Floods on North Toe River and Kentucky Creek in the Vicinity of Newland, North Carolina

FLOODS ON NORTH TOE RIVER AND KENTUCKY CREEK IN THE VICINITY OF NEWLAND, NORTH CAROLINA

Flood Report
TVA/OECD/FPM—83/27
December 1982

TENNESSEE VALLEY AUTHORITY

TENNESSEE VALLEY AUTHORITY

Office of Economic and Community Development

FLOODS ON NORTH TOE RIVER AND KENTUCKY CREEK IN THE VICINITY OF NEWLAND, NORTH CAROLINA

Flood Report

TVA/OECD/FPM-83/27

Knoxville, Tennessee

December 1982

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FLOODS ON NORTH TOE RIVER AND KENTUCKY CREEK IN THE VICINITY OF NEWLAND, NORTH CAROLINA

INTRODUCTION

This study provides floodplain information for the North Toe River and Kentucky Creek in the vicinity of Newland, North Carolina. The study was requested by the town of Newland to provide information reflecting current flood conditions in order for the town to better administer its floodplain management program.

Newland, located in the headwaters of the North Toe River, has a population of approximately 800. It is the county seat of Avery County and noted for growing nursery stock. The area has long attracted summer visitors and due to its proximity to several ski slopes is becoming a year-round resort. As Newland grows, pressure for development in the floodplain is expected to increase.

STUDY AND SCOPE

This investigation covers the North Toe River through the corporate limits of Newland from river mile 69.12 to mile 70.56 and Kentucky Creek from its mouth upstream to mile 0.53. A brief description of the North Toe River watershed and a flood history of Newland are included. Selected flood profiles and 100- and 500-year floodplain delineations for the streams studied are also provided. A proposed 100-year floodway is included as an appendix to this report. The report provides the technical data needed as the foundation for development of the town's floodplain management program.

Both structural and nonstructural measures which may be taken into consideration in reducing future flood damage at Newland are described. Evaluation of these measures, however, is beyond the scope of this report.

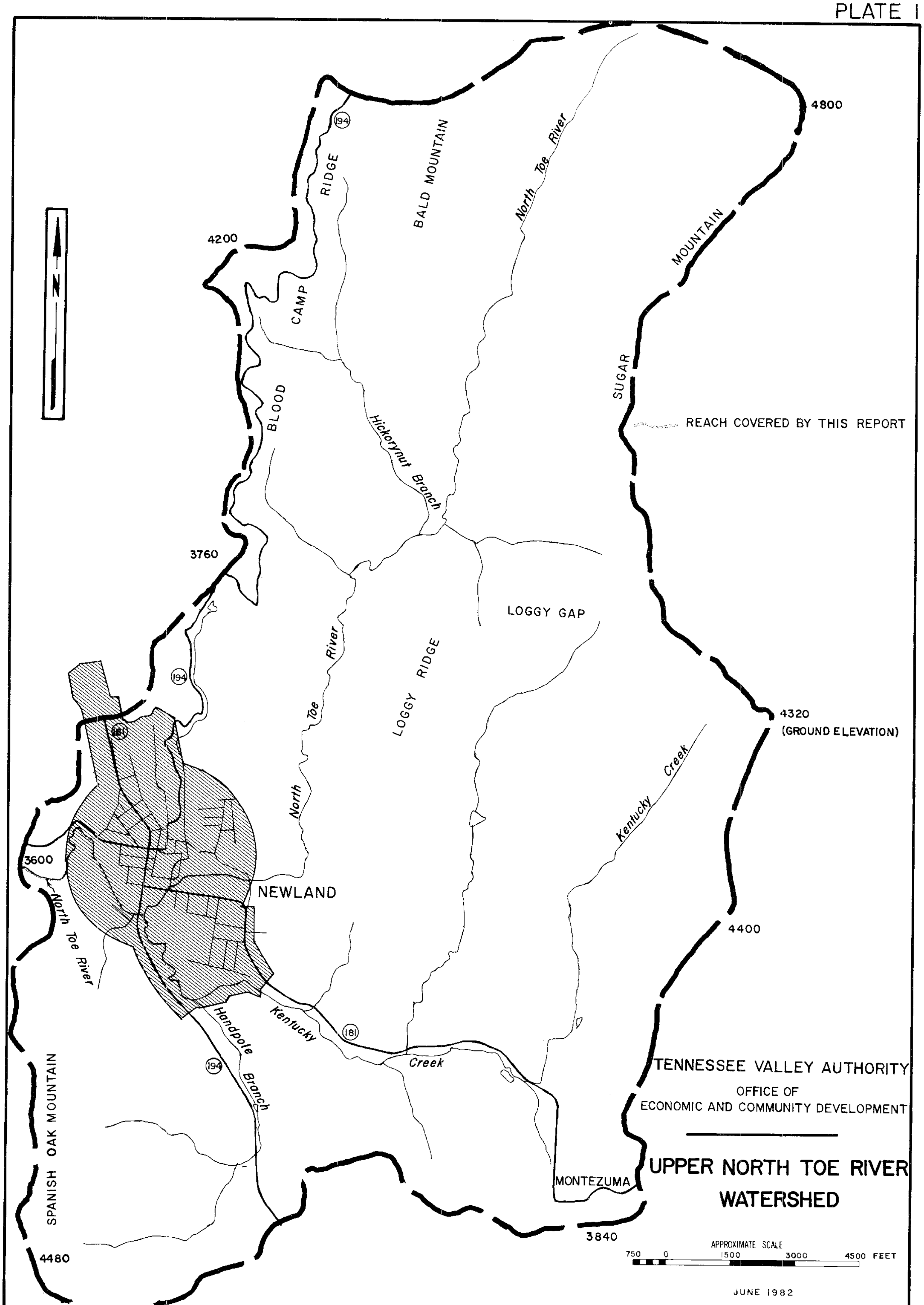
WATERSHED DESCRIPTION

The North Toe River, the largest tributary of the Nolichucky River, drains an area of 442 square miles, all of which lies in North Carolina. The watershed is comprised of rugged mountain land and forms the eastern edge of the Tennessee Valley divide. Newland is located in the northeast corner of the watershed. Above Newland the watershed is approximately 4 miles long and 2 miles wide at its widest point. Mountain peaks are over 4000 feet in elevation with the highest, Sugar Mountain, reaching an elevation of 5240 feet. At the North Carolina Highway 194 bridge (stream mile 70.05) the drainage area is 9.24 square miles.

Kentucky Creek, the largest tributary in Newland, enters the North Toe River just above North Carolina Highway 194 and drains an area of 4.29 square miles. The stream is formed on the western slope of the Blue Ridge Mountains with the highest point about 4600 feet in elevation.

Through Newland, stream slopes are relatively flat and the valley floor has an average elevation of approximately 3600 feet. A map of the watershed indicating the reaches studied is shown on plate 1.

PLATE I



REACH COVERED BY THIS REPORT
4800
4200
3760
3600
4320
(GROUND ELEVATION)
4400
3840
4480
CAMP RIDGE
BALD MOUNTAIN
North Toe River
SUGAR MOUNTAIN
BLOOD
Hickorynut Branch
LOGGY GAP
LOGGY RIDGE
Kentucky Creek
NEWLAND
North Toe River
Handpole Branch
Kentucky Creek
SPANISH OAK MOUNTAIN
MONTEZUMA
194
181
TENNESSEE VALLEY AUTHORITY
OFFICE OF
ECONOMIC AND COMMUNITY DEVELOPMENT
UPPER NORTH TOE RIVER
WATERSHED
APPROXIMATE SCALE
750 0 1500 3000 4500 FEET
JUNE 1982

REVIEW OF HISTORIC FLOODS

The United States Geological Survey (USGS) maintained a crest stage gage on the North Toe River at Newland from 1954 to 1973. Other gages in the past were established in the vicinity of Spruce Pine and Altapass with the earliest records dating back to 1907.

Documentation of the flood history in Newland is sparse. Floods that have occurred in the past in Newland have generally been widespread throughout western North Carolina, and damages in Newland have received little coverage by the press.

A large flood occurred in the area in May 1901 which was known as the "May Tide." The heaviest rainfall from the storm was centered in the Cane Creek watershed near Bakersville in Mitchell County. An unofficial record at Cranberry, 4 miles northwest of Newland, reported a rainfall total of 8 inches in 12 hours. In July 1916 a storm which resulted from a tropical hurricane caused widespread flooding over the area. The highest rainfall occurred along the Blue Ridge Mountains. At Altapass, 22.2 inches of rainfall was recorded during a 24-hour period.

A large flood in mid-August 1940 was remembered as the worst flood by local residents. This flood also resulted from a tropical storm which moved inland. Heaviest rainfall in the Tennessee Valley occurred along the crest of the Blue Ridge Mountains and the adjacent area of the northwest slope. At Mount Mitchell, 30 miles southwest of Newland, a total of 14.33 inches was recorded for the storm. Rainfall exceeded 10 inches all along the crest of the Blue Ridge Mountains from Spruce Pine to Newland. In Newland several homes were washed from their foundations. In the vicinity of Newland several road and railroad bridges were washed out. The East Tennessee and Western Carolina (Tweetsie) Railroad, which runs from Johnson City to Boone, did not resume operation on the Cranberry to Boone section after the flood.

The largest recent flood to have occurred in Newland was that of November 5-6, 1977. This storm was widespread over western North Carolina. In the Tennessee Valley the most severe flooding occurred along the French Broad River and its tributaries downstream from Asheville and along the Cane and South Toe Rivers in Yancey County. Rainfall during the storm ranged from about 2 inches at Rosman in the headwaters of the French Broad River to 11 inches at Boone and 14 inches at Mount Mitchell. At Newland 6.12 inches of rain fell from Saturday morning, November 5, to Sunday morning, November 6, with the majority of the rain falling between 1 a.m. and 6 a.m. on November 6. Damages in Newland were light compared to other areas, but several persons were forced to evacuate as water entered or surrounded their homes. Total flood damages incurred in Avery County were estimated to be approximately $1.5 million.

COMPUTED FLOODS

To assist the town of Newland in administering its floodplain management program, flood discharges and elevations have been computed for the 10-, 100-, and 500-year floods. The information 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 on study streams were based on stream gage records from similar watersheds in the region with special attention given to the stream gage at Newland. All stream gage analyses followed standard procedures outlined in Guidelines for Determining Flood Flow Frequency (reference 1).

Ten-Year Flood

The 10-year flood is defined as the flood which has 1 chance in 10 (10 percent) of being equaled or exceeded in any given year. Although the 10-year flood would be within banks through parts of the reaches studied, it would generally range from 0.5 to 1.5 feet above bank top along North Toe River and Kentucky Creek. The 10-year flood is included on the flood profiles to assist communities in complying with regulations restricting septic tank systems in the 10-year floodplain.

One Hundred-Year Flood

The 100-year flood is defined as the flood which has 1 chance in 100 (1 percent) of being equaled or exceeded in any given year. While this flood may occur at any time, there is a 26-percent chance of its occurrence in a normal 30-year mortgage period. The 100-year flood would generally range from about 2 to 4 feet above bank top along North Toe River and from about 1.5 to 2.5 feet above bank top along Kentucky Creek. The 100-year flood is the minimum standard required by the Federal Emergency Management Agency (FEMA) for floodplain management purposes for those communities participating in the National Flood Insurance Program (NFIP).

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. While this flood may occur at any time, there is about a 6-percent chance of its occurrence in a 30-year period. The 500-year flood would generally range from about 3 to 5 feet above bank top along North Toe River and from about 2.5 to 4.5 above bank top along Kentucky Creek. 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 North Toe River and Kentucky Branch were analyzed using the U.S. Army Corps of Engineers HEC-2N backwater computer program (reference 2) 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 supplemented with valley cross sections plotted from aerial photography to accurately define the floodplains of the North Toe River and Kentucky Creek. Locations of the cross sections used in the hydraulic analyses are shown on the flooded area map (plate 2).

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 3-5). 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 North Toe River and Kentucky Creek are included in tables 1 and 2.

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 map shows the approximate areas that would be inundated by the 100- and 500-year floods. Using the flood profiles and aerial photographs, 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.

Frequently the community must decide how much additional 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.

Table 1

NORTH TOE RIVER PROFILE TABULATION

Cross Section		10-Year Flood		100-Year Flood		500-Year Flood	
No.	Mile	Discharge (cfs)	Elevation[b] (feet)	Discharge (cfs)	Elevation[b] (feet)	Discharge (cfs)	Elevation[b] (feet)
1	69.12	830	3571.9	1,840	3574.2	2,930	3576.0
2	69.30	825	3574.5	1,825	3576.1	2,910	3577.6
*	69.38	820	3575.5	1,820	3577.1	2,900	3578.4
3	69.41	820	3576.1	1,820	3578.3	2,900	3580.0
4	69.65	815	3579.1	1,805	3580.9	2,870	3582.3
5	69.79	810	3580.6	1,795	3582.5	2,850	3583.9
6	69.89	805	3581.4	1,785	3582.9	2,840	3584.2
*	69.97	805	3581.9	1,780	3583.3	2,825	3584.4
7	69.98	805	3582.0	1,780	3583.3	2,825	3584.5
*	69.99	805	3582.3	1,780	3584.3	2,825	3586.6
8	70.05 DS[a]	800	3583.0	1,775	3585.7	2,815	3588.5
8	70.05 US[a]	800	3583.2	1,775	3586.1	2,815	3589.1
9	70.15	505	3585.7	1,110	3587.4	1,750	3589.5
10	70.21 DS	500	3586.4	1,095	3588.0	1,725	3589.8
10	70.21 US	500	3586.9	1,095	3588.9	1,725	3591.3
11	70.28	480	3588.6	1,035	3589.8	1,625	3591.4
12	70.31	480	3590.0	1,035	3591.6	1,625	3592.2
13	70.34	475	3591.3	1,030	3592.8	1,620	3593.7
14	70.49	475	3600.9	1,025	3602.6	1,615	3603.9
*	70.55	470	3612.3	1,020	3613.9	1,610	3615.1
15	70.56	470	3615.7	1,020	3617.1	1,610	3618.3
15	70.56	470	3617.8	1,020	3619.3	1,610	3620.5

*Section not shown on flooded area maps or profiles.

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

Table 2

KENTUCKY CREEK PROFILE TABULATION

Cross Section		10-Year Flood		100-Year Flood		500-Year Flood	
No.	Mile	Discharge (cfs)	Elevation[a] (feet)	Discharge (cfs)	Elevation[a] (feet)	Discharge (cfs)	Elevation[a] (feet)
1	0.05	460	3583.3	995	3584.6	1,575	3585.5
2	0.11	460	3586.6	995	3587.8	1,570	3588.3
3	0.26	455	3589.3	985	3590.1	1,555	3590.8
4	0.40	450	3591.2	975	3592.2	1,540	3592.9
5	0.46	450	3593.3	970	3594.6	1,535	3595.4
6	0.53	450	3594.8	970	3596.1	1,530	3597.0

a. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).

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 uses 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 shallower 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

Although a detailed investigation containing specific solutions to the flood problem is beyond the scope of this report, technical data presented here may be used in developing an effective floodplain management program. Floodplain management measures may be classified into structural and nonstructural solutions. Structural measures may include dams, levees, and channel modification, while nonstructural measures include floodplain regulations, flood insurance, floodproofing, flood warning, and evacuation.

STRUCTURAL MEASURES

Dams

Dams or retention reservoirs may be useful to temporarily impound floodwaters upstream from the area for which protection is needed. Water can be released over a period of several days to avoid increased downstream flooding and to provide space in the reservoir to store future floods. Retention reservoirs are most beneficial when they can be built on only one or two major tributaries above the area being protected in order to control the majority of the drainage area.

Levees

Levees or walls may be used to protect against flood damage. However, certain problems do arise with their use such as internal drainage problems and street and utility relocation. Whenever a levee is used, it must be designed to protect against infrequent floods of large magnitude because failure or overtopping of the levee brings immediate disaster. While levees may not be practical to provide widespread protection, they may be feasible in some cases to provide localized protection.

Channel Modifications

Channel enlargements to carry additional amounts of floodwaters have been used in some locations as a relief against flood damage. However, because of the wide floodplain and flat slopes through Newland, along with existing environmental constraints, channel enlargements would probably not be a viable alternative.

NONSTRUCTURAL MEASURES

Floodplain Regulations

Floodplain regulations are useful in providing an orderly development of the floodplain without causing an undue increase in flood heights and in minimizing potential flood damage. The floodplain is divided into a floodway and flood fringe. The floodway should be kept free from further development. Development in the flood fringe may be permitted by local ordinances if it is elevated or floodproofed to the regulatory flood elevation.

Flood Insurance

While flood insurance does not reduce flood damage, the insurance can help alleviate financial losses. The town of Newland became eligible for the sale of flood insurance under the National Flood Insurance Program (NFIP) on September 17, 1975, and is presently in the emergency phase of the program. Communities participating in the NFIP must, as a condition of their eligibility, utilize and enforce the best available data as the basis for requiring that:

1. All new construction and substantial improvement of residential structures have the lowest floor (including basement) elevated to or above the base (100-year) flood level.

2. All new construction and substantial improvement of nonresidential structures have the lowest floor (including basement) elevated or floodproofed to or above the base (100-year) flood level.

3. The proposed development (meaning any manmade change to improved or unimproved real estate) does not create any adverse effect on the flood-carrying capacity of the stream. "Adverse effect" means any increase in flood elevations on adjacent properties.

Enforcement of the 100-year flood elevations and the floodway delineations in this study will ensure that the community has met these requirements.

For further information or questions concerning the National Flood Insurance Program, the user may contact the regional office of the Federal Emergency Management Agency at the following address:

Federal Emergency Management Agency
Region IV
1375 Peachtree Street, NE
Atlanta, Georgia 30309
(404) 881-2391

Floodproofing

Although it is sometimes possible to floodproof existing buildings, it is easier to floodproof new buildings during construction.

Floodproofing may include either making buildings reasonably impregnable to water or raising floor elevations (either on fill or by other means) to an elevation above the 100-year flood elevation. The Federal Emergency Management Agency requires that new and substantially improved residential buildings have all floors, including basement, elevated above the 100-year flood elevation. Nonresidential buildings may be floodproofed to the 100-year flood elevation. The art of floodproofing is complex and requires detailed engineering or architectural skills. When floodproofing is considered, the services of a qualified engineer or architect should be obtained.

Flood Warning

Some communities have a flood warning system which enables their citizens to temporarily evacuate the floodplain in time of danger. If given adequate warning time, coupled with an evacuation plan, flood warning can prevent loss of life and possible damage to property. Although TVA has participated in the development of flood warning systems, the National Oceanic and Atmospheric Administration (NOAA) has primary responsibility for the development and overall coordination of such systems.

Evacuation

Evacuation from the floodplain can be either permanent or temporary. Temporary evacuation occurs when people leave the floodplain in advance of large floods. Areas which experience chronic flood problems should be considered for permanent evacuation. Limited Federal assistance for evacuation may be available depending on fiscal budgets.

SUMMARY

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 a community's 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 action 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.

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.

Normal Pool - Maximum summer pool elevation during normal reservoir operations.

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
3618.7	TBM-A	A 1970 bronze property marker in the centerline of Avery Square Street at the sidewalk on the northwest side of the courthouse.
3591.3	BM-NTR 70.21	A standard TVA bronze cap set in the top of the left upstream (northeast) corner of the headwall of Highway 181 bridge at North Toe River mile 70.21.
3589.8	BM-NTR 70.05	A standard TVA bronze cap set in the top of the left upstream (southeast) corner of the headwall on Highway 194 bridge at North Toe River mile 70.05.
3590.1	TBM-B	A chiseled square on the downstream, streamward top of a metal manhole rim on the right bank in the field behind the store-gas station at mile 0.26 of Kentucky Handpole Branch.
3594.2	TBM-C	A 60d nail in the creek side of telephone pole number 12, 0.4 foot above ground on the left bank about 90 feet from wooden road bridge at mile 0.45 of Kentucky Handpole Branch, 10 feet upstream of gravel road.
3609.4	TBM-D	A 60d nail with a TVA washer driven in the power pole with transformer on the left bank, 0.7 foot above ground; located at the upsteam edge of gravel road, 36 feet left of centerline culvert in creek at mile 0.73 of Kentucky Handpole Branch.
3660.0	BM-KHB 1.19	A standard TVA bronze cap set on the top of the headwall at the upstream south end of a culvert under Highway 194 at mile 1.19 of Kentucky Handpole Branch.
3581.5	TBM-E	A 60d nail, 0.2 foot above ground, 10 feet north from edge of road in the northeast road side of the power pole with light at mile 69.55 North Toe River at drain under road.
3615.5	TBM-F	A 60d nail 0.8 foot above ground in road side of 14-inch locust tree located 10 feet northwest of road and across from house and drive and north-east of road and 250 feet northwest of high voltage powerline.

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

BENCH MARKS

(Continued)

Elevation	Number	Description
3620.7	TBM-G	A 60d nail with TVA washer, 0.2 foot above ground, 13 feet west of the edge of the road at T-intersection in the road side of a light pole at the fence corner.
3581.4	TBM-H	A chiseled square on top of a 6-foot high rock outcrop (15 feet by 11 feet) located on the left bank, 10 feet from the edge of the bank at the upstream edge of the field. Mile 69.0 of North Toe River.
3572.1	BM-NTR 69.12	A standard TVA bronze cap set in top of a concrete flume retaining wall in a sewage pumping station on the right bank approximately 50 feet from the right water's edge at mile 69.12 of North Toe River.
3594.5	TBM-I	A 60d nail with TVA washer, 0.3 foot above ground in the stream side of the ballfield lightpole located beyond centerfield next to a manhole at the Little League Park at mile 70.38.
3622.7	BM-NTR 70.56	A standard TVA bronze cap set in the top of the right upstream abutment at mile 70.56 of North Toe River.
3660.3	TBM-J	The top of fireplug in the front yard of house at the intersection of Banner Hill Road and the first unnamed sidestreet going west.

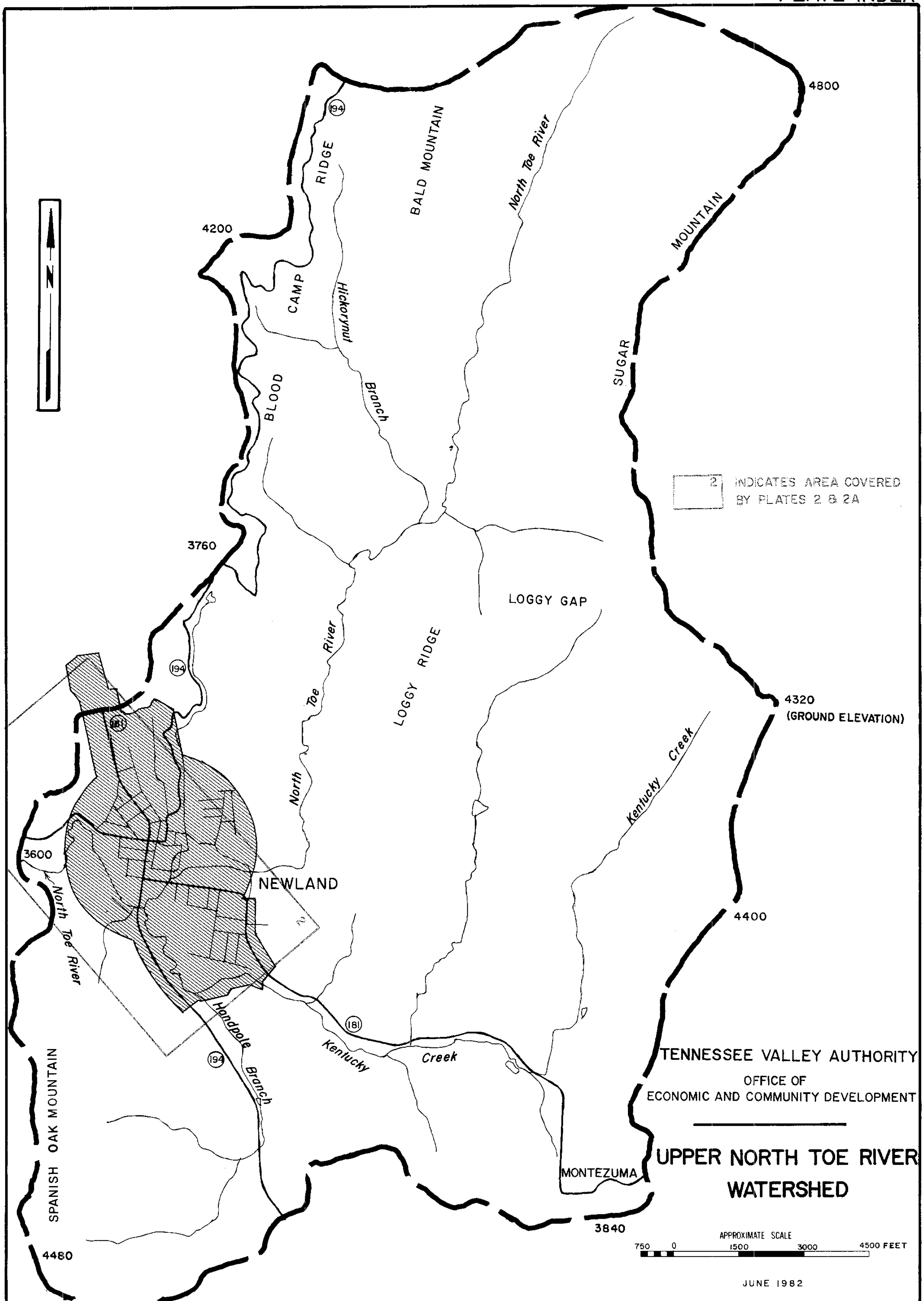
a. Bench marks are fourth order accuracy unless otherwise indicated.
b. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).

REFERENCES

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

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

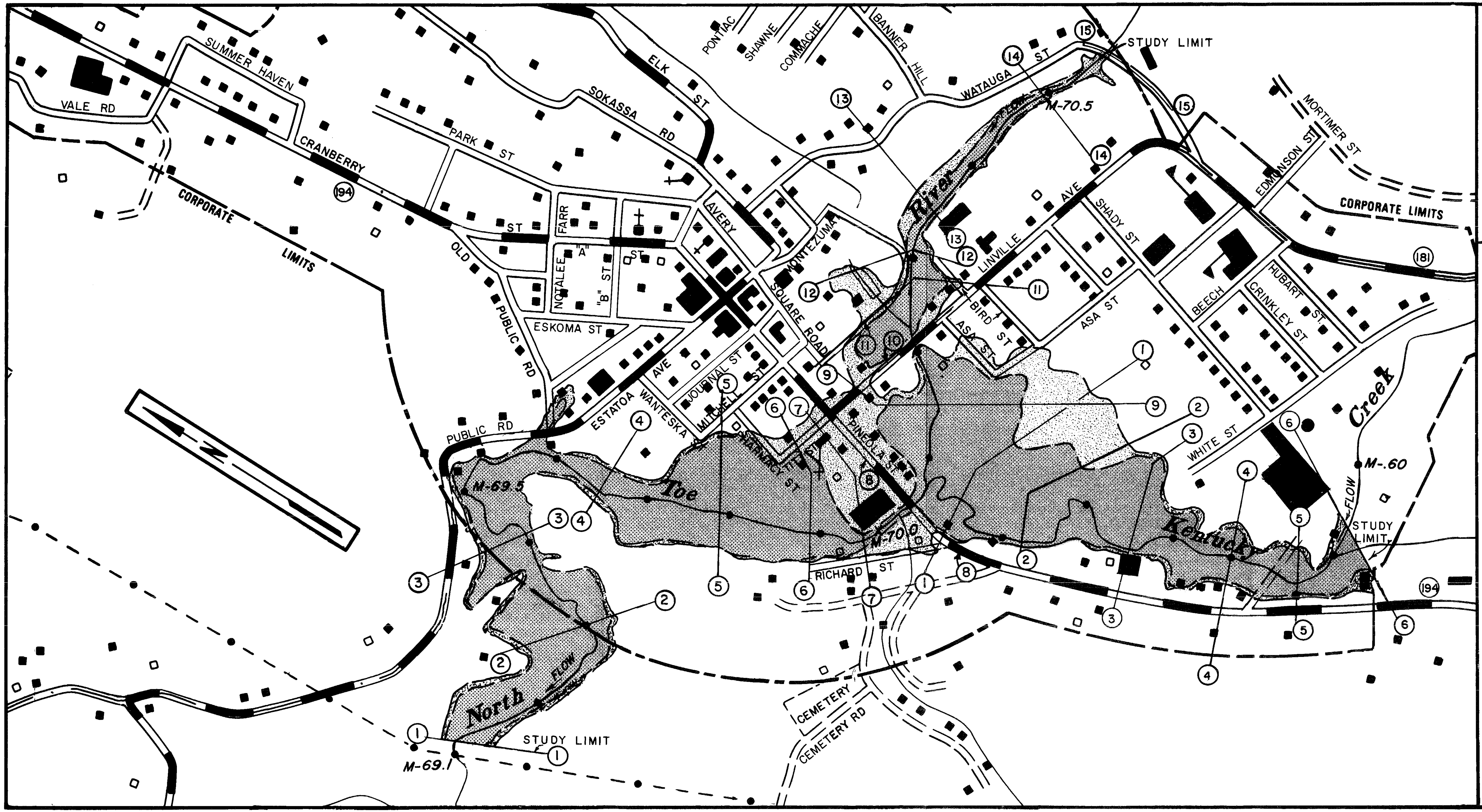
PLATE INDEX



TENNESSEE VALLEY AUTHORITY
OFFICE OF
ECONOMIC AND COMMUNITY DEVELOPMENT

UPPER NORTH TOE RIVER WATERSHED

JUNE 1982



LEGEND:

OVERFLOW LIMITS

100-YEAR FLOOD

500-YEAR FLOOD

+ M-2 MILES ABOVE MOUTH (● INDICATES 1/10 MILE)

(8)——(8) CROSS SECTION

The extent of flood overflow is based on data and measurements from aerial photography. Because of the methods used, the flooded areas as shown may not represent exact conditions on the ground.

BASE MAP IS A PORTION OF USGS-TVA PLANIMETRIC MAP 215 SW DATED 1978 WITH MINOR REVISIONS.

TENNESSEE VALLEY AUTHORITY

OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

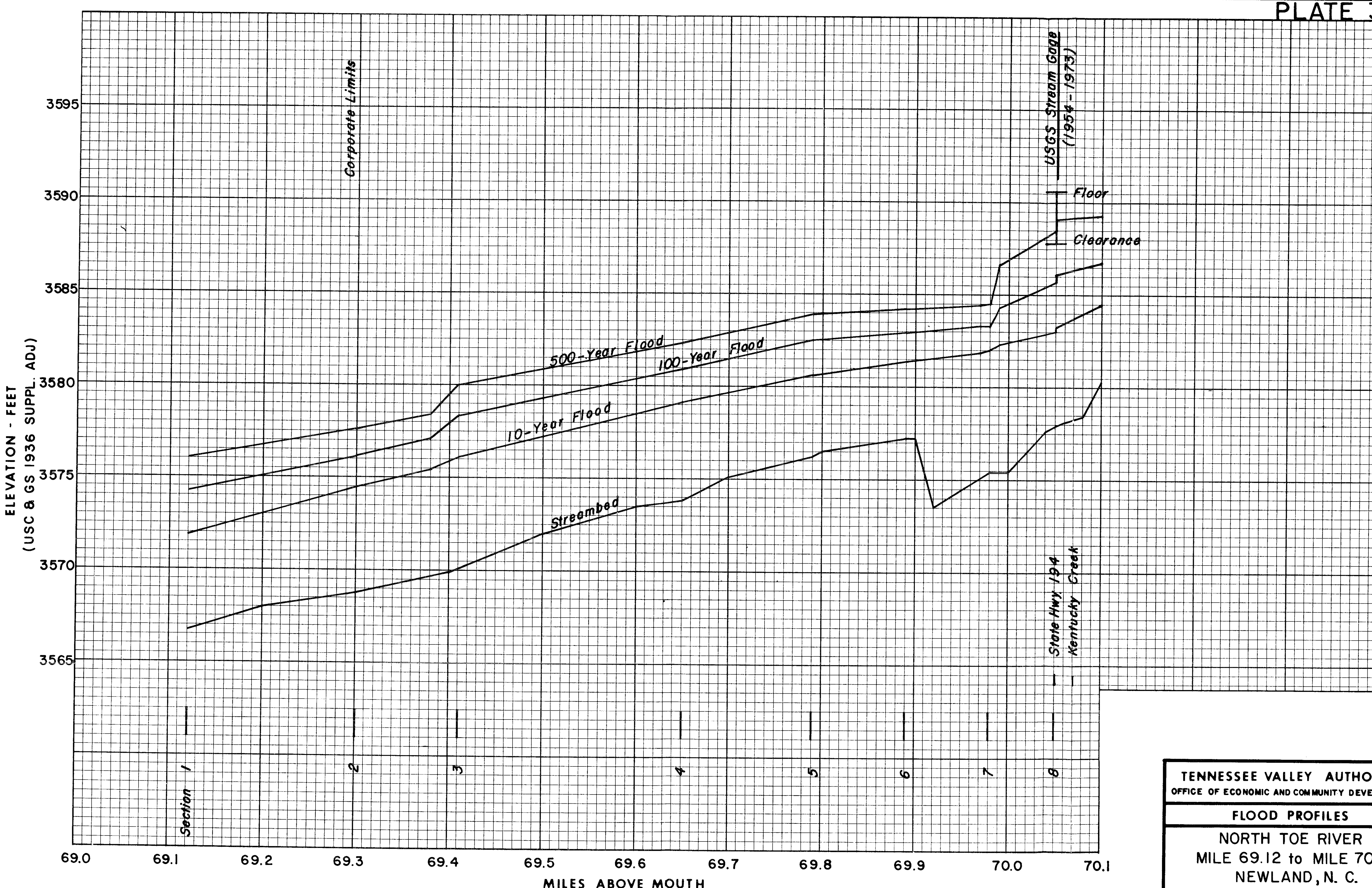
FLOODED AREAS

NORTH TOE RIVER
MILE 69.12 TO MILE 70.56
KENTUCKY CREEK
MILE 0.00 TO MILE 0.53
NEWLAND, N. C.

SCALE 0 400 800 FEET

JUNE 1982

PLATE 3



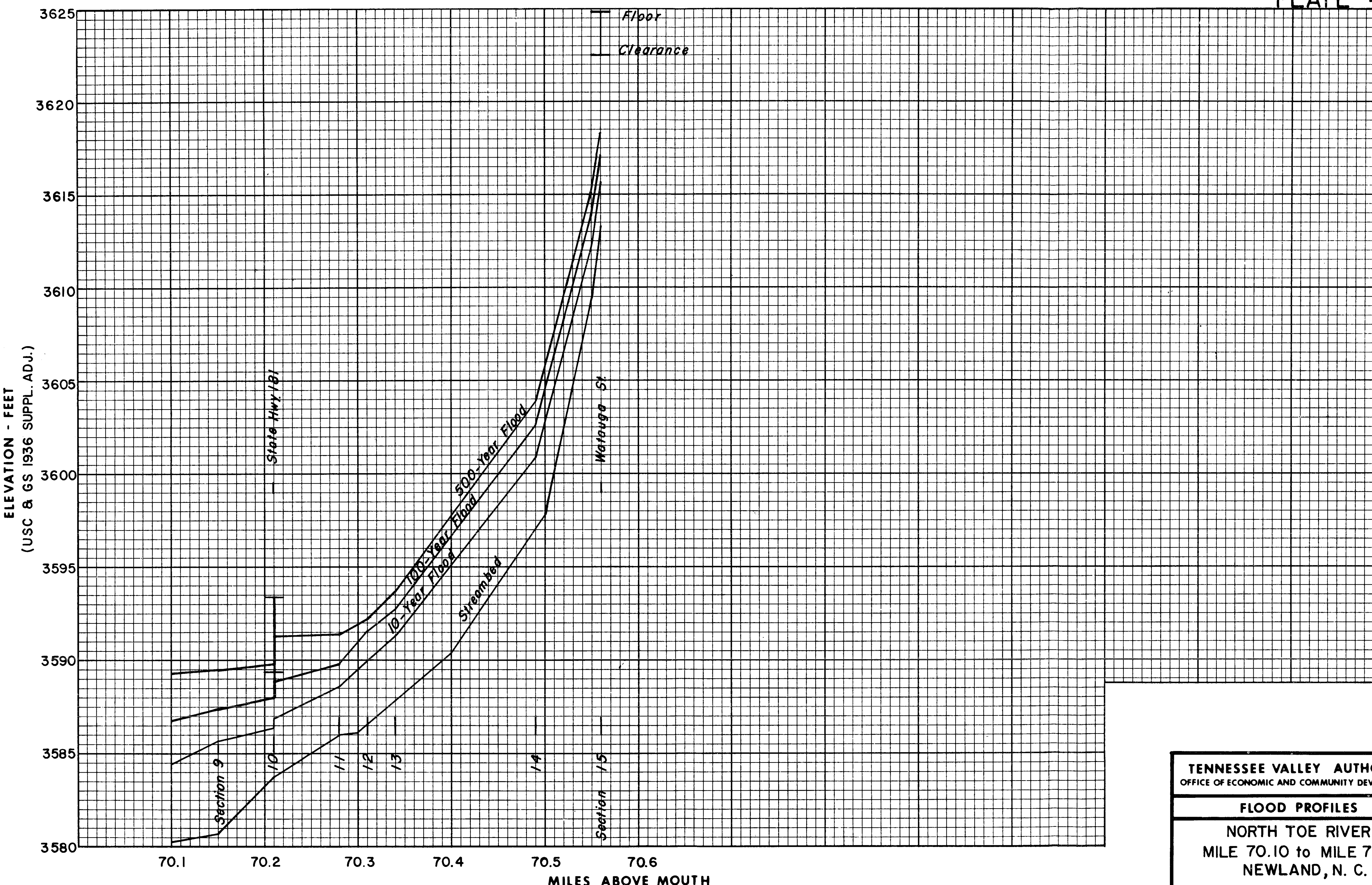
TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

NORTH TOE RIVER
MILE 69.12 to MILE 70.10
NEWLAND, N. C.

JULY 1982

PLATE 4

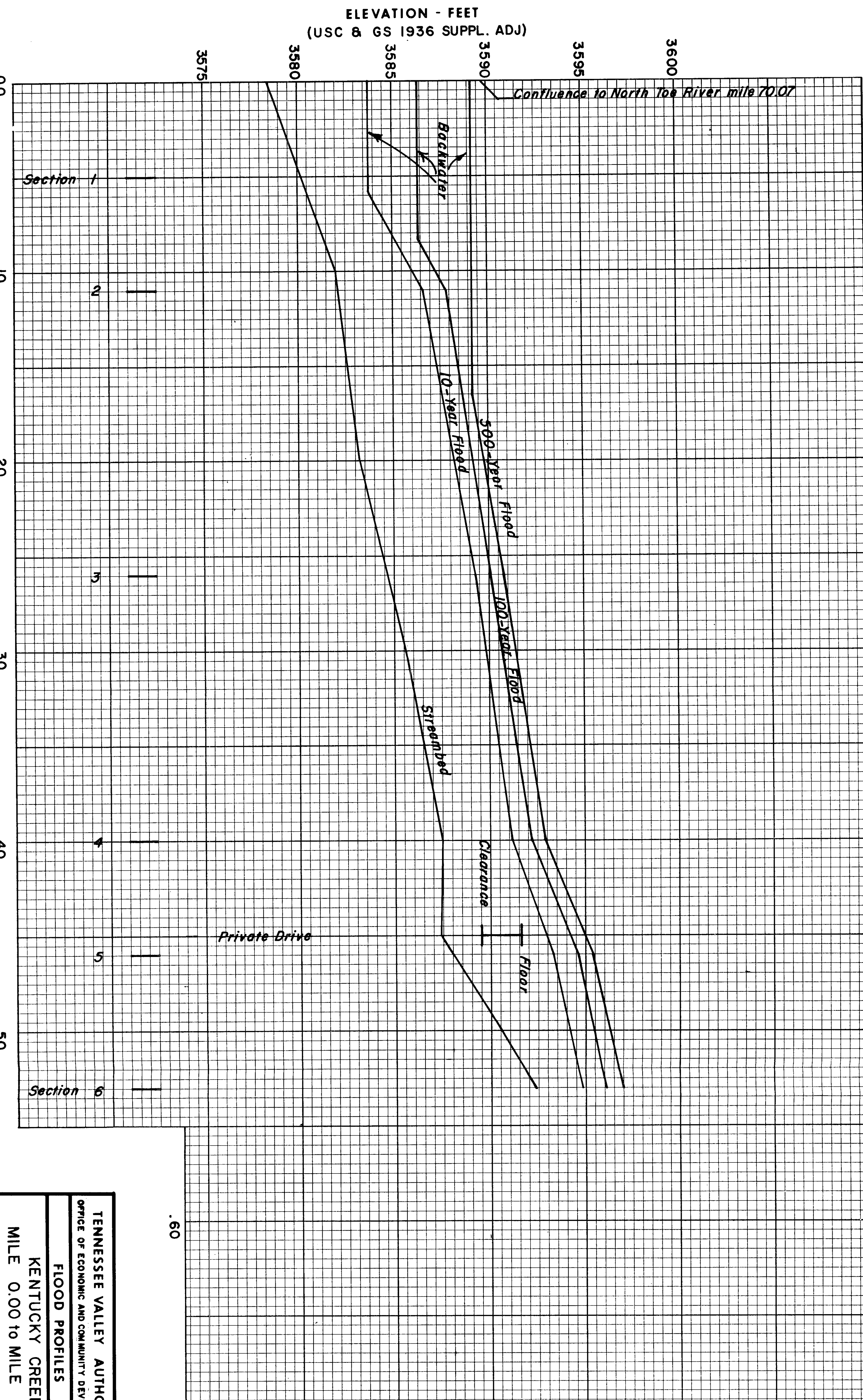


TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

NORTH TOE RIVER
MILE 70.10 to MILE 70.56
NEWLAND, N. C.

JULY 1982



TENNESSEE VALLEY AUTHORITY
OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOOD PROFILES

KENTUCKY CREEK
MILE 0.00 to MILE 0.53
NEWLAND, N. C.

JULY 1982

PLATE 5

APPENDIX

Table 1A

NORTH TOE RIVER 100-YEAR FLOODWAY

Cross Section		Floodway			Water Surface Elevation[b]		
No.	Mile	Width (feet)	Section Area (sq. ft.)	Mean Velocity (ft/sec)	With Floodway	Without Floodway	Difference
1	69.12	120	691	2.7	3575.2	3574.2	1.0
2	69.30	180	785	2.3	3577.0	3576.1	0.9
3	69.41	100	566	3.2	3579.0	3578.3	0.7
4	69.65	100	440	4.1	3581.6	3580.9	0.7
5	69.79	140	640	2.8	3583.1	3582.5	0.6
6	69.89	170	579	3.1	3583.8	3582.9	0.9
7	69.98	40	228	7.8	3584.3	3583.3	1.0
8	70.05 DS[a]	50	322	5.5	3585.8	3585.7	0.1
8	70.05 US[a]	50	280	6.3	3586.1	3586.1	0.0
9	70.15	120	447	2.5	3588.3	3587.4	0.9
10	70.21 DS	50	202	5.4	3588.8	3588.0	0.8
10	70.21 US	50	200	5.5	3589.3	3588.9	0.4
11	70.28	30	123	8.4	3590.5	3589.8	0.7
12	70.31	30	135	7.7	3591.9	3591.6	0.3
13	70.34	36	159	6.5	3593.4	3592.8	0.6
14	70.49	30	99	10.4	3602.6	3602.6	0.0
15	70.56	36	105	9.7	3617.1	3617.1	0.0
15	70.56	32	101	10.1	3619.3	3619.3	0.0

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

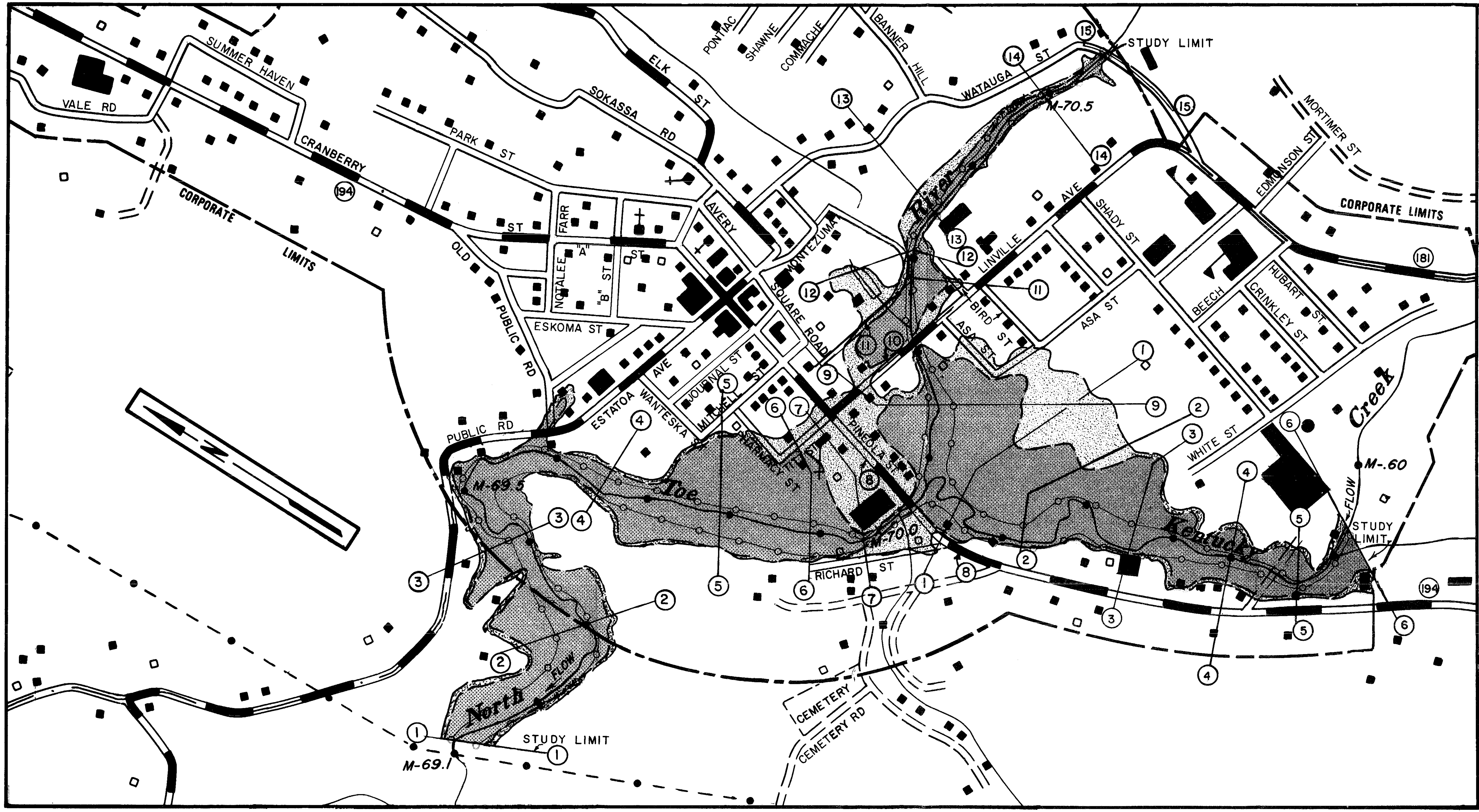
Table 2A

KENTUCKY CREEK 100-YEAR FLOODWAY

Cross Section		Floodway			Water Surface Elevation[a]		
No.	Mile	Width (feet)	Section Area (sq. ft.)	Mean Velocity (ft/sec)	With Floodway	Without Floodway	Difference
1	.05	110	277	3.6	3585.6	3584.6	1.0
2	.11	100	244	4.1	3587.8	3587.8	0.0
3	.26	150	453	2.2	3591.1	3590.1	1.0
4	.40	60	174	5.6	3592.9	3592.2	0.7
5	.46	27	132	7.4	3595.1	3594.6	0.5
6	.53	30	135	7.2	3597.0	3596.1	0.9

a. Feet above mean sea level (USC&GS 1936 Supplementary Adjustment).

PLATE 2A



LEGEND:

OVERFLOW LIMITS

100-YEAR FLOOD — 500-YEAR FLOOD

+ M-2 MILES ABOVE MOUTH (● INDICATES 1/10 MILE)

(8)—(8) CROSS SECTION

FLOODWAY BOUNDARY

The extent of flood overflow is based on data and measurements from aerial photography. Because of the methods used, the flooded areas as shown may not represent exact conditions on the ground.

BASE MAP IS A PORTION OF USGS-TVA PLANIMETRIC MAP 215 SW DATED 1978 WITH MINOR REVISIONS.

TENNESSEE VALLEY AUTHORITY

OFFICE OF ECONOMIC AND COMMUNITY DEVELOPMENT

FLOODED AREAS

WITH PROPOSED FLOODWAY

NORTH TOE RIVER
MILE 69.12 TO MILE 70.56
KENTUCKY CREEK
MILE 0.00 TO MILE 0.53
NEWLAND, N. C.

SCALE 0 400 800 FEET

JUNE 1982