TENNESSEE VALLEY AUTHORITY

Office of Economic and Community Development

FLOODS ON TUCKASEGEE RIVER, CULLOWHEE CREEK, AND LONG BRANCH IN JACKSON COUNTY, NORTH CAROLINA

Flood Report

TVA/OECD/FPM-83/51

Knoxville, Tennessee

August 1983

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FLOODS ON TUCKASEGEE RIVER, CULLOWHEE CREEK, AND LONG BRANCH IN JACKSON COUNTY, NORTH CAROLINA

INTRODUCTION

This floodplain information study provides flooding information for the Tuckasegee River, Cullowhee Creek, and Long Branch in Jackson County, North Carolina. The study was requested by Jackson County to provide information reflecting current flood conditions in order that the community can promote wise use of the floodplain and reduce potential flood damages.

STUDY AND SCOPE

This investigation covers the Tuckasegee River from mile 33.71 near Webster upstream to mile 46.20 above Cullowhee; Cullowhee Creek from its mouth upstream to mile 1.44; and Long Branch from its mouth upstream to mile 1.05.

WATERSHED DATA

The Tuckasegee River watershed drains an area of 734 square miles. At the beginning of the study area, mile 33.71, the drainage area is 244 square miles. The river forms along the northern slopes of the Tennessee Valley Divide where elevations range up to 5000 feet above mean sea level. This area receives some of the heaviest rainfall in the eastern United States.

The two largest tributaries above the study area are Caney Fork and West Fork Tuckasegee River. Caney Fork enters the Tuckasegee River at mile 46.19 from the east and drains an area of 51.2 square miles. West Fork enters from the west at mile 49.56 and has a drainage area of 57.8 square miles.

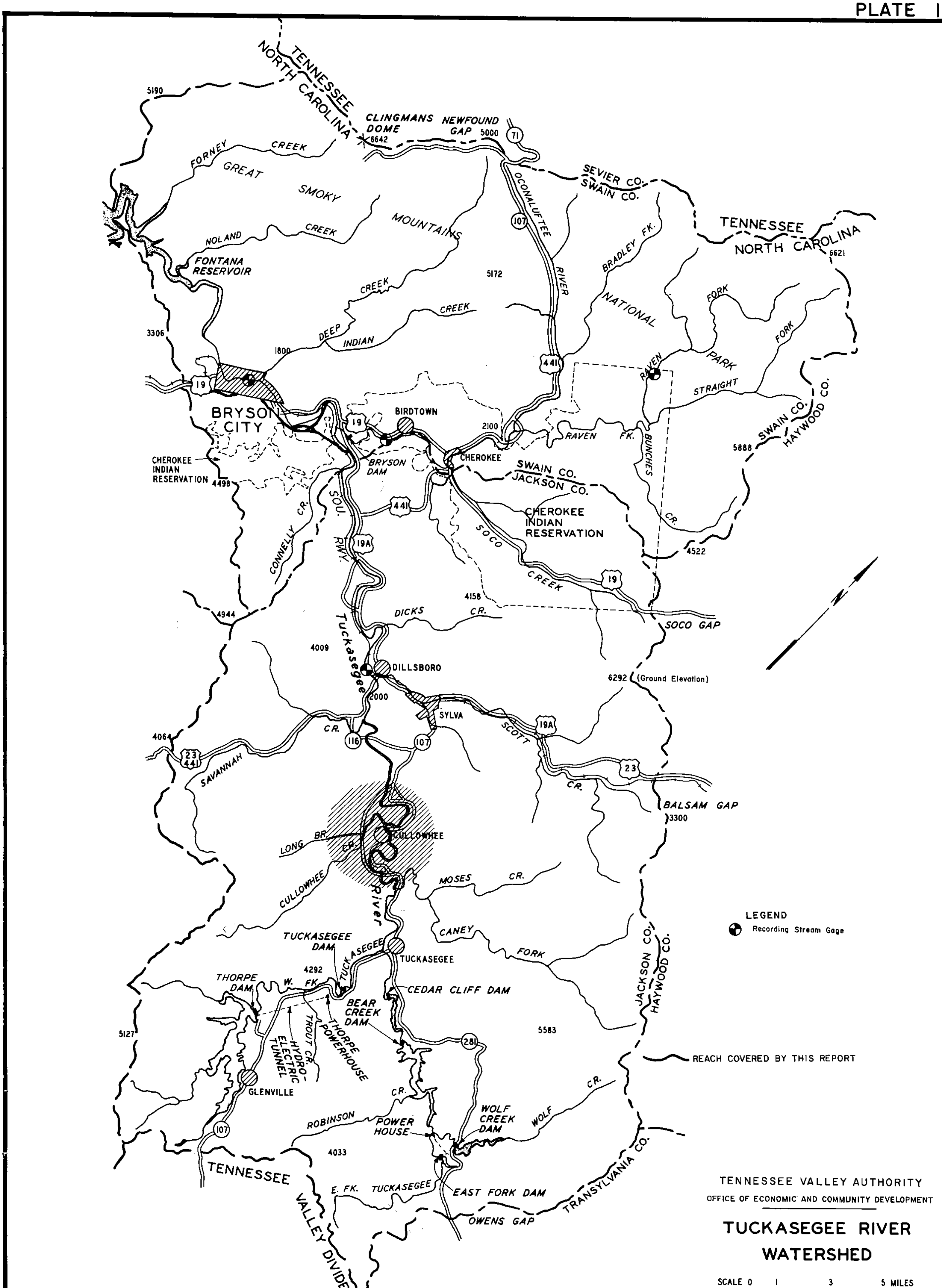
Five small power projects, owned and operated by the Aluminum Company of America or its subsidiary, Nantahala Power and Light Company, are located in the headwaters region of the Tuckasegee River. Of these only Thorpe Dam on the West Fork Tuckasegee River with 66,900 acre-feet provides sufficient storage to potentially alter downstream flooding. The drainage area above the dam is 36.7 square miles, 18 percent of the total area above Cullowhee. The project has no reserved flood control storage, and any effect the reservoir might have on flood heights downstream would depend on the level of the reservoir just prior to the flood.

Cullowhee Creek drains a total of 23.4 square miles and enters the Tuckasegee River at mile 40.88. Long Branch, a tributary to Cullowhee Creek at mile 1.24, has a drainage area of 1.7 square miles.

A map of the watershed designating the reaches studied is shown on plate 1.

FLOODPLAIN DESCRIPTION

Throughout the study reach, the Tuckasegee River floodplain is relatively narrow with the floodplain less than 1,200 feet wide at its widest point. Below Cullowhee, the floodplain is confined by former North Carolina Highway 107 on the right bank (looking downstream) and a new 4-lane highway on its left bank. Located on the right bank floodplain between the highway and the river are a number of mobile home parks which are primarily occupied by students of Western Carolina University. During a large flood many of the mobile homes would be susceptible to flooding with possible injury or loss of life to the occupants. Above Cullowhee the floodplain is less developed.



TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

TUCKASEGEE RIVER WATERSHED

SEPTEMBER 1982

Cullowhee Creek flows through the university campus and enters the Tuckasegee River below the community of Cullowhee. The floodplain below the university is not extensively developed, and on the campus it is occupied mainly by athletic fields. The main university buildings are well above the 100-year floodplain, but expansion could encroach into the floodplain.

Long Branch flows under the Highway 107 bypass and enters Cullowhee Creek on the campus. Upstream from the bypass are mobile homes and apartments for student housing. With the opening of the bypass around the campus, it is expected that further pressure for development will occur along the highway next to the stream.

REVIEW OF HISTORIC FLOODS

Stream gage records have been kept on the Tuckasegee River since 1897. Other reports, newspaper accounts, and interviews with local citizens yielded information about major floods on the Tuckasegee River back to 1840. The May 1840 flood, known as the "May Tide," was the largest flood of record along the lower reaches of the Tuckasegee River, but in the vicinity of Cullowhee it was exceeded by the late August 1940 flood. The latter flood was caused by intense, extremely heavy rain which fell on the headwaters of the Tuckasegee River basin along the Blue Ridge. There were numerous slides or waterspouts occurring on the steep mountain slopes especially on East Fork, West Fork, and Caney Fork. Rainfall above Cullowhee ranged upward from 7 to 13 inches.

Other large floods which occurred on the Tuckasegee River were in June 1876, August 1928, and October 1964.

During the storm of October 4 and 5, 1964, rainfall ranging from about 5 inches at Cullowhee to 10 inches on the headwaters produced a flood which crested 8 feet below the late August 1940 flood. This storm was preceded by a storm a week earlier which had dropped up to 13 inches of rainfall in the watershed. During the October flood, the community of Cullowhee was virtually isolated when floodwaters blocked North Carolina Highway 107 at Ashe bridge north of the town and near Dicks Gap to the south. Many Western Carolina University students returning from weekend visits were delayed for several hours on their return to Cullowhee. A bridge washout and road damage stopped local traffic to the rural communities east of Cullowhee. All occupants of a mobile home park were forced from their quarters, and two houses were evacuated.

The most recent flooding in Jackson County occurred on February 1-2, 1983. Rain began falling during the afternoon of February 1 and continued through the night and into the next day. At Cullowhee, 2.25 inches of rainfall was recorded between 4 p.m. on the first and 6 a.m. on the second, while 3.30 inches was recorded at Thorpe Power Plant by 5 a.m. on the second. Many of the slopes were still covered with snow, and the snow melt contributed to the heavy runoff.

The most severe flooding occurred along the Tuckasegee River between Cullowhee and Dillsboro with the river cresting at Cullowhee at approximately 10 a.m. Many roads were covered and water overtopped several bridges through this stream reach. The river threatened several mobile home parks below Cullowhee. The Cashiers Chronicle reported approximately 100 people were evacuated with all evacuees able to return home by late afternoon.

Particularly hard hit was the University Trailer Park where water was reported to have entered several of the trailers. One resident reported watching her propane gas tank lifting up and floating a short distance away.

There are no flood records or floodmarks for Cullowhee Creek or Long Branch.

REPRESENTATION OF FLOOD DATA

A flood is normally described by data representing its elevation and boundaries at a specified location along the stream. Floodway limits, which are used for regulatory purposes, are not tied to topography and are described solely by horizontal distances measured from prominent features and references.

The flood information in this report is in the following format:

1. Flooded area limits are shown on flooded area maps (plates 2 through 7).
2. Flood elevations are shown on flood profiles (plates 8 through 13).
3. Floodway limits are shown on floodway maps (plates 2A through 7A) and are included as an appendix.
4. Plate layout is indicated on the Tuckasegee River vicinity map included at the beginning of the plates.

COMPUTED FLOODS

Flood discharges and elevations have been computed for the 10-, 100-, and 500-year floods to assist Jackson County in administering its floodplain management program. The data and plates included in this report have been prepared by the Flood Hazard Analysis Branch, Division of Air and Water Resources, Office of Natural Resources.

HYDROLOGY

Computed flood discharges for the Tuckasegee River are based on analyses of stream gage records at Dillsboro and Tuckasegee. Discharges on Cullowhee Creek and Long Branch are based on records from similar watersheds in the region (reference 1). All stream gage analyses follow standard procedures outlined in reference 2.

Ten-Year Flood

The 10-year flood is defined as a flood with 1 chance in 10 (10 percent) of occurring in any given year. The 10-year flood on the Tuckasegee River through the study reach would average 4 feet below the October 1964 flood. The 10-year flood profile has been included in this report in order to assist communities in complying with State regulations restricting septic tank systems in the 10-year floodplain.

One Hundred-Year Flood

The 100-year flood is defined as a flood with 1 chance in 100 (1 percent) of being equaled or exceeded in any given year. There is a 26-percent chance of its occurrence in a 30-year mortgage period. The 100-year flood on the Tuckasegee River through the study reach would average 3 feet above the October 1964 flood and 5 feet below the late August 1940 flood. On Cullowhee Creek and Long Branch, the 100-year flood would average 2 to 3 feet above the 10-year flood. The 100-year flood is the minimum acceptable standard for land-use regulation under requirements governing participation in the National Flood Insurance Program.

Five Hundred-Year Flood

The 500-year flood is a rare event with 1 chance in 500 (0.2 percent) of being equaled or exceeded in any given year. Its chance of occurring during a 30-year mortgage period is about 6 percent. The 500-year flood on the Tuckasegee River through the study reach would be only 1 foot higher than the late August 1940 flood and about 6 feet higher than the 100-year flood. On Long Branch and Cullowhee Creek the 500-year flood would crest about 1 foot above the 100-year flood. The 500-year flood is provided as a guide for planning community and industrial development where risk of flooding must be reduced by providing an increased level of protection.

HYDRAULICS

The hydraulic characteristics of the Tuckasegee River, Cullowhee Creek, and Long Branch were analyzed using the U.S. Army Corps of Engineers HEC-2N backwater computer program (reference 3) to provide estimates of the 10-, 100-, and 500-year flood elevations at selected cross sections. The cross sections were field surveyed at bridges and other locations and supplemented with valley cross sections plotted from aerial photography to accurately define the floodplains of the Tuckasegee River, Cullowhee Creek, and Long Branch. Locations of the cross sections used in the hydraulic analyses are shown on the flooded area maps (plates 2-7).

The computed elevations at the cross sections were plotted on a graph at the stream mile locations of the cross sections and joined with straight lines to create flood profiles (plates 8-13). The elevations are shown in feet above mean sea level and the stream miles are measured from the mouth upstream. Tabulations of the 10-, 100-, and 500-year flood elevations and discharges for the Tuckasegee River, Cullowhee Creek, and Long Branch are included in tables 1-3.

The computed flood elevations are based on the assumption that bridges and other hydraulic structures remain open and unobstructed. The accumulation of debris or other obstructions under bridges during the time of flooding may raise the flood elevations higher than those shown on the stream profile.

The flooded area maps show the approximate areas that would be inundated by the 100- and 500-year floods. Using the flood profiles and orthophotographic maps produced from recent aerial photography, the flood elevations from the profiles were plotted at the corresponding ground elevation locations on the maps to establish the limits of flooding.

Floodways

Encroachments in the floodplain such as fills or structures reduce its flood-carrying capacity and increase the danger of flooding in other areas. In reviewing floodplain development proposals, the economic gain of the proposed development must be compared to the possibility of increased flood damage both to the development and to existing neighboring developments. However, prohibiting any further floodplain development may be excessively restrictive.

Table 1

TUCKASEGEE RIVER PROFILE TABULATION

Cross Section		10-Year Flood		100-Year Flood		500-Year Flood	
No.	Mile	Discharge (cfs)[c]	Elevation[b] (feet)	Discharge (cfs)[c]	Elevation[b] (feet)	Discharge (cfs)[c]	Elevation[b] (feet)
1	33.71	13,195	2001.2	31,190	2007.9	51,575	2013.4
2	33.98	13,180	2003.8	31,160	2010.6	51,515	2016.0
3	34.56	13,145	2008.9	31,095	2016.7	51,390	2022.6
4	35.27 DS[a]	13,110	2014.0	31,015	2022.1	51,235	2027.5
4	35.27 US[a]	13,110	2014.5	31,015	2024.2	51,235	2029.7
5	35.86	13,075	2017.9	30,950	2026.7	51,105	2032.5
6	36.38	13,045	2022.5	30,895	2029.4	50,990	2034.9
7	37.07 DS	13,010	2033.1	30,820	2039.0	50,835	2043.9
7	37.07 US	13,010	2033.7	30,820	2040.1	50,835	2045.5
8	37.54	12,985	2036.9	30,765	2043.5	50,735	2048.9
9	38.10	12,955	2041.8	30,705	2048.6	50,610	2053.7
10	39.08	12,900	2048.2	30,600	2055.5	50,395	2061.1
11	39.87	12,855	2054.2	30,510	2061.8	50,220	2067.6
12	40.34	12,830	2057.7	30,460	2065.2	50,120	2070.7
13	41.02 DS	12,190	2063.3	29,085	2071.4	47,970	2077.1
13	41.02 US	12,190	2063.9	29,085	2072.6	47,970	2079.7
14	41.13 DS	12,185	2064.6	29,070	2073.5	47,950	2080.4
14	41.13 US	12,185	2067.3	29,070	2073.5	47,950	2080.4
15	41.56	12,160	2069.8	29,025	2076.4	47,860	2082.5
16	41.92 DS	12,140	2072.4	28,985	2079.2	47,785	2084.6
16	41.92 US	12,140	2073.1	28,985	2081.6	47,785	2087.3
17	42.33	12,120	2075.4	28,935	2084.1	47,700	2090.0
18	42.70	12,095	2077.4	28,895	2085.5	47,625	2091.4
19	43.33	12,060	2085.3	28,825	2092.1	47,495	2097.4
20	43.87 DS	12,030	2089.6	28,765	2096.6	47,380	2101.6
20	43.87 US	12,030	2090.8	28,765	2098.7	47,380	2104.6
21	44.37	12,005	2093.6	28,705	2101.5	47,280	2107.2

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a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Cubic feet per second (cfs) is a measurement of the volume of water flowing past a given point per second.

Table 1 (Continued)

TUCKASEGEE RIVER PROFILE TABULATION

Cross Section No.	Mile	10-Year Flood Discharge (cfs)[c]	10-Year Flood Elevation[b] (feet)	100-Year Flood Discharge (cfs)[c]	100-Year Flood Elevation[b] (feet)	500-Year Flood Discharge (cfs)[c]	500-Year Flood Elevation[b] (feet)
22	44.98 DS[a]	11,970	2099.2	28,640	2106.0	47,150	2111.4
22	44.98 US[a]	11,970	2099.8	28,640	2106.6	47,150	2112.0
23	45.54	11,935	2107.4	28,575	2112.4	47,035	2117.0
24	46.20	11,900	2117.9	28,500	2122.5	46,900	2126.1

a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Cubic feet per second (cfs) is a measurement of the volume of water flowing past a given point per second.

Table 2

CULLOWHEE CREEK PROFILE TABULATION

Cross Section No.	Cross Section Mile	10-Year Flood Discharge (cfs)[c]	10-Year Flood Elevation[b] (feet)	100-Year Flood Discharge (cfs)[c]	100-Year Flood Elevation[b] (feet)	500-Year Flood Discharge (cfs)[c]	500-Year Flood Elevation[b] (feet)
1	0.01 DS[a]	2,610	2062.2[d]	5,220	2070.1[d]	7,390	2075.8[d]
1	0.01 US[a]	2,610	2062.4	5,220	2070.1[d]	7,390	2075.8[d]
2	0.29	2,600	2064.8	5,200	2070.1[d]	7,360	2075.8[d]
3	0.60	2,590	2073.0	5,175	2074.9	7,330	2076.0
4	0.89	2,580	2079.2	5,155	2081.5	7,305	2082.9
5	1.09 DS	2,575	2083.8	5,140	2085.1	7,285	2086.0
5	1.09 US	2,575	2084.7	5,140	2088.4	7,285	2089.3
6	1.16 DS	2,575	2086.1	5,135	2089.4	7,280	2090.6
6	1.16 US	2,575	2087.6	5,135	2091.6	7,280	2095.8
7	1.34 DS	2,430	2090.8	4,865	2093.9	6,920	2097.2
7	1.34 US	2,430	2091.6	4,865	2095.1	6,920	2097.4
*	1.44	2,425	2093.3	4,850	2096.1	6,900	2097.9

*Section not shown on flooded area map or profile.

a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Cubic feet per second (cfs) is a measurement of the volume of water flowing past a given point per second.
d. Tuckasegee River mile 40.88 elevations at the mouth of Cullowhee Creek.

TABLE 3

LONG BRANCH PROFILE TABULATION

Cross Section		10-Year Flood		100-Year Flood		500-Year Flood	
		Discharge	Elevation[b]	Discharge	Elevation[b]	Discharge	Elevation[b]
No.	Mile	(cfs)[c]	(feet)	(cfs)[c]	(feet)	(cfs)[c]	(feet)
1	0.04	445	2089.6	965	2093.0	1,470	2101.8
*	0.21	415	2106.7	905	2108.7	1,385	2109.9
2	0.22 DS[a]	415	2108.2	905	2109.9	1,385	2111.3
2	0.22 US[a]	415	2109.5	905	2112.5	1,385	2113.1
3	0.44	380	2128.2	830	2130.3	1,275	2131.9
*	0.75	325	2178.7	720	2180.1	1,120	2181.1
4	0.76 DS	325	2179.6	720	2181.1	1,120	2182.2
4	0.76 US	325	2182.0	720	2182.9	1,120	2183.4
*	0.86	310	2194.3	680	2196.2	1,065	2197.1
5	0.87 DS	310	2198.1	680	2199.8	1,065	2201.1
5	0.87 US	310	2199.0	680	2205.2	1,065	2205.9
*	0.88	310	2203.6	680	2205.5	1,065	2206.5
6	1.05	280	2232.7	620	2234.6	980	2235.9

*Sections not shown on flooded area map or profiles.

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a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Cubic feet per second (cfs) is a measurement of the volume of water flowing past a given point per second.

Frequently the community must decide how much further floodplain development to allow, what the effects of such development will be, and where the development should take place. If the community is participating in the National Flood Insurance Program, it must not allow further development which will cumulatively increase the existing level of the 100-year flood by more than 1 foot at any point along the stream.

To accommodate some floodplain development, the floodplain can be divided into two separate parts--the floodway and the flood fringe. This division recognizes the natural functions of the floodplain. The floodway is the stream channel and that portion of the adjacent floodplain which must remain open and unobstructed to permit passage of floodwaters. The floodwaters are deepest and swiftest in the floodway, and structures and other developments located in this area are subject to the greatest danger during times of flooding. The remainder of the floodplain is called the flood fringe. Here the water is more shallow and may have little or no movement. Therefore, most communities permit development in this portion of the floodplain if the development is elevated or otherwise protected to the regulatory (usually 100-year) flood level.

While a community may have some flexibility in setting limits, a floodway must be determined which is capable of handling all of the water which now occupies the entire floodplain. When making this determination, it is assumed that the community will permit development in the remainder of the floodplain (that is, in the flood fringe) and that ultimately total development of the flood fringe will occur, thereby preventing water from flowing through the developed area.

The areas needed to pass floodwaters through the community without causing increases in flood heights by more than the National Flood Insurance Program requirement, or to a lesser amount if desired by the community, are determined by engineering calculations. After the floodway boundaries are determined and officially designated by local ordinance, total filling or development of the flood fringe will not increase flood levels by more than the previously determined amount (usually 1 foot).

FLOODPLAIN MANAGEMENT

The goal of floodplain management is to reduce flood damages and prevent injury and loss of life. A detailed investigation containing specific solutions to flooding problems is beyond the scope of this report; however, the technical data presented here may be used in developing an effective floodplain management program. Measures taken to reduce flood damage may be classified as structural or nonstructural. Structural measures may include dams, levees, and channel modification while nonstructural measures may include floodplain regulation, flood insurance, floodproofing, flood warning, emergency preparedness, and temporary or permanent evacuation.

A community's flood problems are usually as diverse as the methods the community uses to solve them. No one measure will solve all of the flood problems. A community must look for a combination of measures to fit its individual needs and resources to provide the best solution which will be most effective in reducing flood damage. The success in carrying out the goal of floodplain management is dependent upon actions by the local government and the cooperation of its citizens.

To be effective, floodplain management measures should perform the following functions:

1. Reduce or prevent future flood damages and the loss of life.
2. Promote wise use of the floodplain.
3. Reserve for the passage of floodwaters that area of the floodplain where damages and destruction are inevitable during a flood event that equals or exceeds the 100-year flood.
4. Increase the awareness of developers and users of the floodplain regarding the flood potential in the area.

USER'S GUIDE

To aid the user of this study in understanding the technical terms and data presented, TVA has prepared a document entitled "Guide for the Use of Technical Information and Data for Floodplain Management in the Tennessee River Basin," dated October 1980. Copies of this document are available upon request from TVA.

DEFINITION OF TERMS

Base Map - A map from which other maps are prepared by adding such features as floodplain and floodway boundaries.

Computed Flood - An estimated future flood based on a hydraulic analysis of the potential storm runoff from an area and flow of water through the floodplain.

Contour - A line on a map which represents points of equal elevation.

Cross Section of a Floodplain - A vertical section of the floodplain surface, normally taken at right angles to the direction of the floodflow.

Effective Stream Mileage - The point along the centerline of the stream channel which has the same flood elevation as a specified location in the floodplain.

Flood - A temporary rise in water levels or an accumulation of water runoff, resulting in inundation of areas not ordinarily covered by water.

10-Percent-Chance (10-Year) Flood - A flood having 10 chances in 100 (1 chance in 10) of being equaled or exceeded in any 1-year period.

2-Percent-Chance (50-Year) Flood - A flood having 2 chances in 100 (1 chance in 50) of being equaled or exceeded in any 1-year period.

1-Percent-Chance (100-Year) Flood - A flood having 1 chance in 100 of being equaled or exceeded in any 1-year period.

0.2-Percent-Chance (500-Year) Flood - A flood having 0.2 chance in 100 (1 chance in 500) of being equaled or exceeded in any 1-year period.

Flood Boundary - The estimated outermost limit the waters of a flood of a certain magnitude will reach.

Flood Elevation or Water Surface Elevation - The height (expressed in relation to mean sea level) reached by floods or channel flows of various magnitudes.

Flood Fringe - The area of a floodplain which is outside of the floodway.

Floodflow Line - A line drawn on a map indicating the general direction of the floodwaters in a floodplain.

Flood Map - A map which shows the horizontal flood limits for one or more floods.

Floodplain - Any land area susceptible to inundation by water from any source including, at a minimum, that area subject to a 1-percent or greater chance of flooding in any given year.

Floodplain Management - A term applied to the full range of public policy and action for ensuring wise use of the floodplains. It includes, but is not limited to, collection and dissemination of flood control information, acquisition of floodplain lands, enactment and administration of floodplain regulations including building codes, and construction of flood-modifying structures.

Floodplain Regulations - A general term applied to the full range of codes, ordinances, and other regulations relating to the use of land and construction within designated floodplain limits.

Flood Profile - A graph of flood elevations along a stream.

Flood Stage - The vertical distance to the surface of the floodwater as measured from or compared to some arbitrarily fixed and generally accepted point such as a United States Geological Survey stream gage. Local residents may more commonly use the term "flood depth," which is the vertical distance from the water surface to some point such as the floor, ground, or road.

Floodway - The channel of the stream and those portions of the adjoining floodplain which carry and discharge floodwaters of a particular flood event.

Historic Flood - A flood known to have occurred in a specific area.

Maximum Known Flood - The largest flood known to have occurred on a stream or in an area.

Maximum Probable Flood - A flood comparable to the largest floods known to have occurred in the eastern part of the United States. It is used in planning flood protection works, failure of which might be disastrous, and in establishing critical elevations of major water control structures.

Mean Sea Level - The average height of the sea for all stages of the tide over a 19-year period.

Peak Discharge - The greatest rate of flow normally expressed in cubic feet per second (cfs) occurring during a period of high water.

Rate of Rainfall - The amount of rainfall during a selected period of time, usually expressed in inches per hour.

Reach - Segments of a stream which mark boundaries such as the limits of a study, corporate limits, State or county lines, or other definable features.

Stream Gage - An instrument which makes regular observations of either the water surface elevation (measured from some arbitrary point) or streamflow at a particular site on a stream, canal, lake, or reservoir.

Stream Mileage - Distance measured along the centerline of the stream from some designated point, usually where the stream enters into a larger body of water.

U.S. Coast and Geodetic Survey Levels - The vertical control surveys conducted to establish permanent elevation references.

BENCH MARKS[a]

Elevation[b]	Number	Description
2011.105	BM N47[c]	A standard tablet stamped "2011.226 N47 1932," located about 1.7 miles south along U.S. Highway 23 from Dillsboro, about 100 feet south of the curve, about 25 feet west of the west bank of the Tuckasegee River, opposite the downstream end of a 400-foot island, in the east face of a rock bluff, 6 feet west of the west edge of the highway, and 5 feet above the highway, set vertically.
2003.59	TBM TR 34.08	A 60d nail, located 0.4 foot above ground, in a 12-inch walnut tree which is 7 feet from the left edge of the road and 15 feet from the right water's edge on the streamside of the tree of Tuckasegee River mile 34.08.
2007.74	TBM TR 34.32	The top of the fire hydrant at Tuckasegee River mile 34.32.
2016.810	BM LHT 1627[c]	A standard tablet stamped "LHT 1627 1940," set in a concrete post and located 3.6 miles southeast of the Southern Railway Station at Dillsboro. By way of Dillsboro-Webster County road, it is located on the right bank of the Tuckasegee River, 0.3 mile downstream from the steel bridge over the Tuckasegee River at Webster, 14.5 feet east of the centerline of the county road, 9.0 feet north of the centerline of the drive off to the east, 42.0 feet east of the northeast corner of a barn and about 2.0 feet northeast of the corner of a plank and woven wire fence. Reference mark 1 - 47.2 feet northeast to an 8-inch willow. Reference mark 2 - 51.1 feet north to the southeast corner of a small wood bridge. Reference mark 3 - 1.5 feet west to a light pole with a meter.

a. All bench marks are fourth-order accuracy unless otherwise indicated.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. First- or second-order accuracy.

BENCH MARKS[a]
(Continued)

Elevation[b]	Number	Description
2033.16	BM BAR 1	Five feet from the edge of the parking lot on the front step to Webster Baptist Church at Tuckasegee River mile 35.29 is a standard brass plate on the downstream edge of the steps on top of the old concrete step wall, 0.7 foot below the inside of the third step and 0.1 foot downstream of the new step.
2028.98	TBM TR 36.75	A chiseled square in the upstream centerline of the headwall on a small creek. The headwall is 50 feet from the right water's edge of Tuckasegee River mile 36.75.
2046.45	BM BAR 2	A standard brass plate on the downstream side of the bridge at Tuckasegee River mile 37.00.
2047.74	TBM TR 38.16	A chiseled square at the centerline of the headwall to a drop inlet drain which is 5.2 feet from the edge of old Highway 107 at Tuckasegee River mile 38.16.
2059.75	TBM TR 39.43	A chiseled square on the right upstream headwall of a triple box culvert under Highway 107 at Tuckasegee River mile 39.43.
2085.74	TBM TR 39.91	A chiseled square on the upstream right end of a headwall under Highway 107 at Tuckasegee River mile 39.91.
2064.21	TBM TR 40.40	A chiseled square on the upstream right headwall at Tuckasegee River mile 40.40.
2061.74	BM BAR 3	A standard tablet in the downstream right wingwall of the bridge over Cullowhee Creek opposite Tuckasegee River mile 40.88.
2078.38	TBM CC 0.84	A 60d nail 0.2 foot above ground in the landward side of a 12-inch cherry tree on the left bank at Cullowhee Creek mile 0.84.

a. All bench marks are fourth-order accuracy unless otherwise indicated.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).

BENCH MARKS[a]
(Continued)

Elevation[b]	Number	Description
2088.14	BM BAR 8	A standard brass plate in the right upstream wingwall of the bridge at Cullowhee Creek mile 1.09.
2091.84	TBM CC 1.17	The right upstream of the rock headwall on the bypass access road bridge at Cullowhee Creek mile 1.16.
2076.77	BM BAR 4	A standard tablet in the right upstream wingwall of Highway 107 bridge at Tuckasegee River mile 41.02.
2064.56	TBM TR 41.13	A chiseled square on the right upstream corner of the old dam wingwall at Tuckasegee River mile 41.13.
2081.50	BM BAR 5	A standard tablet in the right upstream wingwall of the bridge at Tuckasegee River mile 41.92.
2076.35	TBM TR 42.73	A 60d nail, 1.0 foot above ground on the landward side of a power pole, 10 feet from the edge of the road and 10 feet from the right water's edge at Tuckasegee River mile 42.73.
2101.43	BM BAR 6	A standard brass plate on the right upstream wingwall of the bridge on Highway 107 at Tuckasegee River mile 43.87.
2094.88	TBM TR 44.34	A chiseled square on a concrete slab at Tuckasegee River mile 44.34 that extends from the road shoulder to the steps. The slab is 4.7 feet from the edge of the road and the square is 0.5 foot above the ground at approximately the center of the slab.
2155.01	BM BAR 7	A standard brass plate on the left upstream wingwall of the bridge on the Highway 107 bypass at Tuckasegee River mile 44.98.

a. All bench marks are fourth-order accuracy unless otherwise indicated.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).

BENCH MARKS[a]
(Continued)

Elevation[b]	Number	Description
2129.46	TBM TR 46.20	A chiseled square on the upstream right wingwall of Highway 107 bridge over Caney Fork Creek opposite Tuckasegee River mile 46.20.
2120.82	BM N 507[c]	The top of the main cable anchor on the downstream side of the bridge which is 0.5 mile south along Highway 107 from East Laport. Reference number 1 - 21 feet from end of the floor to the bridge. Reference number 2 - 36 feet southwest of an "A" frame to the bridge.
2144.914	BM N 508[c]	A chiseled square on the concrete footing of a granite monument erected by Dr. J. R. Brinkley in memory of his Aunt Sally. The square is at the east end of the base on the southeast corner of the monument, 27 feet north of the centerline of the highway. The monument is located 0.8 mile south of East Laport on Highway 107.
2088.52	TBM LB 0.00	A chiseled square on the downstream headwall of the culvert over Long Branch, 20 feet upstream of the mouth.
2094.65	TBM LB 0.00A	Right upstream bolt on the end of a wood curb at Long Branch mile 0.00.
2093.26	TBM LB 0.03	A chiseled square on the left upstream headwall of the culvert under Highway 107 bypass at Long Branch mile 0.03.
2111.46	TBM LB 0.22	A curb bolt on the left upstream end of the bridge at Long Branch mile 0.22.
2203.09	TBM LB 0.70	The top of the fire plug in front of the fire station at Long Branch mile 0.70.
2205.58	TBM LB 0.87	The top of the fire plug 10 feet from the edge of the road and 40 feet downstream of corrugated metal pipe at Long Branch mile 0.87.

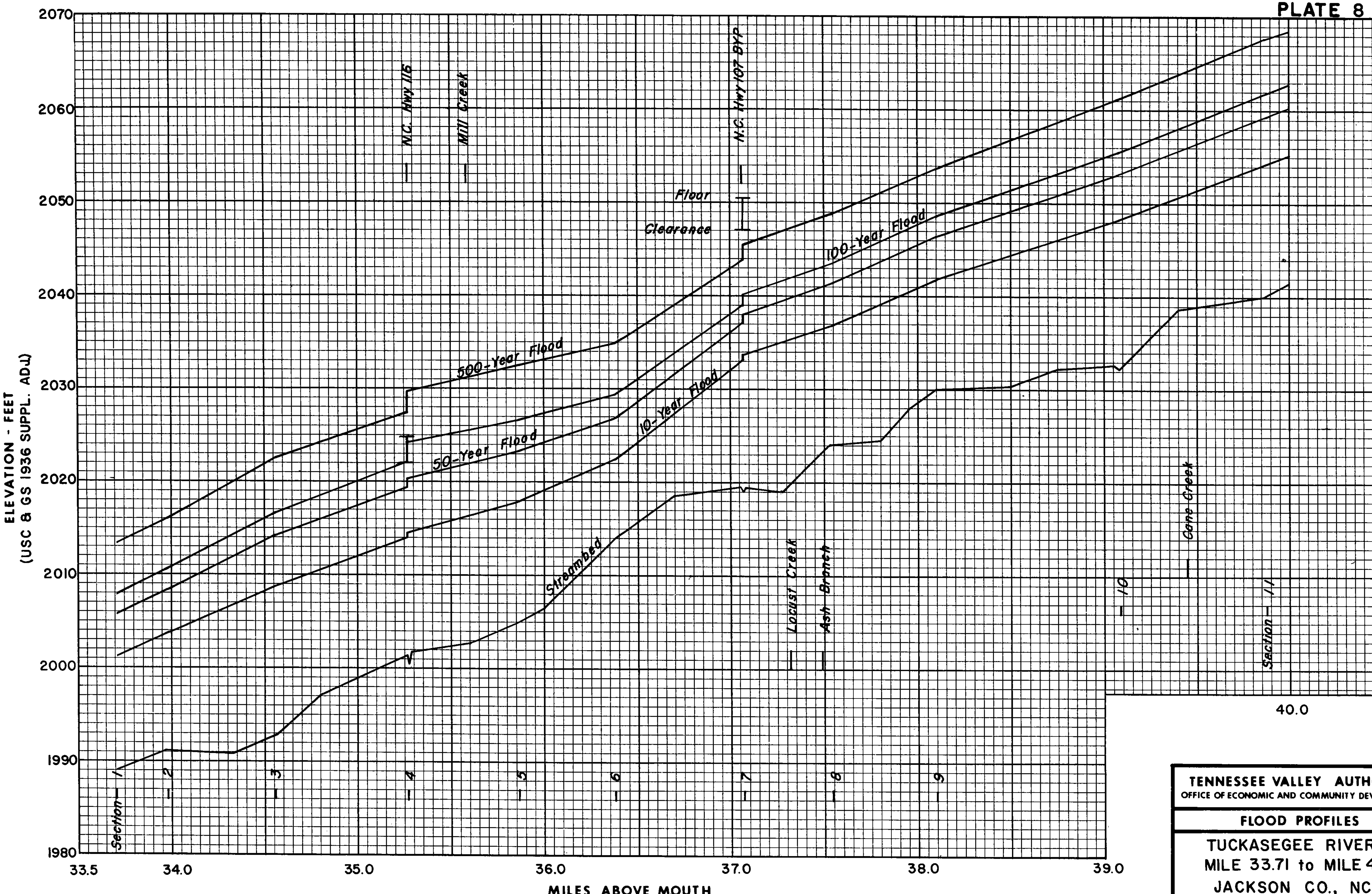
a. All bench marks are fourth-order accuracy unless otherwise indicated.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. First- or second-order accuracy.

REFERENCES

1. Jackson, N. M., Jr., Magnitude and Frequency of Floods in North Carolina, U.S. Geological Survey, Water Resources Investigations 76-17, Raleigh, North Carolina, March 1976.

2. U.S. Water Resources Council, Guidelines for Determining Flood Flow Frequency, Bulletin 17B of the Hydrology Committee, Revised September 1981.

3. U.S. Army Corps of Engineers, HEC-2N Water Surface Profiles Generalized Computer Program, Hydrologic Engineering Center, Davis, California, June 1973.



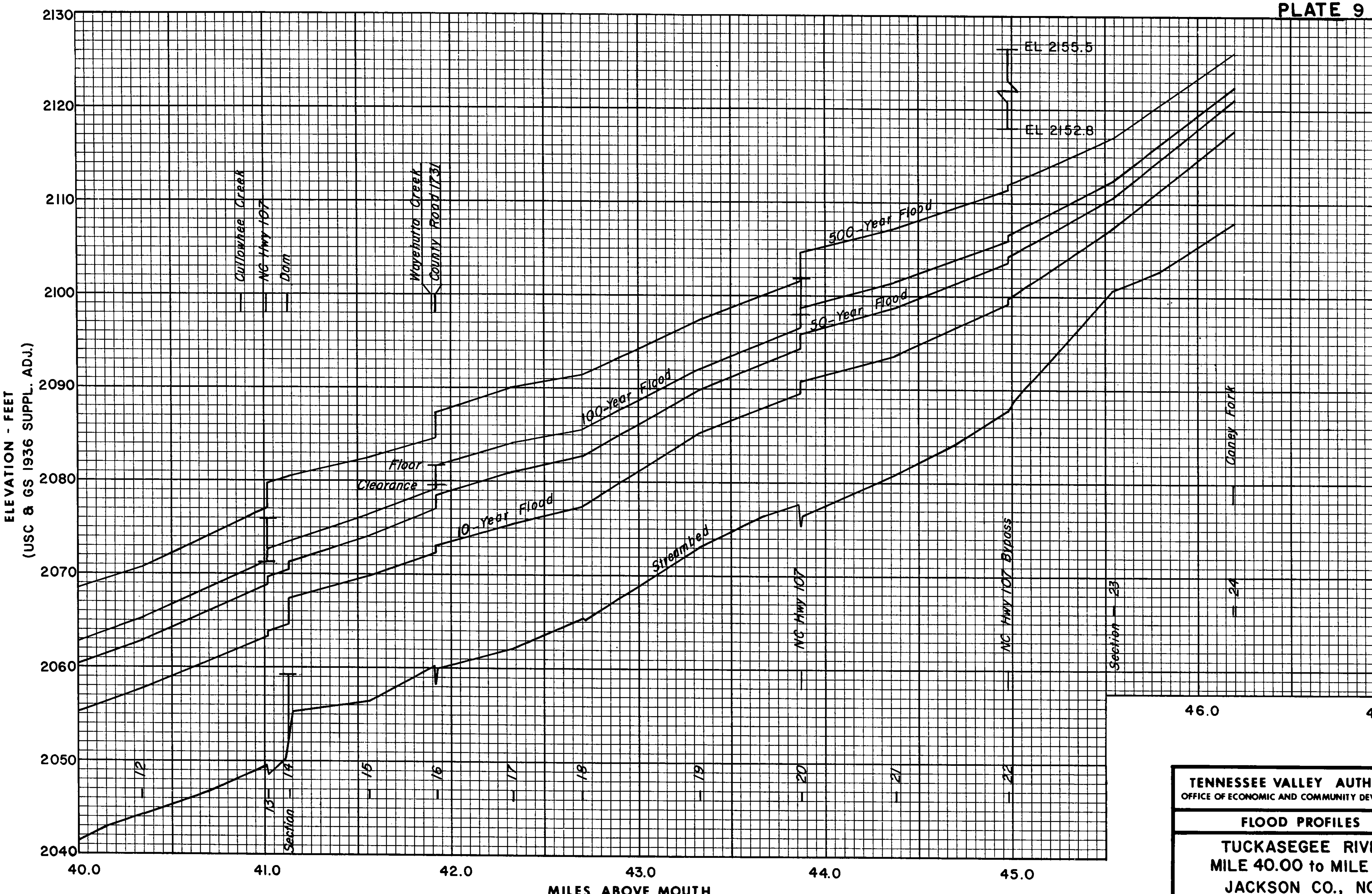
TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

TUCKASEGEE RIVER
MILE 33.71 to MILE 40.00
JACKSON CO., NC

OCTOBER 1982

PLATE 9

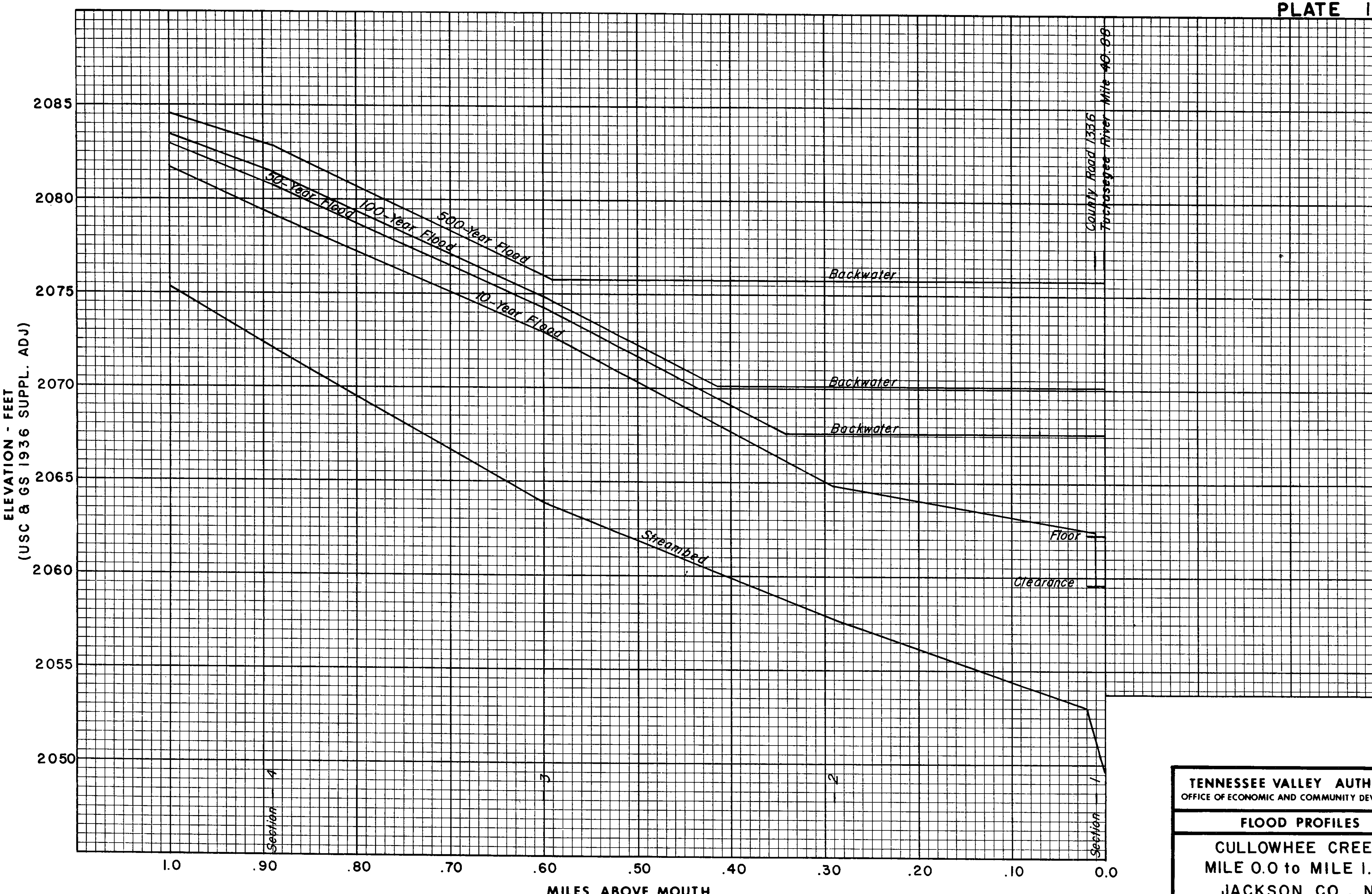


TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

TUCKASEGEE RIVER
MILE 40.00 to MILE 46.20
JACKSON CO., NC

OCTOBER 1982



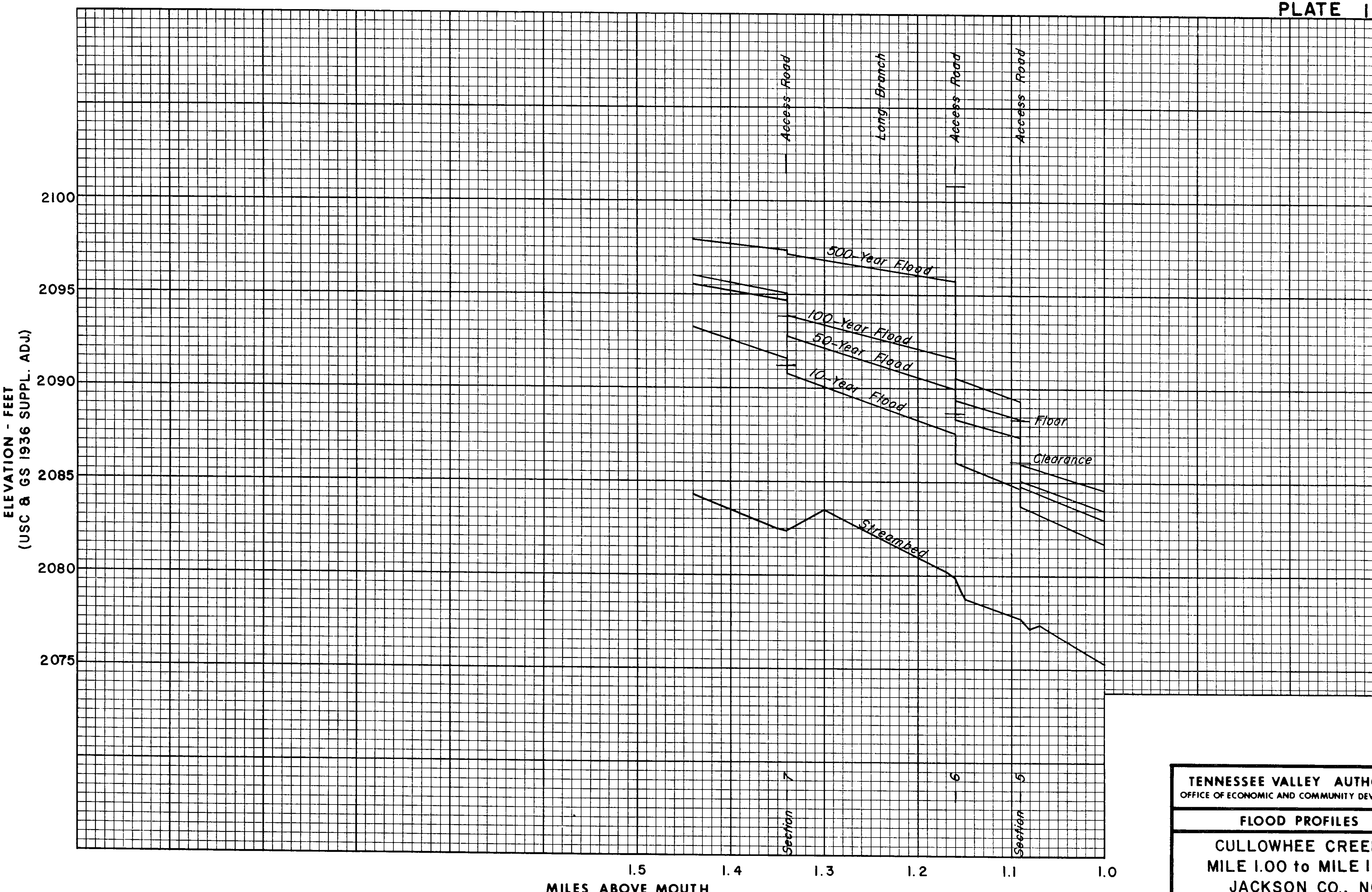
TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

CULLOWHEE CREEK
MILE 0.0 to MILE 1.00
JACKSON CO., NC

OCTOBER 1982

PLATE 11



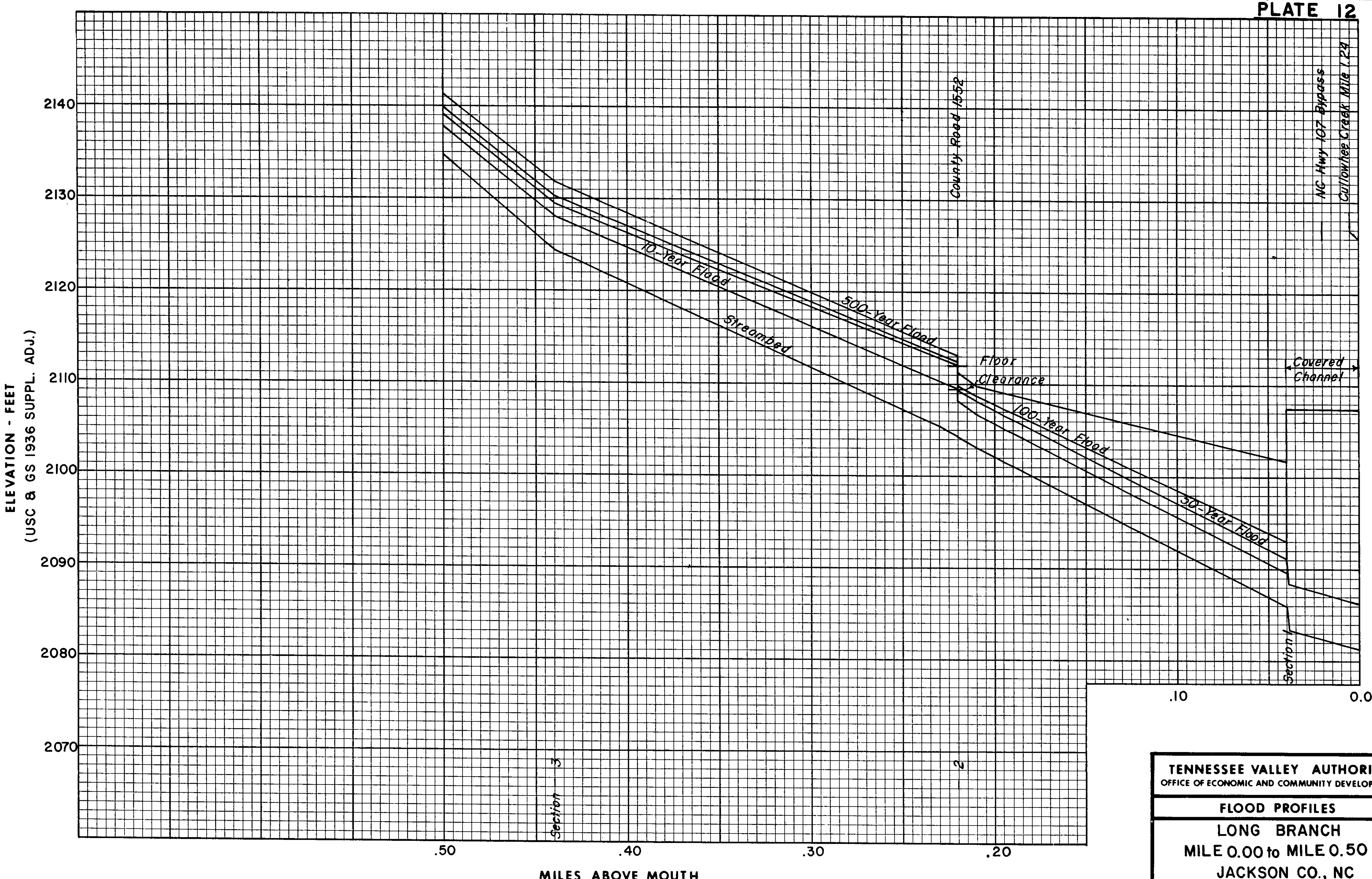
TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

CULLOWHEE CREEK
MILE 1.00 to MILE 1.44
JACKSON CO., NC

OCTOBER 1982

PLATE 12



TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

LONG BRANCH
MILE 0.00 to MILE 0.50
JACKSON CO., NC

OCTOBER 1982

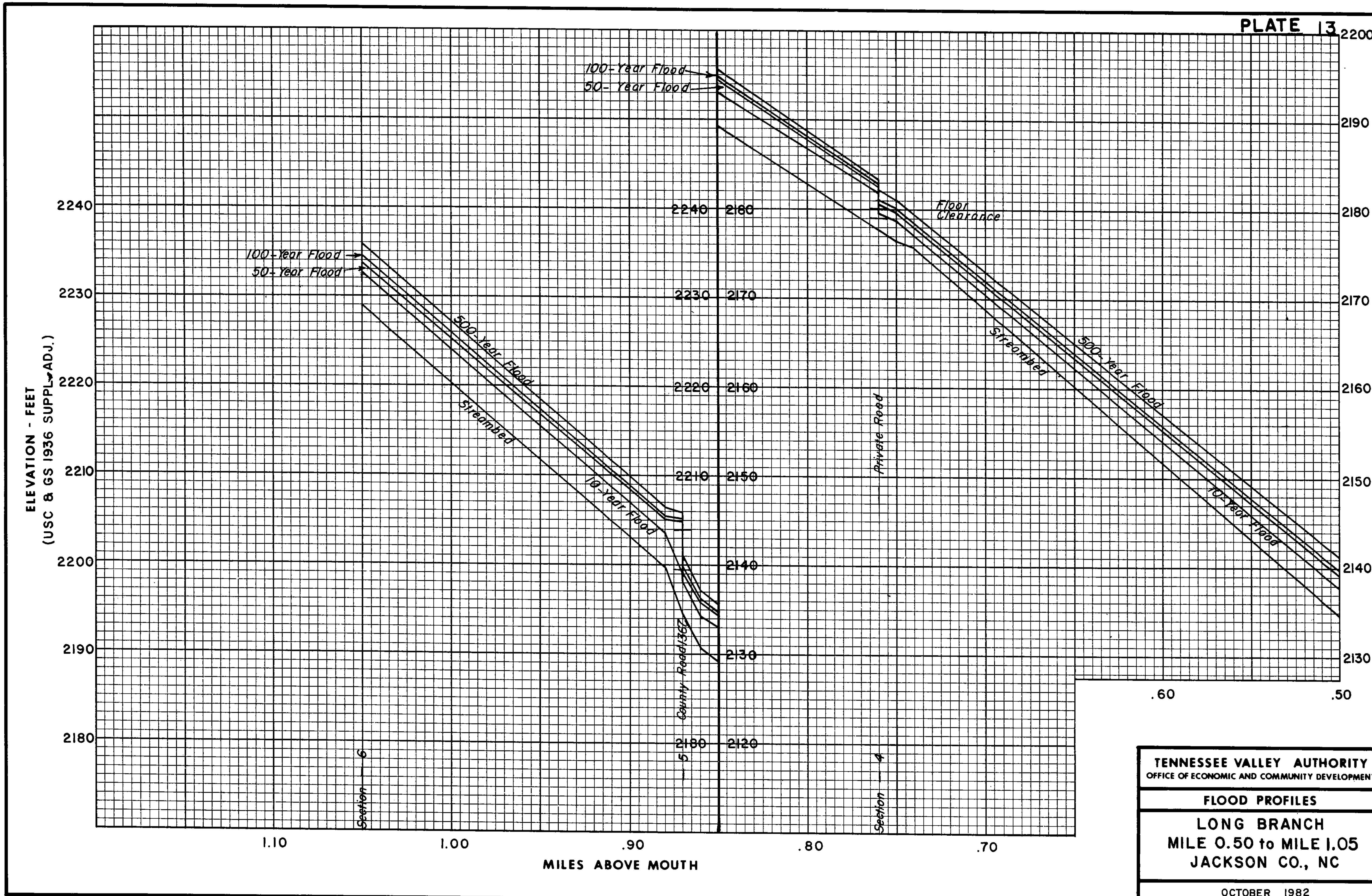


PLATE 13
ELEVATION - FEET
(USC & GS 1936 SUPPL. ADJ.)
2240
2230
2220
2210
2200
2190
2180
2200
2190
2180
2170
2160
2150
2140
2130
2240 2160
2230 2170
2220 2160
2210 2150
2140
2130
2180 2120
100-Year Flood
50-Year Flood
500-Year Flood
10-Year Flood
Streambed
Floor Clearance
County Road 1367
Private Road
Section — 6
Section — 5
Section — 4
1.10
1.00
.90
.80
.70
.60
.50
MILES ABOVE MOUTH
TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT
FLOOD PROFILES
LONG BRANCH
MILE 0.50 to MILE 1.05
JACKSON CO., NC
OCTOBER 1982

APPENDIX

Table 1A

TUCKASEGEE RIVER 100-YEAR FLOODWAY

Cross Section No.	Cross Section Mile	Floodway Width (feet)	Floodway Section Area (sq.ft.)	Floodway Mean Velocity (ft/sec)	Water-Surface Elevation[b] With Floodway	Water-Surface Elevation[b] Without Floodway	Water-Surface Elevation[b] Difference
1	33.71	220	3,953	7.9	2008.9	2007.9	1.0
2	33.98	160	3,056	10.2	2011.4	2010.6	0.8
3	34.56	140	3,050	10.2	2017.3	2016.7	0.6
4	35.27 DS[a]	200	3,274	9.5	2022.6	2022.1	0.5
4	35.27 US[a]	200	3,699	8.4	2024.7	2024.2	0.5
5	35.86	170	3,376	9.2	2027.1	2026.7	0.4
6	36.38	200	3,128	9.9	2030.4	2029.4	1.0
7	37.07 DS	200[c]	2,869	10.7	2039.3	2039.0	0.3
7	37.07 US	200[c]	3,091	10.0	2040.5	2040.1	0.4
8	37.54	170	2,581	11.9	2043.6	2043.5	0.1
9	38.10	200	3,473	8.8	2049.0	2048.6	0.4
10	39.08	170	3,348	9.1	2055.8	2055.5	0.3
11	39.87	160[c]	3,198	9.5	2062.6	2061.8	0.8
12	40.34	160	2,765	11.0	2066.1	2065.2	0.9
13	41.02 DS	220[c]	3,225	9.0	2071.7	2071.4	0.3
13	41.02 US	220[c]	3,523	8.3	2073.1	2072.6	0.5
14	41.13 DS	310[c]	5,727	5.1	2074.1	2073.5	0.6
14	41.13 US	310[c]	3,376	8.6	2074.5	2073.5	1.0
15	41.56	160	2,706	10.7	2076.9	2076.4	0.5
16	41.92 DS	150	2,394	12.1	2079.8	2079.2	0.6
16	41.92 US	150	2,811	10.3	2082.6	2081.6	1.0
17	42.33	160	3,390	8.5	2084.8	2084.1	0.7
18	42.70	160	2,954	9.8	2086.4	2085.5	0.9
19	43.33	210	3,107	9.3	2093.0	2092.1	0.9
20	43.87 DS	190[c]	2,588	11.1	2097.3	2096.6	0.7
20	43.87 US	190[c]	2,998	9.6	2099.4	2098.7	0.7
21	44.37	150	2,694	10.7	2101.9	2101.5	0.4

a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Width perpendicular to flow.

Table 1A (Continued)

TUCKASEGEE RIVER 100-YEAR FLOODWAY

Cross Section No.	Cross Section Mile	Floodway Width (feet)	Floodway Section Area (sq.ft.)	Floodway Mean Velocity (ft/sec)	Water-Surface Elevation[b] With Floodway	Water-Surface Elevation[b] Without Floodway	Water-Surface Elevation[b] Difference
22	44.98 DS[a]	210[c]	3,402	8.4	2107.0	2106.0	1.0
22	44.98 US[a]	210[c]	3,513	8.2	2107.6	2106.6	1.0
23	45.54	200	2,079	13.7	2112.6	2112.4	0.2
24	46.20	180	2,402	11.9	2123.0	2122.5	0.5

a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Width perpendicular to flow.

Table 2A

CULLOWHEE CREEK 100-YEAR FLOODWAY

Cross Section No.	Cross Section Mile	Floodway Width (feet)	Floodway Section Area (sq.ft.)	Floodway Mean Velocity (ft/sec)	Water-Surface Elevation[b] With Floodway	Water-Surface Elevation[b] Without Floodway[d]	Water-Surface Elevation[b] Difference
1	0.01 DS[a]	270[c]	1,293	4.0	2063.1	2062.1	1.0
1	0.01 US[a]	270[c]	1,666	3.1	2064.4	2063.4	1.0
2	0.29	120	783	6.6	2067.9	2066.9	1.0
3	0.60	80	633	8.2	2075.8	2074.9	0.9
4	0.89	140	907	5.7	2082.2	2081.5	0.7
5	1.09 DS	140	741	6.9	2086.1	2085.1	1.0
5	1.09 US	90	650	7.9	2089.4	2088.4	1.0
6	1.16 DS	70[c]	476	10.8	2090.0	2089.4	0.6
6	1.16 US	70[c]	629	8.2	2091.8	2091.6	0.2
7	1.34 DS	180[c]	640	7.6	2094.0	2093.9	0.1
7	1.34 US	180[c]	973	5.0	2095.9	2095.1	0.8

a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Width perpendicular to flow.
d. Elevation computed without consideration of backwater effects.

Table 3A

LONG BRANCH 100-YEAR FLOODWAY

Cross Section No.	Cross Section Mile	Floodway Width (feet)	Floodway Section Area (sq.ft.)	Floodway Mean Velocity (ft/sec)	Water-Surface Elevation[b] With Floodway	Water-Surface Elevation[b] Without Floodway	Water-Surface Elevation[b] Difference
1	0.04	60	296	3.3	2094.0	2093.0	1.0
2	0.22 DS[a]	80[c]	81	11.2	2109.9	2109.9	0.0
2	0.22 US[a]	80[c]	254	3.6	2113.2	2112.5	0.7
3	0.44	25	69	11.9	2130.3	2130.3	0.0
4	0.76 DS	40[c]	82	8.8	2181.1	2181.1	0.0
4	0.76 US	40[c]	168	4.3	2183.5	2182.9	0.6
5	0.87 DS	40[c]	63	10.9	2199.8	2199.8	0.0
5	0.87 US	40[c]	336	2.0	2206.2	2205.2	1.0
6	1.05	30[c]	61	10.2	2234.6	2234.6	0.0

a. Downstream and upstream at bridges.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).
c. Width perpendicular to flow.