	4.80	5.70	6.45
28	7.35	7.40	7.30	7.70	6.65	.....	.....	7.85	6.00	4.80	5.80	6.50
29	7.30	.....	7.25	7.85	8.20	.....	.....	7.45	5.85	4.90	6.00	6.70
30	7.35	.....	7.25	7.85	8.35	.....	.....	7.40	5.55	4.90	6.00	6.45
31	7.35	.....	7.20	.....	7.65	.....	.....	6.65	.....	4.90	.....	6.40

[a] There was no flow on days for which no gage height s are given.

Estimated monthly discharge of the Rio Grande near San Marcial, N. Mex.

[Drainage area, 28,067 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	500	300	370	22,731	0.0132	0.0152
February	480	220	314	17,435	.0112	.0117
March	250	50	129	7,954	.0046	.0053
April	1,650	0	674	40,106	.0240	.0268
May	1,710	35	436	26,787	.0155	.0179
June	560	0	108	6,407	.0038	.0042
July	[a]0	[a]0	[a]0	[a]0	[a]0	[a]0
August	10,500	0	800	49,210	.0285	.0329
September	2,460	0	224	13,349	.0080	.0089
October	75	0	13	823	.0005	.0006
November	180	15	78	4,641	.0028	.0031
December	350	65	184	11,286	.0066	.0076
The year	10,500	0	278	200,729	.0099	.1342

[a] River dry June 14 to August 11, inclusive.

RIO GRANDE AT WATER TANK, NEAR RIO GRANDE, OR BUCKMAN, N. MEX.

Three miles below Embudo the river emerges into Espanola Valley, through which it continues for a few miles and then enters White Rock Canyon, flowing through that canyon for 30 miles. At the lower end of this canyon the river emerges into Albuquerque Valley, and so continues down to about Socorro. This valley averages from 1 to 3 miles in width, and has been irrigated for a great many years by the Mexican settlers. Their primitive methods of irrigation are very wasteful of the waters, so that the duty of water in this section, about 17 acres per second-foot, is not as high as it might be. During the last few years, however, a number of important and modern irrigation systems have been planned and built in the vicinity of Albuquerque. The gaging station, established February 2, 1895, is located about one-fourth of a mile above Water Tank, a section on the Santa Fe Southern Railroad, below Espanola. It was established by Arthur P. Davis and P. E. Harroun on February 1, 1895. The observer is Thomas Dupre, section foreman, whose house is distant from the gaging station about one-fourth of a mile. The inclined portion of the gage is marked from 3.5 feet to 10.6 feet; the vertical portion from 10.6 feet to 16 feet. The inclined part of the gage is braced with wood and anchored with stones. The upper part is set in

the ground, leaning against a huge boulder, and is held in that position by wire, well tightened. The highest point of the boulder is marked with a black cross, and is 6.815 feet above the 11-foot mark. Measurement was made from gaging box suspended from cable placed across just above the gage. The channel is sandy and shifting.

Discharge measurements of the Rio Grande near Rio Grande, N. Mex.

[Made by P. E. Harroun and O. B. Powell.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 23	5.0	484	July 14	3.8	93
February 12	5.05	485	July 17	3.8	110
March 31	5.3	518	July 21	5.0	419
April 3	5.3	519	July 24	5.0	416
April 7	6.7	1,243	July 28	4.3	208
April 10	7.5	1,744	July 31	4.0	112
April 14	7.9	2,252	August 4	4.2	148
April 17	7.5	1,952	August 7	4.7	233
April 22	7.6	2,190	August 11	6.15	[a] 2,009
April 25	6.5	1,333	August 14	4.6	241
April 28	6.6	1,403	August 18	4.3	.172
May 2	6.5	1,164	August 21	3.9	106
May 5	6.6	1,271	August 25	8.1	2,853
May 8	6.3	1,109	August 28	6.0	848
May 12	6.7	1,267	September 1	4.5	232
May 15	6.7	1,391	September 4	4.1	150
May 19	6.1	895	September 8	4.1	139
May 23	5.6	633	September 11	3.8	85
May 26	5.2	516	September 15	4.0	117
May 28	7.4	1,877	September 18	3.8	122
May 30	6.6	1,561	September 21	10.7	6,592
June 2	6.6	1,449	September 25	4.7	309
June 6	5.8	857	September 29	4.7	250
June 9	5.5	672	October 2	4.6	255
June 12	5.0	421	October 6	4.7	325
June 16	4.7	332	October 9	4.7	276
June 19	4.3	180	October 13	4.7	265
June 23	4.0	123	October 16	4.7	294
June 27	3.8	85	October 20	4.7	276
June 30	3.6	71	October 23	4.7	268
July 3	3.5	62	October 27	4.6	266
July 7	3.6	78	October 30	4.7	285
July 10	3.8	125	November 3	4.7	282

[a] Abnormally large.

Discharge measurements of the Rio Grande near Rio Grande, N. Mex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
November 6	4.7	264	December 4	4.4	245
November 10	4.7	261	December 8	4.8	347
November 13	5.0	403	December 11	4.8	320
November 17	4.7	278	December 15	4.8	335
November 21	4.7	295	December 18	4.4	264
November 24	4.9	399	December 22	4.6	267
November 27	4.6	273	December 26	4.7	337
December 1	4.5	276	December 29	4.7	282

Daily gage height, in feet, of the Rio Grande near Rio Grande, N. Mex.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	5.00	4.95	5.15	5.25	6.40	6.70	3.55	5.10	4.45	4.65	4.70	4.50
2	5.05	4.95	5.10	5.35	6.40	6.70	3.60	4.25	4.40	4.60	4.70	4.65
3	5.00	4.95	5.10	5.50	6.40	6.45	3.55	4.10	4.30	4.70	4.70	4.50
4	5.10	4.90	5.10	5.50	6.50	6.15	3.50	4.05	4.10	4.70	4.60	4.40
5	5.10	4.95	5.10	5.55	6.50	6.00	3.50	5.60	4.10	4.80	4.65	4.70
6	5.10	4.95	5.00	6.05	6.35	5.75	3.55	6.35	3.95	4.70	4.65	4.70
7	5.05	4.95	5.00	6.20	6.35	5.70	3.55	4.70	4.15	4.70	4.70	4.75
8	5.05	5.05	5.05	6.95	6.40	5.60	3.55	4.80	4.15	4.65	4.70	4.75
9	5.05	5.05	5.05	7.55	6.55	5.45	3.90	4.50	3.95	4.70	4.70	4.75
10	5.10	5.05	5.25	7.80	6.55	5.15	4.75	4.25	3.90	4.70	4.70	4.75
11	5.10	5.05	5.55	8.05	6.75	5.05	3.65	5.90	3.80	4.70	4.60	4.75
12	5.00	5.05	5.55	8.45	7.20	4.95	3.70	5.30	3.90	4.70	5.05	4.75
13	5.00	5.05	5.40	8.10	7.35	5.15	3.80	4.70	3.90	4.65	5.00	4.90
14	5.05	5.00	5.40	7.95	6.90	4.95	3.65	4.75	3.90	4.65	5.00	4.90
15	5.05	5.00	5.25	7.55	6.65	4.75	3.60	4.50	3.95	4.70	4.90	4.90
16	5.05	5.00	5.20	7.15	6.45	4.65	3.50	4.25	3.85	4.70	4.85	4.65
17	5.00	5.05	5.20	7.55	6.25	4.50	4.25	4.50	3.85	4.70	4.70	4.10
18	5.15	5.15	5.10	7.65	6.20	4.35	4.50	4.30	3.90	4.70	4.70	4.45
19	5.10	5.10	5.45	7.65	6.20	4.30	6.15	4.15	4.05	4.60	4.70	5.05
20	5.10	5.15	5.60	7.90	6.05	4.15	7.80	4.00	6.20	4.70	4.70	4.65
21	5.10	5.05	5.60	7.80	5.95	4.10	5.20	3.90	10.60	4.70	4.70	4.65
22	5.00	5.15	5.75	7.50	5.85	4.00	5.45	4.90	7.35	4.70	4.80	4.65
23	4.95	5.20	5.65	6.75	5.50	3.95	4.35	5.55	5.80	4.70	4.90	4.65
24	5.00	5.20	5.55	6.60	5.30	3.90	4.55	6.35	4.90	4.70	4.90	4.65
25	4.95	5.20	5.40	6.60	5.25	3.95	4.45	7.60	4.80	4.60	4.90	4.75
26	5.00	5.35	5.35	6.60	5.20	3.85	4.45	7.25	4.75	4.60	4.70	4.80
27	4.75	5.35	5.40	6.55	7.80	3.75	4.35	6.15	4.60	4.60	4.70	4.80
28	4.80	5.25	5.25	6.50	7.25	3.60	4.30	5.60	4.60	4.60	4.65	4.90
29	4.95	.....	5.35	6.45	7.05	3.60	4.25	5.15	4.70	4.65	4.60	4.70
30	5.00	.....	5.30	6.45	6.65	3.60	4.15	4.95	4.65	4.70	4.60	4.60
31	4.95	.....	5.30	.....	6.65	.....	4.05	4.70	.....	4.70	.....	4.60

Estimated monthly discharge of the Rio Grande near Rio Grande, N. Mex.

[Drainage area, 14,050 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	495	455	482	29,643	0.034	0.039
February	540	475	489	27,183	.035	.036
March	735	480	548	33,709	.039	.045
April	3,200	510	1,640	97,577	.117	.131
May	2,230	520	1,196	73,567	.085	.098
June	1,530	70	474	28,215	.034	.038
July	2,200	60	272	16,730	.019	.022
August	2,300	105	556	34,165	.040	.046
September	6,460	85	484	28,790	.034	.038
October	345	255	279	17,157	.020	.023
November	420	250	309	18,386	.022	.025
December	440	200	313	19,220	.022	.025
The year	6,460	60	587	424,342	.042	.566

RIO GRANDE AT EMBUDO, N. MEX.

Embudo is a railroad station on the Denver and Rio Grande Railroad, in Rio Arriba County. The station is in a narrow canyon above the head of the valley in which Espanola and other towns are located, and in which the river Chama joins the Rio Grande. In November, 1888, an examination was made along the main stream for the purpose of selecting a point at which the total discharge of the Rio Grande entering New Mexico could be ascertained. Coming from Colorado southward, this is the first point at which the railroad reaches the river, and for this reason it was finally determined to establish a river station here. Measurements were begun at the rocky narrows, about a mile above the railroad station, but in the spring of 1889 the observations were transferred to a point directly behind the railroad station, for convenience of the observer and consequent reduction of expense. The inclined gage, constructed at that time, is made of scantling, 4 by 4 inches, spiked to posts set firmly in the ground. It is on the right hand side of the river, at a place where the slopes are very gentle, and therefore is of considerable length in order to reach out to the low-water channel. It is graduated from about 7.30 feet, the low-water mark, up to 16 feet. The point 3.50 would correspond approximately to the deepest part of the section. The gage is about 75 feet above the cable and is in three parts with different slopes. The cable is five-

eighths-inch wire, with 19 steel strands. It is fastened to a cedar tree on the left-hand side and to sand anchors on the right. Measurements were originally made from a boat held by traveling pulleys running on the cable. The boat being washed away by flood, later measurements were made from a box suspended from the cable.

Bench mark No. 1 is on a rock near the end of the cable, on the left-hand bank, marked "B. M." with white paint. It is 20.66 feet above zero of the gage. Bench mark No. 2 is on a rock about 100 feet above the cable, on the left bank of the river, and is marked "B. M." with white paint. It is 18.79 feet above datum. Bench mark No. 3 is a notch cut in the southeast corner of the station house, about 2 feet above the level of the platform, and is 30.48 feet above datum.

Discharge measurements of the Rio Grande at Embudo, N. Mex.

[Made by P. E. Harroun and O. B. Powell.]

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
January 21	7.5	386	July 1	6.8	147
February 10	7.6	422	July 4	6.8	140
March 28	7.8	410	July 8	6.8	137
April 9	8.2	631	July 12	6.8	140
April 12	8.5	773	July 15	6.8	144
April 15	8.4	771	July 19	6.9	150
April 18	8.3	667	July 22	7.1	192
April 23	8.4	741	July 25	6.8	154
April 26	8.1	604	July 29	6.9	164
April 29	8.1	632	August 1	6.8	158
May 3	8.3	715	August 5	6.8	156
May 6	8.5	849	August 8	7.2	236
May 9	8.6	900	August 13	7.0	191
May 13	8.8	1,099	August 16	6.9	161
May 16	8.5	901	August 19	6.8	152
May 20	8.3	814	August 23	7.0	176
May 24	7.8	471	August 26	8.2	785
May 27	8.1	611	August 29	7.1	227
May 31	8.7	990	September 2	7.0	198
June 4	8.6	917	September 6	6.9	166
June 7	8.3	697	September 9	6.9	164
June 10	7.8	450	September 12	6.9	167
June 13	7.5	364	September 16	6.9	165
June 17	7.2	240	September 19	6.9	169
June 21	7.0	196	September 23	7.2	250
June 25	6.9	179	September 26	7.1	223
June 28	6.9	152	September 30	7.1	239

Discharge measurements of the Rio Grande at Embudo, N. Mex.—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1902.	*Feet.*	*Second-feet.*	1902.	*Feet.*	*Second-feet.*
October 2	7.1	217	November 18	7.1	225
October 6	7.2	217	November 21	7.3	235
October 10	7.2	227	November 25	7.3	247
October 14	7.2	238	November 28	7.1	218
October 17	7.2	229	December 2	7.2	252
October 21	7.2	228	December 5	7.1	225
October 24	7.2	240	December 9	7.2	246
October 28	7.2	230	December 12	7.3	246
October 31	7.2	217	December 16	7.3	244
November 4	7.2	218	December 20	7.5	316
November 7	7.2	219	December 23	7.3	268
November 11	7.2	226	December 27	7.3	266
November 14	7.2	228	December 31	7.2	249

Daily gage height, in feet, of the Rio Grande at Embudo, N. Mex.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	7.60	7.40	8.00	7.70	8.10	9.10	6.80	6.80	7.00	7.10	7.20	7.20
2	7.70	7.70	7.90	7.75	8.20	9.00	6.80	6.80	7.05	7.10	7.20	7.20
3	7.65	7.50	8.00	7.80	8.30	8.85	6.80	6.80	7.00	7.25	7.20	7.20
4	7.70	7.50	8.00	7.80	8.40	8.65	6.80	7.20	7.00	7.20	7.20	7.15
5	7.65	7.55	7.85	7.80	8.40	8.55	6.80	7.40	7.00	7.20	7.20	7.15
6	7.65	7.55	7.85	7.85	8.45	8.45	6.80	7.60	6.95	7.20	7.20	7.20
7	7.65	7.60	7.85	7.90	8.50	8.25	6.80	7.00	6.90	7.20	7.20	7.25
8	7.70	7.55	7.85	8.05	8.50	8.10	6.80	7.20	6.90	7.20	7.20	7.25
9	7.70	7.60	8.05	8.25	8.55	7.90	6.80	7.05	6.90	7.20	7.20	7.20
10	7.70	7.60	8.10	8.30	8.60	7.80	6.80	6.90	6.90	7.20	7.20	7.20
11	7.65	7.60	8.15	8.55	8.75	7.70	6.80	7.65	6.90	7.20	7.25	7.20
12	7.60	7.65	8.00	8.55	8 80	7.60	6.80	7.15	6.90	7.20	7.50	7.30
13	7.65	7.70	7.90	8.55	8.80	7.55	6.80	7.05	6.90	7.20	7.25	7.30
14	7.55	7.60	7.95	8.50	8.80	7.35	6.80	7.00	6.90	7.20	7.25	7.30
15	7.65	7.65	7.90	8.40	8.70	7.25	6.80	7.00	6.90	7.20	7.20	7.20
16	7.65	7.65	7.80	8.40	8.55	7.20	6.80	6.90	6.90	7.20	7.20	7.20
17	7.65	7.75	7.80	8.40	8.40	7.15	6.90	7.05	6.90	7.20	7.20	7.20
18	7.60	7.75	7.70	8.30	8.40	7.10	6.90	6.95	6.90	7.20	7.10	7.20
19	7.60	7.80	8.00	8.40	8.35	7.05	6.90	6.85	6.95	7.20	7.15	7.50
20	7.70	7.70	8.20	8.40	8.25	7.00	7.35	6.80	7.05	7.20	7.20	7.50
21	7.60	7.90	8.10	8.50	8.15	7.00	7.30	6.85	8.75	7.20	7.25	7.40
22	7.55	7.85	8.10	8.45	8.05	7.00	7.00	7.00	7.40	7.20	7.30	7.45
23	7.50	7.85	8.00	8.45	7.95	7.00	6.90	7.15	7.25	7.30	7.30	7.35
24	7.60	7.85	7.95	8.35	7.80	6.90	6.85	7.15	7.15	7.20	7.35	7.45
25	7.60	7.90	7.95	8.25	7.70	6.90	6.90	7.50	7.10	7.20	7.25	7.45
26	7.60	8.00	7.85	8.10	7.75	6.90	6.90	8.25	7.10	7.25	7.10	7.35
27	7.50	8.05	7.80	8.10	8.00	6.90	6.90	7.45	7.10	7.30	7.10	7.35
28	7.60	8.00	7.80	8.10	8.20	6.90	6.90	7.20	7.10	7.25	7.10	7.40
29	7.60	.....	7.95	8.10	8.35	6.80	6.90	7.10	7.10	7.20	7.15	7.35
30	7.60	.....	7.85	8.10	8.55	6.80	6.90	7.10	7.10	7.20	7.20	7.30
31	7.50	.....	7.70	.....	8.80	.....	6.80	7.00	.....	7.20	.....	7.30

Estimated monthly discharge of the Rio Grande at Embudo, N. Mex.

[Drainage area, 10,090 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	460	390	430	26,420	0.043	0.050
February	585	360	462	25,676	.046	.048
March	630	410	532	32,698	.053	.061
April	800	450	661	39,352	.066	.074
May	1,100	420	798	49,061	.079	.091
June	1,360	130	440	26,202	.044	.049
July	280	140	158	9,719	.016	.018
August	820	150	246	15,154	.024	.028
September	1,050	165	228	13,587	.023	.026
October	260	215	231	14,182	.023	.027
November	310	220	231	13,736	.023	.026
December	315	240	264	16,245	.026	.030
The year	1,360	130	390	282,032	.039	.528

RIO GRANDE NEAR CENICERO, COLO.

This station was located on June 28, 1899, by A. L. Fellows. It is at the State bridge across the Rio Grande, at a point near the Colorado-New Mexico State line and about 4 miles west of Eastdale, Colo. The station is favorably located for the purpose, the cross section being fairly uniform, the channel regular and not liable to overflow.

There are two gage rods, one for high water and the other for low water. The high-water rod is a 2 by 6 inch timber attached to the west side of the central downstream cylinder of the bridge. The low-water rod is a scale, marked in feet and tenths, on the perpendicular face of a large bowlder about a hundred yards below the bridge. The channel is in most respects an excellent one. The bed consists of bowlders and rock, and is subject to little change; the banks are high and are not subject to overflow. Gagings can be made at the bridge, but during low water they are usually made by wading. On June 22, 1900, both gages were referred to a bench mark consisting of a chiseled point marked "B. M." on the face of the lava bluff under the west end of the bridge, 7.42 feet above gage datum. The station is an extremely important one, giving, as it does, the discharge of the river at the Colorado State line, including practically all of the Colorado drainage.

Roman Mondragon, who keeps a store at the west end of the bridge, has kept the records during the last year.

The following measurement was made in 1902 by A. L. Fellows:

July 9: Gage height, 0.60 feet; discharge, 6 second-feet.

Daily gage height, in feet, of the Rio Grande near Cenicero, Colo.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.80	2.10	2.40	1.50	1.40	1.80	0.80	0.80	0.70	0.90	0.90	0.90
2	1.80	2.10	2.50	1.60	1.60	1.70	.80	.80	.70	.90	.90	.90
3	1.80	2.00	2.60	1.60	1.70	1.60	.80	.80	.70	.90	.90	.90
4	1.80	2.00	2.60	1.60	1.80	1.50	.80	.80	.70	.90	.90	.90
5	1.80	2.00	3.00	1.60	1.90	1.50	.80	.80	.70	.90	.90	.90
6	1.80	2.00	3.00	1.60	1.90	1.40	.80	.80	.70	.90	.90	.90
7	1.80	2.00	2.60	1.60	1.90	1.40	.80	.80	.70	.90	.90	.90
8	1.80	2.00	2.50	1.70	1.90	1.40	.80	.80	.80	.90	.90	.90
9	1.80	2.00	2.40	1.70	1.90	1.40	.80	.80	.80	1.00	.80	.90
10	1.80	2.00	1.70	1.80	1.90	1.30	.80	.80	.80	1.00	.80	1.00
11	1.80	2.00	1.70	1.80	1.90	1.30	.80	.80	.80	1.00	.80	1.00
12	1.80	2.00	1.70	1.90	1.90	1.30	.80	.80	.90	1.00	.90	1.00
13	1.80	2.00	1.70	1.90	1.90	1.30	.80	.80	.90	1.00	.90	1.00
14	1.80	2.10	1.70	1.90	1.90	1.30	.80	.80	.90	1.00	.90	1.00
15	1.90	2.20	1.70	1.80	2.00	1.20	.80	.80	.90	.90	.90	1.00
16	1.90	2.20	1.70	1.80	2.00	1.20	.80	.80	.90	.90	.90	1.00
17	1.90	2.20	1.90	1.80	1.90	1.20	.80	.70	.90	.90	.90	1.00
18	1.90	2.30	1.70	1.70	1.90	1.20	.80	.70	.90	.90	.90	1.00
19	1.90	2.30	1.70	1.70	1.90	1.20	.80	.70	.90	.90	.90	1.00
20	1.90	2.40	1.60	1.70	1.90	1.20	.80	.70	.90	.90	.90	1.00
21	1.90	2.40	1.60	1.70	1.90	1.20	.80	.60	.90	.80	.90	1.00
22	2.10	2.40	1.60	1.70	1.90	1.10	.80	.60	.90	.80	.90	1.00
23	2.10	2.40	1.60	1.70	1.90	1.10	.80	.60	.90	.80	.90	1.00
24	2.10	2.40	1.60	1.90	1.90	1.10	.80	.60	.90	.80	.90	1.00
25	2.10	2.40	1.60	1.50	1.90	1.00	.80	.60	.90	.90	.90	1.00
26	2.10	2.40	1.90	1.50	2.00	1.00	.80	.60	.90	.90	.90	1.00
27	2.10	2.40	1.70	1.50	2.00	.90	.80	.70	.90	.90	.90	1.00
28	2.10	2.40	1.60	1.50	2.00	.90	.80	.70	.90	.90	.90	.80
29	2.10	.....	1.60	1.50	2.00	.80	.80	.70	.90	.90	.90	.70
30	2.10	.....	1.60	1.50	1.90	.80	.80	.70	.90	.90	.90	.70
31	2.10	.....	1.50	.....	1.80	.....	.80	.70	.....	.90	.....	.80

Rating table for the Rio Grande near Cenicero, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
0.6	6	1.8	414	3.0	1,494	4.2	2,574
0.8	22	2.0	594	3.2	1,674	4.4	2,754
1.0	44	2.2	774	3.4	1,854	4.6	2,934
1.2	82	2.4	954	3.6	2,034	4.8	3,114
1.4	142	2.6	1,134	3.8	2,214	5.0	3,294
1.6	244	2.8	1,314	4.0	2,394		

Estimated monthly discharge of the Rio Grande near Cenicero, Colo.

[Drainage area, 7,695 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	684	414	521	32,035	0.0677	0.078
February	954	594	758	42,097	.0985	.103
March	1,494	185	549	33,757	.0713	.082
April	504	185	315	18,744	.0409	.046
May	594	142	490	30,129	.0637	.074
June	414	22	114	6,783	.0148	.017
July	22	22	22	1,353	.0029	.003
August	22	6	17	1,045	.0022	.003
September	31	14	26	1,547	.0034	.004
October	44	22	32	1,968	.0042	.005
November	31	22	30	1,785	.0039	.004
December	44	14	37	2,275	.0048	.006
The year	1,494	6	243	173,518	.0315	.425

RIO GRANDE NEAR DEL NORTE, COLO.

Measurements and observations were first begun in the vicinity of Del Norte in 1889 by George T. Quinby. The object of the measurements was to obtain the flow of the river before water was diverted for the agricultural region of the San Luis Valley, and, by a comparison of this with the figures obtained at Embudo, to acquire data as to the effect of the numerous ditches taking out water between the two points. The river 25 miles above Del Norte flows out of the canyon at Wagon Wheel Gap. Little water, however, is diverted until the edge of the San Luis Valley is reached, the largest canal heading near the town of Del Norte. During freshets the river divides into a number of channels, making it difficult to obtain measurements near town. In order to avoid the expense of establishing a station during time of high water, the first measurements—those about June 1—were made from several bridges crossing the numerous branches. The results were not wholly satisfactory, and on June 25 a station was established above the branches. Later a locality about 2 miles farther up was chosen.

The station is about 2 miles west of the town of Del Norte, above the main canal taking water from the Rio Grande and is above all the irrigating ditches of importance. The river flows in one channel, about 175 feet wide and of very regular section. The banks on each side are steep, and the water is reported never to overflow. The

course of the stream is straight for several hundred yards both above and below the section. An inclined gage is set, at an angle of about 30° to the horizontal, on the left bank, and is referred to bench marks. As noted on October 10, 1891, No. 1 is a large nail in the root of a tree 15 feet northwest of the end of the cable on left bank of river. Bench mark No. 2 is a large nail in the root of a tree 25 feet southwest of the end of the inclined gage. Both bench marks are 7.54 feet above the datum of the gage.

On June 16, 1900, the gage rod was connected with an iron bench mark of the United States Geological Survey, set in the ground about 25 feet south of the rod, the zero of the rod being 9.25 feet below the bench mark

Gagings were first made from a flatboat, 4 feet wide and 14 feet long, attached by rope and tackle to a five-eights-inch wire cable fastened to a large cottonwood tree on the left bank, and to a sand anchor on the right bank. They are now made by means of a car which travels across the river along a steel cable, the distance being marked on a tag wire. The channel is excellent, the water, although falling rapidly, seldom scouring, and the bed, therefore, remaining practically the same from year to year. The bed of the channel is covered with small bowlders and the sides, although not high, have never been known to overflow. The observer is J. S. Regan, who has kept the records regularly ever since the station was established.

The following discharge measurements were made during 1902 by A. L. Fellows and J. E. Field:

April 24: Gage height, 1.90 feet; discharge, 493 second-feet.
July 8: Gage height, 1.31 feet; discharge, 210 second-feet.

Daily gage height, in feet, of the Rio Grande near Del Norte, Colo.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
1	1.68	1.60	1.68	1.40	2.84	2.66	1.26	1.10	1.34	1.44	1.34	1.84
2	1.62	1.66	1.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
3	1.62	1.66	1.60	1.48	3.24	2.44	1.24	1.06	1.30	1.46	1.36	2.00
4	1.62	1.66	1.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
5	1.58	1.66	1.60	1.60	2.86	2.34	1.24	1.06	1.24	1.40	1.32	1.92
6	1.58	1.66	1.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
7	1.58	1.66	1.60	1.74	2.94	2.30	1.22	1.08	1.20	1.40	1.32	1.96
8	1.58	1.66	1.60	.....	.....	.....	.....	.....	.....	.....	.....	.....
9	1.58	1.62	1.34	2.00	2.86	2.24	1.26	1.08	1.14	1.48	1.32	1.84
10	1.58	1.62	1.34	.....	.....	.....	.....	.....	.....	.....	.....	.....
11	1.58	1.62	1.34	1.94	2.74	2.10	1.22	1.08	1.12	1.44	1.30	1.80
12	1.52	1.62	1.34	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	1.52	1.62	1.34	1.86	2.72	2.14	1.20	1.14	1.10	1.40	1.38	1.82
14	1.52	1.62	1.34	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	1.52	1.62	1.34	1.84	2.70	1.90	1.16	1.12	1.10	1.38	1.32	1.84
16	1.52	1.70	1.40	.....	.....	.....	.....	.....	.....	.....	.....	.....
17	1.52	1.70	1.40	1.82	2.64	1.78	1.10	1.08	1.10	1.34	1.28	1.80
18	1.52	1.70	1.40	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	1.56	1.70	1.40	2.04	2.40	1.66	1.20	1.04	1.12	1.30	1.28	1.82

Daily gage height, in feet, of the Rio Grande near Del Norte, Colo.—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1902.												
20	1.56	1.70	1.40	.....	.....	.....	.....	.....	.....	.....	.....	.....
21	1.56	1.70	1.40	2.46	2.16	1.50	1.20	1.00	1.40	1.30	1.30	1.80
22	1.56	1.70	1.40	.....	.....	.....	.....	.....	.....	.....	.....	.....
23	1.56	1.68	1.26	2.34	2.04	1.50	1.16	1.06	1.52	1.32	1.30	1.78
24	1.56	1.68	1.26	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	1.56	1.68	1.26	1.86	2.00	1.42	1.12	1.96	1.52	1.32	1.28	1.82
26	1.60	1.68	1.26	.....	.....	.....	.....	.....	.....	.....	.....	.....
27	1.60	1.68	1.26	2.42	2.06	1.34	1.14	1.70	1.54	1.26	1.34	1.86
28	1.60	1.68	1.26	.....	.....	.....	.....	.....	.....	.....	.....	.....
29	1.60	.....	1.26	2.46	2.64	1.30	1.14	1.48	1.50	1.22	2.00	1.82
30	1.60	.....	1.36	.....	.....	.....	.....	.....	.....	.....	.....	.....
31	1.60	.....	1.36	.....	2.84	.....	1.10	1.40	.....	1.30	.....	1.80

Rating table for the Rio Grande near Del Norte, Colo., for 1902.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*	*Feet.*	*Second-feet.*
1.0	69	2.2	812	3.4	1,972	4.6	3,651
1.2	159	2.4	976	3.6	2,218	4.8	3,951
1.4	265	2.6	1,148	3.8	2,480	5.0	4,251
1.6	385	2.8	1,330	4.0	2,758	5.2	4,551
1.8	518	3.0	1,528	4.2	3,051	5.4	4,851
2.0	660	3.2	1,742	4.4	3,351	5.6	5,151

Estimated monthly discharge of the Rio Grande near Del Norte, Colo.

[Drainage area, 1,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Second-feet per square mile.	Depth in inches.
1902.						
January	437	336	381	23,427	0.28	0.32
February	450	385	412	22,811	.29	.29
March	437	189	438	26,932	.31	.36
April	1,027	265	638	37,964	.45	.50
May	1,787	660	1,169	71,879	.84	.97
June	1,201	210	618	36,774	.44	.49
July	189	112	152	9,346	.12	.14
August	631	69	180	11,068	.13	.15
September	348	112	206	12,258	.15	.17
October	312	169	242	14,880	.17	.20
November	660	200	249	14,817	.18	.20
December	660	518	547	33,634	.39	.45
The year	1,787	69	436	315,790	.31	4.24

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