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TEXAS FLOODS OF 1940

BY

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TEXAS FLOODS OF 1940

By SETH D. BREEDING

ABSTRACT

Floods occurred in Texas during June, July, and November 1940, that exceeded known stages on many small streams and at a few places on the larger streams. Stages at several stream-gaging stations exceeded the maximum known at those places since the collection of daily records began.

A storm, having its axis generally on a north-south line from Cameron to Victoria and extending across the Brazos, Colorado, Lavaca, and Guadalupe River Basins, caused heavy rainfall over a large part of south-central Texas. The maximum recorded rain of 22.7 inches for the 2-day period June 29–30 occurred at Engle. Of this amount, 17.5 inches fell in the 12-hour period between 8 p. m. June 29, and 8 a. m. June 30. Light rains fell at a number of places on June 28, and additional light rains fell at many places within the area from July 1 to 4. During the period June 28 to July 4 more than 20 inches of rain fell over an area of 300 square miles, more than 15 inches over 1,920 square miles, and more than 10 inches over 5,100 square miles. The average annual rainfall for the area experiencing the heaviest rainfall during this storm is about 35 inches.

Farming is largely confined to the fertile flood plains in much of the area subjected to the record-breaking floods in June and July. Therefore these floods, coming at the height of the growing season, caused severe losses to crops. Much damage was done also to highways and railways.

The city of Hallettsville suffered the greatest damage of any urbar area. The Lavaca River at that place reached a stage 8 feet higher than ever known before, drowned several people, destroyed many homes, and submerged almost the entire business district. The maximum discharge there was 93,100 second-feet from a drainage area of 101 square miles.

Dry Creek near Smithville produced a maximum discharge of 1,870 second-feet from an area of 1.48 square miles and a runoff of 11.3 inches in a 2-day period from a rainfall of 19.5 inches.

The area in the Colorado River Basin between Smithville and La Grange, amounting to 550 square miles, had an average rainfall of 19.3 inches, of which 11.5 inches appeared as runoff. The maximum discharge at La Grange was 182,000 second-feet, with much the greater part coming from below Smithville. This is probably a record-breaking flood for the area between Smithville and La Grange, but stages as much as 16 feet higher have occurred at La Grange.

Heavy rainfall over the east half of Texas November 21–26 caused large floods in all streams in Texas east of the Guadalupe Riiver. The maximum recorded rainfall for the 2-day period November 24–25 was 20.46 inches at Hempstead, of which 16.00 inches fell in 24 hours or less. The storm occurred during the period November 20–26, with the greater part of the rain falling November 23–25. During the period November 20–26, rainfall in Texas amounted to more than 15 inches over an area of 3,380 square miles, and to more than 10 inches over an area of 17,570 square miles. The average annual rainfall for the area in Texas experiencing more than 10 inches of rain during this storm ranges from

50 inches on the east border of the State to 35 inches near the west edge of the area. The study of this storm for the purposes of this report is limited to the San Jacinto River Basin, which had an average rainfall of 13.6 inches. This basin has an area of 2,791 square miles above the gaging station near Huffman and is typical in topographic and hydrologic features of much of eastern Texas.

The stage reached at the gage near Huffman was about 1 foot higher than known before, the maximum discharge was 253,000 second-feet, and the runoff from the storm amounted to 8.8 inches.

The November flood came after crops had been harvested, and its damage was mainly the destruction of highways and railways and the drowning of livestock.

The storage reservoirs on the Colorado River located well upstream from the storm areas herein studied had very little effect on the rates of runoff. A characteristic of most of the streams affected, especially those in the San Jacinto River Basin, is a small cut channel and a wide flood plain affording a large amount of natural storage.

This report presents records of rainfall for the June-July storm at 206 places covering much of central and south Texas, and for the November storm at 40 places in and adjacent to the San Jacinto River Basin; 3 isohyetal maps; records of peak stages and discharges and of mean daily discharges and hydrographs during flood periods at 30 stream-gaging stations; records of other floods at places where maximum discharges were measured during the June-July flood; records of maximum discharges only on five streams that had outstanding floods as a result of the June-July storm; results of studies of rainfall and runoff produced by the June-July storm for selected areas and for the November storm at each gaging station in the San Jacinto River Basin; comparative records of sediment transported by floods in San Jacinto, Brazos, and Colorado Rivers; and other data pertinent to the floods in Texas.

INTRODUCTION

The floods of June-July 1940 were the direct result of excessive rainfall produced by a storm that centered over Bastrop, Fayette, Lee, Lavaca, and De Witt Counties, in south-central Texas, and extended across the Brazos, Colorado, Lavaca, and Guadalupe River Basins. Stages higher than any previously known were reached on many of the smaller streams near the center of the storm area, and on all streams in the upper part of the Lavaca River Basin. This storm covered an area that is largely agricultural and, coming as it did in the height of the growing season, the losses to crops were severe. The floods did great damage to highways, railways, residential property, and especially to Hallettsville, where almost the entire business district was inundated and many homes were washed away.

The floods in November 1940 were caused by a widespread storm that covered the eastern two-thirds of Texas and all of Oklahoma, Arkansas, and Louisiana and produced its heaviest rainfall over a large section of southeastern Texas. This storm was one of the largest in history, if not the largest, with respect to the total quantity of rain falling on the State of Texas within a period of 7 days. All streams in Texas from Sabine River on the east boundary westward

to Guadalupe River were in flood except the upper portions of Brazos, Colorado, and Guadalupe Rivers. For the purposes of this report the study of this storm is limited to the rainfall and runoff in the San Jacinto River Basin. This basin is typical in topographic and hydrologic features of a large part of eastern Texas, and the flood therein was record-breaking. Much of the area covered by the heavy rainfall of November was forested and as the storm did not occur during the growing season, the damage to crops was small. The major losses were the destruction of highways and railways and the drowning of livestock.

Destructive floods produced by heavy rainfall occur in some part of Texas almost every year, and in some years nearly all sections of the State have been subjected to such floods. In recent years many surveys have been made, and some work has been done toward controlling floods and increasing the beneficial use of the waters of the streams. The purpose of this report is to contribute further data concerning rainfall and runoff to the information already available. A record of the magnitude of these rains and subsequent floods and a study of the history of previous floods are useful not only in designing economic engineering structures, such as dams, bridges, levees, and other controlling works, but also in planning for the complete utilization of the water resources of a region.

Plate 1 shows major drainage basins in Texas and the average annual rainfall through 1939.

This report contains all available records of rainfall and all records of discharge during the floods at the 30 stream-gaging stations of the Geological Survey within the areas studied, and records of peak discharges at places other than regular stream-gaging stations. The information presented greatly exceeds in scope and detail that usually obtained under the regular stream-gaging program. Considerable work was done in gathering and analyzing rainfall and stream-flow data and in determining peak discharges at places other than regular stream-gaging stations. This report also contains brief discussions of the meteorological conditions that prevailed before and during the storms, explanations of the pertinent data and flood events, and discussions of the relation between rainfall and runoff and of the comparative sediment loads of the major streams.

ADMINISTRATION AND PERSONNEL

The field and office work involved in the preparation of this report was performed by the Water Resources Branch of the Geological Survey, under the general administrative direction of G. L. Parker, chief hydraulic engineer. The field work and the collection and tabulation of the basic information with respect to stages and discharges

were done in the Surface Water Division, R. G. Kasel, chief, under the direction of C. E. Ellsworth, district engineer. Special data were obtained and analyzed and studies made under the immediate direction of S. D. Breeding, who also wrote the text. The general review of the report was carried on by the Division of Water Utilization, R. W. Davenport, chief.

ACKNOWLEDGMENTS

The stream-gaging work of the Geological Survey in Texas is performed in cooperation with the State Board of Water Engineers, consisting of C. S. Clark, chairman, A. H. Dunlap, and J. W. Pritchett.

Acknowledgment is made to the United States Weather Bureau for many of the data on rainfall and the discussion of weather conditions during the storm periods, and to the Corps of Engineers, United States Army, for many of the supplemental data on rainfall and aid in obtaining stream-flow data in the field.

Some miscellaneous rainfall records were obtained from local observers, and other information was obtained from other sources. So far as practicable, acknowledgments for these contributions are given at appropriate places in the report.

MEASUREMENT OF FLOOD DISCHARGES

The general method employed in obtaining the discharge at stream-gaging stations consists in applying to records of stage the stage-discharge relation defined by means of current-meter measurements of discharge at various stages from low water to high water. The records of stage, unless otherwise noted, are obtained either from readings on nonrecording gages or from graphs of continuous water-stage recorders.

Plate 2 shows typical stream-gaging stations in Texas, equipped with recording gages.

The evaluation of flood discharge in many situations is very difficult, and the accuracy often depends upon surveys, analyses, and computations by rather indirect methods for extending the curve of stage-discharge relation beyond the range covered by current-meter measurements.

At places other than regular stream-gaging stations, peak discharges are nearly always determined by some indirect method. It is usually impossible at such places to obtain sufficient basic information from which the total quantity of water discharged during the flood may be computed.

Maximum discharges of floods described in this report were obtained either by current-meter measurements at crest stages, from rating curves defined by current-meter measurements or extended above the

portion defined by current-meter measurements at lower stages, or from slope-area measurements for crest stages. These and other methods are outlined in standard textbooks and manuals on hydraulics [1] and have been discussed in previous reports of the Geological Survey. [2]

JUNE-JULY FLOODS IN SOUTH-CENTRAL TEXAS

Destructive floods occurred in the Brazos, Colorado, Lavaca, and Guadalupe River Basins in late June and early July 1940. Portions of 11 counties were inundated, 9 people were reported drowned, and property and crop losses have been estimated at more than $1,000,000. [3]

The floods were caused by excessive rainfall, which was produced by a storm that centered over Bastrop, Fayette, Lee, Lavaca, De Witt, and Gonzales Counties and extended across the Brazos, Colorado, Lavaca, and Guadalupe River Basins. The heaviest 2-day rain reported was at Engle, where 22.7 inches fell June 29–30. Of this amount, 17.5 inches fell in the 12-hour period between 8 p. m. June 29 and 8 a. m. June 30. The heaviest 2-day rain recorded by the Weather Bureau was at Smithville, where 20.40 inches fell June 29–30. Of this amount 16 inches fell between 7 p. m. June 29 and 10 a. m. June 30.

Many small streams in the area rose to record-breaking heights and caused considerable damage to crops, highways, railways, and business and residential property. Brazos River below Little River had a moderate flood and caused small damage. Colorado River below Smithville and Guadalupe River below Gonzales had floods of considerable magnitude, but greater floods have occurred. The reservoirs on Brazos and Colorado Rivers were far above the areas of heaviest rainfall and consequently had small effect on the floods on those streams. All streams in the upper Lavaca and Navidad River Basins except East Fork Navidad River had record-breaking floods, but in the lower reaches of these streams the flood of 1936 was greater.

Especially heavy rain covered an area about 150 miles long by 50 miles wide, the long axis of the area extending along a north-south line from Cameron to Victoria. The line showing average annual rainfall of 35 inches almost coincides with this long axis of the area of heaviest rainfall. The area may be properly considered as in the

[1] Corbett, D. M., and others, Stream-gaging procedure, a manual describing methods and practices of practices of the Geological Survey: U. S. Geol. Survey Water-Supply Paper 888, 245 pp., 1943. King H. W., Handbook of hydraulics, 3d ed., McGraw-Hill Book Co., 1939.

[2] Johnson, Hollister, The New York State flood of July 1935: U. S. Geol. Survey Water-Supply Paper 773-E, pp. 251-254, 1936. Dalrymple, Tate, and others, Major Texas floods of 1935: U. S. Geol. Survey Water-Supply Paper 796-G, pp. 229-232, 252-256, 1939; Major Texas floods of 1936: U. S. Geol. Survey Water-Supply Paper 816, pp. 12-18, 1937.

[3] Monthly Weather Rev., vol. 68, No. 7, pp. 198, 199, July 1940.

upper Coastal Plain or in the transitional area between the Coastal Plain and the central plateau. Low rolling hills are found along the divides and near the headwaters of all the small streams. A uniform characteristic of the streams in the area other than the main rivers is the existence of very small cut channels and wide flood plains. The hydrologic and topographic features of the area are generally uniform except for considerable variation in the density of vegetation in the wooded areas and in the percentage of land in cultivation. The soil throughout the area may be classed as sandy loam but with considerable clay and gravel in some parts.

As a background for further discussion of the floods, especially the flood at Hallettsville, the following description is quoted:[4]

A slowly moving cold front attended by excessive rains crossed central and south Texas on June 29–30, and 8 to 22 inches of precipitation occurred over a strip of country 50 miles wide by 100 miles in length. It covered large sections of eight counties centered around Bastrop, Fayette, Lavaca, and De Witt. This record rainfall caused destructive floods along the lower portion of the Colorado and Guadalupe Rivers, and along the upper portion of the Lavaca River and its creek tributaries. Two persons were drowned on the Colorado River and seven lives were lost on the Lavaca River. * * *

Along the lower Colorado River, La Grange, Tex., had 12 inches of rainfall during a period of 29 hours; Smithville had 20.40 inches from the afternoon of June 29 to the morning of the 30th, with 16 inches of this amount falling between 7 p. m. and 10 a. m.—a period of 15 hours. The river did not reach flood stage at Smithville, Tex., but rose to 10 to 12 feet above flood stage from Columbus to Wharton, Tex.

Along the Guadalupe River Basin, rainfall at San Marcos, Tex., measured 6.18 inches; Cuero, Tex., 14.40 inches, with 12.40 inches of this amount falling during the 24 hours ending at 7 a. m., June 30. * * * The river rose 10 feet above flood stage at Gonzales and 9.5 feet above flood stage at Victoria, Tex., with the crest passing Gonzales on July 1 and Victoria on the 3d.

The upper watershed of the small Lavaca River was subjected to an excessive rainfall of unusual intensity and duration, and over parts of that section 22 inches of rainfall occurred within 36 hours, June 29–30. Hallettsville, Tex., approximately 20 miles below the headwaters of the Lavaca River, experienced the most costly flood in its history. It was here that seven persons were drowned and property losses including crops and washed farming lands exceeded $740,000.

Coming in the height of the growing season, and owing to the fact that much of the flood plain was in cultivation, the storm resulted in severe crop losses. The greatest property damage was in the city of Hallettsville, where water reached the second story of the county courthouse and damaged the merchandise of almost every business in town. Seven lives were lost, and many residences were washed away. Lavaca River, which caused the damage at Hallettsville, had the greatest flood ever known at this place, and reached a stage 8 feet higher than the previously highest known flood, which occurred

[4] Monthly Weather Rev., vol. 68, No. 7, pp. 198–199, July 1940.

MAP OF TEXAS SHOWING MAJOR TOPOGRAPHIC DIVISIONS, MAJOR DRAINAGE BASINS, AND AVERAGE ANNUAL RAINFALL THROUGH 1939

763365 O - 48 (Face p. 6)

A, RECORDING GAGE AND SILT TRAP ON COLORADO RIVER AT AUSTIN, TEX.
Photograph by A. D. Boone.

B, RECORDING GAGE AND MEASURING CABLEWAY ON COLORADO RIVER AT COLUMBUS, TEX.

TYPICAL STREAM-GAGING STATIONS.

in 1936. Reliable information concerning floods dates back to 1870.

The flood at Hallettsville has been described by the Ganado Tribune for July 4, 1940, as follows:

HALLETTSVILLE, July 1.—The worst flood in its history struck Hallettsville Sunday morning, leaving behind destruction and death.

Several people perished, and the property loss runs into several hundred thousand dollars. On store stocks and fixtures alone, the loss is estimated at a hundred thousand dollars.

The Lavaca River rose to 41 feet—10 feet above any previous record. Ordinarily crossable anywhere on foot, the little river became a mighty stream almost a mile wide.

Never before did the flood water reach the stores on the square. This time they were flooded from 3 to 8 feet high. * * *

A 4-inch rain came early Saturday. A downpour followed at night. Ten and a half inches of rain fell here, supplemented by a 16-inch rain in the Moulton section. This was more than the Lavaca River could carry.

The first alarm was sounded shortly after 2 a. m., the second 2 hours later. But neither was taken seriously enough, for no one expected this calamity.

About a hundred families had to flee their homes before the rising water. Every store and house from the river up to the highway had to be evacuated.

"Several houses were seen floating down the stream beyond the reach of anyone," reports Sheriff McElroy. "Cries could be heard in the darkness but nothing could be done. The water rose some 8 feet in the county jail, but the prisoners were all safe on the upper floor."

By 5 a. m., the river was flooding the square. It was then the threatened section awakened to its danger. And it was high time, the water rising rapidly. By 7 it was reaching the highway. And shortly afterward, the water stood from 6 to 10 feet on the square, spreading several feet deep over the highway itself—something believed impossible. But what was thought could not, did happen here.

The Lavaca River railroad bridge here was washed out when struck by a floating house about 9 a. m. Railroad service here will be tied up for many days. About 200 yards of the asphalt approach to the Lavaca River bridge here was completely washed out. About a hundred people here were rescued from housetops, some as they floated downstream. Reports from those who lived along the Rocky and other creeks stated that bridges were washed out in wholesale lots. * * *

After reaching its highest peak around 9 a. m., the flood receded slowly until by 3 p. m., the square was free again of the water, which left a thick layer of slimy mud on everything it touched.

It rained almost till noon. Later on the sun came out smiling on the vengeance nature wrought because man allowed nature's stream to fill up with his best soil. * * *

The Red Cross sent its help, and radio stations called up asking what could be done, while they broadcast Hallettsville's calamity. * * *

Soon after daybreak Monday morning, NYA, WPA, CCC, and Salvation Army help arrived. All this help was greatly needed as hundreds are left homeless. It was a pitiful scene here in Hallettsville Monday, with ambulances hauling dead bodies, merchants cleaning slush out of their stores, and people looking for their belongings along the Lavaca River after the water receded. * * *

The traffic connection with Schulenburg was cut off by a highway wash-out at the Navidad bridge, and with Yoakum by a wash-out at the Lavaca bridge. The city was without outside newspapers or mail Sunday and Monday. * * *

Much cattle and poultry were destroyed along both the Navidad and the Lavaca Rivers, although the reports are indefinite. The flood rose so rapidly that many were caught unprepared. Several hundred head of cattle, besides hogs and poultry, must have been lost, according to estimates. * * *

The Cuero Record of July 1, 1940, reports:

Cuero appears to have borne the brunt of the flood in De Witt County.

Damage estimated at between $150,000 and $200,000 was checked in Cuero proper Monday as a result of the torrential downpour.

A report by the United States Weather Bureau rainfall observer, showed a total of 12.40 inches of rain fell in Cuero between the hours of 6 p. m. Saturday and 8 a. m. Sunday.

Ditches and storm sewers were unable to care for the heavy overflow which engulfed the business district within a comparatively short time.

Rain fell throughout the night Saturday, but it was between the hours of 2 and 6 a. m. that the heaviest precipitation came.

Water was rising slowly in the business section at 4 a. m. By 5:30 a score of business houses had been engulfed. * * *

Hundreds of persons fled from the western section of the city as the water rose to a depth of around 6 feet in many portions of the residential section across the tracks. Two or three hundred persons were carried to safety by boat and were cared for Sunday night by the city, sandwiches and coffee being served at various refugee centers.

Views of the flood at Hallettsville are shown in plates 3 and 4.

RAINFALL

Immediately after the storm an extensive search was made for information regarding rainfall throughout the areas where it was unusually heavy. Many reliable records of the rainfall were found in addition to those from official gages. Many estimates were obtained and usually disregarded. In a number of places the catchment vessels overflowed, which, at least, gave a positive minimum to the amount of rain received.

No recording rain gages were located in the areas of heaviest rainfall. However, the gages at Cheapside, Lexington, and Somerville were not far from the center of the storm, and they recorded rains totaling from 9 to 12 inches for June 29–30. Cumulative rainfall recorded by these gages is shown graphically in figure 1. An indication of the intensity in the area of heaviest rainfall is given by the record from the Weather Bureau gage at Smithville, which showed 16 inches of rain between 7 p. m. June 29 and 10 a. m. June 30, and also by the record from an unofficial observer at Engle, who used a gage of the Weather Bureau type that showed 17.5 inches of rain between 8 p. m. June 29 and 8 a. m. June 30.

The available records of rainfall for the storm period are given in table 1. This table contains the records for the Weather Bureau stations and all other reliable rain-gage and other measurements within the area covered by this report and within adjacent areas.

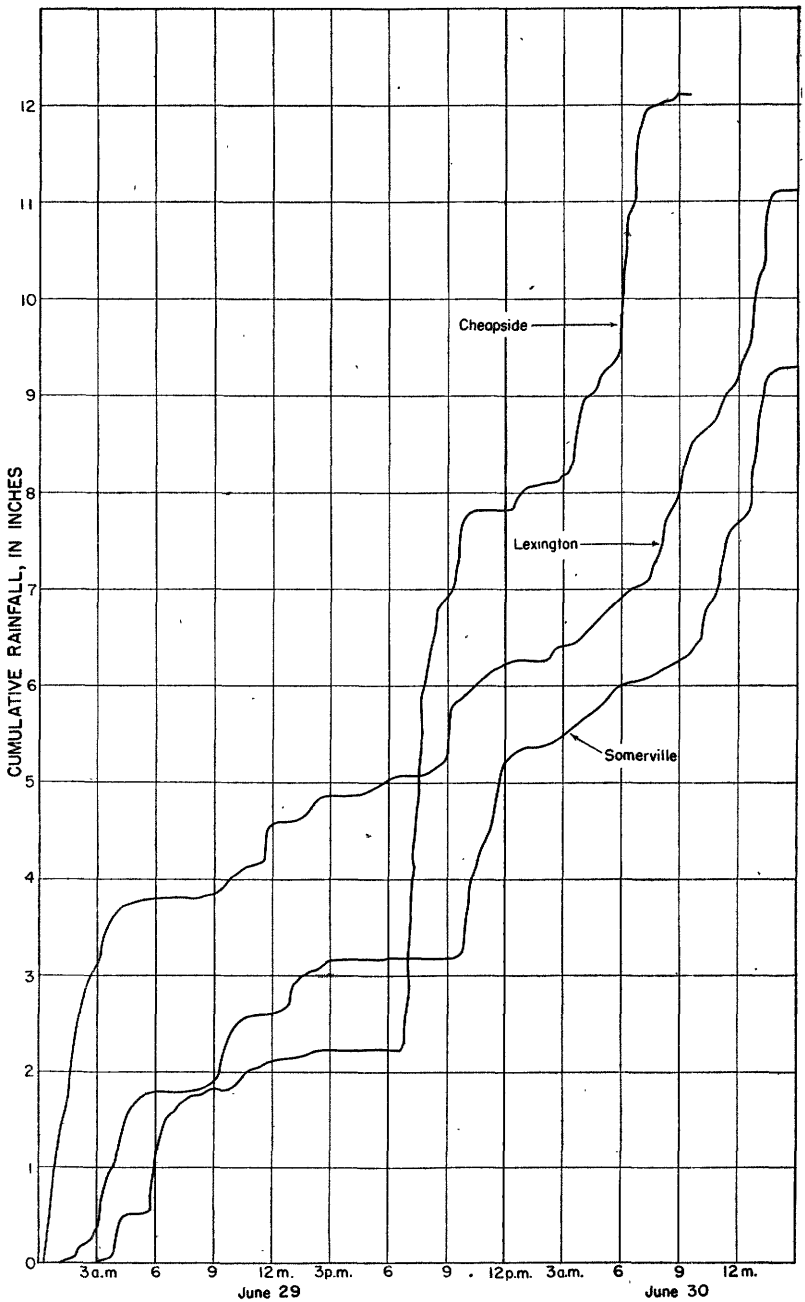


FIGURE 1.—Graphs of cumulative rainfall, in inches, at Cheapside, Lexington, and Somerville, June 29-30, 1940.

TABLE 1.—*Rainfall, in inches, June 28 to July 4, 1940*

[Measured in the morning except as noted. *Included in the next measurement]

No. on pl. 5	Station	Latitude	Longitude	June			July	Total June 28 to July 1	July			Total June 28 to July 4	Data furnished by—
				28	29	30	1		2	3	4		
	Neches River Basin:	° ′	° ′										
1	Alto (near)	31 39	95 05	------	2.08	------	0.21	2.29	(*)	0.73	0.05	3.07	U. S. Weather Bureau.
2	Dialville [1]	31 52	95 15	0.21	1.22	0.29	.42	2.14	0.33	.10	------	2.57	Do.
3	Nogalus [1]	31 16	95 05	------	.51	.20	.05	.76	------	------	1.06	1.82	Do.
	Trinity River Basin:												
4	Bedias	30 46	95 56	------	1.02	.28	.51	1.81	------	------	.09	1.90	Do.
5	Buffalo	31 32	95 57	------	1.98	.08	1.62	3.68	.13	.25	.17	4.23	Do.
6	Centerville [1]	31 15	95 58	------	2.27	.28	3.50	6.05	.15	.25	.95	7.40	Do.
7	Dawson	31 56	96 40	1.45	------	.32	------	1.77	1.02	.16	------	2.95	Do.
8	Groveton	31 03	95 07	------	.73	.24	.03	1.00	.73	------	.40	2.13	Do.
9	Huntsville	30 44	95 35	------	2.91	.25	.10	3.26	------	------	------	3.26	Do.
10	Long Lake	31 38	95 46	------	1.50	1.78	------	3.28	.58	1.78	1.95	7.59	Do.
11	Lovelady [2]	31 07	95 27	.12	.31	.07	------	.50	.24	1.52	------	2.26	Do.
12	Madisonville [1]	30 57	95 54	------	1.12	3.58	------	4.70	.13	------	------	4.83	Do.
13	Palestine [2]	31 45	95 40	1.24	.30	.79	------	2.33	5.02	.66	------	8.01	Do.
14	Riverside	30 51	95 25	------	1.34	.32	------	1.66	------	.07	------	1.73	Do.
15	Shepherd [2]	30 30	95 00	------	2.48	.06	------	2.54	.05	.69	------	3.28	Do.
16	Young	31 52	96 05	------	2.80	------	------	2.80	(*)	2.91	.17	5.88	Do.
	San Jacinto River Basin:												
17	Conroe	30 18	95 28	------	1.41	.51	.20	2.12	------	.09	.01	2.22	Do.
18	Four Notch	30 39	95 24	.04	(*)	5.24	------	5.28	------	------	------	5.28	Do.
19	Montgomery [2]	30 23	95 42	.29	2.28	.41	------	2.98	.03	------	------	3.01	Do.
20	Splendora	30 14	95 09	------	.60	.57	.15	1.32	------	------	.21	1.53	Do.
	Brazos River Basin:												
21	Anderson	30 28	95 59	------	2.77	.61	.40	3.78	------	.52	------	4.30	Do.
22	Bartlett	30 48	97 22	3.60	2.10	.11	------	5.81	1.00	.24	------	7.05	Do.
23	Brenham	30 10	96 24	------	2.02	2.45	1.51	5.98	------	.71	.50	7.19	Do.
24	Burlington (near) [3]	31 00	96 55	2.00	.34	.58	------	2.92	------	.44	------	3.36	Do.
25	Caldwell	30 32	96 42	(*)	(*)	(*)	------	[4] 8.59	------	------	------	------	Newspaper editor.
26	Cameron	30 51	96 59	------	1.63	1.72	.36	3.71	------	------	.16	3.87	U. S. Weather Bureau.
27	Chilton (near) [3]	31 17	97 10	1.90	------	------	------	1.90	------	.20	------	2.10	Do.
28	Clifton [1]	31 47	97 27	------	2.58	1.11	------	3.69	.46	.68	.01	4.84	Do.
29	College Station [1]	30 37	96 23	.01	2.57	3.62	.01	6.21	------	1.42	.10	7.73	Do.
30	Comanche [1]	31 54	98 36	------	.11	.78	.05	.94	------	.13	------	1.07	Do.
31	Copperas Cove [1]	31 07	97 54	------	.58	.65	------	1.23	------	------	------	1.23	Do.
32	Coryell	31 31	97 39	------	1.42	.85	.36	2.63	1.16	.03	.47	4.29	Do.
33	Cranfills Gap [2]	31 46	97 50	.21	.16	------	------	.37	------	.27	------	.64	Do.
34	Dime Box	30 22	96 49	(*)	(*)	(*)	------	[5] 17.50	------	------	------	------	J. D. Casper.
35	Eddy (near) [2]	31 15	97 19	.80	1.04	.34	------	2.18	.76	------	------	2.94	U. S. Weather Bureau.
36	Freeport	28 59	95 20	.12	.03	------	------	.15	------	.14	.67	.96	Do.
37	Gatesville [1]	31 26	97 45	------	1.81	1.47	------	3.28	1.08	.02	.56	4.94	Do.
38	Gindale (near) [3]	30 57	97 04	1.66	.56	1.68	------	3.90	.15	.10	------	4.15	Do.

39	Hamilton	31	43	98	07	------	------	.40	------	.40	------	------	.28	.68	Do.
40	Heidenheimer (near) [3]	31	00	97	14	2.44	.82	.09	------	3.35	.46	------	------	3.81	Do.
41	Hempstead	30	06	96	05	------	2.63	2.00	.47	5.10	------	2.07	.35	7.52	Do.
42	Hewitt [1]	31	27	97	10	.37	2.41	.08	.05	2.91	.11	.15	------	3.17	Do.
43	Hico [1]	31	59	98	01	------	------	.28	------	.28	------	.20	------	.48	Do.
44	Highbank (near) [1]	31	09	96	49	------	2.66	.23	.04	2.93	(*)	1.23	------	4.16	Do.
45	Hillsboro	32	01	97	07	------	2.30	------	.33	2.63	.05	1.55	.80	5.03	Do.
46	Industry	29	58	96	30	------	1.00	6.50	------	7.50	------	------	------	------	E. M. Helwig.
47	Industry, 4 miles southeast	29	57	96	27	------	1.75	2.75	------	4.50	------	------	------	------	Lee Hiiebner.
48	Lake Victor	30	54	98	11	------	1.37	2.25	------	3.62	------	------	------	3.62	U. S. Weather Bureau.
49	Lampasas	31	04	98	10	------	2.32	1.06	.84	4.22	------	------	.12	4.34	Do.
50	Lexington [2]	30	25	97	01	.41	6.24	4.92	------	11.57	.09	.15	------	11.81	Do.
51	Liberty Hill	30	40	97	55	3.50	2.50	3.80	.35	10.15	.30	------	------	10.45	Do.
52	Lincoln	30	17	96	58	(*)	(*)	(*)	------	[6] 17.00	------	------	------	------	H. H. Marburger, Jr.
53	Marlin [1]	31	18	96	54	.20	3.05	.15	.03	3.43	.03	.33	.06	3.85	U. S. Weather Bureau.
54	McGregor [1]	31	25	97	24	------	2.23	.29	------	2.52	.89	.12	------	3.53	Do.
55	Mexia	31	40	96	30	------	2.60	.18	.09	2.87	.23	.20	.33	3.63	Do.
56	Moline [2]	31	24	98	18	1.33	.22	.99	------	2.54	------	.09	------	2.63	Do.
57	Moody [3]	31	19	97	22	------	1.37	.81	------	2.18	------	.57	------	2.75	Do.
58	Mosheim [1]	31	37	97	35	1.67	.12	1.40	------	3.19	1.54	.44	------	5.17	Do.
59	Navasota (airway) [2]	30	24	96	04	.09	2.82	.89	------	3.80	.30	.02	------	4.12	Do.
60	New Bremen	29	54	96	24	------	1.00	7.00	------	8.00	------	------	------	------	J. J. Korenek.
61	Oenaville [3]	31	06	97	09	3.10	1.09	.15	------	4.34	.62	------	------	4.96	U. S. Weather Bureau.
62	Richmond	29	35	95	45	------	.06	.26	.18	.50	------	.65	.64	1.79	Do.
63	Riesel (near) [2]	31	30	96	51	.36	.47	.10	------	.93	------	1.42	------	2.35	Do.
64	Sealy [1]	29	47	96	10	.09	1.12	.77	------	1.98	------	1.44	.32	3.74	Do.
65	Somerville [2]	30	21	96	31	------	5.22	4.08	------	9.30	.28	.18	------	9.76	Do.
66	Taylor	30	33	97	25	------	2.10	4.92	.15	7.17	------	.97	.31	8.45	Do.
67	Temple [2]	31	05	97	17	3.24	1.25	.58	------	5.07	.40	.06	------	5.53	Do.
68	Troy [1]	31	10	97	18	------	2.09	.36	.11	2.56	1.64	.23	.03	4.46	Do.
69	Valley Junction	30	50	96	40	------	2.44	1.39	2.74	6.57	------	.04	1.12	7.73	Do.
70	Waco	31	33	97	08	------	1.32	.30	.06	1.68	------	.40	.25	2.33	Do.
71	West	31	46	97	08	------	.72	.24	.28	1.24	.03	.20	------	1.47	Do.
72	Westphalia (near) [3]	31	06	97	03	2.40	------	.62	------	3.02	.18	.07	------	3.27	Do.
73	Wheelock (near) [2]	30	52	96	23	.23	1.15	2.98	------	4.36	1.11	.02	------	5.49	Do.
74	Zabcikville (near) [2]	31	01	97	03	1.28	1.09	.70	------	3.07	------	.03	------	3.10	Do.
	Colorado River Basin:														
75	Anderson ranch [3]	31	20	98	48	.09	.46	.79	------	1.34	------	.09	------	1.43	Do.
76	Austin [3]	30	17	97	44	1.47	3.02	.70	------	5.19	------	.11	------	5.30	Do.
77	Bankersmith [2]	30	07	98	50	.10	1.12	------	------	1.22	.17	.22	------	1.61	Do.
78	Bastrop	30	07	97	19	(*)	(*)	(*)	------	[6] 11.00	------	------	------	------	J. R. Pfeiffer, Sr.
79	Ben Riley ranch	30	25	98	51	------	1.75	1.68	------	3.43	------	.89	.01	4.33	U. S. Weather Bureau.
80	Blanket	31	50	98	47	.11	.29	.50	------	.90	.04	.08	------	1.02	Do.
81	Brownwood	31	43	98	59	------	.10	.15	.52	.37	------	------	.03	.90	Do.
82	Buchanan Dam	30	45	98	26	------	2.37	2.70	------	5.07	------	.01	------	5.08	Do.
83	Calhoun [2]	29	32	96	22	.10	.37	.62	.06	1.15	1.03	.31	------	2.49	Do.
84	Carmine	30	09	96	41	(*)	(*)	(*)	(*)	9.75	------	------	------	------	A. J. Harzke.
85	Castell	30	42	98	57	1.78	.92	1.93	------	4.63	------	------	------	4.63	U. S. Weather Bureau.
86	Columbus	29	42	96	33	------	.24	2.68	3.22	6.14	------	.36	.06	6.56	Do.
87	Cypress Mill	30	22	98	17	------	1.45	2.59	.18	4.22	------	.58	------	4.80	Do.
88	Eckhardt ranch	30	20	98	44	2.11	2.19	------	------	4.30	.07	------	------	4.37	Do.

See footnotes at end of table.

TABLE 1.—*Rainfall, in inches, June 28 to July 4, 1940*—Continued

No. on pl. 5	Station	Latitude	Longitude	June 28	June 29	June 30	July 1	Total June 28 to July 1	July 2	July 3	July 4	Total June 28 to July 4	Data furnished by—
	Colorado River Basin—Continued	° ′	° ′										
89	Elgin	30 21	97 22	------	------	6.54	------	6.54	------	------	------	------	G. C. Westbrook.
90	Elkins	31 37	98 53	0.04	0.20	.78	------	1.02	------	------	------	1.02	U. S. Weather Bureau.
91	Fairland [1]	30 39	98 17	------	3.54	2.15	0.92	6.61	0.08	0.08	0.06	6.83	Do.
92	Fayetteville [1]	29 54	96 40	------	2.08	4.66	------	6.74	------	------	------	------	W. C. Langlotz.
93	Fredericksburg [2]	30 15	98 52	.03	1.79	------	------	1.82	.15	.06	.02	2.05	U. S. Weather Bureau.
94	Giddings	30 11	96 56	------	4.75	5.50	6.50	16.75	------	.36	.04	17.15	Do.
95	Giddings, 5 miles southeast	30 07	96 53	(*)	(*)	(*)	------	[5] 20.00	------	------	------	------	Willie Wagner.
96	Goldthwaite [1]	31 27	98 34	------	.50	.60	------	1.10	------	.36	------	1.46	U. S. Weather Bureau.
97	Henly	30 11	98 13	------	1.40	2.32	------	3.72	------	------	------	3.72	Do.
98	Hye	30 16	98 32	1.64	.86	------	------	2.50	------	.23	------	2.73	Do.
99	La Grange	29 55	96 52	1.63	9.41	1.68	------	12.72	.60	------	------	13.32	Do.
100	L. C. Atkinson ranch	31 23	98 52	------	.38	.46	.73	1.57	------	------	------	1.57	Do.
101	Ledbetter	30 09	96 48	(*)	(*)	(*)	------	[7] 17.25	------	------	------	------	T. M. Banderwerth.
102	Leon Haynes ranch	30 27	98 26	1.43	2.17	------	------	3.60	.27	------	------	3.87	U. S. Weather Bureau.
103	Ligon ranch	30 37	98 34	1.60	2.23	2.02	------	5.85	------	------	------	5.85	Do.
104	Llano	30 45	98 40	------	1.75	2.80	.90	5.45	------	------	------	5.45	Do.
105	Lometa	31 13	98 23	------	.20	.70	1.16	2.06	------	------	------	2.06	Do.
106	Manchaca	30 08	97 50	1.03	3.66	------	------	4.69	.20	.15	------	5.04	Do.
107	Manley ranch	31 05	98 44	1.98	------	1.52	------	3.50	------	------	------	3.50	Do.
108	Marble Falls	30 34	98 17	------	2.16	2.50	.02	4.68	------	.02	.08	4.78	Do.
109	Marshall Ford Dam	30 23	97 55	------	1.31	2.08	.01	3.40	------	.07	.02	3.49	Do.
110	McDade (near)	30 13	97 12	------	(*)	(*)	------	14.00	------	------	------	------	Dunbar Ranch.
111	Moss ranch	30 32	98 43	------	.43	.40	------	.83	------	------	------	.83	U. S. Weather Bureau.
112	Mullin	31 33	98 40	.09	.14	.47	------	.70	------	.07	------	.77	Do.
113	Nechanitz	30 03	96 49	------	(*)	(*)	------	[8] 17.00	------	------	------	------	Mr. Matejowsky.
114	Nix store	31 06	98 22	.65	------	1.00	------	1.65	------	------	.26	1.91	U. S. Weather Bureau.
115	Northrup, 2½ miles southwest	30 05	97 00	------	(*)	(*)	------	[9] 20.25	------	------	------	------	B. P. Schultz.
116	Ohlenbusch ranch	31 18	98 34	------	.17	.50	------	.67	------	.18	------	.85	U. S. Weather Bureau.
117	Owens (near) [1]	31 51	98 55	.35	.33	.18	------	.86	------	------	------	.86	Do.
118	Page ranch [2]	30 56	98 44	------	3.10	1.34	------	4.44	------	.02	.12	4.58	Do.
119	Pierce	29 14	96 12	.18	.40	.25	.03	.86	------	.33	.05	1.24	Do.
120	Pontotoc	30 54	98 59	1.40	1.18	.10	------	2.68	------	------	------	2.68	Do.
121	Prairie Mountain [2]	30 35	98 51	.04	2.07	1.13	------	3.24	.12	------	------	3.36	Do.
122	Red Bluff Crossing	31 13	98 34	.57	.80	1.33	------	2.70	------	------	------	2.70	Do.
123	Red Rock	29 58	97 27	------	(*)	(*)	------	[10] 7.10	------	------	------	------	O. B. Lentz.
124	Richland Springs	31 17	98 57	.77	.60	.34	------	1.71	------	------	------	1.71	U. S. Weather Bureau.
125	Rockne	30 00	97 26	------	(*)	(*)	------	[11] 8.00	------	------	------	------	Fred Hilbig.
126	Rosanky	29 56	97 18	------	(*)	(*)	------	[12] 20.25	------	------	------	------	G. E. Ray.
127	Round Top	30 04	96 42	------	8.25	1.75	------	10.00	------	------	------	------	Ernest Fricke.
128	Rutersville	29 57	96 48	------	(*)	(*)	------	[13] 9.40	------	------	------	------	H. O. Hackebeil.
129	Sandy	30 22	98 28	1.48	2.22	------	------	3.70	.24	.14	------	4.08	U. S. Weather Bureau.
130	San Saba	31 12	98 43	2.43	1.50	------	------	3.93	------	------	------	3.93	Do.

131	Sayers	30	14	97	20	------	(*)	(*)	------	10.00	------	------	------	------	C. H. Evans.
132	Sloan [1]	31	07	98	57	1.00	1.00	.65	------	2.65	------	------	.18	2.83	U. S. Weather Bureau.
133	Smithville [1]	30	01	97	10	.15	4.35	16.05	------	20.55	------	.19	------	20.74	Do.
134	Upton	30	00	97	16	------	(*)	(*)	------	[14] 17.00	------	------	------	------	J. W. Young.
135	Wharton	29	19	96	07	.14	.46	.26	------	.86	.04	------	.49	1.39	U. S. Weather Bureau.
136	Winchester	30	01	97	00	------	(*)	(*)	------	[15] 22.00	------	------	------	------	W. C. Froelich.
137	Yates ranch	30	54	98	31	------	5.12	1.63	1.18	7.93	------	------	------	7.93	U. S. Weather Bureau.
	Lavaca River Basin:														
138	Edna	28	59	96	38	------	------	.48	------	.48	------	1.70	------	2.18	Do.
139	Engle [1]	29	41	97	01	------	4.50	18.20	------	22.70	------	------	------	------	Ervin Stavinoha.
140	Fordtran, 3 miles north	29	06	97	00	------	(*)	(*)	------	[16] 14.00	------	------	------	------	V. A. Cooper.
141	Freyburg, 3 miles northwest	29	48	96	59	------	(*)	(*)	------	20.50	------	------	------	------	Adolph Ulrich.
142	Ganado	29	02	96	31	------	------	.50	------	.50	------	------	------	------	C. W. Christ.
143	Hallettsville [1]	29	26	96	56	1.30	4.25	6.50	------	12.05	2.00	.18	------	14.23	U. S. Weather Bureau.
144	Morales	29	08	96	45	(*)	(*)	(*)	------	4.00	------	------	------	------	Mr. Boles.
145	Moulton (near) [1]	29	36	97	08	------	2.75	17.98	------	20.73	------	.43	------	21.16	U. S. Weather Bureau.
146	Provident City	29	16	96	37	------	(*)	(*)	------	2.75	------	------	------	------	J. C. Clearham.
147	Schulenburg	29	41	96	54	------	3.20	10.37	------	13.57	------	------	------	------	H. P. Schaeffer.
148	Do. [1]	29	41	96	54	------	4.20	9.48	------	13.68	------	------	------	------	Emil Schulz.
149	Shiner	29	27	97	10	.12	2.60	13.00	------	15.72	------	------	------	------	O. A. Kosler.
150	Yoakum, 2 miles east [1]	29	18	97	07	.63	3.57	6.41	------	10.61	------	------	------	------	A. L. Harrison.
151	Yoakum	29	17	97	11	.99	3.46	8.59	------	13.04	------	1.43	.73	15.20	U. S. Weather Bureau.
	Guadalupe River Basin:														
152	Arneckeville	28	59	97	17	------	1.50	10.00	------	11.50	------	------	------	------	C. H. Arnecke.
153	Blanco	30	05	98	25	------	.55	.64	------	1.19	------	.32	.05	1.56	U. S. Weather Bureau.
154	Boerne [1]	29	47	98	44	------	.82	------	------	.82	------	.14	------	.96	Do.
155	Bulverde	29	38	98	27	.09	.95	.77	------	1.81	------	.90	.05	2.76	Do.
156	Cestohowa	29	01	97	56	------	(*)	(*)	------	7.00	------	------	------	------	Red and White Grocery.
157	Cheapside [2]	29	16	97	24	------	7.82	4.30	------	12.12	.50	.01	------	12.63	U. S. Weather Bureau.
158	Cistern	29	49	97	13	------	(*)	(*)	------	[17] 18.00	------	------	------	------	Eddie Breitschoph.
159	Cuero	29	04	97	17	------	2.00	12.40	.05	14.45	------	.60	.50	15.55	U. S. Weather Bureau.
160	Flatonia [1]	29	41	97	07	.02	2.23	14.21	------	16.46	------	1.38	.05	17.89	Do.
161	Floresville	29	08	98	09	------	.79	2.92	------	3.71	------	.49	------	4.20	Do.
162	Goliad [1]	28	40	97	23	.44	.58	2.17	------	3.19	------	.76	------	3.95	Do.
163	Gonzales	29	30	97	27	------	1.40	4.58	.10	6.08	------	.75	------	6.83	Do.
164	Gonzales, 10 miles northeast	29	37	97	20	------	(*)	(*)	------	[18] 18.75	------	------	------	------	H. A. Adams.
165	Hochheim	29	18	97	18	------	2.25	11.25	------	13.50	------	------	------	------	C. E. Bressel.
166	Jeddo	29	49	97	23	------	1.94	5.11	1.75	8.80	------	.40	.34	9.54	U. S. Weather Bureau.
167	Karnes City	28	52	97	54	------	1.25	2.75	------	4.00	------	.25	------	4.25	Do.
168	Kyle (near) [1]	30	00	97	54	------	5.19	.81	.43	6.43	------	------	------	6.43	Do.
169	Lockhart (near) [1]	29	51	97	44	------	2.50	2.42	------	4.92	.34	------	------	5.26	Do.
170	Luling	29	41	97	39	------	2.28	3.01	.43	5.72	------	.54	.06	6.32	Do.
171	New Braunfels [1]	29	42	98	07	------	3.71	.25	------	3.96	------	.49	------	4.45	Do.
172	Nixon [1]	29	17	97	46	.54	6.08	.36	------	6.98	------	.47	------	7.45	Do.
173	Nursery	28	56	97	06	------	(*)	(*)	------	6.00	------	------	------	------	E. P. Price.
174	Riomedina [1]	29	26	98	52	------	1.10	------	------	1.10	------	------	------	1.10	U. S. Weather Bureau.
175	Runge [1]	28	54	97	43	.75	3.64	4.00	------	8.39	------	1.29	.43	10.11	Do.
176	San Antonio [2]	29	27	98	28	.02	3.23	.02	------	3.27	.24	------	------	3.51	Do.
177	San Marcos	29	53	97	57	------	.85	5.35	------	6.20	------	.02	------	6.22	Do.
178	Seguin [1]	29	34	97	58	.28	7.06	.66	------	8.00	------	.06	.01	8.07	Do.
179	Thomaston	29	00	97	09	------	(*)	(*)	------	6.75	------	------	------	------	Local resident.

See footnotes at end of table.

TABLE 1.—*Rainfall, in inches, June 28 to July 4, 1940*—Continued

No. on pl. 5	Station	Latitude	Longitude	June			July	Total June 28 to July 1	July			Total June 28 to July 4	Data furnished by—
				28	29	30	1		2	3	4		
	Guadalupe River Basin—Continued	° ′	° ′										
180	Uhland (near) [2]	29 57	97 47	------	4.60	0.22	------	4.82	0.20	0.18	------	5.20	U. S. Weather Bureau.
181	Victoria [2]	28 48	97 01	0.07	.31	.51	------	.89	.35	.10	------	1.34	Do.
182	Waelder	29 42	97 19	------	(*)	(*)	------	13.50	------	------	------	------	Nolan Haddock.
183	Yorktown	29 00	97 32	------	.75	5.98	0.12	6.85	------	.37	------	7.22	U. S. Weather Bureau.
	Nueces River Basin:												
184	Cadiz [2]	28 26	97 55	.05	.44	.02	------	.51	.47	.23	0.09	1.30	Do.
185	Devine	29 09	98 54	------	.95	.64	------	1.59	------	.18	------	1.77	Do.
186	Fowlerton	28 28	98 49	------	1.43	1.02	------	2.45	------	------	------	2.45	Do.
187	George West [1]	28 20	98 07	------	.29	------	------	.29	------	.13	.43	.85	Do.
188	Hindes [2]	28 43	98 47	2.57	------	------	------	2.57	.52	------	------	3.09	Do.
189	Jourdanton	28 55	98 32	.08	1.79	1.03	------	2.90	------	.33	------	3.23	Do.
190	Three Rivers	28 28	98 11	------	------	.71	------	.71	------	------	.76	1.47	Do.
191	Whitsett [1]	28 40	98 18	------	3.15	.04	------	3.19	------	------	.84	4.03	Do.
	Coast basins:												
192	Alief (near) [2]	29 43	95 36	------	2.20	.28	------	2.48	.34	.36	------	3.18	Do.
193	Angleton [1]	29 10	95 25	.03	.30	------	------	.33	------	.04	.60	.97	Do.
194	Austwell	28 22	96 51	------	------	------	------	------	------	.66	------	.66	Do.
195	Bay City [2]	28 59	95 58	------	------	------	------	------	.12	.12	------	.24	Do.
196	Beeville [1]	28 24	97 44	------	2.59	------	------	2.59	------	.76	.05	3.40	Do.
197	Danevang [1]	29 03	96 14	.39	.01	------	------	.40	------	.37	------	.77	Do.
198	Houston [2]	29 46	95 22	------	1.62	.21	------	1.83	.20	.45	------	2.48	Do.
199	Houston airport [2]	29 39	95 17	------	1.10	.09	------	1.19	.24	.02	------	1.45	Do.
200	Katy [2]	29 47	95 49	.32	.56	.54	.07	1.49	1.01	1.87	------	4.37	Do.
201	Matagorda [1]	28 42	95 58	------	------	------	------	------	------	2.39	------	2.39	Do.
202	Port Lavaca	28 36	96 38	.18	------	.05	------	.23	------	.37	.40	1.00	Do.
203	Satsuma [2]	29 54	95 36	------	1.48	.48	------	1.96	------	------	------	1.96	Do.
204	Sinton [1]	28 02	97 31	------	.15	------	------	.15	------	.61	.14	.90	Do.
205	Sugarland	29 36	95 40	------	.02	2.05	.17	2.24	------	.76	.05	3.05	Do.
206	Woodsboro [1]	28 13	97 20	------	------	1.70	------	1.70	------	.82	------	2.52	Do.

[1] Measured in the afternoon.
[2] Measured at midnight.
[3] Measured after each rain.
[4] 11 p. m. June 28 to 1 p. m. June 30.
[5] Afternoon June 28 to afternoon June 30.
[6] Afternoon June 28 to noon June 30.
[7] Morning June 28 to noon June 30.
[8] 3 a. m. June 29 to 11 a. m. June 30.
[9] 2.30 a. m. June 29 to 1 p. m. June 30.
[10] 1 a. m. June 29 to 10 a. m. June 30.
[11] 2 a. m. June 29 to 11 a. m. June 30.
[12] Morning June 29 to 1 p. m. June 30.
[13] 3 a. m. June 29 to noon June 30.
[14] Morning June 29 to noon June 30.
[15] 2 a. m. June 29 to noon June 30.
[16] Afternoon June 29 to morning June 30.
[17] Morning June 29 to 11 a. m. June 30.
[18] 2 a. m. June 29 to noon June 30.

A, RECORDING GAGE AND SILT TRAP ON COLORADO RIVER AT AUSTIN, TEX.
Photograph by A. D. Boone.

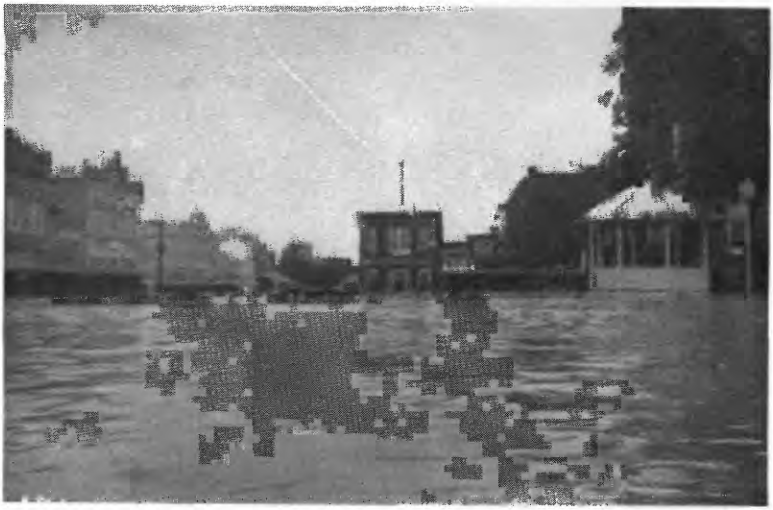
B, RECORDING GAGE AND MEASURING CABLEWAY ON COLORADO RIVER AT COLUMBUS, TEX.

TYPICAL STREAM-GAGING STATIONS.

A, VIEW TOWARD HIGHWAY BRIDGE FROM NEAR LEFT EDGE OF OVERFLOW.
Water has receded about 2 feet

B, VIEW FROM LEFT BANK AT RAILWAY CROSSING.
Bridge destroyed. Water has receded about 2 feet.

LAVACA RIVER AT HALLETTSVILLE, FLOOD OF JUNE 30, 1940.
Photographs by Mrs. James Pogue.



A, VIEW NEAR CENTER OF BUSINESS DISTRICT
Water has receded about 2 feet.

B, VIEW OF CHANNEL LOOKING DOWNSTREAM FROM HIGHWAY BRIDGE AFTER FLOOD RECEDED.

LAVACA RIVER AT HALLETTSVILLE, FLOOD OF JUNE 30, 1940.
Photographs by J. J. Dibala.

Distribution of the rain with respect to time and area is shown by isohyetal lines in plates 5 and 6. Plate 5 shows the total rain for the 4-day period June 28 to July 1. The rains of June 28 caused no floods but served to condition the soil to permit a greater runoff from the heavy rains, which fell mostly during the 12-hour period centering around midnight June 29. The latter rains caused all the record-breaking peak rates of flow. The rainfall recorded for July 1 probably contributed slightly to the peak flows in the lower reaches of some of the streams. Plate 6 shows the total rain for the 7-day period June 28 to July 4, which includes all the rainfall contributing to the flood runoff during the period covered by this report.

FLOOD STAGES AND DISCHARGES

In addition to the records of stage and discharge collected at the regular stream-gaging stations, measurements of peak rates of flow were obtained at five places on comparatively small streams that had record-breaking floods. These measurements were made by the slope-area method. The results are shown in table 2.

In general, because of the small cut channels and wide flood plains covered with varying amounts of timber and brush or with growing crops, opportunities for measuring peak discharges by slope-area methods were scarce. Conditions are considered fair to good at the sites where the five measurements were made.

At two places where slope-area measurements were made, Buckner Creek near La Grange and West Fork Navidad River near Schulenberg, the floods were particularly outstanding. Buckner Creek near La Grange reached a stage about 10 feet higher than known before at a point upstream from the backwater from Colorado River. The highest known flood prior to 1940 occurred May 18, 1935, and destroyed a bridge that had been built in 1880 about 4 miles above the mouth of the creek. After being rebuilt, the bridge was destroyed a second time by the flood of June 30, 1940.

The flood on West Fork Navidad River at the place of measurement below Mulberry Creek near Schulenburg reached a stage 6 feet higher than in 1936, the year of the greatest flood previously known. The flood on Navidad River at Vienna, 20 miles downstream from the place of measurement on West Fork Navidad River, was 2.1 feet higher in 1940 than in 1936. About 30 miles farther downstream, at the stream-gaging station on Navidad River near Ganado, the situation was reversed and the flood of 1940 was 3.3 feet lower than the flood of 1936. A view of the flood on Navidad River near Ganado is shown in plate 7, *A*.

TABLE 2.—*Summary of flood stages and discharges in south-central Texas for the floods of June–July 1940*

No. on pl. 6	Stream and place of determination	Drainage area (square miles)	Maximum flood previously known					Maximum during present flood				
			Period of known floods	Date	Gage height (feet)	Discharge		Time	Gage height (feet)	Discharge		
						Second-feet	Second-feet per square mile			Second-feet	Second-feet per square mile	
	Brazos River Basin:											
1	Brazos River at Waco	[1] 19,260	1854–1940	Sept. 27, 1936	[2] 40.9	246,000	12.8	June 29, 4:30 a. m	20.78	38,500	2.0	
2	Brazos River near Marlin	[1] 19,910	1899–1940	Dec. 3 or 4, 1913	35.8			June 29, 12 m.[3]	16.00	30,000	1.5	
3	Brazos River near Bryan	[1] 29,190	1899–1940	Dec. 5, 1913	54.0			July 2, 4 to 8 p. m.[3]	26.80	57,900	2.0	
4	Brazos River near Hempstead	[1] 33,430	1899–1940	Dec. 8, 1913	61.1			July 3, 6 to 10 p. m.[3]	42.80	83,100	2.5	
5	Brazos River near San Felipe	[1] 34,450	1899–1940	Dec. 9, 1913	49.0			July 4, 9 a. m.[3]	33.44	80,200	2.3	
6	Brazos River at Richmond	[1] 34,810	1899–1940	Dec. 10, 1913	48.2			July 5, 6 a. m.[3]	31.22	82,100	2.4	
7	Brazos River at East Columbia	[1] 35,300	1898–1940	Dec. 11 or 12, 1913	35.3			July 5, 2 p. m.[4]	32.14	65,000	1.8	
8	Little River at Cameron	7,034	1852–1940	Sept. 10, 1921	53.2	[5] 647,000	92.0	July 1, 11 a. m	36.65	75,400	10.7	
9	Yequa Creek near Somerville	990	1913–40	Dec. 5, 1913	22.0			July 1, 4:30 a. m	19.27	56,800	57.4	
10	Navasota River near Easterly	949	1899–1940	1900	24.0	71,000	74.8	July 1	12.83	1,800	2.0	
	Colorado River Basin:											
11	Colorado River at Austin	[1] 26,360	1843–1940	July 7, 1869	46.0			June 30, 11 a. m	17.44	45,700	1.7	
12	Colorado River at Smithville	[1] 27,850	1870–1940	Dec. 4, 1913	47.4			July 1, 1 a. m	21.24	70,400	2.5	
13	Colorado River at La Grange	[1] 28,400	1869–1940	July 9, 1869	56.7			June 30, 8:20 p. m	40.18	182,000	6.4	
14	Colorado River at Columbus	[1] 29,040	1869–1940	July 1869 Dec. 6, 1913	[6] 41.6 [6] 41.6			July 1, 12 m. to 2 p. m	36.2	152,000	5.2	
15	Colorado River at Wharton	[1] 29,350	1869–1940	Dec. 8, 1913	[7] 38.9			July 3, 4 a. m	35.99	100,000	3.4	
16	Colorado River near Bay City	29,620	1940					July 4, 9 a. m	78.8	83,300	2.8	
17	Dry Creek at Buescher Lake, near Smithville.	1.48	1940					June 30, 8:45 a. m	24.96	1,870	1,260	
18	Rabbs Creek near Warda	92.8	1879–1940	1879	([8])			June 30		[5] 55,000	593	
19	Buckner Creek near La Grange	184	1880–1940	May 18, 1935				do.[9]		[5] 106,000	576	
	Lavaca River Basin:											
20	Lavaca River at Hallettsville	101	1870–1940	July 16, 1936	32.8	28,300	280	June 30, 8 a. m.[9]	40.6	[5] 93,100	922	
21	Lavaca River near Edna	887	1909–40	May 25, 1936	33.8	83,400	94.0	July 1, 9:25 p. m	32.51	73,000	82.3	
22	Youngs Branch near Moulton	6.8	1887–1940					June 30 [9]		[5] 8,900	1,310	
23	Rocky Creek near Hallettsville	116	1913–40					do.[9]		[5] 74,700	644	
24	Navidad River near Ganado	1,116	1909–40	May 27, 1936	39.8	94,000	84.2	July 2, 8:30 a. m.[3]	36.54	64,500	57.8	
25	West Fork Navidad River near Schulenburg.	106	1909–40	May 1936				June 30 [9]		[5] 124,000	1,170	

	Guadalupe River Basin:											
26	Guadalupe River above Comal River at New Braunfels.	1,666	1869–1940	July 1869	38			July 4, 5 p. m	2.77	773	.5
				December 1913	38						
27	Guadalupe River at Victoria	5,676	1904–40	July 3, 1936	31.22	179,000	31.5	July 3, 3 a. m	29.67	55,900	9.8
28	San Marcos River at Ottine	1,249	1913–40	December 1913	44.0			June 30, 2 p. m	34.38	20,000	16.0
29	Coleto Creek near Victoria	514	1903–40	July 1, 1936	27.2			June 30, 4:15 p. m	22.05	39,200	76.3
30	San Antonio River at Goliad	3,914	1913–40	October 1913	45			July 2, 11 a. m	31.37	11,600	3.0
				June 15, 1935	45						

[1] Excluding noncontributing area above the Cap Rock.
[2] Levee on left bank overtopped and broken.
[3] See station descriptions for data on floods in November 1940.
[4] Occurred 3 a. m. July 6.
[5] Slope-area measurement.
[6] To datum of gage used after Aug. 21, 1934, which is 3 feet higher than datum of gage used prior to that date.
[7] Flood of July 12, 1869, reached about same stage.
[8] Flood in 1879 reached about same stage as that on June 30, 1940.
[9] Greatest flood known to local residents

The records obtained at the stream-gaging station on Dry Creek at Buescher Lake, near Smithville, are of special interest because of the small drainage area, 1.48 square miles, and the heavy rain, 19.5 inches. This was probably the first time in Texas that a reliable record of discharge was obtained from so small an area subjected to such an amount of rain. The hydrograph of discharge for this station is shown in figure 6. The flood is discussed more fully under "Rainfall and runoff studies." (See p. 82.)

The stage-discharge relation was defined by current-meter measurements at 23 of the 25 stream-gaging stations that are listed in this report for study of the floods of June–July. The discharge was computed either from the rate of change in contents in reservoir or from the formula for discharge over the spillway for Dry Creek at Buescher Lake, and the peak discharge was obtained by slope-area measurement of Lavaca River at Hallettsville.

SUMMARY OF FLOOD STAGES AND DISCHARGES

Table 2 contains data showing maximum stages and discharges for the flood of June–July 1940 at places where discharge records were obtained, together with similar data, where available, for the maximum flood previously known. The locations of places in table 2 are shown in plate 6, which is a map of the area affected by the storm and flood of June–July.

STAGES AND DISCHARGES AT STREAM-GAGING STATIONS

Stage and discharge records at the 25 stream-gaging stations within and adjacent to the area of heavy rainfall during the storm of June-July are given on the following pages. A number of these stations, located upstream from the area of heavy rainfall, had only small floods. Floods in the main Brazos and Guadalupe Rivers were small in comparison with the maximum known. Records from such stations are included to give as complete a picture as possible of the rainfall-runoff relations in the area covered by this report. Maximum stage and discharge records are given for the flood in November 1940 at stations on Brazos River where that flood was greater than the flood in June or July. However, as the November flood was not outstanding in Brazos River Basin and as no report has been prepared covering the November flood except in San Jacinto River Basin, tables of discharges are not included. The records consist of a station description, a table of daily mean discharges and daily and total runoff for

the flood period, and a table of discharges at indicated times during the flood in sufficient detail for a reasonably reliable delineation of the hydrograph.

Under the heading "Drainage area" in the station description for some stations the probable noncontributing area is noted. This area lies above the Cap Rock (see pl. 1) and rarely contributes any direct flow to the lower reaches of the streams. The drainage areas were measured from topographic maps where available and from soil maps, county road maps, and the Geological Survey base map of Texas.

The heading "Maxima" in the station description is divided into several paragraphs. The first paragraph, headed 1940, gives the maximum discharge and gage height that occurred during the flood of June-July. Succeeding paragraphs give information about other outstanding floods. The dates heading the second paragraph are the inclusive dates of gaging-station records, and those heading the third paragraph give the period during which no known floods occurred that were greater than any described. It may be assumed that no reliable information was available concerning floods prior to the earliest date shown. In a few places information is given concerning a flood in November 1940.

The tables showing gage height and discharge at indicated time are designed to give the rise and recession of the flood in detail. The rate of rise and fall is frequently so rapid that daily mean values do not define the hydrographs adequately. Hydrographs of discharge, showing characteristics of the flood peaks and conditions of flow during the flood period, are shown in figures 2–8.

The discharge at an indicated time is related to the corresponding gage height in accordance with a stable stage-discharge relation, except for those stations where there are changing conditions of channel at which stations the gage height has been adjusted somewhat. In determining the discharge from the gage height, the gage height has been used to the nearest hundredth, half tenth, or tenth of a foot, in accordance with certain established limits of refinements, which are indicated in the station description.

The records conform to the regular arrangement used by the Geological Survey in its water-supply papers. The stations on the main stem of a stream are treated first, in downstream order, and then stations on the tributaries in similar order, beginning with the uppermost. The streams in each tributary basin are listed before those of the next basin below.

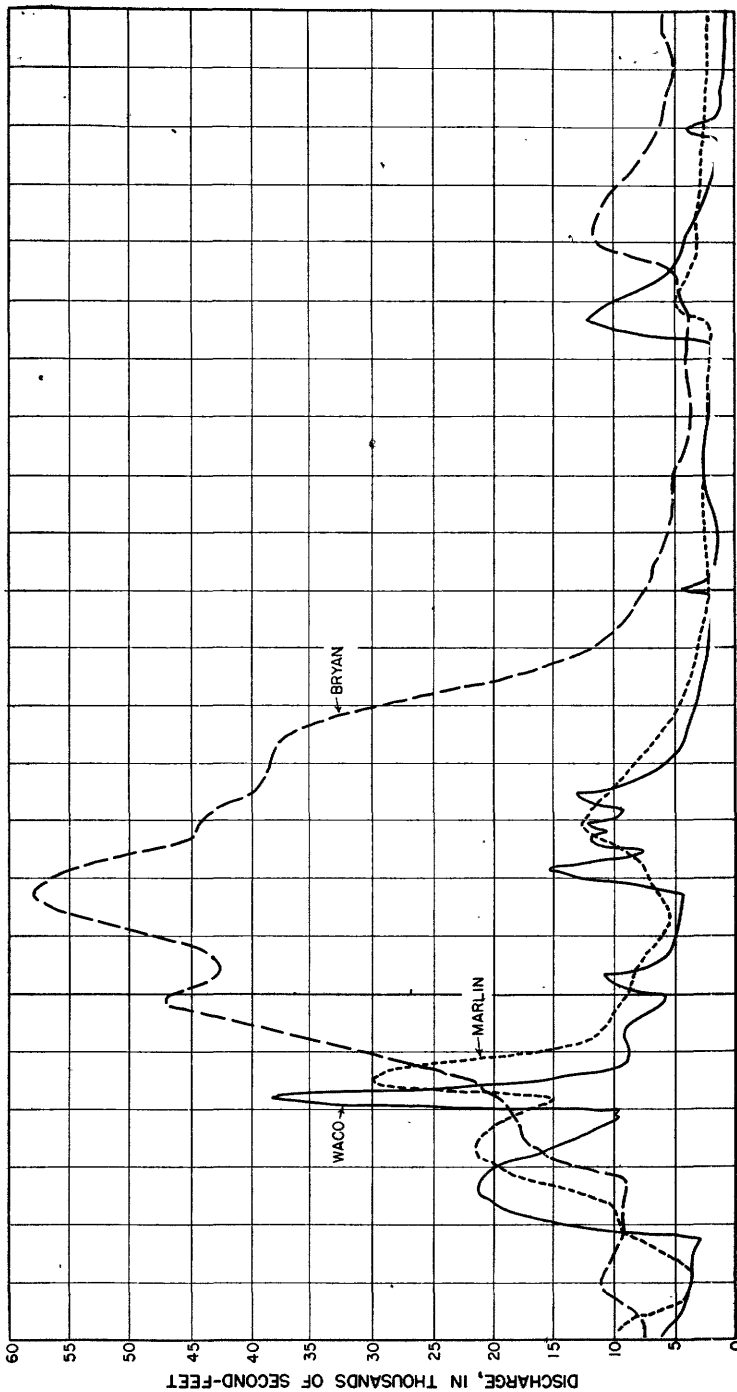


FIGURE 2.—Graphs of discharge at stream-gaging stations on upper Brazos River, June 25 to July 17, 1940.

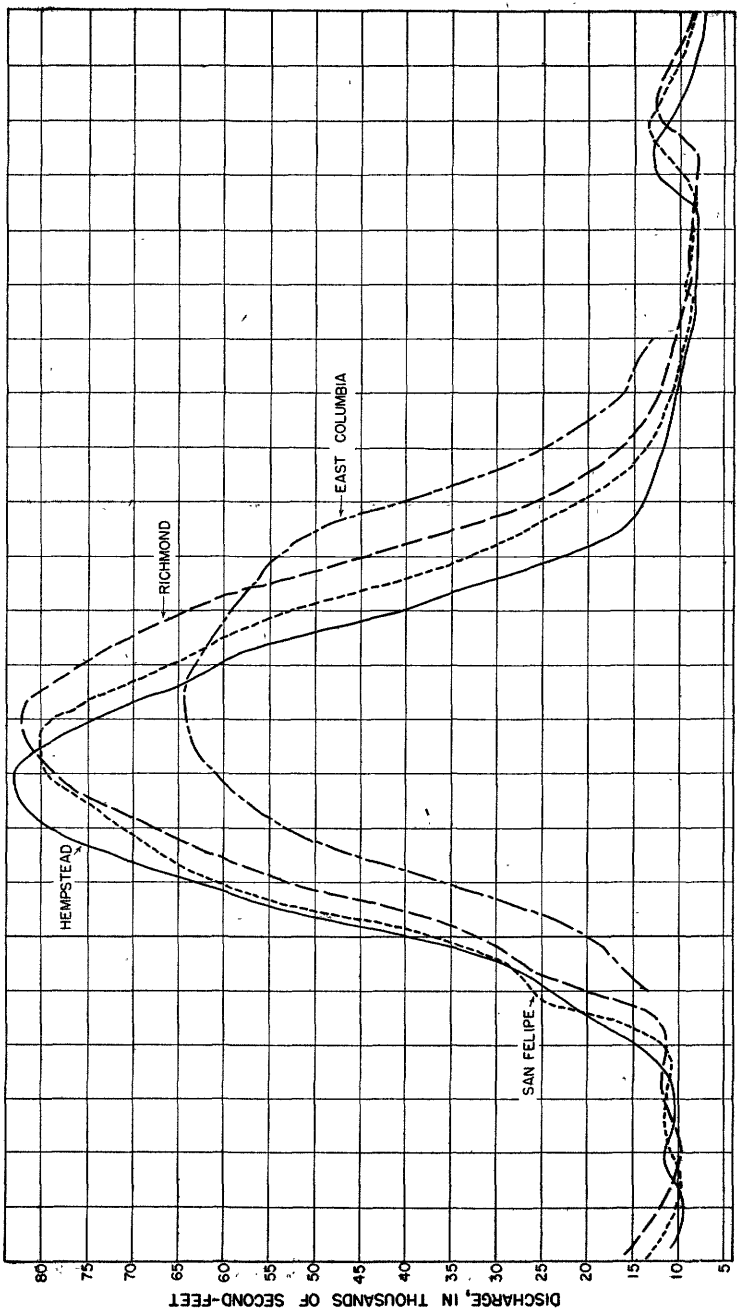


FIGURE 3.—Graphs of discharge at stream-gaging stations on lower Brazos River, June 25 to July 17, 1940.

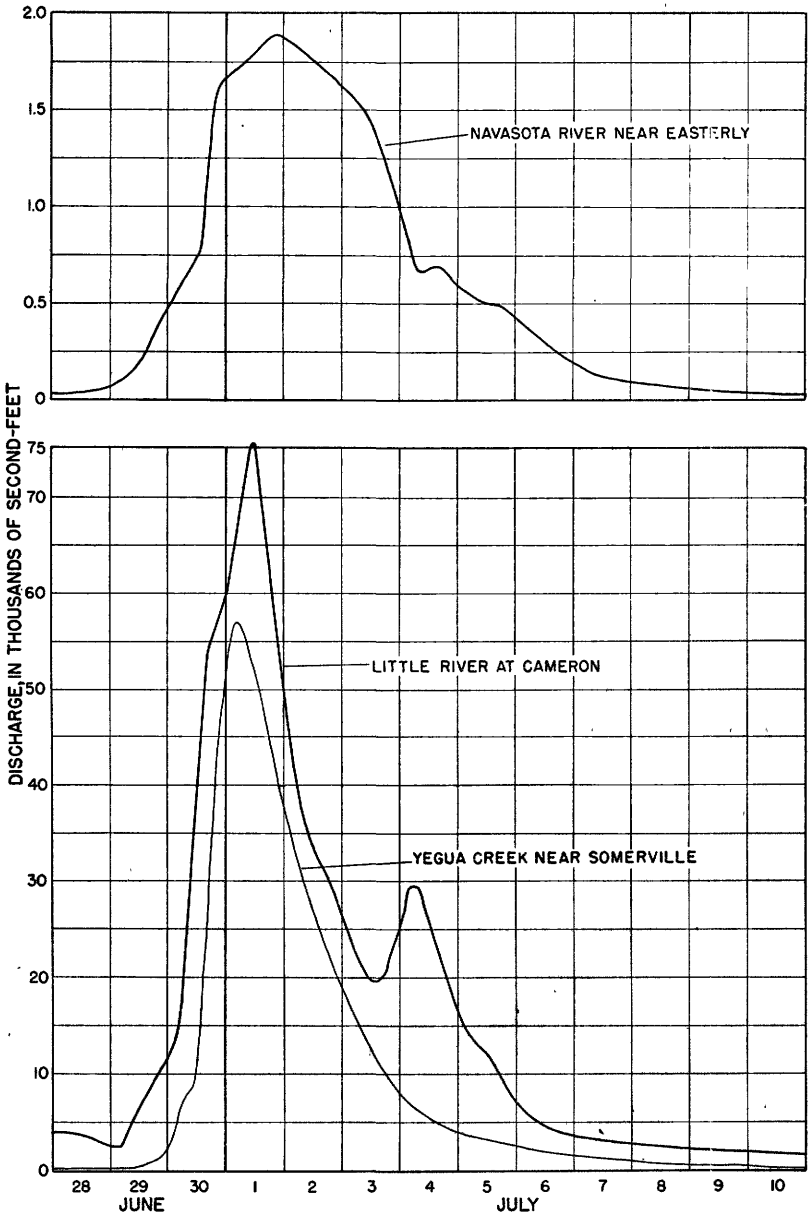


FIGURE 4.—Graphs of discharge at stream-gaging stations on tributaries of Brazos River, June 28 to July 10, 1940.

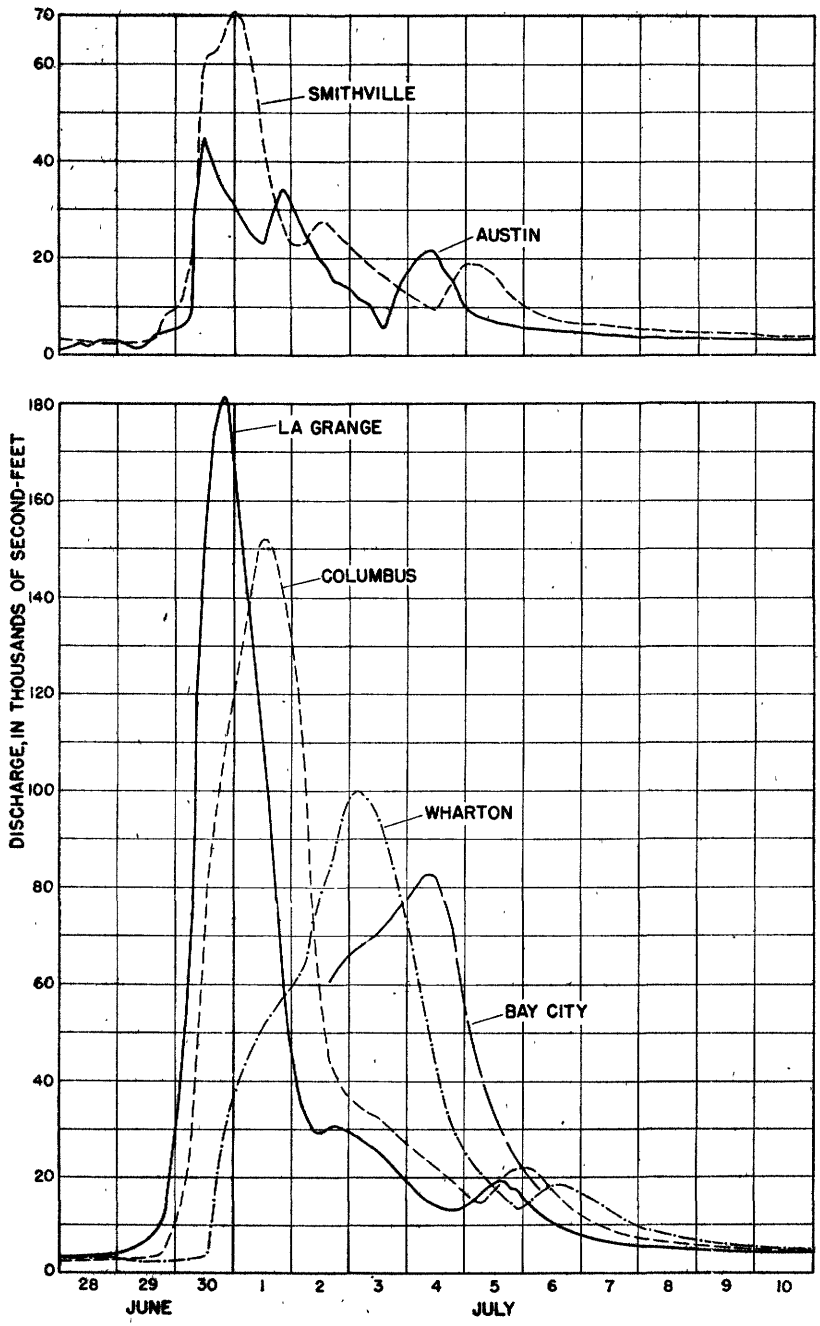


FIGURE 5.—Graphs of discharge at stream-gaging stations on Colorado River, June 28 to July 10, 1940.

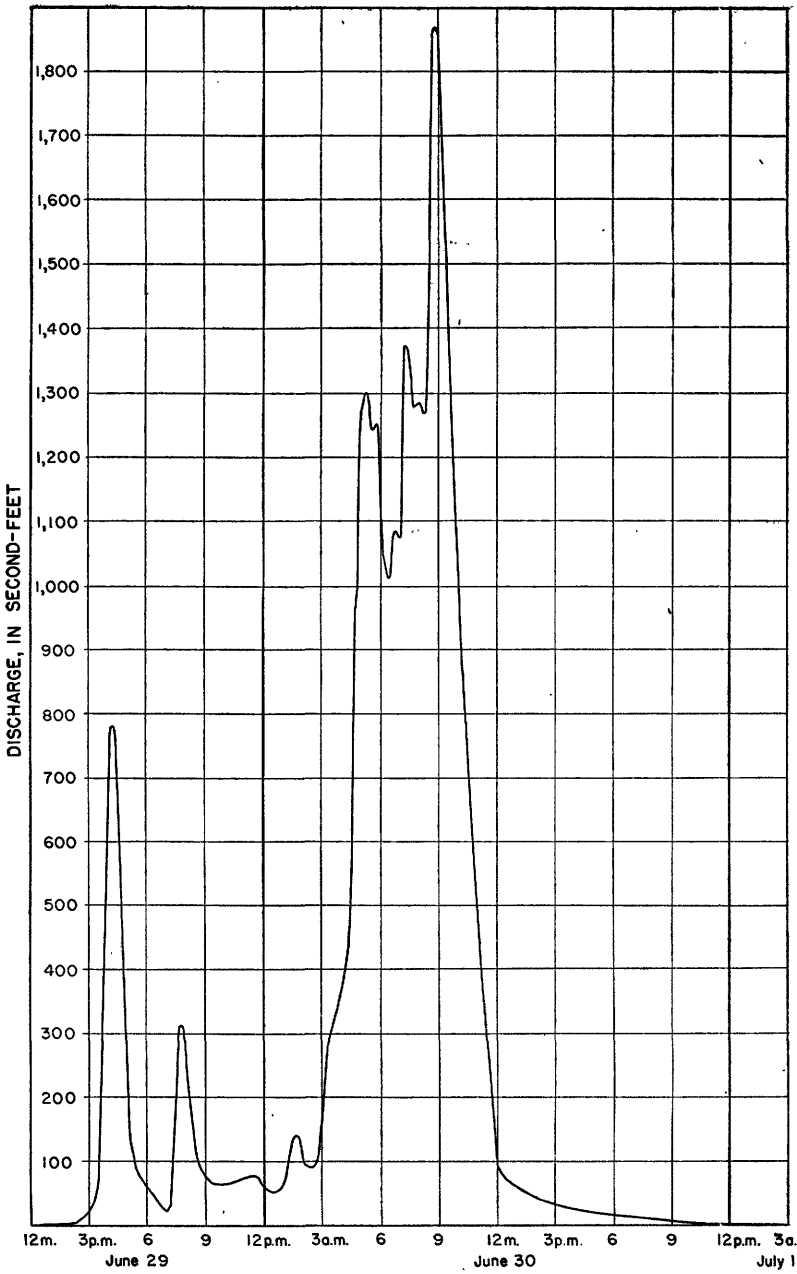


FIGURE 6.—Graph of discharge at stream-gaging station on Dry Creek at Buescher Lake, near Smithville, Tex., June 29 to July 1, 1940.

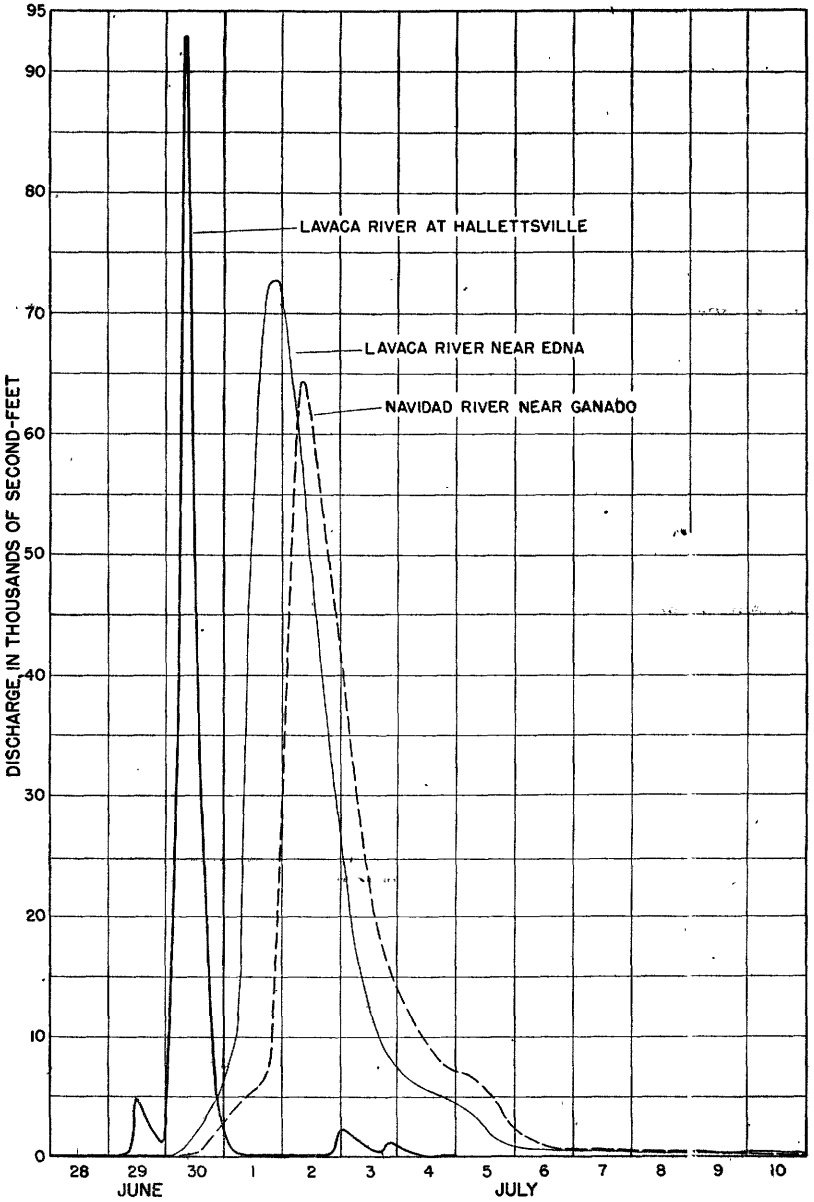


FIGURE 7.—Graphs of discharge at stream-gaging stations in the Lavaca River Basin, June 28 to July 10, 1940.

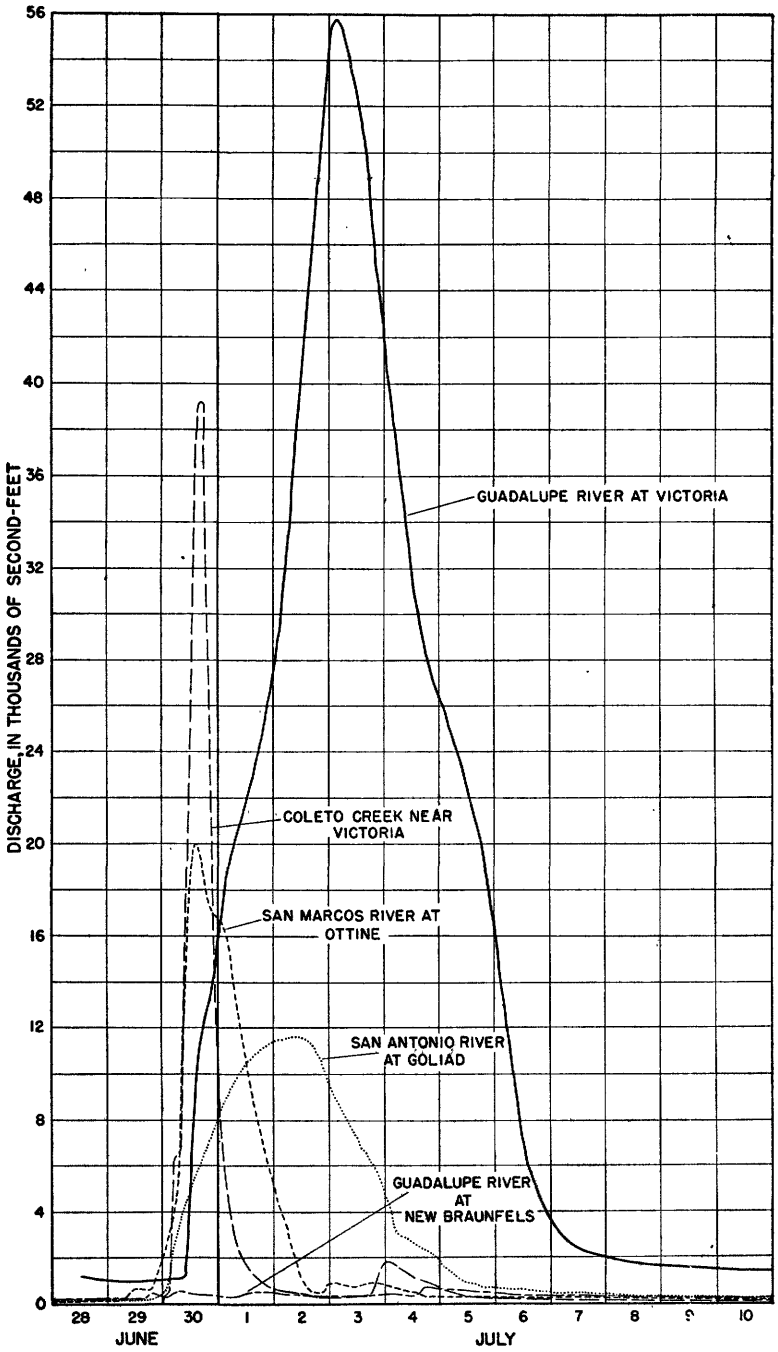


FIGURE 8.—Graphs of discharge at stream-gaging stations in the Guadalupe River Basin, June 28 to July 10, 1940.

BRAZOS RIVER BASIN

BRAZOS RIVER AT WACO, TEX.

LOCATION.—Lat. 31°33'40", long. 97°07'45", at Washington Avenue Bridge in Waco, McLennan County, 2½ miles downstream from Bosque River. Datum of gage is 356.80 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—28,500 square miles, of which about 9,240 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 7.6 and 9.3 feet; hundredths below and tenths above these limits. Discharge obtained by shifting-control method.

MAXIMA.—1940: Discharge, 38,500 second-feet at 4:30 a. m. June 29 (gage height, 20.78 feet).

1898–1939: Discharge, 246,000 second-feet 9:30 p. m. Sept. 27, 1936 (gage height, 40.9 feet), levee on left bank overtopped and broken.

Flood of Dec. 3, 1913, reached a stage of 39.7 feet (levee on left bank broken, discharge not determined) according to information furnished by U. S. Weather Bureau.

REMARKS.—Small diversions upstream affect low flow only.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*			*July*—Con.		
24	7,280	14,440	1	7,400	14,680	10	2,540	5,040
25	4,700	9,320	2	5,720	11,350	11	1,940	3,850
26	4,700	9,320	3	11,600	23,010	12	7,420	14,720
27	19,500	38,680	4	9,480	18,800	13	6,130	12,160
28	13,500	26,780	5	4,190	8,310	14	3,200	6,350
29	19,400	38,480	6	2,820	5,590	15	1,910	3,790
30	7,960	15,790	7	2,240	4,440	16	1,480	2,940
			8	2,090	4,150	17	939	1,860
			9	2,110	4,190			

Runoff, in acre-feet, for period June 24 to July 17 298,000

Gage-height, in feet, and discharge, in second-feet, at indicated times, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 24			*June 25*			*June 26*—Continued		
1 a. m.	10.5	4,310	2 a. m.	11.8	6,100	10 p. m.	14.1	10,800
6	10.3	4,060	4	11.4	5,520	11	14.7	12,500
9	10.4	4,180	6	11.2	5,240	12	15.1	13,700
10	10.7	4,570	9	10.9	4,830			
11	11.8	6,100	12 m.	10.7	4,570	*June 27*		
12 m.	12.5	7,330	6 p. m.	10.3	4,060	1 a. m.	15.5	14,800
1 p. m.	13.3	8,950	12	10.0	3,700	2	15.8	15,700
2	13.8	10,100				3	16.1	16,700
3	14.1	10,800	*June 26*			4	16.3	17,500
5	14.3	11,400	3 a. m.	9.9	3,580	6	16.7	19,100
8	14.4	11,700	12 m.	9.7	3,340	8	16.9	20,000
9	14.0	10,600	6 p. m.	9.4	3,000	10	17.0	20,400
10	13.3	8,950	7	10.9	4,830	12 m.	17.2	21,300
11	12.7	7,710	8	12.5	7,330	2 p. m.	17.2	21,300
12	12.4	7,140	9	13.4	9,180			

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 27—Continued			*July 2*—Continued			*July 9*		
4 p. m.	17.2	21,300	10 p. m.	14.0	10,400	6 a. m.	8.22	1,690
8	17.1	20,800	11	14.8	12,500	12 m.	8.65	2,100
12	16.8	19,500	12	14.9	12.800	6 p. m.	9.06	2,500
						12	9.23	2,670
June 28			*July 3*			*July 10*		
4 a. m.	16.3	17,500	2 a. m.	15.5	14,500	6 a. m.	9.26	2,720
8	15.6	15,100	3	15.8	15.400	6 p. m.	8.98	2,400
12 m.	14.9	13,100	4	15.8	15,400	12	8.80	2,250
6 p. m.	14.0	10,600	6	14.6	11,900			
9	13.6	9,640	8	13.9	10,100	*July 11*		
10	13.8	10,100	10	12.9	7,900	6 a. m.	8.65	2,050
11	13.7	9,870	11	12.7	7,520	6 p. m.	8.37	1,820
12	15.5	14,800	12 m.	12.9	7,900	12	8.24	1,690
			1 p. m.	14.3	11,100			
June 29			2	14.5	11,700	*July 12*		
1 a. m.	17.9	24,000	4	14.6	11,900	4 a. m.	8.18	1,640
2	19.6	32,500	6	14.4	11,400	6	8.50	1,920
3	20.2	35,500	7:30	14.1	10,600	8	10.5	4,180
4	20.7	38,000	8	14.4	11,400	10	12.8	7,710
4:30	20.8	38,500	9	14.6	11,900	12 m.	13.7	9,640
5	20.7	38,000	11	14.7	12,200	2 p. m.	14.2	10,800
6	20.2	35,500	12	14.3	11,100	4	14.7	12,200
7	19.2	30,500				6	14.5	11,700
8	18.4	26,500	*July 4*			9	14.3	11,100
9	17.7	23,100	1 a. m.	13.8	9,870	12	13.8	9,870
10	17.1	20,400	5	13.5	9,180			
11	16.4	17,500	6	14.3	11,100	*July 13*		
12 m.	15.7	15,100	8	14.7	12,200	3 a. m.	13.3	8,740
1 p. m.	15.3	14,000	10	15.0	13,100	6	12.8	7,710
2	15.1	13,400	12 m.	14.2	10,800	9	12.1	6,440
3	14.6	11,900	2 p. m.	13.7	9,640	12 m.	11.5	5,520
4	14.1	10,600	4	13.3	8,740	3 p. m.	11.1	4,960
5	13.7	9,640	6	12.9	7,900	6	10.8	4,570
7	13.4	8,950	8	12.5	7,140	9	10.6	4,310
8	13.4	8,950	10	12.1	6,440	12	10.6	4,180
12	13.4	8,950	12	11.7	5,800			
						July 14		
June 30			*July 5*			4 a. m.	10.4	4,060
7 a. m.	13.5	9,180	4 a. m.	11.0	4,830	8	10.2	3,700
10	13.4	8,950	8	10.6	4,310	12 m.	9.7	3,110
12 m.	13.2	8,530	12 m.	10.4	4,060	4 p. m.	9.25	2,670
3 p. m.	12.7	7,520	6 p. m.	10.2	3,820	8	8.92	2,300
6	12.2	6,610	12	9.8	3,340	12	8.70	2,100
9	11.8	5,950						
10	11.7	5,800	*July 6*			*July 15*		
12	12.0	6,270	6 a. m.	9.5	3,000	6 a. m.	8.35	1,780
			12 m.	9.3	2,780	12 m.	8.14	1,600
July 1			6 p. m.	9.10	2,560	6 p. m.	7.94	1,440
1 a. m.	12.9	7,900	12	8.90	2,350	8	7.90	1,400
2	13.4	8,950				9	9.00	2,400
3	13.7	9,640				10	10.0	3,460
7	14.2	10,800	*July 7*			11	10.5	4,060
8	13.6	9,410	6 a. m.	8.80	2,250	12	10.4	3,940
9	13.1	8,320	12 m.	8.60	2,050			
10	12.8	7,710	9 p. m.	8.40	1,870	*July 16*		
11	12.6	7,330	10	8.70	2,150	1 a. m.	9.9	3,340
12 m.	12.3	6,780	11	9.9	3,460	2	9.3	2,670
3 p. m.	11.8	5,950	12	10.7	4,440	4	8.40	1,780
6	11.5	5,520				6	8.00	1,440
12	11.1	4,960				1 p. m.	7.65	1,160
			July 8			2	7.80	1,280
			12:30 a. m.	10.8	4,570	4	7.70	1,200
July 2			2	10.2	3,820	8	7.60	1,120
12 m.	10.8	4,570	4	9.25	2,720	12	7.53	1,080
5 p. m.	10.6	4,310	6	8.67	2,100			
6	11.5	5,520	8	8.40	1,870	*July 17*		
7	12.2	6,610	12 m.	8.20	1,690	6 a. m.	7.42	992
8	12.5	7,140	6 p. m.	8.10	1,600	6 p. m.	7.26	876
9	12.8	7,710	12	8.07	1,560	12	7.25	869

BRAZOS RIVER NEAR MARLIN, TEX.

LOCATION.—Lat. 31°17'20", long. 96°58'10", on bridge on State Highway 139 1 mile upstream from Deer Creek and 4.5 miles southwest of Marlin, Falls County. Datum of gage is 312.15 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—29,150 square miles, of which about 9,240 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Graph drawn on basis of two or more wire-weight gage readings daily and crest gage height obtained from floodmark.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 4.3 and 6.1 feet; hundredths below and tenths above these limits. Discharge obtained by shifting-control method.

MAXIMA.—June 1940: Discharge, 30,000 second-feet 12 m. June 29 (gage height, 16.0 feet, from floodmark).

1938–40: Discharge, 69,500 second-feet Nov. 26, 1940 (gage height, 25.0 feet).

1899–1937: Stage, 35.8 feet Dec. 3 or 4, 1913, and 35.2 feet Sept. 28, 1936 (discharges not determined).

REMARKS.—Small diversions upstream affect low flow only.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
24	5,880	11,660	2	6,000	11,900	10	2,600	5,160
25	6,600	13,090	3	9,700	19,240	11	2,310	4,580
26	6,200	12,300	4	10,400	20,630	12	2,770	5,490
27	13,500	26,780	5	6,300	12,500	13	3,980	7,890
28	20,200	40,070	6	3,750	7,440	14	3,240	6,430
29	23,300	46,210	7	2,600	5,160	15	2,900	5,750
30	11,000	21,820	8	2,310	4,580	16	2,450	4,860
July			9	2,750	5,450	17	2,310	4,580
1	7,900	15,670						

Runoff, in acre-feet, for period June 24 to July 17 319,200

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 24			*June 27*			*June 29*—Continued		
2 a. m.	8.4	4,800	8 a. m.	10.5	10,300	8 a. m.	14.8	25,400
6	8.3	4,590	12 m.	11.2	12,500	10	15.6	28,500
12 m.	8.5	5,020	2 p. m.	11.6	13,800	12 m.	16.0	30,000
4 p. m.	8.9	5,940	4	12.1	15,500	2 p. m.	15.9	29,600
8	9.6	7,760	6	12.5	16,900	4	15.6	28,500
12	10.1	9,160	8	12.9	18,300	6	15.0	26,200
June 25			10	13.1	19,000	8	14.3	23,500
4 a. m.	10.3	9,720	12	13.3	19,700	10	13.4	20,100
8	10.0	8,880	*June 28*			12	12.2	15,800
12 m.	9.1	6,420	4 a. m.	13.7	21,200			
4 p. m.	8.2	4,380	8	13.8	21,600	*June 30*		
8	7.9	3,790	12 m.	13.7	21,200	2 a. m.	11.6	13,800
12	7.8	3,600	4 p. m.	13.5	20,500	4	11.2	12,500
June 26			8	13.1	19,000	8	10.8	11,200
4 a. m.	7.8	3,600	12	12.5	16,900	12 m.	10.6	10,600
8	8.3	4,590	*June 29*			6 p. m.	10.3	9,720
12 m.	8.9	5,940	2 a. m.	12.1	15,500	12	10.0	8,880
4 p. m.	9.5	7,480	3	12.0	15,100	*July 1*		
8	10.1	9,160	4	12.0	15,100	12 m.	9.7	8,040
12	10.2	9,440	6	13.1	19,000	12 p. m.	8.9	5,940

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 2			*July 7*			*July 13*		
6 a. m.	8.7	5,460	12 m.	7.2	2,600	4 a. m.	8.4	4,590
8	8.7	5,460	12 p. m.	6.9	2,170	8	8.1	4,170
12 m.	8.8	5,700				12 m.	8.0	3,790
6 p. m.	9.1	6,420	*July 8*			6 p. m.	7.7	3,240
12	9.4	7,200	12 m.	7.0	2,310	12	7.6	3,240
			12 p. m.	7.2	2,600			
July 3						*July 14*		
6 a. m.	9.6	7,760	*July 9*			12 m.	7.6	3,240
12 m.	10.2	9,440	12 m.	7.3	2,750	12 p. m.	7.5	2,900
6 p. m.	11.0	11,800	12 p. m.	7.2	2,600			
8	11.2	12,500				*July 15*		
10	11.3	12,800	*July 10*			12 m.	7.4	2,900
12	11.2	12,500	12 m.	7.2	2,600	12 p. m.	7.2	2,600
			12 p. m.	7.0	2,310			
July 4						*July 16*		
6 a. m.	10.9	11,500	*July 11*			12 m.	7.2	2,450
12 m.	10.5	10,300	12 m.	7.0	2,310	12 p. m.	7.2	2,310
6 p. m.	10.1	9,160	12 p. m.	6.9	2,030			
12	9.8	8,320				*July 17*		
			July 12			12 m.	7.2	2,310
July 5			12 m.	6.8	2,030	12 p. m.	7.1	2,310
12 m.	9.0	6,180	2 p. m.	6.8	2,030			
12 p. m.	8.3	4,590	4	7.2	2,600			
			6	7.8	3,600			
July 6			8	8.3	4,590			
12 m.	7.8	3,600	10	8.5	4,800			
12 p. m.	7.5	3,070	12	8.6	5,020			

BRAZOS RIVER NEAR BRYAN, TEX.

LOCATION.—Lat. 30°37′, long. 96°29′, 2.4 miles downstream from Little Brazos River and 9 miles southwest of Bryan, Brazos County. Datum of gage is 192.3 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—38,430 square miles, of which about 9,240 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Water-stage recorder graph except July 10–12, for which a graph was drawn on the basis of twice-daily staff gage readings.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 5.0 and 7.4 feet; hundredths below and tenths above these limits. Discharge obtained by shifting-control method.

MAXIMA.—July 1940: Discharge, 57,900 second-feet 4 to 8 p. m. July 2 (gage height, 26.80 feet).

1925–40: Stage observed, 46.1 feet, present site and datum, May 20, 1930 (discharge not determined). Flood of Nov. 27, 1940, reached a stage of 42.5 feet (discharge, 150,000 second-feet).

1899–1924: Stage about 54.0 feet, present datum, Dec. 5, 1913 (discharge not determined).

REMARKS.—Small diversions upstream affect low flow only.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
25	8,940	17,730	2	55,400	109,900	11	4,000	7,930
26	10,100	20,030	3	49,000	97,190	12	4,110	8,150
27	9,700	19,240	4	40,400	80,130	13	6,610	13,110
28	16,900	33,520	5	35,500	70,410	14	11,200	22,210
29	23,100	45,820	6	19,200	38,080	15	7,780	15,430
30	40,600	80,530	7	9,200	18,250	16	5,710	11,330
July			8	6,600	13,090	17	5,710	11,330
1	44,300	87,870	9	5,400	10,710			
			10	4,250	8,430			

Runoff, in acre-feet, for period June 25 to July 17, 1940 840,400

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 25			*July 1*			*July 6*—Continued		
1 a. m.	10.0	7,550	3 a. m.	23.0	44,800	12 m.	14.4	18,300
6	10.0	7,550	6	22.5	43,200	2 p. m.	13.8	16,800
12 m.	10.4	8,370	10	22.3	42,600	4	13.4	15,600
8 p. m.	11.6	11,000	12 m.	22.3	42,600	6	13.0	14,600
12	11.7	11,200	3 p. m.	22.5	43,200	9	12.4	12,900
June 26			6	22.8	44,100	12	11.9	11,700
1 a. m.	11.7	11,200	9	23.5	46,300	*July 7*		
6 p. m.	10.9	9,440	12	24.1	48,300	3 a. m.	11.6	11,000
12	10.9	9,440	*July 2*			6	11.2	10,100
June 27			2 a. m.	24.6	50,000	9	10.9	9,440
12 m.	10.8	9,220	4	25.1	51,700	12 m.	10.7	9,000
6 p. m.	10.7	9,000	6	25.5	53,200	3 p. m.	10.5	8,580
8	11.1	9,880	8	26.0	55,000	6	10.4	8,370
10	11.9	11,700	10	26.3	56,000	9	10.2	7,950
12	12.5	13,100	12 m.	26.5	56,800	12	10.0	7,550
June 28			2 p. m.	26.7	57,500	*July 8*		
1 a. m.	12.8	14,100	4	26.8	57,900	3 a. m.	9.9	7,350
2	13.0	14,600	8	26.8	57,900	9	9.7	6,970
3	13.2	15,000	10	26.6	57,200	3 p. m.	9.4	6,230
4	13.4	15,600	12	26.4	56,400	9	9.2	5,880
6	13.6	16,000	*July 3*			12	9.1	5,710
9	13.9	17,000	3 a. m.	26.0	55,000	*July 9*		
12 m.	14.1	17,600	6	25.4	52,800	6 a. m.	9.0	5,540
6 p. m.	14.3	18,100	9	24.8	50,700	12 m.	8.9	5,370
12	14.6	18,900	12 m.	24.0	47,900	9 p. m.	8.9	5,370
June 29			2 p. m.	23.6	46,600	12	8.8	5,210
3 a. m.	14.7	19,100	4	23.1	45,100	*July 10*		
9	15.3	20,900	6	23.0	44,800	3 a. m.	8.7	4,890
12 m.	15.7	22,200	12	22.8	44,100	9	8.3	4,280
2 p. m.	16.2	23,600	*July 4*			3 p. m.	8.1	3,998
4	16.5	24,400	3 a. m.	22.6	43,500	9	8.0	3,850
6	17.0	26,000	6	22.2	42,300	12	7.9	3,710
8	17.5	27,800	9	21.7	40,700	*July 11*		
10	18.1	29,400	12 m.	21.3	39,500	6 a. m.	7.9	3,710
12	18.6	31,200	3 p. m.	21.2	39,200	9	8.0	3,850
June 30			12	20.9	38,300	12 m.	8.1	3,990
2 a. m.	19.2	32,900	*July 5*			6 p. m.	8.2	4,180
4	19.7	34,700	6 a. m.	20.8	38,000	12	8.3	4,280
6	20.2	36,200	9	20.7	37,700	*July 12*		
8	20.7	37,700	12 m.	20.3	36,800	2 a. m.	8.2	4,130
10	21.3	39,500	3 p. m.	20.0	35,600	6	8.2	4,130
12 m.	21.8	41,000	6	19.4	33,500	10	8.2	4,130
2 p. m.	22.3	42,600	8	19.0	32,400	2 p. m.	8.1	3,990
4	22.8	44,100	10	18.5	30,600	6	8.1	3,990
5	23.3	45,700	12	17.9	28,900	10	8.3	4,280
6	23.6	46,600	*July 6*			12	8.4	4,430
7	23.7	47,000	2 a. m.	17.4	27,200			
8	23.8	47,300	4	16.8	25,500			
9	23.8	47,300	6	16.2	23,600			
10	23.7	47,000	8	15.6	21,700			
12	23.5	46,300	10	14.9	19,600			

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 13			*July 15*			*July 17*		
2 a. m.	8.6	4,730	6 a. m.	10.7	8,580	3 a. m.	8.9	5,210
6	8.7	4,890	6 p. m.	9.9	6,970	9	9.1	5,540
10	8.6	4,730	12	9.5	6,230	3 p. m.	9.4	6,050
2 p. m.	9.2	5,710				9	9.4	6,050
6	10.7	8,580				12	9.4	6,050
10	11.8	11,000	*July 16*					
12	12.0	11,500						
			3 a. m.	9.4	6,050			
July 14			9	9.3	5,880			
6 a. m.	12.1	11,700	3 p. m.	9.2	5,710			
6 p. m.	11.7	10,800	9	8.9	5,210			
12	11.2	9,660	12	8.8	5,050			

BRAZOS RIVER NEAR HEMPSTEAD, TEX.

LOCATION.—Lat. 30°07′05″, long. 96°11′30″, at Texas and New Orleans R. R. bridge prior to Nov. 1, 1940, and thereafter at bridge on U. S. Highway 290 4,500 feet upstream, 6.5 miles northwest of Hempstead, Waller County, and 7 miles upstream from Caney Creek. Datum of gage at railroad bridge is 112.10 feet and at highway bridge 118.07 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—42,670 square miles, of which about 9,240 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Graph drawn on basis of two or more chain gage readings daily, including reading at crest stage.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 7.2 and 10.7 feet; hundredths below and tenths above these limits. Discharge 9 a. m. July 5 to July 17 obtained by shifting-control method.

MAXIMA.—July 1940: Discharge, 83,100 second-feet 6 to 10 p. m. July 3 (gage height, 42.8 feet at railroad bridge and 37.7 feet at highway bridge from U. S. Weather Bureau gage).

1938–40: Discharge, 116,000 second-feet Nov. 30, 1940 (gage height, 44.04 feet, observed at crest at highway bridge).

1899–1937: Stage, 61.1 feet on Dec. 8, 1913 (gage height of this flood at U. S. Weather Bureau gage 4,500 feet upstream, which is at same location and to same datum as wire-weight gage used after Nov. 1, 1940, was 56.1 feet; discharge not determined).

REMARKS.—Flood flow during major floods affected by natural storage in wide flood plain.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
25	10,300	20,430	2	72,000	142,800	10	11,100	22,020
26	10,600	21,020	3	82,000	162,600	11	9,500	18,840
27	11,100	22,020	4	79,100	156,900	12	8,600	17,060
28	11,600	23,010	5	66,800	132,500	13	8,100	16,070
29	20,000	39,670	6	51,600	102,300	14	9,400	18,640
30	30,400	60,300	7	31,600	62,680	15	12,600	24,990
			8	17,000	33,720	16	9,640	19,120
July			9	13,000	25,790	17	7,440	14,760
1	53,000	105,100						

Runoff, in acre-feet, for period June 25 to July 17 1,262,000

Gage-height, in feet, and discharge, in second-feet, at indicated times, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 25			*July 3*			*July 9*		
6 a. m.	18.4	10,800	3 a. m.	42.0	80,200	6 a. m.	21.7	13,400
6 p. m.	17.7	9,780	9	42.5	82,000	12 m.	21.1	12,800
12	17.5	9,500	3 p. m.	42.7	82,700	6 p. m.	20.7	12,400
June 26			9	42.8	83,100	12	20.2	11,800
6 a. m.	17.6	9,640	12	42.7	82,700	*July 10*		
6 p. m.	18.9	11,500	*July 4*			12 m.	19.6	11,000
12	19.0	11,600	3 a. m.	42.6	82,400	12 p. m.	19.1	10,300
June 27			9	42.2	80,900	*July 11*		
2 a. m.	19.0	11,600	3 p. m.	41.6	78,800	12 m.	18.6	9,640
10 p. m.	18.3	10,600	9	40.7	75,500	12 p. m.	17.9	8,720
12	18.2	10,500	12	40.3	74,100	*July 12*		
June 28			*July 5*			12 m.	17.6	8,330
6 a. m.	18.1	10,300	3 a. m.	39.9	72,600	12 p. m.	17.6	8,330
6 p. m.	19.6	12,500	9	39.0	68,400	*July 13*		
12	21.3	15,200	3 p. m.	38.1	64,200	12 m.	17.6	8,330
June 29			9	37.3	61,800	12 p. m.	17.4	8,070
6 a. m.	22.5	17,700	12	36.9	60,500	*July 14*		
6 p. m.	24.2	22,200	*July 6*			8 a. m.	17.3	7,940
12	24.9	24,100	3 a. m.	36.5	59,100	12 m.	17.9	8,720
June 30			9	35.5	55,000	6 p. m.	19.5	10,900
4 a. m.	25.4	25,500	3 p. m.	34.3	49,900	12	20.6	12,500
8	26.0	27,200	9	32.9	42,800	*July 15*		
12 m.	26.8	29,400	12	32.1	40,600	3 a. m.	20.8	12,800
4 p. m.	27.8	32,400	*July 7*			9	20.9	13,000
8	28.9	35,700	3 a. m.	31.2	38,400	3 p. m.	20.8	12,800
12	30.7	40,000	9	29.6	34,500	9	20.0	11,600
July 1			3 p. m.	28.0	29,400	12	19.7	11,200
3 a. m.	31.4	43,500	9	26.6	25,200	*July 16*		
9	33.6	50,900	12	25.9	23,000	6 a. m.	19.1	10,300
3 p. m.	35.1	56,000	*July 8*			6 p. m.	18.1	8,980
9	36.6	61,100	3 a. m.	25.4	21,100	12	17.6	8,330
12	37.3	63,600	6	24.8	19,300	*July 17*		
July 2			9	24.3	17,700	6 a. m.	17.1	7,680
3 a. m.	38.0	66,000	12 m.	23.8	16,200	6 p. m.	16.7	7,190
9	39.2	70,200	3 p. m.	23.5	15,200	12	16.6	7,070
3 p. m.	40.4	74,400	6	23.0	14,700			
9 p. m.	41.3	77,700	9	22.6	14,400			
12	41.6	78,800	12	22.3	14,200			

BRAZOS RIVER NEAR SAN FELIPE, TEX.

LOCATION.—Lat. 29°46'20", long. 96°02'10", at bridge on U. S. Highway 90 200 feet downstream from Missouri-Kansas-Texas R. R. bridge, 1.3 miles downstream from Irons Creek, and 5.0 miles southeast of San Felipe, Austin County. Datum of gage is 79.32 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—43,690 square miles, of which about 9,240 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 8.1 and 10.4 feet; hundredths below and tenths above these limits. Discharge obtained by shifting-control method.

MAXIMA.—July 1940: Discharge, 80,200 second-feet at 9 a. m. July 4 (gage height, 33.44 feet).

1938–40: Discharge, 152,000 second-feet Nov. 25, 1940 (gage height, 41.1 feet).

1899–1937: Stage, 49.0 feet on Dec. 9. 1913 (discharge not determined).

REMARKS.—Flood flow during major floods affected by natural storage in wide flood plain.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
25	11,500	22,810	2	66,800	132,500	11	10,200	20,230
26	9,940	19,720	3	76,000	150,700	12	8,900	17,650
27	11,000	21,820	4	80,100	158,900	13	9,000	17,850
28	11,000	21,820	5	72,200	143,200	14	8,600	17,060
29	18,800	37,290	6	60,000	119,000	15	12,100	24,000
30	30,000	59,500	7	42,400	83,700	16	11,900	23,600
July			8	26,700	52,960	17	9,180	18,210
1	50,000	99,170	9	16,500	32,730			
			10	12,000	23,800			

Runoff, in acre-feet, for period June 25 to July 17 1,318,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 25			*July 2*—Continued			*July 9*		
1 a. m.	14.7	13,400	3 p. m.	30.3	68,000	3 a. m.	17.3	19,500
6	14.4	12,400	9	30.9	70,300	9	16.6	17,200
12 m.	14.0	11,500	12	31.2	71,500	3 p. m.	16.1	15,300
6 p. m.	13.6	10,900	*July 3*			9	15.7	14,200
12	13.4	10,200	3 a. m.	31.5	72,600	12	15.5	13,700
June 26			9	32.0	74,600	*July 10*		
3 a. m.	13.2	10,000	3 p. m.	32.6	77,000	6 a. m.	15.2	12,700
9	13.1	9,780	9	33.1	79,000	6 p. m.	14.7	11,500
3 p. m.	13.1	9,780	12	33.2	79,400	12	14.4	10,900
9	13.4	10,200	*July 4*			*July 11*		
12	13.6	10,900	6 a. m.	33.4	80,200	12 m.	14.2	10,200
June 27			9	33.44	80,200	12 p. m.	13.8	9,340
1 p. m.	14.0	11,500	6 p. m.	33.4	80,200	*July 12*		
12	13.9	11,300	12	33.1	79,000	12 m.	13.4	8,700
June 28			*July 5*			6 p. m.	13.3	8,500
12 m.	13.7	10,900	3 a. m.	32.9	76,600	10	13.8	9,560
5 p. m.	13.6	10,700	9	32.5	74,200	12	13.7	9,340
12	14.1	11,800	3 p. m.	31.9	70,700	*July 13*		
June 29			9	31.3	67,600	12 m.	13.3	8,700
3 a. m.	14.6	12,700	12	30.9	65,700	12 p. m.	13.3	8,700
9	15.7	15,600	*July 6*			*July 14*		
12 m.	16.5	18,200	3 a. m.	30.6	64,100	12 m.	13.1	8,300
3 p. m.	17.5	21,500	6	30.2	62,600	12 p. m.	13.5	9,120
6	18.3	24,200	9	29.9	61,100	*July 15*		
12	18.9	26,300	12 m.	29.6	60,000	3 a. m.	14.0	10,200
June 30			3 p. m.	29.2	58,500	9	14.7	11,800
3 a. m.	19.1	26,600	6	28.7	56,600	3 p. m.	15.2	12,900
9	19.5	28,000	9	28.2	54,800	9	15.4	13,400
3 p. m.	20.3	30,900	12	27.7	52,900	12	15.4	13,400
6	20.7	32,300	*July 7*			*July 16*		
9	21.3	34,500	3 a. m.	27.0	50,000	3 a. m.	15.2	12,900
12	22.1	37,400	6	26.3	47,400	9	15.0	12,400
July 1			9	25.7	45,100	3 p. m.	14.6	11,500
3 a. m.	22.8	40,000	12 m.	24.8	41,800	9	14.2	10,700
6	23.6	42,900	3 p. m.	24.0	39,600	12	14.0	10,200
9	24.7	47,000	6	23.2	37,000	*July 17*		
12 m.	25.8	51,100	9	22.5	34,800	3 a. m.	13.8	10,000
3 p. m.	26.6	54,000	12	21.8	33,000	9	13.4	9,340
6	27.3	56,600	*July 8*			3 p. m.	13.2	8,900
9	28.0	59,200	3 a. m.	21.2	31,200	9	13.1	8,500
12	28.4	60,700	9	20.0	27,700	12	12.9	8,100
July 2			3 p. m.	18.9	24,900			
3 a. m.	29.0	63,000	9	18.0	22,100			
9	29.7	65,700	12	17.7	21,200			

BRAZOS RIVER AT RICHMOND, TEX.

LOCATION.—Lat. 29°35′, long. 95°45′, on bridge on U. S. Highway 59 in Richmond, Fort Bend County, 925 feet downstream from bridge of Texas and New Orleans R. R. (formerly Galveston, Harrisburg & San Antonio Ry.). Datum of gage is 40.8 feet above mean sea level, datum of 1917.

DRAINAGE AREA.—44,050 square miles, of which about 9,240 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 2.5 and 4.5 feet; hundredths below and tenths above these limits. Discharge obtained by shifting-control method.

MAXIMA.—July 1940: Discharge, 82,100 second-feet 6 a. m. July 5 (gage height, 31.22 feet).

1903–6, 1922–40: Discharge, 120,000 second-feet June 7 1929 (gage height, 40.6 feet), and 117,000 second-feet Nov. 28, 1940 (gage height, 38.40 feet).

1899–1902, 1907–21: Stage, 48.2 feet, present datum, Dec. 10, 1913 (discharge not determined), from flood marks on right bank 1,000 feet upstream from gage.

REMARKS.—Considerable water diverted above station for irrigation. Flood flow during major floods affected by natural storage in wide flood plain.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
25	14,100	27,970	2	61,000	121,000	11	11,200	22,210
26	10,200	20,230	3	74,000	146,800	12	9,400	18,640
27	10,200	20,230	4	81,200	161,100	13	8,900	17,650
28	11,500	22,810	5	80,000	158,700	14	8,400	16,660
29	13,500	26,780	6	70,200	139,200	15	9,110	18,070
30	27,000	53,550	7	54,500	108,100	16	12,200	24,200
July			8	34,600	68,630	17	9,700	19,240
1	41,800	82,910	9	20,500	40,660			
			10	14,000	27,770			

Runoff, in acre-feet, for period June 25 to July 17, 1940 1,363,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 25			*June 28*			*June 30*—Continued		
3 a. m.	11.8	15,900	12 m.	10.1	11,800	6 p. m.	16.1	29,000
9	11.3	14,700	12 p. m.	9.8	11,200	9	16.5	30,500
3 p. m.	10.8	13,500				12	17.0	32,000
9	10.3	12,300	*June 29*					
12	10.1	11,800	6 a. m.	9.8	11,200	*July 1*		
			12 m.	10.2	12,300	4 a. m.	17.6	34,100
June 26			6 p. m.	11.4	15,100	8	18.7	37,400
2 a. m.	10.0	11,600	12	13.1	20,300	12 m.	19.8	40,700
2 p. m.	9.4	10,100				4 p. m.	21.1	44,900
12	9.2	9,640	*June 30*			8	22.6	50,000
			3 a. m.	14.0	22,600	12	23.5	53,000
June 27			6	14.7	24,600			
6 a. m.	9.3	9,860	9	15.2	26,200	*July 2*		
12 m.	9.5	10,300	12 m.	15.5	27,100	4 a. m.	24.3	55,600
12 p. m.	10.0	11,600	3 p. m.	15.8	28,200	8	25.2	58,300

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 2—Continued			*July 8*			*July 13*		
12 m	25.8	61,100	3 a. m	22.7	42,000	2 a. m	9.7	8,800
4 p. m	26.4	63,400	6	21.8	39,500	4	9.8	9,000
8	26.9	65,500	9	20.9	36,800	6	9.8	9,000
12	27.4	67,900	12 m	20.0	34,400	12 m	9.8	9,000
July 3			3 p. m	19.2	32,000	6 p. m	9.8	9,000
4 a. m	27.9	70,200	6	18.4	29,900	12	9.6	8,600
8	28.3	71,900	9	17.6	27,600	*July 14*		
12 m	28.8	74,700	12	16.9	26,000	3 a. m	9.6	8,600
4 p. m	29.1	76,400	*July 9*			9	9.5	8,400
8	29.5	77,700	3 a. m	16.2	24,000	3 p. m	9.5	8,400
12	29.8	78,700	6	15.6	22,600	9	9.4	8,200
July 4			9	15.1	21,300	12	9.4	8,200
6 a. m	30.2	80,100	12 m	14.6	20,000			
12 m	30.6	81,500	3 p. m	14.2	19,000	*July 15*		
6 p. m	30.9	82,100	6	13.8	17,900	3 a. m	9.3	8,020
12	31.2	82,100	9	13.5	17,100	9	9.3	8,020
July 5			12	13.2	16,400	3 p. m	9.9	9,200
6 a. m	31.22	82,100	*July 10*			9	10.8	11,200
12 m	31.2	80,100	6 a. m	12.6	14,900	12	11.2	12,100
6 p. m	30.9	77,700	12 m	12.2	13,900			
12	30.6	75,300	6 p. m	11.8	13,000	*July 16*		
July 6			12	11.4	12,300	3 a. m	11.4	12,500
6 a. m	30.3	73,600	*July 11*			9	11.4	12,500
12 m	29.8	70,200	6 a. m	11.1	11,800	3 p. m	11.3	12,300
4 p. m	29.4	68,200	12 m	10.8	11,200	9	11.0	11,600
8	29.0	66,500	6 p. m	10.6	10,700	12	10.8	11,200
12	28.5	64,100	12	10.5	10,500			
July 7			*July 12*			*July 17*		
4 a. m	28.0	61,100	6 a. m	10.3	10,100	3 a. m	10.6	10,700
8	27.3	58,700	12 m	10.2	9,860	9	10.2	9,860
12 m	26.5	54,600	2 p. m	10.2	9,860	3 p. m	10.0	9,420
4 p. m	25.6	51,000	6	9.9	9,200	9	9.7	8,800
8	24.6	48,400	12	9.7	8,800	12	9.6	8,600
12	23.6	44,900						

BRAZOS RIVER AT EAST COLUMBIA, TEX.

LOCATION.—Lat. 29°09′, long. 95°37′, at bridge on State Highway 35 at East Columbia, Brazoria County, 1 mile downstream from Yarners Creek. Datum of gage is 2.9 feet below mean sea level, datum of 1929.

DRAINAGE AREA.—44,540 square miles, of which about 9,240 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Graph drawn on basis of two or more wire-weight gage readings daily.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to tenths throughout. Discharge below 8,000 second-feet seriously affected by tides. Discharge June 30 to July 9 obtained by shifting-control method; the amount of shift used July 4–7 was generally taken as the mean of the shifts indicated by the two discharge measurements made on each of those days.

MAXIMA.—July 1940: Discharge, 65,000 second-feet 2 p. m. July 5; gage height, 32.14 feet 3 a. m. July 6.

1938–40: Stage, 34.12 feet Dec. 5, 1940 (discharge not determined).

1898–1937: Stage, 35.3 feet Dec. 11 or 12, 1913 (discharge not determined). The flood of 1899 reached a stage 0.3 foot lower than the flood of 1913, according to information furnished by a local resident.

REMARKS.—Flood flow greatly affected by natural storage in wide flood plain. Results of eight discharge measurements made July 4–7, 1940, furnished by Corps of Engineers, U. S. Army.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
30	16,800	33,320	3	57,600	114,200	8	48,500	96,200
July			4	63,000	125,000	9	32,100	63,670
1	27,100	53,750	5	64,100	127,100	10	20,100	39,870
2	45,500	90,250	6	61,100	121,200	11	14,700	29,160
			7	56,700	112,500			

Runoff, in acre-feet, for period June 30 to July 11 1,006,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 30			*July 3*—Continued			*July 7*—Continued		
3 a. m.	12.4	14,400	6 p. m.	29.9	59,600	3 p. m.	31.0	56,000
6	12.9	15,300	9	30.2	60,400	6	30.8	55,500
9	13.3	16,100	12	30.4	60,900	9	30.5	55,000
12 m.	13.6	16,700				12	30.0	53,900
3 p. m.	13.9	17,500	*July 4*					
6	14.2	18,100	3 a. m.	30.7	62,000	*July 8*		
9	14.6	19,000	6	30.9	62,500	3 a. m.	29.6	53,100
12	15.1	20,100	9	31.1	63,100	6	29.1	52,000
July 1			12 m.	31.2	63,300	9	28.6	50,900
3 a. m.	15.6	21,400	3 p. m.	31.3	63,600	12 m.	28.1	49,800
6	16.1	22,600	6	31.4	63,600	6 p. m.	26.3	45,200
9	17.0	24,600	9	31.5	63,900	12	24.4	40,400
12 m.	17.8	26,500	12	31.6	64,200			
2 p. m.	18.4	28,200				*July 9*		
4	19.0	29,600	*July 5*			3 a. m.	23.5	38,300
6	19.6	31,200	3 a. m.	31.7	64,200	6	22.5	36,000
8	20.2	32,600	6	31.7	64,200	9	21.6	33,900
10	20.8	34,200	9	31.8	64,400	12 m.	20.7	31,900
12	21.4	35,700	12 m.	31.9	64,700	3 p. m.	19.8	29,900
July 2			2 p. m.	32.0	65,000	6	18.9	27,900
2 a. m.	22.0	37,600	3	32.0	64,400	9	18.2	26,200
4	22.6	39,100	6	32.1	64,200	12	17.6	24,800
6	23.2	40,700	9	32.1	63,600			
8	23.8	42,600	12	32.1	63,100	*July 10*		
10	24.5	44,400				3 a. m.	17.0	23,700
12 m.	25.2	45,800	*July 6*			6	16.5	22,600
2 p. m.	25.6	47,400	3 a. m.	32.1	62,500	9	16.0	21,400
4	26.1	48,800	6	32.1	62,000	12 m.	15.4	20,100
6	26.6	50,100	9	32.1	61,400	3 p. m.	14.9	19,000
8	27.0	51,200	12 m.	32.1	61,200	6	14.3	17,700
10	27.4	52,300	3 p. m.	32.0	60,600	9	13.9	16,900
12	27.7	53,100	6	32.0	60,400	12	13.6	16,300
			9	31.9	59,800			
July 3			12	31.8	59,300	*July 11*		
3 a. m.	28.2	54,700	*July 7*			3 a. m.	13.4	15,900
6	28.6	55,800	3 a. m.	31.7	58,800	9	13.0	15,100
9	29.0	56,900	6	31.6	58,200	3 p. m.	12.6	14,400
12 m.	29.3	57,700	9	31.4	57,400	9	12.1	13,500
3 p. m.	29.6	58,800	12 m.	31.3	56,900	12	11.8	13,000

LITTLE RIVER AT CAMERON, TEX.

LOCATION.—Lat. 30°50′, long. 96°57′, at site of old McCowan bridge 2,100 feet upstream from bridge on U. S. Highway 77 and 2 miles southeast of Cameron, Milam County. Datum of gage is 281.9 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—7,034 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 90,000 second-feet, and extended above by logarithmic plotting on basis of one slope-area measurement at 53.2 feet gage height. Gage heights used to half tenths between 5.0 and 6.2 feet, and 32.4 and 34.8 feet; hundredths below and tenths between and above these limits.

MAXIMA.—July 1940: Discharge, 75,400 second-feet 11 a. m. July 1 (gage height, 36.65 feet).

1916–39: Discharge, 647,000 second-feet Sept. 10, 1921 (gage height, 53.2 feet, present site and datum), by slope-area method.

1852–1915: The flood of 1852 reached about the same stage as that of Sept. 10, 1921, according to information furnished by local resident.

REMARKS.—Flood flow affected by natural storage in wide flood plain. Small diversions affect low flow only.

Mean discharge, in second-feet, and runoff in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	3,500	6,940	2	35,500	70,410	8	2,490	4,940
29	6,500	12,890	3	22,000	43,640	9	2,100	4,170
30	38,000	75,370	4	25,000	49,590	10	1,830	3,630
July			5	11,800	23,400			
1	66,000	130,900	6	4,900	9,720			
			7	3,000	5,950			

Runoff, in acre-feet, for period June 28 to July 10 441,500

Gage-height, in feet, and discharge, in second-feet, at indicated time 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 29*—Continued			*June 30*—Continued		
1 a. m.	13.9	4,000	7 p. m.	25.7	9,540	8 p. m.	35.8	56,600
6	13.2	3,700	8	26.4	9,920	10	35.8	56,600
12 m.	12.6	3,460	9	27.2	10,400	12	36.0	61,000
6 p. m.	11.7	3,090	10	27.8	10,700			
12	10.5	2,610	11	28.5	11,200	*July 1*		
			12	29.2	11,600	3 a. m.	36.2	65,500
June 29						6	36.3	67,900
3 a. m.	9.9	2,370	*June 30*			9	36.5	72,900
4	9.9	2,370	1 a. m.	30.1	12,100	10	36.6	75,400
5	10.8	2,730	2	31.0	12,700	11	36.65	75,400
6	12.0	3,210	3	31.7	13,300	12 m.	36.6	75,400
7	13.0	3,620	4	32.35	14,400	3 p. m.	36.4	70,400
8	14.4	4,210	5	32.80	16,800	6	36.0	61,000
9	15.6	4,730	6	33.15	19,600	9	35.8	56,600
10	16.8	5,260	7	33.40	21,800	12	35.5	50,400
11	17.8	5,710	8	33.70	24,600			
12 m.	18.7	6,120	9	33.95	27,200	*July 2*		
1 p. m.	19.8	6,610	10	34.20	30,000	2 a. m.	35.2	45,000
2	20.9	7,100	11	34.50	34,200	4	35.0	41,700
3	22.0	7,650	12 m.	34.75	38,000	6	34.80	38,700
4	23.0	8,150	2 p. m.	35.3	46,700	8	34.65	36,400
5	23.9	8,600	4	35.6	52,400	10	34.55	35,000
6	24.8	9,050	6	35.8	56,600	12 m.	34.45	33,400

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 2—Continued			*July 5*—Continued			*July 7*		
4 p. m.	34.35	32,000	6 a. m.	32.0	13,600	4 a. m.	12.3	3,330
8	34.15	29,400	8	31.6	13,200	8	11.9	3,170
12	33.85	26,100	10	31.0	12,700	12 m.	11.6	3,050
July 3			12 m.	30.1	12,100	4 p. m.	11.3	2,930
6 a. m.	33.40	21,800	2 p. m.	28.8	11,300	8	11.0	2,810
12 m.	33.15	19,600	4	27.2	10,400	12	10.8	2,730
6 p. m.	33.25	20,400	6	25.3	9,320	*July 8*		
12	33.75	25,100	8	23.9	8,600	6 a. m.	10.4	2,570
July 4			10	22.4	7,850	12 m.	10.1	2,450
3 a. m.	34.10	28,800	12	21.0	7,150	6 p. m.	9.9	2,370
6	34.16	29,400	*July 6*			12	9.6	2,250
9	34.10	28,800	2 a. m.	19.7	6,560	*July 9*		
12 m.	33.85	26,100	4	18.4	5,980	6 a. m.	9.4	2,180
2 p. m.	33.70	24,600	6	17.3	5,480	12 m.	9.2	2,100
4	33.50	22,700	8	16.3	5,040	6 p. m.	9.0	2,020
6	33.30	20,900	10	15.5	4,690	12	8.8	1,940
8	33.15	19,600	12 m.	14.8	4,380	*July 10*		
10	32.95	18,000	2 p. m.	14.2	4,130	6 a. m.	8.6	1,870
12	32.75	16,400	4	13.7	3,910	12 m.	8.5	1,830
July 5			6	13.4	3,790	6 p. m.	8.3	1,750
2 a. m.	32.55	15,200	8	13.2	3,700	12	8.1	1,680
4	32.4	14,400	10	12.9	3,580			
			12	12.7	3,500			

YEGUA CREEK NEAR SOMERVILLE, TEX.

LOCATION.—Lat. 30°19′, long. 96°30′, at bridge on State Highway 36, 760 feet downstream from bridge of Gulf, Colorado & Santa Fe Ry., 2 miles south of Somerville, Burleson County, and 5 miles upstream from Davidson Creek. Datum of gage is 199.29 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—990 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights June 28–30 used to half tenths between 6.5 and 10.2 feet; July 1–10, 7.0 and 10.2 feet; hundredths below and tenths above these limits. Discharge obtained by shifting-control method July 9, 10.

MAXIMA.—1940: Discharge, 56,800 second-feet 4:30 a. m. July 1 (gage height, 19.27 feet).

1924–39: Discharge observed, 33,600 second-feet May 30, 1929 (gage height, 16.7 feet, present site and datum).

1913–23: Stage, 22.0 feet, present site and datum, Dec. 5, 1913 (discharge not determined), according to information furnished by chief engineer of Gulf, Colorado & Santa Fe Ry. Co.

REMARKS.—Flow affected by natural storage in wide flood plain.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	37	73	2	27,300	54,150	7	1,180	2,340
29	585	1,160	3	12,800	25,390	8	636	1,260
30	19,500	38,680	4	5,700	11,310	9	378	750
July			5	3,150	6,250	10	174	345
1	49,900	98,980	6	1,940	3,850			

Runoff, in acre-feet, for period June 28 to July 10 244,500

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 30*—Continued			*July 4*		
1 a. m.	3.17	44	8 p. m.	17.2	40,700	3 a. m.	10.5	7,340
12 m.	2.99	36	9	17.6	43,700	6	10.2	6,520
12 p. m.	2.95	34	10	18.0	46,600	9	10.0	6,000
June 29			11	18.3	48,900	12 m.	9.75	5,410
2 a. m.	2.94	34	12	18.6	51,200	4 p. m.	9.45	4,780
4	3.20	45	*July 1*			8	9.20	4,320
5	3.85	80	1 a. m.	18.9	53,600	12	9.00	3,980
6	4.35	114	2	19.0	54,400	*July 5*		
7	4.62	136	3	19.2	56,000	6 a. m.	8.70	3,480
8	4.80	154	4:30	19.27	56,800	12 m.	8.50	3,160
19	4.95	180	6	19.2	56,000	6 p. m.	8.25	2,740
10	5.15	230	8	19.1	55,200	12	8.05	2,410
11	5.25	265	10	18.9	53,600	*July 6*		
2 m.	5.35	310	12 m.	18.6	51,200	6 a. m.	7.85	2,120
2 p. m.	5.62	473	2 p. m.	18.4	49,700	12 m.	7.70	1,930
4	5.94	694	4	18.1	47,400	6 p. m.	7.55	1,760
6	6.27	936	6	17.8	45,200	12	7.35	1,550
8	6.70	1,290	8	17.5	42,900	*July 7*		
10	7.05	1,590	10	17.2	40,700	6 a. m.	7.15	1,350
11	7.45	1,940	12	16.8	37,800	6 p. m.	6.78	1,020
12	7.80	2,260	*July 2*			12	6.58	860
June 30			3 a. m.	16.4	34,800	*July 8*		
1 a. m.	8.25	2,790	6	15.9	31,400	6 a. m.	6.38	716
2	8.70	3,480	9	15.5	28,800	6 p. m.	6.12	556
3	9.20	4,320	12 m.	15.2	27,000	12	5.98	485
4	9.70	5,300	3 p. m.	14.8	24,800	*July 9*		
5	10.2	6,520	6	14.4	22,600	6 a. m.	5.89	440
6	10.4	7,060	9	14.0	20,700	6 p. m.	5.64	316
7	10.6	7,620	12	13.6	18,800	12	5.43	250
9	10.8	8,200	*July 3*			*July 10*		
10	11.0	8,800	3 a. m.	13.2	17,000	6 a. m.	5.25	195
11	11.2	9,440	6	12.8	15,300	6 p. m.	4.82	153
12 m.	11.7	11,100	9	12.5	14,100	12	4.59	133
1 p. m.	12.4	13,700	12 m.	12.1	12,500			
2	13.2	17,000	3 p. m.	11.7	11,100			
3	14.1	21,100	6	11.3	9,760			
4	14.9	25,300	9	11.0	8,800			
5	15.6	29,400	12	10.8	8,200			
6	16.3	34,100						
7	16.8	37,800						

NAVASOTA RIVER NEAR EASTERLY, TEX.

LOCATION.—Lat. 31°10′10″, long. 96°17′55″, at bridge on U. S. Highway 79 1 mile upstream from Missouri Pacific R. R. bridge and 6 miles northeast of Easterly, Robertson County. Datum of gage is 276.42 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—949 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 35,000 second-feet. Gage heights used to half tenths between 4.9 and 7.2 feet; hundredths below and tenths above these limits.

MAXIMA.—July 1940: Discharge, 1,880 second-feet 7 to 12 p. m. July 1 (gage height, 12.83 feet).

1924–39: Discharge, 53,200 second-feet Sept. 5, 1932 (gage height, 21.9 feet, from floodmark).

1899–1923: Discharge, about 71,000 second-feet in 1900 (gage height, 24.0 feet), according to information furnished by local residents.

REMARKS.—Flood flow affected by natural storage in wide flood plain.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	46	91	2	1,750	3,470	7	137	272
29	216	428	3	1,400	2,780	8	75	149
30	933	1,850	4	708	1,400	9	50	99
July			5	510	1,010	10	37	73
1	1,790	3,550	6	319	633			

Runoff, in acre-feet, for period June 28 to July 10 15,800

Gage-height, in feet, and discharge, in second-feet, at indicated time. 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*July 2*			*July 6*		
1 a. m.	3.68	47	6 a. m.	12.7	1,840	6 a. m.	6.75	380
12 m.	3.55	42	12 m.	12.5	1,750	12 m.	6.35	316
10 p. m.	3.76	50	6 p. m.	12.4	1,710	6 p. m.	5.90	246
12	4.00	62	12	12.2	1,630	12	5.55	200
June 29			*July 3*			*July 7*		
6 a. m.	4.62	108	6 a. m.	12.0	1,560	12 m.	4.93	132
12 m.	5.25	170	12 m.	11.7	1,460	12 p. m.	4.54	95
6 p. m.	6.35	324	6 p. m.	11.0	1,260	*July 8*		
12	7.2	474	12	9.9	998	12 m.	4.23	75
June 30			*July 4*			12 p. m.	3.96	60
6 a. m.	7.8	600	7 a. m.	8.4	680	*July 9*		
12 m.	8.5	720	9	8.3	660	12 m.	3.75	50
2 p. m.	8.7	760	12 m.	8.4	680	12 p. m.	3.57	43
6	11.2	1,340	3 p. m.	8.4	680	*July 10*		
8	11.8	1,560	6	8.4	680	12 m.	3.41	37
10	12.1	1,630	12	8.0	600	12 p. m.	3.27	32
12	12.2	1,670	*July 5*					
July 1			6 a. m.	7.7	546			
6 a. m.	12.4	1,710	12 m.	7.5	510			
12 m.	12.6	1,790	6 p. m.	7.4	492			
7 p. m.	12.8	1,880	12	7.15	447			
12	12.8	1,880						

COLORADO RIVER BASIN

COLORADO RIVER AT AUSTIN, TEX.

LOCATION.—Lat. 30°14′40″, long. 97°41′20″, at Montopolis bridge on U. S. Highway 290 at southeast edge of Austin, Travis County, 2.8 miles upstream from Walnut Creek, 3.8 miles downstream from Waller Creek, 5 miles downstream from Barton Creek, and about 7 miles downstream from Austin Dam. Datum of gage is 407.3 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—38,160 square miles, of which about 11,800 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 3.1 and 5.2 feet; hundredths below and tenths above these limits. Discharge June 28, 29, July 3, 5–10, obtained by shifting-control method.

MAXIMA.—1940: Discharge, 45,700 second-feet (partly regulated) 11 a. m June 30 (gage height, 17.44 feet).

1898–1939: Discharge, 481,000 second-feet June 15, 1935 (gage height, 45.0 feet, present site and datum, from floodmark).

1843–97: Stage, 46.0 feet, present site and datum, July 7, 1869 (discharge not determined) from information furnished by Prof. T. U. Taylor concerning gage at former site.

REMARKS.—Flow partly regulated by reservoirs upstream having a combined capacity of 1,180,000 acre-feet exclusive of Marshall Ford Reservoir, in which storage was begun Sept. 10, 1940. Rehabilitation of Austin Dam completed and power plant placed in operation April 1940 (reservoir capacity, 20,000 acre-feet).

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	2,320	4,600	2	20,600	40,860	7	4,000	7,930
29	2,980	5,910	3	10,200	20,230	8	3,910	7,760
30	28,100	55,740	4	18,000	35,700	9	3,330	6,600
July			5	7,200	14,280	10	2,760	5,470
1	28,100	55,740	6	5,130	10,180			

Runoff, in acre-feet, for period June 28 to July 10 271,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 30*—Continued			*July 2*		
1 a. m	2.82	1,560	7 a. m	7.8	12,100	1 a. m	13.6	31,600
4	3.03	1,820	8	11.6	24,400	2	13.3	30,500
8	3.20	2,090	9	15.6	38,900	3	12.2	28,700
10	3.15	2,020	10	17.0	44,200	4	12.2	26,500
12 m	3.01	1,820	11	17.44	45,700	5	12.0	25,800
1 p. m	3.15	2,020	12 m	17.4	45,700	6	11.6	24,400
2	3.40	2,380	1 p. m	17.0	44,200	7	11.3	23,300
3	3.65	2,680	2	16.5	42,300	8	11.1	22,600
4	3.75	2,910	3	15.9	40,000	9	10.9	22,000
6	4.10	3,400	4	15.3	37,800	10	11.0	22,300
7	4.25	3,650	5	14.9	36,300	11	10.6	21,000
8	3.85	3,070	6	14.7	35,600	12 m	10.1	19,300
10	3.25	2,160	8	14.4	34,500	1 p. m	9.8	18,400
12	3.85	2,990	12	13.9	32,600	3	9.5	17,400
June 29			*July 1*			5	9.0	15,800
1 a. m	3.65	2,760	1 a. m	13.4	30,800	7	8.7	14,900
3	3.35	2,300	2	12.9	29,000	8	8.7	14,900
5	2.92	1,690	4	12.5	27,600	10	8.6	14,600
7	2.54	1,220	6	12.0	25,800	11	8.5	14,200
11	2.81	1,550	7	11.6	24,400	12	8.4	13,900
12 m	3.15	2,020	10	11.2	23,000	*July 3*		
1 p. m	3.55	2,600	12 m	11.0	22,300	1 a. m	7.8	12,400
2	4.10	3,480	1 p. m	11.3	23,300	2	7.3	10,900
4	4.70	4,550	2	11.9	25,400	3	7.0	10,000
6	4.75	4,640	3	12.4	27,200	4	7.4	11,500
8	4.75	4,640	4	12.9	29,000	7	7.0	10,000
10	4.80	4,740	5	13.4	30,800	8	7.1	10,300
12	4.95	5,040	6	13.8	32,300	10	6.8	9,490
June 30			7	14.2	33,700	11	6.1	7,700
1 a. m	5.05	5,040	8	14.3	34,100	12 m	5.4	6,000
3	5.3	5,560	9	14.1	33,400	1 p. m	5.15	5,350
5	5.6	6,230	10	13.9	32,600	2	5.20	5,560
6	5.8	6,710	12	13.7	31,900	4	5.6	6,470
						5	6.2	7,950

Gage-height, in feet, and discharge, in second-feet, at indicated hr. 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 3—Continued			*July 5*			*July 6—Continued*		
6 p. m.	7.0	10,000	1 a. m.	6.7	9,230	9 p. m.	4.60	4,360
7	7.6	12,100	3	6.8	9,490	12	4.55	4,270
8	8.0	13,000	4	6.7	9,230			
9	8.2	13,600	5	6.6	8,710	*July 7*		
10	8.6	15,200	6	6.2	7,700	12 m.	4.45	4,090
11	8.8	15,800	7	5.9	7,200	9 p. m.	4.30	3,820
12	9.2	16,800	8	6.5	8,710	12	4.40	3,910
			9	6.4	8,450			
July 4			10	6.0	7,450	*July 8*		
1 a. m.	9.6	17,700	12 m.	5.6	6,470	7 a. m.	4.30	3,820
3	10.0	19,000	1 p. m.	5.5	6,230	8	4.60	4,270
5	10.4	20,300	2	5.6	6,470	10	4.45	4,090
7	10.6	21,000	3	6.0	7,450	12 m.	4.35	3,820
8	10.8	21,600	4	5.9	7,200	12 p. m.	4.35	3,820
10	10.9	22,000	5	5.6	6,470			
11	10.9	22,000	7	5.4	5,780	*July 9*		
12 m.	10.8	21,600	9	5.15	5,350	2 a. m.	4.30	3,820
1 p. m.	10.5	20,600	12	5.35	5,780	4	3.85	3,070
2	10.0	19,000	*July 6*			8	3.45	2,460
3	9.8	18,400	1 a. m.	5.35	5,780	10	3.60	2,680
4	9.4	17,100	7	5.20	5,560	12 m.	4.20	3,650
5	9.6	17,700	8	5.20	5,560	2 p. m.	4.35	3,910
6	9.4	17,100	9	5.6	6,470	7	4.30	3,820
7	9.0	15,800	10	5.5	6,230	12	3.85	3,070
8	8.6	14,600	11	5.3	5,780			
9	8.0	12,700	12 m.	5.10	5,350	*July 10*		
10	7.4	10,900	1 p. m.	5.00	5,140	6 a. m.	3.40	2,380
11	7.0	9,750	3	4.85	4,740	12 m.	3.65	2,760
12	6.8	9,230	7	4.65	4,460	12 p. m.	3.85	3,070

COLORADO RIVER AT SMITHVILLE, TEX.

LOCATION.—Lat. 30°01′, long. 97°10′, 1,200 feet upstream from bridge on State Highway 71 at Smithville, Bastrop County, and 3.7 miles downstream from Alum Creek. Datum of gage is 270.14 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—39,650 square miles, of which about 11,800 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 210,000 second-feet and extended to a slope-area measurement at 305,000 second-feet. Gage heights used to half tenths between 3.8 and 5.8 feet; hundredths below and tenths above these limits.

MAXIMA.—1940: Discharge, 70,400 second-feet 1 a. m. July 1 (gage height, 21.24 feet).

1930–39: Discharge, 305,000 second-feet June 16, 1935 (gage height, 42.5 feet, from floodmark).

1870–1929: Stage, about 47.4 feet Dec. 4, 1913, according to information furnished by local residents (discharge not determined).

REMARKS.—Flow during flood period under study only slightly affected by reservoirs upstream.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	2,880	5,710	2	25,100	49,790	7	6,170	12,240
29	4,370	8,670	3	17,400	34,510	8	4,980	9,880
30	44,000	87,270	4	12,600	24,990	9	4,500	8,930
July			5	15,600	30,940	10	3,980	7,890
1	46,900	93,020	6	8,040	15,950			

Runoff, in acre-feet, for period June 28 to July 10 389,800

Gage-height, in feet, and discharge, in second-feet, at indicated times, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*July 1*—Continued			*July 5*		
1 a. m.	5.10	3,560	2 p. m.	16.6	39,600	3 a. m.	11.7	19,000
12 m.	4.60	2,810	4	15.7	34,500	4	11.7	19,000
12 p. m.	4.30	2,420	6	14.8	30,300	6	11.6	18,800
June 29			8	14.2	27,600	9	11.2	17,700
9 a. m.	4.40	2,550	10	13.7	25,600	12 m.	10.7	16,300
12 m.	4.70	2,940	12	13.2	23,600	3 p. m.	10.1	14,700
3 p. m.	4.90	3,240	*July 2*			6	9.4	12,900
4	5.20	3,730	3 a. m.	13.0	22,900	9	8.8	11,400
5	6.0	5,170	6	13.2	23,600	12	8.4	10,400
6	7.0	7,210	9	13.8	26,000	*July 6*		
8	7.4	8,070	12 m.	14.1	27,200	6 a. m.	7.7	8,760
10	7.8	8,990	2 p. m.	14.2	27,600	12 m.	7.3	7,840
12	8.0	9,450	4	14.1	27,200	6 p. m.	7.0	7,210
June 30			6	13.9	26,400	12	6.8	6,790
2 a. m.	8.4	10,400	9	13.4	24,400	*July 7*		
3	8.7	11,100	12	12.8	22,300	12 m.	6.5	6,170
4	9.2	12,400	*July 3*			12 p. m.	6.1	5,370
5	9.7	13,600	3 a. m.	12.4	21,100	*July 8*		
6	10.5	15,800	6	11.9	19,600	12 m.	5.8	4,790
7	11.7	19,000	9	11.4	18,200	12 p. m.	5.7	4,600
8	13.0	22,900	12 m.	10.9	16,900	*July 9*		
9	15.0	31,200	6 p. m.	10.4	15,500	12 m.	5.70	4,600
10	17.3	43,800	9	10.0	14,400	12 p. m.	5.60	4,410
11	18.7	52,900	12	9.6	13,400	*July 10*		
12 m.	19.7	59,900	*July 4*			6 a. m.	5.35	3,980
1 p. m.	20.0	62,000	3 a. m.	9.1	12,100	10	5.20	3,730
6	20.2	63,400	6	8.5	10,600	12 m.	5.20	3,730
8	20.6	66,200	9	8.1	9,680	6 p. m.	5.40	4,070
10	21.0	69,000	10	8.0	9,450	12	5.35	3,980
12	21.2	70,400	11	8.0	9,450			
July 1			12 m.	8.1	9,680			
1 a. m.	21.24	70,400	2 p. m.	8.6	10,900			
4	20.9	68,300	4	9.4	12,900			
6	20.4	64,800	6	10.1	14,700			
8	19.6	59,200	8	10.7	16,300			
10	18.6	52,200	10	11.2	17,700			
12 m.	17.5	45,000	12	11.5	18,500			

COLORADO RIVER AT LA GRANGE, TEX.

LOCATION.—Lat. 29°53′45″, long. 96°52′15″, at bridge on U. S. Highway 77 in La Grange, Fayette County, 1.2 miles downstream from Buckner Creek. Datum of gage is 211.23 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—40,200 square miles, of which about 11,800 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Graph drawn on basis of two or more wire-weight gage readings daily, including observation of crest gage height.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 200,000 second-feet and extended above. Gage heights used to half tenths between 2.5 and 4.4 feet; hundredths below and tenths above these limits. Discharge, July 3–10 obtained by shifting-control method.

MAXIMA.—1940: Discharge, 182,000 second-feet 8:20 p. m. June 30 (gage height, 40.18 feet).

July–August, 1938, November 1938 to September 1939: Discharge observed, 15,900 second-feet July 17, 1939 (gage height, 10.27 feet).

1869–1938: Stage, about 56.7 feet July 9, 1869, from marble high-water marker in La Grange (discharge not determined). Flood of Dec. 5, 1913, reached a stage of 56.4 feet, from floodmarks.

A stage of 50.84 feet, from floodmark, was reached June 17, 1935 (discharge, 255,000 second-feet). The flood of July 27, 1938, reached a stage of 42.95 feet (discharge, 200,000 second-feet).

REMARKS.—Flow during flood period under study only slightly affected by reservoirs upstream.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	3,470	6,880	2	31,900	63,270	8	5,370	10,650
29	9,120	18,090	3	24,900	49,390	9	4,640	9,200
30	124,000	246,000	4	14,400	28,560	10	4,380	8,690
			5	17,600	34,910			
July			6	10,700	21,220			
1	109,000	216,200	7	6,550	12,990			

Runoff, in acre-feet, for period June 28 to July 10 726,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 30*—Continued			*July 1*—Continued		
2 a. m.	3.80	3,470	5 a. m.	20.6	52,500	8 a. m.	33.0	132,000
4	3.90	3,630	6	21.9	59,400	9	32.2	127,000
6	3.90	3,630	7	23.7	70,600	10	31.5	122,000
8	3.90	3,630	8	27.0	92,000	11	30.6	116,000
10	3.85	3,550	9	30.3	114,000	12 m.	29.9	111,000
12 m.	3.80	3,470	10	32.3	128,000	1 p. m.	29.1	106,000
4 p. m.	3.70	3,320	11	34.1	140,000	2	28.3	100,000
8	3.80	3,470	12 m.	35.5	149,000	3	27.5	95,200
12	4.05	3,870	1 p. m.	36.7	157,000	4	26.4	88,100
June 29			2	37.7	164,000	5	25.4	81,600
2 a. m.	4.20	4,120	3	38.3	169,000	6	24.4	75,100
4	4.4	4,460	4	38.8	172,000	7	23.5	69,200
6	4.6	4,820	5	39.3	176,000	8	22.5	63,000
8	4.8	5,180	6	39.7	178,000	9	21.5	57,200
10	5.1	5,750	7	40.1	181,000	10	20.6	52,500
12 m.	5.4	6,340	8	40.15	182,000	11	19.8	48,600
2 p. m.	5.8	7,150	8:20	40.18	182,000	12	19.0	44,900
4	6.4	8,420	9	40.1	181,000			
6	7.2	10,200	10	39.7	178,000	*July 2*		
7	8.4	12,900	11	39.3	176,000	1 a. m.	18.3	42,000
8	9.6	15,700	12	38.6	171,000	2	17.5	38,900
9	10.9	18,800	*July 1*			3	16.9	36,600
10	12.1	21,700	1 a. m.	38.0	166,000	4	16.5	35,200
11	13.4	25,200	2	37.3	162,000	5	16.2	34,100
12	14.7	29,100	3	36.7	157,000	6	15.8	32,700
June 30			4	36.0	152,000	8	15.1	30,400
1 a. m.	16.0	33,400	5	35.2	147,000	10	14.7	29,100
2	17.2	37,800	6	34.4	142,000	12 m.	14.7	29,100
3	18.2	41,600	7	33.7	137,000	6 p. m.	15.0	30,100
4	19.4	46,700				12	14.8	29,500

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 3			*July 5*—Continued			*July 7*—Continued		
6 a. m.	14.4	27,900	10 p. m.	11.0	17,600	12 m.	6.0	6,340
12 m.	13.7	25,400	11	10.8	17,100	6 p. m.	5.7	5,940
6 p. m.	12.5	22,000	12	10.3	15,900	12	5.6	5,750
12	11.4	19,000	*July 6*			*July 8*		
July 4			3 a. m.	9.4	13,800	12 m.	5.4	5,370
6 a. m.	10.2	15,900	6	8.7	12,200	12 p. m.	5.2	5,000
12 m.	9.3	13,600	9	8.2	11,100			
2 p. m.	9.1	13,200	12 m.	7.8	10,200	*July 9*		
4	9.0	12,900	3 p. m.	7.5	9,520	8 a. m.	5.0	4,820
6	8.9	12,700	6	7.2	8,860	4 p. m.	4.9	4,640
8	9.0	12,900	9	6.9	8,200	12	4.85	4,460
12	9.3	13,600	12	6.7	7,780			
July 5			*July 7*			*July 10*		
12 m.	11.7	19,200	6 a. m.	6.4	7,150	8 a. m.	4.80	4,460
4 p. m.	11.8	19,500	9	6.2	6,740	4 p. m.	4.67	4,200
9	11.0	17,600				12	4.55	4,040

COLORADO RIVER AT COLUMBUS, TEX.

LOCATION.—Lat. 29°42′20″, long. 96°32′05″, at bridge on U. S. Highway 90 at eastern edge of Columbus, Colorado County, 340 feet downstream from Texas and New Orleans R. R. bridge and 2.6 miles downstream from Cummins Creek. Datum of gage is 155.52 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—40,840 square miles, of which about 11,800 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 3.3 and 5.5 feet; hundredths below and tenths above these limits. Discharge July 2–14 obtained by shifting-control method.

MAXIMA.—1940: Discharge, 152,000 second-feet 12 m. to 2 p. m. July 1 (gage height, 36.2 feet).

1903–11; 1916–30; 1939: Discharge, 110,000 second-feet June 1, 1929 (gage height, 35.00 feet, present datum).

1869–1902; 1912–15; 1931–38: Stage, 41.6 feet, present datum, in July 1869 and Dec. 6, 1913, according to information furnished by a local resident (discharge not determined; river divided each time and left Columbus on an island).

Flood of June 18, 1935, reached an observed peak of 38.5 feet, present datum, furnished by U. S. Weather Bureau (discharge, 190,000 second-feet, computed on basis of records for station near Eagle Lake, 23 miles downstream); flood of July 29, 1938, observed stage, 38.4 feet, present datum, furnished by U. S. Weather Bureau (discharge, 175,000 second-feet, computed on basis of records for station near Eagle Lake).

REMARKS.—Flow during flood period under study only slightly affected by reservoirs upstream.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	2,500	4,960	2	70,900	140,600	8	6,600	13,090
29	4,130	8,190	3	31,900	63,270	9	5,220	10,350
30	64,000	126,900	4	21,900	43,440	10	4,660	9,240
July			5	17,800	35,310			
1	142,000	281,700	6	17,500	34,710			
			7	9,260	18,370			

Runoff, in acre-feet, for period June 28 to July 10 790,100

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*July 1*—Continued			*July 4*		
1 a. m.	5.10	2,400	3 a. m.	34.9	129,000	4 a. m.	15.4	25,100
12 m.	5.30	2,600	4	35.1	132,000	8	14.7	23,700
9 p. m.	5.10	2,400	5	35.3	134,000	12 m.	14.1	22,000
12	5.20	2,500	6	35.5	138,000	4 p. m.	13.5	20,400
June 29			7	35.7	142,000	8	12.9	18,700
3 a. m.	5.40	2,700	8	35.8	144,000	12	12.3	16,800
6	5.7	3,030	9	35.9	146,000	*July 5*		
9	5.9	3,250	10	36.0	148,000	3 a. m.	11.8	15,300
12 m.	6.1	3,470	12 m.	36.2	152,000	6	11.6	14,600
3 p. m.	6.4	3,810	2 p. m.	36.2	152,000	9	11.8	15,300
5	6.5	3,930	5	36.1	150,000	12 m.	12.4	17,100
6	6.5	3,930	6	36.0	148,000	3 p. m.	13.1	19,400
7	6.8	4,290	9	35.7	142,000	6	13.6	21,000
8	7.3	4,920	12	35.1	132,000	9	13.8	21,700
9	8.2	6,410	*July 2*			12	13.9	22,000
10	9.0	8,010	2 a. m.	34.5	124,000	*July 6*		
11	9.6	9,450	4	34.0	115,000	3 a. m.	13.8	21,700
12	10.0	10,500	6	33.2	102,000	6	13.5	20,700
June 30			8	32.1	85,500	9	13.1	19,400
2 a. m.	10.4	11,700	10	30.7	66,200	12 m.	12.6	17,700
3	10.7	12,500	12 m.	29.2	56,700	3 p. m.	12.0	15,900
4	11.9	16,200	1 p. m.	28.2	52,200	6	11.5	14,300
5	13.3	20,700	2	27.2	49,500	9	11.1	13,100
6	14.7	25,400	3	26.3	46,800	12	10.7	12,000
7	16.3	31,300	4	25.4	45,600	*July 7*		
8	17.8	37,200	5	24.6	44,000	6 a. m.	10.1	10,200
9	20.0	46,000	6	23.7	42,400	12 m.	9.7	9,210
10	21.7	53,600	7	22.9	40,800	6 p. m.	9.2	8,010
11	23.7	62,600	8	22.2	39,600	12	8.9	7,380
12 m.	25.8	72,000	9	21.6	39,200	*July 8*		
1 p. m.	27.2	79,000	10	21.2	38,400	3 a. m.	8.8	7,170
2	28.2	84,000	11	20.8	37,600	9	8.6	6,790
3	29.1	88,500	12	20.5	36,800	3 p. m.	8.3	6,220
4	29.7	91,500	*July 3*			9	8.1	5,860
5	30.4	95,000	1 a. m.	20.2	35,600	12	8.0	5,690
6	31.2	99,100	2	20.1	35,600	*July 9*		
7	31.6	101,000	4	19.8	34,400	12 m.	7.6	5,220
8	32.1	104,000	6	19.5	34,000	12 p. m.	7.4	4,790
9	32.6	107,000	8	19.2	33,600	*July 10*		
10	33.1	110,000	10	18.9	32,900	12 m.	7.3	4,660
11	33.6	114,000	12 m.	18.6	32,500	12 p. m.	7.1	4,530
12	34.0	118,000	3 p. m.	18.1	31,300			
July 1			6	17.5	29,800			
1 a. m.	34.3	121,000	9	16.8	28,000			
2	34.6	125,000	12	16.2	26,900			

COLORADO RIVER AT WHARTON, TEX.

LOCATION.—Lat. 29°18'30", long. 96°06'15", at bridge on U. S. Highway 96 in Wharton, Wharton County, 1,000 feet downstream from Texas and New Orleans R. R. bridge and 12 miles upstream from Jones Creek. Datum of gage is 65.42 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—41,150 square miles, of which about 11,800 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—From graph drawn on basis of two or more wire-weight gage readings daily, including observation of crest gage height. Gage read frequently July 1–4.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 145,000 second-feet. Gage heights used to half tenths between 1.8 and 3.4 feet; hundredths below and tenths above these limits. Discharge, June 28–30, July 4–10, obtained by shifting-control method.

MAXIMA.—1940: Discharge, 100,000 second-feet 4 a. m. July 3 (gage height, 35.99 feet).

1919–25; 1938–39: Stage, about 35.6 feet, present datum, May 6, 1922 (discharge not determined).

1869–1918; 1926–37: Stage, 38.9 feet, present datum, Dec. 8, 1913, according to information furnished by local residents (discharge not determined). Flood of July 12, 1869, reached approximately same stage.

Flood of June 20, 1935, reached a stage of 38.2 feet, present datum (discharge, 159,000 second-feet). Flood of July 30, 1938, reached a stage of 37.4 feet, present datum (discharge, 145,000 second-feet).

REMARKS.—Flood flow affected by natural storage in wide flood plain. Below Wharton during flood of Dec. 8, 1913, the floodwaters combined with those of Brazos River.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	3,120	6,190	2	77,300	153,300	8	8,300	16,460
29	2,520	5,000	3	90,600	179,700	9	6,200	12,300
30	11,100	22,020	4	45,100	89,450	10	5,050	10,020
			5	18,200	36,100			
July			6	17,100	33,920			
1	49,600	98,380	7	13,200	26,180			

Runoff, in acre-feet, for period June 28 to July 10 689,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*July 1*—Con.			*July 5*		
1 a. m.	4.8	3,370	10	28.8	57,900	3 a. m.	18.8	23,100
12 m.	4.5	3,120	12	29.3	59,500	6	17.9	21,000
10 p. m.	4.2	2,860				9	17.1	19,300
12	4.1	2,780	*July 2*			12 m.	16.4	17,900
			3 a. m.	30.1	62,000	3 p. m.	15.6	16,400
June 29			6	31.0	65,200	6	14.9	15,200
1 a. m.	4.0	2,690	9	32.4	71,700	9	14.3	13,900
9	3.7	2,440	12 m.	33.4	77,400	12	14.3	13,900
12 p. m.	4.0	2,690	3 p. m.	34.2	82,400			
			6	34.8	87,200	*July 6*		
June 30			9	35.4	93,100	3 a. m.	14.5	15,000
12 m.	4.6	3,120	12	35.9	98,800	6	15.0	16,400
1 p. m.	5.6	3,980				12 m.	15.7	18,400
2	7.2	5,580	*July 3*			3 p. m.	15.7	18,400
3	9.3	8,490	4 a. m.	35.99	100,000	6	15.7	18,400
4	12.0	13,500	6	35.9	98,800	9	15.3	17,700
5	13.5	16,700	9	35.7	96,400	12	14.8	16,700
6	15.0	19,900	12 m.	35.5	94,200			
7	16.6	23,600	3 p. m.	35.0	89,000	*July 7*		
8	17.9	26,800	6	34.5	84,700	6 a. m.	13.9	15,000
9	19.1	30,000	9	33.6	78,600	12 m.	13.1	13,300
10	19.8	31,900	12	32.5	72,200	6 p. m.	12.2	11,400
11	20.5	33,900				12	11.4	9,880
12	21.3	36,100	*July 4*					
			2 a. m.	31.6	66,800	*July 8*		
July 1			4	30.6	61,700	12 m.	10.4	8,170
2 a. m.	22.4	38,900	6	29.6	57,300	12 p. m.	9.6	6,980
4	23.4	41,800	8	28.5	52,800			
6	24.2	44,100	10	27.4	49,200	*July 9*		
8	25.1	46,800	12 m.	26.0	43,200	12 m.	8.9	6,180
10	25.8	48,900	2 p. m.	24.7	38,900	12 p. m.	8.3	5,470
12 m.	26.4	50,700	4	23.5	35,000			
2 p. m.	27.0	52,500	6	22.5	32,200	*July 10*		
4	27.4	53,700	8	21.4	29,100	12 m.	7.9	5,050
6	27.9	55,200	10	20.5	27,100	12 p. m.	7.7	4,850
8	28.3	56,400	12	19.7	25,000			

COLORADO RIVER NEAR BAY CITY, TEX.

LOCATION.—Lat. 28°59′, long. 96°, at bridge on State Highway 35 500 feet downstream from Texas and New Orleans R. R. bridge and 2 miles west of Bay City, Matagorda County. Datum of gage is 30.60 feet below mean sea level.

DRAINAGE AREA.—41,420 square miles, of which about 11,800 square miles is probably noncontributing.

GAGE-HEIGHT RECORD.—Graph drawn on basis of frequent tape readings, by engineers, of distance of water surface below reference mark, including observation of flood crest.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to tenths of a foot.

MAXIMA.—1940: Discharge, 83,300 second-feet 9 a. m. July 4 (gage height, 78.8 feet).

REMARKS.—Flood flow affected by natural storage in wide flood plain. Records furnished by Corps of Engineers, U. S. Army.

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 2			*July 4*—Con.			*July 5*—Con.		
4 p. m.	76.2	60,700	4	78.2	76,700	12 m.	68.2	33,300
6	76.5	62,500	5	78.0	74,500	1 p. m.	67.6	31,700
8	76.7	63,800	6	77.8	72,700	2	67.2	30,600
10	76.9	65,200	7	77.6	70,900	3	66.7	29,300
12	77.0	65,900	8	77.1	66,700	4	66.3	28,300
			9	76.6	63,100	5	65.9	27,200
July 3			10	76.1	60,100	6	65.5	26,200
3 a. m.	77.2	67,500	11	75.5	57,200	7	65.2	25,500
6	77.4	69,100	12	75.0	55,000	8	64.9	24,800
9	77.4	69,100				9	64.5	23,800
12 m.	77.6	70,900	*July 5*			10	64.2	23,000
3 p. m.	77.7	71,800	1 a. m.	74.5	52,800	11	63.9	22,200
6	78.0	74,500	2	73.9	50,400	12	63.6	21,500
9	78.2	76,700	3	73.4	48,400			
12	78.3	77,800	4	72.8	46,400	*July 6*		
			5	72.3	44,700	1 a. m.	63.3	20,800
July 4			6	71.7	43,000	2	63.0	20,000
3 a. m.	78.5	80,000	7	71.1	41,300	3	62.8	19,500
6	78.6	81,100	8	70.5	39,600	4	62.5	18,800
9	78.8	83,300	9	69.9	37,900	5	62.3	18,200
12 m.	78.7	82,200	10	69.3	36,300	6	62.1	17,800
2 p. m.	78.4	78,900	11	68.7	34,700	12 m.	62.2	18,000

DRY CREEK AT BUESCHER LAKE NEAR SMITHVILLE, TEX.

LOCATION.—Lat. 30°03′, long. 97°09′, at Buescher Lake in Bastrop-Buescher State Park 1.9 miles upstream from mouth and 2.2 miles north of Smithville, Bastrop County. Datum of gage is 327.9 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—1.48 square miles (measured at Buescher Lake spillway).

GAGE-HEIGHT RECORD.—Graph from water-stage recorder 200 feet upstream from dam.

DISCHARGE RECORD.—Represents inflow to Buescher Lake. Discharge figures for stages below 22.27 feet (minimum elevation of spillway crest) obtained from rate of change in contents of reservoir, using gage heights to hundredths of a foot. Discharge figures for stages above 22.27 feet were obtained from rating curve for spillway based on the formula $Q=3.09LH^{3/2}$ (using gage heights to hundredths below 24.3 feet, half tenths above) and adjusted for rate of change in contents in reservoir.

MAXIMA.—1940: Discharge, 1,870 second-feet 8:45 a. m. June 30; gage height, 24.96 feet 9 a. m. June 30.

REMARKS.—Capacity of reservoir, 255 acre-feet at spillway crest.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June 29	64	127	June 30	383	760	July 1	2.0	4
Total								891

Discharge, in second-feet, at indicated time, 1940

Hour	Second-feet	Hour	Second-feet	Hour	Second-feet	Hour	Second-feet
June 29		*June 29*—Con.		*June 30*—Con.		*June 30*—Con.	
12 m	0	10:30 p. m	73	5:30 a. m	1,250	10:30 a. m	735
1 p. m	2	11	77	5:45	1,250	11	496
2	2	11:30	81	6	1,190	11:30	266
3	23	12	61	6:15	1,030	12:30 p. m	75
3:30	92			6:30	1,010	1	68
4	690	*June 30*		6:45	1,080	1:30	54
4:15	782	12:30 a. m	52	7	1,080	2	46
4:30	710	1	76	7:15	1,380	3	35
5	178	1:30	139	7:30	1,340	4	27
5:30	91	1:45	142	7:45	1,280	5	21
6	61	2	101	8	1,280	6	18
6:30	37	2:30	90	8:15	1,270	8	13
7	25	3	161	8:30	1,540	10	7
7:30	248	3:30	304	8:45	1,870	12	4
7:45	315	4	369	9	1,800		
8	270	4:30	534	9:15	1,590	*July 1*	
8:30	114	4:45	1,100	9:30	1,360	6 a. m	2
9	75	5:00	1,230	9:45	1,160	12 m	1
9:30	66	5:15	1,300	10:00	998	12 p. m	0
10	67						

LAVACA RIVER BASIN

LAVACA RIVER AT HALLETTSVILLE, TEX.

LOCATION.—Lat. 29°26′, long. 96°57′, at bridge on U. S. Highway 77 in Hallettsville, Lavaca County, 0.4 mile upstream from Texas and New Orleans R. R. bridge. Datum of gage is 186.7 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—101 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph June 28–30, and July 6–10. Graph for June 30 to July 5 drawn on basis of partial water-stage recorder graph and gage heights obtained by levels to stakes set at water surface during flood, and floodmark.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 25,000 second-feet and extended to slope-area measurement for crest gage height. Gage heights used to half tenths between 7.2 and 8.4 feet June 28–30 and between 7.2 and 11.2 feet July 1–10; hundredths below and tenths above these limits. Discharge obtained by shifting-control method.

MAXIMA.—1940: Discharge, 93,100 second-feet, 8 a. m. June 30 (gage height, 40.60 feet). This is the highest flood known.

July to September 1939: Discharge, 3,980 second-feet July 12 (gage height, 21.50 feet, from graph based on gage readings).

1870–1938: Discharge, 28,300 second-feet July 16, 1936 (gage height, 32.8 feet).

REMARKS.—Flow not affected by artificial storage or diversions.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	0.8	1.6	2	215	426	8	16	32
29	1,690	3,350	3	1,170	2,320	9	15	30
30	33,500	66,450	4	218	432	10	14	28
July			5	33	65			
1	241	478	6	20	40			
			7	18	36			

Runoff, in acre-feet, for period June 28 to July 10 73,690

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 30*—Continued			*July 3*—Continued		
12 m	4.65	0.8	10 p. m	20.8	3,520	7 p. m	14.6	1,030
12 p. m	4.65	.8	11	19.0	2,440	8	15.2	1,170
June 29			12	17.2	1,820	9	15.2	1,170
4 a. m	4.65	.8				10	14.7	1,050
5	5.10	4.7	*July 1*			12	13.7	850
6	6.00	32	1 a. m	15.4	1,270	*July 4*		
7	5.70	19	2	13.7	890	1 a. m	13.2	753
8	8.00	175	3	11.5	472	2	12.6	643
9	12.0	590	4	10.7	352	3	12.0	540
10	18.0	1,980	5	10.2	280	4	11.6	472
11	22.0	4,280	6	9.8	230	5	11.0	368
12 m	22.7	4,980	8	9.2	162	6	10.5	294
1 p. m	22.1	4,280	10	8.8	114	7	10.0	230
2	21.6	3,680	12 m	8.4	90	8	9.6	180
3	21.2	3,360	3 p. m	8.0	70	9	9.3	153
4	20.8	3,080	6	7.7	58	10	9.0	128
5	20.2	2,740	9	7.5	51	12 m	8.7	107
6	19.5	2,400	12	7.4	48	4 p. m	8.2	80
7	18.6	2,120	*July 2*			8	7.8	62
8	17.7	1,880	12 m	7.4	48	12	7.5	51
9	16.5	1,520	6 p. m	7.4	48	*July 5*		
10	15.2	1,170	7	8.2	80	6 a. m	7.2	41
11	17.2	1,730	8	10.0	235	12 m	6.85	32
12	21.0	3,360	9	11.7	489	6 p. m	6.65	26
June 30			10	13.2	753	12	6.50	22
1 a. m	24.6	7,400	11	16.6	1,550	*July 6*		
2	28.4	14,500	12	18.7	2,220	12 m	6.38	19
3	30.7	20,700	*July 3*			12 p. m	6.36	19
4	32.5	27,100	1 a. m	19.0	2,320	*July 7*		
5	34.8	38,800	2	18.6	2,180	12 m	6.33	18
6	37.1	54,800	3	18.0	1,980	12 p. m	6.29	17
7	39.5	79,000	4	17.5	1,820	*July 8*		
8	40.6	93,100	5	17.0	1,670	12 m	6.27	16
8:20	40.6	93,100	6	16.5	1,520	12 p. m	6.24	16
9	40.4	90,300	7	15.9	1,350	*July 9*		
10	39.4	77,800	8	15.4	1,220	12 m	6.22	15
11	38.1	64,000	9	14.9	1,100	12 p. m	6.19	15
12 m	36.9	53,200	10	14.4	990	*July 10*		
1 p. m	35.4	42,400	11	13.9	890	12 m	6.18	14
2	34.0	34,000	12 m	13.4	791	12 p. m	6.16	14
3	32.5	27,100	1 p. m	12.9	697			
4	31.2	22,300	2	12.4	608			
5	29.3	16,800	3	11.8	506			
6	27.7	12,900	4	11.5	455			
7	25.9	9,280	5	11.5	455			
8	24.0	6,980	6	13.0	715			
9	22.7	5,440						

LAVACA RIVER NEAR EDNA, TEX.

LOCATION.—Lat. 28°58′, long. 96°42′, at bridge on U. S. Highway 59 550 feet upstream from Texas and New Orleans R. R. bridge and 2.8 miles southwest of Edna, Jackson County. Datum of gage is 13.88 feet above mean sea level, datum of 1929 (levels by Corps of Engineers, U. S. Army).

DRAINAGE AREA.—887 square miles.

GAGE-HEIGHT RECORD.—Graph drawn on basis of two or more wire-weight gage readings daily, including reading at crest stage.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 72,000 second-feet. Gage heights used to half tenths between 2.5 and 3.3 feet; hundredths below and tenths above these limits. Discharge 9 a. m. July 3 to 8 p. m. July 5 was affected by backwater from return flow and was computed from backwater curve defined by current-meter measurements.

MAXIMA.—1940: Discharge, 73,000 second-feet 9:25 p. m. July 1 (gage height, 32.51 feet).

1938–39: Discharge observed, 13,600 second-feet July 13, 1939 (gage height, 23.90 feet).

1909–37: Discharge, 83,400 second-feet May 25, 1936 (gage height, 33.8 feet).

REMARKS.—Flow affected by natural storage in wide flood plain as indicated by backwater effect from return flow on falling stages.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	22	44	2	49,600	98,380	7	432	857
29	18	36	3	13,900	27,570	8	340	674
30	2,300	4,560	4	5,650	11,210	9	284	563
July			5	2,450	4,860	10	243	482
1	44,000	87,270	6	614	1,220			

Runoff, in acre-feet, for period June 28 to July 10 237,700

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 30*—Continued			*July 1*—Continued		
1 a. m.	1.82	16	12 m.	12.0	1,920	6 a. m.	23.2	11,800
1 p. m.	1.90	22	1 p. m.	12.8	2,210	7	24.6	15,800
June 29			2	13.4	2,450	8	26.0	23,500
1 a. m.	1.85	18	3	14.1	2,760	9	27.2	32,500
1 p. m.	1.82	16	4	14.8	3,100	10	28.4	41,500
6	1.82	16	5	15.4	3,400	11	29.2	47,500
10	2.00	30	6	16.1	3,750	12 m.	29.9	52,800
12	2.22	48	7	16.8	4,130	1 p. m.	30.4	56,500
June 30			8	17.4	4,530	2	31.0	61,900
2 a. m.	2.65	88	9	18.1	5,080	3	31.4	64,200
4	3.6	204	10	18.7	5,560	4	31.8	67,400
5	4.5	326	11	19.3	6,100	5	32.2	70,600
6	5.4	464	12	20.0	6,800	6	32.3	71,400
7	6.5	650	*July 1*			7	32.4	72,200
8	7.7	866	1 a. m.	20.5	7,400	8	32.5	73,000
9	9.1	1,140	2	20.9	7,880	9	32.5	73,000
10	10.2	1,390	3	21.3	8,450	9:25	32.51	73,000
11	11.2	1,660	4	21.8	9,200	10	32.5	73,000
			5	22.3	9,950	11	32.5	73,000
						12	32.4	72,200

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 2			*July 3*—Continued			*July 5*—Continued		
1 a. m.	32.2	70,600	7 p. m.	22.2	8,700	4:30 p. m.	10.0	1,260
2	32.0	69,900	8	22.0	8,300	5	9.8	1,220
3	31.8	67,400	9	21.8	8,000	5:30	9.5	1,180
4	31.6	65,800	10	21.7	7,800	6	9.2	1,140
5	31.4	64,200	11	21.6	7,600	7	8.8	1,070
6	31.2	62,600	12	21.4	7,300	8	8.5	1,010
7	30.9	60,200	*July 4*			9	8.2	960
8	30.7	58,800	2 a. m.	21.2	7,000	10	7.9	902
9	30.4	56,500	4	21.0	6,700	11	7.6	848
10	30.1	54,200	6	20.8	6,300	12	7.5	830
11	29.8	52,000	8	20.6	6,000	*July 6*		
12 m.	29.5	49,800	10	20.4	5,700	1 a. m.	7.4	812
1 p. m.	29.2	47,500	12 m.	20.3	5,600	2	7.2	776
2	28.8	44,500	2 p. m.	20.2	5,400	3	7.0	740
3	28.6	43,000	4	20.0	5,250	4	6.9	722
4	28.4	41,500	6	20.0	5,200	5	6.8	704
5	28.0	38,500	8	19.8	5,000	6	6.6	668
6	27.8	37,000	10	19.6	4,800	8	6.4	632
7	27.6	35,500	12	19.3	4,600	10	6.2	596
8	27.4	34,000	*July 5*			12 m.	6.1	578
9	27.1	31,800	2 a. m.	19.0	4,300	2 p. m.	6.0	560
10	26.9	30,200	3	18.8	4,200	6	5.8	528
11	26.6	28,000	4	18.6	4,000	12	5.6	496
12	26.4	26,500	5	18.4	3,900	*July 7*		
July 3			6	18.1	3,700	6 a. m.	5.4	464
1 a. m.	26.2	25,000	7	17.8	3,500	12 m.	5.2	432
2	26.0	23,500	8	17.4	3,300	6 p. m.	5.0	400
3	25.8	22,100	9	17.0	3,080	12	4.9	385
4	25.5	20,200	10	16.4	2,900	*July 8*		
5	25.3	19,000	10:30	15.8	2,730	12 m.	4.6	340
6	25.0	17,500	11	15.4	2,600	12 p. m.	4.4	312
7	24.8	16,600	11:30	14.8	2,430	*July 9*		
8	24.6	15,800	12 m.	14.2	2,260	12 m.	4.2	284
9	24.4	15,000	12:30 p. m.	13.6	2,090	12 p. m.	4.0	256
10	24.2	14,500	1	13.2	1,980	*July 10*		
11	24.0	13,700	1:30	12.6	1,820	12 m.	3.9	243
12 m.	23.7	12,500	2	12.2	1,720	12 p. m.	3.8	230
1 p. m.	23.5	12,000	2:30	11.7	1,600			
2	23.2	11,000	3	11.2	1,480			
3	23.0	10,500	3:30	10.8	1,400			
4	22.8	10,000	4	10.4	1,330			
5	22.6	9,600						
6	22.4	9,100						

NAVIDAD RIVER NEAR GANADO, TEX.

LOCATION.—Lat. 29°02′, long. 96°33′ at bridge on U. S. Highway 59 100 feet upstream from Texas and New Orleans R. R. bridge, a quarter of ε mile downstream from Sandy Creek, and 2¼ miles southwest of Ganado, Jackson County. Datum of gage is 13.62 feet above mean sea level, datum of 1929 (levels by Corps of Engineers, U. S. Army).

DRAINAGE AREA.—1,116 square miles.

GAGE-HEIGHT RECORD.—Graph from two or more wire-weight gage readings daily and crest gage height obtained from floodmark.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 60,000 second-feet. Gage heights used to half tenths between 3.9 and 4.8 feet; hundredths below and tenths above these limits. Discharge 12 m. July 4 to 12 m. July 8 was affected by backwater from return flow and was computed from backwater curve defined by current-meter measurements.

MAXIMA.—1940: Discharge, 64,500 second-feet 8:30 a. m. July 2 and on Nov. 26; gage height, 36.54 feet July 2, from floodmark.

May to September 1939: Discharge, 9,440 second-feet July 13 1939 (gage height, 27.21 feet).

1909–38: Discharge, 94,000 second-feet May 27, 1936 (gage height, 39.8 feet, according to information furnished by Texas and New Orleans R. R. Co.).

REMARKS.—Flow affected by natural storage in wide flood plain as indicated by backwater effect from return flow on falling stages.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	66	131	2	53,300	105,700	7	470	932
29	49	97	3	24,500	48,600	8	340	674
30	724	1,440	4	9,980	19,800	9	242	480
July			5	5,260	10,430	10	186	369
1	7,430	14,740	6	1,140	2,260			

Runoff, in acre-feet, for period June 28 to July 10 205,700

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*July 2*—Continued			*July 5*—Continued		
12 m	4.20	62	4 a. m	34.6	50,200	7 p. m	21.6	3,650
12 p. m	4.05	52	5	35.4	55,800	8	21.0	3,320
June 29			6	36.0	60,500	9	20.4	3,020
12 m	3.90	46	7	36.3	62,900	10	19.7	2,740
12 p. m	3.85	40	8	36.5	64,500	11	19.1	2,520
June 30			8:30	36.54	64,500	12	18.3	2,300
1 a. m	3.85	40	9	36.5	64,500	*July 6*		
9	3.85	40	10	36.4	63,700	1 a. m	17.6	2,120
12 m	4.40	73	11	36.3	62,900	2	17.0	1,980
1 p. m	5.2	139	12 m	36.2	62,100	3	16.4	1,840
2	6.8	364	1 p. m	36.0	60,500	4	15.9	1,720
3	8.0	580	2	35.8	58,900	5	15.4	1,620
4	9.4	854	4	35.4	55,800	6	14.9	1,510
5	10.7	1,130	6	34.9	52,300	7	14.4	1,400
6	11.8	1,380	8	34.4	48,800	8	14.0	1,320
7	13.0	1,670	10	33.9	45,400	9	13.6	1,250
8	14.0	1,930	12	33.4	42,100	10	13.2	1,160
9	15.0	2,200	*July 3*			11	12.8	1,100
10	15.9	2,460	2 a. m	32.8	38,300	12 m	12.4	1,020
11	16.7	2,690	4	32.3	35,300	1 p. m	12.0	950
12	17.5	2,940	6	31.7	31,800	2	11.6	890
July 1			8	31.0	28,000	3	11.2	830
1 a. m	18.2	3,200	10	30.5	25,500	4	10.8	760
2	18.9	3,480	12 m	30.0	23,000	5	10.4	700
3	19.5	3,720	2 p. m	29.5	20,500	6	10.0	670
4	20.1	4,000	4	29.1	18,600	7	9.7	640
5	20.6	4,250	6	28.9	17,800	8	9.4	610
6	21.1	4,500	9	28.3	15,000	9	9.2	600
7	21.5	4,720	12	28.0	13,700	10	9.0	580
8	22.0	5,000	*July 4*			11	8.9	570
9	22.1	5,060	6 a. m	27.5	11,700	12	8.8	560
10	22.3	5,180	12 m	27.1	9,800	*July 7*		
11	22.6	5,360	2 p. m	26.8	9,000	3 a. m	8.4	530
12 m	22.9	5,540	4	26.5	8,100	6	8.1	500
2 p. m	23.4	5,840	6	26.2	7,800	12 m	7.8	470
4	23.9	6,150	8	26.0	7,400	6 p. m	7.4	420
6	24.7	6,740	10	26.0	7,400	12	7.2	400
7	25.8	7,920	12	25.9	7,200	*July 8*		
8	26.9	9,960	*July 5*			12 m	6.7	340
9	28.0	13,700	3 a. m	25.7	6,920	12 p. m	6.4	292
10	29.0	18,200	6	25.5	6,700	*July 9*		
11	30.0	23,000	9	25.0	6,200	12 m	6.1	242
12	31.0	28,000	12 m	24.3	5,600	12 p. m	5.9	212
July 2			2 p. m	23.8	5,200	*July 10*		
1 a. m	31.9	33,000	4	23.2	4,720	12 m	5.7	186
2	32.9	38,900	5	22.8	4,440	12 p. m	5.6	176
3	33.7	44,000	6	22.3	4,080			

GUADALUPE RIVER BASIN

GUADALUPE RIVER ABOVE COMAL RIVER, AT NEW BRAUNFELS, TEX.

LOCATION.—Lat. 29°42'55", long. 98°06'40", at New Braunfels, Comal County, 1.1 miles upstream from Comal River. Datum of gage is 586.6 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—1,666 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 3.7 and 4.9 feet; hundredths below and tenths above these limits. Discharge obtained by shifting-control method.

MAXIMA.—July 1940: Discharge, 773 second-feet 5 p. m. July 4 (gage height, 2.77 feet).

1927–39: Discharge, 101,000 second-feet June 15, 1935 (gage height, 32.95 feet).

1869–1926: Stage, about 38 feet, July 1869 and December 1913 (discharge not determined) according to information furnished by local residents.

REMARKS.—Flood flow not affected by regulaton or storage.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	259	514	2	408	809	8	254	504
29	280	555	3	379	752	9	228	452
30	429	851	4	520	1,030	10	215	426
July			5	529	1,050			
1	379	752	6	372	738			
			7	299	593			

Runoff, in acre-feet, for period June 28 to July 10 9,030

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*July 2*			*July 6*		
1 a. m.	2.19	293	12 m.	2.34	393	12 m.	2.32	379
12 m.	2.13	259	12 p. m.	2.34	393	12 p. m.	2.25	330
12 p. m.	2.09	238	*July 3*			*July 7*		
June 29			12 m.	2.33	386	12 m.	2.20	299
12 m.	2.10	244	12 p. m.	2.36	408	12 p. m.	2.16	275
4 p. m.	2.10	244						
6	2.36	408	*July 4*			*July 8*		
7	2.40	439	2 a. m.	2.38	423	12 m.	2.12	254
12	2.19	293	12 m.	2.27	343	12 p. m.	2.10	244
June 30			2 p. m.	2.35	401	*July 9*		
2 a. m.	2.20	299	5	2.77	773	12 m.	2.07	228
6	2.59	599	12	2.68	683	12 p. m.	2.03	220
12 m.	2.43	463	*July 5*			*July 10*		
12 p. m.	2.28	350	12 m.	2.51	529	12 m.	2.03	211
July 1			12 p. m.	2.40	439	12 p. m.	2.01	203
6 a. m.	2.23	318						
12 m.	2.38	423						
12 p. m.	2.41	447						

GUADALUPE RIVER AT VICTORIA, TEX.

LOCATION.—Lat. 28°47′, long. 97°01′, at bridge on U. S. Highway 59 in Victoria, Victoria County, 1,300 feet upstream from bridge of Texas and New Orleans R. R. and 10 miles upstream from Coleto Creek. Datum of gage is 29.23 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—5,676 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights June 27 to July 4 used to half tenths between 2.8 and 4.4 feet; hundredths below 2.8 and between 29.0 and 30.4 feet; and tenths between 4.4 and 29.0 feet. Gage heights July 5–15 used to half tenths below 5.1 feet and tenths above. Discharge June 27–29, July 7–15 obtained by shifting-control method.

MAXIMA.—1940: Discharge, 55,900 second-feet 3 a. m. July 3 (gage height, 29.67 feet).

1934–39: Discharge, 179,000 second-feet July 3, 1936 (gage height, 31.22 feet).

1904–33: Discharge, 79,000 second-feet June 1, 1929 (gage height, 29.9 feet).

REMARKS.—Flood flow not affected by regulation or artificial storage.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
27	1,170	2,320	2	39,800	78,940	9	1,610	3,190
28	1,200	2,380	3	51,000	101,200	10	1,440	2,860
29	1,010	2,000	4	32,500	64,460	11	1,330	2,640
30	6,770	13,430	5	22,000	43,640	12	1,100	2,180
			6	8,180	16,220	13	1,100	2,180
July			7	2,520	5,000	14	1,200	2,380
1	22,300	44,230	8	1,780	3,530	15	1,220	2,420

Runoff in acre-feet, for period June 27 to July 15 395,200

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 27			*June 30*—Continued			*July 1*—Continued		
12 p. m.	5.5	1,140	5 p. m.	24.3	11,600	4 p. m.	28.6	23,400
June 28			6	25.0	12,100	6	28.7	24,400
12 p. m.	5.2	1,040	7	25.6	12,600	8	28.8	25,400
			8	26.0	13,000	11	28.9	26,400
June 29			9	26.5	13,800	12	29.0	27,400
12 p. m.	5.3	1,070	10	26.8	14,400			
			11	27.1	15,300			
June 30			12	27.3	15,900	*July 2*		
1 a. m.	5.4	1,070				1 a. m.	29.04	28,000
2	5.5	1,100				2	29.09	28,800
8	5.5	1,100	*July 1*			4	29.18	30,600
9	5.6	1,140	1 a. m.	27.5	16,700	6	29.25	32,800
10	7.7	1,820	2	27.6	17,200	8	29.31	35,000
10:30	10.6	2,900	3	27.8	18,200	10	29.38	38,100
11	13.3	4,180	4	27.9	18,700	12 m.	29.42	40,100
11:30	15.2	5,300	5	28.0	19,200	2 p. m.	29.46	42,300
12 m.	16.3	6,000	6	28.1	19,800	4	29.49	44,000
1 p. m.	19.3	8,060	8	28.2	20,400	6	29.53	46,400
2	21.4	9,530	10	28.3	21,100	8	29.59	50,400
3	22.7	10,400	12 m.	28.4	21,800	10	29.62	52,400
4	23.6	11,100	2 p. m.	28.5	22,600	12	29.66	55,200

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 3			*July 6*—Continued			*July 10*		
2 a. m.	29.66	55,200	11 a. m.	18.9	7,780	6 a. m.	7.7	1,440
3	29.67	55,900	12 m.	18.1	7,220	12 p. m.	7.7	1,440
4	29.66	55,200	1 p. m.	17.3	6,660	*July 11*		
6	29.66	55,200	2	16.6	6,190	6 a. m.	7.7	1,440
10	29.64	53,800	3	16.0	5,800	12 m.	7.5	1,370
12 m.	29.61	51,700	4	15.5	5,480	6 p. m.	7.2	1,270
4 p. m.	29.59	50,400	5	15.0	5,180	12	7.0	1,200
8	29.51	45,200	6	14.5	4,880	*July 12*		
12	29.45	41,800	7	14.1	4,640	6 a. m.	6.9	1,160
July 4			8	13.7	4,400	12 m.	6.6	1,070
4 a. m.	29.38	38,100	9	13.4	4,240	6 p. m.	6.5	1,030
8	29.31	35,000	10	13.0	4,020	12	6.7	1,100
12 m.	29.22	31,700	11	12.7	3,860	*July 13*		
4 p. m.	29.10	29,000	12	12.4	3,690	6 a. m.	6.8	1,130
8	29.00	27,400	*July 7*			12 m.	6.6	1,070
12	28.9	26,400	2 a. m.	11.9	3,300	3 p. m.	6.5	1,030
July 5			4	11.4	3,040	6	6.7	1,100
3 a. m.	28.8	25,400	6	11.0	2,840	9	6.9	1,160
6	28.7	24,400	8	10.7	2,690	12	6.9	1,160
9	28.6	23,400	10	10.4	2,540	*July 14*		
12 m.	28.5	22,600	12 m.	10.1	2,390	3 a. m.	6.9	1,160
3 p. m.	28.3	21,100	3 p. m.	9.8	2,260	9	7.3	1,300
6	28.1	19,800	6	9.5	2,120	1 p. m.	7.3	1,300
9	27.9	18,700	9	9.3	2,040	6	7.0	1,200
10	27.7	17,700	12	9.1	1,960	12	6.7	1,100
11	27.5	16,700	*July 8*			*July 15*		
12	27.3	15,900	4 a. m.	8.9	1,860	6 a. m.	6.5	1,030
July 6			8	8.8	1,860	10	6.3	970
1 a. m.	27.0	15,000	12 m.	8.7	1,780	12 m.	6.3	970
2	26.6	14,000	6 p. m.	8.6	1,780	2 p. m.	6.7	1,100
3	26.1	13,100	12	8.4	1,710	4	7.4	1,330
4	25.6	12,600	*July 9*			6	8.0	1,540
5	24.9	12,000	6 a. m.	8.3	1,640	8	8.4	1,680
6	24.1	11,400	12 m.	8.2	1,610	10	8.6	1,760
7	23.1	10,700	6 p. m.	8.1	1,570	12	8.8	1,850
8	22.1	10,000	12	7.8	1,470			
9	21.0	9,250						
10	19.9	8,480						

SAN MARCOS RIVER AT OTTINE, TEX.

LOCATION.—Lat. 29°36′, long. 97°35′, at highway bridge a quarter of a mile southwest of Ottine, Gonzales County, and 4 miles downstream from Plum Creek. Datum of gage is 285.2 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—1,249 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 12,000 second-feet and extended above on basis of one slope-area measurement at 125,000 second-feet. Gage heights used to half tenths between 2.5 and 4.2 feet; hundredths below and tenths above these limits. Discharge June 29, July 5–10, obtained by shifting-control method.

MAXIMA.—1940: Discharge, 20,000 second-feet 2 p. m. June 30 (gage height, 34.38 feet).

1915–39: Discharge, about 202,000 second-feet May 29, 1929 (gage height, 43.32 feet).

1913–14: Stage, about 44.0 feet in December 1913 (discharge not determined) according to information furnished by local residents.

Large floods also occurred in 1869 and 1870, but stages are not known.

REMARKS.—Flood flow not affected by regulation or artificial storage.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	132	262	2	1,800	3,570	8	200	397
29	620	1,230	3	831	1,650	9	194	385
30	12,900	25,590	4	520	1,030	10	188	373
July			5	277	549			
1	10,900	21,620	6	256	508			
			7	221	438			

Runoff, in acre-feet, for period June 28 to July 10 57,550

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 30*—Continued			*July 2*—Continued		
a. m.	2.34	167	6 p. m.	34.0	18,400	5 p. m.	4.8	511
6	2.29	160	7	33.8	17,700	8	4.4	447
9	2.10	137	8	33.7	17,400	9	5.5	623
11	1.72	97	10	33.5	16,800	10	6.3	756
1 p. m.	1.54	81	12	33.5	16,800	12	7.1	898
2	1.38	68						
5	1.84	109	*July 1*			*July 3*		
7	2.23	153	1 a. m.	33.5	16,800	1 a. m.	7.2	916
12	2.32	164	3	33.3	16,200	6	6.6	808
June 29			5	32.9	15,200	10	6.1	722
2 a. m.	2.31	163	6	32.5	14,200	2 p. m.	6.6	808
3	2.33	165	7	32.1	13,400	7	7.1	898
5	2.22	151	8	31.7	12,800	12	6.6	808
6	2.44	181	9	31.2	12,200			
7	3.10	270	10	30.7	11,600	*July 4*		
8	3.85	383	11	30.2	11,000	5 a. m.	5.8	671
9	4.10	415	12 m.	29.7	10,500	12 m.	4.8	511
10	4.3	447	1 p. m.	29.2	9,980	5 p. m.	4.00	383
11	4.8	527	2	28.6	9,400	9	3.70	337
1 p. m.	5.7	671	3	28.1	8,930	12	3.60	322
2	5.7	671	4	27.6	8,490			
4	5.5	639	5	27.0	7,980	*July 5*		
6	5.5	639	6	26.4	7,500	7 a. m.	3.35	292
7	6.4	790	7	25.9	7,130	12 m.	3.25	277
8	7.6	1,010	8	25.3	6,720	12 p. m.	3.15	256
9	8.9	1,250	9	24.6	6,280			
10	10.6	1,580	10	23.8	5,810	*July 6*		
11	11.9	1,890	11	23.2	5,500	12 m.	3.10	256
12	13.2	2,180	12	22.4	5,120	3 p. m.	2.95	235
						7	3.15	263
June 30			*July 2*			12	3.05	249
1 a. m.	14.6	2,520	1 a. m.	21.5	4,720			
2	16.0	2,900	2	20.5	4,320	*July 7*		
3	17.4	3,310	3	19.4	3,950	12 m.	2.80	214
4	18.8	3,750	4	18.8	3,750	12 p. m.	2.75	207
5	20.4	4,290	5	17.9	3,460			
6	22.1	4,980	6	16.5	3,040	*July 8*		
7	24.4	6,160	7	14.4	2,470	12 m.	2.70	200
8	28.2	9,020	8	13.1	2,150	12 p. m.	2.65	194
9	31.0	12,000	9	11.6	1,800			
10	32.6	14,400	10	10.4	1,530	*July 9*		
11	33.7	17,400	11	9.0	1,250	12 m.	2.60	188
12 m.	34.1	18,800	12 m.	7.8	1,020	12 p. m.	2.55	181
1 p. m.	34.3	19,600	1 p. m.	6.9	862	*July 10*		
2	34.38	20,000	2	6.0	705	12 m.	2.60	188
4	34.3	19,600	3	5.4	607	12 p. m.	2.50	174

COLETO CREEK NEAR VICTORIA, TEX.

LOCATION.—Lat. 28°43′, long. 97°08′, at bridge on U. S. Highway 59 100 feet upstream from Texas and New Orleans R. R. bridge, 1.1 miles downstream from Perdido Creek, and 9.4 miles southwest of Victoria, Victoria County. Datum of gage is 49.2 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—514 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 2.7 and 4.6 feet; hundredths below and tenths above these limits. Discharge July 1–4, 6–10, obtained by shifting-control method.

MAXIMA.—June 1940: Discharge, 39,200 second-feet 4:15 p. m. June 30 (gage height, 22.05 feet).

June to September 1939: Discharge, 6,760 second-feet July 12 (gage height, 11.40 feet).

1932-38: Stage, 27.2 feet July 1, 1936, at railroad bridge, based on information from railroad company (discharge not determined).

REMARKS.—Flood flow not affected by storage.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	7.1	14	2	416	825	7	148	294
29	17	34	3	576	1,140	8	112	222
30	18,600	36,890	4	1,240	2,460	9	87	173
July			5	401	795	10	70	139
1	2,660	5,280	6	211	419			

Runoff, in acre-feet, for period June 28 to July 10 48,680

Gage-height, in feet, and discharge, in second-feet, at indicated times, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*June 30*—Continued			*July 1*—Continued		
12 m	0.60	6.6	4 p. m.	22.0	39,200	3 p. m.	5.0	1,270
12 p. m.	.58	5.9	4:15	22.05	39,200	4	4.8	1,220
June 29			5	22.0	39,200	5	4.6	1,100
1 a. m.	.58	5.9	6	21.4	36,600	6	4.40	995
12 m	.57	5.5	7	20.4	32,400	7	4.25	925
9 p. m.	.57	5.5	8	19.1	27,100	8	4.15	880
10	.75	15	9	17.6	21,600	9	3.90	796
11	1.60	147	10	16.1	16,800	10	3.80	754
12	2.35	351	11	14.6	12,700	11	3.70	714
June 30			12	13.4	10,100	12	3.60	674
1 a. m.	2.65	444	*July 1*			*July 2*		
2	2.75	476	1 a. m.	12.4	8,240	1 a. m.	3.50	634
3	8.0	3,300	2	11.4	6,760	6	3.15	509
4	10.2	5,400	3	10.6	5,800	12 m	2.85	428
5	11.1	6,380	4	9.6	4,800	6 p. m.	2.62	298
6	11.2	6,500	5	8.9	4,020	12	2.50	278
7	11.3	6,620	6	8.3	3,480			
8	12.4	8,240	7	7.8	2,980			
9	14.4	12,200	8	7.4	2,700	*July 3*		
10	16.0	16,500	9	7.0	2,440	1 a. m.	2.60	306
11	17.6	21,600	10	6.6	2,100	6	2.59	303
12 m	18.8	25,900	11	6.2	1,820	12 m	2.88	390
1 p. m.	20.0	30,700	12 m	5.9	1,670	6 p. m.	3.30	526
2	20.8	34,100	1 p. m.	5.6	1,570	9	5.0	1,270
3	21.6	37,400	2	5.3	1,420	12	6.1	1,820

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
July 4			*July 5*—Continued			*July 8*		
3 a. m.	5.8	1,770	6 p. m.	2.13	300	12 m.	1.27	112
6	5.3	1,520	12	1.97	261	12 p. m.	1.18	96
9	4.7	1,220						
12 m.	4.6	1,170	*July 6*			*July 9*		
6 p. m.	4.15	948	12 m.	1.74	208	12 m.	1.12	87
12	3.40	634	12 p. m.	1.58	173	12 p. m.	1.05	76
July 5			*July 7*			*July 10*		
3 a. m.	3.00	560	12 m.	1.45	146	12 m.	1.00	70
6	2.74	476	12 p. m.	1.34	124	12 p. m.	.94	61
12 m.	2.37	358						

SAN ANTONIO RIVER AT GOLIAD, TEX.

LOCATION.—Lat. 28°39′, long. 97°23′, at bridge on State Highway 29, 1.3 miles southeast of courthouse in Goliad, Goliad County, and 10 miles upstream from Manahuilla Creek. Datum of gage is 91.1 feet above mean sea level, datum of 1929, Houston supplementary adjustment of 1943.

DRAINAGE AREA.—3,914 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 3.7 and 4.8 feet; hundredths below and tenths above these limits. Shifting-control method used from 2 p. m. July 1 to July 10.

MAXIMA.—1940: Discharge, 11,600 second-feet at 11 a. m., July 2 (gage height, 31.37 feet, present site).

1924–29, 1939: Discharge, 13,100 second-feet Jan. 11, 1929 (gage height, about 30.5 feet, present site, from floodmark).

1913–23; 1930–38: Stage, about 45 feet, present site and datum, October 1913 and June 15, 1935, according to information furnished by local residents (discharge not determined).

REMARKS.—Flow at high stages affected by natural storage in wide flood plain.

Mean discharge, in second-feet, and runoff, in acre-feet, 1940

Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet	Day	Second-feet	Acre-feet
June			*July*—Con.			*July*—Con.		
28	223	442	2	11,300	22,410	8	371	736
29	222	440	3	7,440	14,760	9	317	629
30	4,760	9,440	4	2,850	5,650	10	272	540
			5	1,030	2,040	11	236	468
July			6	632	1,250	12	218	432
1	10,200	20,230	7	488	968			

Runoff, in acre-feet, for period June 28 to July 12 80,440

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
June 28			*July 1—* Continued			*July 4*		
1 a. m.	3.55	227	5 a. m.	28.2	9,280	2 a. m.	21.1	4,280
2	3.53	223	6	28.4	9,430	4	19.9	3,580
6	3.52	222	7	28.7	9,660	6	18.8	2,930
11	3.54	225	8	29.0	9,880	8	17.6	2,900
12 m.	3.62	240	9	29.2	10,000	10	16.7	2,930
6 p. m.	3.53	223	10	29.4	10,200	12 m.	15.9	2,760
12	3.46	211	11	29.6	10,400	2 p. m.	15.1	2,560
June 29			12 m.	29.7	10,500	4	14.4	2,450
6 a. m.	3.41	202	2 p. m.	30.0	10,600	6	13.8	2,340
7	3.45	209	4	30.2	10,800	8	13.2	2,200
8	3.46	211	6	30.4	11,000	10	12.5	2,010
12 m.	3.38	196	8	30.7	11,100	12	11.7	1,830
5 p. m.	3.38	196	10	30.8	11,200	*July 5*		
8	3.41	202	12	31.0	11,400	3 a. m.	10.4	1,490
9	3.65	245	*July 2*			6	9.2	1,230
10	4.10	326	3 a. m.	31.2	11,400	9	8.2	1,010
11	4.30	362	6	31.3	11,500	12 m.	7.5	881
12	4.60	416	9	31.3	11,500	3 p. m.	7.2	820
June 30			11	31.37	11,600	6	7.0	782
1 a. m.	5.9	650	3 p. m.	31.3	11,400	12	6.6	725
2	8.2	1,120	6	31.2	11,000	*July 6*		
3	10.6	1,700	9	30.8	10,400	12 m.	6.0	632
4	12.5	2,200	11	30.5	9,880	12 p. m.	5.6	542
5	14.3	2,700	12	30.4	9,580	*July 7*		
6	15.8	3,130	*July 3*			12 m.	5.2	488
7	17.1	3,520	2 a. m.	29.9	9,060	12 p. m.	4.8	407
8	18.2	3,860	4	29.4	8,680	*July 8*		
9	19.2	4,180	5	29.0	8,460	12 m.	4.55	371
10	20.0	4,450	6	28.7	8,240	12 p. m.	4.35	335
11	20.8	4,750	7	28.4	8,100	*July 9*		
12 m.	21.4	5,000	8	28.0	7,890	12 m.	4.20	317
1 p. m.	22.0	5,260	9	27.7	7,750	12 p. m.	4.05	290
2	22.6	5,560	10	27.3	7,540	*July 10*		
3	23.1	5,840	11	26.9	7,330	12 m.	3.95	272
4	23.6	6,130	12 m.	26.6	7,200	12 p. m.	3.81	250
5	24.0	6,370	1 p. m.	26.2	7,000	*July 11*		
6	24.4	6,610	2	25.9	6,800	12 m.	3.72	234
7	24.8	6,870	3	25.6	6,610	12 p. m.	3.66	223
8	25.2	7,130	4	25.2	6,490	*July 12*		
9	25.6	7,400	5	24.9	6,310	12 m.	3.63	218
10	25.9	7,610	6	24.6	6,190	12 p. m.	3.61	214
11	26.3	7,890	7	24.3	6,010			
12	26.6	8,100	8	24.0	5,780			
July 1			9	23.6	5,620			
1 a. m.	27.0	8,380	10	23.2	5,360			
2	27.2	8,530	11	22.8	5,090			
3	27.6	8,830	12	22.1	4,720			
4	27.9	9,060						

NOVEMBER FLOODS IN THE SAN JACINTO RIVER BASIN

A flood in the San Jacinto River Basin late in November covered the entire basin and broke known records at a number of places. The most outstanding part of the flood was in the lower reaches of the stream. At the stream-gaging station San Jacinto River near Huffman below the confluence of the East and West Forks, the stage was 51.2 feet, the highest ever known, and the peak discharge was 253,000 second-feet. The second highest known flood at this place occurred on May 31, 1929, and was about 1 foot lower than the flood of November 26, 1940. Reliable records concerning floods date back to 1876. At four other stream-gaging stations located on the main tributaries of San Jacinto River the stage that was reached was slightly higher

than any previously known at two stations; it equaled the highest known at the third station; and was slightly less than the highest known at the fourth.

Highways and railways were damaged greatly, and livestock valued at many thousands of dollars was drowned. No estimate of the total damage is available. Only a small part of the land within the basin is cultivated, and not much of this is within the flood plain. As crops had already been harvested, crop losses were very small.

The San Jacinto River Basin is located in the Coastal Plain area of Texas, is heavily forested, is cultivated to only a small extent, and has a low rolling topography varying in altitude above mean sea level from about 50 to 350 feet. In general, the topsoil is a fine sandy loam, and the subsoil varies in texture from friable to dense.[5] The friable subsoil predominates in the basin of the East Fork, whereas the dense subsoil is more generally found in the basin of the West Fork. The average annual rainfall is about 45 inches. The low-water channels are invariably small, and the flood plains are usually wide and heavily forested. Owing to flat gradients, streams rise and recede slowly, in contrast to the flashy rises of streams in the central and western parts of the State. Velocities are moderate, and erosion is not a serious problem.

A map of the San Jacinto River Basin is shown in figure 9.

METEOROLOGIC CONDITIONS

The following discussion by Ferguson[6] describes the meteorologic conditions during the storm period:[7]

On November 21, 1940, at 7:30 a. m., eastern standard time, a cold front extended from a low center of 1,005.4 millibars (29.69 inches) in Iowa, through western Arkansas, then southwestward to near Laredo, Tex., becoming quasi-stationary in the interior of southeast Texas. Warm, moist air from the Gulf was to the south of the front, and cool, moist air was to the north. An elongated, high-pressure area of about 1029.0 mb. (30.38 inches), composed of dry, cold air, which was changing into moist, cold air, dominated the section east of the Mississippi, centered in the Middle Atlantic States and extending south to the east Gulf. A weak, high-pressure ridge of approximately 1,016.5 mb. (30.04 inches) extended through central Texas to New Mexico. A secondary, active cold front extended from South Dakota west-southwestward through Utah with relatively moist, cold air over the Northwest United States, with a high-pressure ridge extending from central Canada west-southwestward to the northern California

[5] The soils of Texas, Texas Agr. Exper. Sta. Bull. 431, July 1931.

[6] Ferguson, J. H., The meteorological aspects preceding and during the heavy rains over southeast Texas for the period November 22–25, 1940, in Precipitation in hydrologic region 6, except Colorado and Tennessee, storm of November 21–27, 1940, with precipitation in selected areas of Texas and Louisiana for December 1–16, 1940: U. S. Weather Bur., Daily and hourly precipitation, Supplement 3, 1941.

[7] For explanation of meteorologic terms and descriptions see such texts as: Petterssen, Sverre, Introduction to meteorology, 236 pp., 1941. Hayes, B. C., Meteorology for pilots, U. S. Dept. Commerce, Civil Aeronautics Bull. 25, 167 pp., 1940.

coast with a center of approximately 1,029.0 mb. (30.38 inches) off the northern California coast.

By 7:30 a. m. of November 22, the quasi-stationary front over southeast Texas had advanced northwestward as a warm front to north Texas due to a low-pressure

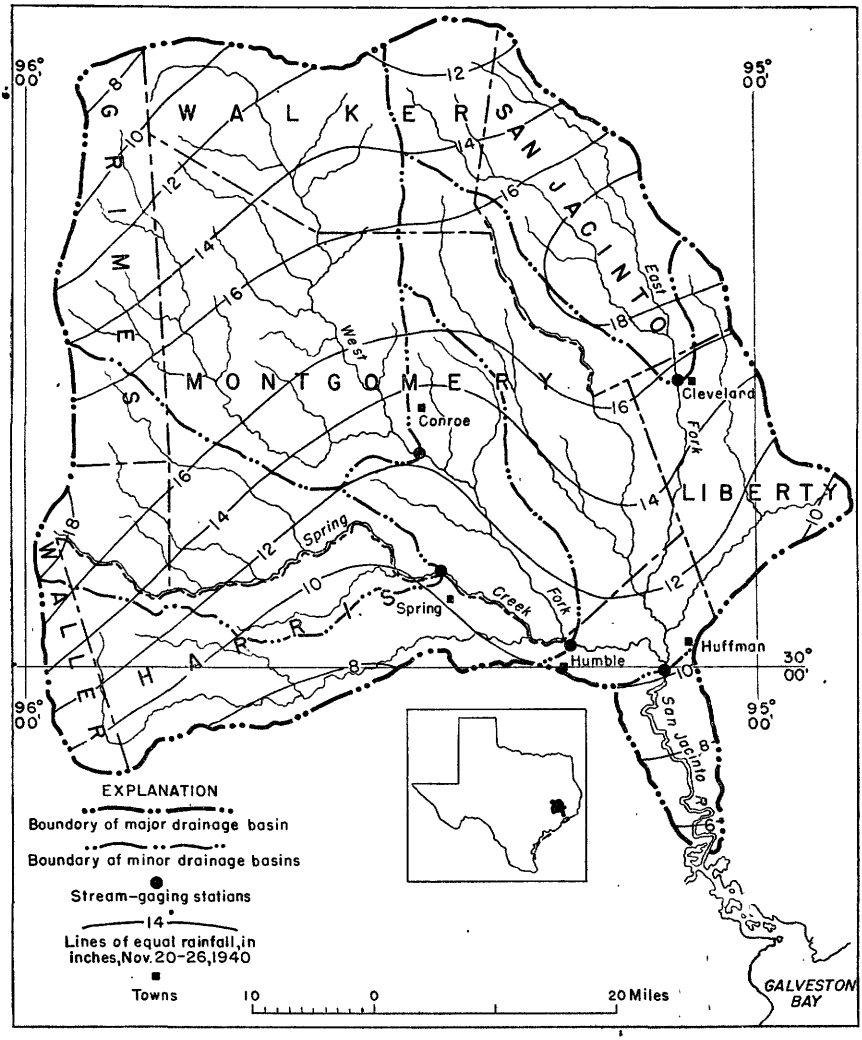


FIGURE 9.—Isohyetal map of San Jacinto River Basin, Tex., showing total rainfall, in inches, November 20-26, 1940, and locations of stream-gaging stations.

trough forming over Oklahoma. This caused light, instability showers over south and central Texas. The active cold front through the Dakotas extending westward had advanced rapidly to southern Kansas, northern New Mexico, and central Arizona, with a deepening trough over Texas westward to Arizona. During the night of November 22 heavy thunderstorms and rain occurred over southeast

Texas as warm, moist Gulf air overran cold air in central-southeast Texas, the immediate area where the cold front became quasi-stationary and later started northward as a warm front.

By 7:30 a. m. of November 23 the active cold front over southern Kansas had advanced rapidly southward to the Alpine-Fort Worth area and was underrunning the warm air southward over west Texas, causing a warm frontogenesis to develop over south-central Texas eastward to central Mississippi. That part of the cold front in north Texas had not moved nearly so far as the part farther west, but it had returned to the Palestine area by 7:30 p. m. November 23. The cold air underruning the warm air in that vicinity caused more heavy rains. In the meantime the cold front over central Texas had continued southeastward to the Texarkana-Palestine-Austin-Del Rio line with a warm-wave development still indicated over the region Shreveport to Austin. During the night of November 23 the cold air continued to move southward in the Palestine area and caused more rains as the warm air was displaced.

On November 24 and that night the warm air just south of Palestine again started moving northward, the rest of the cold front continuing southward past Brownsville. As this warm front near Palestine moved north, more rain fell due to overunning of the cold air. The whole low-pressure system then started moving north, the cold front to the west becoming active and moving eastward. The cold air from the west lifting the warm air caused additional showers in southeast Texas.

By November 25 a secondary low-pressure area had developed just off the Texas coast near Galveston, and began moving north-northeastward to near Texarkana. As the warm, moist air was moved eastward, cool air flowed over south-central and southeast Texas, causing the rain at Palestine to end at 3 p. m. on November 25.

The upper air conditions over Texas and the Southwest during this rain period were especially important. During the periods of heavy rainfall the winds aloft in the vicinity of El Paso eastward to the Gulf were southerly, 30 to 50 miles an hour, at intermediate and high levels, and only began to turn southwesterly over El Paso on November 24 at 4 a. m., after which a general clearing began over Texas from the southwest. The moisture content as shown from upper-air soundings at Brownsville, Oklahoma City, and El Paso increased rapidly after November 21, preceding the rain period.

RAINFALL

The storm of November 1940, which caused the floods in the San Jacinto River Basin as well as in many other streams, covered the eastern two-thirds of Texas and all of Oklahoma, Arkansas, and Louisiana. Soon after the storm the Weather Bureau made an extensive search for information concerning rainfall in areas remote from official gages. The data collected, together with the records obtained at the official gages, have been published in a special report.[8] The records of rainfall included in that report for the San Jacinto River Basin and adjacent areas are given in table 3.

[8] Precipitation in hydrologic region 6, except Colorado and Tennessee, storm of November 21–27, 1940, with precipitation in selected areas of Texas and Louisiana for December 1–16, 1940: U. S. Weather Bur., Daily and hourly precipitation, supplement 3, 1941.

TABLE 3.—*Rainfall, in inches, in San Jacinto River Basin and adjacent areas, Nov. 20–26, 1940* [1]

[Measured in morning except as noted. T=less than 0.01 inch. * Included in next measurement]

Station	Latitude	Longitude	November 1940							Total Nov. 20 to Nov. 26	Data furnished by—
			20	21	22	23	24	25	26		
Neches River Basin:	° ′	° ′									
Hyatt [2]	30 33	94 26	0.03	0.10	0.10	2.40	5.40	3.39	0.02	11.44	U. S. Weather Bureau.
Kountze [3]	30 23	94 19	.12	.11	.06	2.17	2.82	2.02	-------	7.30	Do.
Trinity River Basin:											
Bedias	30 46	95 56	-------	.02	T	.65	2.43	2.55	.14	5.79	Do.
Cold Springs	30 35	95 08	-------	(*)	(*)	(*)	(*)	(*)	(*)	18 to 20	Polk County Agent.
Groveton	31 03	95 07	-------	-------	.03	1.62	3.10	3.04	.50	8.29	U. S. Weather Bureau.
Huntsville	30 44	95 35	-------	T	.11	1.48	7.05	3.15	.41	12.20	Do.
Liberty [2]	30 04	94 49	-------	-------	.07	.45	3.86	2.55	-------	6.93	Do.
Livingston	30 43	94 57	.01	.15	.47	.37	10.20	3.70	.53	15.43	Do.
Lovelady [3]	31 07	95 27	-------	.25	2.47	1.72	4.39	.95	-------	9.78	Do.
Madisonville [2]	30 57	95 54	.12	-------	-------	(*)	3.25	1.32	-------	4.69	Do.
Midway (near)	31 05	95 42	-------	(*)	(*)	(*)	(*)	(*)	-------	6.00	Mr. Pitts, 4 miles northeast of Midway.
Moscow	30 55	94 50	.02	.05	.39	.28	8.40	3.36	.45	12.95	U. S. Weather Bureau.
Riverside	30 51	95 24	-------	T	.13	1.80	4.70	2.77	.48	9.88	Do.
Rye (near)	30 27	94 46	-------	(*)	(*)	(*)	(*)	(*)	-------	13+	Farmer, 1 mile south of Rye.
Schwab City	30 35	94 52	-------	(*)	(*)	(*)	(*)	(*)	-------	16.75	Jim Reading, 10 miles southeast of Livingston.
Shepherd [3 4]	30 30	95 00	-------	.15	.22	7.92	10.05	1.34	-------	19.68	U. S. Weather Bureau.
San Jacinto River Basin:											
Cleveland	30 21	95 05	-------	(*)	(*)	(*)	(*)	(*)	-------	12 to 14	Liberty County Agent.
Conroe (near)	30 18	95 28	-------	T	-------	.89	7.06	4.53	.40	12.88	U. S. Weather Bureau.
Four Notch Guard Station	30 39	95 26	-------	.05	T	1.40	7.75	2.80	.42	12.42	U. S. Forest Service.
Montgomery [3 5]	30 23	95 42	-------	.05	.70	6.22	9.53	.96	-------	17.46	U. S. Weather Bureau.
Splendora	30 14	95 09	-------	-------	-------	.34	8.80	5.30	.20	14.64	Do.
Buffalo Bayou Basin:											
Addicks (near) [3]	29 46	95 39	.15	-------	.15	.49	3.38	.40	-------	4.57	City of Houston.
Alief (near) [3]	29 43	95 36	-------	-------	.07	.13	4.08	.80	-------	5.08	Do.
Barker (near) [3]	29 52	95 41	-------	-------	.36	1.68	4.76	.40	-------	7.20	Do.
Bear Creek [3]	29 53	95 47	-------	-------	.44	1.99	4.79	.40	-------	7.62	Do.
Houston (city) [3]	29 47	95 24	-------	-------	.09	1.11	3.35	1.45	-------	6.00	U. S. Weather Bureau.
Katy [3]	29 47	95 49	-------	.12	.32	1.30	4.10	.28	-------	6.12	City of Houston.
Satsuma [3]	29 54	95 36	-------	-------	.20	.70	5.00	.48	-------	6.38	Do.
Brazos River Basin:											
Anderson	30 27	95 59	-------	.03	.03	.86	6.97	2.25	.25	10.39	U. S. Weather Bureau.
Brenham	30 10	96 24	-------	.15	.11	.56	3.50	4.23	.10	8.65	Do.
College Station	30 37	96 23	-------	T	.03	2.01	2.03	1.80	.08	5.95	Do.
Hempstead	30 06	96 05	-------	-------	-------	.35	16.00	4.46	.25	21.06	Do.
Navasota	30 23	96 06	-------	-------	.23	.27	9.60	2.68	.15	12.93	Do.
Navasota (airway) [3]	30 24	96 04	.04	.07	.36	5.52	6.87	.55	-------	13.41	Do.

Sealy [2]	29	47	96	10	-------	.07	.31	.31	3.36	1.54	-------	5.59	Do.
Somerville [3]	30	21	96	31	-------	.08	.16	2.15	2.24	.37	-------	5.00	Do.
Wheelock (near) [3]	30	52	96	23	-------	.01	3.76	2.65	2.38	.25	-------	9.05	Do.
Coast:													
Amelia	30	04	94	11	.07	-------	.12	.07	.42	2.87	.22	3.77	Texas Agricultural Experiment Station.
Anahuac (near)	29	46	94	41	.02	-------	-------	T	.08	4.00	.29	4.39	U. S. Weather Bureau.
Goose Creek	29	45	94	59	-------	-------	-------	.41	.47	3.51	.07	4.46	Do.

[1] From Precipitation in hydrologic region 6, except Colorado and Tennessee, storm of Nov. 21–27, 1940, with precipitation in selected areas of Texas and Louisiana for Dec. 1–16, 1940: U. S. Weather Bureau, daily and hourly precipitation, supplement No. 3, 1941.

[2] Measured in afternoon.

[3] Measured at midnight.

[4] No record 6:30 a. m. to 8:30 a. m. Nov. 24 because of overflowing bucket. Observer estimates 3 inches of rainfall during that time.

[5] No record 5:30 a. m. to 8 a. m. Nov. 24 because of overflowing bucket. 2 inches of rain fall estimated during that period on basis of rate of rainfall prior to 5:30 a. m. and comparison with other stations.

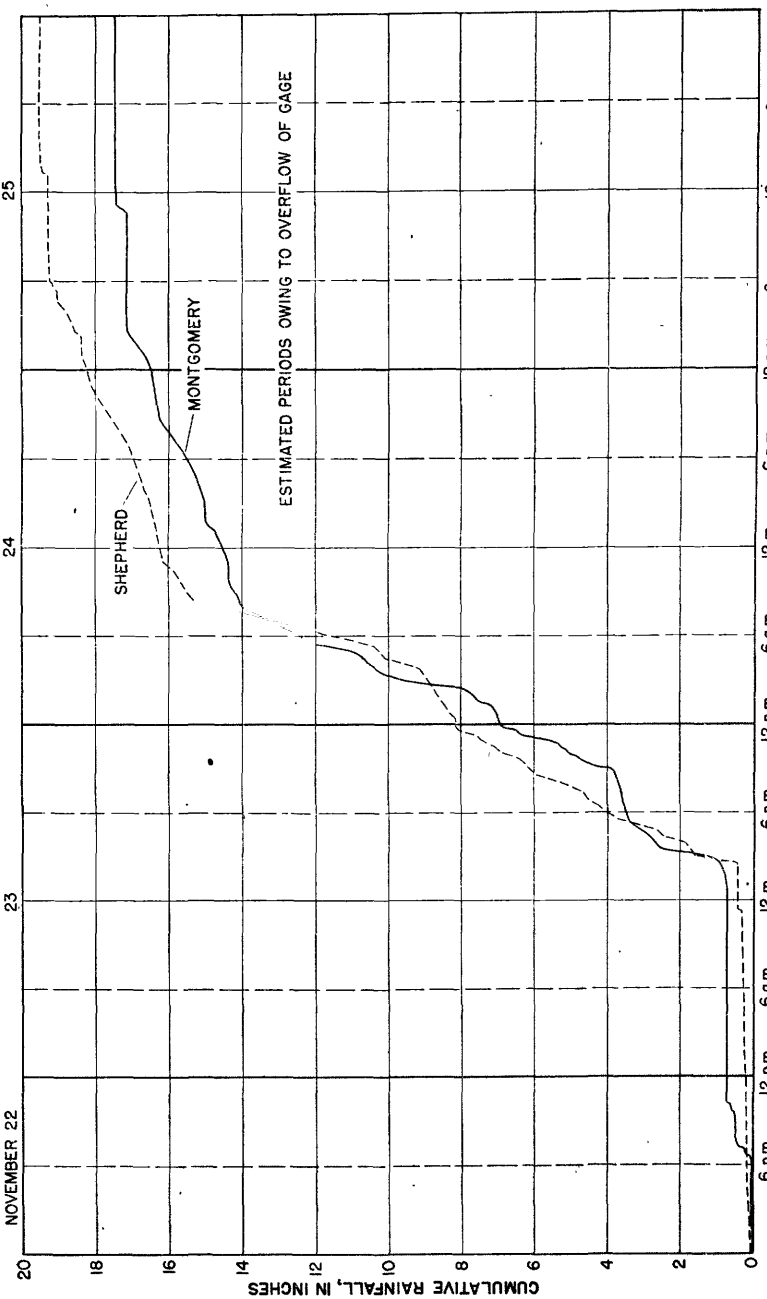


FIGURE 10.—Graphs of cumulative rainfall, in inches, at Montgomery and Shepherd, November 22-25, 1940.

The heaviest rainfall recorded within the San Jacinto River Basin occurred at the recording rain gage at Montgomery, where a total of 17.46 inches fell November 21–25. Fourteen inches of this amount fell during the 24-hour period from 2 p. m. November 23 to 2 p. m. November 24. The same gage registered 8 inches in the 8.5-hour period from 9 p. m. November 23 to 5:30 a. m. November 24. The recording gage at Shepherd, about 5 miles east of the San Jacinto River Basin, registered a total of 19.68 inches during November 21–25. Sixteen inches of this amount fell in the 24-hour period from 2 p. m. November 23 to 2 p. m. November 24. Graphs of cumulative rainfall obtained from the above recording gages are shown in figure 10. Records from a nonrecording rain gage at Hempstead, 7 miles west of the San Jacinto River Basin, show a total of 21.06 inches during November 23–26. Of this amount 16 inches was reported for the morning reading on November 24.

Distribution of the rain with respect to time and area within the San Jacinto River Basin is shown by the isohyetal lines in figure 9. For discussion of rainfall-runoff relations, see page 82.

STAGES AND DISCHARGES AT STREAM-GAGING STATIONS

Stage and discharge records obtained at the five stream-gaging stations in the San Jacinto River Basin during November and December 1940 are given on the following pages. The records for December are included because a flood of considerable magnitude occurred during the middle of that month. The locations of the stations are shown in figure 9. Graphs of discharge, plotted from station records, are shown in figures 11 and 12. For an explanation of the station records see the section of this report on stages and discharges at stream-gaging stations in the description of the flood of June-July 1940.

A view of the San Jacinto River flood is shown in plate 7, *B*.

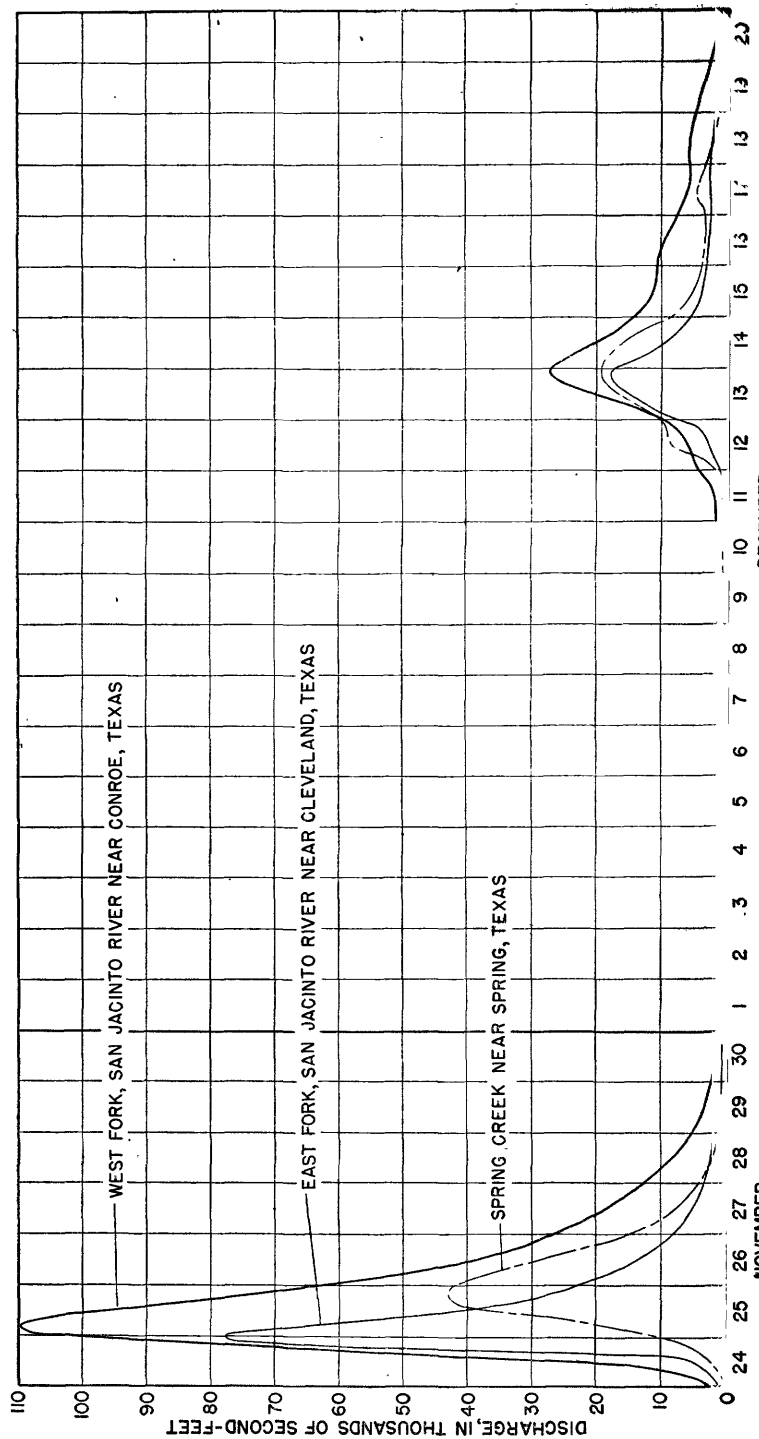


FIGURE 11.—Graphs of discharge at various stream-gaging stations in the San Jacinto River Basin, November 24 to December 20, 1940.

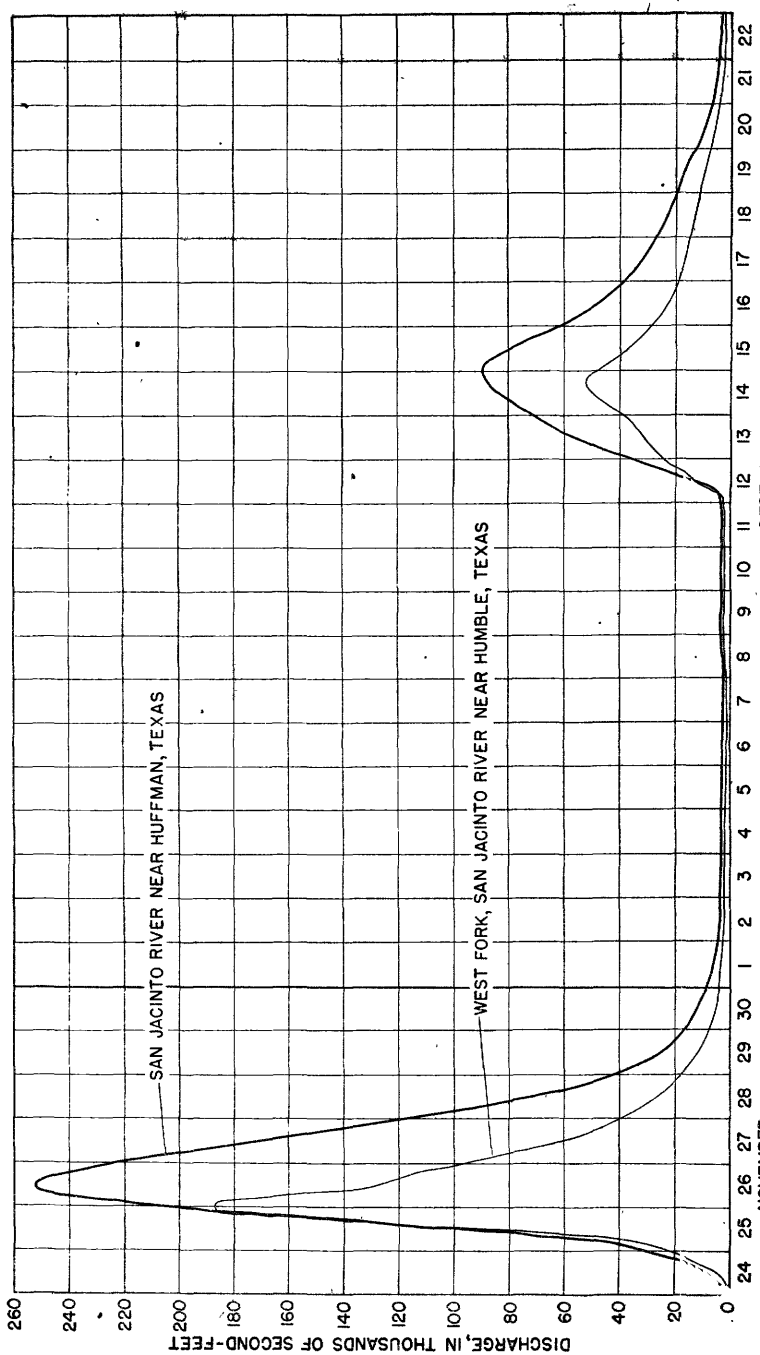


FIGURE 12.—Graphs of discharge at various stream-gaging stations in the San Jacinto River Basin, November 24 to December 22, 1940.

SAN JACINTO RIVER BASIN

WEST FORK SAN JACINTO RIVER NEAR CONROE, TEX.

LOCATION.—Lat. 30°15′, long. 95°28′, at bridge on U. S. Highway 75, 285 feet feet upstream from bridge of International-Great Northern R. R., 3½ miles downstream from Lake Creek, and 4¼ miles south of Conroe, Montgomery County. Datum of gage is 100.1 feet above mean sea level, datum of 1929, Galveston-Houston supplementary adjustment of 1936.

DRAINAGE AREA.—832 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 43,000 second-feet and extended above by velocity-area studies. Gage heights used to half tenths between 2.8 and 5.5 feet; hundredths below and tenths above these limits.

MAXIMA.—1940: Discharge, 110,000 second-feet 5 a. m. Nov. 25 (gage height, 25.85 feet).

1924–27, 1939: Discharge, 88,100 second-feet Apr. 22, 1926 (gage height, 24.2 feet, present site and datum).

1913–23, 1928–38: Discharge, 101,000 second-feet December 1913 (gage height, 25.2 feet, present site and datum, from information furnished by International-Great Northern R. R. Co. engineers for site at railroad bridge) from 1940 rating curve.

Stage, 24.2 feet, May 1922, and 21.7 feet May 30, 1929, from information by International-Great Northern R. R. Co.

REMARKS.—Flood runoff not affected by artificial storage; probably considerably affected by natural storage in wide flood plain.

Mean discharge in second-feet, 1940

Day	November	December	Day	November	December	Day	November	December
1	73	799	11	186	2,060	21	42	961
2	57	560	12	320	6,110	22	42	742
3	74	451	13	222	19,900	23	278	551
4	53	342	14	143	20,200	24	36,700	451
5	72	271	15	155	11,300	25	92,900	412
6	108	262	16	135	9,300	26	40,600	920
7	89	770	17	91	6,310	27	18,600	1,180
8	88	1,340	18	69	5,360	28	8,400	1,670
9	106	1,240	19	55	3,440	29	3,590	2,360
10	136	1,500	20	46	1,680	30	1,660	3,220
						31		2,340
Monthly mean discharge, in second-feet							6,834	3,484
Runoff, in acre-feet							406,600	214,200

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Nov. 23			*Nov. 28*			*Dec. 3*		
1 a. m.	1.76	44	1 a. m.	15.98	12,400	12 m.	5.09	451
3	1.77	44	3	15.85	11,400	12 p. m.	4.90	400
5	1.77	44	5	15.75	10,700			
7	1.79	46	7	15.63	10,100	*Dec. 4*		
9	1.82	49	9	15.49	9,300	12 m.	4.72	342
11	1.87	54	11	15.35	8,600	12 p. m.	4.56	310
1 p. m.	1.95	62	1 p. m.	15.16	7,820			
3	2.06	72	3	14.98	7,300	*Dec. 5*		
5	2.25	91	5	14.81	6,600	12 m.	4.42	271
7	2.96	173	7	14.60	6,000	12 p. m.	4.32	253
9	4.50	477	9	14.38	5,500			
11	7.30	1,340	11	14.15	5,140	*Dec. 6*		
12	8.85	1,870	12	14.01	4,880	6 a. m.	4.33	262
						6 p. m.	4.33	262
Nov. 24			*Nov. 29*			12	4.31	253
1 a. m.	10.17	2,500	1 a. m.	13.90	4,780			
3	12.52	3,720	3	13.66	4,480	*Dec. 7*		
5	14.02	4,880	5	13.41	4,220	1 a. m.	4.31	253
7	15.19	8,000	7	13.16	4,000	3	4.38	271
9	16.04	12,800	9	12.87	3,820	5	4.54	300
11	16.77	17,800	11	12.60	3,660	7	4.85	376
1 p. m.	18.22	29,200	1 p. m.	12.29	3,440	9	5.37	530
3	20.00	44,500	3	12.01	3,280	11	6.00	712
5	21.51	58,000	5	11.73	3,110	1 p. m.	6.64	890
7	22.93	72,400	7	11.31	2,900	3	7.13	1,050
9	24.23	88,100	9	11.00	2,700	5	7.44	1,140
11	25.03	98,500	11	10.71	2,550	7	7.60	1,210
12	25.33	103,000	12	10.59	2,450	9	7.68	1,240
						11	7.79	1,270
Nov. 25			*Nov. 30*			12	7.84	1,270
1 a. m.	25.55	107,000	1 a. m.	10.45	2,400			
3	25.81	110,000	3	10.12	2,220	*Dec. 8*		
5	25.85	110,000	5	9.81	2,040	2 a. m.	7.97	1,340
7	25.72	108,000	7	9.52	1,910	6	8.09	1,370
9	25.45	104,000	9	9.22	1,790	10	8.06	1,370
11	25.08	99,900	11	8.91	1,670	2 p. m.	7.96	1,340
1 p. m.	24.66	94,600	1 p. m.	8.61	1,560	6	7.87	1,300
3	24.18	88,100	3	8.30	1,430	10	7.85	1,300
5	23.71	81,900	5	8.05	1,370	12	7.83	1,270
7	23.25	75,900	7	7.81	1,270			
9	22.71	70,200	9	7.54	1,180	*Dec. 9*		
11	22.18	65,000	11	7.32	1,110	2 a. m.	7.82	1,270
12	21.89	62,000	12	7.18	1,080	6	7.80	1,270
						10	7.74	1,240
Nov. 26			*Dec. 1*			2 p. m.	7.67	1,240
1 a. m.	21.67	60,000	1 a. m.	7.08	1,050	6	7.64	1,210
3	21.21	55,300	3	6.90	984	10	7.69	1,240
5	20.72	50,800	5	6.72	920	12	7.76	1,240
7	20.31	47,200	7	6.54	860			
9	19.87	43,600	9	6.40	830	*Dec. 10*		
11	19.52	40,200	11	6.28	800	2 a. m.	7.86	1,300
1 p. m.	19.22	37,700	1 p. m.	6.17	755	6	8.11	1,370
3	18.88	35,200	3	6.07	726	10	8.38	1,460
5	18.59	32,600	5	5.96	698	2 p. m.	8.64	1,560
7	18.34	30,000	7	5.87	670	6	8.84	1,630
9	18.10	28,400	9	5.81	656	10	8.95	1,670
11	17.88	26,700	11	5.75	642	12	8.98	1,670
12	17.83	25,900	12	5.72	628			
Nov. 27			*Dec. 2*			*Dec. 11*		
1 a. m.	17.77	25,900	1 a. m.	5.70	628	1 a. m.	8.98	1,670
3	17.56	24,300	3	5.64	614	3	8.97	1,670
5	17.37	22,700	5	5.60	600	5	8.92	1,670
7	17.17	21,200	7	5.54	586	7	8.85	1,630
9	17.04	19,700	9	5.50	572	9	8.75	1,600
11	16.87	18,600	11	5.46	558	11	8.64	1,560
1 p. m.	16.72	17,400	1 p. m.	5.42	544	1 p. m.	8.64	1,560
3	16.58	16,700	3	5.40	544	3	9.08	1,710
5	16.46	15,600	5	5.36	530	5	9.83	2,080
7	16.32	14,500	7	5.33	530	7	10.80	2,600
9	16.21	13,800	9	5.30	516	9	11.85	3,220
11	16.10	13,100	11	5.26	503	11	12.75	3,770
12	16.04	12,800	12	5.25	503	12	13.13	4,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Dec. 12			*Dec. 15*			*Dec. 19*—		
1 a. m.	13.38	4,220	3 a. m.	16.03	12,800	Continued		
3	13.72	4,580	9	15.84	11,400	9 p. m.	10.90	2,700
5	13.92	4,780	3 p. m.	15.73	10,700	12	10.45	2,450
7	14.04	4,880	9	15.68	10,400			
9	14.12	5,000	12	15.67	10,100	*Dec. 20*		
11	14.18	5,140				3 a. m.	10.00	2,220
1 p. m.	14.27	5,300	*Dec. 16*			9	9.05	1,790
3	14.60	6,000	3 a. m.	15.68	10,400	3 p. m.	8.23	1,460
5	14.86	6,780	9	15.58	9,800	9	7.53	1,240
7	15.20	8,000	3 p. m.	15.40	8,800	12	7.22	1,140
9	15.42	8,800	9	15.23	8,200			
11	15.58	9,800	12	15.14	7,820	*Dec. 21*		
12	15.66	10,100				3 a. m.	6.98	1,080
			Dec. 17			9	6.65	984
Dec. 13			3 a. m.	15.02	7,300	3 p. m.	6.46	920
2 a. m.	15.84	11,400	9	14.76	6,450	9	6.35	860
6	16.26	14,200	3 p. m.	14.55	5,880	12	6.29	860
10	16.77	17,800	9	14.47	5,620			
2 p. m.	17.38	22,700	12	14.48	5,750	*Dec. 22*		
6	17.83	25,900				3 a. m.	6.21	830
10	18.00	27,500	*Dec. 18*			9	6.01	770
12	17.98	27,500	3 a. m.	14.50	5,750	3 p. m.	5.80	712
			9	14.47	5,620	9	5.60	656
Dec. 14			3 p. m.	14.30	5,300	12	5.52	628
2 a. m.	17.80	25,900	9	13.90	4,780			
6	17.57	24,300	12	13.63	4,480	*Dec. 23*		
10	17.20	21,200				6 a. m.	5.38	586
2 p. m.	16.88	19,000	*Dec. 19*			6 p. m.	5.15	516
6	16.55	16,300	3 a. m.	13.32	4,140	12	5.07	503
10	16.30	14,500	9	12.58	3,720			
12	16.18	13,800	3 p. m.	11.78	3,220			

WEST FORK SAN JACINTO RIVER NEAR HUMBLE, TEX.

LOCATION.—Lat. 30°01'35", long. 95°15'30", at bridge on U. S. Highway 59, 1,160 feet upstream from bridge of Texas and New Orleans R. R., half a mile downstream from Spring Creek, and 2½ miles north of Humble, Harris County. Datum of gage is 30.53 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—1,811 square miles.

GAGE-HEIGHT RECORD.—Water-stage recorder graph.

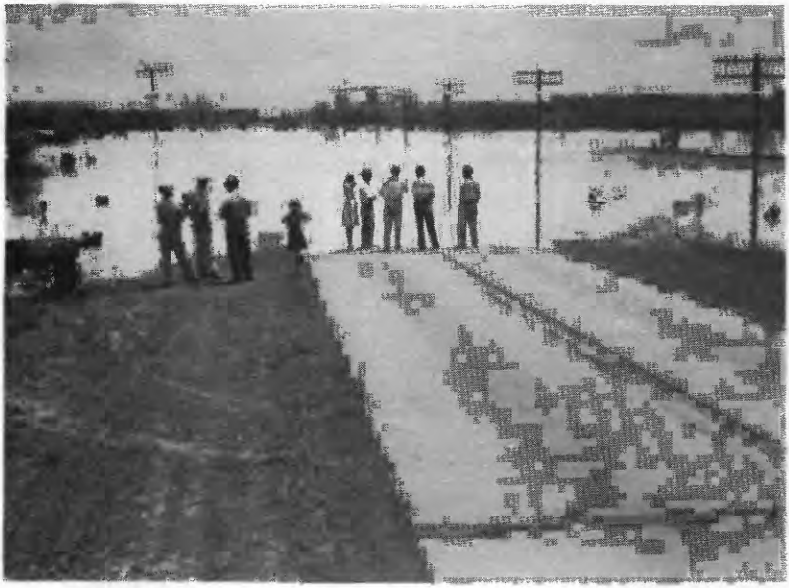
DISCHARGE RECORD.—Discharge Nov. 23 to Dec. 6, 1940, computed on basis of loop rating curve caused by rapidly changing stage, wide overflow, and backwater from East Fork San Jacinto River, which became effective about 7 p. m. Nov. 25. The rising-stage part of the loop curve was defined by current-meter measurements up to 153,000 second-feet, and the falling-stage part was defined by current-meter measurements below 127,000 second-feet. For rest of period of record, rating curve is well defined by current-meter measurements. Gage heights used to half tenths between 5.0 and 7.0 feet; hundredths below and tenths above these limits.

MAXIMA.—1940: Discharge, 187,000 second-feet, 11 p. m. Nov. 25 to 1 a. m. Nov. 26; gage height, 32.68 feet, by recorder attached to web of bridge pier, and 33.00 feet by chain gage attached to upstream handrail of bridge, away from influence of pier, 8 a. m. Nov. 26 (both gage heights affected by backwater from East Fork San Jacinto River).

1928–39: Discharge, 187,000 second-feet May 31, 1929 (gage height, 32.7 feet, probably affected by backwater from East Fork San Jacinto River).

1908–27: Stage, 30.5 feet in 1908, according to information furnished by Texas and New Orleans R. R. Co.

REMARKS.—Flood runoff not affected by artificial stc , probably considerably affected by natural storage in wide flood plain.



A, NAVIDAD RIVER NEAR GANADO AT PEAK OF FLOOD OF JULY 2, 1940.
View of submerged highway and railway from right bank.

B, SAN JACINTO RIVER FLOOD OF NOVEMBER 27, 1940, AT HIGHWAY CROSSING NEAR CROSBY.
View from left bank. Water has receded about 1 foot.

Mean discharge in second-feet, 1940

Day	November	December	Day	November	December	Day	November	December
1	449	3,120	12	386	12,800	22	58	2,620
2	345	2,170	13	491	31,300	23	92	2,100
3	275	1,750	14	330	48,200	24	8,040	1,610
4	195	1,430	15	225	37,400	25	103,000	1,380
5	156	1,210	16	195	23,400	26	137,000	1,790
6	235	1,010	17	156	17,200	27	63,400	2,300
7	345	1,070	18	114	13,200	28	27,300	2,560
8	320	2,030	19	91	9,320	29	12,000	2,980
9	315	2,250	20	74	5,730	30	5,570	3,700
10	398	2,220	21	64	3,520	31		3,840
11	295	2,360						
Monthly mean discharge, in second-feet							12,060	7,986
Runoff, in acre-feet							717,800	491,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Nov. 23			*Nov. 26—*			*Nov. 30*		
1 a. m.	2.96	50	Continued			1 a. m.	10.65	7,400
3	2.96	50	3 p. m.	32.18	121,000	3	10.40	7,000
5	2.96	50	5	31.85	117,000	5	10.13	6,600
7	2.96	50	7	31.50	113,000	7	9.92	6,200
9	2.96	50	9	30.97	106,000	9	9.68	5,900
11	2.96	50	11	30.52	99,600	11	9.43	5,600
1 p. m.	2.96	50	12	30.32	97,000	1 p. m.	9.23	5,300
3	2.99	54				3	9.04	5,000
5	3.02	58	*Nov. 27*			5	8.86	4,800
7	3.07	67	1 a. m.	30.04	93,400	7	8.68	4,600
9	3.38	136	3	29.54	87,700	9	8.52	4,300
11	4.02	436	5	29.00	81,200	11	8.36	4,100
12	4.34	631	7	28.40	75,000	12	8.28	4,100
			9	27.77	68,800			
Nov. 24			11	27.17	63,200	*Dec. 1*		
1 a. m.	4.60	1,000	1 p. m.	26.51	58,000	4 a. m.	7.98	3,640
3	4.98	1,300	3	25.86	53,400	12 m.	7.45	3,060
5	5.23	1,600	5	25.19	49,400	8 p. m.	7.05	2,660
7	5.39	1,800	7	24.57	46,400	12	6.88	2,400
9	5.62	2,300	9	23.94	43,700			
11	7.57	4,600	11	23.24	40,600	*Dec. 2*		
1 p. m.	9.55	7,900	12	22.89	39,300	4 a. m.	6.72	2,380
3	10.95	10,800				12 m.	6.50	2,160
5	11.81	13,000	*Nov. 28*			8 p. m.	6.30	1,980
7	12.56	14,800	1 a. m.	22.56	38,000	12	6.22	1,900
9	13.43	17,000	3	21.88	35,500			
11	14.67	20,400	5	21.22	33,300	*Dec. 3*		
12	15.42	22,800	7	20.55	31,100	4 a. m.	6.18	1,900
			9	19.97	29,200	12 m.	5.97	1,740
Nov. 25			11	19.43	27,800	8 p. m.	5.83	1,620
1 a. m.	16.13	25,000	1 p. m.	18.87	26,100	12	5.76	1,570
3	17.46	29,400	3	18.27	24,400			
5	19.60	38,300	5	17.69	23,000	*Dec. 4*		
7	22.21	53,000	7	17.10	21,200	4 a. m.	5.70	1,520
9	24.02	67,500	9	16.48	19,800	12 m.	5.58	1,420
11	25.89	89,600	11	15.91	18,300	8 p. m.	5.46	1,350
1 p. m.	27.15	109,000	12	15.65	17,800	12	5.40	1,310
3	28.25	130,000						
5	29.32	153,000	*Nov. 29*			*Dec. 5*		
7	30.22	173,000	1 a. m.	15.40	17,200	4 a. m.	5.35	1,280
9	30.87	184,000	3	14.89	16,000	12 m.	5.25	1,200
11	31.60	187,000	5	14.40	14,900	8 p. m.	5.13	1,140
12	31.85	187,000	7	13.94	13,800	12	5.08	1,100
			9	13.52	13,000			
Nov. 26			11	13.08	12,100	*Dec. 6*		
1 a. m.	32.05	187,000	1 p. m.	12.68	11,200	6 a. m.	5.00	1,050
3	32.35	183,000	3	12.29	10,400	6 p. m.	4.86	970
5	32.58	172,000	5	11.94	9,800	12	4.82	965
7	32.68	156,000	7	11.62	9,200			
9	32.67	138,000	9	11.29	8,600	*Dec. 7*		
11	32.57	129,000	11	10.92	7,900	3 a. m.	4.84	965
1 p. m.	32.40	124,000	12	10.78	7,700	9	4.87	1,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Dec. 7—Continued			*Dec. 13*—Continued			*Dec. 17*		
3 p. m.	4.93	1,050	5 a. m.	18.13	27,800	3 a. m.	14.67	19,000
9	5.21	1,260	7	18.45	28,800	9	14.15	17,400
12	5.44	1,480	9	18.78	30,100	3 p. m.	13.78	16,700
Dec. 8			11	19.02	30,800	9	13.48	15,900
3 a. m.	5.65	1,660	1 p. m.	19.27	31,900	12	13.31	15,400
9	5.99	2,000	3	19.50	32,600	*Dec. 18*		
3 p. m.	6.18	2,200	5	19.77	33,700	3 a. m.	13.13	14,900
9	6.25	2,250	7	20.05	34,500	9	12.68	13,700
12	6.27	2,250	9	20.38	36,300	3 p. m.	12.20	12,600
Dec. 9			11	20.72	37,600	9	11.72	11,700
6 a. m.	6.27	2,250	12	20.90	38,600	12	11.53	11,300
6 p. m.	6.25	2,250	*Dec. 14*			*Dec. 19*		
12	6.26	2,250	1 a. m.	21.18	40,100	3 a. m.	11.32	10,800
Dec. 10			3	21.55	42,200	9	10.86	9,800
6 a. m.	6.25	2,250	5	21.90	44,000	3 p. m.	10.40	8,800
6 p. m.	6.18	2,200	7	22.23	45,900	9	9.88	7,880
12	6.17	2,150	9	22.54	48,000	12	9.61	7,520
Dec. 11			11	22.78	50,100	*Dec. 20*		
6 a. m.	6.23	2,250	1 p. m.	22.93	50,800	3 a. m.	9.34	6,800
2 p. m.	6.36	2,350	3	23.05	51,500	9	8.87	6,120
6 p. m.	6.48	2,500	5	23.10	52,300	3 p. m.	8.40	5,320
10 p. m.	6.56	2,560	7	23.08	52,300	9	7.99	4,680
12	6.66	2,680	9	22.95	51,500	12	7.79	4,400
Dec. 12			11	22.77	50,100	*Dec. 21*		
1 a. m.	6.78	2,860	12	22.65	48,700	3 a. m.	7.62	4,120
3	7.40	3,580	*Dec. 15*			9	7.28	3,580
5	8.90	5,800	2 a. m.	22.33	46,600	3 p. m.	7.00	3,340
7	10.25	8,060	6	21.64	42,200	9	6.80	3,040
9	11.27	10,200	10	20.82	38,100	12	6.72	2,920
11	11.93	11,500	2 p. m.	20.17	35,400	*Dec. 22*		
1 p. m.	12.58	13,000	6	19.44	32,200	6 a. m.	6.61	2,740
3	13.20	14,400	10	18.67	29,800	6 p. m.	6.40	2,500
5	14.40	17,400	12	18.31	28,500	12	6.28	2,400
7	15.47	20,300	*Dec. 16*			*Dec. 23*		
9	16.20	22,300	2 a. m.	17.93	27,500	6 a. m.	6.13	2,250
11	16.77	23,900	6	17.25	25,700	6 p. m.	5.84	1,950
12	17.01	24,500	10	16.64	23,700	12	5.73	1,850
Dec. 13			2 p. m.	16.08	22,500			
1 a. m.	17.25	25,100	6	15.58	21,100			
3	17.70	26,600	10	15.16	20,000			
			12	14.96	19,500			

SAN JACINTO RIVER NEAR HUFFMAN, TEX.

LOCATION.—Lat. 29° 59′ 40″, long. 95° 08′ 00″, at bridge of the Beaumont, Sour Lake & Western Ry., 0.4 mile downstream from the confluence of the East Fork and West Fork San Jacinto Rivers, and 3.4 miles southwest of Huffman, Harris County. Datum of gage is 1.93 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—2,791 square miles.

GAGE-HEIGHT RECORD.—Graph drawn on basis of one or more gage readings daily during low stages and two or more gage readings daily during high stages, including observation at crest stage. Below a stage of 39 feet gage heights were obtained from wire-weight gage; above 39 feet from a temporary staff gage, which was read at frequent intervals by employees of the Beaumont, Sour Lake & Western Ry. Co. from 10 a. m. Nov. 25 to 4 p. m. Nov. 27.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 10.5 and 12.0 feet; hundredths below and tenths above these limits.

MAXIMA.—1940: Discharge, 253,000 second-feet, 11 a. m. Nov. 26 (gage height, 51.2 feet).

1936–39: Discharge, 16,800 second-feet Mar. 1, 1939 (gage height, 23.7 feet, from graph based on gage readings).

1876–1935: Discharge, 237,000 second-feet, May 31, 1929 (gage height, 50.3 feet, from information furnished by Beaumont, Sour Lake & Western Ry. Co.) from 1940 rating curve.

Flood of April 1876 reached a stage of about 48.7 feet, from information furnished by local residents. Flood of April 1922 reached a stage of 41.8 feet, from information furnished by Beaumont, Sour Lake & Western Ry. Co.

REMARKS.—Flood runoff not affected by artificial storage; probably considerably affected by natural storage in wide flood plain.

Mean discharge, in second-feet, 1940

Day	November	December	Day	November	December	Day	November	December
1	569	6,080	11	632	3,200	21	203	5,200
2	471	3,650	12	584	14,400	22	186	3,700
3	411	2,540	13	621	55,300	23	210	3,200
4	354	2,010	14	676	83,000	24	10,900	2,260
5	380	1,820	15	476	78,600	25	108,000	1,870
6	467	1,480	16	384	48,600	26	240,000	2,940
7	519	1,380	17	325	32,000	27	172,000	3,850
8	554	2,610	18	267	22,900	28	77,200	4,090
9	564	3,390	19	246	16,300	29	27,100	4,490
10	584	3,390	20	232	9,010	30	12,300	5,030
						31		5,300
Monthly mean discharge, in second-feet							21,910	13,990
Runoff, in acre-feet							1,304,000	860,000

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Nov. 24			*Nov. 26*			*Nov. 28*		
1 a. m.	11.0	900	1 a. m.	48.9	212,000	1 a. m.	41.7	116,000
3	12.5	1,800	3	49.7	226,000	3	41.0	109,000
5	14.0	2,900	5	50.3	237,000	5	40.3	101,000
7	15.6	4,400	7	50.8	246,000	7	39.6	93,000
9	17.1	5,900	9	51.1	251,000	9	38.9	86,000
11	18.6	7,600	11	51.2	253,000	11	38.2	79,000
1 p. m.	20.1	9,700	1 p. m.	51.1	251,000	1 p. m.	37.5	72,000
3	21.7	12,300	3	51.0	249,000	3	36.8	65,000
5	23.2	15,100	5	50.8	246,000	5	36.1	59,000
7	24.9	19,000	7	50.5	240,000	7	35.4	53,000
9	26.5	23,100	9	50.2	235,000	9	34.8	49,000
11	28.2	28,400	11	49.9	229,000	11	34.1	44,600
12	29.0	31,000	12	49.6	224,000	12	33.8	43,000
Nov. 25			*Nov. 27*			*Nov. 29*		
1 a. m.	29.9	34,400	1 a. m.	49.4	221,000	1 a. m.	33.4	40,800
3	31.6	41,000	3	48.9	212,000	3	32.8	37,700
5	33.4	50,000	5	48.3	203,000	5	32.2	34,800
7	35.2	61,600	7	47.7	193,000	7	31.5	31,500
9	37.0	75,500	9	47.1	185,000	9	30.9	28,800
11	39.0	93,500	11	46.5	176,000	11	30.3	26,300
1 p. m.	40.9	112,000	1 p. m.	45.8	167,000	1 p. m.	29.8	24,600
3	42.7	131,000	3	45.2	159,000	3	29.2	23,000
5	44.4	150,000	5	44.5	150,000	5	28.7	21,600
7	45.7	166,000	7	43.8	141,000	7	28.1	20,000
9	47.0	183,000	9	43.1	133,000	9	27.5	18,800
11	48.0	198,000	11	42.4	124,000	11	27.0	17,700
12	48.5	206,000	12	42.0	120,000	12	26.7	17,100

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con.

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Nov. 30			*Dec. 7*			*Dec. 16*		
1 a. m.	26.4	16,600	6 a. m.	11.90	1,380	2 a. m.	35.0	59,600
3	25.9	15,700	6 p. m.	11.90	1,380	6	34.2	54,200
5	25.4	15,000	12	11.90	1,380	10	33.5	50,000
7	24.8	14,000				2 p. m.	32.8	46,000
9	24.3	13,200	*Dec. 8*			6	32.1	42,500
11	23.8	12,500	3 a. m.	12.45	1,760	10	31.4	39,300
1 p. m.	23.2	11,700	9	13.5	2,500	12	31.1	38,000
3	22.7	11,000	3 p. m.	14.1	2,940			
5	22.2	10,400	9	14.5	3,240	*Dec. 17*		
7	21.7	9,900	12	14.6	3,320	3 a. m.	30.7	36,300
9	21.2	9,300				9	29.9	33,200
11	20.7	8,800	*Dec. 9*			3 p. m.	29.1	30,400
12	20.4	8,500	6 a. m.	14.7	3,390	9	28.4	28,100
			6 p. m.	14.7	3,390	12	27.0	26,800
Dec. 1			12	14.7	3,390			
1 a. m.	20.2	8,200				*Dec. 18*		
3	19.7	7,800	*Dec. 10*			3 a. m.	27.6	25,700
5	19.2	7,200	6 a. m.	14.7	3,390	9	27.0	24,000
7	18.7	6,800	6 p. m.	14.7	3,390	3 p. m.	26.2	22,000
9	18.3	6,400	12	14.6	3,320	9	25.4	20,000
11	17.9	6,000				12	25.1	19,200
1 p. m.	17.5	5,700	*Dec. 11*					
3	17.2	5,400	6 a. m.	14.5	3,240	*Dec. 19*		
5	16.9	5,100	6 p. m.	14.4	3,160	2 a. m.	24.8	18,500
7	16.6	5,000	12	14.3	3,090	6	24.4	17,600
9	16.3	4,800				10	24.1	17,000
11	16.1	4,600	*Dec. 12*			2 p. m.	23.8	16,300
12	16.0	4,500	1 a. m.	14.3	3,090	6	23.2	15,100
			3	14.3	3,090	10	22.4	13,500
Dec. 2			5	14.2	3,020	12	22.0	12,700
1 a. m.	15.9	4,400	7	16.0	4,490			
3	15.7	4,200	9	18.1	6,600	*Dec. 20*		
5	15.5	4,100	11	20.3	9,640	3 a. m.	21.3	11,400
7	15.3	3,900	1 p. m.	22.5	13,500	9	20.1	9,490
9	15.2	3,800	3	24.5	17,800	3 p. m.	19.1	8,090
11	15.0	3,700	5	26.2	22,000	9	18.3	7,060
1 p. m.	14.9	3,600	7	27.7	26,000	12	17.9	6,600
3	14.8	3,500	9	28.9	29,700			
5	14.6	3,400	11	30.0	33,500	*Dec. 21*		
7	14.5	3,100	12	30.4	35,100	3 a. m.	17.5	6,060
9	14.4	3,100				9	16.9	5,480
11	14.3	3,000	*Dec. 13*			3 p. m.	16.2	4,850
12	14.2	2,900	2 a. m.	31.5	39,800	9	15.7	4,410
			6	33.0	47,000	12	15.4	4,170
Dec. 3			10	34.0	53,000			
6 a. m.	13.9	2,720	2 p. m.	34.9	58,900	*Dec. 22*		
6 p m.	13.4	2,360	6	35.6	63,800	3 a. m.	15.2	4,010
12	13.2	2,220	10	36.3	69,400	9	14.8	3,690
			12	36.6	71,800	3 p. m.	14.6	3,540
Dec. 4			*Dec. 14*			9	14.6	3,540
6 a. m.	13.0	2,080	2 a. m.	36.9	74,200	12	14.6	3,540
6 p. m.	12.8	1,940	6	37.4	78,600			
12	12.8	1,940	10	37.8	82,200	*Dec. 23*		
			2 p. m.	38.2	85,800	3 a. m.	14.6	3,540
Dec. 5			6	38.4	87,600	9	14.5	3,460
6 a. m.	12.8	1,940	10	38.6	89,400	3 p. m.	14.0	3,090
6 p. m.	12.45	1,700	12	38.6	89,400	9	13.5	2,720
12	12.25	1,560	*Dec. 15*			12	13.4	2,640
			2 a. m.	38.6	89,400			
Dec. 6			6	38.3	86,700	*Dec. 24*		
6 a. m.	12.10	1,480	10	37.8	82,200	3 a. m.	13.2	2,500
6 p. m.	12.00	1,420	2 p. m.	37.2	76,800	9	12.9	2,290
12	11.95	1,480	6	36.5	71,000	3 p. m.	12.7	2,150
			10	35.8	65,400	9	12.6	2,080
			12	35.4	62,400	12	12.5	2,010

SPRING CREEK NEAR SPRING, TEX.

LOCATION.—Lat. 30°06'35", long. 95°26'10", at bridge on U. S. Highway 75, 4,500 feet upstream from bridge of International-Great Northern R. R., 2.4 miles northwest of Spring, Harris County, and 4 miles downstream from Willow Creek. Datum of gage is 78.16 feet above mean sea level, unadjusted.

DRAINAGE AREA.—400 square miles.

GAGE-HEIGHT RECORD.—Graph drawn on basis of two or more readings of wire-weight gage daily, including observation of crest gage height.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements. Gage heights used to half tenths between 3.0 and 5.5 feet; hundreths below and tenths above these limits.

MAXIMA.—1940: Discharge, 42,700 second-feet 8 p. m. Nov. 25 (gage height, 28.60 feet).

April to September 1939: Discharge observed, 838 second-feet June 3 (gage height, 8.75 feet).

1880–1938: Discharge, 48,300 second-feet May 30, 1929 (gage height, 29.3 feet, from floodmarks identified by a local resident), from extension of 1940 rating curve.

REMARKS.—Flood runoff not affected by artificial storage; probably considerably affected by natural storage in wide flood plain.

Mean discharge, in second-feet, 1940

Day	November	December	Day	November	December	Day	November	December
1	74	274	12	65	6,760	23	31	292
2	124	235	13	57	15,600	24	2,770	218
3	71	202	14	54	15,200	25	31,500	182
4	41	158	15	37	5,590	26	28,400	204
5	55	129	16	28	3,290	27	8,540	392
6	115	126	17	24	3,900	28	2,220	526
7	208	166	18	21	1,900	29	854	694
8	110	276	19	20	791	30	402	522
9	61	464	20	18	435	31		257
10	67	330	21	18	400			
11	70	456	22	18	435			
Monthly mean discharge, in second-feet							2,536	1,949
Runoff, in acre-feet							150,900	119,800

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Nov. 23			*Nov. 25*			*Nov. 27—Continued*		
2 a. m.	1.72	16	2 a. m.	22.42	13,000	6 p. m.	18.57	5,840
6	1.75	17	6	24.70	20,800	10	17.60	4,640
10	1.77	18	10	26.63	30,000	12	17.10	4,090
2 p. m.	1.80	18	2 p. m.	28.20	39,600			
6	1.86	21	6	28.55	42,700			
10	3.35	98	10	28.58	42,700			
12	4.50	192	12	28.48	41,900	*Nov. 28*		
						2 a. m.	16.64	3,420
Nov. 24			*Nov. 26*			6	15.70	2,730
1 a. m.	5.15	262	2 a. m.	28.34	40,300	10	14.82	2,230
3	6.42	420	6	27.56	35,800	2 p. m.	13.95	1,910
5	7.78	643	10	26.67	30,500	6	13.04	1,620
7	9.20	893	2 p. m.	25.75	25,700	10	12.10	1,420
9	10.60	1,160	6	24.80	21,200	12	11.60	1,320
11	11.90	1,420	10	23.70	17,100			
1 p. m.	13.40	1,790	12	23.15	15,400			
3	14.90	2,380				*Nov. 29*		
5	16.50	3,510	*Nov. 27*			3 a. m.	10.85	1,180
7	18.00	5,100	2 a. m.	22.63	13,600	9	9.45	912
9	19.30	6,790	6	21.57	11,000	3 p. m.	8.45	730
11	20.60	8,900	10	20.57	8,900	9	7.67	592
12	21.25	10,200	2 p. m.	19.55	7,230	12	7.35	542

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940—Con

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Nov. 30			*Dec. 11*			*Dec. 17*		
3 a. m.	7.04	494	2 a. m.	4.72	213	4 a. m.	16.78	3,790
9	6.48	420	6	4.33	177	12 m.	17.34	4,310
3 p. m.	6.07	366	10	4.50	192	8 p. m.	16.60	3,600
9	5.76	328	2 p. m.	5.38	292	12	15.88	3,010
12	5.63	304	6	7.80	643			
			10	10.90	1,220	*Dec. 18*		
Dec. 1			12	12.50	1,550	2 a. m.	15.47	2,730
6 a. m.	5.42	286				6	14.68	2,280
6 p. m.	5.18	262	*Dec. 12*			10	13.87	1,940
12	5.10	242	1 a. m.	13.20	1,730	2 p. m.	13.02	1,680
			3	14.70	2,280	6	12.20	1,480
Dec. 2			5	16.20	3,240	10	11.30	1,300
12 m.	4.91	235	7	17.67	4,750	12	10.82	1,200
12 p. m.	4.77	218	9	19.18	6,650			
			11	20.05	7,840	*Dec. 19*		
Dec. 3			1 p. m.	20.40	8,520	3 a. m.	10.02	1,040
12 m.	4.58	202	3	20.60	8,900	9	8.90	838
12 p. m.	4.37	177	5	20.70	9,100	3 p. m.	8.13	694
			7	20.75	9,300	9	7.47	592
Dec. 4			9	20.83	9,300	12	7.20	542
12 m.	4.14	158	11	20.90	9,500			
12 p. m.	3.95	140	12	20.95	9,720	*Dec. 20*		
						4 a. m.	6.86	494
Dec. 5			*Dec. 13*			12 m.	6.42	420
12 m.	3.81	129	3 a. m.	21.35	10,600	8 p. m.	6.21	392
12 p. m.	3.70	122	9	22.90	14,500	12	6.15	392
			3 p. m.	23.86	17,800			
Dec. 6			9	24.27	19,300	*Dec. 21*		
12 m.	3.73	126	12	24.28	19,300	6 a. m.	6.12	379
12 p. m.	3.90	136				6 p. m.	6.42	420
			Dec. 14			12	6.65	449
Dec. 7			3 a. m.	24.23	18,900			
6 a. m.	4.02	144	9	23.73	17,100	*Dec. 22*		
6 p. m.	4.45	187	3 p. m.	22.90	14,500	6 a. m.	6.66	464
12	4.67	208	9	21.30	10,400	6 p. m.	6.32	406
			12	20.55	8,900	12	6.05	366
Dec. 8								
6 a. m.	4.92	235	*Dec. 15*			*Dec. 23*		
6 p. m.	5.60	316	4 a. m.	19.60	7,230	12 m.	5.42	292
12	6.17	392	12 m.	18.15	5,340	12 p. m.	5.04	242
			8 p. m.	17.22	4,200			
Dec. 9			12	16.88	3,890	*Dec. 24*		
4 a. m.	6.50	434				12 m.	4.77	218
12 m.	6.86	494	*Dec. 16*			12 p. m.	4.59	202
8 p. m.	6.66	464	6 a. m.	16.45	3,420			
12	6.43	420	6 p. m.	16.12	3,160	*Dec. 25*		
			12	16.40	3,420	12 m.	4.41	182
Dec. 10						12 p. m.	4.23	167
6 a. m.	6.12	379						
6 p. m.	5.30	280						
12	4.80	224						

EAST FORK SAN JACINTO RIVER NEAR CLEVELAND, TEX.

LOCATION.—Lat. 30°20′, long. 95°07′, at bridge on State Highway 105, 83 feet downstream from bridge of Gulf, Colorado & Santa Fe Ry., 1¼ miles west of Cleveland, Liberty County, and 4 miles downstream from Nebblets Creek. Datum of gage is 113.0 feet above mean sea level, datum of 1929.

DRAINAGE AREA.—330 square miles.

GAGE-HEIGHT RECORD.—Water-gage recorder graph except during low-water period 3 a. m. Dec. 3 to 3 p. m. Dec. 10, when clock was stopped.

DISCHARGE RECORD.—Stage-discharge relation defined by current-meter measurements up to 14,000 second-feet and extended above by logarithmic plotting. Gage heights used to half tenths between 2.6 and 3.9 feet; hundredths below and tenths above these limits. Discharge 3 a. m. Dec. 3 to 3 p. m. Dec. 10 estimated on basis of indicated peaks and troughs on recorder graph, and rainfall record.

MAXIMA.—1940: Discharge, 77,500 second-feet 11 p. m. Nov. 24 (gage height, 20.37 feet).

April to September 1939: Discharge, 140 second-feet Apr. 29 (gage height, 1.94 feet).

1900–38: Discharge, 69,500 second-feet May 5, 1935 (gage height, 19.9 feet, from floodmarks), from 1940 rating curve.

REMARKS.—Flood runoff not affected by artificial storage; probably considerably affected by natural storage in wide flood plain.

Mean discharge in second-feet, 1940

Day	November	December	Day	November	December	Day	November	December
1	59	278	12	139	3,130	23	157	194
2	53	228	13	87	14,100	24	26,100	173
3	33		14	53	10,300	25	43,200	162
4	24		15	37	3,990	26	13,700	328
5	27		16	27	2,620	27	5,100	598
6	52	265	17	24	2,380	28	2,410	1,040
7	42		18	22	2,060	29	1,080	1,430
8	29		19	22	1,030	30	358	1,260
9	36		20	20	368	31		452
10	33	1,060	21	20	278			
11	57	452	22	20	227			
Monthly mean discharge, in second-feet							3,101	1,613
Runoff, in acre-feet							184,500	99,160

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Nov. 23			*Nov. 25*—Continued			*Nov. 28*		
1 a. m.	1.12	20	10 a. m.	18.40	46,700	2 a. m.	10.28	3,190
2 p. m.	1.15	22	12 m.	17.95	41,500	4	10.10	2,990
4	1.25	29	2 p. m.	17.60	36,700	6	9.92	2,800
5	1.35	39	4	17.23	32,500	8	9.74	2,640
6	1.80	108	6	16.90	29,600	10	9.56	2,580
7	2.50	238	8	16.57	27,000	12 m.	9.37	2,440
8	3.20	378	10	16.29	24,600	2 p. m.	9.18	2,320
9	4.00	538	12	16.02	22,500	4	8.95	2,200
10	4.85	704				6	8.75	2,100
11	5.55	897	*Nov. 26*			8	8.56	1,990
12	6.20	1,060	2 a. m.	15.77	21,300	10	8.35	1,890
Nov. 24			4	15.50	19,500	12	8.15	1,800
2 a. m.	7.10	1,360	6	15.23	17,700	*Nov. 29*		
4	7.80	1,620	8	14.95	16,600	2 a. m.	7.92	1,660
6	8.75	2,100	10	14.67	15,100	4	7.68	1,580
8	9.95	2,890	12 m.	14.38	13,800	6	7.42	1,460
9	10.65	3,510	2 p. m.	14.10	12,600	8	7.10	1,360
10	11.15	4,400	4	13.77	11,400	10	6.76	1,260
12 m.	11.90	5,950	6	13.50	10,300	12 m.	6.40	1,120
2 p. m.	12.80	8,200	8	13.24	9,400	2 p. m.	6.00	1,000
3	14.00	12,200	10	12.97	8,800	4	5.59	897
4	15.60	20,100	12	12.73	7,950	6	5.16	798
5	17.10	31,500				8	4.75	704
6	18.30	45,300	*Nov. 27*			10	4.33	598
7	19.30	59,900	2 a. m.	12.52	7,450	12	3.97	538
8	19.80	67,900	4	12.31	6,950			
9	20.15	74,300	6	12.12	6,450	*Nov. 30*		
10	20.33	75,900	8	11.92	5,950	2 a. m.	3.67	468
11	20.37	77,500	10	11.68	5,450	4	3.45	428
12	20.36	77,500	12 m.	11.52	5,000	6	3.29	398
Nov. 25			2 p. m.	11.35	4,800	8	3.15	368
1 a. m.	20.30	75,900	4	11.16	4,400	10	3.05	348
2	20.17	74,300	6	10.98	4,050	12 m.	2.97	328
4	19.83	67,900	8	10.82	3,750	4 p. m.	2.86	308
6	19.40	61,500	10	10.63	3,510	8	2.78	298
8	18.87	53,700	12	10.47	3,400	12	2.72	278

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1940

Hour	Feet	Second-feet	Hour	Feet	Second-feet	Hour	Feet	Second-feet
Dec. 1			*Dec. 12—*			*Dec. 16*		
2 a. m.	2.70	278	Continued			3 a. m.	12.00	2,890
4	2.75	288	1 p. m.	10.15	3,090	9	9.75	2,720
6	2.78	298	3	10.35	3,290	3 p. m.	9.48	2,510
10	2.73	288	5	10.80	3,750	9	9.34	2,380
2 p. m.	2.69	278	7	11.05	4,050	12	9.37	2,440
6	2.65	268	9	11.28	4,600	*Dec. 17*		
12	2.59	256	11	11.75	5,700	3 a. m.	9.40	2,440
Dec. 2			12	12.23	6,700	9	9.35	2,440
4 a. m.	2.55	248	*Dec. 13*			3 p. m.	9.23	2,320
8	2.50	238	2 a. m.	13.18	9,400	9	9.23	2,320
12 m.	2.45	228	6	13.83	11,400	12	9.20	2,320
4 p. m.	2.42	223	10	14.37	13,800	*Dec. 18*		
8	2.38	215	2 p. m.	14.74	15,100	3 a. m.	9.15	2,320
12	2.35	210	6	15.10	17,100	9	8.93	2,150
Dec. 11			10	15.15	17,700	3 p. m.	8.62	1,990
2 a. m.	3.98	558	12	15.00	16,600	9	8.15	1,880
6	3.27	428	*Dec. 14*			12	7.85	1,620
10	2.87	348	2 a. m.	14.78	15,600	*Dec. 19*		
2 p. m.	2.67	308	6	14.23	13,000	2 a. m.	7.63	1,540
6	2.75	318	10	13.60	10,600	6	7.10	1,360
10	4.85	750	2 p. m.	13.02	8,800	10	6.40	1,120
12	6.00	1,060	6	12.54	7,450	2 p. m.	5.60	897
Dec. 12			10	12.08	6,450	6	4.77	704
1 a. m.	6.85	1,320	12	11.87	5,950	10	4.08	558
3	8.20	1,850	*Dec. 15*			12	3.81	498
5	8.93	2,200	3 a. m.	11.57	5,200	*Dec. 20*		
7	9.40	2,440	9	11.05	4,050	3 a. m.	3.50	438
9	9.65	2,580	3 p. m.	10.62	3,510	9	3.20	378
11	9.83	2,720	9	10.28	3,190	3 p. m.	3.02	338
			12	10.14	2,990	9	2.91	318
						12	2.86	308

RAINFALL AND RUNOFF STUDIES

Comparisons of rainfall with associated runoff furnish useful information concerning the relation between rainfall and the resulting direct runoff under varying hydrologic conditions. The differences between rainfall and runoff show the volume of water retained in the drainage basins. This retention is an important factor in flood control and other problems. These comparisons also serve as tests of the accuracy and adequacy of the base data.

Over a given area subjected to a given amount of rain, many factors affect the relation between the rainfall and its associated runoff, the most important being the moisture content of the soil at the time of the flood-producing rain and the rate of rainfall. Among other factors affecting the relation are the type of soil, slope of the ground, season of the year, condition of the vegetal growth, and state of cultivation of the farming lands.

Rainfall over the area subjected to the flood-producing rain of June 29 and 30, 1940, averaged about 2.4 inches for the period June 10–21 and less than 0.5 inch for the period June 22–27. The normal average rainfall for this area for the month of June is about 3.3 inches. No rain fell in the San Jacinto River Basin during the 9 days preceding

the storm of November 20–26. Rainfall over the basin averaged about 2.9 inches for the period October 25–31 and about 4.2 inches for the period November 1–11. The normal average rainfall for this basin for the month of October is about 3.7 inches and for November about 3.8 inches.

For the purpose of these studies of the storm of June-July 1940 certain areas in the Colorado and Lavaca River Basins were selected for the comparison of rainfall and runoff. The rainfall was uniformly heavy in each of these areas in the Colorado River Basin and in the Lavaca River Basin above Hallettsville, but, as shown in table 4, it varied widely in quantity for other parts of the Lavaca River Basin. For the storm in November similar studies were made at five stream-gaging stations in the San Jacinto River Basin where the rain was heavy and uniform throughout. Each storm was considered to be a unit, as most of the rain in each storm fell during a short period. For the storm of June–July the rain that fell during the period June 28–July 4 is considered to have contributed to the total runoff from that storm, and the rain that fell during November 20–26 is considered to have contributed to the runoff from the November storm.

The volume of rainfall for each area was determined by planimeter from the isohyetal maps (pl. 6 and fig. 9), and its accuracy depends on the accuracy of the isohyets. The isohyetal maps for the areas studied are considered to be reasonably accurate.

The determinations of direct runoff during the storm periods have been based on records of daily mean discharge at stream-gaging stations. For those areas studied for the storm of June-July, the base flow attributed to ground water was either zero or so small that consideration of it was neglected. For the areas in the San Jacinto River Basin studied for the storm of November, the base flow was estimated on the basis of the flow before and after the storm period and was subtracted from the total flow.

DISCUSSION OF RESULTS

The results of the rainfall and runoff studies for the storm of June-July are summarized in table 4. The first entry in that table is for the area tributary to Colorado River between the stream-gaging stations at Smithville and La Grange. This area has a rather uniform, low, rolling topography with hillsides generally heavily wooded and with valleys mostly cultivated. In general the soil is gravelly or sandy loam.[9]

The second entry in table 4 is for the basin above the station on Dry Creek at Buescher Lake near Smithville. Because of the rarity

[9] Soil survey of Lee County, Tex., 1906, and Soil survey of Bastrop County, Tex., 1908, U. S. Dept. Agr., Bur. Soils.

TABLE 4.—*Rainfall and direct runoff of storm of June 28 to July 4, 1940, for certain areas in the Colorado and Lavaca River Basins*

No. on pl. 6	Stream and place of measurement	Drainage area (square miles)	Mean depth in inches			Area, in square miles, having rainfall between limits shown										
			Rainfall	Runoff	Retention	2–4	4–6	6–8	8–10	10–12	12–14	14–16	16–18	18–20	20–22	22
12	Colorado River at Smithville															
	Area between Smithville and La Grange	550	19.3	11.5	7.8	----	----	----	----	----	4.2	23.8	78.2	259.7	171.5	12.6
13	Colorado River at La Grange															
17	Dry Creek at Buescher Lake, near Smithville	1.48	19.5	11.3	8.2	----	----	----	----	----	----	----	----	1.48	----	----
20	Lavaca River at Hallettsville	101	18.2	13.7	4.5	----	----	----	----	----	----	19.6	23.8	35.9	21.7	----
21	Lavaca River near Edna	887	13.4	5.0	8.4	11.7	19.6	24.3	90.0	156.6	188.6	190.2	91.9	92.4	21.7	----
24	Navidad River near Ganado	1,116	9.8	3.5	6.3	164.0	156.4	167.8	156.5	121.1	105.3	76.3	56.4	47.3	51.9	13.0

of discharge records from so small an area subjected to heavy rains, the results will be discussed in more detail. The basin above this station is 1.48 square miles in area, about 2.5 miles long, and from one-half to three-quarters of a mile wide. It is an area of rolling hills and varies about 150 feet in altitude from the bottom of the reservoir to the highest point of divide. There is no cultivated land and not much open country. The area is well covered with cedar, post oak, yaupon, and other trees and brush, with small trees and brush predominating. The flood plain especially is covered with a heavy growth of brush. The soil is sandy gravel underlain by a heavy red sandy clay. The clay is exposed at places on hillsides and in washes.[10]

The nearest rain gage to the Dry Creek Basin is the standard non-recording Weather Bureau gage at Smithville, about 3.5 miles from the center of the basin. This gage is read once daily, late in the afternoon. The reading on June 28 showed 0.15 inch of rain; June 29, 4.35 inches; and June 30, 16.05 inches, all of the last falling between 7 p. m. June 29 and 10 a. m. June 30. Part of the 4.35 inches measured on the afternoon of June 29 fell on the night of June 28–29, but no runoff of consequence occurred until after 2 p. m. June 29. Very little rain fell after 9 a. m. June 30. Eighty percent of the total runoff occurred between 3 a. m. and noon on June 30, which indicates a heavy concentration of rain between 3 and 9 a. m. on that day.

Lines of equal rainfall drawn on the basis of all available rainfall data show that the Dry Creek Basin lies mostly between the 19-inch and the 20-inch isohyets. Assuming an average rainfall of 19.5 inches, the total rainfall on the basin of 1.48 square miles was 1,540 acre-feet. The total runoff was 891 acre-feet, leaving a retention of 649 acre-feet, or 8.2 inches of rainfall.

Other entries in table 4 are for studies of the areas above the stations in the Lavaca River Basin. The results obtained for the area above Hallettsville, showing considerably less retention than adjoining areas, call for some discussion. The basin above Hallettsville is about 20 miles long and 5 miles wide. One record of rainfall was obtained near the headwaters and one at Hallettsville. No other records were found in the vicinity of the basin. The rating curve used for the record at Hallettsville gage was defined by current-meter measurements up to 25,000 second-feet, and a slope-area measurement of 93,100 second-feet. Some error, therefore, may enter into both the isohyetal map and the record of runoff. However, the characteristics of this basin that are considered to affect rainfall-runoff relations are quite different from those in other basins included in this study.

[10] Soil survey of Bastrop County, Tex., 1908, U. S. Dept. Agr., Bur. Soils.

TABLE 5.—*Rainfall and direct runoff of storm of Nov. 20–26, 1940, in the San Jacinto River Basin*

No. on fig. 9	Stream and place of measurement	Drainage area (square miles)	Mean depth in inches			Area, in square miles, having rainfall between limits shown						
			Rainfall	Runoff	Retention	6–8	8–10	10–12	12–14	14–16	16–18	18–20
1	West Fork San Jacinto River near Conroe	832	13.9	9.1	4.8	10	57	107	238	233	187	-------
2	West Fork San Jacinto River near Humble	1,811	13.1	7.5	5.6	40	250	374	440	372	325	10
3	San Jacinto River near Huffman	2,791	13.6	8.8	4.8	40	256	559	677	588	563	108
4	Spring Creek near Spring	400	13.9	7.0	6.9	-------	42	80	66	83	119	10
5	East Fork San Jacinto River at Cleveland	330	15.7	10.5	5.2	-------	-------	35	75	55	75	90

One important difference is that in more than 90 percent of the basin above Hallettsville the soil is identified as clay [11] with the rest a sandy loam. This relation between clay and sand or sandy loam is more nearly reversed for other areas studied. Also the area is treeless except for fringes of timber along the streams and small timber and brush growing on the small areas of sandy soil, and much the greater part of the area is cultivated, whereas the greater part of the other areas is timbered and the smaller part is cultivated.

The results of the rainfall and runoff studies in the San Jacinto River Basin for the storm of November are summarized in table 5. Only five records of rainfall were available within the basin above Huffman, an area of 2,791 square miles. The isohyets were necessarily based to a large extent on rainfall records in areas adjacent to the basin. The records of runoff at the stream-gaging stations on San Jacinto River near Huffman and Spring Creek near Spring are considered more reliable than others within the basin. It was necessary to make long extensions of the rating curves at the stations on West Fork San Jacinto River near Conroe, and on East Fork San Jacinto River near Cleveland, and some uncertainty enters the record for West Fork San Jacinto River near Humble because of backwater from East Fork.

The physical features of the basin are so uniform (see p. 63) as to indicate that nearly the same relation between rainfall and runoff would exist for all parts. However, comparison of runoff records of East Fork with those of West Fork during a period of several years shows a greater runoff per unit of area from East Fork than from West Fork.

SEDIMENT

Studies of sediment loads have been made at several places on streams in Texas, for a number of years by agencies of the United States Department of Agriculture, in cooperation with the State Board of Water Engineers. Measurement stations are maintained at three of the regular stream-gaging stations included in this report where the flood runoff was considerable. Each station is on a different stream, and the records show a striking variation in the sediment load for comparable amounts of rainfall and runoff.

Measurements of sediment loads collected at these stations are based on samples taken near the water surface containing only the finer particles. The portion of the suspended sediment load thus sampled has been termed "silt" by the Soil Conservation Service, from whom these data were obtained. Table 6 shows this silt load at the three stations, and for comparative purposes the peak discharge and total

[11] Soil survey of Lavaca County, Tex., 1905, U. S. Dept. Agr., Bur. Soils.

runoff for the flood periods at each station. During the period of flood runoff the average silt load, in percentage by weight, at the station on the Brazos River at Richmond was 2 times that at Colorado River at Columbus and 17 times that at San Jacinto River near Humble.

TABLE 6.—*Silt load and runoff at measurement stations on West Fork San Jacinto, Brazos, and Colorado Rivers during flood periods, 1940*

[Base data on silt load was furnished by U. S. Department of Agriculture, Soil Conservation Service, Division of Irrigation]

	West Fork San Jacinto River near Humble Nov. 23 to Dec. 6	Brazos River at Richmond June 28 to July 14	Colorado River at Columbus June 28 to July 14
Maximum discharge, second-feet	187,000	82,100	152,000
Runoff, acre-feet	728,100	1,233,000	818,700
Silt load, tons	409,600	12,010,000	3,959,000
Silt, acre-feet [1]	269	7,880	2,600
Average weight of silt, percentage	0.041	0.717	0.356

[1] Volume of silt obtained from total load, assuming that silt weighs 70 pounds per cubic foot. See Faris, O. A., The silt load of Texas streams: U. S. Dept. Agr. Tech. Bull. 382, pp. 49, 55, September 1933.

PREVIOUS FLOODS

Data pertaining to previous floods in Texas have been presented in the following publications of the Geological Survey:

Water-Supply Paper 488. The floods in central Texas in September 1921, by C. E. Ellsworth. Contains precipitation and discharge records for the floods of September 1921 and previous floods in the Brazos, Colorado, Guadalupe, and San Antonio River Basins.

Water-Supply Paper 771. Floods in the United States, magnitude and frequency, by C. S. Jarvis and others. Gives the gage height, peak discharge, daily mean discharge, and other pertinent information relative to all floods of record above a certain selected base flow for stream-gaging stations on Brazos River at Waco, Colorado River at Austin, Rio Grande near El Paso, and Pecos River near Comstock.

Water-Supply Paper 796–G. Major Texas floods of 1935, by Tate Dalrymple and others. Contains precipitation and discharge records for the flood in May on Seco Creek in the Nueces River Basin, the floods of June in the Colorado, Nueces, and Rio Grande Basins, and the flood of December on Buffalo Bayou at Houston. Contains also short discussions of previous floods in these basins.

Water-Supply Paper 816. Major Texas floods of 1936, by Tate Dalrymple and others. Presents detailed information on rainfall and flood discharges of the floods of June-July in the Guadalupe, San Antonio, and Neches River Basins and of the floods of September in the Trinity, Brazos, and Colorado River Basins; detailed data on previous floods in Texas; special data about precipitation and discharge during the floods of May 1929 in the Colorado and Guadalupe River Basins and during the floods of July 1932 in the Llano, Guadalupe, and Nueces River Basins; also, in tabular form, records of maximum floods on streams over the entire State.

Water-Supply Paper 847. Maximum discharges at stream-measurement stations through December 31, 1937, by G. R. Williams and L. C. Crawford,

with a supplement including additions and changes through September 30, 1938, by W. S. Eisenlohr, Jr. Contains, in tabular form, records of maximum discharges at practically all stream-measurement stations that have been operated in the State and also peak discharges computed at miscellaneous places in the State.

Water-Supply Paper 850. Summary of records of surface waters of Texas, 1898–1937, by C. E. Ellsworth. Contains, in tabular form, records of maximum discharges at practically all stream-measurement stations that have been operated in the State and also peak discharges computed at miscellaneous places in the State.

Water-Supply Paper 914. Texas floods of 1938 and 1939, by S. D. Breeding and Tate Dalrymple. Contains detailed information on rainfall and discharges of floods of January 1938 in east Texas, June 1938 on Lake Creek in Donley County, July 1938 in the Colorado River Basin, and June 1939 in the upper Colorado River Basin; data concerning silt carried by flood of July 1938 in Colorado River Basin; studies of rainfall-runoff relations for the flood of July 1938 in the Colorado River Basin; also, in tabular form, records of maximum floods on streams in the Red, Sabine, and Colorado River Basins.

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