UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FLOODS IN NORTH CAROLINA

MAGNITUDE AND FREQUENCY

By H. C. Riggs

Prepared in cooperation with the

NORTH CAROLINA STATE HIGHWAY AND PUBLIC WORKS COMMISSION

Open-file report
55-151
Raleigh, N. C., 1955

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ABSTRACT

Recorded annual flood stages and discharges at 144 gaging stations are listed. Also included are maximum known flood stages and discharges, both at gaging stations and at miscellaneous sites. Using the annual flood discharges at gaging stations a regional analysis of flood magnitudes and frequencies in the State was made. Results of the analysis are (1) a composite annual flood frequency curve for North Carolina, (2) two composite seasonal flood-frequency curves for the State, and (3) curves for transferring the composite frequency curves to specific sites on the basis of location and drainage area. A summary shows the flood-frequency relationships, the method of determining flood frequency at a site, and the application of flood-frequency information to typical problems.

INTRODUCTION

Purpose

Floods are most often studied because of their potential for damaging the works of man and the natural resources he depends on. Protection from flood damage cannot be provided unless reliable estimates of the magnitudes of future floods are available. Such estimates must necessarily be based on past flood experience. For North Carolina this report provides (1) available basic data on floods, (2) definition of the geographic variations in flood potential, and (3) a simple method of estimating flood magnitudes and frequencies at gaged and ungaged sites in the State.

Scope

This report presents for the first time a compilation of annual floods (the highest instantaneous gage height and discharge during the year) at each of 144 stream-gaging stations in North Carolina and adjacent states. These flood discharges have been computed from the original records of stage and discharge; in some cases this involved revision of previously published figures on the basis of more recent information. In addition, major floods that occurred prior to the beginning of the record have been included where stage and discharge were found available. These data provide the basis for development of flood-frequency relations for streams in the State.

A flood-frequency curve for a gaging station can be constructed by any of several standard methods. Such a curve shows the known flood experience at the site and allows the estimation of future flood magnitudes corresponding to selected recurrence intervals. However, the small sample of annual floods may not truly represent the long-term frequency relation because of random variation and possibly because of time trends. Experience has shown that a general frequency curve applicable over a fairly wide region may be obtained by combining the records of many stations within that region. The composite flood-frequency curve averages the flood experience throughout the area, in effect improving the record over that for any one station. Furthermore, it provides a frequency curve applicable not only to gaged sites but to ungaged sites as well. Any effect of time trends is included in the composite curve; that effect can only be reduced by using as long a record as possible.

Analyses of floods are made using discharge in preference to stage. Discharge depends upon storm types and drainage-basin characteristics, both of which are ordinarily subject to little change over a period of years. The relation of stage to flood magnitude changes from place to place along the channel and often changes with time at any given location. Further, stage data at gaged sites cannot be used to estimate flood magnitudes at ungaged sites.

Individual discharge-frequency curves may be combined after reducing their ordinates to a common (dimensionless) factor called "ratio to mean annual flood." Obviously, individual curves that differ markedly should not be combined. A statistical test is used to determine whether the variation of an individual curve from the group mean is greater than might be attributed to chance.

The composite curve defines in shape and slope the frequency relation throughout the area, the ordinate being expressed in dimensionless terms. In order to transfer the composite curve to a specific site, its position with respect to that site must be established; in other words, the ordinate must be changed back to discharge. This is accomplished by establishing a definite value for the mean annual flood at the site. The mean annual flood as determined at each individual gaging station is a sample of the basic long-term value, and subject to chance variation.

In order to reduce that variation, areas of similar flood behavior are defined by correlating the data on mean annual floods and drainage-basin characteristics, and a mean curve is drawn for each such area. Then the mean annual flood for a specific site may be obtained from the appropriate mean curve. These curves permit mean annual floods to be determined for ungaged sites. Use of this procedure even at gaged sites tends to give more reliable values of mean annual floods than would be obtained from individual station records.

The composite frequency curve and the curves relating mean annual flood to basin characteristics allow computation of the flood magnitude-frequency relation at any selected site as needed for planning and design. Many structures are designed to withstand a flood having a recurrence interval of less than 50 years and it is below that recurrence interval that frequency curves are most reliable. The greater part of this report is given to flood-frequency analysis and its application to North Carolina streams. Emphasis is placed on the development of relations that are simple to apply and that yield reliable results.

Although the procedure just described provides information most frequently needed, problems arise in which other aspects of frequency are involved. For instance, the frequency of overtopping a fill on a secondary road may be considered in the economics of a crossing design. For such purpose a modification of the above-described flood-frequency method is presented. Likewise, construction plans may be based on the probable frequency of floods at the time of year in which the work is to be accomplished. Such seasonal information is provided by composite frequency curves of annual summer floods and annual winter floods. Results of the various analyses and instructions for use are summarized at the end of the report.

Personnel and Acknowledgments

This report was prepared in the Raleigh district office of the Water Resources Division of the U. S. Geological Survey as part of a cooperative program with the North Carolina State Highway and Public Works Commission. The Water Resources Division of the Geological Survey is under the direction of C. G. Paulsen, Chief Hydraulic Engineer, with J. V. B. Wells, Chief of the Surface Water Branch. Surface-water work in North Carolina is directed by E. B. Rice, District Engineer. The North Carolina State Highway and Public Works Commission is represented by W. H. Rogers, Jr., State Highway Engineer, T. B. Gunter, Jr., State Bridge Engineer, and W. S. Winslow, Hydrographic Engineer.

The basic data on floods were collected principally by the Geological Survey in cooperation with various state, federal, and other public agencies. Flood records in this report include data furnished by Geological Survey offices in Virginia, South Carolina, Georgia, and Tennessee and by the following federal agencies: Weather Bureau, Corps of Engineers, and Tennessee Valley Authority. Analysis of the data follows general procedures developed by the Geological Survey.

PHYSICAL CHARACTERISTICS OF THE STATE

North Carolina is situated on the eastern slope of the Appalachian Mountains and extends from the highest mountains in eastern United States to the Atlantic Ocean. The State comprises three distinct physiographic regions, the Mountain Region, the Piedmont Plateau, and the Coastal Plain. These regions are shown in figure 1. The Mountain Region may be considered a high plateau bounded and crossed by mountain ranges. The transition from the Mountain Region to the Piedmont Plateau is very sharp, there being a drop of as much as 1,500 feet within a few miles. The Piedmont Plateau is a region of gently rolling topography ranging in altitude from about 1,000 feet in the northwestern section to approximately 300 feet in the southeast. The boundary between the Piedmont and Coastal Plain, commonly called the fall line, is actually a zone 30 to 40 miles wide through which the topography slopes from an average of about 450 feet above sea level at the eastern edge of the Piedmont to an average of about 250 feet at the western edge of the Coastal Plain. The Coastal Plain may be further divided into an inner portion that is slightly rolling and

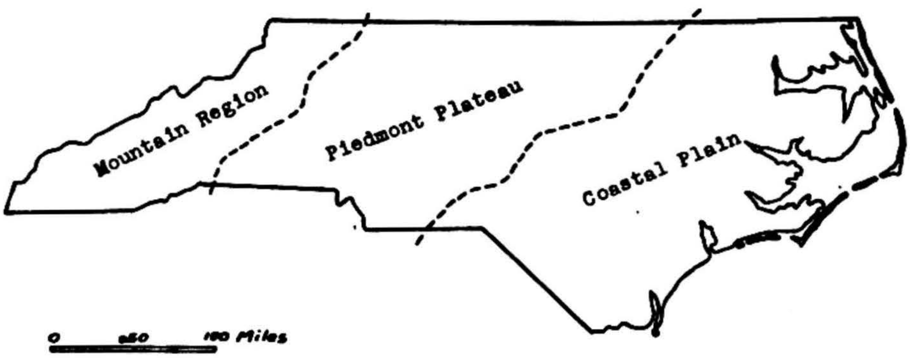

Figure 1.--Physiographic regions of North Carolina

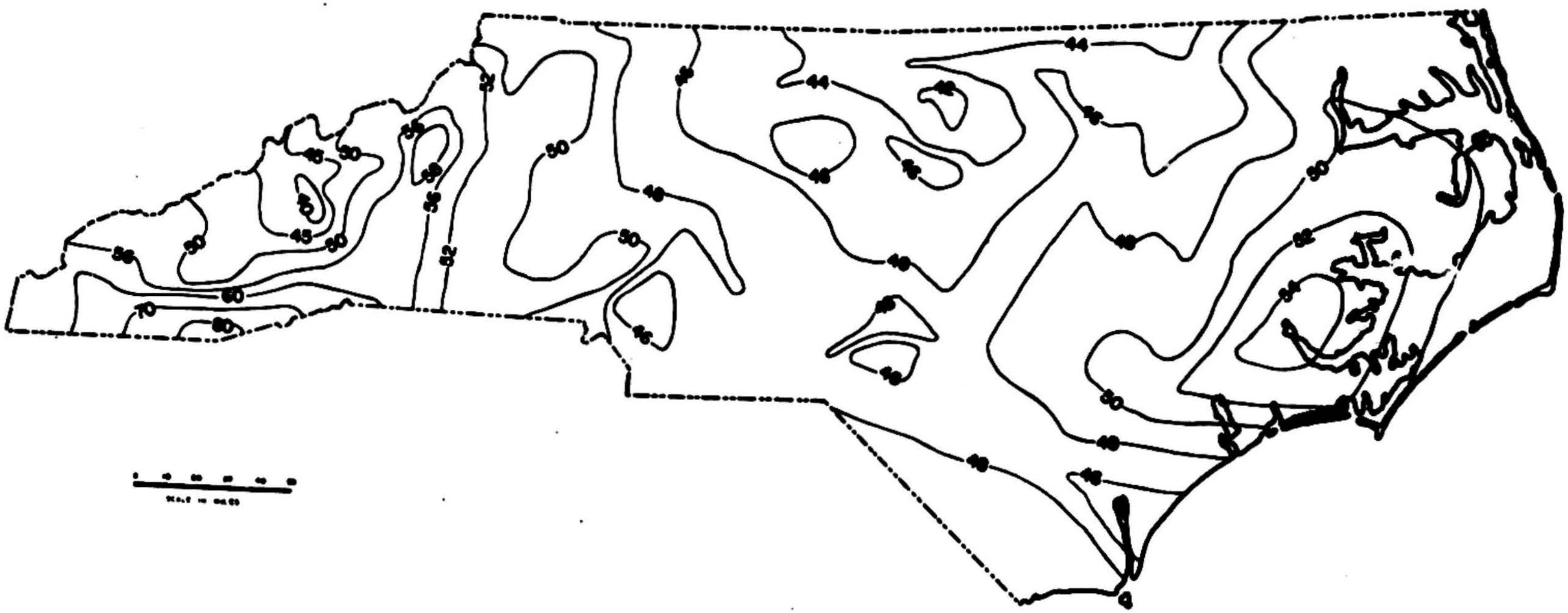

Figure 2.--Mean annual precipitation in inches in North Carolina

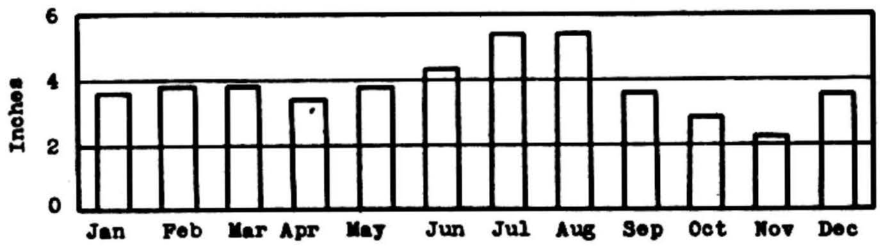

Figure 3.--Mean monthly precipitation, in inches, at Raleigh, N. C.

well drained and a tidal portion consisting of flat swampy land. A portion of the inner Coastal Plain in Moore and adjacent counties is locally known as the Sandhills.

The geology of North Carolina is complex. Regions of similar geologic conditions do not produce similar flood activity except insofar as they correspond with regions of similar topography and soil types.

North Carolina has an average climate typical of the warm temperate zone. The climate of the Coastal Plain is affected by the moderating influence of the ocean and by its location in the path of northeastward storms. In contrast, the Mountain Region has experienced the lowest temperatures and the greatest extremes of precipitation. Figure 2 shows mean annual precipitation for the State. Mean monthly rainfall is a minimum in autumn, increases progressively through winter and spring, and reaches a maximum in summer. A typical monthly rainfall distribution is shown in figure 3. The intensity of rainfall is usually greatest in summer. Snow is not uncommon except along the coast but even in the mountains snow rarely contributes to production of a large flood.

The larger North Carolina streams originate in the Piedmont or in the Mountain Region. Those east of the mountains flow from the Piedmont through the Coastal Plain to the Atlantic Ocean. The Roanoke, Tar, Neuse, and Cape Fear Rivers have their mouths in North Carolina. The Yadkin-Pee Dee, Catawba, and Broad Rivers flow southward into South Carolina. Streams draining the Mountain Region west of the Blue Ridge flow into Tennessee River with the exception of those draining a small area comprising principally Ashe and Alleghany Counties which is in the New-Kanawha River Basin. Both Tennessee and Kanawha Rivers are tributary to Ohio River.

GAGING-STATION RECORDS

Stream flow data in North Carolina are available in records of the Geological Survey since 1889.

Annual flood peaks are published in many of the Water-Supply Papers of the Geological Survey but a compilation of annual floods for North Carolina streams has never been made previously. This report contains listings of annual floods for all stations used in the flood-frequency analysis. Preparation of this compilation began with a review of original analyses of gaging-station data. This review was followed by (1) computation of certain annual flood discharges which were not previously determined, (2) revision of some published annual flood discharges, (3) search for flood data recorded by other sources, and (4) the compilation. Revised flood stages and discharges are not labelled as such in this report. If those given in this report differ considerably from figures previously published in Water-Supply Papers the appropriate changes will be noted as revisions in subsequent Water-Supply Papers.

The bar graph of figure 4 (p. 5) shows the identifying number, the gaging-station name, the drainage area, and the period of years for which annual floods are available for each of the gaging stations used in this study. Many gaging stations other than those listed have been or are being operated in North Carolina; they were not used in this study because of the short length of available records or because of substantial artificial regulation of flood flows.

Table 1 (p. 10) shows (for the gaging stations listed in figure 4) the gage heights and discharges of all known annual floods and of known historic floods. The record for each gaging station is identified by number and name. Approximate locations of these gaging stations are shown and identified by number on the map of figure 5 (p. 9). Gaging-station descriptions are not included in this report but may be found in applicable Water-Supply Papers.

MAXIMUM FLOODS KNOWN

Maximum known flood stages and discharges of North Carolina streams are given in table 2 (p. 37). Most of these maximums were selected from table 1 but are repeated in table 2 for convenience. The order of listing is the same as that used in figure 4. Discharges are given in cubic feet per second and also in cubic feet per second per square mile. Some of the maximum discharges listed differ from those previously published in Water-Supply Papers. Where these differences are substantial and refer to the same flood, appropriate revisions will be published in subsequent Water-Supply Papers.

The maximum discharges in cubic feet per second per square mile are plotted against drainage area in figure 6 (p. 42).

Gaging Station	Drainage area (Square miles)
CHOWAN RIVER BASIN	
1. Blackwater River near Franklin, Va.	613
2. Meherrin River near Lawrenceville, Va.	553
3. Fontaine Creek near Emporia, Va.	96
ROANOKE RIVER BASIN	
4. Roanoke River at Roanoke, Va.	388
5. Dan River near Francisco, N. C.	124
6. North Mayo River near Spencer, Va.	108
7. Mayo River near Price, N. C.	260
8. Dan River near Wentworth, N. C.	1050
9. Smith River at Martinsville, Va.	374
10. Smith River at Spray, N. C.	538
11. Sandy River near Danville, Va.	113
12. Dan River at Danville, Va.	2050
13. Dan River at South Boston, Va.	2730
14. Banister River at Halifax, Va.	552
15. Hyco River near Omega, Va.	338
16. Roanoke River at Roanoke Rapids, N.C.	8410
17. Roanoke River near Scotland Neck, N. C.	8700
TAR RIVER BASIN	
18. Tar River near Tar River, N. C.	161
19. Tar River near Nashville, N. C.	701
20. Fishing Creek near Enfield, N. C.	521
21. Tar River at Tarboro, N. C.	2140
NEUSE RIVER BASIN	
22. Eno River at Hillsboro, N. C.	66.5
23. Flat River at Bahama, N. C.	150
24. Dial Creek near Bahama, N. C.	4.9
25. Rocky Creek near Bahama, N. C.	2.7
26. Neuse River near Northside, N. C.	526
27. Neuse River near Clayton, N. C.	1140
28. Middle Creek near Clayton, N. C.	80.7
29. Little River near Princeton, N. C.	229
30. Neuse River near Goldsboro, N. C.	2390
31. Neuse River at Kinston, N. C.	2690
32. Contentnea Creek near Wilson, N. C.	236
33. Contentnea Creek at Hookerton, N. C.	789
CAPE FEAR RIVER BASIN	
34. Haw River near Benaja, N. C.	168
35. Horsepen Creek at Battle Ground, N.C.	15.9
36. Reedy Fork near Gibsonville, N. C.	133
37. South Buffalo Creek near Greensboro, N. C.	32.8
38. North Buffalo Creek near Greensboro, N. C.	36.4
39. Haw River at Haw River, N. C.	599
40. Haw River near Pittsboro, N. C.	1310
41. Morgan Creek near Chapel Hill, N. C.	27
42. West Fork Deep River near High Point, N. C.	32.1

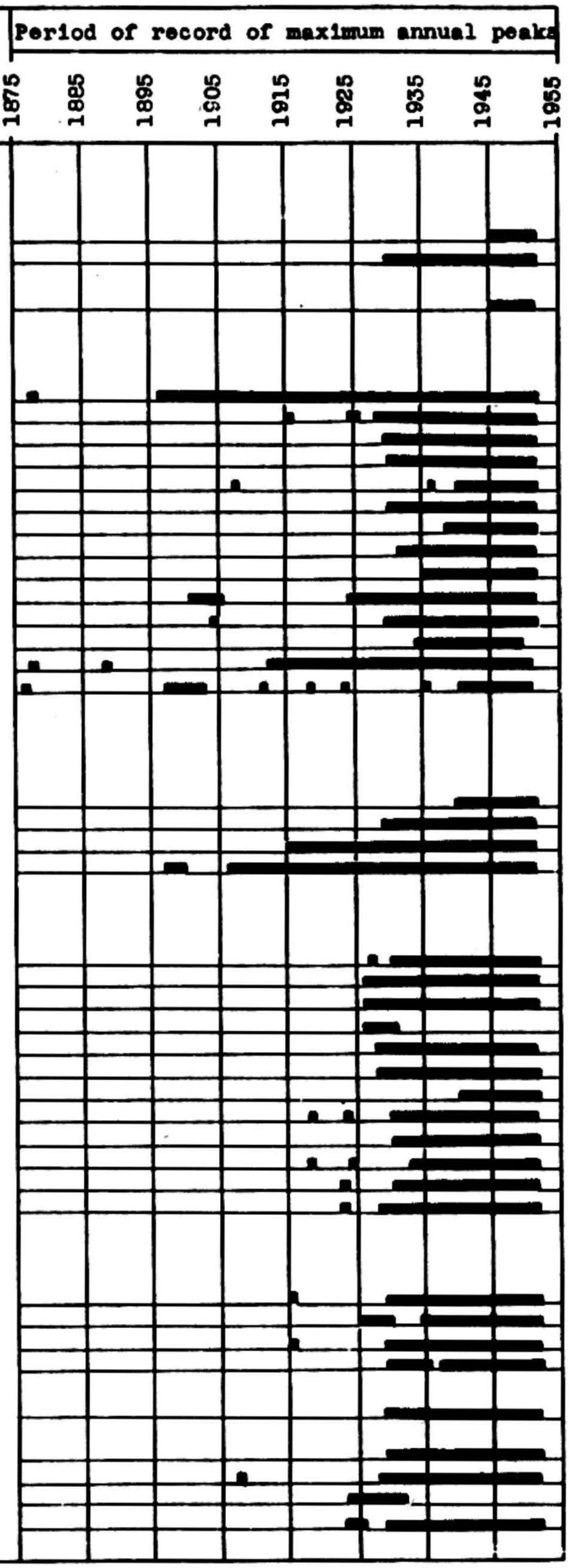

Figure 4 - Period of record of maximum annual peaks at gaging stations

Gaging Station	Drainage area (Square miles)
CAPE FEAR RIVER BASIN--Con.	
43. East Fork Deep River near High Point, N. C.	14.2
44. Deep River near Randleman, N. C.	124
45. Muddy Creek near Archdale, N. C.	16.2
46. Deep River at Ramseur, N. C.	346
47. Bear Creek at Robbins, N. C.	134
48. Deep River at Moncure, N. C.	1410
49. Cape Fear River at Lillington, N.C.	3440
50. Little River at Manchester, N. C.	348
51. Little River at Linden, N. C.	460
52. Cape Fear River at Fayetteville, N. C.	4370
53. Rockfish Creek near Hope Mills, N.C.	284
54. N. E. Cape Fear River near Chinquapin, N. C.	600
WACCAMAW RIVER BASIN	
55. Waccamaw River at Freeland, N. C.	626
YADKIN-PEE DEE RIVER BASIN	
56. Yadkin River at Patterson, N. C.	28.8
57. Reddies River at North Wilkesboro, N. C.	93.9
58. Yadkin River at Wilkesboro, N. C.	493
59. Fisher River near Dobson, N. C.	109
60. Fisher River near Copeland, N. C.	121
61. Forbush Creek near Yadkinville, N. C.	21.7
62. Yadkin River at Yadkin College, N. C.	2280
63. Rocky River at Turnersburg, N. C.	85.5
64. South Yadkin River near Mocksville, N. C.	313
65. Third Creek at Cleveland, N. C.	87.4
66. Yadkin River near Salisbury, N. C.	3400
67. Abbotts Creek at Lexington, N. C.	174
68. Yadkin River at High Rock, N. C.	3980
69. Uwharrie River near Trinity, N. C.	11.3
70. Uwharrie River near Eldorado, N. C.	347
71. Rocky River near Norwood, N. C.	1370
72. Little Brown Creek near Polkton, N. C.	13.5
73. Brown Creek near Polkton, N. C.	110
75. Pee Dee River at Cheraw, S. C.	7350
76. Juniper Creek near Cheraw, S. C.	64
77. Drowning Creek near Hoffman, N. C.	178
78. Lumber River at Boardman, N. C.	1220
79. Little Pee Dee River near Dillon, S. C.	524
SANTEE RIVER BASIN	
80. Catawba River near Marion, N. C.	171
81. Linville River at Branch, N. C.	65
82. Henry Fork near Henry River, N. C.	80
83. South Fork Catawba River at Lowell, N. C.	630

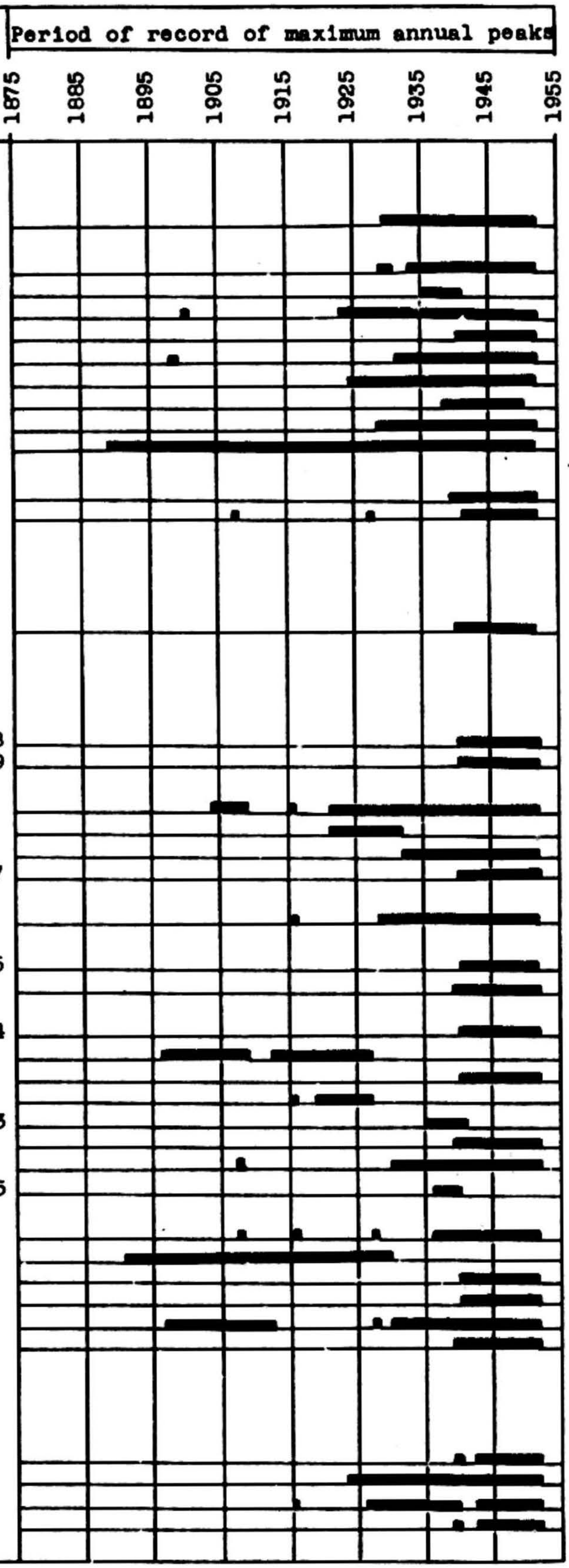

Figure 4 - Period of record of maximum annual peaks at gaging stations--Continued

Gaging Station	Drainage area (Square miles)
SANTEE RIVER BASIN--Con.	
84. Little Sugar Creek near Charlotte, N. C.	41.4
86. Second Broad River at Cliffside, N. C.	211
87. Broad River near Boiling Springs, N. C.	864
88. First Broad River near Lawndale, N. C.	198
89. North Pacolet River at Fingerville, S. C.	116
NEW RIVER BASIN	
91. South Fork New River near Jefferson, N. C.	207
93. New River near Galax, Va.	1131
94. North Fork New River at Crumpler, N. C.	277
FRENCH BROAD RIVER BASIN	
96. French Broad River at Rosman, N. C.	67.9
97. French Broad River at Calvert, N. C.	103
98. Catheys Creek near Brevard, N. C.	11.7
100. Davidson River near Brevard, N. C.	40.4
101. Little River near Penrose, N. C.	41.4
102. Crab Creek near Penrose, N. C.	10.9
103. French Broad River at Blantyre, N. C.	296
104. Boylston Creek near Horseshoe, N.C.	14.8
105. South Fork Mills River at The Pink Beds, N. C.	9.99
108. Mills River near Mills River, N. C.	66.7
109. Clear Creek near Hendersonville, N. C.	42.2
110. Mud Creek at Naples, N. C.	109
111. Cane Creek at Fletcher, N. C.	63.1
112. French Broad River at Bent Creek, N. C.	676
113. Hominy Creek at Candler, N. C.	79.8
114. North Fork Swannanoa River near Black Mountain, N. C.	23.8
115. Swannanoa River at Swannanoa, N. C.	62.1
116. Beetree Creek near Swannanoa, N. C.	5.46
117. Swannanoa River at Biltmore, N. C.	130
118. French Broad River at Asheville, N. C.	945
119. Sandymush Creek near Alexander, N. C.	79.5
120. Ivy River near Marshall, N. C.	158
121. French Broad River at Marshall, N. C.	1332
122. Big Laurel Creek near Stackhouse, N. C.	126
123. French Broad River at Hot Springs, N. C.	1567

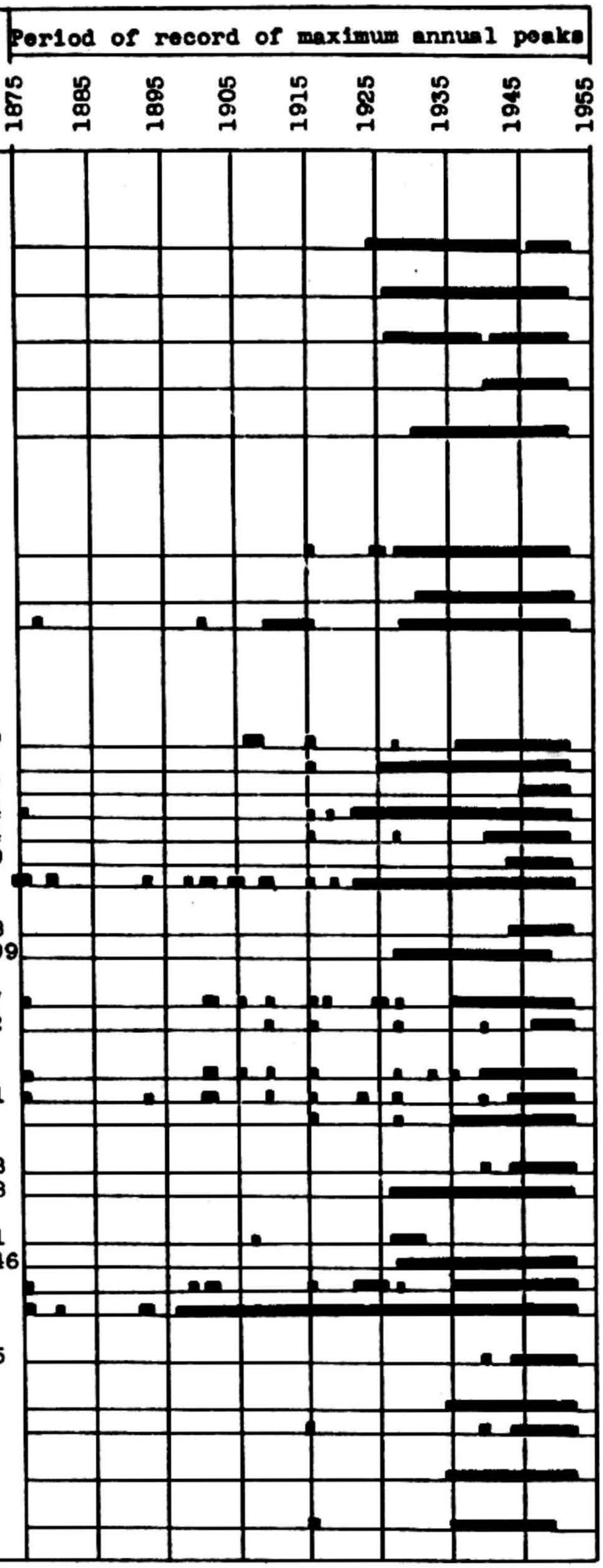

Figure 4 - Period of record of maximum annual peaks at gaging stations--Continued

Gaging Station	Drainage area (Square miles)
PIGEON RIVER BASIN	
124. Pigeon River at Canton, N. C.	133
126. Jonathan Creek near Cove Creek, N. C.	65.3
127. Pigeon River near Hepco, N. C.	350
128. Cataloochee Creek near Cataloochee, N. C.	49.2
NOLICHUCKY RIVER BASIN	
129. North Toe River at Altapass, N.C.	104
130. South Toe River at Newdale, N. C.	60.8
131. Cane River near Sioux, N. C.	157
132. Nolichucky River at Poplar, N. C.	608
WATAUGA RIVER BASIN	
133. Watauga River near Sugar Grove, N. C.	90.8
135. Elk River near Elk Park, N. C.	42.0
LITTLE TENNESSEE RIVER BASIN	
136. Little Tennessee River near Prentiss, N. C.	140
137. Cullasaja River at Highlands, N. C.	14.9
138. Cullasaja River at Cullasaja, N.C.	86.5
140. Little Tennessee River at Iotla, N. C.	323
142. Nantahala River near Rainbow Springs, N. C.	51.9
143. Nantahala River at Almond, N. C.	174
144. Little Tennessee River at Judson, N. C.	664
145. Tuckasegee River at Tuckasegee, N. C.	143
147. Scott Creek above Sylva, N. C.	50.7
148. Tuckasegee River at Dillsboro, N. C.	347
149. Oconoluftee River at Cherokee, N. C.	131
151. Tuckasegee River at Bryson City, N. C.	655
152 Noland Creek near Bryson City, N. C.	13.8
153. Hazel Creek at Proctor, N. C.	44.4
154. Little Tennessee River at Fontana Dam, N. C.	1571
155. Snowbird Creek near Robbinsville, N. C.	42.0
HIWASSEE RIVER BASIN	
157. Hiwassee River at Presley, Ga.	45.5
158. Shooting Creek near Hayesville, N. C.	37.6
159. Hiwassee River below Hayesville, N. C.	252
160. Hiwassee River at Murphy, N. C.	421
161. Valley River at Tomotla, N. C.	104
162. Nottely River near Blairsville, Ga.	74.8
164. Nottely River near Ranger, N. C.	272

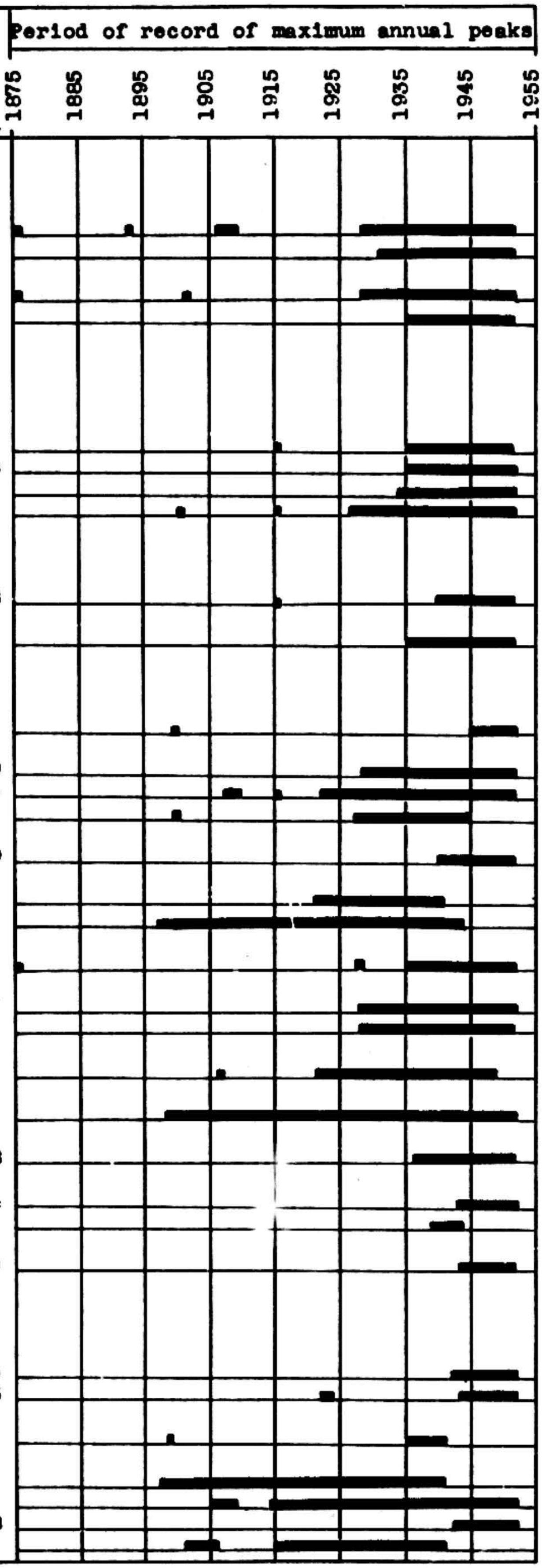

Figure 4 - Period of record of maximum annual peaks at gaging stations--Continued

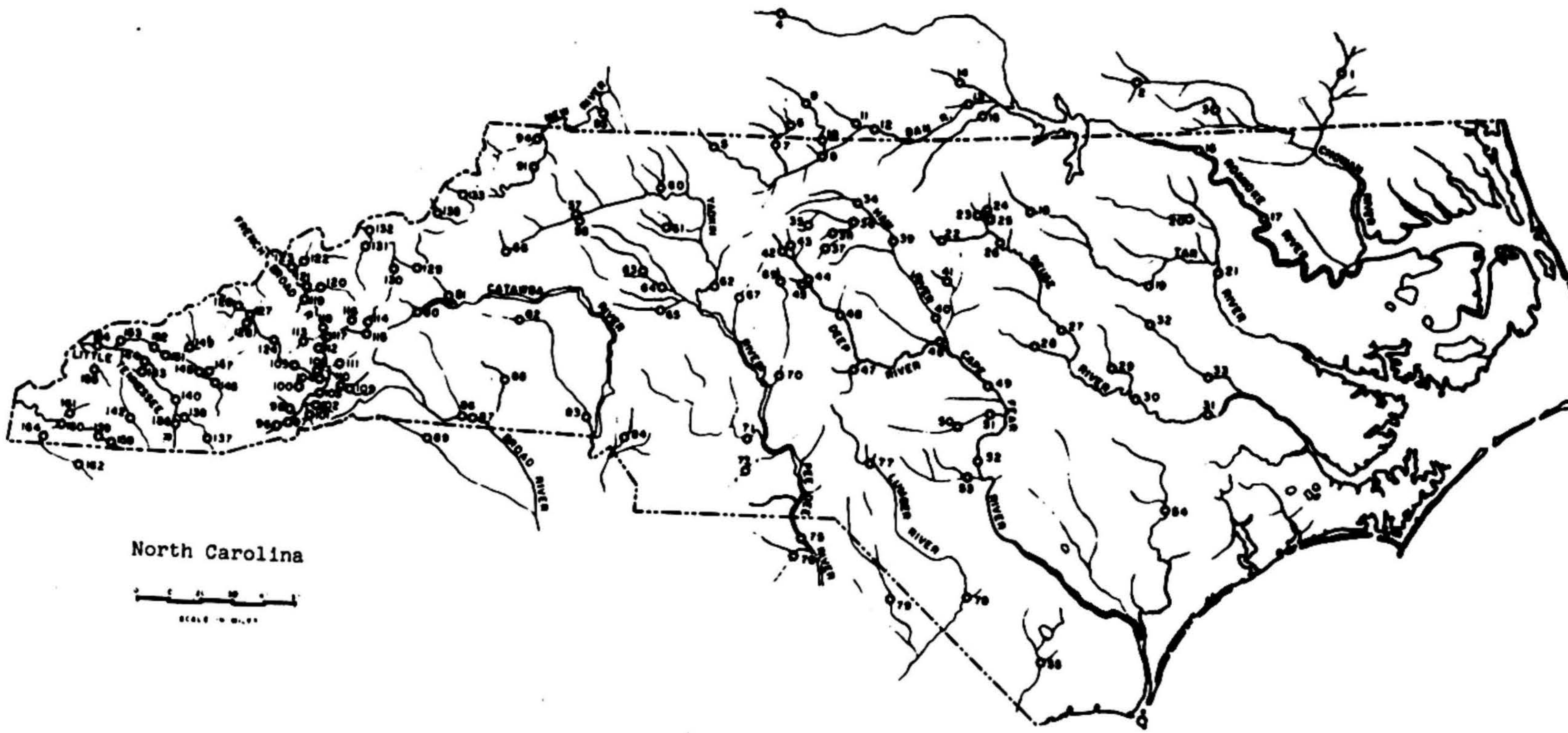

Figure 5.--Map showing locations of gaging stations pertinent to this report

Table 1 - Annual flood stages and discharges at gaging stations

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1. Blackwater River near Franklin, Va.								
1945	13.4	5,360	1948	10.9	3,180	1951	8.1	1,350
1946	11.1	3,340	1949	11.5	3,660	1952	12.2	4,190
1947	8.2	1,280	1950	9.9	2,480			
2. Meherrin River near Lawrenceville, Va.								
1929	22.1	6,990	1937	30.9	17,300	1946	18.7	6,190
1930	22.7	7,270	1938	28.7	14,500	1947	19.1	5,280
			1939	21.0	6,480	1948	22.4	7,660
1931	15.9	4,320	1940	42.0	38,000	1949	19.4	5,430
1932	23.4	3,600				1950	16.0	4,110
1933	18.0	5,200	1941	17.0	4,450			
1934	19.6	5,880	1942	15.6	3,970	1951	15.1	3,800
1935	24.2	9,420	1943	18.4	4,970	1952	21.4	6,800
			1944	18.2	4,890			
1936	25.8	11,200	1945	26.4	11,800			
3. Fontaine Creek near Emporia, Va.								
1945	10.6	3,500	1948	7.3	1,660	1951	4.6	520
1946	9.5	2,840	1949	6.1	1,120	1952	7.9	2,010
1947	4.2	354	1950	6.3	1,220			
4. Roanoke River at Roanoke, Va.								
1876	16.0	20,300	1914	3.9	2,780	1933	13.1	13,900
			1915	10.0	11,000	1934	8.3	6,570
1896	5.0	4,260				1935	11.7	11,400
1897	11.2	12,600	1916	7.8	8,040			
1898	5.9	5,470	1917	6.6	6,420	1936	11.0	10,400
1899	10.0	11,000	1918	8.2	6,440	1937	10.2	9,180
1900	5.6	5,060	1919	8.4	6,700	1938	10.8	10,000
			1920	6.2	4,270	1939	9.7	8,480
1901	15.0	19,000				1940	18.2	28,000
1902	13.2	15,300	1921	3.5	1,700			
1903	9.4	10,200	1922	13.2	14,100	1941	5.8	3,910
1904	4.0	2,900	1923	7.4	5,510	1942	7.4	5,740
1905	12.8	14,800	1924	10.5	9,600	1943	7.5	5,870
			1925	3.00	1,300	1944	6.6	4,750
1906	5.2	4,520				1945	13.7	15,100
1907	-	10,000	1926	4.1	2,240			
1908	10.6	11,800	1927	10.0	8,900	1946	7.3	5,400
1909	9.0	9,660	1928	18.1	26,100	1947	7.8	5,960
1910	8.8	9,380	1929	7.1	5,180	1948	12.0	11,900
			1930	11.5	11,100	1949	13.7	15,100
1911	4.1	3,040				1950	8.6	6,960
1912	8.5	8,980	1931	5.4	3,470	1951	11.2	10,600
1913	8.6	9,120	1932	4.1	2,240	1952	8.3	6,570
5. Dan River near Francisco, N. C.								
1916	15.0	-	1934	5.6	3,190	1944	4.0	1,530
			1935	6.0	3,640	1945	5.5	2,950
1925	10.0	8,350						
1926	5.0	2,500	1936	6.1	3,760	1946	4.4	1,880
			1937	6.2	3,880	1947	9.4	7,630
1928	10.8	9,450	1938	12.4	12,400	1948	4.3	1,740
1929	5.8	3,300	1939	10.2	8,670	1949	6.2	3,690
1930	8.0	5,800	1940	9.4	7,630	1950	4.5	1,960
1931	5.1	2,820	1941	5.1	2,550	1951	5.6	3,050
1932	4.6	2,300	1942	8.6	6,590	1952	6.0	3,470
1933	7.5	5,520	1943	5.0	2,400			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
			6. North Mayo River near Spencer, Va.					
1929	5.8	1,660	1937	7.0	3,060	1945	10.4	7,280
1930	9.0	4,600	1938	14.3	14,300	1946	5.4	1,850
			1939	7.8	3,820	1947	4.9	1,480
1931	6.2	1,980	1940	10.1	6,800	1948	15.8	17,200
1932	7.2	2,840				1949	6.3	2,500
1933	11.0	7,200	1941	4.4	1,180	1950	4.7	1,390
1934	5.5	1,450	1942	8.8	4,980			
1935	5.3	1,300	1943	6.5	2,660	1951	5.2	1,680
1936	7.7	3,300	1944	6.4	2,580	1952	6.0	2,270
			7. Mayo River near Price, N. C.					
1930	10.2	15,900	1937	7.3	8,020	1945	10.6	17,000
			1938	14.0	30,000	1946	5.5	3,900
1931	5.4	3,960	1939	8.9	12,300	1947	5.1	3,190
1932	7.0	7,300	1940	11.0	19,600	1948	11.6	20,800
1933	10.0	15,600				1949	6.3	5,270
1934	6.4	5,550	1941	5.2	3,720	1950	4.5	2,460
1935	5.3	3,880	1942	8.2	10,400			
			1943	7.7	8,370	1951	5.8	4,350
1936	8.5	11,200	1944	6.8	6,310	1952	6.8	6,310
			8. Dan River near Wentworth, N. C.					
1908	34.9	-	1943	19.8	18,100	1949	18.9	16,000
			1944	16.7	13,200	1950	15.0	10,600
1937	29.8	-	1945	27.8	56,800			
						1951	16.4	12,200
1940	26.9	50,200	1946	16.4	12,800	1952	19.1	16,400
1941	19.2	17,000	1947	18.6	16,000			
1942	20.0	18,600	1948	21.5	22,400			
			9. Smith River at Martinsville, Va.					
1930	12.3	15,200	1937	11.6	13,600	1945	15.3	21,600
			1938	21.5	39,000	1946	9.3	9,510
1931	7.7	6,620	1939	16.8	25,400	1947	7.8	7,080
1932	6.6	5,660	1940	19.5	34,200	1948	12.0	14,400
1933	17.5	27,200				1949	12.7	15,800
1934	8.7	8,520	1941	10.1	10,900	1950	14.5	19,700
1935	8.4	8,040	1942	11.4	14,200			
			1943	12.5	16,600	1951	11.0	12,500
1936	11.8	14,000	1944	8.0	7,600	1952	7.4	6,440
			10. Smith River at Spray, N. C.					
1938	-	33,000	1943	11.8	15,700	1948	13.2	20,400
1939	-	19,000	1944	9.6	10,200	1949	11.5	15,100
1940	19.3	45,600	1945	15.3	28,200	1950	13.8	21,400
1941	9.8	10,700	1946	10.2	11,700	1951	10.7	12,000
1942	11.2	13,900	1947	7.7	6,440	1952	8.7	7,870
			11. Sandy River near Danville, Va.					
1931	9.4	4,590	1938	10.0	5,180	1945	6.6	4,270
1932	8.7	3,990	1939	7.4	3,000			
1933	9.3	4,500	1940	17.4	23,000	1946	5.0	2,100
1934	11.6	7,140				1947	5.8	3,110
1935	9.8	4,980	1941	5.4	1,650	1948	5.8	3,180
			1942	7.1	2,780	1949	5.2	2,330
1936	11.0	6,330	1943	5.3	2,400	1950	6.1	3,400
1937	9.2	4,410	1944	10.5	11,800	1951	6.2	3,630
						1952	5.3	2,270

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
12. Dan River at Danville, Va.								
1935	12.3	28,100	1941	9.6	19,300	1947	13.0	30,700
1936	17.3	52,400	1942	11.4	25,600	1948	14.0	34,400
1937	13.4	31,800	1943	11.7	26,300	1949	10.9	23,500
1938	18.3	54,100	1944	13.1	31,400	1950	9.7	19,300
1939	12.9	30,600	1945	19.0	59,400	1951	10.1	20,900
1940	21.0	75,000	1946	10.5	22,200	1952	10.9	23,500
13. Dan River at South Boston, Va.								
1901	24.5	51,000	1930	27.0	40,000	1942	23.9	25,700
1902	25.5	55,000				1943	24.3	26,900
1903	23.5	45,000	1931	20.5	20,400	1944	24.0	26,000
1904	13.0	14,000	1932	24.5	28,700	1945	30.5	68,000
1905	16.2	20,000	1933	26.5	33,500			
1906	20.5	32,000	1934	23.5	26,500	1946	22.5	22,200
			1935	24.5	26,100	1947	25.7	32,000
1924	25.0	29,900				1948	25.0	29,000
1925	24.7	29,200	1936	28.5	51,000	1949	24.2	26,600
			1937	25.7	32,000	1950	23.0	23,400
1926	21.7	22,700	1938	28.2	48,600			
1927	20.5	20,400	1939	24.5	27,500	1951	22.6	22,400
1928	26.2	34,700	1940	31.8	81,000	1952	24.1	26,300
1929	22.8	25,000	1941	20.9	19,400			
14. Banister River at Halifax, Va.								
1905	14.5	3,650	1936	24.1	10,200	1945	24.2	11,100
			1937	22.9	9,110			
1929	19.4	6,430	1938	31.2	19,000	1946	21.0	7,800
1930	24.0	10,100	1939	19.3	6,360	1947	19.4	6,420
			1940	37.8	34,000	1948	19.0	6,100
1931	14.2	3,530				1949	20.7	7,530
1932	21.9	8,310	1941	14.6	3,690	1950	20.4	7,260
1933	20.6	7,270	1942	21.2	7,750			
1934	19.6	6,570	1943	16.9	4,750	1951	13.6	3,320
1935	20.6	7,270	1944	40.8	50,000	1952	19.8	6,740
15. Hyco River near Omega, Va.								
1934	27.5	11,000	1940	25.6	9,280	1946	17.1	3,660
1935	21.2	6,040	1941	16.2	3,140	1947	18.3	4,190
1936	22.9	7,230	1942	15.4	2,890	1948	22.1	6,810
1937	25.0	8,800	1943	16.7	3,470	1949	17.5	3,790
1938	23.2	7,440	1944	20.7	5,690	1950	14.6	2,780
1939	18.5	4,030	1945	28.4	11,900			
16. Roanoke River at Roanoke Rapids, N. C. (at Old Gaston prior to 1931)								
1878	19	212,000	1923	13.1	105,000	1937	20.4	78,000
			1924	10.9	73,400	1938	22.8	96,400
1889	15	137,000	1925	11.4	80,300	1939	17.3	62,500
						1940	39.0	261,000
1912	16.2	158,000	1926	9.4	54,600			
1913	14.3	125,000	1927	9.1	51,200	1941	12.5	42,500
1914	8.9	49,000	1928	13.2	107,000	1942	15.3	55,400
1915	10.9	73,400	1929	10.5	68,200	1943	15.2	53,500
			1930	12.7	99,200	1944	26.9	127,000
1916	11.0	74,700				1945	26.7	121,000
1917	11.8	85,900	1931	12.8	41,900			
1918	11.2	77,500	1932	17.5	75,400	1946	15.4	52,900
1919	12.8	101,000	1933	20.8	90,400	1947	15.4	54,100
1920	11.5	81,700	1934	17.5	69,600	1948	19.2	72,100
			1935	20.8	80,300	1949	18.9	69,300
1921	10.2	64,300				1950	15.9	54,900
1922	10.8	72,100	1936	24.7	110,000	1951	10.3	28,800

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
17. Roanoke River near Scotland Neck, N. C. (at Neal 1897-1903)								
1877	37.8	140,000	1919	34.9	87,000	1944	35.7	96,300
						1945	37.0	119,000
1897	28.0	60,000	1924	32.9	60,000			
1898	23.9	37,000				1946	30.5	38,800
1899	30.0	74,000	1936	35.1	90,000	1947	30.8	37,800
1900	26.0	47,000				1948	33.9	61,900
1901	30.3	77,000	1940	41.9	260,000	1949	33.3	55,400
1902	29.8	73,000	1941	29.3	32,200	1950	31.4	40,500
1903	30.4	78,000	1942	29.8	35,700			
			1943	31.5	39,900	1951	28.4	-
1912	36.8	120,000						
18. Tar River near Tar River, N. C.								
1940	11.9	5,550	1944	14.3	8,050	1948	13.2	6,840
1941	10.6	4,380	1945	16.5	10,600	1949	12.0	5,640
1942	8.0	2,370	1946	10.8	4,560	1950	9.5	3,500
1943	9.2	3,220	1947	-	-	1951	7.2	1,940
						1952	13.4	7,060
19. Tar River near Nashville, N. C.								
1929	14.7	8,960	1937	15.8	9,560	1945	20.2	15,500
1930	17.0	11,100	1938	15.5	9,200	1946	12.3	5,970
			1939	16.0	9,800	1947	9.2	3,490
1931	11.2	4,850	1940	17.4	11,700	1948	15.2	8,520
1932	13.5	7,240				1949	12.8	6,420
1933	10.5	4,360	1941	10.2	4,140	1950	9.9	4,030
1934	15.8	9,480	1942	9.6	3,720			
1935	20.8	16,900	1943	11.9	5,540	1951	8.8	3,260
1936	15.6	9,220	1944	11.7	5,360	1952	13.7	7,200
20. Fishing Creek near Enfield, N. C.								
1915	13.1	2,940	1927	12.2	2,480	1940	17.7	12,600
			1928	16.7	9,850	1941	11.7	2,210
1916	11.4	2,160	1929	15.0	5,130	1942	11.1	1,950
1917	14.4	4,810	1930	16.2	8,480	1943	13.4	3,270
1918	16.0	8,130				1944	13.7	3,680
1919	19.6	20,300	1931	15.5	6,180	1945	16.0	7,700
1920	13.6	3,280	1932	14.6	4,430			
			1933	12.7	2,710	1946	13.8	3,890
1921	12.4	2,570	1934	14.6	4,430	1947	10.7	1,900
1922	15.6	7,200	1935	17.7	12,600	1948	15.6	5,810
1923	14.5	4,970				1949	14.4	4,810
1924	16.8	10,600	1936	15.8	7,720	1950	11.2	2,150
1925	17.3	12,300	1937	15.0	5,420			
			1938	14.1	3,920	1951	10.9	2,030
1926	13.4	3,140	1939	17.4	11,600	1952	14.5	5,050

Table 1 - Annual flood stages and discharges at gaging stations..Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
			21. Tar River at Tarboro, N. C.					
1897	21.2	14,600	1919	34.0	52,800	1936	25.5	20,200
1898	15.2	8,680	1920	19.1	10,900	1937	26.2	21,500
1899	26.5	22,400				1938	21.3	13,500
1900	19.5	13,000	1921	17.7	9,030	1939	27.0	23,000
			1922	26.4	21,400	1940	31.8	37,200
1906	23.5	16,600	1923	22.8	15,500			
1907	21.2	13,400	1924	20.7	12,700	1941	16.7	8,460
1908	29.4	27,300	1925	33.5	39,800	1942	14.8	7,310
1909	19.7	11,500				1943	1910	10,800
1910	27.3	23,100	1926	19.2	11,000	1944	21.6	13,800
			1927	17.8	9,570	1945	28.0	24,600
1911	17.4	9,210	1928	30.2	29,200			
1912	17.7	9,480	1929	25.5	19,800	1946	21.0	13,200
1913	21.2	13,400	1930	27.8	24,000	1947	14.1	6,570
1914	19.2	11,000				1948	25.3	19,800
1915	19.1	10,900	1931	17.7	9,480	1949	22.5	15,300
			1932	20.2	12,100	1950	14.3	6,990
1916	16.9	8,770	1933	16.0	8,050			
1917	23.3	16,200	1934	22.1	15,900	1951	13.4	6,250
1918	21.0	13,100	1935	27.4	23,500	1952	24.2	17,600
			22. Eno River at Hillsboro, N. C.					
1928	16.0	3,880	1937	13.4	2,500	1946	16.4	4,280
			1938	-	6,750	1947	10.8	1,610
1930	18.0	6,750	1939	16.9	4,910	1948	12.6	2,110
1931	16.3	3,880	1940	11.4	1,830	1949	14.9	3,060
1932	15.6	3,530				1950	10.3	1,500
1933	11.1	1,690	1941	12.4	2,180			
1934	13.0	2,240	1942	11.3	1,800	1951	10.6	1,570
1935	14.9	3,260	1943	10.8	1,650	1952	16.0	3,980
			1944	17.3	5,530			
1936	16.0	3,670	1945	20.0	11,000			
			23. Flat River at Bahama, N. C.					
1926	6.7	3,610	1935	8.5	6,880	1944	9.0	7,970
1927	7.3	4,580				1945	11.9	16,100
1928	8.0	5,860	1936	9.3	8,670			
1929	8.7	7,300	1937	9.6	9,420	1946	7.9	5,670
1930	10.8	12,500	1938	-	16,000	1947	6.4	3,050
			1939	9.5	9,170	1948	8.4	6,820
1931	8.5	6,880	1940	9.7	9,670	1949	8.6	7,250
1932	8.6	7,090				1950	6.4	3,200
1933	7.4	4,750	1941	7.6	5,110			
1934	11.1	13,600	1942	7.2	4,410	1951	6.2	3,580
			1943	8.3	6,460	1952	9.8	10,500
			24. Dial Creek near Bahama, N. C.					
1926	4.5	550	1935	4.5	550	1944	4.1	368
1927	3.2	134				1945	5.0	818
1928	5.6	1,330	1936	4.8	682			
1929	4.4	500	1937	4.1	346	1946	3.6	214
1930	5.3	1,090	1938	5.3	1,050	1947	3.8	256
			1939	4.4	475	1948	4.1	356
1931	4.0	321	1940	7.6	3,000	1949	3.8	244
1932	4.0	307				1950	4.0	328
1933	3.3	142	1941	3.5	174			
1934	4.1	360	1942	3.4	162	1951	3.0	98
			1943	3.5	164	1952	4.8	728
			25. Rocky Creek near Bahama, N. C.					
1926	4.0	155	1928	5.1	340	1930	4.3	195
1927	3.6	107	1929	5.0	320	1931	4.5	225

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
26. Neuse River near Northside, N. C.								
1928	24.4	14,300	1936	23.8	14,400	1945	31.0	36,600
1929	23.5	12,600	1937	21.9	10,600			
1930	28.6	26,600	1938	26.8	22,100	1946	21.8	10,200
			1939	24.1	15,200	1947	18.8	6,040
1931	18.0	5,680	1940	17.3	4,500	1948	22.8	12,200
1932	21.7	9,300				1949	22.1	9,340
1933	16.8	4,470	1941	19.0	6,180	1950	18.7	5,200
1934	23.6	12,600	1942	16.5	4,260			
1935	22.4	11,300	1943	17.9	5,280	1951	16.8	4,340
			1944	19.4	6,870	1952	23.2	11,200
27. Neuse River near Clayton, N. C.								
1928	17.5	16,000	1936	15.4	12,600	1945	22.1	22,900
1929	16.2	13,800	1937	13.2	9,920			
1930	21.6	22,000	1938	15.0	12,000	1946	12.2	8,950
			1939	15.2	12,300	1947	12.2	8,950
1931	14.0	11,000	1940	14.6	11,500	1948	14.2	11,200
1932	13.0	9,900				1949	12.5	9,150
1933	-	7,500	1941	9.9	6,520	1950	10.1	6,790
1934	12.2	9,020	1942	9.7	6,030			
1935	18.7	17,000	1943	11.4	8,250	1951	7.8	4,680
			1944	12.2	9,120	1952	15.7	12,900
28. Middle Creek near Clayton, N. C.								
1940	6.5	577	1944	9.6	1,600	1948	9.5	1,550
1941	9.0	1,350	1945	11.7	3,460	1949	11.5	3,260
1942	9.2	1,430	1946	7.9	950	1950	5.5	426
1943	10.4	2,260	1947	7.7	850	1951	5.0	360
						1952	12.3	4,100
29. Little River near Princeton, N. C.								
1919	14.6	8,600	1936	11.7	3,340	1945	12.1	3,600
			1937	12.2	3,680			
1924	14.9	9,500	1938	11.6	3,270	1946	9.2	1,880
			1939	11.2	3,010	1947	6.4	1,050
1930	13.5	6,000	1940	11.7	3,270	1948	12.1	3,750
1931	10.1	2,380				1949	10.4	2,400
1932	6.3	1,160	1941	10.7	2,580	1950	5.8	808
1933	7.5	1,500	1942	7.2	1,260			
1934	10.0	2,450	1943	12.3	3,780	1951	4.5	655
1935	12.7	4,470	1944	10.8	2,640	1952	12.4	4,110
30. Neuse River near Goldsboro, N. C.								
1930	25.3	38,600	1938	19.2	11,400	1946	19.2	10,600
1931	17.5	11,400	1939	21.9	15,500	1947	16.7	8,490
1932	17.2	10,900	1940	19.2	11,400	1948	24.5	20,300
1933	16.3	9,660	1941	17.8	9,560	1949	20.0	13,000
1934	16.0	9,330	1942	14.7	7,100	1950	15.2	7,660
1935	23.8	21,400	1943	20.4	12,200	1951	12.4	5,680
1936	25.3	26,300	1944	20.9	13,000	1952	22.3	17,300
1937	24.1	22,000	1945	26.7	30,700			
31. Neuse River at Kinston, N. C.								
1919	25.0	39,000	1934	14.7	9,320	1944	17.8	13,600
			1935	19.2	18,500	1945	22.4	25,900
1925	24.7	36,000	1936	20.9	24,400	1946	16.8	11,500
			1937	20.0	21,200	1947	15.1	8,740
1928	24.2	34,000	1938	16.6	11,800	1948	20.8	21,100
1929	20.8	22,000	1939	18.9	17,200	1949	17.8	13,600
1930	22.8	28,000	1940	16.1	10,900	1950	14.2	7,620
1931	16.0	11,600	1941	15.8	9,880	1951	11.6	5,340
1932	16.2	12,000	1942	13.1	6,690	1952	19.2	17,100
1933	15.0	9,800	1943	17.7	13,400			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
32. Contentnea Creek near Wilson, N. C.								
1924	24.3	-	1937	13.4	4,820	1945	12.2	3,770
			1938	10.4	2,790	1946	7.4	1,750
1931	8.0	2,140	1939	12.2	3,510	1947	5.5	1,150
1932	5.0	1,020	1940	13.8	4,830	1948	12.4	4,070
1933	6.1	1,400	1941	6.4	1,340	1949	7.3	1,750
1934	8.7	2,220	1942	7.1	1,640	1950	4.3	892
1935	9.5	2,580	1943	11.0	3,430	1951	3.8	705
1936	12.6	4,220	1944	9.7	2,730	1952	13.3	4,660
33. Contentnea Creek at Hookerton, N. C.								
1924	23.2	-	1935	12.8	2,980	1944	14.5	5,110
			1936	15.9	6,670	1945	15.0	5,840
1928	23.3	-	1937	16.3	7,450	1946	13.3	3,630
1929	14.8	4,870	1938	12.4	2,590	1947	11.4	2,210
1930	18.9	11,100	1939	15.3	5,650	1948	17.8	10,000
			1940	15.2	6,100	1949	13.9	4,040
1931	11.1	2,100				1950	-	1,600
1932	10.2	1,720	1941	14.0	4,340			
1933	12.2	2,620	1942	11.0	2,040	1951	8.3	1,030
1934	11.9	2,470	1943	15.5	6,620	1952	14.8	4,950
34. Haw River near Benaja, N. C.								
1916	17.5	9,800	1936	9.5	2,250	1945	18.1	10,100
			1937	9.6	2,270	1946	7.1	1,410
1929	9.3	2,180	1938	11.8	3,570	1947	19.2	12,300
1930	13.5	5,020	1939	8.2	1,770	1948	7.9	1,670
			1940	13.7	5,200	1949	7.8	1,640
1931	7.8	1,680				1950	11.3	3,190
1932	7.9	1,710	1941	7.6	1,570			
1933	8.4	1,870	1942	7.4	1,510	1951	6.6	1,260
1934	7.7	1,640	1943	7.5	1,540	1952	8.0	1,700
1935	7.8	1,680	1944	8.2	1,770			
35. Horsepen Creek at Battle Ground, N. C.								
1926	7.2	766	1937	5.5	365	1945	7.9	1,540
1927	6.7	515	1938	5.2	296	1946	7.2	852
1928	5.6	254	1939	5.5	382	1947	10.4	6,400
1929	7.4	750	1940	6.6	820	1948	5.8	262
1930	7.2	680				1949	6.9	838
			1941	6.1	595	1950	6.8	830
1934	6.6	675	1942	7.1	1,240			
1935	6.0	520	1943	6.6	612	1951	5.8	282
1936	7.1	980	1944	6.4	568	1952	7.3	1,200
36. Reedy Fork near Gibsonville, N. C.								
1916	17.9	8,640	1936	13.3	4,390	1945	16.6	7,340
			1937	10.1	2,640	1946	8.7	2,160
1929	10.1	2,640	1938	4.8	942	1947	20.8	11,600
1930	12.6	3,770	1939	11.1	3,040	1948	5.7	1,190
			1940	12.7	3,830	1949	10.7	2,880
1931	6.7	1,500				1950	10.5	2,800
1932	7.7	1,810	1941	8.5	2,080			
1933	9.4	2,390	1942	9.7	2,500	1951	5.5	1,130
1934	8.6	2,110	1943	7.0	1,590	1952	10.5	2,870
1935	6.2	1,340	1944	10.6	3,000			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
37. South Buffalo Creek near Greensboro, N. C.								
1929	8.7	2,680	1937	7.4	1,170	1945	9.5	3,780
1930	8.4	2,230	1938	-	-	1946	8.3	2,110
			1939	7.4	1,180	1947	10.6	8,000
1931	7.4	1,120	1940	7.3	1,060	1948	6.7	590
1932	8.0	1,700				1949	11.5	10,000
1933	8.2	2,110	1941	7.1	688	1950	7.6	1,100
1934	7.4	959	1942	6.8	622			
1935	7.5	1,200	1943	8.7	2,610	1951	8.2	1,670
1936	8.2	1,990	1944	8.2	1,990	1952	8.4	2,130
38. North Buffalo Creek near Greensboro, N. C.								
1929	10.9	1,620	1937	6.8	927	1945	14.4	4,640
1930	9.6	1,320	1938	6.7	912	1946	11.3	2,120
			1939	10.1	1,420	1947	16.0	6,000
1931	6.4	882	1940	8.9	1,200	1948	9.2	1,290
1932	9.8	1,360				1949	13.7	4,060
1933	11.0	1,650	1941	12.2	2,400	1950	10.2	1,600
1944	7.9	1,080	1942	8.5	1,150			
1935	9.9	1,380	1943	14.2	4,470	1951	9.2	1,290
1936	11.4	2,100	1944	10.9	1,940	1952	11.5	2,370
39. Haw River at Haw River, N. C.								
1929	24.0	18,400	1937	19.5	11,800	1945	31.1	37,000
1930	22.4	16,400	1938	-	11,000	1946	21.5	13,400
			1939	18.8	11,000	1947	27.9	27,200
1931	12.7	5,830	1940	20.4	12,700	1948	18.1	9,500
1932	21.0	13,300				1949	19.6	11,100
1933	14.5	6,800	1941	18.6	10,800	1950	19.1	10,500
1934	23.0	15,800	1942	21.1	13,500			
1935	17.5	9,820	1943	17.5	8,850	1951	16.3	7,770
1936	21.9	14,400	1944	22.3	13,300	1952	22.8	15,200
40. Haw River near Pittsboro, N. C.								
1908	32.1	98,000	1935	16.2	23,300	1944	16.0	22,700
			1936	20.7	41,000	1945	28.6	79,000
1928	20.3	39,200	1938	16.0	22,700	1946	18.7	32,400
1929	18.4	32,000	1938	17.4	27,400	1947	16.2	23,300
1930	22.1	47,300	1939	17.8	28,900	1948	15.3	20,500
			1940	14.7	18,900	1949	17.7	28,600
1931	13.4	16,000				1950	16.3	23,700
1932	18.0	29,700	1941	15.5	21,100			
1933	13.0	15,100	1942	14.1	17,400	1951	14.5	18,400
1934	18.4	31,200	1943	15.5	21,100	1952	20.1	38,300
41. Morgan Creek near Chapel Hill, N. C.								
1923	8.5	1,380	1926	11.8	3,570	1929	11.0	3,000
1924	25	19,000	1927	8.3	1,620	1930	15.4	6,400
1925	8.2	1,370	1928	12.6	4,240	1931	14.0	5,770
						1932	12.2	3,800
42. West Fork Deep River near High Point, N. C.								
1924	10.1	1,100	1934	10.7	1,250	1943	11.0	1,310
1925	9.5	1,010	1935	10.1	986	1944	11.7	1,680
1926	9.8	1,060	1936	13.8	2,880	1945	13.5	2,840
			1937	11.7	1,570	1946	12.5	2,200
1929	12.4	1,980	1938	11.3	1,420	1947	19.9	8,450
1930	11.3	1,450	1939	11.7	1,780	1948	9.0	692
			1940	13.1	2,610	1949	12.2	2,000
1931	9.0	740				1950	13.2	2,650
1932	11.3	1,370	1941	8.6	736	1951	8.2	546
1933	12.5	1,980	1942	12.8	2,430	1952	12.9	2,460

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
			43. East Fork Deep River near High Point, N. C.					
1929	5.4	1,040	1937	3.9	1,570	1945	4.4	1,820
1930	4.4	750	1938	4.4	1,820	1946	4.5	1,870
			1939	5.1	2,170	1947	10.9	6,300
1931	4.1	656	1940	5.8	2,520	1948	2.9	679
1932	5.1	950				1949	4.9	2,180
1933	5.8	1,160	1941	3.0	830	1950	3.7	1,440
1934	7.5	1,660	1942	4.7	1,970			
1935	4.2	1,100	1943	3.7	1,440	1951	2.7	588
1936	5.1	2,170	1944	3.7	1,460	1952	4.8	2,120
			44. Deep River near Randleman, N. C.					
1929	23.9	8,470	1937	16.0	3,610	1945	25.2	9,530
1930	20.1	5,720	1938	14.7	3,170	1946	21.4	6,580
			1939	17.0	4,000	1947	32.2	20,000
1931	14.0	2,930	1940	20.5	5,980	1948	12.7	2,570
1932	-	-				1949	19.8	5,320
1933	-	-	1941	17.8	4,400	1950	18.2	4,500
1934	16.8	3,670	1942	18.9	5,000			
1935	17.0	3,730	1943	17.1	4,050	1951	13.8	2,900
1936	22.8	7,600	1944	23.9	8,470	1952	21.7	6,540
			45. Muddy Creek near Archdale, N. C.					
1935	6.5	600	1937	8.2	1,310	1939	7.2	952
1936	10.1	2,030	1938	10.5	2,180	1940	9.3	1,720
						1941	5.1	430
			46. Deep River at Ramseur, N. C.					
1901	28.8	30,000	1932	19.2	13,100	1943	13.2	7,940
			1933	16.2	10,400	1944	29.2	30,900
1923	19.2	13,100	1934	20.3	14,200	1945	34.0	43,000
1924	17.9	11,900	1935	18.7	12,600			
1925	15.7	9,950				1946	21.9	16,200
			1936	22.2	16,600	1947	24.7	21,000
1926	13.3	8,020	1937	24.3	20,200	1948	13.6	8,260
1927	14.1	8,660	1938	12.7	7,480	1949	18.8	12,700
1928	25.4	22,400	1939	15.0	9,500	1950	11.8	6,820
1929	23.3	18,300	1940	14.8	9,320			
1930	22.1	16,400	1941	12.6	7,460	1951	18.1	12,100
1931	8.4	4,620	1942	13.9	8,510	1952	25.4	22,400
			47. Bear Creek at Robbins, N. C.					
1940	10.1	3,420	1944	20.5	9,970	1948	15.2	6,410
1941	12.2	4,810	1945	32.0	27,000	1949	15.4	6,530
1942	15.5	6,590	1946	14.3	5,880	1950	18.2	8,400
1943	12.4	4,930	1947	13.8	5,640	1951	10.8	3,960
						1952	23.5	14,000
			48. Deep River at Moncure, N. C.					
1899	25.9	24,600	1937	7.5	15,100	1945	17.2	80,300
			1938	8.9	21,500	1946	9.3	23,800
1931	8.0	17,200	1939	9.1	22,600	1947	8.4	19,100
1932	9.5	25,000	1940	7.0	13,100	1948	9.4	24,400
1933	8.3	18,600	1941	7.1	13,500	1949	9.4	24,400
1934	7.9	16,800	1942	7.6	15,400	1950	8.6	20,100
1935	9.0	22,100	1943	9.0	22,100	1951	7.5	15,200
1936	10.5	31,400	1944	10.6	32,100	1952	12.3	43,700

Table 1 - Annual flood stages and discharges at gaging stations-- Continued

49. Cape Fear River at Lillington, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1924	18.8	51,000	1934	16.4	40,000	1944	16.9	42,300
1925	17.6	45,000	1935	16.6	41,000	1945	33.2	150,000
1926	13.3	26,800	1936	22.9	73,200	1946	19.4	54,400
1927	14.8	32,300	1937	15.2	34,800	1947	16.3	39,600
1928	24.8	84,000	1938	17.9	47,000	1948	18.5	49,900
1929	21.9	67,700	1939	18.0	47,500	1949	19.2	53,400
1930	27.6	107,000	1940	14.5	32,000	1950	15.6	36,500
1931	13.8	29,200	1941	14.4	31,600	1951	15.2	34,800
1932	18.7	50,900	1942	14.2	30,800	1952	23.6	77,100
1933	13.8	29,200	1943	16.6	40,900			

50. (Lower) Little River at Manchester, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1938	11.0	2,290	1942	11.7	2,540	1946	10.5	2,080
1939	12.8	2,960	1943	10.6	2,150	1947	11.2	2,340
1940	6.6	1,110	1944	17.6	4,880	1948	15.8	4,160
1941	12.3	2,760	1945	29.0	12,000	1949	16.6	4,480
						1950	11.2	2,340

51. (Lower) Little River at Linden, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1928	37.3	9,500	1936	25.4	5,630	1944	14.7	4,860
1929	20.6	4,850	1937	14.8	4,150	1945	41.5	10,200
1930	35.5	10,300	1938	11.5	2,500	1946	9.9	2,840
1931	14.4	4,980	1939	12.0	3,600	1947	10.3	3,010
1932	11.3	2,530	1940	7.2	1,710	1948	17.1	4,500
1933	7.2	1,760	1941	9.7	2,840	1949	17.0	5,260
1934	8.4	2,280	1942	10.2	3,060	1950	9.5	2,580
1935	8.8	2,470	1943	10.0	2,970	1951	6.3	1,300
						1952	18.2	5,860

52. Cape Fear River at Fayetteville, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1889	45.0	51,100	1911	30.2	24,200	1933	33.3	30,500
1890	32.0	26,500	1912	50.0	61,500	1934	36.0	36,700
1891	45.1	51,300	1913	37.1	33,300	1935	38.9	39,700
1892	49.5	60,500	1914	38.3	35,000	1936	54.9	75,000
1893	42.3	44,600	1915	41.0	42,000	1937	39.4	41,700
1894	42.0	44,000	1916	44.5	50,000	1938	42.4	44,200
1895	58.0	83,000	1917	42.0	44,000	1939	40.2	45,600
1896	49.5	60,500	1918	44.9	50,900	1940	33.2	32,400
1897	37.6	34,000	1919	51.3	64,700	1941	32.0	31,100
1898	29.2	22,900	1920	40.9	41,800	1942	30.3	27,400
1899	52.0	66,500	1921	47.3	55,900	1943	37.6	40,900
1900	44.0	48,000	1922	46.3	53,800	1944	40.2	46,300
1901	58.5	84,500	1923	39.3	38,900	1945	68.8	117,000
1902	41.7	43,400	1924	33.3	29,000	1946	44.2	55,500
1903	50.5	62,700	1925	48.9	59,300	1947	38.2	40,300
1904	50.0	61,500	1926	30.3	24,400	1948	47.2	53,800
1905	46.4	54,000	1927	33.4	29,100	1949	41.1	48,600
1906	40.5	41,000	1928	63.4	107,000	1950	36.6	34,400
1907	28.0	21,500	1929	52.2	61,600	1951	33.8	34,800
1908	68.7	120,000	1930	63.4	110,000	1952	51.9	70,000
1909	47.6	56,600	1931	36.8	35,300			
1910	38.5	35,300	1932	42.0	46,500			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
53. Rockfish Creek near Hope Mills, N. C.								
1939	14.1	2,280	1944	12.1	1,810	1949	22.5	4,000
1940	7.3	813	1945	31.8	8,000	1950	17.4	2,950
1941	7.4	835	1946	17.1	3,020	1951	8.7	1,050
1942	22.6	4,530	1947	12.4	1,880	1952	20.9	3,590
1943	13.3	2,090	1948	15.6	1,700			
54. Northeast Cape Fear River near Chinquapin, N. C.								
1908	22.6	-	1942	12.6	3,850	1947	12.1	3,500
			1943	16.7	11,000	1948	14.9	6,700
1928	21.8	-	1944	10.9	2,610	1949	13.2	4,400
			1945	13.1	4,370	1950	15.3	7,800
1941	10.8	2,810	1946	10.9	2,700	1951	11.4	3,080
						1952	10.5	2,530
55. Waccamaw River at Freeland, N. C.								
1940	13.2	1,910	1944	14.9	3,720	1948	15.9	7,500
1941	13.1	1,860	1945	15.5	5,600	1949	15.4	5,440
1942	14.4	3,090	1946	15.2	4,840	1950	14.2	2,800
1943	13.4	2,050	1947	15.2	4,570	1951	11.9	1,280
						1952	12.9	1,670
56. Yadkin River at Patterson, N. C.								
1940	12.7	16,200	1944	-	-	1948	3.7	1,040
1941	2.8	1,020	1945	3.7	1,510	1949	4.6	1,500
1942	5.9	2,960	1946	3.4	1,330	1950	3.7	1,020
1943	3.1	1,160	1947	3.0	700	1951	-	1,940
						1952	7.7	4,930
57. Reddies River at North Wilkesboro, N. C.								
1940	22.0	27,000	1944	8.6	4,500	1948	6.6	2,680
1941	11.1	7,330	1945	12.2	8,780	1949	11.5	5,600
1942	11.0	7,200	1946	5.7	2,030	1950	6.5	2,210
1943	7.4	3,360	1947	7.6	3,540	1951	10.2	4,690
						1952	12.5	7,400
58. Yadkin River at Wilkesboro, N. C. (at North Wilkesboro prior to 1929)								
1904	9.8	9,250	1927	7.4	4,200	1940	37.6	160,000
1905	13.4	14,300	1928	20.8	22,000	1941	13.4	9,350
1906	18.0	22,100	1929	12.0	10,300	1942	16.0	12,200
1907	18.8	22,300	1930	24.0	29,000	1943	12.8	8,750
1908	14.0	14,100				1944	14.8	10,800
1909	18.3	21,400	1931	9.1	6,030	1945	22.4	23,200
			1932	10.7	7,500			
1916	34.5	116,000	1933	20.9	19,200	1946	13.4	9,350
			1934	13.7	10,600	1947	17.6	14,200
1921	13.0	10,700	1935	14.0	11,000	1948	13.3	9,250
1922	13.4	11,300				1949	17.1	12,800
1923	15.1	13,600	1936	13.8	10,800	1950	9.8	5,770
1924	15.2	13,700	1937	19.2	17,100			
1925	14.2	12,300	1938	21.0	19,300	1951	16.8	12,300
1926	14.0	12,000	1939	14.5	11,600	1952	17.1	12,800
59. Fisher River near Dobson, N. C.								
1921	4.1	2,110	1925	7.1	4,320	1929	6.3	3,720
1922	6.0	3,540	1926	5.6	3,200	1930	12.1	8,300
1923	10.1	6,700	1927	5.9	3,420	1931	6.8	4,100
1924	9.9	6,540	1928	10.1	6,700	1932	3.4	1,640

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge	Water year	Gage height (feet)	Discharge (cfs)
60. Fisher River near Copeland, N. C.								
1932	5.7	2,060	1939	12.4	9,200	1946	6.2	2,160
1933	10.6	6,890	1940	18.4	27,300	1947	15.6	16,400
1934	77.2	3,160	1941	5.5	1,740	1948	8.2	3,800
1935	11.2	7,600	1942	8.7	4,200	1949	10.3	6,000
1936	10.5	6,780	1943	9.9	5,530	1950	9.3	4,870
1937	9.3	5,460	1944	8.5	4,070	1951	8.4	3,980
1938	13.6	10,500	1945	10.1	5,760	1952	7.4	3,100
61. Forbush Creek near Yadkinville, N. C.								
1940	7.8	819	1944	11.0	2,450	1948	6.2	611
1941	6.1	598	1945	7.9	882	1949	6.9	738
1942	7.3	754	1946	8.4	1,020	1950	8.5	1,120
1943	6.3	624	1947	5.8	559	1951	6.4	668
						1952	7.4	818
62. Yadkin River at Yadkin College, N. C.								
1916	36.3	94,300	1935	18.8	27,900	1944	15.8	20,600
			1936	24.9	47,900	1945	26.2	46,800
1928	25.5	50,200	1937	21.5	35,700	1946	17.7	24,500
1929	17.4	24,600	1938	27.5	58,400	1947	25.8	46,000
1930	29.8	67,800	1939	23.4	36,200	1948	17.5	20,800
			1940	33.8	80,200	1949	17.8	24,800
1931	12.8	16,600				1950	17.0	23,000
1932	12.4	16,000	1941	15.9	18,000			
1933	26.0	52,200	1942	18.8	28,100	1951	16.2	21,400
1934	16.2	22,400	1943	17.9	26,000	1952	18.8	27,000
63. Rocky River at Turnersburg, N. C.								
1940	8.0	2,840	1944	8.6	3,430	1948	6.1	1,860
1941	9.4	3,800	1945	12.1	5,100	1949	6.7	2,200
1942	7.8	2,700	1946	8.8	3,570	1950	6.9	2,320
1943	6.7	2,010	1947	7.6	2,600	1951	4.8	1,110
						1952	7.1	2,340
64. South Yadkin River near Mocksville, N. C.								
1939	9.3	3,110	1944	7.6	2,250	1949	9.5	2,950
1940	12.3	4,600	1945	16.0	8,000	1950	9.1	2,760
1941	10.9	3,900	1946	11.6	3,950	1951	6.6	1,660
1942	9.8	3,390	1947	9.4	2,750	1952	10.0	3,150
1943	11.0	4,100	1948	8.6	2,710			
65. Third Creek at Cleveland, N. C.								
1940	8.9	1,380	1944	15.3	2,890	1948	9.7	1,080
1941	7.5	1,000	1945	15.8	3,080	1949	9.9	1,120
1942	9.0	1,420	1946	11.1	1,650	1950	8.9	932
1943	9.1	1,450	1947	9.6	1,060	1951	6.9	699
						1952	13.3	1,920
66. Yadkin River near Salisbury, N. C.								
1896	15.8	79,000	1906	12.0	52,000	1918	7.8	25,700
1897	10.8	44,800	1907	10.4	42,400	1919	16.9	80,000
1898	15.3	76,000	1908	15.5	77,000	1920	10.6	42,200
1899	18.5	100,000	1909	12.5	55,000			
1900	11.8	50,800				1921	11.2	45,800
			1912	19.0	104,000	1922	8.1	27,400
1901	17.4	91,000	1913	15.4	76,000	1923	15.0	68,600
1902	19.7	109,000	1914	7.8	26,800	1924	10.5	41,600
1903	16.8	83,000	1915	13.0	59,000	1925	14.7	66,800
1904	6.3	18,400	1916	23.8	121,000	1926	10.0	38,600
1905	9.7	38,200	1917	11.2	45,800	1927	8.4	29,000

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
			67. Abbotts Creek at Lexington, N. C.					
1940	16.9	6,820	1944	14.8	4,740	1948	10.7	2,410
1941	10.8	2,550	1945	17.7	7,740	1949	14.7	4,660
1942	-	-	1946	16.4	6,300	1950	14.7	5,160
1943	13.1	3,510	1947	22.1	14,800	1951	6.3	1,140
						1952	16.8	7,470
			68. Yadkin River at High Rock, N. C.					
1916	22.1	138,000	1921	12.0	43,800	1925	13.5	55,600
			1922	9.7	27,800	1926	-	-
1919	15.9	76,600	1923	13.8	53,100	1927	10.0	29,700
1920	12.5	47,600	1924	11.1	37,200			
			69. Uwharrie River near Trinity, N. C.					
1935	4.0	748	1937	5.7	1,540	1939	4.6	1,040
1936	5.6	1,500	1938	3.6	609	1940	6.9	2,140
						1941	7.0	2,190
			70. Uwharrie River near Eldorado, N. C.					
1939	13.7	9,400	1944	12.2	7,160	1949	13.8	8,810
1940	8.8	4,810	1945	26.2	23,300	1950	12.6	7,670
1941	8.3	4,380	1946	15.5	10,400	1951	7.6	3,480
1942	15.4	10,300	1947	16.3	11,200	1952	20.8	16,100
1943	13.6	8,480	1948	12.5	7,570			
			71. Rocky River near Norwood, N. C.					
1908	35	67,600	1937	27.3	42,600	1945	46.4	105,000
			1938	13.5	16,800	1946	20.2	28,600
1930	31.4	52,500	1939	21.1	30,200	1947	19.5	27,200
1931	17.2	23,600	1940	9.5	10,400	1948	22.9	34,000
1932	23.8	36,100				1949	26.7	42,200
1933	27.6	44,100	1941	15.5	20,200	1950	15.2	19,600
1934	11.4	13,600	1942	22.0	31,900			
1935	21.1	30,200	1943	20.9	29,800	1951	11.8	14,000
1936	32	52,800	1944	27.0	42,000	1952	34.0	63,400
			72. Little Brown Creek near Polkton, N. C.					
1936	5.6	1,500	1938	4.6	1,000	1940	3.8	668
1937	5.4	1,400	1939	7.0	2,200			
			73. Brown Creek near Polkton, N. C.					
1908	16.4	12,500	1938	10.6	1,870	1945	17.7	17,300
			1939	12.5	3,960	1946	9.4	1,180
1916	15.7	10,400	1940	6.2	535	1947	10.6	1,920
						1948	10.5	1,790
1928	15.0	8,500	1941	11.6	2,880	1949	11.7	3,000
			1942	10.7	1,950	1950	6.3	503
1936	13.1	4,820	1943	9.6	1,270	1951	8.9	995
1937	9.4	1,190	1944	12.5	3,960	1952	14.3	7,000

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water Year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
75. Pee Dee River at Cheraw, S. C.								
(Gage heights observed; daily-mean discharges computed on basis of records at other sites)								
1891	34.2	88,700	1904	25.7	42,800	1917	33.1	73,500
1892	36.8	146,000	1905	33.8	81,900	1918	35.4	115,000
1893	34.1	86,500				1919	36.0	128,000
1894	32.9	71,600	1906	31.8	64,200	1920	28.6	50,900
1895	34.4	93,000	1907	25.0	41,100			
			1908	44.3	309,000	1921	36.0	128,000
1896	36.4	137,000	1909	32.9	71,600	1922	34.7	99,600
1897	31.2	61,000	1910	31.8	64,100	1923	35.2	111,000
1898	29.5	54,000				1924	29.3	53,200
1899	34.9	104,000	1911	25.4	42,000	1925	34.8	102,000
1900	32.1	65,900	1912	39.2	198,000			
			1913	36.1	130,000	1926	24.8	40,600
1901	36.2	132,000	1914	29.2	52,900	1927	27.0	46,200
1902	35.5	117,000	1915	33.1	73,500	1928	42.0	259,000
1903	33.8	81,900	1916	36.3	135,000	1929	37.7	165,000
						1930	39.7	209,000
76. Juniper Creek near Cheraw, S. C.								
1940	1.1	256	1944	1.1	286	1948	1.4	430
1941	1.3	395	1945	5.7	3,910	1949	-	459
1942	1.2	332	1946	1.3	410	1950	1.0	224
1943	1.1	295	1947	1.3	369	1951	1.3	392
						1952	2.0	778
77. Drowning Creek near Hoffman, N. C.								
1940	5.3	435	1944	9.6	8,000	1948	6.5	1,280
1941	6.4	1,130	1945	10.3	10,900	1949	9.2	6,360
1942	5.8	740	1946	6.4	1,210	1950	7.6	2,710
1943	6.2	989	1947	8.2	1,050	1951	5.5	576
						1952	6.9	1,480
78. Lumber River at Boardman, N. C.								
(Gage heights observed and stage-discharge relation estimated, 1897-1913)								
1897	10.0	9,900	1911	8.6	5,720	1939	10.4	12,600
1898	7.6	3,660	1912	9.6	8,360	1940	6.3	1,830
1899	10.3	11,500	1913	9.1	6,940	1941	8.2	4,660
1900	9.0	6,680				1942	7.9	4,160
			1928	11.8	25,000	1943	8.1	4,560
1901	10.8	14,800				1944	8.4	5,420
1902	9.2	7,200	1930	9.2	7,430	1945	10.6	13,400
1903	8.9	6,440	1931	7.2	3,110			
1904	9.0	6,680	1932	6.5	2,150	1946	8.0	4,120
1905	8.7	5,960	1933	8.3	5,230	1947	7.7	3,750
			1934	6.6	2,120	1948	9.2	7,070
1906	9.7	8,700	1935	9.1	7,080	1949	9.3	7,600
1907	7.9	4,220				1950	7.1	2,880
1908	10.5	12,700	1936	10.1	10,800			
1909	7.3	3,160	1937	8.7	5,920	1951	-	1,600
1910	7.7	3,840	1938	8.7	5,920	1952	7.0	2,740
79. Little Pee Dee River near Dillon, S. C.								
1939	10.2	2,910	1944	9.6	2,130	1949	10.5	3,330
1940	8.4	1,080	1945	14.6	9,810	1950	8.1	915
1941	9.6	2,130	1946	9.4	2,020	1951	8.5	1,200
1942	10.1	2,770	1947	9.8	2,470	1952	8.9	1,540
1943	9.5	2,020	1948	10.8	3,750			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
80. Catawba River near Marion, N. C.								
1940	19.3	71,400	1944	6.5	3,560	1948	10.4	6,790
			1945	11.4	8,210	1949	15.0	19,700
1942	10.0	6,300	1946	7.9	4,420	1950	11.2	7,630
1943	7.7	4,260	1947	6.4	3,240	1951	12.7	9,620
						1952	10.6	7,010
81. Linville River at Branch, N. C.								
1923	5.9	4,100	1933	7.1	6,700	1943	5.3	2,900
1924	6.7	5,750	1934	4.3	1,700	1944	4.0	1,360
1925	4.7	2,170	1935	7.9	10,000	1945	7.3	7,420
1926	4.7	2,170	1936	4.8	2,250	1946	5.5	3,380
1927	5.0	2,350	1937	8.0	10,400	1947	4.2	1,620
1928	7.5	8,350	1938	5.9	4,130	1948	5.9	4,040
1929	6.8	6,000	1939	6.1	4,400	1949	8.0	10,400
1930	5.6	3,530	1940	11.4	39,500	1950	6.4	5,100
1931	4.4	1,810	1941	5.0	2,420	1951	7.4	8,030
1932	4.1	1,450	1942	6.3	4,700	1952	6.6	5,500
82. Henry Fork near Henry River, N. C.								
1916	23.0	20,700	1940	29.2	31,300	1948	14.5	9,000
						1949	11.9	6,910
1926	9.5	4,400	1942	8.0	3,300	1950	8.4	3,930
1927	5.6	2,100	1943	7.4	2,980			
1928	15.3	9,800	1944	8.7	3,800	1951	10.5	4,870
1929	9.8	4,600	1945	16.6	11,400	1952	11.2	5,350
1930	18.4	13,600	1946	8.1	3,400			
1931	6.5	2,420	1947	16.6	11,400			
83. South Fork Catawba River at Lowell, N. C.								
1940	21.3	34,000	1944	12.0	11,000	1948	10.6	8,060
			1945	17.0	22,000	1949	11.6	9,450
1942	10.8	8,850	1946	13.0	13,000	1950	12.7	12,300
1943	12.9	12,800	1947	10.6	8,540	1951	7.6	3,980
						1952	15.3	18,300
84. Little Sugar Creek near Charlotte, N. C.								
1924	13.4	5,500	1934	13.9	5,860	1944	12.6	4,840
1925	12.5	4,700	1935	10.6	3,300	1945	10.5	3,430
1926	10.5	3,150	1936	16.2	8,370	1946	-	-
1927	10.1	2,900	1937	11.9	4,280	1947	7.4	1,800
1928	15.0	7,030	1938	6.4	1,020	1948	10.8	3,360
1929	13.4	5,340	1939	10.9	3,520	1949	11.3	3,730
1930	10.4	2,760	1940	8.8	2,230	1950	8.5	2,160
1931	9.6	2,260	1941	12.4	4,680	1951	8.7	2,240
1932	13.9	5,860	1942	14.5	6,600	1952	12.0	4,360
1933	12.8	4,760	1943	10.2	3,040			
86. Second Broad River at Cliffside, N. C.								
1926	4.7	3,860	1935	5.3	4,300	1944	4.9	3,390
1927	2.9	1,450	1936	10.1	8,490	1945	12.5	10,600
1928	17.3	14,500	1937	6.1	4,600	1946	7.9	6,400
1929	8.6	7,590	1938	9.5	7,950	1947	9.0	7,500
1930	12.6	10,800	1939	4.6	3,060	1948	5.1	3,600
			1940	17.9	15,000	1949	8.7	6,340
1931	3.7	2,500				1950	4.4	2,510
1932	5.3	4,300	1941	6.0	4,500			
1933	7.0	6,100	1942	5.1	3,600	1951	7.8	5,400
1934	7.6	6,670	1943	5.7	4,200	1952	7.9	5,480

Table 1 - Annual flood stages and discharges at gaging stations--Continued

87. Broad River near Boiling Springs, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1926	8.5	12,400	1935	10.3	14,300	1944	9.2	11,800
1927	6.2	7,550	1936	14.8	26,000	1945	16.3	32,300
1928	24.3	73,300	1937	14.8	26,000	1946	13.4	22,700
1929	13.4	24,500	1938	13.9	23,500	1947	12.5	20,000
1930	17.2	35,900	1939	9.1	11,500	1948	8.7	10,800
			1940	22.1	60,400	1949	12.6	20,300
1931	5.1	5,790				1950	10.1	13,800
1932	7.6	10,100	1941	-	-			
1933	13.0	23,300	1942	9.9	13,400	1951	10.9	15,800
1934	8.0	10,900	1943	11.6	17,600	1952	11.6	17,600

88. First Broad River near Lawndale, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1940	37.8	32,500	1944	11.9	4,840	1948	12.5	5,320
1941	21.7	12,400	1945	19.9	9,530	1949	20.8	10,200
1942	18.2	9,170	1946	20.3	9,810	1950	22.4	11,300
1943	15.5	7,250	1947	17.4	8,580	1951	12.8	5,390
						1952	20.4	9,880

89. North Pacolet River at Fingerville, S. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1930	4.6	1,160	1938	17.5	5,400	1946	17.1	5,040
1931	4.0	872	1939	10.6	2,480	1947	12.3	3,110
1932	7.0	2,120	1940	27.1	12,500	1948	7.3	1,370
1933	15.7	6,820				1949	13.7	3,780
1934	12.0	2,100	1941	8.5	1,540	1950	16.7	5,150
1935	-	1,760	1942	11.4	2,700			
			1943	10.2	2,200	1951	9.9	2,320
1936	19.8	6,120	1944	9.7	1,620	1952	-	3,880
1937	21.2	7,270	1945	13.9	3,780			

91. South Fork New River near Jefferson, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1916	-	35,200	1934	5.0	3,390	1943	6.1	3,540
			1935	8.5	7,870	1944	5.7	3,260
1925	5.1	4,000				1945	9.2	9,280
1926	5.1	4,000	1936	6.0	3,610			
			1937	6.1	3,730	1946	6.1	3,900
1928	8.4	9,800	1938	5.9	3,490	1947	4.6	1,990
1929	5.3	4,300	1939	6.4	4,090	1949	6.7	4,800
1930	7.0	7,090	1940	22.5	52,800	1949	8.8	8,460
1931	3.9	2,440				1950	6.0	3,750
1932	4.8	3,580	1941	5.2	2,740	1951	8.6	8,060
1933	7.8	8,610	1942	5.8	3,470	1952	6.2	4,100

94. North Fork New River at Crumpler, N. C.

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
1878	17.6	44,300	1929	7.0	6,250	1942	4.6	3,850
			1930	7.3	6,670	1943	6.7	7,780
1901	16.4	23,500				1944	6.2	6,620
			1931	4.2	2,980	1945	8.5	11,400
1909	7.8	6,660	1932	5.4	4,570			
1910	4.9	2,700	1933	4.8	3,670	1946	7.6	8,830
			1934	5.2	4,220	1947	6.9	7,290
1911	6.1	4,190	1935	7.0	7,500	1948	6.2	6,380
1912	6.2	4,320				1949	8.6	11,300
1913	8.6	7,960	1936	6.2	5,910	1950	5.6	4,870
1914	4.8	2,590	1937	4.6	3,450			
1915	6.9	5,290	1938	5.0	3,900	1951	10.7	17,100
1916	16.4	38,700	1939	4.8	3,670	1952	5.3	4,380
			1940	23.0	73,000			
1928	6.8	5,970	1941	4.4	3,450			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
93. New River near Galax, Va.								
1930	9	33,100	1938	6.0	19,200	1946	6.8	22,000
1931	4.4	12,000	1939	6.4	21,400	1947	5.6	16,400
1932	4.0	9,470	1940	25.7	141,000	1948	5.4	15,400
1933	6.5	22,000				1949	8.4	30,000
1934	5.2	14,800	1941	3.8	8,940	1950	4.9	13,200
1935	7.4	24,900	1942	5.3	15,000			
			1943	5.6	15,400	1951	9.9	38,000
1936	6.3	20,800	1944	5.0	13,600	1952	5.2	14,500
1937	5.2	14,800	1945	9.9	38,000			
96. French Broad River at Rosman, N. C.								
1907	5.0	1,930	1937	7.5	2,560	1945	7.3	2,360
1908	9.0	6,000	1938	10.2	5,400	1946	7.4	2,460
1909	7.5	4,350	1939	10.6	6,100	1947	7.8	2,730
			1940	11.9	9,410	1948	9.1	3,620
1916	13.9	-				1949	9.5	4,080
			1941	6.4	1,970	1950	11.2	5,700
1928	12.9	-	1942	10.4	5,740			
			1943	9.9	4,940	1951	10.2	4,500
1936	9.4	4,280	1944	5.2	1,340	1952	11.2	5,660
97. French Broad River at Calvert, N. C.								
1916	18.3	-	1934	6.1	3,100	1944	4.2	2,010
			1935	9.4	5,870	1945	5.5	2,610
1925	8.1	4,490						
1926	9.0	5,330	1936	8.8	5,100	1946	7.2	3,750
1927	4.0	1,940	1937	7.3	3,880	1947	7.0	3,600
1928	13.0	16,100	1938	9.2	5,580	1948	7.7	4,120
1929	8.6	4,730	1939	10.5	8,000	1949	8.8	5,190
1930	4.9	2,430	1940	11.7	12,300	1950	9.4	6,140
1931	8.0	4,410	1941	5.0	2,450	1951	9.1	5,600
1932	6.6	3,400	1942	9.6	6,510	1952	9.8	6,960
1933	11.6	11,200	1943	9.2	5,810			
98. Catheys Creek near Brevard, N. C.								
1945	1.9	207	1948	3.4	675	1951	3.5	735
1946	2.3	333	1949	4.4	1,250	1952	4.0	1,260
1947	2.8	401	1950	3.6	794			
100. Davidson River near Brevard, N. C.								
1876	11.9	-	1928	11.8	8,400	1940	9.2	6,100
			1929	7.0	3,160	1941	2.9	701
1916	10.3	-	1930	4.9	1,630	1942	7.5	5,110
						1943	5.7	2,930
1919	10.9	-	1931	5.3	1,880	1944	3.2	870
			1932	4.3	1,280	1945	4.9	2,140
1921	7.7	3,780	1933	10.0	6,130			
1922	5.0	1,690	1934	4.0	1,070	1946	4.3	1,670
1923	6.3	2,590	1935	8.8	3,700	1947	4.9	2,180
1924	6.8	2,950				1948	5.7	2,930
1925	4.5	1,390	1936	7.0	2,780	1949	8.7	6,800
			1937	6.2	2,110	1950	6.1	3,340
1926	6.0	2,360	1938	7.8	3,450	1951	5.6	2,830
1927	5.7	2,150	1939	7.1	3,650	1952	7.0	4,490
101. Little River near Penrose, N. C.								
1916	14	-	1942	9	2,550	1947	4.8	1,060
			1943	9.4	2,730	1948	5.4	1,240
1928	13.5	-	1944	4.2	873	1949	8.7	2,450
			1945	3.5	656	1950	5.6	1,310
1940	11	3,800	1946	6.3	1,560	1951	8.5	2,380
						1952	10.7	3,280

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
102. Crab Creek near Penrose, N. C.								
1943	7.0	1,000	1946	4.7	396	1949	6.1	707
1944	3.6	308	1947	4.9	428	1950	4.2	347
1945	4.7	396	1948	4.4	369	1951	7.0	1,080
						1952	7.6	1,500
103. French Broad River at Blantyre, N. C.								
1875	17	-	1921	16.2	5,170	1938	18.8	9,470
1876	23	-	1922	15.2	4,840	1939	17.4	6,180
			1923	16.0	5,220	1940	21.9	20,800
1880	19	-	1924	15.1	4,470			
			1925	14.6	4,280	1941	13.5	3,580
1893	18	-				1942	19.9	12,800
			1926	16.5	5,100	1943	20.2	13,800
1899	17	-	1927	13.2	3,700	1944	15.8	4,220
			1928	22.9	26,500	1945	13.1	3,360
1901	20	-	1929	19.2	10,600			
1902	19	-	1930	16.7	5,420	1946	18.5	8,720
						1947	17.2	5,400
1905	21	-	1931	13.9	3,960	1948	16.5	4,720
1906	22	-	1932	14.5	4,280	1949	18.6	8,010
			1933	20.7	15,600	1950	17.0	5,180
1910	21	-	1934	17.3	6,110			
			1935	18.3	8,040	1951	18.2	6,880
1916	27.1	-				1952	19.0	9,730
			1936	18.8	9,470			
1919	20	-	1937	17.7	6,560			
104. Boylston Creek near Horseshoe, N. C.								
1943	3.5	380	1946	4.9	659	1949	5.1	662
1944	3.0	292	1947	4.5	575	1950	3.5	365
1945	2.8	252	1948	3.2	336	1951	5.7	805
						1952	5.4	693
105. South Fork Mills River at The Pink Beds, N. C.								
1927	4.4	317	1935	5.4	679	1943	5.3	618
1928	8.0	2,220	1936	4.6	386	1944	4.4	309
1929	5.5	700	1937	5.8	833	1945	4.8	434
1930	5.1	541	1938	5.4	638			
			1939	5.2	560	1946	4.8	395
1931	4.3	284	1940	7.2	1,610	1947	5.0	504
1932	5.2	579				1948	5.4	658
1933	5.7	787	1941	4.5	330	1949	7.4	1,850
1934	4.5	331	1942	4.9	490			
108. Mills River near Mills River, N. C.								
1876	12	6,800	1925	3.6	1,600	1942	6.8	2,730
			1926	5.7	2,670	1943	6.7	2,670
1901	11	5,100				1944	3.8	935
1902	12	6,800	1928	13.5	12,800	1945	3.9	995
1906	10	4,400	1935	8.4	3,560	1946	5.2	1,870
			1936	5.1	1,850	1947	6.1	2,310
1910	12	6,800	1937	8.4	3,560	1948	6.6	2,630
			1938	6.2	2,340	1949	11.2	5,330
1916	12.5	8,400	1939	6.8	2,600	1950	4.6	1,460
			1940	13.6	13,400			
1918	10	4,400	1941	3.7	900	1951	7.2	2,910
						1952	8.1	3,360

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
109. Clear Creek near Hendersonville, N. C.								
1910	13	-	1940	12	-	1949	10.5	4,020
						1950	8.0	1,590
1916	16	-	1946	7.7	1,480	1951	8.8	2,240
			1947	6.6	749	1952	8.9	2,340
1928	13	-	1948	7.2	972			
110. Mud Creek at Naples, N. C.								
1876	15	-	1928	14.9	17,000	1943	10.1	3,070
						1944	8.4	1,430
1901	13	-	1933	13.5	12,000	1945	8.6	1,440
1902	12	-				1946	10.0	2,880
			1936	9.0	1,800	1947	9.2	1,930
1906	10	-				1948	9.2	1,910
			1939	-	1,520	1949	11.5	5,740
1910	15.5	-	1940	13.1	10,800	1950	9.8	2,470
			1941	8.2	1,480	1951	11.6	5,940
1916	21.5	40,000	1942	12.6	8,880	1952	11.6	5,940
111. Cane Creek at Fletcher, N. C.								
1876	9	-	1923	6.5	-	1947	6.4	1,420
						1948	6.1	1,360
1893	8	-	1928	8.5	2,900	1949	8.4	2,770
						1950	7.0	1,680
1901	7	-	1940	9.2	4,000			
1902	7	-				1951	8.0	2,000
			1943	8.0	2,200	1952	8.3	2,090
1910	9	-	1944	3.4	680			
			1945	4.8	1,000			
1916	14.8	23,000	1946	8.2	2,410			
112. French Broad River at Bent Creek, N. C.								
1916	27.3	-	1939	7.0	8,250	1946	8.4	10,700
			1940	12.6	23,600	1947	7.9	9,540
1928	16.1	-				1948	6.7	7,170
			1941	5.9	5,700	1949	8.2	10,200
1935	8.7	12,300	1942	11.8	19,600	1950	7.2	8,220
1936	9.0	13,200	1943	10.6	16,100			
1937	8.5	11,900	1944	6.8	7,300	1951	9.1	12,400
1938	8.4	11,600	1945	6.3	6,200	1952	8.5	11,000
113. Hominy Creek at Candler, N. C.								
1940	18.0	13,100	1945	3.5	935	1949	13.2	6,800
			1946	5.5	2,160	1950	4.2	1,300
1943	4.5	1,520	1947	4.6	1,550	1951	6.9	2,890
1944	3.5	935	1948	4.7	1,640	1952	4.8	1,670
114. North Fork Swannanoa River near Black Mountain, N. C.								
1926	4.6	1,830	1935	4.7	1,730	1944	4.5	1,480
1927	5.5	2,760	1936	4.4	1,400	1945	3.6	758
1928	7.0	6,180	1937	5.3	2,420	1946	4.2	1,120
1929	4.3	1,270	1938	4.2	1,210	1947	4.3	1,270
1930	6.0	3,640	1939	4.9	2,030	1948	6.2	4,030
			1940	8.6	12,900	1949	9.1	16,500
1931	3.8	884				1950	5.4	2,650
1932	4.4	1,400	1941	4.0	1,000			
1933	4.6	1,610	1942	4.4	1,320	1951	4.6	1,540
1934	4.6	1,570	1943	4.5	1,460	1952	4.5	1,510

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
			115. Swannanoa River at Swannanoa, N. C.					
1908	7.8	4,360	1927	4.7	2,260	1930	6.7	3,220
			1928	10.9	10,400	1931	5.2	1,830
1926	4.5	2,080	1929	5.9	3,440			
			116. Beetree Creek near Swannanoa, N. C.					
1927	4.1	362	1936	3.7	220	1945	3.0	101
1928	5.4	830	1937	3.7	216	1946	3.3	141
1929	3.5	192	1938	3.4	179	1947	3.8	253
1930	4.2	379	1939	3.8	262	1948	3.4	158
			1940	6.2	1,370	1949	4.8	565
1931	3.6	204				1950	3.4	152
1932	3.5	180	1941	3.7	232			
1933	3.7	242	1942	3.4	151	1951	3.9	265
1934	3.6	204	1943	3.6	207	1952	3.8	247
1935	3.6	204	1944	3.7	220			
			117. Swannanoa River at Biltmore, N. C.					
						1939	6.0	2,460
1791	26	-	1902	15	-	1940	19.0	18,400
1796	15	-	1916	21.5	-	1941	4.9	1,500
						1942	5.6	1,910
1810	15	-	1921	5.0	2,220	1943	7.0	2,840
			1922	4.0	1,500	1944	6.0	2,150
1845	18	-	1923	8.2	4,690	1945	4.6	1,340
			1924	6.2	3,090			
1850	13	-	1925	6.0	2,930	1946	7.1	2,810
			1926	6.1	3,010	1947	6.8	2,650
1852	15	-				1948	7.7	3,180
			1928	18.7	18,000	1949	14.6	9,930
1875	17	-				1950	8.5	3,820
1876	15	-	1935	7.1	3,260			
			1936	7.0	3,340	1951	7.0	2,850
1899	14	-	1937	8.6	4,380	1952	7.6	3,270
1901	16	-	1938	5.0	1,780			
			118. French Broad River at Asheville, N. C.					
1796	14	-	1906	8.4	28,500	1931	4.3	7,010
			1907	6.2	15,800	1932	4.2	6,780
1810	13	-	1908	6.3	16,600	1933	7.3	15,800
			1909	7.1	19,200	1934	6.0	11,500
1845	14	-	1910	10.3	30,300	1935	7.6	16,900
1850	13	-	1911	5.8	14,900	1936	7.5	16,500
			1912	6.1	15,900	1937	8.2	19,200
1852	15	-	1913	7.7	21,300	1938	6.4	12,700
			1914	4.5	10,800	1939	6.1	11,700
1875	9	-	1915	7.3	19,900	1940	12.2	34,800
1876	18	-						
			1916	23.1	110,000	1941	4.4	7,140
1880	9	-	1917	5.5	13,800	1942	8.9	20,900
			1918	5.0	12,200	1943	8.1	18,000
1892	10	-	1919	9.0	25,600	1944	5.2	9,110
1893	9	-	1920	7.1	19,000	1945	4.9	7,490
1896	10.3	21,600	1921	5.0	12,000	1946	7.6	16,000
1897	7.9	12,500	1922	4.2	9,920	1947	7.1	13,600
1898	8.7	13,900	1923	6.5	13,300	1948	5.6	9,540
1899	12.0	26,600	1924	5.4	9,600	1949	9.0	20,100
1900	9.0	14,900	1925	5.3	9,210	1950	6.9	13,000
1901	12.6	29,300	1926	5.6	10,300	1951	8.1	16,400
1902	12.2	26,900	1927	5.4	9,770	1952	7.8	15,600
1903	7.0	19,000	1928	13.3	42,700			
1904	5.6	13,800	1929	7.1	15,100			
1905	8.0	23,000	1930	7.1	15,100			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
119. Sandymush Creek near Alexander, N. C.								
1940	16.7	-	1945	5.3	1,550	1949	8.0	3,600
			1946	9.6	5,490	1950	5.8	1,500
1943	5.8	1,980	1947	6.7	2,280	1951	5.9	1,550
1944	7.8	3,950	1948	5.5	1,250	1952	5.9	1,580
120. Ivy River near Marshall, N. C.								
1934	7.3	2,670	1941	8.0	3,370	1947	8.4	3,820
1935	7.5	2,830	1942	7.8	3,170	1948	7.7	3,100
			1943	8.3	3,670	1949	8.0	3,370
1936	10.7	5,850	1944	8.9	4,290	1950	7.3	2,740
1937	10.2	5,350	1945	7.0	2,430			
1938	8.1	3,360				1951	6.9	2,360
1939	7.3	2,670	1946	11.4	7,190	1952	7.0	2,390
1940	12.7	8,880						
121. French Broad River at Marshall, N. C.								
1916	18.5	-	1944	5.2	11,400	1949	7.9	22,400
			1945	4.7	8,940	1950	6.4	15,300
1940	13.5	-	1946	9.2	29,600	1951	7.2	19,000
			1947	7.6	21,400	1952	7.9	22,400
1943	7.6	23,600	1948	5.7	12,400			
122. Big Laurel Creek near Stackhouse, N. C.								
1934	3.8	1,320	1941	3.4	987	1947	5.6	3,320
1935	7.9	7,260	1942	3.7	1,230	1948	5.3	2,830
			1943	7.1	5,530	1949	5.5	3,140
1936	6.8	5,070	1944	4.8	2,370	1950	5.5	3,020
1937	5.3	3,010	1945	4.4	1,980			
1938	4.5	2,140				1951	5.1	2,490
1939	4.3	1,920	1946	7.2	5,870	1952	4.5	1,810
1940	6.7	4,920						
123. French Broad River at Hot Springs, N. C.								
1916	19.3	-	1939	5.7	15,600	1944	5.5	14,200
			1940	16.1	75,900	1945	4.9	9,850
1935	7.2	28,800						
1936	8.8	38,600	1941	5.3	12,600	1946	10.0	43,500
1937	7.5	29,500	1942	6.7	22,900	1947	7.5	27,200
1938	6.1	18,100	1943	7.9	31,000	1948	6.0	16,800
						1949	6.8	23,000
124. Pigeon River at Canton, N. C.								
1876	18	-	1932	7.6	5,950	1942	7.0	5,080
			1933	9.3	8,530	1943	8.8	7,630
1893	18	-	1934	7.1	5,240	1944	5.2	2,950
			1935	9.0	8,050	1945	8.8	7,630
1907	8.5	4,600						
1908	10.0	6,600	1936	8.1	6,700	1946	7.6	5,920
1909	7.5	3,430	1937	9.0	8,050	1947	8.9	7,780
			1938	8.0	6,550	1948	7.2	5,290
1928	16	-	1939	9.4	8,690	1949	15.4	19,500
1929	8.9	7,900	1940	20.8	31,600	1950	9.3	8,320
1930	7.4	5,660						
			1941	5.2	2,950	1951	9.8	9,180
1931	7.7	6,100				1952	8.7	7,450

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
126. Jonathan Creek near Cove Creek, N. C.								
1931	4.4	1,160	1938	4.4	1,150	1946	6.8	2,680
1932	4.7	1,300	1939	6.0	2,120	1947	7.0	2,820
1933	5.6	1,930	1940	7.5	3,200	1948	4.9	1,400
1934	5.1	1,600	1941	3.9	830	1949	5.8	1,970
1935	4.3	1,050	1942	4.8	1,310	1950	5.2	1,550
			1943	5.4	1,710			
1936	6.2	2,270	1944	5.2	1,580	1951	5.0	1,450
1937	5.9	2,050	1945	4.4	1,070	1952	5.6	1,860
127. Pigeon River near Hepco, N. C.								
1876	18	-	1934	9.9	13,800	1943	9.2	11,800
			1935	9.0	11,300	1944	6.4	5,320
1902	18	-				1945	7.7	7,510
			1936	9.7	13,200			
1928	12.6	21,900	1937	9.2	11,800	1946	10.2	13,600
1929	8.5	9,950	1938	7.1	6,670	1947	9.8	12,400
1930	7.1	6,670	1939	8.4	9,690	1948	6.9	5,940
			1940	15.8	32,700	1949	12.4	21,000
1931	7.7	7,970				1950	7.6	7,260
1932	8.0	8,680	1941	5.4	3,660			
1933	9.8	13,800	1942	7.3	7,090	1951	9.0	10,600
						1952	9.1	10,800
128. Cataloochee Creek near Cataloochee, N. C.								
1935	5.3	1,440	1941	3.6	457	1947	6.7	2,960
			1942	4.8	1,120	1948	5.2	1,400
1936	6.6	2,700	1943	5.2	1,480	1949	5.5	1,690
1937	6.1	2,220	1944	6.5	2,640	1950	5.4	1,640
1938	4.6	1,040	1945	5.3	1,520			
1939	5.8	1,900				1951	4.7	1,090
1940	7.0	3,390	1946	6.8	3,170	1952	6.0	2,140
129. North Toe River at Altapass, N. C. (above Spruce Pine 1935-38)								
1916	24	-	1940	19.5	22,200	1946	7.5	2,940
						1947	6.0	1,960
1935	11.8	4,450	1941	3.4	878	1948	7.0	2,590
1936	7.7	2,680	1942	6.6	3,020	1949	10.7	4,760
1937	7.8	2,360	1943	6.9	3,290	1950	5.4	1,580
1938	7.5	2,430	1944	5.1	1,500	1951	10.9	4,970
1939	6.2	2,530	1945	8.2	3,450	1952	5.9	1,820
130. South Toe River at Newdale, N. C.								
1935	10.0	11,700	1941	6.0	3,380	1947	8.4	6,570
			1942	5.0	2,380	1948	9.0	7,740
1936	5.7	4,250	1943	5.8	3,180	1949	12.5	14,300
1937	10.2	12,100	1944	5.6	2,960	1950	11.2	11,700
1938	5.0	3,040	1945	6.8	4,300			
1939	7.1	6,480				1951	8.1	6,240
1940	17.4	29,400	1946	6.6	4,110	1952	7.1	4,390
131. Cane River near Sioux, N. C.								
1934	12.1	11,400	1941	5.8	2,320	1947	10.6	8,320
1935	9.1	5,710	1942	6.0	2,520	1948	8.7	5,370
			1943	6.3	2,820	1949	15.6	23,800
1936	8.6	5,340	1944	6.5	3,020	1950	8.6	5,360
1937	9.0	5,780	1945	6.2	2,670			
1938	6.0	2,650				1951	8.8	5,640
1939	6.9	3,450	1946	10.2	7,670	1952	7.5	3,550
1940	17.8	31,800						

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
132. Nolichucky River at Poplar, N. C.								
1901	21	-	1933	8.4	13,500	1943	9.1	15,900
			1934	11.0	23,500	1944	6.4	8,140
1916	21	-	1935	12.5	28,000	1945	8.2	13,000
1926	5.7	9,770	1936	9.6	18,400	1946	10.8	22,200
1927	6.6	12,300	1937	11.8	26,400	1947	8.6	14,400
1928	14.7	41,400	1938	6.3	7,900	1948	9.4	16,800
1929	9.3	16,900	1939	7.0	9,500	1949	14.4	39,500
1930	9.7	17,500	1940	19.7	74,500	1950	11.0	22,900
1931	7.2	9,810	1941	5.7	6,440	1951	11.4	24,500
1932	7.4	10,900	1942	6.8	9,100	1952	7.1	9,700
133. Watauga River near Sugar Grove, N. C.								
1916	22.1	28,000	1943	9.7	5,420	1948	8.3	3,910
			1944	6.4	2,320	1949	11.1	7,070
1940	29.6	50,800	1945	11.1	7,020	1950	7.3	2,880
1941	7.3	3,020	1946	8.0	3,590	1951	16.4	15,500
1942	11.0	6,900	1947	6.0	1,840	1952	8.5	4,060
135. Elk River near Elk Park, N. C.								
1935	7.2	3,640	1941	4.8	1,020	1947	5.0	1,220
1936	5.2	1,650	1942	6.7	3,140	1948	7.1	3,630
1937	5.0	1,490	1943	5.7	1,880	1949	7.9	4,690
1938	4.4	1,080	1944	5.0	1,140	1950	6.0	2,200
1939	6.0	2,370	1945	6.5	2,880	1951	8.3	5,320
1940	17.8	27,500	1946	5.8	2,060	1952	5.8	1,980
136. Little Tennessee River near Prentiss, N. C.								
1899	15	-	1946	9.3	3,880	1949	12.8	5,900
			1947	9.2	3,250	1950	8.0	3,180
1945	4.3	1,300	1948	6.3	2,270	1951	-	2,000
						1952	10.5	5,190
137. Cullasaja River at Highlands, N. C.								
1928	5.1	2,420	1936	4.1	1,360	1945	2.7	504
1929	4.2	1,120	1937	3.0	692			
1930	3.3	382	1938	3.6	990	1946	3.2	760
			1939	3.2	805	1947	3.1	724
1931	3.6	596	1940	9.4	5,100	1948	4.1	1,420
1932	3.0	680				1949	5.1	2,090
1933	3.1	730	1941	3.5	982	1950	3.1	761
1934	2.8	590	1942	3.0	762			
1935	3.0	738	1943	3.8	1,200	1951	3.2	802
			1944	2.6	442	1952	4.4	1,630
138. Cullasaja River at Cullasaja, N. C.								
1908	6.6	1,660	1929	12.8	4,180	1941	8.8	2,420
1909	9.2	2,580	1930	7.3	1,900	1942	7.9	2,100
1910	8.0	2,150				1943	12.1	3,850
			1931	7.4	1,940	1944	6.6	1,630
1916	17.2	8,000	1932	8.8	2,430	1945	6.7	1,720
			1933	9.2	2,580			
1922	8.0	2,150	1934	8.5	2,320	1946	10.0	2,900
1923	10.1	2,940	1935	10.2	3,000	1947	10.4	2,990
1924	8.6	2,360				1948	8.6	2,350
1925	7.6	2,010	1936	13.4	4,520	1949	17.6	8,620
			1937	7.8	2,070	1950	8.6	2,330
1926	8.2	2,220	1938	10.5	3,090			
1927	6.0	1,450	1939	8.5	2,320	1951	9.4	2,640
1928	17.0	7,770	1940	20.8	16,500	1952	13.9	4,810

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
140. Little Tennessee River at Iotla, N. C.								
1899	13	-	1932	6.3	5,420	1939	6.8	6,350
			1933	8.3	9,580	1940	13.5	19,600
1927	-	5,500	1934	6.8	6,320			
1928	-	8,400	1935	6.0	4,970	1941	5.6	4,300
1929	8.5	10,000				1942	6.0	4,940
1930	6.0	4,550	1936	8.8	10,900	1943	9.0	10,400
			1937	7.0	6,730	1944	6.1	5,110
1931	5.4	3,750	1938	7.4	7,530	1945	4.7	2,990
142. Nantahala River near Rainbow Springs, N. C.								
1940	6.5	3,420	1944	3.9	1,550	1948	4.6	1,960
1941	4.4	1,860	1945	3.1	980	1949	9.7	6,300
1942	4.1	1,650	1946	5.4	2,580	1950	4.6	1,990
1943	5.9	2,960	1947	5.5	2,670	1951	4.4	1,800
						1952	5.7	2,760
143. Nantahala River at Almond, N. C.								
1921	4.8	5,190	1928	6.8	9,790	1935	6.0	3,950
1922	7.8	-	1929	5.6	6,910	1936	10.2	11,000
1923	5.2	6,030	1930	4.1	3,780	1937	7.1	5,330
1924	4.2	3,980				1938	6.6	4,030
1925	5.0	5,610	1931	4.0	3,590	1939	7.7	5,560
			1932	5.1	5,820	1940	6.3	4,000
1926	4.1	3,780	1933	7.6	-			
1927	4.8	5,190	1934	6.8	9,790	1941	4.5	2,230
144. Little Tennessee River at Judson, N. C. (1911-23 computed from daily mean)								
1897	9.2	17,400	1913	-	18,400	1929	25.8	16,300
1898	11.9	29,000	1914	-	5,200	1930	22.2	7,350
1899	15.0	44,400	1915	-	12,800			
1900	11.4	26,400				1931	22.1	6,740
			1916	-	19,100	1932	23.2	8,960
1901	12.3	31,000	1917	-	38,000	1933	27.8	22,800
1902	16.2	51,000	1918	-	15,000	1934	26.7	17,500
1903	10.6	23,200	1919	-	24,700	1935	23.1	8,740
1904	6.2	7,600	1920	-	20,300			
1905	9.1	17,100				1936	26.7	19,000
			1921	-	16,200	1937	24.8	13,300
1906	12.0	14,800	1922	-	20,500	1938	24.4	12,300
1907	13.5	17,400	1923	-	14,200	1939	25.3	14,600
1908	10.9	13,000	1924	22.7	7,900	1940	27.6	22,100
1909	9.8	11,100	1925	24.2	11,200			
1910	6.7	5,930				1941	21.8	6,400
			1926	23.6	10,400	1942	22.7	8,400
1911	-	15,100	1927	24.6	12,900	1943	25.2	14,600
1912	-	18,000	1928	25.8	16,300	1944	23.0	8,970
145. Tuckasegee River at Tuckasegee, N. C.								
1840	18	23,100	1937	6.2	3,650	1945	5.8	3,340
			1938	7.0	4,450	1946	8.1	5,670
1876	17	17,100	1939	7.4	4,850	1947	6.5	4,000
			1940	21.1	40,800	1948	10.4	8,320
1928	14	13,200				1949	10.2	7,950
			1941	5.3	2,930	1950	6.9	4,350
1935	6.9	3,980	1942	6.3	3,820			
			1943	7.9	5,450			
1936	8.8	6,330	1944	4.2	1,920	1951	8.6	6,130
						1952	6.3	3,720

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
147. Scott Creek above Sylva, N. C. (at Sylva prior to 1942)								
1928	4.9	1,720	1936	5.8	2,040	1945	4.2	958
1929	6.0	2,200	1937	4.6	1,330			
1930	2.2	675	1938	4.1	1,130	1946	6.4	1,990
			1939	4.6	1,330	1947	5.8	1,640
1931	2.7	685	1940	8.6	3,360	1948	4.1	802
1932	3.6	905				1949	6.0	1,750
1933	4.6	1,330	1941	3.1	476	1950	5.2	1,360
1934	4.9	1,460	1942	4.9	1,210			
1935	3.0	765	1943	4.8	1,140	1951	3.8	685
			1944	5.0	1,260	1952	5.3	1,420
148. Tuckasegee River at Dillsboro, N. C.								
1928	11.2	14,000	1936	10.3	9,800	1945	7.3	4,780
1929	8.6	10,200	1937	9.0	7,140			
1930	3.9	3,360	1938	8.5	6,300	1946	10.9	11,700
			1939	9.0	7,380	1947	10.2	10,100
1931	5.0	4,900	1940	22.0	52,600	1948	9.7	8,940
1932	5.0	4,900				1949	11.8	13,900
1933	7.3	8,200	1941	7.1	4,480	1950	9.2	8,060
1934	6.0	6,270	1942	8.4	6,520			
1935	8.0	5,410	1943	10.1	9,850	1951	9.4	8,500
			1944	6.9	4,200	1952	8.9	7,420
149 Oconoluftee River at Cherokee, N. C.								
1907	12	-	1930	6.1	2,330	1940	8.8	6,310
						1941	7.2	3,830
1921	7.8	5,010	1931	8.1	5,100	1942	6.9	3,410
1922	9.5	7,500	1932	8.3	5,420	1943	9.2	6,990
1923	7.4	4,030	1933	9.0	6,600	1944	8.3	5,500
1924	7.3	3,890	1934	8.2	5,320	1945	8.2	5,340
1925	8.6	6,000	1935	7.7	4,540			
						1946	11.5	11,200
1926	7.2	3,780	1936	10.2	8,760	1947	10.6	9,490
1927	7.8	4,430	1937	8.6	5,980	1948	9.2	6,950
1928	7.9	4,780	1938	6.2	2,460	1949	9.4	7,400
1929	8.6	5,920	1939	9.7	7,860			
151. Tuckasegee River at Bryson City, N. C.								
1840	21	-	1916	9.8	24,400	1936	9.7	24,800
			1917	12.8	39,000	1937	8.1	18,600
1898	9.3	22,000	1918	10.3	26,200	1938	5.4	9,730
1899	11.6	32,500	1919	8.6	19,600	1939	7.7	17,200
1900	8.0	17,500	1920	13.1	41,100	1940	16.0	61,600
1901	11.5	32,000	1921	7.8	16,800	1941	5.2	9,270
1902	12.8	39,300	1922	9.2	21,800	1942	5.5	10,200
1903	9.0	21,100	1923	7.0	14,100	1943	8.8	21,700
1904	5.4	9,080	1924	5.9	10,700	1944	7.0	15,000
1905	6.8	13,500	1925	6.5	12,500	1945	5.8	10,400
1906	8.0	17,500	1926	6.8	13,500	1946	9.7	23,800
1907	14.2	48,300	1927	6.7	13,100	1947	10.6	27,600
1908	8.0	17,500	1928	9.2	21,600	1948	6.7	13,100
1909	7.9	17,100	1929	6.9	13,800	1949	8.4	18,800
1910	4.5	6,900	1930	4.0	5,680	1950	7.6	16,000
1911	8.2	18,200	1931	5.4	8,660	1951	7.0	14,300
1912	7.2	14,800	1932	5.8	9,540	1952	7.1	14,400
1913	10.7	28,000	1933	9.2	22,000			
1914	3.5	4,610	1934	8.1	17,900			
1915	6.2	11,600	1935	5.6	10,300			

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
152. Noland Creek near Bryson City, N. C.								
1936	4.4	1,060	1941	4.0	810	1947	4.6	1,300
1937	3.7	649	1942	4.0	840	1948	4.2	959
1938	3.3	447	1943	4.3	1,050	1949	4.1	938
1939	3.8	708	1944	4.4	1,130	1950	3.8	715
1940	4.9	1,530	1945	3.9	744	1951	3.8	745
			1946	4.5	1,260	1952	4.1	931
153. Hazel Creek at Proctor, N. C.								
1943	4.6	2,540	1946	4.0	1,740	1949	3.9	1,340
1944	5.4	3,880	1947	5.1	3,370	1950	5.7	4,500
1945	3.8	1,440	1948	4.0	1,660	1951	5.9	4,870
						1952	3.8	1,250
154. Little Tennessee River at Fontana Dam, N. C.								
1840	21	-	1939	11.0	37,000	1942	8.8	20,200
			1940	15.9	71,200	1943	15.8	60,000
1867	23	-	1941	8.3	16,500	1944	11.8	31,600
155. Snowbird Creek near Robbinsville, N. C.								
1943	5.6	2,620	1946	5.1	2,250	1949	6.3	3,160
1944	5.3	2,430	1947	6.4	3,650	1950	6.4	3,580
1945	4.4	1,690	1948	5.2	2,320	1951	9.0	7,430
						1952	5.6	2,690
157. Hiwassee River at Presley, Ga.								
1942	6.8	1,330	1945	5.4	750	1949	12.8	3,660
1943	10.2	2,600	1946	9.7	2,040	1950	10.4	2,540
1944	6.3	1,170	1947	7.8	1,510	1951	7.1	1,310
			1948	6.2	1,020	1952	15.2	5,700
158. Shooting Creek near Hayesville, N. C.								
1923	7.8	3,500	1944	4.8	871	1948	5.6	1,240
1924	4.9	940	1945	4.5	790	1949	9.2	6,820
			1946	-	-	1950	5.7	1,390
1943	6.0	1,420	1947	5.5	1,210	1951	4.7	920
						1952	5.3	1,210
159. Hiwassee River below Hayesville, N. C.								
1899	16.1	-	1936	12.4	10,600	1939	9.1	5,980
			1937	8.9	5,850	1940	8.0	4,610
1935	7.2	4,120	1938	11.1	8,720	1941	8.2	5,070

Table 1 - Annual flood stages and discharges at gaging stations--Continued

Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)	Water year	Gage height (feet)	Discharge (cfs)
160. Hiwassee River at Murphy, N. C. (above Murphy 1940-41)								
1897	14.0	15,200	1912	11.7	10,500	1927	8.4	10,300
1898	17.6	22,000	1913	14.0	14,400	1928	11.7	17,400
1899	18.6	23,100	1914	9.5	6,300	1929	10.3	14,300
1900	12.6	13,100	1915	11.5	10,100	1930	6.9	7,330
1901	12.7	13,200	1916	12.8	12,300	1931	7.5	8,500
1902	14.2	15,900	1917	15.0	15,400	1932	8.3	10,100
1903	12.0	12,000	1918	-	-	1933	12.2	18,700
1904	7.8	3,990	1919	15.1	16,500	1934	10.7	15,200
1905	10.3	8,490	1920	14.6	15,100	1935	7.2	7,880
1906	10.0	7,950	1921	12.8	12,400	1936	13.2	20,200
1907	15.8	18,400	1922	15.3	16,500	1937	9.2	11,800
1908	10.6	8,730	1923	12.3	13,400	1938	9.8	12,400
1909	13.0	12,700	1924	9.1	8,700	1939	8.8	10,100
1910	10.5	8,400	1925	8.0	6,700	1940	7.9	5,940
1911	11.0	9,300	1926	8.4	7,400	1941	8.4	6,660
161. Valley River at Tomotla, N. C.								
1905	9.6	3,350	1923	10.4	3,750	1938	9.6	3,240
1906	7.8	2,490	1924	6.6	1,970	1939	10.4	3,330
1907	17.3	9,030	1925	5.8	1,630	1940	6.0	1,440
1908	7.2	2,230						
1909	10.5	3,800	1926	6.8	2,050	1941	4.5	915
			1927	8.6	2,860	1942	8.3	2,400
1914	5.0	1,310	1928	12.8	5,140	1943	14.1	5,500
1915	11.0	4,080	1929	10.5	3,800	1944	11.5	3,900
			1930	7.9	2,540	1945	9.4	2,870
1916	10.2	3,650	1931	6.3	1,840	1946	14.2	5,570
1917	15.9	7,610	1932	10.0	3,550	1947	14.9	6,130
1918	-	-	1933	15.1	6,890	1948	10.0	3,150
1919	11.0	4,080	1934	13.0	5,280	1949	14.6	5,920
1920	14.6	6,480	1935	8.5	2,820	1950	14.0	5,460
1921	10.6	3,860						
1922	15.5	7,250	1936	16.4	8,100	1951	15.7	6,910
			1937	10.3	3,540	1952	12.2	4,330
162. Nottely River near Blairsville, Ga.								
1942	8.0	2,430	1945	4.8	1,040	1949	8.9	2,900
1943	8.8	2,860	1946	11.2	4,670	1950	11.4	4,880
1944	6.1	1,840	1947	9.2	3,100	1951	7.3	2,140
			1948	6.9	1,980	1952	16.8	8,500
164. Nottely River near Ranger, N. C.								
1901	16.7	7,680	1920	20.0	12,300	1931	12.5	5,170
1902	21.0	14,100				1932	13.1	5,160
1903	20.0	12,300	1921	16.0	7,000	1933	18.0	8,750
1904	9.0	2,600	1922	18.5	9,840	1934	13.9	5,980
1905	14.8	6,010	1923	16.0	7,000	1935	9.8	3,510
1906	11.8	4,060	1924	14.0	5,350			
			1925	10.0	3,080	1936	19.1	12,300
						1937	11.4	4,360
1915	13.4	5,060	1926	11.0	3,610	1938	18.5	11,300
			1927	13.0	4,800	1939	11.8	4,820
1916	19.4	11,200	1928	14.6	6,320	1940	10.0	3,560
1917	17.4	8,440	1929	14.1	6,160			
1918	-	-	1930	9.4	3,390	1941	12.2	4,780
1919	19.5	11,400						

Table 2 - Maximum known flood stages and discharges of North Carolina streams

Stream and place of determination	Drainage area (Square miles)	Period of known floods	Maximum stage and discharge: Date	Gage height (feet)	Elevation above mean sea level (feet)	Discharge: Cfs	Discharge: Cfs per square mile
CHOWAN RIVER BASIN							
1. Blackwater River near Franklin, Va.	613	1945-52	July 25, 1945	13.4	15.[illegible]	5,360	8.7
2. Meherrin River near Lawrenceville, Va.	553	1929-52	Aug. 17, 1940	42.0	178.6	38,000	68.7
3. Fontaine Creek near Emporia, Va.	96	1945-52	July 19, 1945	10.6	108.6	3,500	36.5
ROANOKE RIVER BASIN							
4. Roanoke River at Roanoke, Va.	388	1896-1952	Aug. 14, 1940	18.2	925.1	28,000	72.2
5. Dan River near Francisco, N. C.	124	1916-52	1916	15.0	845.0	15,800	127
6. N. Mayo River near Spencer, Va.	108	1929-52	Oct. 9, 1947	15.8	746.7	17,200	159
7. Mayo River near Price, N. C.	260	1930-52	Oct. 19, 1937	14.0	704.0	30,000	115
8. Dan River near Wentworth, N. C.	1050		1908	34.9	552.9	-	-
		1940-52	Sept. 18, 1945	27.8	545.8	56,800	54.1
8A Dan River at Leaksville, N. C.	1150	1930-49	Aug. 15, 1940				
		-	and Sept. 18,1945	28.3	518.6		
9. Smith River near Martinsville, Va.	374	1930-52	Oct. 19, 1937	21.5	678.7	39,000	104
10. Smith River at Spray, N. C.	538	1938-52	Aug. 15, 1940	19.3	558.8	45,600	84.8
11. Sandy River near Danville, Va.	113	1929-52	Aug. 14, 1940	14.8	475.2	23,000	204
12. Dan River at Danville, Va.	2050	1935-52	Aug. 15, 1940	21.0	400.2	75,000	36.6
13. Dan River at South Boston, Va.	2730	1901-06					
		1924-52	Aug. 16, 1940	31.8	331.0	81,000	29.7
14. Banister River at Halifax, Va.	552	1905,					
		1929-52	Sept. 20, 1944	40.8	359.3	50,000	90.6
14A Marlowe Creek at highway NC 49 at Roxboro, N. C.	1.99	-	June 13, 1953	-	-	1,460	734
15. Hyco River near Omega, Va.	338	1934-50	Sept. 20, 1945	28.4	322.8	11,900	35.2
16. Roanoke River at Roanoke Rapids, N.C.	8410	1877-1952	Aug. 18, 1940	39.0	82.8	261,000	31.0
17. Roanoke River near Scotland Neck, N. C.	8700	1877-1952	Aug. 19, 1940	42.0	47.8	260,000	29.9
PAMLICO RIVER BASIN							
18. Tar River near Tar River, N. C.	161	1940-52	Sept. 18, 1945	16.5	297	10,600	65.8
19. Tar River near Nashville, N. C.	701	1929-52	Dec. 3, 1934	20.8	131.8	16,900	24.1
20. Fishing Creek near Enfield, N. C.	521	1915-52	July 24, 1919	19.6	95.9	20,300	39.0
21. Tar River at Tarboro, N. C.	2140	1897-1952	July 27, 1919	34.0	44.4	52,800	24.7
21A Tar River at Greenville, N. C.	2620	-	July 28, 1919	24.5	22.1	-	-
			Aug. 22, 1940	22.1	19.7	36,500	13.9
NEUSE RIVER BASIN							
22. Eno River at Hillsboro, N. C.	66.5	1930-52	Sept. 18, 1945	20.0	507.4	11,000	165
23. Flat River at Bahama, N. C.	150	1926-52	Sept. 18, 1945	11.9	357.9	16,100	107
24. Dial Creek near Bahama, N. C.	4.9	1926-52	May 24, 1940	7.6	364	3,000	612
25. Rocky Creek near Bahama, N. C.	2.7	1926-31	Apr. 27, 1928	5.1	-	340	126
26. Neuse River near Northside, N. C.	526	1928-52	Sept. 18, 1945	31.0	257.3	36,600	69.6
26A Stirrup Iron Creek Trib. near Nelson, N. C.	0.23	-	Aug. 31, 1952	-	-	172	748
26B Brier Creek near Raleigh-Durham Airport, N. C.	1.24	-	Aug. 31, 1952	-	-	553	446
26C Sycamore Creek near Raleigh-Durham Airport, N. C.	2.56	-	Aug. 31, 1952	-	-	890	348
27. Neuse River near Clayton, N. C.	1140	1928-52	Sept. 19, 1945	22.1	150.2	22,900	20.1
28. Middle Creek near Clayton, N. C.	80.7	1940-52	Sept. 1, 1952	12.3	189	4,100	50.8
29. Little River near Princeton, N. C.	229	1919-52	September 1924	14.9	123	9,500	41.5
30. Neuse River near Goldsboro, N. C.	2390	1930-52	Oct. 5, 1929	-	-	38,300	16.0
31. Neuse River at Kinston, N. C.	2690	1919-52	July 1919	25.0	35.9	39,000	14.5
32. Contentnea Creek near Wilson, N. C.	236	-	September 1924	24.3	102	-	-
		1931-52	Aug. 17, 1940	13.8	92	4,830	20.5
33. Contentnea Creek at Hookerton, N.C.	789	-	September 1928	23.3	39	-	-
		1929-52	Oct. 6, 1929	18.9	35	11,100	14.1
CAPE FEAR RIVER BASIN							
34. Haw River near Benaja, N. C.	168	1916-52	Sept. 25, 1947	19.2	648	12,300	73.2
35. Horsepen Creek at Battle Ground, N. C.	15.9	1926-30					
		1934-52	Sept. 24, 1947	10.4	747	6,400	403
36. Reedy Fork near Gibsonville, N. C.	133	1916-52	Sept. 25, 1947	20.8	661	11,600	87.2
37. South Buffalo Creek near Greensboro, N. C.	32.8	1929-52	July 15, 1949	11.5	702	10,000	305
38. North Buffalo Creek near Greensboro, N. C.	36.4	1929-52	Sept. [illegible], 1947	16.0	692	6,000	165
39. Haw River at Haw River, N. C.	599	1929-52	Sept. [illegible]945	31.1	502.8	37,000	61.8
40. Haw River near Pittsboro, N. C.	1310	1865-1952	August 1[illegible]	32.1	212.2	98,000	74.8
41. Morgan Creek near Chapel Hill, N.C.	27	1923-32	Aug. 4, 1924	25	-	19,00[illegible]	704
42. West Fork Deep River near High Point, N. C.	32.1	1924-26					
		1929-52	Sept. 24, 1947	19.9	778	8,450	263
43. East Fork Deep River near High Point, N. C.	14.2	1929-52	Sept. 24, 1947	10.9	774.9	6,300	444
44. Deep River near Randleman, N. C.	124	1929-52	Sept. 25, 1947	32.2	670.3	20,000	161
45. Muddy Creek near Archdale, N. C.	16.2	1935-41	June 28, 1938	10.5	-	2,180	135

Table 2 - Maximum known flood stages and discharges of North Carolina Streams--Continued

	Stream and place of determination	Drainage area (Square miles)	Period of known floods	Maximum stage and discharge				
				Date	Gage height (feet)	Elevation above mean sea level (feet)	Discharge	
							Cfs	Cfs per square mile
	CAPE FEAR RIVER BASIN--Con.							
46.	Deep River at Ramseur, N. C.	346	1901-52	Sept. 18, 1945	34.0	453.5	43,000	124
47.	Bear Creek at Robbins, N. C.	134	1940-52	Sept. 18, 1945	32.0	355.2	27,000	201
48	Deep River at Moncure, N. C.	1410	1899, 1931-52	Sept. 18, 1945	17.2	203.1	80,300	56.9
49.	Cape Fear River at Lillington, N.C.	3440	1924-52	Sept. 19, 1945	33.2	138.9	150,000	43.6
49A	Sugar Creek near Tramway, N. C.	0.85	-	Feb. 21, 1954	-	-	327	385
50.	Little River at Manchester, N. C.	348	1938-50	Sept. 18, 1945	29.0	156.4	12,000	34.5
51.	Little River at Linden, N. C.	460	1929-52	Sept. 19, 1945	41.5	114.6	10,200	22.2
52.	Cape Fear River at Fayetteville, N. C.	4370	1889-1952	Aug. 29, 1908	68.7	88.9	120,000	27.5
53.	Rockfish Creek near Hope Mills, N.C.	284	1939-52	Sept. 18, 1945	31.8	84.0	8,000	28.2
54.	Northeast Cape Fear River near Chinquapin, N. C.	600	-	1908	22.6	39.9	-	-
			1941-52	Oct. 16, 1942	16.7	34.0	11,000	18.3
54A	Middle Swamp near Elkton, N. C.	3.7	-	Aug. 17, 1940	3.3	-	56	15.1
	WACCAMAW RIVER BASIN							
55.	Waccamaw River at Freeland, N. C.	626	1940-52	Feb. 14, 1948	15.9	31.4	7,500	12.0
55A	Beaverdam Swamp at Lebanon, N. C.	21.3	-	June 3, 1940	4.1	-	102	4.8
	PEE DEE RIVER BASIN							
56.	Yadkin River at Patterson, N. C.	28.8	1940-52	Aug. 13, 1940	12.7	1225.2	16,200	562
56A	Buffalo Creek at Patterson School Dam near Patterson, N. C.	31.6	-	Aug. 13, 1940	-	-	17,000	538
56B	Elk Creek at Elkville, N. C.	50	-	Aug. 13, 1940	-	-	70,000	1400
56C	Stony Fork near mouth near Hendrix, N. C.	27.1	-	Aug. 13, 1940	-	-	37,000	1370
56D	Lewis Fork above Cole Creek near Purlear, N. C.	27.3	-	Aug. 13, 1940	-	-	7,400	271
56E	West Lewis Fork near Champion, N.C.	25.8	-	Aug. 13, 1940	-	-	27,000	1050
57.	Reddies River at North Wilkesboro, N. C.	93.9	1940-52	Aug. 14, 1940	22.0	1000.6	27,000	288
58.	Yadkin River at Wilkesboro, N. C.	493	1904-52	Aug. 14, 1940	37.6	980.0	160,000	325
58A	Mulberry River below Hay Meadow Creek near Mulberry, N. C.	39.3	-	Aug. 14, 1940	-	-	16,000	407
58B	Roaring River at Gordon Cotton Mill near Roaring River, N. C.	136	-	Aug. 14, 1940	-	-	17,000	125
59.	Fisher River near Dobson, N. C.	109	1921-32	Oct. 2, 1929	12.1	-	8,300	76.1
60.	Fisher River near Copeland, N. C.	121	1932-52	Aug. 14, 1940	18.4	931	27,300	226
60A	Ararat River at Duke Power Co. Plant No. 3 near Pilot Moutain, NC	287	1937-52	June 14, 1947	-	-	40,000	139
60B	Little Yadkin River near Donnaha, NC	59.7	-	Aug. 14, 1940	11.5	-	3,470	58.1
61.	Forbush Creek near Yadkinville, N.C.	21.7	1940-52	Sept. 30, 1944	11.0	739	2,450	113
61A	Reedy Creek near Yadkin College, N.C.	13.3	-	Aug. 14, 1940	5.5	-	738	55.5
62.	Yadkin River at Yadkin College, N.C.	2280	1916-52	July 1916	36.3	675	94,300	41.4
62A	Dutchmans Creek near Cornatzer, N.C.	83.6	-	Aug. 15, 1940	10.6	-	3,300	39.5
62B	Hunting Creek near Spurgeon, N. C.	14.6	-	Aug. 14, 1940	-	-	12,000	822
62C	Rocky River at Robertson's Mill near Jennings, N. C.	44.9	-	Aug. 14, 1940	-	-	3,000	66.8
63.	Rocky River at Turnersburg, N. C.	85.5	-	1936 to 1938	18	742	-	-
			1940-52	Sept. 18, 1945	12.1	736.2	5,100	59.6
64.	South Yadkin River near Mocksville, N. C.	313	1939-52	Sept. 19, 1945	16.0	676	8,000	25.6
64A	South Yadkin River at Cooleemee, N.C.	569	1929-52	Oct. 3, 1929	32.2	656.8	24,800	43.6
65.	Third Creek at Cleveland, N. C.	87.4	1940-52	Sept. 19, 1945	15.8	700.2	3,080	35.2
66.	Yadkin River near Salisbury, N. C.	3400	1896-1927	July 18, 1916	23.8	-	121,000	35.6
67.	Abbotts Creek at Lexington, N. C.	174	1940-52	Sept. 25, 1947	22.1	649	14,800	85.1
67A	Fourmile Branch near Southmont, N.C.	19.4	-	Aug. 14, 1940	7.0	-	1,800	92.8
68.	Yadkin River at High Rock, N. C.	3980	1916-27	July 1916	22.1	580.8	138,000	34.7
68A	Yadkin River at Narrows Reservoir near Badin, N. C.	4160	-	Oct. 3, 1929	-	-	113,000	27.2
69.	Uwharrie River near Trinity, N. C.	11.3	1935-41	July 17, 1941	7.0	-	2,190	194
70.	Uwharrie River near Eldorado, N.C.	347	1928, 1939-52	Sept. 18,1945	26.2	323	23,300	67.1
71.	Rocky River near Norwood, N. C.	1370	1908-52	Sept. 18, 1945	46.4	259.3	105,000	76.6
71A	Little Brown Creek near Polkton, N.C.	13.5	1936-40	July 21, 1939	7.0	-	2,200	163
73.	Brown Creek near Polkton, N. C.	110	1908-52	Sept. 18, 1945	17.7	234	17,300	157
73A	Pee Dee River near Ansonville, N.C.	6330	-	1908	41.3	-	-	-
			-	Aug. 16, 1940	28.3	-	78,700	12.4
73B	Pee Dee River at Blewett Reservoir near Rockingham, N. C.	6830	-	Aug. 17, 1940	-	-	82,800	12.1
73C	Pee Dee River near Rockingham, N. C.	6870	1906-52	Aug. 27, 1908	31.3	152	276,000	40.2
73D	North Fork Jones Creek near Wadesboro, N. C.	10.0	1936-41	June 4, 1937				
				July 20, 1939	6.4	-	2,410	241
75.	Pee Dee River at Cheraw, S. C.	7380	1891-1930	Aug. 27, 1908	44.3	-	309,000	41.9
76.	Juniper Creek near Cheraw, S. C.	64	1940-52	Sept. 18, 1945	5.7	-	3,910	61.1
77.	Drowning Creek near Hoffman, N. C.	178	1940-52	Sept. 18, 1945	10.3	280	10,900	61.2
78.	Lumber River at Boardman, N. C.	1220	1897-1952	August 1928	11.8	83.8	25,000	20.5
79.	Little Pee Dee River near Dillon, S. C.	524	1939-52	Sept. 20, 1945	14.6	-	9,810	18.7

Table 2 - Maximum known flood stages and discharges of North Carolina streams--Continued

Stream and place of determination	Drainage area (Square miles)	Period of known floods	Maximum stage and discharge				
			Date	Gage height (feet)	Elevation above mean sea level (feet)	Discharge	
						Cfs	Cfs per square mile
SANTEE RIVER BASIN							
79A. Mill Creek at Old Fort, N. C.	20.7	-	Aug. 13, 1940	10.1	-	7,900	382
79B Buck Creek at Lake Tahoma near Marion, N. C.	22.7	-	Aug. 13, 1940	-	-	6,200	273
80. Catawba River near Marion, N. C.	171	1940-52	Aug. 13, 1940	19.3	1227	71,400	418
80A North Fork Catawba River at Linville Caverns near Asheford, N. C.	5.2	-	Aug. 13, 1940	-	-	15,000	2880
80B North Fork Catawba River above Sevier near Woodlawn, N. C.	41.8	-	Aug. 13, 1940	-	-	55,000	1320
81. Linville River at Branch, N. C.	65	1916-52	Aug. 13, 1940	11.4	1217.3	39,500	608
81A Bailey Fork at mouth near Morganton, N. C.	8.0	-	Aug. 13, 1940	-	-	9,700	1210
81B Steels Creek near Tablerock, N. C.	16.0	-	Aug. 13, 1940	-	-	24,000	1500
81C Upper Creek above Steels Creek near Tablerock, N. C.	20.2	-	Aug. 13, 1940	-	-	25,000	1240
81D Warrior Fork below Worry near Morganton, N. C.	80.5	-	Aug. 13, 1940	-	-	38,000	472
81E Hunting Creek at Southern Railway crossing near Morganton, N. C.	21.7	-	Aug. 13, 1940	-	-	14,000	645
81F Little Mulberry Creek near Collettsville, N. C.	27.3	-	Aug. 13, 1940	-	-	14,000	513
81G Johns River at Collettsville, N.C.	69.1	-	Aug. 13, 1940	-	-	31,000	449
81H Wilson Creek near Adako, N. C.	66.0	1916,1940	Aug. 13, 1940	36.5	-	99,000	1500
81I Lower Creek at Lenoir, N. C.	47.6	-	Aug. 13, 1940	-	-	20,000	420
81J Gunpowder Creek at Duke Power Co. Gunpowder Plant 2 near Granite Falls, N. C.	34.9	-	Aug. 13, 1940	-	-	13,000	372
81K Lower Little River at Liledown Mills near Taylorsville, N. C.	69.9	-	Aug. 14, 1940	-	-	23,000	329
81L Catawba River at Catawba, N. C.	1535	1897-1952	July 16, 1916	44.1	-	-	-
			Aug. 14, 1940	36.8	783.3	177,000	115
82. Henry Fork near Henry River, N. C.	80	1916-52	Aug. 13, 1940	29.2	920.2	31,300	391
82A Indian Creek near Laboratory, N. C.	69.3	1929,1940	October 1929	-	-	9,920	143
82B South Fork Catawba River at High Shoals, N. C.	506	1916,1940	July 1916	-	-	31,900	63.0
83. South Fork Catawba River at Lowell, N. C.	630	1940-52	Aug. 14, 1940	21.3	624.4	34,000	54.0
84. Little Sugar Creek near Charlotte, N. C.	41.4	1925-52	Apr. 6, 1936	16.2	587.8	8,370	202
85. Broad River near Chimney Rock, N.C.	97	1928-52	Aug. 15, 1928	16.8	877	26,000	268
85A Green River at Turner Shoals Dam, N. C.	135	-	Aug. 28, 1949	-	-	12,000	88.9
85B Green River near Mill Spring, N.C.	174	1916-52	July 1916	24.2	-	-	-
86. Second Broad River at Cliffside, N. C.	211	1926-52	Aug. 14, 1940	17.9	688	15,000	71.1
87. Broad River near Boiling Springs, N. C.	864	1926-52	Aug. 16, 1928	24.3	664.2	73,300	84.8
87A First Broad River near Gambles Store, N. C.	25.1	-	Aug. 13, 1940	-	-	14,000	558
88. First Broad River near Lawndale, N. C.	198	1916-52	Aug. 14, 1940	37.8	788	32,500	164
88A Buffalo Creek at Stubbs, N. C.	53.8	-	Aug. 14, 1940	-	-	8,800	164
89. North Pacolet River at Fingerville, S. C.	116	1930-[illegible]	Aug. 14, 1940	27.1	742.7	12,500	108
SAVANNAH RIVER BASIN							
90. Chattooga River near Clayton, Ga.	203	1921-52	Aug. 30, 1940	13.8	1179.4	29,000	143
NEW RIVER BASIN							
90A Middle Fork, South Fork New River about 3.3 miles below Blowing Rock, N. C.	9.2	-	Aug. 13, 1940	-	-	5,100	554
90B Howard Creek near mouth near Boone, N. C.	11.6	-	Aug. 13, 1940	-	-	7,000	603
90C Rittle Creek at mouth near Boone, N. C.	3.5	-	Aug. 13, 1940	-	-	1,900	543
91. South Fork New River near Jefferson, N. C.	207	1916-52	Aug. 14, 1940	22.5	2679.5	52,800	255
92. South Fork New River near Crumpler, N. C.	325	1909-16	July 15, 1916	21.3	2571	46,000	142
92A Buffalo Creek near mouth near West Jefferson, N. C.	12.6	-	Aug. 13, 1940	-	-	8,400	667
92B Horse Creek at N & W R.R. trestle near Tuckerdale, N. C.	32	-	Aug. 13, 1940	-	-	8,100	253
92C Horse Creek at Lansing, N. C.	58	-	Aug. 13, 1940	-	-	18,000	310
94. North Fork New River at Crumpler, N. C.	277	1909-52	Aug. 14, 1940	23.0	2541.8	73,000	264
93. New River near Galax, Va.	1131	1930-52	Aug. 14, 1940	25.7	2053.7	141,000	125
95. Chestnut Creek at Galax, Va.	39	1940-52	Aug. 14, 1940	17.4	2362.4	11,000	282

Table 2 - Maximum known flood stages and discharges of North Carolina streams--Continued

Stream and place of determination	Drainage area (Square miles)	Period of known floods	Maximum stage and discharge				
			Date	Gage height (feet)	Elevation above mean sea level (feet)	Discharge	
						Cfs	Cfs per square mile
FRENCH BROAD RIVER BASIN							
96. French Broad River at Rosman, N.C.	67.9	1908-09,	July 1916	13.9	2187.7	-	-
		1936-52	Aug. 30, 1940	11.9	2185.7	9,410	139
97. French Broad River at Calvert, N.C.	103	-	July 1916	18.3	2172.9	-	-
		1925-52	Aug. 15, 1928	13.0	2167.6	16,100	156
98. Catheys Creek near Brevard, N. C.	11.7	1945-52	Mar. 11, 1952	4.0	2234.4	1,260	108
100. Davidson River near Brevard, N. C.	40.4	1876-1952	June 1876	11.9	2127	8,700	215
101. Little River near Penrose, N. C.	41.4	-	July 1916	14	213.6	-	-
		1942-52	Mar. 11, 1952	10.7	2110.3	3,280	79.2
102. Crab Creek near Penrose, N. C.	10.9	-	1916	10.5	2117.9	-	-
		1943-52	Mar. 11, 1952	7.6	2115.0	1,500	138
103. French Broad River at Blantyre,	296	-	July 1916	27.1	2087.4	-	-
N. C.		1921-52	Aug. 16, 1928	22.9	2083.2	26,500	89.5
104. Boylston Creek near Horseshoe, N.C.	14.8	1943-52	Dec. 7, 1950	5.7	2075.1	805	54.4
105. South Fork Mills River at The Pink Beds, N. C.	9.99	1927-49	Aug. 15, 1928	8.0	-	2,200	222
108. Mills River near Mills River, N. C.	66.7	1876-1952	Aug. 30, 1940	13.6	2102.1	13,400	201
109. Clear Creek near Hendersonville, N.C.	42.2	1916-52	July 16, 1916	16	2088	9,000	213
110. Mud Creek at Naples, N. C.	109	1916-52	July 16, 1916	21.5	2069.0	40,000	367
111. Cane Creek at Fletcher, N. C.	63.1	1916-52	July 1916	14.8	2087.0	23,000	364
112. French Broad River at Bent Creek,	676	-	July 15, 1916	27.3	2023.2	-	-
N. C.		1935-52	Aug. 14, 1940	12.6	2008.5	23,600	34.9
112A North Hominy Creek at mouth near Canton, N. C.	7.8	-	Aug. 30, 1940	-	-	5,000	641
112B Hominy Creek above Candler, N. C.	28.9	-	Aug. 30, 1940	-	-	12,400	429
112C South Hominy Creek above Stony Fork near Candler, N. C.	5.1	-	Aug. 30, 1940	-	-	1,500	294
112D Stony Fork near mouth near Candler, N. C.	4.1	-	Aug. 30, 1940	-	-	1,300	317
112E South Hominy Creek above Beaverdam Creek at Candler, N. C.	29.2	-	Aug. 30, 1940	-	-	5,500	188
112F Hominy Creek below Candler, N. C.	67.7	-	Aug. 30, 1940	-	-	12,800	189
113. Hominy Creek at Candler, N. C.	79.8	1940-52	Aug. 30, 1940	18.0	2083.8	13,100	164
113A Hominy Creek at American Enka Corporation rayon plant at Enka, N. C.	86.4	-	Aug. 30, 1940	-	-	12,800	148
113B Right Hand Fork of North Fork Swannanoa River at Asheville water system intake near Black Mountain, N. C.	5.35	-	Aug. 13, 1940	-	-	3,100	580
114. North Fork Swannanoa River near Black Mountain, N. C.	23.8	1926-52	June 16, 1949	9.1	2437.1	16,500	693
115. Swannanoa River at Swannanoa, N.C.	62.1	1908-31	Aug. 16, 1928	10.9	-	10,400	167
116. Beetree Creek near Swannanoa, N. C.	5.46	1927-52	Aug. 13, 1940	6.2	2734.6	1,370	251
117. Swannanoa River at Biltmore, N. C.	130	1791-1952	April 1791	26	2003	31,000	238
118. French Broad River at Asheville, N. C.	945	1791-1952	July 16, 1916	23.1	1973.4	110,000	116
118A Beaverdam Creek at dam at mouth near Asheville, N. C.	12.4	-	Aug. 30, 1940	-	-	3,100	250
118B Newfound Creek below Dix Creek near Leicester, N. C.	34.2	-	Aug. 30, 1940	-	-	12,000	351
118C Reems Creek at Weaverville, N. C.	30.9	-	Aug. 30, 1940	-	-	4,400	142
118D Sandymush Creek above Turkey Creek near Marshall, N. C.	45.5	-	Aug. 30, 1940	-	-	7,600	167
119. Sandymush Creek near Alexander,	79.5	-	Aug. 30, 1940	16.7	1749.2	-	-
N. C.		1943-52	Feb. 10, 1946	9.6	1742.1	5,490	69.1
120. Ivy River near Marshall, N. C.	158	1934-52	Aug. 30, 1940	12.7	1713.1	8,880	56.2
121. French Broad River at Marshall,	1332	-	July 1916	18.5	1665.3	-	-
N. C.		1943-52	Jan. 7, 1946	9.2	1656.0	29,600	22.2
122. Big Laurel Creek near Stackhouse, N. C.	126	1934-52	Mar. 25, 1935	7.9	1603.6	7,260	57.6
123. French Broad River at Hot Springs,	1567	-	July 1916	19.3	-	-	-
N. C.		1935-49	Aug. 30, 1940	16.1	-	75,900	48.8
123A Spring Creek at Hot Springs, N. C.	71.5	-	Aug. 30, 1940	-	-	6,300	88.1
PIGEON RIVER BASIN							
123B West Fork Pigeon River at Spruce near Waynesville, N. C.	12.2	-	Aug. 30, 1940	-	-	16,500	1350
123C Middle Prong, West Fork Pigeon River near Spruce near Waynesville, N. C.	8.4	-	Aug. 30, 1940	-	-	16,400	1950
123D Big Creek at Lake Logan near Waynesville, N. C.	1.32	-	Aug. 30, 1940	-	-	12,900	9770
123E Big Creek at Lake Logan near Waynesville, N. C.	1.69	-	Aug. 30, 1940	-	-	12,000	7100
123F Big Branch (tributary to Little East Fork Pigeon River) near Waynesville, N. C.	0.4	-	Aug. 30, 1940	-	-	4,500	11200
123G West Fork Pigeon River at Lake Logan Dam near Waynesville, N. C.	32.8	-	Aug. 30, 1940	-	-	14,900	454
124. Pigeon River at Canton, N. C.	133	1876-1952	Aug. 30, 1940	20.8	2593.0	31,600	238

Table 2 - Maximum known flood stages and discharges of North Carolina streams--Continued

Stream and place of determination	Drainage area (Square miles)	Period of known floods	Maximum stage and discharge: Date	Gage height (feet)	Elevation above mean sea level (feet)	Discharge: Cfs	Discharge: Cfs per square mile
PIGEON RIVER BASIN--Con.							
125. Pigeon River near Crabtree, N. C.	243	1921-29	Aug. 16, 1928	18.0	-	23,000	94.7
126. Jonathan Creek near Cove Creek, NC	65.3	1931-52	Aug. 30, 1940	7.5	2391.4	3,200	49.0
127. Pigeon River near Hepco, N. C.	350	1876-1952	1876 and 1902	18	2354	42,000	120
128. Cataloochee Creek near Cataloochee, N. C.	49.2	1935-52	Aug. 30, 1940	7.0	2464.5	3,390	68.9
NOLICHUCKY RIVER BASIN							
129. North Toe River at Altapass, N.C.	104	-	July 1916	24	2567	-	-
		1935-52	Aug. 13, 1940	19.5	2562.4	22,200	213
129A South Toe River above Locust Creek near Busick, N. C.	32.8	-	Aug. 13, 1940	-	-	18,000	550
129B Crabtree Creek above Roaring Branch near Estatoe, N. C.	15.4	-	Aug. 13, 1940	-	-	3,400	221
130. South Toe River at Newdale, N. C.	60.8	1935-52	Aug. 13, 1940	17.4	2461.4	29,400	484
130A North Toe River at Toecane, N. C.	233	-	Aug. 13, 1940	-	-	51,000	219
130B Cane River at dam near Burnsville, N. C.	36.6	-	Aug. 13, 1940			18,000	492
131. Cane River near Sioux, N. C.	157	1934-52	Aug. 13, 1940	17.8	2063.0	31,800	203
132. Nolichucky River at Poplar, N. C.	608	-	1901 and 1916	21	1993	-	-
		1926-52	Aug. 13, 1940	19.7	1991.7	74,500	123
WATAUGA RIVER BASIN							
132A Watauga River below Laurel Fork near Valle Crucis, N. C.	33.1	-	Aug. 13, 1940	-	-	38,000	1150
132B Dutch Creek near Valle Crucis, N.C.	2.42	-	Aug. 13, 1940	-	-	9,200	3800
132C Craborchard Creek near Valle Crucis, N. C.	2.09	-	Aug. 13, 1940	-	-	6,000	2870
132D Dutch Creek at Valle Crucis, N. C.	10.6	-	Aug. 13, 1940	-	-	16,000	1510
132E Watauga River above Cove Creek near Sugar Grove, N. C.	55.1	-	Aug. 13, 1940	-	-	41,000	744
132F Linville Creek near Sugar Grove, N. C.	4.8	-	Aug. 13, 1940	-	-	4,200	875
132G Cove Creek near Sugar Grove, N.C.	17.7	-	Aug. 13, 1940	-	-	12,000	678
133. Watauga River near Sugar Grove, N. C.	90.8	1916-52	Aug. 13, 1940	29.6	2637.3	50,800	559
133A Elk River near Banner Elk, N. C.	17.8	1935-40	Aug. 13, 1940	16.9	-	21,900	1230
135. Elk River near Elk Park, N. C.	42.0	1935-52	Aug. 13, 1940	17.8	2828	27,500	655
LITTLE TENNESSEE RIVER BASIN							
136. Little Tennessee River near Prentiss, N. C.	140	1898-1952	October 1898	15	2023	7,800	55.7
137. Cullasaja River at Highlands, N.C.	14.9	1928-52	Aug. 30, 1940	9.4	3383.0	5,100	342
138. Cullasaja River at Cullasaja, N.C.	86.5	1908-52	Aug. 30, 1940	20.8	2044.2	16,500	191
139. Little Tennessee River at Franklin, N. C.	295	1907-10 1921-25	June 4, 1909	10.3	-	7,950	26.9
140. Little Tennessee River at Iotla, N. C.	323	1898-1945	Aug. 30, 1940	13.5	-	19,600	60.7
141. Little Tennessee River at Needmore, N. C.	436	1940-52	Aug. 30, 1940	11.5	1772.7	22,000	50.5
142. Nantahala River near Rainbow Springs, N. C.	51.9	1940-52	June 16, 1949	9.7	3082.7	6,300	121
142A Nantahala River at Nantahala, N.C.	144	1943-52	Feb. 10, 1946	8.2	1902.8	7,510	52.2
143. Nantahala River at Almond, N. C.	174	1921-41	Feb. 4, 1936	10.2	-	11,000	63.2
144. Little Tennessee River at Judson, N. C.	664	1897-1944	Feb. 28, 1902	16.2	-	51,000	76.8
144A Wolf Creek near Tuckasegee, N. C.	14.1	-	Aug. 30, 1940	-	-	14,500	1030
144B East Fork Tuckasegee River near Tuckasegee, N. C.	80.3	-	Aug. 30, 1940	-	-	30,000	374
145. Tuckasegee River at Tuckasegee, N. C.	143	1840-1952	Aug. 30, 1940	21.1	2146.3	40,800	285
145A West Fork Tuckasegee River above Glenville Dam near Glenville, N. C.	26.8	-	Aug. 30, 1940	-	-	10,300	384
145B West Fork Tuckasegee River at Glenville Powerhouse near Tuckasegee, N. C.	52.5	-	Aug. 30, 1940	-	-	14,000	267
145C Caney Fork near East Laport, N.C.	39.4	-	Aug. 30, 1940	-	-	21,700	551
147. Scott Creek above Sylva, N. C.	50.7	1928-52	Aug. 30, 1940	8.6	2065.0	3,090	60.9
148. Tuckasegee River at Dillsboro, N. C.	347	1928-52	Aug. 30, 1940	22.0	1972.1	52,600	152
149. Oconoluftee River at Cherokee, N.C.	131	1907-49	November 1906	12	-	12,000	91.6
149A Oconoluftee River at Birdtown, N. C.	184	1946-52	Jan. 7, 1946	12.0	1855.3	15,000	81.5
151. Tuckasegee River at Bryson City, N. C.	655	1840-1952	May 1840	21	1738	100,000	153
152. Noland Creek near Bryson City, N.C.	13.8	1936-52	Aug. 30, 1940	4.9	2285	1,530	111
153. Hazel Creek at Proctor, N. C.	44.4	1943-52	Mar. 29, 1951	5.9	1809.2	4,870	110

Table 2 - Maximum known flood stages and discharges of North Carolina streams--Continued

Stream and place of determination	Drainage area (Square miles)	Period of known floods	Maximum stage and discharge: Date	Gage height (feet)	Elevation above mean sea level (feet)	Discharge: Cfs	Discharge: Cfs per square mile
LITTLE TENNESSEE RIVER BASIN--Con.							
154. Little Tennessee River at Pontana Dam, N. C.	1571	-	March 1867	23	1298	-	-
		1939-44	Aug. 30, 1940	15.9	1291.0	71,200	45.3
155. Snowbird Creek near Robbinsville, N. C.	42.0	1943-52	Mar. 29, 1951	9.0	1962.5	7,430	177
155A Cheoah River at Johnson, N. C.	177	1921-27	Dec. 25, 1926	8.2	-	11,000	62.1
HIWASSEE RIVER BASIN							
157. Hiwassee River at Presley, Ga.	45.5	1942-52	Mar. 11, 1952	15.2	1947.9	5,700	125
158. Shooting Creek near Hayesville, N. C.	37.6	1923-24, 1943-52	June 16, 1949	9.2	1939.5	6,820	181
159. Hiwassee River below Hayesville, N. C.	252	1898, 1935-51	Oct. 3, 1898	16.1	-	17,000	67.5
160. Hiwassee River at and above Murphy, N. C.	421	1897-1952	Mar. 19, 1899	18.4	1526.4	23,100	54.9
161. Valley River at Tomotla, N. C.	104	1905-52	Nov. 19, 1906	17.3	1573.8	9,030	86.8
162. Nottely River near Blairsville, Ga.	74.8	1942-52	Mar. 11, 1952	16.8	1829.2	8,500	114
163. Nottely River near Ivylog, Ga.	191	1937-42	July 22, 1938	12.2	-	11,500	60.2
164. Nottely River near Ranger, N. C.	272	1901-40	Feb. 28, 1902	21.0	-	14,100	51.8
165. Hiwassee River at Hiwassee Dam, N. C.	968	1934-43	Feb. 4, 1936	13.4	1276.8	42,800	44.2

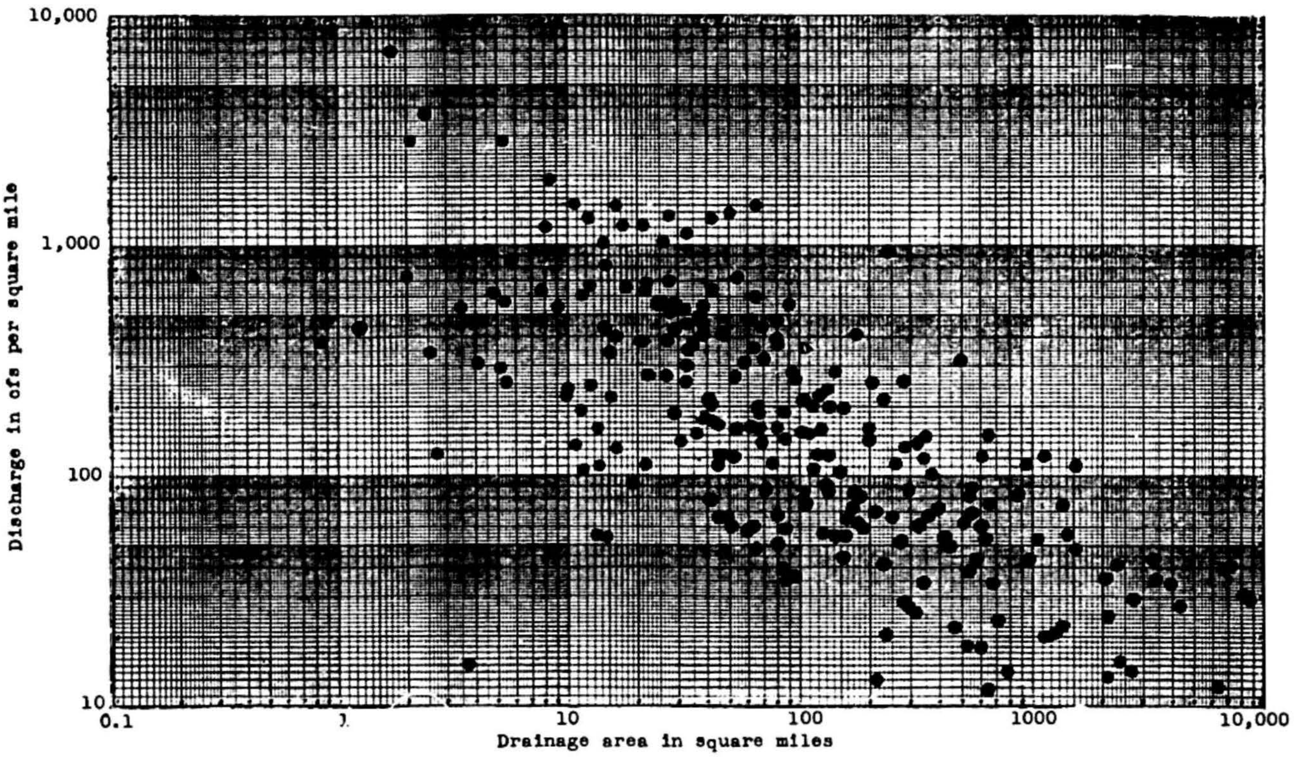

Figure 6.--Relation of unit discharge to drainage area for maximum known discharge in North Carolina

METHODS OF DETERMINING FLOOD FREQUENCY

Several methods have been developed and used to compute flood frequency. The methods used in this report reflect the present status of a continuing study by engineers of the Water Resources Division, Geological Survey. Analyses are first made to determine the frequency relation at a gaging station. Then further analysis on a regional basis permits frequency to be determined at both gaged and ungaged sites. The general description of flood-frequency methods given in this report is taken for the most part from Geological Survey Circular 100, Floods in Georgia, by R. W. Carter.

Flood Frequency at a Gaging Station

Kinds of Flood Series

Two kinds of flood series may be considered, annual-flood series and partial-duration series.

An annual flood is defined as the highest instantaneous peak discharge in a water year (October 1 to September 30). In the annual-flood series only the highest flood in each water year is used. This method of establishing the series ignores the second-highest floods in each year, some of which may be larger than many annual floods.

The partial-duration series includes all major floods even though several occur in one year. Such a series is obtained by listing all floods above a selected base discharge. The base usually selected is equal to the lowest annual flood so that at least one flood will be included from each year. An objection to the use of this series is that floods closely consecutive may not be fully independent events; that is, one flood sets the stage for another. Furthermore, the frequency of floods is usually of interest because of the possibility of damage that may result from a given flood. Several closely consecutive floods may cause little more damage than the highest one of the group. On the other hand, the partial-duration series could be used to determine the frequency of inundation of a highway fill that will not necessarily be destroyed by any flood.

There is an important distinction in meaning between the recurrence intervals of annual floods and the recurrence intervals of partial-duration series floods. In the annual-flood series the recurrence interval is the average interval in which a flood of a given size will recur as an annual maximum. In the partial-duration series it is the average interval in which a given flood will be equaled or exceeded, regardless of relationship to the year or any other period of time.

For intervals of less than 10 years, a flood of a given size will have a shorter recurrence interval in the partial-duration series than it will in the annual series. The two methods give esentially identical results for the larger floods and for intervals greater than 10 years. As most designs are for intervals greater than this, it is apparent that the use of either method will produce satisfactory results. The annual-flood series is used in this report because of its simplicity and because it lends itself more readily to statistical analysis. Furthermore, a definite relationship 1/ between the values in the two series allows the partial-duration series to be computed from the annual-flood series. Comparative values of recurrence intervals by the two methods are shown below:

Table 3.--Relationship of recurrence interval (in years) of floods on two bases

Annual-flood series	Partial-duration series
1.10	0.41
1.25	.62
1.50	.91
1.75	1.18
2.00	1.45
2.54	2.00
5.0	4.6
10.0	9.5
15.0	14.5
20.5	20
100.5	100

Plotting a Flood Series

The annual floods are listed and numbered in order of magnitude beginning with the largest as number 1. Fitting a time scale to the array may be done in several ways. The formula adopted by the Geological Survey is simple and yet gives results acceptably in conformance with some of the latest theories. Recurrence intervals are computed from the formula $(N+1)/M$, where "N" equals the number of years of record and "M" equals the relative magnitude of the event, beginning with the highest as 1 down to the lowest as a number equal to "N".

The annual floods are plotted against their corresponding recurrence intervals on a special form 2/ for analysis of flood frequencies by the theory of extreme values 3/. The discharges are ordinarily plotted to a linear scale as ordinate; the abscissa (scale of recurrence intervals) is especially graduated according to the theory of extreme values. According to that theory the relation between magnitude and frequency should be a straight line when the points are plotted on a chart so graduated. Some of the basic assumptions used in developing the theory are not in strict accordance with the characteristics of the hydrologic data involved, and experience with the comparatively short records available indicates that the points define curves that are generally more or less concave upward in the defined range.

Historical Data

Historical floods provide probably the most effective data on which to base flood-fre-

1/ Langbein, W. B., Annual floods and the partial-duration series: Am. Geophys. Union Trans., pp. 879-881, Dec. 1949.

2/ Powell, R. W., A simple method of estimating flood frequency: Civil Eng., pp. 105-106, Feb. 1943

3/ Gumbel, E. J., Floods estimated by probability method: Eng. News Rec., June 14, 1945.

quency relationships. Reliable historical data should be given the greatest weight in defining the flood-frequency graph.

The historical account of all floods above a certain stage is especially valuable. Such a list is of the nature of a partial-duration series above a high base, or it may be similar to the upper end of an annual series. In either case the treatment is the same. All floods, both historical and those for the period of record, above the high base, are listed in order of magnitude and assigned recurrence intervals in the same manner as previously discussed but are based on the period of time for which they are known to be the highest.

Fitting Frequency Graphs

After the annual floods have been plotted it is necessary to fit a curve to the points. Several frequency functions may be used for this purpose, the assumption being that an analytically-fitted function could then be extended to give the magnitude of floods of recurrence intervals much greater than the period of record. Such an approach is likely to give undependable results. A sample of 25 floods may define a curve considerably different from the true curve; an extension of such a curve would be increasingly in error. An unpublished study entitled "Characteristics of Frequency Curves Based on a Theoretical 1,000-year Record", by M. A. Benson of the Geological Survey, shows the variation from the true curve that may occur in samples of 10, 25, 50, and 100 years. Few of these curves based on 25-year samples could be extended with reliability. Since extrapolation of a curve based on few data is of questionable use, the main purpose of curve fitting reduces to smoothing the data. For such smoothing the analytically fitted functions seem unwarranted. Therefore, graphical treatment only is used in this report.

Regional Flood Frequency

Determination of flood frequency as described above can be made only when a discharge record of floods is available. It would be impracticable to obtain a discharge record at every point at which flood-frequency information is or may be needed. There is, then, a need for developing frequency relations on a regional basis. Such an approach not only provides areal coverage but, by averaging occurrences over a region, gives a more reliable basis for estimating flood frequency at gaged sites.

Regional analysis requires combining frequency curves. This is done by expressing the flood magnitudes as "ratio to mean-annual flood", and then combining the data for many stations. The resulting composite frequency curve is fixed in shape and slope. Its position for any given site must then be fixed by a relation between "mean-annual flood" and basin characteristics. Details of the method are described below.

Selection of Base Period

All records to be combined should be for the same base period of time in order to minimize differences resulting from time trends in flood runoff. The base period selected should be one for which many complete flood records are available and in addition it should be as long as the records permit.

Computation of Comparable Means

Individual frequency curves should be prepared for the base period for all station records to be combined. For stations having records shorter than the base period, estimates of the unknown annual floods are made on the basis of records for nearby stations. These estimates are not plotted on a frequency chart; they are used solely to fix the recurrence intervals of the known annual floods.

After plotting known floods on the individual frequency chart, a curve is fitted graphically to the points and the mean-annual flood determined as the intersection of the fitted line and the 2.33-year recurrence interval. The mean annual flood is defined as the discharge corresponding to the above-described intersection. The significance of the 2.33-year recurrence interval comes from the extreme-value theory 4/ which requires that the mean of the annual floods plots at 2.33 years on the abscissa scale. Geological Survey practice favors the graphical over the analytical method of determining the mean annual flood because the graphical solution gives greater weight to the medium floods and is not appreciably influenced by the inclusion or exclusion of an extremely high flood in the base period as would the arithmetic mean annual flood. The study by Benson, previously referred to, indicates that the graphical mean annual flood as estimated from a short record is more reliable than the floods for larger recurrence intervals estimated from the same record.

Combining Frequency Curves

The objectives of combining frequency curves are to develop frequency relations on an areal basis and to obtain an average curve of increased reliability. However, the curves selected for combination must be estimates of the same underlying relation; that is, none should differ from the group mean more than would be ascribable to chance variation. The above provision would also require that there be no significant variations in the curves due to differences in drainage area. Frequency curves ordinarily approximate straight lines through the lower range; such lines show a variation in slope. The slopes are expressed as the ratio of a flood of definite recurrence interval (the 10-year flood is used) to the mean annual flood. Then a statistical test 5/ for homogeneity of the group of stations is made at the 95% confidence interval on the basis of the computed slopes.

Variations in individual curves resulting from size of drainage area are examined by plotting ratio to mean-annual flood against drainage area for selected recurrence inter-

4/ Mitchell, W. D., Floods in Illinois, magnitude and frequency: State of Illinois, Department of Waterways, p. 373, 1954.

5/ Carter, R. W., Floods in Georgia, frequency and magnitude: U. S. Geological Survey Circular 100, p. 13, 1951.

vals. The presence of a significant relation would indicate the need for grouping frequency curves for stations having drainage areas within certain limits. No such significant relation has been found in previous studies but a tendency has been noted and the possibility should be examined for each area analyzed.

The composite or average flood-frequency curve for a homogeneous group of stations is prepared by (1) computing the order number (starting with 1 as the highest) and ratio to mean annual flood for the known floods in each station record, (2) listing all flood ratios corresponding to each order number of flood and determining the median, (3) plotting the median ratios against their corresponding recurrence intervals, and (4) graphically fitting a line to the plotted points.

Relating Composite Frequency Curve to a Specific Site

The composite curve defines frequency throughout its applicable area in terms of ratio to mean annual flood. In order to apply the curve to a specific site the mean annual flood for that site must be determined. Mean annual floods are already available at gaging stations but will be needed for ungaged sites. Both the mean annual flood and the physical characteristics of the basin are related to the flood potential of that basin. Then the establishment of a relation between mean annual floods and basin characteristics allows the mean annual flood for any given site, gaged or ungaged, to be found. The use of that relation for a gaged site should provide a more reliable value of mean annual flood than would be determined from the individual station record. The composite frequency curve may be transferred to the selected site using that mean annual flood. The flood magnitude-frequency relation at an ungaged site can be derived similarly.

FLOOD FREQUENCY IN NORTH CAROLINA

Development of Composite Frequency Curve

The methods of analysis just described were applied to data for North Carolina streams. The result is the composite annual flood-frequency curve shown in figure 7, applicable to streams throughout the entire State. The curve was derived as follows :

(1) Frequency curves for 144 gaging stations were developed for the base period 1925-52.

(2) The test for variation in slope of the individual frequency curves showed that the group, with the exception of 6 curves for stations located at random throughout the State, represented a homogeneous region. Because this number of non-conforming items is within the number permissible due to chance elements involved, it was concluded that the

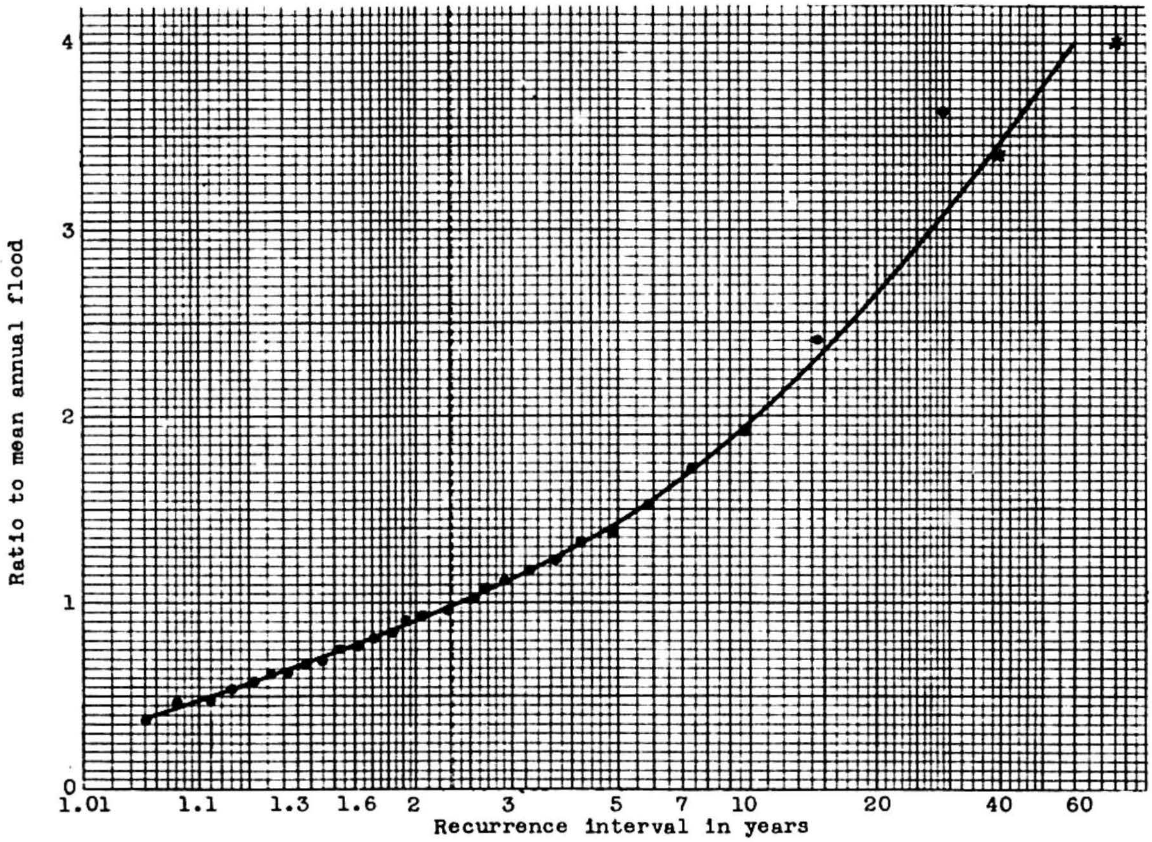

Figure 7.--Composite annual flood-frequency curve for North Carolina

State could be treated as a unit in obtaining a composite frequency curve.

(3) The possibility of a relation between slope of the frequency curve and drainage area was investigated. A significant relation would preclude combination of individual frequency curves from drainage areas of greatly different size. The 144 frequency curves exhibited a tendency toward flatter slopes corresponding to larger drainage areas but the relation was not statistically significant. No reduction in accuracy of a composite curve is likely to result because of this possible relation.

(4) Frequency curves for the 144 gaging stations were combined into a composite curve for the base period 1925-52.

(5) The frequency relation for the period 1925-52 was related to the period 1895-1952 by deriving composite frequency curves for both periods for records from 18 gaging stations in North Carolina and adjacent states. The gaging stations used are listed in table 4 along with their drainage areas and period of record. Their locations are plotted on the map of figure 8. The resulting composite curves are practically identical for the two periods, indicating no change in average frequency characteristics from one period to another. Some of the individual records seem to indicate the possibility of progressive changes. For instance, long-term stations in the French Broad, Little Tennessee, and Cape Fear River Basins show a progressive movement of the frequency curve to the right with increased record, signifying decreasing flood discharges. Frequency curves at other stations show little change, and at still others in adjacent states the curves show a trend toward

Table 4.--Gaging stations from which records were used in derivation of composite annual flood-frequency curves for periods 1895-1952 and 1925-52

Gaging station		Drainage Area (Square miles)	Period of record of annual floods
4.	Roanoke River at Roanoke, Va.	388	1896-1952
13.	Dan River at South Boston, Va.	2730	1901-06, 1924-52
16.	Roanoke River at Roanoke Rapids, N. C.	8410	1912-50
20.	Fishing Creek near Enfield, N. C.	521	1915-52
21.	Tar River at Tarboro, N. C.	2140	1897-1900, 1906-52
52.	Cape Fear River at Fayetteville, N. C.	4370	1889-1952
58.	Yadkin River at Wilkesboro, N. C.	493	1904-09, 1916, 1920-52
75.	Pee Dee River at Cheraw, S. C.	7380	1891-1930
76a	Lynches River at Effingham, S. C.	1030	1892-1952
118.	French Broad River at Asheville, N. C.	945	1896-1952
132a	South Fork Holston River at Bluff City, Tenn.	813	1900-1950
144.	Little Tennessee River at Judson, N. C.	664	1897-1944
151.	Tuckasegee River at Bryson City, N. C.	655	1898-1952
160.	Hiwassee River at Murphy, N. C.	421	1897-1941
161.	Valley River at Tomotla, N. C.	104	1905-09, 1914-17, 1919-52
162.	Nottley River near Ranger, N. C.	272	1901-06, 1915-17, 1919-41
165.	Oostanaula River at Resaca, Ga.	1610	1892-1952
166.	Etowah River at Canton, Ga.	605	1892-1952

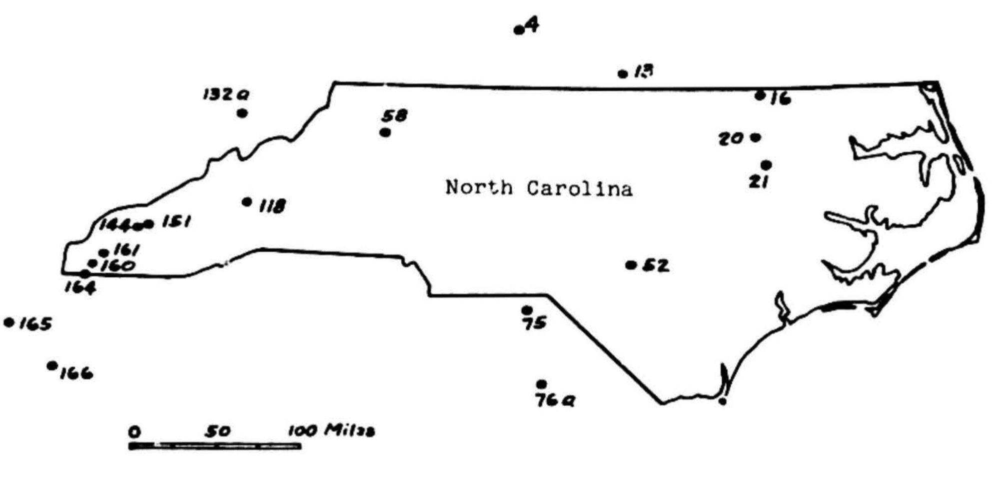

Figure 8.--Locations of gaging stations used in flood-frequency analysis, 1895-1952 and 1925-52

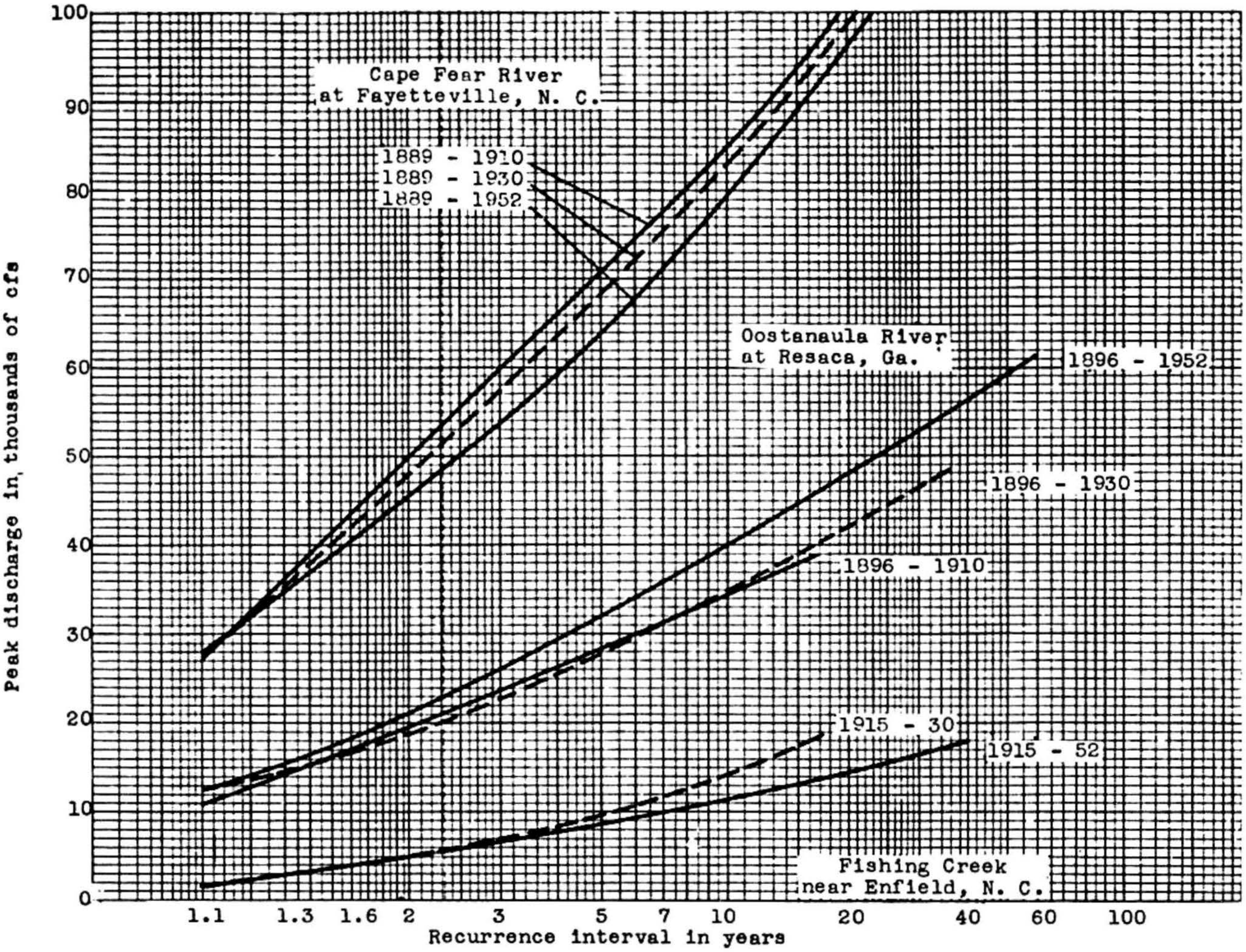

Figure 9.--Frequency curves for 3 selected stations showing changes with time

increasing floods with more recent records. Figure 9 shows the changes indicated by 3 selected stations. These apparent trends are most probably due to sampling variations. They show one of the possible sources of error in estimating frequency characteristics from an individual short record.

(6) The composite of 144 individual curves was extended from 29 years to 60 years by using data on available historic floods. It is further confirmed as representing conditions for the period 1895-1952 on the basis of the study described in (5).

Relation of Mean Annual Flood to Drainage Area

Of the various drainage-basin characteristics, drainage area has by far the greatest effect on flood magnitudes in North Carolina. Therefore, the relation between mean annual flood and drainage area was first investigated. The variation in this relation throughout the State was found to be considerable.

The next step was to look for additional variables that would help explain the residual variation after correlation with drainage area. This step was carried out in the Little Tennessee and French Broad River Basins. Results indicated some correlation with main-channel slope and with an index describing the relative efficiency of the drainage system. However, (1) accuracy of the results obtained by using the additional variables was not appreciably greater than could be obtained by using drainage area alone, (2) the determination of these additional variables would require considerable work by the user of the curves, and (3) topographic maps have not been prepared for much of the State. Therefore, the use of additional variables is considered impracticable at present.

Alternative to the use of other basin characteristics is the division of the State into areas in each of which the total effect of basin characteristics other than drainage area is sensibly constant and to determine for each such area the relation of mean annual flood to drainage area. Subdivision of the State into river basins is not feasible because streams in the eastern part of the State originate in the Piedmont and flow through the Coastal Plain, thus crossing boundaries between apparently homogeneous areas. Even in the western part of the State many streams drain two areas of different flood-producing characteristics. Apparently the delineation of hydrologically homogeneous areas must be based on the plotting of available points supplemented by some knowledge of physical characteristics of the basins. Details of the solution are given in subsequent paragraphs.

In grouping station records by areas of similar flood-producing characteristics, several difficulties arise. The principal ones are (1) lack of knowledge of the true shape of the relation between mean annual flood and drainage area, (2) inadequate information as to which basin characteristics other than drainage area exert the largest influence in a particular area, (3) indications that changes do not always occur on drainage divides but apparently occur gradually over a considerable area, (4) the fact that the mean annual flood of a stream draining more than one area may not be used to define the relation in either area, and (5) variations of the mean-annual floods (as determined from available data) from their true values.

The first difficulty can be partially met by some premise as to the shape of the curve of relation between mean annual flood and drainage area. It has been determined in many previous studies that the mean annual flood varies as the product of a coefficient and some power of the drainage area over areas apparently representing similar topographic characteristics. Here it is considered further that if each of these areas is homogeneous with respect to production of flood runoff then one area would produce higher runoff than another for any given size of drainage area. The additional premise is used that all curves would converge towards the zero origin of mean annual flood and drainage area. In such case, the curves defining mean annual flood would be a non-intersecting set of straight lines on log-log plotting. Whether the assumed form of relation holds down to very small drainage areas is not known. However, in the drainage area range above 5 square miles it is believed that such a set of curves will serve as a satisfactory basis for expressing the relation of mean annual flood to drainage area. The assumption of curves of a fixed pattern does not mean that the curves should be derived by mathematical analysis. It merely provides general guides for the graphical analysis. Summarizing, the relations should be straight lines on log-log paper, should vary in slope, and should, if extended downward, converge approximately at the origin.

Little can be done to overcome the other difficulties. The mean annual flood can vary considerably from its long-time value because of chance elements. The possible range in value due to chance can be computed by a statistical procedure similar to the one used to test the homogeneity of a group of frequency curves. The computed range is based on 95% confidence limits. These limits include the true mean annual flood 19 times out of 20 and when plotted against drainage area are helpful in establishing the curve of relation between mean annual flood and drainage area.

Hydrologic Areas of North Carolina

Analysis of the relations between mean annual flood and drainage area was pursued along the lines previously described. Results of the analysis are 6 different curves each of which is applicable to one or more of 11 hydrologic areas of the State. No information is available for an additional area adjacent to the coast. Figure 10 is a map of North Carolina showing the 12 hydrologic areas 6/. Mean annual floods and drainage areas used in defining the relation curves are given in table 5 (p. 50).

Some individual station means deviate excessively from the appropriate curve. These deviations can in some instances be explained by known characteristics of the drainage basins. Others are unexplainable except by chance variation. The 95% confidence intervals used should include the true mean annual flood 95% of the time. There is still 1 chance in 20 that a mean annual flood will fall outside those limits.

The following paragraphs describe each hydrologic area briefly, discuss the plotting of points that deviate considerably from the mean curve, and provide suggestions for determining mean annual floods in each area. The curves relating mean annual flood to drainage area are presented at appropriate locations.

Area 1A.--This area comprises the following basins: Catawba River upstream from Catawba, First Broad River upstream from Shelby, Swannanoa River upstream from Swannanoa, South Toe River, Cane River upstream from Hinton Creek, Elk River, and Watauga River. Curve 1 shown in figure 11 (p.51) describes the applicable relation between mean annual flood and drainage area. The highest runoff in the State occurs in this area and in Area 1B. The limits of Area 1A are not well defined. The curve is fairly well defined by the data except for stations 80, 116, and 130. It is not known whether the plotting of these points results from random variation or from some significant difference in flood characteristics. Station 116 plots extremely low. Rather than base the lower end of the curve on station 116 alone it is believed that the curve should be considered as undefined below 10 square miles. Catawba River main stem below Lake James is subject to substantial artificial regulation and the methods used here are not applicable to it.

Area 1B.--French Broad River Basin upstream from Little River and Pigeon River basin upstream from Richland Creek constitute this area. The five stations check curve 1 (fig. 11) within reasonable limits.

Area 2A.--This irregular-shaped area includes headwaters of the Tar and Neuse Rivers, most of the upper Cape Fear River Basin, and some lower tributaries of Yadkin-Pee Dee River. Curve 2 shown in figure 12 (p.51) averages the points in this region but the scatter is appreciable. The upper Haw River Basin lies outside this area in a region of

6/ A Geological Survey base map of North Carolina (scale 1:1,000,000) on which the hydrologic area boundaries are plotted is available for inspection at the Raleigh, N. C. office of the Geological Survey.

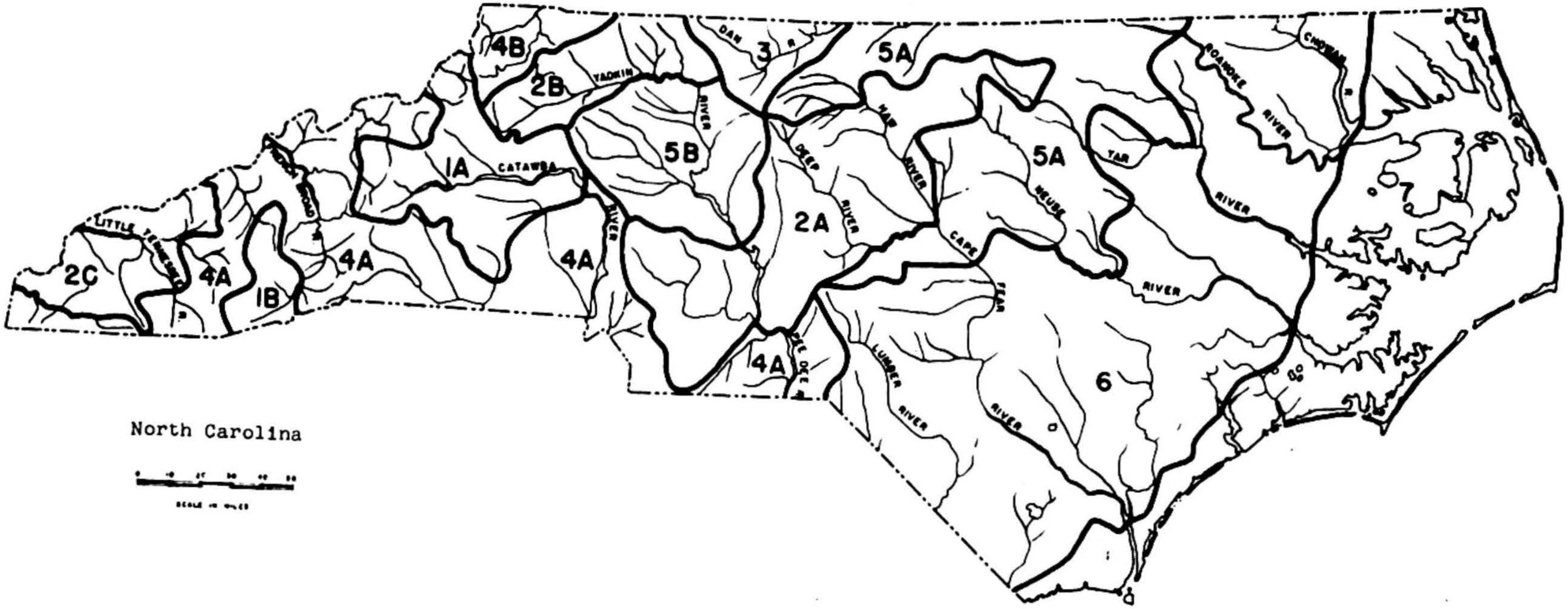

Figure 10.--Map showing hydrologic areas to which the curves (figures 11-16) of relation between mean annual flood and drainage area apply

Table 5 - Mean annual floods determined from individual frequency curves for the base period 1925-52

Gaging Station (stream and town)	Drainage area (Square miles)	Mean annual flood (cfs)
1. Blackwater - Franklin	613	3,400
2. Meherrin - Lawrenceville	553	6,800
3. Fontaine - Emporia	96	1,920
4. Roanoke - Roanoke	388	8,800
5. Dan - Francisco	124	4,000
6. N. Mayo - Spencer	108	3,100
7. Mayo - Price	260	8,300
8. Dan - Wentworth	1050	19,200
9. Smith - Martinsville	374	13,400
10. Smith - Spray	538	13,700
11. Sandy - Danville	113	3,700
12. Dan - Danville	2050	29,200
13. Dan - South Boston	2730	28,800
14. Banister - Halifax	552	7,600
15. Hyco - Omega	338	5,100
16. Roanoke - Roanoke Rapids	8410	75,000
17. Roanoke - Scotland Neck	8700	59,000
18. Tar - Tar River	161	6,700
19. Tar - Nashville	701	8,200
20. Fishing - Enfield	521	5,200
21. Tar - Tarboro	2140	16,300
22. Eno - Hillsboro	66.5	2,900
23. Flat - Bahama	150	7,400
24. Dial - Bahama	4.9	400
25. Rocky - Bahama	2.7	192
26. Neuse - Northside	526	9,800
27. Neuse - Clayton	1140	10,800
28. Middle - Clayton	80.7	2,320
29. Little - Princeton	229	3,000
30. Neuse - Goldsboro	2390	14,700
31. Neuse - Kinston	2690	15,500
32. Contentnea - Wilson	236	2,880
33. Contentnea - Hookerton	789	4,580
34. Haw - Benaja	168	1,850
35. Horsepen - Battle Ground	15.9	700
36. Reedy - Gibsonville	[illegible]3	2,520
37. S. Buffalo - Greensboro	32.8	1,720
38. N. Buffalo - Greensboro	36.4	1,600
39. Haw - Haw River	599	12,800
40. Haw - Pittsboro	1310	26,000
41. Morgan - Chapel Hill	27	3,900
42. W. F. Deep - High Point	32.1	1,780
43. E. F. Deep - High Point	14.2	1,500
44. Deep - Randleman	124	5,100
45. Muddy - Archdale	16.2	1,230
46. Deep - Ramseur	346	13,800
47. Bear - Robbins	134	6,000
48. Deep - Moncure	1410	22,500
49. Cape Fear - Lillington	3440	45,000
50. Little - Manchester	348	3,500
51. Little - Linden	460	3,700
52. Cape Fear - Fayetteville	4370	45,400
53. Rockfish - Hope Mills	284	2,700
54. N. E. Cape Fear - Chinquapin	600	3,980
55. Waccamaw - Freeland	626	4,340
56. Yadkin - Patterson	28.8	1,490
57. Reddies - N. Wilkesboro	93.9	5,600
58. Yadkin - Wilkesboro	493	14,000
60. Fisher - Copeland	121	5,400
61. Forbush - Yadkinville	21.7	775
62. Yadkin - Yadkin College	2280	32,900
63. Rocky - Turnersburg	85.5	2,750
64. S. Yadkin - Mocksville	313	3,400
65. Third - Cleveland	87.4	1,410
67. Abbotts - Lexington	174	4,100
69. Uwharrie - Trinity	11.3	1,250
70. Uwharrie - Eldorado	347	9,350
71. Rocky - Norwood	1370	33,100
73. Brown - Polkton	110	2,980
75. Pee Dee - Cheraw	7380	138,000
76. Juniper - Cheraw	64	398
77. Drowning - Hoffman	178	1,390
78. Lumber - Boardman	1220	5,750
79. Little Pee Dee - Dillon	524	2,610
80. Catawba - Marion	171	6,200
81. Linville - Branch	65	4,540
82. Henry Fork - Henry River	80	5,200
83. S. F. Catawba - Lowell	630	11,400
84. Little Sugar - Charlotte	41.4	4,000
86. Second Broad - Cliffside	211	5,800
87. Broad - Boiling Springs	864	18,000
88. First Broad - Lawndale	198	9,700
89. N. Pacolet - Fingerville	116	3,200
91. S. F. New - Jefferson	207	4,600
93. New - Galax	1131	19,900
94. N. F. New - Crumpler	277	6,000
96. French Broad - Rosman	67.9	4,360
97. French Broad - Calvert	103	5,300
98. Catheys Creek - Brevard	11.7	786
100. Davidson - Brevard	40.4	3,000
101. Little - Penrose	41.4	1,730
102. Crab - Penrose	10.9	790
103. French Broad - Blantyre	296	7,000
104. Boylston - Horseshoe	14.8	590
105. S. F. Mills - The Pink Beds	9.99	610
108. Mills - Mills River	66.7	2,650
109. Clear - Hendersonville	42.2	1,700
110. Mud - Naples	109	3,100
111. Cane - Fletcher	63.1	2,050
112. French Broad - Bent Creek	676.	11,200
113. Hominy - Candler	79.8	2,000
114. N. F. Swannanoa - Blk. Mtn.	23.8	1,750
115. Swannanoa - Swannanoa	62.1	3,500
116. Beetree - Swannanoa	5.46	240
117. Swannanoa - Biltmore	130	3,050
118. French Broad - Asheville	945	14,500
119. Sandymush - Alexander	79.5	2,500
120. Ivy - Marshall	158	3,400
121. French Broad - Marshall	1332	18,600
122. Big Laurel - Stackhouse	126	2,970
123. French Broad - Hot Springs	1567	23,400
124. Pigeon - Canton	133	7,600
126. Jonathan - Cove Creek	65.3	1,690
127. Pigeon - Hepco	350	10,500
128. Cataloochee - Cataloochee	49.2	1,880
129. N. Toe - Altapass		
130. S. Toe - Newdale	60.8	6,300
131. Cane - Sioux	157	5,500
132. Nolichucky - Poplar	608	16,600
133. Watauga - Sugar Grove	90.8	5,200
135. Elk - Elk Park	42.0	2,500
136. L. Tennessee - Prentiss	140	2,770
137. Cullasaja - Highlands	14.9	880
138. Cullasaja - Cullasaja	86.5	2,800
140. L. Tennessee - Iotla	323	7,050
142. Nantahala - Rainbow Springs	51.9	2,200
143. Nantahala - Almond	174	6,600
144. L. Tennessee - Judson	664	14,300
145. Tuckasegee - Tuckasegee	143	4,530
147. Scott - Sylva	50.7	1,230
148. Tuckasegee - Dillsboro	347	7,800
149. Oconoluftee - Cherokee	131	5,890
151. Tuckasegee - Bryson City	655	16,000
152. Noland - Bryson City	13.8	900
153. Hazel - Proctor	44.4	2,500
154. L. Tennessee - Fontana	1571	32,000
155. Snowbird - Robbinsville	42.0	2,700
157. Hiwassee - Presley	45.5	1,770
158. Shooting - Hayesville	37.6	1,190
159. Hiwassee - Hayesville	252	7,450
160. Hiwassee - Murphy	421	12,800
161. Valley - Tomotla	104	4,080
162. Nottely - Blairsville	74.8	2,650
164. Nottely - Ranger	272	6,400

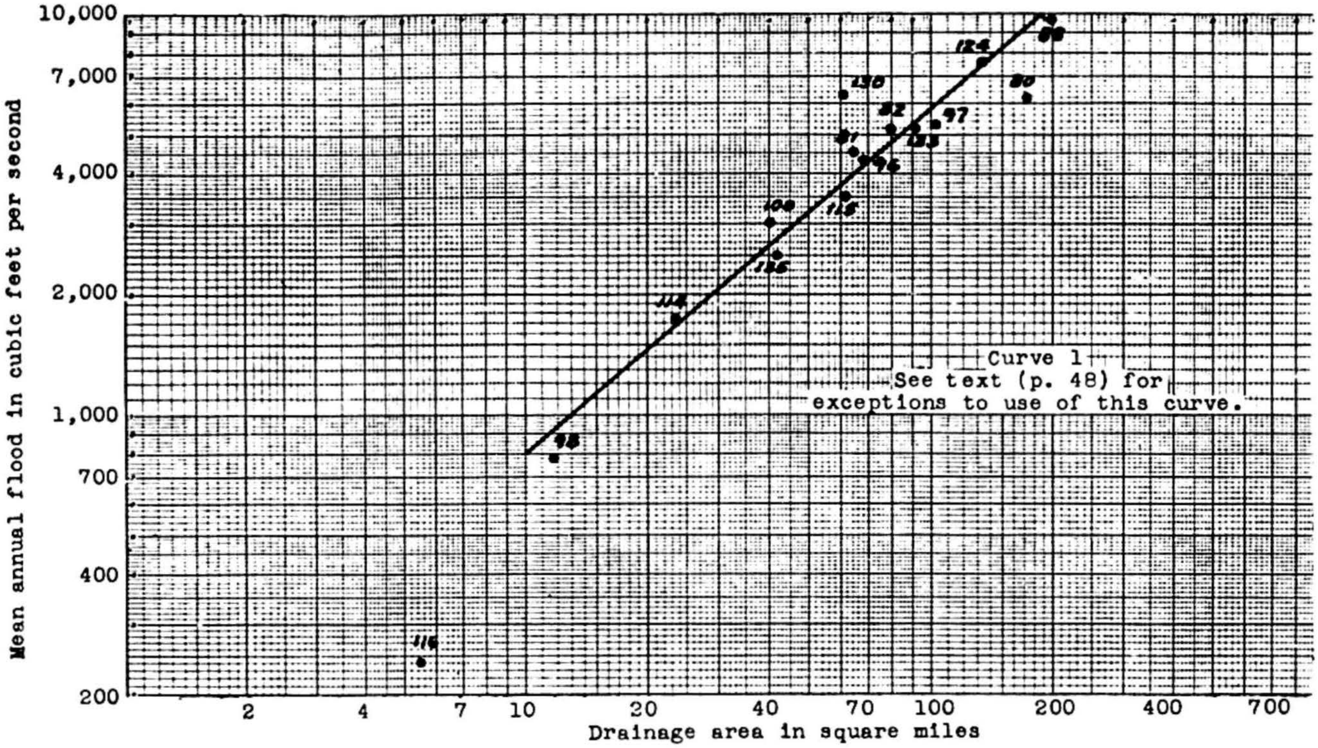

Figure 11.--Relation of mean annual flood to drainage area for Areas 1A and 1B

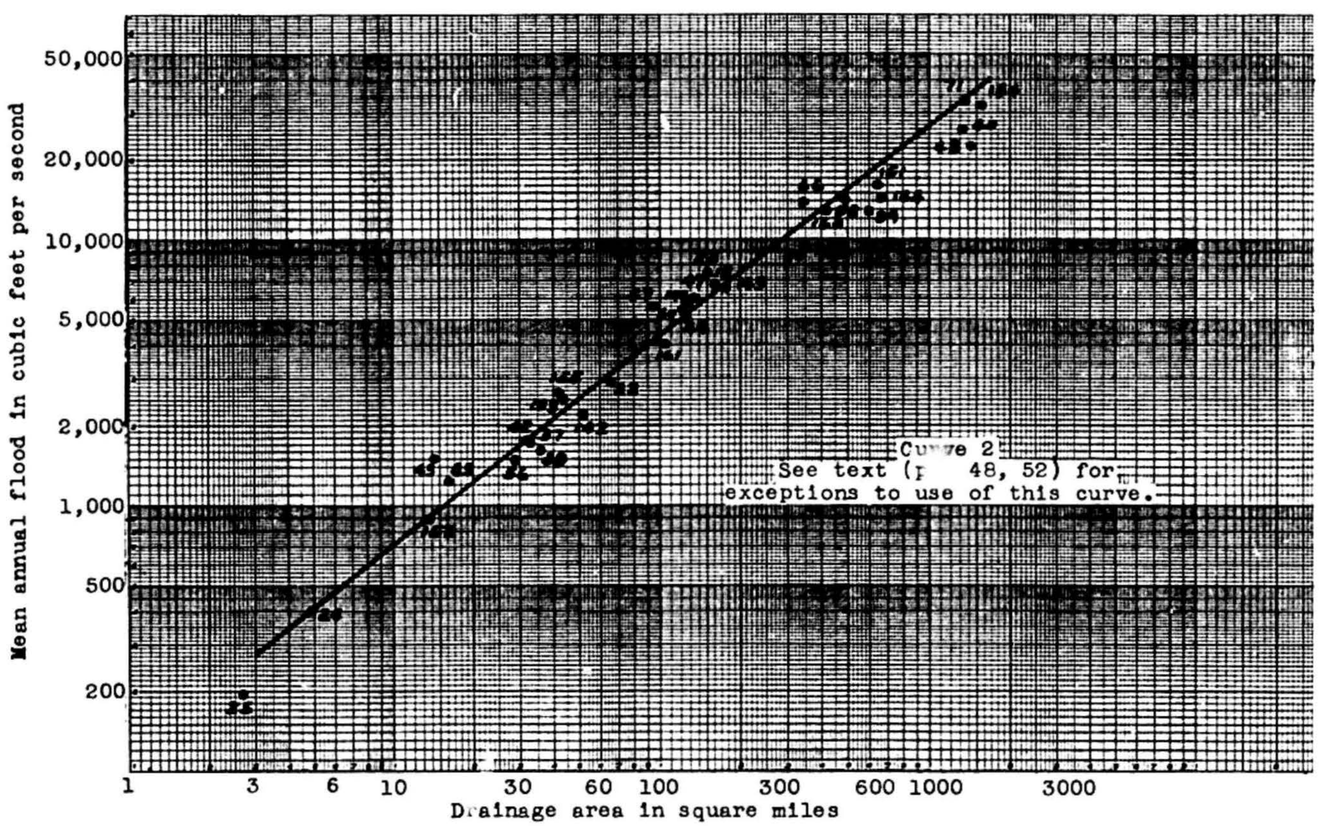

Figure 12.--Relation of mean annual flood to drainage area for Areas 2A, 2B, and 2C

lower flood potential (Area 5A); the effect shows up as lower flood runoff on the main stem of Haw River in Area 2A (No's. 39, 40). Other systematic deviations may be noted. Rather than subdivide this area and draw additional curves it is suggested that the mean curve be used and adjustments be made as follows: (1) For Haw River main stem downstream from the town of Haw River and Deep River main stem downstream from Bear Creek in Moore County, reduce the mean annual flood obtained from curve 2 by 30%. (2) For Deep River Basin upstream from mouth of Bear Creek in Moore County increase the curve value by 20%. (3) For all other parts of the area use the curve value directly except for the main stem of Yadkin-Pee Dee River which is subject to substantial artificial regulation.

Area 2B.--Four stations in this section of the Upper Yadkin River Basin check curve 2 (fig. 12) fairly well. For treatment of the main stem of the Yadkin River below Wilkesboro see the section "Along the main stems of large rivers."

Area 2C.--Records for the smaller streams in lower Little Tennessee and Hiwassee River Basins help to define curve 2 (fig. 12). Station 144 plots low because much of its drainage area lies outside Area 2C. Stations 151 and 154 plot low for the same reason. The boundaries of this area are not well defined, particularly in the Hiwassee River Basin. Regulation of main stem Little Tennessee River below Fontana Dam precludes use of this method in that reach.

Area 3.--Dan River Basin upstream from Draper contains eight stations used in this study. Six stations are in North Carolina and two are in Virginia. Curve 3 is fairly well defined as shown by figure 13.

Area 4A.--This area extends from Richmond County to the western boundary of the State and includes most of the French Broad River Basin. Curve 4 (fig. 14) defines the relation between mean annual flood and drainage area. Stations 127, 131, and 132 are affected by high runoff in other areas from which they originate. Station 136 (Little Tennessee River at Prentiss) plots low because of flat channel slope. Stations 126 and 147 plot inexplicably low and their deviations are attributed to chance. Stations 113, 117, 120, and 122 plot somewhat low. This may be due to characteristics of these drainage areas which produce comparatively low floods in the range of the mean annual, but normal floods in the upper range. For each of these latter 4 stations the composite frequency curve will better fit the base data for higher recurrence intervals if used with the mean annual flood obtained from curve 4 rather than the one obtained from the individual frequency curve. Station 84 represents considerable urban runoff and is not representative of the area. Portions of the main stems of Catawba and Pee Dee Rivers in this area are substantially regulated and the flood-frequency method is not applicable to them.

Area 4B.--Stations 91, 93, and 94 in New River Basin agree closely with curve 4 (fig. 14).

Areas 5A and 5B.--These areas include parts of the Roanoke, Tar, Neuse, Cape Fear, and Yadkin River Basins. Plotted points scatter somewhat, perhaps because these areas represent zones of transition rather than areas of equal flood-producing potential. Main-stem stations were not used in defining curve 5, which is shown in figure 15. Station 34 is believed to plot low for the reasons given for stations 113, 117, 120, and 122 under Area 4A. The inexplicable high plotting of station 41 may be due in part to a poorly defined stage-discharge relation, but can otherwise be attributed only to chance variation. For treatment of main stems of Yadkin, Neuse, and Cape Fear Rivers see the section "Along the main stems of large rivers."

Area 6.--Ten stations in the Coastal Plain and Sandhills define the relation for Area 6 (excepting the main stem Cape Fear, Neuse, and Tar Rivers). The curve is shown in figure 16. Relations for the main stems of large streams are given in a later section.

Area 7.--This area is composed entirely of flat swampy land along the coast. Because there are no gaging-station records in this area no flood discharge information is available. Even with records of annual floods it is unlikely that methods of analysis used for the rest of the State would be applicable here because drainage areas are generally indeterminate.

Streams in More Than One Hydrologic Area

The curves developed for the hydrologic areas allow mean annual floods to be determined for streams entirely within one hydrologic area. Because the boundaries of these hydrologic areas sometimes cross drainage basins certain streams are in two or more of these hydrologic areas. The mean annual flood for such streams cannot be obtained directly but may be determined by weighting the curve values according to the drainage area in each hydrologic area. For instance, consider Tar River at Louisburg. The total drainage area is 430 sq mi of which 310 sq mi is in Area 2A and 120 sq mi is in Area 5A. From curves 2 and 5 the mean annual floods for 430 sq mi are 14,000 and 6,000 cfs respectively. The mean annual flood for Tar River at Louisburg would be computed as follows:

$$\frac{(14{,}000)(310)+(6{,}000)(120)}{430} = 11{,}800 \text{ cfs}$$

This procedure can be used to obtain the mean annual flood on certain main-stem rivers but special considerations make it inapplicable on others. The following section describes the methods for determining mean annual floods on the large streams of the State.

Along Main Stems of Large Rivers

The main stems of large rivers are not amenable to uniform treatment. Some may be included with the tributaries in a hydrologic area, others may be treated by drawing a curve of mean annual flood in relation to drainage area for the particular main stem, and still others are artificially regulated to such an extent that the mean annual flood is no longer of value for prediction purposes.

The relation between mean annual flood and drainage area for the main stem of a large stream would be discontinuous at the tributary mouths as the total drainage area increases by the addition of the tributary drainage area. Furthermore, if the

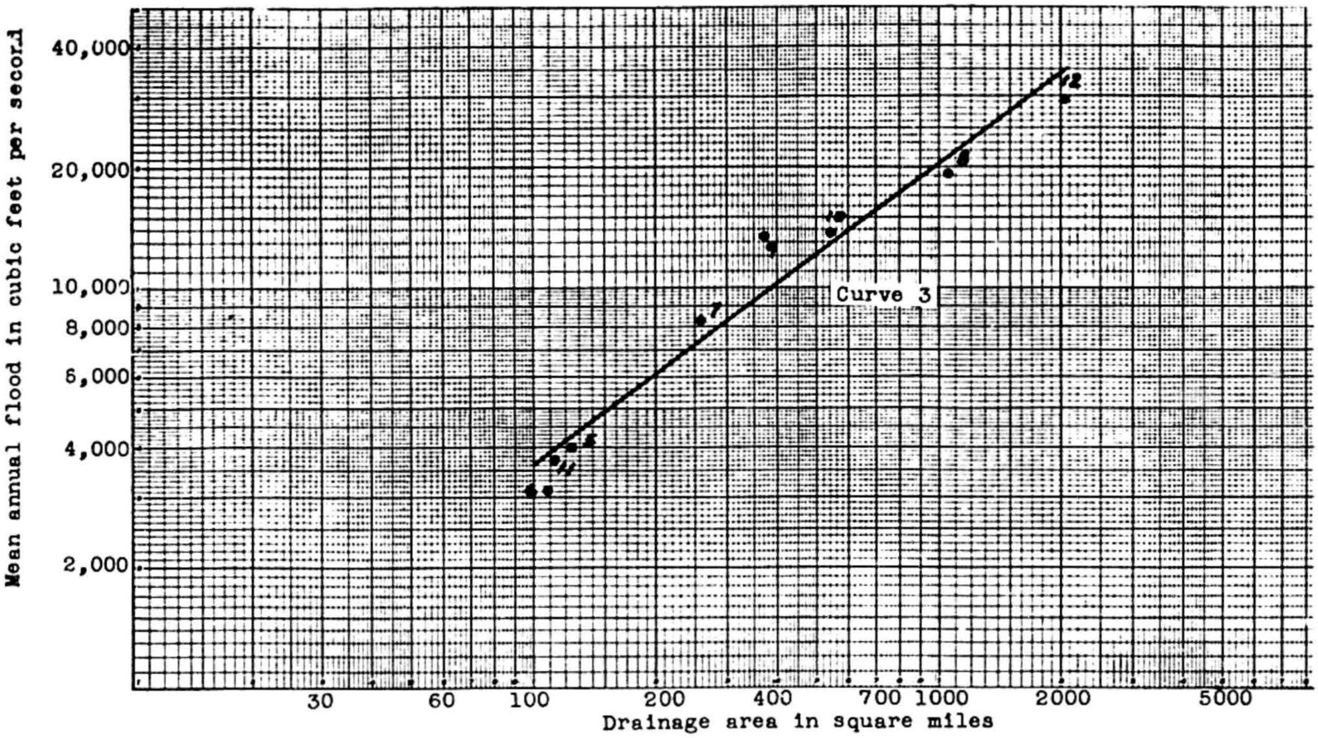

Figure 13.— Relation of mean annual flood to drainage area for Area 3

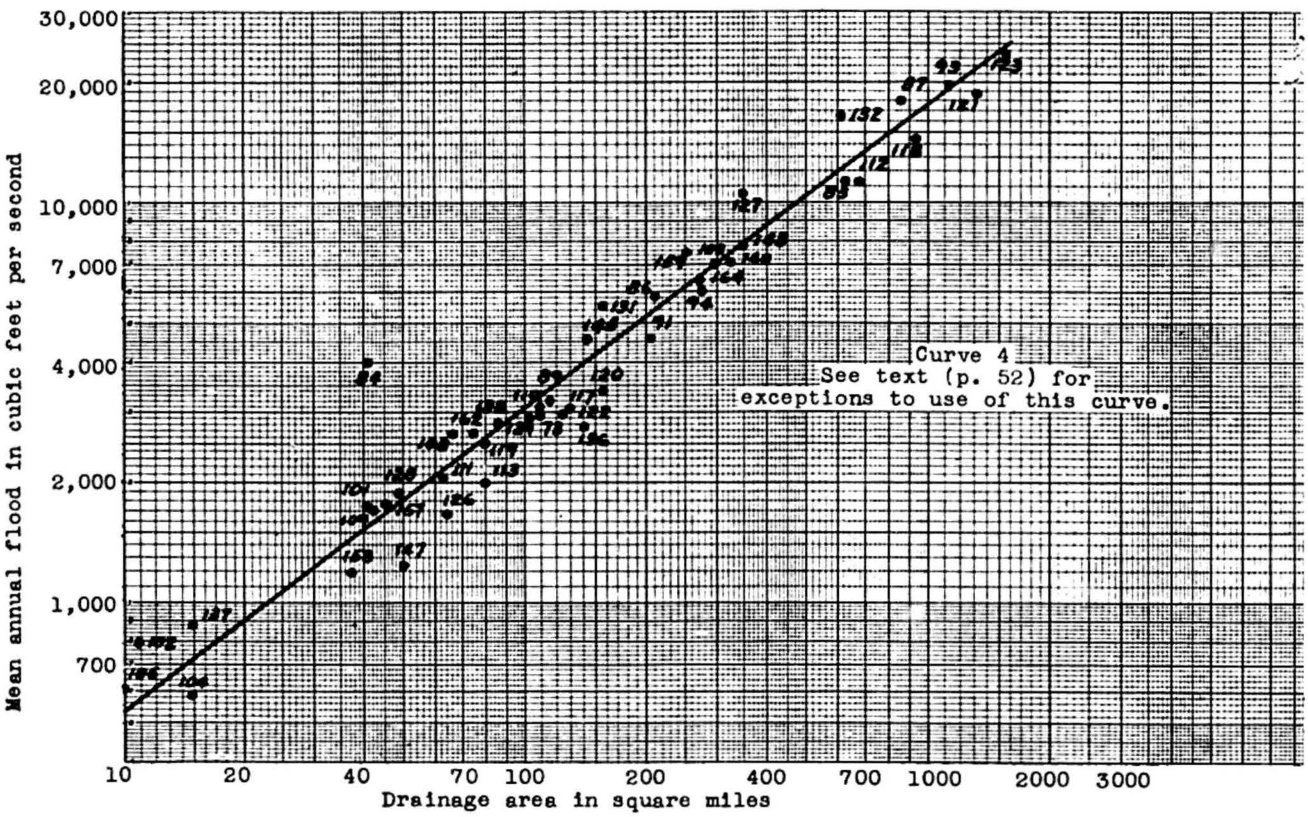

Figure 14.--Relation of mean annual flood to drainage area for Areas 4A and 4B

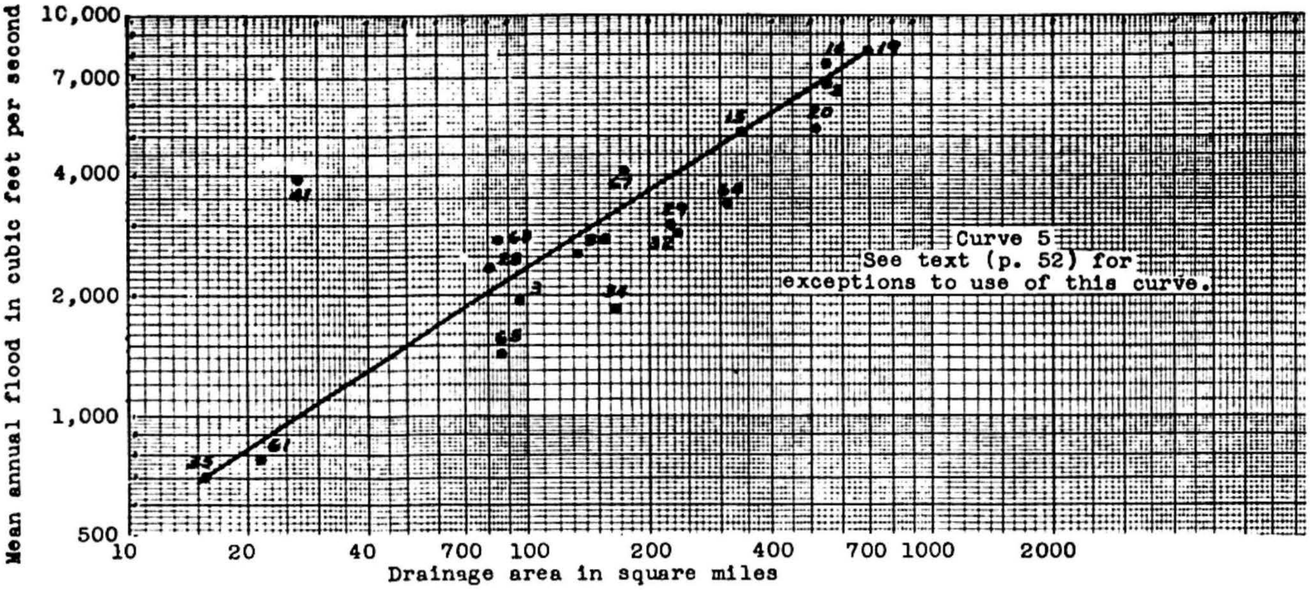

Figure 15.--Relation of mean annual flood to drainage area for Areas 5A and 5B

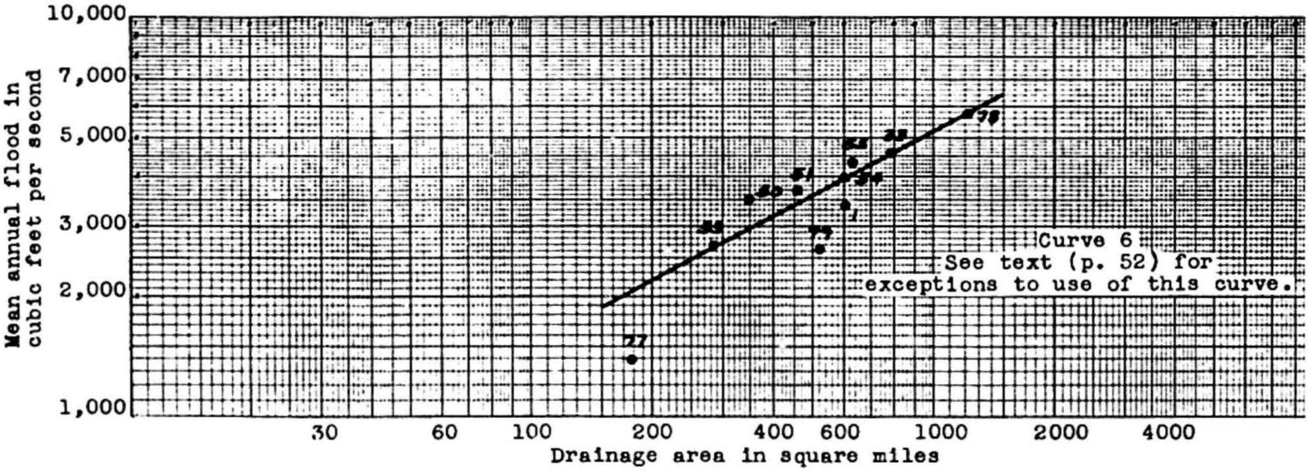

Figure 16.--Relation of mean annual flood to drainage area for Area 6

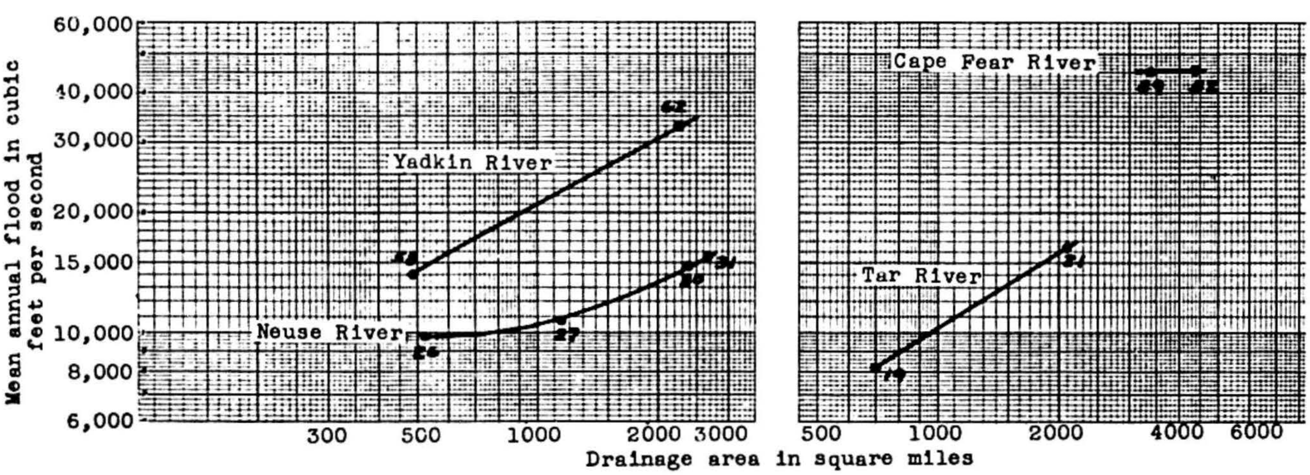

Figure 17.--Relations of mean annual flood to drainage area along the main stems of large rivers

tributary is large relative to the main stem and has considerably different flood characteristics the curve of relation downstream from the tributary may change in shape. These tributary effects cannot be defined precisely by the number of gaging-station records usually available, but for all practical purposes the relation between the mean annual flood and drainage area is sufficiently defined by a smooth curve through the available data.

The principal rivers of the State (see fig. 5 or fig. 10) are considered below with respect to determination of mean annual flood. For those not mentioned the relations given under "Hydrologic areas of North Carolina" are applicable.

Chowan River.--No data available.

Roanoke River.--Regulation by John H. Kerr Dam precludes use of flood-frequency methods on the portion of this stream in North Carolina.

Tar River.--Above the Franklin-Nash County line use curves 2 and 5 (weighted as described in text, p. 52). Between Franklin-Nash County line and Tarboro use relation given in figure 17 for main stem Tar River. Below Tarboro the relation is not defined.

Neuse River.--Use relation for main stem Neuse (fig. 17) from confluence of Eno and Flat Rivers to Kinston. Below Kinston the relation is not defined.

Cape Fear River.--Use relation for main stem (fig. 17) from confluence of Haw and Deep Rivers to Fayetteville. The relation is undefined below Fayetteville.

Yadkin-Pee Dee River.--For main stem above Wilkesboro use curve 2. From Wilkesboro to head of High Rock Reservoir use relation for main stem shown in figure 17. Artificial regulation downstream from High Rock Reservoir precludes use of the flood-frequency methods developed for this report.

Catawba River.--Above Lake James use curve 1. Flood frequency on the rest of the main stem Catawba River cannot be determined by methods given in this report because of substantial artificial regulation.

French Broad River.--Use curves 1 and 4 (weighted) as applicable.

Little Tennessee River.--Use curves 4 and 2 (weighted) to head of Fontana Reservoir. Flood-frequency methods are not applicable downstream.

Summer and Winter Floods

The composite flood-frequency curve derived from annual floods should be used to determine critical flood characteristics that might occur in a given period of years. For instance, the design of a structure might be dependent upon the highest probable flood expected during the life of the structure. But in building that structure, the contractor would be interested only in probable flood expectancy during the particular construction period. The frequency relations hitherto developed do not apply to periods of less than a year. Analysis of frequency relations for specific periods during the year is needed to furnish such information. The selection of such periods is described below.

The distribution of annual floods by months for the three physiographic regions of the State is shown in figure 18. On the basis of these graphs the year has been divided at times of low flood activity into two periods. The summer period was considered to extend from May 1 to October 31 and the winter period to include the rest of the year. In North Carolina major floods usually result from West Indian hurricanes which occur in summer but rarely after the end of October. On the smaller streams summer thunderstorms may also cause major floods. In contrast, the majority of annual summer floods are of minor magnitude. That winter floods are considerably different was shown by examination of flood peaks for the two periods. Those of small recurrence interval are greater than comparable summer ones but major winter floods are smaller than major summer floods. These differences between summer and winter flood characteristics are related to soil moisture conditions (as affected by

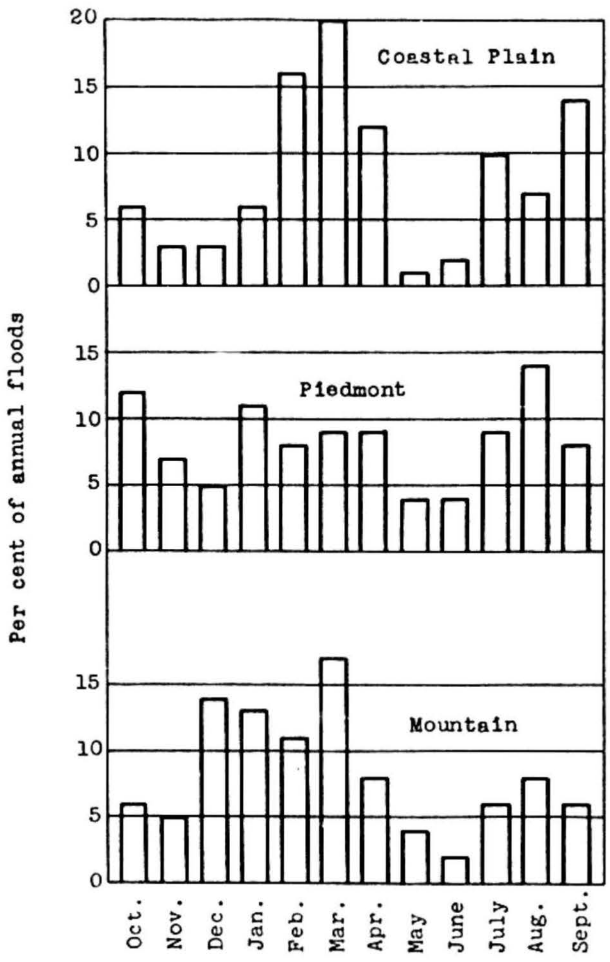

Figure 18.--Distribution of annual floods by months for the three physiographic regions of North Carolina

vegetation and by evaporation) as well as to storm types, and the general effect of both these factors might be expected to remain fairly constant throughout each period. If such is the case, summer and winter frequency curves would provide reliable information on seasonal frequency.

Individual annual-summer-flood frequency curves were developed by determining the highest summer flood of each year at each site and then developing frequency curves from the resultant lists of floods. These individual frequency curves were then combined into a composite annual-summer-frequency curve. An annual-winter composite frequency curve was derived similarly. The ordinates for both of these composite curves are in terms of ratio to mean annual flood instead of ratio to mean annual summer (or winter) flood. By referring these recurrence intervals to ratio to mean annual flood (1) the summer and winter composite frequency curves can be compared directly with the annual composite frequency curve and (2) the mean annual floods taken from the curves of figures 11-17 can be used to transfer the seasonal frequency curves to ungaged sites. These summer and winter composite curves are based on records for 28 gaging stations in the State and for the base period 1925-52. They are shown in figure 19.

Gaging stations used were those (1) for which records are available for most of the base period 1925-52, and (2) which also formed a group well distributed both geographically and with respect to size of drainage area. These criteria limited the available stations to the 28 shown in table 6.

The interpretation of these annual-seasonal curves is comparable with the interpretation of the annual flood-frequency curve. For instance, consider the annual-summer-flood frequency curve. The flood discharge corresponding to a selected recurrence interval is the discharge that will be equalled or exceeded as a summer maximum once (on the average) in the number of summers given by the recurrence interval. This discharge is independent of what happens in the winter seasons of those years.

The principal application of annual-seasonal-flood frequency curves is that of evaluating the probability of occurrence of a flood of a selected magnitude in one season. This probability (in percent) is 100 times the reciprocal of the recurrence interval. For recurrence intervals of 50 years, 20 years, and 5 years, the corresponding probabilities of occurrence in any one season are 2%, 5%, and 20%. Another way to express this probability would be to say that a

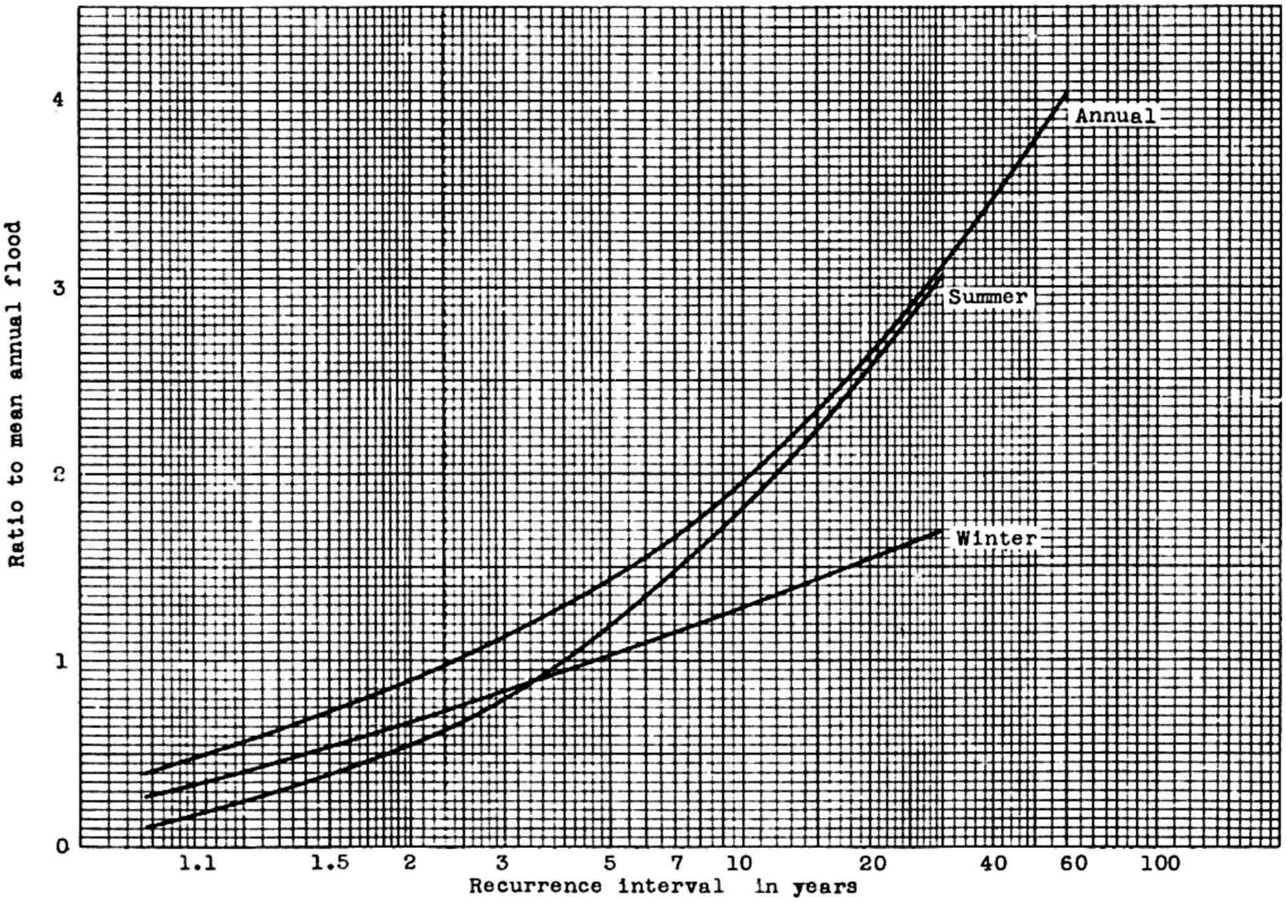

Figure 19.--Composite flood-frequency curves for North Carolina

Table 6.--Gaging stations from which records were used in developing composite seasonal flood-frequency curves

Gaging stations	Drainage Area (Square miles)	Period of record used in development of composite seasonal frequency curves
5. Dan River near Francisco, N. C.	124	1925-52
7. Mayo River near Price, N. C.	260	1930-52
19. Tar River near Nashville, N. C.	701	1929-52
20. Fishing Creek near Enfield, N. C.	521	1925-52
21. Tar River at Tarboro, N. C.	2140	1925-52
23. Flat River at Bahama, N. C.	150	1926-52
24. Dial Creek near Bahama, N. C.	4.9	1926-52
26. Neuse River near Northside, N. C.	526	1928-52
29. Little River near Princeton, N. C.	229	1930-52
31. Neuse River at Kinston, N. C.	2690	1928-52
33. Contentnea Creek at Hookerton, N. C.	789	1929-52
34. Haw River near Benaja, N. C.	168	1929-52
35. Horsepen Creek at Battle Ground, N. C.	15.9	1926-30, 1934-52
39. Haw River at Haw River, N. C.	599	1929-52
42. West Fork Deep River near High Point, N. C.	32.1	1925-26, 1929-52
46. Deep River at Ramseur, N. C.	346	1925-52
49. Cape Fear River at Lillington, N. C.	3440	1925-52
58. Yadkin River at Wilkesboro, N. C.	493	1925-52
62. Yadkin River at Yadkin College, N. C.	2280	1928-52
71. Rocky River near Norwood, N. C.	1370	1930-52
78. Lumber River at Boardman, N. C.	1220	1930-52
81. Linville River at Branch, N. C.	65	1925-52
100. Davidson River near Brevard, N. C.	40.4	1925-52
118. French Broad River at Asheville, N. C.	945	1925-52
132. Nolichucky River at Poplar, N. C.	608	1926-52
138. Cullasaja River at Cullasaja, N. C.	86.5	1925-52
151. Tuckasegee River at Bryson City, N. C.	655	1925-52
161. Valley River at Tomotla, N. C.	104	1925-52

flood of 20-year recurrence interval would have 1 chance in 20 of occurring in any one season.

The seasonal flood-frequency curves as developed and as interpreted in the preceding paragraphs are to the "annual" base. That is, they show the recurrence intervals of floods that may be expected to occur as maximums for the appropriate season. These seasonal flood-frequency curves can be converted to the "partial-duration series" base by the relationship given in table 3. When so converted the recurrence interval is the average number of seasons in which the corresponding flood will be equaled or exceeded. For instance, a flood of 0.5-year recurrence interval would be expected to be equaled or exceeded on the average once every half season. Similarly a flood of 1-year recurrence interval would be expected to occur on the average once per season. A seasonal curve to the "partial-duration series" base gives the probability of occurrence of minor floods. For recurrence intervals of more than 5 years the curve to the "partial-duration series" base has no advantage over the curve to the "annual" base.

Summary

Flood-Frequency Relationships

The composite flood-frequency curves for annual floods, annual summer floods, and annual winter floods (compared in figure 19) are applicable throughout the State. Coordinates of these curves and of their respective partial-duration series counterparts (computed on basis of the data of table 3) are given in table 7. The six curves of relation between mean annual flood and drainage area (ranging in slope from 0.86 to 0.54) are given in figure 20. Their areas of applicability are shown on figure 10, page 49. No information is available for Area 7. Relations for portions of the main stems of certain large rivers are given in figure 17.

Table 7.--Coordinates of composite frequency curves for North Carolina

Recurrence Interval		Ratio to M.A.F.		
Annual	Partial Duration	Annual	Summer	Winter
1.1	0.41	0.48	0.19	0.33
1.2	.56	.57	.26	.40
1.4	.80	.69	.35	.50
1.7	1.13	.82	.46	.60
2.0	1.45	.91	.55	.68
3.0	2.47	1.13	.81	.84
5.0	4.60	1.42	1.20	1.04
10	9.50	1.96	1.84	1.29
20	19.5	2.65	2.57	1.55
30	29.5	3.13	3.04	1.69
40	39.5	3.47	-	-
60	59.7	4.00	-	-

The relations between mean annual flood and drainage area allow the mean annual flood to be computed for any point on any stream in the State except for (1) streams on which flood flow is subject to substantial artificial regulation, (2) streams having drainage areas greater or less than those for which the applicable curve is defined, and (3) streams in Area 7.

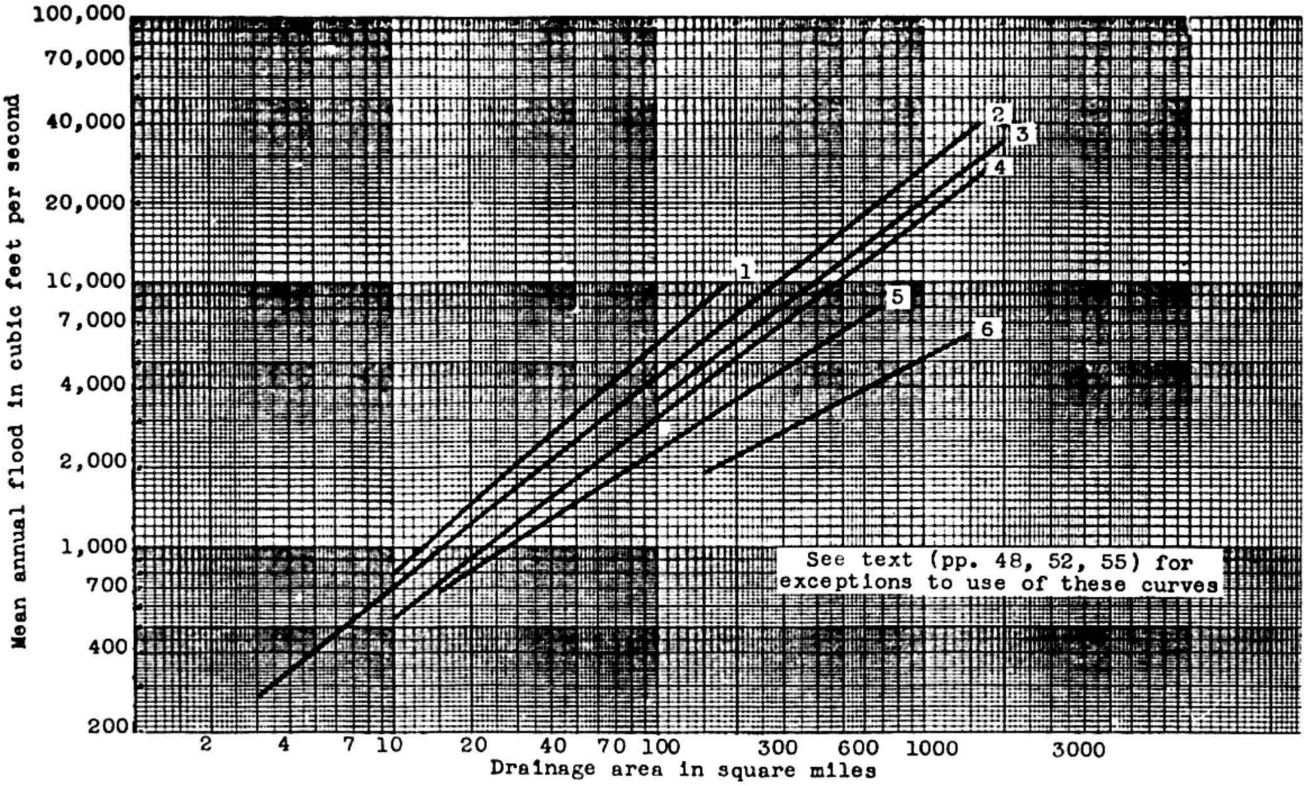

Figure 20.--Summary of relations of mean annual flood to drainage area for North Carolina

How to Determine Flood Frequency at a Site

To determine the flood of a given recurrence interval at an ungaged site:

1. Measure the drainage area above the site.
2. For this drainage area enter the applicable curve of relation between mean annual flood and drainage area and determine the mean annual flood at the site. The applicable curve may be found in the section "Relation of mean annual flood to drainage area". That section also includes methods for handling special problems such as main-stem rivers and streams draining more than one hydrologic area. See text, pp. 48-55 , for application and exceptions to the use of each general curve.
3. From the applicable composite flood-frequency curve determine the ratio to mean annual flood corresponding to the desired recurrence interval.
4. Multiply the mean annual flood by the ratio obtained in step 3. The result is the desired flood discharge. The entire frequency curve at the specified site can be obtained by repetition of steps 3 and 4 for various recurrence intervals.

It is recommended that the above method be followed to determine magnitude and frequency at gaged sites as well. The results based on a composite frequency curve and an average relation between mean annual flood and drainage area should be more reliable than would be obtained from a frequency curve based on data for the individual site alone.

Frequency of Flood Stages

Flood magnitudes as hitherto described are in terms of discharge. In many problems flood stages are of equal, or greater, interest and it may be desirable to express frequency in terms of stage. The stages corresponding to given discharges at a gaging station can be obtained from the established stage-discharge relation. This relation for any station can be examined by plotting flood stages against corresponding discharges as given in table 1. The stage-discharge relation changes with time at some stations. Such changes during the period of record may be indicated if the points do not all plot on a smooth curve. Other factors which would cause erratic plotting of points are changes in gage location and changes in gage datum. Where changes have occurred, the relation defined by the most recent station records should be used.

The possibility of change is large enough so that current information should always be used. No attempt has been made to furnish information on stage frequencies in this report, except that gage heights are shown for annual floods at the gaging stations. The necessary current data, whereby stage frequencies may be determined at any gaging-station site, are on file at the offices of the U. S. Geological Survey at Raleigh, Asheville, or Statesville, N. C.

The determination of the relation between stages and discharges at ungaged sites requires specialized knowledge of the hydraulics of open channels and the methods may vary depending on the amount of flood information found available at the design site or nearby. Some help may be obtained from the Geological Survey for particular sites.

Typical Problems Involving Flood Frequency

Flood magnitude and frequency information furnished herein will be found useful in four general types of problems:

1. Engineering design of bridges, flood-control works, or other hydraulic structures, generally involving design for floods of between 10 and 50-year recurrence intervals. For such a problem the composite frequency curve of annual floods should be used to determine the magnitude of a flood of the selected recurrence interval. For the design of such structures as dams whose failure may result in heavy damage or loss of life downstream, special studies are generally made to compute the expectancies of very rare floods.

2. The design of structures such as road fills which will not be seriously damaged by flooding and will be returned to use soon after the flood recedes may involve recurrence intervals of less than a year. In this problem a partial-duration-series frequency curve is required. Coordinates of the partial-duration-series curve converted from the composite annual frequency curve are shown in table 7, page 57.

3. Planning seasonal operations at sites subject to flooding requires estimating the probability of occurrence of floods of a given discharge (or stage) for the particular season. Winter and summer composite frequency curves, when transferred to the site, provide the basis for estimating the probability of selected flood discharges. If the "annual" seasonal curve is used the probability is obtained that the selected discharge will be exceeded as a seasonal maximum during the season of that particular year. Use of the "partial-duration" seasonal curve provides the probability of the selected flood being equaled or exceeded at any time during any particular season. After the appropriate frequency curve of flood discharge is established at the site a stage-frequency curve may if desired be developed by the method described under "Frequency of flood stages."

4. Evaluation of the risk of building highways, commercial structures, or residences, or of carrying on farming within a flood plain is a common problem. Either the annual-flood or the partial-duration-series frequency relations may be used for such evaluation.

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