FLOOD PLAIN INFORMATION

CAPE FEAR RIVER
AND
CROSS CREEK WATERSHED

FAYETTEVILLE, NORTH CAROLINA

PREPARED FOR
THE CITY OF FAYETTEVILLE, NORTH CAROLINA
BY
CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

SEPTEMBER, 1970

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INTRODUCTION

This report relates to the flood situation along the Cape Fear River and in the Cross Creek watershed in the vicinity of Fayetteville, North Carolina. It was prepared at the request of the City of Fayetteville through the North Carolina Department of Water and Air Resources to aid in the solution of local flood problems and in the best utilization of land subject to overflow. The report is based upon information on rainfall, runoff, historical and current flood heights, and other technical data bearing upon the occurrence and size of floods in the Fayetteville area.

The report covers two significant phases of the flood problem at Fayetteville. It brings together a record of the largest known floods of the past on Cape Fear River and Cross, Little Cross, Blounts, and Branson Creeks. Secondly, it describes the effects of probable future floods: namely, Intermediate Regional Floods and Standard Project Floods. Intermediate Regional Floods are determined from an analysis of known floods on Cape Fear River and other regional streams having similar physical characteristics. These floods, representative of the larger floods to be expected, should be used as a guide to establish minimum building elevations for permanent structures. Standard Project Floods are floods of rare occurrence and, on most streams, are considerably larger than any floods that have occurred in the past. These floods define the practical upper limits of the flood plain and should be considered in planning for use of the flood plains.

The report contains maps, profiles, and cross sections which indicate the extent of flooding that has been experienced and that which might occur in the future in the vicinity of Fayetteville. This should prove helpful in planning the best use of the flood plains. From the maps, profiles, and cross sections, the depth of probable flooding, either by recurrence of the largest known floods, or by occurrence of the Intermediate Regional or Standard Project Floods at any location, may be learned. With this information, floor levels of buildings may be planned high enough to avoid flood damage or, if at

lower elevations, with recognition of the chance and hazards of flooding that are being taken.

The report does not include plans for the solution of flood problems. Rather, it is intended to provide the basis for further study and planning on the part of the City of Fayetteville in arriving at solutions to minimize vulnerability to flood damages. This might involve local planning programs to guide developments by controlling the type of use made of the flood plain through zoning and subdivision regulations, the construction of flood protection works, or a combination of the two approaches.

The Wilmington District of the Corps of Engineers will, upon request, provide technical assistance to Federal, State, and local agencies in the interpretation and use of the information contained herein, and will provide other available flood data related thereto.

SUMMARY OF FLOOD SITUATION

The largest portion of the City of Fayetteville, North Carolina, is located on the west bank of the Cape Fear River. Cross Creek joins the Cape Fear River from the west bank above Person Street bridge. Blounts, Branson, and Little Cross Creeks are all tributaries of Cross Creek and serve as major drains for the area within the city limits of Fayetteville. This report covers the Cape Fear River from Mile 143.3 to Mile 150.1, Cross Creek from its confluence with the Cape Fear River to Mile 7.0, Little Cross Creek from its mouth to Mile 2.7, Blounts Creek from its confluence with Cross Creek to Mile 4.8, and Bransons Creek from its mouth to Mile 0.8. Plate 1 shows the Upper Cape Fear River Basin above Fayetteville and also shows Cross Creek Watershed within the basin. Plate 2 shows study areas within Cross Creek Watershed.

A large portion of the residential development of Fayetteville is on high ground west of the river; however, there is a considerable amount of commercial and residential development along the Cape Fear River and the streams covered in this study. Portions of this land have been inundated by floods of the past, and a substantially greater area is within reach of the potentially greater floods of the future.

The U. S. Weather Bureau has maintained a stream-gaging station on the Cape Fear River at Fayetteville since 1893. There are no streamflow records on any of the streams in the Cross Creek watershed. Residents along the streams have been interviewed and newspaper files and historical documents searched for information concerning past floods. From these investigations and from studies of possible future floods on the Cape Fear River and in the Cross Creek watershed, the local flood situation, both past and future, has been developed. The following paragraphs summarize the significant findings which are discussed in more detail in succeeding sections of this report.

* * *

THE GREATEST FLOOD known to have occurred on the Cape Fear River at Fayetteville during the past 82 years occurred in September 1945.

Newspapers pointed out the disastrous proportions of the flood at Fayetteville, and leave no doubt that it was the most damaging by far of any known to the oldest residents at that time. The greatest known flooding in the Cross Creek watershed occurred due to the backwater effects of the river during the 1945 flood. However, the backwater flooding from the river during the 1945 flood was confined to the lower portion of the Cross Creek watershed.

* * *

ANOTHER GREAT FLOOD in August 1908 was the second highest flood on the Cape Fear River and the lower portion of Cross Creek. The flood was only 0.2 foot lower than the September 1945 flood at the site of the present gage on the Cape Fear River.

* * *

OTHER LARGE FLOODS on the Cape Fear River at Fayetteville occurred in October 1929 and September 1928. These floods were within 4 feet of the August 1908 flood. In the lower portion of the Cross Creek watershed, floods usually occur at the same time as floods on the river.

* * *

INTERMEDIATE REGIONAL FLOODS on the Cape Fear River and the Cross Creek watershed are floods, developed from a statistical study of regional flood data, that have an average frequency of occurrence in the order of once in 100 years. They are determined from an analysis of floods on these streams and other streams in the same general area. The analysis indicates that the Intermediate Regional Floods for the Cape Fear River with the New Hope Dam in operation are from 6 to 7 feet lower than the September 1945 flood. On Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek they would range from 2 to 20 feet above overbank stages.

* * *

STANDARD PROJECT FLOOD determinations indicate that, with the New Hope Dam in operation, floods could occur on the Cape Fear River in the vicinity of Fayetteville about 1.6 feet higher than the September 1945 flood crest. Standard Project Floods on Cross, Little Cross, Blounts, and Branson Creeks would be about 1 to 8 feet higher than the Intermediate

Regional Floods on these streams. They would range from 3 to 23 feet above overbank stages along these streams.

* * *

FLOOD DAMAGES that would result from recurrences of major known floods would be substantial. Extensive damages would be caused by the Intermediate Regional Floods and Standard Project Floods because of their wider extent, greater depths, and higher velocities.

* * *

MAIN FLOOD SEASON for the Cape Fear River at Fayetteville is during the hurricane season of August through November when floods are most severe. However, in winter and spring, flood events are more numerous. Floods due to intense local thunderstorms occur in the summer, and large floods may occur any time, particularly on the small streams in the Cross Creek watershed.

* * *

VELOCITIES OF WATER during major floods range up to 5.2 feet per second (about 3 miles per hour) in the channel of the Cape Fear River. Velocities on the flood plain vary widely, depending on location, but generally are less than 1.5 feet per second. Velocities for floods of comparable magnitude are higher on Cross, Little Cross, Blounts, and Branson Creeks than on the Cape Fear River. During a Standard Project Flood, velocities would be extremely dangerous to life and property. In the channel, they would range up to 5.4 feet per second on the Cape Fear River, 10.1 feet per second on Cross Creek, 10.5 feet per second on Blounts Creek, 8.5 feet per second on Little Cross Creek, and 6.5 feet per second on Branson Creek. On the flood plain, the corresponding figures would be 1.1, 3.2, 2.8, 4.9, and 1.8 feet per second. Velocities greater than 3 feet per second, combined with depths of 3 feet or greater, are generally considered hazardous.

* * *

DURATION OF FLOODS from the Cape Fear River at Fayetteville is long. Stages rise from normal within-bank flows to major flood crests in 3

to 4 days following heavy rainfall periods in the upper basin area. During the flood of September 1945, the Cape Fear River at Fayetteville had a maximum rate of rise of about 1 foot per hour and remained out of its banks for a week. The overall ranges in stage on Cross, Little Cross, Blounts, and Branson Creeks are less than those for the Cape Fear River, and these streams rise to flood peaks considerably faster than the river. During a Standard Project Flood on the Cape Fear River, the stream would rise 55 feet in 126 hours, with a maximum rate of rise of 0.8 foot per hour, and would remain out of its banks for about 7-1/2 days. On Cross Creek, the Standard Project Flood would rise 19 feet in 39 hours, with a maximum rate of rise of 1.0 foot in 1 hour, and the stream would remain out of banks for about 45 hours. For a similar flood on Little Cross, Blounts, and Branson Creeks, the rate of rise for each would be about 1.2 feet per hour, and the duration above bankfull would be nearly 40 hours.

* * *

HAZARDOUS CONDITIONS would occur during large floods as a result of the rapidly rising streams, high velocities, and deep flows.

* * *

FLOOD-DAMAGE-PREVENTION MEASURES. The New Hope Dam and Reservoir project, located about 55 miles upstream from Fayetteville, is currently under construction; and, when completed, will provide a considerable amount of flood protection for Fayetteville. Channel improvement projects on Cross and Blounts Creeks are under study, and, if provided, will lower flood stages from flooding by the creeks. The backwater effects of the Cape Fear, however, would not be measurably lowered by the improvements on the creeks. There are no flood plain regulations in Fayetteville.

* * *

FUTURE FLOOD HEIGHTS that would be reached if the Intermediate Regional and Standard Project Floods occurred in the Fayetteville vicinity are shown in Table 1. The table gives the comparison of these flood crests and also shows the comparison with the September 1945 flood for the Cape Fear River.

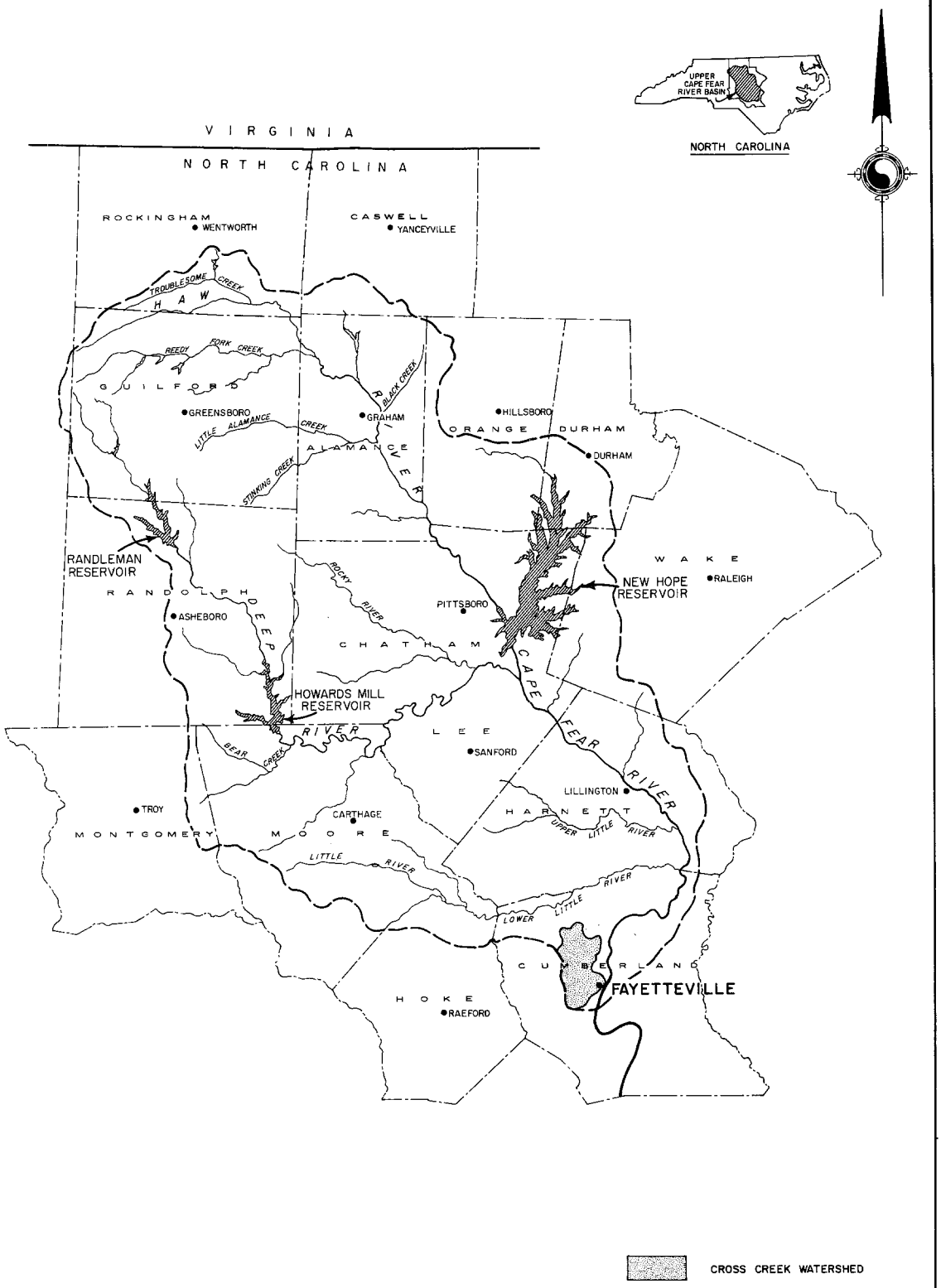
TABLE 1

RELATIVE FLOOD HEIGHTS

Flood	Location	Mile above Mouth	Estimated Peak Discharge cfs	Above 1945 Flood feet
	Cape Fear River			
September 21, 1945	N.C. Hwy. 24&210 Bridge (USWB Gage)	145	124,000	0
Intermediate Regional	"	145	100,000*	-5.8*
Standard Project	"	145	136,000*	2.4*

Flood	Location	Mile above Mouth	Estimated Peak Discharge cfs	Above Intermediate Regional Flood feet
	Cross Creek			
Intermediate Regional	Green St. Bridge (Upstream side)	2.52	4,260	0
Standard Project	"	2.52	7,550	4.0
	Little Cross Creek			
Intermediate Regional	Filter Drive Bridge	0.31	1,900	0
Standard Project	"	0.31	3,800	3.3
	Blounts Creek			
Intermediate Regional	SCL RR Bridge	1.75	1,975	0
Standard Project	"	1.75	3,850	3.8
	Branson Creek			
Intermediate Regional	Weiss Ave. Bridge	0.36	1,500	0
Standard Project	"	0.36	2,700	2.2

*With New Hope Dam in operation.



CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

UPPER CAPE FEAR RIVER BASIN

ABOVE FAYETTEVILLE, NORTH CAROLINA

SEPTEMBER, 1970

PLATE 1

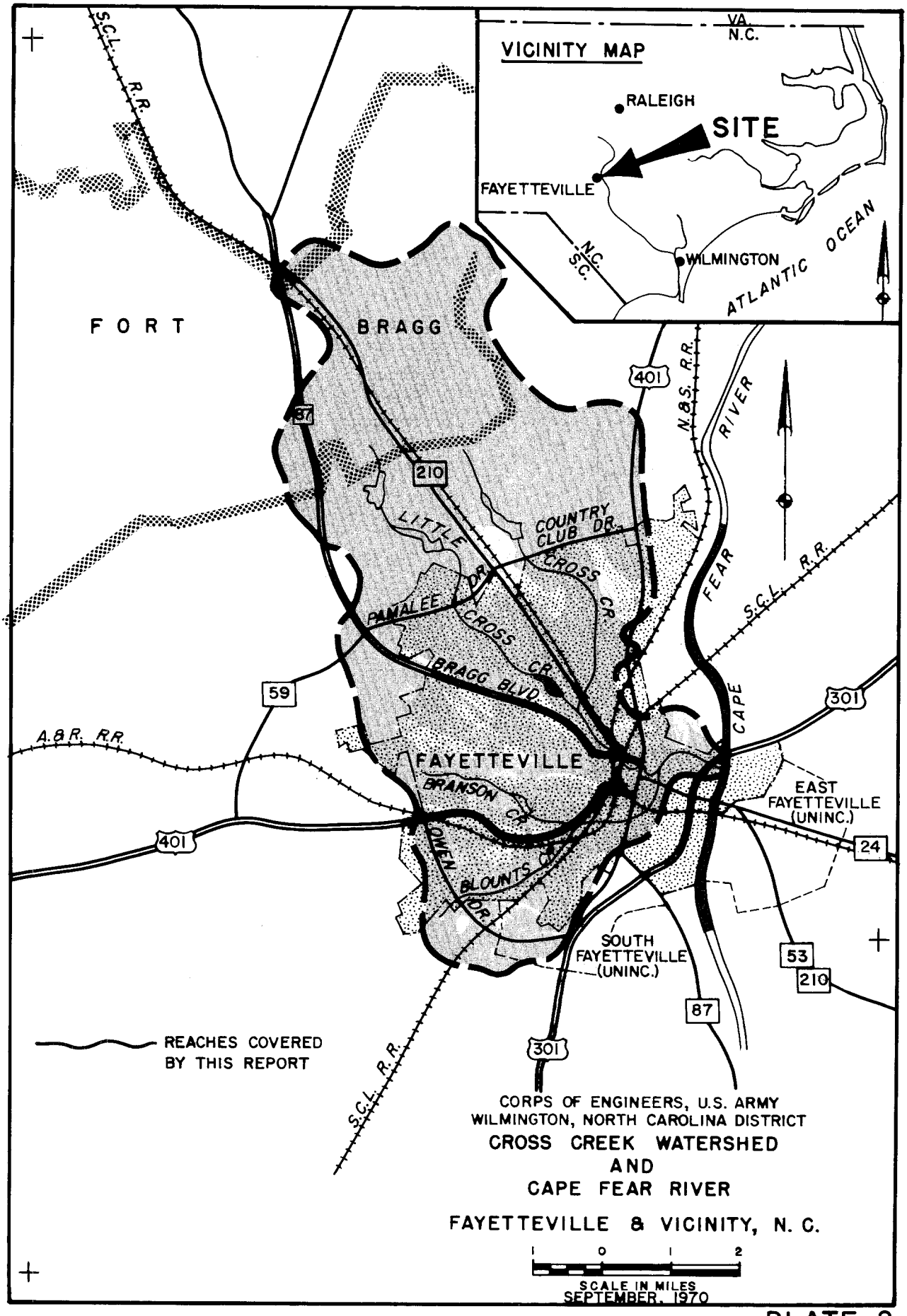

VICINITY MAP
VA
N.C.
RALEIGH
SITE
FAYETTEVILLE
N.C.
S.C.
WILMINGTON
ATLANTIC OCEAN
FORT
BRAGG
S.C.L. R.R.
401
87
210
N.&S. R.R.
RIVER
FEAR
LITTLE
COUNTRY CLUB DR.
CROSS CR
PANALEE DR.
CROSS CR
BRAGG BLVD
59
A.&R. R.R.
S.C.L. R.R.
301
CAPE
FAYETTEVILLE
BRANSON CR
OWEN DR.
BLOUNTS CR
EAST FAYETTEVILLE (UNINC.)
24
SOUTH FAYETTEVILLE (UNINC.)
53
210
87
301
REACHES COVERED BY THIS REPORT
CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT
CROSS CREEK WATERSHED
AND
CAPE FEAR RIVER
FAYETTEVILLE & VICINITY, N. C.
1 0 1 2
SCALE IN MILES
SEPTEMBER, 1970

PLATE 2

GENERAL CONDITIONS AND PAST FLOODS

GENERAL

This section of the report is a history of floods on the Cape Fear River and the Cross Creek watershed in the vicinity of Fayetteville, in Cumberland County, North Carolina. Fayetteville is located on the right bank of the Cape Fear River about 145 miles above its mouth at Cape Fear near Southport, N. C. The portion of the Cape Fear River studied extends from Mile 143.3 to Mile 150.1, a distance of 6.8 miles. The investigation on Cross Creek covers the lower 7.0 miles from its confluence with the Cape Fear River to N. C. Highway 59 crossing at the northern city limits of Fayetteville. Little Cross Creek was studied from its confluence with Cross Creek to Pamalee Drive (N. C. Hwy. 59) at Mile 2.7. Blounts Creek was investigated from its confluence with Cross Creek to Mile 4.8 at Owen Drive, and Branson Creek was studied from its confluence with Blounts Creek to Forest Lake Dam, a distance of 0.8 mile.

Cross Creek joins the Cape Fear River from the right bank at Mile 145.26 within the corporate limits of Fayetteville and just downstream from U. S. Highway 301 bridge. Little Cross Creek joins Cross Creek from the right bank at Mile 3.79, and Blounts Creek joins Cross Creek from the right bank at Mile 1.76 near Grove Street. Branson Creek is a tributary of Blounts Creek and joins that stream from the left bank at Mile 2.23. The drainage area of the Cross Creek watershed covers about 40.1 square miles. Little Cross, Blounts, and Branson Creeks are all tributaries of Cross Creek and have drainage areas of 9.9, 12.0, and 5.1 square miles, respectively. The drainage area of the Cape Fear River at the lower end of the study is about 4,400 square miles.

The Cape Fear River flows generally from north to south in the reach covered in this report. The Cross Creek watershed is fan shaped, with the main tributaries flowing generally southeastward, except for Blounts Creek which flows generally northeastward. Bottomlands

along the streams in the Cross Creek watershed are not wide except when the streams enter the broad flood plain of the Cape Fear River.

Most of the residential properties and the larger part of the business section of Fayetteville are on high ground above flood danger, but there are extensive and important commercial and industrial establishments on the flood plains of the Cape Fear River and the streams in the Cross Creek watershed. Business and commercial establishments in the city have developed particularly along U. S. Highway 301, which is in the broad flood plain of the Cape Fear River. The narrower flood plains along the tributaries in the Cross Creek watershed in their upper reaches are mostly undeveloped; however, residential construction is already extensive along the lower portion of these streams. Several small lakes have been developed along these streams for recreational and water supply purposes.

The first records of river stage on the Cape Fear River date from 1888 when the U. S. Geological Survey established a gage on the Person Street Bridge at Mile 145.0. The U. S. Weather Bureau also established a gage station in 1893 and is in operation today, while the U. S. Geological Survey discontinued readings of their gage in 1937. No records of stage or discharge have been maintained on Cross, Little Cross, Blounts, or Branson Creeks.

Flood history searches developed information on the Cape Fear River and the Cross Creek watershed in the Fayetteville area. Investigations were made following the floods of September 21, 1945, and October 7, 1964. Local residents were interviewed. Field investigations and office computations were made to supplement the early data and to develop the flood profiles for these floods on the Cape Fear River and in the Cross Creek watershed. A search was also made of newspaper files and historical documents. From these sources and gage records, it has been possible to develop a history of the known floods on the Cape Fear River covering the past 82 years. A partial flood history has been developed for Cross Creek, but no reliable data on floods on Little Cross, Blounts, and Branson Creeks were found.

CAPE FEAR RIVER

Settlement

Subsequent to the organization of Cumberland County by the North Carolina General Assembly in 1754, Fayetteville (then known as Campbelton) was established as the county seat in 1762. Cross Creek, an adjacent town separated by Blounts Creek, and Campbelton were combined in 1778. Five years later the General Assembly changed the name of Campbelton to Fayetteville after the Marquis de LaFayette, who had so generously aided the colonies in achieving their independence. It was the first town in the United States to honor him in this manner.

Early in its history, Fayetteville's economic development centered around agricultural products and for perhaps half a century before the Civil War, Fayetteville was the major inland trade center of North Carolina, providing and outfitting wagon trains during the great western migration.

Agriculture activities are still of major importance to the economy of Cumberland County and markets for tobacco, cotton, and livestock are located in Fayetteville. However, in recent years, industrial retail distribution and service activities have come more and more to the front. There are over 100 industrial payrolls in Cumberland County, with cotton, rayon, and synthetic textiles, lumber, electronic equipment, plywood, and power tools being the principal products.

Fort Bragg, one of the Nation's largest and most important military installations, is located near Fayetteville. This vast military complex is the home of the famed 82nd Airborne Division, the John F. Kennedy Center for Special Warfare, and the United States Army Training Center. Adjacent to Fort Bragg is Pope Air Force Base, home of the 464th Troop Carrier Wing. The development of these facilities has been a major factor in rapid and continuing growth of the Fayetteville area.

Cumberland County, of which Fayetteville is the county seat, is growing rapidly. The 1960 Census lists its population as

148,418. Preliminary 1970 Census figures show the Cumberland County population to be 228,000.

Flood-Damage-Prevention Measures

On 30 December 1963, Congress authorized the construction of the New Hope Dam and Reservoir project located on the Haw River about 55 miles upstream from Fayetteville. This multiple-purpose reservoir project is now under construction by the Corps of Engineers, and is currently scheduled to be completed in 1974. Although the flood control effects of the New Hope project will provide substantial reduction to natural flood stages in the Fayetteville area, flooding from the Cape Fear River will still occur, but at less frequent intervals.

It is important that the citizens of Fayetteville be aware of the areas that will be still subject to flooding as well as the degree of flood risk remaining. Without such an understanding, unrestrained development on flood plain lands thought to be protected by the New Hope project but, in reality, still subject to relatively frequent floods, could result in greater flood damages than are currently being experienced. Accordingly, the extent and degree of risk of future floods in the Fayetteville area are described in this report, assuming the New Hope project is in operation.

In addition to the New Hope project on the Haw River, Congress has authorized construction of the Randleman and Howards Mill reservoir projects located on Deep River about 140 and 110 miles, respectively, upstream from Fayetteville. The flood control effects of these two Corps of Engineers' projects, while substantial in the upper basin area, will be relatively insignificant in the Fayetteville area.

At the present time, the City of Fayetteville has no flood plain regulations. Plate 1 is a map of the upper Cape Fear River Basin and shows the location of the New Hope, Randleman, and Howards Mill projects in relation to the Fayetteville area.

Flood-Warning and Forecasting Services

The City of Fayetteville receives flood warnings and flood forecasting services from the Wilmington office of the Environmental Science Services Administration-Weather Bureau. The flood warning service is given only for floods on the Cape Fear River and in terms of expected river stages at the Weather Bureau's river gage at Fayetteville. General weather forecasts of intense rainfall are also issued by the Weather Bureau.

The Stream and Its Valley

The Cape Fear River has a drainage area of 9,136 square miles and is the largest river basin lying wholly within the State of North Carolina. The river is formed about 55 miles upstream from Fayetteville by the confluence of the Deep and Haw Rivers, each of which have their headwaters in Guilford County in the Piedmont Plateau. The Cape Fear River flows generally southeast for a distance of about 200 miles before emptying into the Atlantic Ocean at Cape Fear near Southport, North Carolina.

Fayetteville is located at River Mile 145, slightly southeast of the Fall Zone where the river leaves the Piedmont Plateau and enters the Coastal Plains Region. The Cape Fear River flood plain at Fayetteville is very broad, extending to a total width of about 3 miles. The flood plain on the west side of the river is about 1 mile in width, while that on the east side is 2 miles wide. The flood plain in Fayetteville has two terraces and the upland terrain varies from flat to rolling with partly wooded hills.

Above the lower end of the study area, near Mile 143, the drainage area of the Cape Fear River is about 4,400 square miles. The total fall in the Cape Fear River from its beginning at the confluence of the Deep and Haw Rivers near Moncure to its mouth is about 160 feet. This is an average of about 1 foot per mile. In the 7-mile study reach, the Cape Fear River has an average fall of about 1 foot per mile.

The only significant tributaries of the Cape Fear River within the reach studied are Cross Creek and Locks Creek. Cross Creek enters the Cape Fear River from the right bank at Mile 145.26 and drains the major portion of the City of Fayetteville. This creek and its tributaries are discussed separately in later sections of this report. Locks Creek enters the Cape Fear River from the left bank at Mile 144.73. The flood effects from Locks Creek are not covered in this report. Pertinent drainage areas of the Cape Fear River are given in Table 2.

TABLE 2

DRAINAGE AREAS OF THE CAPE FEAR RIVER

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Cape Fear River	Mouth	0.0	9,136
	Lower limit of study	143.25	4,400
	Above Locks Creek (Person Street bridge)	145.00	4,376
	U.S.W.B. Gage	145.00	4,376
	Above Cross Creek	145.26	4,332
	Upper limit of study	150.05	4,326
	Confluence of Haw and Deep Rivers	200.00	3,127
Locks Creek	Mouth	0.0	38.1
Cross Creek	Mouth	0.0	40.1

Developments in the Flood Plain

Plate 5 is an index map of the thirteen sheets that show the flooded areas of the Cape Fear River, Cross Creek and its tributaries. Plates 6 through 15 show the flood plain of the Cape Fear River for the reach covered in this report. As shown on these plates, there are considerable commercial, industrial, and residential developments in and adjacent to the City of Fayetteville on the west side of the river. Similar development has occurred on the east side of the river in and

around East Fayetteville, but to a lesser extent. The remaining flood plain areas are devoted primarily to agricultural or related purposes.

Many structures in the Cape Fear River flood plain have been damaged by floods in the past; furthermore, numerous ones were only slightly above past flood levels. Many additional buildings, including residences, commercial establishments and industrial plants would be damaged by the Standard Project Flood.

Two railroads and two highways cross the Cape Fear River in the study area. They are discussed in the next section.

Bridges Across the Stream

Two highway and two railroad bridges cross the Cape Fear River in the reach included in this study. Table 3 lists pertinent elevations for these structures and shows their relation to the crest of the flood of September 21, 1945, and the Intermediate Regional Flood. Figures 1 and 2 show photographs of these bridges.

None of the bridges across the Cape Fear River are serious obstructions to streamflow. The Seaboard Coast Line Railroad bridge at Mile 144.91 serves the Atlantic and Yadkin Branch connecting Wilmington and Fayetteville. This bridge is a steel truss structure supported by several masonry piers. The piers and truss offer little obstruction to floodflows as negligible head loss would occur during major floods. The Standard Project Flood would inundate the trestle by 4.8 feet, but the Intermediate Regional Flood would not overtop the trestle.

N. C. Highways 24 and 210 cross the Cape Fear River on the Person Street Bridge at Mile 145.0. This structure has a concrete deck supported by steel girders and concrete piers. Negligible head losses would occur during large floods, with no water reaching the road surface at mid-span. However, the east and west approaches would be inundated.

The concrete highway bridge crossing the Cape Fear River at Mile 145.81 serves north and southbound traffic using Interstate Route 95 and U. S. Highway 301. The deck, beams, and piers are of concrete. The piers supporting the deck offer little resistance to floodflow, resulting in no head losses during major floods. Neither the Standard Project Flood nor Intermediate Regional Flood would overtop the bridge roadway.

The main line of the Seaboard Coast Line Railroad, consisting of a double track, crosses the Cape Fear River north of Fayetteville at Mile 147.25 on a pair of steel truss structures about 20 feet apart, supported by masonry piers. The clear openings are sufficient to prevent head losses during major floods such as the Standard Project Flood and Intermediate Regional Flood. Water would overtop these trestles by 3.6 feet during the Standard Project Flood; however, it would not reach them during the Intermediate Regional Flood.

TABLE 3

BRIDGES ACROSS CAPE FEAR RIVER

Mile Above Mouth	Identification	Streambed Elevation feet	Floor Elevation feet	Underclearance Elevation feet	Intermediate Regional Flood Crest* feet	September 1945 Flood feet	Relation of September 1945 Flood to Underclearance Below feet	Relation of September 1945 Flood to Underclearance Above feet
144.91	SCL RR	19.3	87.0	83.9	83.4	89.4		5.5
145.00	N.C. Highway 24	19.5	93.9	88.6	83.5	89.4		0.8
145.81	U.S. Highway 301	17.4	95.8	92.4	84.4	90.4	2.0	
147.25	SCL RR	17.0	90.4	86.5	86.0	92.5		6.4

*With New Hope project in operation.

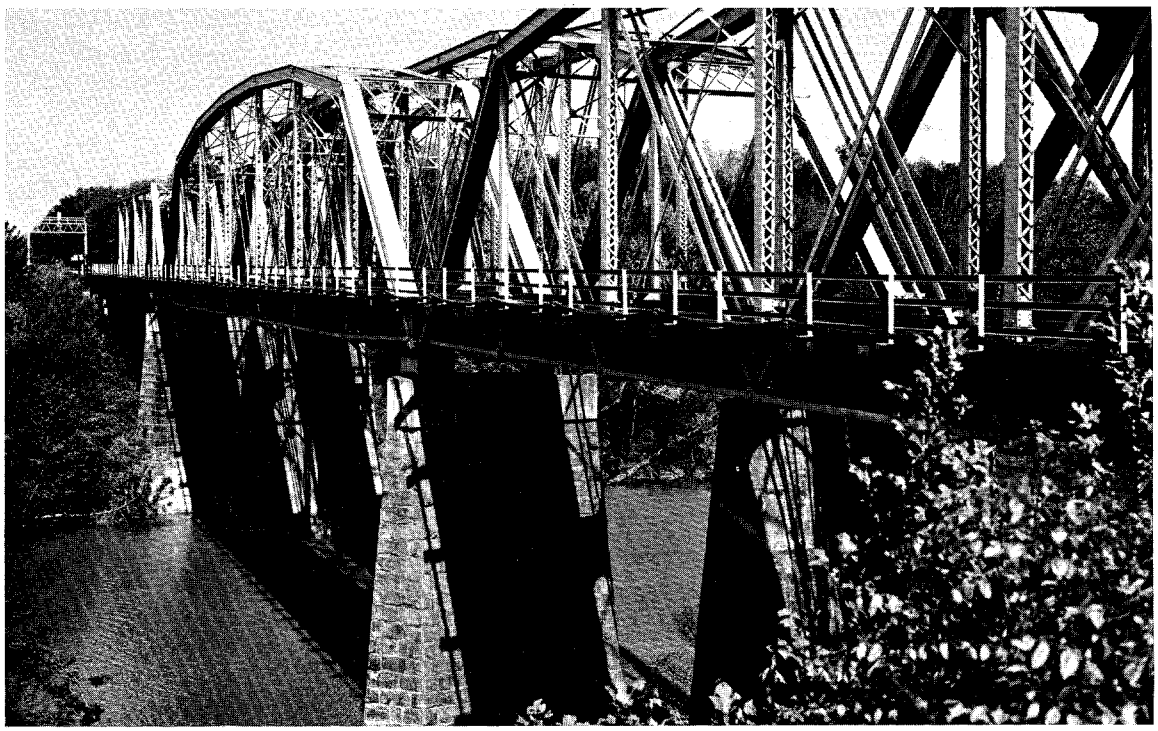
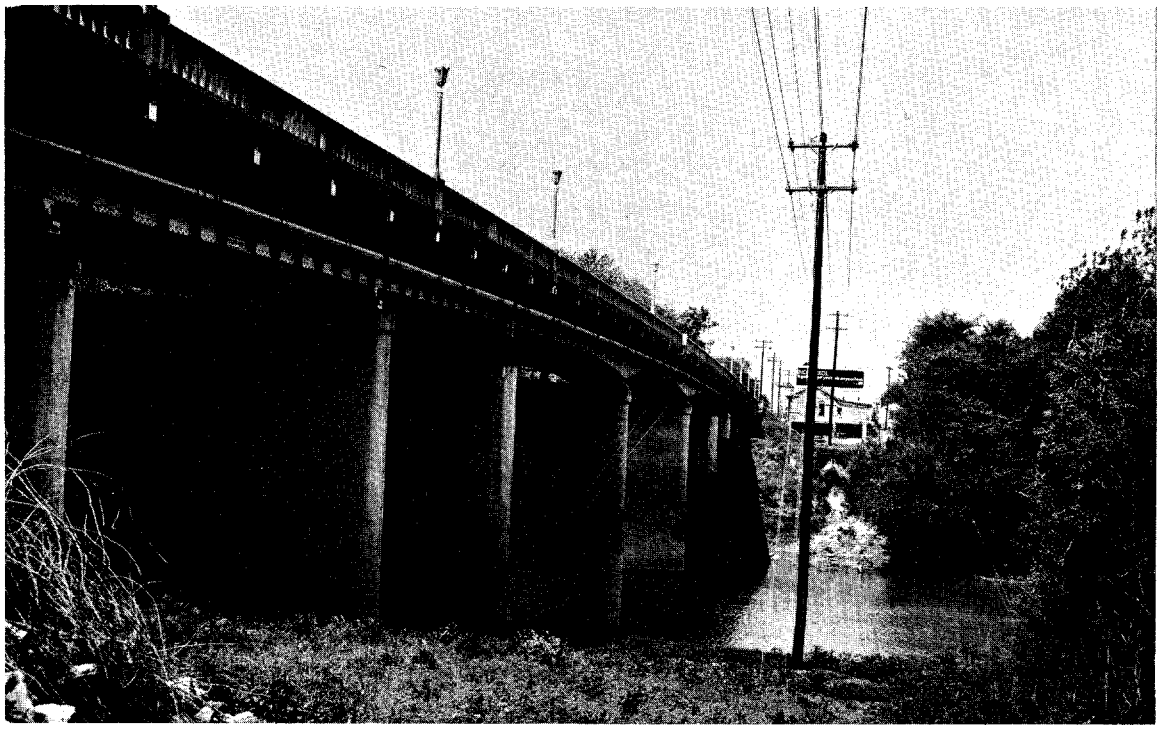


FIGURE 1. CAPE FEAR RIVER BRIDGES
The upper view is the upstream side of the Seaboard Coast Line Railroad bridge at Mile 147.25. Lower view is the downstream side of the U. S. Highway 301 bridge at Mile 145.81.



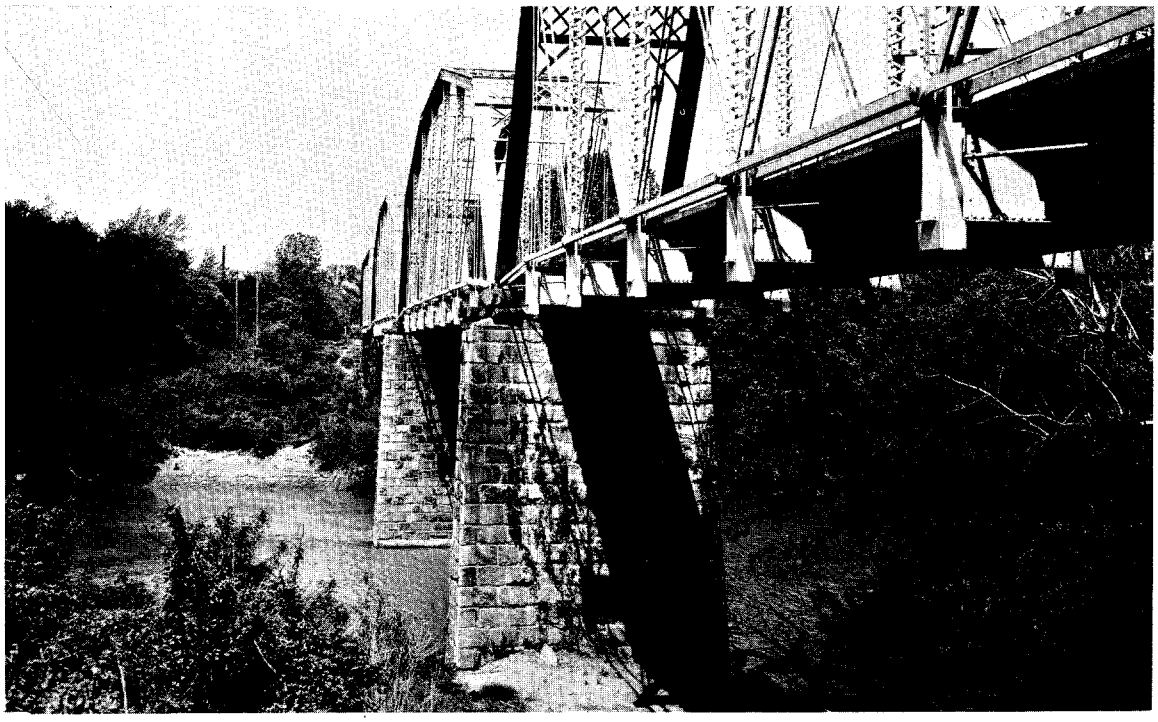


FIGURE 2. CAPE FEAR RIVER BRIDGES
Upper view is the Person Street bridge serving N. C. Highways 24 and 210 at Mile 145.0. Lower view is the Seaboard Coast Line bridge at Mile 144.91.

Obstructions to Floodflow

The effects of obstruction due to bridges and their approach fill have been described in the previous paragraphs. With the exception of the bridges, there are no significant obstructions to flows in the reach of Cape Fear River included in this study.

FLOOD SITUATION

Flood Records

Records of river stages on the Cape Fear River at Fayetteville have been maintained since 1888, when the U. S. Geological Survey began observations on a staff gage on the Person Street bridge at Mile 145.0. The U. S. Weather Bureau installed and operated a stream gage to obtain stream discharge data in 1893 and has been in operation since. These records are the longest in the Cape Fear River Basin. There is believed to be considerable error in discharge records from November 1909 to September 1913 due to changes in the length of the gage chain which were not taken into account, but office computation has been used to take this into consideration.

To supplement the record obtained at this gaging station, local residents were interviewed for information on dates and heights of floods. Newspaper files were searched, as were historical documents and records. Valuable data were obtained from reports of field investigations made after floods. These records and investigations have developed a knowledge of floods on the Cape Fear River at Fayetteville covering the past 82 years.

Flood Stages and Discharges

Table 4 lists crest stages and discharges for the known floods exceeding bankfull stage of 35 feet at the gaging station on the Cape Fear River at the Person Street bridge at Fayetteville, North Carolina. Table 5 lists the highest ten floods in order of magnitude.

Flood Occurrences

Plate 3 shows known crest stages and years of occurrence of known floods since 1888 which have exceeded the bankfull stage of 35 feet on the Cape Fear River at the Person Street bridge stream-gaging station at Fayetteville.

Duration and Rate of Rise

Plate 4 shows the stage hydrograph on the Cape Fear River at the stream-gaging station on the Person Street bridge for the floods of September 1945 and August 1908. During the 1945 flood, the river rose to its crest in about 8 days at an average rate of 0.2 foot per hour, with a maximum rate of 1.0 foot per hour, and remained above bankfull stage for 8 days.

TABLE 4

CAPE FEAR RIVER AT FAYETTEVILLE, NORTH CAROLINA
FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE
1888-1969

The table includes all known floods above bankfull stage of 35 feet at the U. S. Weather Bureau gaging station at the Person Street bridge, Mile 145.0. Drainage area = 4,376 square miles. Zero of gage = 20.52, USC&GS 1929 General Adjustment datum, 1936 Supplemental Adjustment.

Date of Crest	Gage Heights		Discharge
	Stage feet	Elevation feet	cfs
March 1, 1888	52.3	72.8	66,000
September 13, 1888	49.7	70.2	59,900
December 18, 1888	44.1	64.6	49,000
February 20, 1889	43.0	63.5	47,000
July 29, 1889	45.0	65.5	50,500
March 14, 1891	41.0	61.5	44,000
May 30, 1891	45.1	65.6	50,800
August 24, 1891	43.1	63.6	47,200
January 21, 1892	49.5	70.0	59,400
February 15, 1893	42.3	62.8	46,000

TABLE 4--Continued

CAPE FEAR RIVER AT FAYETTEVILLE, NORTH CAROLINA
FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE
1888-1969

Date of Crest	Gage Heights		Discharge
	Stage feet	Elevation feet	cfs
October 24, 1893	42.0	62.5	45,600
October 12, 1894	47.9	68.4	56,000
January 12, 1895	58.0	78.5	84,000
April 10, 1895	47.7	68.2	55,500
January 11, 1896	49.5	70.0	59,400
February 8, 1896	48.0	68.5	56,000
February 8, 1897	36.5	57.0	35,000
March 16, 1897	37.6	58.1	37,200
February 9, 1899	52.0	72.5	65,000
March 17, 1899	42.0	62.5	45,600
June 2, 1899	40.0	60.5	42,000
April 20, 1900	44.0	64.5	48,800
April 5, 1901	47.7	68.2	55,500
May 24, 1901	58.5	79.0	86,000
August 6, 1901	44.8	65.3	50,000
September 20, 1901	43.6	64.1	48,000
March 2, 1902	41.7	62.2	45,000
March 25, 1903	50.5	71.0	62,000
September 17, 1904	49.9	70.4	60,000
February 22, 1905	46.4	66.9	53,500
August 12, 1905	41.4	61.9	44,500
January 14, 1908	36.3	56.8	34,600
March 26, 1908	41.7	62.2	45,000
August 29, 1908	68.7	89.2	123,000
December 25, 1908	35.0	55.5	30,000
August 5, 1909	47.6	68.1	55,300
March 18, 1912	49.2	69.7	58,500
December 27, 1914	40.2	60.7	42,600
January 14, 1915	36.8	57.3	35,600
January 20, 1915	37.3	57.8	36,800
June 4, 1915	40.2	60.7	42,600
February 4, 1916	44.5	65.0	49,800
March 6, 1917	42.0	62.5	45,600
April 23, 1918	45.6	66.1	51,500
July 24, 1919	52.0	72.5	65,000

TABLE 4--Continued

CAPE FEAR RIVER AT FAYETTEVILLE, NORTH CAROLINA
FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE
1888-1969

Date of Crest	Gage Heights		Discharge
	Stage feet	Elevation feet	cfs
July 21, 1920	41.6	62.1	44,800
December 10, 1920	42.0	62.5	45,600
February 12, 1921	48.0	68.5	56,000
February 17, 1922	47.0	67.5	54,000
March 6, 1922	44.5	65.0	49,800
March 15, 1923	38.0	58.5	38,000
March 18, 1923	40.0	60.5	42,000
October 2, 1924	49.6	70.1	59,500
January 2, 1925	36.5	57.0	35,000
January 12, 1925	42.0	62.5	45,600
January 21, 1925	43.9	64.4	48,500
December 6, 1927	39.3	59.8	40,600
April 29, 1928	44.4	64.9	49,500
August 18, 1928	36.2	56.7	34,400
September 8, 1928	55.5	76.0	76,000
September 22, 1928	64.7	85.2	108,000
March 2, 1929	49.9	70.4	60,000
March 6, 1929	48.0	68.5	56,000
October 4, 1929	65.3	85.8	110,000
February 11, 1931	40.1	60.6	42,200
August 23, 1931	36.7	57.2	35,400
January 10, 1932	41.3	61.8	44,300
March 8, 1932	46.5	67.0	53,600
Arpil 11, 1934	37.3	57.8	36,800
December 3, 1934	38.2	58.7	38,600
January 5, 1936	43.3	63.8	47,600
January 21, 1936	40.2	60.7	42,600
March 19, 1936	42.5	63.0	46,400
April 2, 1936	42.0	62.5	45,600
April 8, 1936	55.4	75.9	75,000
July 27, 1936	40.0	60.5	42,000
December 12, 1936	35.3	55.8	31,200
January 4, 1937	35.6	56.1	32,400
January 21, 1937	35.6	56.1	32,400
January 30, 1937	39.8	60.3	41,600

TABLE 4--Continued

CAPE FEAR RIVER AT FAYETTEVILLE, NORTH CAROLINA
FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE
1888-1969

Date of Crest	Gage Heights		Discharge
	Stage feet	Elevation feet	cfs
February 11, 1939	42.0	62.5	45,600
February 27, 1939	36.7	57.2	35,400
March 3, 1939	37.6	58.1	37,200
August 20, 1939	39.2	59.7	40,500
August 29, 1939	39.0	59.5	40,000
January 21, 1943	36.9	57.4	35,800
April 21, 1943	35.3	55.8	31,200
July 15, 1943	37.6	58.1	37,200
March 21, 1944	40.2	60.7	42,600
April 13, 1944	39.5	60.0	41,000
July 16, 1944	35.6	56.1	32,400
October 2, 1944	44.4	64.9	49,500
September 21, 1945	68.9	89.4	124,000
December 31, 1945	35.9	56.4	33,600
February 12, 1946	44.2	64.7	49,200
January 15, 1947	35.0	55.5	30,000
January 22, 1947	37.3	57.8	36,800
February 16, 1948	49.7	70.2	59,900
November 30, 1948	43.9	64.4	48,500
August 30, 1949	41.0	61.5	44,000
November 3, 1949	36.4	56.9	34,800
March 6, 1952	51.9	72.4	64,000
March 26, 1952	38.1	58.6	38,300
September 2, 1952	47.0	67.5	54,000
November 22, 1952	38.2	58.7	38,600
February 17, 1953	39.7	60.2	41,400
January 18, 1954	37.0	57.5	36,000
January 24, 1954	47.1	67.6	54,600
October 18, 1954	42.1	62.6	45,800
February 8, 1955	35.8	56.3	33,200
August 19, 1955	40.7	61.2	43,500
September 5, 1955	42.8	63.3	46,700
March 18, 1956	39.9	60.4	41,800
February 3, 1957	39.1	59.6	40,500
March 2, 1957	39.4	59.9	40,800

TABLE 4--Continued

CAPE FEAR RIVER AT FAYETTEVILLE, NORTH CAROLINA
FLOOD CREST ELEVATIONS ABOVE BANKFULL STAGE
1888-1969

Date of Crest	Gage Heights		Discharge
	Stage	Elevation	
	feet	feet	cfs
November 27, 1957	44.1	64.6	49,000
January 16, 1958	35.0	55.5	30,000
January 26, 1958	38.7	59.2	39,500
May 1, 1958	37.0	57.5	36,000
May 8, 1958	41.4	61.9	44,500
April 14, 1959	39.7	60.2	41,400
February 2, 1960	40.8	61.3	43,700
February 7, 1960	40.5	61.0	43,000
February 20, 1960	38.7	59.2	39,500
April 1, 1960	36.3	56.8	34,600
April 7, 1960	43.1	63.6	47,200
February 26, 1961	37.8	58.3	37,600
March 23, 1961	36.0	56.5	33,900
January 8, 1962	43.9	64.4	48,500
January 22, 1963	35.1	55.6	30,400
March 8, 1963	38.3	58.8	39,100
April 10, 1964	39.9	60.4	41,800
September 1, 1964	36.5	57.0	35,000
October 7, 1964	49.4	69.9	59,100
December 28, 1964	36.7	57.2	35,400
February 9, 1965	38.8	59.3	39,700
March 6, 1965	37.1	57.6	35,500
June 17, 1965	35.8	56.3	32,800
July 13, 1965	38.4	58.7	38,600
July 29, 1965	44.2	64.7	49,200
March 2, 1966	42.8	63.3	46,700
March 6, 1966	42.4	62.9	46,200

TABLE 5

HIGHEST TEN KNOWN FLOODS IN ORDER OF MAGNITUDE
CAPE FEAR RIVER AT FAYETTEVILLE, NORTH CAROLINA

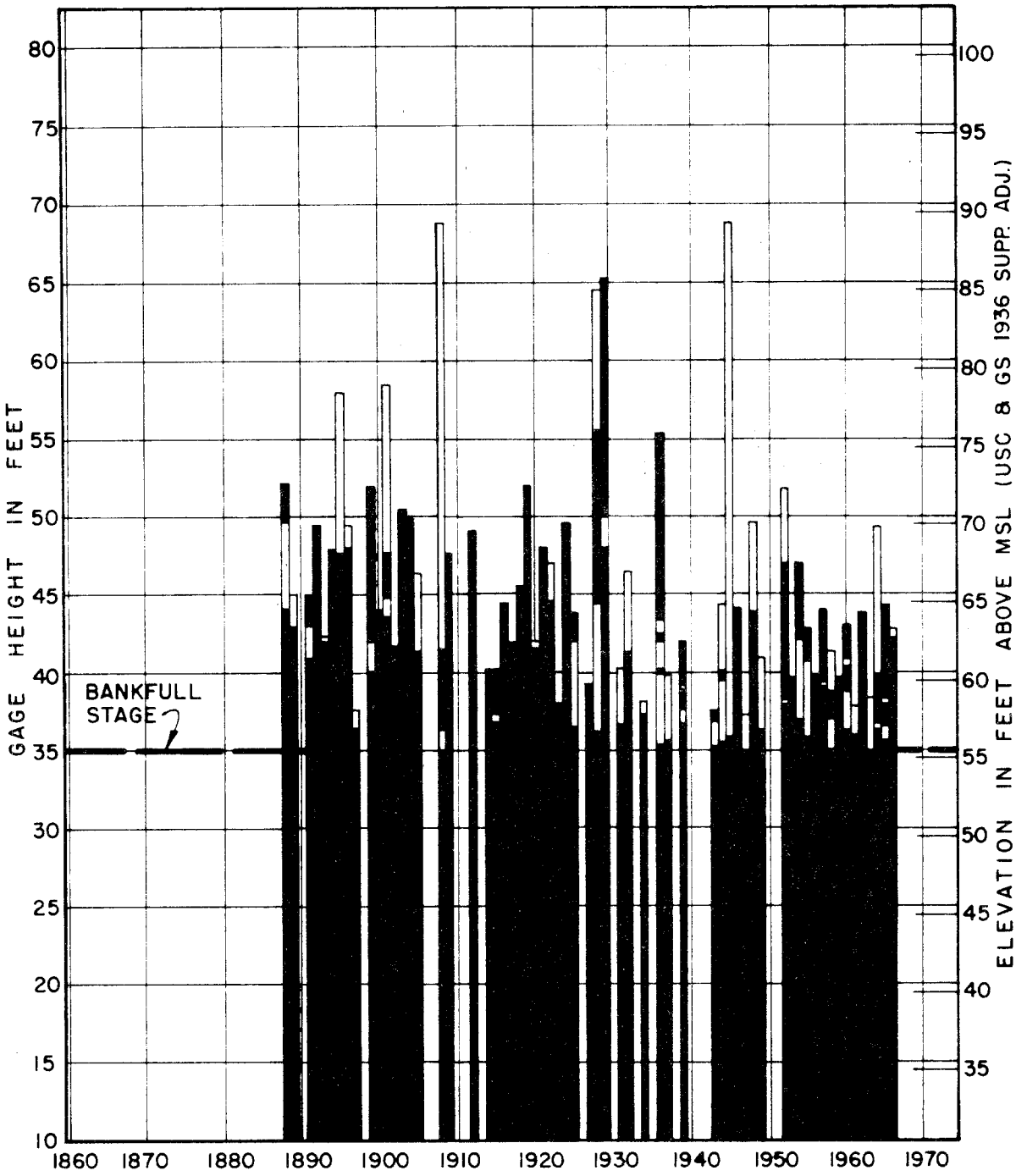
Order No.	Date of Crest	Gage Height		Estimated Peak Discharge
		Stage feet	Elevation feet	cfs
1	September 21, 1945	68.9	89.4	124,000
2	August 29, 1908	68.7	89.2	123,000
3	October 4, 1929	65.3	85.8	110,000
4	September 22, 1928	64.7	85.2	108,000
5	May 24, 1901	58.5	79.0	86,000
6	January 12, 1895	58.0	78.5	84,000
7	September 8, 1928	55.5	76.0	76,000
8	April 8, 1936	55.4	75.9	75,000
9	March 1, 1888	52.3	72.8	66,000
10	February 9, 1899	52.0	72.5	65,000

Velocities

During the September 1945 flood, it is estimated that velocities in the channel of the Cape Fear River at Fayetteville ranged up to 5.3 feet per second. Overbank velocities ranged up to 1.4 feet per second. During larger floods, velocities would be greater.

Flooded Areas, Flood Profiles, and Cross Sections

Plates 6 through 18 show the approximate areas along the Cape Fear River at Fayetteville that would be inundated by the Intermediate Regional Flood and the Standard Project Flood with the New Hope Reservoir project in operation. The actual limits of these overflow areas on the ground may vary some from those shown on the map, because interpretation of ground elevations between known elevation points and the scale of the maps do not permit precise plotting of the flooded area boundaries.



Variation in shading on the bar graph indicates more than one flood during the year. For example, in 1888 there were 3 floods, gage heights were 44.1, 49.7, and 52.3 feet.

Zero of gage, elevation 20.52

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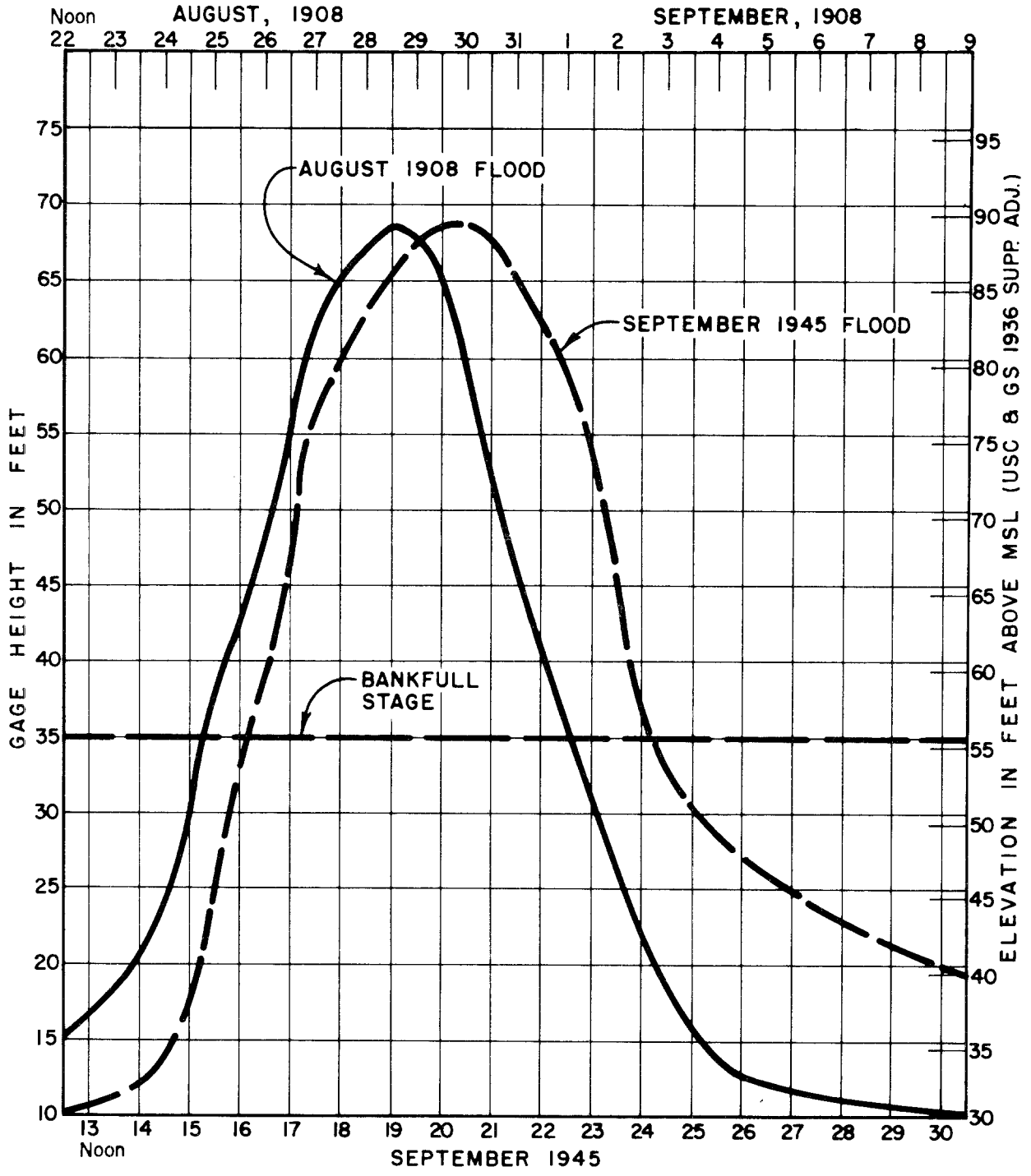
WILMINGTON, NORTH CAROLINA

FLOODS ABOVE BANKFULL STAGE
CAPE FEAR RIVER
AT
FAYETTEVILLE, NORTH CAROLINA

SEPTEMBER, 1970

PLATE 3



Stream Gage at river mile 145.00
Zero of gage, El. 20.52

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA

STAGE HYDROGRAPHS
CAPE FEAR RIVER
AT
FAYETTEVILLE, NORTH CAROLINA

SEPTEMBER, 1970

PLATE 4

Plate 19 shows the high-water profile for the flood of September 1945. Also shown are the profiles for the Intermediate Regional Flood and the Standard Project Flood that would occur with the New Hope project in operation.

Plate 24 shows four cross sections that are typical of the total of ten sections obtained for the Cape Fear River in the reach investigated. The locations of all sections are shown on Plates 6 through 23. The elevation and extent of overflow of the Intermediate Regional Flood and the Standard Project Flood are indicated on these sections.

FLOOD DESCRIPTIONS

Following are descriptions of known large floods that have occurred on Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek in the vicinity of Fayetteville. These are based upon newspaper accounts, historical records, and field investigations.

September 21, 1945

Torrential rains at Fayetteville and upstream in the Cape Fear River basin caused water to rise far out of its banks at Fayetteville and low-lying parts of the city and surrounding rural areas. More than one-fourth of the area within the city limits was covered by water, with estimates indicating floodwater more than 3 miles wide at Fayetteville. As water rose to an all time high gage reading of 68.9 feet at the U. S. Geological Survey gage at Person Street bridge, water depths around the city varied from depths of a few inches to many feet, with an estimated average of 4 feet.

As the Cape Fear receded, more than 2,500 were homeless out of the city's population of 20,000. Four thousand families had their dwellings invaded by water in the city and more than 500 others in the rural areas were stricken. Also reported was the flooding of

125 business establishments. In addition to residences and businesses, farmlands were invaded with 50,000 acres in the county under floodwater, of which one-third was under cultivation.

More detailed descriptions of the damages and extent of flooding are contained in the following excerpts from newspapers concerning the 1945 flood at Fayetteville:

Fayetteville Observer
September 18, 1945

"One major highway south of Fayetteville was blocked by the closing of the Rockfish bridge, on Route 301, five miles south of the city. Four bridges within the city, those on Hillsboro Street, Cool Spring Street, Campbell and Washington Avenues were closed also. North of town route 15-A to Raleigh was blocked."

Fayetteville Observer
September 19, 1945

HIGHWAYS OUT OF THE CITY BLOCKED EXCEPT 15-A FAR AS RAEFORD

"As waters of the main river and Cross Creek continued to swell, a widening area of streets and highways were closed to traffic. Since last midnight the Slough bridge and approaches to roads leading from the east bank of the river went under water, while small lakes rose at points on Person, Cool Spring, East Russell and other low lying areas in the eastern part of the city. Cross Creek at Green Street spread to the front doorways and first floor of homes."

"Early this morning the water level reached the Atlantic Coast Line Railway trestle below the river bridge."

Fayetteville Observer
September 20, 1945

LATEST OFFICIAL REPORT GIVES STAGE OF 68.1 FEET AND WATER STILL RISING

"Army ordinance workers and city police worked for hours evacuating flood marooned people in the rural areas and bringing them

into the city while they took food and supplies to persons still surrounded by water."

"In the city itself many more homes were inundated particularly in areas south of Person and east of Gillespie Street and in the northeast near Cross Creek. Green Street bridge over Cross Creek was completely covered."

Fayetteville Observer
September 21, 1945

FLOOD SETS ALL-TIME RECORD
Depth of 68.9 Reached Early This Morning

Water Now Receding; More Than a Quarter of the City, Housing Approximately a Third of the Residents, Covered With Water; Train Service Remains Disrupted

". . . East Russell Street from Cool Spring to the river likewise was a continuous canal.

"South of that area and reaching inland for a mile or more the flood was universal. Houses and industrial buildings were standing in water, street surfaces were invisible and scores of automobiles and trucks stood motionless in streets, yards, and fields.

"The river bridge pavement was above water, but no daylight was visible between the river surface and the bottom of the span. The Atlantic Coast Line railway trestle was covered across the tracks, . . . Immediately north of the river bridge on the Fayetteville side, two radio towers stood, but the small building which housed the equipment was lost to sight. Completely lost to sight were Breece's Landing pavilion and surrounding buildings, . . .

"Farther inland and north of Hay Street Cross Creek appeared as a small river, and widened lakes along its course showed where blocks of homes were flooded. Green Street was covered from south of the creek bridge almost to the Confederate monument.

"Across the river to the southeast were thousands of acres of drowned lands, houses, and out-buildings standing in water of depths from a foot to a story."

Fayetteville Observer
September 22, 1945

"A check made of flood extent by city officials and the Red Cross yesterday showed an area, 'conservatively estimated' of 125 city blocks under water at the greatest depth. Depth varied from a few inches to many feet, with an estimated average of four feet. Four thousand families had their dwelling invaded by water in the city and more than 500 others in the rural areas were stricken."

"In the city flood area are four lumber yards, 15 service stations, three coal yards, 50 retail stores, two schools and 15 churches. In the county total area under flood was 50,000 acres, about a third of which was under cultivation."

"At Fayetteville, the Cape Fear was receding slowly after leaving more than 2,500 homeless out of the city's population of 20,000."

August 29, 1908

The flood of 1908 is the second largest of record, with a stage reading of 68.7 recorded at the gaging station at Person Street bridge. The rains preceding the flood began on August 23, 1908, and during the initial 24-hour rainfall, a 17-year record of 4.86 inches fell. The rains fell continuous for 2 days and 2 nights in Fayetteville, followed by intermittent showers. Heavy rains, however, continued in the upper end of the river basin. The stage of the 1908 flood was more than 10 feet higher than any previously known to have occurred. The greatest damage was inflicted on the farmers along the Cape Fear. Little damage was done to Clarendon bridge, but most of the bridges in town were more or less damaged.

The following are excerpts from newspapers concerning the 1908 flood at Fayetteville:

Fayetteville Observer
September 3, 1908

"The greatest freshet of the Cape Fear, of 1908, is now a thing of the past, and for years to come or until another freshet comes and surpasses it, it will be an epoch in local history."

"The greatest loss is, of course, by the farmers along the valley of the Cape Fear, and though it is impossible to make an estimate with any accuracy, the amount will go considerably beyond one thousand dollars."

"The Clarendon bridge stood the great flood, and is damaged to the extent of only a few hundred dollars. The two steel railway bridges across the Cape Fear, and the county steel bridge across Lock's Creek, are apparently uninjured. Most of the bridges in town are more or less injured, and some of them a total loss."

Fayetteville Observer
August 25, 1963*

"And for two days and two nights the rain falls continuously with menacing voice. Flood has come to the Cape Fear country."

". . . from 6:00 o'clock Sunday afternoon to 3:30 Monday morning 4.86 inches of rain fell. This is the largest recorded for any 24-hour period in 17 years."

". . . There is news that throughout North Carolina creeks have become rivers and rivers floods. People are leaving their partly submerged home seeking higher ground, bringing away by boat as many household effects as conditions permit. Residents from the county districts reach town the long way around. They report washed out dams and bridges, crops under water, stock lost and drowned, railroad tracks covered."

". . . Every kind of small boat is secured. The bateau is now the only means of transportation to and from the Cape Fear River, for the water has risen within one block of the Old Market House."

*An account of the 1908 flood from a resume of the Cape Fear River flood history.

". . . The flood waters have extended east as far as the eye can see, and west 1-1/2 miles, to the heart of town.

". . . On Green and Person Streets regular ferry service is established."

"The Clarendon bridge, for the first time, is submerged in water. . ."

"Business is paralyzed, railroad traffic at a standstill."

"The morning of August 28: The townspeople are notified that at three o'clock this morning the electric light plant was flooded and is now out of business. 'Tonight the city will be in darkness,' a news report says."

"It is no uncommon sight to see driftwood, pianos, organs, bedsteads, and other household effects, floating around, while the bodies of chickens and hogs, caught by the waters and drowned, can be seen on every hand."

"'at four o'clock yesterday p.m., Friday, August 28, the flood reached its greatest height, the phenomenal record of 71 feet ...'"

"The water subsides, the trees emerge, Crops are lost, stock is drowned, many homes are destroyed and many more damaged. Nearly one-half million dollars has been lost in property."

October 4, 1929

On October 4, 1929, the third highest stage reading of record, 65.3 feet, was recorded at the U. S. Weather Bureau station at the Person Street bridge.

The following are excerpts from newspapers concerning the 1929 flood at Fayetteville:

Fayetteville Observer
Wednesday, October 2, 1929

"The rainfall in Fayetteville since Monday afternoon measured 6.66 inches."

Fayetteville Observer

October 3, 1929

CAPE FEAR RIVER HAS REACHED 61.7 AND STILL RISING

"The high water has done thousands of dollars damage to crops along the river. . ."

"No part of the bridge over the creek on Cool Spring Street can be seen today."

Fayetteville Observer

October 5, 1929

RIVER GOES OVER LAST YEAR MARK

"The damage to the plant of Premier Fertilizer will run into thousands of dollars and stores, homes, filling stations, and farmland suffered heavily."

September 22, 1928

The flood of 1928 was the highest water in Fayetteville since 1908. Much damage was done to the crops and many bridges within town and in outlying areas were under water as a height of 64.7 feet was reached.

The following are excerpts from newspapers concerning the 1928 flood at Fayetteville.

Fayetteville Observer

Wednesday, September 19, 1928

"Yesterday's storm did untold damage to cotton, corn, and other crops in this section, uprooted trees in every section of the city and outlying districts and plunged the city in almost total darkness last night."

"The rainfall measured 6.54 inches the past twenty-four hours."

"The Water of Cross Creek is out of its bank at the bridge on Hillsboro Street, Ray Avenue, and the Mile Branch, and it is expected that it will rise higher on Cool Spring Street than it did about two weeks ago when it covered the bridge."

Fayetteville Observer
September 20, 1928

"The present flood is the highest water this section has experienced since 1908 and the damage to crops from the water and storm Tuesday and Tuesday night is expected to run between 10 and 25 percent.

Fayetteville Observer
September 21, 1928

". . . a number of small dwellings on Ann and other streets near the creek (Cross) had been vacated. . ."

"The water this morning had reached to the Coast Line bridge but still lacked several feet of touching the structure used by vehicles and pedestrians."

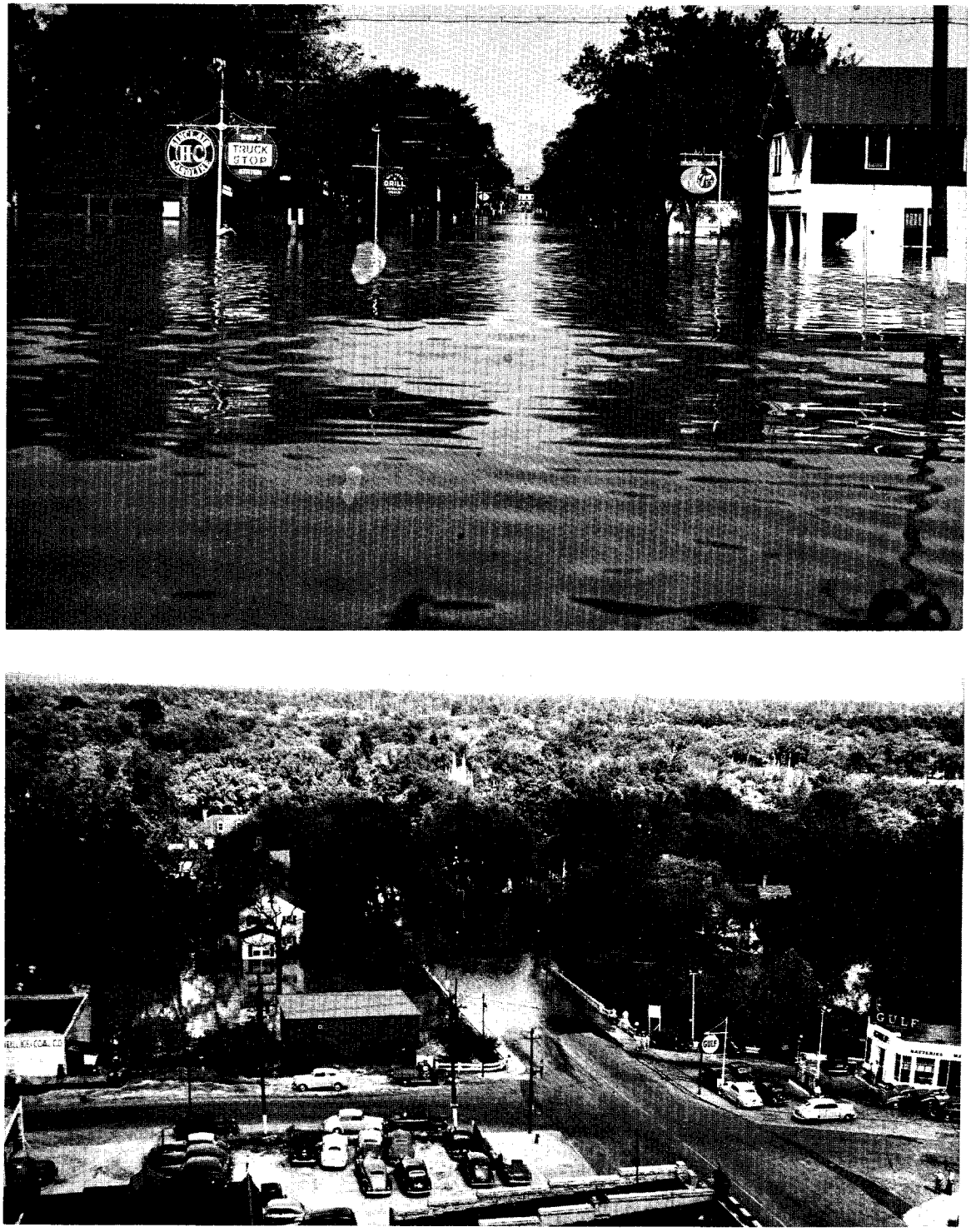


FIGURE 3. FLOOD SCENES IN FAYETTEVILLE - SEPTEMBER 1945

The views above give extent of flooding from the Cape Fear River and Cross Creek near the central business district. Upper view is on Person Street looking west toward the Market House. Lower view is from the upper story of First Citizens Bank looking north on Green Street.

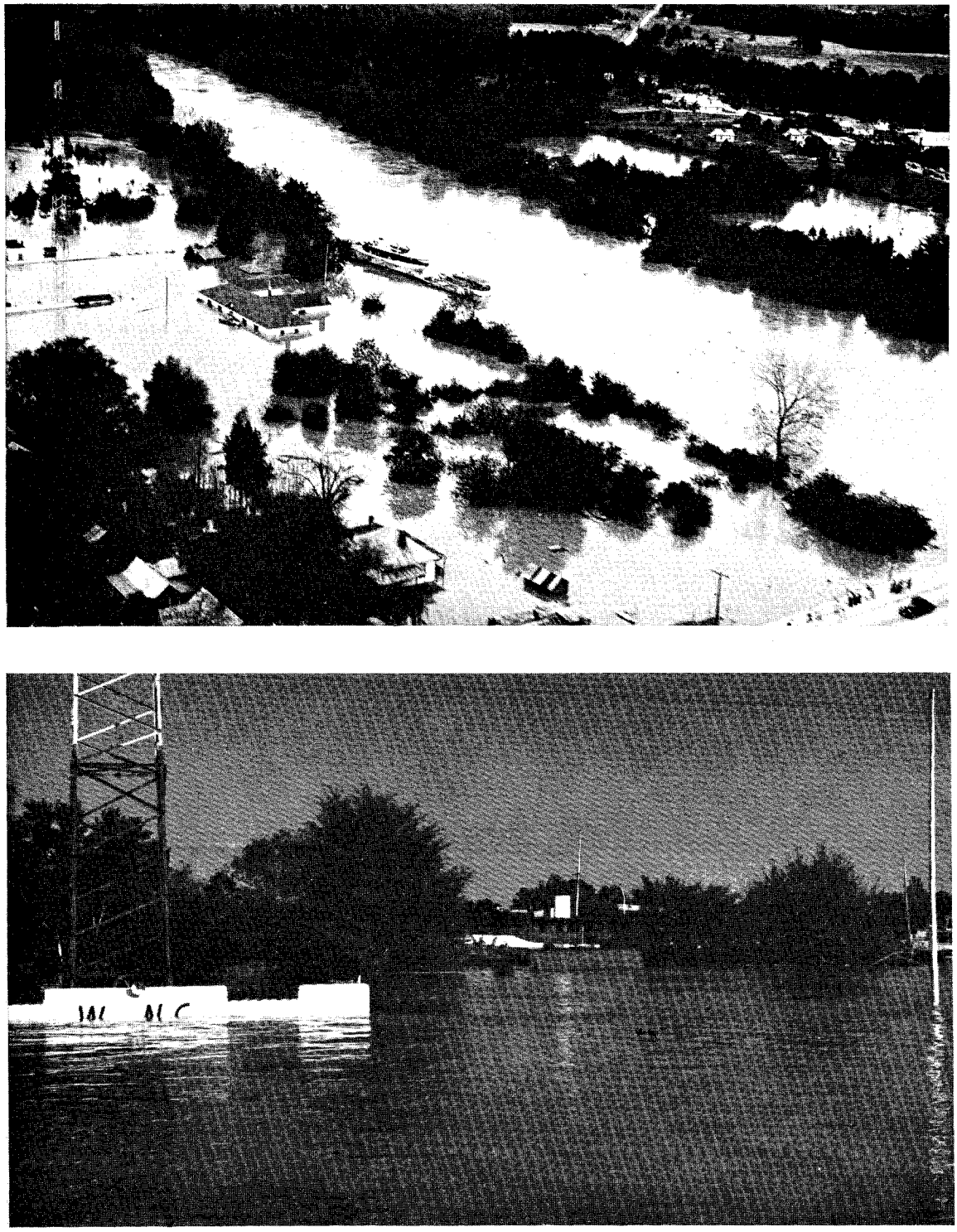


FIGURE 4. FLOOD SCENES IN FAYETTEVILLE - SEPTEMBER 1945

The above flood scenes were present north of Person Street bridge on Cape Fear River. The upper view is an aerial view of Cape Fear River flooding upstream of Person Street. The lower view shows WIDU radio station and Breece's Landing during higher stages of flooding than were present in the upper view.

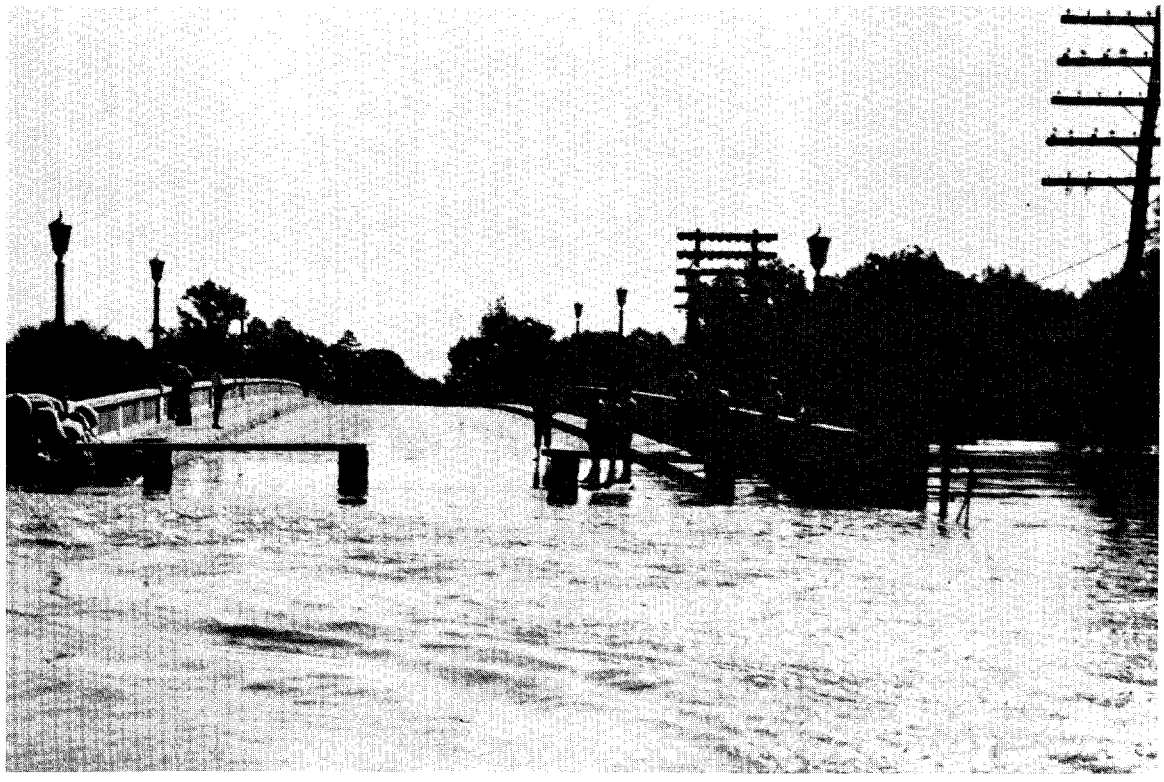


FIGURE 5. FLOOD SCENES IN FAYETTEVILLE - SEPTEMBER 1945
These scenes indicate the extent of flooding on the east and west approaches to Person Street bridge. The upper view is seen from Person Street bridge looking east toward East Fayetteville. The lower view is at Person Street bridge looking from the west approach.

CROSS CREEK

The Stream and Its Valley

Cross Creek has a drainage area of 40.1 square miles, which lies in and north of Fayetteville. The basin is fan shaped, about 10 miles long, and averaging about 4 miles wide. The City of Fayetteville occupies almost all of the lower half of the basin, while the upper third of the basin is within the Fort Bragg Military Reservation. The area between Fayetteville and Fort Bragg is devoted primarily to suburban residential developments. Cross Creek has two major tributaries--Little Cross Creek and Blounts Creek. The flood situation along these tributaries is discussed separately in later sections in this report. The location of the streams and the watershed is shown on Plate 2.

Elevations in the Cross Creek watershed range from a maximum of about 300 at the northern end of the basin to 20 in the streambed at its mouth at Mile 145.26 on the Cape Fear River, for an average slope of about 22 feet per mile. The total length of Cross Creek is 12.9 miles. Several small lakes or ponds have been constructed for recreation and water supply in the surrounding areas.

This investigation covers the lower 7.0 miles of Cross Creek. The total stream fall is about 105 feet in this reach, with average slopes of approximately 11 feet per mile from the upper study limit to Mile 2.6, and 22 feet per mile from there to the mouth of the stream. The width of the flood plain varies from about 500 feet at the upper end to about 300 feet near Green Street. The lower 3.5 miles is in the Cape Fear River flood plain.

Pertinent drainage areas of Cross Creek are given in Table 6.

TABLE 6

DRAINAGE AREAS IN WATERSHED OF CROSS CREEK

Stream	Location	Mile Above Mouth	Drainage Area sq. mi.
Cross Creek	Mouth	0.0	40.1
Cross Creek	Grove Street	1.7	38.9
Cross Creek	Above Blounts Creek	1.8	27.6
Cross Creek	North Cool Spring Street	2.0	26.8
Cross Creek	Above Little Cross Creek	3.8	15.6
Cross Creek	Upper Limit of Study	7.0	8.9
Blounts Creek	Mouth	0.0	12.0
Little Cross Creek	Mouth	0.0	9.9

Developments in the Flood Plain

Plates 14, 15, and 16 show the flood plain of Cross Creek above the Cape Fear River backwater for the reach covered in this investigation. Plates 7, 8, and 14 show the Cross Creek flood plain lying in the Cape Fear River flood plain. The upper 3 miles of the reach are relatively undeveloped or devoted to agricultural purposes. The flood plain has extensively developed commercially and residentially as Cross Creek approaches confluence with the Cape Fear River near the central business district of Fayetteville.

Fayetteville State University, one of the fastest growing Universities in North Carolina, lies in the flood plain. In addition,the flood plain is becoming more densely populated and therefore increasing customer-service oriented businesses nearby in shopping centers. Also, several cemeteries are located in the flood plain.

In the business district of the city there are numerous retail and discount businesses which are in areas which have been flooded by past floods and would be flooded by the Intermediate Regional Flood. Many more structures are subject to flooding by the Standard Project Flood, especially the central business district. Also affected in this area is City Hall.

Bridges Across the Stream

There are a total of 18 bridges across Cross Creek in the 7.0-mile study reach. Views of some of the bridges are given on Figures 6 and 7. Three Seaboard Coast Line Railroad lines cross at Miles 2.99, 3.01, and 4.10. Major highways which bridge Cross Creek are U.S. Highways 401 and 301, and North Carolina Highways 210 and 87. There are also several other vehicular bridges. Table 7 lists pertinent elevations for the bridges and shows their relation to the Intermediate Regional Flood.

Several of the bridges are severe obstructions to floodflows. Descriptions of some of the more significant bridges are given in the following paragraphs.

U. S. Highway 301 crosses Cross Creek at Mile 0.68. This bridge has sufficient opening to allow floodwater to flow freely. No head losses are created, and major flood crests are well below the bridge roadway.

N. C. Highway 210, or Grove Street, crosses Cross Creek at Mile 1.73. This bridge, like U. S. 301, is not an obstruction to floodflows. The concrete piers beneath the roadway offer little resistance to streamflow. There are no head losses, and the roadway stands 3.4 feet above the Standard Project Flood.

U. S. Highway 401, or Green Street, crosses Cross Creek at Mile 2.52. A double-barrel culvert bridges the creek, allowing the normal flow to travel unobstructed. During Intermediate Regional Floods, no roadway flooding would occur, but head losses of 2.0 feet would take place. As floodwaters of the Standard Project Flood reach a depth of 1.2 feet above the roadway, head losses diminish to zero.

The combination of Seaboard Coast Line Railroad bridges at Mile 2.99 and Mile 3.01 would constitute a major obstruction during the Standard Project Flood. It would cause head losses of 7.5 feet and be inundated by about 1.5 feet. The Intermediate Regional Flood would not reach the rail, but a head loss of about 3 feet would occur.

N. C. Highway 210 crosses the Cross Creek at Mile 3.22. This bridge is not an obstruction to floodflows. The head loss would be negligible during major floods such as the Intermediate Regional Flood and the Standard Project Flood because the roadway would be inundated by 1.7 feet and 8.0 feet, respectively.

Country Club Drive crosses the Cross Creek at Mile 6.96. This bridge, which defines the upper limit of the study area on Cross Creek, would not be inundated by a large flood. The insufficient clear opening would, however, cause head losses of 1.0 foot during a Standard Project Flood. The Intermediate Regional Flood would be free to pass without any head losses.

Obstructions to Floodflows

The effects of obstruction due to bridges and their approach fills have been described in the previous paragraphs. With the exception of the bridges, there are no significant obstructions to flows in the Cross Creek reach included in this study.

TABLE 7

BRIDGES ACROSS CROSS CREEK

Mile Above Mouth	Identification	Streambed Elevation feet	Floor Elevation feet	Under-clearance Elevation feet	Standard Project Flood Crest feet	Inter-mediate Regional Flood Crest feet	Relation of Intermediate Regional Flood Height to Underclearance Below feet	Above feet
0.68	U.S. 301 North	34.5	94.6	90.0	(91.8)[1]	(83.8)[1]	6.2	-
1.73	N.C. 210, Grove Street	50.0	95.2	91.6	(91.8)[1]	(83.8)[1]	7.8	-
1.98	N. Cool Spring Street	56.0	73.2	69.2	(91.8)[1]	(83.8)[1]	-	14.6
2.26	Ann Street	62.8	82.0	80.4	(91.8)[1]	(83.8)[1]	-	3.4
2.52	U.S. 401, Green Street	74.0	90.6	82.0	(91.8)[1]	(83.8)[1]	-	1.8
2.63	Anderson Street	77.4	88.1	83.4	92.5	90.2	-	6.8
2.80	Ray Avenue	79.1	89.3	86.7	93.6	91.4	-	4.7
2.99	Seaboard Coast Line RR	81.1	101.0	88.1	102.5	94.6	-	6.5
3.01	Seaboard Coast Line RR	81.6	101.7	93.9	102.5	95.8	-	1.9
3.08	Hillsboro Street	82.7	92.2	90.1	103.0	96.6	-	6.5
3.22	N.C. 210	83.3	95.2	91.6	103.2	96.9	-	5.3
3.33	West Rowan Street	84.3	95.0	92.9	103.4	97.5	-	4.6
3.65	Blue Street	86.8	98.1	96.6	103.9	99.4	-	2.8
3.94	Murchison Road	88.8	102.5	97.8	104.3	100.0	-	2.2
4.10	Seaboard Coast Line RR	95.5	124.5	106.5	119.0	116.3	-	9.8
4.14	Monagan Street Extension	95.0	100.2	99.0	119.0	116.3	-	17.3
4.81	Langdon Street	99.8	111.0	108.8	119.5	116.7	-	7.9
6.96	N.C. 59, Country Club Dr.	126.4	136.6	134.4	136.1	133.4	1.0	-

[1]Elevations shown are those due to backwater from the Cape Fear River with New Hope project in operation.

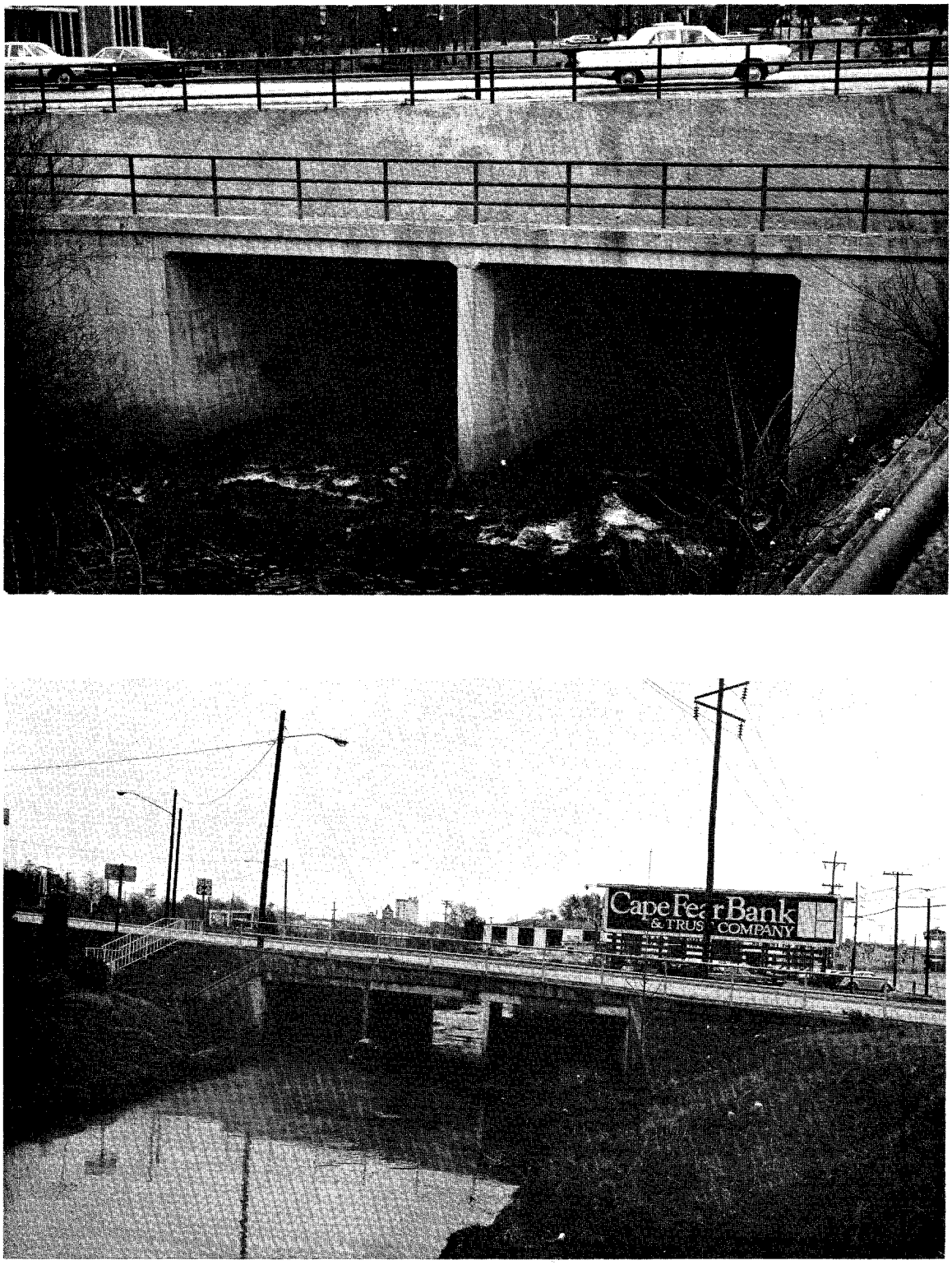


FIGURE 6. CROSS CREEK BRIDGES
The upper view is the upstream side of the Green Street bridge at Mile 2.52. Lower view is the upstream side of the U.S. 210 bridge at Mile 3.22.

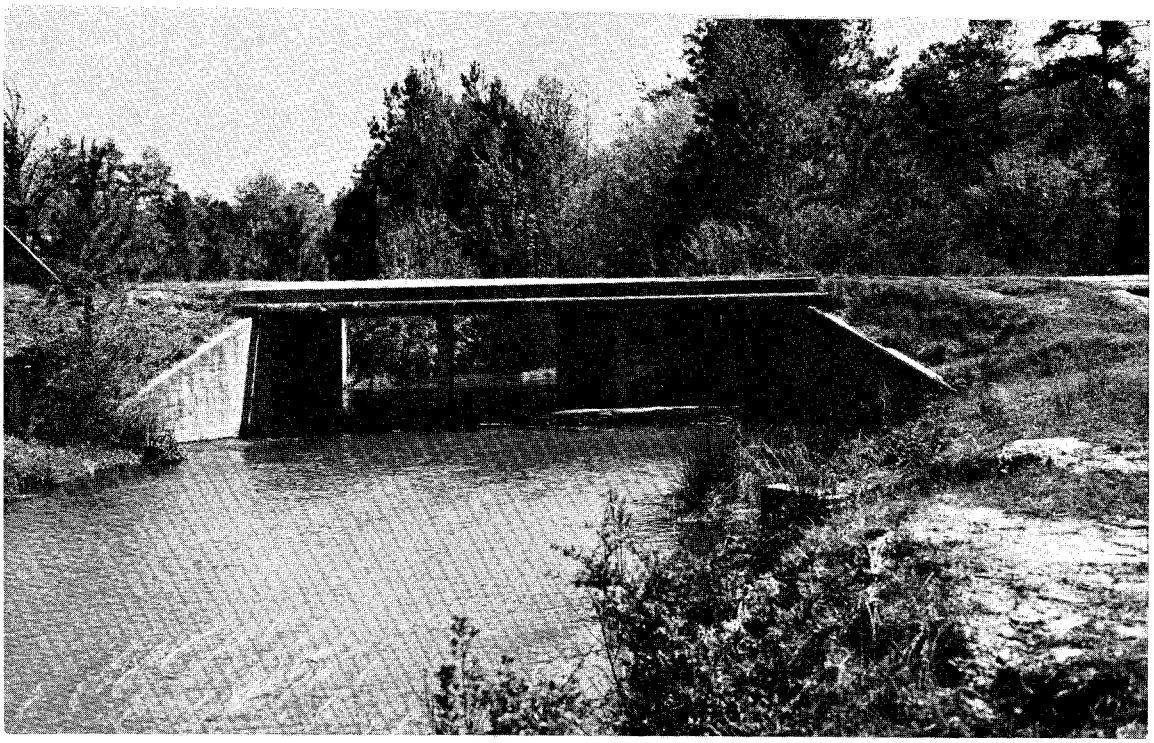


FIGURE 7. CROSS CREEK BRIDGES

The upper view is the upstream side of the Langdon Street bridge at Mile 4.81. Lower view is the downstream side of the Country Club bridge at Mile 6.96.

FLOOD SITUATION

Flood Records

There are no records of stream gages or discharges available for Cross Creek. Information on floods in the Cross Creek watershed was obtained from interviews with local residents and from a search of newspaper files and historical records. Information obtained by field investigations and office computations were used to develop a knowledge of floods on Cross Creek.

Flood Occurrences

The investigation indicates major floods have occurred with about the same frequency on Cross Creek as on the Cape Fear River.

Duration and Rate of Rise

Small streams draining urban areas, such as Cross Creek, are characterized by rapidly rising stages immediately after heavy rain occurs and cresting shortly after rainfall ceases.

Velocities

Along Cross Creek, in the reach investigated, velocities in the channel during large floods would range up to 10.1 feet per second, and, in the overbank areas, would be as high as 3.2 feet per second.

Flooded Areas, Flood Profiles, and Cross Sections

Plates 7, 8, 14, 15, and 16 show the approximate areas along Cross Creek at Fayetteville that would be inundated by the Intermediate Regional Flood and the Standard Project Flood with the New Hope Reservoir project in operation. The actual limits of these overflow areas on the ground may vary somewhat from those shown on the map because the scale of the maps do not permit precise plotting of the flooded area boundaries.

Plate 20 shows the high-water profile for the Intermediate Regional Flood and the Standard Project Flood with the New Hope project in operation. The New Hope project would reduce the extent of flooding at the lower end of Cross Creek by lowering the backwater effects of the Cape Fear River on Cross Creek.

Plate 25 shows 3 cross sections that are typical of the total of 33 sections obtained for the Cross Creek reach investigated. The location of all sections is shown on Plates 6 through 23. The elevation and extent of overflow of the Intermediate Regional Flood and the Standard Project Flood are indicated in these sections.

FLOOD DESCRIPTIONS

Descriptions of the large floods on Cross Creek are included with the discussion of past floods on Cape Fear River.

LITTLE CROSS CREEK

The Stream and Its Valley

Little Cross Creek has a drainage area of 9.94 square miles, which lies in and north of Fayetteville. The basin is rectangular in shape, about 7 miles long, and averaging about 1.5 miles wide. The City of Fayetteville occupies almost all of the lower half of the basin, while the upper one-third lies within the Fort Bragg Military Reservation. The area between Fayetteville and Fort Bragg is devoted primarily to suburban residential developments. Little Cross Creek is one of the two major tributaries of Cross Creek, which has been discussed previously. The location of Little Cross Creek within the Cross Creek watershed is shown on Plate 2.

Elevations in the Little Cross Creek watershed range from a maximum of about 290 feet at the northern end of the basin to 90 feet in the streambed at its mouth at Mile 3.78 on Cross Creek. The total length of Little Cross Creek is 7.3 miles. Upstream from Mile 2.7, the average slope is 3.6 feet per mile. In the lower 2.7 miles, the average

slope is about 1.3 feet per mile. There are several small lakes including Glenville Lake, Mintz Pond, Kornbow Lake, and Bonnie Doone Lake which feed Little Cross Creek.

This investigation covers the lower 2.7 miles of Little Cross Creek. The total stream fall through the study area is about 35 feet, and the width of the flood plain varies from about 500 feet at the upper end to about 600 feet at the lower end. The lower 0.4 mile is in the Cross Creek flood plain.

Pertinent drainage areas of Little Cross Creek are given in Table 8.

TABLE 8

DRAINAGE AREAS IN WATERSHED OF LITTLE CROSS CREEK

Stream	Location	Miles Above Mouth	Drainage Area sq. mi.
Little Cross Creek	Mouth	0.00	9.94
	Glenville Dam	0.38	9.71
	Pamalee Drive (Upper limit of study)	2.72	5.60

Developments in the Flood Plain

Plates 14, 15, and 18 show the flood plain of Little Cross Creek for the reach covered in this investigation. The major existing developments in the Little Cross Creek flood plain are the filtration plant and the water treatment plant. With only limited development in the flood plain area, extensive flood damages have not occurred in this watershed. The Intermediate Regional Flood and the Standard Project Flood would reach into the newly developed residential areas near the outer limits of the flood plain.

Bridges Across the Stream

There is a total of four bridges across Little Cross Creek in the 2.7-mile study reach. Two of the bridges are shown on Figure 8. The major bridges over Little Cross Creek in the study area are Filter Plant Road at Mile 0.35, and Pamalee Drive at Mile 2.72. Table 9 lists pertinent elevations for the bridges and shows their relation to the Intermediate Regional Flood.

None of the bridges is a severe obstruction to floodflows with the exception of Pamalee Drive. Descriptions of the bridges are given in the following paragraphs.

All of the bridges in the study area would be inundated by both the Intermediate Regional Flood and the Standard Project Flood except Pamalee Drive, which would be above the Intermediate Regional Flood. Depths of inundation during the Standard Project Flood would range from 4.4 feet at Filter Drive to 2.0 feet at Pamalee Drive. Roadways would not be overtopped by more than 1.5 feet during the Intermediate Regional Flood.

The only head losses caused by a bridge in the study area would occur at Pamalee Drive, which is at the upper limit of the study area. Pamalee Drive would cause losses of 3.5 and 10.0 feet during the Intermediate Regional Flood and Standard Project Flood, respectively.

Obstructions to Floodflow

The effects of obstruction due to bridges and their approach fills have been described in the previous paragraphs. The only other obstruction to floodflow on Little Cross Creek in the reach under investigation is Glenville Dam at Mile 0.38. Head losses of 10 feet and 9 feet would occur during the Intermediate Regional Flood and Standard Project flood, respectively. A view of the obstruction is shown on Figure 9.

TABLE 9

BRIDGES ACROSS LITTLE CROSS CREEK

Mile Above Mouth	Identification	Streambed Elevation feet	Floor Elevation feet	Under-clearance Elevation feet	Standard Project Flood Crest feet	Inter-mediate Regional Flood Crest feet	Relation of Intermediate Regional Flood Height to Underclearance Below feet	Above feet
0.14	Washington Avenue	90.8	100.5	97.9	104.9	102.0	-	4.1
0.31	Filter Plant Drive	94.8	104.6	103.2	109.0	106.2	-	3.0
0.35	Filter Plant Service Road	96.7	107.2	104.3	109.5	107.6	-	3.3
2.72	Pamalee Drive	124.7	143.4	132.1	145.4	136.8	-	4.7

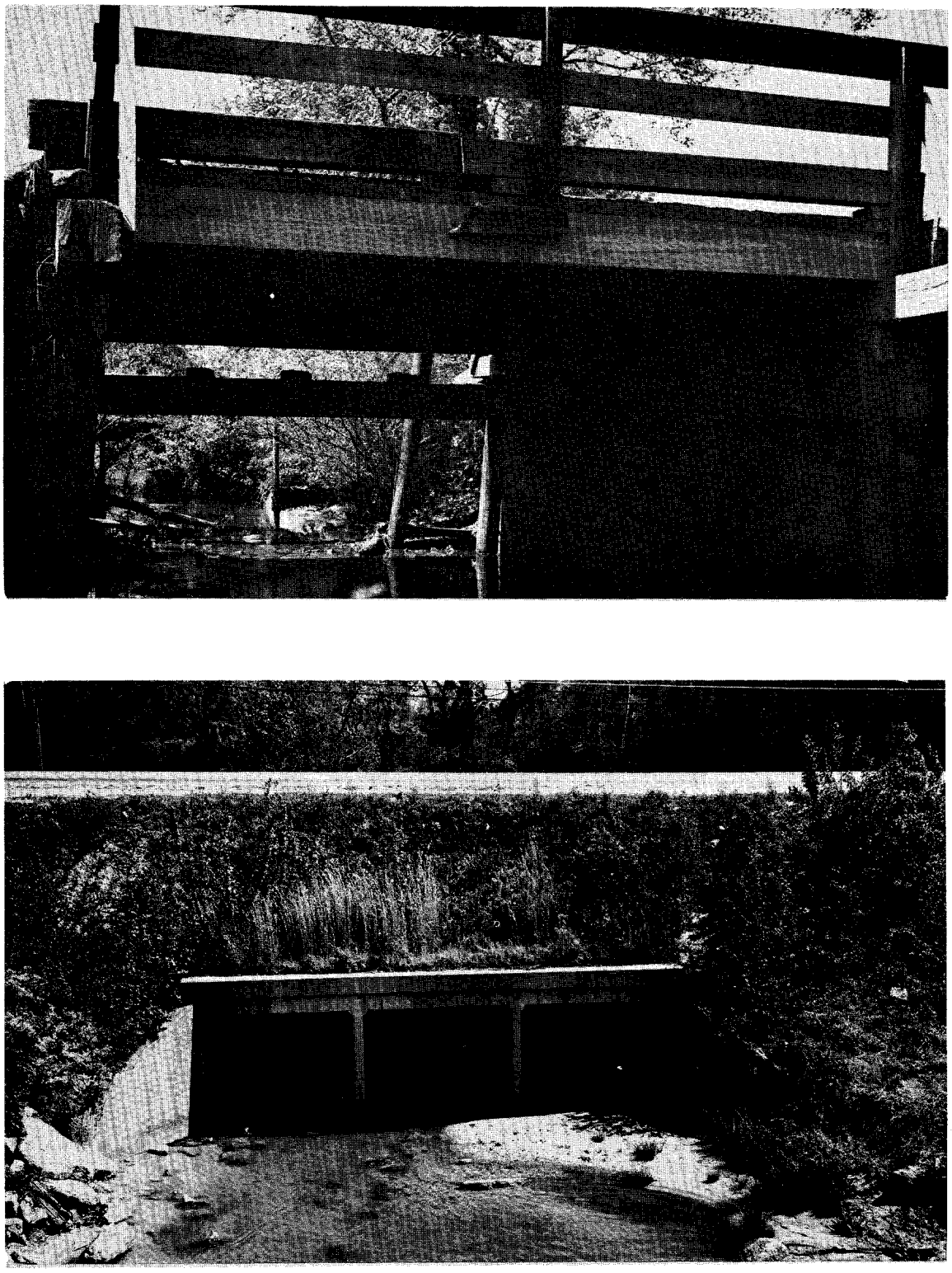
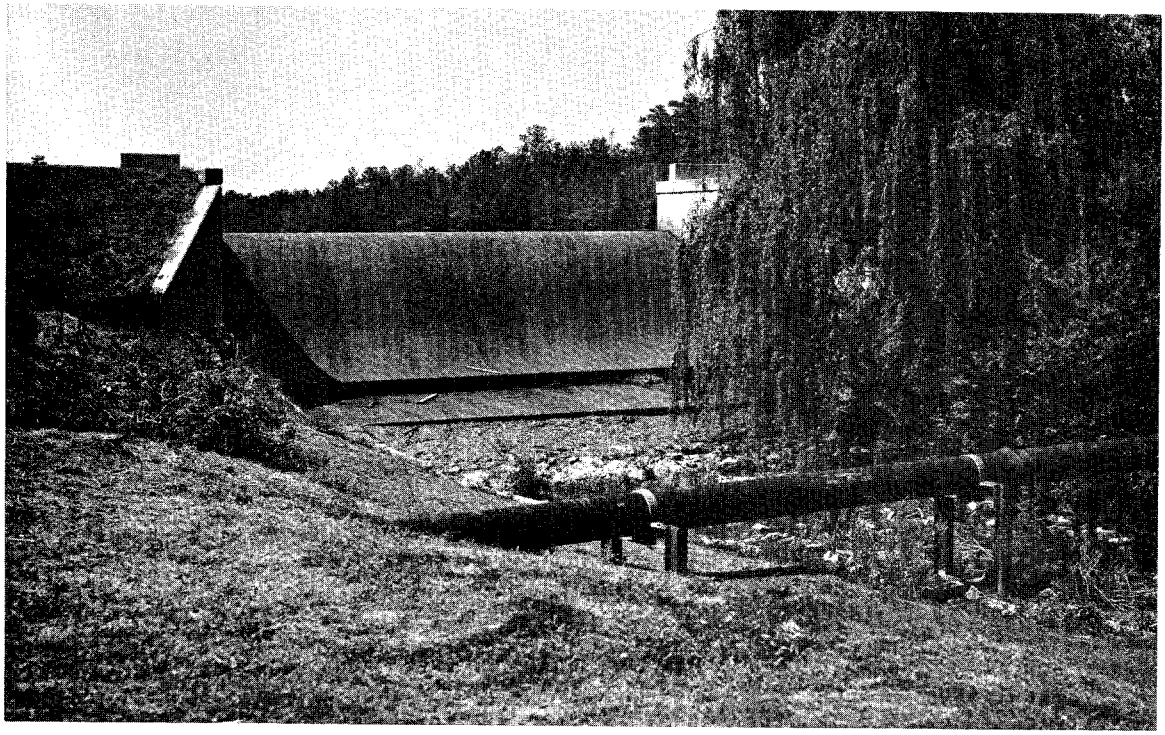


FIGURE 8. LITTLE CROSS CREEK BRIDGES

The upper view is the downstream side of Filter Plant Drive at Mile 0.31. Lower view is the downstream view of Pamalee Drive bridge at Mile 2.72.



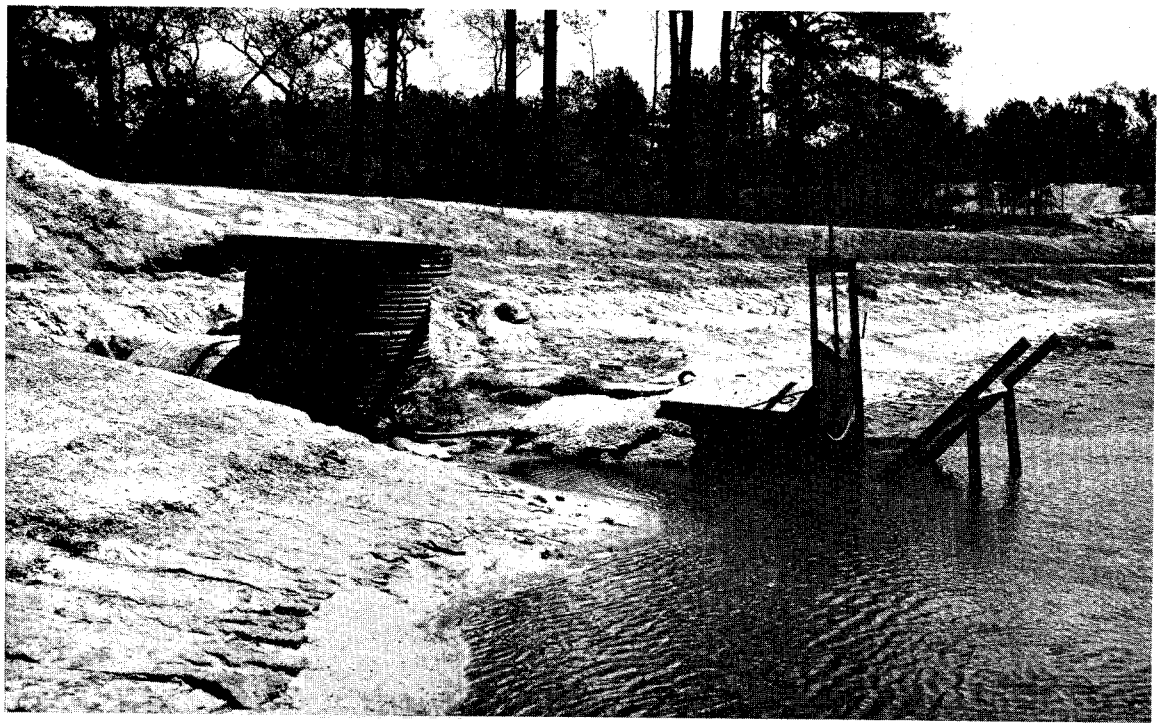


FIGURE 9. DAMS ON LITTLE CROSS CREEK AND BLOUNTS CREEK
The upper view shows Glenville Dam on Little Cross Creek at Mile 0.38.
The lower view shows an earth dam on Blounts Creek at Mile 3.57.

FLOOD SITUATION

Flood Records

There are no records of stream gages or discharges available for Little Cross Creek. Information on floods in the Little Cross Creek watershed was obtained from interviews with local residents and from a search of newspaper files and historical records. Information obtained by field investigations and office computations were used to develop a knowledge of floods on Little Cross Creek.

Flood Occurrences

The investigation indicates major flood rises have occurred with about the same frequency on Little Cross Creek as on Cross Creek and the Cape Fear River.

Duration and Rate of Rise

Small streams draining urban areas, such as that for Little Cross Creek, are characterized by rapidly rising stages immediately after heavy rain occurs and cresting shortly after rainfall ceases.

Velocities

Along Little Cross Creek in the reach investigated, velocities in the channel during large floods would range up to 8.5 feet per second, and, in the overbank areas, would be as high as 4.9 feet per second.

Flooded Areas, Flood Profiles, and Cross Sections

Plates 14, 15, and 18 show the approximate areas along Little Cross Creek at Fayetteville that would be inundated by the Intermediate Regional Flood and the Standard Project Flood. The actual limits of these overflow areas on the ground may vary somewhat from those shown on the map because the scale of the maps do not permit precise plotting of the flooded area boundaries.

Plate 21 shows the high-water profiles for the Intermediate Regional Flood and the Standard Project Flood.

Plate 25 shows 2 cross sections that are typical of the total of 15 sections obtained for the Little Cross Creek reach investigated. The location of all sections is shown on Plates 14, 15, 18 and 21. The elevation and extent of overflow of the Intermediate Regional Flood and the Standard Project Flood are also indicated.

BLOUNTS CREEK

The Stream and Its Valley

Blounts Creek has a drainage area of 12.0 square miles, which lies in and to the south of Fayetteville. The basin is fan shaped, about 4 miles long, and averaging about 3 miles wide. The City of Fayetteville occupies almost three-quarters of the basin, with Blounts Creek forming the southern boundary for the corporate limits of Fayetteville for about 0.7 mile. Blounts Creek is one of the two major tributaries of Cross Creek, which has been discussed previously. The location of Blounts Creek within the Cross Creek watershed is shown on Plate 2. The largest tributary of Blounts Creek is Branson Creek which will be discussed in another section of this report.

Elevations in the Blounts Creek watershed range from a maximum of about 190 feet at the southwestern end of the basin to approximately 50 feet in the streambed at its mouth at Mile 1.76 on Cross Creek. The total length of Blounts Creek is 5.3 miles. Upstream from Mile 4.8 the average slope is about 80 feet per mile. In the lower 4.8 miles, the average slope is about 19 feet per mile.

This investigation covers the lower 4.8 miles of Blounts Creek. The total stream fall through the study area is about 90 feet and the width of the flood plain varies from about 600 feet at the lower end to about 300 feet at the upper end. The lower 1.35 miles are in the Cape Fear River flood plain.

Pertinent drainage areas of Blounts Creek are given in Table 10.

TABLE 10

DRAINAGE AREAS IN WATERSHED OF BLOUNTS CREEK

Stream	Location	Mile Above Mouth	Drainage Area sq. mi.
Blounts Creek	Mouth	0.00	12.0
	Russell Street	0.60	11.9
	Campbell Avenue	1.00	11.5
	Gillespie Street	1.35	11.2
	Above Branson Creek	2.23	4.4
	Owen Drive (Upper Limit of Study)	4.76	0.6
Branson Creek	Mouth	0.00	5.1
Dark Branch	Mouth	0.00	1.3

Developments in the Flood Plain

Plates 12, 13, and 17 show the flood plain of Blounts Creek upstream of the Cape Fear River backwater for the reach covered in this investigation. The upper 2.4 miles is undeveloped. The lower 2.4 miles are devoted to residential and commercial developments. Except for development within the central business district, there have been only minor and scattered developments elsewhere within the reach.

Bridges Across the Stream

There are a total of 17 bridges across Blounts Creek in the 4.8-mile study reach. Views of the bridges are given on Figures 10 and 11. Table 11 lists pertinent elevations for the bridges and shows their relation to the Intermediate Regional Flood.

Several of the bridges are severe obstructions to floodflows. Descriptions of these bridges and major highway bridges are given in the following paragraphs.

Person Street and Russell Street, both serving U.S. 301A, cross Blounts Creek at Mile 0.44 and Mile 0.60, respectively. Neither would create head losses during major floods; however, each would be inundated by 6.0 feet during a Standard Project Flood. The Intermediate Regional Flood would not reach the roadway of either bridge structure.

Two highway bridges causing hazardous head losses during major floods are those serving Gillespie Street and Owen Street at Miles 1.35 and 4.76, respectively. During Standard Project Floods, head losses would be 4.0 feet at Gillespie Street and nearly 6.0 feet at Owen Street. Each would be submerged by the Standard Project Flood to depths of around 1 foot. Gillespie Street would be practically unaffected by the Intermediate Regional Flood, having no head losses and standing above floodwaters. The Intermediate Regional Flood would have slightly lower effects on Owen Street than would the Standard Project Flood.

The Seaboard Coast Line Railroad bridge at Mile 1.92, and the Aberdeen-Rockfish Railroad at Mile 2.30, are serious obstructions to floodflows. Floodwaters would not reach the top of the rail at the Seaboard Coast Line Railroad bridge during major floods, but a head loss of 2.5 feet would occur during a Standard Project Flood. The Aberdeen-Rockfish Railroad is subject to inundation from 3.1 to 4.9 feet by the Intermediate Regional and Standard Project Floods, respectively. Head losses of 6 to 9 feet would accompany the preceding flood conditions.

Obstructions to Floodflow

The effects of obstruction due to bridges and their approach fill have been described in the previous paragraphs. With the exception of the bridges, there is only one more significant obstruction to floodflow in the Blounts Creek reach included in this study. This is an earth dam at Mile 3.57. A picture of this dam is shown on Figure 9. The outlet pipe is 5 feet in diameter. Head losses of about 5.5 feet would occur during both the Intermediate Regional and the Standard Project Floods.

TABLE 11

BRIDGES ACROSS BLOUNTS CREEK

Mile Above Mouth	Identification	Streambed Elevation feet	Floor Elevation feet	Under-clearance Elevation feet	Standard Project Flood Crest feet	Inter-mediate Regional Flood Crest feet	Relation of Intermediate Regional Flood Height to Underclearance Below feet	Relation of Intermediate Regional Flood Height to Underclearance Above feet
0.18	Hawley Lane	54.0	76.8	72.8	(91.8)[1]	(83.8)[1]	-	11.0
0.36	Adams Street	61.7	81.5	67.7	(91.8)[1]	(83.8)[1]	-	16.1
0.44	U.S. 301A-Person St.	67.1	85.8	82.8	(91.8)[1]	84.2	-	1.4
0.60	U.S. 301A-Russell St.	69.3	85.7	82.9	(91.8)[1]	84.8	-	1.9
1.00	Campbell Ave.	77.6	84.3	82.6	(91.8)[1]	86.2	-	3.6
1.18	Cool Spring St.	78.7	86.7	84.8	(91.8)[1]	88.6	-	3.8
1.28	Dick St.	80.4	89.9	88.9	92.0	90.6	-	1.7
1.35	U.S. 301A-Gillespie St.	81.0	97.7	91.1	98.2	92.3	-	1.2
1.51	Aberdeen-Rockfish Railroad spur	83.8	96.7	94.9	98.2	94.5	0.4	-
1.66	Aberdeen-Rockfish Railroad	84.3	102.2	100.6	99.9	96.4	4.2	-
1.75	Seaboard Coast Line Railroad	87.5	106.0	104.4	100.8	97.0	7.4	-
1.88	Winslow St.	90.5	100.5	98.8	101.6	100.8	-	2.0
1.92	Seaboard Coast Line Railroad	92.0	109.7	104.4	107.4	101.4	3.0	-
1.98	Gurley St.	93.3	98.3	97.8	107.5	102.5	-	4.7
2.30	Aberdeen-Rockfish Railroad	94.7	109.0	101.7	113.9	112.1	-	10.4
2.42	Whitfield St.	96.5	110.4	103.3	114.1	112.5	-	9.2
4.76	Owen Dr.	142.4	153.2	148.4	154.8	154.3	-	5.9

[1]Elevations shown are those due to backwater from the Cape Fear River with New Hope project in operation.

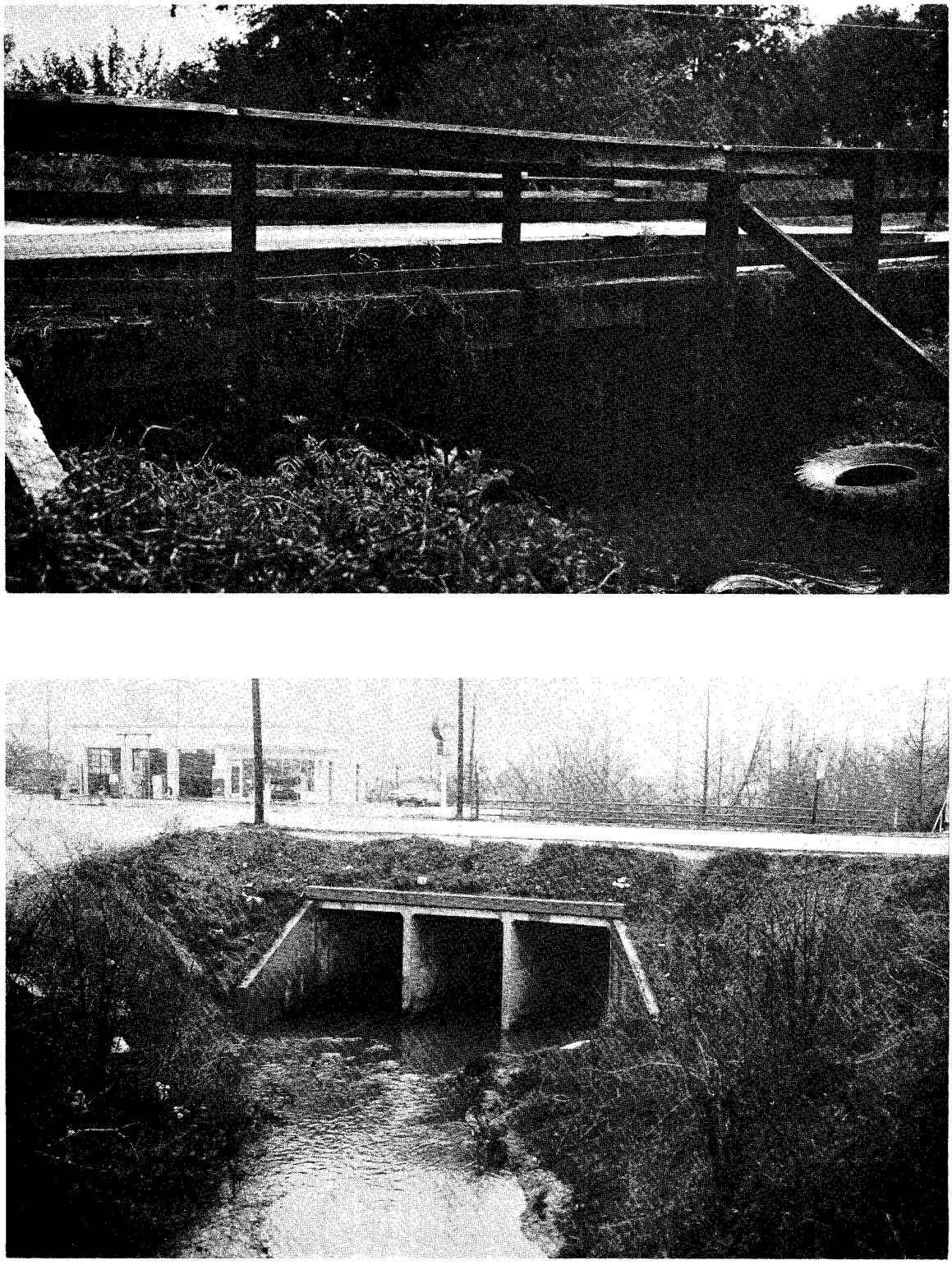
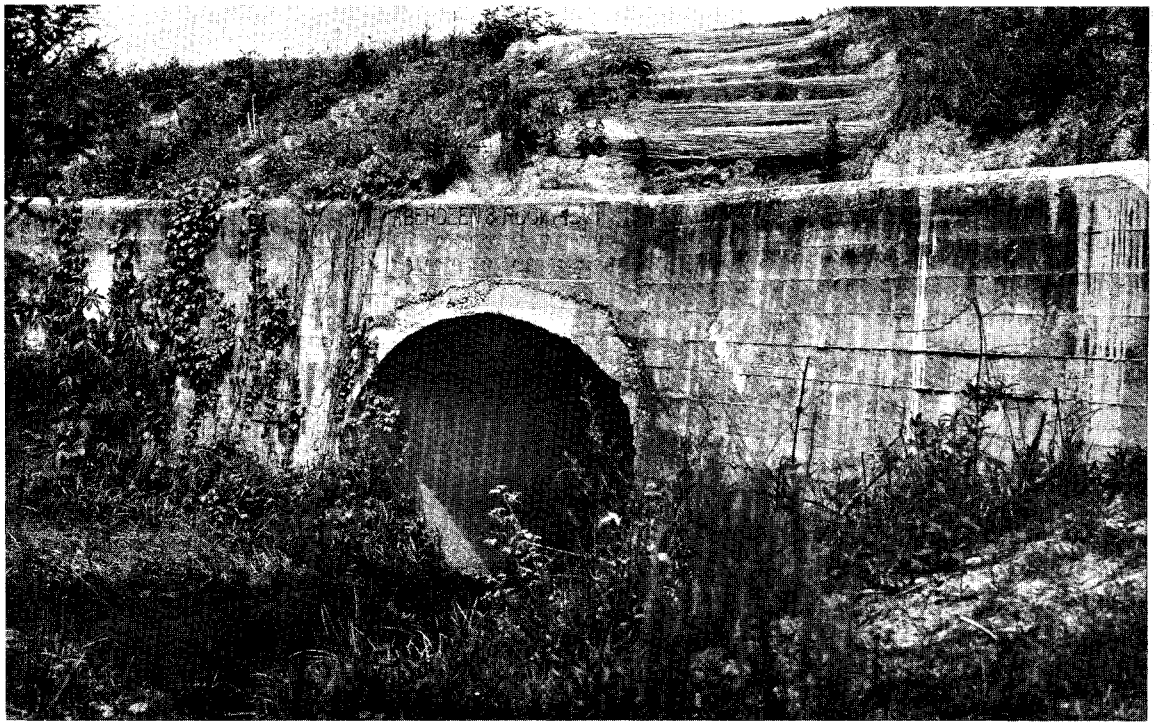


FIGURE 10. BLOUNTS CREEK BRIDGES
The upper view is the downstream side of the Campbell Street bridge at Mile 1.00. Lower view is the downstream view of the Gillespie Street bridge at Mile 1.35.



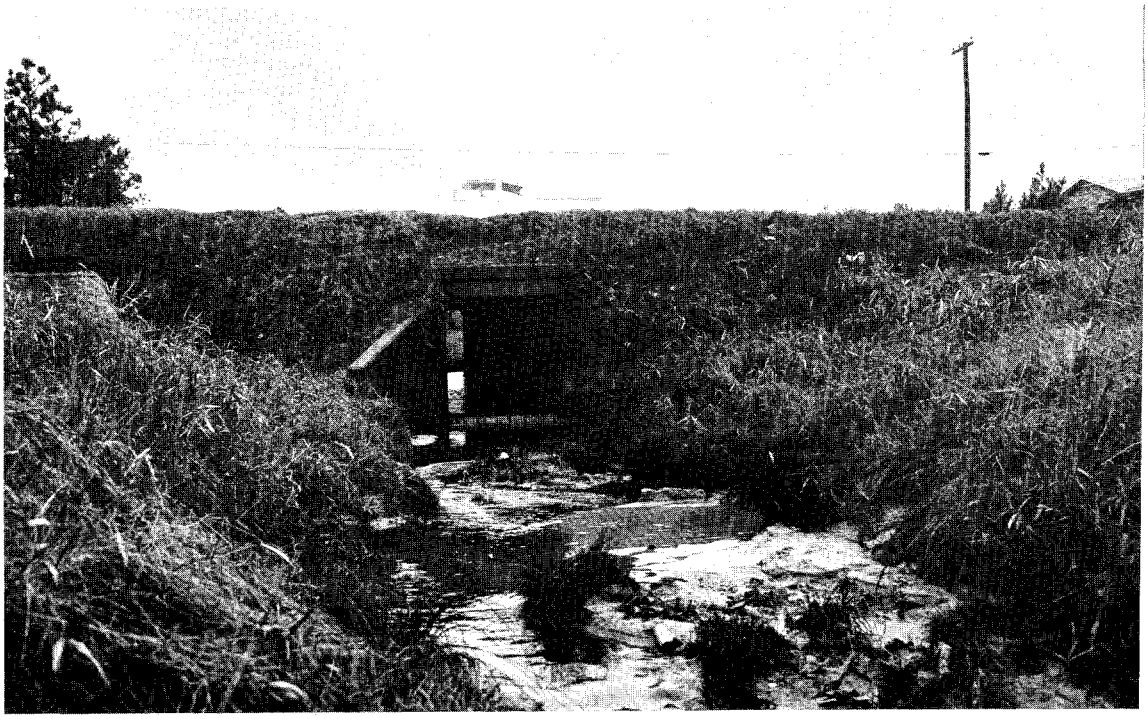


FIGURE 11. BLOUNTS CREEK BRIDGES

upper view is upstream side of the Aberdeen-Rockfish Railroad at Mile 2.30. Bottom view is the downstream side of Owen Drive at Mile 4.79.

FLOOD SITUATION

Flood Records

There are no records of stream gages or discharges available for Blounts Creek. Information on floods in the Blounts Creek reach was obtained from interviews with local residents and from a search of newspaper files and historical records. Information obtained by field investigations and office computations were used to develop a knowledge of floods on Blounts Creek.

Flood Occurrences

The investigation indicates major flood rises have occurred with about the same frequency as on Cross Creek and the Cape Fear River.

Duration and Rate of Rise

Small streams draining urban areas, such as Blounts Creek, are characterized by rapidly rising stages immediately after heavy rain occurs and cresting shortly after rainfall ceases.

Velocities

Along Blounts Creek in the reach investigated, velocities in the channel during large floods will range up to as high as 10.5 feet per second and up to 2.8 feet per second in some overbank sections.

Flooded Areas, Flood Profiles, and Cross Sections

Plates 12-14 and 17 show the approximate areas along Blounts Creek at Fayetteville that would be inundated by the Intermediate Regional Flood and the Standard Project Flood with the New Hope Reservoir project in operation. The actual limits of these overflow areas on the ground may vary some from those shown on the map, because interpolation of ground elevations between known elevation points and the scale of the maps do not permit precise plotting of the flooded area boundaries.

Plate 22 shows the high-water profiles for the Intermediate Regional Flood and the Standard Project Flood with the New Hope project in operation.

Plate 26 shows 4 cross sections that are typical of the total of 27 sections obtained for the Blounts Creek reach studied. The location of all sections are shown on Plates 12-14, 17 and 22. The elevation and extent of overflow of the Intermediate Regional Flood and the Standard Project Flood are also shown.

FLOOD DESCRIPTIONS

General descriptions of large floods on Blounts Creek are included with the discussion of past floods on the Cape Fear River.

BRANSON CREEK

The Stream and Its Valley

Branson Creek has a drainage area of 5.1 square miles, which lies in and to the southwest of Fayetteville. The basin is about 4.5 miles long and averages about 1.1 miles in width. Branson Creek lies entirely within the corporate limits of the city. Branson Creek is the major tributary of Blounts Creek, which has been discussed previously. The location of Branson Creek within the Cross Creek watershed is shown on Plate 2.

Elevation in the Branson Creek watershed ranges from a maximum of about 240 feet at the northern end of the basin to about 95 feet in the streambed at its mouth at Mile 2.23 on Blounts Creek. The total length of Branson Creek is 4.7 miles. Upstream from Mile 0.8 the average slope is 32 feet per mile. In the lower 0.8 mile the average slope is about 16 feet per mile.

This investigation covers the lower 0.8 mile of Branson Creek. The total stream fall through the study area is about 12 feet and the width of the flood plain varies from about 400 feet at the lower

end to about 350 feet at the upper end. The lower 0.5 mile is in the Blounts Creek flood plain.

Pertinent drainage areas of Branson Creek are given in Table 12.

TABLE 12

DRAINAGE AREAS IN WATERSHED OF BRANSON CREEK

Streams	Location	Miles Above Mouth	Drainage Area sq. mi.
Branson Creek	Mouth	0.0	5.14
	Forest Lake Dam (Upper limit of study)	0.8	4.85

Developments in the Flood Plain

Plate 13 shows the flood plain of Branson Creek for the reach covered in this investigation. This area is primarily undeveloped with only a small scattered population.

Bridges Across the Stream

There are a total of two bridges across Branson Creek in the 0.8-mile study reach. Views of the bridges are given on Figure 12. Table 13 lists pertinent elevations for the bridges and shows their relation to the Intermediate Regional Flood.

The only major bridge crossing Branson Creek is U. S. Highway 401, or Robeson Street, which crosses at Mile 0.10. The highway is bridged at Branson Creek by a double-barrel, concrete culvert. The culvert has sufficient opening to pass floodwaters without head loss. Nearly 2 feet of water, however, would top the roadway during a Standard Project Flood.

Weiss Avenue, upstream of Robeson Street, is located at Mile 0.36. Head losses around 1.5 feet are indicated during a major flood. The crest of a Standard Project Flood would overtop the roadway by 1.3 feet, but the roadway would be above the Intermediate Regional Flood.

TABLE 13

BRIDGES ACROSS BRANSON CREEK

Mile Above Mouth	Identification	Streambed Elevation feet	Floor Elevation feet	Under-clearance Elevation feet	Standard Project Flood Crest feet	Intermediate Regional Flood Crest feet	Relation Intermediate Regional Flood Height to Underclearance Below feet	Above feet
0.10	Robeson Street	95.0	105.5	99.9	107.5	105.0	-	5.1
0.36	Weiss Avenue	100.9	110.5	108.8	112.3	110.1	-	1.3

FIGURE 12. BRANSON CREEK BRIDGES

The upper view is the upstream side of the Robeson Street bridge at Mile 0.10. Lower view is the upstream view of the Weiss Avenue bridge at Mile 0.36.

Obstructions to Floodflow

The effects of obstructions due to bridges and their approach fills have been described in the previous paragraphs. With the exception of the bridges, there are no significant obstructions to flows in the Branson Creek reach included in this study.

FLOOD SITUATION

Flood Records

There are no records of stream gages or discharges available for Branson Creek. Information on floods in the Branson Creek reach was obtained from interviews with local residents and from a search of newspaper files and historical records. Information obtained by field investigations and office computations were used to develop a knowledge of floods on Branson Creek.

Flood Occurrences

The investigation indicates major flood rises have occurred with about the same frequency as on Blounts Creek and the Cape Fear River.

Duration and Rate of Rise

Small streams draining urban areas, such as Branson Creek, are characterized by rapidly rising stages immediately after heavy rain occurs and cresting shortly after rainfall ceases.

Velocities

Along Branson Creek in the reach investigated, velocities in the channel during large floods will range up to as high as 6.5 feet per second and up to 1.8 feet per second in some overbank sections.

Flooded Areas, Flood Profiles, and Cross Sections

Plate 13 shows the approximate areas along Branson Creek at Fayetteville that would be inundated by the Intermediate Regional Flood

and the Standard Project Flood. The actual limits of these overflow areas on the ground may vary some from those shown on the map because interpolation of ground elevations between known elevation points and the scale of the maps do not permit precise plotting of the flooded area boundaries.

Plate 23 shows the high-water profile for the Intermediate Regional Flood and the Standard Project Flood.

Plate 26 shows a cross section which is typical of the nine obtained through the Branson Creek reach studied. The location of these sections is shown on Plates 13 and 23. The elevation and extent of overflow of the Intermediate Regional Flood and the Standard Project Flood are also shown.

FLOOD DESCRIPTIONS

General descriptions of large floods on Branson Creek are included with the discussion of past floods on the Cape Fear River.

FUTURE FLOODS

This section of the report discusses the Standard Project Flood and the Intermediate Regional Flood on Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek in the vicinity of Fayetteville, North Carolina, and some of the hazards of great floods. Floods of the size of the Standard Project Flood represent reasonable upper limits of expected flooding. Those of the size of the Intermediate Regional Flood represent floods that may reasonably be expected to occur more frequently, although they will not be as high as the Standard Project Flood.

Large floods have been experienced in the past on streams in the general geographical and physiographical region of Fayetteville. Heavy storms similar to those causing these floods could occur over the watersheds of Cape Fear River and Cross Creek. In this event, floods would result on these streams comparable in size with those experienced on neighboring streams. It is, therefore, desirable, in connection with any determination of future floods which may occur on the Cape Fear River and Cross Creek watershed, to consider storms and floods that have occurred in the region on watersheds whose topography, watershed cover, and physical characteristics are similar to those of these two watersheds.

DETERMINATION OF INTERMEDIATE REGIONAL FLOODS

The Intermediate Regional Flood is defined as a flood having an average frequency of occurrence in the order of once in 100 years, at a designated location, although the flood may occur in any year. Some probability estimates are based on statistical analyses of streamflow records available for the watersheds under study, but limitations in such records usually require analyses of rainfall and runoff characteristics in the "general region" of the area under study. The Intermediate Regional Flood represents a major flood, although it is much less severe than the Standard Project Flood.

In order to determine the Intermediate Regional Floods for Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek in the vicinity of Fayetteville, statistical studies were made using the U. S. Weather Bureau record of flood data for Cape Fear River at Person Street bridge, and other available records for the Cape Fear River basin. Table 14 lists the maximum known floods that have occurred on watersheds comparable with Cape Fear River and Cross Creek watershed at Fayetteville and within the same geographical region.

With the New Hope project in operation, studies indicate that the Intermediate Regional Flood at Fayetteville on Cape Fear River at the Weather Bureau's gaging station would have a peak discharge of 100,000 cubic feet per second and would be about 20 percent less than the September 1945 flood. The Intermediate Regional Flood for Cross Creek would have a peak discharge at its mouth of 10,500 cubic feet per second.

TABLE 14

MAXIMUM KNOWN FLOOD DISCHARGES ON STREAMS IN THE REGION OF FAYETTEVILLE, N. C.

Stream	Location	Drainage Area sq. mi.	Record Used years	Date	Peak Discharge c.f.s.	Peak Discharge c.f.s./sq. mi.
Dial Creek	Near Bahama, N.C.	4.7	43	May 24, 1940	3,000*	61
Eno River	Hillsboro, N.C.	66.5	41	Sep. 18, 1945	11,000	165
Flat River	Bahama, N.C.	150	43	Jul. 26, 1938	20,000	133
Neuse River	Smithfield, N.C.	1,200	9	Oct. 7, 1964	11,600	10
Neuse River	Near Northside, N.C.	526	41	Sep. 18, 1945	36,600	70
Neuse River	Near Goldsboro, N.C.	2,390	38	Oct. 5, 1929	38,600	16
Reedy Fork Creek	Near Gibsonville, N.C.	133	40	Sep. 25, 1947	11,600	87
North Buffalo Creek	Near Greensboro, N.C.	37	40	Sep. 25, 1947	6,000	162
Haw River	Near Benaja, N.C.	168	40	Sep. 25, 1947	12,300	73
Haw River	Haw River, N.C.	599	40	Sep. 18, 1945	37,000	62
New Hope River	Near Pittsboro, N.C.	285	20	Mar. 5, 1952	7,900	28
Cape Fear River	Fayetteville, N.C.	4,376	82	Sep. 21, 1945	124,000	28
East Fork Deep River	Near High Point, N.C.	14.7	40	Sep. 24, 1947	6,300	429
Deep River	Near Randleman, N.C.	124	41	Sep. 25, 1947	20,000	161
Tar River	Near Tar River, N.C.	167	29	Aug. 18, 1955	13,100	78
Tar River	Near Nashville, N.C.	701	40	Dec. 3, 1934	16,900	24
Fishing Creek	Near Enfield, N.C.	521	45	Aug. 18, 1940	12,600	24

*Estimated.

Peak discharges of the Intermediate Regional Floods on Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek are shown in Table 15.

Intermediate Regional Floods, after the reduction effects of the New Hope project, may occur on Cape Fear River in the reach investigated that would be from 5 to 7 feet lower than the September 1945 flood.

DETERMINATION OF STANDARD PROJECT FLOODS

Only in rare instances has a specific stream experienced the largest flood that is likely to occur. Severe as the maximum known flood may have been on any given stream, it is a commonly accepted fact that a larger flood probably will occur. The Corps of Engineers, in cooperation with the Weather Bureau, has made broad and comprehensive studies and investigations based on the vast records of experienced storms and floods and has evolved generalized procedures for estimating the flood potential of streams. These procedures have been used in determining the Standard Project Floods. It is defined as the largest flood that can be expected from the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographical region involved.

Standard Project Flood estimates have been made for Cape Fear River at the gaging station at Person Street bridge, and for the streams studied in Cross Creek watershed. The storm rainfall runoff used for Cape Fear River amounts to 2.86 inches in 6 hours, 7.25 inches in 24 hours, and a total of 7.93 inches. Rainfall amounts used for the Cross Creek watershed are 6.66 inches in 3 hours, 9.88 inches in 6 hours, and a total of 13.36 inches in 24 hours. Peak discharges of the Standard Project Floods on Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek are shown in Table 15 and compared with the Intermediate Regional Floods.

TABLE 15

STANDARD PROJECT AND INTERMEDIATE REGIONAL FLOODS

PEAK DISCHARGES

Stream	Location	River Mile	Drainage Area sq. mi.	Intermediate Regional Flood Discharge c.f.s.	Standard Project Flood Discharge c.f.s.
Cape Fear River	Person Street bridge (USWB gage)	145.0	4,376	100,000*	136,000*
Cross Creek	Mouth	0.0	40.1	5,500	10,500
Little Cross Creek	Mouth	0.0	9.9	1,900	3,800
Blounts Creek	Mouth	0.0	12.0	2,190	3,925
Branson Creek	Mouth	0.0	5.1	1,500	2,700

*With New Hope Dam in operation.

Frequency

It is not practical to assign a frequency to the Standard Project Flood. The occurrence of such a flood would be a rare event; however, it could occur in any year.

Possible Larger Floods

Floods larger than the Standard Project Flood are possible and should not be ignored in the planning of urban areas; however, the combination of factors that would be necessary to produce such floods would seldom occur.

HAZARDS OF GREAT FLOODS

The amount and extent of damage caused by any flood depends in general upon how much area is flooded, the height of flooding, the velocity of flow, the rate of rise, and the duration of flooding.

Areas Flooded and Heights of Flooding

The areas along Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek flooded by the Standard Project Flood and the Intermediate Regional Flood are shown on Plates 6 through 18. Depths of flow can be estimated from the crest profiles which are shown on Plates 19 through 23. Table 16 gives an estimate of the area and the number of structures flooded by the Standard Project Flood and Intermediate Regional Flood.

TABLE 16

EXTENT OF FLOODING

Stream	Flood	Number of Structures Flooded	Area Flooded acres
Cape Fear River	Standard Project	3,200	7,110
	Intermediate Regional	150	1,680
Cross Creek	Standard Project	325	460
	Intermediate Regional	235	390
Little Cross Creek	Standard Project	35	185
	Intermediate Regional	25	160
Blounts Creek	Standard Project	155*	260*
	Intermediate Regional	485*	350*
Branson Creek	Standard Project	35	45
	Intermediate Regional	10	30

*Due to change in location of backwater effects from Cape Fear River. See Plates 13 and 22.

The profiles for the streams were computed by using stream characteristics for selected reaches as determined from observed flood profiles, topographic maps, and valley cross sections which were surveyed in 1968 and 1969. The elevations shown on Plates 19 through 23 and the overflow areas shown on Plates 6 through 18 have been determined with an accuracy consistent with the purposes of this study and the accuracy of the basic data.

The profiles of the Standard Project Flood and the Intermediate Regional Flood depend in part upon the degree of destruction or clogging of various bridges during the flood. Because it is impossible to forecast these events, it was assumed that all bridge structures would stand, and that no clogging would occur.

The Standard Project Flood profile for Cape Fear River is 1 to 3 feet higher than the September 1945 flood. The maximum difference occurs in the downstream reaches of the study area as the flood plain becomes flatter and lower. The Standard Project Flood profile for Cross Creek is from 2 to 7 feet higher than the Intermediate Regional Flood. In the lower 2.5 miles of Cross Creek the backwater from the Cape Fear River Standard Project Flood is 2.5 feet higher than the backwater of the September 1945 flood. The profile of the Standard Project Flood on Little Cross Creek and Blounts Creek varies from 1 to 5 feet above the Intermediate Regional Flood. In the lower reach of Blounts Creek, at its confluence with Cross Creek, the Cape Fear River Standard Project Flood is 2.5 feet higher than the September 1945 flood due to the Cape Fear River backwater. On Branson Creek the Standard Project Flood is 2 feet higher than the Intermediate Regional Flood.

The Intermediate Regional Flood profile for Cape Fear River is from 6 to 7 feet lower than the September 1945 flood, with the maximum differences in the upper reaches of the study area. Similar stage comparison cannot be made on the creeks in the Cross Creek watershed due to lack of data on past floods except where backwater effects of the Cape Fear River are present on Blounts Creek and Cross Creek. On these streams the September 1945 flood would be 6 feet above the Intermediate Regional Flood.

Figures 13 through 17 show the heights that would be reached by the Standard Project Flood and Intermediate Regional Flood on facilities presently existing within the flood plain near Fayetteville.

FIGURE 13. FLOOD HEIGHTS ALONG CAPE FEAR RIVER

Arrows show heights of the Standard Project Flood and the Intermediate Regional Flood near the left bank on Person Street.

FIGURE 14. FLOOD HEIGHTS ON CROSS CREEK

Arrows show heights of the Standard Project Flood and the Intermediate Regional Flood just below the intersection of Bragg Boulevard and West Rowan Streets.

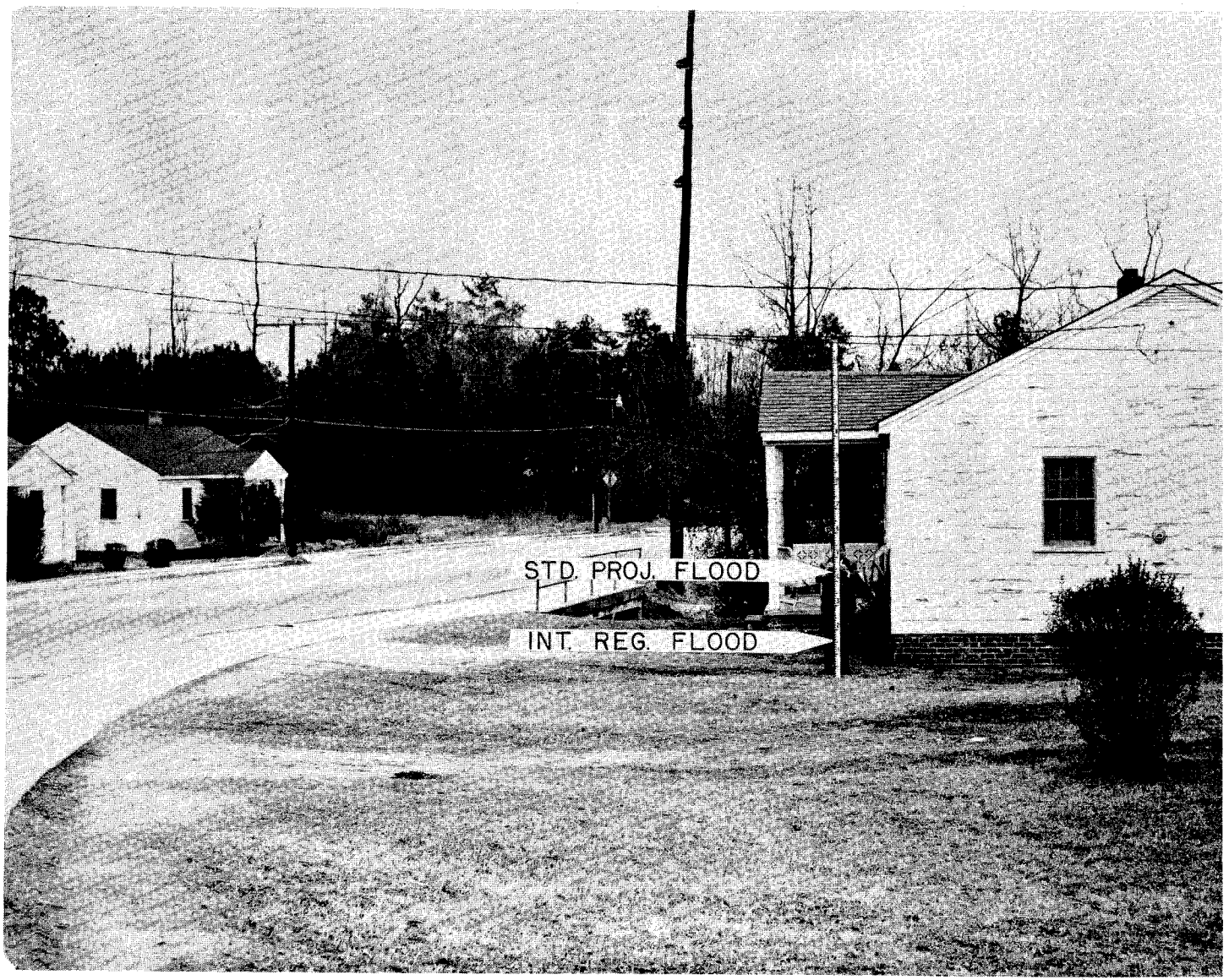


FIGURE 15. FLOOD HEIGHTS ON LITTLE CROSS CREEK

Arrows show heights of the Standard Project Flood and the Intermediate Regional Flood at Washington Street.

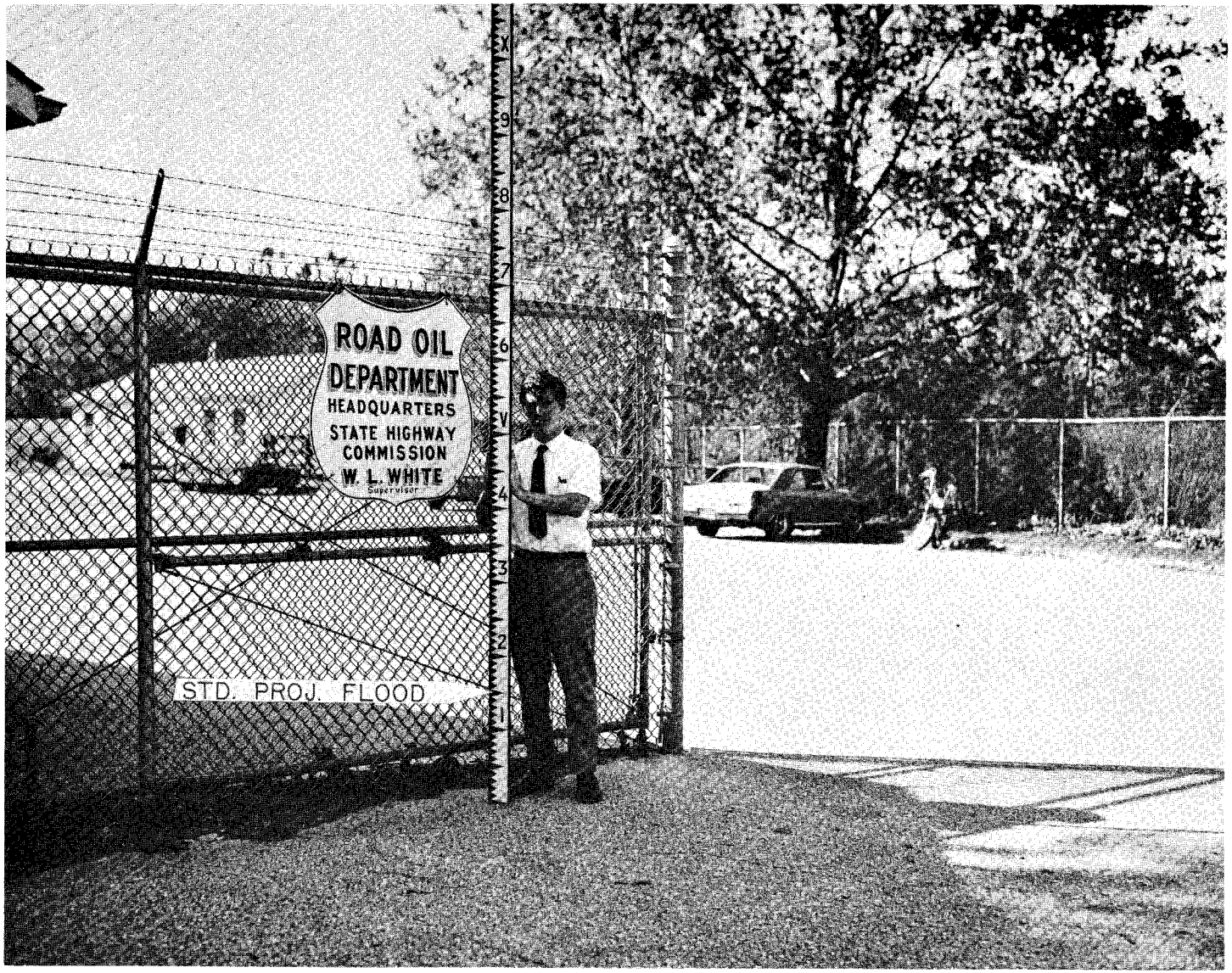


FIGURE 16. FLOOD HEIGHT ALONG BLOUNTS CREEK
Arrow shows height of the Standard Project Flood just upstream from Gillespie Street.

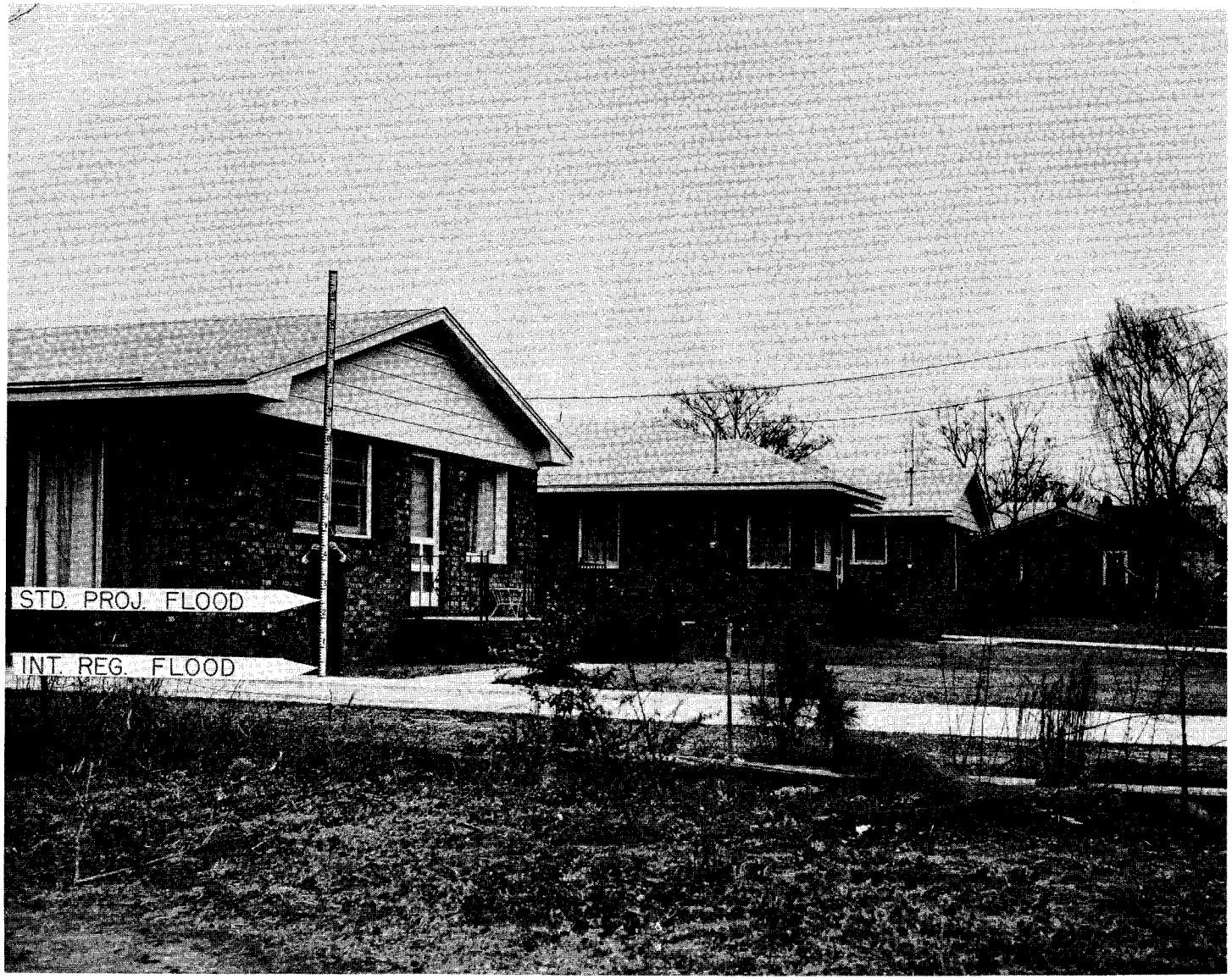


FIGURE 17. FLOOD HEIGHTS ON BRANSON CREEK

Arrows show heights of the Standard Project Flood and the Intermediate Regional Flood just upstream from Weiss Avenue.

Velocities, Rates of Rise, and Duration

Water velocities during floods depend largely upon the size and shape of the cross section, the condition of the stream, and the bed slope, all of which vary on different streams and at different locations on the same stream.

Table 17 lists the maximum velocities that would occur in the main channel and overbank areas of Cape Fear River and streams of the Cross Creek watershed during the Intermediate Regional Floods.

TABLE 17

INTERMEDIATE REGIONAL FLOODS

MAXIMUM VELOCITIES

Stream	Location	Maximum Velocities	
		Channel	Overbank
		ft. per sec.	ft. per sec.
Cape Fear River	Mile 147.60	5.1	
	Mile 143.25		1.5
Cross Creek	Mile 0.85	8.2	
	Mile 2.10		2.2
Little Cross Creek	Mile 0.31	7.7	2.5
Blounts Creek	Mile 0.08	7.7	2.1
Branson Creek	Mile 0.79	5.8	1.4

Table 18 lists the maximum velocities that would occur in the main channel and overbank areas of Cape Fear River and streams of the Cross Creek watershed during the Standard Project Floods.

TABLE 18

STANDARD PROJECT FLOODS

MAXIMUM VELOCITIES

Stream	Location	Maximum Velocities	
		Channel ft. per sec.	Overbank ft. per sec.
Cape Fear River	Mile 146.80	5.4	
	Mile 147.60		1.1
Cross Creek	Mile 0.85	10.1	
	Mile 2.10		3.2
Little Cross Creek	Mile 0.31	8.5	4.9
Blounts Creek	Mile 1.31	10.5	
	Mile 0.08		2.8
Branson Creek	Mile 0.79	6.5	1.8

Table 19 lists the total rise above low water to the crest of the Intermediate Regional Flood, the maximum rate of rise, and the duration above bankfull stage of the Intermediate Regional Flood for Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek.

TABLE 19

INTERMEDIATE REGIONAL FLOODS

RATES OF RISE AND DURATION

Stream	Location	Height of Rise feet	Time of Rise hours	Maximum Rate of Rise ft. per hr.	Duration above Bankfull hours
Cape Fear River	Mile 145.0	42	108	0.8	155
Cross Creek	Mouth	14	39	0.6	36
Little Cross Creek	Below Glenville Dam	12	30	0.9	33
Blounts Creek	Mouth	12	31	0.9	33
Branson Creek	Mouth	12	29	1.0	33

Table 20 lists the total rise above low water to the crest of the Standard Project Flood, the maximum rate of rise, and the duration above bankfull stage of the Standard Project Flood for Cape Fear River, Cross Creek, Little Cross Creek, Blounts Creek, and Branson Creek.

TABLE 20

STANDARD PROJECT FLOODS

RATES OF RISE AND DURATION

Stream	Location	Height of Rise feet	Time of Rise hours	Maximum Rate of Rise ft. per hr.	Duration above Bankfull hours
Cape Fear River	Mile 145.0	55	126	0.8	180
Cross Creek	Mouth	19	39	1.0	45
Little Cross Creek	Below Glenville Dam	13	30	1.2	39
Blounts Creek	Mouth	14	31	1.2	39
Branson Creek	Mouth	12	29	1.2	38

These rapid rates of rise and high stream velocities in combination with deep, fairly long-duration flooding would create a hazardous situation in developed areas. Velocities greater than 3 feet per second, combined with depths of 3 feet or greater, are generally considered hazardous.

GLOSSARY OF TERMS

Flood. An overflow of lands not normally covered by water and that are used or usable by man. Floods have two essential characteristics: The inundation of land is temporary; and the land is adjacent to and inundated by overflow from a river or stream or an ocean, lake, or other body of standing water.

Normally, a "flood" is considered as any temporary rise in streamflow or stage, but not the ponding of surface water, that results in significant adverse effects in the vicinity. Adverse effects may include damages from overflow of land areas, temporary backwater effects in sewers and local drainage channels, creation of unsanitary conditions or other unfavorable situations by deposition of materials in stream channels during flood recessions, rise of ground water coincident with increased streamflow, and other problems.

Flood crest. The maximum stage or elevation reached by the waters of a flood at a given location.

Flood Peak. The maximum instantaneous discharge of a flood at a given location. It usually occurs at or near the time of the flood crest.

Flood Plain. The relatively flat area or lowlands adjoining the channel of a river, stream or watercourse or ocean, lake, or other body of standing water, which has been or may be covered by floodwater.

Flood Profile. A graph showing the relationship of water surface elevation to location, the latter generally expressed as distance above mouth for a stream of water flowing in an open channel. It is generally drawn to show surface elevation for the crest of a specific flood, but may be prepared for conditions at a given time or stage.

Flood Stage. The stage or elevation at which overflow of the natural banks of a stream or body of water begins in the reach or area in which the elevation is measured.

Head Loss. The effect of obstructions, such as narrow bridge openings or buildings that limit the area through which water must flow, raising the surface of the water upstream from the obstruction.

Intermediate Regional Flood. A flood having an average frequency of occurrence in the order of once in 100 years although the flood may occur in any year. It is based on statistical analyses of streamflow records available for the watershed and analyses of rainfall and runoff characteristics in the "general region of the watershed."

Left Bank. The bank on the left side of a river, stream, or watercourse, looking downstream.

Low Steel (or Underclearance). See "underclearance."

Right Bank. The bank on the right side of a river, stream, or watercourse, looking downstream.

Standard Project Flood. The flood that may be expected from the most severe combination of meteorological and hydrological conditions that is considered reasonably characteristic of the geographical area in which the drainage basin is located, excluding extremely rare combinations. Peak discharges for these floods are generally about 40% to 60% of the Probable Maximum Floods for the same basins. Such floods, as used by the Corps of Engineers, are intended as practicable expressions of the degree of protection that should be sought in the design of flood control works, the failure of which might be disastrous.

Underclearance. The lowest point of a bridge or other structure over or across a river, stream, or watercourse that limits the opening through which water flows. This is referred to as "low steel" in some regions.

AUTHORITY, ACKNOWLEDGEMENTS, AND INTERPRETATION OF DATA

This report has been prepared in accordance with the authority granted by Section 206 of the Flood Control Act of 1960 (P.L. 86-645), as amended.

* * *

The assistance and cooperation of the Environmental Science Services Administration-Weather Bureau, U. S. Geological Survey, North Carolina Department of Water and Air Resources, the City of Fayetteville, and private citizens in supplying useful data, are appreciated.

* * *

This report presents the local flood situation for Fayetteville. The Wilmington District of the Corps of Engineers will, upon request, provide interpretation and limited technical assistance in the application of data presented herein, and will provide other available flood data related thereto.

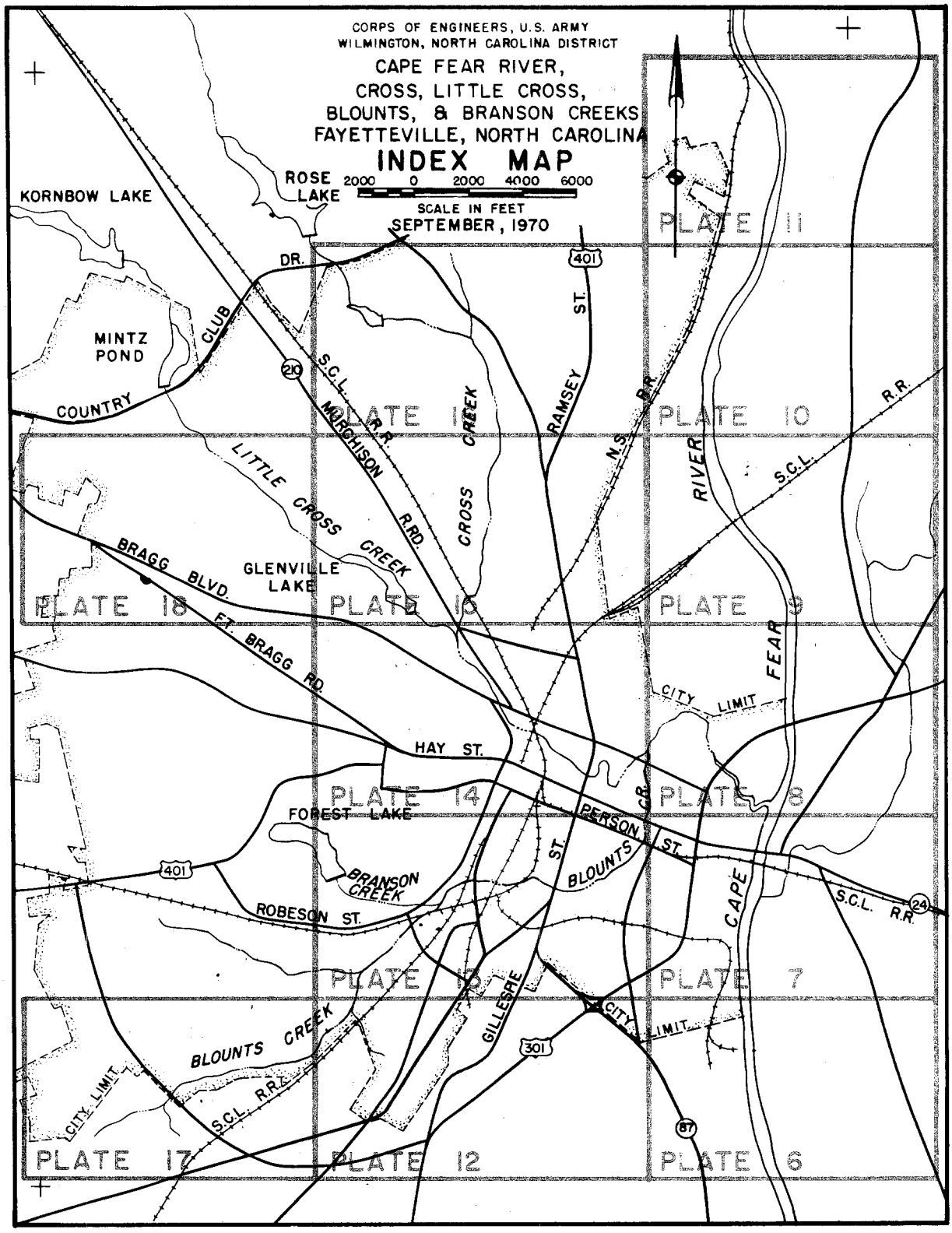
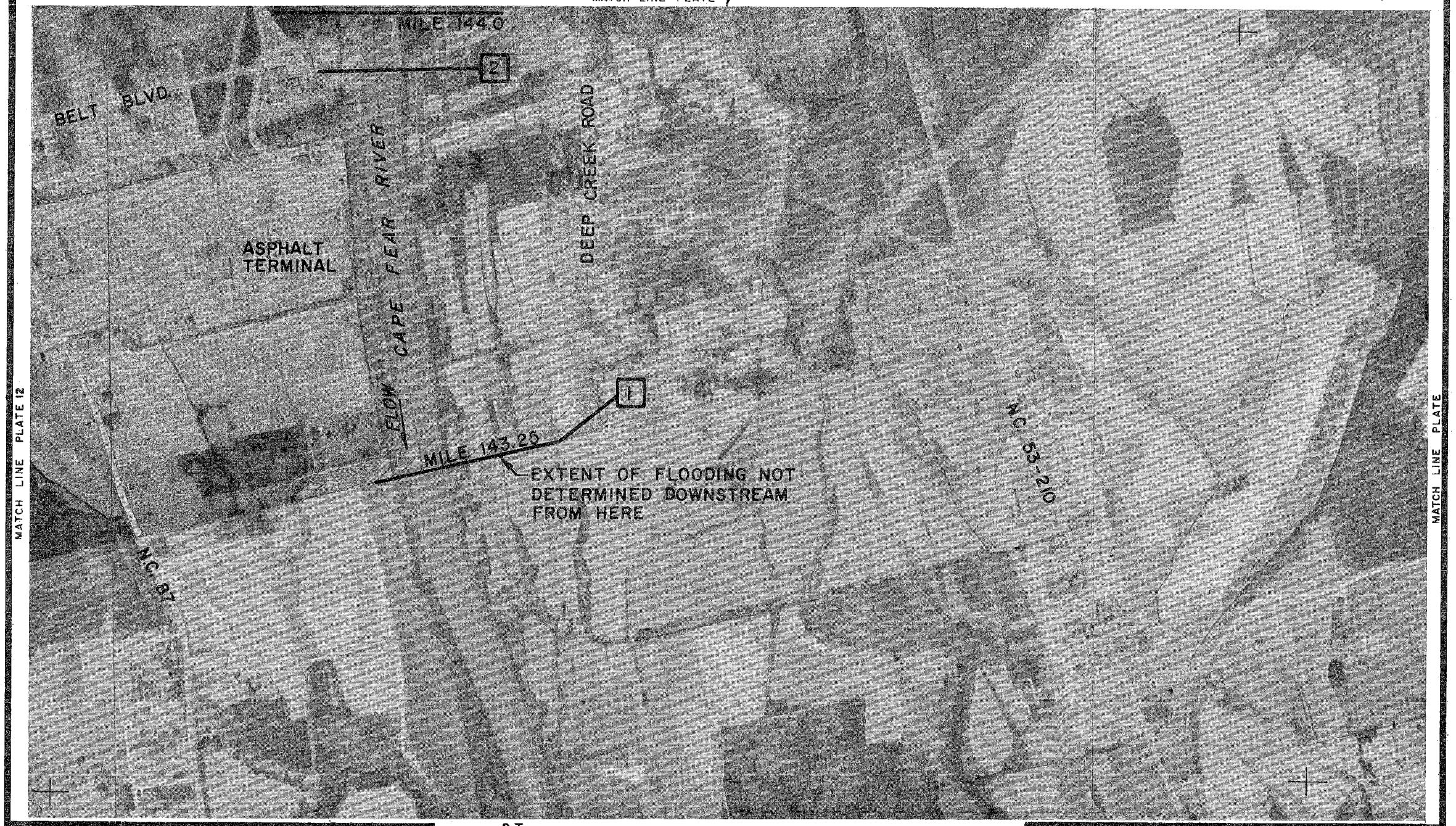

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT
CAPE FEAR RIVER,
CROSS, LITTLE CROSS,
BLOUNTS, & BRANSON CREEKS
FAYETTEVILLE, NORTH CAROLINA
INDEX MAP
2000 0 2000 4000 6000
SCALE IN FEET
SEPTEMBER, 1970
KORNBOW LAKE
ROSE LAKE
MINTZ POND
COUNTRY CLUB DR.
MURCHISON RRD.
S.C.L. R.R.
LITTLE CROSS CREEK
CROSS CREEK
RAMSEY ST.
N.S. R.R.
CAPE FEAR RIVER
S.C.L. R.R.
BRAGG BLVD.
GLENVILLE LAKE
EX. BRAGG RD.
CITY LIMIT
HAY ST.
FORT BRAGG
PERSON ST.
BLOUNTS ST.
FOREST LAKE
BRANSON CREEK
ROBESON ST.
CAPE FEAR
S.C.L. R.R.
GILLESPIE
BLOUNTS CREEK
CITY LIMIT
S.C.L. R.R.
CITY LIMIT
PLATE 11
PLATE 10
PLATE 9
PLATE 8
PLATE 7
PLATE 6
PLATE 12
PLATE 13
PLATE 14
PLATE 15
PLATE 16
PLATE 17
401
210
401
301
87
24

PLATE 5

MATCH LINE PLATE 7

MATCH LINE PLATE 12

MATCH LINE PLATE



LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
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FLOODED AREA

CAPE FEAR RIVER

FAYETTEVILLE, NORTH CAROLINA

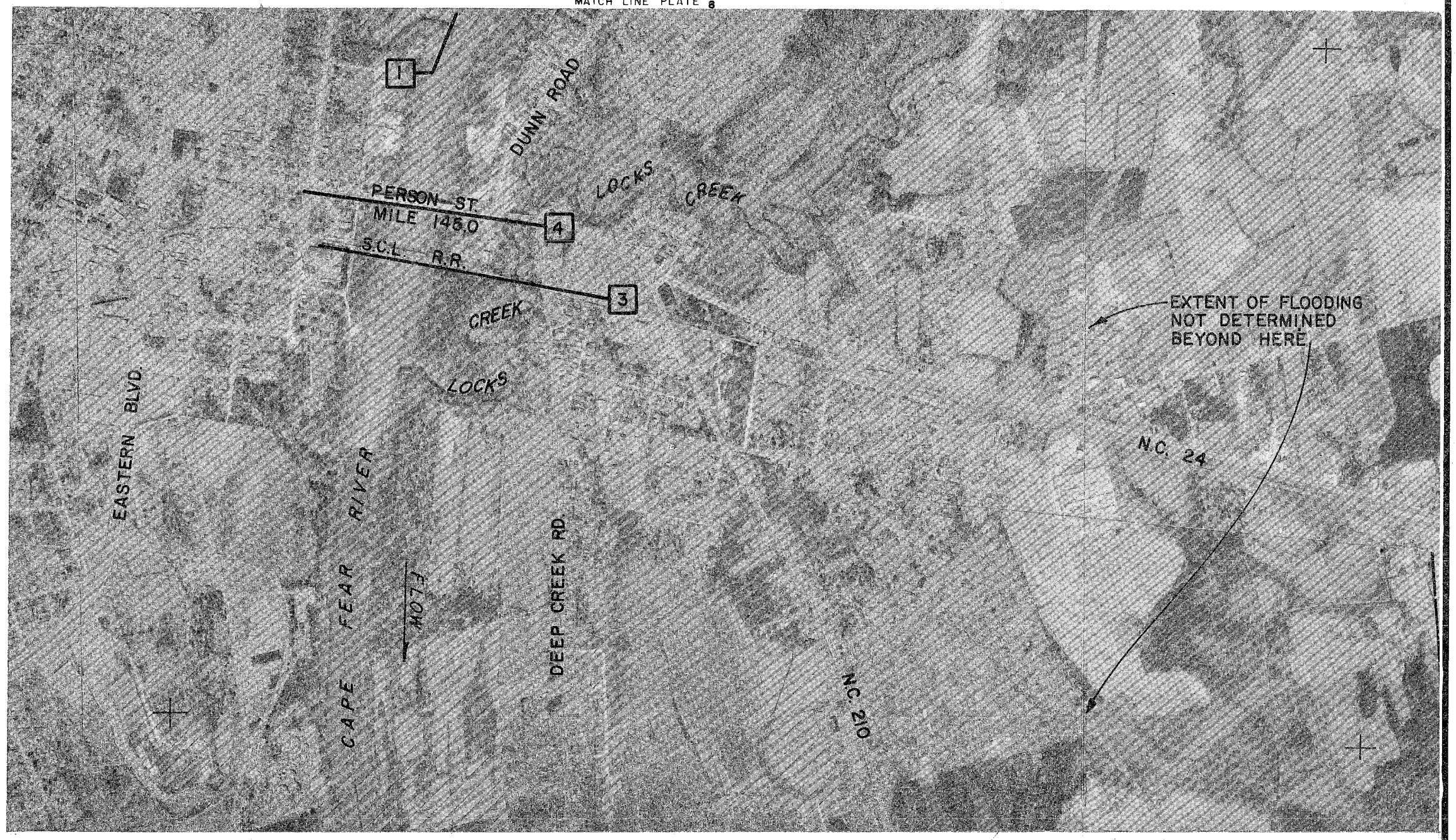
1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 6

MATCH LINE PLATE 8



MATCH LINE PLATE 13

MATCH LINE PLATE 6

LEGEND

- STANDARD PROJECT FLOOD
- INTERMEDIATE REGIONAL FLOOD
- 10 — CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

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FLOODED AREA
CAPE FEAR RIVER AND CROSS CREEK
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000
SCALE IN FEET

SEPTEMBER, 1970

PLATE 7

MATCH LINE PLATE

MATCH LINE PLATE 14

MATCH LINE PLATE

MATCH LINE PLATE 7

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 — CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
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FLOODED AREA
CAPE FEAR RIVER AND CROSS CREEK
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 8

MATCH LINE PLATE 10

MATCH LINE PLATE 15

MILE 148.0

MILE 147.0

FEAR RIVER

CAPE FEAR R.R.

RIVER ROAD

EXTENT OF FLOODING NOT DETERMINED BEYOND HERE

8

7

6

FLOW

MATCH LINE PLATE 8

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA
CAPE FEAR RIVER

FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 9

MATCH LINE PLATE 11

MATCH LINE PLATE 16

MATCH LINE PLATE 9

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 — CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA
CAPE FEAR RIVER

FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 10

MATCH LINE PLATE 10

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA

CAPE FEAR RIVER

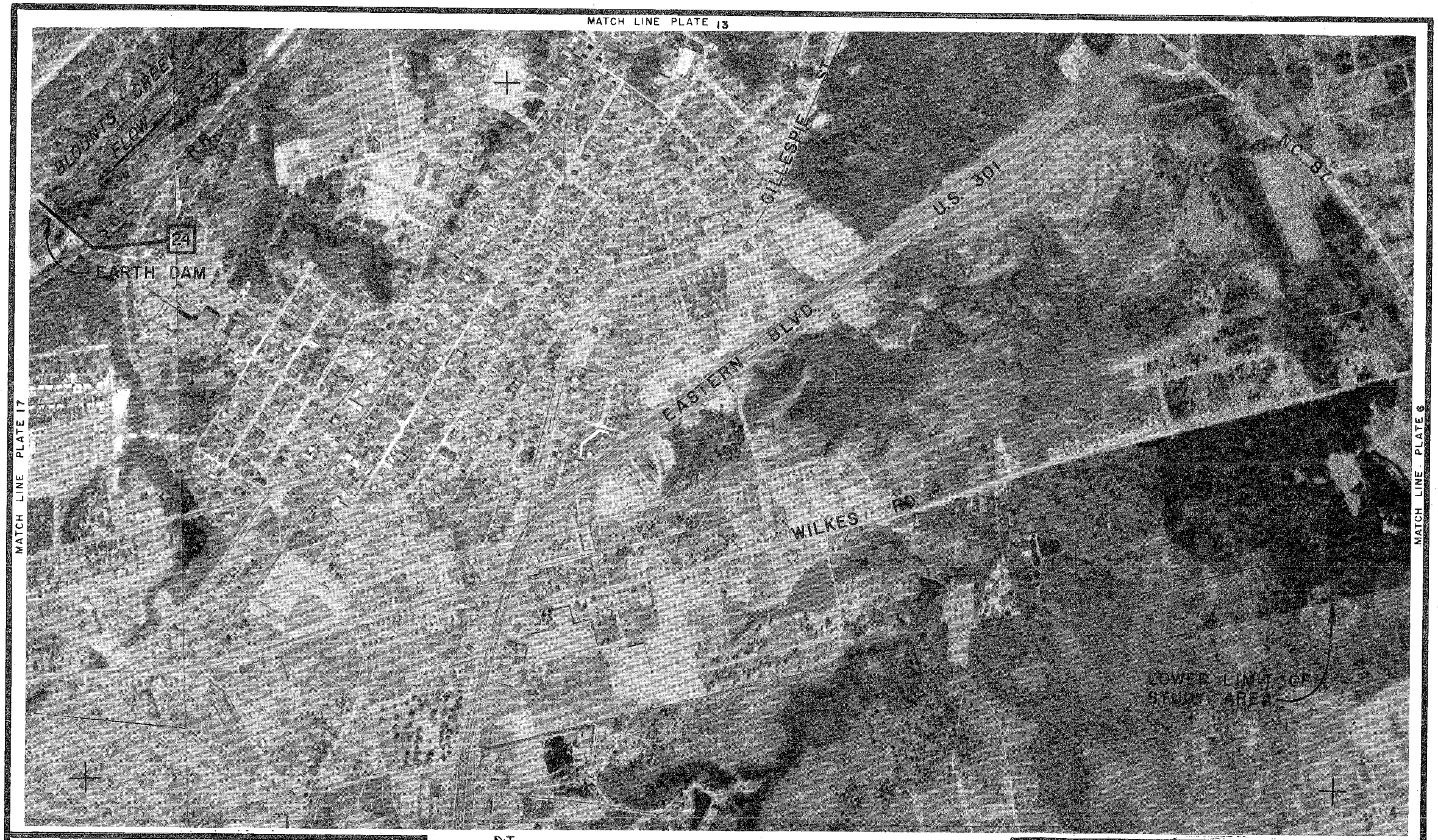
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 11



LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA
CAPE FEAR RIVER AND BLOUNTS CREEK
FAYETTEVILLE, NORTH CAROLINA

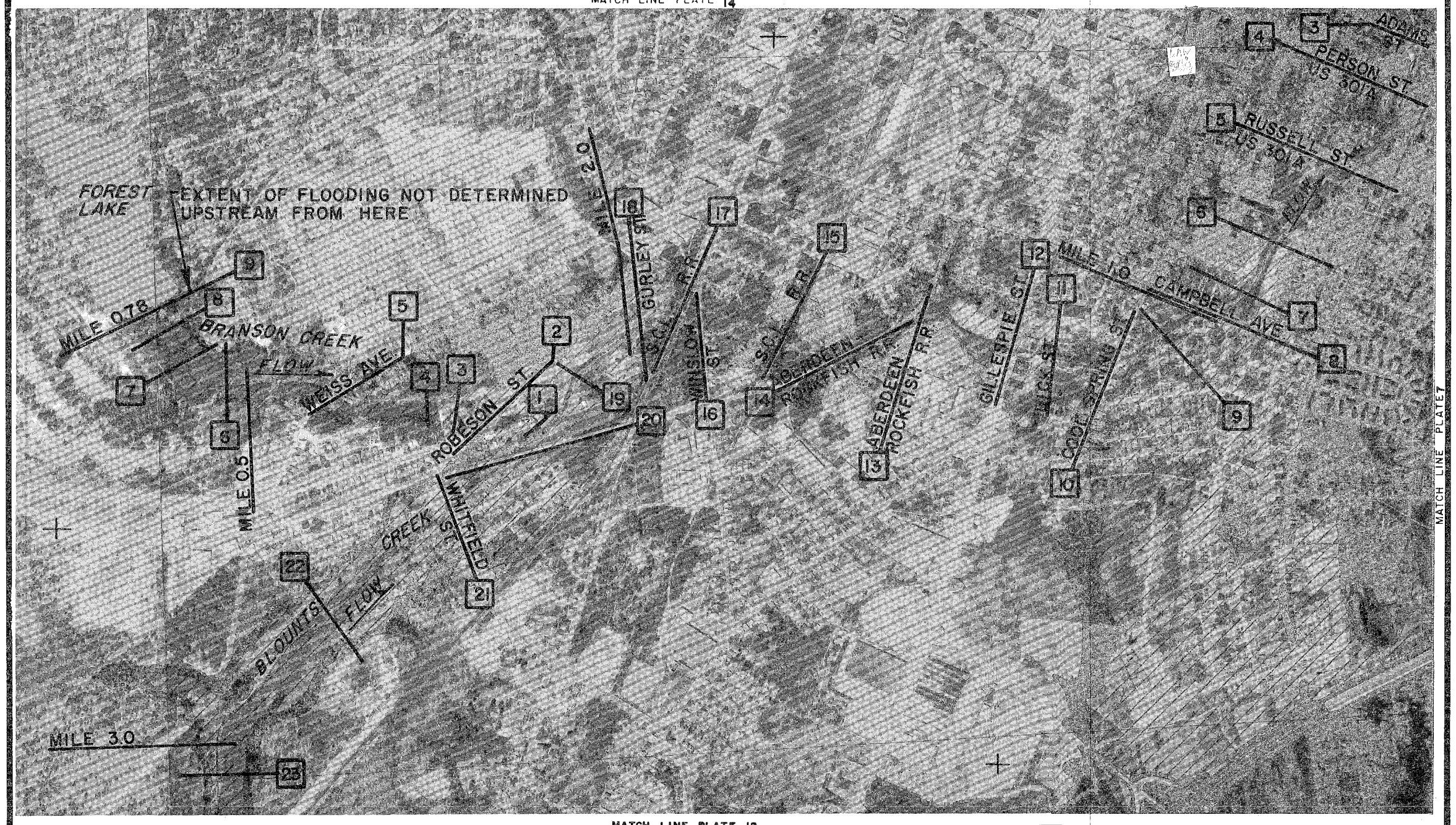
1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 12

MATCH LINE PLATE 14



MATCH LINE PLATE 12

MATCH LINE PLATE 17

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 — CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

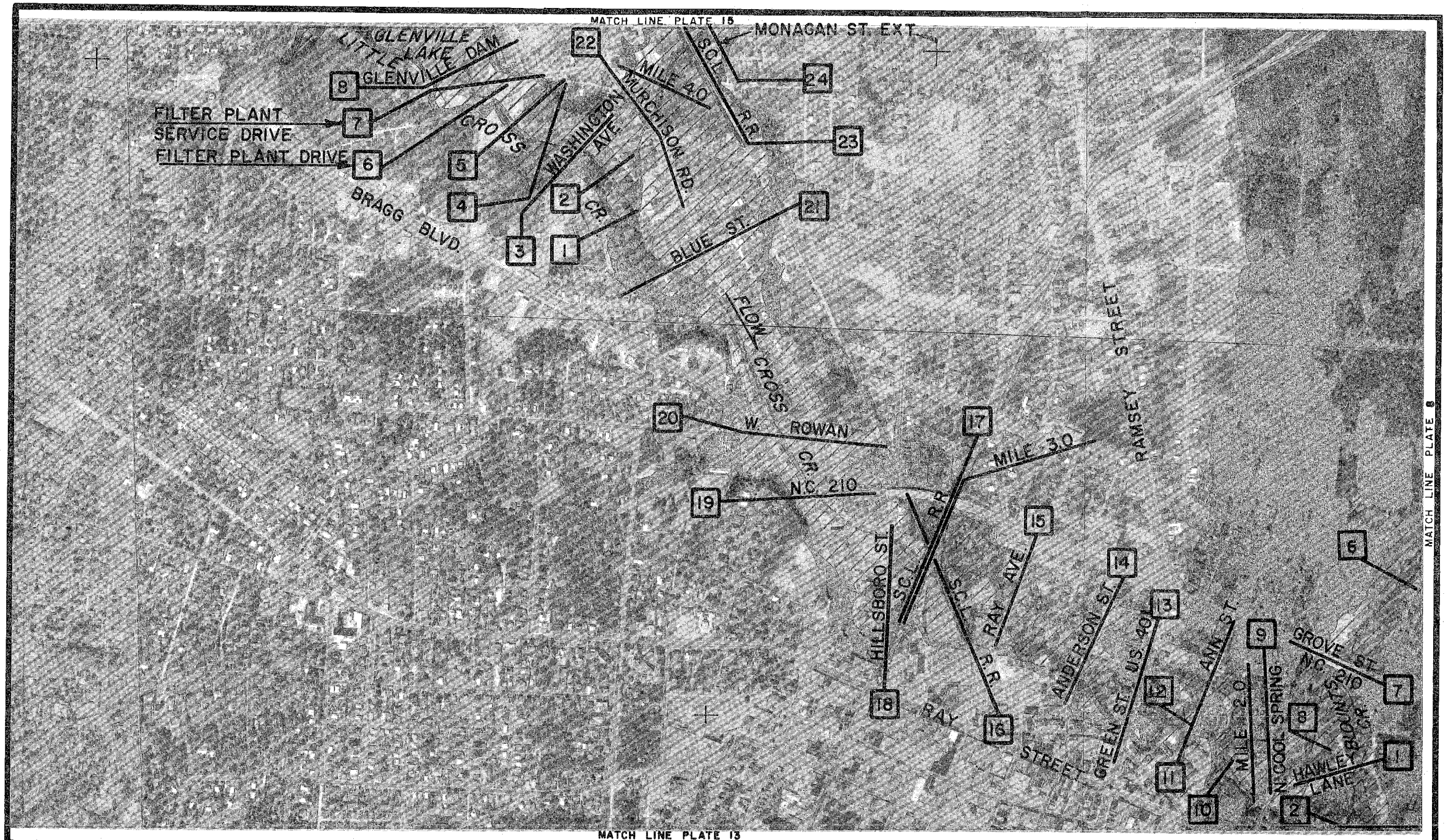
FLOODED AREA
CAPE FEAR RIVER, BLOUNTS, AND BRANSON CREEKS
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 13



LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

CORPS OF ENGINEERS, U.S ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA
CAPE FEAR RIVER, BLOUNTS, CROSS, & LITTLE CROSS CR.
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000
SCALE IN FEET

SEPTEMBER, 1970

PLATE 14

MATCH LINE PLATE 18

MATCH LINE PLATE 18

MATCH LINE PLATE 9

MATCH LINE PLATE 14

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA
CAPE FEAR RIVER, CROSS, & LITTLE CROSS CREEK
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 15

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA
CROSS CREEK

FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 16

LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOODED AREA
BLOUNTS CREEK

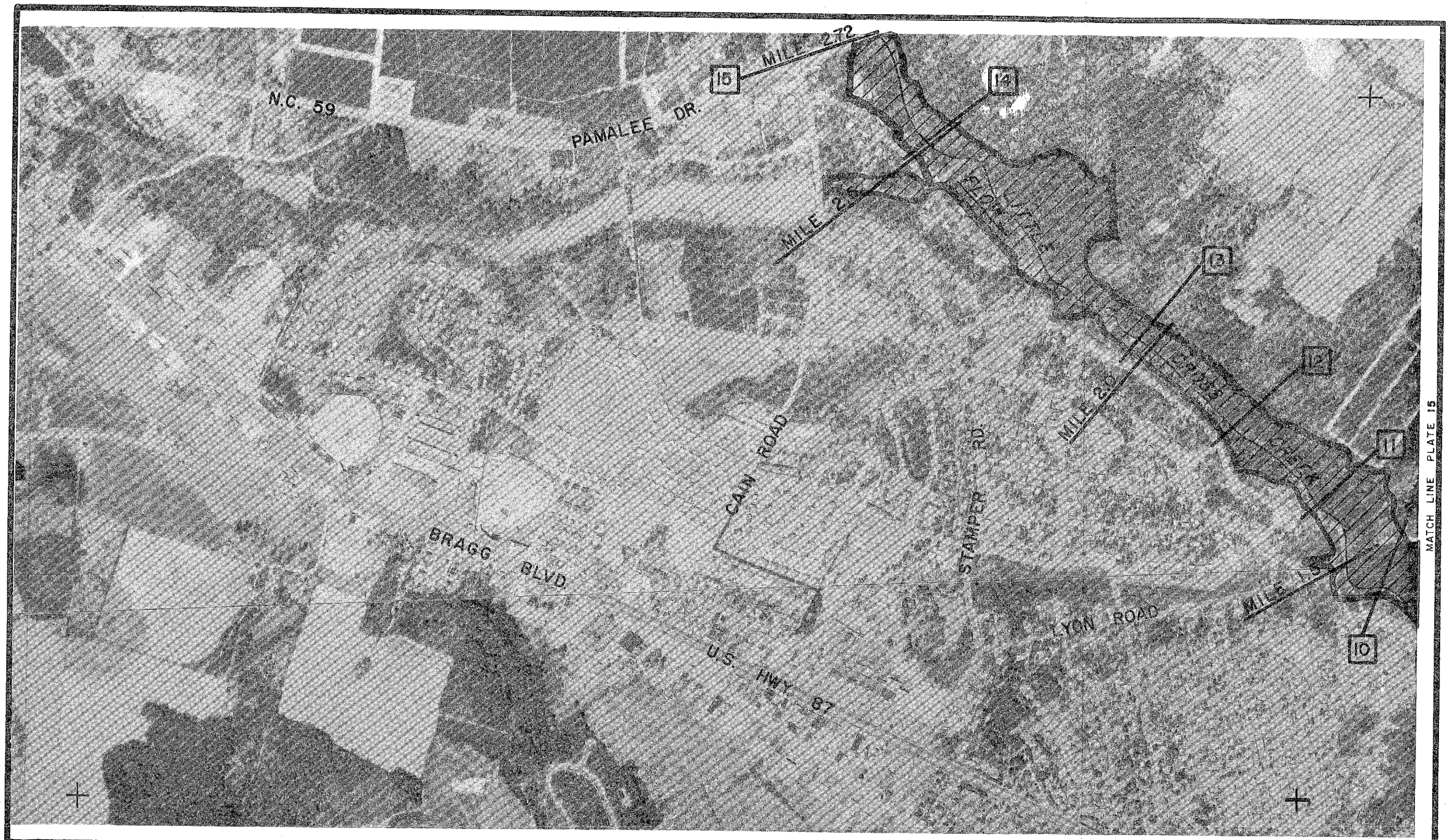
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 17



LEGEND

STANDARD PROJECT FLOOD

INTERMEDIATE REGIONAL FLOOD

10 — CROSS SECTION

NOTE: LIMITS OF OVERFLOWS INDICATED MAY VARY SLIGHTLY FROM ACTUAL LOCATIONS ON GROUND AS EXPLAINED IN THE REPORT

N

CORPS OF ENGINEERS, U.S ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

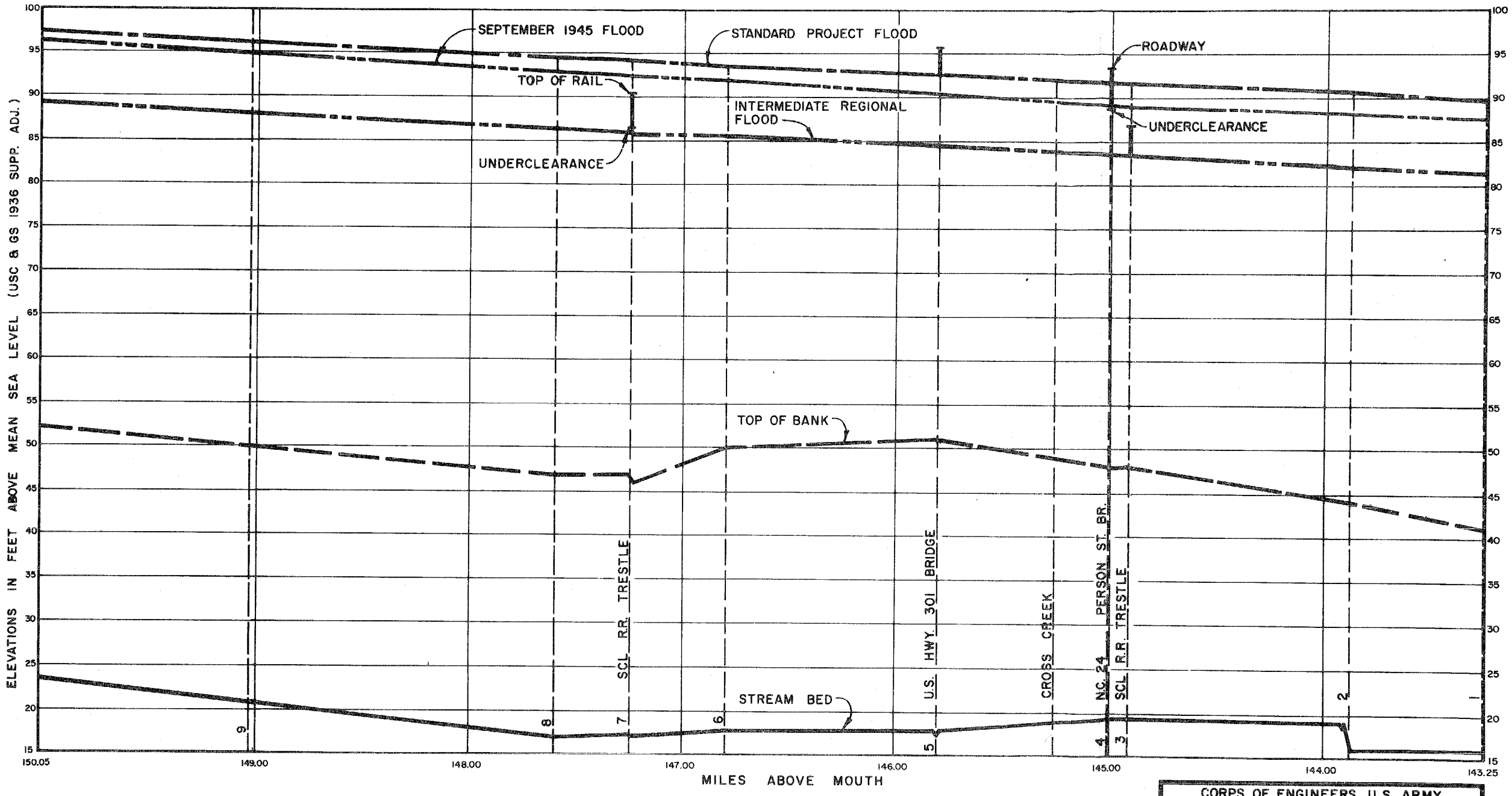
FLOODED AREA
LITTLE CROSS CREEK
FAYETTEVILLE, NORTH CAROLINA

1000 0 1000 2000

SCALE IN FEET

SEPTEMBER, 1970

PLATE 18



5 CROSS SECTION LOCATION AND NUMBER

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

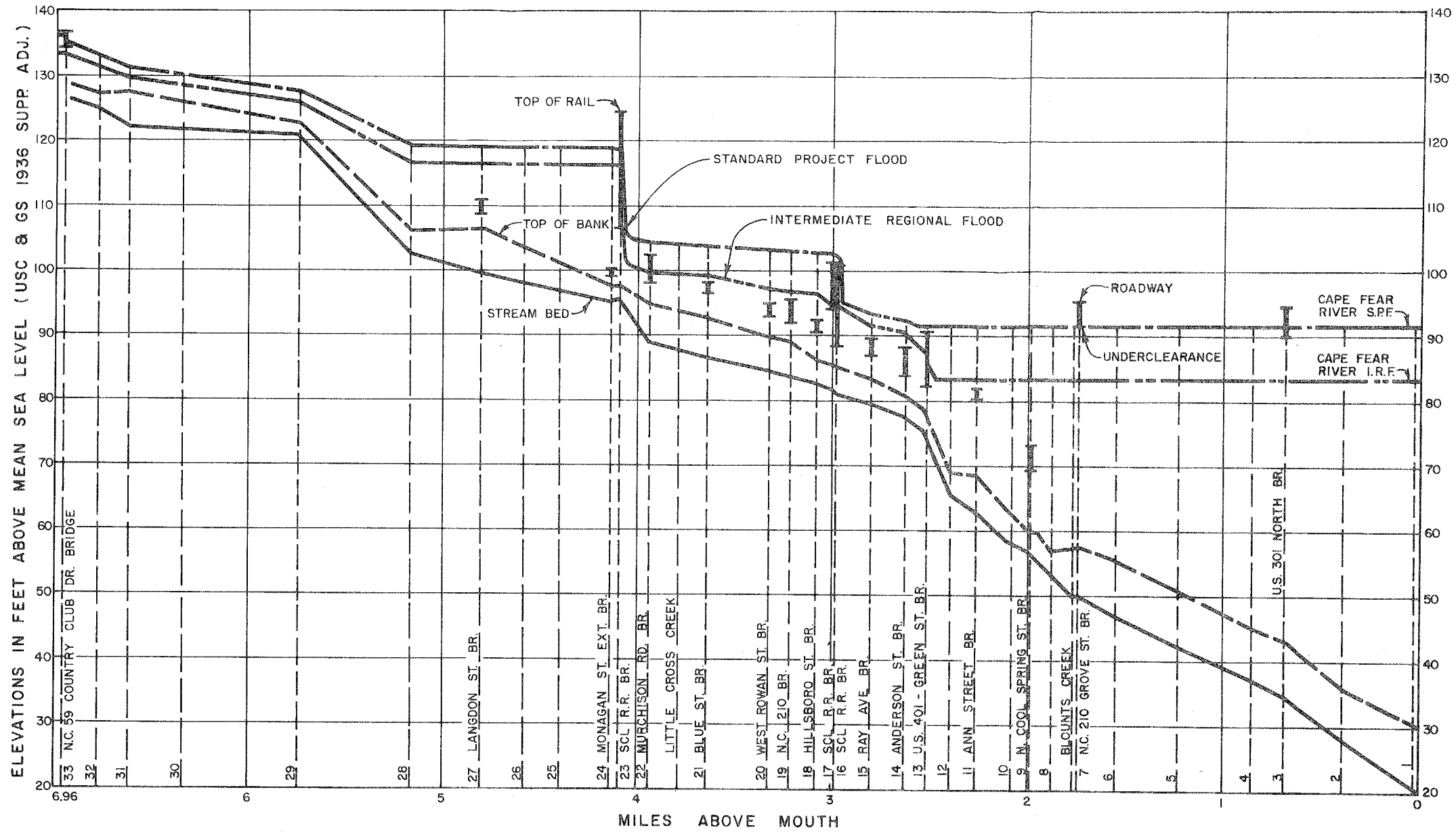
FLOOD PROFILES

CAPE FEAR RIVER

FAYETTEVILLE, NORTH CAROLINA

SEPTEMBER, 1970

PLATE 19



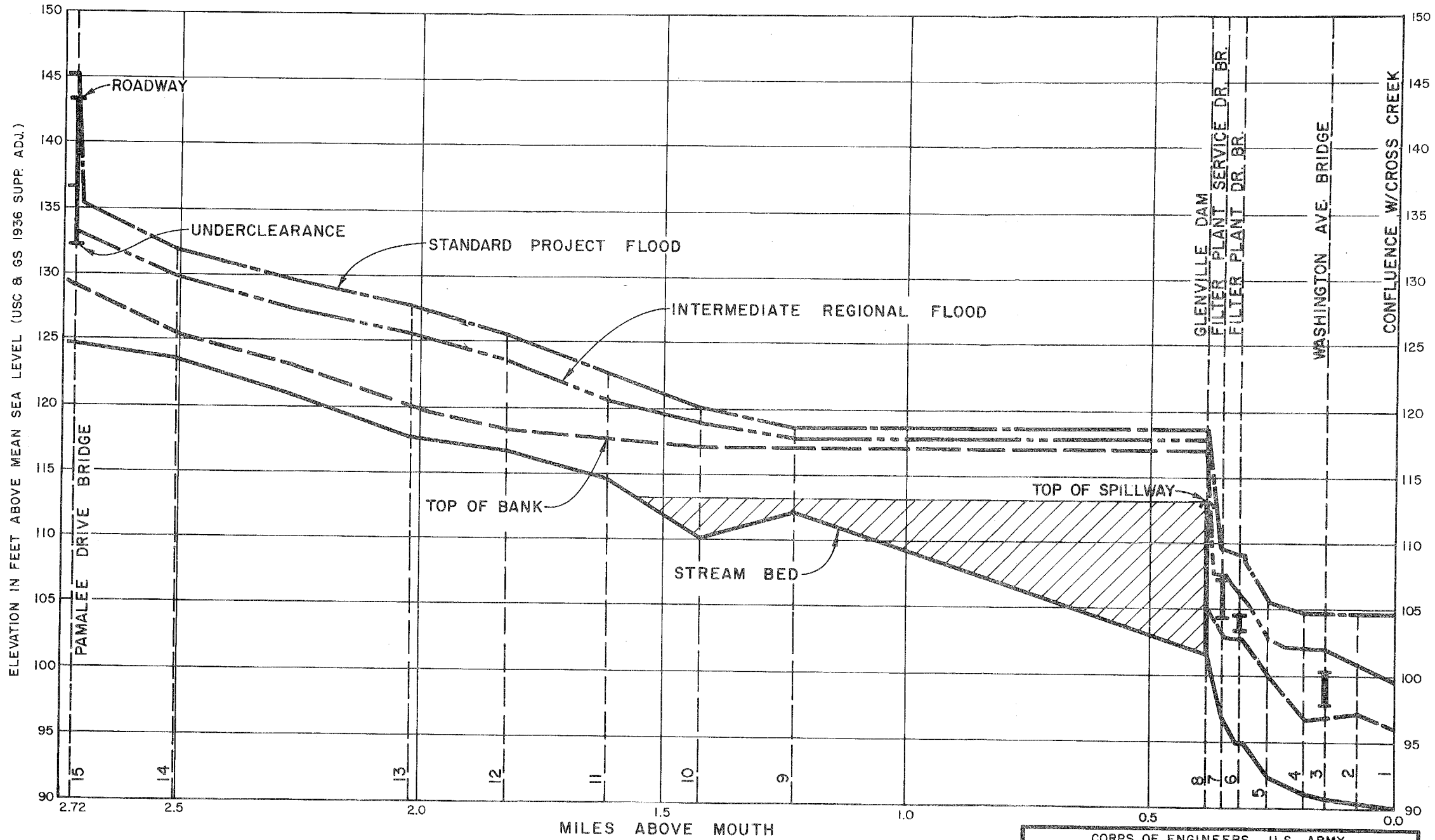
—5— CROSS SECTION LOCATION AND NUMBER

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOOD PROFILES
CROSS CREEK
FAYETTEVILLE, NORTH CAROLINA

SEPTEMBER, 1970

PLATE 20



—2— CROSS SECTION LOCATION AND NUMBER

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOOD PROFILES
LITTLE CROSS CREEK
FAYETTEVILLE, NORTH CAROLINA

SEPTEMBER, 1970

PLATE 21

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

FLOOD PROFILES
BLOUNTS CREEK
FAYETTEVILLE, NORTH CAROLINA

SEPTEMBER, 1970

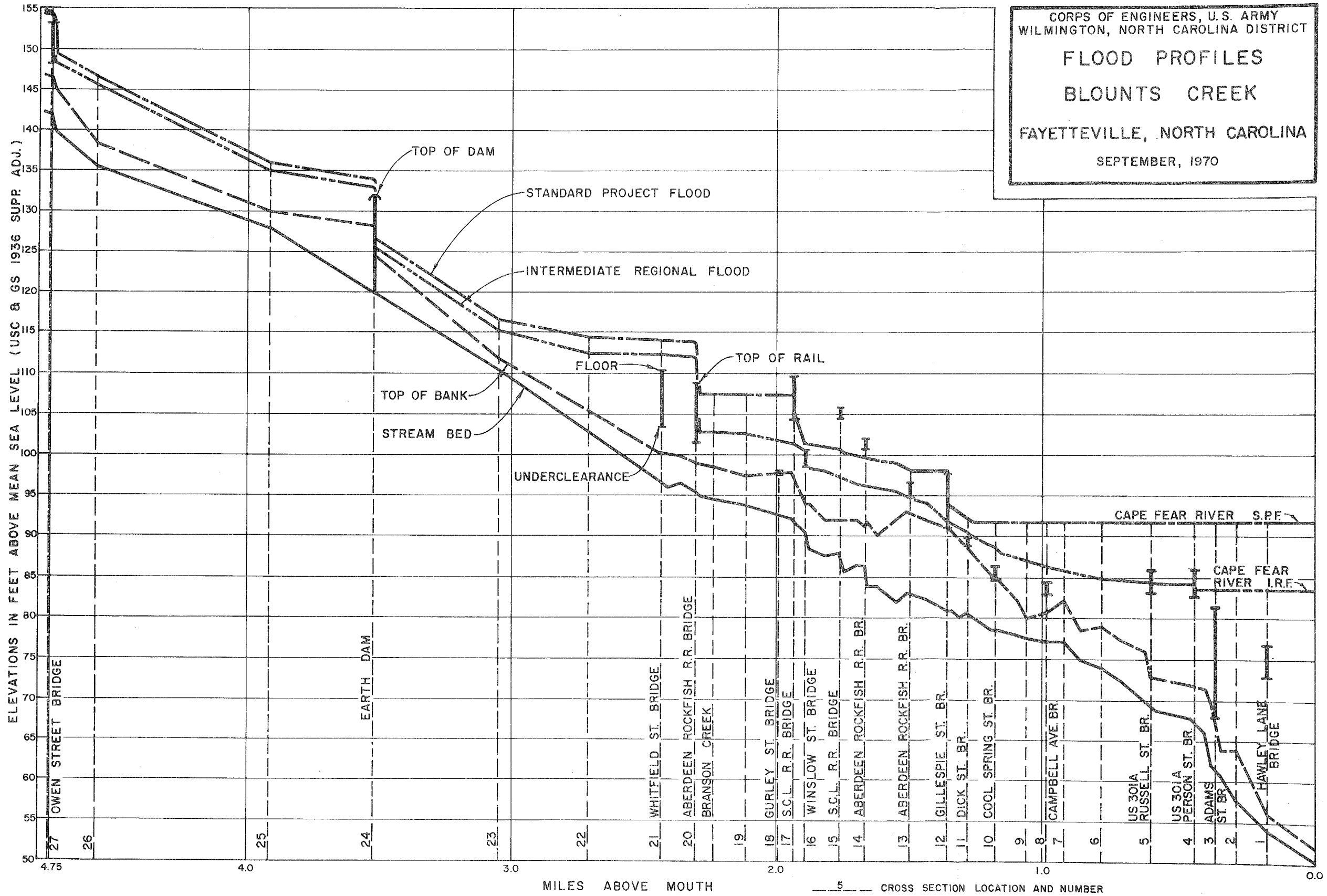
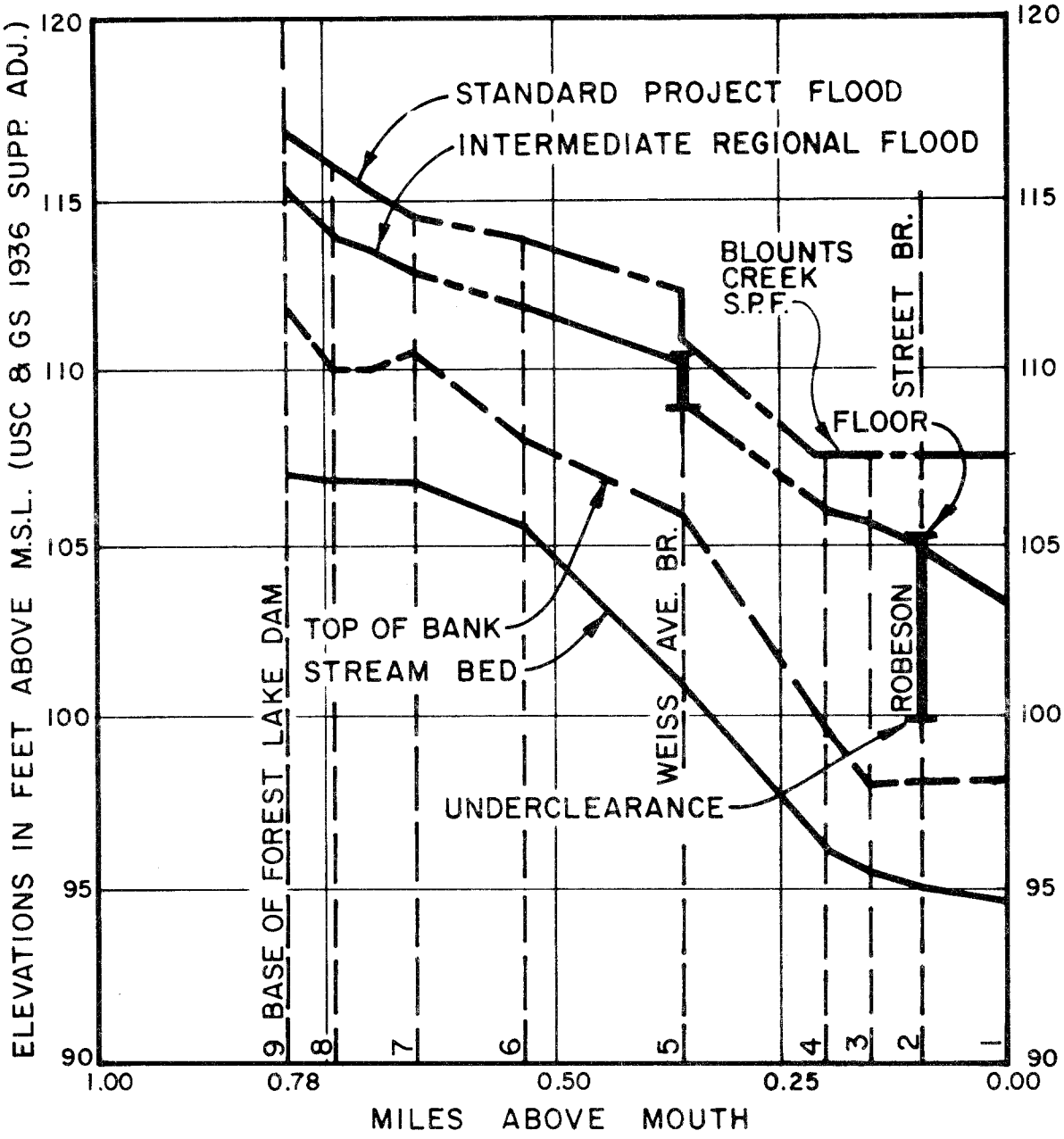


PLATE 22



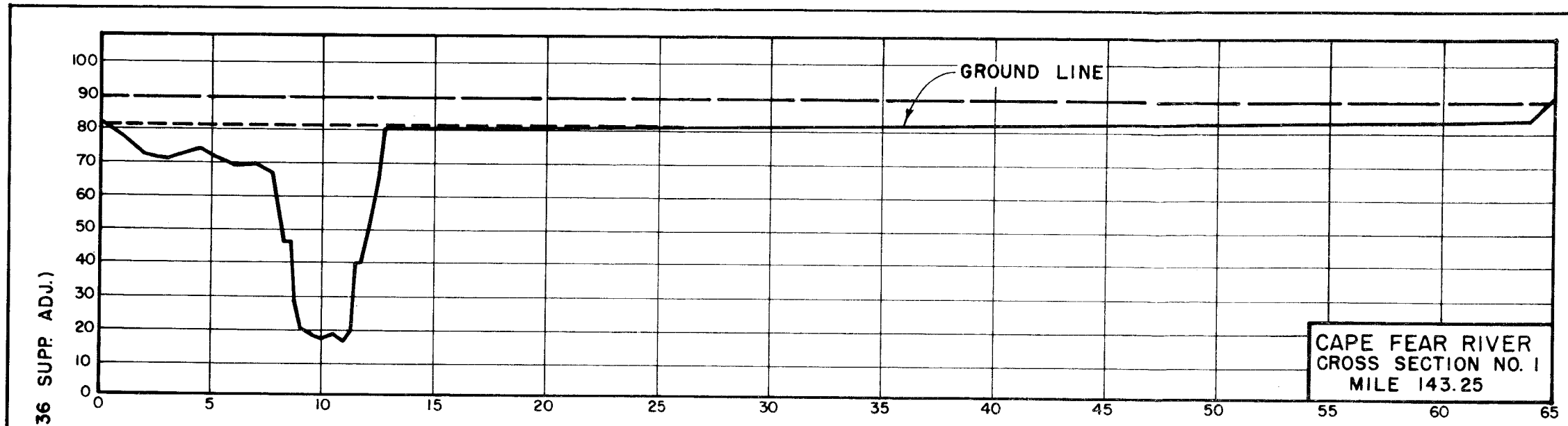
__2__ CROSS SECTION LOCATION AND NUMBER

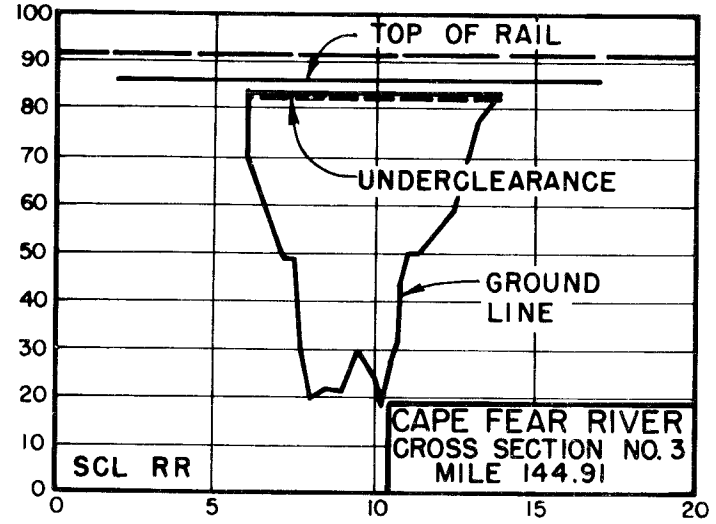
CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA DISTRICT

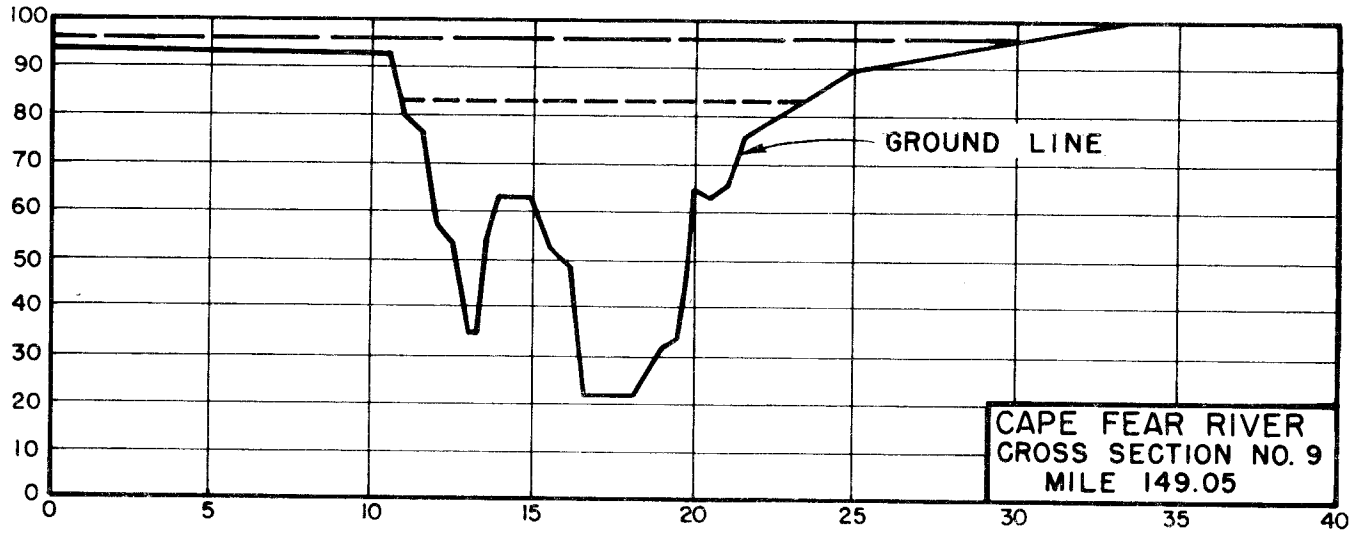
FLOOD PROFILES
BRANSON CREEK

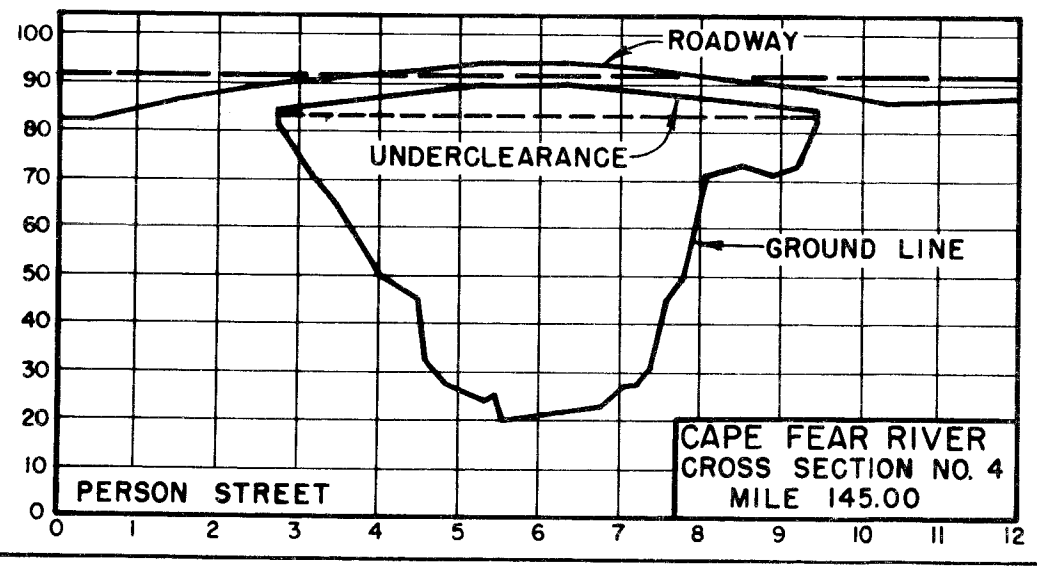
FAYETTEVILLE, NORTH CAROLINA
SEPTEMBER, 1970

PLATE 23









ELEVATION IN FEET ABOVE MSL (USC & GS 1936 SUPP. ADJ.)

LEGEND

——— ——— STANDARD PROJECT FLOOD

– – – – – – INTERMEDIATE REGIONAL FLOOD

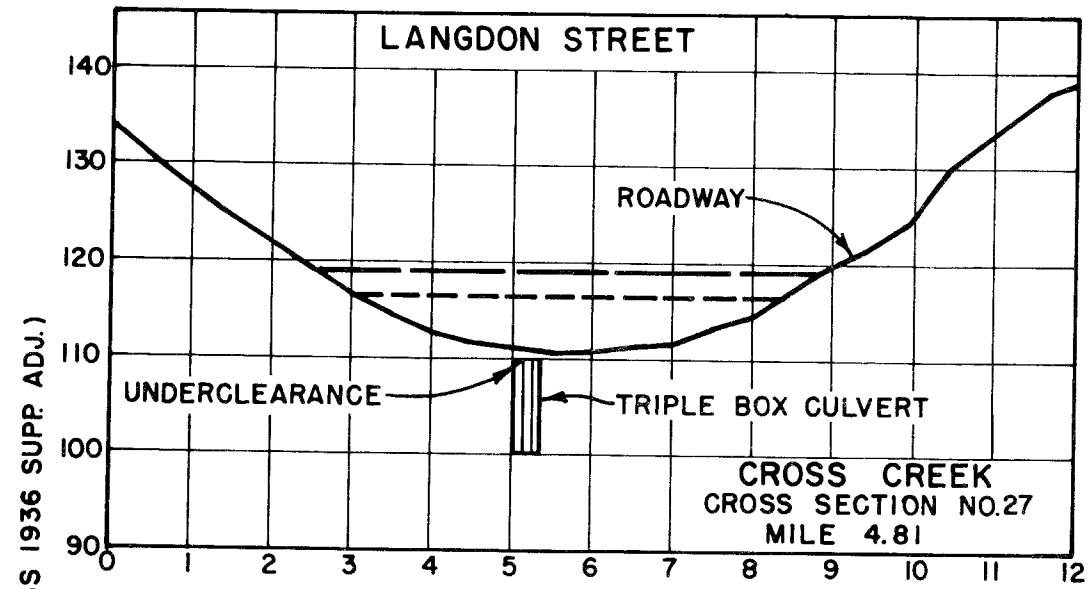
NOTE:
HORIZONTAL DISTANCES IN HUNDRED FEET.
CROSS SECTIONS TAKEN LOOKING DOWNSTREAM.

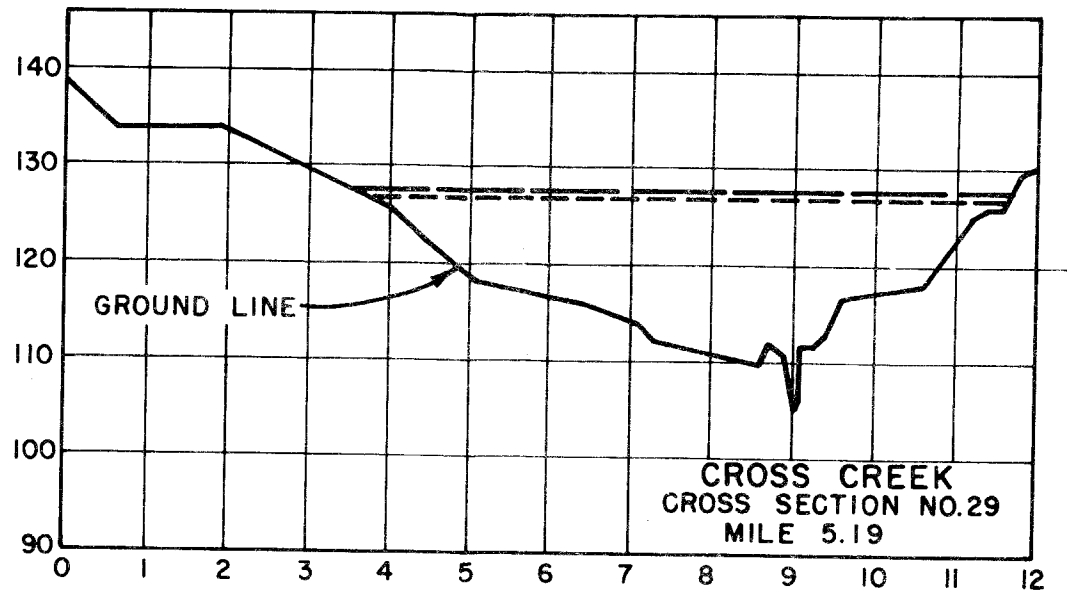
CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA

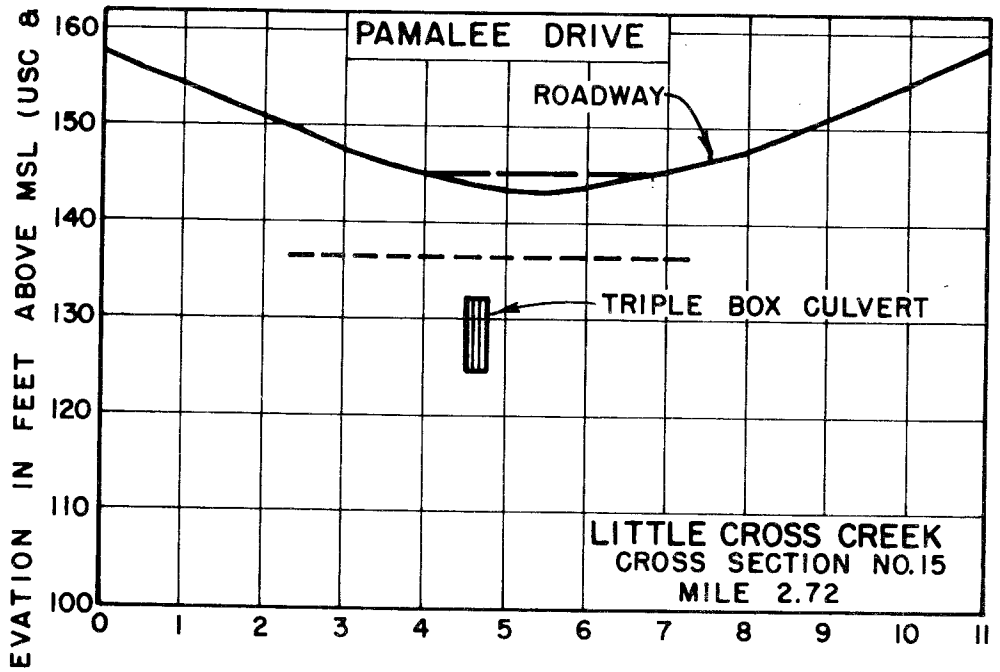
CROSS SECTIONS
CAPE FEAR RIVER
AT
FAYETTEVILLE, NORTH CAROLINA

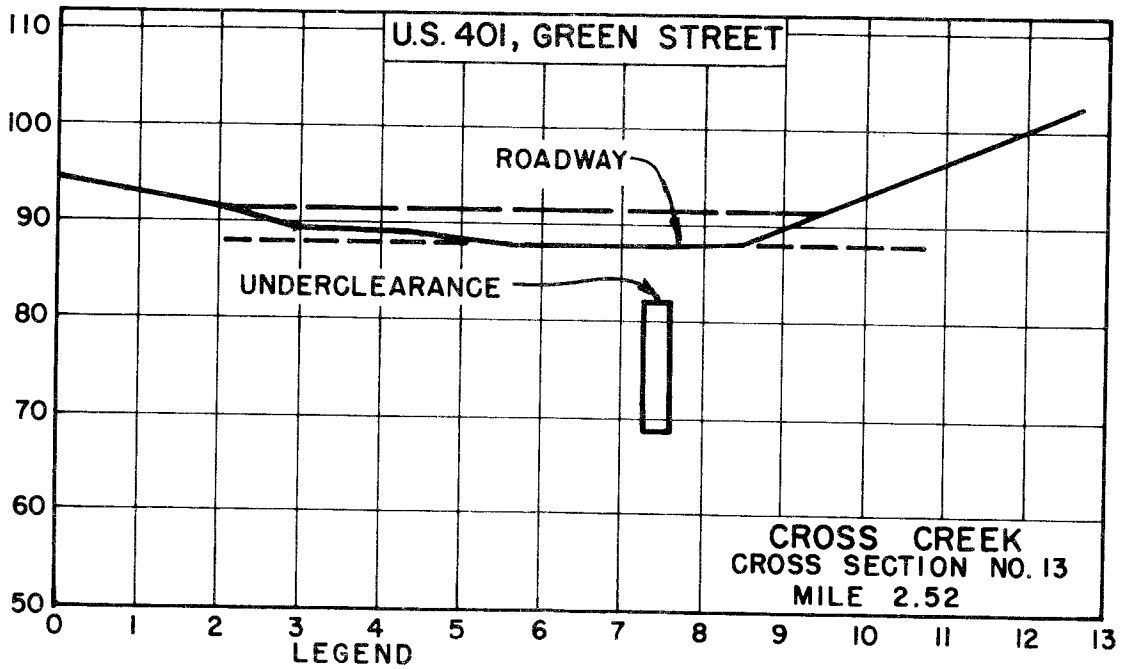
SEPTEMBER, 1970

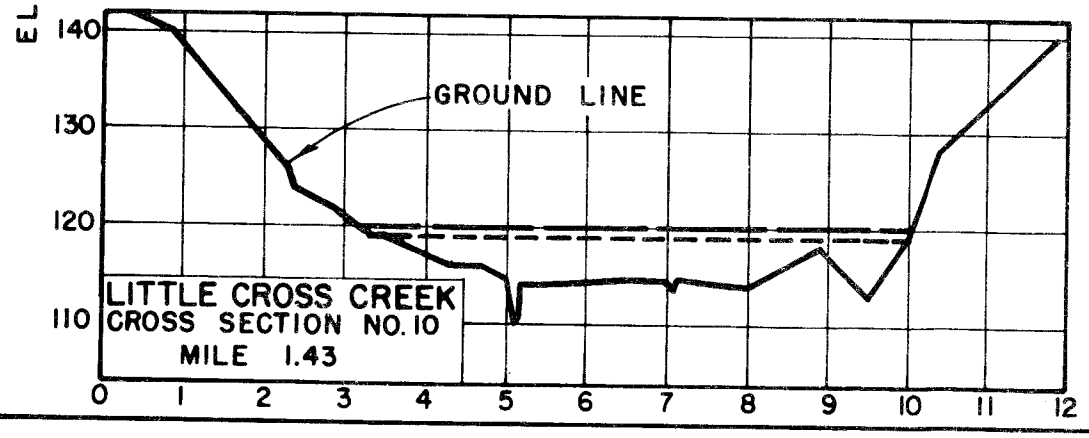
PLATE 24











LEGEND

——— ——— STANDARD PROJECT FLOOD

– – – – – – – – INTERMEDIATE REGIONAL FLOOD

NOTE:

HORIZONTAL DISTANCES IN HUNDRED FEET.

CROSS SECTIONS TAKEN LOOKING DOWNSTREAM.

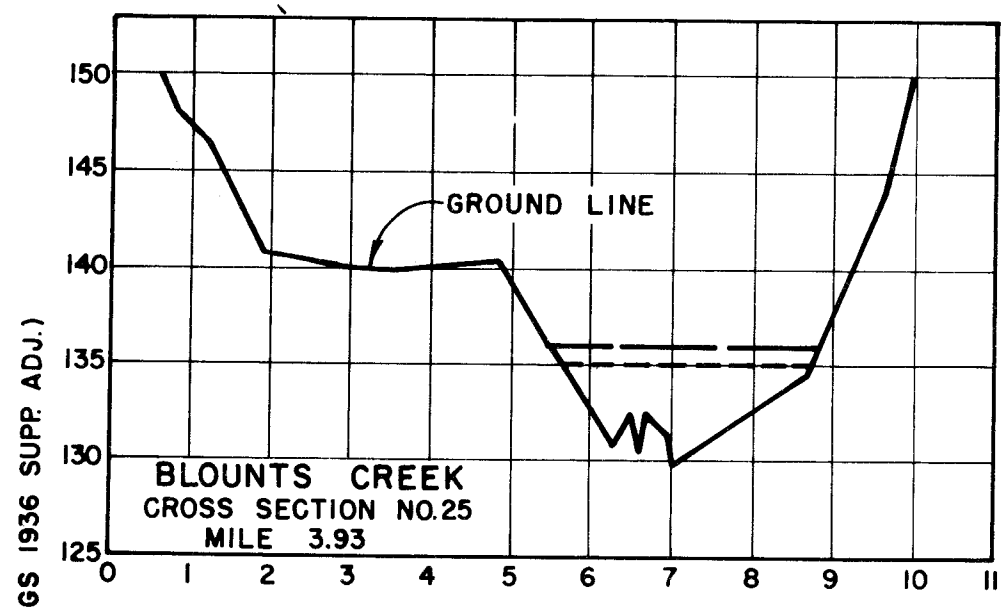
CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA

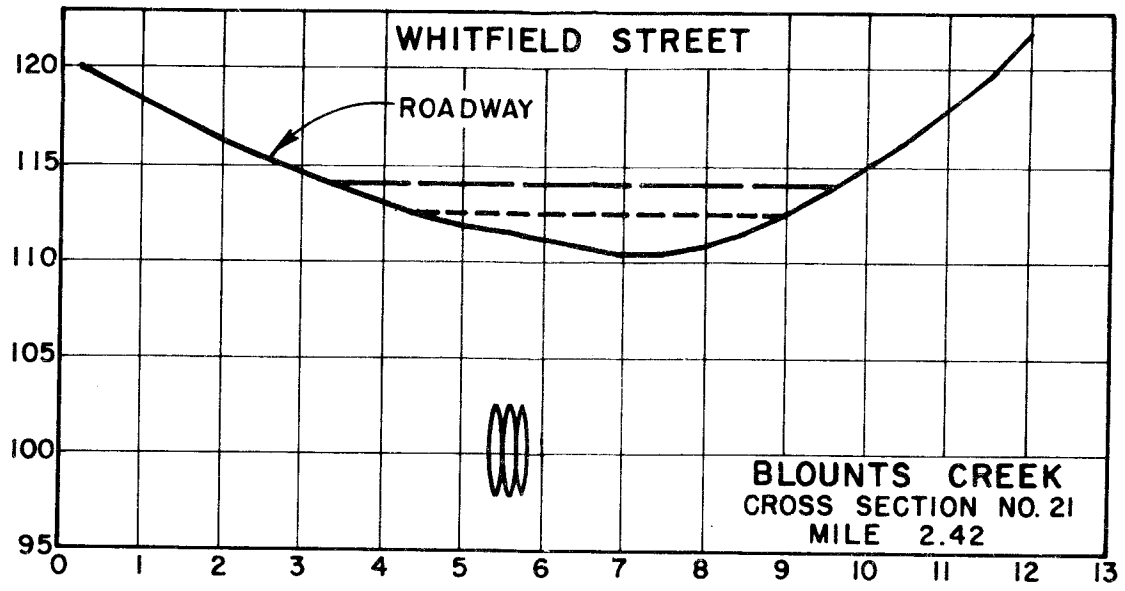
CROSS SECTIONS

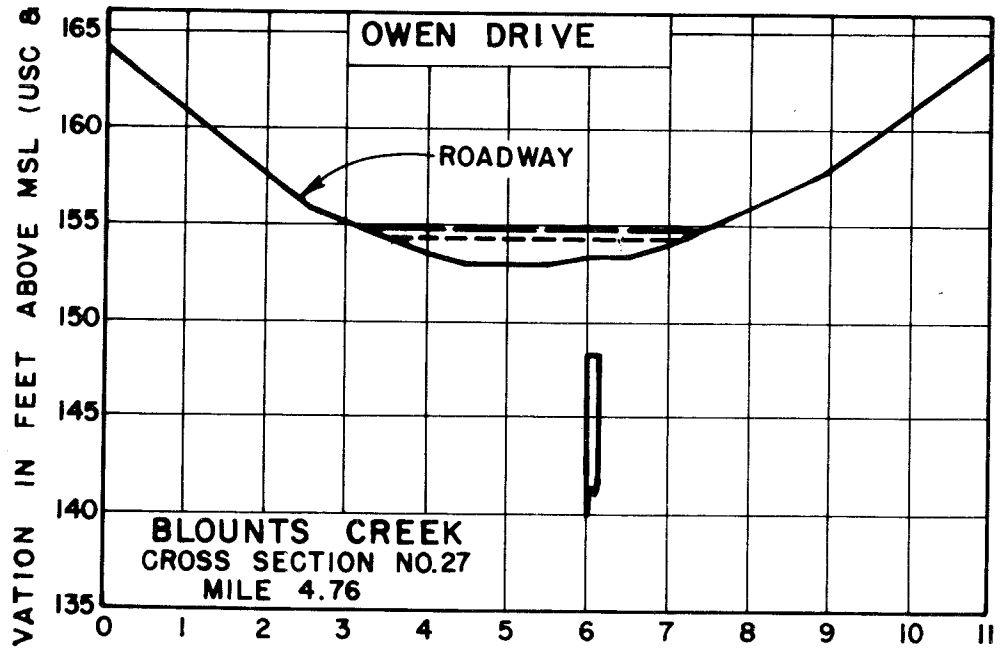
CROSS CREEK AND LITTLE CROSS CREEK

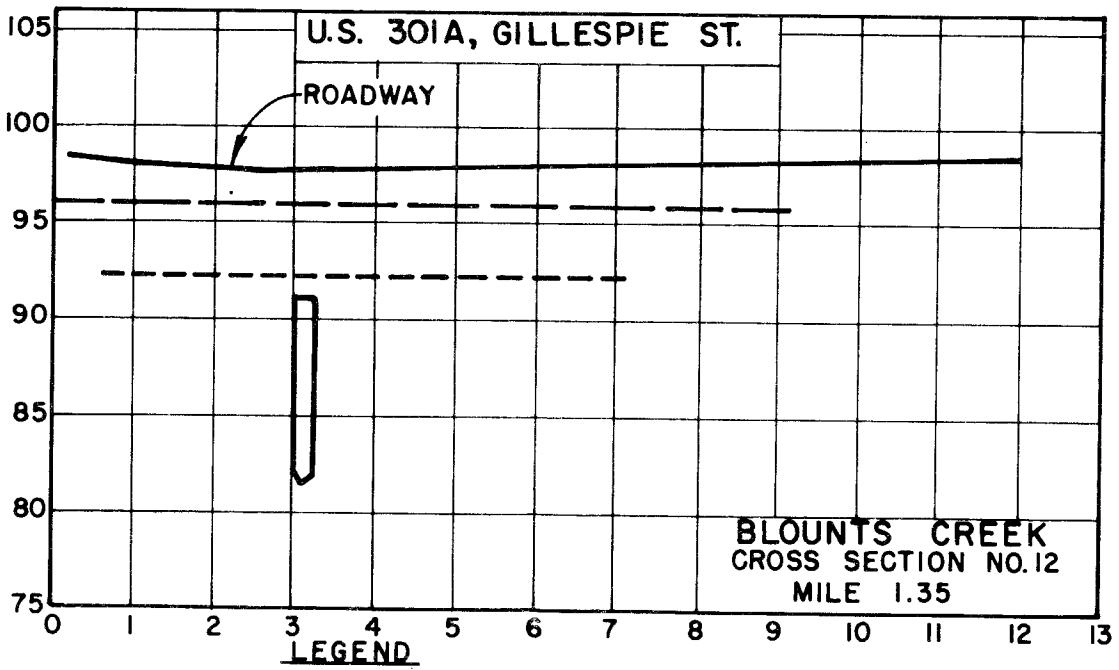
FAYETTEVILLE, NORTH CAROLINA
SEPTEMBER, 1970

PLATE 25

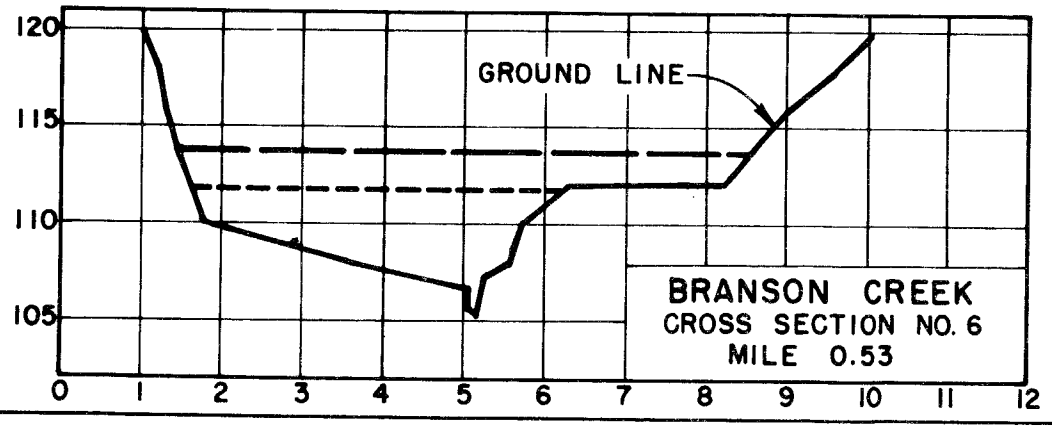








ELEVATION IN FEET ABOVE MSL (USC & GS 1936 SUPP. ADJ.)



LEGEND

———— STANDARD PROJECT FLOOD

– – – – – – – – INTERMEDIATE REGIONAL FLOOD

NOTE:
HORIZONTAL DISTANCES IN HUNDRED FEET.
CROSS SECTIONS TAKEN LOOKING DOWNSTREAM.

CORPS OF ENGINEERS, U.S. ARMY
WILMINGTON, NORTH CAROLINA

CROSS SECTIONS

BLOUNTS CREEK AND BRANSON CREEK

FAYETTEVILLE, NORTH CAROLINA
SEPTEMBER, 1970

PLATE 26