FLOODS
ON
CHEOAH RIVER
& TRIBUTARY CREEKS
IN VICINITY OF
ROBBINSVILLE
NORTH CAROLINA

TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

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REPORT NO. 0-6734

KNOXVILLE, TENNESSEE
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Tennessee Valley Authority
Division of Water Control Planning

FOREWORD

This report relates to the flood situation along Cheoah River and along Tulula, Sweetwater, Long, and Atoah Creeks in the vicinity of Robbinsville, North Carolina. It has been prepared at the request of the Graham County Planning Board through the North Carolina Department of Water and Air Resources to aid (1) in the solution of local flood problems and (2) in the best utilization of land subject to overflow. Data assembled by TVA on rainfall, runoff, historical and current flood heights, and other technical information bearing upon the occurrence and magnitude of floods in localities throughout the region provide the basis for this report.

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 town of Robbinsville in arriving at solutions to minimize vulnerability to flood damages. This might involve (1) the construction of flood protection works, (2) local planning programs to guide developments by controlling the type of use made of the flood plain through zoning and subdivision regulations, or (3) a combination of the two approaches.

The report covers three significant phases of the Robbinsville flood problem. The first brings together a record of the largest known floods of the past on Cheoah River and Tulula, Sweetwater, Long, and Atoah Creeks. The second treats of Regional Floods. These are derived from consideration of the largest floods known to have occurred in the same general geographical region as the five streams and generally within 85 miles of Robbinsville. The third develops the Maximum Probable Floods for these streams. Floods of this magnitude on most streams are considerably larger than any that have occurred in the past. They are the floods of infrequent occurrence that are considered in planning protective works, the failure of which might be disastrous.

The report contains maps, profiles, and cross sections which indicate the extent of flooding that has been experienced and that might occur in the future in the vicinity of Robbinsville. This should be useful in planning future developments in the flood plains. Structures or building floor levels may be planned either high enough to avoid flood damage or at lower elevations with recognition of the chance and hazards of flooding that are being taken.

I.

SUMMARY

OF

FLOOD SITUATION

I.

SUMMARY OF FLOOD SITUATION

Robbinsville, North Carolina, is located on the left bank of Cheoah River 18 miles above its confluence with Little Tennessee River. The river begins at Robbinsville at the confluence of Tulula and Sweetwater Creeks which have a combined drainage area of 42.9 square miles. Long Creek, a tributary with a drainage area of 11.8 square miles, joins the river at the lower limits of Robbinsville. Atoah Creek is a tributary of Long Creek with a drainage area of 4.29 square miles. It joins Long Creek at the upper limits of Robbinsville at Mile 1.4.

This investigation covers the Cheoah River from Mile 17.7 to the confluence of Tulula and Sweetwater Creeks at Mile 18.4, Tulula Creek from the mouth to Mile 6.5, Sweetwater Creek from the mouth to Mile 4.2, Long Creek from the mouth to Mile 2.2, and Atoah Creek from the mouth to Mile 1.0.

Much of the residential, commercial, and industrial development of Robbinsville is located on the flood plains of Cheoah River and Tulula and Long Creeks; other communities, primarily residential, are located on land along the four creeks. Portions of this land have been inundated by floods of the past, and a substantially greater area is within reach of the greater floods of the future.

No records of streamflow have been maintained on the reaches of the streams covered by this investigation. Some staff gage records are available from gages maintained by the U. S. Geological Survey during the period from 1912 to 1927 on the Cheoah River near its mouth. Headwater gage records at Santeetlah Dam, on the Cheoah River 9 miles downstream from Robbinsville, provide some information on Cheoah River floods. During the period from October 1942 to September 1952, the U. S. Geological Survey maintained a recording gage on Snowbird Creek, a Cheoah River tributary 3 miles west of Robbinsville. Since 1918 the Geological Survey has maintained a gage on Valley River at Tomotla, about 16 miles southwest of Robbinsville, with intermittent records extending back to 1904.

In compiling a record of the early floods on the streams, it has been necessary to interview residents along the streams who have knowledge of past floods and to conduct research in newspaper files and historical documents. From

these investigations and from studies of possible future floods on the streams in the vicinity of Robbinsville, the flood situation, both past and future, has been developed. The following paragraphs summarize the significant findings with regard to the flood situation which are discussed in more detail in succeeding sections of the report.

* * *

THE GREATEST FLOOD known to have occurred in recent years on the streams in the vicinity of Robbinsville was on March 12, 1963. The investigations indicate that it was probably exceeded by a flood on November 19, 1906. During such floods there is considerable overflow with high velocities along the streams.

* * *

OTHER LARGE FLOODS on streams in the vicinity of Robbinsville occurred in February 1936, April 1936, March 1951, and January 1957.

* * *

REGIONAL FLOODS on Cheoah River and Tulula, Sweetwater, Long, and Atoah Creeks in the vicinity of Robbinsville are based upon floods experienced on streams within 85 miles of the town, a number of which are larger than any known floods on the five streams. This indicates that greater floods than those experienced so far may reasonably be expected in the future. Based upon the magnitude of floods that have occurred on neighboring streams, a Regional Flood may occur on Cheoah River that would be from 8 to 16 feet higher than the March 12, 1963, flood in the vicinity of Robbinsville. On Tulula Creek a Regional Flood would be 2 to 13 feet higher than the 1963 flood. On Sweetwater Creek a Regional Flood would average about 6 feet higher than the flood of March 12, 1963, but would range from about 3 feet to 14 feet higher. A Regional Flood on Long Creek would also average about 6 feet higher than the 1963 flood and would range from 3 to 12 feet higher. On Atoah Creek a Regional Flood would be about 3.5 feet higher than the estimated profile for the 1963 flood.

* * *

MAXIMUM PROBABLE FLOOD determinations indicate that floods could occur on Cheoah River that would exceed the March 12, 1963, flood in the vicinity of Robbinsville by 16 to 25 feet. On Tulula Creek the Maximum Probable Flood

would be 5 to 17 feet higher than the 1963 flood, averaging about 9 feet higher. The Maximum Probable Flood on Sweetwater Creek would exceed the March 12, 1963, flood by 7 to 18 feet, averaging about 10 feet higher. On Long Creek the Maximum Probable Flood would average about 8 feet higher than the 1963 flood, ranging from 5 to 14 feet higher. The Maximum Probable Flood on Atoah Creek would be 5 to 6 feet higher than the estimated profile for the 1963 flood.

* * *

FLOOD DAMAGES that would result from a recurrence of floods as large as that of 1963 on the streams in the vicinity of Robbinsville would be greater than in 1963 because of the increased development on the flood plains, particularly along Cheoah River and Tulula Creek. Historical floods on Sweetwater Creek and Atoah Creek have not caused great damage, but extensive damages would be caused along all five streams by the Regional and Maximum Probable Floods because of their greater depths and velocities.

* * *

MOST FREQUENT FLOOD OCCURRENCES on the streams in the vicinity of Robbinsville have resulted from general heavy rainfall in winter and spring months. However, large floods may occur any time.

* * *

VELOCITIES OF WATER during the March 12, 1963, flood ranged up to 7 feet per second in the channel and one foot per second on the flood plain of Cheoah River. Along Tulula Creek, velocities during the March 12, 1963, flood were up to 10 feet per second in the channel and 4 feet per second on the flood plain. During the 1963 flood on Sweetwater Creek, channel and flood-plain velocities ranged up to 8 and 2 feet per second, respectively. On Long and Atoah Creeks, velocities in the channel during the 1963 flood ranged up to 12 and 7 feet per second, respectively. Flood-plain velocities ranged up to 2 feet per second along both streams. During a Maximum Probable Flood, velocities in the channel would range up to 16 feet per second on Cheoah River, 20 feet per second on Tulula Creek, 22 feet per second on Sweetwater Creek, 19 feet per second on Long Creek, and 15 feet per second on Atoah Creek. On the flood plain the corresponding figures would be 4, 9, 8, 5, and 4 feet per second, extremely dangerous to life and property.

* * *

DURATION OF FLOODS is relatively short on all streams in the vicinity of Robbinsville. During a Maximum Probable Flood on Cheoah River, the stream would rise 31 feet in 8 hours with a maximum rate of rise of 7 feet per hour, remaining out of banks for about 40 hours. On Tulula Creek the Maximum Probable Flood would rise 15 feet in 7 hours with a maximum rate of rise of 3 feet in $\frac{1}{2}$ hour, and the stream would remain out of banks for 32 hours. Sweetwater Creek would rise 17 feet in 3 hours with a maximum rate of rise of 4 feet in 0.5 hour during a Maximum Probable Flood. It would remain out of banks for 25 hours. On Long Creek the Maximum Probable Flood would rise 11 feet in 3 hours with a maximum rate of rise of 3 feet in $\frac{1}{2}$ hour, and the stream would remain out of banks for 8 hours. Atoah Creek would rise 10 feet in 3 hours with a maximum rate of rise of 2 feet in $\frac{1}{2}$ hour during a Maximum Probable Flood. The creek would remain out of banks for 13 hours.

* * *

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

* * *

FUTURE FLOOD HEIGHTS that would be reached if floods of the magnitude of the Regional and Maximum Probable occurred in the vicinity of Robbinsville are shown in Table 1. The table compares these flood crests with the crest of the March 12, 1963, flood at each location.

TABLE 1

RELATIVE FLOOD HEIGHTS

Flood	Location	Mile above Mouth	Estimated Peak Discharge cfs	Above 1963 Flood feet
	Cheoah River			
March 12, 1963	Old U. S. Highway 129	17.92	4,200	0
Regional			23,000	15.1
Maximum Probable			40,000	23.5
	Tulula Creek			
March 12, 1963	Sweetwater Road	0.49	3,500	0
Regional			19,000	6.1
Maximum Probable			30,000	7.4
March 12, 1963	County Road 1206	3.76	2,700	0
Regional			14,000	7.2
Maximum Probable			25,000	8.3
	Sweetwater Creek			
March 12, 1963	County Road 1214	0.58	1,800	0
Regional			12,000	13.6
Maximum Probable			24,000	16.9
	Long Creek			
March 12, 1963	U. S. Highway 129	0.04	2,100	0
Regional			11,000	11.5
Maximum Probable			22,000	13.9
March 12, 1963	Snowbird Road	1.88	1,500	0
Regional			7,500	5.3
Maximum Probable			15,000	7.1
	Atoah Creek			
March 12, 1963 (est.)	Snowbird Road	0.66	1,100	0
Regional			5,400	3.7
Maximum Probable			11,000	5.8

II.

THE WATERSHED AND REGION

II.

THE WATERSHED AND REGION

Robbinsville, the county seat of Graham County, North Carolina, is located on Cheoah River 18 miles above the mouth and about one mile above the upper limit of Santeetlah Reservoir. Cheoah River is formed by Tulula Creek and Sweetwater Creek which join within the corporate limit of Robbinsville. Long Creek joins Cheoah River 0.6 mile downstream from the confluence of Tulula and Sweetwater Creeks. Atoah Creek is a tributary of Long Creek. The Cheoah River drainage system has its origin in the Snowbird Mountains where elevations reach to more than 5,000 feet. The stream flows in a generally northwesterly direction and joins the Little Tennessee River at Tapoco, just above the North Carolina-Tennessee state line. Little Tennessee River is one of the principal tributaries of the Tennessee River. This section of the report includes a brief history of the region and descriptions of the streams and watersheds covered by this report.

Settlement

The land which constitutes Graham County was considered Cherokee Indian land until the Indians relinquished their claims to all land east of the Mississippi River in 1835. The area first was a part of Macon County which had been formed in 1828 and was included in the portion which was taken to form Cherokee County in 1839. Graham County was created by an Act of the North Carolina Legislature in 1872 and was named for Dr. W. A. Graham, a Confederate leader and former governor of North Carolina.

The Cherokee Indian influence is still strong in the county, with many place names which reflect that origin. Some Indians live in the county and a number of tracts of land are under the jurisdiction of the Eastern Band of the Cherokee Indians. The first white man to settle in the area was probably John Stratton, who came from Tennessee to make his home at Stratton Bald on the western divide of Cheoah River about 1830. The first courthouse was built at Robbinsville in 1874. The town was incorporated by an Act of the North Carolina Legislature on February 27, 1893. Robbinsville is the only incorporated town in Graham County. In 1960 the population of Robbinsville was 587, and the population of Graham County was 6,432.

The early development of Graham County was closely linked to lumbering activities, but for many years growth was painfully slow because of the poor roads and a lack of railroad connections. There was considerable speculation in the timber lands of the county prior to the turn of the century, and some lumber firms had set up operations but these were mostly of short duration.

Construction had begun in 1873 on a railroad line from Asheville westward toward Murphy, but it was 1890 before the line was completed as far as Topton, at the southeastern corner of Graham County. In 1891 the railroad reached Murphy where a connection was provided to another line leading to north Georgia and Atlanta. The Whiting Lumber Company began the first large-scale lumber operations in Graham County about 1905. A large sawmill was built at Robbinsville, a narrow-gage railroad was built into the woods to bring logs to the mill, and construction was begun on a railroad between Robbinsville and Topton. In 1924 the Bemis Hardwood Lumber Company took over the operations of the Whiting Lumber Company, and the following year the Graham County Railroad was completed to Topton providing a rail connection from Robbinsville to the Asheville-Murphy line which by then had become a part of the Southern Railway system.

Hydroelectric power projects have had a place in the development of Graham County. In 1919 the Aluminum Company of America completed a dam and generating station at Cheoah Dam on the Little Tennessee River just above the mouth of Cheoah River. The Santeetlah project was built in the period 1926-1928. This included a dam on Cheoah River below Robbinsville with a tunnel-pipeline connection to a powerhouse located on the shore of Cheoah Reservoir. Calderwood Dam and powerhouse, located on Little Tennessee River downstream from Cheoah Dam, was completed in 1930. The Tennessee Valley Authority built Fontana Dam on Little Tennessee River in 1942-1945.

Joyce Kilmer Memorial Forest was established by the Federal Government in 1926, setting aside some of the last native forest land which remained in the Appalachian region. More than 100,000 acres of Graham County are now under National Forest supervision, and another 60,000 acres are in private forest operations. The 1960 Census reports show that about 63 percent of the county is in Government ownership. Farms total some 16 percent of the county area, but only about 6 percent of the county is considered to be producing farm land, making Graham County one of the smallest in the state in this category.

The Bemis Hardwood Lumber Company continues to be a principal employer in the county. It supplies high-grade hardwoods to furniture manufacturers throughout the southeast. The industrial base of the county was diversified in 1956 by the addition of the plant of the James Lees and Son Company, a division of Burlington Industries and manufacturers of high-grade carpeting. Burlington Industries has become part owner of the Graham County Railroad. The community's newest industry is American Components, Incorporated, maker of electrical resistors.

The Cheoah River and Its Valley

The Cheoah River drains an area of 215 square miles which lies wholly within Graham County and includes about three-quarters of the county area. The watershed is roughly rectangular in shape, 24 miles wide by 16 miles long, bounded on the west by the Unicoi Mountains at the North Carolina-Tennessee state line, on the south by the Snowbird Mountains, which separate Graham County from Cherokee County, on the east by the Cheoah Mountains, and on the north by the Yellow Creek Mountains. At least 85 percent of the watershed is rugged, heavily forested mountain land. Elevations range up to 5,472 feet at Haw Knob on the state line on the western divide of the basin. Cheoah Bald on the eastern divide is at 5,062 feet elevation. Elevations are mostly above 4,000 feet along the state line and 3,000 to 4,700 feet along the south basin rim. Around the east and north divides the elevations drop from 5,062 feet at Cheoah Bald to around 3,000 feet along the crest of the Yellow Creek Mountains.

Santeetlah Creek, Buffalo Creek, and Snowbird Creek are the largest of the Cheoah tributary streams. Together they drain the west and southwest portions of the basin and join Cheoah River in Santeetlah Reservoir downstream from Robbinsville. In the lower basin downstream from Santeetlah Dam, Deep Creek and Yellow Creek drain left-bank and right-bank areas, respectively. The normal full-pool level of Santeetlah Reservoir is at 1,940 feet elevation. Cheoah River joins Little Tennessee River at an elevation of 1,080 feet. Robbinsville lies on rolling to mountainous land with elevations mostly between 2,000 and 2,200 feet.

Above the lower limits of this study, the Cheoah River watershed is broadly fanshaped, 12 miles wide by 8 miles long. This portion of the watershed is shown on Plate 1. The drainage system is made up of three streams, Long

Creek, Tulula Creek, and Sweetwater Creek, which head up to the southwest, southeast, and east, respectively, of Robbinsville and meet at the town.

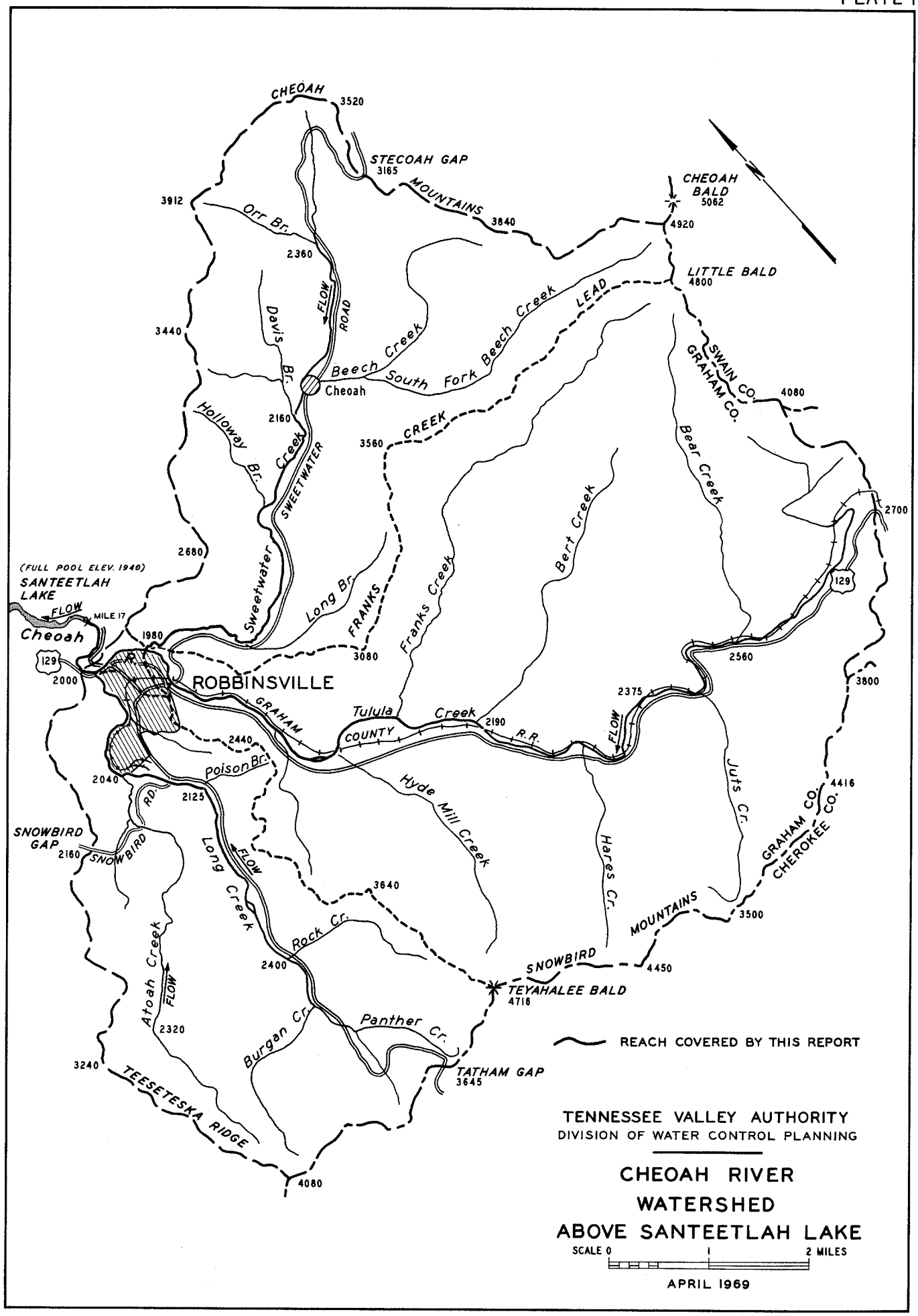
This investigation covers Cheoah River from Mile 17.7, downstream from the mouth of Long Creek, to the head of the river at the confluence of Tulula and Sweetwater Creeks at Mile 18.4. In this 0.7-mile reach the river falls from elevation 1,972 to 1,952 feet, a rate of 27 feet per mile. The flood plain is about 3,000 feet wide at the upper end of the reach, but narrows to about 300 feet at Mile 18.0 and remains in narrow confines through the rest of the reach. The corporate limit of Robbinsville follows Cheoah River from the confluence of Tulula and Sweetwater Creeks to the mouth of Long Creek at Mile 17.8, with the town located on the left side of the stream.

Pertinent drainage areas of Cheoah River are shown in Table 2.

TABLE 2

DRAINAGE AREAS IN WATERSHED OF CHEOAH RIVER

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Cheoah River	Mouth	0.0	215
	Santeetlah Dam	9.27	176
	Below Long Creek	17.83	54.9
	Old U.S. Highway 129	17.92	43.1
	Head of river	18.44	42.9
Tulula Creek	Mouth	0.0	28.9
	Sweetwater Road	0.49	28.6
	Railroad bridge	2.47	23.9
	County Road 1206	3.76	17.3
	Private bridge (upper limit of study)	6.50	9.34
Sweetwater Creek	Mouth	0.0	14.0
Long Creek	Mouth	0.0	11.8



TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

CHEOAH RIVER WATERSHED ABOVE SANTEETLAH LAKE

SCALE 0 1 2 MILES

APRIL 1969

HD-1311

Tulula Creek and Its Valley

The watershed of Tulula Creek is rectangular, 8 miles by 6 miles in size, with the long dimension lying east and west and with the northwest corner at Robbinsville as shown on Plate 1. The upper watershed is bounded by high mountain ridges ranging up to 4,800 feet elevation at Little Bald at the northeast corner. Teyahalee Bald at the southwest corner of the watershed is at 4,716 feet elevation. From these high points elevations fall off gradually along the west and north boundaries to 2,000 feet at Robbinsville. The south and east basin rims are mostly over 4,000 feet except at the gap at the southeast corner of the watershed which overlooks the Nantahala River Gorge. The elevation there is 2,700 feet. Except for the stream bottom areas, the watershed is heavily forested.

Tulula Creek rises at the southeast corner of the drainage area and follows a course which is first westward, then curves northward as the stream approaches Robbinsville. The largest tributary is Franks Creek, which rises at Little Bald, drains a narrow area between Franks Creek Lead and Bert Creek Lead and enters Tulula Creek at Mile 3.3. Bert Creek and Bear Creek also rise on the slopes of Little Bald and flow southward to join Tulula Creek. Left-bank tributaries are all steep and small in size.

This investigation covers Tulula Creek from its mouth to Mile 6.5, a short distance above the community of Tulula. The average slope in the reach is 61 feet per mile, although it gradually steepens from 40 feet per mile near the mouth to 78 feet per mile in the upper 1.7 miles. From the upper limits at Mile 6.5 to Mile 0.5 at Robbinsville, the flood plain of Tulula Creek averages about 800 feet in width, ranging from 1,600 feet at Mile 1.9 to 200 feet at Mile 5.8. Below Mile 0.5 the flood plain widens to more than 2,000 feet as it joins the flood plain of Sweetwater Creek.

Robbinsville lies on the left bank of Tulula Creek, the corporate limit following the stream from Mile 0.5 to the mouth.

Table 2 lists pertinent drainage areas in the watershed of Tulula Creek.

Sweetwater Creek and Its Valley

The watershed of Sweetwater Creek adjoins the Tulula Creek watershed on the north as shown on Plate 1. The drainage area is triangular in shape,

$6\frac{1}{2}$ miles long by 4 miles at its widest point. Cheoah Bald at the southeast corner of the basin is the highest point at 5,062 feet. From Cheoah Bald the south divide follows Franks Creek Lead to Cooper Knob, with elevations mostly from 3,000 feet to 4,000 feet. From Cooper Knob the divide turns northwestward and falls off in elevation to 2,200 feet near the lower end of the watershed. On the ridge which marks the eastern divide the elevations are mostly 3,500 to 4,000 feet but range down to 3,165 feet at Stecoah Gap. From the northeast corner of the watershed the divide follows the Cheoah Mountains westward for $1\frac{1}{2}$ miles then turns southwestward. Elevations drop off from near 4,000 feet to 2,200 feet along the divide. Except for the stream bottoms, the watershed is heavily forested.

Sweetwater Creek heads up at the northeast corner of the watershed. Beech Creek drains the southeast corner of the watershed and joins Sweetwater Creek at Cheoah, five miles above the mouth. The tributaries which join the main stream below Cheoah all drain relatively small areas heading up on the steep slopes which bound this narrow portion of the basin.

This investigation covers Sweetwater Creek from its mouth to the mouth of Davis Branch at Mile 4.2. The slope of the stream channel averages 45 feet per mile but varies from 33 feet per mile near the mouth to 63 feet per mile near Mile 4. From the upper end of the study reach to Mile 0.6 the flood plain has an average width of 600 feet. It ranges from 1,000 feet at Mile 1.0 down to 200 feet or less in the vicinity of Mile 0.6. Below Mile 0.6 the flood plain widens to 1,800 feet as Sweetwater Creek joins Tulula Creek.

Pertinent drainage areas of Sweetwater Creek are given in Table 3.

TABLE 3

DRAINAGE AREAS IN WATERSHED OF SWEETWATER CREEK

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Sweetwater Creek	Mouth	0.0	14.0
	County Road 1214	0.58	13.6
	Below Davis Branch (upper limit of study)	4.17	8.93

Long Creek and Its Valley

The Long Creek watershed adjoins the Tulula Creek watershed on the west, as shown on Plate 1. The basin is wedge-shaped, 5 miles long by 3 miles wide at the upper end. The basin is bounded on the south by the Snowbird Mountains which form the Graham-Cherokee County line. Elevations are mostly 3,800 feet to 4,200 feet but range from 3,645 feet at Tatham Gap to 4,716 feet at Teyahalee Bald. The west boundary is Teeseteska Ridge which separates the drainage from that of upper Snowbird Creek, and a lower ridge passing through Snowbird Gap. Elevations are 3,000 to 4,000 feet along Teeseteska Ridge. Along the lower ridge they drop off to 2,160 feet at Snowbird Gap and to 2,000 feet at the confluence with Cheoah River. Along the east divide which is common with Tulula Creek, elevations drop gradually from the 4,716 feet at Teyahalee Bald to 2,200 feet at the Robbinsville corporate limit. The upper watershed is in heavy timber, mostly in holdings of the Nantahala National Forest. The rest of the basin is also mostly in woodlands except for the relatively sparse flood-plain areas.

Long Creek has its head on the slopes of the Snowbird Mountains and drops from a ridge-top elevation of 3,800 feet to a valley floor elevation of 2,400 feet in a distance of 2 miles. Burgan Creek, Panther Creek, and Rock Creek join Long Creek in this reach to make up the headwater drainage system. Atoah Creek, which heads up near the southwest corner of the basin, drains a long, narrow area which lies to the west of the main stream and joins Long Creek at Mile 1.4.

This investigation covers Long Creek from its mouth to the mouth of Poison Branch, a distance of 2.2 miles, and Atoah Creek from the mouth to the bridge at Mile 1.04. The average fall on Long Creek is 73 feet per mile, increasing from 58 feet per mile near the mouth to more than 100 feet per mile near Poison Branch. Atoah Creek falls at the rate of 48 feet per mile over the short reach covered.

The flood plain on Long Creek varies from 300 to 1,700 feet in width. From a width of 700 feet at the upper end of the study reach, the flood plain narrows to 350 feet at Mile 2.0. From this point the flood plain widens gradually to about 1,700 feet between Miles 1.4 and 1.0. At Mile 0.8 the flood plain is just 300 feet wide and from that point it increases to 1,000 feet in width at Mile 0.3. It then narrows down to 600 feet at Mile 0.1 where it joins the flood plain of

Cheoah River. The Atoah Creek flood plain is 250 to 650 feet wide in the study reach. The corporate limit of Robbinsville follows Long Creek from Mile 1.4 to the mouth.

Pertinent drainage areas of Long and Atoah Creeks are given in Table 4.

TABLE 4

DRAINAGE AREAS IN WATERSHED OF LONG CREEK

Stream	Location	Mile above Mouth	Drainage Area sq. mi.
Long Creek	Mouth	0.0	11.8
	U. S. Highway 129	0.04	11.8
	Above Atoah Creek	1.38	6.20
	Snowbird Road	1.88	6.03
	Below Poison Branch (upper limit of study)	2.24	5.91
Atoah Creek	Mouth	0.0	4.29
	Snowbird Road	0.66	3.42
	County Road 1114 (upper limit of study)	1.04	3.21

III.

THE FLOOD PLAINS

III.

THE FLOOD PLAINS

Along the streams covered by this report, there are many man-made features which may be affected by floods or which may have an effect upon the height of floodwaters. This section of the report discusses the industrial, commercial, and residential developments in the flood plains, the highways and railroads that parallel the streams or cross the flood plains, and the bridges and dams spanning the streams.

1. CHEOAH RIVER AND TULULA CREEK

Developments in the Flood Plain

Plate 4 shows the flood plain of Cheoah River for the reach covered by this investigation. Most of the area shown on Plate 4 is also shown on an aerial photograph, Plate 6. Robbinsville is situated on the left or southwest side of the river. The principal business district is located on high ground far above the river, but in recent years residential and business developments have located on the flood plain of Cheoah River.

U. S. Highway 129 follows the left-bank flood plain of Cheoah River through the reach. The highway formerly passed through the main business section of Robbinsville, followed the left bank of the river only from Mile 18.0 to Mile 17.9, then crossed the river at the latter point. In the period 1957 to 1959, U. S. Highway 129 was relocated to bypass the business district utilizing a route on the broad left-bank flood plain of Tulula Creek and Cheoah River. In the period 1966 to 1968 the highway was relocated to the left bank downstream from Mile 17.9. The highway along the Cheoah River is above the 1963 flood level, but in the vicinity of the old bridge and Long Creek it is as much as 9 feet below the Regional Flood level. A Maximum Probable Flood would overtop U. S. Highway 129 along the entire Cheoah River reach covered in this report.

Most of the development along the left bank of the Cheoah River is above the 1963 flood level, but about 20 residences have been built with floors below the level of the Regional Flood, some as much as 8 feet lower. A number

of commercial developments also have floors below the level of possible future floods. The following tabulation shows the relation of the floor and ground elevations to the elevations of the Regional and Maximum Probable Floods at some of the developments.

Mile	Identification	Elevation in Feet			
		Floor	Ground	Regional Flood	Maximum Probable Flood
18.00	Motel (lower)	1970.9	-	1984.8	1993.5
	(upper)	1980.2	1980.2	1984.8	1993.5
18.01	Patton Marine Store	1968.7	1968.7	1985.0	1993.8
18.03	Perkins Market (lower)	1973.3	-	1985.5	1994.5
	(upper)	1984.7	1984.7	1985.5	1994.5
18.22	Phillips Motel	1979.3	1980.4	1987.8	1996.8
		1985.7	1985.7	1987.8	1996.8
		1988.2	1988.2	1987.8	1996.8
18.26	Trailer park	-	1977.8	1987.8	1996.9
18.27	Phillips & Jordon Equip. Shop	1979.3	1979.1	1987.9	1996.9
18.28	Ford's Body Shop	1981.4	1980.3	1987.9	1996.9
18.30	Esso service station	1985.9	1985.6	1988.0	1996.9
18.37	Graham County Cleaners	1985.8	1985.1	1988.2	1997.1
18.38	Dr. J. E. Stephens's office	1982.6	1981.2	1988.2	1997.1
18.44	Trailer park	-	1984.6	1988.4	1997.2

The flood plain on the right bank of Cheoah River at Robbinsville is mostly in agricultural use.

Plates 4 and 5 show the flood plain of Tulula Creek for the reach covered by this investigation. Robbinsville is located on the left side of the stream along the lower 0.5 mile of the reach, with developments occupying much of the flood-plain land.

U. S. Highway 129 follows the left-bank flood plain throughout the reach. In the period 1953-54 the road was rebuilt over the reach above Mile 0.5. The new route follows the old road much of the way but alignment, width, and grades were improved. In 1957-59 the highway was relocated downstream from Mile 0.5 as part of the Robbinsville bypass. The highway was not flooded during the March 12, 1963, flood, but it dips below the Regional Flood height in the vicinity of Miles 0.5, 2.0, and 5.0. A Maximum Probable Flood on Tulula Creek would inundate long sections of the highway with depths up to 7 feet.

Sweetwater Road crosses the flood plain at Mile 0.5. Secondary roads which serve sizable areas cross the flood plain at Miles 1.6, 3.8, 4.4, and 5.7. All these are subject to overflow in large floods and would be impassable during a Regional Flood.

The Graham County Railroad follows Tulula Creek, crossing the stream seven times in the reach included in the investigation. The track is on the flood plain through most of the distance and was overflowed at several places during the 1963 flood. A Regional Flood would overtop the rails through most of the reach with depths ranging up to 11 feet.

Developments in the flood plain of Tulula Creek within the corporate limits of Robbinsville downstream from Mile 0.5 have increased rapidly in recent years. A few houses were flooded or surrounded by water during the 1963 flood, but a Regional Flood would be above the floors of about 20 residences and 6 businesses. A Maximum Probable Flood would enter additional houses and businesses. Upstream from Robbinsville, several other places of business and about 40 residences are subject to flooding by the Maximum Probable Flood. Elevations of the floor, ground, Regional Flood, and Maximum Probable Flood are listed in the following tabulation for some of the developments in the flood plain of Tulula Creek.

		Elevation in Feet			
Mile	Identification	Floor	Ground	Regional Flood	Maximum Probable Flood
0.05	Redi-Mix concrete plant	1984.4	1984.4	1988.6	1997.1
0.13	San Ran Motel	1987.7	1986.6	1989.4	1997.2
0.20	Odom's Building Supply	1986.4	1985.5	1991.0	1998.0
0.46	Hooper's Grocery	2001.7	-	2002.0	2003.8
0.48	Five Points Cafe	2003.0	-	2003.9	2005.9
0.50	Esso bulk plant	2003.5	2000.2	2005.2	2006.5
0.50	Griggs Appliance Store	2004.0	2000.2	2005.2	2006.5
0.55	North Carolina Highway office	2000.9	1999.4	2007.2	2008.7
0.58	Sinclair service station	2007.8	2007.8	2008.4	2010.0
1.33	Grocery store	2037.3	2037.0	2037.6	2039.4
3.79	Sweetgum Church	2164.9	2161.7	2169.0	2170.4
4.67	Appliance shop	2243.3	-	2243.0	2245.0

Upstream from Mile 0.6 most of the flood plain is in agricultural use. Regional and Maximum Probable Floods would inundate many acres of cultivated land.

Channel Changes

There have been changes in the channel and overbank areas of this reach of Cheoah River which have altered streamflow conditions. These occurred when material was removed for use in construction of the U. S. Highway 129 bypass in 1957-59. Banks were cleared of growth and the channel was increased in size considerably from Mile 18.1 to the head of the reach. The stream channel was shortened by about 0.1 mile by the opening of a cutoff channel upstream from Mile 18.2.

Gravel removal operations have affected the stream channel size and alignment at a number of points along Tulula Creek. These changes took place mostly when U. S. Highway 129 was improved in 1953 and 1954. Extensive gravel deposits were removed from the stream channel and overbank areas.

Bridges across the Streams

Only one bridge, former U. S. Highway 129, crosses Cheoah River in the reach covered by this investigation, but there are 15 bridges crossing Tulula Creek in the 6.5 miles of that reach. Table 5 lists pertinent elevations for the bridges and shows their relation to the crest of the flood of March 12, 1963, and the Regional Flood. Plate 7 shows the relation of the floor and underclearance of the bridges to the flood profiles for the reaches. Figure 1 shows a photograph of the Cheoah River bridge, and Figures 1 and 2 show photographs of some of the bridges on Tulula Creek.

The Cheoah River bridge is above the level of past floods but it would be overtopped by a Regional Flood. The bridge offers little obstruction to flood flows and heading up of only about one foot occurs during major floods.

Seven railroad bridges, five highway bridges, and three private bridges cross Tulula Creek. Only two, the railroad bridge at Mile 2.47, and the private bridge at Mile 4.81, are below the 1963 flood crest, but approaches were flooded at several other bridges. A Regional Flood would overtop all 15 bridges by amounts ranging up to almost 12 feet. The greatest depth of flooding would be at the highway bridge at Mile 5.73 where the overbank channel is naturally constricted.

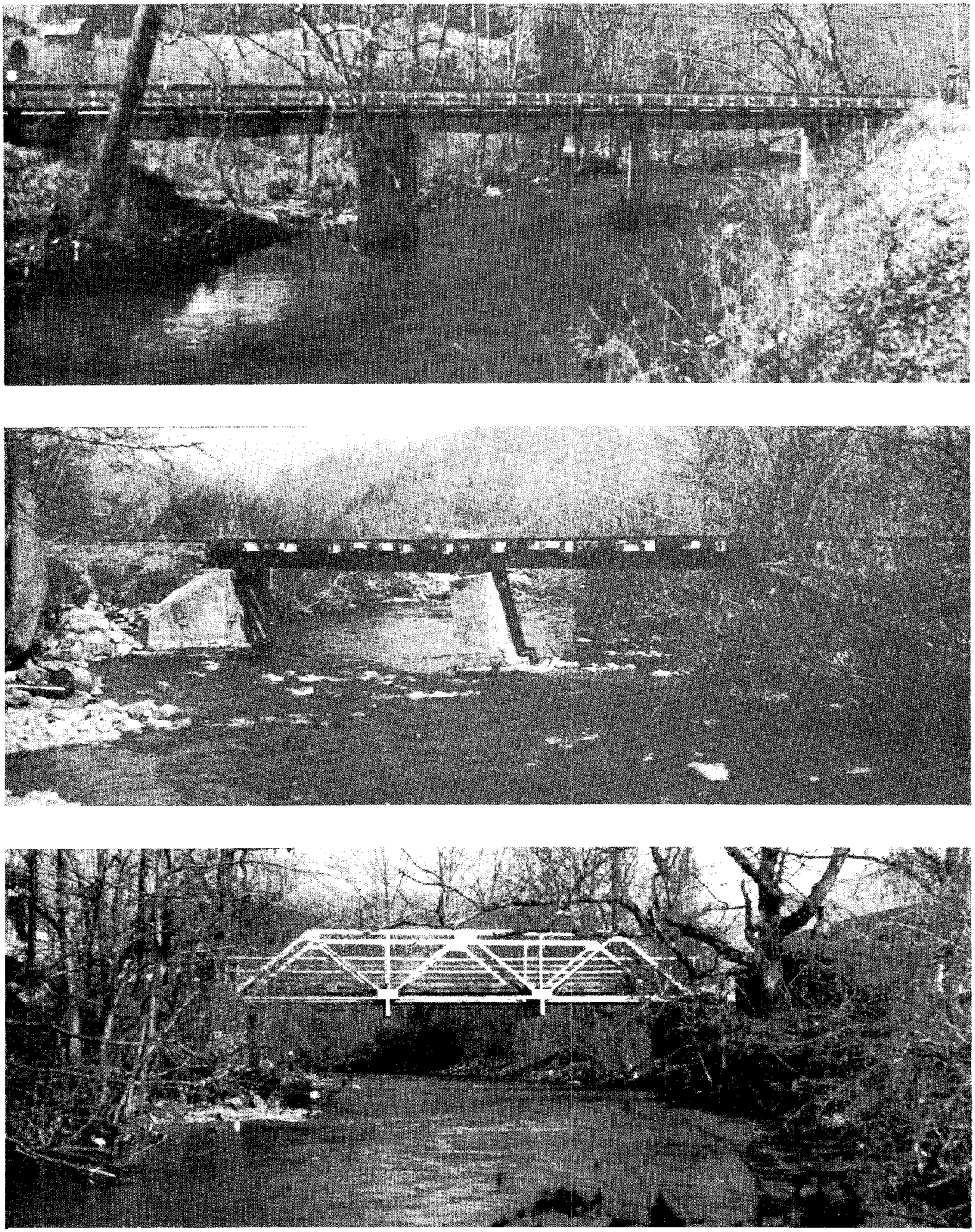


Figure 1.--CHEOAH RIVER AND TULULA CREEK BRIDGES

Top view is upstream side of Cheoah River bridge on Old U. S. Highway 129, at Mile 17.92. Middle view is Tulula Creek Railroad bridge, upstream side, at Tulula Creek Mile 0.44. Bottom view is upstream side of Sweetwater Road bridge over Tulula Creek at Mile 0.49.

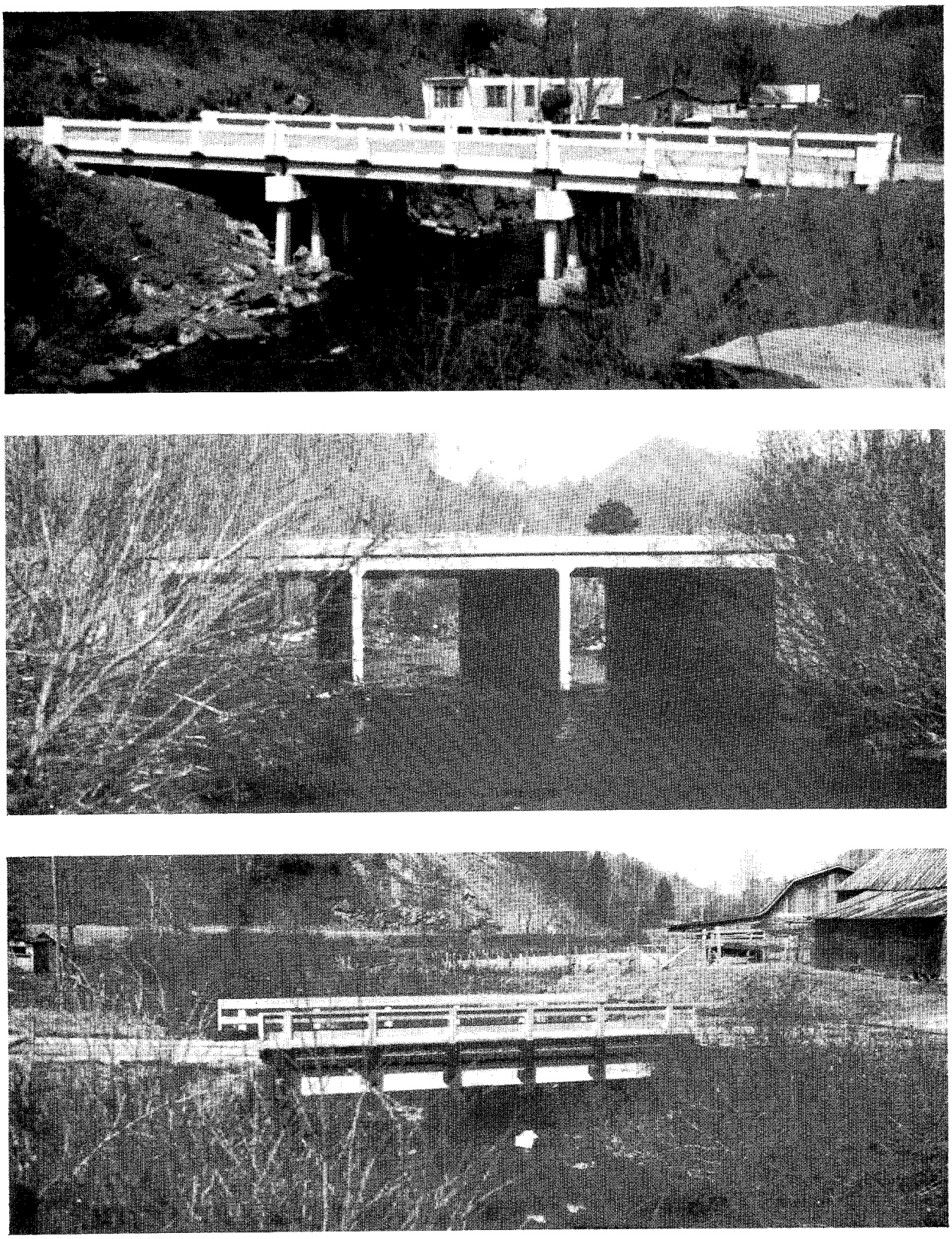


Figure 2.--TULULA CREEK BRIDGES

Top view is upstream side of bridge on County Road 1260 at Mile 1.62. Middle view is upstream side of bridge at Mile 4.38 on County Road 1204. Bottom view is upstream side of bridge on County Road 1101 at Mile 5.73.

TABLE 5

BRIDGES ACROSS CHEOAH RIVER AND TULULA CREEK

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Mar. 12, 1963, Flood Crest Elev. feet	Underclearance Elev. feet	Underclearance Above 1963 Flood feet	Underclearance Below 1963 Flood feet
			Cheoah River					
17.92	Old U. S. Highway 129	1960.4	1975.0	1983.8	1968.7	1972.6	3.9	
			Tulula Creek					
0.44	Graham County Railroad	1987.8	1997.2*	2000.7	1996.5	1995.0		1.5
0.49	Sweetwater Road (Rt. 1211)	1991.2	2003.6	2005.2	1999.1	2002.0	2.9	
1.62	County Road 1260	2038.0	2049.2	2050.0	2042.8	2047.2	4.4	
2.47	Graham County Railroad	2077.3	2086.5*	2089.3	2086.9	2084.4		2.5
3.18	Private road	2112.0	2121.7	2125.5	2119.0	2120.6	1.6	
3.76	County Road 1206	2152.1	2163.7	2167.2	2160.0	2161.4	1.4	
4.18	Graham County Railroad	2187.0	2194.2*	2200.6	2193.0	2191.8		1.2
4.38	County Road 1204	2206.8	2216.0	2216.8	2212.0	2213.7	1.7	
4.81	Private road	2237.8	2243.5	2252.6	2243.8	2242.3		1.5
5.18	Graham County Railroad	2269.4	2277.5*	2281.3	2275.5	2275.5	0	
5.30	Graham County Railroad	2280.7	2286.7*	2291.0	2285.2	2284.7		0.5
5.73	County Road 1101	2314.6	2321.9	2333.5	2320.1	2319.7		0.4
5.82	Graham County Railroad	2321.6	2327.2*	2337.8	2326.0	2324.9		1.1
6.49	Graham County Railroad	2366.9	2373.2*	2380.8	2371.5	2370.9		0.6
6.50	Private road	2368.9	2375.2	2381.5	2372.0	2373.8	1.8	

*Top of rail.

During the 1963 flood the railroad bridge and its approach fills at Mile 2.47 caused heading up of about 3 feet. Heading up of about one foot occurred at the bridges at Miles 0.49, 3.76, and 5.73. Negligible heading up occurred at the other bridges. During a Regional Flood, heading up of about one foot would occur at the bridges at Miles 0.44, 0.49, 3.76, and 5.73, and heading up of almost 4 feet would occur at the railroad bridge at Mile 4.18 where approach fills block much of the flood plain. During a Maximum Probable Flood heading up would be about the same or slightly less than during a Regional Flood.

Obstructions to Flood Flow

The effect of obstructions due to the bridges and their approach fills has been described in the previous section. The changes in the channel and flood plain due to the removal of sand and gravel in the Cheoah River reach upstream from Mile 18.1, and along some reaches of Tulula Creek, will affect future flood heights. In the reaches where the channel is enlarged or deepened, flood heights will be lowered. Changes made prior to February 1969 were considered in calculating flood profiles for this report.

2. SWEETWATER CREEK

Developments in the Flood Plain

Plate 4 shows the flood plain of Sweetwater Creek for the reach which is covered by this investigation. None of the developments which are associated with the town of Robbinsville is in the flood plain of Sweetwater Creek. The land is currently used for agricultural purposes. Residences and farm buildings are mostly located back from the flood plain.

Sweetwater Road follows the left side of Sweetwater Creek through the study reach and connects Robbinsville with N. C. Highway 28 at Stecoah, 12 miles to the east. Highway 28 serves Fontana Village, a principal resort development in the Great Smoky Mountains National Park area. Robbinsville is the closest service area to the Fontana Village development. Sweetwater Road is above the height of the March 12, 1963, flood but it would be overtopped by Regional or Maximum Probable Floods in the reach from Mile 0.7 to Mile 1.5.

Ten secondary or private roads cross the flood plain, and three were overtopped by the 1963 flood. All would be impassable during a Regional Flood. Several barns, but few residences, are below the Maximum Probable Flood level.

Bridges across the Stream

Five highway bridges and five private road bridges cross Sweetwater Creek in the reach covered by this investigation. Table 6 lists pertinent elevations for the bridges and shows their relation to the crest of the flood of March 12, 1963, and the Regional Flood. Plate 9 shows the relation of the floor and underclearance of the bridges to the flood profiles for the reach. Figure 3 shows photographs of some of the bridges on Sweetwater Creek.

The 1963 flood overtopped the bridge on the private road at Mile 3.80 and flooded one or both approaches to the bridges at Miles 1.66 and 4.44. A Regional Flood would overtop all of the bridges with depths ranging up to almost 8 feet.

During the 1963 flood, the bridges and their approach fills caused heading up of about 1 foot at Mile 0.58 and Mile 2.42, and of about 2 feet at Miles 2.73, 3.13, 3.43, 3.64, and 4.44. During a Regional Flood or a Maximum Probable Flood, heading up at the bridge at Mile 3.13 would be about 6 feet, and at the bridge at Mile 0.58 heading up would be more than 4 feet. Heading up of about 3 feet would occur at the bridge at Mile 2.42 and heading up of 1 to 2 feet would occur at the bridges at Miles 2.73 and 3.64.

Obstructions to Flood Flow

The effect of obstructions due to the bridges and their approach fills has been described in the previous section. With the exception of the bridges, there are no significant obstructions to flows in the Sweetwater Creek reach included in this study.

TABLE 6

BRIDGES ACROSS SWEETWATER CREEK

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Mar. 12, 1963, Flood Crest Elev. feet	Underclearance Elev. feet	Underclearance Above 1963 Flood feet	Underclearance Below 1963 Flood feet
0.58	County Road 1214	1989.6	2000.3	2007.9	1994.3	1997.8	3.5	
1.66	Private road	2027.9	2034.4	2037.8	2032.8	2032.8	0	
2.42	County Road 1212	2060.1	2068.2	2072.5	2065.5	2065.8	0.3	
2.73	County Road 1218	2076.5	2083.9	2087.7	2081.4	2081.4	0	
3.13	County Road 1219	2097.0	2105.1	2111.8	2102.5	2102.8	0.3	
3.43	Private road	2113.8	2119.9	2126.4	2119.9	2118.7		1.2
3.64	Private road	2127.2	2133.0	2138.2	2133.0	2131.8		1.2
3.80	Private road	2136.6	2140.8	2147.8	2142.2	2139.8		2.4
3.95	Private road	2147.6	2155.2	2156.9	2151.4	2154.2	2.8	
4.44	County Road 1221	2181.0	2186.1		2185.8	2183.6		2.2

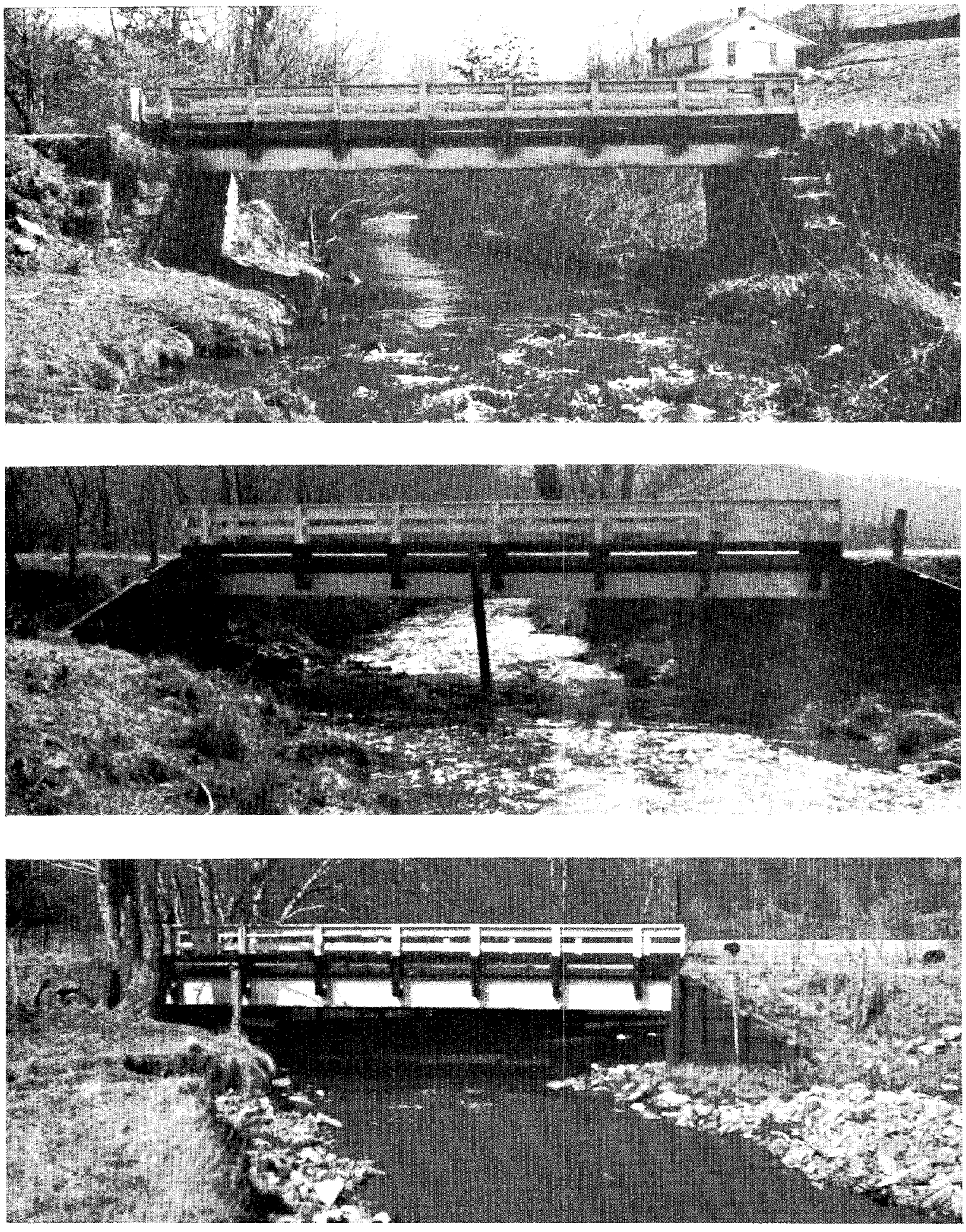


Figure 3.--SWEETWATER CREEK BRIDGES

Top view is downstream side of County Road 1214 bridge at Mile 0.58. Middle view is upstream side of bridge at Mile 2.42; note wire fence across the whole waterway. Bottom view is downstream side of County Road 1218 bridge at Mile 2.73.

3. LONG AND ATOAH CREEKS

Developments in the Flood Plain

Plate 4 shows the flood plains of Long Creek and Atoah Creek. Most of the area shown on Plate 4 is also shown on the aerial photograph, Plate 6. The corporate limits of Robbinsville include the right side of Long Creek from Mile 1.43 to the mouth. The principal business development of Robbinsville is on high ground to the east of the flood plain but industrial, commercial, and residential developments occupy a large part of the flood-plain land within the corporate limit and also much of the land from the corporate limit to the limit of the study at Mile 2.2. There are a few residences in the flood plain of Atoah Creek but most of that land is in agricultural use.

U. S. Highway 129 crosses the flood plain of Long Creek just above its mouth and a secondary road crosses at Mile 0.3. Both are above the height of past floods, but would be impassable during a Regional Flood.

Snowbird Road crosses the Long Creek flood plain at Mile 1.9 and has been overflowed by some of the floods of the past. The road follows the edge of the right-bank flood plain into Robbinsville but is generally above flood heights there. Secondary roads on both banks upstream from Mile 1.9 would be inundated by a Regional Flood. Snowbird Road crosses Atoah Creek at Mile 0.7 and is subject to overflow there and where it follows the right bank down to Mile 0.3. A secondary road which follows the old railroad grade along Atoah Creek from Mile 0.7 to the head of the study reach would be overtopped by a Regional Flood.

The Graham County Railroad is on the right-bank flood plain of Long Creek from Mile 0.3 to Mile 1.7 and on the left bank from Mile 1.7 to 1.8. Between Miles 0.9 and 1.8 the railroad would be overtopped in a Regional Flood. A railroad line which formerly followed Atoah Creek through the study reach brought logs to the Robbinsville mill from the Snowbird Creek area, but the tracks and trestles have been taken up for some years.

Two industries are located on the flood plain of Long Creek. James Lees and Son Company, a carpet manufacturing division of Burlington Industries, occupies the broad right-bank area which lies in the long curve of the stream between Miles 0.7 and 1.6. All the principal floors at the plant are at elevation 2,033.0 feet. At the upstream end of the plant the Regional Flood would be at

elevation 2,042.8, but it would drop to 2,035.8 feet at the downstream end of the plant. The Maximum Probable Flood on Long Creek would exceed the Regional Flood by about 2.5 feet in that vicinity.

The Bemis Hardwood Lumber Company occupies the land on both sides of Long Creek from Mile 1.5 to 1.9. Included in their installations are a large band sawmill, a dry kiln, a large lumber and log storage area, an office, other service buildings, and a builders' supply business which they also operate. Floods of the past have overflowed a log storage pond and have affected the dry kiln and other buildings. During a Regional Flood, most of the plant would be flooded with depths ranging from about 1 foot in the office to 6 feet in the dry kiln. A Maximum Probable Flood would be 2 to 3 feet higher than the Regional Flood. The floor of the Snowbird Supply Company would be above flood levels, but the building would be surrounded by water during large floods.

On the flood plain at Mile 0.3 are the playground of the Robbinsville School, a gymnasium and several other buildings connected with the school, an electric substation, and buildings housing a Rescue Squad and a Health Center. Floor elevations range from 1,982.2 feet at the gymnasium to 1,996.4 feet at the Rescue Squad building. The ground elevation at the substation is 1,999.2 feet. All developments are above flood danger except the gymnasium which is 5.5 feet below the Regional Flood and 7.8 feet below the Maximum Probable Flood.

At the present time Robbinsville does not have a sewage treatment plant; however, preliminary plans have been approved and a Federal grant awarded for construction of intercepting sewers and treatment facilities. Final plans are being prepared for a treatment plant to be located on the right-bank flood plain of Long Creek just upstream from U. S. Highway 129.

Most of the residential development on Long and Atoah Creeks is above flood danger, but some of the homes located near the confluence of the two creeks and on the Long Creek flood plain upstream from Snowbird Road would be flooded by a Regional Flood. Several homes along Atoah Creek would be flooded by a Regional Flood and others by a Maximum Probable Flood.

Bridges across the Streams

One railroad bridge, three highway bridges, four private road bridges, and two footbridges cross Long Creek in the reach investigated. Crossing Atoah

Creek are three highway bridges, five private road bridges, and three footbridges. Table 7 lists pertinent elevations for the bridges on the two streams and shows their relation to the crest of the flood of March 12, 1963, and the Regional Flood. Plate 9 shows the relation of the floor and underclearance of the bridges to the flood profiles for the reaches. Figure 4 shows photographs of some of the bridges on Long Creek, and Figure 5 shows photographs of some of the bridges on Atoah Creek.

The two footbridges on Long Creek and the left approach to the bridge at Mile 0.58 are below the level of the 1963 flood. A Regional Flood would overtop all of the bridges except that at Mile 1.72; however, the left approach at that bridge would be under 3 feet of water. On Atoah Creek most of the bridges or their approaches are below the 1963 flood level, and a Regional Flood would overtop all of the bridges with depths ranging up to 5 feet.

During the 1963 flood on Long Creek, heading up due to the bridges and their approach fills was negligible except at the bridges at Mile 0.32 and Snowbird Road at Mile 1.88. At those two bridges heading up of about 2 feet occurred. During larger floods the heading up at these bridges would decrease to 1 foot or less. Heading up at the bridges on Atoah Creek is negligible.

Obstructions to Flood Flow

The effect of obstructions due to the bridges and their approach fills has been described in the previous section. With the exception of the bridges, there are no significant obstructions to flows in the Long and Atoah Creek reaches included in this study.

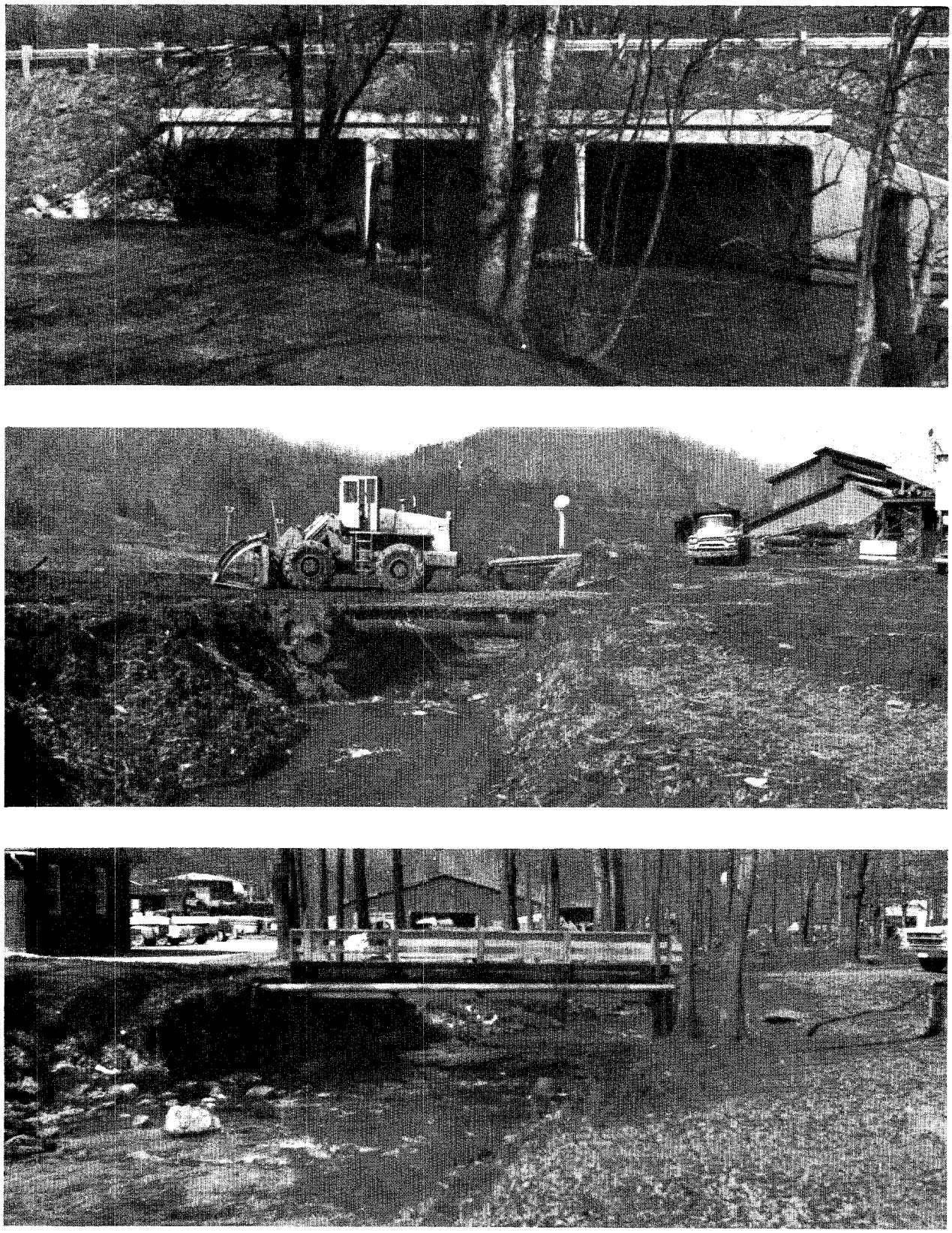


Figure 4.--LONG CREEK BRIDGES

Top view is upstream side of U. S. Highway 129 bridge at Mile 0.04. Middle view is upstream side of private bridge to Bemis Hardwood Lumber Company at Mile 1.77. Bottom view is upstream side of Snowbird Road bridge at Mile 1.88.

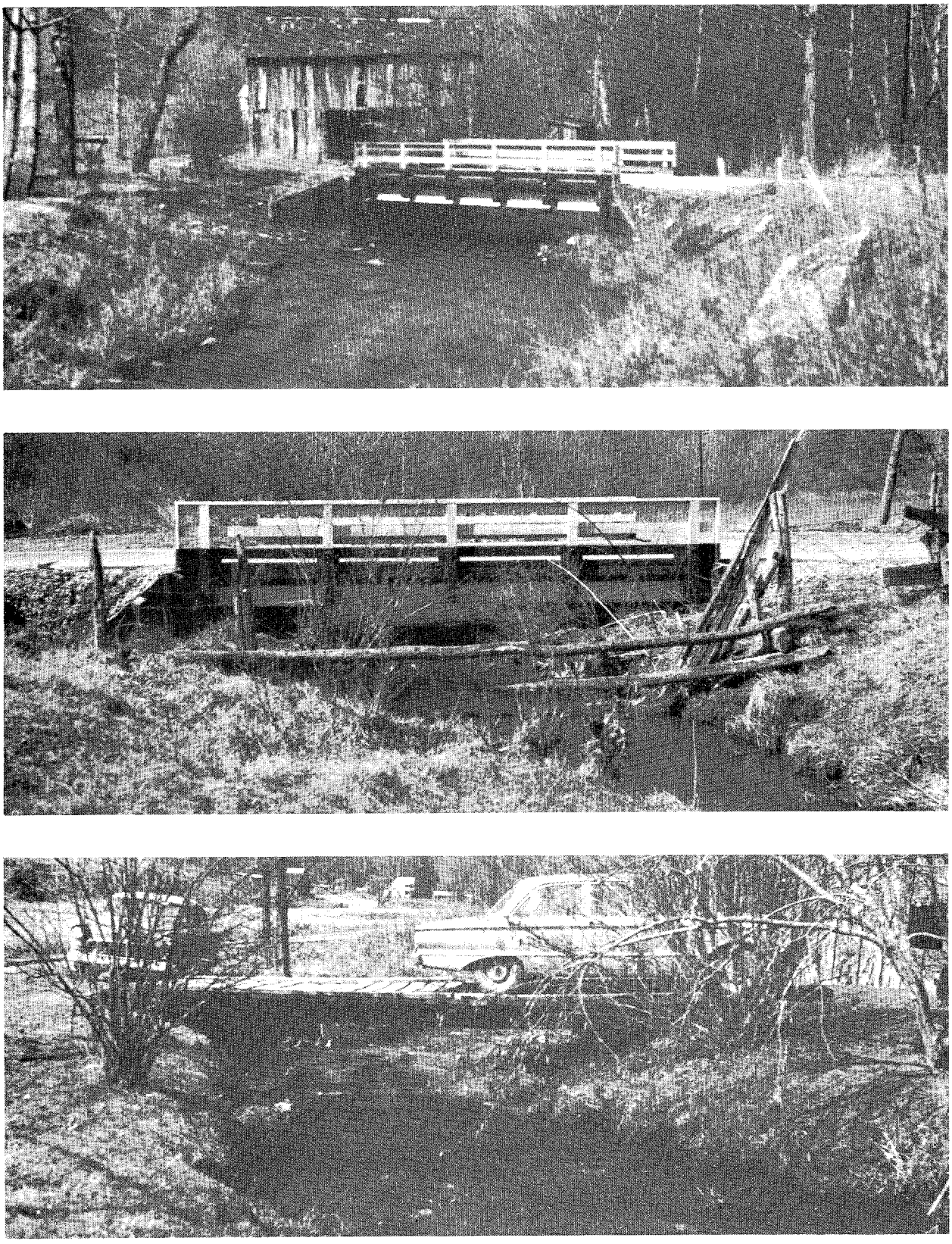


Figure 5.--ATOAH CREEK BRIDGES

Top view is upstream side of bridge on County Road 1113, at Mile 0.07. Middle view is upstream side of the Snowbird Road bridge at Mile 0.66. Bottom view is upstream side of a private bridge at Mile 0.95.

TABLE 7

BRIDGES ACROSS LONG AND ATOAH CREEKS

Mile above Mouth	Identification	Low Water Elev. feet	Floor Elev. feet	Regional Flood Crest Elev. feet	Mar. 12, 1963, Flood Crest Elev. feet	Underclearance Elev. feet	Underclearance Above 1963 Flood feet	Underclearance Below 1963 Flood feet
			Long Creek					
0.04	U. S. Highway 129	1960.0	1974.4	1978.9	1967.4	1969.1	1.7	
0.32	County Road 1117	1977.8	1985.4	1988.2	1983.3	1983.2		0.1
0.58	Private road	1992.8	1999.8	1999.9	1996.7	1998.6	1.9	
1.40	Footbridge	2039.8	2043.2	2050.4	2043.8	2042.7		1.1
1.61	Private road	2057.8	2065.9	2066.5	2062.5	2064.2	1.7	
1.70	Graham County Railroad	2066.3	2074.6*	2075.7	2072.0	2072.5	0.5	
1.72	Private road	2068.9	2078.8	2077.7	2074.0	2076.4	2.4	
1.77	Private road	2072.8	2079.0	2082.7	2078.5	2076.6		1.9
1.81	Footbridge	2076.5	2081.6	2086.7	2082.2	2080.6		1.6
1.88	Snowbird Road (Rt. 1127)	2083.7	2090.4	2094.7	2089.4	2089.4	0	
			Atoah Creek					
0.07	County Road 1113	2041.6	2046.9	2050.0	2046.0	2044.9		1.1
0.25	Private road	2051.1	2053.9	2058.6	2055.0	2053.1		1.9
0.37	Private road	2056.6	2059.6	2064.6	2061.0	2058.6		2.4
0.43	Private road	2058.8	2064.3	2067.2	2063.6	2062.6		1.0
0.66	Snowbird Road (Rt. 1127)	2069.0	2073.2	2077.6	2073.9	2071.4		2.5
0.70	Footbridge	2071.2	2074.2	2079.2	2075.6	2073.7		1.9
0.90	Footbridge	2080.0	2083.3	2087.4	2083.8	2082.1		1.7
0.91	Footbridge	2080.2	2083.6	2087.8	2084.3	2082.7		1.6
0.95	Private road	2082.3	2085.5	2089.5	2085.9	2084.5		1.4
1.01	Private road	2085.5	2089.5	2092.2	2088.6	2088.2		0.4
1.04	County Road 1114	2087.6	2091.3	2093.2	2090.0	2089.9		0.1

*Top of rail.

IV.

PAST FLOODS

IV.

PAST FLOODS[1]

This section of the report is a history of floods which have occurred on Cheoah River, Tulula Creek, Sweetwater Creek, Long Creek, and Atoah Creek in the vicinity of Robbinsville in Graham County, North Carolina. The portion of Cheoah River considered extends from Mile 17.7 below the mouth of Long Creek to the confluence of Tulula and Sweetwater Creeks at Mile 18.4, a distance of 0.7 river mile. The investigation on Tulula Creek covers the reach from the mouth to the bridge at Mile 6.5, and Sweetwater Creek is covered from the mouth to the bridge at Mile 4.2. The investigation on Long Creek covers the 2.2 miles from its confluence with Cheoah River to the mouth of Poison Branch. Atoah Creek is covered from the mouth to the bridge at Mile 1.0.

Records of stages and discharges on the Cheoah River and its tributaries are limited, and no records have been maintained on the reaches of the streams covered by this report. Records are available from gages located on the Cheoah River near its mouth for the periods 1912 to 1918 and 1921 to 1927, and from a gage on Snowbird Creek, a Cheoah River tributary not far from Robbinsville, for the period 1942 to 1952. Long-term records are also available from a station on Valley River, the watershed of which adjoins the watersheds of Tulula and Long Creeks. These records were used to establish the probable dates and frequency of flooding on the streams covered by this report. Following the floods of January 21, 1959, and March 13, 1963, flood marks were located in some reaches of the streams included, and in connection with this report investigations have been made to supplement the flood information on Cheoah River and on Tulula, Sweetwater, Long, and Atoah Creeks. Profile data were obtained on most of the streams following the flood on February 2, 1969.

This section of the report discusses the flood history of those five streams.

1. CHEOAH RIVER AND TULULA CREEK

Flood Records

No records of streamflow have been maintained on Cheoah River in the vicinity of Robbinsville, and no records of streamflow have been maintained at any

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1. Prepared by Hydraulic Data Branch.

location on Tulula Creek. However, records have been maintained on the lower reaches of Cheoah River and on other streams near Robbinsville, and these are useful in a study of this nature.

From November 1, 1912, through December 1918, and from December 29, 1920, through September 1927 the U. S. Geological Survey maintained a staff gage at Johnson, North Carolina, 7.8 miles above the mouth of Cheoah River. Records are also available from a Geological Survey staff gage on the river at Tapoco, 0.2 mile above the mouth, for the period September 24, 1924, through September 1927. The only other records of streamflow within the Cheoah River watershed are those from a Geological Survey recording gage on Snowbird Creek 3.1 miles west of Robbinsville from October 3, 1942, through September 1952.

The nearest stream gage with long-term records is that on Valley River at Tomotla, North Carolina, 16 miles southwest of Robbinsville. The watershed of the Valley River adjoins the Cheoah River watershed, particularly that of Tulula and Long Creeks. Continuous records are available on Valley River since October 1918 with additional records during the periods from May 1904 through December 1909 and January 1914 through April 1917.

Since the closure of Santeetlah Dam on December 7, 1927, the records of headwater elevation, turbine discharge, and gate discharge provide a means of computing inflows into the reservoir during any time period. During periods of high flows the peak flow can be estimated from these data.

Information on floods on Cheoah River and Tulula Creek was obtained from these gage records and from interviews with local residents and from a search of newspaper files. In 1938 TVA engineers made a flood history investigation on Cheoah River downstream from Santeetlah Dam, and following the floods of January 21, 1959, and March 12, 1963, some high-water marks were established on Cheoah River and Tulula Creek in the vicinity of Robbinsville. Detailed profiles were obtained along both streams for the flood of February 2, 1969.

Flood Stages and Discharges

Table 8 lists the peak stages and discharges for the known floods exceeding the bankfull stage of 13 feet at the U. S. Geological Survey gaging station on Valley River at Tomotla, North Carolina. The table also lists the stages and discharges

for some floods which did not reach the 13-foot stage on Valley River but which reached flood stage on Cheoah River as indicated by Santeetlah Reservoir inflows. There is no direct correlation between crest stages on Valley River and on Cheoah River or Tulula Creek; however, it was found that floods above bankfull stage usually occurred on Cheoah River and Tulula Creek at the same time when floods occurred on Valley River.

Listed in Table 9 are the greatest six known floods on Cheoah River. Although their relative heights and discharges are not known, it is probable that the flood of November 19, 1906, is the greatest known flood on the river. During the 1938 flood history investigation, old residents along the lower reaches of the river pointed out three high-water marks for the 1906 flood. All stated that it was the largest flood in their memory, which covered a period extending back to about 1880. Since the 1906 flood was one of the largest two floods on Valley River, it must have been a large flood on the Cheoah River headwater streams in the Robbinsville vicinity.

Flood Occurrences

Plate 2 shows the month of occurrence of the floods listed in Table 8. Table 10 shows the monthly distribution of the 30 floods occurring since 1904 when stream gage records are fairly complete on either Valley River or Cheoah River. The records show that floods have occurred most frequently in the winter and spring months, November through April. On Tulula Creek there is a greater possibility of large floods during the summer months resulting from intense local thunderstorms over the smaller drainage area.

Duration and Rate of Rise

Small watersheds such as that of Cheoah River and Tulula Creek experience floods that are characterized by very rapid rates of rise and short duration.

Velocities

In the Cheoah River reach investigated, velocities in the channel during such floods as that of March 12, 1963, would range up to 7 feet per second, and in the overbank areas velocities would range up to one foot per second. Along Tulula Creek in the reach investigated, velocities during floods such as that of March 12,

TABLE 8

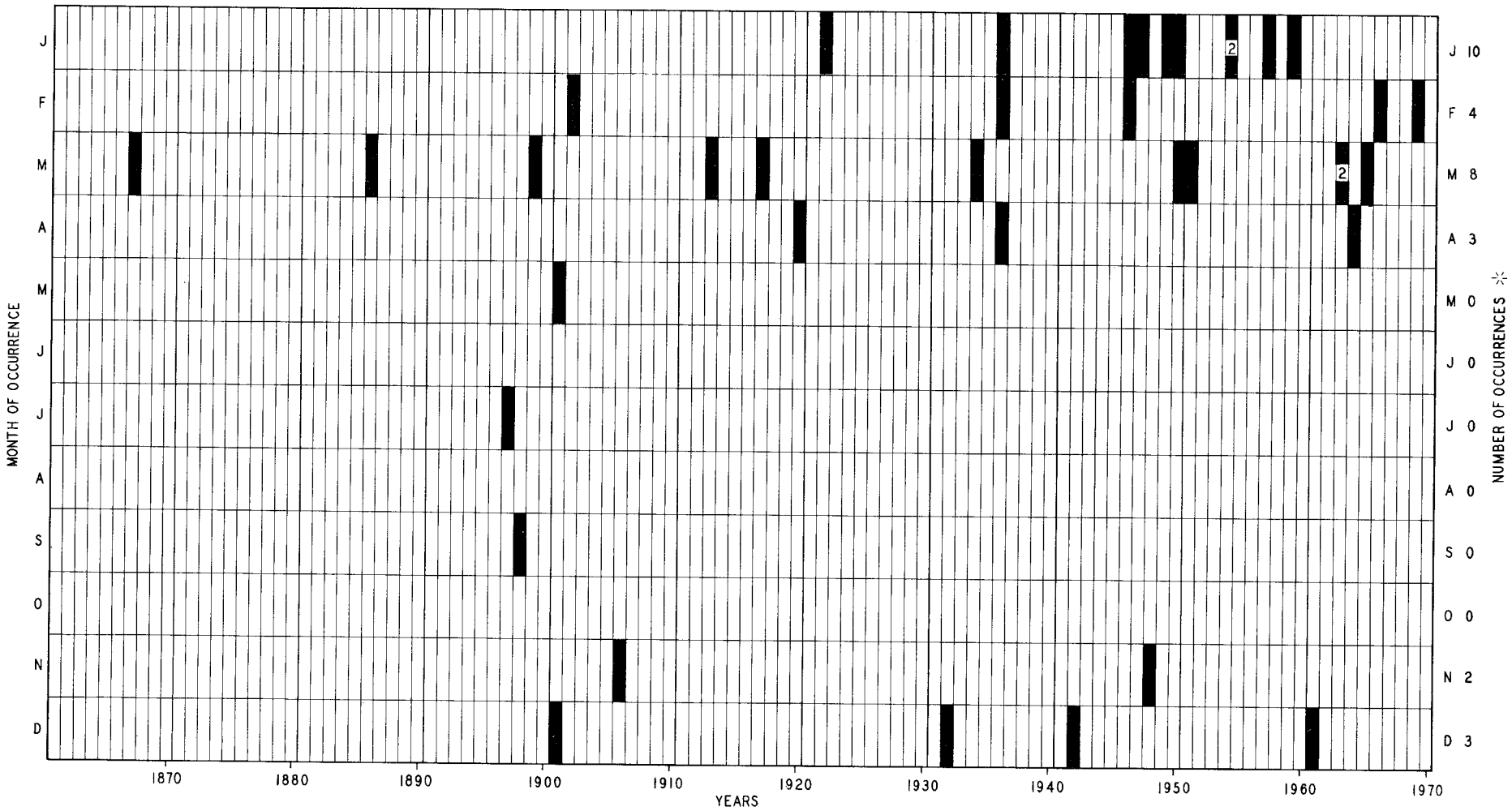
VALLEY RIVER AT TOMOTLA, NORTH CAROLINA

FLOODS ABOVE BANKFULL STAGE

This table includes all known floods above bankfull stage of 13 feet at the U. S. Geological Survey stream gaging station on Valley River at Tomotla, North Carolina, plus those floods known to have occurred on Cheoah River as indicated by Santeetlah Reservoir inflows. The drainage area at Tomotla is 104 square miles; zero of the gage is 1,556.46.

Date of Crest	Stage feet	Discharge cfs
May 1840	a	
March 1867	a	
March 1886	a	
July 25, 1897	a	
September 3, 1898	21.2[b]	20,000
March 19, 1899	a	
May 21, 1901	a	
December 29, 1901	a	
February 28, 1902	a	
November 19, 1906	20.5[b]	18,000
March 14, 1913	a	
March 4, 1917	15.9	7,610
April 2, 1920	14.6	6,480
January 21, 1922	15.5	7,250
December 28, 1932	15.06	6,850
March 3, 1934	13.01[c]	5,200
January 19, 1936	11.65[c]	4,440
February 4, 1936	16.35[c]	8,100
April 6, 1936	12.12[c]	4,720
December 29, 1942	14.12	5,500
January 7, 1946	10.10[c]	3,200
February 10, 1946	14.25	5,570
January 20, 1947	14.90	6,130
November 28, 1948	14.65	5,920
January 5, 1949	13.74	5,250
January 19, 1950	14.05	5,460
March 13, 1950	13.98	5,420
March 29, 1951	15.70	6,910
January 16, 1954	15.25	6,450
January 21, 1954	13.02	4,810
January 31, 1957	16.70[c]	8,320
January 21, 1959	9.70[c]	3,020
December 18, 1961	14.40	6,010
March 6, 1963	15.25	6,800
March 12, 1963	15.22	6,770
April 7, 1964	14.18	5,810
March 26, 1965	13.78	5,460
February 13, 1966	15.11	6,660
February 2, 1969	14.04	5,690

a Stage unknown.
b Crest stage based upon high-water mark information.
c Santeetlah Reservoir inflows indicate flood on Cheoah River.



☆ Number of occurrences since 1904 when gage records are fairly complete on nearby streams.

Flood occurrences are based upon records at nearby stream gages or upon inflows into Santeetlah Reservoir.

TENNESSEE VALLEY AUTHORITY
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MONTH OF OCCURRENCE OF FLOODS ABOVE BANKFULL STAGE

CHEOAH RIVER
AT
ROBBINSVILLE, N.C.
APRIL 1969

PLATE 2

1963, would range up to 10 feet per second in the channel and 4 feet per second in the overbank areas. During larger floods on the two streams, velocities would be greater.

TABLE 9

LARGEST KNOWN FLOODS ON CHEOAH RIVER

November 19, 1906	March 29, 1951
February 4, 1936	January 31, 1957
April 6, 1936	March 12, 1963

TABLE 10

MONTHLY FLOOD DISTRIBUTION

Month	Number of Occurrences*	Month	Number of Occurrences*
January	10	July	0
February	4	August	0
March	8	September	0
April	3	October	0
May	0	November	2
June	0	December	3
		Total	30

*Number of occurrences May 1904 through February 1969.

Flooded Areas, Flood Profiles, and Cross Sections

Plates 4 and 5 show the approximate areas along Cheoah River and Tulula Creek in the vicinity of Robbinsville that were inundated by the flood of March 12, 1963, and that would be inundated by the Maximum Probable Flood. The actual limits of these overflow areas on the ground may vary somewhat from those shown on the maps because the contour interval of the maps does not permit precise plotting of the flooded area boundaries. The contour interval of Plates 4 and 5 is 40 feet.

Plate 7 shows the high water profiles on Cheoah River and Tulula Creek for the floods of March 12, 1963, and February 2, 1969. Also shown are the profiles for the Regional and Maximum Probable Floods discussed in Sections V and VI of this report.

Plate 8 shows typical cross sections of Cheoah River and Tulula Creek in the reaches investigated. The locations of the sections are shown on the maps and profiles, Plates 4, 5, and 7. The cross sections show the elevation and extent of overflow of the March 12, 1963, flood and the Regional and Maximum Probable Floods.

Flood Descriptions

Following are descriptions of known large floods that have occurred on streams in the vicinity of Robbinsville. These are based upon newspaper accounts, historical records, and investigations by TVA engineers.

November 19, 1906

An intense storm occurred over the Hiwassee and Little Tennessee River basins on November 18 and 19, 1906. At Murphy, North Carolina, rainfall in a 24-hour period totaled 8 inches. The storm caused major floods on all streams in both basins, and on some streams the resulting flood is the maximum of record. Three high-water marks for the flood were obtained by TVA engineers from residents along the lower reaches of the Cheoah River during an investigation made in 1938. No higher flood was known to those residents. On the Little Tennessee River at McGhee, Tennessee, downstream from the mouth of Cheoah River, the November 19, 1906, flood was exceeded only by floods in March 1867 and March 1884.

January - April 1936

During the first four months of 1936, flood stages were reached several times on most of the streams in the eastern half of the Tennessee River Basin. Floods were widespread on January 19, February 4, March 27, April 2, and April 6. Streams in the Hiwassee River basin generally reached the highest stage on February 4, while the highest stages on streams in the Little Tennessee River basin were reached on April 6. Inflows into Santeetlah Reservoir indicate that large floods occurred in the headwaters of Cheoah River on both of those dates.

March 29, 1951

Floods occurred on most of the streams in the vicinity of Robbinsville on this date. On the Valley River it is among the highest five floods during the period of gage record extending back to 1904, and it is the highest flood recorded during the ten years of gage record on Snowbird Creek.

January 31, 1957

A series of storms occurred over the Tennessee River Basin between January 20 and February 10, 1957, producing rainfall totals that in many places exceeded previous records for a similar period. At the recording rain gage on Teyahalee Bald at the head of the Tulula and Long Creek watersheds, 7 inches of rain fell from January 20 to midnight January 30. This rain had saturated the ground so that heavy runoff occurred during the next 18 hours when 4.8 inches of rainfall was recorded. By February 10, a total of 20 inches had been recorded at the Teyahalee Bald rain gage. On the adjoining Valley River, the flood on January 31 was the highest since that of 1906, and the inflow into Santeetlah Reservoir on Cheoah River was high indicating flood flows on streams at Robbinsville.

March 6 and 12, 1963

The Cheoah River and its tributaries in the Robbinsville vicinity went out of banks on both of these dates. The March 12 flood was the higher of the two and is the highest flood in recent years on streams in the area. Following this flood, TVA engineers established high-water marks to develop the flood profiles on Cheoah River, Tulula Creek, Sweetwater Creek, and Long Creek. The flood caused some damage, particularly along the lower reaches of Tulula Creek where homes and roads were inundated. Figure 6 shows two photographs taken along Tulula Creek during the March 12 flood.

2. SWEETWATER CREEK

Flood Records

No records of stages and discharges have been maintained on Sweetwater Creek. Information on floods was obtained from interviews with local residents and from an inspection of records from nearby stream gages. Immediately after the flood of March 12, 1963, TVA engineers obtained information in the field to establish the profile for the flood. In connection with this report, high-water marks were obtained after the flood of February 2, 1969.

Flood Occurrences

The investigation indicates that major floods have occurred at about the same frequency on Sweetwater Creek as on Cheoah River and Tulula Creek;

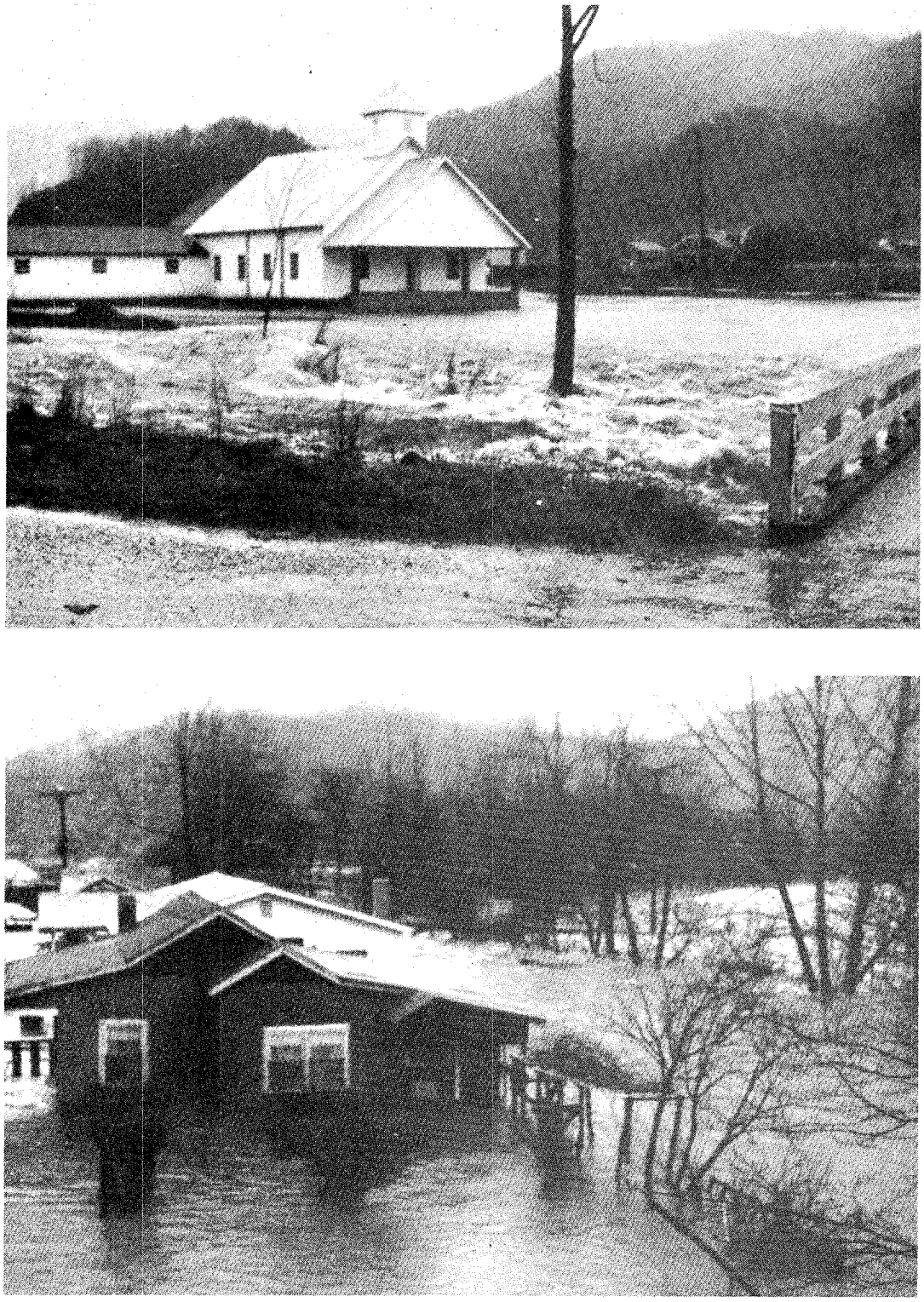

Figure 6.--FLOOD OF MARCH 12, 1963, ON TULULA CREEK

Tulula Creek above Robbinsville reached a crest height which surrounded the Sweetgum Church and practically filled the waterway under the county road bridge at right in upper view, which is southerly across the creek. Lower picture is a downstream view at the southern corporate limit of Robbinsville at crest stage, near the confluence with the Cheoah River.

(Photos by Graham County Star)

however, there is a greater possibility of large floods on the smaller creek during the summer months resulting from intense local thunderstorms.

Duration and Rate of Rise

Small watersheds such as that of Sweetwater Creek experience floods that are characterized by very rapid rates of rise and short duration.

Velocities

Along Sweetwater Creek in the reach investigated, velocities in the channel during floods such as that of March 12, 1963, would range up to 8 feet per second, and in the overbank areas velocities would range up to 2 feet per second. During larger floods, velocities would be greater.

Flooded Areas, Flood Profiles, and Cross Sections

Plate 4 shows the approximate area along Sweetwater Creek that was inundated by the flood of March 12, 1963, and that would be inundated by the Maximum Probable Flood. The actual limits of the overflow area on the ground may vary somewhat from that shown on the map because the contour interval of the map does not permit precise plotting of the flooded area boundaries. The contour interval on Plate 4 is 40 feet.

Plate 9 shows the high water profile on Sweetwater Creek for the floods of March 12, 1963, and February 2, 1969. Also shown are the profiles for the Regional and Maximum Probable Floods, which are discussed in Sections V and VI of this report.

Plate 10 shows typical cross sections of Sweetwater Creek in the reach investigated. The locations of the sections are shown on the map, Plate 4, and the profiles, Plate 9. Each cross section shows the elevation and extent of overflow of the 1963 flood and the Regional and Maximum Probable Floods.

Flood Descriptions

Descriptions of the large floods on Sweetwater Creek are included with the discussion of past floods on Cheoah River and Tulula Creek.

3. LONG AND ATOAH CREEKS

Flood Records

Records of stream stage and discharge have not been maintained on Long or Atoah Creeks. To develop information on floods, local residents have been interviewed for information on dates and heights of floods, and newspaper files have been searched. High-water marks were located in the field to develop the flood-crest profiles on Long Creek for the floods of January 21, 1959, March 12, 1963, and February 2, 1969. No high-water marks could be found along Atoah Creek; however, a profile for the 1963 flood was developed upon the basis of computed discharges and the cross sections.

Flood Occurrences

The investigation indicates that major floods have occurred at about the same frequency on Long and Atoah Creeks as on Cheoah River; however, there is a greater possibility of large floods on the creeks during the summer months resulting from intense local thunderstorms.

Duration and Rate of Rise

Small watersheds such as that of Long and Atoah Creeks experience floods that are characterized by very rapid rates of rise and short duration.

Velocities

Along Long Creek in the reach investigated, velocities in the channel during floods such as that of 1963 would range up to 12 feet per second, and in the overbank areas velocities would be as high as 2 feet per second. During larger floods, velocities would be greater. Velocities along Atoah Creek during a flood such as that of 1963 would range up to 7 feet per second in the channel and 2 feet per second in the overbank areas.

Flooded Areas, Flood Profiles, and Cross Sections

Plate 4 shows the approximate area along Long and Atoah Creeks that was inundated by the flood of March 12, 1963, and that would be inundated by the Maximum Probable Flood. The actual limits of the overflow area on the ground

may vary somewhat from that shown on the map because the contour interval of the map does not permit precise plotting of the flooded area boundaries. The contour interval on Plate 4 is 40 feet.

Plate 9 shows the high-water profiles on Long and Atoah Creeks for the flood of March 12, 1963. Several high-water marks are shown on Long Creek for the flood of 1959, and the profile for the February 1969 flood is shown for the reach from the mouth to Snowbird Road. Also shown are the profiles for the Regional and Maximum Probable Floods, which are discussed in Sections V and VI of this report.

Plate 10 shows typical cross sections of Long and Atoah Creeks in the reach investigated. The locations of the sections are shown on the map, Plate 4, and the profile, Plate 9. Each cross section shows the elevation and extent of overflow of the March 12, 1963, flood and the Regional and Maximum Probable Floods.

Flood Descriptions

Descriptions of the large floods on Long and Atoah Creeks are included with the discussion of past floods on Cheoah River and Tulula Creek.

V.

REGIONAL FLOODS

V.

REGIONAL FLOODS[1]

This section of the report relates particularly to floods on streams whose watersheds are comparable with those of Cheoah River and Tulula, Sweetwater, Long, and Atoah Creeks.

Large floods have been experienced in the past on streams in the general geographical and physiographical region of Robbinsville, North Carolina. Storms similar to those causing these floods could occur over the watersheds of Cheoah River and its tributaries. In this event, floods would result on these streams comparable in magnitude with those experienced on neighboring streams. Floods of this size are designated as Regional Floods. It is therefore desirable, in connection with determination of future floods which may occur on Cheoah River or Tulula, Sweetwater, Long, and Atoah Creeks, to consider floods that have occurred in the region on watersheds whose topography, cover, and physical characteristics are similar to those of these five streams.

Maximum Known Floods in the Region

Table 11 lists the maximum known floods experienced on watersheds comparable with those of the Cheoah River and its tributaries and within about 85 miles of Robbinsville. Streams which differ significantly in watershed characteristics from the streams studied in this report have not been included. This limits the streams considered to those which have their headwaters in the southern Appalachian Mountains. Table 11 does not include the flood discharges which occurred in the French Broad watershed as a result of the hurricanes of 1916 and 1940. Within the Tennessee Valley, the heaviest rainfall from hurricanes is generally confined to a narrow band along the southeastern Tennessee Valley Divide. Therefore, because of geographic location, flooding in the Cheoah River watershed due to hurricanes would be less severe than along the upper French Broad River.

One of the earliest documented large storms in the region was that of February 1875. This storm brought very heavy rains over the entire eastern Tennessee River watershed, resulting in large floods on many streams in the area. The storm, preceded by cold weather, probably fell on frozen ground and

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1. Prepared by Hydraulic Data Branch.

TABLE 11

MAXIMUM KNOWN FLOOD DISCHARGES OF STREAMS

IN THE REGION OF ROBBINSVILLE, NORTH CAROLINA

No.	Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per Sq. Mi. cfs
1	Toccoa River	nr. Dial, Ga.	177	November 19, 1906	28,000	158
2	West Fork Little Pigeon River	at Sevierville, Tenn.	151	April 1, 1896	30,000	199
3	Tuckasegee River	at Tuckasegee, N. C.	143	August 30, 1940	40,800	285
4	Pigeon River	at Canton, N. C.	133	August 30, 1940	31,600	238
5	Swannanoa River	at Biltmore, N. C.	130	April 1791	40,000	308
6	Little River	at Townsend, Tenn.	120	February 1875	26,000	217
7	Valley River	at Tomotla, N. C.	104	September 1898	20,000	192
8	Cullasaja River	at Cullasaja, N. C.	86.5	October 4, 1964	16,900	195
9	Sandymush Creek	nr. Alexander, N. C.	79.5	August 30, 1940	20,000	252
10	West Fork Tuckasegee River	nr. Tuckasegee, N. C.	52.5	August 30, 1940	14,000	267
11	Nottely River	nr. Blairsville, Ga.	45.4	August 23, 1967	21,200	467
12	Caney Fork	above Cowarts, N. C.	39.4	August 30, 1940	21,700	551
13	Toccoa River	below Gaddistown, Ga.	38.1	August 23, 1967	16,600	436
14	Panther Creek	nr. Toccoa, Ga.	32.5	June 16, 1949	15,100	465
15	Hominy Creek	above Candler, N. C.	28.9	August 30, 1940	12,400	429
16	North Fork Swannanoa River	nr. Black Mountain, N. C.	23.8	July 16, 1949	16,500	693
17	Brasstown Creek	nr. Young Harris, Ga.	20.3	August 23, 1967	8,590	423
18	Wolf Creek	nr. Tuckasegee, N. C.	14.1	August 30, 1940	14,500	1030
19	West Fork Pigeon River	at Spruce, nr. Waynesville, N. C.	12.2	August 30, 1940	16,500	1350
20	West Fork Little Pigeon River	below Trout Branch, Sevier Co., Tenn.	7.6	September 1, 1951	8,500	1120
21	Pilkey Creek	at Fontana Reservoir, N. C.	3.87	July 5, 1943	4,520	1170

therefore produced unusually high runoff. At Knoxville, Tennessee, rainfall totaled 8 inches in about two days. This storm produced the highest floods of record on the Little River and its tributaries.

The storm of November 19, 1906, caused the maximum flood of record in the Toccoa River basin. This storm was preceded by 4 to 8 inches of snow which fell on November 14 and 15. Rising temperatures on the 16th to 18th rapidly melted the snow. Heavy rainfall on the 18th and 19th combined with the snowmelt to produce severe flooding on many streams in the region. Rainfall amounts varied considerably during the storm; however, a maximum point rainfall of 8 inches was recorded at Murphy, North Carolina, where several "water spouts" were reported.

Two storms in August 1940 caused widespread flooding over the Robbinsville region. In mid-August most of the streams in the area had experienced flooding from heavy rainfall associated with a hurricane. Much of the same area was again deluged by heavy rains on August 29-30. The heaviest rain fell over the headwaters of the Cullasaja, Tuckasegee, and Pigeon Rivers and exceeded 10 inches.

On June 14-16, 1949, a widespread storm produced floods of considerable magnitude over a large part of the region. Rainfall of 8.50 inches in 21 hours was recorded in the Swannanoa River watershed, producing a flood on the North Fork Swannanoa River second only to the great flood of July 1916.

On September 1, 1951, an intense thunderstorm in the Great Smoky Mountains National Park caused severe flooding in the West Fork Little Pigeon watershed above Gatlinburg, Tennessee. A total storm catch of 4.0 inches in a 2-hour period was measured at the U. S. Weather Bureau gage on Mount Le Conte.

On August 19-27, 1967, a widespread frontal system extending from Alabama to Virginia brought heavy rains to the area. Flooding was particularly severe in the Toccoa River and Nottely River basins within the Tennessee Valley and along the headwaters of the Chattahoochee River basin on the south slopes of the Blue Ridge. Rainfall during the 8-day period ranged up to 22 inches, the greatest amounts occurring on August 22-23. During a 30-hour period beginning about noon on August 22, the maximum rainfall observed was 12.8 inches in the Nottely River basin and 9.7 inches in the Toccoa River basin.

All of the floods listed in Table 11 have occurred on watersheds in the region of Robbinsville that have similar physical characteristics. This indicates that floods of like magnitude, modified to take into account differences in drainage area characteristics, could occur in the future on the Cheoah River and on Tulula, Sweetwater, Long, and Atoah Creeks.

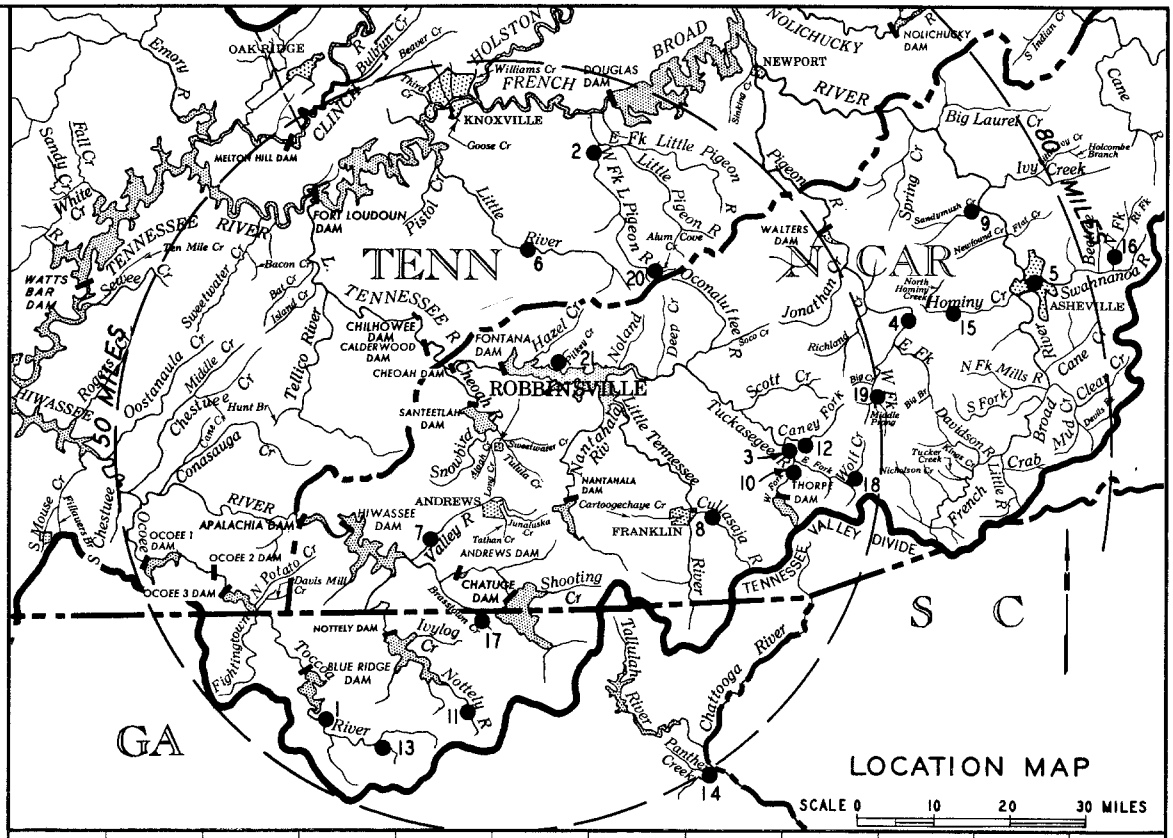
Determination of Regional Floods

Plate 3 is a diagram of the discharges listed in Table 11 together with a map showing the locations of the discharge measurements. Most of these floods occurred during the summer months and the most significant were those of August 30, 1940; June 16, 1949; September 1, 1951; and August 23, 1967. Although the September 1951 flood was not so widespread as the other three, all of these floods resulted from general thunderstorm activity which produced intense rainfall over local areas. Each of these storms was experienced within the past 30 years, which emphasizes that storms of this magnitude are not a rare event. Undoubtedly storms of this type occur quite often in the mountain regions, but because of their limited size and the remoteness of the area affected, very little damage is sustained and the storm is not recorded.

In addition to the intense local storms typical of the summer months, flooding can occur from storms of low intensity which extend over several days. Most often such storms occur during the winter and spring months and may fall on saturated ground or snow which contributes to the runoff. The February 1875 storm was a storm of this type.

Based upon the maximum flood discharges experienced in the region, it is reasonable to expect future flood discharges on the Cheoah River and Tulula, Sweetwater, Long, and Atoah Creeks to be in the order of those given in Table 12. For the purposes of this report, floods of this magnitude are designated as Regional Floods.

The profiles of the Regional Floods on Cheoah River and Tulula Creek are shown on Plate 7. Such a flood on Cheoah River would be 8 to 16 feet higher than the March 12, 1963, flood, being about 15 feet higher at the old U. S. Highway 129 bridge. A Regional Flood may occur on Tulula Creek in the reach investigated that would be from 2 to 13 feet higher than the 1963 flood, averaging about 5 feet higher in the immediate vicinity of Robbinsville. The Regional Flood profile on Sweetwater Creek is shown on Plate 9. In the reach investigated on Sweetwater



TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

MAXIMUM KNOWN FLOOD DISCHARGES
REGION OF ROBBINSVILLE, N.C.

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HD-1311

Creek, a Regional Flood may occur that would be 3 to 14 feet higher than the March 12, 1963, flood, averaging 6 feet higher. On Long Creek a Regional Flood may occur that would also average about 6 feet higher than the 1963 flood, but which would range from 3 to 12 feet higher as shown on Plate 9. The profile of the Regional Flood on Atoah Creek is also shown on Plate 9. It would be about 3.5 feet higher than the estimated profile for the flood of March 12, 1963. Figures 7 to 9 show the height that would be reached by the Regional Flood at several locations along the streams in the vicinity of Robbinsville.

TABLE 12

REGIONAL FLOOD PEAK DISCHARGES

Stream	Location	Mile above Mouth	Drainage Area sq. mi.	Discharge cfs
Cheoah River	Old U. S. Highway 129	17.92	43.1	23,000
Tulula Creek	Sweetwater Road	0.49	28.6	19,000
	County Road 1206	3.76	17.3	14,000
Sweetwater Creek	County Road 1214	0.58	13.6	12,000
Long Creek	U. S. Highway 129	0.04	11.8	11,000
	Snowbird Road	1.88	6.03	7,500
Atoah Creek	Snowbird Road	0.66	3.42	5,400

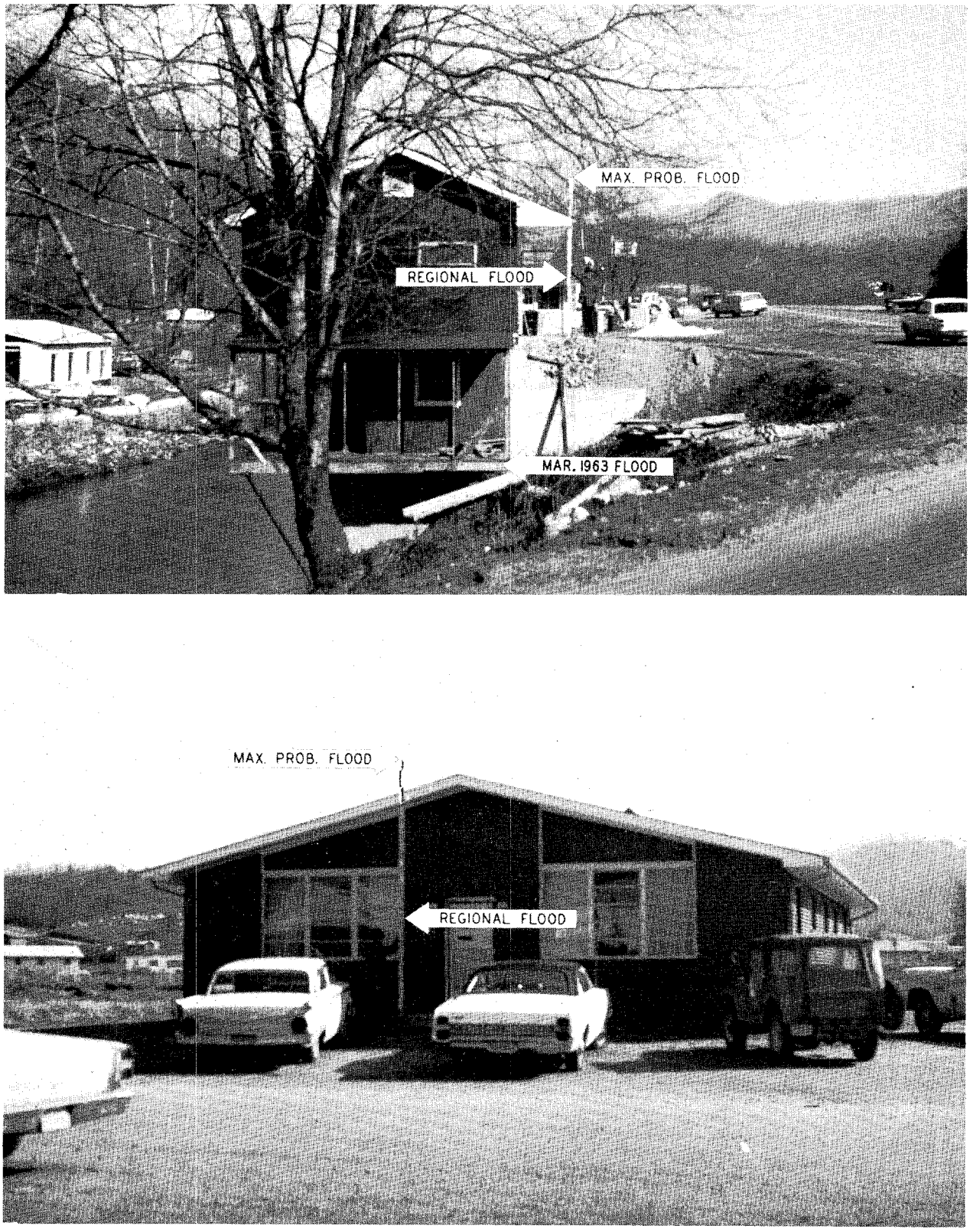

Figure 7.--FLOOD HEIGHTS ALONG CHEOAH RIVER

Upper view shows motel under construction at Mile 18.00. Lower view is office of Dr. J. E. Stephens at Mile 18.38. The flood of March 12, 1963, was 0.5 foot below the lower floor level of the motel and 3.3 feet lower than the floor of the doctor's office. Arrows show the Regional and Maximum Probable Flood heights.

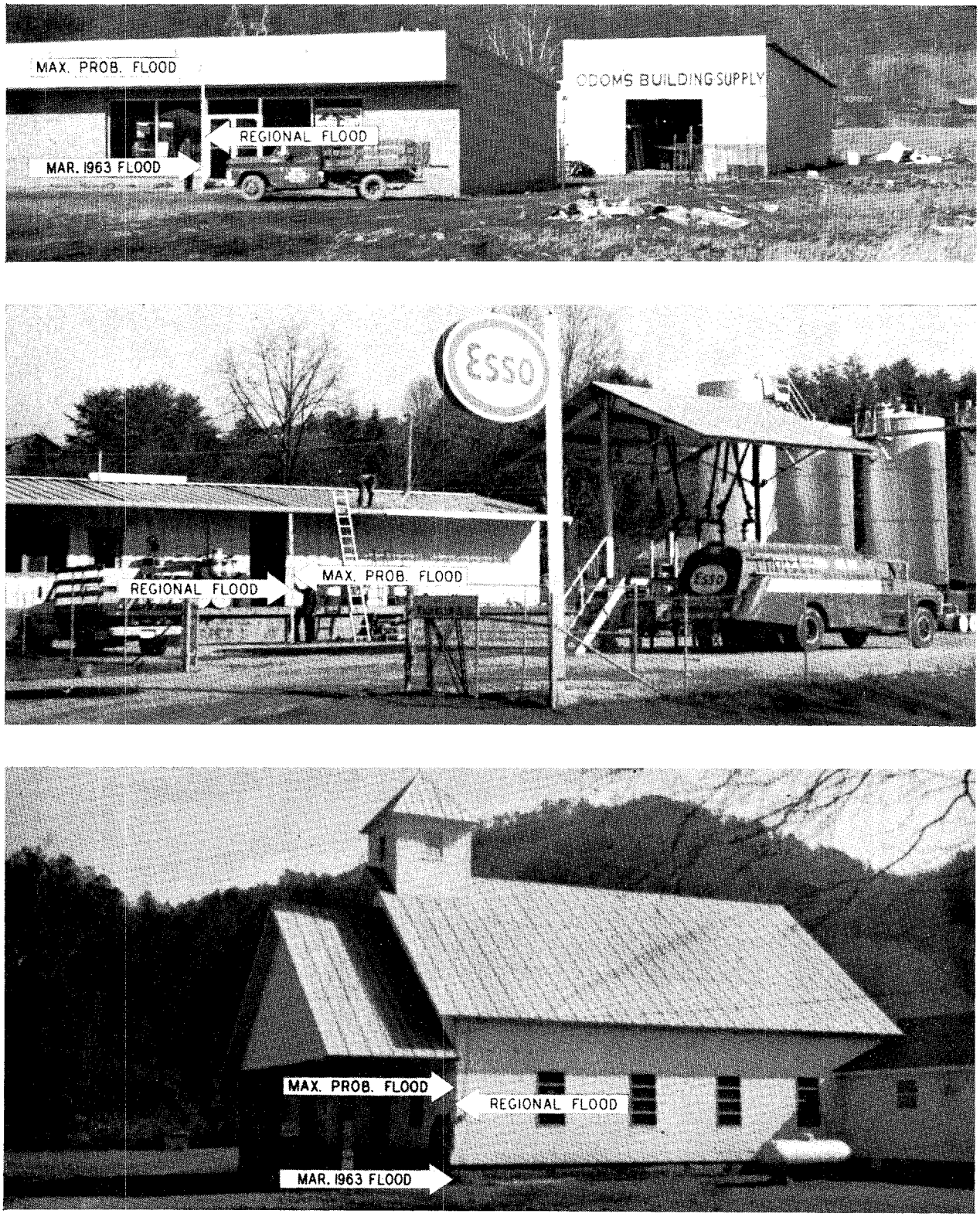

Figure 8.--TULULA CREEK FLOOD HEIGHTS

Odom's Building Supply at Mile 0.20, the Veach-Wilson Oil Company at Mile 0.50, and the Sweetgum Church at Mile 3.79 are shown in these three views. Arrows indicate the heights of the flood of March 12, 1963, the Regional Flood, and the Maximum Probable Flood. At the oil company, the 1963 flood was 1.1 feet lower than the base of rod in the picture.

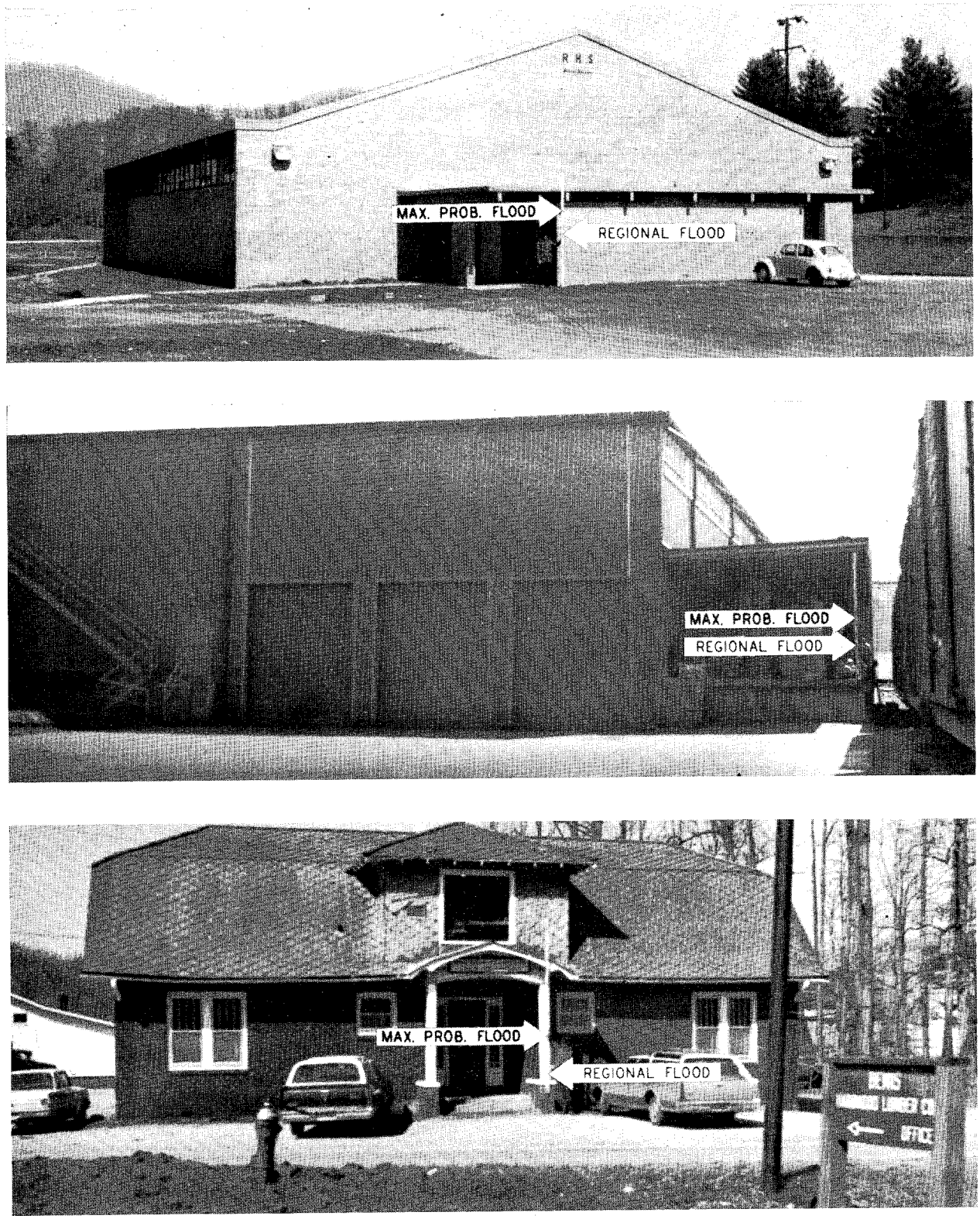

Figure 9.--FLOOD HEIGHTS ON LONG CREEK

Top view is the gymnasium of Robbinsville High School. Middle view is the carpet factory of James Lees and Son Company. Bottom view is the office of Bemis Hardwood Lumber Company. The flood of March 12, 1963, was lower than the base of rod in these pictures by margins of 0.9, 3.3, and 4.5 feet respectively. Arrows show heights of the Regional and Maximum Probable Floods.

VI.

MAXIMUM PROBABLE FLOODS

VI.

MAXIMUM PROBABLE FLOODS[1]

This section discusses the Maximum Probable Floods on the streams involved in this study and some of the hazards of great floods. Floods of the magnitude of the Maximum Probable are the kind considered in planning construction and operation of protective works, the failure of which might be disastrous. They represent reasonable upper limits of expected flooding.

Drainage areas of the streams involved in this study are as follows:

Stream	Mile above Mouth		Drainage Area	
	From	To	Downstream Limit	Upstream Limit
			sq. mi.	sq. mi.
Cheoah River	17.70	18.44	54.9	42.9
Tulula Creek	0	6.50	28.9	9.34
Sweetwater Creek	0	4.17	14.0	8.93
Long Creek	0	2.24	11.8	5.91
Atoah Creek	0	1.04	4.29	3.21

Extreme floods on these streams are most likely to result from either of two types of storms--intense periods of rainfall during winter storms of fairly long duration, or short-duration storms of the thunderstorm or hurricane type usually occurring during summer or early fall. Infiltration and other losses are generally low in winter and high in summer.

DETERMINATION OF FLOOD DISCHARGES

In determining the Maximum Probable Floods on the streams involved in this study, consideration was given to great storms and floods that have already occurred on these watersheds and to those which have occurred elsewhere but could have occurred in this area. This procedure provides information about possible floods and storms additional to that which can be gained from the short-term local hydrologic records alone.

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1. Prepared by Flood Control Branch.

The greatest known flood for which data are available on the Cheoah River in the vicinity of Robbinsville occurred March 12, 1963. The peak discharge is estimated to have been 4,800 cubic feet per second at the lower limit of the study.

Knowledge of past flooding on Tulula, Sweetwater, and Long Creeks is extremely limited. The greatest known flood in recent years is that of March 1963 with estimated peak discharges of 3,500, 1,900, and 3,100 cubic feet per second at their respective mouths. There is no historic flood information on Atoah Creek.

It is reasonable to expect that greater floods than those of the past will occur on these streams.

Maximum Probable Storms

Observed storms are meteorologically transposable to the Robbinsville area from within broad regions both east and west of the Appalachian Divide. The region to the west extends to Oklahoma and Nebraska and from the Great Lakes to the middle of Mississippi, Alabama, and Georgia. The region to the east extends to the Atlantic Ocean and from Pennsylvania to Florida. The moisture source for storms in these regions is the warm, moist air flowing northward from the tropical Atlantic Ocean. In general the moisture potential for a given region decreases with its increased distance from the moisture source. It is further decreased when mountain barriers lie between the moisture source and the watershed. Transposition of storms from within the broad regions includes adjustments for the particular meteorological conditions to be expected in the Robbinsville area. Table 13 lists known rainfall depths for several large storms transposable to this area.

TABLE 13

SELECTED MAXIMUM OBSERVED STORMS TRANSPOSABLE TO THE REGION OF ROBBINSVILLE, NORTH CAROLINA

Date	Location	Drainage Area sq. mi.	Rainfall Duration hours	Rainfall Depth inches
July 1939	Kentucky	10	3	21.0
September 1940	Oklahoma	55	6	15.9
		30	6	17.1
September 1940	New Jersey	55	6	18.3
		30	6	19.2
		10	3	13.2
		Point	3	14.2
July 1942	Pennsylvania	55	6	19.3
		30	6	21.6

Upon the basis of these and other data, as adjusted for conditions at Robbinsville, the following rainstorms were adopted for computing the Maximum Probable Floods.

Location	Drainage Area sq. mi.	Rainfall Duration hours	Rainfall Depth inches
Cheoah River			
Upper limit (Mile 18.44)	42.9	6	16.8
Lower limit (Mile 17.70)	54.9	6	16.3
Tulula Creek			
Upper limit (Mile 6.50)	9.34	3	15.1
Mouth	28.9	6	17.5
Sweetwater Creek			
Upper limit (Mile 4.17)	8.93	3	15.1
Mouth	14.00	3	14.6
Long Creek			
Upper limit (Mile 2.24)	5.91	3	15.4
Mouth	11.8	3	14.8
Atoah Creek			
Upper limit (Mile 1.04)	3.21	3	15.6
Mouth	4.29	3	15.6

From a meteorological standpoint, storms 1.6 times greater than these can occur.

Maximum Probable Flood Discharges

The peak discharges expected to result from an occurrence of the maximum probable storm were computed by using average runoff conditions. Table 14 lists the peak discharges at selected locations on the streams included in this study.

Maximum Recorded Floods

As a guide in determining their reasonableness, the computed Maximum Probable Floods were compared with maximum observed floods on other streams. Factors such as the meteorology of the region and flood-producing characteristics of the watershed were given consideration in determining whether peak discharges on other streams were comparable. Table 15 lists peak discharges for observed floods on several streams approximately the size of those discussed in this report,

some of which equal or approach the adopted Maximum Probable Flood rates if allowance is made for the size of a watershed. For comparison, the discharges of the March 12, 1963, flood on the streams included in this study are listed.

TABLE 14

MAXIMUM PROBABLE FLOOD PEAK DISCHARGES

Location	Mile above Mouth	Drainage Area sq. mi.	Discharge cfs
Cheoah River			
Lower limit	17.70	54.9	46,000
Old U. S. Highway 129	17.92	43.1	40,000
Tulula Creek			
Sweetwater Road	0.49	28.6	30,000
County Road 1206	3.76	17.3	25,000
Upper limit	6.50	9.34	20,000
Sweetwater Creek			
County Road 1214	0.58	13.6	24,000
Upper limit	4.17	8.93	19,500
Long Creek			
U. S. Highway 129	0.04	11.8	22,000
Snowbird Road	1.88	6.03	15,000
Upper limit	2.24	5.91	15,000
Atoah Creek			
Mouth	0.0	4.29	12,000
Snowbird Road	0.66	3.42	11,000
Upper limit	1.04	3.21	10,000

Frequency

It is not possible to assign a probability of occurrence or frequency to the Maximum Probable 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 Maximum Probable are hydrologically possible; however, the combination of factors that would be necessary to produce such floods would seldom occur. The consideration of floods of this magnitude is of greater importance in some problems than in others but should not be overlooked in the study of any problem.

TABLE 15

SELECTED MAXIMUM OBSERVED FLOODS

APPLICABLE TO ROBBINSVILLE, NORTH CAROLINA

Stream	Location	Drainage Area sq. mi.	Date	Peak Discharge Amount cfs	Peak Discharge Per Sq. Mi. cfs
Big Creek	Sunburst, N. C.	1.69	1940	12,400	7340
N. F. Catawba R.	Asheford, N. C.	5.2	1940	15,000	2880
W. F. Pigeon R.	nr Spruce, N. C.	8.4	1940	16,400	1950
Steels Creek	Tablerock, N. C.	16	1940	24,000	1500
Elk Creek	Banner Elk, N. C.	17.8	1940	22,000	1200
Upper Creek	Tablerock, N. C.	20.2	1940	25,000	1240
Cane Creek	Bakersville, N. C.	22	1901	29,500	1340
Charles Creek	Faulkner Spr., Tenn.	32	1952	23,000	720
N. F. Catawba R.	Woodlawn, N. C.	41.8	1940	55,000	1320
Elkhorn Creek	Keystone, W. Va.	44	1901	60,000	1360
Triplett Creek	Morehead, Ky.	47.5	1939	44,000	926
Elk Creek	Elkville, N. C.	50	1940	70,000	1400
Wilson Creek	Adako, N. C.	66	1940	99,000	1500
Cheoah R.	Robbinsville, N. C.	54.9	1963	4,800	87
Tulula Creek	Robbinsville, N. C.	28.9	1963	3,500	121
Sweetwater Creek	Robbinsville, N. C.	14.0	1963	1,900	136
Long Creek	Robbinsville, N. C.	11.8	1963	2,100	178

HAZARDS OF GREAT FLOODS

The amount and extent of damage caused by any flood depend 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 flooded by the Maximum Probable Flood and the flood of March 12, 1963, are shown on Plates 4 and 5. Depths of flooding can be estimated from the crest profiles which are shown on Plates 7 and 9.

The profiles for the five streams were computed by using stream characteristics for selected reaches as determined from available observed flood profiles, topographic maps, and valley cross sections which were surveyed in 1968.

The elevations shown on Plates 7 and 9 and the overflow areas shown on Plates 4 and 5 have been determined with an accuracy consistent with the purposes of this study and the accuracy of the basic data. More precision would require costly surveys not warranted by this study.

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

The Maximum Probable Flood profile on the Cheoah River is from about 25 to about 35 feet higher than the low water, the maximum difference occurring at Mile 17.7.

On Tulula Creek the Maximum Probable Flood profile is 9 to 22 feet higher than the low water of October 1968. The greatest difference occurs in the vicinity of the community of Tulula at Mile 5.8 and is due to the narrow flood plain at that location.

The Maximum Probable Flood profile on Sweetwater Creek is 11 to 23 feet higher than the low-water profile. The maximum difference occurs in the vicinity of Mile 0.8 and is the result of a natural constriction in the overbank channel downstream to Mile 0.6.

On Long and Atoah Creeks the Maximum Probable Flood profiles are 9 to 16, and 9 to 11 feet higher, respectively, than the 1968 low-water profile. The greatest difference on Long Creek occurs at Mile 1.0 and the greatest difference on Atoah Creek occurs at Mile 0.5.

Figures 7 to 9 on pages 50 to 52 show the heights that would be reached by the Maximum Probable Flood at several locations along the streams included in this report.

Velocities, Rates of Rise, and Duration

Water velocities in the streams during a flood 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.

During the Maximum Probable Flood, the range of velocities in the main channel and in the overflow plain of the five streams of this study would be as shown in Table 16.

TABLE 16

MAXIMUM PROBABLE FLOOD VELOCITIES

Stream	Feet per Second			
	Main Channel		Overflow Plain	
	From	To	From	To
Cheoah River	2	16	Less than 1	4
Tulula Creek	4	20	Less than 1	9
Sweetwater Creek	2	22	Less than 1	8
Long Creek	10	19	2	5
Atoah Creek	10	15	2	4

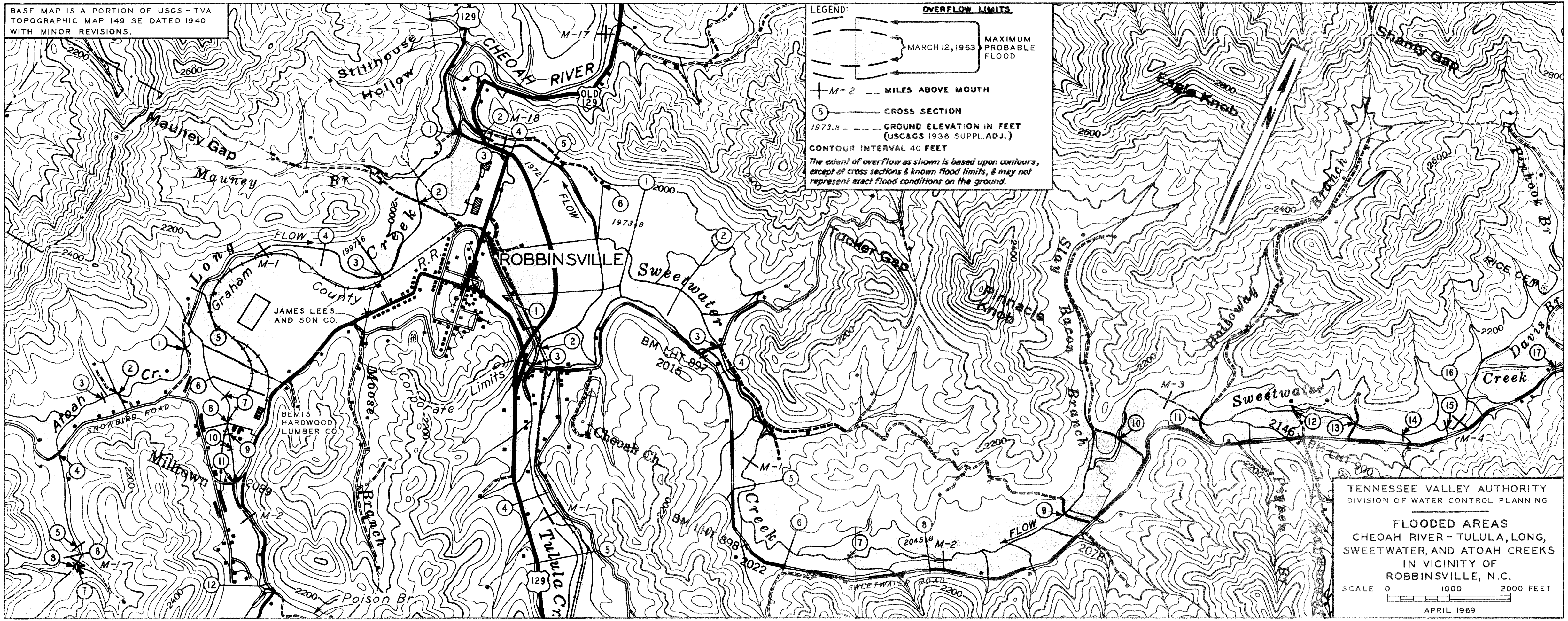
The total rise above low water to the crest stage, the maximum rate of rise, and the duration above bankfull stage of the Maximum Probable Flood on each of these five streams would be as shown in Table 17.

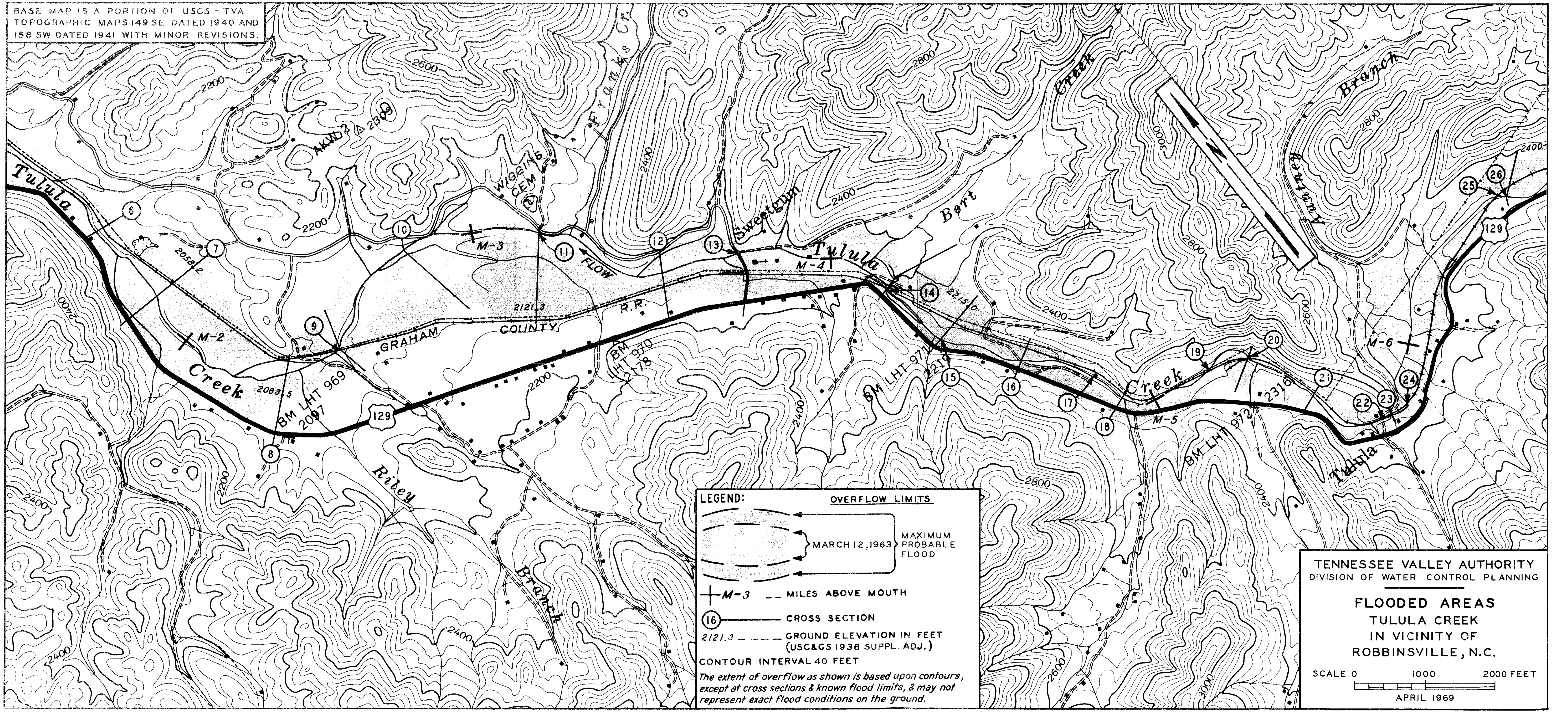
These rapid rates and high stream velocities in combination with deep, long-duration flooding would create a hazardous situation in developed areas.

TABLE 17

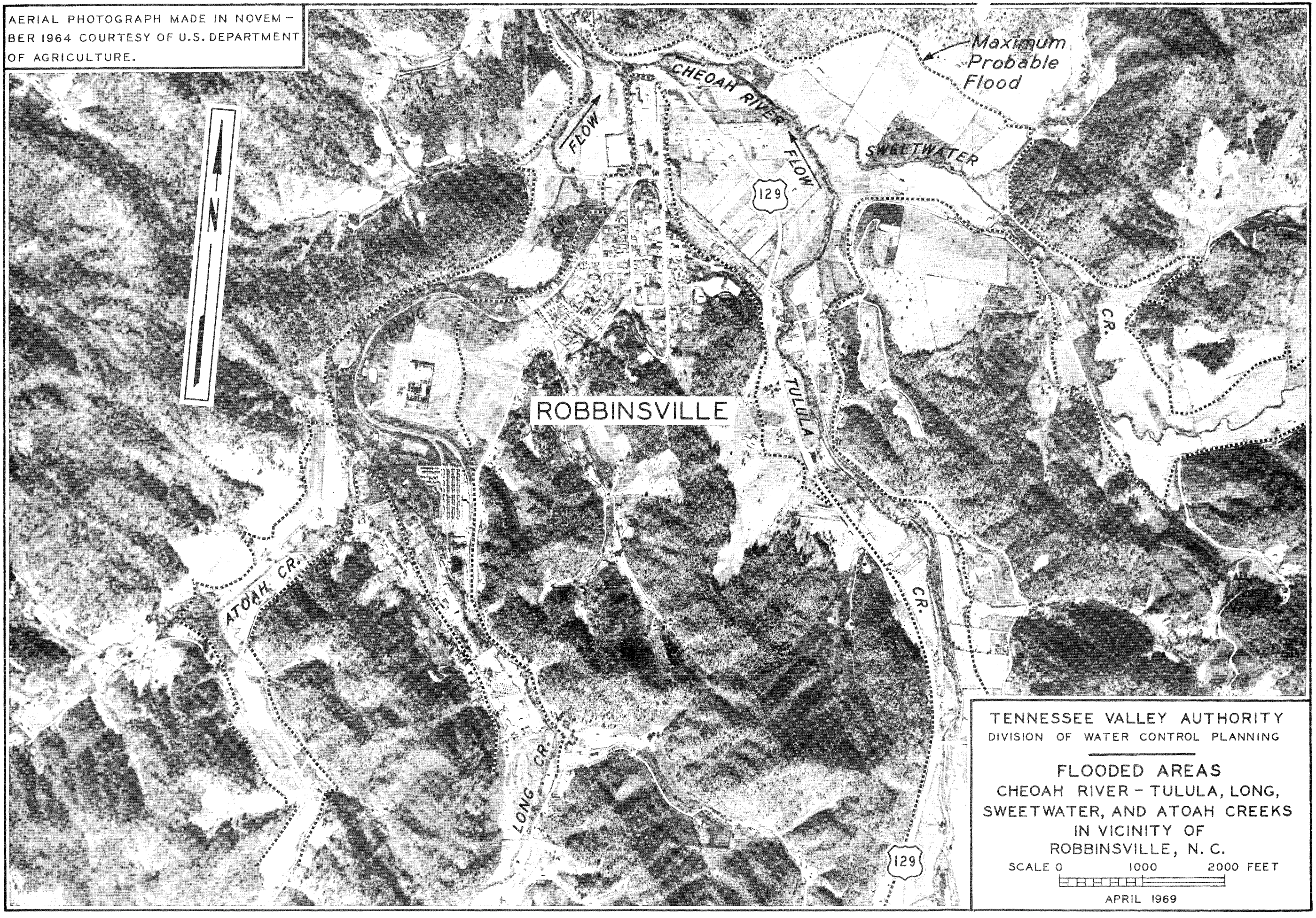
MAXIMUM PROBABLE FLOODS--RATE OF RISE AND DURATION

Stream	Location	Total Rise above Low Water	Maximum Rate of Rise	Duration above Bankfull Stage
Cheoah River	Old U. S. Highway 129, Mile 17.92	31 feet in 8 hours	7 feet in 1 hour	40 hours
Tulula Creek	Sweetwater Road, Mile 0.49	15 feet in 7 hours	3 feet in 0.5 hour	32 hours
Sweetwater Creek	Below bridge, Mile 0.58	17 feet in 3 hours	4 feet in 0.5 hour	25 hours
Long Creek	Railroad bridge, Mile 1.70	11 feet in 3 hours	3 feet in 0.5 hour	8 hours
Atoah Creek	Snowbird Road, Mile 0.66	10 feet in 3 hours	2 feet in 0.5 hour	13 hours


BASE MAP IS A PORTION OF USGS - TVA TOPOGRAPHIC MAP 149 SE DATED 1940 WITH MINOR REVISIONS.
LEGEND:
OVERFLOW LIMITS
MARCH 12, 1963 MAXIMUM PROBABLE FLOOD
M-2 MILES ABOVE MOUTH
5 CROSS SECTION
1973.8 GROUND ELEVATION IN FEET (USC&GS 1936 SUPPL. ADJ.)
CONTOUR INTERVAL 40 FEET
The extent of overflow as shown is based upon contours, except at cross sections & known flood limits, & may not represent exact flood conditions on the ground.
CHEOAH RIVER
ROBBINSVILLE
Stillhouse Hollow
Maurey Gap
Maurey Br
Long Creek
Graham County
JAMES LEES AND SON CO.
BEMIS HARDWOOD LUMBER CO
Corporate Limits
Moose Br
Atoah Cr.
SNOWBIRD ROAD
Milltown
Poison Br
Cheoah Ck
Tulula Cr.
Sweetwater Creek
Tucker Gap
Pinnacle Knob
Slay Bacon Branch
Eagle Knob
Shanty Gap
Rattlesnake Branch
Pinhook Br
Halloway Br
Davis Br
Creek
SWEETWATER ROAD
BM LMT 897 2015
BM LMT 898 2022
BM LMT 900
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
FLOODED AREAS
CHEOAH RIVER - TULULA, LONG, SWEETWATER, AND ATOAH CREEKS IN VICINITY OF ROBBINSVILLE, N.C.
SCALE 0 1000 2000 FEET
APRIL 1969


BASE MAP IS A PORTION OF USGS-TVA TOPOGRAPHIC MAPS 149 SE DATED 1940 AND 158 SW DATED 1941 WITH MINOR REVISIONS.
Tulula
Creek
Franks Cr.
Sweetgum
Bert
Creek
Auntney
Branch
Riley
Branch
WIGGINS CEM
FLOW
GRAHAM
COUNTY
R.R.
BM LHT 969
2097
BM LHT 970
2178
BM LHT 971
2219
BM LHT 972
2316
AKIN 2 △ 2303
129
M-2
M-3
M-4
M-5
M-6
2056.2
2083.5
2121.3
2215.0
LEGEND:
OVERFLOW LIMITS
MARCH 12, 1963
MAXIMUM PROBABLE FLOOD
M-3 __ MILES ABOVE MOUTH
16 CROSS SECTION
2121.3 ____ GROUND ELEVATION IN FEET (USC&GS 1936 SUPPL. ADJ.)
CONTOUR INTERVAL 40 FEET
The extent of overflow as shown is based upon contours, except at cross sections & known flood limits, & may not represent exact flood conditions on the ground.
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING
FLOODED AREAS
TULULA CREEK
IN VICINITY OF
ROBBINSVILLE, N.C.
SCALE 0 1000 2000 FEET
APRIL 1969

AERIAL PHOTOGRAPH MADE IN NOVEMBER 1964 COURTESY OF U.S. DEPARTMENT OF AGRICULTURE.



TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

FLOODED AREAS
CHEOAH RIVER - TULULA, LONG, SWEETWATER, AND ATOAH CREEKS IN VICINITY OF ROBBINSVILLE, N. C.

SCALE 0 1000 2000 FEET

APRIL 1969

HD-1311

HD-1311

ELEVATION IN FEET (USC&GS 1936 SUPPL. ADJ.)

1960 1980 2000 2020 2040 2060 2080

17.5 18 18.5 0 1 2 3 4 5 6

CHEOAH RIVER

Section X

Long Creek

Old U.S. Hwy. 129

Robbinsville

Confluence of Tuluia and Sweetwater Creeks

Floor Clearance

March 12, 1963 (Estimated)

1960 1980 2000 2020 2040 2060 2080

Robbinsville

Cheoah River - Mile 18.44

1 2 3 4 5 6 7 8

Graham County R.R.

Sweetwater Road

Jan. 1939

Water Surface - Oct. 1968

Stream bed

February 1969

Regional Flood

Maximum Probable Flood

March 12, 1963

County Road 1260

Riley Creek

Graham County R.R.

1960 2000 2020 2060 2100 2120 2140 2160 2180 2200 2220

1 2 3 4 5 6 7 8 9

10 11 12 13 14 15 16

Private Road

Franks Creek

TULULA CREEK

County Road 1206

Top of Rail

Clearance

Bert Creek

Graham County R.R.

County Road 1204

1960 2000 2020 2060 2100 2120 2140 2160 2180 2200 2240 2260 2280 2300 2320 2340 2360

10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Private Road

Anderson Creek

February 1969

Maximum Probable Flood

March 12, 1963

Stream Bed

Graham County R.R.

Hares Creek

Campbell Creek

County Road 1101

Graham County R.R.

Regional Flood

Water Surface - Oct. 1968

Graham County R.R.

Private Road

Section

25 26

2200 2300 2320

MILES ABOVE MOUTH

TENNESSEE VALLEY AUTHORITY

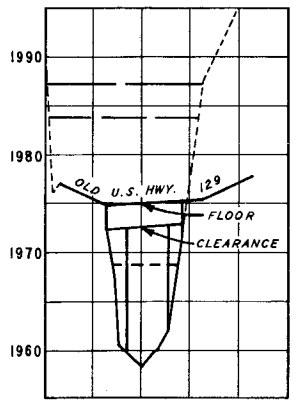
DIVISION OF WATER CONTROL PLANNING

HIGH WATER PROFILES

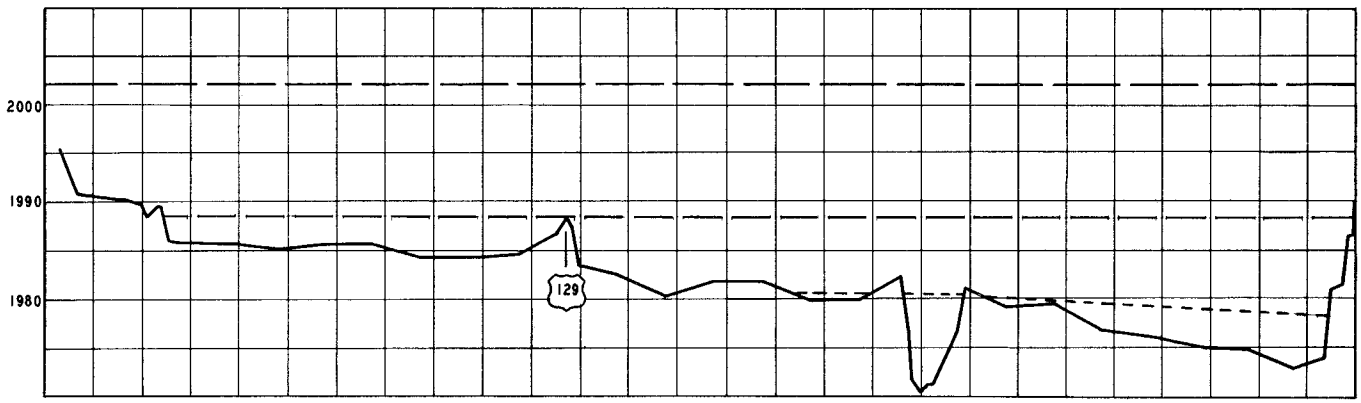
CHEOAH RIVER AND
TULULA CREEK
IN VICINITY OF
ROBBINSVILLE, N.C.

APRIL 1969

PLATE 7



SECTION 2 - MILE 17.92

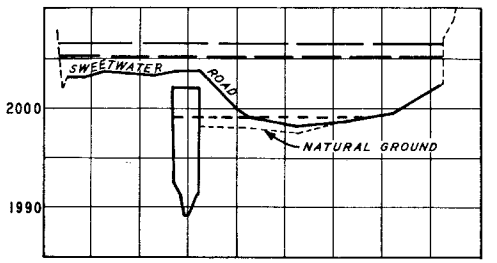


SECTION 6 - MILE 18.44

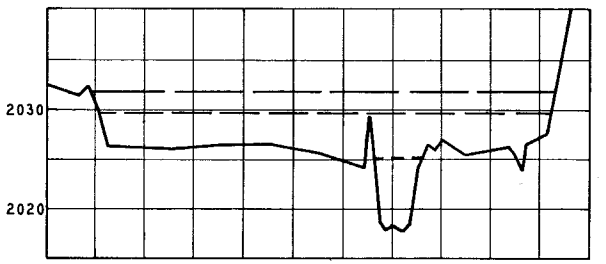
CHEOAH RIVER

4 sections not shown

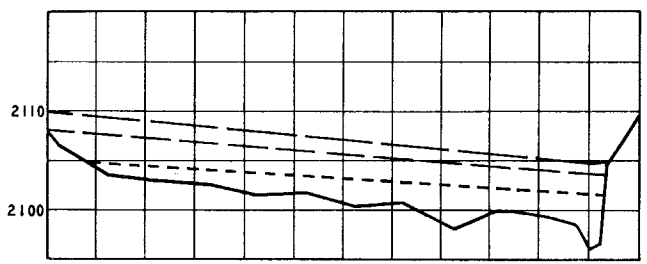
ELEVATION IN FEET (USC&GS 1936 SUPPL. ADJ.)



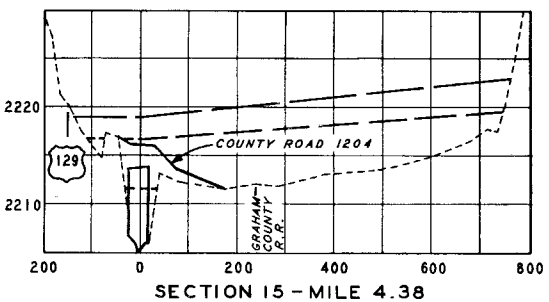
SECTION 3 - MILE 0.49



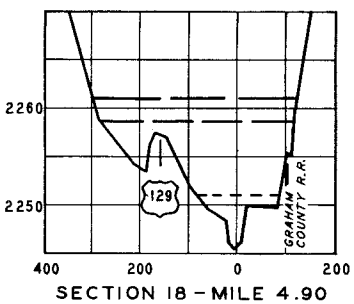
SECTION 5 - MILE 1.15



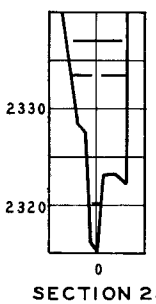
SECTION 10 - MILE 2.80



SECTION 15 - MILE 4.38



SECTION 18 - MILE 4.90



SECTION 23
MILE 5.73

Sections taken looking downstream

TULULA CREEK

20 sections not shown

LEGEND:

Maximum Probable Flood

Regional Flood

March 12, 1963

TENNESSEE VALLEY AUTHORITY

DIVISION OF WATER CONTROL PLANNING

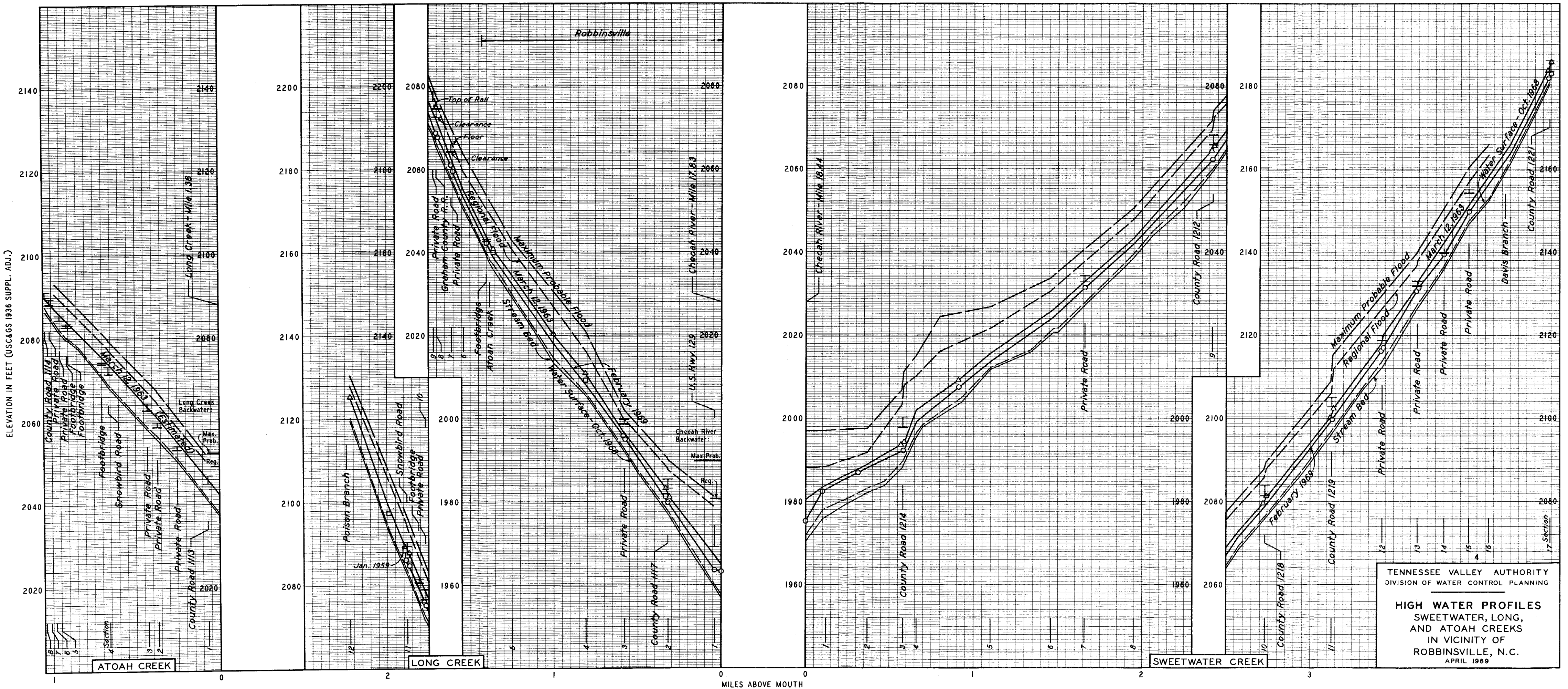
CROSS SECTIONS

CHEOAH RIVER AND TULULA CREEK IN VICINITY OF ROBBINSVILLE, N.C.

APRIL 1969

HORIZONTAL DISTANCE IN FEET

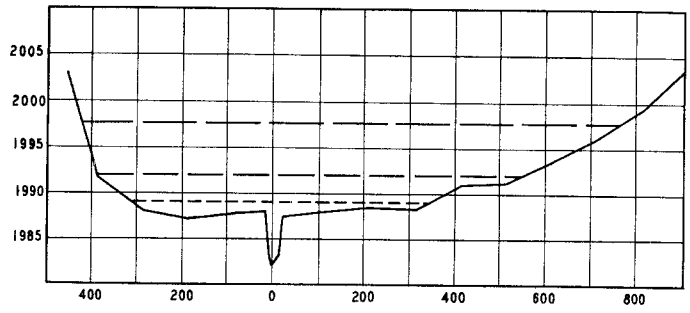
PLATE 8



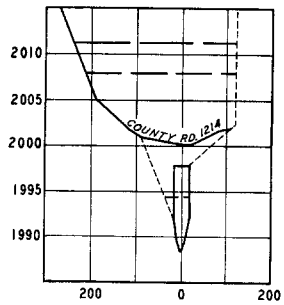
TENNESSEE VALLEY AUTHORITY
DIVISION OF WATER CONTROL PLANNING

HIGH WATER PROFILES
SWEETWATER, LONG, AND ATOAH CREEKS IN VICINITY OF ROBBINSVILLE, N.C.
APRIL 1969

HD-1311

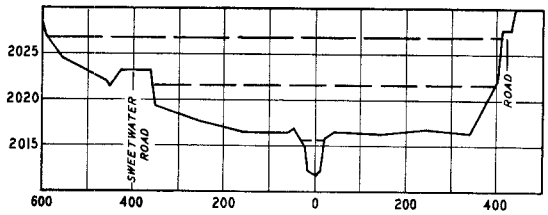


SECTION 2 – MILE 0.37

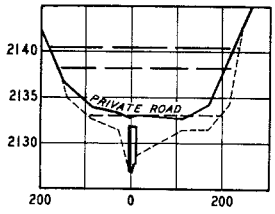


SECTION 3 – MILE 0.58

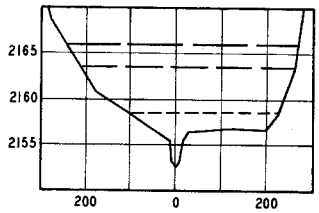
Sections taken looking downstream



SECTION 5 – MILE 1.10



SECTION 13 – MILE 3.64

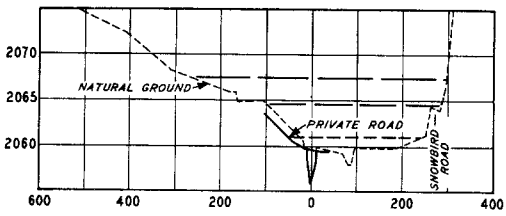


SECTION 16 – MILE 4.07

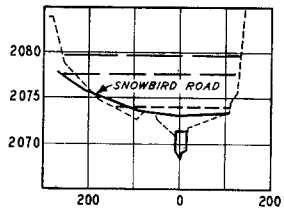
SWEETWATER CREEK

12 Sections not shown

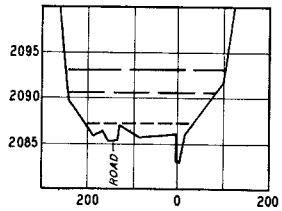
ELEVATION IN FEET (USC&GS 1936 SUPPL. ADJ.)



SECTION 2 – MILE 0.37



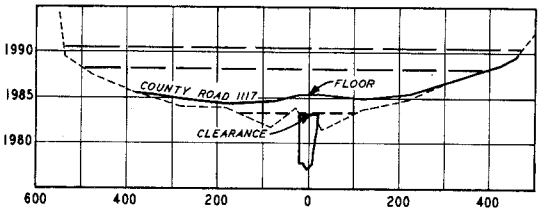
SECTION 4 – MILE 0.66



SECTION 6 – MILE 0.98

ATOAH CREEK

5 Sections not shown



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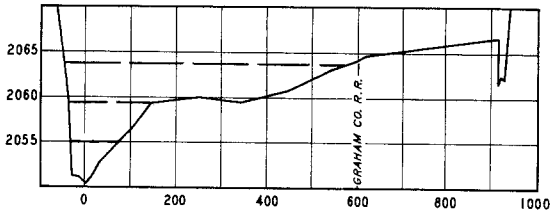
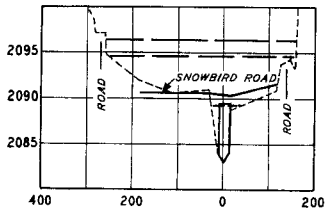
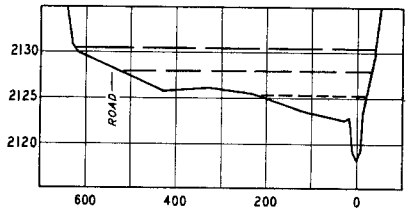


SECTION 6 – MILE 1.54



SECTION 11 – MILE 1.88



SECTION 12 – MILE 2.22

LEGEND:

——— ——— Maximum Probable Flood

— — — Regional Flood

– – – – – March 12, 1963

LONG CREEK

11 Sections not shown

TENNESSEE VALLEY AUTHORITY

DIVISION OF WATER CONTROL PLANNING

CROSS SECTIONS

SWEETWATER, ATOAH, AND LONG CREEKS IN VICINITY OF ROBBINSVILLE, N.C.

APRIL 1969

HORIZONTAL DISTANCE IN FEET