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Flood of May 30-31, 1965
in the
Carlsbad, N. Mex., area

By

Ralph W. Clement

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Open-file report

U.S. Geological Survey
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Flood of May 30-31, 1965, in the Carlsbad, N. Mex. area

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ABSTRACT

Locally severe thunderstorms of May 30, 1965, deposited as much as four inches of rain in the Carlsbad, N. Mex. area and caused flooding in the Pecos River basin between Lake McMillan and Red Bluff Reservoir. Storage in Lake Avalon reduced some peak stages at downstream stations on the Pecos River. Record peaks were experienced at two gaging stations. One area located northeast of Carlsbad Caverns experienced extremely high unit runoff, as much as 3,500 cfs per square mile on Cass Draw whose drainage area is 9.3 square miles. Stages on tributary streams rose and fell rapidly, reaching peak flow within one to two hours after storm runoff began. Runoff from these storms exceeded 40 percent of the annual total from tributary streams. The main stem of the Pecos River, carried the discharge with little over-bank flow and extreme flooding was limited mostly to tributaries.

Damage was confined almost entirely to agriculture lands, irrigation facilities, and crops although some streets and roads required repairs. One death was attributed to the floods.

INTRODUCTION

Moderate to severe tributary flooding occurred west of the Pecos River near Carlsbad, N. Mex., on May 30-31, 1965. Flooding caused varying amounts of damage throughout the area when thunderstorms dropped heavy rains and scattered hail. As much as four inches of rain was deposited over a wide area west of the Pecos River from the New Mexico-Texas State line northward to South Seven Rivers on the afternoon of May 30. Flooding was most severe along South Seven Rivers, Cass Draw, Black River, and on some tributaries of Dark Canyon. Flood peaks on the Pecos River were moderate. Storage in Lake Avalon reduced some downstream flood peaks. Peak of record was recorded at two gaging stations while other stations sustained peaks somewhat less than those known to have occurred in the past.

The area discussed in this report is in southeastern New Mexico and is located in the southern part of a vast plains area which covers the eastern one-third of the State (fig. 1). It is semiarid with an annual precipitation averaging 12 to 14 inches and annual runoff normally less than 1 inch. Most of the water courses in the area are ephemeral streams. Vegetation is sparse and tributary stream gradients are steep. These features cause flood stages to rise and fall rapidly in a manner generally known as "flash flooding."

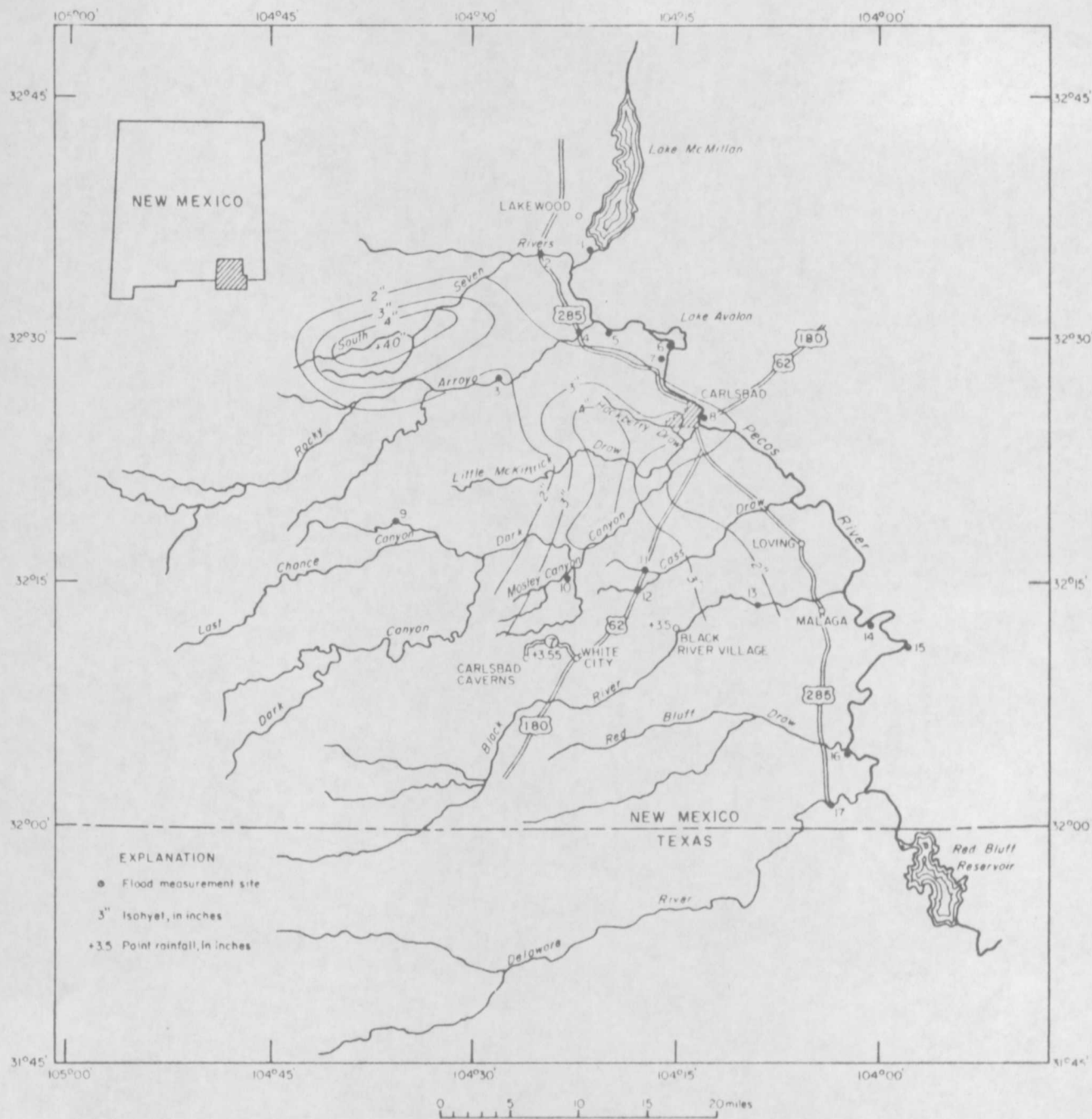


Figure 1.--Isohyetal map of storm area with flood measurement sites,
flood of May 30-31, 1965.

The purpose of this report is to present detailed data, supplemental to that which appears in the annual summary of stream-flow published by the Geological Survey. This report discusses precipitation, flood damages, and nature of flooding during the flood of May 30-31, 1965. These data are presented in one or more phases of the report - in the text, in the table summarizing peak stages and discharge, or in the station data. References made in the text to flood measurement sites shown in the summary table, in the station data and on the map shown in figure 1, give the identifying station number in parenthesis, e.g., Black River above Malaga (No. 13).

Discharges were determined by referring gage heights to a stage-discharge relation at some recording and crest-stage stations and by indirect measurements at two miscellaneous sites, one crest-stage station, and two recording stations.

ACKNOWLEDGEMENTS

Records of discharge in the area discussed in this report are collected as a part of cooperative programs between the U.S. Geological Survey, New Mexico State Engineer's Office, New Mexico Highway Department, Pecos River Commission, Corps of Engineers, and other federal and local agencies. The U.S. Weather Bureau, Soil Conservation Service, several State, local and private organizations furnished additional information; appropriate acknowledgement is made where data appear.

Data were collected and compiled by the personnel in the offices of the U.S. Geological Survey, Water Resources Division in Santa Fe and Carlsbad, New Mexico, under the general supervision of W. E. Hale, District Chief.

PRECIPITATION

The storm systems responsible for the floods consisted of several high intensity thunderstorms typical of the area. The storm area extended from the Texas-New Mexico border northward to South Seven Rivers. Precipitation began about 1400 hours on May 30 and lasted into early evening. The most intense rainfall occurred between 1500 and 1700 hours during which time 2.14 inches were recorded at Carlsbad. The Howell Ranch, located in the South Seven Rivers area, reported 2.8 inches during a one hour period. At Carlsbad Caverns about 3.4 inches reportedly fell in an hour. Amounts in excess of four inches were recorded at several points north of Carlsbad Caverns, west of the city of Carlsbad, and along South Seven Rivers.

Precipitation data were obtained from the U.S. Weather Bureau and from a "bucket" survey conducted by the Soil Conservation Service. The precipitation pattern is shown in figure 1.

DESCRIPTION OF FLOODS

Flooding in the Carlsbad area was limited to the tributaries west of the Pecos River. Previous maximums were exceeded at 2 gaging stations and several miscellaneous tributaries. The main stem of the Pecos River handled the flow easily as indicated in table 2 with the maximum recurrence interval being as low as 8 years.

The northern boundary of the flood area can be delineated as the watershed of South Seven Rivers. Even though a peak discharge of 18,000 cfs occurred at the gaging station on South Seven Rivers near Lakewood (No. 2), North Seven Rivers which borders South Seven Rivers on the north, had no flow.

Flooding on South Seven Rivers was severe causing an estimated \$18,000 worth of agricultural damage. Peak discharge at the gaging station near Lakewood (No. 2) exceeded the peak of record (1,050 cfs in 1964) but was slightly less than the historical maximum of 20,000 cfs which occurred in 1954.

Rocky Arroyo sustained probably the least flooding of any main tributary in the flood area north of Delaware River. The peak discharge of 9,700 cfs, at the crest-stage station near Carlsbad (No. 3) was the fourth highest during the period of record, but highest since 1958; however, it was considerably below the peak of record (63,300 cfs) which occurred in 1954. Little damage was noted on Rocky Arroyo. A peak discharge of 7,450 cfs was measured at the gaging station at the bridge near Carlsbad (No. 4). The peak discharge of 21,700 cfs at the station on the Pecos River at damsite 3, near Carlsbad (No. 5) was the second highest of record and the highest since 1954. The floods in 1893, 1904, 1905, 1915, 1916 and 1937 probably exceeded 40,000 cfs.

The Pecos River tributaries south of the city of Carlsbad experienced the worst flooding of the entire storm. The most severe flooding in the area was along Cass Draw. Peak discharges of 32,500 cfs on Cass Draw at Highway 62-180 (No. 11) and 6,410 cfs on Elbow Canyon on Highway 62-180 (No. 12), tributary to Cass Draw, combined to cause and estimated \$31,200 damage and destroyed a part of the main canal of the Carlsbad Irrigation District. The flood waters from Cass Draw spread out over the flat area between the Canal and the Pecos River and entered the river through various drainage ditches and small washes. The one life lost during the flood was by drowning at the Cass Draw crossing at Highway 62-180.

The peak discharge of 16,400 cfs at the crest-stage station on Mosley Canyon near White City (No. 10), a tributary to Dark Canyon, exceeded the peak of record (2,850 cfs), although the record is but six years in length. Flood waters from Mosley Canyon along with the runoff from Last Chance Canyon, Little McKittrick and Hackberry Draws caused moderate flooding but little damage to the southern part of the city of Carlsbad. Some damage, especially agricultural, was noted along Hackberry Draw.

Black River also sustained moderate to severe flooding but only minor damage was reported. The peak discharge of 18,400 cfs at the gaging station above Malaga (No. 13) was the second highest of record.

Flooding along the Delaware River in the southern edge of the storm area was insignificant. Peak flow of 2,710 cfs at the gaging station near Red Bluff (No. 17) was well below that of the peak of record in 1955, 81,400 cfs. The crest-stage station on Last Chance Canyon tributary near Carlsbad Caverns (No. 9) which is also out of the main storm area recorded a peak stage of 1.37 feet; however, the discharge was not determined. That peak, recorded on May 30, was well below that of the peak of record which occurred in 1960, 5.72 feet (439 cfs).

Peak discharges on the Pecos River below Avalon Dam were moderate and little flooding occurred. The reduced flows downstream from the dam can be attributed to the regulation affected by storage in Lake Avalon. Contents of Lake Avalon had receded to 1,280 acre-feet on May 30 but began filling during that same evening. Over fifty percent of the runoff originating above Damsite 3 was retained by Lake Avalon or was lost to bank storage before it reached the gaging station below the dam (No. 7). Records on the Pecos River below Lake Avalon (No. 7) indicate that capacity storage was reached about midnight on May 30 and at that time water began flowing over the spillway. Timing of tributary flood peaks was such that the downstream flows had entered the main stem and passed on downstream prior to the time flow from Lake Avalon was added to the floodwaters.

The gage on the Pecos River near Malaga (No. 14) recorded two peaks of about equal magnitude. At midnight on May 30 the first peak of 12,000 cfs reached the station, the result of runoff from Black River. The maximum discharge of 12,900 cfs occurred about 0630 hours on May 31. This second peak began as runoff from Cass Draw reached the station and was magnified by the additional runoff from Dark Canyon and intermediate areas. The recession was extended by the releases from Lake Avalon.

The gage on the Pecos River at Pierce Canyon Crossing (No. 15) recorded but one peak, 9,860 cfs, due to the merging of the two peaks as they moved down the channel.

The peak discharge which was recorded at the Pierce Canyon Crossing gage had diminished to 8,820 cfs when it reached Red Bluff Station (No. 16) at 2110 hours on May 31. The rise and decline of this surge of water was spread over a 24-hour period. The accompanying peak was actually the lesser and last of two peaks which occurred as a result of the storm. The maximum peak discharge of 16,800 cfs, which occurred at 2240 hours on May 30, was the result of direct runoff from an area of about 280 square miles, two-thirds of which consists of the drainage area of Red Bluff Draw. Red Bluff Draw enters the Pecos River from the west just above the Red Bluff gage (No. 16), and apparently contributed considerable runoff as is evidenced by the fact that during the period from May 30 through June 3, 17,000 acre-feet passed the Pierce Canyon Crossing gage (No. 15) on the Pecos River as compared to 25,000 acre-feet passing the Red Bluff gage (No. 16). The distance between the two stations is about fourteen river miles.

The Pecos River below the Red Bluff Station received only nominal amounts of tributary runoff and the majority of that originated from the Delaware River basin. The peak on the Delaware River (No. 17) reached the Pecos River about two hours ahead of the peaks originating above.

The flood of May 30-31, was not the largest known to this area, however, it would rank high with those that have occurred in the past. Of the two stations that experienced record peak discharges neither record was more than six years old. However, five stations (three of which were on the Pecos River) observed peak discharges that were second only to the maximum known during periods of record which at some stations was as much as twenty-three years in length. Table 1 shows the ranking of the May 30-31, 1965, peaks as compared with annual maximums which exceeded them in the past.

Flood hydrographs are shown in figures 2 and 3. Figure 2 covers selected gaging stations above Avalon Dam plus the station located immediately below the dam. The latter indicates the effect of storage in Lake Avalon. Figure 3 includes stations located below Avalon Dam.

Table 1.--Ranking of May 1965 Floods
when compared to annual maximums at the same site.

Station	Length of record (years)	Flood of May 30-31, 1965	
		Discharge (cfs)	Ranking
South Seven Rivers near Lakewood	2	18,000	1
Rocky Arroyo near Carlsbad	12	9,700	4
Rocky Arroyo at highway bridge near Carlsbad	2	7,450	2
Pecos River at Damsite 3 near Carlsbad	22	21,700	2
Pecos River below Avalon Dam	14	10,600	2
Pecos River at Carlsbad	48	9,900	14
Last Chance tributary near Carlsbad Caverns	6	-	7 ^{a/}
Mosley Canyon near White City	6	16,400	1
Black River above Malaga	18	18,400	2
Pecos River near Malaga	45	12,900	10
Pecos River at Pierce Canyon Crossing near Malaga	17	9,860	2
Pecos River at Red Bluff	28	16,800	4
Delaware River near Red Bluff	28	2,710	18

^{a/} Discharge not determined; seventh highest gage-height.

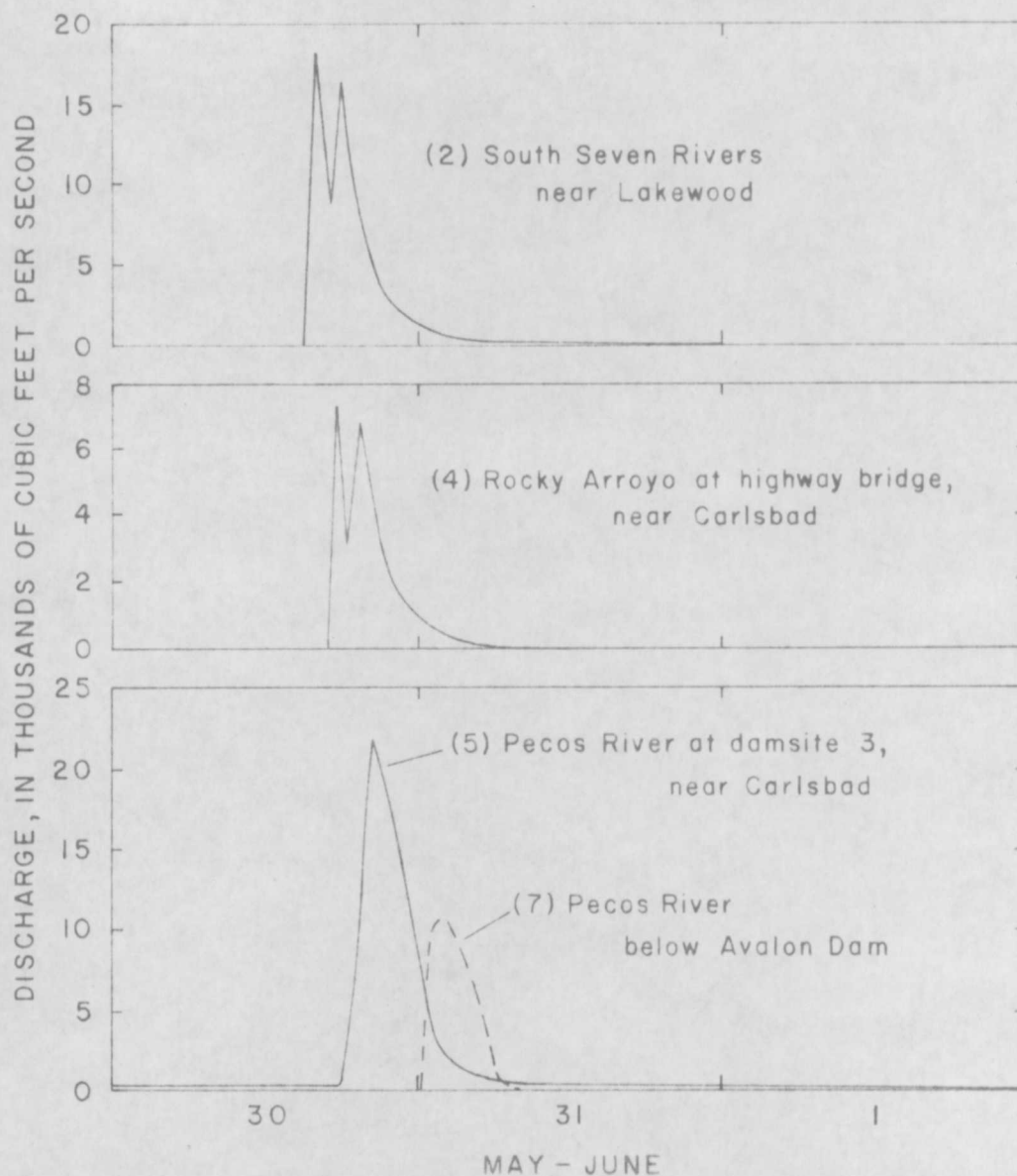


Figure 2.--Discharge hydrographs at selected gaging stations
above Avalon Dam, May 30-June 1, 1965.

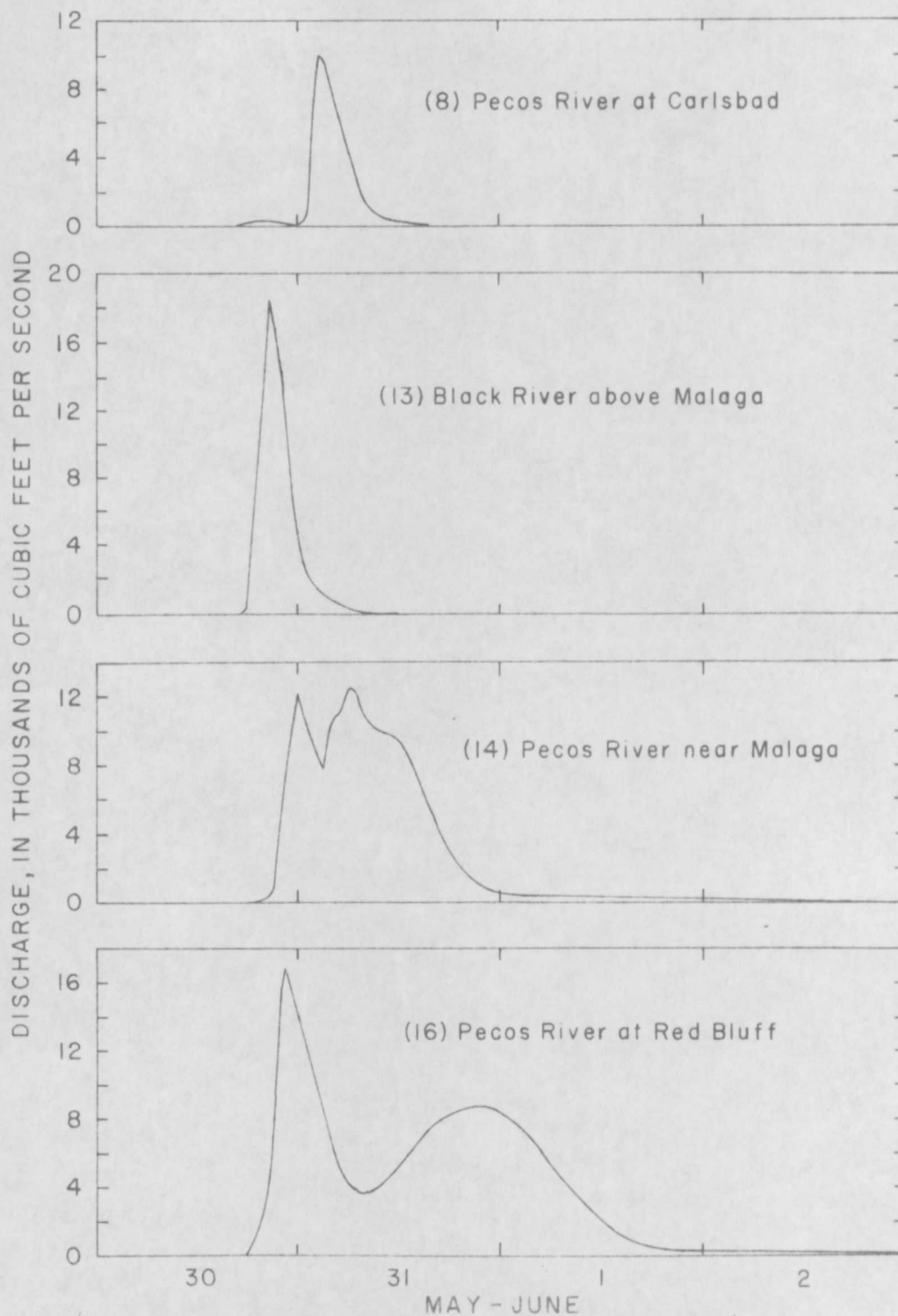


Figure 3.--Discharge hydrographs at selected gaging stations below Avalon Dam, May 30-June 2, 1965.

FLOOD DAMAGES

Moderate to severe damage occurred on Pecos River tributaries west of the main channel from South Seven Rivers downstream to the Delaware River. Information on flood damages was obtained from several sources, including the Soil Conservation Service, newspaper clippings from the Carlsbad Current-Argus, and the Carlsbad office of the U.S. Geological Survey. In most cases damage was of such a nature that monetary values would be more or less meaningless. Reports indicated that most of the damage was to agricultural lands and crops. Other damages, though nominal, included those to streets and roads. No bridges were reported destroyed.

Utilities sustained some damage as communication facilities and power were disrupted in a few areas. Highway traffic was interrupted at several crossings on main routes due to flooding. U.S. Highway 285 at South Seven Rivers and at several locations south of Carlsbad were flooded as was U.S. Highway 26-180 at Cass Draw and State Highway 7 into Carlsbad Caverns. A part of a street in Carlsbad was closed due to flow in Dark Canyon. Many persons were stranded in the storm area during flood flows. Many automobiles became stalled or were washed off roads at various crossings. A woman was drowned when the car in which she was riding was washed off the U.S. Highway 62-180 crossing of Cass Draw.

Agricultural damage, as reported by the Soil Conservation Service, totaled about \$56,100 in four watersheds - Avalon-Alacran, Hackberry Draw, Cass Draw and South Seven Rivers, the latter two being the heavier. Losses were estimated to be \$2,800 in the Avalon-Alacran watershed, \$3,200 on Hackberry Draw, \$32,200 along Cass Draw and about \$18,900 on South Seven Rivers.

DETERMINATION OF FLOOD DISCHARGES

There are several methods presently used by the Geological Survey to determine peak discharges. These methods have been explained fully in previous texts, hence, the following paragraphs contain only brief descriptions of those methods used to determine the magnitude of the floods during May 30-31, 1965.

The basic method used at stream-gaging stations is to relate the maximum stage to an established stage-discharge relationship (rating curve). This relationship normally is determined by current-meter measurements through a range in stage sufficient to establish a rating curve. At times an extension of the curve may be accomplished above the stage of the highest measurement by logarithmic plotting, velocity-area studies, or by use of indirect measurements.

Indirect measurements are another widely used method of determining peak discharges, and are based on computations either from slope-area observations, flow through contracted openings or culverts, or flow over roads or other embankments. Indirect methods are valuable for determining peak discharges at miscellaneous sites where no gage data are available, at gaging stations where maximum stage exceeds the highest point on the established stage-discharge relation, or where extreme stages or their timing preclude the use of current-meter methods.

In determining the peak discharges for the flood of May 30-31, 1965, the method employing rating curves was the most frequently used. However, five indirect measurements of peak flow were made; two at miscellaneous sites, one at a crest-stage gage and two at regular gaging stations.

RECURRENCE INTERVAL OF PEAK DISCHARGES

The recurrence interval of a flood of a particular magnitude is the average time interval in years that the flood will be equalled or exceeded once. It is further defined as the reciprocal of the probability of exceedance. For example, a 50-year flood is one that has a 2% chance of occurring in any one year.

The recurrence intervals of peak discharges produced by this storm are listed in the last column of table 2. Computations are based on data contained in WSP 1682 "Western Gulf of Mexico Basins, Magnitude and Frequency of Floods, Part 8" by James L. Patterson. Extrapolation of data beyond the limits of the 50-year flood is not recommended, therefore, peak discharges on May 30-31, 1965, which exceeded the 50-year flood are shown as a ratio to that flood.

Recurrence intervals for the peak discharges which occurred on May 30-31, 1965, varied widely from 1.6 years at the station on the Delaware River near Red Bluff (No. 17) to the flood on Cass Draw (No. 11) which was 3.8 times the 50-year flood. The extreme differences in recurrence intervals is explained in the following narrative.

The relatively low recurrence intervals at the stations on Rocky Arroyo can be attributed to the fact that the storm covered only about one-half of the drainage basin, and rainfall amounts were not as great as in other areas covered by the storm. The recurrence intervals on South Seven Rivers (No. 2) and on Black River (No. 13) were also comparatively low. This can be explained by the fact that even though their drainage basins received considerable moisture, the precipitation fell in a relatively small area which composed only a portion of the respective drainage basins. The recurrence intervals at the six flood measurement sites on the main stem of the Pecos River were all less than nine years even though three of the stations observed peaks which were the second highest during the period of record. Those stations on the Pecos River located immediately below Avalon Dam, below Lake Avalon (No. 7) and at Carlsbad (No. 8), had the lowest recurrence interval, due to the regulation at Avalon Dam.

The greatest recurrence intervals occurred in an area north of White City where precipitation in amounts of 3.5 to 4 inches occurred. Mosley Canyon (No. 10), Cass Draw (No. 11), and Elbow Canyon (No. 12), observed peak discharges in excess of the 50-year flood. The storm covered the entire drainage area above all three of these determination points and in no case did the area of any of the respective drainage basins exceed 15 square miles.

Figure 4 shows the graphical relation of peak discharges to size of the drainage basins for most of the tributary streams discussed in this report. It also shows their relation to the 50-year, 10-year, and mean annual floods as determined by data contained in WSP 1682. The reference numbers refer to those in table 2. Only those flood determination points which apply to this regional type frequency relation are shown. Delaware River near Red Bluff (No. 17) and Last Chance Canyon tributary (No. 9) were deleted as their recurrence intervals were smaller than even the mean annual flood.

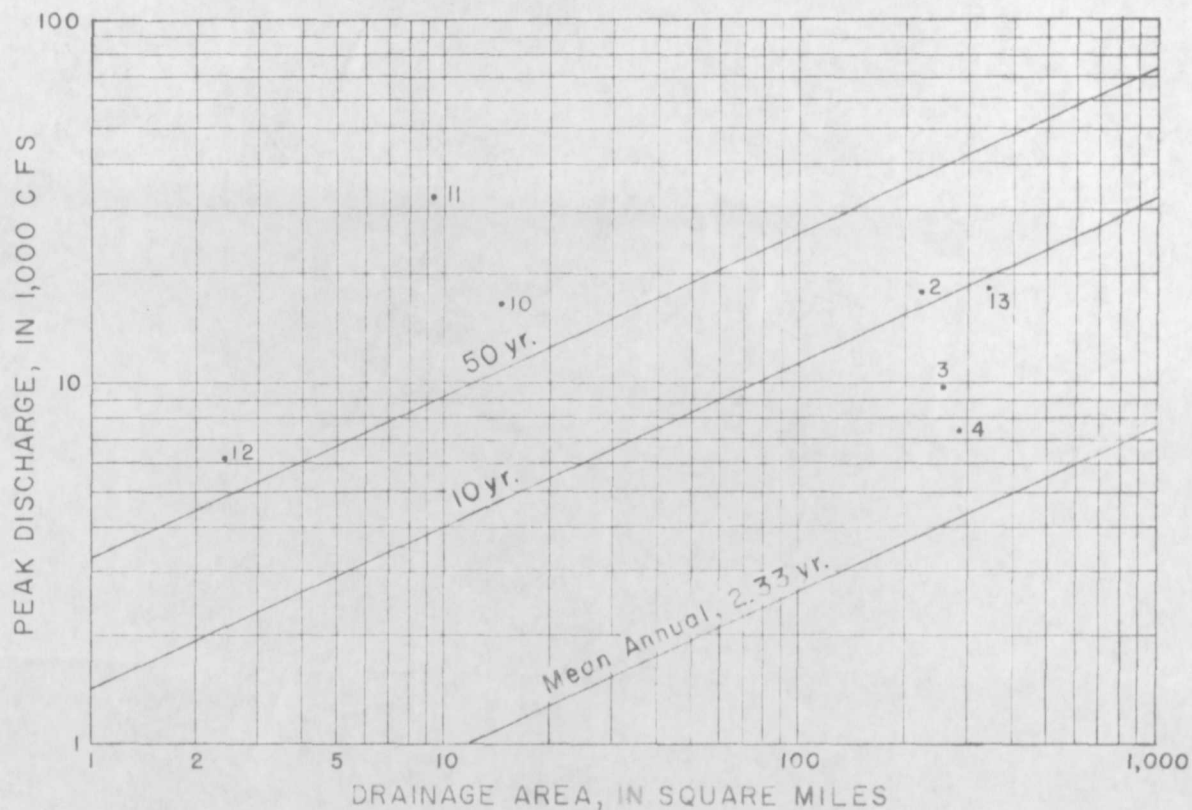


Figure 4.--Relation of peak discharge to size of drainage basin on selected streams tributary to Pecos River in Carlsbad, N. Mex. area, May 30-31, 1965. Numbers conform to those in table 2.

STREAMFLOW DATA AT FLOOD MEASUREMENT SITES

Explanation of data

The latter part of this report summarizes information relative to peak stages and discharges and historical data on all flood determination points covered by this report. Much of the information is in addition to that which appears in regular publications of the Geological Survey. These data are presented in two parts and are explained in the following paragraphs.

Summary of peak stages and discharges

The summary of peak stages and discharges shown in table 2 presents brief information on maximum stage and discharge known to have occurred during and prior to the period of record as well as for the flood of May 30-31, 1965.

Information listed includes identification numbers as shown in figure 1, permanent station number for regular and crest-stage stations, stream name and place of determination, the drainage area, and the period of record.

Under "Maximum previously known" the first column indicates the water year in which known maximums occurred and the second and third columns list the respective gage height and discharge, where known. Entries in these columns include known maximums during the period of record and those which occurred prior to the period of record or during breaks in that period.

The data shown under "Maximum May 30-31, 1965" are the flood peaks and discharges during the period covered by this report. The first column gives the date on which the event occurred, the second and third columns the respective gage heights and discharges and the last column the recurrence interval as discussed in a previous section of this report.

Table 2.--Summary of flood stages and discharges

No.	Permanent station number	Stream and place of determination	Drainage area (sq mi.)	Period of Record	Maximum previously known			Maximum May 30-31, 1965			
					Year	Gage height (ft)	Discharge (cfs)	Date	Gage height	CFS	Recurrence interval (years)
1	8-4010	RIO GRANDE BASIN Pecos River below McMillan Dam	16,990	1940 1947-65	1954 1904 1893	(a) (a) (a)	b16,100 (c) (d)	-	-	0	-
2	-4012	South Seven Rivers near Lakewood	220	1964-65	1964 1954	7.98 ef22.8	1,050 f30,000	30	e21.8	18,000	12
3	-4018	Rocky Arroyo near Carlsbad	254	1953-65	1954	eg56.8	63,300	30	45.07	9,700	5
4	-4019	Rocky Arroyo at highway bridge near Carlsbad	285	1964-65	1964 1954	13.40 22.0	9,760 (a)	30	e11.70	7,450	4
5	-4020	Pecos River at Damsite 3 near Carlsbad	17,980	1940 1945-65	1954 1893 1904 1905 1915 1916 1937	18.53 (a)	53,000 (h)	30	14.33	21,700	7
6	-4038	Lake Avalon near Carlsbad	18,070	1939-65	1941	i25.0	j11,000	31	i20.40	j4,970	-
7	-4040	Pecos River below Avalon Dam	18,080	1952-65	1954 1904	e23.3 (a)	b41,000 (a)	31	16.05	b10,600	4

Table 2.--Summary of flood stages and discharges - Continued

No.	Permanent station number	Stream and place of determination	Drainage area (sq mi)	Period of Record	Maximum previously known			Maximum May 30-31, 1965			
					Year	Gage height (ft)	Discharge (cfs)	Date	Gage height	Discharge	
										CFS	Recurrence interval (years)
RIO GRANDE BASIN - Continued											
8	8-4050	Pecos River at Carlsbad	18,100	1904-06 -1915 1920-65	1904	eg23.44	(k)	31	d11.17	b9,900	44
9	-4050.5	Last Chance Canyon tributary near Carlsbad Caverns	0.2	1959-65	1893	(a)	(a)	30	1.37	(a)	-
10	-4051	Mosley Canyon near White City	14.6	1959-65	1960	6.67	2,850	30	13.7	16,400	m1.5
11	-	Cass Draw near Carlsbad	9.3	-	-	-	-	30	-	32,500	m3.8
12	-	Elbow Canyon near Carlsbad	2.4	-	-	-	-	30	-	6,410	m1.4
13	-4055	Black River above Malaga	343	1941-65	1955 1941	14.70 e19.0	205,500 d33,000	30	13.95	18,400	9
14	-4065	Pecos River near Malaga	19,190	1920-65	1941 1941 1904	e35.1 - (ad)	63,700 (ad)	31	18.55	12,900	15
15	-4070	Pecos River at Pierce Canyon Crossing near Malaga	19,260	1939-41 1952-65	1941	eg24.8	(a)	31	15.06	b9,860	14

Table 2.--Summary of flood stages and discharges - Concluded

No.	Permanent station number	Stream and place of determination	Drainage area (sq mi)	Period of Record	Maximum previously known			Maximum May 30-31, 1965			
					Year	Gage height (ft)	Discharge (cfs)	Date	Gage height	CFS	Discharge Recurrence interval (years)
		RIO GRANDE BASIN - Continued									
16	8-4075	Pecos River at Red Bluff	19,540	1938-65	1941 1904	28.3 e28.0	52,600 (a)	30	19.06	16,800	18
17	-4085	Delaware River near Red Bluff	689	1938-65	1955 1911	e27.0 (d)	81,400 (a)	30	7.26	2,710	2.0
a -		not determined.									
b -		flow controlled wholly or in part by one or more reservoirs; see station description.									
c -		may have exceeded 60,000 cfs; see station description.									
d -		see station description.									
e -		from floodmarks.									
f -		about.									
g -		at different site and (or) datum; see station description.									
h -		exceeded 40,000 cfs; see station description.									
i -		elevation, in feet.									
j -		contents, acre-feet.									
k -		probably exceeded 90,000 cfs; see station description.									
m -		ratio of peak discharge to 50-year flood.									

Station descriptions and discharge table

Station data on all flood determination points covered in this report are presented in detail in this section. Information is presented in three parts for recording stations and includes a station description, a table of daily mean discharge for the period May 29 through June 6, and a table of gage-heights and discharges during the peaks. The station description is the only item included for crest-stage stations and miscellaneous sites.

The station description for each flood determination point presents data relative to type of station, location, drainage area, gage-height record, discharge record, maximum known events, and miscellaneous remarks pertinent to the record. The paragraph on gage-height record covers the type of gage, the datum and describes any abnormal performance of the station during the period covered by this report. The information presented in the paragraph on discharge record pertains to methods used to define the stage-discharge relation through the range in stage which occurred in May 1965. Maximum stage and discharge for the period covered by this report and for previous floods both during, prior to or during breaks in the period of record are shown under "Maxima". Information on floods outside the period of record is listed in as much detail as possible. Remarks are made on regulation, data source and other pertinent information.

The table of daily mean discharge covers the period May 29 through June 6, 1965, in order to relate flood discharges to antecedent and subsequent conditions. Also included is total runoff in acre-feet for the nine-day period.

The table of stages and discharges generally covers the period of flow which sufficiently defines the flood hydrograph for all recording stations covered in this report except Pecos River below McMillan Dam (No. 1) which experienced no flow and South Seven Rivers (No. 2) whose record was destroyed.

STATION DATA

Pecos River Basin

(1) 8-4010. Pecos River below McMillan Dam, N. Mex.

Location.--Lat 32°35'40", long 104°21'00", in NE¼ sec.11, T.20 S., R.26 E., on left bank 700 ft downstream from gates in McMillan Dam and 3 miles southeast of Lakewood.

Drainage area.--16,990 sq mi, approximately (contributing area).

Gage-height record.--Water-stage recorder graph. Datum of gage is 3,238.21 ft above mean sea level, datum of 1929.

Discharge record.--Stage discharge relation defined by current-meter measurements below 3,000 cfs.

Maxima.--May 30-31, 1965: No flow.

1940, 1947 to May 29, 1965: Discharge, 16,100 cfs Oct. 11, 1954 (gage height, not determined).

Flood of Oct. 2, 1904, may have reached 60,000 cfs; figure of 82,000 cfs previously published has been found to be "inflow to McMillan Reservoir" and is considered too high. This station may have had a higher discharge in August 1893 when part of McMillan Dam was blasted to prevent total destruction of dam (that flood was described as "highest in 50 years" and it also destroyed Avalon Dam).

Remarks.--Flow regulated by Alamogordo Reservoir and Lake McMillan.

(2) 8-4012. South Seven Rivers near Lakewood, N. Mex.

Location.--Lat 32°35'20", long 104°25'20", in SE $\frac{1}{4}$ SE $\frac{1}{4}$ NW $\frac{1}{4}$ sec.7, T.20 S., R.26 E., on left bank 400 ft upstream from bridge on U.S. Highway 285, 0.4 mile south of Seven Rivers, 3 miles upstream from mouth and 4 miles southwest of Lakewood.

Drainage area.--220 sq mi, approximately.

Gage-height record.--Water-stage recorder station, destroyed by flood. Altitude of gage is 3,277 ft (from topographic map).

Discharge record.--Stage-discharge relation defined by current-meter measurements below 1,000 cfs and by slope-area measurement at 18,000 cfs. Discharge for periods of no gage-height record estimated on basis of records for nearby stations.

Maxima.--May 30-31, 1965: Discharge, 18,000 cfs May 30, about 1700 hours (gage height, 21.8 ft from floodmarks).

196 $\frac{1}{4}$ to May 29, 1965: Discharge, 1,050 cfs July 12, 196 $\frac{1}{4}$ (gage height, 7.98 ft).

Maximum since at least 1941, about 20,000 cfs (gage height, 22.8 ft, from old debris on left bank, former site and datum), from rating curve extended above 1,000 cfs on basis of slope-area measurement at 18,000 cfs and logarithmic plotting. Probable date of flood, Oct. 7, 1954.

(3) 8-4018. Rocky Arroyo near Carlsbad, N. Mex.

(Crest-stage station)

Location.--In SW $\frac{1}{4}$ sec.23, T.21 S., R.24 E., 0.1 mile north of State Highway 137, 0.7 mile above dip on State Highway 137, and 14 miles west of Carlsbad.

Drainage area.--254 sq mi.

Gage-height record.--Crest stages only.

Discharge record.--Stage-discharge relation defined by current-meter measurement at 109 cfs and by slope-area measurements at 9,800 and 14,200 cfs.

Maxima.--May 30-31, 1965: Discharge, 9,700 cfs May 30 (gage height, 45.07 ft, from floodmarks).

1953 to May 29, 1965: Discharge, 63,300 cfs Oct. 7, 1954 (gage height, 56.8 ft, from floodmarks, site and datum then in use). From information by local resident, 1954 flood was greatest since at least 1916.

(4) 8-4019. Rocky Arroyo at highway bridge near Carlsbad, N. Mex.

Location.--Lat 32°30'20", long 104°22'28" in SE $\frac{1}{4}$ SE $\frac{1}{4}$, sec.3, T.21 S., R.25 E., at downstream end of bridge pier nearest left bank on U.S. Highway 285, 2 miles upstream from mouth and 10 miles northwest of Carlsbad.

Drainage area.--285 sq mi, approximately.

Gage-height record.--Water-stage recorder graph. Altitude of gage is 3,248 ft (from topographic map).

Discharge record.--Stage-discharge relation defined by current-meter measurements below 130 cfs and by slope-area measurement at 7,450 cfs.

Maxima.--May 30-31, 1965: Discharge, 7,450 cfs May 30, 1730 hours, (gage height, 11.70 ft, from floodmarks).

1964 to May 29, 1965: Discharge, 9,760 cfs July 11, 1964 (gage height, 13.40 ft), from rating curve extended above 130 cfs on basis of slope-area measurement at gage height 11.7 ft and logarithmic plotting.

Since about 1941 the highest peak probably occurred October 7, 1954; discharge not determined, gage height, 22 ft, from debris on bridge piers.

Mean discharge, in cubic feet per second, May 29-June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	0	June 1	0	June 4	0
30	1,050	2	0	5	0
31	99	3	0	6	0

Runoff, in acre-feet, May 29-June 6, 1965 2,280

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 30--con			May 31--con		
2400	-	0	2030	8.95	4,250	1200	2.55	25
May 30			2200	6.50	1,980	2400	1.89	2
1700	-	0	2400	5.08	962	June 1		
1730	11.70	7,450	May 31			0600	1.67	0
1830	7.70	3,020	0200	3.98	352			
1930	11.30	6,940	0600	3.23	116			

Note: Daily means computed from data in addition to figures shown.

(5) 8-4020. Pecos River at Damsite 3, near Carlsbad, N. Mex.

Location.--Lat 32°30'40", long 104°20'00", in lot 14, sec.6, T.21 S., R.26 E., on right bank at damsite 3 of Carlsbad project of Bureau of Reclamation, about 1 mile upstream from flow line of Lake Avalon, 1.3 miles downstream from Rocky Arroyo, and 8 miles northwest of Carlsbad.

Drainage area.--17,980 sq mi, approximately (contributing area).

Gage-height record.--Water-stage recorder graph. Datum of gage is 3,172.31 ft above mean sea level (Bureau of Reclamation datum).

Discharge record.--Stage-discharge relation defined by current-meter measurements below 2,500 cfs and by slope-area measurement at 53,000 cfs.

Maxima.--May 30 to 31, 1965: Discharge, 21,700 cfs May 30, 2040 hours (gage height, 14.33 ft).

1940, 1945 to May 29, 1965: Discharge, 53,000 cfs October 7, 1954 (gage height, 18.53 ft) from rating curve extended above 15,000 cfs on basis of slope-area measurement of peak flow.

Peaks which probably exceeded 40,000 cfs occurred in August 1893, October 2, 1904, July 25, 1905, April 17, 1915, August 7, 1916, and May 30, 1937, based primarily on records for station at Carlsbad. Floods of 1893 and 1904 originated above McMillan Dam and contributed to two failures of Avalon Dam. The flood of October 2, 1904, probably did not exceed 60,000 cfs; the estimate of 82,000 cfs erroneously published as flow over McMillan Dam was actually inflow to Lake McMillan and thought to be high.

Remarks.--Flow regulated by Alamogordo Reservoir and Lake McMillan. Peak of May 30, 1965, originated downstream from reservoirs.

Mean discharge, in cubic feet per second, May 29-June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	22	June 1	27	June 4	20
30	3,450	2	22	5	22
31	776	3	22	6	22

Runoff, in acre-feet, May 29-June 6, 1965.... 8,690

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 31			May 31--con		
2400	0.01	21	0100	7.43	5,090	1600	0.59	76
May 30			0200	5.35	2,740	2000	0.38	59
1800	0.06	25	0300	4.06	1,720	2400	0.25	43
1900	7.28	4,880	0400	3.16	1,160	June 1		
2000	13.26	18,000	0500	2.58	835	0600	0.13	31
2040	14.33	21,700	0600	2.14	618	1200	0.07	25
2100	14.16	21,000	0800	1.53	363	2400	0.04	23
2200	13.21	17,800	1000	1.15	234			
2300	11.75	13,600	1200	0.91	165			
2400	9.38	8,310						

Note: Daily means computed from data in addition to figures shown.

(6) 8-4038 Lake Avalon near Carlsbad, N. Mex.

Location.--Lat 32°29'25", long 104°15'00", in SW $\frac{1}{4}$ sec.12, T.21 S., R.26 E., on headwall at outlet gate of dam on Pecos River, 5 miles north of Carlsbad.

Drainage area.--18,070 sq mi (contributing area).

Gage-height record.--Daily staff gage readings at 0800 hours. Datum of gage 3,157.0 ft above mean sea level, Bureau of Reclamation datum.

Maxima.--May 30-31, 1965: Contents, 4,970 acre-feet, 0800 hours May 31, (gage height, 20.40 ft).

1939 to May 29, 1965: Contents observed 11,000 acre-feet May 22, 1941 (gage height, 25.0 ft).

Remarks.--Lake is formed by Avalon Dam. The original Eddy (Avalon) dam was completed and storage began in 1893. The dam was destroyed by flood of October 1893 (date of reconstruction not available), was destroyed again by flood of October 2, 1904; present dam rebuilt in 1905-06. Capacity 4,970 acre-feet between gage heights 0.0 (sill of outlet gates) and 20.4 ft (crest of spillway 2). No dead storage. No storage allocated to flood control.

Cooperation.--Capacity table based on data furnished by Carlsbad Irrigation District.

Elevation and contents, May 29 - June 6, 1965

Date	Hour	Elevation (feet)	Contents (Acre-feet)	Date	Hour	Elevation (feet)	Contents (Acre-feet)
May 29	0800	15.65	1,280	June 3	0800	20.35	4,920
May 31	0800	20.40	4,970	June 6	0800	20.15	4,740

(7) 8-4040. Pecos River below Avalon Dam, N. Mex.

Location.--Lat 32°28'53", long 104°15'43", in SW $\frac{1}{4}$ SW $\frac{1}{4}$ NE $\frac{1}{4}$, sec.14, T.21 S., R.26 E., on right bank 5,200 ft below Avalon Dam, and 4.5 miles northwest of Carlsbad.

Drainage area.--18,080 sq mi, approximately (contributing area).

Gage-height record.--Water-stage recorder graph. Altitude of gage is 3,130 ft (from topographic map).

Discharge record.--Stage-discharge relation defined by current-meter measurements below 7,000 cfs and extended above by logarithmic plotting.

Maxima.--May 30-31, 1965: Discharge, 10,600 cfs May 31, 0200 hours (gage height, 16.05 ft).

1952 to May 29, 1965: Discharge, 41,000 cfs October 7, 1954 (gage height, 23.3 ft, from floodmarks).

Flood of October 2, 1904, caused, in part, by failure of Avalon Dam, was described as the greatest flood known. Flood of August 1893 is probably second highest, and was described as "greatest in 50 years"; it damaged McMillan Dam and washed out original Avalon Dam.

Remarks.--Flow regulated by Alamogordo Reservoir, Lake McMillan and Lake Avalon.

Mean discharge, in cubic feet per second, May 29 - June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	0	June 1	8	June 4	0
30	0	2	0	5	0
31	1,940	3	0	6	0

Runoff, in acre-feet, May 29 - June 6, 1965 3,860

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 30			May 31--con			June 1		
2400	-	0	0500	13.05	5,400	0600	4.25	12
May 31			0600	10.47	2,560	1200	4.15	8
0030	12.22	4,480	0700	6.50	402	2400	3.95	2
0100	15.07	8,900	0800	4.81	62	June 2	-	0
0130	15.89	10,400	1200	4.17	9			
0200	16.05	10,600	1600	4.30	15			
0300	15.62	9,760	2000	4.33	22			
0400	14.57	7,790	2400	4.30	15			

Note: Daily means computed from data in addition to figures shown.

(8) 8-4050. Pecos River at Carlsbad, N. Mex.

Location.--Lat 32°25'05", long 104°13'25", in NW¼SE¼ sec.6, T.22S., R.27 E., in downstream end of pier near center of Greene Street Bridge in Carlsbad, half a mile upstream from Dark Canyon.

Drainage area.--18,100 sq mi, approximately (contributing area).

Gage-height record.--Water-stage graph except for period 2000 hours May 30 to 0100 hours May 31 when gage was affected by backwater from Dark Canyon. Datum of gage is 3,080.28 ft above mean sea level.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 9,500 cfs and extended above by logarithmic plotting. Discharge during backwater period estimated on basis of normal recession curves.

Maxima.--May 30-31, 1965: Discharge, 9,900 cfs May 31, 0240 hours; gage height, 11.17 ft May 30, 2000 hours (backwater from Dark Canyon).

1903-06, 1915, 1921 to May 29, 1965: Discharge probably exceeded 90,000 cfs October 2, 1904, (gage height, 23.44 ft from floodmarks, site and datum then in use).

Flood of October 2, 1904, caused in part by the failure of Avalon Dam, was described at that time as "greatest flood known at Carlsbad". Flood of August 1893 is probably second highest, and was described as "greatest in 50 years"; it damaged McMillan Dam and washed out the original Avalon Dam.

Remarks.--Flow regulated by Alamogordo Reservoir, Lake McMillan and Lake Avalon.

Mean discharge, in cubic feet per second, May 29 - June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	0.7	June 1	18	June 4	7.0
30	60	2	7.0	5	6.1
31	1,750	3	5.3	6	6.1

Runoff, in acre-feet, May 29 - June 6, 1965 3,690

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 31			May 31--con		
2400	0.20	1.0	0100	3.40	580	1100	2.15	226
May 30			0200	10.09	8,920	1300	1.35	90
1600	0.20	1.0	0240	10.47	9,900	1700	0.86	38
1700	1.18	70	0300	10.38	9,670	2400	0.67	22
1800	2.42	287	0400	9.78	8,170	June 1		
1830	2.72	366	0500	8.90	6,310	1200	0.61	18
2000	2.25	230	0600	7.64	4,270	2400	0.47	9.4
2100	11.17	200	0700	6.30	2,660	June 2		
2200	9.25	150	0800	4.84	1,420	1200	0.42	7.0
2400	5.45	110	0900	3.60	700	2400	0.38	5.3

Note: Daily means computed from data in addition to figures shown.

(9) 8-4050.5. Last Chance Canyon tributary, near Carlsbad Caverns, N. Mex.

(Crest-stage station)

Location.--In E $\frac{1}{2}$ NW $\frac{1}{4}$ sec.21, T.23 S., R.23 E., above culvert on State Highway 137, 0.1 mile north of road to Sitting Bull Falls, add 12 $\frac{1}{2}$ miles northwest of Carlsbad Caverns.

Drainage area.--0.2 sq mi, approximately.

Gage-height record.--Crest stages only.

Discharge record.--Stage-discharge relation not defined below gage-height 3.56 ft.

Maxima.--May 30-31, 1965: Gage height, 1.37 ft May 30, (discharge not determined).
1959 to May 29, 1965: Discharge 439 cfs July 6, 1960 (gage height, 5.72 ft).

(10) 8-4051. Mosley Canyon near White City, N. Mex.

(Crest-stage station)

Location.--In SE $\frac{1}{4}$ sec.34, T.23 S., R.25 E., on right bank, 600 ft upstream from dip in Dark Canyon Road, and 5 $\frac{1}{2}$ miles north of White City.

Drainage area.--14.6 sq mi.

Gage-height record.--Crest stages only.

Discharge record.--Maximum discharge computed by slope-area measurement.

Maxima.--May 30-31, 1965: Discharge 16,400 cfs May 30, (gage height, 13.7 ft).
1959 to May 29, 1965: Discharge, 2,850 cfs July 6, 1960 (gage height, 6.67 ft) from slope-area measurement.

(11) Cass Draw near Carlsbad, N. Mex.

(Miscellaneous site)

Location.--Lat 32°15'50", long 104°16'30", in NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec.33, T.23 S., R.26 E., at culvert on Highway 62, 6 miles south of Carlsbad, and about 14 miles upstream from mouth.

Drainage area.--9.3 sq mi.

Discharge record.--Peak discharge determined by flow over road embankment and flow through culvert.

Maxima.--May 30-31, 1965: Discharge, 32,500 cfs May 30.

(12) Elbow Canyon near Carlsbad, N. Mex.

(Miscellaneous site)

Location.--Lat 32°14'45", long 104°18'05", in NE¼SW¼, sec.4, T.24 S., R.26 E., at culvert on U.S. Highway 62-180, about 1.7 miles upstream from mouth, and 7.2 miles southwest of Carlsbad.

Drainage area.--2.4 sq mi.

Discharge record.--Peak discharge determined by flow over road embankment and flow through culvert.

Maxima.--May 30-31, 1965: Discharge, 6,410 cfs May 30.

(13) 8-4055. Black River above Malaga, N. Mex.

Location.--Lat 32°13'40", long 104°09'05", in SW¼, sec.12, T.24 S., R.27 E., on right bank 0.6 mile upstream from Black River diversion dam, 4.8 miles west of Malaga, and 7 miles upstream from mouth.

Drainage area.--343 sq mi.

Gage-height record.--Water-stage recorder graph. Altitude of gage 3,070 ft (from topographic map).

Discharge record.--Stage discharge relation defined by current-meter measurements below 6,000 cfs and by slope-area measurement at gage-height 12.6 ft, and extended above by logarithmic plotting.

Maxima.--May 30-31, 1965: Discharge 18,400 cfs May 30, 2045 hours (gage height, 13.95 ft).

1947 to May 29, 1965: Discharge 20,500 cfs September 23, 1955 (gage height, 14.70 ft) from rating curve extended above 1,400 cfs on basis of slope-area measurements at gage heights 8.41 and 12.60 ft.

Maximum flood known since 1908 (from information by local residents), 33,000 cfs September 20 or 21, 1941, (gage height, 19.0 ft, determined in 1947 from well-defined floodmarks), from rating curve extended above 1,400 cfs. Flood of April 17, 1915, reached stage of 11 ft at bridge on Loving-Malaga road.

Mean discharge, in cubic feet per second, May 29 - June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	2.1	June 1	31	June 4	11
30	2,710	2	16	5	9.6
31	466	3	14	6	9.2

Runoff, in acre-feet, May 29 - June 6, 1965 6,480

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 30--con			May 31--con		
2400	0.64	2	2100	13.56	17,200	0700	2.56	324
May 30			2200	12.31	13,900	0900	2.23	219
1700	0.66	2	2300	9.31	7,300	1200	1.91	136
1800	2.46	275	2400	7.36	4,190	1800	1.59	75
1900	9.96	8,570	May 31			2400	1.41	49
2000	12.81	15,200	0100	5.96	2,550	June 1		
2030	13.65	17,600	0300	4.18	1,110	1200	1.18	23
2045	13.95	18,400	0500	3.16	551	2400	1.05	18

Note: Daily means computed from data in addition to figures shown.

(14) 8-4065. Pecos River near Malaga, N. Mex.

Location.--Lat 32°12'30", long 104°01'20" in N½ sec.19, T.24 S., R.29 E., on right bank 3 miles southeast of Malaga, and 4 miles downstream from Black River.

Drainage area.--19,190 sq mi, approximately (contributing area).

Gage-height record.--Digital recorder tape punched at 30-minute intervals. Datum of gage is 2,895.64 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 12,000 cfs and extended above by logarithmic plotting.

Maxima.--May 30-31, 1965: Discharge, 12,900 cfs May 31, 0630 hours (gage height, 18.55 ft).

1921 to May 29, 1965: Discharge, 63,700 cfs Sept. 21, 1941, from rating curve extended above 22,500 cfs by logarithmic plotting; gage height, 35.1 ft May 22, 1941, present datum, from floodmarks.

Flood of 1941 believed to be highest since 1904 when a flood of about the same magnitude occurred. Flood of August 7, 1916, was revised to 70,000 cfs at Carlsbad, 27 miles upstream. Flood in September 1919 reached a stage of 29.4 ft, present datum (discharge, 40,400 cfs).

Remarks.--Flow regulated by Alamogordo Reservoir, Lake McMillan and Lake Avalon.

Mean discharge, in cubic feet per second, May 29 - June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	7.5	June 1	260	June 4	32
30	1,110	2	92	5	24
31	7,160	3	54	6	20

Runoff, in acre-feet, May 29 - June 6, 1965 17,370

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 31--con			May 31--con		
2400	1.56	7	0400	16.74	10,600	2200	6.56	969
May 30			0500	18.01	11,200	2400	5.40	653
1800	1.59	8	0600	18.55	12,900	June 1		
1900	3.04	144	0630	18.55	12,900	0200	4.85	499
2000	3.13	156	0700	18.47	11,900	0600	4.20	340
2100	5.04	595	0800	18.11	10,700	1000	3.77	248
2200	12.88	5,770	0900	17.73	10,100	1800	3.21	156
2300	16.78	10,200	1000	17.64	9,910	2400	2.94	120
2400	18.19	12,000	1200	17.33	9,390	June 2		
May 31			1400	16.07	7,510	1200	2.62	90
0100	17.86	10,200	1600	13.64	5,050	2400	2.41	67
0200	16.75	8,480	1800	10.70	3,050			
0300	15.84	7,660	2000	8.10	1,590			

Note: Daily means computed from data in addition to figures shown.

(15) 8-4070. Pecos River at Pierce Canyon Crossing, near Malaga, N. Mex.

Location.--Lat 32°11'20", long 103°58'45", in W½ sec.27, T.24 S., R.29 E., on right bank a quarter of a mile upstream from Pierce Canyon Crossing, and 6 miles southeast of Malaga.

Drainage area.--19,260 sq mi, approximately (contributing area).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,889.18 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 330 cfs and extended above by logarithmic plotting and comparison with Pecos River near Malaga.

Maxima.--May 30-31, 1965: Discharge, 9,860 cfs May 31 1200 hours, (gage height, 15.06 ft) from rating curve extended above 330 cfs by logarithmic plotting and correlation of peaks with associated station.

1939-41, 1952 to May 29, 1965: Gage height, 24.8 ft, May 22, 1941 (datum then in use), from floodmarks, (discharge not determined).

Remarks.--Flow regulated by Alamogordo Reservoir, Lake McMillan, and Lake Avalon.

Mean discharge, in cubic feet per second, May 29 - June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	4.0	June 1	663	June 4	49
30	53	2	128	5	36
31	7,720	3	73	6	32

Runoff, in acre-feet, May 29 - June 6, 1965 17,370

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 31--con			June 1		
2400	0.68	4.1	0600	13.46	8,260	0300	4.90	1,480
May 30			0800	14.58	9,380	0600	3.10	630
1600	0.67	3.7	1000	15.00	9,800	1200	2.35	353
2300	1.60	130	1200	15.06	9,860	2400	1.80	182
2400	6.40	2,440	1400	14.96	9,760	June 2		
May 31			1600	14.38	9,180	1200	1.56	121
0200	11.46	6,400	1800	13.06	7,860	2400	1.43	92
0300	12.41	7,270	2100	10.30	5,420	June 3		
0400	12.71	7,540	2400	7.46	3,180	1200	1.33	73
0500	12.94	7,750				2400	1.25	59

Note: Daily means computed from data in addition to figures shown.

(16) 8-4075. Pecos River at Red Bluff, N. Mex.

Location.--Lat 32°04'30", long 104°02'20", in sec.1, T.26 S., R.28 E., on right bank at Red Bluff, 0.2 mile downstream from Red Bluff Draw, and 5.5 miles upstream from Delaware River.

Drainage area.--19,540 sq mi, approximately (contributing area).

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,850.05 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 6,000 cfs and extended above by logarithmic plotting.

Maxima.--May 30-31, 1965: Discharge, 16,800 cfs May 30, 2240 hours (gage height, 19.06 ft).

1928 to May 29, 1965: Discharge, 52,600 cfs May 24, 1941 (gage height, 28.3 ft), from rating curve extended above 30,000 cfs on basis of slope-area measurement of peak flow.

Maximum stage known, that of May 24, 1941. Flood of October, 1904 reached a stage of 28.0 ft, from information by Panhandle and Santa Fe Railway Co.

Remarks.--Flow regulated by Alamogordo Reservoir, Lake McMillan, and Lake Avalon.

Mean discharge, in cubic feet per second, May 29 - June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	2.7	June 1	3,040	June 4	61
30	2,120	2	196	5	41
31	7,060	3	100	6	33

Runoff, in acre-feet, May 29 - June 6, 1965 25,100

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 31--con			June 1--con		
2400	2.50	2	0700	9.16	3,760	1500	5.70	938
May 30			0800	9.09	3,680	1800	4.92	542
1800	2.50	2	0900	9.20	3,800	2400	4.39	334
1900	6.00	1,100	1100	9.90	4,620	June 2		
2000	7.84	2,450	1300	10.86	5,850	0600	4.11	239
2100	11.03	6,070	1500	11.75	7,040	1200	3.92	189
2200	18.78	16,300	1800	12.71	8,310	2400	3.66	138
2240	19.06	16,800	2000	13.06	8,770	June 3		
2300	18.73	16,200	2110	13.10	8,820	1200	3.51	100
2400	17.55	14,300	2200	13.08	8,790	2400	3.37	76
May 31			2400	12.76	8,380	June 4		
0100	16.10	12,400	June 1			1200	3.26	59
0200	14.60	10,600	0300	11.83	7,080	2400	3.17	47
0300	12.90	8,560	0600	10.55	5,380	June 5		
0400	11.35	6,420	0900	8.97	3,560	1200	3.11	40
0500	10.10	4,800	1200	7.16	1,890	2400	3.06	30

Note: Daily means computed from data in addition to figures shown.

(17) 8-4085. Delaware River near Red Bluff, N. Mex.

Location.--Lat 32°01'25", long 104°03'15", in SE¼ sec.23, T.26 S., R.28 E., near center of channel on downstream side of pier of bridge on U.S. Highway 285, 3.5 miles upstream from mouth, 4 miles south of Red Bluff, and 14 miles south of Malaga.

Drainage area.--689 sq mi.

Gage-height record.--Water-stage recorder graph. Datum of gage is 2,900.66 ft above mean sea level, datum of 1929.

Discharge record.--Stage-discharge relation defined by current-meter measurements below 4,000 cfs.

Maxima.--May 30-31, 1965: Discharge, 2,710 cfs May 30, 2025 hours (gage height, 7.26 ft).

1938 to May 29, 1965: Discharge, 81,400 cfs October 2, 1955 (gage height, 27.0 ft, from floodmarks), from rating curve extended above 1,500 cfs on basis of slope-area measurements at gage-height, 8.65, 12.84, 18.0 and 27.0 ft.

Maximum stage known since 1911, that of October 2, 1955. Flood of June 27, 1938, reached stage of 18.00 ft, from floodmark.

Mean discharge, in cubic feet per second, May 29 - June 6, 1965

Day	Discharge	Day	Discharge	Day	Discharge
May 29	0	June 1	5.6	June 4	0.4
30	405	2	2.0	5	0.2
31	77	3	0.9	6	0.1

Runoff, in acre-feet, May 29 - June 6, 1965 974

Gage height and discharge, at indicated time, 1965

Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)	Date and Hour	Gage Height (feet)	Dis-charge (cfs)
May 29			May 31			June 1		
2400	-	0	0100	3.27	254	0600	1.44	7.3
May 30			0200	2.97	183	1200	1.33	5.2
1800	-	0	0600	2.67	110	1800	1.23	3.7
1900	6.70	2,320	0800	2.45	71	2400	1.17	2.9
2000	6.63	2,270	1000	2.25	44	June 2		
2025	7.26	2,710	1800	1.82	23	1200	1.08	1.9
2100	5.83	1,710	2400	1.57	10	2400	0.99	1.3
2300	5.00	1,180						
2400	4.43	838						

Note: Daily means computed from data in addition to figures shown.