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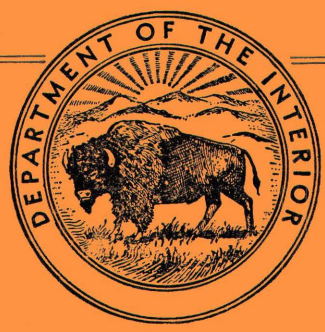


January 1951

# FLOOD OF AUGUST 1-6, 1950, AT WICHITA FALLS, TEX.

By

Ivan D. Yost

Prepared cooperatively with the
TEXAS BOARD OF WATER ENGINEERS

UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, Secretary

GEOLOGICAL SURVEY

W. E. Wrather, Director

WASHINGTON, D. C.

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## INTRODUCTION

Floods occurred on streams in the vicinity of Wichita Falls, Tex., during the period Aug. 1-6, 1950, as a result of heavy rains falling immediately southwest of the city on August 1, 1950. Serious flooding occurred along Holliday Creek in the city, necessitating the evacuation of about five hundred families from the low areas; however, no loss of life was reported. The total direct damage to residential and industrial property was estimated by Corps of Engineers, U. S. Army, to be $291,500. No estimate was available, but crop and soil losses in the rural areas were probably very high.

The purpose of this report is to present certain rainfall and runoff data in the flood area in greater detail than is usually found in regular Water-Supply Papers. The report contains a summary of peak discharges at six points, and detailed records of discharge during the flood period at five points in the vicinity of Wichita Falls. The report also contains a discussion of rainfall associated with the flood and a description of the general features of the flood.

This report was prepared in the Surface Water Branch of the Water Resources Division, U. S. Geological Survey, C. G. Paulsen, chief hydraulic engineer. Field data were obtained and computations made by the Wichita Falls area office of the Surface Water Branch, J. O. Joerns, area engineer.

Base data used in this report were obtained in cooperation with the Texas Board of Water Engineers. The Corps of Engineers, U. S. Army,

furnished a statement of damages resulting from the flood. The city of Wichita Falls furnished lake-level elevations for Lake Kickapoo during part of the flood period. The Wichita County Water Improvement Districts Nos. 1 and 2 furnished daily lake-level elevations for Lake Diversion and Lake Kemp. The United States Weather Bureau furnished records of rainfall at official stations.

## RAINFALL

Rainfall during the month of July 1950 was the heaviest during the period of continuous record, beginning in 1931, at the Kell Field Weather Bureau Station near Wichita Falls. The total rainfall at this station for the month was 11.86 inches - the wettest on record for July - exceeding the July normal by 9.53 inches; and that monthly total has been exceeded only by an unofficial record of rainfall for May 1901. This heavy rainfall in July did not produce excessive runoff as it was fairly well distributed throughout the month; however, the ground was saturated to the point that the rate of runoff of the subsequent heavy rains was increased.

Records show that the heavy rainfall producing the floods began about 1 a.m., August 1. Reports indicate the heaviest rain fell between 1 a.m. and 6 a.m. with a steady drizzle throughout the day and heavy rains again falling late in the afternoon. The greatest amount of rainfall recorded was on the Charles Williams Ranch 6.5 miles southeast of Dundee, where 6.50 inches was recorded at 6 a.m. and 3.25 inches recorded at 6 p.m., making a total of 9.75 inches for the storm. The area of heaviest rainfall was in sparsely settled farm and ranch country; therefore very

few reliable rainfall records were obtained in that area. Isohyetal lines shown on map (fig. 1) were based on all available rainfall records. No record from recording gage was available for the area of heaviest rainfall.

The heaviest rainfall of the August 1 storm occurred on the upper watersheds of the Little Wichita River and Holliday Creek causing serious flood conditions on both streams. The average rainfall on the drainage area of the North Fork Little Wichita River above Lake Kickapoo was about 8 inches, and on the Holliday Creek drainage area about 5 inches.

The following discussion of the meteorological situation in northwest Texas on July 31 and August 1, 1950, was prepared by E. A. Moore, meteorologist, Kell Field Weather Bureau Station, Wichita Falls, Tex.:

> "On the evening of July 31, a low pressure system was centered over Wisconsin. A cold front extended southwestward, from this low, to the Texas Panhandle. There was a strong flow of warm moist air from the Gulf over Texas and Oklahoma, with moist polar air over Kansas northward. The meeting of these two air masses, or frontal zone, produced showers and thunderstorms with locally heavy rains in the Wichita Falls area. As the front moved slowly to the south and east, the rains persisted in this section, immediately in advance of the front. As usual in showery conditions, the rainfall measurements varied widely, but in this northwest Texas area, all amounts were heavy following an extremely wet July. At the Weather Bureau Station, located approximately 5 miles north of Wichita Falls, the twenty-four hour rainfall from 3 a.m., August 1 to 3 a.m. of the second was 1.83 inches. Much heavier rains occurred to the immediate west and southwest in the watersheds of Holliday Creek and the Wichita River. An unofficial report, but believed to be reliable, show amounts as great as 9.75 inches in the vicinity of Dundee."

## GENERAL FEATURES OF THE FLOOD

All lakes in the area - Lake Wichita, Lake Kickapoo, Lake Kemp, and Lake Diversion - made substantial gains in storage during the month of July 1950, and all lakes, except Lake Kemp, had flow over the spillways

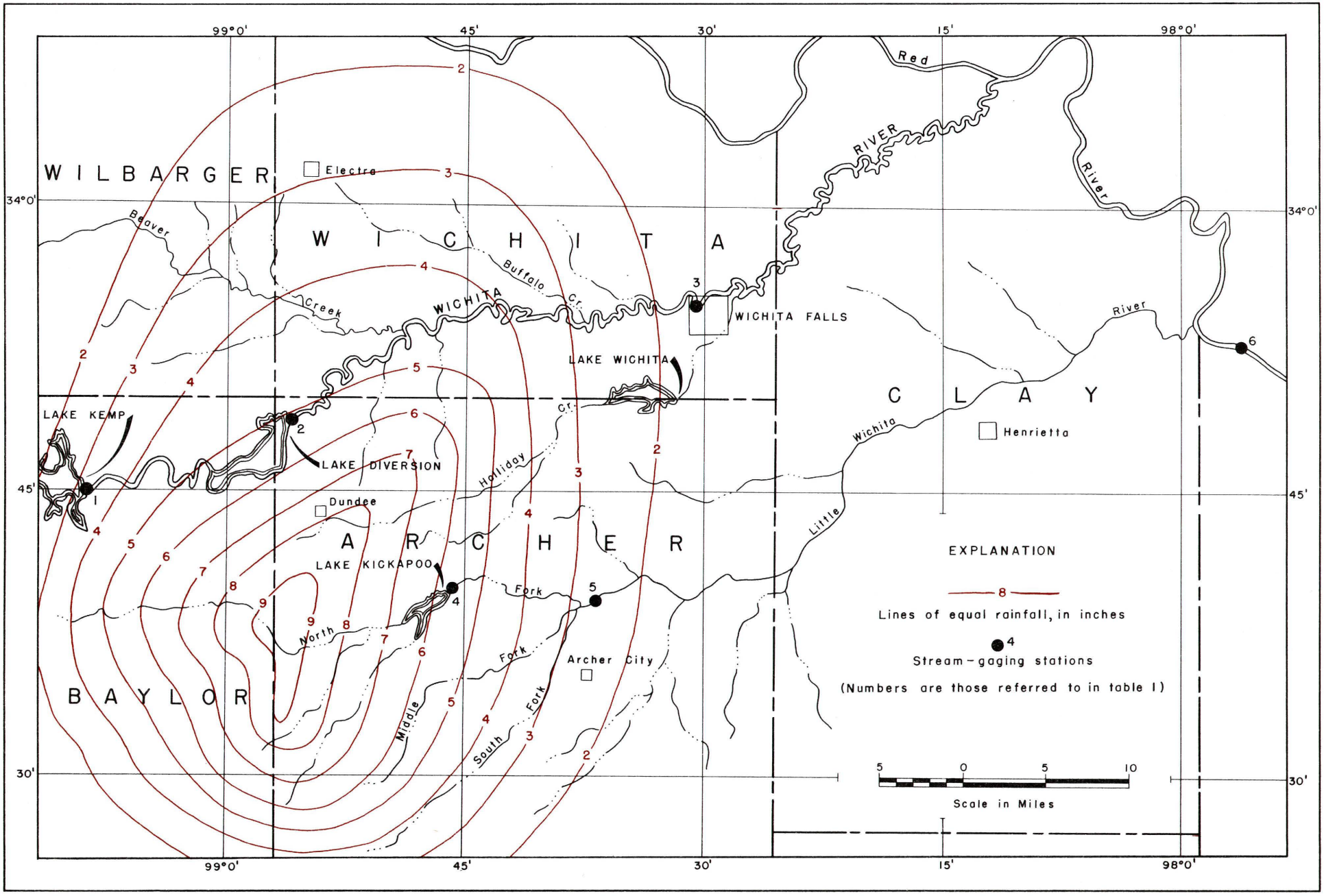


Figure 1.-- Isohyetal map showing total rainfall August 1, 1950 in the vicinity of Wichita Falls, Tex.

before the heavy rainfall of August 1, 1950. Lake Kemp did not spill any water during this flood.

Lake Wichita, on Holliday Creek at the edge of the city of Wichita Falls, was full and discharging some water over its spillway when the August 1 storm occurred. The normal channel of Holliday Creek below Lake Wichita, where it meanders through the city, can carry about 1,000 second-feet without serious flooding. The channel was still full from previous rainfall, and, when the flood waters from the upper reaches of Holliday Creek reached Lake Wichita, a large amount of water was again spilled into the creek, quickly flooding the low areas and causing considerable property damage. A view of part of the flooded area along Holliday Creek is shown in figure 2. Peak discharge over the spillway at Lake Wichita was computed to be about 3,000 second-feet. This checked fairly well with the peak discharge of Holliday Creek at U. S. Highway 82, 6.2 miles below Lake Wichita, which was determined from the known peak stage and area-velocity studies of current-meter measurements made after the peak occurred. A view of the spillway at Lake Wichita at about the peak discharge is shown in figure 4.

Lake Kickapoo on the North Fork Little Wichita River reached its maximum stage and discharged over the spillway for the first time since storage began February 1, 1946. Peak discharge over the spillway was 14,500 second-feet by computed spillway rating. A view of Lake Kickapoo some time after the peak had passed is shown in figure 3. The gaging station on the Little Wichita River below the confluence of the North and Middle Forks had a peak discharge of 15,100 second-feet, indicating that the major part of the flow came from the North Fork. The Little

Figure 2.-- Flooded area along Holliday Creek in Wichita Falls, Tex. August 1 - 6, 1950

Figure 3.--Lake Kickapoo on North Fork Little Wichita River near Archer City, Tex. August 2, 1950

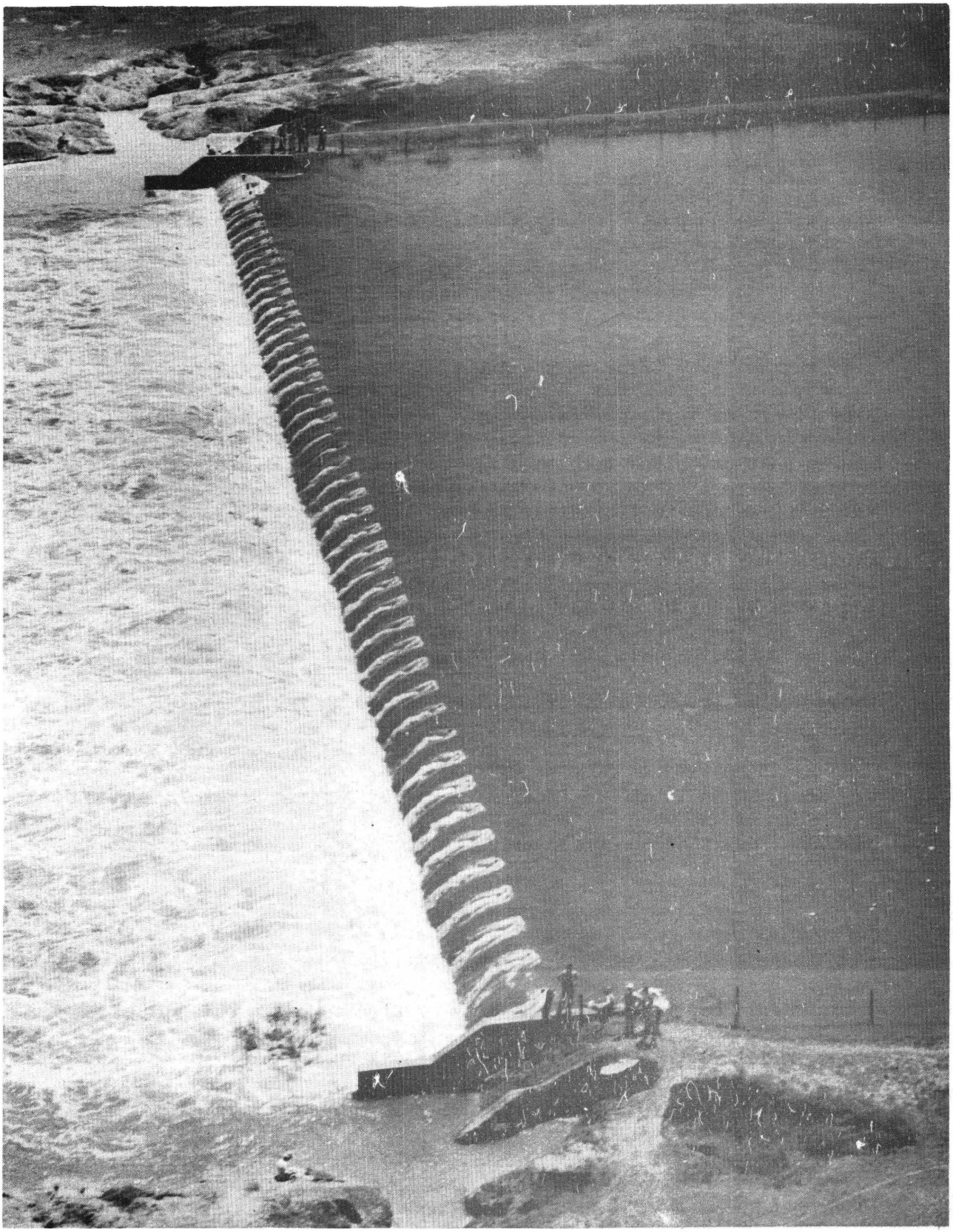

Figure 4.-- Lake Wichita on Holliday Creek near Wichita Falls, Tex. at about the peak of flood of August 3, 1950

Wichita River, though seriously flooded, did not cause much damage other than soil and crop losses because it heads in and meanders through farm and ranch country.

Lake Kemp on the Wichita River made a considerable gain in storage, but at no time during the flood period was any water released from the lake nor did any flow over the spillway. Lake Diversion on the Wichita River, 18 river miles below the Lake Kemp dam, was discharging some water over the spillway prior to the August 1 storm. The peak discharge over Lake Diversion spillway was computed to be 5,360 second-feet, and at the gaging station on the Wichita River at Wichita Falls, the peak discharge was 9,000 second-feet, indicating considerable inflow between Lake Diversion, mainly from Beaver Creek and Buffalo Creek. Only a small area was inundated by the Wichita River within the city.

Reports indicate that high stages of this flood were exceeded by those during the flood of 1941. The peak discharge of the flood of June 8, 1915, on the Wichita River was computed to be 50,000 second-feet by Vernon L. Sullivan, engineer for the Big Wichita River Irrigation Co.; however, this flood occurred prior to the completion of Lake Kemp on the Wichita River.

## DAMAGES

The direct damages in the city of Wichita Falls resulting from the flood on Holliday Creek during the period August 1-3, 1950, are estimated at $291,500 as shown below:

| | Estimated damage |
|---|---|
| Residential property | $210,000 |
| Municipal property | 65,000 |
| Business and Industrial property | 16,500 |
| | $291,500 |

The above figures do not include indirect damages which consist of losses due to the interruption to normal business and commerce, wage losses, and relief, care and rehabilitation of flood victims.

## STAGES AND DISCHARGES AT STREAM-GAGING STATIONS

Stage and discharge records obtained at four stream-gaging stations in the vicinity of Wichita Falls during the flood of August 1-6, 1950, are presented on the following pages. The stations are listed in table 1 and their locations shown on figure 1. Graphs of discharge plotted from station records are shown in figure 5. Complete records for all stations except Wichita River at Lake Diversion near Dundee are published regularly in the annual series of reports on Surface Water Supply of the United States, Part 7, Lower Mississippi River Basin. There is no regular stream-gaging station maintained on Wichita River at Lake Diversion near Dundee, but available records are included in this report to obtain a more complete study of the flood flow. Daily records of stage and discharge or contents are available for the stations as follows:

| Station | Period of Record |
|---|---|
| Wichita River at Lake Kemp near Mabelle, Tex. | October 1922, to date |
| Wichita River at Lake Diversion near Dundee, Tex. | August 1-6, 1950 |
| Wichita River at Wichita Falls, Tex. | March 1938, to date |
| North Fork Little Wichita River at Lake Kickapoo near Archer City, Tex. | February 1946, to date |
| Little Wichita River near Archer City, Tex. | May 1932, to date |
| Red River near Terral, Okla. | April 1938, to date |

No reliable data were available for floods prior to period of record.

Table 1.--Summary of Peak Discharges in the Wichita Falls Area, August 1950

| No. on Fig. 1 | Stream | Drainage area (square miles) | Maximum flood previously known | | | | Maximum during present flood | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Period of known floods | Date | Gage height (feet) | Discharge (second-feet) | Time | Gage height (feet) | Discharge (second-feet) |
| 1 | Wichita River at Lake Kemp near Mabelle | 1,988 | 1922-50 | June 30, 1941 | 1,149.6 | a/420,900 | Aug. 5-7 | 1,148.5 | a/402,500 |
| 2 | Wichita River at Lake Diversion near Dundee | b/2,108 | - | - | - | - | Aug. 1 4:30 p.m. | 1,054.4 | c/ 5,360 |
| 3 | Wichita River at Wichita Falls | b/3,105 | 1915-23 | d/June 8, 1915 | | e/ 50,000 | Aug. 4, 1:30 a.m. | 21.42 | 9,000 |
| | | | 1924-50 | Oct. 3, 1941 | 24.00 | 17,800 | | | |
| 4 | North Fork Little Wichita River at Lake Kickapoo near Archer City | 284 | 1946-50 | f/ - | - | - | Aug. 2, 1 a.m. | 1,049.2 | g/ 14,500 |
| 5 | Little Wichita River near Archer City | 496 | 1932-50 | Oct. 31, 1941 | 26.18 | 17,900 | Aug. 2, 4 p.m. | 25.91 | 15,100 |
| 6 | Red River near Terral, Okla. | h/28,280 | 1938-50 | June 8, 1941 | 28.12 | 197,000 | Aug. 2, 1 p.m. | 17.36 | 25,800 |

a/ Maximum contents in acre-feet.
b/ Of which 1,988 square miles is above Lake Kemp dam.
c/ Discharge from computed rating for spillway of Lake Diversion dam.
d/ Flood occurred prior to completion Lake Kemp dam.
e/ Discharge computed by Vernon L. Sullivan, engineer for Big Wichita Irrigation Co.
f/ No discharge over spillway prior to July 28,1950.
g/ Discharge from computed rating for spillway of Lake Kickapoo dam furnished by city of Wichita Falls.
h/ Of which 5,440 square miles is probably noncontributing.

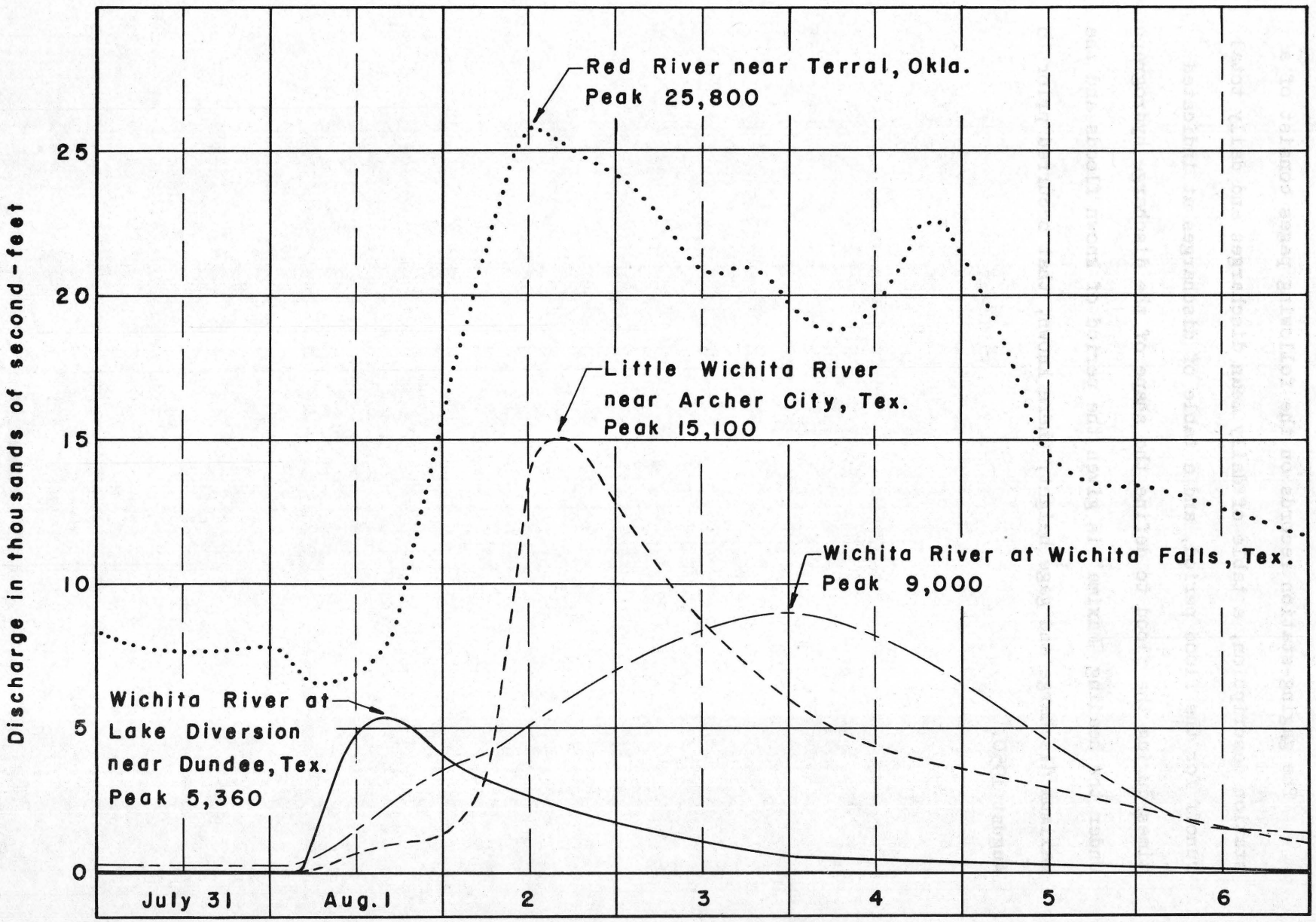


Figure 5. -- Graphs of discharge of various streams in Wichita Falls area, 1950.

The gaging-station records on the following pages consist of a station description, a table of daily mean discharges and daily total runoff for the flood period, and a table of discharges at indicated times during the flood to define the shape of the discharge hydrograph. Under the heading "Maxima" is given the period of known floods and the maximum discharge and gage height, where known, that occurred prior to August 1950.

## Wichita River at Lake Kemp near Mabelle, Tex.

Location.- Lat. 33°45', long. 99°09', in outlet-gate control house of reservoir, 6.2 miles north of Mabelle, Baylor County, and 10.2 miles northeast of Seymour. Datum of gage is 2.4 feet above mean sea level, datum of 1929, Fort Worth supplementary adjustment of 1942.

Drainage area - 1,988 square miles.

Gage-height record.- From graph based on tape-gage readings.

Discharge record.- No flow over spillway. Capacity table furnished by Corps of Engineers and was based on their field survey in 1944. Storage began Oct. 1, 1922, and dam completed Aug. 25, 1923.

Maxima.- Aug. 1950: Contents, 402,500 acre-feet, Aug. 5-7 (gage height, 1,148.5 feet).
1922-49: Contents, 420,900 acre-feet, June 30, 1941 (gage height, 1,149.6 feet).

Remarks.- No water was released from Lake Kemp during the period Aug. 1-6. Records of daily gage heights furnished by Wichita County Water Improvement Districts Nos. 1 and 2. Reservoir capacity 438,000 acre-feet at spillway service crest (gage height, 1,150.6).

Contents in and runoff into Lake Kemp, in acre-feet, 1950

| Day | Contents | Runoff | Day | Contents | Runoff |
|---|---|---|---|---|---|
| July 31 | 371,100 | -- | Aug. | | |
| Aug. 1 | 374,400 | 3,300 | 4 | 400,800 | 1,600 |
| 2 | 390,900 | 16,500 | 5 | 402,500 | 1,700 |
| 3 | 399,200 | 8,300 | 6 | 402,500 | 0 |
| Runoff in acre-feet, for period Aug. 1-6 . . . . . | | | | | 31,400 |

## Wichita River at Lake Diversion near Dundee, Tex.

Location.- Lat. 33°49', long. 98°56', above spillway of Lake Diversion dam, 5.7 miles north northeast of Dundee, Archer County.

Drainage Area.- 2,108 square miles of which 1,988 square miles is above Lake Kemp dam.

Gage-height record.- From graph based on staff-gage readings.

Discharge record.- Stage-discharge relation from computed rating curve for spillway.

Maxima.- Aug. 1950: Discharge, 5,360 second-feet at 4:30 p.m. Aug. 1 (elevation 1054.4 feet).
No record of previous floods available.

Remarks.- Reservoir full and discharging over spillway during flood period, capacity about 40,000 acre-feet. No water released from Lake Kemp during the period of Aug. 1-6.

Mean discharge, in second-feet, and runoff, in acre-feet, 1950

| Day | Second-feet | Acre-feet | Day | Second-feet | Acre-feet |
|---|---|---|---|---|---|
| Aug. | | | Aug. | | |
| 1 | 3,300 | 6,550 | 4 | 465 | 922 |
| 2 | 2,760 | 5,470 | 5 | 270 | 536 |
| 3 | 1,060 | 2,100 | 6 | 150 | 298 |

Runoff, in acre-feet, for period Aug. 1-6..... 15,880

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1950

| Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. |
|---|---|---|---|---|---|---|---|---|
| July 31 | | | (Aug. 1 cont.) | | | (Aug. 3 cont.) | | |
| 1 a.m. | 1051.53 | 70 | 4 p.m. | 1054.40 | 5,360 | 12 m. | 1052.47 | 1,040 |
| 12 m. | 1051.48 | 60 | 6 | 1054.38 | 5,300 | 6 p.m. | 1052.32 | 760 |
| | | | 8 | 1054.28 | 5,060 | | | |
| Aug. 1 | | | 10 | 1054.11 | 4,580 | Aug. 4 | | |
| 1 a.m. | 1051.43 | 30 | | | | 1 a.m. | 1052.18 | 590 |
| 4 | 1051.55 | 80 | Aug. 2 | | | 12 m. | 1052.07 | 470 |
| 5 | 1051.92 | 320 | 1 a.m. | 1053.88 | 4,010 | | | |
| 6 | 1052.38 | 880 | 6 | 1053.58 | 3,300 | Aug. 5 | | |
| 7 | 1052.80 | 1,650 | 12 m. | 1053.32 | 2,700 | 1 a.m. | 1051.96 | 360 |
| 8 | 1053.22 | 2,500 | 6 p.m. | 1053.07 | 2,200 | 12 m. | 1051.87 | 280 |
| 10 | 1053.78 | 3,780 | | | | | | |
| 12 m. | 1054.18 | 4,790 | Aug. 3 | | | Aug. 6 | | |
| 2 p.m. | 1054.36 | 5,220 | 1 a.m. | 1052.81 | 1,660 | 1 a.m. | 1051.76 | 200 |
| | | | 6 | 1052.64 | 1,340 | 12 m. | 1051.67 | 150 |

## Wichita River at Wichita Falls, Tex.

Location.- Lat. 33°54'33", long. 98°32'05" at Tenth Street bridge in Wichita Falls, Wichita County, 7 miles upstream from Holliday Creek. Datum of gage is 924.3 feet above mean sea level, datum of 1929.

Drainage area.- 3,105 square miles, of which 1,988 square miles is above Lake Kemp dam.

Gage-height record.- From graph based on wire-weight gage readings.

Discharge record.- Stage-discharge relation defined by current-meter measurements.

Maxima.- Aug. 1950: Discharge, 9,000 second-feet at 1:30 a.m. Aug. 4 (gage height, 21.42 feet).

1938-49: Discharge, 17,800 second-feet Oct. 3, 1941 (gage height, 24.00 feet).

Maximum discharge known prior to the completion of Lake Kemp, 50,000 second-feet June 8, 1915, computed by Vernon L. Sullivan, engineer for Big Wichita River Irrigation Co.

Remarks.- Flow partly regulated by Lake Kemp (capacity 438,000 acre-feet). Storage in Lake Kemp increased about 31,400 acre-feet as a result of inflow from the Aug. 1 storm. No water was released from Lake Kemp during the period Aug. 1-6.

Mean discharge, in second-feet, and runoff in acre-feet, 1950.

| Day | Second-feet | Acre-feet | Day | Second-feet | Acre-feet |
|---|---|---|---|---|---|
| Aug. 1 | 1,660 | 3,290 | Aug. 4 | 7,800 | 15,470 |
| 2 | 5,180 | 10,270 | 5 | 4,540 | 9,000 |
| 3 | 8,280 | 16,420 | 6 | 1,760 | 3,490 |
| Runoff, in acre-feet, for period Aug. 1-6. . . . . | | | | | 57,940 |

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1950

| Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. |
|---|---|---|---|---|---|---|---|---|
| July 31 | | | (Aug. 1 cont.) | | | (Aug. 2 cont.) | | |
| 1 a.m. | 4.25 | 313 | 10 a.m. | 6.76 | 1,100 | 3 a.m. | 13.72 | 3,830 |
| 12 m. | 4.08 | 261 | 12 m. | 7.82 | 1,460 | 6 | 14.52 | 4,180 |
| 6 p.m. | 3.88 | 202 | 2 p.m. | 9.00 | 1,940 | 9 | 15.35 | 4,580 |
| | | | 4 | 9.88 | 2,280 | 12 m. | 16.38 | 5,160 |
| Aug. 1 | | | 6 | 10.80 | 2,640 | 3 p.m. | 17.25 | 5,710 |
| 1 a.m. | 4.20 | 298 | 8 | 11.67 | 2,990 | 6 | 18.02 | 6,210 |
| 4 | 4.58 | 420 | 10 | 12.38 | 3,270 | 9 | 18.72 | 6,660 |
| 6 | 5.20 | 604 | | | | | | |
| 8 | 5.94 | 840 | Aug. 2 | | | Aug. 3 | | |
| | | | 1 a.m. | 13.20 | 3,610 | 1 a.m. | 19.44 | 7,220 |

## Wichita River at Wichita Falls, Tex. (Cont'd)

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1950

| Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. |
|---|---|---|---|---|---|---|---|---|
| (Aug. 3 cont.) | | | (Aug. 4 cont.) | | | (Aug. 5 cont.) | | |
| 4 a.m. | 19.87 | 7,600 | 8 p.m. | 20.18 | 7,210 | 9 p.m. | 12.56 | 3,090 |
| 8 | 20.36 | 8,000 | | | | | | |
| 12 m. | 20.74 | 8,350 | Aug. 5 | | | Aug. 6 | | |
| 4 p.m. | 21.06 | 8,660 | 1 a.m. | 19.25 | 6,480 | 1 a.m. | 10.90 | 2,510 |
| 8 | 21.28 | 8,880 | 3 a.m. | 18.80 | 6,120 | 3 | 10.08 | 2,230 |
| | | | 6 | 18.03 | 5,600 | 6 | 9.26 | 1,940 |
| Aug. 4 | | | 9 | 17.14 | 5,010 | 9 | 8.77 | 1,780 |
| 1 a.m. | 21.42 | 9,000 | 12 m. | 16.16 | 4,500 | 12 m. | 8.41 | 1,660 |
| 12 m. | 21.10 | 8,200 | 3 p.m. | 15.03 | 4,020 | 4 p.m. | 8.07 | 1,540 |
| 4 p.m. | 20.77 | 7,700 | 6 | 13.82 | 3,550 | 8 | 7.82 | 1,450 |

## Little Wichita River near Archer City, Tex.

Location.- Lat. 33°40', long. 98°36', at bridge on State Highway 79, 1.5 miles downstream from confluence of North and Middle Forks, and 4.8 miles north of Archer City, Archer County. Datum of gage is 934.72 feet above mean sea level, datum of 1929.

Drainage area.- 496 square miles.

Gage-height record.- Water-stage recorder graph.

Discharge record.- Stage-discharge relation defined by current-meter measurements.

Maxima.- Aug. 1950: Discharge, 15,100 second-feet at 4 p.m. Aug. 2 (gage height, 25.91 feet).
1932-49: Discharge, 17,900 second-feet, Oct. 31, 1941 (gage height, 26.18 feet).

Remarks.- Flow partly regulated by Lake Kickapoo on North Fork. Lake Kickapoo full and discharging over spillway during period Aug. 1-6. Flow at high stages affected by natural storage in wide flood plain.

Mean discharge, in second-feet, and runoff, in acre-feet, 1950

| Day | Second-feet | Acre-feet | Day | Second-feet | Acre-feet |
|---|---|---|---|---|---|
| Aug. | | | Aug. | | |
| 1 | 614 | 1,220 | 4 | 4,400 | 8,730 |
| 2 | 9,550 | 18,940 | 5 | 2,970 | 5,890 |
| 3 | 9,100 | 18,050 | 6 | 1,660 | 3,290 |
| Runoff, in acre-feet, for period Aug. 1-6. . . . . | | | | | 56,120 |

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1950

| Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. |
|---|---|---|---|---|---|---|---|---|
| July 31 | | | (Aug. 1 cont.) | | | Aug. 4 | | |
| 12 m. | 5.03 | 43 | 10 p.m. | 19.08 | 1,230 | 1 a.m. | 24.99 | 6,000 |
| | | | 11:30 | 19.94 | 1,350 | 12 m. | 24.82 | 4,420 |
| Aug. 1 | | | | | | | | |
| 1 a.m. | 5.02 | 42 | Aug. 2 | | | Aug. 5 | | |
| 5 | 5.02 | 42 | 1 a.m. | 21.07 | 1,550 | 1 a.m. | 24.57 | 3,600 |
| 6 | 5.45 | 88 | 2 | 21.82 | 1,720 | 6 | 24.39 | 3,300 |
| 7 | 7.40 | 180 | 4 | 23.17 | 2,180 | 12 m. | 24.03 | 2,990 |
| 8 | 9.00 | 295 | 6 | 24.30 | 3,140 | 6 p.m. | 23.62 | 2,680 |
| 9 | 10.45 | 405 | 9 | 25.12 | 7,200 | | | |
| 10 | 11.72 | 505 | 12 m. | 25.70 | 13,200 | Aug. 6 | | |
| 11 | 12.80 | 595 | 4 p.m. | 25.91 | 15,100 | 1 a.m. | 22.90 | 2,230 |
| 12 m. | 13.72 | 674 | 8 | 25.84 | 14,400 | 4 | 22.56 | 2,050 |
| 1 p.m. | 14.60 | 753 | 11:30 | 25.71 | 13,200 | 8 | 22.00 | 1,840 |
| 2 | 15.30 | 818 | | | | 12 m. | 21.28 | 1,630 |
| 4 | 16.33 | 915 | Aug. 3 | | | 3 p.m. | 20.68 | 1,490 |
| 6 | 17.18 | 1,000 | 1 a.m. | 25.65 | 12,600 | 6 | 19.96 | 1,350 |
| 8 | 17.97 | 1,090 | 6 | 25.46 | 10,800 | 9 | 19.17 | 1,240 |
| | | | 12 m. | 25.26 | 8,800 | 11 | 18.62 | 1,170 |
| | | | 6 p.m. | 25.10 | 7,200 | | | |

## Red River near Terral, Okla.

Location.- Lat. 33°52'50", long. 97°56'15", at bridge on U. S. Highway 81, 1.2 miles south of Terral, Jefferson County, and 3.2 miles downstream from Little Wichita River. Datum of gage is 770.31 feet above mean sea level, datum of 1929.

Drainage area.- 28,280 square miles, of which 5,440 square miles is probably noncontributing.

Gage-height record.- Water-stage recorder graph.

Discharge record.- Stage-discharge relation defined by current-meter measurements.

Maxima.- Aug. 1950: Discharge, 25,800 second-feet at 1 p.m. Aug. 2 (gage height, 17.36 feet).
1938-49: Discharge, 197,000 second-feet June 8, 1941 (gage height, 28.12 feet).

Remarks.- Flow slightly regulated by Lake Kemp on Wichita River in Baylor County, Tex.

Mean discharge, in second-feet, and runoff, in acre-feet, 1950

| Day | Second-feet | Acre-feet | Day | Second-feet | Acre-feet |
|---|---|---|---|---|---|
| Aug. 1 | 8,320 | 16,500 | Aug. 4 | 20,300 | 40,260 |
| 2 | 23,100 | 45,820 | 5 | 15,800 | 31,340 |
| 3 | 21,700 | 43,040 | 6 | 12,600 | 24,990 |
| Runoff, in acre-feet, for period Aug. 1-6 . . . . . | | | | | 201,950 |

Gage-height, in feet, and discharge, in second-feet, at indicated time, 1950

| Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. | Hour | Feet | Sec.-ft. |
|---|---|---|---|---|---|---|---|---|
| July 31 | | | (Aug. 2 cont.) | | | (Aug. 4 cont.) | | |
| 1 a.m. | 14.72 | 8,390 | 6 a.m. | 16.87 | 21,700 | 6 p.m. | 16.95 | 22,400 |
| 12 m. | 14.50 | 7,780 | 9 | 17.06 | 24,000 | | | |
| | | | 1 p.m. | 17.36 | 25,800 | Aug. 5 | | |
| Aug. 1 | | | 6 | 17.30 | 25,100 | 1 a.m. | 16.85 | 20,900 |
| 1 a.m. | 14.11 | 7,880 | | | | 6 | 16.47 | 18,400 |
| 6 | 13.96 | 6,550 | Aug. 3 | | | 12 m. | 15.94 | 14,600 |
| 12 m. | 14.13 | 6,900 | 1 a.m. | 17.19 | 24,200 | 6 p.m. | 15.77 | 13,500 |
| 4 p.m. | 14.44 | 7,610 | 12 m. | 16.75 | 20,900 | | | |
| 6 | 14.88 | 8,940 | 6 p.m. | 16.80 | 20,900 | Aug. 6 | | |
| 8 | 15.40 | 11,400 | | | | 1 a.m. | 15.73 | 13,400 |
| 10 | 15.82 | 13,800 | Aug. 4 | | | 12 m. | 15.61 | 12,700 |
| | | | 1 a.m. | 16.62 | 19,500 | | | |
| Aug. 2 | | | 6 | 16.40 | 17,900 | | | |
| 1 a.m. | 16.27 | 16,900 | 12 m. | 16.66 | 19,700 | | | |
| 3 | 16.48 | 18,500 | 3 p.m. | 16.84 | 20,900 | | | |