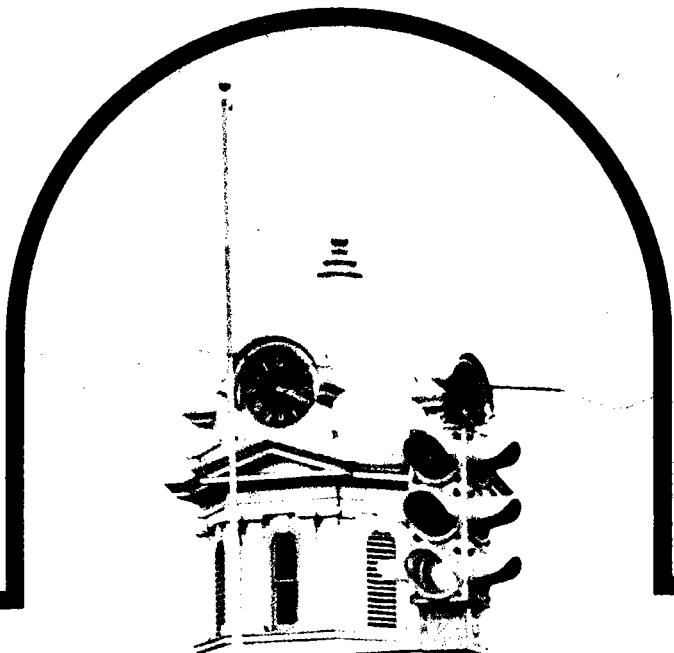


**FLOODS  
on  
TUCKASEGEE  
RIVER  
and  
DEEP CREEK**

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**Vicinity  
of  
BRYSON  
CITY  
N. C.**



**TENNESSEE VALLEY AUTHORITY  
DIVISION OF WATER CONTROL PLANNING**

TENNESSEE VALLEY AUTHORITY  
DIVISION OF WATER CONTROL PLANNING

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FLOODS  
ON  
TUCKASEGEE RIVER  
AND DEEP CREEK  
IN VICINITY OF  
BRYSON CITY, N. C.

REPORT NO. 0-5930

KNOXVILLE, TENNESSEE

JANUARY 1960

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### COVER PHOTO

This view shows the Swain County Courthouse, located in Bryson City at the intersection of Main and Everett Streets and less than 200 feet from the Tuckasegee River. The arrows on the rod held against the right front of the building show the crest level that would be reached by the Maximum Probable Flood (upper arrow) and the Regional Flood (lower arrow), both of which are discussed in this report. A recurrence of the record May 1840 flood under present conditions would be about 2.8 feet deep on the Courthouse floor, or one foot below the Regional Flood.

**FOREWORD**

Tennessee Valley Authority  
Division of Water Control Planning

**FOREWORD**

This report relates to the flood situation along Tuckasegee River and Deep Creek in the vicinity of Bryson City, North Carolina. It has been prepared at the request of the Mayor and Board of Aldermen of the town of Bryson City through the North Carolina Department of Water Resources to aid (1) in the solution of local flood problems and (2) in the best utilization of lands subject to overflow. The report is based on work the TVA has been carrying on since its beginning in connection with its water resource operations throughout the Tennessee Valley. TVA has assembled information on rainfall, runoff, historical and current flood heights, and other technical data bearing on the occurrence and magnitude of floods in localities throughout the region which provide the basis for preparation of the report.

The report does not include plans for the solution of flood problems. Rather, it is intended to provide a basis for further study and planning on the part of the town of Bryson City in arriving at solutions to minimize vulnerability to flood damages. This might involve (1) 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 Bryson City flood problem. The first brings together a record of the largest known floods of the past on Tuckasegee River and Deep Creek. The second treats of Regional Floods. These are derived from consideration of the largest floods known to have occurred on streams of similar physical characteristics in the same general geographical region as that of Tuckasegee River and Deep Creek and generally within 40 miles of Bryson City. The third develops the Maximum Probable Floods for Tuckasegee River and Deep Creek. 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. Such floods are used by TVA in the design



of the physical features of reservoirs, dams, powerhouses, and local flood protection works.

The report contains maps, profiles, and valley cross sections which indicate the extent of flooding that has been experienced and that might occur in the future in Bryson City.

In problems concerned with the control of developments in the flood plains of Tuckasegee River and Deep Creek, and in reaching decisions on the magnitude of floods to consider for this purpose, appropriate consideration should be given to the possible future occurrence of floods of the magnitude of (1) those that have occurred in the past, (2) the Regional Floods derived from those that have occurred on streams of similar physical characteristics in the region of Bryson City, and (3) the Maximum Probable Floods that it is estimated might occur.

The report should be useful in planning new developments in the flood plain. From the maps, profiles, and cross sections, the depth of probable flooding by either recurrence of the largest known historic floods or by occurrence of the Regional or Maximum Probable Floods at any location may be ascertained. Having this information, floor levels for buildings 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.

L.  
RESUME  
OF  
FLOOD SITUATION



Figure 1. --MAXIMUM PROBABLE AND REGIONAL FLOODS AT BRYSON CITY

The upper view shows Main Street westward from the vicinity of the Town Square. The center view shows Everett Street southward from the Southern Railway crossing toward the Tuckasegee River bridge. The lower view is north across the Town Square toward the Everett Street bridge. The circles and dashed lines show the height of the Maximum Probable Flood discussed in Section IV and the Regional Flood discussed in Section III. The difference between the two floods in these views is about 5.5 feet.

Tennessee Valley Authority  
Division of Water Control Planning

I.

RESUME OF FLOOD SITUATION

Bryson City, North Carolina, is located on the Tuckasegee River about 13 miles above the mouth of the stream. The river flows diagonally through the corporate limits for three miles, bisecting the business section of the city. The river watershed above the business section covers 655 square miles. Deep Creek, a tributary with a drainage area of 43.9 square miles, flows out of the Great Smoky Mountains through a rapidly growing residential area, entering the corporate limits near the mouth.

The flood plain of the river through Bryson City is well developed, and a large number of commercial establishments and residences and several industries are subject to inundation. The town has experienced overflows several times since it was incorporated nearly 75 years ago, the largest and most damaging of these being in August 1940. Even higher floods occurred before the town was developed. The Deep Creek flood plain has been largely in agricultural use until about five years ago when residential development began. Extensive overflows are relatively rare on the creek but very large floods have occurred in the past that, should they recur, would inundate some of this flood plain development.

Continuous records of stream stages and discharges are available on the Tuckasegee River since 1896. There are no such records on Deep Creek. In compiling a record of past floods on the creek and of early floods on the river, it has been necessary to interview residents along the two 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 Tuckasegee River and Deep Creek in the Bryson City vicinity, 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 described in more detail in succeeding sections of this report.

- ▶ THE GREATEST FLOOD on both the Tuckasegee River and Deep Creek in more than 120 years occurred in May 1840. A story which has been handed down by the Cherokee Indians tells of a greater flood on the river in the 17th century, but no support was found for this flood.
- ▶ OTHER BIG FLOODS in March 1867 and June 1876 were 3 feet lower than the 1840 flood on Tuckasegee River, and a flood on August 30, 1940, was 4 feet lower. The second greatest flood on Deep Creek, occurring sometime between 1899 and 1902, was several feet lower than the 1840 flood. The third greatest known flood on Deep Creek occurred in April 1920. The largest recent flood, in January 1957, was 1 to 2 feet lower than the one in 1920.
- ▶ REGIONAL FLOODS on the Tuckasegee River and Deep Creek are based on floods experienced on streams within 40 miles of Bryson City, many of which are larger than any known floods on the streams at Bryson City. This indicates that greater floods than those experienced so far may reasonably be expected on the two streams. Based on the magnitude of floods that have occurred on the neighboring streams, future floods may occur at Bryson City on the Tuckasegee River about 1 foot higher than the May 1840 flood and on Deep Creek approximately 1 foot above the May 1840 flood. (Figure 1 shows the height of the Regional Flood at three locations in Bryson City.)
- ▶ MAXIMUM PROBABLE FLOOD determinations indicate that floods could occur on Tuckasegee River and Deep Creek at Bryson City 7 to 9 feet higher than the 1840 flood on Tuckasegee River and 3 to 7 feet higher on Deep Creek. Floods of this magnitude would be expected to occur only rarely. (Figure 1 shows the height of the Maximum Probable Flood.)

- ▶ FLOOD DAMAGES that would result from recurrences of the floods of 1840, 1867, and 1876 would be great under present conditions. The August 1940 flood, which covered the business section of Bryson City with water as much as 5 feet deep, caused heavy damages in the city. Thirty business establishments were flooded. The Regional and Maximum Probable Floods with their great depths and high velocities would cause even heavier damages.
- ▶ MOST FREQUENT FLOOD OCCURRENCES on Tuckasegee River and Deep Creek are in the winter and early spring, but 3 of the 4 highest floods on the river have occurred in the late spring and summer and floods may come on either stream at any time.
- ▶ OBSTRUCTIONS TO FLOW in the Tuckasegee River at Bryson City are chiefly the Everett Street bridge and the nearly solid mass of business buildings that line Everett Street on both sides of the river. During major floods such as the Regional and Maximum Probable Floods, heading up of approximately 2 feet would occur at this location as shown on the profile in this report. On Deep Creek, heading up would occur at the highway bridge at Mile 0.67 and at the railway and highway bridges near the mouth of the creek.
- ▶ UPSTREAM RESERVOIRS would have no important effect on the crest height of large floods on the Tuckasegee River at Bryson City.
- ▶ VELOCITIES OF WATER averaged from 13 to 14 feet per second in the channel and 3 to 4 feet per second in the flood plain of the Tuckasegee River during the August 1940 flood and may be as high as 19 and 9 feet per second, respectively, should a Maximum Probable Flood occur. Along Deep Creek, velocities during a Maximum Probable Flood would range up to 26 feet per second in the channel and up to 13 feet per second in the flood plain.
- ▶ DURATION OF FLOODS, particularly those resulting from intense summer storms, is relatively short on both streams. In August 1940 the Tuckasegee River rose to its crest at the rate of 1 to 2 feet per hour and fell almost as fast.

▶ EXTREMELY HAZARDOUS CONDITIONS may be expected during large future floods. The entire flood plain areas of Tuckasegee River and of Deep Creek would be submerged and practically the entire downtown area of Bryson City would be surrounded. Along Everett Street the water during such floods would be as much as 11 to 17 feet deep, flooding the first floors of every building from the town offices on the south end to the Water Street buildings on the north end. Coupled with the deep flooding would be swift velocities throughout the flood plains of both streams which would undoubtedly sweep away buildings and endanger life.

▶ FUTURE FLOOD HEIGHTS that would be reached, if floods of the magnitude of the Regional and Maximum Probable occurred, are shown by the following Table 1. This compares these flood crests to the crest of the August 1940 flood on the Tuckasegee River at Everett Street and to the January 1957 flood at Mile 0.5 on Deep Creek.

TABLE 1  
RELATIVE FLOOD HEIGHTS

<u>Date</u>	<u>Stream</u>	<u>Location</u>	<u>Mile</u>	<u>Estimated Peak Discharge</u> cubic feet per second	<u>Above 1940 or 1957 Flood</u> feet
1940	Tuckasegee	Everett St.	12.72	61,600	0
1840*				90,000	4.3
Regional				100,000	5.4
Max. Probable				150,000	11.2
1957	Deep Creek		0.50	4,300	0
1840				20,000	8.0
Regional				23,000	8.7
Max. Probable				44,000	13.2

\*1840 flood under present conditions.

II.

PAST FLOODS



Tennessee Valley Authority  
Division of Water Control Planning  
Hydraulic Data Branch

II.

**PAST FLOODS**

This section of the report is a history of floods that have occurred on Tuckasegee River and its tributary Deep Creek in the vicinity of Bryson City, Swain County, North Carolina. The investigations cover 3.8 miles of Tuckasegee River, extending from the U. S. Highway 19 bridge, 0.48 mile upstream from the eastern corporate limit of Bryson City, to Buckner Branch, 0.33 mile downstream from the western corporate limit. The investigations on Deep Creek cover the 1.86 miles of the creek from the Great Smoky Mountain Park boundary to the mouth. The west side of the creek in the lower 0.38 mile of this reach is within the corporate limits of Bryson City.

The Tuckasegee River flows from east to west through the center of Bryson City, bisecting both the business and residential sections of the city which are located largely in the flood plain. The Deep Creek flood plain is in the early stages of development into a residential area.

Records of Tuckasegee River stages and discharges have been maintained at Bryson City since July 1896 by the U. S. Geological Survey. Flood history investigations made by Hydraulic Data Branch engineers in 1937 and 1938 developed information on floods prior to stream gage records along the 49-mile reach of the river from the mouth to the confluence of the East and West Forks. Field investigations were made along the river immediately after the floods of August 13 and 30, 1940. A number of other flood investigations made in the past 25 years have provided additional data. Information on floods on Tuckasegee River and Deep Creek has also been obtained from local residents and by research in newspaper files. From these sources, knowledge of large floods has been developed on Tuckasegee River and Deep Creek covering the past 120 years.

## TUCKASEGEE RIVER AND DEEP CREEK VALLEYS

### Settlement

Swain County, of which Bryson City is the county seat, was formed in 1871 from a part of Macon and Jackson Counties. Bryson City, first called Big Bear Spring and then Charleston, was incorporated in 1887 and named for Col. Thaddeus Bryson.

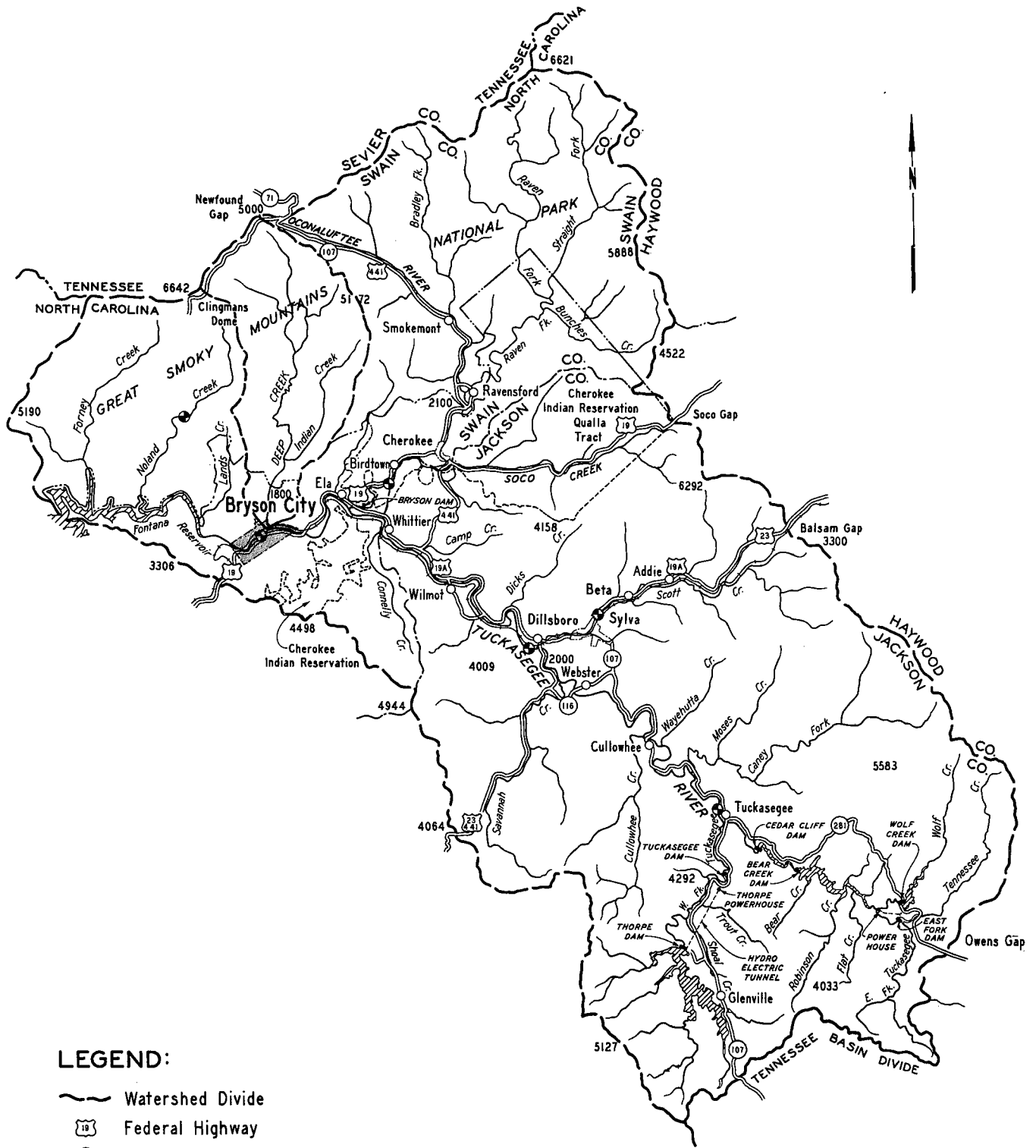
Railroad service reached Bryson City from Asheville in 1889. This line, running down the Scott Creek valley to Sylva and thence down the Tuckasegee River to and below Bryson City, was extended in 1891 to Murphy, North Carolina, and is now the Murphy Branch of the Southern Railway.

Swain County had a population of 9,921 in the 1950 census. Of this number, 1,499 people lived in Bryson City.

### The Streams and Their Valleys

The Tuckasegee River watershed, shown on Plate 1, drains an area of 734 square miles of which 655 square miles are upstream from Everett Street bridge in downtown Bryson City. The river heads some 30 miles southeast of Bryson City along the northern slopes of the Tennessee Valley Divide where elevations range up to 5,000 feet above sea level. Elevations are even higher along the eastern and northern boundaries of the watershed, ranging up to 6,400 feet along the eastern side and up to 6,600 feet along the crest of the Great Smoky Mountains on the north. The entire watershed is in the Appalachian Mountain physiographic subregion. Forests cover 83 percent of the area.

Deep Creek flows southward to enter the Tuckasegee River at Mile 13.25. Heading on the high ridges of the Great Smoky Mountains at elevations 5,000 to 6,000 feet above sea level, its basin is about 12 miles long and up to 5 miles wide. Ninety-four percent of its 43.9-square-mile drainage basin is in the Great Smoky Mountains National Park and the only cleared land is that along the stream in the reach investigated.



**LEGEND:**

- Watershed Divide
- Federal Highway
- State Highway
- Great Smoky Mountains National Park Boundary
- Indian Reservation Boundary
- Recording Stream Gage

TENNESSEE VALLEY AUTHORITY  
 DIVISION OF WATER CONTROL PLANNING  
 HYDRAULIC DATA BRANCH

**TUCKASEGEE RIVER WATERSHED**



JANUARY 1960

The corporate limits of Bryson City lie on either side of the Tuckasegee River between river Miles 11.25 and 14.23. Above the confluence with Deep Creek the corporate limits on the right bank of the river are at the north edge of the Southern Railway right of way. Low water level of the river falls from elevation 1739 to elevation 1705 in this 2.98-mile reach or about 11.5 feet per mile. The fall in the total reach investigated is at the rate of 12.3 feet per mile. Flood plain widths from the U. S. Highway 19 bridge downstream to Deep Creek range from almost nothing to a few hundred feet. Below Deep Creek, where the principal development of the town has taken place, the bottoms widen on the right side to 1,000 feet and on the left side to 300 feet. Below the business section the flood plain width again decreases and there is practically none at the lower end of the reach. Large floods such as those of 1840 and 1940 cover most of the bottoms, reaching a maximum width of 2,000 feet a short distance below Everett Street.

Deep Creek channel has a slope of about 35 feet per mile from the Park boundary to the mouth. The valley floor in this reach has an average width of 1,000 feet and a maximum width near the upper end of 2,000 feet. The tops of banks in the reach are 8 to 14 feet above the stream bed, and the steep channel can carry a substantial flood discharge without overflowing the bottoms. The corporate limits since 1945 follow the creek from Mile 0.38 almost to the mouth and only the bottom land on the west side in this reach is in the city. The State Legislature in 1945 passed an Act which eliminated from the corporate limits the land lying east of Deep Creek.

Drainage areas at significant locations along the two streams covered by this report are listed in Table 2.

TABLE 2  
DRAINAGE AREAS IN WATERSHEDS  
OF TUCKASEGEE RIVER AND DEEP CREEK

<u>Stream</u>	<u>Location</u>	<u>Mile Above Mouth</u>	<u>Drainage Area sq. mi.</u>
Tuckasegee River	U. S. Highway 19	14.71	603
	Everett Street	12.72	655
	Bryson City stream gage	12.64	655
	Above Buckner Branch	10.92	661
Deep Creek	Park Boundary	1.86	41.2
		0.50	42.7
	Mouth	0.0	43.9

#### Developments in the Flood Plain

The Tuckasegee River flood plain through Bryson City is well developed. Within the area that was overflowed in May 1840 are now located 63 commercial establishments, 3 industries, 86 residences, a courthouse, post office, fire station, telephone exchange, and 2 churches.

The Deep Creek flood plain has in the past been devoted entirely to agriculture. During the past five years, however, there has been considerable residential development, and some 32 homes are now located in the flood plain. In January 1960 streets were being laid out for additional development in the creek bottoms on the left bank near Mile 1.65. This is also a potential industrial area.

The river flood plain development in the city has been greatest along Main Street and Everett Street. Most of the business places are along these two streets. Main Street, running generally east and west along the left bank edge of the flood plain, carries U. S. Highway 19 through the city. Everett Street runs north and south across the flood plain at right angles to the river and Main Street. Plate 9 shows a profile along this street. The flood of August 30, 1940, covered

the right bank portion of Everett Street from the bridge nearly to Water Street with water up to 5 feet deep. Figures 2 and 3 show scenes along the street during this flood. On the left bank portion of Everett Street water reached only a short distance from the bridge toward the Town Square and depths were relatively shallow.

Residences are concentrated principally in an area upstream from Everett Street on the right bank and downstream from Everett Street on the left bank. Homes also occupy most of the narrow left bank flood plain upstream from the business district. The current home building except in the Deep Creek area is primarily on high ground away from the river and well above any flood danger.

The Carolina Wood Turning Company, located on the right bank at Mile 11.6, is the largest industry and the principal employer in the community. Figure 4 shows the plant during the August 1940 flood. The firm prepares furniture stock and manufactures furniture. Flood waters begin to enter the lumber storage yard at the downstream end of the plant property at a stage of 9 feet on the Bryson City stream gage. At a stage two feet higher water enters some of the storage buildings. On August 30, 1940, water was four feet deep in the plant sawmill and the main office and just about level with the floor in the main production part of the plant.

The Wallace Tube Company occupies a tract on the right bank above the Southern Railway bridge, at Mile 12.1. This firm supplies seamless steel tubing and does custom pipe bending. The plant was built in 1952 and the plant area of some 8 acres has been given a measure of protection against floods by the construction of a levee along the river bank. The plant floor is at elevation 1720.7, about 8 feet lower than the crest of the August 30, 1940, flood at this point. The top of the levee is at elevations about  $1\frac{1}{2}$  feet under the 1940 level.

The Maness Manufacturing Company operates a sawmill and manufactures wood pallets and other items at a site on the right bank just above the business district, at Mile 12.9. A repetition of the 1940 flood would cover the plant floor 1.6 feet deep.

A tourist court, located in the narrow bottom on the left bank at Mile 12, has floor levels at elevation 1722.3. The flood of January 31, 1957,

reached these floors. The 1940 flood crest level was six feet higher at this point. Two more motels are on the left bank of the river, one at Mile 12.5 and one at Mile 13.5. Both have units located on ground which was flooded in August 1940.

The Swain County school bus repair shop is just upstream from the tourist court, at Mile 12. The shop floor is at elevation 1728, about the same as the 1940 flood crest elevation at this point. A machine shop and an auto repair shop are just upstream from the school bus garage. Water was over the ground at these shops in 1940.

An oil bulk plant is on the right bank of the river at Mile 12.15, upstream from Wallace Tube Company. Water was six feet over the ground at the oil storage tanks in 1940.

Automatic dial telephone equipment serving the town is in a building on the right bank at Mile 12.8 with a floor elevation of 1731.9 feet. The flood of August 30, 1940, was  $3\frac{1}{2}$  feet above the floor elevation at the building.

Two power transformer stations are near the edge of the flood plain on the right bank, one at Mile 12.7 and one at Mile 12.8. These are at higher levels than known floods on the river.

Bryson City obtains most of its water supply from intakes on Lands Creek and on Jenkins Branch, away from any flood danger. However, a well located in the flood plain of the Tuckasegee River is used to supplement the surface water supply during periods of drought. This well and the building housing the pump is on the right bank at Mile 12.5 between the railroad and Gibson Avenue. The pump floor level is at elevation 1730.8, 1.3 feet below the 1940 flood crest elevation.

A flood of the magnitude of the flood of May 1840 would cover tracks of the Southern Railway from Deep Creek, Mile 13.25, through the business district of Bryson City nearly to the railroad bridge, Mile 11.75.

The only sizable area on the Bryson City flood plain that has not yet been developed is on the right bank between Everett Street and the mouth of Bryson

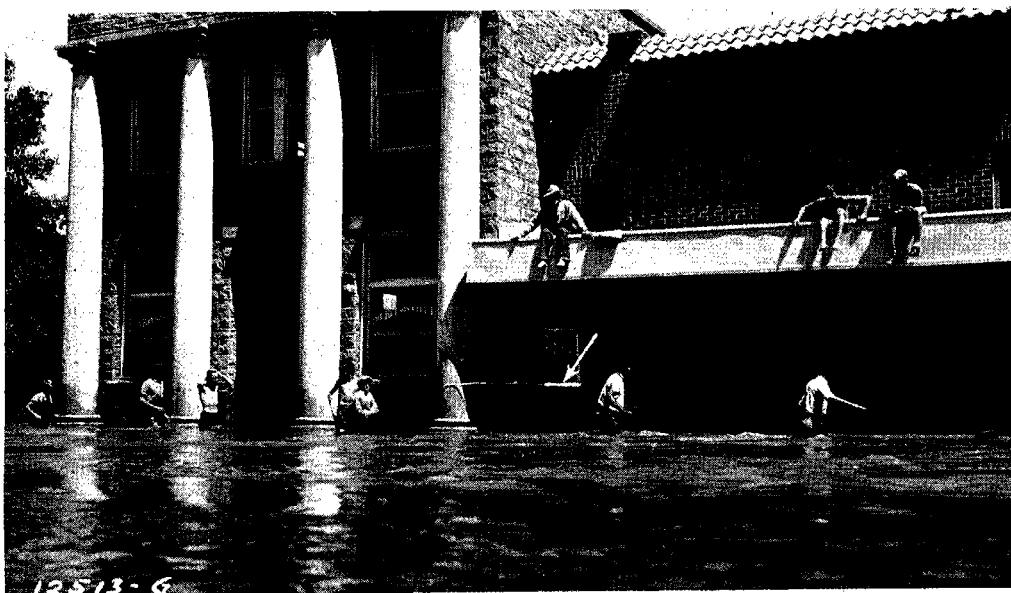


Figure 2. --BRYSON CITY BUSINESS BUILDINGS FLOODED

These buildings are near the lowest portion of Everett Steet about midway between the river bridge and the Southern Railway. At the crest of the August 30, 1940, flood occurring one and one-half hours before this picture was taken, the water was about chest deep as indicated in the center of the picture.



Figure 3. --EVERETT STREET IN AUGUST 1940

Flood waters of the Tuckasegee River were still knee-deep on Everett Street when this picture was taken soon after noon on August 30, 1940. At the crest stage the water was near the top of the fenders on the automobile or about 18 inches deeper.



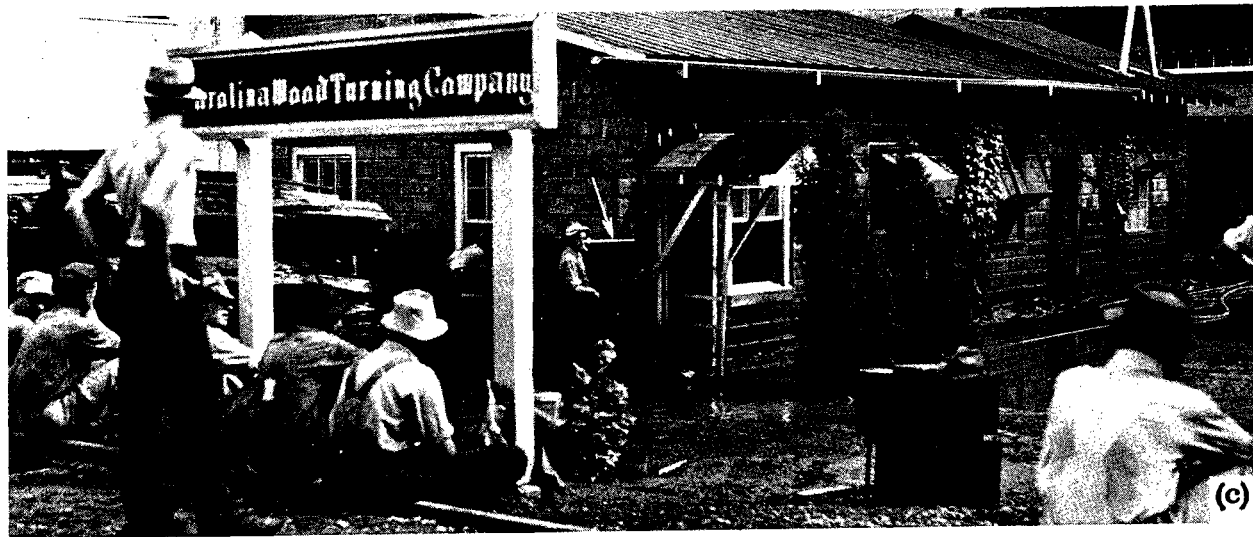
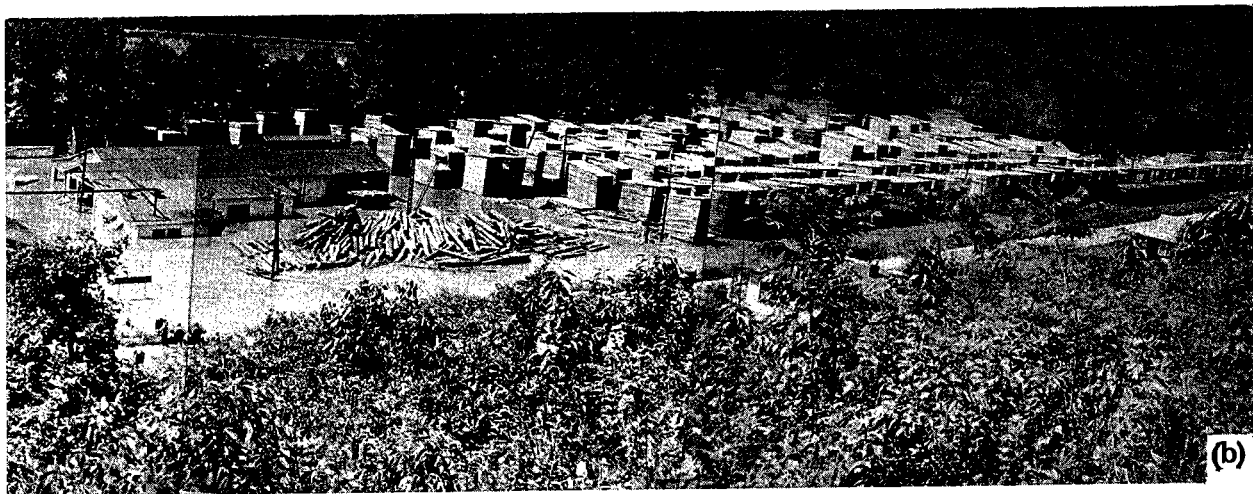
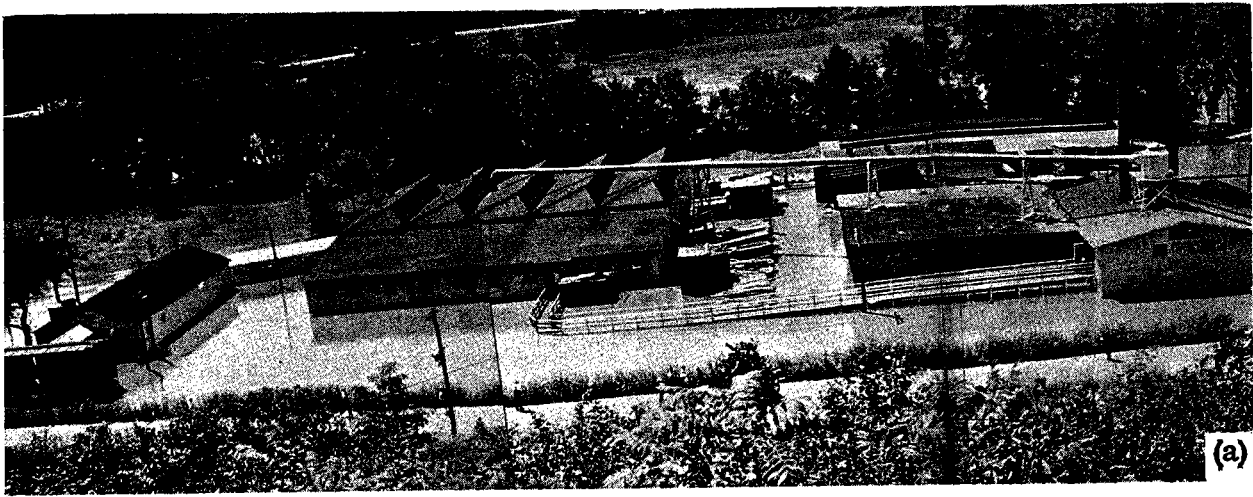


Figure 4. --CAROLINA WOOD TURNING COMPANY IN AUGUST 1940

This plant is on the north side of the Tuckasegee River near Mile 11.6. On August 30, 1940, the river flooded the entire plant area (a) and (b) and water was 4 feet deep in the sawmill and the main office (c). The man in the center of picture (c) is holding a ruler at the flood crest level.

(Photos (a) and (b) by J. K. Stearns)

Branch and between the river and the railroad. This area is about 1500 feet in length by 600 feet wide at the upstream end. The whole area is low and any developments that might be put here would be subject to flooding, as are those now on the flood plain.

Houses on the Deep Creek flood plain are located along the left bank near the mouth, at a development between Mile 0.4 to Mile 0.5 on the left bank, and at scattered points elsewhere along the stream. The houses which are along the roads at the right and left edges of the flood plain are mostly above flood danger. Deep Creek Church and parsonage are on the right bank at Mile 0.7.

### Bridges Across the Streams

Two road bridges and a railroad bridge cross the Tuckasegee River in the reach investigated. Deep Creek is crossed by a railroad and highway bridge, near the mouth, a road bridge farther upstream, and a footbridge near the Park boundary. Table 3 lists pertinent elevations and shows the relation to the crest elevation of the May 1840 flood on the Tuckasegee River and the January 1957 flood on Deep Creek. Figures 5 and 6 show the three Tuckasegee River bridges and the two bridges near the mouth of Deep Creek.

Of the 3 river bridges, the one at Everett Street offers the greatest obstruction to flood flows. This three-span concrete arch structure with a solid concrete guard rail caused a heading up of approximately 2 feet at the peak level of the August 30, 1940, flood. A recurrence of the May 1840 flood under present conditions would also cause heading up of about 2 feet at this bridge.

The U. S. Highway 19 bridge at the upper end of the reach is of similar construction to the one at Everett Street, except that the solid concrete rail was replaced with an open railing when the bridge floor was widened in 1954. An approach fill 300 feet long on the right bank blocks the overflow section on that side to a height of 8 or 10 feet. The August 30, 1940, flood overtopped the bridge floor by 0.5 foot.

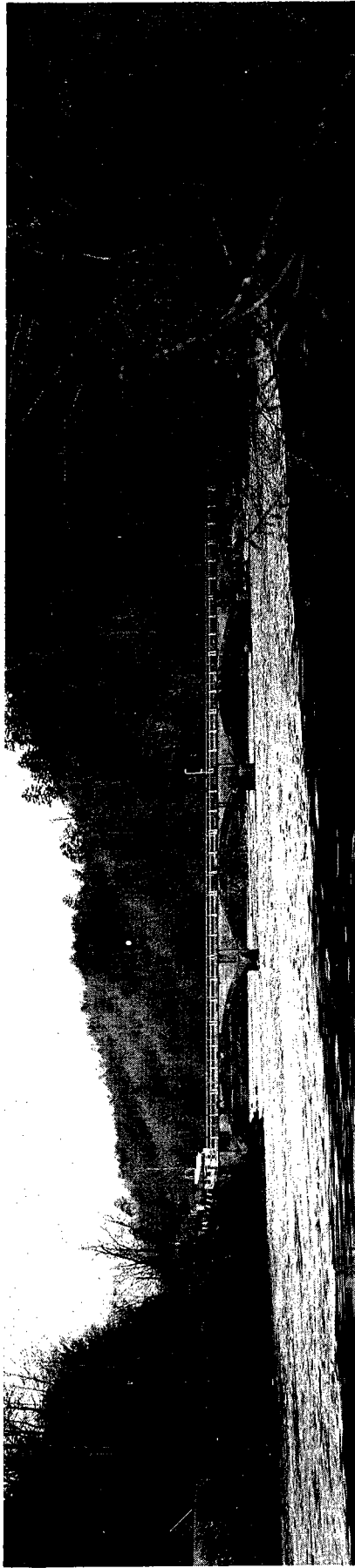
The Southern Railway bridge at Mile 11.75, built in 1942-1944 in connection with relocations for Fontana Reservoir, has a clearance well above any flood level, but high approach fills block the flood plain.

TABLE 3BRIDGES ACROSS TUCKASEGEE RIVER AND DEEP CREEKVICINITY OF BRYSON CITY, NORTH CAROLINATUCKASEGEE RIVER

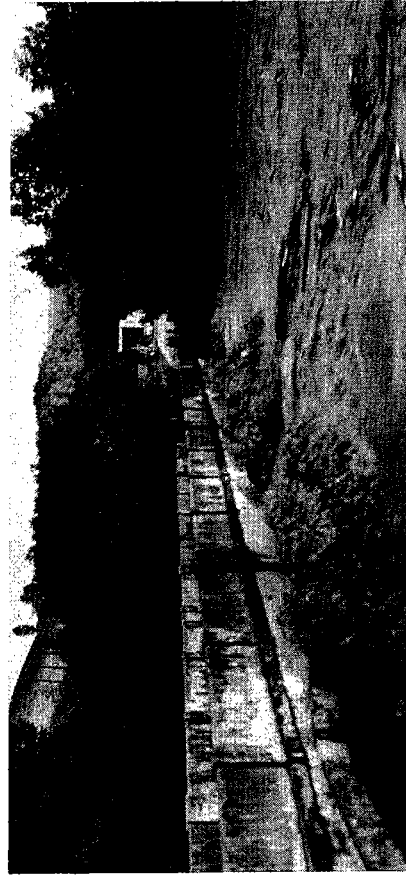
<u>Mile Above Mouth</u>	<u>Identification</u>	<u>Low Water feet</u>	<u>Floor Elev. feet</u>	<u>1840 Flood Elev. feet</u>	<u>Underclearance</u>		
					<u>Eleva- tion feet</u>	<u>Above 1840 feet</u>	<u>Below 1840 feet</u>
11.75	Southern Railway	1706.1	1746.3	1730.1	1741.1	11.0	
12.72	Everett Street	1717.4	1736.3	1737.3	1733.9		3.4
14.71	U. S. Highway 19	1746.8	1765.8	1769.5	1762.8		6.7

DEEP CREEK

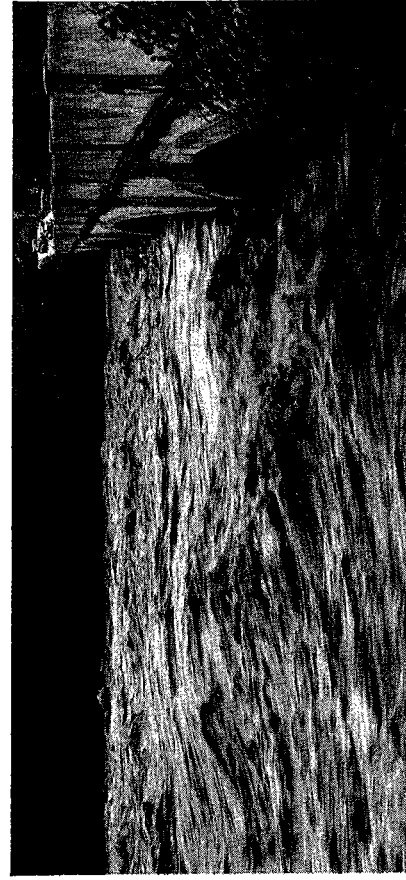
<u>Mile Above Mouth</u>	<u>Identification</u>	<u>Stream Bed feet</u>	<u>Floor Elev. feet</u>	<u>1957 Flood Elev. feet</u>	<u>Underclearance</u>		
					<u>Eleva- tion feet</u>	<u>Above 1957 feet</u>	<u>Below 1957 feet</u>
0.03	Southern Railway	1721.0	1743.8	1734.5	1735.0	0.5	
0.04	Highway	1717.5	1740.1	1734.6	1737.4	2.8	
0.67	Deep Creek Church Road	1738.9	1756.4	1749.8	1755.2	5.4	
1.85	Footbridge	1787.9	1799.1	1793.4	1798.6	5.2	



(a) View of the present bridge, looking downstream.



(b) Upstream side of bridge during August 30, 1940, flood.  
Note high velocity of flow.

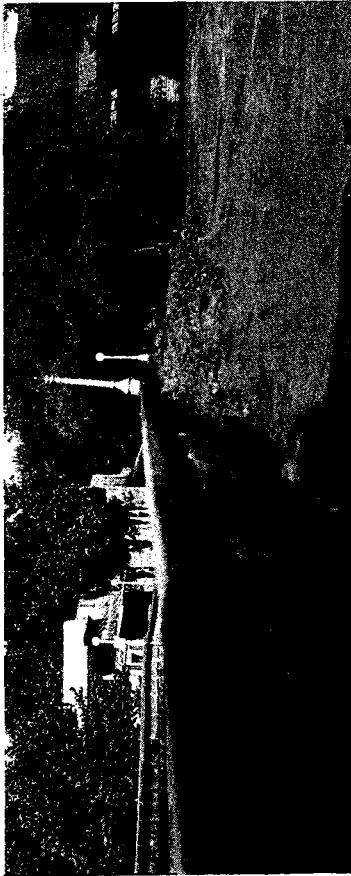


(c) Downstream side of bridge on August 30, 1940, after  
river had fallen several feet.

(Photo by K. E. Bennett)

Figure 5. --U. S. HIGHWAY 19 BRIDGE

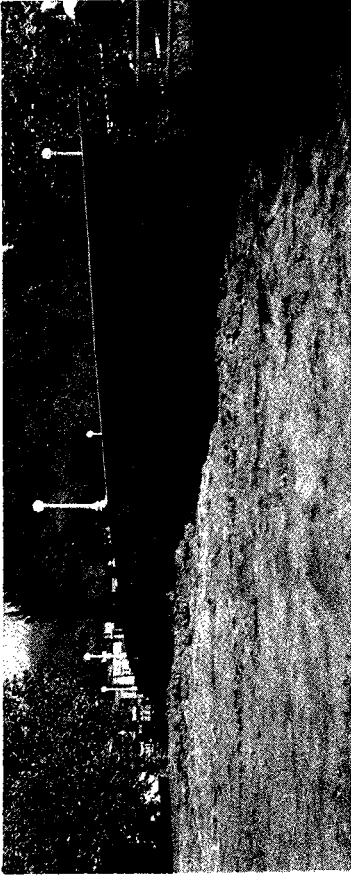
This bridge is at river Mile 14.71, about 2 miles upstream from Everett Street. Since the August 1940 flood the bridge floor has been widened and an open railing has replaced the solid concrete railing. The 1940 flood overtopped the bridge floor level by about 0.5 foot.



(a) Upstream side of bridge across Tuckasegee River near crest of flood of August 30, 1940. The crest level was about a foot above the underclearance.

(Photo by K. E. Bennett)

**EVERETT STREET BRIDGE**



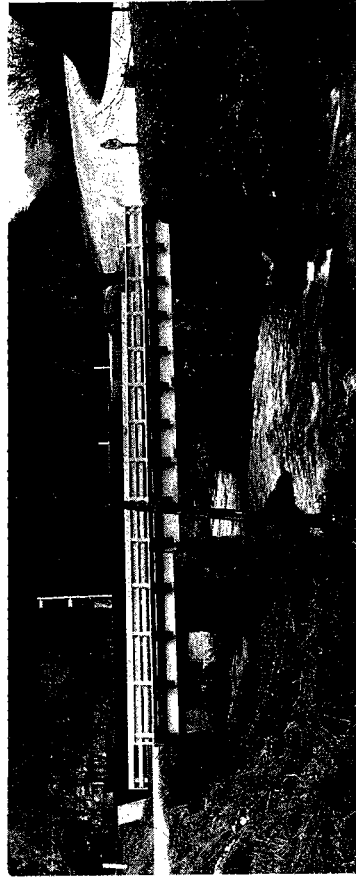
(b) Downstream side of bridge near crest of August 30, 1940, flood. Note turbulent flow resulting from high velocities.

(Photo by K. E. Bennett)



**SOUTHERN RAILWAY BRIDGE**

This bridge is at river Mile 11.75. Built after the 1940 flood, the underclearance is 15 feet above the crest stage of that flood.



**DEEP CREEK BRIDGES**

Highway and Southern Railway bridges near mouth of Deep Creek. The view is downstream toward the river.

**Figure 6. --BRIDGES ON TUCKASEGEE RIVER AND DEEP CREEK**

### Obstructions to Flood Flows

The extensive business, industrial, and residential developments in the flood plain through Bryson City form a substantial obstruction to flood flows in the Tuckasegee River. This is particularly true in the vicinity of Everett Street where buildings extend almost in a solid wall across the full width of the flood plain. Plate 9 indicates the extent to which the buildings along Everett Street fill the flood waterway. There is no significant filling on the flood plain in the business district except for the railroad fill along the right bank edge of the overflow area.

The obstruction to flood flows caused by the 3 river bridges has been discussed previously.

Elsewhere on the river flood plain, the levee at the Wallace Tube Company plant at Mile 12.1 will restrict flood flows until overtopping occurs.

### Regulation by ALCOA Projects

Five small power projects owned and operated by the Aluminum Company of America or its subsidiary, Nantahala Power and Light Company, are located in the headwater region of the Tuckasegee River. There is also a small power dam near the mouth of the Oconaluftee River. The only one of these with any significant storage is Thorpe on the West Fork Tuckasegee River about 46 river miles above Bryson City. This dam, completed in 1941, impounds a useful storage volume of 67,100 acre-feet. The drainage area above the dam is 36.7 square miles, only 5.6 percent of the total area of 655 square miles above Bryson City. The project has no flood control function, and any effect the reservoir might have on flood heights below would depend on the level of the reservoir just prior to the flood. Because of the small size of the tributary area and the long distance from the dam to Bryson City, it is doubtful if water stored in Thorpe Reservoir would have any important effect on flood crest heights at Bryson City.

### Fontana Reservoir Property Boundaries

Fontana Reservoir at normal maximum pool elevation 1710 (top of gates) extends up the Tuckasegee River to about Mile 12. 2. Land acquired by TVA for the reservoir is largely within the river banks in the reach investigated, extending upstream to within 300 feet of Everett Street. The habitable structure profile in this reach is at elevation 1720. The TVA prohibits construction of buildings for human habitation and requires approval in advance and in writing for buildings or structures of any nature below this level. The reservoir backwater would have no significant effect on the height of large floods at Bryson City.

## FLOOD SITUATION

### Flood Records

The U. S. Geological Survey has maintained records of streamflow at and near Bryson City almost continuously since 1896. From July 1896 to March 1897 the readings were on a staff gage 4 miles upstream from Bryson City. From November 7, 1897, to February 2, 1914, observations were made twice daily at a staff gage about 150 feet upstream from the present Everett Street bridge. Subsequent gages were as follows: from February 3, 1914, to May 17, 1920, at a recording gage just below the present bridge site; from May 18, 1920, to June 27, 1927, at a staff gage on the present bridge; and from June 28, 1927, to date at a recording gage on the left bank 400 feet downstream from Everett Street.

On Deep Creek some miscellaneous observations have been made by the Geological Survey on a staff gage located in the Great Smoky Mountains Park about 0.6 mile above the reach investigated. This gage was installed on April 14, 1950, but the observations have not been continuous and there are no records of flood crest stages or flows.

For flood data on the Tuckasegee River prior to the beginning of gage records, local residents were interviewed for information on dates and heights of floods. A similar investigation was made on Deep Creek. Files of the "Smoky Mountain Times" of Bryson City were searched for flood stories on both streams.

Reports on flood investigations made by the Hydraulic Data Branch during the last 25 years were reviewed. These included investigations of the floods of August 13 and 30, 1940, and January 31, 1957, on the Tuckasegee River and of the flood of January 21, 1959, on Deep Creek.

#### Flood Stages and Discharges

Peak stages and discharges are given in Table 4 for floods exceeding bankfull stage of 9 feet at the Bryson City stream gage since stream gage records began in 1896. Also shown are heights of known floods prior to the beginning of gage records, based on high water marks and newspaper accounts, together with estimated discharges for these floods. Undoubtedly this portion of the list is incomplete, especially for the lesser floods.

On Deep Creek, the crest discharge of January 21, 1959, is estimated to have been 2,400 cubic feet per second. The May 1840 flood discharge has been estimated from the best available information to have been about 20,000 cubic feet per second.

#### Flood Occurrences

Plate 2 shows crest stages and months of occurrence of known floods which have exceeded bankfull stage of 9 feet on the Tuckasegee River at Bryson City. The tabulation below shows the monthly distribution of the 32 floods since the stream gage was established in 1896.

<u>Month</u>	<u>Number of Occurrences</u>	<u>Month</u>	<u>Number of Occurrences</u>
January	6	July	0
February	6	August	3
March	7	September	1
April	2	October	1
May	1	November	1
June	0	December	<u>4</u>
		Total	32



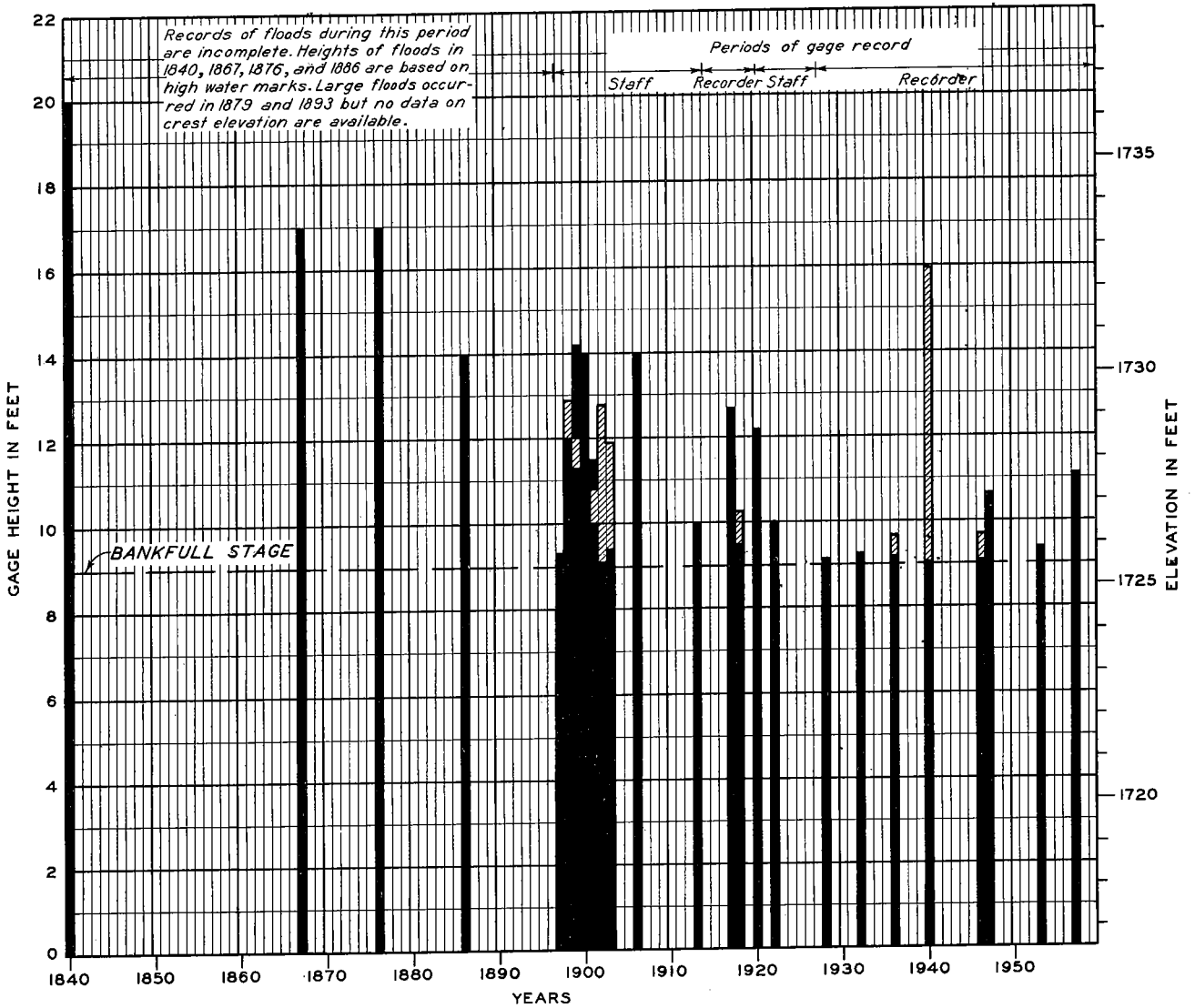
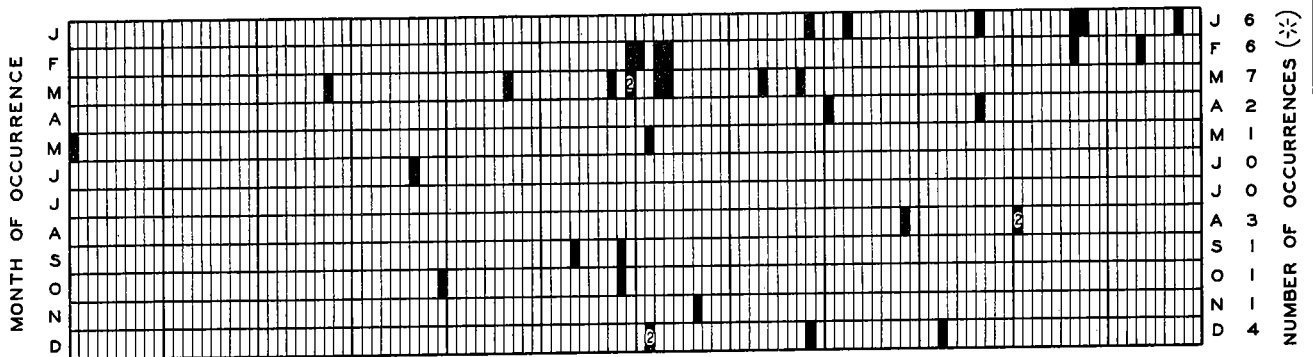
**TABLE 4**  
**TUCKASEGEE RIVER AT BRYSON CITY, NORTH CAROLINA**  
**FLOOD CREST ELEVATIONS AND DISCHARGES ABOVE BANKFULL STAGE**  
**1840-1959**

This table includes all floods recorded since July 1896 that exceeded bankfull stage of 9 feet, elevation 1725.5. Prior to that time the records are necessarily incomplete. Drainage area at Bryson City - 655 square miles; zero elevation 1716.54, USC&GS 1936 Supplementary Adjustment.

Date of Crest	Gage Height		Order of Magnitude (a)	Peak Discharge	
	Stage feet	Elevation feet		Amount cfs	Per Sq. Mile cfs
May 1840	20	1736.5±	1	90,000	137
March 6, 1867	17	1733.5±	2	65,000	99
June 1876	17	1733.5±	3	65,000	99
October 18, 1879	(b)				
March 1886	14	1730.5±	6	42,000	64
September 1893	(b)				
March 12, 1897	9.3	1725.8		18,000	27
September 3, 1898	12.0	1728.5		30,000	46
October 5, 1898	12.9	1729.4	9	35,000	53
February 6, 1899	12.1	1728.6		31,000	47
March 15, 1899	11.3	1727.8		26,800	41
March 18, 1899	14.2	1730.7	5	43,500	66
February 12, 1900	14.0	1730.5	7	42,200	64
May 21, 1901	11.5	1728.0		27,800	42
December 14, 1901	10.0	1726.5		21,000	32
December 29, 1901	10.8	1727.3		24,500	37
February 28, 1902	12.8	1729.3	10	34,600	53
March 29, 1902	9.1	1725.6		17,000	26
February 28, 1903	9.4	1725.9		18,000	27
March 22, 1903	11.9	1728.4		29,700	45
November 19, 1906	14.0	1730.5	8	41,700	64
March 27, 1913	10.0	1726.5		21,000	32
March 4, 1917	12.7	1729.2		37,700	58
January 28, 1918	10.3	1726.8		21,200	32
December 22, 1918	9.5	1726.0		18,000	27
April 2, 1920	12.2	1728.7		35,000	54
January 21, 1922	10.0	1726.5		21,000	32
August 16, 1928	9.15	1725.7		18,300	28
December 28, 1932	9.25	1725.8		18,300	28
January 19, 1936	9.20	1725.7		22,800	35
April 6, 1936	9.67	1726.2		24,800	38
August 13, 1940	9.05	1725.6		22,500	34
August 30, 1940	15.96	1732.5	4	61,600	94
January 7, 1946	9.72	1726.3		23,800	36
February 10, 1946	9.08	1725.6		21,400	33
January 20, 1947	10.65	1727.2		27,600	42
February 21, 1953	9.38	1725.9		22,500	34
January 31, 1957	11.11	1727.6		30,000	46

(a) For highest 10 floods.

(b) Large floods occurred on these dates but crest stages are not known.



ASF-1311

USGS gaging station established at Bryson City November 7, 1897. Gage 4 miles upstream observed from July 1896 to March 1897. During periods of staff gage observations flood crests are estimated from once or twice daily gage readings.

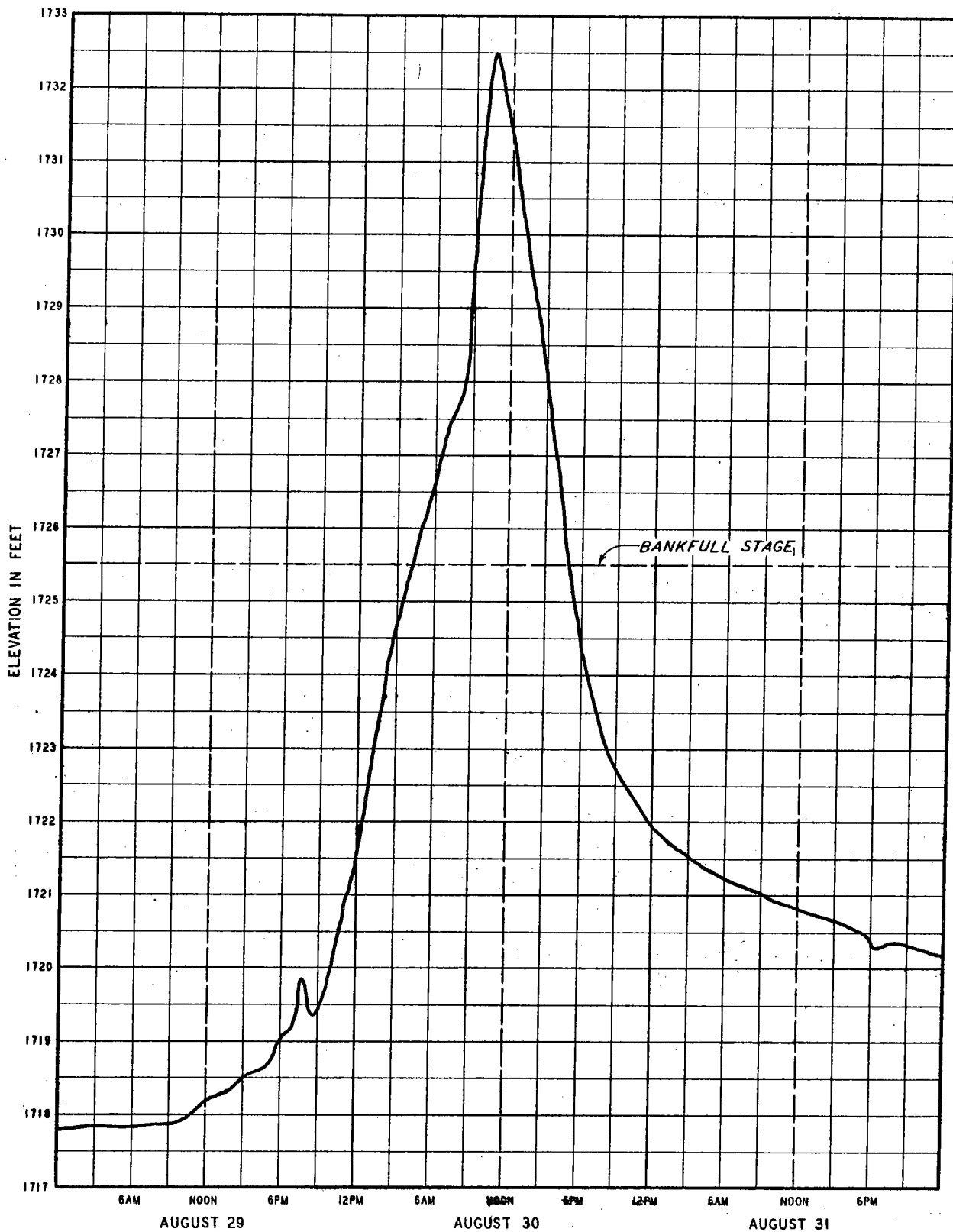
Drainage area at present gage=655 square miles.

Elevation of zero=1716.54 (USC & GS 1936 Suppl. Adj.)

(\*) Number of occurrences during 63 years, 1896-1959.

TENNESSEE VALLEY AUTHORITY  
DIVISION OF WATER CONTROL PLANNING  
HYDRAULIC DATA BRANCH

**FLOODS ABOVE  
BANKFULL STAGE  
TUCKASEGEE RIVER  
AT BRYSON CITY, NORTH CAROLINA  
JANUARY 1960**



Elevations are based on U.S. Geological Survey water-stage recorder record. Gage is located at river mile 12.64 and 400 feet downstream from bridge in Bryson City. Datum of gage is 1,716.54 feet above mean sea level, datum of 1929, supplementary adjustment of 1936.

TENNESSEE VALLEY AUTHORITY  
 DIVISION OF WATER CONTROL PLANNING  
 HYDRAULIC DATA BRANCH

**STAGE HYDROGRAPH**  
 FLOOD OF LATE AUGUST 1940  
 TUCKASEGEE RIVER AT  
 BRYSON CITY, NORTH CAROLINA  
 JANUARY 1960

The tabulation and Plate 2 show that floods occur most frequently in the winter months December through March. The upper portion of the Tuckasegee River watershed is also subject to heavy summer and fall rains resulting from either tropical hurricane storms or intense thunderstorms. These storms produce severe floods on the river, and three of the four highest known floods at Bryson City occurred in the period May through August.

There is no continuous record of floods on Deep Creek but records on the adjacent basin of the Oconaluftee River show characteristics of flood occurrence similar to those of the Tuckasegee River. It is probable that most storms that have caused flooding along the river at Bryson City have also caused floods on Deep Creek. But it is also true that because of the much smaller drainage area of Deep Creek, many storms have caused floods on Deep Creek when there was no flood on the Tuckasegee.

#### Rate of Rise and Velocities During Floods

Plate 3 shows the hydrograph of the flood of late August 1940 on the Tuckasegee River which exceeded any other rise since establishment of stream gage records at Bryson City. This flood resulted from rainfall averaging 7.2 inches over the river basin above Bryson City between the early morning of August 29 and the morning of August 30. Storm totals in the headwaters ranged up to 13 inches.

At Bryson City, in the  $13\frac{1}{2}$  hours before the crest, the river rose 13 feet at an average rate of one foot per hour. The rise in the last  $2\frac{1}{2}$  hours before the crest was extremely fast, averaging two feet per hour. The recession was also quite rapid and the river was above bankfull stage for only 13 hours.

During floods of the magnitude of the 1940 flood, average velocities in the channel of the Tuckasegee River are approximately 13 to 14 feet per second in the reach below the stream gage with maximum velocities of about 18 to 20 feet per second. In the flood plain bordering the main channel, velocities are estimated to have been 3 to 4 feet per second. During larger floods, velocities in the channel and in the overflow area would be greater.

No data are available on the rate of rise of Deep Creek but the relatively small drainage area and steep slope of the creek are indicative of a rapidly rising stream.

In the flood of January 1959 the velocities in the Deep Creek channel averaged about 6 feet per second. In a flood of the probable magnitude of the May 1840 flood the channel velocities would average up to 20 feet per second in the steep upper reaches and velocities in the overflow area would be in the order of 2 to 10 feet per second.

#### Flooded Area, Flood Profiles, and Cross Sections

Plate 6 shows the approximate area inundated by the flood of May 1840 on the Tuckasegee River and Deep Creek in the Bryson City vicinity. While no high water marks are available for the 1840 flood on Deep Creek, this flood is believed to have been of the magnitude of the Regional Flood described in Section III and the overflow limits were determined on this basis. The overflow limits of the late August 1940 flood were used as a guide in defining this area, together with topographic and flood profile data. The actual limits of the overflow on the ground may vary somewhat from those shown on the map because the contour interval of the map, which is 40 feet, does not permit precise plotting of the flooded area boundaries.

Plate 7 shows at an enlarged scale the 1840 flooded area in the business and industrial sections of Bryson City and vicinity.

Plate 8 shows high water profiles on Tuckasegee River for the floods of May 1840, August 30, 1940, January 1957, and January 1959. The 1840 flood is the highest known on the river, and the 1940 flood is the highest since gage records began. Plate 8 shows high water profiles on Deep Creek for the floods of January 1957 and January 1959 and high water marks for floods in 1899-1902 and 1920.

Plate 8 also shows profiles for the Regional Floods and for the Maximum Probable Floods discussed in Sections III and IV of this report.

Plate 9 shows a cross section of the Tuckasegee River valley along Everett Street in Bryson City. Plates 10 and 11 show typical stream and valley cross sections of Tuckasegee River and Deep Creek. The location of cross

sections is shown on the map and profiles. The cross sections show the elevation and extent of overflows of the floods of May 1840 and January 1957, respectively, and of the Regional and Maximum Probable Floods. A number of cross sections on Deep Creek, the locations of which are shown on the map and profile, are not reproduced but are available from the Hydraulic Data Branch of TVA to anyone who may have need for them.

### FLOOD DESCRIPTIONS

Following are descriptions of known large floods that have occurred in the Bryson City vicinity. These are based on newspaper accounts, historical records, and investigations by Hydraulic Data Branch engineers.

#### May 1840

The greatest flood on Tuckasegee River since its settlement by white men was the flood of May 1840, known as the "May Fresh." In "A Paper on the Tennessee River and Flood System," written in 1896 by Mr. L. M. Pindell of the Chattanooga office of the U. S. Weather Bureau, the following statement is attributed to Miss Jennie Collins, special rainfall observer at Bryson City: "The oldest inhabitant states that the highest water occurred in 1840. There is a tradition among the Cherokee Indians that at sometime in the 17th century the water reached a height of more than 50 feet, covering all the flat lands."

This is the only reference found to a flood in the 17th century. The height of 50 feet referred to would be 30 feet above the 1840 flood which does not seem credible. Three 1840 high water marks were found along the Tuckasegee River by Hydraulic Data Branch engineers in or a short distance above the reach covered by this investigation, one at Bryson City and two near Whittier. While the marks were based on stories handed down by older relatives of the person who was contacted, their plotted position shows a consistent relation to the low water profile and to the profiles of other floods.

While definite evidence of the 1840 flood has not been found on Deep Creek, it is reasonable to estimate that the storm rainfall that produced the great flood on the Tuckasegee must have produced a flood on Deep Creek only slightly smaller, perhaps about 1 foot lower, than the Regional Flood estimated for that stream.

March 1867

The storm of March 1867 produced great floods throughout the eastern portion of the Tennessee Valley. On the Little Tennessee River at Judson, above the confluence with the Tuckasegee River, and at Fontana, below the confluence, the 1867 flood was the greatest known. A comparison of flood peak discharges at these two locations indicates that a very high flow in the order of 60,000 to 70,000 cubic feet per second must have come from the Tuckasegee River.

No high water marks for this flood were recalled by old residents along the Tuckasegee River. A crest stage and discharge have been estimated for Bryson City based on the correlation with the Little Tennessee River gages.

June 1876

The next large flood on the Tuckasegee for which data were obtained was the "June Fresh" of 1876. This flood was of importance principally in the upper river above Dillsboro, since all the persons who gave marks for it lived at or above that town. In Arthur's "History of Western North Carolina," page 306, mention is made of the "Speeches and Writings" of General Thomas L. Clingmans in which he describes, among other phenomena, "The falling of several destructive water-spouts in Macon and Jackson Counties on the 15th of June 1876." Since these so called "water-spouts" usually occur during excessive rain over a comparatively small area, it would appear that the flood was due principally to heavy rainfall over the headwaters. The crest elevation of this flood has been estimated at 3 feet lower than the 1840 flood at Bryson City or about the same as that for the flood of 1867.

March 1886

Four persons between Bryson City and Dillsboro furnished marks for what was described as an exceptionally large flood which occurred at this time. Data obtained indicate ~~that~~ this flood was about 6 feet lower than the 1840 flood. It is reported that only three families lived along the river between Bryson City and Cherokee in 1886, which helps explain the scarcity of marks for these early floods.

April 1896

The greatest flood known on the West Fork Little Pigeon River at Gatlinburg occurred on April 1, 1896, and resulted from an intense storm in the Great Smoky Mountains in the vicinity of the Deep Creek headwaters. It is quite likely that Deep Creek with a drainage area of approximately the same size as the stream at Gatlinburg also experienced a large flood at this time. This flood occurred prior to the establishment of a gage on the Tuckasegee River at Bryson City and there is no record of the crest stage on the river.

1899-1902

About the turn of the century a great flood occurred on Deep Creek which exceeded any that old residents recall since that time. Statements of three people who witnessed the flood indicate that it occurred prior to 1902 and one man thought that it was in March or April.

Sam Woody, born in 1888, has lived on or near Deep Creek all of his life except in the period 1902-1919. The old home site was at the present J. B. Jenkins home, Mile 1.80, and Mr. Woody helped his father build the barn that still stands there. He showed on the ground the height of this old flood which he said occurred in March or April of 1901 or 1902. He said there were water-spouts on the left fork of Deep Creek at this time, indicating intense rainfall in the Great Smoky Mountains. He could not recall any flood since then that was as high.

Mrs. Hassie Thomas Carson, age 75, recalled that the greatest flood to her knowledge came when she may have been about 12 years old. She was living in a house near the mouth of Deep Creek at Mile 0.24. Water during the flood came into the house and boats were floated up to the porch. Flood waters covered the creek bottom from hill to hill. Mrs. Carson's nephew, Ervin Thomas, said he had heard his father tell of this flood and that a mill dam just above the mouth of the creek was washed out.

Mrs. Roxie Davis, age 73, who has lived on a hill overlooking the right side of Deep Creek at Mile 1.20 most of her life, said the greatest flood on Deep Creek occurred when she was just a girl. At that time the creek overflowed some of the bottoms at Mile 1.20 and damaged the old creek bank road. She could not recall the height of the flood.



The level of this old flood at Mile 1.80 was slightly higher than that of January 1957. However, at Mile 0.24 the high water mark shown by Mrs. Carson was some 5 feet higher than the 1957 flood profile. Part of this difference is probably due to the relative levels of the Tuckasegee River during the two floods and part may have been due to the mill dam near the mouth of the creek.

Several floods occurred on the Tuckasegee River during this general period. The larger ones and their crest stages at the Bryson City stream gage were March 18, 1899 - 14.2 feet; February 12, 1900 - 14.0 feet; and February 28, 1902 - 12.8 feet.

#### November 1906

This is one of the large floods of record at Bryson City. On the Oconaluftee River, which enters the Tuckasegee River about 5 miles above Bryson City, the 1906 flood was the greatest known. At the stream gage at Bryson City the crest was 14.0 feet. This is 6 feet lower than the 1840 flood and 2 feet lower than the 1940 flood.

Since the Deep Creek watershed adjoins that of the Oconaluftee River, it is reasonable to believe that a large flood also occurred on Deep Creek. However, the statements of old residents regarding the flood a few years earlier indicate that the 1906 rise was not a record on the creek.

#### March 1913

One of the largest floods of record occurred on Oconaluftee River, Soco Creek, and other streams in the Bryson City vicinity on March 27, 1913. On Oconaluftee River this flood equaled that of November 1906. Undoubtedly a substantial rise also occurred on Deep Creek which rises in the same area as the river. The Tuckasegee River crest stage at Bryson City stream gage was 10.0 feet on March 27, 1913.

#### April 1920

Several old residents along Deep Creek recalled a large flood occurring about 40 years ago. Very large floods occurred in April 1920 on West

Fork Little Pigeon River and on Little River whose watersheds lie just north of that of Deep Creek, and it is probable that an important flood also occurred on Deep Creek at this time.

Sam Woody, who was living in a house at Mile 0.24 in 1920, said water was one foot deep in the house, enough to float a trunk. He thought the high stage was caused by backwater from a sawmill dam located about 200 feet upstream from the present highway across Deep Creek. The house and the dam are no longer in existence.

Zeb Morris, Sr., age 70, recalled this flood and said it occurred in early spring. His son, Zeb, was a baby at the time and he estimated the year as 1920. The bottoms at his home at Mile 1.05 were partly flooded, and logs two feet in diameter were washed out of his field. The level which he showed for the 1920 flood crest was about 1.7 feet higher than the January 1957 flood.

The Tuckasegee River on April 2, 1920, reached a crest stage of 12.2 feet at the Bryson City stream gage.

#### August 30, 1940

This was by far the most severe flood on the Tuckasegee River since the great flood 100 years earlier in 1840, and the most damaging flood known. Above Dillsboro the highest stages known occurred. At Bryson City the flood was the highest since stream gage records began in 1896. Through the reach covered by this report the August 30, 1940, flood was about 2 feet higher than the November 1906 flood and 3 to 5 feet lower than the great flood of May 1840.

Extremely heavy rain fell on the head of the Tuckasegee River basin along the Blue Ridge during this storm, with numerous slides or waterspouts occurring on the steep mountain slopes, especially on East Fork, West Fork, and Caney Fork. Amounts above Cullowhee, 28 miles upstream from Bryson City, ranged upward from 7 inches to a high of 13 inches on East Fork from the morning of August 29 to the morning of August 30. Plate 4 shows the rainfall over the Tuckasegee River drainage area during this great storm. Great Smoky Mountain streams which contribute to the Tuckasegee River at Bryson City, especially the Oconaluftee River, received far less rainfall, ranging from 4 to 5 inches in amount.

Damages resulting from this flood were very severe. Figures 7 and 8 show scenes of the flooding and its effects. Wide overflow occurred through Bryson City, and Everett Street was inundated between the vicinity of the town square on the left bank and Water Street on the right bank. Thirty business establishments were flooded, including 7 grocery stores, a furniture store, a hardware store, 4 cafes, a feed and fertilizer warehouse, a theatre, a beauty parlor, a newspaper, a wholesale mercantile store, a five and ten-cent store, a drug store, and a boarding house. A furniture manufacturing plant at the lower edge of town was flooded and lumber and machinery damaged.

Above Bryson City all bridges, including steel truss bridges at Ela, Whittier, and Dillsboro and a reinforced concrete bridge at Cullowhee, were destroyed. Only the two concrete arch bridges in the reach of the river covered by this report, Everett Street at Mile 12.7 and U. S. Highway 19, 2 miles upstream, remained following the crest.

The TVA report "Floods of August 1940 in the Tennessee River Basin" describes the flood on Tuckasegee River in greater detail.

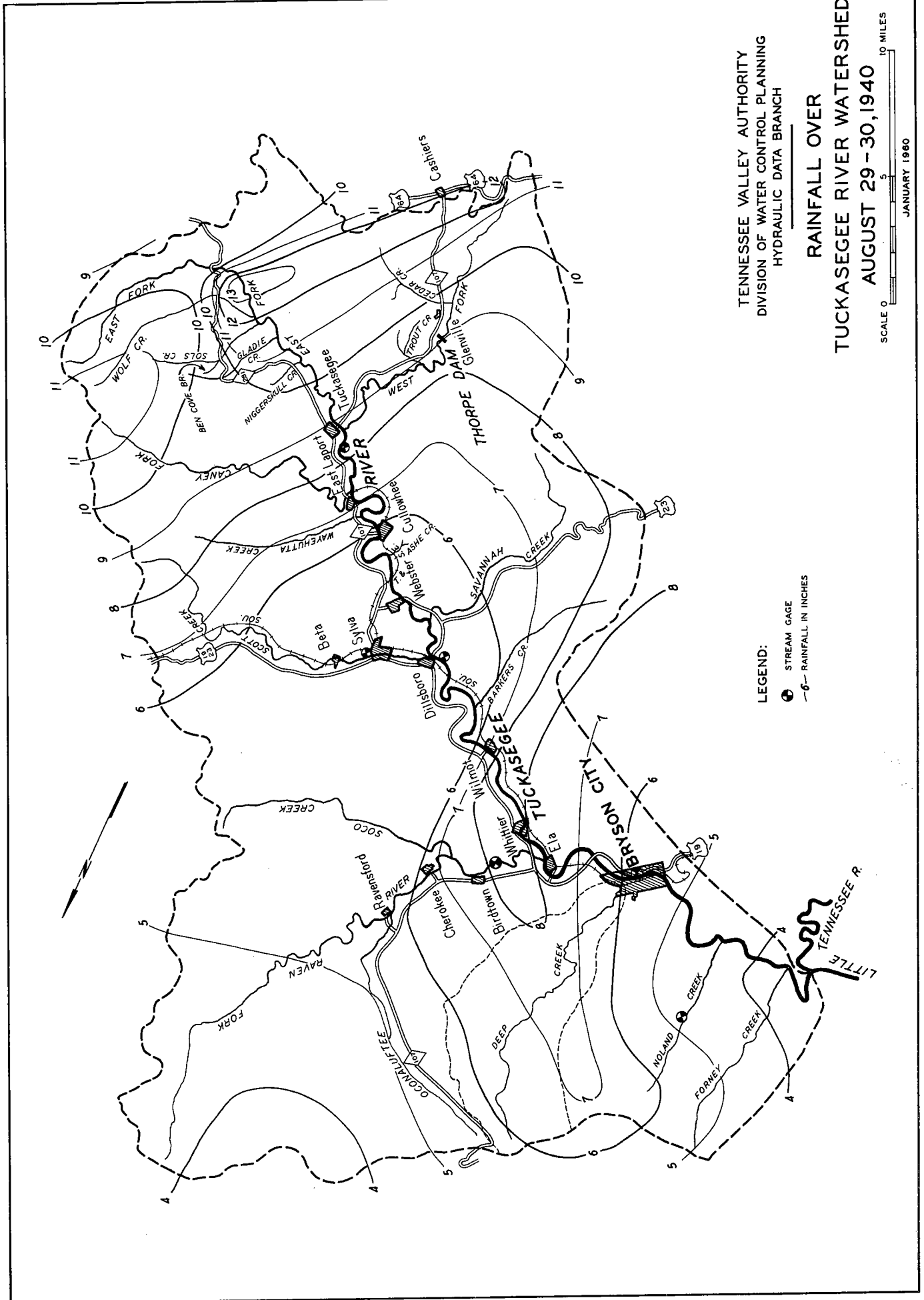
#### February 1953

Several of the people living midway of the reach investigated on Deep Creek said that a flood 6 or 7 years ago was the highest in the past 10 or more years. These references are probably to the flood of February 21, 1953, which was an important one on the Tuckasegee River, Oconaluftee River, Noland Creek, and Soco Creek.

#### January 31, 1957

The crest stage of 11.11 feet which occurred on this date is nearly 5 feet lower than the 1940 flood which is vivid in the memory of local residents. Water surrounded a few residences in Bryson City and came within inches of entering some business establishments. Coming with ample warning, the principal damage done was the expense and preparation undertaken by merchants and residents in the flood plain to protect against a higher stage should it have occurred.

On Deep Creek overflow broke across a field and surrounded a large commercial chickenhouse although little damage resulted.



TENNESSEE VALLEY AUTHORITY  
 DIVISION OF WATER CONTROL PLANNING  
 HYDRAULIC DATA BRANCH

**RAINFALL OVER  
 TUCKASEGE RIVER WATERSHED  
 AUGUST 29 - 30, 1940**

SCALE 0 5 10 MILES  
 JANUARY 1960

LEGEND:  
 ● STREAM GAGE  
 -6- RAINFALL IN INCHES



Figure 7. --AUGUST 1940 FLOOD CAUSED DAMAGE  
ALONG EVERETT STREET

Upper view: Muddy flood waters on August 30, 1940, reached a depth of about 2 feet in this furniture store on Everett Street.

Lower view: The boy in front of the Bryson City Post Office is pointing to the crest level of the August 30, 1940, flood which entered many buildings in the business district.



Figure 8. --BRYSON CITY BUILDINGS AND HOMES  
WERE FLOODED IN 1940

Upper view, eastward or upstream from the Everett Street bridge, shows buildings along Gibson Street deeply flooded on August 30, 1940.

(Photo by K. E. Bennett)

Lower view: These two homes in Bryson City were badly damaged by the flood of August 30, 1940.

III.

REGIONAL FLOODS

Tennessee Valley Authority  
Division of Water Control Planning  
Hydraulic Data Branch

III.

REGIONAL FLOODS

Large floods have been experienced in the past on streams in the general geographical and physiographical region of Bryson City, North Carolina. Heavy rainstorms comparable to those that caused these floods could occur over the watersheds of Tuckasegee River and Deep Creek. In such event, floods would result on these streams comparable in magnitude to those that occurred on the neighboring streams. Floods of this size are designated as Regional Floods. It is therefore desirable, in connection with any determination of future floods that may occur on Tuckasegee River and Deep Creek, to consider the floods that have occurred in the Bryson City region on watersheds whose topography, watershed cover, and other physical characteristics are similar to the watersheds of these two streams.

Maximum Known Regional Floods

Table 5 lists the maximum known floods experienced on watersheds comparable to those of the Tuckasegee River and Deep Creek and generally within 40 miles of Bryson City. Included also are two locations in the watershed of Nolichucky River which are about 75 miles to the northeast. Streams which differ significantly in watershed characteristics from those of the Tuckasegee River and Deep Creek have not been included. The maximum known floods on both Tuckasegee River and Deep Creek are given in the table.

One of the earliest documented large storms in this region was that of February 23-25, 1875. During this storm very heavy rainfall was experienced over the entire eastern Tennessee River watershed resulting in high floods on streams all over this territory. Cold weather preceded the storm and the rains probably fell on frozen ground, contributing to the high flood water runoff. In the



TABLE 5

MAXIMUM KNOWN FLOODS ON STREAMSIN BRYSON CITY REGION

Map Refer- ence No.	Stream	Location	Drain- age Area sq. mi.	Date	Peak Discharge	
					Amount cfs	Per Sq. Mi. cfs
1	Nolichucky River	at Embreeville, Tenn.	805	May 22, 1901	120,000	149
2	Little Tennessee River	at Judson, N. C.	664	March 1867	50,000	75
3	Tuckasegee River	at Bryson City, N. C.	655	August 30, 1940	61,600	94
4	Tuckasegee River	at Bryson City, N. C.	655	May 1840	90,000	137
5	Nolichucky River	at Poplar, N. C.	608	July 1916	93,000	153
	Little Tennessee River	at Almond, N. C.	451	February 28, 1902	42,000	93
6	Little Pigeon River	at Sevierville, Tenn.	353	February 25, 1875	55,000	156
7	Little Tennessee River	at Iotla, N. C.	323	February 28, 1902	38,000	118
8	Little River	near Maryville, Tenn.	269	February 1875	60,000	223
9	Little River	near Walland, Tenn.	192	February 1875	50,000	260
10	Cheoah River	at Johnson, N. C.	177	November 19, 1906	40,000	226
11	Tuckasegee River	at Tuckasegee, N. C.	143	August 30, 1940	40,800	285
12	Oconaluftee River	at Cherokee, N. C.	131	May 1840	17,500	134
13	Cullasaja River	at Cullasaja, N. C.	86.5	August 30, 1940	16,500	191
14	E. Fk. Tuckasegee River	near Tuckasegee, N. C.	80.3	August 30, 1940	30,000	374
15	Deep Creek	at Mouth, Bryson City, N. C.	43.9	May 1840	20,000 est.	455
16	W. Fk. Little Pigeon River	at Gatlinburg, Tenn.	42	April 1, 1896	17,000	405
17	Caney Fork	above Cowarts, N. C.	39.4	August 30, 1940	21,700	551
18	M. Prong W. Fk. Pigeon River	above Spruce, N. C.	8.4	August 30, 1940	16,400	1,950

vicinity of the Little River watershed rising in the Great Smoky Mountains, the rainfall totaled 8 or more inches in about two days. The resulting flood was higher than any known by the oldest inhabitants at that time and has not been exceeded since.

Another early large storm occurred on May 18-21, 1901. This storm extended from the eastern Tennessee River Basin east as far as the coast. Rainfall was particularly heavy in the vicinity of the Watauga and Nolichucky Rivers where approximately 8 inches of rain fell within a 24-hour period on ground that had been saturated from earlier rains. The numerous waterspouts and landslides that were reported in the area attest to the intensity of the rainfall. The resulting flood, which became known as the "May Tide" on the Nolichucky River, is one of the highest floods that has occurred on a relatively large drainage area in the Bryson City region.

The most recent large storm that has occurred in the region was that of late August 1940. Heavy thunderstorm rains occurred along the Southern Appalachian Mountains of eastern Tennessee and western North Carolina. About  $2\frac{1}{2}$  weeks prior to this storm, in mid-August, most of the watersheds along the eastern Tennessee Valley divide from the Blue Ridge Mountains south to the Hiwassee River basin had experienced high floods from a hurricane that brought heavy rainfall to the area. Much of this same area again received heavy rainfall from the late August storm which followed. The upper Tuckasegee River watershed streams, which had been moderately flooded by the mid-August storm, rose to record heights during this latter storm. An average of over 10 inches of rain fell in approximately 24 hours on the Tuckasegee River watershed above Tuckasegee, North Carolina, as shown on Plate 4. The total rainfall diminished downstream from Tuckasegee, and at Bryson City the average rainfall for the watershed was approximately 7 inches. At Bryson City this flood ranks as the fourth highest known, although the record May 1840 flood is the only one that has materially exceeded it.

All of the floods that are listed in Table 5 have occurred on watersheds in the region of Bryson City that are generally similar in physical characteristics. This indicates that floods of like magnitude, modified to take into account drainage area characteristics, may occur in the future on the Tuckasegee River and Deep Creek.

Tuckasegee River and Deep Creek vs. Regional Flood Discharges

Plate 5 is a diagram of the flood discharges given in Table 5. The points on the streams for which the discharges are charted and their proximity to Bryson City are shown by the location map on this plate. Plate 5 shows that the largest known flood on both Tuckasegee River and Deep Creek has been exceeded by floods on other streams in the region. However, the storms that caused the maximum floods on the streams in the Bryson City region could occur over the Tuckasegee River watershed including that of Deep Creek, in which case floods of like magnitude, modified to take into account differences in drainage area characteristics, could occur in the future on the two streams.

Using only the criteria of the experienced maximum flood discharges on streams in the Bryson City region, it would be reasonable to expect future floods on Tuckasegee River and Deep Creek of magnitudes as shown in Table 6. Floods of this magnitude are designated as Regional Floods.

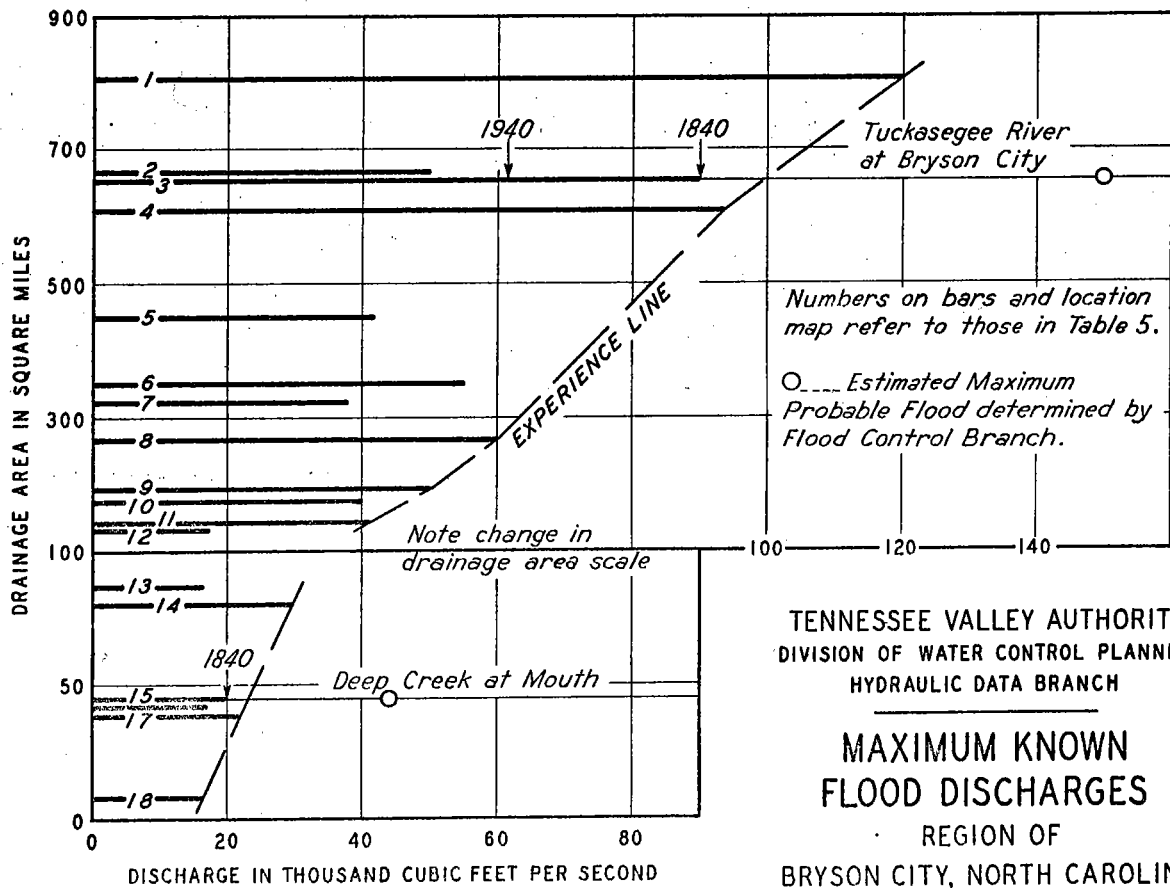
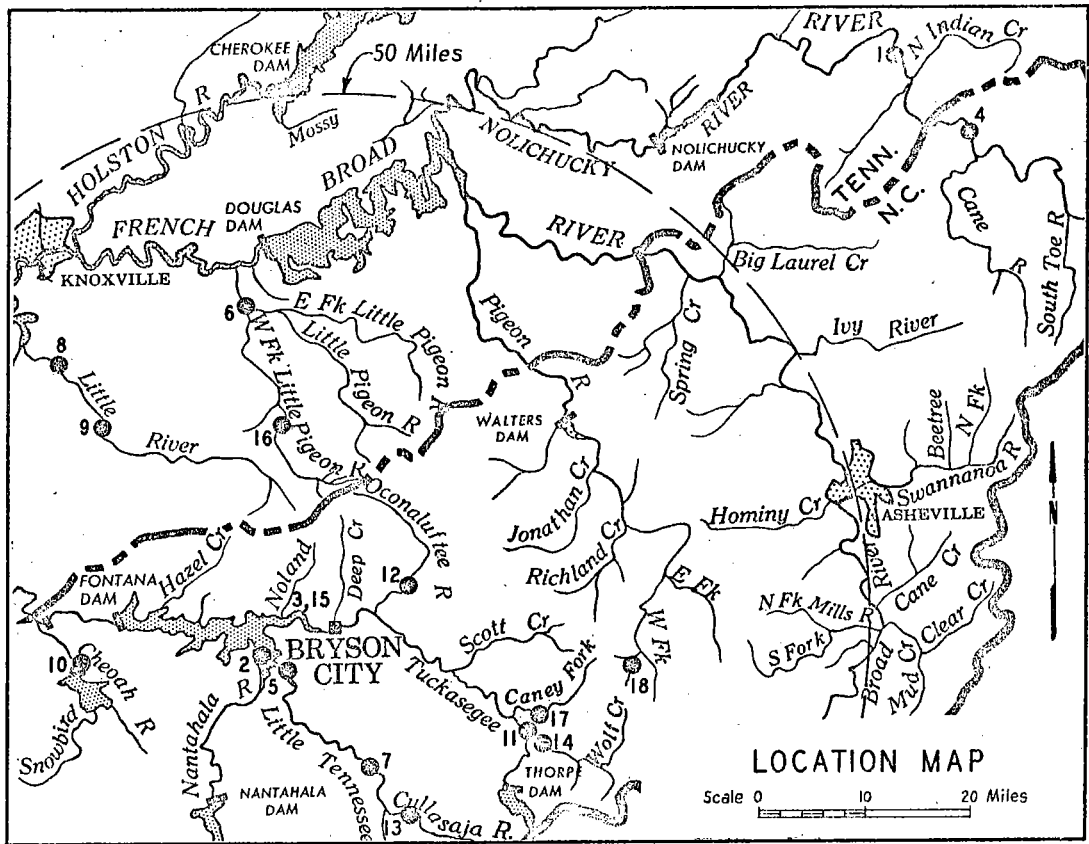
TABLE 6

REGIONAL FLOOD PEAK DISCHARGES

<u>Stream</u>	<u>Location</u>	<u>Drainage Area</u> sq. mi.	<u>Peak Discharge</u> cubic feet per second
Tuckasegee River	Everett Street, Mile 12.72	655	100,000
Deep Creek	Mouth	43.9	23,000
	At Mile 0.50	42.7	23,000

Regional Flood Profiles

Profiles of the Regional Flood on Tuckasegee River and Deep Creek are shown on Plate 8.



ASF - 1311

IV.

MAXIMUM PROBABLE FLOODS

Tennessee Valley Authority  
Division of Water Control Planning  
Flood Control Branch

IV.

MAXIMUM PROBABLE FLOODS

The preceding sections have told about the floods that have already occurred and about the Regional Floods on Tuckasegee River and Deep Creek in the vicinity of Bryson City. This section describes the basis for the Maximum Probable Floods that may reasonably be expected and discusses the extent of the flood plains that would be affected by these floods. Floods of these magnitudes are of the kind considered in planning construction and operation of protective works, the failure of which might be disastrous.

Extreme floods on the 655-square-mile drainage area above Bryson City and on the 43.9-square-mile area of Deep Creek may result from either of two types of storms. Such floods may result from intense rainfall during winter storms of fairly long duration when infiltration and other losses are generally small or from intense, short-duration storms or cloudbursts usually occurring in the summer or early fall when loss rates are generally high.

DETERMINATION OF MAXIMUM PROBABLE FLOODS

In determining the Maximum Probable Floods on Tuckasegee River and Deep Creek in the vicinity of Bryson City, 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 on these areas. This procedure helps to overcome the lack of local hydrologic data available from the relatively short period for which there are dependable records.

The maximum known flood on the Tuckasegee River occurred in May 1840 with an estimated peak discharge of 90,000 cubic feet per second at Bryson City. It is reasonable to estimate that the storm which produced this great flood on

the Tuckasegee River also caused a very large flood on Deep Creek which was nearly of the magnitude of the Regional Flood on that stream. The recent flood of January 21, 1959, on Deep Creek had an estimated flow of 2,400 cubic feet per second and that of January 1957 was 4,300 cubic feet per second. Floods larger than those of 1957 and 1959 occurred on Deep Creek in April 1920 and near the turn of the century, according to the statements of local residents.

It is reasonable to expect that greater floods than those of the past will occur on Tuckasegee River and Deep Creek.

### Observed Storms

Observed storms are meteorologically transposable to the Tuckasegee River and Deep Creek watersheds from within a broad region extending generally from the Atlantic Ocean to the Appalachian Divide and from Florida through Pennsylvania. The moisture source for storms in this region is the warm, moist air flowing northward from the tropical Atlantic Ocean. In general, the moisture potential for a given region decreases with its distance from the moisture source. When transferring storms to the Tuckasegee River and Deep Creek watersheds, appropriate adjustments were made for differences in this moisture potential.

Table 7 lists known rainfall depths for several large storms transposable to these watersheds.

TABLE 7  
SELECTED MAXIMUM OBSERVED STORMS

<u>Date</u>	<u>Location</u>	<u>Rainfall Depth - Inches</u>	
		<u>6 Hours</u> <u>44 Sq. Mi.</u>	<u>12 Hours</u> <u>650 Sq. Mi.</u>
June 1889	Pennsylvania	7.3	8.0
July 1916	North Carolina	7.5	10.9
August 1939	New Jersey	9.3	12.7
September 1940	New Jersey	18.6	12.2
October 1941	Florida	11.6	14.3

The June 30, 1956, storm at Haywood County, North Carolina, produced a point rainfall of 10 to 12 inches in one hour.

The adjustment of these and other storms for application to the Tuckasegee River watershed took into account its unusual shape, topography, and orientation with respect to the moisture source. The following rainstorms were adopted for computing the Maximum Probable Floods:

<u>Stream</u>	<u>Location</u>	<u>Drainage Area sq. mi.</u>	<u>Storm</u>
Tuckasegee River	Everett Street	655	11.2 inches in 12 hours
Deep Creek	Mouth	43.9	15.3 inches in 6 hours

Storms greater than these can occur. Storms considered to be the greatest from a meteorological standpoint would be approximately 65 percent more than those adopted for the Maximum Probable Floods at these locations.

#### Observed Floods

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 are applicable. In addition to the floods listed in Table 5 of Section III, Table 8 lists peak discharges for observed floods on several streams of approximately the size of Tuckasegee River and Deep Creek. For comparison, the discharges of the maximum known floods on these streams are listed.



TABLE 8  
SELECTED MAXIMUM OBSERVED FLOODS  
IN VICINITY OF BRYSON CITY, NORTH CAROLINA

<u>Stream</u>	<u>Location</u>	<u>Drainage Area sq. mi.</u>	<u>Date of Flood</u>	<u>Peak Discharge</u>	
				<u>Amount cfs</u>	<u>Per Sq. Mi. cfs</u>
Stony Fork	Hendrix, N. C.	27.1	1940	37,000	1,370
Hominy Creek	Canton, N. C.	28.9	1940	12,400	428
W. Fk. Pigeon River	Lake Logan, N. C.	32.8	1940	14,900	454
Watauga River	Valle Crucis, N. C.	33.1	1940	38,000	1,150
Newfound Creek	Leicester, N. C.	34.2	1940	12,000	350
Cane River	Burnsville, N. C.	36.6	1940	18,000	490
Caney Fork	E. Laport, N. C.	37.5	1940	21,700	578
N. F. Catawba River	Woodlawn, N. C.	41.8	1940	55,000	1,320
Elk River	Elk Park, N. C.	42.0	1940	27,500	655
Clear Creek	Hendersonville, N. C.	44.6	1916	20,600	461
Mud Creek	Hendersonville, N. C.	52.7	1916	20,000	379
S. Toe River	New Dale, N. C.	60.8	1927	33,000	544
Linville River	Branch, N. C.	65.0	1940	39,500	608
Wilson Creek	Adako, N. C.	66.0	1940	99,000	1,500
Yadkin River	Wilkesboro, N. C.	493.0	1940	160,000	325
French Broad River	Bent Creek, N. C.	676.0	1916	105,000	155
Tuckasegee River	Bryson City, N. C.	655.0	1840	90,000	137
Deep Creek	Bryson City, N. C.	43.9	1840	20,000 est.	455

Maximum Probable Flood Discharges

From consideration of the flood discharges in Tables 5 and 8 and of the transposition to the Tuckasegee River and Deep Creek areas of outstanding storms which have occurred elsewhere but can occur over these watersheds, the peak discharges of the Maximum Probable Floods for these streams were determined to be as follows:

TABLE 9  
MAXIMUM PROBABLE FLOOD  
PEAK DISCHARGES

<u>Stream</u>	<u>Location</u>	<u>Mile</u>	<u>Peak Discharge</u> cubic feet per second
Tuckasegee River	Everett Street	12.72	150,000
Deep Creek	Mouth	0.0	44,000
Deep Creek		0.50	44,000

These flood rates were computed from the appropriate adopted storms using the unit hydrograph technique. The peak rate on Tuckasegee River is 1.7 times that of the 1840 flood, the maximum known. The Deep Creek peak rate is approximately 2.2 times that estimated for the 1840 flood on that stream.

#### Frequency

The frequency of a flood of the magnitude of the Maximum Probable Flood is not susceptible of definite determination. Such a flood would occur on the average only at rather long intervals of time, but it could occur in any year.

#### Possible Larger Floods

Floods larger than any of those discussed are hydrologically possible. However, the combination of factors that would be necessary to produce such floods would occur at rare intervals, if at all. The consideration of floods of this magnitude is of greater importance in some problems than in others and should not be overlooked in the study of any problem. Such floods, because of their extreme rarity and uncertainty of occurrence on a given watershed, need be given greatest consideration where dependence is placed on protective works, the failure of which would cause loss of life or destruction of valuable property.

## FLOOD HEIGHTS AND VELOCITIES

### Flood Crest Profiles and Overflow Areas

The crest profiles computed for the Maximum Probable Floods on Tuckasegee River and Deep Creek in the vicinity of Bryson City are shown on Plate 8. These profiles were computed using stream characteristics for selected reaches as determined from observed flood profiles, topographic maps, and valley cross sections. On Deep Creek the cross sections were for conditions in 1959. The overflow areas that would be covered by the Maximum Probable Floods are shown on Plate 6.

The height of the Tuckasegee River Maximum Probable Flood profile above elevations already experienced varies from 7 to 9 feet. The greatest difference occurs at the Bryson City bridge and is the result of heading up above the bridge which was not in place at the time of the maximum known flood of May 1840. On Deep Creek the Maximum Probable Flood profile is from 8 to 20 feet above the January 1957 flood and 3 to 7 feet above the estimated 1840 flood. The maximum difference between the 1957 and the Maximum Probable Flood occurs near the mouth of the stream where the Southern Railway bridge and a highway bridge greatly constrict the flow area and cause considerable heading up above the bridge. At the extreme upper end of the study, Mile 1.86, the Maximum Probable Flood will flow at or near critical depth and could result in unstable elevations.

It is impossible to foretell the destructive effect of velocities such as those described in the succeeding section of this report, "Velocities and Rates of Rise," on bridges over the stream. In computing the profile of the Maximum Probable Flood, there was no choice but to assume the survival of all structures. No clogging was assumed at bridges.

The elevations shown on Plate 8 and the overflow areas shown on Plate 6 have been determined as accurately as possible consistent with the basic data, but actual elevations may vary from those shown on the maps. To determine elevations and flooded area limits more accurately would require costly surveys.

### Velocities and Rates of Rise

During the Maximum Probable Flood, velocities in the main channel of Tuckasegee River would range from about 8 to 19 feet per second, with possibly some higher rates under bridges. In the overflow area, velocities would range from about 3 to about 9 feet per second. The greatest channel and overflow velocities would occur at the constricted section at about Mile 10.9.

Velocities in the main channel of Deep Creek in the Maximum Probable Flood would range from about 4 to 26 feet per second. In the overflow area, velocities would range from about 2 to 13 feet per second. The greatest channel velocity would occur at the extreme upper limit of the study where the water will flow at or near critical depth as a result of a greatly restricted flow area. In the overbank, the greatest velocity would occur at the restricted overbank section at about Mile 1.0.

The Maximum Probable Flood on Tuckasegee River would rise about 25 feet above low water to its crest stage in about 15 hours. The maximum rate of rise would be about 6 feet in 2 hours.

The Maximum Probable Flood on Deep Creek would rise about 24 feet above low water to its crest stage in 9 hours. The maximum rate of rise would be 8 feet in 1 hour.

These high velocities in combination with deep flooding would create a hazardous situation in developed areas, especially on Deep Creek.

V.

**ACKNOWLEDGMENTS**

Tennessee Valley Authority  
Division of Water Control Planning

V.

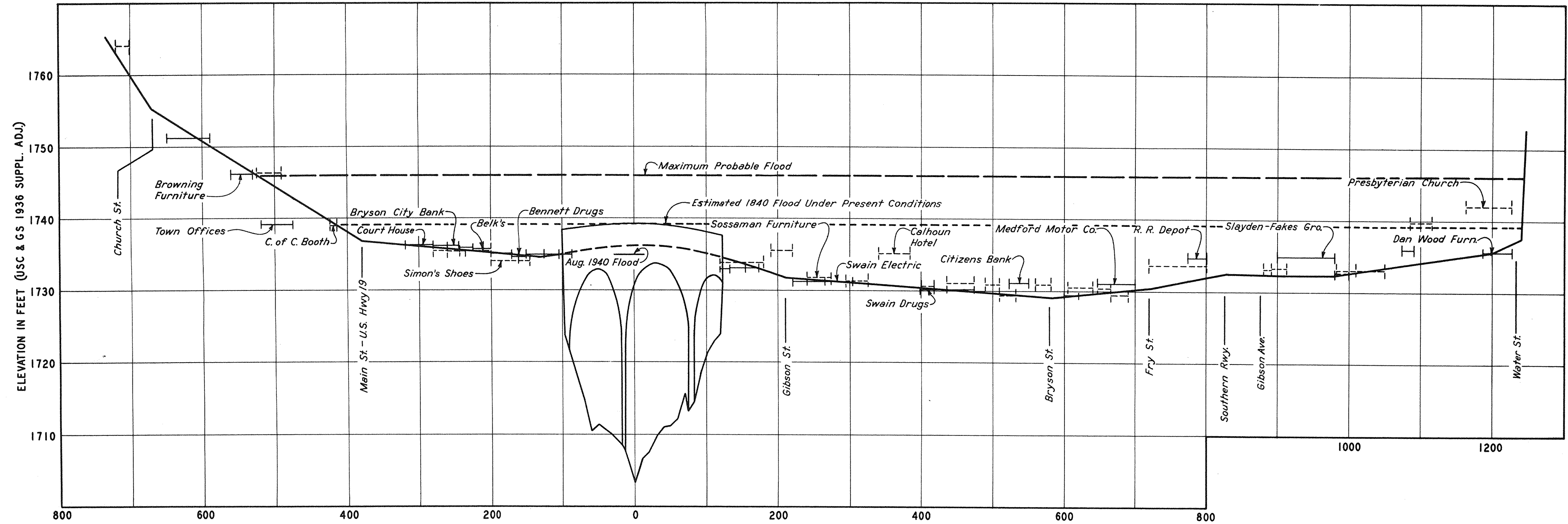
**ACKNOWLEDGMENTS**

This report has been prepared by the Division of Water Control Planning under the general direction of Reed A. Elliot, Chief Water Control Planning Engineer.

All of the report except Section IV has been prepared by the Hydraulic Data Branch under the immediate supervision of Albert S. Fry, Chief, Hydraulic Data Branch. The report has been edited by James Smallshaw, Assistant Branch Chief. Investigations for compiling Section II, Flood History, were made under the direction of James W. Beverage, Head of the Field Investigations Section, by District Engineer Myron O. Jensen and Area Engineer James K. Curtis. Paul C. Spath, Head of the Hydraulic Investigations Section, and Thomas C. Bounds, Head of the Office Engineering Unit, prepared charts and maps for the report and, together with Mr. Smallshaw, Mr. Jensen, and Mr. Curtis, analyzed the flood information. Mr. Curtis searched the Bryson City newspapers for flood data. Studies for development of the Regional Flood, Section III, were made under the direction of Willard M. Snyder, Head of the Hydrology Section, by Roger P. Betson. The entire report was typed for reproduction by Juanita K. Sloan under the direction of Elizabeth G. Breeden, Head, Administrative Unit. The report cover and photographs in the report were prepared for reproduction by Robert Forbes of the Engineering Administration Section.

Section IV, Maximum Probable Floods, was prepared by the Flood Control Branch under the immediate direction of Edward J. Rutter, Chief, Flood Control Branch. Basic hydraulic data were furnished by the Hydraulic Data Branch. Flood studies were under the supervision of B. J. Buehler, Head, Operation Studies Section. The flood discharges were determined by Donald W. Newton, and the profiles were computed by Logan A. Gillett and Bevan W. Brown, Jr.

Photographs showing the heights of the Regional and Maximum Probable Floods were taken by TVA photographer Lloyd C. Bloomer.



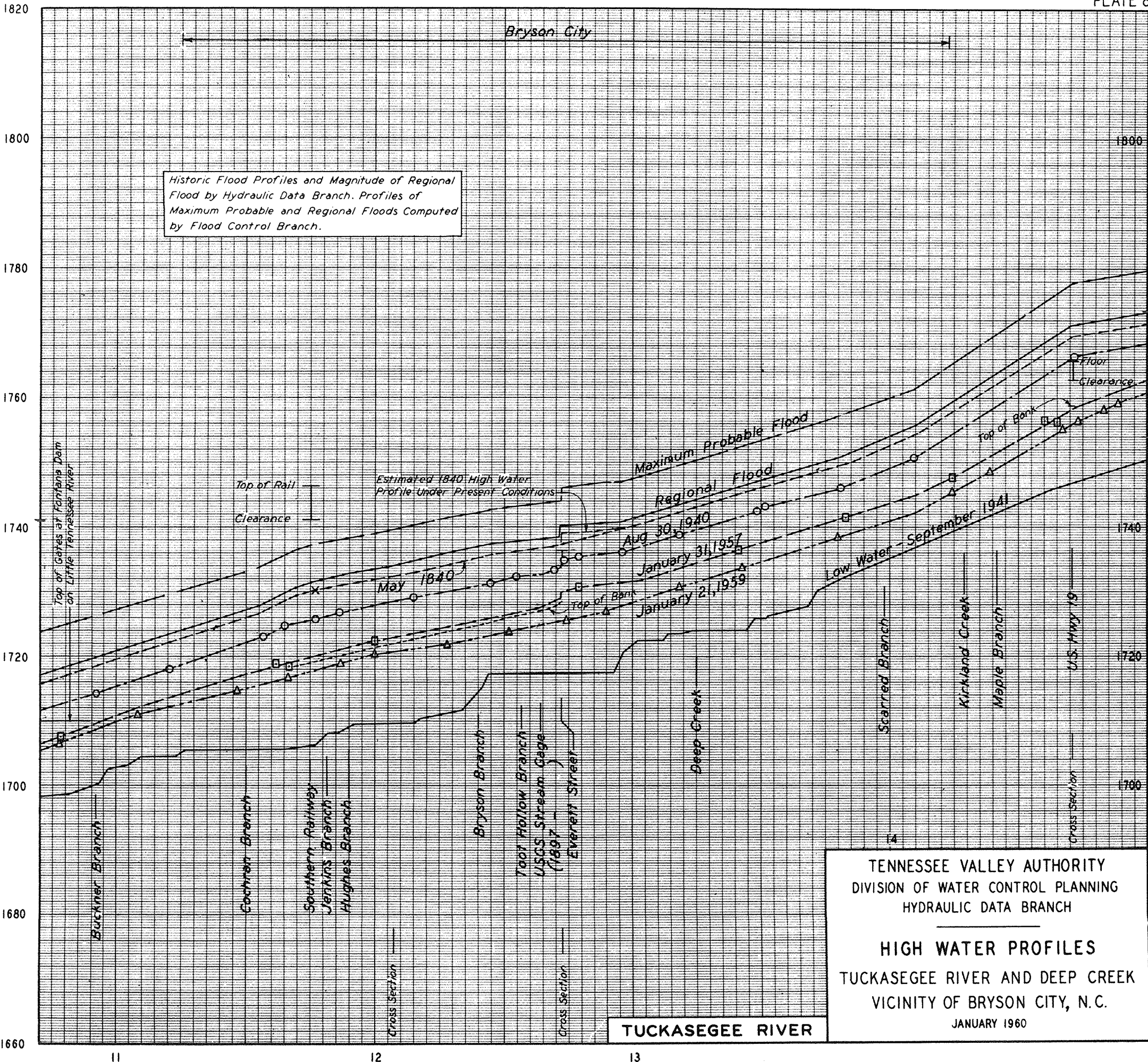
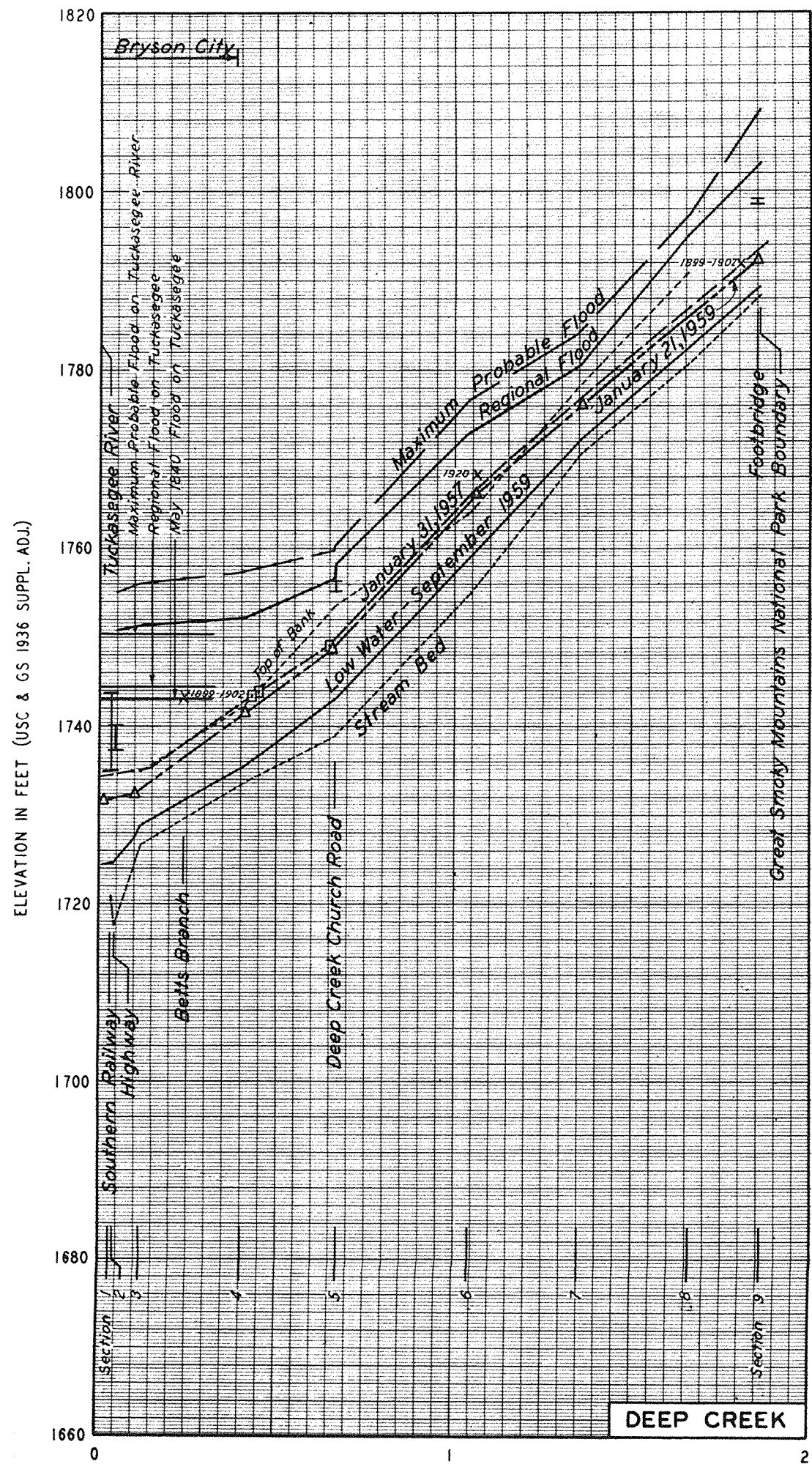
EVERETT STREET - MILE 12.72

|—| Floor elevation - upstream side of street  
 - - - |—| Floor elevation - downstream side of street

HORIZONTAL DISTANCE IN FEET

TENNESSEE VALLEY AUTHORITY  
 DIVISION OF WATER CONTROL PLANNING  
 HYDRAULIC DATA BRANCH  
  
**VALLEY CROSS SECTION**  
**TUCKASEGEE RIVER**  
**AT BRYSON CITY, NORTH CAROLINA**  
 JANUARY 1960

ASF-1311



TENNESSEE VALLEY AUTHORITY  
 DIVISION OF WATER CONTROL PLANNING  
 HYDRAULIC DATA BRANCH

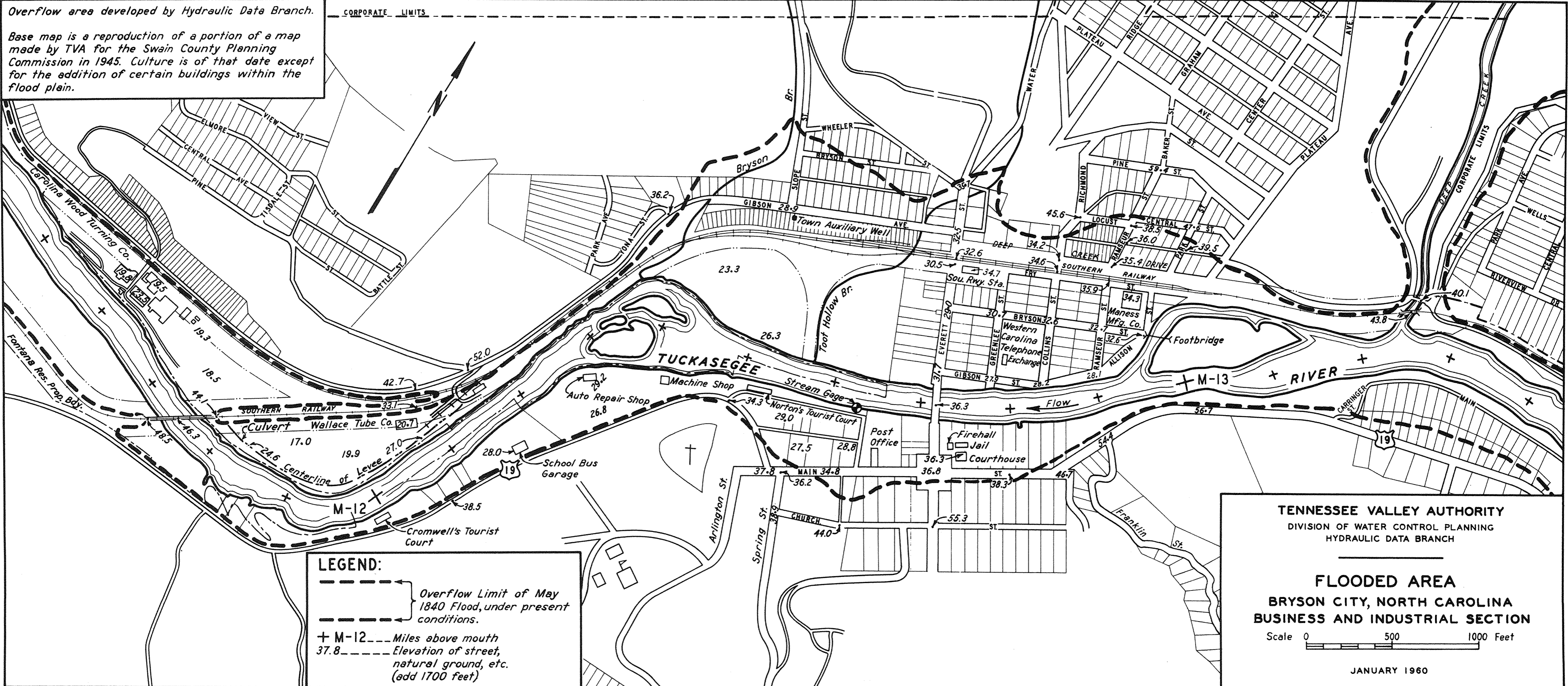
**HIGH WATER PROFILES**  
 TUCKASEGEE RIVER AND DEEP CREEK  
 VICINITY OF BRYSON CITY, N.C.  
 JANUARY 1960

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Overflow area developed by Hydraulic Data Branch.

Base map is a reproduction of a portion of a map made by TVA for the Swain County Planning Commission in 1945. Culture is of that date except for the addition of certain buildings within the flood plain.



**LEGEND:**

--- Overflow Limit of May 1840 Flood, under present conditions.

+ M-12 --- Miles above mouth

37.8 --- Elevation of street, natural ground, etc. (add 1700 feet)

**TENNESSEE VALLEY AUTHORITY**  
 DIVISION OF WATER CONTROL PLANNING  
 HYDRAULIC DATA BRANCH

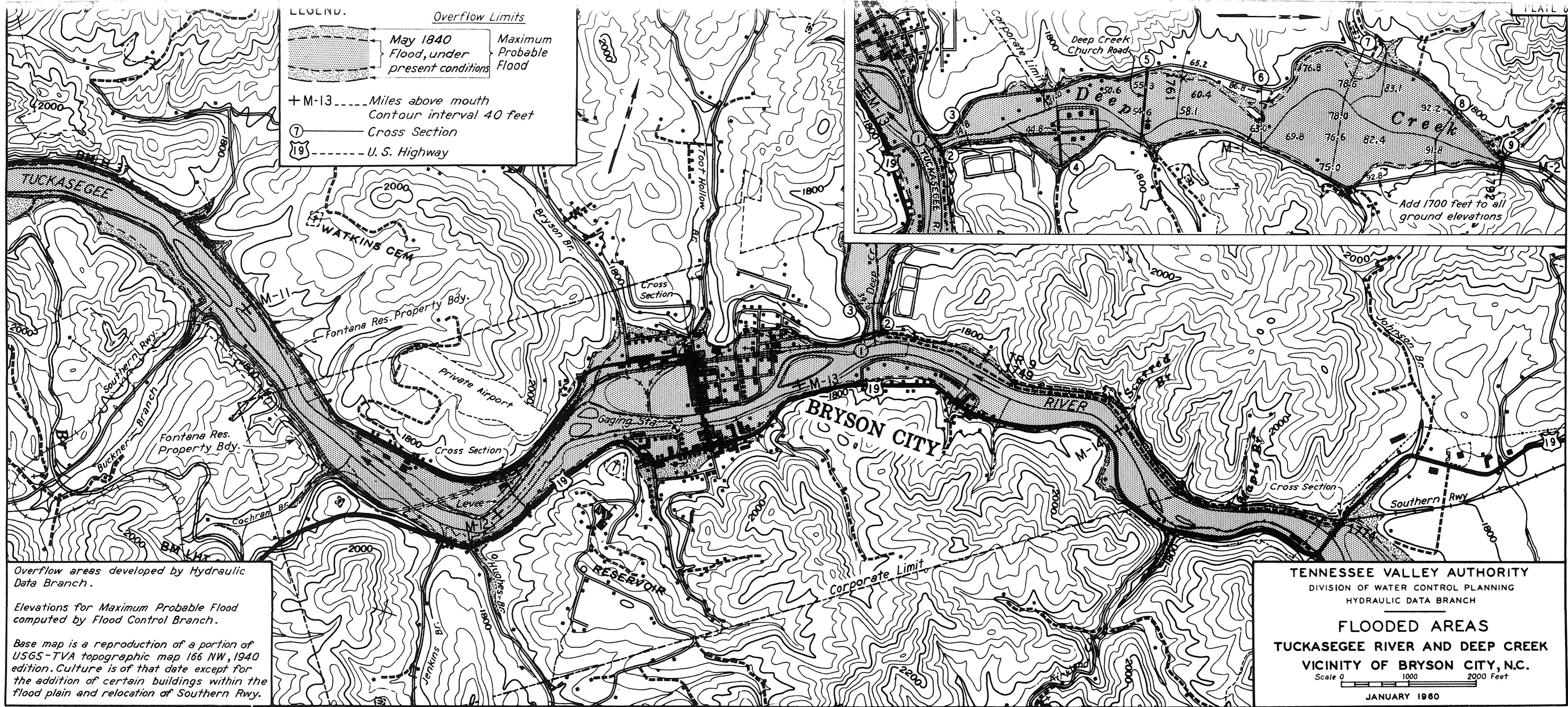
**FLOODED AREA**  
**BRYSON CITY, NORTH CAROLINA**  
**BUSINESS AND INDUSTRIAL SECTION**

Scale 0 500 1000 Feet

JANUARY 1960

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**LEGEND.**

*Overflow Limits*

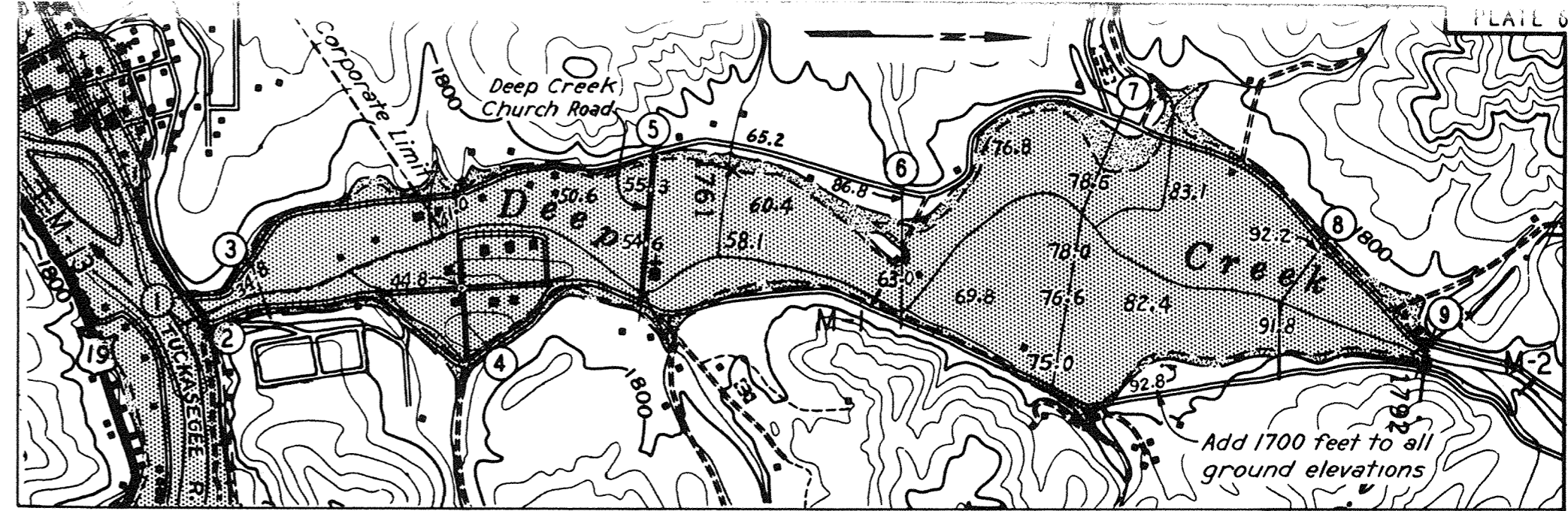
May 1840 Flood, under present conditions

Maximum Probable Flood

+ M-13 ----- Miles above mouth  
Contour interval 40 feet

⑦ ----- Cross Section

①⑨ ----- U. S. Highway



Overflow areas developed by Hydraulic Data Branch.

Elevations for Maximum Probable Flood computed by Flood Control Branch.

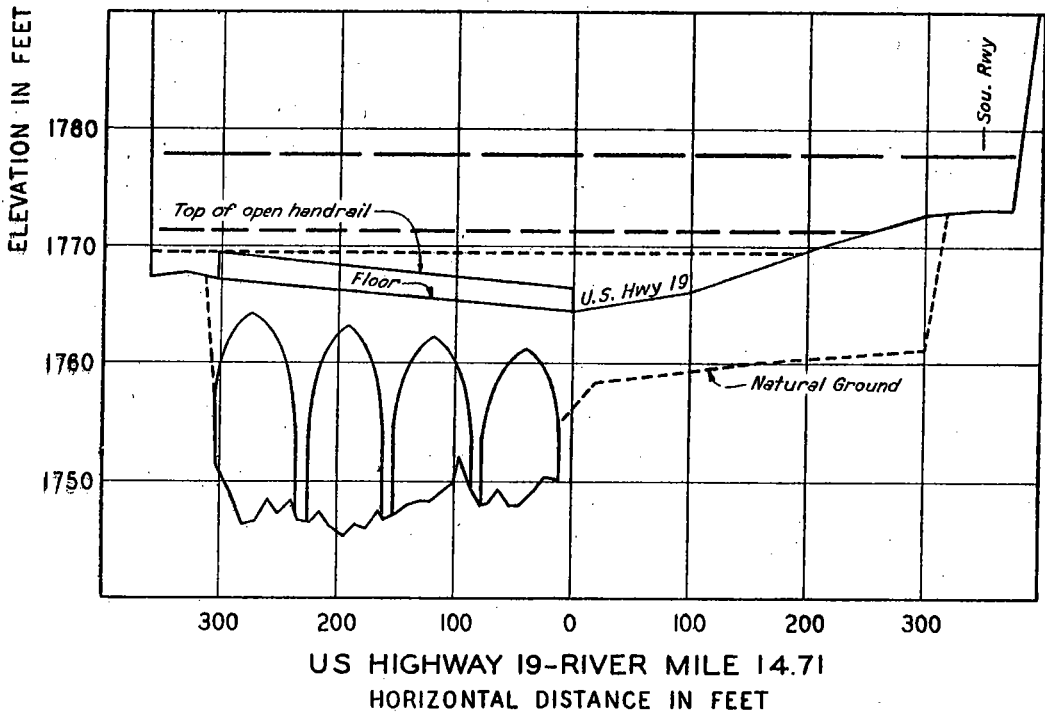
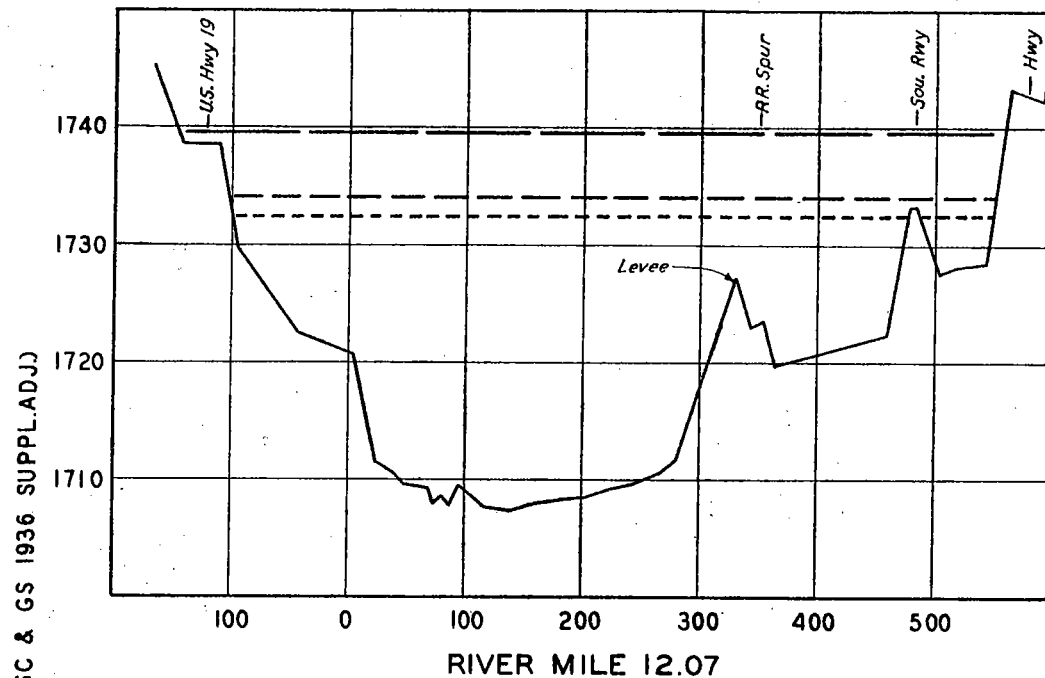
Base map is a reproduction of a portion of USGS-TVA topographic map 166 NW, 1940 edition. Culture is of that date except for the addition of certain buildings within the flood plain and relocation of Southern Rwy.

TENNESSEE VALLEY AUTHORITY  
DIVISION OF WATER CONTROL PLANNING  
HYDRAULIC DATA BRANCH

**FLOODED AREAS**  
**TUCKASEGEE RIVER AND DEEP CREEK**  
**VICINITY OF BRYSON CITY, N.C.**

Scale 0 1000 2000 Feet

JANUARY 1960



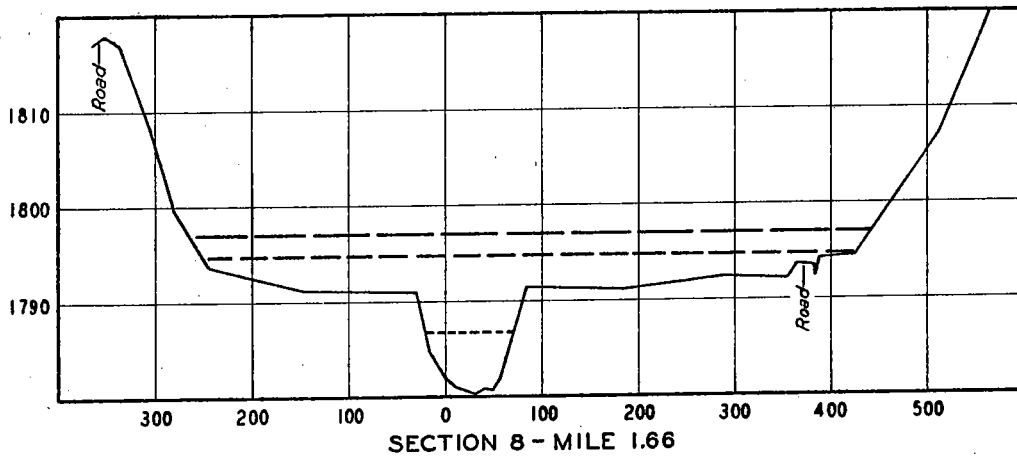
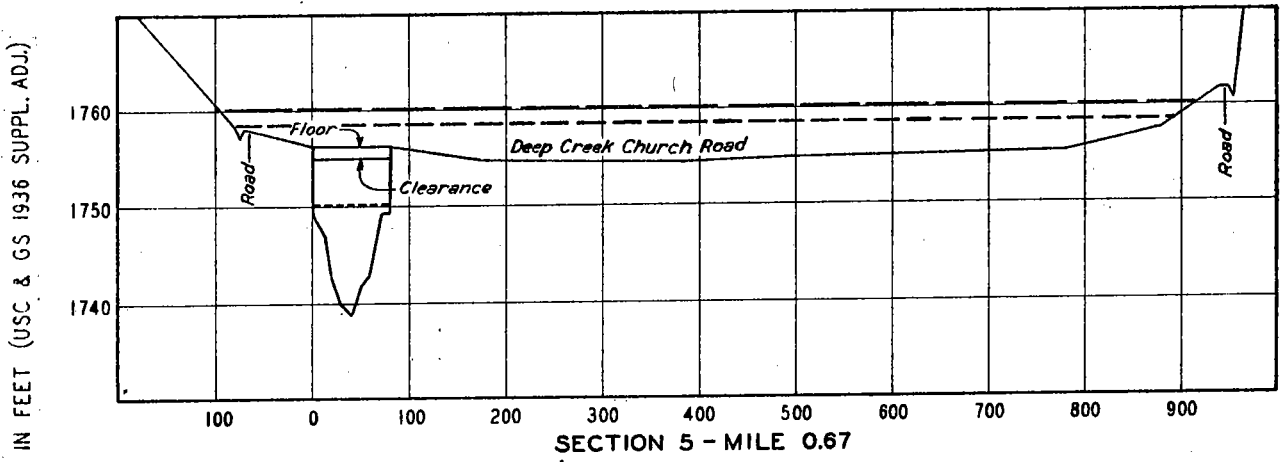
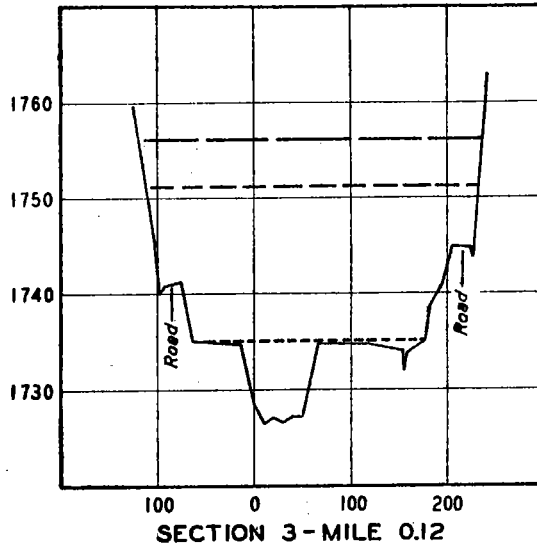
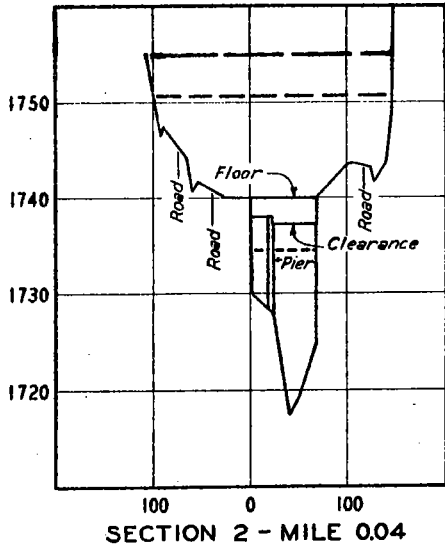
- Maximum Probable Flood
- Regional Flood
- - - - May 1840 Flood

TENNESSEE VALLEY AUTHORITY  
 DIVISION OF WATER CONTROL PLANNING  
 HYDRAULIC DATA BRANCH

**VALLEY CROSS SECTIONS  
 TUCKASEGEE RIVER  
 VICINITY OF BRYSON CITY, N.C.**

JANUARY 1960

ASF 1311



LEGEND:

- Maximum Probable Flood
- - - Regional Flood
- · - · - January 31, 1957 Flood

Sections taken looking downstream.  
5 Sections not shown.

Elevations of Maximum Probable and Regional Floods computed by Flood Control Branch.  
January 1957 Flood by Hydraulic Data Branch.

TENNESSEE VALLEY AUTHORITY  
DIVISION OF WATER CONTROL PLANNING  
HYDRAULIC DATA BRANCH

VALLEY CROSS SECTIONS

DEEP CREEK  
VICINITY OF BRYSON CITY, N. C.  
JANUARY 1960

HORIZONTAL DISTANCE IN FEET

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

CASE - 1311

