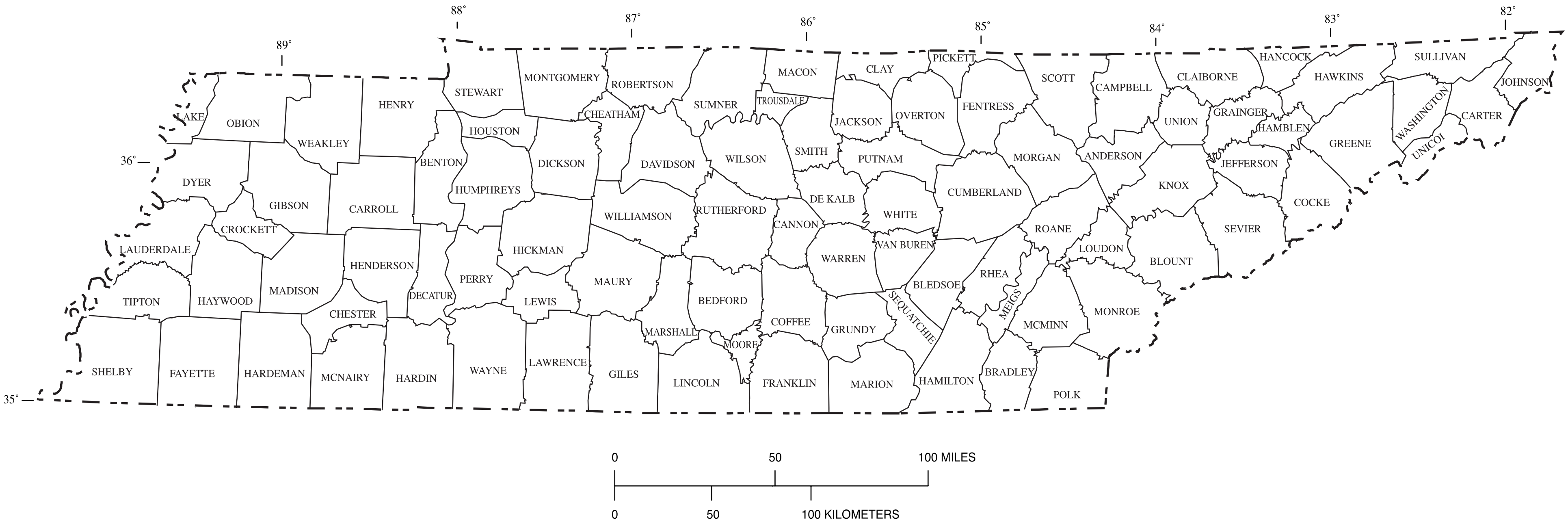
Prepared in cooperation with the
Tennessee Department of Transportation

Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000

Water-Resources Investigations Report 03-4176

U.S. Department of the Interior
U.S. Geological Survey



Location of Tennessee counties.

Cover photo: Caney Fork at State Route 1, Warren and Van Buren Counties, Tennessee, October 1995
(Courtesy of Terry Mackie and John Zirkle, Tennessee Department of Transportation).

Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000

By George S. Law and Gary D. Tasker

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 03-4176

Prepared in cooperation with the
Tennessee Department of Transportation

Nashville, Tennessee
2003

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY
CHARLES G. GROAT, Director

For additional information write to:

District Chief
U.S. Geological Survey
640 Grassmere Park, Suite 100
Nashville, Tennessee 37211

Copies of this report may be purchased from:

U.S. Geological Survey
Branch of Information Services
Federal Center
Box 25286
Denver, Colorado 80225

CONTENTS

FIGURES

TABLES

CONVERSION FACTORS, TEMPERATURE, DATUMS, AND ABBREVIATIONS

Multiply	By	To obtain
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.59	square kilometer (km^2)
cubic foot (ft^3)	0.02832	cubic meter (m^3)
cubic foot (ft^3)	28.32	liter (L)
cubic foot (ft^3)	28,320	cubic centimeter (cm^3)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows: °F = (1.8 X °C) + 32

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows: °C = (°F – 32)/1.8

Vertical coordinate information is referenced to the National Geodetic Vertical Datum of 1929 (NGVD of 1929)—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Horizontal coordinate information is referenced to the North American Datum of 1927.

SELECTED ABBREVIATIONS

CDA	Contributing drainage area
CF	Climate factor
CS	Main-channel slope
HA	Hydrologic area
LAT	Latitude
LNG	Longitude
MRE	Multivariable regional-regression equations
PF	Physiographic-region factor
ROI	Region-of-influence method
SRE	Single-variable regional-regression equations
TDOT	Tennessee Department of Transportation
USGS	U.S. Geological Survey

Flood-Frequency Prediction Methods for Unregulated Streams of Tennessee, 2000

By George S. Law *and* Gary D. Tasker

ABSTRACT

Up-to-date flood-frequency prediction methods for unregulated, ungaged rivers and streams of Tennessee have been developed. Prediction methods include the regional-regression method and the newer region-of-influence method. The prediction methods were developed using stream-gage records from unregulated streams draining basins having from 1 percent to about 30 percent total impervious area. These methods, however, should not be used in heavily developed or storm-sewered basins with impervious areas greater than 10 percent. The methods can be used to estimate 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence-interval floods of most unregulated rural streams in Tennessee. A computer application was developed that automates the calculation of flood frequency for unregulated, ungaged rivers and streams of Tennessee.

Regional-regression equations were derived by using both single-variable and multivariable regional-regression analysis. Contributing drainage area is the explanatory variable used in the single-variable equations. Contributing drainage area, main-channel slope, and a climate factor are the explanatory variables used in the multivariable equations. Deleted-residual standard error for the single-variable equations ranged from 32 to 65 percent. Deleted-residual standard error for the multivariable equations ranged from 31 to 63 percent. These equations are included in the computer application to allow easy comparison of results produced by the different methods.

The region-of-influence method calculates multivariable regression equations for each ungaged site and recurrence interval using basin characteristics from 60 similar sites selected from the study area. Explanatory variables that may be used in regression equations computed by the region-of-influence method include contributing drainage area, main-channel slope, a climate factor, and a physiographic-region factor. Deleted-residual standard error for the region-of-influence method tended to be only slightly smaller than those for the regional-regression method and ranged from 27 to 62 percent.

INTRODUCTION

Planners and engineers require reliable estimates of the magnitude and frequency of floods to design bridges, culverts, embankments, dams, levees, and buildings near unregulated streams and rivers. Flood-plain management needs up-to-date information and techniques for predicting floods to protect the public and minimize flood-related costs to government and private enterprise. Standardized techniques for the measurement and analysis of hydrologic data, especially through regionalization of streamflow and basin characteristics, are essential for understanding and predicting the magnitude and frequency of floods on unregulated streams of Tennessee.

The U.S. Geological Survey (USGS), in cooperation with the Tennessee Department of Transportation (TDOT), developed and tested a computer application that automates the complex calculations necessary to predict flood magnitude and frequency. The computer application allows planners and engineers to compare flood-frequency predictions for unregulated rivers and streams in Tennessee produced with regional-regression equations and the newer region-of-influence method.

This report describes the application of flood-frequency prediction methods in Tennessee based on statistical and hydrologic techniques and data developed by various Federal, State, and local government agencies that work cooperatively with the USGS. These agencies include the Federal Highway Administration, U.S. Army Corps of Engineers, National Weather Service, Tennessee Valley Authority, Tennessee Department of Environment and Conservation, TDOT, Metropolitan Government of Nashville and Davidson County, and other Federal, State, and local agencies.

Purpose and Scope

The purpose of this report is to describe the development of linear-regression methods that can be used to predict flood frequency for unregulated streams in Tennessee. Regression methods used include the regional-regression method and the region-of-influence method. A computer application that automates these prediction methods is described in this report.

Flood-frequency prediction methods provided in this report are applicable in the State of Tennessee. The database of information used for this study is derived from 453 streamgaging stations located primarily in rural and lightly developed areas of Tennessee and the adjacent states of Georgia, North Carolina, Virginia, Alabama, Kentucky, and Mississippi (fig. 1). These stations measure flow in streams draining basins with 1 percent to about 30 percent total impervious area.

Gaging stations in the database were required to have at least 10 years of observed annual peaks and to be free of regulation from large dams and reservoirs. A number of urban sites in Nashville, Tennessee, having from 20 to 30 percent impervious ground cover, are included in the database because they have been shown to have streamflow characteristics similar to nearby undeveloped sites (Wibben, 1976). Flood-frequency prediction methods described in this report should not be applied to heavily developed basins or storm-sewered basins having greater than 10-percent impervious cover.

Previous Studies

Previous reports by Jenkins (1960), Patterson (1964), Speer and Gamble (1964), Randolph and Gamble (1976), and Weaver and Gamble (1993) provided methods to define flood frequency for rural streams in Tennessee. The first three of these reports used a graphical fit on Gumbel probability paper for gaging station flood-frequency analysis and the index-flood method (Dalrymple, 1960) to regionalize the results for application at ungaged sites. The first two reports were based on data collected mostly on the main channels of rivers.

Randolph and Gamble (1976) were the first to define flood frequency at gaging stations in Tennessee by using the log-Pearson Type III statistical distribution and methodology described in U.S. Water Resources Council Bulletin 17 (1976). Randolph and Gamble delineated four hydrologic areas that are based on physiographic provinces of Tennessee. Randolph and Gamble performed statistical analyses that showed each hydrologic-area set of stations was statistically different from a single set of all gaging stations in the study area. Flood-frequency analyses were performed for 281 gaging stations having 10 or more years of record through 1972. Ordinary least-squares regression was used to develop single-variable regional-regression equations for estimating flood frequency at rural unregulated streams in each of the hydrologic areas.

Weaver and Gamble (1993) defined flood frequency at gaging stations in Tennessee using the log-Pearson Type III statistical distribution and methodology described by the Hydrology Subcommittee of the Interagency Advisory Committee on Water Data Bulletin 17B (1982). Weaver and Gamble used flood-frequency analyses for 304 gaging stations having 10 or more years of record through 1986, and continued the use of the hydrologic areas for Tennessee that were previously established by Randolph and Gamble (1976). Weaver and Gamble were the first to use the operational generalized least-squares regression computer application (Tasker and Stedinger, 1989) to develop single-variable regional-regression equations to estimate flood frequency at rural unregulated streams in each of the hydrologic areas.

Recent flood-frequency studies in other states (Tasker and Slade, 1994; Tasker and others, 1996; Asquith and Slade, 1999; Pope and others, 2001; Feaster and Tasker, 2002) have introduced a new computer-based method to produce flood-frequency estimates at unregulated streams. The region-of-influence method has demonstrated advantages by building on the regional-regression method and improving the accuracy of flood-frequency estimates at unregulated streams. The region-of-influence method is a computer application that can be revised by periodically updating the database, which contains gaging station flood-frequency values and basin characteristics used by the program. Tennessee's flood-frequency computer program is a result of these studies and incorporates both the regional-regression method and the region-of-influence method.

Description of Study Area

Tennessee's diverse topography ranges from the lowlands of the Mississippi Valley and Coastal Plain Physiographic Provinces and the hills of the Western Valley Physiographic Province; to the gently rolling hills and glades of the Highland Rim and Central Basin Physiographic Provinces; across the elevated Cumberland Plateau section and the highly incised Sequatchie Valley Physiographic Province; to the steep hills of the Valley and Ridge and mountains of the Blue Ridge Physiographic Provinces (Fenneman, 1946; U.S. Geological Survey, 1970, p. 59; and Miller, 1974). Land-surface elevations range from about 250 ft above NGVD of 1929 along the Mississippi River in West Tennessee to over 6,600 ft in the mountains of East Tennessee.

Geology in Tennessee is variable. West Tennessee is characterized by horizontal beds of unconsolidated sand, silt, clay, and gravel. Middle Tennessee is dominated by horizontal beds of karstic limestone. East Tennessee is characterized by folded beds of limestone and dolomite. The mountains of East Tennessee are underlain by folded beds of complex metamorphic and igneous rock.

Average precipitation in Tennessee varies from about 40 in. to nearly 80 in. per year, generally increasing from west to east (Dickson, 1960). Precipitation is lowest in the Mississippi Valley and Coastal Plain Physiographic Provinces of West Tennessee and the Central Basin Physiographic Province in Middle Tennessee where average annual precipitation totals about 45 in. Areas of the Highland Rim, Cumberland Plateau, and southern part of the Valley and Ridge Physiographic Provinces receive from 50 to 60 in. of precipitation annually. Maximums for the State occur along the foothills and peaks of the Great Smoky Mountains where average annual precipitation totals from 60 to 80 in.

Widespread flooding is uncommon in Tennessee, but typically occurs during the winter and early spring (December through March) when frequent frontal storms bring widespread rains of high intensity on already saturated ground. Localized flooding is common during the summer when thunderstorms often produce intense downpours. In the fall, while flood-producing rains are rare, the remnants of hurricanes sometimes cause serious flooding. The numerous dams constructed along the Tennessee and Cumberland Rivers and their tributaries are major features in the control of flood waters in the State (Dickson, 1960). Some of the more notable floods in Tennessee occurred in 1793, 1867, 1902, 1929, 1948, 1955, 1973, 1975, and 1984.

Acknowledgments

We gratefully acknowledge the assistance and support of Mr. Jon Zirkle of the Tennessee Department of Transportation. Certain descriptions, definitions, methods, and processes described in this report were adapted from USGS Water-Resources Investigations Report 01-4207, "Estimating the Magnitude and Frequency of Floods in Rural Basins of North Carolina—Revised." We acknowledge the contribution of Tim Diehl of the USGS Tennessee District for proposing and developing the physiographic-region factor used in this study. We would like to recognize the valuable comments and suggestions made by Larry Bohman, Lamar Sanders, and Toby Feaster of the USGS. We also recognize the dedicated work of the USGS field office staff in collecting, processing, and storing most of the streamflow data used in this study.

BASIN CHARACTERISTICS

Basin characteristics are factors that describe the physical attributes of a drainage basin. Because differences in basin characteristics can be used to account for differences in flow magnitudes of Tennessee streams, these factors are often used as explanatory variables in regression equations and hydrologic models.

Selected factors that characterize size, shape, relief, geology, physiography, and climate were computed and compiled for the 453 gaging stations used in this study (fig. 1). Of the 453 stations, 297 are located in Tennessee, 21 in Georgia, 37 in North Carolina, 28 in Virginia, 20 in Alabama, 36 in Kentucky, and 14 in

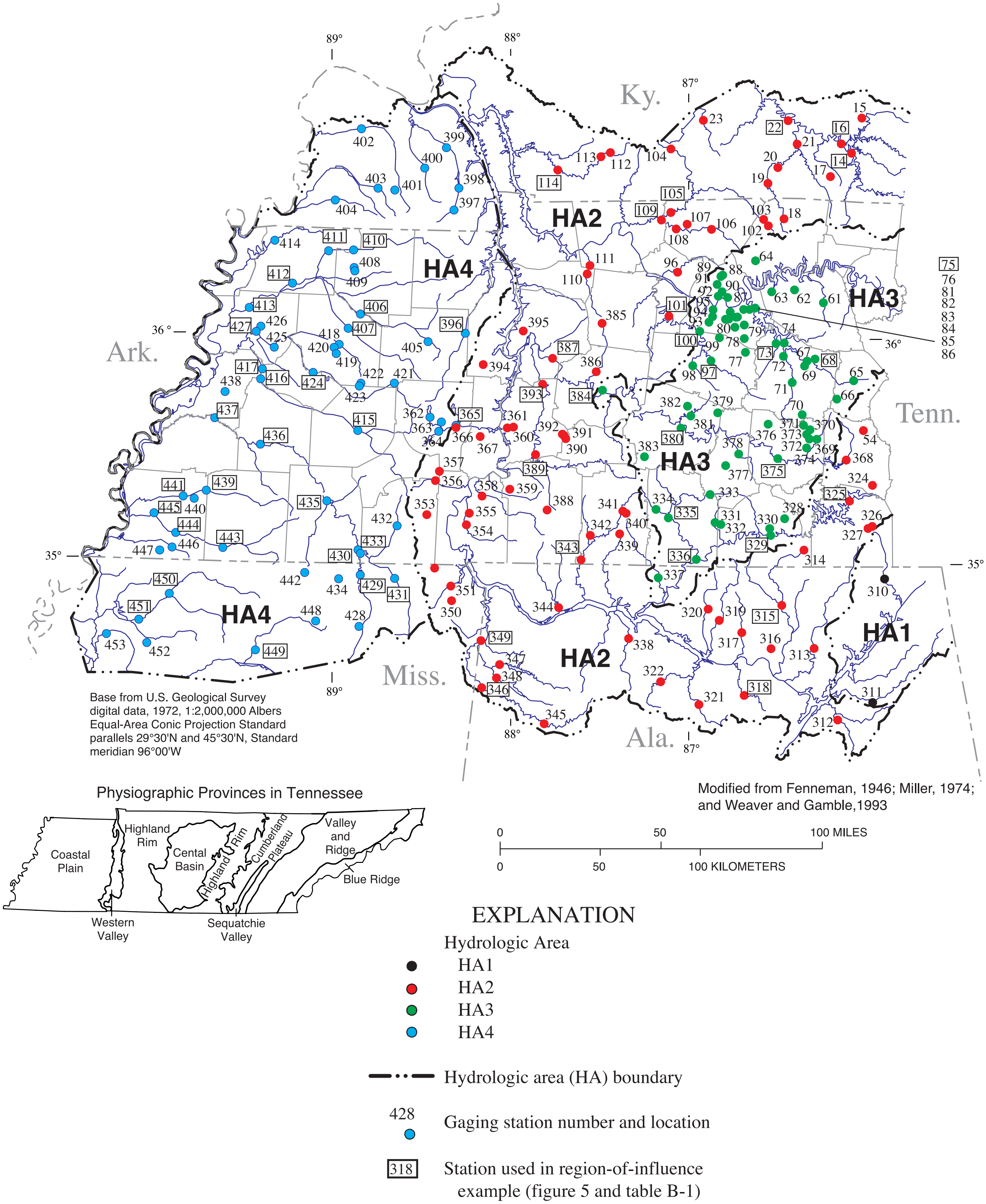


Figure 1. Gaging stations, hydrologic areas, and physiographic provinces in the study area.

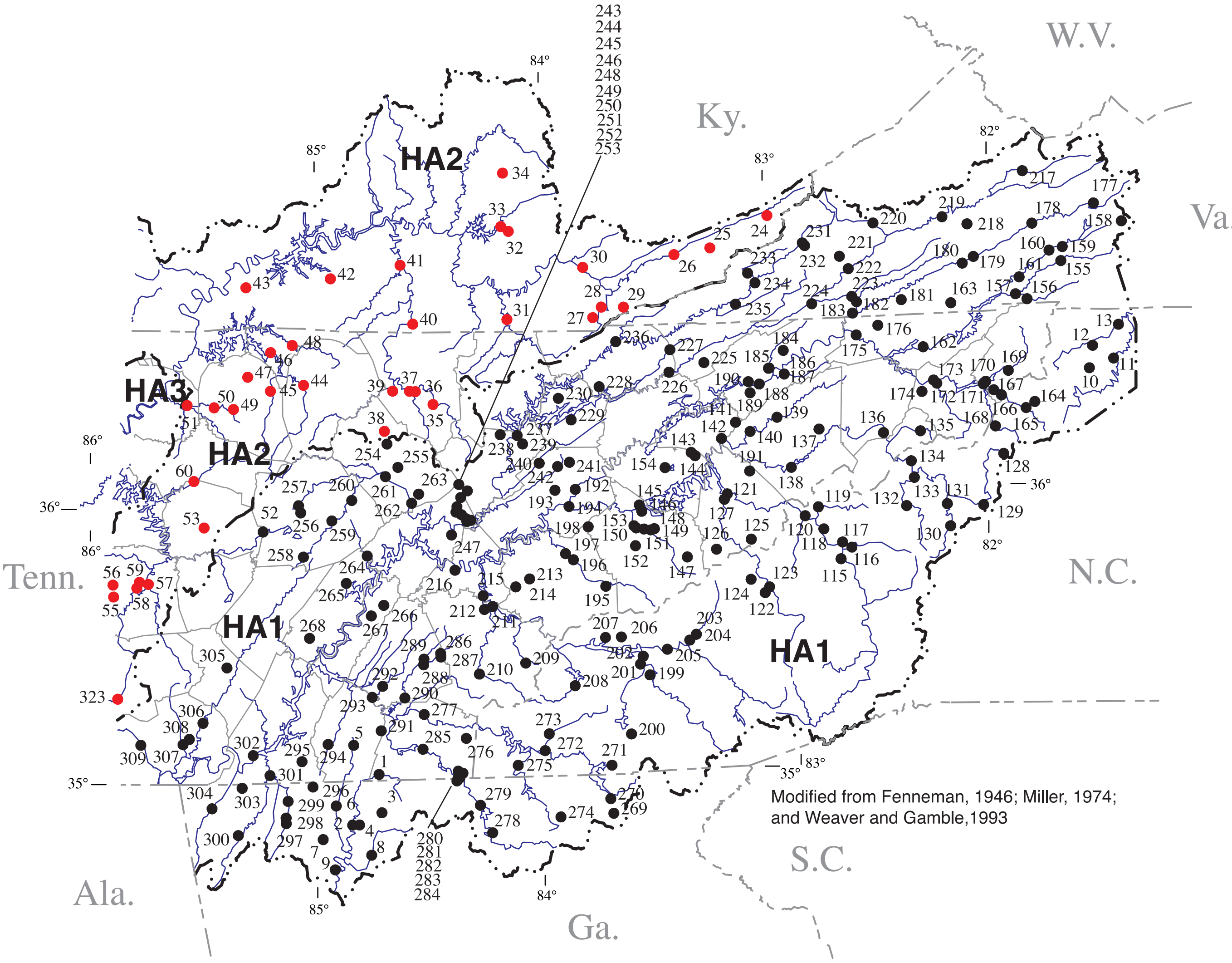


Figure 1. Gaging stations, hydrologic areas, and physiographic provinces in the study area—Continued.

Mississippi (table 1). The drainage basins measured by these stations represent a wide range of physical and climatic conditions within the study area. Basin characteristics that were analyzed for possible inclusion in the flood-frequency prediction methods include contributing drainage area (*CDA*), main-channel slope (*CS*), stream length (*L*), average basin elevation (*BE*), a basin shape factor (*SF*), selected recurrence-interval climate factors (*CF*), hydrologic region (*REG*), and a physiographic-region factor (*PF*) (table 2).

Stream length (*L*), main-channel slope (*CS*), and average basin elevation (*BE*) values were available for approximately 80 percent of the gaging stations used in this study. Values for the remaining 20 percent of the stations were computed using manual techniques. Values of *L* were determined by measuring along a stream from the gaging station proceeding upstream to the watershed divide. Values of *CS* were calculated as the change in land elevation divided by the distance between two points located 10 percent and 85 percent of the stream length upstream from the station. Values of *BE* were the average of 40 to 100 land elevations in the basin selected by using a grid-sampling method. These measurements can be calculated by using either manual or digital methods.

Pope and others (2001) indicated that the primary climatic characteristics relevant to flood frequency in a basin are the intensity, duration, and amount of rainfall, as well as other meteorologic inputs that control evaporation and transpiration. Lichty and Liscum (1978) suggested the use of a regional climate factor, CF_t, where t = 2-, 25-, and 100-year recurrence intervals, which integrates long-term rainfall and pan evaporation information and represents the effect of these climatic influences on flood frequency. In this study, a refined version of CF_t, as developed and described by Lichty and Karlinger (1990), is used to characterize climatic effects of flood frequency. Climate factors, CF_t, for each site are computed by using a computer program that includes the maps of climate-factor isolines presented in Lichty and Karlinger (1990), and the latitude and longitude of a site to interpolate values for the three climate factors, CF_2, CF_{25}, and CF_{100}. This climate-factor computer program is part of the flood-frequency computer application for Tennessee that is described in this report.

Hydrologic Areas

Parts of eight physiographic regions defined by Fenneman (1946), the U.S. Geological Survey (1970, p. 59), and Miller (1974) are represented by distinct hydrologic, geologic, and topographic characteristics in Tennessee (fig. 1). Four hydrologic areas (HA1-4), previously defined by Randolph and Gamble (1976) and Weaver and Gamble (1993), were slightly modified for use in this analysis of flood frequency and follow the general physiographic province boundaries.

HA1 contains 211 stations (table 1) and includes most of the Cumberland Plateau Physiographic Province and all of the Valley and Ridge and Blue Ridge Physiographic Provinces of East Tennessee. These areas are distinct physiographically, although their flood statistics are similar, therefore these three regions are treated as a single hydrologic area. HA2 contains 115 stations and includes almost all of the

Table 1. Number of gaging stations by hydrologic area and state
[See figure 1 for station and hydrologic area locations]

State	Number of stations by hydrologic area				Total stations by State
	1	2	3	4	
Georgia	21	0	0	0	21
Tennessee	123	67	64	43	297
North Carolina	37	0	0	0	37
Kentucky	0	28	0	8	36
Virginia	28	0	0	0	28
Alabama	2	17	1	0	20
Mississippi	0	3	0	11	14
Total stations by hydrologic area	211	115	65	62	453

Table 2. Basin characteristics

[See figure 1 for hydrologic area locations; ----, dimensionless characteristic; NGVD, National Geodetic Vertical Datum]

Basin characteristic	Unit of measure	Definition
		Physical characteristics
LAT	dd mm ss	Latitude, in degrees, minutes, and seconds, at the site of interest.
LNG	dd mm ss	Longitude, in degrees, minutes, and seconds, at the site of interest.
CDA	mi^2	Contributing drainage area is the watershed area, in square miles, that contributes directly to surface runoff.
CS	ft/mi	Main-channel slope, in feet per mile, measured between points 10 and 85 percent of the stream length upstream from the site of interest.
L	mi	Stream length, in miles, measured along stream channel from the site of interest to watershed divide.
BE	ft	Average basin elevation, in feet above NGVD of 1929, measured from topographic maps using a grid-sampling method (40 to 100 points in each basin were sampled).
SF	----	Shape factor is a dimensionless watershed descriptor defined as CDA/L^2.
		Climatic characteristics
CF_2	----	2-year recurrence-interval climate factor
CF_{25}	----	25-year recurrence-interval climate factor
CF_{100}	----	100-year recurrence-interval climate factor
		Regional identifiers
REG	----	1, if site is in hydrologic area 1; 2, if site is in hydrologic area 2; 3, if site is in hydrologic area 3; or 4, if site is in hydrologic area 4.
		Physiographic characteristics
PF	----	Physiographic-region factor is used in the region-of-influence method to capture the uniqueness of flood-magnitude potential inherent in the hydrologic areas. It is the ratio of the 2-year peak discharge from a regression equation for a hydrologic area divided by the 2-year peak discharge from a regression equation for the entire study area.

Highland Rim Physiographic Province, which is a dissected limestone plateau with karst features. In addition, HA2 includes parts of the Cumberland Plateau and Western Valley Physiographic Provinces. HA3 contains 65 stations and closely conforms to the Central Basin Physiographic Province, which is a less karstic area underlain by limestone that has less relief than the Highland Rim. HA4 contains 62 stations and includes all of the Coastal Plain Physiographic Province and the western part of the Western Valley Physiographic Province (Weaver and Gamble, 1993).

Hydrologic areas presented by Weaver and Gamble (1993) were slightly modified in two places for use in this study. First, approximately 200 mi^2 of land drained by the Elk River and its tributaries, in Coffee, Franklin, and Grundy Counties (see map on inside of front cover) formerly in HA1, was reassigned to HA2. This change allows the hydrologic area boundary to trace the regional drainage basin divide and conform more closely to the physiography and geology of the area. Second, about 75 mi^2 of the Duck River Basin, in Hickman County formerly in HA2, was reassigned to HA3. This change extends HA3 farther down the Duck River, which exhibits flood characteristics associated with this hydrologic area. HA4 was not modified for this study.

The hydrologic area for each site of interest can be determined by examining the study area map (fig. 1) or, if necessary, by using more detailed maps. The integer value for the dominant hydrologic area that each gaging station measures was assigned to the region variable (*REG*). The dominant hydrologic area was assigned to the *REG* for each gaging station, even if the drainage basin for that station lies in two hydrologic areas, thus allowing for the database to be easily sorted by hydrologic area for regional flood-frequency analyses.

Physiographic-Region Factor

Physiographic information can be used in flood-frequency analysis in several ways. Previous studies in Tennessee (Randolph and Gamble, 1976; Weaver and Gamble, 1993), as well as the current study (2002), analyzed flood frequency separately in the four hydrologic areas. An alternative approach, used in this study, is to compute a dimensionless basin characteristic that quantifies the effect of the physiographic provinces on flood statistics at gaged and ungaged sites. This factor, known as the physiographic-region factor (*PF*), is treated as an explanatory variable in further statistical analyses, such as those performed by the region-of-influence method, which combines data from all the physiographic regions. *PF* allows the region-of-influence method to capture some of the uniqueness in flood-magnitude potential inherent in the physiographic province-based hydrologic areas (fig. 1) (T.H. Diehl, U.S. Geological Survey, written commun., 2001). The physiographic-region factor is computed as

$$PF = Q_{2,REG} / Q_{2,ALL}, \qquad (1)$$

where

$Q_{2,REG}$ is the 2-year recurrence-interval peak discharge computed by using a single-variable ordinary least-squares regression equation developed for each of the hydrologic-area groupings of stations, and

$Q_{2,ALL}$ is the 2-year recurrence-interval peak discharge computed using a single-variable ordinary least-squares regression equation developed using all 453 gaging stations in the study area.

The 2-year recurrence-interval peak discharge (Q_2) was used as an indicator of the response of floods within a physiographic region because the Q_2 is a common event and an indicator of the amount of water that will run off during flood conditions. *PF* is computed at sites of interest in Tennessee using the hydrologic area (*HA*) and the contributing drainage area (*CDA*) of the site of interest. Contributing drainage area is the most important basin characteristic in flood-frequency prediction in Tennessee. *PF* equations (table 3) are incorporated into the flood-frequency computer application for Tennessee.

FLOOD-FREQUENCY PREDICTION METHODS

Flood discharges for 453 gaging stations located in Tennessee and six adjacent States (fig. 1) with 10 or more years of record through water year 1999 were used to develop the regression methods presented in this report. Water year refers to the period of record beginning October 1st and ending September 30th of the designated year. For example, the 1999 water year is from October 1, 1998, through September 30, 1999. Flood discharges for these gaging stations were computed by fitting the peak streamflow data and supplemental historic information for each station to the log-Pearson Type III distribution as described in Bulletin 17B of the Interagency Advisory Committee on Water Data (1982).

Table 3. Physiographic-region factor equations

[OLS, ordinary least-squares regression; *Q2*, 2-year recurrence-interval peak discharge in cubic feet per second; *CDA*, contributing drainage area in square miles]

Hydrologic area	Physiographic-region factor equations	OLS *Q2* equations: For each hydrologic area	OLS *Q2* equations: For the entire study area
1	$0.6124CDA^{0.0626}$	$125.6CDA^{0.7482}$	$205.1CDA^{0.6855}$
2	$1.0394CDA^{0.0353}$	$213.2CDA^{0.7208}$	$205.1CDA^{0.6855}$
3	$1.7057CDA^{-0.0242}$	$349.9CDA^{0.6613}$	$205.1CDA^{0.6855}$
4	$2.0156CDA^{-0.1540}$	$413.4CDA^{0.5313}$	$205.1CDA^{0.6855}$

Gaging stations are grouped by hydrologic area and related to contributing drainage area (*CDA*), main-channel slope (*CS*), and a climate factor (*CF*) to produce the regional-regression equations. The regional-regression equations, in particular the single-variable regression equations, which are easy to solve manually, are an alternative that can be used to obtain estimates of flood frequency at unregulated sites in Tennessee if the computer application, and therefore the region-of-influence method, is not available.

The region-of-influence method by Tasker and others (1996), required the development of a computer application to derive prediction equations that relate recurrence-interval flood discharges for gaging stations, computed using Bulletin 17B of the Interagency Advisory Committee on Water Data (1982), to *CDA*, *CS*, *CF*, and a physiographic-region factor (*PF*). The physiographic-region factor allows the region-of-influence method to capture the uniqueness in flood-magnitude potential inherent in the four hydrologic areas in Tennessee, which are based on physiographic provinces. Similar to the regional-regression method, the region-of-influence method uses generalized least-squares regression to compute flood-frequency prediction equations. However, the region-of-influence regression analysis is applied to 60 of the most similar stations chosen from the database of 453 gaging stations, rather than the four hydrologic-area groupings of stations.

Unregulated, Gaged Sites

Different methods are used to compute flood frequency at gaged sites than at ungaged sites. The methodology described in the following paragraphs of this section describes the prediction of flood frequency at gaged sites on unregulated streams in Tennessee.

Recurrence Intervals

Flood-frequency estimates for given stream sites are typically presented as sets of exceedance probabilities or, alternatively, recurrence intervals along with the associated discharges. Exceedance probability is defined as the probability of exceeding a specified discharge in a 1-year period and is expressed as decimal fractions less than 1.0 or as percentages less than 100. A discharge with an exceedance probability of 0.10 has a 10-percent chance of being exceeded in any given year. Recurrence interval is defined as the number of years, on average, during which the specified discharge is expected to be exceeded one time and is expressed as number of years. A discharge with a 10-year recurrence interval is one that, on average, will be exceeded once every 10 years.

Recurrence interval and exceedance probability are the mathematical inverses of each other; thus, a discharge with an exceedance probability of 0.10 has a recurrence interval of 1/0.10 or 10 years. Note: Recurrence intervals, regardless of length, always refer to an estimated average number of occurrences over a long period of time; for example, a 10-year flood discharge is one that might occur about 10 times in a 100-year period, rather than exactly once every 10 years. A 10-year flood discharge might occur 3 years consecutively. Thus, exceedance probability and recurrence interval do not indicate when a particular flood discharge will occur.

Bulletin 17B Method

Flood-frequency estimates for gaged sites are computed by fitting the series of annual peak flows to a known statistical distribution. For the purposes of this study, estimates of flood-flow frequency are computed by fitting the logarithms (base 10) of the annual peak flows to a log-Pearson Type III distribution, following the guidelines and using the computational methods described in Bulletin 17B of the Hydrology Subcommittee (Interagency Advisory Committee on Water Data, 1982). The equation for fitting the log-Pearson Type III distribution to an observed series of annual peak flows is as follows:

$$\log_{10} Q_t = \bar{X} + KS \quad , \tag{2}$$

where

Q_t is the *t*-year recurrence-interval peak discharge, in cubic feet per second,

$\bar{X}$ is the mean of the log (base 10)-transformed annual peak flows,

K is a factor dependent on recurrence interval and the skew coefficient of the log (base 10)-transformed annual peak flows, and

S is the standard deviation of the log (base 10)-transformed annual peak flows.

Values for *K* for a wide range of recurrence intervals and skew coefficients are published in appendix 3 of Bulletin 17B (Interagency Advisory Committee on Water Data, 1982).

Fitting the log-Pearson Type III distribution to a long-term, well-distributed series of annual peak flows generally is straightforward; however, a series of peak flows may include low or high peak flows that depart noticeably from the trend in the data. The station record also may include information about maximum peak flows that occurred outside of the period of regularly collected, or systematic, record. Such peak flows, known as historic peaks, are often the maximum peak flows known to have occurred during an extended period of time, longer than the period of data collection. Interpretation of outliers and historic peak information in the fitting process can affect the final flood-frequency estimate.

Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) provides guidelines for detecting and interpreting outliers and historic peaks and provides computational methods for making appropriate adjustments to the distribution to account for their presence. In some cases, high or low outliers are excluded from the record, so that the number of systematic peaks may not be equal to the number of years in the period of record.

Statistical measures of data, such as mean, standard deviation, or skew coefficient, can be described in terms of the sample or computed measure and the population or true measure. In terms of annual peak flows, the period of collected record can be thought of as a sample, or small part, of the entire record, or population. Statistical measures computed from the sample record are estimates of what the measure would be if the entire population were known and used to compute the given measure. The accuracy of these estimates depends on the nature of the specific measure and the given sample of the population.

Skew coefficient measures the symmetry of the distribution of a set of peak flows about the median of the distribution. A peak-flow distribution with the mean equal to the median is said to have zero skew. A positively skewed distribution has a mean that exceeds the median, typically as a result of one or more extremely high peak flows. A negatively skewed distribution has a mean that is less than the median, typically because of one or more extremely low peak flows.

The computed skew coefficient for the peak-flow record of a given station is very sensitive to extreme events; therefore, the sample skew coefficient for short records may not provide an accurate estimate of the population skew. This is problematic because the *K*-factor in equation 2 for a given recurrence interval is dependent only on skew coefficient; therefore, an inaccurate skew coefficient will result in a flood-frequency estimate that is not representative of the true, or population, value.

An improved estimate of skew coefficient at a site can be obtained by using a weighted average of the sample skew coefficient estimate with a generalized, or regional, skew coefficient. A generalized skew coefficient is obtained by combining skew estimates from nearby, similar sites. A nationwide generalized skew study was conducted as documented in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). Skew coefficients for long-term gaged sites from across the Nation were computed and used to produce a map of isolines of generalized skew. The nationwide map of generalized skews was used in the computation of the weighted skew coefficient used to determine the *K*-factor in equation 2.

Peak discharges for recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years were determined for each of the 453 gaging stations by using data collected through the 1999 water year and the methodology described above (table 4 at back of report). For those streams where regulation now exists, the discharge values calculated are based on streamflow data collected prior to regulation. Flood-frequency estimates for 156 gaging stations located in adjacent states (table 5 at back of report) were used strictly to supplement the database used by the flood-frequency computer application for Tennessee; these estimates for sites in other states should not be used for design purposes.

Flood-frequency estimates for the 156 stream gages located outside of Tennessee should be obtained from the most recently published flood-frequency report for that state (Landers and Wilson, 1991; Stamey and Hess, 1993; Bisese, 1995; Atkins, 1996; Pope and others, 2001; and Hodgkins and Martin, in press). Any significant difference in flood-frequency estimates provided in these reports and the supplemental data used in this study likely is caused by differences in historical-record adjustment methodology, inclusion of additional systematic data, and the use of the nationwide skew map in this study.

Unregulated, Ungaged Sites

Regional regression can be used to estimate flood frequency for all unregulated streams and rivers and allows planners, hydrologists, and engineers to enhance the value of discharge records measured at gaging stations. Because streamflow is recorded at only a few of the many sites where information is needed, gaging-station information must be transferred to ungaged sites. Regional regression provides a tool for doing this. In addition, a regional regression may produce improved estimates of streamflow characteristics at the gaged sites (Riggs, 1973).

Two regression methods were developed that estimate flood discharges for unregulated sites in Tennessee. The first method, regional regression, uses generalized least-squares regression to define a set of predictive equations that relate peak discharges for various recurrence intervals to selected basin characteristics for unregulated streams and rivers in each of four hydrologic areas of Tennessee (fig. 1). The second method, the region-of-influence, required the development of a computer application to derive unique predictive relations that relate peak discharges to selected basin characteristics at unregulated sites in Tennessee. Just as in the regional-regression method, generalized least-squares regression is used to develop these predictive relations; however, in the region-of-influence method, regression analysis is applied to a subset of gaged sites chosen from the entire database of gaged sites, rather than the regional groupings of gaged sites.

Regional-Regression Method

The four hydrologic area groups of streamgaging stations were analyzed to ensure that these regional groups (fig. 1) contribute to improved flood-frequency predictions in Tennessee. Regional-regression equations used to estimate flood frequency in Tennessee were developed by applying statistical techniques of ordinary and generalized least-squares regression to the hydrologic area groups of stations (table 1). Single-variable and multivariable regression equations that relate flood frequency to the best combination of explanatory basin characteristics (table 2) are presented in this section of the report.

The validity of the hydrologic areas were examined by performing a Wilcoxon signed-ranks test (Tasker, 1982) using a single-variable ordinary least-squares regression equation for the 50-year recurrence-interval peak discharge (Q_{50}) developed from all 453 stations used in the study. Additionally, a test was conducted by introducing the regional identifiers (*REG*) (table 2) into the single-variable regression equations developed using all 453 stations in the study area. For each station, *REG* was set either at 1, if the site was in a particular region, or 0, if not. A multivariable ordinary least-squares regression equation developed using all 453 stations and (1) *CDA*, (2) *REG*, and (3) *REG* multiplied by *CDA*, was constructed for Q_{50} in each of the four hydrologic areas. For each equation, a significant coefficient for *REG* indicates a difference in the intercept between stations in that hydrologic area and stations in the rest of the study area; a significant coefficient for the product of *REG* and *CDA* indicates a difference in the coefficients of *CDA* between stations in that hydrologic area and stations in the rest of the study area. In this study, a 95-percent confidence interval was specified for significance testing. Each hydrologic-area group of gaging stations was shown to be significant by either the Wilcoxon signed-ranks test or the multivariable ordinary least-squares regression equations developed using the regional identifiers. Therefore, the hydrologic areas proposed for use in this study were accepted.

Ordinary least-squares regression is an appropriate and efficient method for use when flow estimates that are used as response variables are independent of one another (no correlation exists between pairs of sites) and when the reliability and variability of flow estimates that are used as response variables are approximately equal. Flood-frequency estimates for streams (Interagency Advisory Committee on Water Data, 1982) used in this study were calculated from peak-flow records measured at gaging stations throughout Tennessee and in parts of adjacent states. Systematic periods of record for the gaging stations used in this study range from 10 years to about 100 years. Records from gaging stations on the same stream within the same basin or even in adjacent basins may be highly correlated because the peak flows result from the same rainfall events, similar antecedent conditions, and similar basin characteristics. However, records from other gaging stations, in more remote basins, have varying degrees of correlation. In general, correlation between pairs of gaging stations can be described as a function of the distance between stations. Additionally, the reliability of the flood-frequency estimates computed using methods from Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) generally is a function of record length and, as such, cannot be considered equal for all gaging stations. Variability of the flow estimates, characterized by the standard deviation of the peak-flow record that was used to compute the flow estimate, depends in large part on characteristics of the basin and cannot be considered equal for all gaging stations used in the study. For these reasons, ordinary least-squares regression was used only as an exploratory technique in this study to identify the basin characteristics most likely to be significant in the regression equations and to validate the hydrologic areas. The coefficients for the final regression equations were calculated by using generalized least-squares regression.

Generalized least-squares regression, as described by Stedinger and Tasker (1985), is a regression technique that takes into account the correlation between, as well as differences in, the variability and reliability of the flow estimates used as dependent, or response, variables. These factors are accounted for in generalized least-squares regression by assigning different weights to each observation of the response variable used in the regression, based on its contribution to the total variance of the sample-flow statistic used as the response variable. In contrast, ordinary least-squares regression assumes equal reliability and variability in flow estimates at all gaging stations that are assigned equal weight in the regression.

The use of generalized least-squares regression techniques to model the relations between peak discharges and basin characteristics of unregulated streams in Tennessee requires estimates of the cross-correlation coefficients and standard deviation of the peak-flow records that were used to compute peak discharges for the selected recurrence intervals. For each of the four hydrologic areas, a scatter plot of sample correlation coefficients versus distance between stations was constructed for gaging station pairs with at least 30 years of concurrent record. A graphical "best-fit" line to these points was used to define the relation between cross-correlation coefficient and distance between stations. This relation was then used to populate a cross-correlation matrix for the stations within each area. Variability of each peak-flow estimate is measured by the standard deviation of the peak-flow record used to compute that estimate. For each hydrologic area, a generalized least-squares regression of the sample standard deviations against *CDA* was used to obtain estimates of the standard deviations of the peak-flow records at each station. These regression estimates of the standard deviations were used to assign weights to flow estimates because they are independent of the sample standard deviation estimates used to compute the flow estimate. Finally, length of record at each gaging station, which at many stations is adjusted for historical information, was used as a direct measure of the relative reliability of the flow estimates computed from those records.

Generalized least-squares regression was used to improve the single-variable and multivariable regional-regression equations determined by exploratory analysis using ordinary least-squares regression. Single-variable regional-regression equations are provided for all four hydrologic areas of Tennessee (table 6). In HA1, the inclusion of multiple variables in the regression equations marginally improves their predictive ability when compared to the single-variable regression equations. In HA2, 3, and 4, the inclusion of multiple variables in the regression equations provides little or no improvement in predictive ability when compared to the single-variable regression equations. However, for comparison purposes in the computer application, multivariable regression equations are provided for HA1, 2, and 3, but not for HA4 (table 7).

Regional-regression equations for HA1, 2, and 4 are single-segment linear equations. However, regression equations for HA3 are two-segment linear equations (fig. 2). Segmented equations were necessary in HA3 to account for curvature in the explanatory data. Determining the causes of the curvature in the explanatory data for HA3 (fig. 3) requires further study.

The final single-variable regression equations for each of the hydrologic areas relate peak discharge to *CDA* (table 6). The multivariable regression equations for HA1, 2, and 3 include *CDA* and *CS*, and in HA1, CF_2 (table 7). In each of the regression methods described in this report, CF_2 is renamed *CF* for simplicity.

Uncertainty in a flow estimate that was predicted for a site of interest, indexed by i, by using the regional-regression equations can be measured by the standard error of prediction, $S_{p,i}$, which is computed as the square root of the prediction error variance (MSE_p). The MSE_p, as described by Stedinger and Tasker (1985), is the sum of two components—the model error variance described by Moss and Karlinger (1974) that results from the regression equation, γ^2, and the sampling error variance ($MSE_{s,i}$) which results from estimating equation coefficients from samples of the population. The model error variance, γ^2, is a characteristic of the regression equation and is assumed

Table 6. Single-variable regional-regression equations and accuracy statistics

[ft^3/s, cubic feet per second; *CDA*, contributing drainage area in square miles; see figure 1 for hydrologic area locations; mi², square miles]

Recurrence interval, in years	Peak-discharge equation, in ft^3/s	Average prediction error, in percent	Prediction-error departure: Under-estimation, in percent	Prediction-error departure: Over-estimation, in percent
Hydrologic area 1 (CDA=0.20 to 9,000 mi²)				
2	$119CDA^{0.755}$	42.9	-33.7	+50.9
5	$197CDA^{0.740}$	42.2	-33.3	+49.9
10	$258CDA^{0.731}$	43.0	-33.8	+51.0
25	$342CDA^{0.722}$	44.9	-34.9	+53.6
50	$411CDA^{0.716}$	47.0	-36.1	+56.4
100	$484CDA^{0.710}$	49.5	-37.4	+59.7
500	$672CDA^{0.699}$	56.1	-40.7	+68.7
Hydrologic area 2 (CDA=0.47 to 2,557 mi²)				
2	$204CDA^{0.727}$	32.0	-26.8	+36.7
5	$340CDA^{0.716}$	30.2	-25.6	+34.4
10	$439CDA^{0.712}$	31.2	-26.3	+35.6
25	$573CDA^{0.709}$	33.4	-27.7	+38.4
50	$677CDA^{0.707}$	35.6	-29.2	+41.3
100	$785CDA^{0.705}$	37.9	-30.7	+44.2
500	$1,050CDA^{0.702}$	43.9	-34.3	+52.2
Hydrologic area 3 (CDA=0.17 to 30.2 mi²)				
2	$280CDA^{0.789}$	34.3	-28.4	+39.6
5	$452CDA^{0.769}$	34.1	-28.3	+39.4
10	$574CDA^{0.761}$	34.6	-28.5	+39.9
25	$733CDA^{0.753}$	35.5	-29.2	+41.1
50	$853CDA^{0.748}$	36.5	-29.8	+42.5
100	$972CDA^{0.745}$	37.7	-30.5	+43.9
500	$1,250CDA^{0.739}$	40.8	-32.5	+48.1
Hydrologic area 3 (CDA=30.21 to 2,048 mi²)				
2	$679CDA^{0.527}$	27.4	-23.6	+30.9
5	$1,040CDA^{0.523}$	28.0	-24.0	+31.6
10	$1,280CDA^{0.523}$	29.6	-25.1	+33.6
25	$1,590CDA^{0.525}$	32.5	-27.1	+37.2
50	$1,800CDA^{0.527}$	34.9	-28.8	+40.4
100	$2,020CDA^{0.529}$	37.7	-30.5	+43.9
500	$2,490CDA^{0.537}$	44.4	-34.6	+52.9
Hydrologic area 4 (CDA=0.76 to 2,308 mi²)				
2	$436CDA^{0.527}$	38.7	-31.2	+45.3
5	$618CDA^{0.545}$	37.2	-30.3	+43.4
10	$735CDA^{0.554}$	38.0	-30.7	+44.3
25	$878CDA^{0.564}$	40.1	-32.0	+47.1
50	$981CDA^{0.570}$	42.2	-33.3	+49.9
100	$1,080CDA^{0.575}$	44.7	-34.7	+53.2
500	$1,310CDA^{0.586}$	51.1	-38.2	+61.8

Table 7. Multivariable regional-regression equations and accuracy statistics

[ft^3/s, cubic feet per second; *CDA*, contributing drainage area in square miles; *CS*, main-channel slope in feet per mile; *CF*, 2-year recurrence-interval climate factor; see figure 1 for hydrologic area locations; mi², square miles]

Recurrence interval, in years	Peak-discharge equation, in ft^3/s	Average prediction error, in percent	Prediction-error departure	
			Under-estimation, in percent	Over-estimation, in percent
Hydrologic area 1 (CDA=0.20 to 9,000 mi²)				
2	$1.72\ CDA^{0.798}\ CS^{0.112}\ CF^{4.581}$	39.2	-31.5	+45.9
5	$3.41\ CDA^{0.783}\ CS^{0.114}\ CF^{4.330}$	38.2	-31.3	+45.6
10	$5.34\ CDA^{0.775}\ CS^{0.116}\ CF^{4.087}$	40.1	-32.0	+47.1
25	$9.00\ CDA^{0.766}\ CS^{0.117}\ CF^{3.778}$	42.7	-33.6	+50.6
50	$12.8\ CDA^{0.760}\ CS^{0.117}\ CF^{3.560}$	45.2	-35.0	+53.8
100	$17.9\ CDA^{0.754}\ CS^{0.117}\ CF^{3.354}$	47.9	-36.5	+57.6
500	$36.1\ CDA^{0.742}\ CS^{0.114}\ CF^{2.904}$	55.2	-40.3	+67.5
Hydrologic area 2 (CDA=0.47 to 2,557 mi²)				
2	$106\ CDA^{0.787}\ CS^{0.151}$	30.5	-25.8	+34.8
5	$170\ CDA^{0.779}\ CS^{0.158}$	28.5	-24.4	+32.2
10	$218\ CDA^{0.776}\ CS^{0.160}$	29.4	-25.0	+33.3
25	$285\ CDA^{0.772}\ CS^{0.160}$	31.8	-26.7	+36.4
50	$340\ CDA^{0.769}\ CS^{0.159}$	34.1	-28.3	+39.4
100	$397\ CDA^{0.766}\ CS^{0.157}$	36.7	-29.9	+42.7
500	$547\ CDA^{0.761}\ CS^{0.151}$	43.1	-33.8	+51.1
Hydrologic area 3 (CDA=0.17 to 30.2 mi²)				
2	$211\ CDA^{0.815}\ CS^{0.063}$	35.2	-28.9	+40.7
5	$329\ CDA^{0.798}\ CS^{0.071}$	34.9	-28.8	+40.4
10	$405\ CDA^{0.793}\ CS^{0.078}$	35.4	-29.1	+41.0
25	$497\ CDA^{0.789}\ CS^{0.086}$	36.4	-29.7	+42.3
50	$565\ CDA^{0.786}\ CS^{0.092}$	37.4	-30.4	+43.6
100	$632\ CDA^{0.785}\ CS^{0.096}$	38.6	-31.1	+45.2
500	$789\ CDA^{0.781}\ CS^{0.102}$	40.5	-32.5	+47.7
Hydrologic area 3 (CDA=30.21 to 2,048 mi²)				
2	$409\ CDA^{0.584}\ CS^{0.102}$	27.9	-23.9	+31.4
5	$767\ CDA^{0.558}\ CS^{0.061}$	28.6	-24.4	+32.3
10	$980\ CDA^{0.554}\ CS^{0.054}$	30.3	-25.7	+34.5
25	$1,200\ CDA^{0.557}\ CS^{0.056}$	33.4	-27.7	+38.4
50	$1,330\ CDA^{0.562}\ CS^{0.061}$	35.9	-29.4	+41.7
100	$1,430\ CDA^{0.568}\ CS^{0.068}$	38.6	-31.1	+45.2
500	$1,600\ CDA^{0.587}\ CS^{0.090}$	45.7	-35.3	+54.6
Hydrologic area 4 (CDA=0.76 to 2,308 mi²)				
No multivariable regression equations developed for this region (see table 6).				

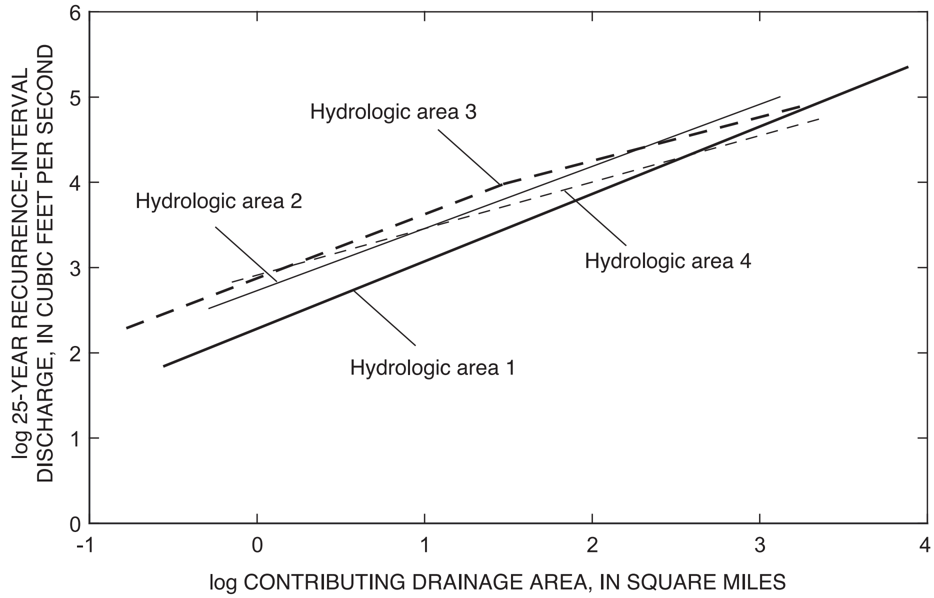


Figure 2. Regional-regression equations for the 25-year flood for Tennessee.

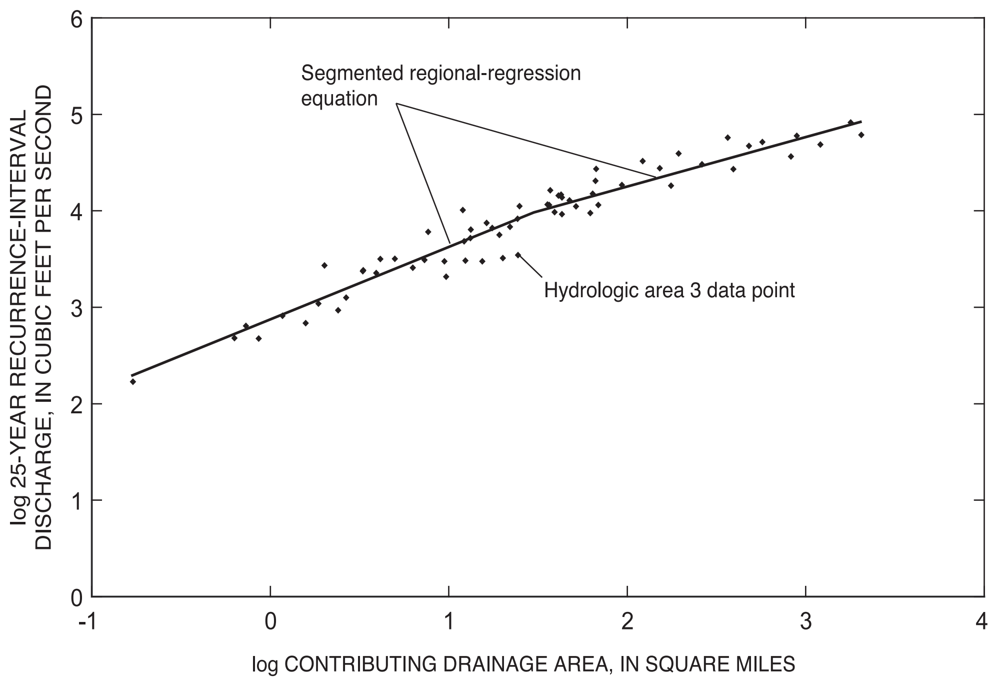


Figure 3. A segmented regional-regression equation used for hydrologic area 3.

constant for all sites. $MSE_{s,i}$ for a given site, however, depends on the values of the explanatory variables used to develop the flow estimate at that site. The standard error of prediction for a site, i, is computed as:

$$S_{p,i} = (\gamma^2 + MSE_{s,i})^{1/2} \,, \qquad (3)$$

and, therefore, varies from site to site. If the values of the explanatory variables for the gaging stations used in the regression are assumed to be representative of all sites in the region, then a general measure of the prediction accuracy of the regression equation can be determined by computing the average prediction error:

$$S_{\bar{p}} = \left[\gamma^2 + (1/n) \sum_{i=1}^{n} MSE_{s,i}\right]^{1/2} . \qquad (4)$$

The average prediction error for a regression equation can be transformed from log (base 10) units to percent error by equation 5. Negative and positive prediction-error departures, in percent of the predicted value in cubic feet per second, may be calculated by equations 6 and 7 as follows:

$$\%SE_p = 100\{[e^{5.302\ (S_{\bar{p}}^{\ 2})} - 1]^{1/2}\}, \text{ and} \qquad (5)$$

$$\%SE_{p(\text{- departure})} = 100[10^{-\ (S_{\bar{p}})} - 1], \text{ and} \qquad (6)$$

$$\%SE_{p(\text{+ departure})} = 100[10^{\ (S_{\bar{p}})} - 1]. \qquad (7)$$

Average prediction errors provide a measure of potential underestimation or overestimation of a regression method. Computation of $S_{p,i}$ for a given ungaged site, i, involves complex matrix algebra (appendix A). The average prediction error and the negative and positive prediction-error departures computed by using $S_{\bar{p}}$ provide an overall measure of the predictive ability of a regression equation. Average prediction errors for the regional-regression equations range from about 27 to 56 percent (tables 6 and 7). The negative and positive prediction-error departures for the single-variable and multivariable regional-regression equations range from about -24 to -41 percent and +31 to +69 percent, respectively (tables 6 and 7).

Another useful measure of the quality of a discharge estimate is the prediction interval for the estimate. A prediction interval consists of an upper limit and a lower limit for a discharge estimate for a given level of confidence. A reduced prediction interval for a given level of confidence indicates a better discharge estimate. In this study, a 90-percent level of confidence is used to compute prediction intervals, which means there is a 95-percent chance that the true discharge value lies between the upper and lower limits. Computational procedures and the matrices needed to compute prediction intervals are provided in appendix A.

Region-of-Influence Method

Another technique for estimating flood frequency at unregulated sites is the region-of-influence method (Tasker and Slade, 1994; Hodge and Tasker, 1995; Tasker and others, 1996; Asquith and Slade, 1999; Pope and others, 2001). In this method, multivariable regression equations for each recurrence-interval peak flow are developed by using explanatory data from a unique group of similar gaging stations selected from all the stations in the study area. This unique group of stations that are most similar to the site of interest is called the “region-of-influence” by Burn (1990a, b) and suggested by Acreman and Wiltshire (1987). In this method, the similarity of a gaging station to the site of interest is measured not by the physical distance between the sites, but by the similarity in terms of the basin charactersitics. The mathematical formula for the similarity between sites i and j is defined by the Euclidean distance metric:

$$d_{ij} = \left\{ \sum_{k=1}^{p} [(x_{ik} - x_{jk})/sd(X_k)]^2 \right\}^{1/2} , \qquad (8)$$

where

d_{ij} is the distance between sites i and j in terms of basin characteristics,

p is the number of basin characteristics used to calculate d_{ij},

X_k is the kth basin characteristic,

$sd(X_k)$ is the sample standard deviation for X_k, and

x_{ik} is the value of X_k at the ith site.

This distance metric is directly analogous to the more familiar equation for distance (D) between two points, (x_1,y_1) and (x_2,y_2) in a two-dimensional rectangular coordinate system:

$$D = [(x_2 - x_1)^2 + (y_2 - y_1)^2]^{1/2} \,, \qquad (9)$$

where the only difference is the use of sample standard deviation to standardize the different basin characteristics and the slight notational difference of using an additional subscript *k* rather than changing variable symbols (*x*, *y*).

Using *CDA*, *CS,* and *CF*, the distances or similarities (d_{ij}'s) between a given site of interest and all the gaged sites are computed and ranked; the number of gaging stations (*N*) with the smallest d_{ij} compose the region-of-influence for the site of interest. Once the region-of-influence is determined, generalized least-squares regression techniques are used to develop the unique predictive relations between flood discharge and the basin characteristics *CDA*, *CS*, *CF*, and *PF*, and estimates of the recurrence-interval flood discharges at the site of interest are computed.

The number (*p*) and identity of basin characteristics that are used to compute d_{ij} and the *N* gaging stations that compose the region-of-influence are specific to a given set of flood-discharge estimates and basin characteristics. In order to adapt the region-of-influence method to that data set, these parameters must be determined. In addition to these parameters, the set of basin characteristics also must be chosen for use as explanatory variables in the generalized least-squares regression equations developed for each recurrence-interval peak discharge at the site of interest.

A subtle but important distinction exists between the two sets of basin characteristics—the first is used to define the region-of-influence for the site of interest; the second serves as explanatory variables that may or may not be used in the unique predictive equations that are developed for the site. These two sets of basin characteristics need not be identical but are in some cases. In other cases, such as in this study, the set of basin characteristics used to define the region-of-influence is a fixed subset (*CDA*, *CS*, and *CF*) of the set of characteristics that potentially can be included in the predictive equations for the site of interest (*CDA*, *CS*, *CF*, and *PF*).

The number of gaging stations (*N*) and the basin characteristics that are used to define the region-of-influence for unregulated sites in Tennessee were selected by using a computer program that computes prediction error for various combinations of *N* and basin characteristics. One of the best measures of the quality of a regression equation is the PRediction Error Sum of Squares (*PRESS*) statistic (Helsel and Hirsch, 1992). *PRESS* is a validation-type estimator of error. Instead of splitting a data set in half, one half to develop the equation, and the second to validate the equation, the *PRESS* statistic uses *N*-1 observations to develop the equation, then estimates the value of the observation left out. The *PRESS* statistic then changes the omitted observation, and repeats the process for each observation. The prediction errors are squared and summed. In multiple regression, the *PRESS* statistic is a useful estimate of the quality of competing regression equations. An interactive computer program that computes the *PRESS* statistic was used to determine the characteristics of the region-of-influence method in Tennessee. Various combinations of *N* (20, 30, 40, 50, 60, and 70) and basin characteristics (*CDA*, *CS*, *CF*, and *PF*) were compared by using the *PRESS* computer program and a trial and error process to select the characteristics of the region-of-influence computer application in Tennessee.

As implemented in Tennessee, the region-of-influence method compares basin characteristics for all 453 gaging stations and selects 60 sites having basin characteristics most similar to the site of interest. *CDA*, *CS*, and *CF* are the basin characteristics used in the distance or similarity metric that defines the region-of-influence for unregulated sites in Tennessee.

To estimate recurrence-interval discharges at an unregulated site of interest, the region-of-influence method performs generalized least-squares regression using *CDA*, *CS*, *PF*, and *CF* from the 60 most similar sites. Because generalized least-squares regression was used to develop the predictive equations, the prediction-error departures and the 90-percent prediction interval are computed for each recurrence-interval peak discharge as described in appendix A.

The region-of-influence computer application for Tennessee will add or drop basin characteristics to or from a given recurrence-interval regression equation by performing a significance test ($\alpha = 0.10$, two-tailed *t* test) for each basin characteristic. Therefore, a site of interest can have recurrence-interval regression equations with different combinations of basin characteristics. This freedom was built into the region-of-influence method to maximize flexibility, but occasionally minor inconsistencies are produced in the recurrence-interval discharge estimates for a given site of interest.

For sites of interest having combinations of basin characteristics near the outer limits of the basin-characteristic data space, a subsequent recurrence-interval discharge estimate may be less than the previous lower recurrence-interval discharge estimate, for example, Q_{100} less than Q_{50}. When inconsistent discharge estimates occur, the region-of-influence method uses a smoothing procedure to adjust the inconsistent values.

If the inconsistent point is an interior point (Q_5 to Q_{100}), then the point is estimated based on a linear interpolation on a log-probability scale defined by the preceding and following points. For example, if the region-of-influence method estimates a Q_{100} less than the Q_{50}, then a new Q_{100} is estimated based on a straight line on a log-probability scale between the Q_{50} and Q_{500} estimates.

If the inconsistent point is an end point, for example Q_{500} less than Q_{100}, then the next-to-end point and the end point are adjusted based on a straight line on a log-probability scale from the second-to-the-end point with a slope defined as the average between a slope from the second-to-the-end point through the next-to-end point and a slope from the second-to-end point and the end point, which was estimated by regression. When the smoothing procedure is used, the region-of-influence method provides both the unadjusted and adjusted discharge estimates for easy identification and comparison by the user.

Comparison of Methods

When comparing accuracy estimates for the regional-regression method and the region-of-influence method at a particular site of interest, the following points should be considered. Occasionally, the scatter of data about a regional-regression equation has a subtle downward curving appearance. This slight curvature can be overcome by segmenting the data into two drainage-area ranges and fitting a regression equation to each range (fig. 3). This is essentially what the region-of-influence method does by placing the site of interest as near the center of a regression equation as possible. The negative and positive prediction-error departures are calculated assuming that the scatter about the fitted regression equation is uniform throughout the range of the data for every recurrence interval, which may not always be the case. In such cases, the regional-regression method, which uses the average scatter for the entire range of the data in the calculation, may produce a relatively poor estimate of the prediction-error departures for a particular site.

The region-of-influence method takes advantage of the non-uniform distribution of the data (scatter), limiting the data used to develop regression equations and associated error estimates to a small range around *CDA* for the particular site (fig. 4). Thus, in some hydrologic areas, the region-of-influence method can be expected to provide a better "local" estimate of the peak at the site of interest. Further, the region-of-influence method also may provide a better estimate of the "local" accuracy of that peak than the regional-regression method, even in those instances where the

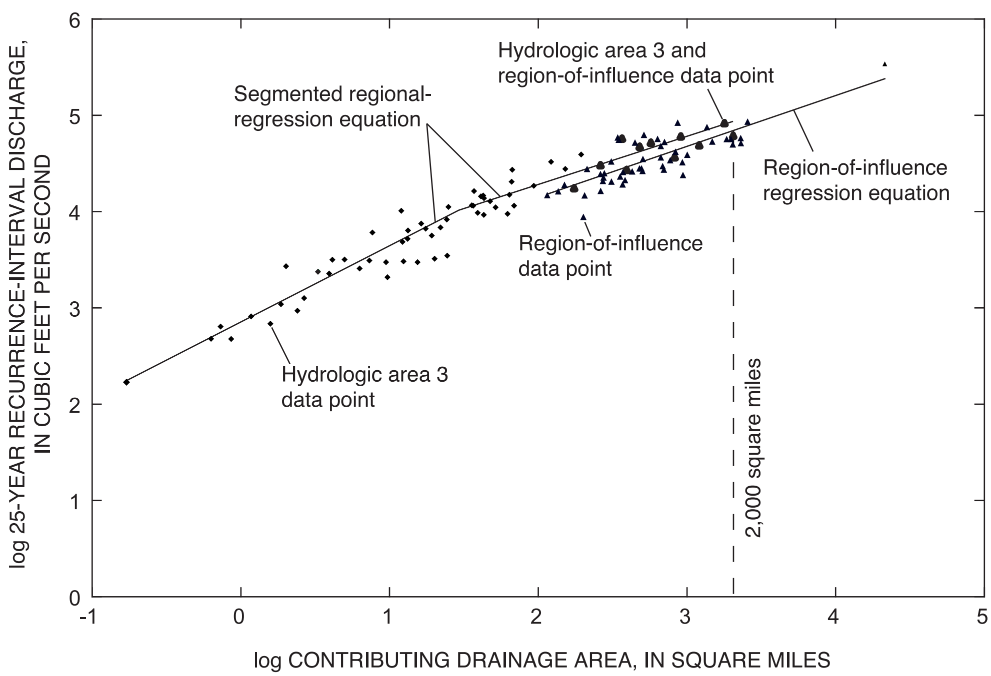


Figure 4. Segmented regional-regression equation and region-of-influence regression equation for the 25-year flood at a 2,000-square-mile ungaged site in hydrologic area 3.

estimates of the prediction error from the computer application are smaller for the regional-regression method.

The deleted-residual standard error, $S_{(-)}$, for a regression method is the square root of the average prediction error sum of squares, $(PRESS/N)^{1/2}$. The $S_{(-)}$ is used to compare the predictive ability of regression methods with differing degrees of freedom. The deleted-residual standard error for a regression method in percent, $\%S_{(-)}$, is computed as:

$$\%S_{(-)} = 100\{[e^{5.3026(PRESS/N)} - 1]^{1/2}\}. \qquad (10)$$

PRESS is the sum of the squared residuals obtained by subtracting the flood-frequency estimate determined by using Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) from the flood-frequency computed using a regression method. The *PRESS* statistic was previously described in the Region-of-Influence Method section of this report; and *N* is the number of residuals summed to produce the *PRESS* statistic. Comparison of the $\%S_{(-)}$ values indicates that, in general, the region-of-influence method is slightly more accurate than the regional-regression method (table 8). In most cases, deleted-residual standard errors are slightly less for the region-of-influence method than for the regional-regression equations, and about 5 percent less than some of the single-variable equations.

Using the computer application, little difference exists in the ease of application between the region-of-influence method and the regional-regression equations. A comparison of the region-of-influence method and the regional-regression equations based on the overall predictive ability of the methods indicates that the region-of-influence method is, on average, the better of the two methods tested for predicting flood frequency for unregulated streams and rivers in Tennessee.

Use of Computer Application

Application of the single-variable regional-regression equations requires much less effort than the multivariable regional-regression equations or the region-of-influence method. The single-variable regional-regression equations require input of *CDA* only, and the computation of the estimate is simple. Therefore, the single-variable equations should be used in the absence of the flood-frequency computer application. The need to provide *CS*, and possibly *CF*,

Table 8. Comparison of deleted-residual standard error for the region-of-influence method and regional-regression equations

[See figure 1 for hydrologic area locations. ----, not applicable]

	Deleted-residual standard error, in percent		
		Regional-regression equations	
Recurrence interval, in years	Region-of-influence method	Multivariable	Single-variable
	Hydrologic area 1		
2	40.8	40.8	45.7
5	40.3	41.1	45.7
10	41.9	43.0	47.2
25	45.1	46.7	50.1
50	48.3	50.0	52.9
100	52.2	53.7	56.1
500	61.6	63.4	64.8
	Hydrologic area 2		
2	29.4	32.2	33.5
5	27.5	31.1	32.3
10	29.3	33.1	34.0
25	33.3	36.8	37.4
50	37.0	40.1	40.3
100	40.3	43.5	43.5
500	50.7	52.0	51.5
	Hydrologic area 3		
2	32.2	34.7	33.2
5	31.8	34.3	33.0
10	32.4	35.4	34.2
25	35.0	37.6	36.5
50	37.7	39.7	38.6
100	40.2	42.0	41.0
500	45.5	48.0	47.0
	Hydrologic area 4		
2	38.0	----	41.7
5	37.2	----	40.6
10	40.0	----	41.7
25	43.0	----	44.3
50	46.3	----	46.7
100	50.2	----	49.4
500	57.1	----	56.4

make the multivariable regional-regression equations difficult to apply manually. The region-of-influence method is computationally intensive and is not suitable for manual application. However, each of the methods can be easily applied using a personal computer.

The flood-frequency computer application for Tennessee estimates flood frequency at unregulated sites by using all three methods for easy comparison by the user. Therefore, in addition to *CDA* and *CS*, the latitude (*LAT*), longitude (*LNG*), and hydrologic area(s) (*HA*) of the site of interest must be specified. The explanatory variables *CF* and *PF* are automatically computed using the *LAT*, *LNG*, and *HA*(s) of the site of interest. Tennessee's flood-frequency computer application automatically adjusts flood discharges for watersheds draining two hydrologic areas.

The flood-frequency computer application for Tennessee includes the following six files (approximate size shown in parentheses): (1) an executable main-program file named *TDOTv203.exe* (437 kilobytes); (2) an external subroutine used by the main executable program named *tnff.cmn* (1 kilobyte); and four supporting data files: (3) *cgrid.krg* (41 kilobytes), (4) *v203inp.txt* (91 kilobytes), (5) v203*M1* (413 kilobytes), and (6) *v203M2* (413 kilobytes). These files should be located in a common directory on the computer hard drive for the flood-frequency application to function properly. The flood-frequency computer application can be downloaded from the Tennessee District homepage at *http://tn.water.usgs.gov.*

Each time the flood-frequency computer application is executed, flood-frequency estimates are produced by using the single-variable and multivariable regional-regression equations, and the region-of-influence method. The computer application produces on-screen summary of results and generates two user-named output files containing the results of flood-frequency estimates at unregulated sites in Tennessee. The first user-named output file (fig. 5), which is identical to the on-screen output, contains discharge predictions, negative and positive prediction-error departures, and 90-percent prediction intervals for each recurrence interval. The second output file (table B-1 in appendix B) contains detailed diagnostic information for the region-of-influence method including a listing of the gaging stations in the region-of-influence and their respective basin characteristics; and the significant regression coefficients for each recurrence-interval discharge, the observed and regression-predicted discharges, residual and influence statistics for the stations in the region-of-influence including standardized residual, leverage, and *Cook's D*; and overall quality measures for the regression.

Suggested procedures for estimating flood frequency at unregulated streams and rivers in Tennessee are as follows:

- Determine the latitude (*LAT*) and longitude (*LNG*), in degrees, minutes, and seconds, of the site of interest.
- Determine the hydrologic area(s) (HA) of the drainage basin upstream from the site of interest.
- Determine the contributing drainage area (*CDA*), in square miles, and the main-channel slope (*CS*), in feet per mile, of the site of interest using the best available information. If there are two HAs, determine the proportion of CDA that lies within each HA.

To assist the user of the flood-frequency computer application for Tennessee, the following suggested ranges for *CDA* and *CS* (table 9) are provided on screen while the computer application is in use. Supplying input to the computer program that is within these ranges will decrease the chance of generating an extrapolated estimate beyond the range of the basin-characteristic data. However, values of *CDA* and *CS* that are within the ranges shown in table 9, when taken in combination, could be outside the basin-characteristic data space, thus producing an extrapolated result at the site of interest.

Table 9. Suggested ranges for contributing drainage area and main-channel slope for input to the computer application

Hydrologic area	Contributing drainage area, in square miles		Main-channel slope, in feet per mile	
	Lower	Upper	Lower	Upper
1	0.20	9,000	3.29	950
2	.47	2,557	1.90	343
3	.17	2,048	2.12	132
4	.76	2,308	.89	63

```
TDOT Version 2.0.3

SINGLE-VARIABLE REGIONAL-REGRESSION EQUATION (SRE) METHOD FOR TENNESSEE
Flood frequency estimates for:
Big River at Centerville, TN
Hydrologic Areas (percent): HA 3 ( 80.0) HA 2 ( 20.0)
LAT:   35  50  10    LNG:   87  25  30
Explanatory variable:
Contributing drainage area: 2000.00 square miles
RI       DISCHARGE    - SE (%)    + SE (%)        90% PRED. INTERVAL
           (cfs)
     2        39700.0       -24.4       32.3     25000.0     63200.0
     5        59600.0       -24.5       32.4     37400.0     94900.0
    10        73700.0       -25.5       34.3     45200.0    120000.0
    25        92400.0       -27.4       37.7     54300.0    157000.0
    50       107000.0       -29.0       40.9     60600.0    189000.0
   100       122000.0       -30.7       44.3     66400.0    224000.0
   500       160000.0       -34.7       53.2     78500.0    324000.0

MULTIVARIABLE REGIONAL-REGRESSION EQUATION (MRE) METHOD FOR TENNESSEE
Flood frequency estimates for:
Big River at Centerville, TN
Hydrologic Areas (percent): HA 3 ( 80.0) HA 2 ( 20.0)
LAT:   35  50  10    LNG:   87  25  30
Explanatory variables:
Contributing drainage area: 2000.00 square miles
Channel slope:   2.50 ft/mi
RI       DISCHARGE    - SE (%)    + SE (%)        90% PRED. INTERVAL
           (cfs)
     2        39900.0       -24.9       33.1     24800.0     64200.0
     5        59400.0       -25.0       33.4     36800.0     95900.0
    10        73400.0       -26.2       35.5     44400.0    122000.0
    25        92100.0       -28.2       39.3     53100.0    160000.0
    50       107000.0       -29.9       42.7     59200.0    193000.0
   100       122000.0       -31.7       46.4     64800.0    230000.0
   500       160000.0       -35.9       55.9     76500.0    334000.0

REGION-OF-INFLUENCE (ROI) METHOD FOR TENNESSEE
Flood frequency estimates for:
Big River at Centerville, TN
Hydrologic Areas (percent): HA 3 ( 80.0) HA 2 ( 20.0)
LAT:   35  50  10    LNG:   87  25  30
Explanatory variables:
Contributing drainage area: 2000.00 square miles
Channel slope:   2.50 ft/mi
Climate factor:   2.38
Log(Physiographic Factor):   0.152( HA 3 )     0.133( HA 2 )
RI       DISCHARGE    - SE (%)    + SE (%)        90% PRED. INTERVAL
           (cfs)
     2        38800.0       -19.7       24.6     26900.0     55900.0
     5        56300.0       -20.2       25.3     38700.0     81900.0
    10        68400.0       -20.9       26.5     46300.0    101000.0
    25        88900.0       -22.4       28.8     58400.0    135000.0
    50       101000.0       -23.4       30.5     65200.0    158000.0
   100       114000.0       -24.4       32.3     71600.0    182000.0
   500       145000.0       -27.2       37.4     85500.0    246000.0
```

Figure 5. Sample of summary output file produced by flood-frequency computer application.

APPLICATION OF METHODS

Methods of estimating flood discharges for unregulated streams in Tennessee vary depending on the amount of data available at a site of interest. These methods are designed for use at streams with unregulated flows, including sites on streams and rivers that flow into Tennessee from adjacent states.

Several points to consider when estimating flood-frequency of streams and rivers in Tennessee are as follows:

- Determine that the stream or river is not appreciably regulated; if regulated, regression methods presented in this report should not be used.
- Search for streamgage data at the site of interest; if available, this information should be weighted with the regression estimate using the methods presented in this section.
- Search for streamgage data for nearby stations on the same stream; if available, this information should be combined with the regression estimate using the methods presented in this section.

Flood-peak estimates suitable for design purposes at gaged sites can best be determined by a combined use of the log-Pearson Type III station estimates (Interagency Advisory Committee on Water Data, 1982) and the regression-method estimates. In this study, region-of-influence method estimates are used in the computation of weighted discharge estimates at gaging stations in Tennessee.

Weighted discharge estimates computed from station estimates and regression estimates are given for 297 gaging stations located in Tennessee (table 4 at back of report). The weighted value is based on the effective record length, in years, at the gaging station (table 4 and appendix C at back of report) and the equivalent years of record for the region-of-influence method estimate (example in table B-1; and appendix D at back of report). Weighted discharge values in table 4 were computed using the dominant hydrologic area for each station. The equation below is used to compute the weighted value at gaging stations:

$$\log_{10}(Q_t(w)) = \{[\log_{10}(Q_t(g))N_e] + [\log_{10}(Q_t(r))EY]\} / (N_e + EY), \qquad (11)$$

where

$\log_{10}(Q_t(w))$ is the logarithm of the weighted discharge at the gaging station for recurrence interval t;

$\log_{10}(Q_t(g))$ is the logarithm of the discharge for recurrence interval t determined using systematic and historical peak-flow record from the gaged site;

$\log_{10}(Q_t(r))$ is the logarithm of the discharge for recurrence interval t determined using the region-of-influence method;

N_e is the number of systematic peaks in the gaging-station record, or the effective record length, in years, (table 4) computed using the method described in appendix C if adjusted for historical information;

EY is the equivalent years of record for the region-of-influence method estimate (example in table B-1).

Flood-frequency estimates at a site of interest that is on the same stream as a gaging station can be determined by using a combination of the regression estimate for the site of interest and the station estimate for the nearby gaged site. In order to make the appropriate adjustment, first compute the ratio,

$$R = Q_t(w) \,/\, Q_t(r)\,, \qquad (12)$$

for the gaged site by using $(Q_t(w))$ and $(Q_t(r))$ as defined in the preceding paragraph. Next, a correction factor, R', is computed as follows:

$$R' = R - (\Delta CDA(R\text{-}1)/0.5CDA_g), \qquad (13)$$

where

ΔCDA is the absolute value of the difference between the contributing drainage areas of the gaged site and site of interest, and

CDA_g is the contributing drainage area of the gaged site.

If $\Delta CDA/CDA_g$ is less than 0.5, then the corrected discharge for the site of interest, $(Q_t(\text{corr}))$, can be computed by multiplying the correction factor, R', by the regression estimate for the site of interest $(Q_t(r))$. If $\Delta CDA/CDA_g$ is greater than 0.5, or no station data are available, then select the regression method having the better prediction error and use the results without correction.

At times, flood-frequency estimates may be needed for a site of interest that is between two gaged sites on the same stream. In this case, select the gaged site for which $\Delta CDA/CDA_g$ is less than 0.5, compute R', and apply as described above. If $\Delta CDA/CDA_g$ is less than 0.5 for both gaged sites, compute R' for each. If both correction factors are greater than 1.0, then use the larger R'; if both correction factors are less than 1.0, then use the smaller R'. If one correction factor is greater than 1.0 and the other smaller than 1.0, then an average of the two correction factors should be used.

If the drainage basin for a site of interest lies within two hydrologic areas (HA_i and HA_j), then the computed discharge should be adjusted according to the proportion of the total contributing drainage area that lies within each hydrologic area. The adjusted discharge can be determined by the equation:

$$(Q_t)(\text{adjusted}) = Q_t(HA_i)(CDA_i/CDA_{\text{total}}) + Q_t(HA_j)(CDA_j/CDA_{\text{total}}), \quad (14)$$

where

(Q_t)(adjusted) is the adjusted discharge for the t-year recurrence interval,

$(Q_t)(HA_i)$ and $(Q_t)(HA_j)$ are the discharges computed as if the entire contributing drainage area were within the hydrologic areas, HA_i and HA_j, respectively,

CDA_i and CDA_j are the total contributing drainage areas within each of the respective hydrologic areas, and

CDA_{total} is the sum of the total contributing drainage areas within each of the respective hydrologic areas.

SUMMARY

Reliable and accurate estimates of the magnitude and frequency of floods are needed for the design of bridges and culverts, the delineation and management of flood zones, and the management of water-control structures. The U.S. Geological Survey, in cooperation with the Tennessee Department of Transportation, applied the region-of-influence method to improve estimates of flood frequency for unregulated streams and rivers in Tennessee. For comparison with the region-of-influence method, the regional-regression method for estimating flood frequency at unregulated sites was updated and expanded to include single-variable and multivariable regression equations. The prediction methods are part of an interactive computer application used to estimate flood frequency at unregulated streams and rivers in Tennessee. The computer application allows for easy comparison of results from both of the regression methods.

Annual-peak streamflow records, historical flood information, and selected basin characteristics for streamgages in the study area with 10 or more years of record through water year 1999 were combined to form a database that was used to develop the prediction methods for use at unregulated sites in Tennessee. These stations measure the flow in streams draining basins with 1 percent to about 30 percent total impervious area; these methods should not be used on regulated streams, or in heavily developed or storm-sewered basins with impervious areas greater than 10 percent. Flood frequency at each of the gaging stations used in this study was computed by fitting the peak streamflow data and supplemental historic information for each station to the log-Pearson Type III distribution as described in Bulletin 17B of the Interagency Advisory Committee on Water Data (1982).

Basin characteristics and flood-frequency estimates for 453 gaging stations located in Tennessee and six adjacent States were merged to form the database that was used to develop the regional-regression equations described in this report. Of the 453 stations, 297 are located in Tennessee, 21 in Georgia, 37 in North Carolina, 28 in Virginia, 20 in Alabama, 36 in Kentucky, and 14 in Mississippi. For the regional-regression method, generalized least-squares regression was used to develop single-variable and multivariable regression equations for the hydrologic areas of Tennessee. The regional-regression equations can be used to compute the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence-interval flood discharges at unregulated streams and rivers using contributing drainage area, main-channel slope, and a climatic factor.

The region-of-influence method was applied in Tennessee using the same 453 gaging stations that were used to develop the regional-regression equations. For an unregulated site of interest, the region-of-influence is defined as the 60 most similar stations selected from the database. The region-of-influence for a site of interest is determined by comparing the contributing drainage area, main-channel slope, and climate factor of the gaged sites to the site of interest. The region-of-influence method uses generalized least-squares regression to estimate the 2-, 5-, 10-, 25-,

50-, 100-, and 500-year recurrence-interval flood discharges at unregulated sites using contributing drainage area, main-channel slope, a climatic factor, and a physiographic-region factor as explanatory variables. The physiographic-region factor allows the region-of-influence method to capture the uniqueness in flood-magnitude potential inherent in the four hydrologic areas in Tennessee, which are based on physiographic provinces.

The regional-regression equations, in particular the single-variable regression equations, are easy to solve manually and are an alternative that can be used to obtain estimates of flood frequency at unregulated sites in Tennessee if the computer application, and therefore the region-of-influence method, is not available. A comparison of the regional-regression method to the region-of-influence method, based on average predictive ability of the methods, indicates that the region-of-influence method is the better method of the two methods tested for predicting flood frequency in Tennessee. The flood-frequency computer application for Tennessee can be downloaded from the website *http://tn.water.usgs.gov.*

REFERENCES

Acreman, M.C., and Wiltshire, S.E., 1987, Identification of regions for regional flood frequency analysis [abs.]: EOS, v. 68, no. 44, p. 1262.

Asquith, W.H., and Slade, R.M., Jr., 1999, Site-specific estimation of peak-streamflow frequency using generalized least-squares regression for natural basins in Texas: U.S. Geological Survey Water-Resources Investigations Report 99-4172, 19 p.

Atkins, J.B., 1996, Magnitude and frequency of floods in Alabama: U.S. Geological Survey Water-Resources Investigations Report 95-4199, 234 p.

Bisese, J.A., 1995, Methods for estimating the magnitude and frequency of peak discharges of rural, unregulated streams in Virginia: U.S. Geological Survey Water-Resources Investigations Report 94-4148, 70 p.

Bobee, Bernard, 1973, Sample error of T-year events computed by fitting a Pearson Type 3 Distribution: Water Resources Research, v. 9, no. 5, p. 1264-1270.

Burn, D.H., 1990a, An appraisal of the "region of influence" approach to flood frequency analysis: Hydrological Sciences Journal, v. 35, no. 2, p. 149-165.

Burn, D.H., 1990b, Evaluation of regional flood frequency analysis with a region of influence approach: Water-Resources Research, v. 26, no. 10, p. 2257-2265.

Dalrymple, Tate, 1960, Flood frequency analyses: U.S. Geological Survey Water-Supply Paper 1543-A, 80 p.

Dickson, R.R., 1960, Climates of the states—Tennessee: U.S. Department of Commerce, Weather Bureau, Climatography of the United States no. 60-40, 13 p.

Feaster, T.D., and Tasker, G.D., 2002, Techniques for estimating the magnitude and frequency of floods in rural basins of South Carolina, 1999: U.S. Geological Survey Water-Resources Investigations Report 02-4140, 34 p.

Fenneman, N.M., 1946, Physical divisions of the United States: U.S. Geological Survey special map, scale 1:7,000,000.

Hardison, C.H., 1971, Prediction error of regression estimates of streamflow characteristics at ungaged sites, *in* Geological Survey Research 1971: U.S. Geological Survey Professional Paper 750-C, p. C228-C236.

Helsel, D.R., and Hirsch, R.M., 1992, Statistical methods in water resources: Amsterdam, Elsevier, 522 p.

Hodge, S.A., and Tasker, G.D., 1995, Magnitude and frequency of floods in Arkansas: U.S. Geological Survey Water-Resources Investigations Report 95-4224, 52 p.

Hodgkins, G.A., and Martin, G.R., in press, Estimating the magnitude of peak flows for streams in Kentucky for selected recurrence intervals: U.S. Geological Survey Water-Resources Investigations Report 03-4180.

Interagency Advisory Committee on Water Data, 1982, Guidelines for determining flood flow frequency: U.S. Geological Survey, Office of Water Data Coordination Bulletin 17B, 186 p.

Jenkins, C.T., 1960, Floods in Tennessee, magnitude and frequency: Tennessee Department of Highways, 68 p.

Landers, M.N., and Wilson, K.V., Jr., 1991, Flood characteristics of Mississippi streams: U.S. Geological Survey Water-Resources Investigations Report 91-4037, 82 p.

Lichty, R.W., and Karlinger, M.R., 1990, Climate factor for small-basin flood frequency: Water Resources Bulletin, v. 26, no. 4, p. 577-586.

Lichty, R.W., and Liscum, Fred, 1978, A rainfall-runoff modeling procedure for improving estimates of T-year (annual) floods for small drainage basins: U.S. Geological Survey Water-Resources Investigations Report 78-7, 44 p.

Miller, R.A., 1974, The geologic history of Tennessee: Tennessee Division of Geology Bulletin 74, 63 p.

Moss, M.E., and Karlinger, M.R., 1974, Surface water network design by regression analysis simulation: Water Resources Research, v. 10, no. 3, p. 427-433.

Patterson, J.L., 1964, Magnitude and frequency of floods in the United States, Part 7, Lower Mississippi River basin: U.S. Geological Survey Water-Supply Paper 1681, 636 p.

Pope, B.F., Tasker, G.D., and Robbins, J.C., 2001, Estimating the magnitude and frequency of floods in rural basins of North Carolina—Revised: U.S. Geological Survey Water-Resources Investigations Report 01-4207, 44 p.

Randolph, W.J., and Gamble, C.R., 1976, Technique for estimating magnitude and frequency of floods in Tennessee: Tennessee Department of Transportation, 52 p.

Riggs, H.C., 1973, Regional analyses of streamflow characteristics: Techniques of Water-Resources Investigations of the U.S. Geological Survey, Book 4, Chapter B3, 15 p.

Speer, P.R., and Gamble, C.R., 1964, Magnitude and frequency of floods in the United States, pt. 3B, Cumberland and Tennessee River basins: U.S. Geological Survey Water-Supply Paper 1676, 340 p.

Stamey, T.C., and Hess, G.W., 1993, Techniques for estimating magnitude and frequency of floods in rural basins of Georgia: U.S. Geological Survey Water-Resources Investigations Report 93-4016, 75 p.

Stedinger, J.R., and Cohn, T.A., 1985, Flood frequency analysis with historical and Paleoflood information: Water Resources Research, v. 22, p. 785-793.

Stedinger, J.R., and Tasker, G.D., 1985, Regional hydrologic regression: 1. Ordinary, weighted and generalized least squares compared: Water Resources Research, v. 21, no. 9, p. 1421-1432.

Tasker, G.D., 1982, Simplified testing of hydrologic regression regions: Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, v. 108, no. HY10, p. 1218-1222.

Tasker, G.D., Hodge, S.A., and Barks, C.S., 1996, Region of influence regression for estimating the 50-year flood at ungaged sites: Water Resources Bulletin, v. 32, no. 1, p. 163-170.

Tasker, G.D., and Slade, R.M., 1994, An interactive regional regression approach to estimating flood quantiles, *in* Fontane, D.G., and Tuvel, H.N., eds., Water policy and management, solving the problems, Proceedings of the Twenty-First Annual Conference, May 23-26, 1994: Denver, Colo., Denver Society of American Society of Civil Engineers, p. 782-785.

Tasker, G.D., and Stedinger, J.R., 1989, An operational GLS model for hydrologic regression: Journal of Hydrology, v. 111, p. 361-375.

Tasker, G.D., and Thomas, W.O, 1978, Flood frequency analysis with pre-record information: Journal of Hydraulic Division of American Society of Civil Engineers, v. 104, no. 2, p. 249-259.

U.S. Geological Survey, 1970, The national atlas of the United States of America: Washington, D.C., U.S. Geological Survey, 417 p.

U.S. Water Resources Council, 1976, Guidelines for determining flood flow frequency: U.S. Water Resources Council Bulletin 17, 221 p.

Weaver, J.D., and Gamble, C.R., 1993, Flood frequency of streams in rural basins of Tennessee: U.S. Geological Survey Water-Resources Investigations Report 92-4165, 38 p.

Wibben, H.C., 1976, Effects of urbanization on flood characteristics in Nashville-Davidson County, Tennessee: U.S. Geological Survey Water-Resources Investigations Report 76-121, 33 p.

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee

[For each site, the discharge values in the first row are Bulletin 17B station estimates (Interagency Advisory Committee on Water Data, 1982); the discharge values in the second row are weighted estimates based on equation 11; CDA, contributing drainage area in square miles; CS, main-channel slope in feet per mile; CF, 2-year recurrence interval climate factor; PF, physiographic-region factor; Z, number of historic peaks and high outliers; H, total historical period in years; N, systematic record length in years; N_e, effective record length in years; See appendix C for description of computing effective record length; See figure 1 for station location]

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 1															
5	02384900	Coahulla Creek near Cleveland; 1955-85					526	996	1,420	2,100	2,740	3,490	5,800	0	0	31	31
		35.117 84.838	4.35	31.6	2.32	0.67	519	970	1,370	2,000	2,570	3,250	5,430				
52	03418500	Caney Fork at Clifty; 1931-49					6,260	9,120	11,400	14,600	17,400	20,500	29,100	1	108	19	27
		35.891 85.218	111	15.3	2.29	0.82	6,030	8,740	10,800	13,800	16,400	19,200	27,000				
121	03455000	French Broad River near Newport; 1901-05, 1921-99					27,700	45,100	58,400	77,200	92,500	109,000	153,000	1	134	84	87
		35.980 83.160	1,858	8.6	2.21	0.98	27,800	45,100	58,300	76,700	91,700	108,000	150,000				
125	03461000	Pigeon River at Hartford; 1926-48					12,200	19,400	24,700	31,700	37,200	42,900	57,000	1	47	23	27
		35.814 83.062	547	28.9	2.21	0.91	12,400	19,700	25,000	32,200	37,900	43,900	59,300				
126	03461200	Cosby Creek above Cosby; 1959-87					746	1,120	1,370	1,700	1,960	2,210	2,830	0	0	29	29
		35.783 83.217	10.2	484.9	2.21	0.71	744	1,120	1,380	1,730	1,990	2,270	2,950				
127	03461500	Pigeon River at Newport; 1901-05, 1908-30, 1932-40, 1943, 1946-82, 1997-99					15,700	24,800	31,400	40,300	47,300	54,500	72,500	1	134	78	82
		35.961 83.174	666	31.1	2.21	0.92	15,700	24,900	31,500	40,400	47,400	54,700	73,000				
135	03465000	North Indian Creek near Unicoi; 1945-57, 1959-84					470	689	840	1,040	1,190	1,340	1,700	0	0	39	39
		36.176 82.293	15.9	189.0	2.16	0.73	478	708	872	1,090	1,260	1,440	1,860				
136	03465500	Nolichucky River at Embreeville; 1921-99					20,400	34,100	45,500	63,000	78,400	96,000	147,000	1	98	79	81
		36.176 82.457	805	18.1	2.16	0.93	20,300	33,700	44,700	61,200	75,700	92,200	141,000				
137	03466228	Sinking Creek at Afton; 1978-99					349	681	979	1,460	1,900	2,420	3,980	0	0	22	22
		36.199 82.742	13.7	55.5	2.18	0.72	363	710	1,020	1,520	1,970	2,500	4,090				
138	03466500	Nolichucky River below Nolichucky Dam; 1904-08, 1920-25, 1946-73					21,400	33,100	42,100	54,900	65,300	76,800	108,000	1	73	39	44
		36.066 82.872	1,184	18.3	2.19	0.96	21,600	33,500	42,500	55,300	65,900	77,300	107,000				
139	03466890	Lick Creek near Albany; 1985-99					3,610	5,110	6,180	7,630	8,770	9,960	13,000	1	23	15	17
		36.248 82.926	172	6.6	2.19	0.85	3,790	5,530	6,880	8,730	10,200	11,700	15,800				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 1—Continued															
140	03467000	Lick Creek at Mohawk; 1947-71					5,490	7,890	9,610	11,900	13,800	15,700	20,600	0	0	25	25
		36.201 83.048	220	4.2	2.19	0.86	5,400	7,780	9,530	12,000	14,000	16,000	21,800				
141	03467480	Bent Creek at Taylor Gap; 1986-99					1,790	2,290	2,590	2,950	3,200	3,440	3,970	0	0	14	14
		36.236 83.111	28.6	18.4	2.20	0.76	1,750	2,290	2,610	3,050	3,390	3,780	4,620				
142	03467500	Nolichucky River near Morristown; 1921-57, 1959-82					23,300	36,000	46,000	60,500	72,700	86,200	123,000	1	195	61	65
		36.180 83.176	1,679	15.2	2.20	0.98	23,600	36,600	46,800	61,600	74,000	87,500	124,000				
143	03467993	Cedar Creek near Valley Home; 1986-99					113	151	178	214	243	273	351	0	0	14	14
		36.134 83.313	2.01	85.7	2.20	0.64	119	166	204	262	309	358	484				
144	03467998	Sinking Fork at White Pine; 1986-99					838	1,180	1,420	1,730	1,970	2,220	2,820	0	0	14	14
		36.122 83.296	6.38	49.3	2.20	0.69	792	1,110	1,330	1,630	1,870	2,130	2,810				
145	03469000	French Broad River below Douglas Dam; 1919-42					48,800	66,800	77,900	91,200	101,000	110,000	129,000	1	76	24	31
		35.952 83.551	4,543	7.9	2.21	0.91	48,800	67,200	79,200	93,900	105,000	115,000	139,000				
146	03469010	Millican Creek near Douglas Dam; 1943-47, 1950-52, 1954-62					745	1,070	1,290	1,570	1,780	1,990	2,490	0	0	17	17
		35.929 83.541	4.2	23.2	2.22	0.67	696	978	1,140	1,360	1,540	1,720	2,190				
147	03469110	Ramsey Creek near Pitman Center; 1967-85					125	237	331	470	590	722	1,090	0	0	19	19
		35.759 83.347	2.2	649	2.22	0.64	131	247	343	487	610	745	1,130				
148	03469130	Little Pigeon River near Sevierville; 1954-82					8,780	11,200	12,900	15,200	17,000	19,000	23,900	0	0	29	29
		35.861 83.504	110	114.3	2.22	0.82	8,570	11,000	12,700	15,000	16,900	18,900	24,200				
149	03469160	East Fork Little Pigeon River near Sevierville; 1954-82					2,830	4,530	5,910	7,960	9,730	11,700	17,300	0	0	29	29
		35.865 83.488	64.1	29.8	2.22	0.80	2,830	4,520	5,890	7,890	9,600	11,500	17,000				
150	03469175	Little Pigeon River above Sevierville; 1989-99					8,740	12,500	15,200	18,900	21,900	25,000	33,100	0	0	11	11
		35.865 83.534	184	87.2	2.22	0.85	8,620	12,300	15,000	18,800	21,800	25,300	33,800				
151	03469200	Little Pigeon River above W Prong near Sevierville; 1954-67					11,400	15,900	19,200	23,800	27,600	31,600	42,300	0	0	14	14
		35.870 83.568	201	81.1	2.22	0.86	11,000	15,300	18,500	23,000	26,600	30,500	41,200				
152	03469500	West Prong Little Pigeon R near Pigeon Forge; 1947-49, 1954-82					5,730	7,840	9,170	10,800	12,000	13,100	15,700	0	0	32	32
		35.806 83.574	76.2	166.7	2.22	0.80	5,660	7,750	9,090	10,800	12,000	13,200	16,100				
153	03470000	Little Pigeon River at Sevierville; 1920-82					14,700	23,100	29,200	37,500	44,100	51,000	68,600	1	116	63	68
		35.878 83.578	353	76.3	2.22	0.89	14,700	22,900	28,900	37,100	43,600	50,400	67,800				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 1—Continued															
154	03470215	Dumplin Creek at Mt. Hareb; 1986-99					100	154	192	242	281	320	414	0	0	14	14
		36.083 83.431	3.65	39.1	2.21	0.67	111	183	242	325	391	458	626				
162	03477000	South Fork Holston River at Bluff City; 1901-50					12,200	16,600	19,600	23,300	26,200	29,000	35,900	1	84	50	54
		36.477 82.263	813	16.2	2.11	0.93	12,300	16,900	20,100	24,300	27,600	30,800	38,700				
166	03479500	Watauga River at N.C.-Tenn. State line; 1943-55					5,210	7,890	10,200	14,000	17,500	21,600	34,700	1	106	13	22
		36.290 81.926	152	25.3	2.10	0.84	5,100	7,690	9,910	13,400	16,500	20,200	31,900				
167	03480000	Watauga River at Stump Knob; 1928-31, 1935-45					5,720	9,190	12,200	16,900	21,100	26,100	41,300	1	96	15	23
		36.310 81.959	171	43.3	2.10	0.85	5,630	9,010	11,800	16,200	20,000	24,600	38,300				
169	03482000	Roan Creek near Neva; 1943-55, 1959-85					2,730	4,280	5,480	7,200	8,620	10,200	14,400	1	46	40	41
		36.377 81.890	102	61.8	2.10	0.82	2,760	4,340	5,570	7,350	8,840	10,500	14,800				
170	03482500	Roan Creek at Butler; 1935-48					2,550	3,480	4,120	4,950	5,580	6,230	7,820	0	0	14	14
		36.342 81.993	166	48.4	2.10	0.85	2,790	4,000	4,960	6,300	7,360	8,690	11,500				
171	03483000	Watauga River at Butler; 1921-48					9,740	13,600	16,700	21,400	25,600	30,300	44,000	1	99	28	35
		36.333 82.004	427	40.8	2.10	0.90	9,690	13,600	16,800	21,600	25,800	30,500	44,200				
172	03485500	Doe River at Elizabethton; 1912-16, 1921-31, 1933-82					3,170	5,260	7,030	9,770	12,200	15,100	23,500	1	116	66	70
		36.344 82.210	137	58.9	2.12	0.83	3,210	5,330	7,130	9,960	12,500	15,400	23,900				
173	03486000	Watauga River at Elizabethton; 1927-48					13,500	21,100	27,300	36,600	44,700	53,900	80,200	1	82	22	29
		36.356 82.224	692	29.8	2.12	0.92	13,500	21,000	27,100	36,100	43,900	52,600	77,900				
174	03486225	Powder Branch near Johnson City; 1973-84					121	230	328	488	636	813	1,360	0	0	12	12
		36.317 82.278	3.5	124.8	2.16	0.66	128	243	348	517	668	845	1,370				
175	03487500	South Fork Holston River at Kingsport; 1926-48					25,100	37,600	46,600	59,000	68,800	79,200	106,000	1	158	23	29
		36.531 82.558	1,935	11.2	2.14	0.99	25,500	38,300	47,800	60,700	71,000	81,700	109,000				
176	03487550	Reedy Creek at Orebank; 1964-87, 1989-99					1,180	1,960	2,670	3,860	5,000	6,390	11,000	1	73	35	40
		36.562 82.460	36.3	56.2	2.14	0.77	1,190	1,970	2,680	3,860	4,970	6,320	10,700				
184	03490522	Forgey Creek at Zion Hill; 1986-1999					82	151	214	322	424	550	961	0	0	14	14
		36.487 82.886	0.86	193.0	2.14	0.61	81	145	203	296	383	487	816				
185	03491000	Big Creek near Rogersville, 1942-49; 1955-99					2,560	3,680	4,420	5,350	6,050	6,740	8,350	0	0	53	53
		36.426 82.952	47.3	14.4	2.14	0.78	2,510	3,600	4,320	5,240	5,940	6,680	8,360				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 1—Continued															
186	03491200	Big Creek trib near Rogersville; 1955-85					152	318	484	780	1,080	1,460	2,780	0	0	31	31
		36.425 82.955	2.00	102.0	2.14	0.64	151	310	464	731	991	1,320	2,420				
187	03491300	Beech Creek at Kepler; 1966-87					2,040	2,740	3,180	3,700	4,080	4,440	5,240	0	0	22	22
		36.402 82.886	47.0	13.8	2.14	0.78	2,010	2,720	3,180	3,780	4,230	4,720	5,760				
188	03491500	Holston River near Rogersville; 1902-41					37,400	53,200	63,300	75,400	84,200	92,600	111,000	0	0	40	40
		36.370 82.999	3,035	8.2	2.19	1.01	37,700	54,000	64,600	78,100	87,800	97,300	119,000				
189	03491540	Robertson Creek near Persia; 1986-99					851	1,030	1,130	1,250	1,340	1,410	1,580	0	0	14	14
		36.340 83.041	14.6	8.3	2.19	0.73	823	1,010	1,140	1,300	1,420	1,550	1,830				
190	03491544	Crockett Creek below Rogersville; 1989-99					439	665	838	1,080	1,280	1,500	2,090	0	0	11	11
		36.380 83.047	4.67	56.0	2.19	0.68	426	646	812	1,050	1,250	1,470	2,080				
191	03494714	Dry Land Creek trib nr New Market; 1986-1999					42	60	72	88	101	114	145	0	0	14	14
		36.059 83.057	0.20	259.0	2.20	0.56	39	57	70	89	106	122	166				
192	03495500	Holston River near Knoxville; 1931-40					39,200	51,900	60,300	71,000	79,000	87,100	106,000	0	0	10	10
		36.016 83.832	3,747	5.1	2.24	1.03	41,300	57,000	68,500	83,700	95,400	107,000	135,000				
193	03496000	First Creek at Mineral Springs Ave at Knoxville; 1946-63					609	905	1,110	1,390	1,600	1,820	2,370	0	0	18	18
		36.015 83.922	11.9	16.7	2.24	0.72	621	937	1,170	1,490	1,740	2,000	2,660				
194	03497000	Tennessee River at Knoxville; 1883-1941					97,000	141,000	171,000	209,000	237,000	265,000	332,000	2	75	50	56
		35.955 83.862	8,934	7.1	2.24	1.08	96,800	141,000	170,000	207,000	234,000	262,000	327,000				
195	03497300	Little River above Townsend; 1964-99					6,630	10,500	13,300	17,300	20,500	23,800	32,400	1	50	36	39
		35.664 83.711	106	101.5	2.26	0.82	6,590	10,300	13,100	16,900	19,900	23,100	31,500				
196	03498000	Little River near Walland; 1932-51, 1994					9,220	14,100	17,600	22,300	25,900	29,600	38,900	2	78	21	33
		35.763 83.850	192	59.7	2.25	0.85	9,170	14,000	17,500	22,200	25,800	29,600	39,100				
197	03498500	Little River near Maryville; 1951-99					12,300	18,600	23,200	29,300	34,100	39,100	51,500	1	125	49	55
		35.786 83.884	269	53.6	2.25	0.87	12,200	18,500	23,000	29,100	33,800	38,700	51,100				
198	03498700	Nails Creek near Knoxville; 1955-85					66	107	142	194	240	291	441	0	0	31	31
		35.880 83.780	0.36	135.6	2.24	0.58	65	105	139	193	238	289	436				
209	03518400	North Fork Citico Creek near Tellico Plains; 1961-70					668	954	1,140	1,380	1,560	1,730	2,140	0	0	10	10
		35.397 84.074	7.04	468.3	2.30	0.69	662	969	1,190	1,480	1,710	1,940	2,590				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	2	5	10	25	50	100	500	Z	H	N	N_e
							Recurrence interval, in years; Peak discharge, in cubic feet per second							Parameters for effective record			
		Hydrologic area 1—Continued															
210	03518500	Tellico River at Tellico Plains; 1926-82					7,620	11,300	13,800	17,100	19,700	22,300	28,600	1	143	57	62
		35.362 84.279	118	90.5	2.30	0.83	7,560	11,200	13,600	16,900	19,400	21,900	28,200				
211	03519500	Little Tennessee River at McGhee; 1905-44					47,400	68,200	82,100	99,600	113,000	126,000	156,000	1	78	40	45
		35.604 84.212	2,443	13.5	2.30	1.00	46,500	67,300	81,000	98,400	111,000	125,000	153,000				
212	03519600	Island Creek at Vonore; 1954-76					621	1,070	1,460	2,110	2,720	3,440	5,740	0	0	23	23
		35.594 84.249	11.2	20.3	2.30	0.71	638	1,090	1,500	2,140	2,720	3,410	5,520				
213	03519610	Baker Creek trib near Binfield; 1967-77, 1979-99					132	295	453	724	985	1,300	2,320	0	0	32	32
		35.699 84.046	2.1	63.4	2.25	0.64	136	300	457	716	966	1,250	2,100				
214	03519640	Baker Creek near Greenback; 1966-98					642	1,270	1,890	2,960	4,030	5,370	9,900	0	0	33	33
		35.672 84.108	16.0	17.4	2.25	0.73	659	1,300	1,910	2,930	3,920	5,120	9,040				
215	03519700	Bat Creek near Vonore; 1954-76					1,360	2,410	3,250	4,490	5,530	6,680	9,790	0	0	23	23
		35.643 84.253	30.7	9.1	2.25	0.76	1,380	2,420	3,240	4,380	5,340	6,400	9,370				
216	03520100	Sweetwater Creek near Loudon; 1954-82					1,330	2,090	2,690	3,570	4,310	5,140	7,430	0	0	29	29
		35.738 84.374	62.2	7.7	2.26	0.79	1,420	2,300	3,030	4,070	4,920	5,840	8,370				
225	03527800	Big War Creek at Luther; 1986-99					1,440	2,210	2,810	3,690	4,420	5,240	7,490	0	0	14	14
		36.455 83.241	22.3	38.7	2.15	0.75	1,410	2,140	2,700	3,500	4,150	4,880	6,890				
226	03528000	Clinch River above Tazewell; 1920-99					24,100	34,600	42,000	51,700	59,100	66,800	85,600	1	138	80	84
		36.425 83.398	1,474	6.6	2.19	0.97	24,100	34,700	42,100	52,100	59,700	67,500	86,800				
227	03528100	Big Sycamore Creek near Sneedville; 1935-44					318	524	669	858	1,000	1,150	1,490	0	0	10	10
		36.506 83.390	5.49	36.7	2.16	0.68	318	523	671	868	1,020	1,180	1,580				
228	03528300	Big Barren Creek near New Tazewell; 1935-44					280	465	606	801	959	1,130	1,560	0	0	10	10
		36.382 83.711	13.2	54.6	2.21	0.72	319	549	738	1,010	1,230	1,460	2,050				
229	03528390	Crooked Creek near Maynardville; 1986-99					299	521	713	1,010	1,280	1,600	2,550	0	0	14	14
		36.266 83.840	2.23	81.0	2.22	0.65	289	493	660	926	1,150	1,400	2,130				
230	03528400	White Creek near Sharps Chapel; 1935-70					117	223	311	442	553	676	1,010	0	0	36	36
		36.345 83.894	2.68	154	2.22	0.65	121	231	323	460	582	712	1,060				
236	03532000	Powell River near Arthur; 1920-82, 1997-99					15,200	21,700	26,400	32,700	37,600	42,700	55,800	1	119	66	70
		36.542 83.630	685	3.8	2.19	0.92	15,000	21,400	25,900	32,000	36,800	42,000	55,500				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2 (Peak discharge, in cubic feet per second)	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 1—Continued															
237	03533000	Clinch River below Norris Dam; 1902-36					46,600	71,200	87,900	109,000	125,000	141,000	178,000	1	109	33	40
		36.216 84.082	2,913	4.9	2.23	1.01	46,100	69,900	86,200	106,000	121,000	136,000	171,000				
238	03534000	Coal Creek at Lake City; 1955-99					3,170	4,950	6,240	7,980	9,350	10,800	14,300	1	71	45	49
		36.221 84.157	24.5	59.4	2.23	0.75	3,100	4,810	6,010	7,630	8,910	10,200	13,700				
239	03534500	Buffalo Creek at Norris; 1948-50, 1955-82					684	970	1,160	1,410	1,600	1,790	2,230	0	0	31	31
		36.185 84.059	7.82	21.1	2.23	0.70	678	965	1,160	1,420	1,620	1,820	2,340				
240	03535000	Bullrun Creek near Halls Crossroads; 1958-97					3,050	5,870	8,490	12,800	16,900	21,800	37,500	0	0	30	30
		36.114 83.988	68.5	15.2	2.23	0.80	3,040	5,740	8,130	11,900	15,200	19,200	31,400				
241	03535140	South Fork Beaver Creek at Harbison; 1967-78					250	410	521	665	775	884	1,140	0	0	12	12
		36.114 83.854	1.23	52.8	2.23	0.62	232	372	468	609	713	822	1,100				
242	03535180	Willow Fork near Halls Crossroads; 1967-99					216	432	629	947	1,240	1,590	2,640	0	0	33	33
		36.100 83.907	3.23	58.1	2.23	0.66	219	435	630	944	1,220	1,550	2,500				
243	03536450	First Creek near Oak Ridge; 1987-96					76	152	222	338	448	580	997	0	0	10	10
		35.922 84.319	0.33	184.0	2.25	0.57	70	130	179	255	325	422	668				
244	03536550	Whiteoak Creek below Melton Valley Dr near Oak Ridge; 1985-96					380	554	678	845	977	1,120	1,460	0	0	12	12
		35.919 84.317	3.28	73.8	2.25	0.66	373	551	683	885	1,040	1,200	1,630				
245	03537000	Whiteoak Creek below Oak Ridge National Laboratory; 1951-52, 1956-63					415	528	598	682	742	799	928	0	0	10	10
		35.912 84.316	3.62	72.4	2.25	0.67	405	536	628	774	880	991	1,260				
246	03537100	Melton Branch near Melton Hill near Oak Ridge; 1985-95					69	116	155	213	264	321	485	0	0	11	11
		35.916 84.298	0.52	126.0	2.25	0.59	69	117	158	226	281	343	515				
247	03538130	Caney Creek near Kingston; 1962-85					1,060	1,410	1,640	1,920	2,130	2,340	2,830	0	0	24	24
		35.865 84.385	5.55	32.6	2.25	0.68	1,010	1,340	1,550	1,820	2,030	2,240	2,770				
248	03538200	Poplar Creek near Oliver Springs; 1954-85					3,470	5,370	6,850	8,980	10,800	12,700	18,100	1	86	32	38
		36.022 84.310	55.9	19.2	2.24	0.79	3,430	5,300	6,730	8,790	10,500	12,400	17,600				
249	03538215	Indian Creek at Oliver Springs; 1962-72					1,590	2,450	3,160	4,250	5,220	6,340	9,660	1	50	10	18
		36.046 84.347	18.4	116.0	2.24	0.74	1,560	2,390	3,070	4,090	4,990	6,010	8,970				
250	03538225	Poplar Creek near Oak Ridge; 1961-89					4,160	6,140	7,640	9,770	11,500	13,400	18,600	0	0	29	29
		35.999 84.340	82.5	13.2	2.25	0.81	4,100	6,020	7,460	9,510	11,200	13,100	18,300				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 1—Continued															
251	03538250	East Fork Poplar Creek near Oak Ridge; 1961-88					1,370	2,070	2,630	3,430	4,120	4,880	6,990	0	0	28	28
		35.966 84.358	19.5	12.9	2.25	0.74	1,360	2,050	2,590	3,360	4,020	4,780	6,780				
252	03538270	Bear Creek at State Hwy 95 near Oak Ridge; 1985-99					389	611	769	979	1,140	1,310	1,710	0	0	15	15
		35.937 84.339	4.34	34.7	2.25	0.67	389	612	775	998	1,180	1,360	1,870				
253	03538275	Bear Creek near Oak Ridge; 1961-78					469	648	771	932	1,060	1,180	1,500	0	0	18	18
		35.947 84.363	7.15	32.4	2.25	0.69	475	669	813	1,010	1,170	1,330	1,730				
254	03538300	Rock Creek near Sunbright; 1955-71					744	1,040	1,250	1,520	1,720	1,940	2,450	0	0	17	17
		36.198 84.661	5.54	121.5	2.24	0.68	717	1,010	1,210	1,480	1,690	1,920	2,520				
255	03538500	Emory River near Wartburg; 1935-82					6,890	10,800	13,800	18,200	21,800	25,700	36,400	1	136	48	54
		36.113 84.615	83.2	30.6	2.25	0.81	6,750	10,500	13,400	17,400	20,700	24,300	34,200				
256	03538600	Obed River at Crossville; 1955-85, 1992-95					650	927	1,120	1,380	1,580	1,780	2,300	0	0	35	35
		35.957 85.050	12.0	12.8	2.28	0.72	659	957	1,170	1,460	1,690	1,920	2,510				
257	03538800	Obed River tributary near Crossville; 1955-70					129	201	259	346	422	506	748	0	0	16	16
		35.983 85.059	0.72	52.5	2.28	0.60	125	195	253	339	413	498	759				
258	03538900	Self Creek near Big Lick; 1968-85					271	549	808	1,240	1,640	2,130	3,670	0	0	18	18
		35.798 85.042	3.8	45.4	2.29	0.67	284	566	821	1,230	1,590	2,050	3,470				
259	03539500	Daddys Creek near Crab Orchard; 1931-58					4,830	7,630	9,590	12,100	14,100	16,000	20,700	1	57	28	33
		35.926 84.913	93.5	9.3	2.28	0.82	4,760	7,450	9,330	11,800	13,700	15,700	20,600				
260	03539600	Daddys Creek near Hebbertsburg; 1958-68					7,840	9,310	10,200	11,400	12,300	13,100	15,100	0	0	11	11
		35.998 84.823	139	8.7	2.28	0.84	7,150	8,950	10,300	12,200	13,700	15,300	19,000				
261	03539800	Obed River near Lancing; 1958-68, 1973-87					30,600	45,600	55,300	67,500	76,300	84,900	105,000	1	59	27	32
		36.081 84.671	518	17.2	2.25	0.91	28,400	41,300	49,400	59,500	67,200	75,100	94,100				
262	03540500	Emory River at Oakdale; 1929-99					47,800	76,500	97,800	127,000	150,000	174,000	237,000	1	143	71	75
		35.983 84.558	764	18.0	2.25	0.93	45,400	70,800	88,500	112,000	132,000	152,000	205,000				
263	03541100	Bitter Creek near Camp Austin; 1967-85					1,320	2,620	3,680	5,220	6,490	7,850	11,400	0	0	19	19
		36.015 84.526	5.53	190.1	2.25	0.68	1,220	2,280	3,050	4,120	5,000	5,960	8,670				
264	03541500	Whites Creek near Glen Alice; 1935-78					11,200	19,600	26,700	37,700	47,400	58,500	91,000	1	127	44	50
		35.797 84.760	108	54.0	2.27	0.82	10,900	18,700	24,900	34,200	42,200	51,300	77,300				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 1—Continued															
265	03542500	Piney River at Spring City; 1928-31, 1955-82					8,380	14,000	18,400	24,900	30,300	36,400	52,900	1	55	32	35
		35.700 84.855	95.9	55.7	2.29	0.82	8,140	13,400	17,400	23,100	27,800	32,900	47,400				
266	03543200	Ten Mile Creek near Decatur; 1954-70					2,520	4,010	5,100	6,570	7,740	8,950	12,000	0	0	17	17
		35.618 84.692	26.4	8.3	2.30	0.75	2,290	3,530	4,390	5,700	6,690	7,750	10,500				
267	03543500	Sewee Creek near Decatur; 1935-94					5,360	8,670	11,200	14,600	17,500	20,500	28,300	0	0	60	60
		35.581 84.748	117	11.5	2.30	0.83	5,330	8,560	11,000	14,400	17,100	20,000	27,600				
268	03544500	Richland Creek near Dayton; 1928-31, 1935-82					4,540	7,500	9,640	12,500	14,700	16,900	22,400	1	83	52	56
		35.505 85.022	50.2	103.0	2.32	0.78	4,490	7,370	9,410	12,100	14,200	16,300	21,500				
276	03556000	Turtletown Creek at Turtletown; 1935-71					629	876	1,030	1,230	1,370	1,510	1,820	0	0	37	37
		35.132 84.344	26.9	25.3	2.31	0.75	682	981	1,200	1,470	1,670	1,870	2,310				
277	03557000	Hiwassee River near Reliance; 1901-13, 1920-39					26,800	37,900	45,500	55,500	63,100	70,900	90,000	0	0	33	33
		35.222 84.526	1,223	13.4	2.31	0.96	26,500	37,800	45,700	55,900	63,900	72,000	91,900				
280	03559500	Ocoee River at Copperhill; 1904-10, 1912-13, 1916-17, 1920					8,030	12,800	16,000	20,100	23,100	26,000	32,600	0	0	13	13
		34.991 84.377	352	13.2	2.32	0.89	8,580	13,700	17,300	21,900	25,300	28,800	36,700				
282	03560500	Davis Mill Creek at Copperhill; 1950-67, 1969-77, 1987-94					856	1,310	1,660	2,150	2,560	2,990	4,150	0	0	35	35
		34.995 84.382	5.16	63.0	2.32	0.68	821	1,240	1,570	2,060	2,460	2,900	4,150				
283	03561000	North Potato Creek near Ducktown; 1935-70					1,580	2,750	3,760	5,360	6,820	8,510	13,600	0	0	36	36
		35.015 84.383	13.0	48.0	2.32	0.72	1,540	2,640	3,560	4,970	6,220	7,680	12,000				
284	03561500	Ocoee River at McHarg; 1918-30					10,600	14,800	17,800	22,000	25,300	28,900	38,100	1	91	13	21
		35.007 84.363	447	12.1	2.32	0.90	10,900	15,500	19,000	23,700	27,400	31,300	41,300				
285	03563000	Ocoee River at Emf; 1913-30					14,100	21,100	26,300	33,500	39,200	45,300	61,100	1	91	18	26
		35.097 84.535	524	14.0	2.32	0.91	14,100	21,300	26,500	33,500	39,100	45,000	60,100				
286	03565040	Chestuee Creek above Englewood; 1945-57					1,190	1,890	2,460	3,300	4,020	4,830	7,110	0	0	13	13
		35.440 84.447	14.8	13.5	2.30	0.73	1,150	1,800	2,310	3,070	3,710	4,440	6,490				
287	03565080	Little Chestuee Creek below Wilson Station; 1948-57					742	935	1,050	1,200	1,300	1,400	1,620	0	0	10	10
		35.427 84.446	8.24	28.8	2.30	0.70	729	969	1,140	1,390	1,570	1,790	2,260				
288	03565120	Chestuee Creek at Zion Hill; 1945-61					2,120	3,080	3,720	4,530	5,130	5,730	7,130	0	0	17	17
		35.401 84.523	37.8	9.2	2.31	0.77	2,090	3,060	3,750	4,660	5,370	6,090	7,840				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees		CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
								Peak discharge, in cubic feet per second										
		Hydrologic area 1—Continued																
289	03565160	Middle Creek below Hwy 39 near Englewood; 1945-60						1,430	2,300	2,960	3,880	4,630	5,430	7,510	0	0	16	16
		35.421	84.521	32.7	12.0	2.31	0.76	1,470	2,380	3,080	4,080	4,890	5,760	8,030				
290	03565250	Chestuee Creek at Dentville; 1945-61						3,280	4,720	5,650	6,780	7,600	8,400	10,200	0	0	17	17
		35.283	84.609	114	4.9	2.31	0.83	3,390	5,070	6,270	7,830	8,980	10,100	12,700				
291	03565300	South Chestuee Creek near Benton; 1958-87						2,090	3,590	4,810	6,610	8,140	9,860	14,600	0	0	30	30
		35.167	84.716	31.8	14.3	2.32	0.76	2,060	3,470	4,580	6,190	7,560	9,070	13,300				
292	03565500	Oostanaula Creek near Sanford; 1955-89						1,400	2,680	3,820	5,610	7,230	9,110	14,700	0	0	35	35
		35.327	84.705	57.0	7.5	2.31	0.79	1,490	2,860	4,060	5,880	7,470	9,270	14,500				
293	03566000	Hiwassee River at Charleston; 1899-1903, 1920-39						35,400	45,200	50,800	57,100	61,400	65,300	73,500	1	73	25	31
		35.288	84.752	2,298	11.5	2.31	1.00	35,800	46,600	53,500	62,000	68,100	74,000	86,600				
294	03566200	Brymer Creek near McDonald; 1955-85						818	1,250	1,610	2,150	2,630	3,180	4,790	0	0	31	31
		35.122	84.950	9.68	22.6	2.35	0.71	813	1,250	1,620	2,170	2,660	3,220	4,980				
295	03566420	Wolftever Creek near Ooltewah; 1965-99						1,440	2,360	3,160	4,390	5,510	6,810	10,700	0	0	35	35
		35.062	85.066	18.8	16.6	2.35	0.74	1,410	2,320	3,080	4,260	5,310	6,540	10,200				
301	03567500	South Chickamauga Creek near Chickamauga; 1929-78, 1981-94						12,300	17,700	21,300	25,800	29,100	32,400	40,000	0	0	64	64
		35.014	85.207	428	5.6	2.35	0.90	12,200	17,600	21,300	26,000	29,500	33,000	41,300				
302	03568000	Tennessee River at Chattanooga; 1874-1936						206,000	264,000	299,000	340,000	368,000	395,000	452,000	1	133	63	68
		35.087	85.279	21,400	4.5	2.35	1.14	203,000	260,000	294,000	333,000	360,000	387,000	444,000				
305	03570800	Little Brush Creek near Dunlap; 1958-85						1,870	2,520	2,930	3,450	3,830	4,210	5,090	0	0	28	28
		35.404	85.388	15.4	152.2	2.34	0.73	1,830	2,470	2,910	3,470	3,910	4,360	5,680				
306	03571000	Sequatchie River near Whitwell; 1921-94						11,900	17,600	21,500	26,400	30,000	33,700	42,300	1	128	74	78
		35.206	85.497	384	3.3	2.35	0.89	11,700	17,400	21,200	26,200	29,900	33,700	42,600				
307	03571500	Little Sequatchie River at Sequatchie; 1980-87, 1989-99						7,760	9,300	10,100	11,100	11,700	12,300	13,400	0	0	19	19
		35.130	85.586	116	56.8	2.35	0.83	7,510	9,200	10,200	11,500	12,400	13,300	15,300				
308	03571600	Brown Spring Branch near Sequatchie; 1955-78						100	143	171	205	230	254	309	0	0	24	24
		35.149	85.558	0.67	954.3	2.35	0.60	99	144	180	224	258	311	398				
309	03571800	Battle Creek near Monteagle; 1955-99						3,840	5,160	6,150	7,510	8,620	9,810	13,000	1	97	45	50
		35.130	85.771	50.4	136.0	2.36	0.78	3,810	5,150	6,150	7,550	8,760	9,990	13,200				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years / Peak discharge, in cubic feet per second: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 2															
18	03313600	West Fork Drakes Creek trib near Fountain Head; 1967-85					203	394	559	815	1,040	1,300	2,060	0	0	19	19
		36.559 86.457	0.95	73.9	2.31	1.04	203	379	523	733	916	1,120	1,700				
35	03407908	New River at Cordell; 1978-87					12,800	16,800	19,200	22,100	24,100	26,000	30,100	0	0	10	10
		36.336 84.452	198	7.6	2.24	1.25	11,800	15,700	18,200	21,700	25,200	28,100	35,200				
36	03408000	New River near New River; 1923-34					17,800	25,100	30,800	39,100	46,000	53,800	75,200	1	32	12	16
		36.384 84.529	314	7.0	2.23	1.28	16,900	23,600	28,500	35,200	40,800	46,800	64,100				
37	03408500	New River at New River; 1935-93, 1995-99					24,600	34,600	41,700	51,200	58,700	66,400	86,000	1	96	64	67
		36.386 84.555	382	7.1	2.23	1.28	24,000	33,600	40,300	49,100	56,000	63,200	81,400				
38	03409000	White Oak Creek at Sunbright; 1933, 1955-73, 1975					1,950	2,910	3,560	4,410	5,060	5,710	7,290	1	44	21	25
		36.244 84.671	13.5	54.5	2.24	1.14	1,920	2,840	3,470	4,290	4,920	5,560	7,130				
39	03409500	Clear Fork near Robbins; 1931-71, 1973, 1975-99					14,500	21,700	26,800	33,300	38,300	43,400	55,500	0	0	67	67
		36.388 84.630	272	12.0	2.23	1.27	14,400	21,600	26,600	33,100	38,100	43,200	55,600				
44	03414500	East Fork Obey River near Jamestown; 1944-99					16,400	25,100	31,200	39,300	45,500	51,800	67,200	1	71	56	58
		36.416 85.026	196	37.0	2.26	1.25	16,200	24,500	30,200	37,600	42,500	48,100	61,900				
45	03415000	West Fork Obey River near Alpine; 1943-71, 1980-81					7,040	10,300	12,500	15,200	17,200	19,100	23,700	0	0	31	31
		36.397 85.174	81	33.6	2.27	1.22	6,980	10,200	12,300	15,000	17,000	19,000	23,200				
46	03415500	Obey River near Byrdstown; 1920-43					16,500	25,900	32,200	40,200	46,000	51,800	64,800	0	0	24	24
		36.536 85.170	445	21.2	2.26	1.29	16,700	26,600	33,200	41,800	48,200	54,500	69,100				
47	03415700	Big Eagle Creek near Livingston; 1955-78					727	1,120	1,370	1,660	1,860	2,050	2,440	0	0	24	24
		36.449 85.274	4.77	68.5	2.27	1.10	722	1,110	1,360	1,650	1,870	2,080	2,580				
48	03416000	Wolf River near Byrdstown; 1945-99					6,950	9,900	11,800	14,000	15,600	17,200	20,600	1	71	55	57
		36.560 85.073	106	12.3	2.26	1.23	6,950	9,960	11,900	14,400	16,100	17,900	21,900				
49	03417700	Mathews Branch trib near Livingston; 1955-85					134	231	311	432	538	657	997	0	0	31	31
		36.334 85.340	0.49	161.4	2.27	1.02	131	223	295	403	496	596	891				
50	03418000	Roaring River near Hilham; 1933-75					3,370	5,420	6,850	8,700	10,100	11,500	14,800	0	0	43	43
		36.341 85.426	51.6	14.6	2.28	1.20	3,410	5,490	6,960	8,870	10,300	11,800	15,300				
51	03418070	Roaring River above Gainesboro; 1975-97					9,640	14,700	18,200	22,700	26,000	29,400	37,200	0	0	23	23
		36.351 85.546	176	16.2	2.28	1.25	9,740	14,900	18,500	23,200	26,800	30,400	39,000				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 2—Continued															
53	03420000	Calfkiller River below Sparta; 1941-71					7,610	10,900	13,200	16,400	18,900	21,600	28,300	1	43	31	33
		35.909 85.479	111	5.2	2.29	1.23	7,370	10,600	12,800	16,000	18,500	21,100	27,800				
54	03420360	Mud Creek trib no. 2 near Summitville; 1967-92					487	1,010	1,530	2,410	3,280	4,350	7,930	0	0	26	26
		35.603 86.026	2.28	35.4	2.35	1.07	478	956	1,390	2,090	2,740	3,550	5,980				
55	03420500	Barren Fork near Trousdale; 1933-83					9,760	16,100	20,700	6,900	31,700	36,700	48,800	1	82	51	55
		35.665 85.883	126	11.8	2.34	1.23	9,590	15,600	19,800	25,400	29,800	34,400	45,600				
56	03420600	Owen Branch near Centertown; 1955-89					330	888	1,460	2,470	3,440	4,600	8,220	1	88	35	41
		35.708 85.885	4.6	20.8	2.33	1.10	345	907	1,470	2,420	3,310	4,370	7,600				
57	03421000	Collins River near McMinnville; 1926-99					23,600	36,800	45,800	57,500	66,200	75,000	95,500	1	139	74	78
		35.709 85.729	640	25.9	2.34	1.31	23,600	36,700	45,700	57,300	66,000	74,700	95,200				
58	03421100	Sink trib at McMinnville; 1955-76					186	278	346	441	517	599	813	0	0	22	22
		35.696 85.780	0.47	68.0	2.34	1.02	175	258	318	403	474	551	764				
59	03421200	Charles Creek near McMinnville; 1955-99					3,250	5,410	7,290	10,300	13,000	16,300	26,300	1	100	45	50
		35.717 85.768	31.1	20.3	2.34	1.18	3,220	5,300	7,070	9,800	12,200	15,000	23,600				
60	03423000	Falling Water River near Cookeville; 1933-56					3,380	4,470	5,110	5,850	6,350	6,810	7,780	0	0	24	24
		36.077 85.521	45.9	18.2	2.29	1.19	3,430	4,690	5,520	6,570	7,340	8,080	9,690				
96	03431800	Sycamore Creek near Ashland City; 1962-87, 1989-99					7,640	12,300	15,700	20,300	23,800	27,500	36,700	0	0	37	37
		36.320 87.051	97.2	11.7	2.33	1.22	7,500	11,900	15,000	19,200	22,500	26,000	34,600				
101	03434500	Harpeth River near Kingston Springs; 1926-99					20,800	31,400	38,400	47,100	53,400	59,600	73,600	1	97	74	77
		36.122 87.099	667	2.8	2.34	1.31	20,500	30,800	37,600	46,100	52,500	58,800	73,400				
102	03434590	Jones Creek near Burns; 1984-99					1,590	2,520	3,180	4,040	4,710	5,390	7,040	0	0	16	16
		36.528 86.545	9.32	46.5	2.31	1.13	1,580	2,510	3,170	4,040	4,720	5,420	7,140				
103	03435030	Red River near Portland; 1967-86					2,340	4,190	5,770	8,220	10,400	12,900	20,200	0	0	20	20
		36.557 86.571	15.1	28.0	2.31	1.15	2,260	3,900	5,210	7,150	8,830	10,800	16,300				
105	03435500	Red River near Adams; 1921-69					14,100	21,000	26,000	32,800	38,100	43,800	58,000	1	87	49	53
		36.589 87.089	309	4.4	2.32	1.27	13,900	20,700	25,500	32,100	37,300	42,800	56,900				
106	03435770	Sulphur Fork Red River above Springfield; 1976-99					6,130	9,380	11,500	14,200	16,200	18,100	22,400	0	0	24	24
		36.513 86.862	56.6	14.7	2.31	1.20	5,860	8,830	10,800	13,100	14,900	16,700	21,100				
107	03435930	Spring Creek trib near Cedar Hill; 1986-99					96	128	146	167	181	194	220	0	0	14	14
		36.536 86.998	1.28	5.7	2.32	1.05	99	138	164	197	219	241	368				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 2—Continued															
108	03436000	Sulphur Fork Red River near Adams; 1939-91					7,080	10,700	13,400	17,200	20,200	23,400	31,800	1	89	53	57
		36.515 87.059	165	6.6	2.32	1.25	7,160	10,900	13,800	17,700	20,700	24,000	32,600				
109	03436100	Red River at Port Royal; 1962-99					21,200	30,800	37,400	46,100	52,700	59,500	76,000	1	97	38	44
		36.555 87.142	498	4.2	2.32	1.30	20,600	29,900	36,400	45,000	51,600	58,900	76,000				
110	03436690	Yellow Creek at Ellis Mills; 1981-97					4,920	8,530	11,300	15,200	18,300	21,700	30,300	0	0	17	17
		36.311 87.554	103	14.0	2.34	1.23	5,260	9,110	12,000	15,900	19,000	22,200	30,400				
111	03436700	Yellow Creek near Shiloh; 1958-80, 1982-97					5,600	9,050	11,700	15,800	18,200	21,300	29,300	0	0	39	39
		36.349 87.539	124	12.3	2.34	1.23	5,790	9,500	12,300	16,200	19,200	22,400	30,500				
314	03574700	Big Huckleberry Creek near Belvidere; 1955-74					386	691	938	1,300	1,610	1,950	2,870	0	0	20	20
		35.067 86.358	2.18	15.0	2.38	1.07	375	656	877	1,200	1,460	1,770	2,550				
323	03578000	Elk River near Pelham; 1952-87					3,940	6,400	8,360	11,200	13,700	16,400	23,900	0	0	36	36
		35.297 85.870	65.6	78.3	2.35	0.80	4,000	6,500	8,470	11,300	13,700	16,300	23,200				
324	03578500	Bradley Creek near Prairie Plains; 1952-83					2,530	3,960	4,890	6,030	6,840	7,620	9,340	0	0	32	32
		35.356 85.979	41.3	14.2	2.35	0.77	2,620	4,160	5,210	6,530	7,490	8,430	10,500				
325	03579100	Elk River near Estill Springs; 1921-51					7,050	12,500	16,600	22,300	26,900	31,700	43,800	0	0	31	31
		35.286 86.106	275	4.2	2.37	1.27	7,550	13,200	17,500	23,300	27,800	32,600	44,500				
326	03579800	Miller Cr near Cowan; 1955-78					1,580	2,330	2,820	3,440	3,900	4,350	5,400	0	0	24	24
		35.171 85.983	4.3	236	2.36	1.10	1,460	2,090	2,490	2,940	3,300	3,610	4,520				
327	03579900	Boiling Fork Creek at Cowan; 1955-78					2,030	2,940	3,620	4,570	5,350	6,200	8,450	0	0	24	24
		35.162 86.006	17	28.6	2.36	1.15	2,010	2,930	3,630	4,620	5,420	6,290	8,590				
339	03587200	Bluewater Creek trib near Leoma; 1955-83					148	212	256	314	359	405	517	0	0	29	29
		35.141 87.368	0.49	78.1	2.40	1.02	145	209	256	319	369	421	551				
340	03587500	Shoal Creek above Little Shoal Creek at Lawrenceburg; 1955-82					2,910	5,130	7,010	9,880	12,400	15,300	23,800	1	140	28	35
		35.234 87.333	27.0	19.7	2.40	1.17	2,870	4,970	6,680	9,270	11,500	14,100	21,600				
341	03588000	Shoal Creek at Lawrenceburg; 1968-91					5,220	8,720	11,600	15,800	19,400	23,500	34,900	2	97	24	37
		35.244 87.351	55.4	17.9	2.40	1.20	5,160	8,500	11,100	15,000	18,300	22,000	32,200				
342	03588400	Chisholm Creek at Westpoint; 1963-87					3,270	6,350	9,070	13,400	17,200	21,700	34,800	0	0	25	25
		35.134 87.529	43.0	15.1	2.40	1.19	3,320	6,260	8,700	12,400	15,600	19,300	30,000				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	2	5	10	25	50	100	500	Z	H	N	N_e
							Recurrence interval, in years — Peak discharge, in cubic feet per second							Parameters for effective record			
		Hydrologic area 2—Continued															
343	03588500	Shoal Creek at Iron City; 1926-94					17,300	30,200	40,300	54,900	67,100	80,300	116,000	1	93	69	72
		35.024 87.579	348	8.2	2.40	1.28	17,100	29,500	39,000	52,600	63,800	76,100	109,000				
353	03593300	Snake Creek near Adamsville; 1940-59					4,460	6,010	7,110	8,590	9,750	11,000	14,100	0	0	20	20
		35.220 88.427	49.4	12.3	2.41	1.20	4,410	6,120	7,400	9,120	10,500	11,900	15,300				
354	03593800	Horse Creek near Savannah; 1940-75					4,960	10,500	15,700	24,400	32,600	42,400	73,000	0	0	36	36
		35.177 88.209	104	13.5	2.42	1.23	5,140	10,700	15,500	22,600	29,000	36,500	59,000				
355	03594040	Turkey Creek near Savannah; 1940-59					3,070	5,870	8,170	11,600	14,500	17,700	26,300	0	0	20	20
		35.229 88.194	53.7	16.9	2.41	1.20	3,240	6,110	8,350	11,500	14,100	17,000	24,600				
356	03594058	White Oak Creek near Milledgeville; 1941-59					5,100	7,290	8,820	10,800	12,400	14,000	18,000	0	0	19	19
		35.374 88.382	46.1	10.6	2.41	1.19	4,860	6,920	8,390	10,400	12,000	13,600	17,600				
357	03594120	Middleton Creek near Milledgeville; 1940-59					3,850	5,340	6,350	7,660	8,660	9,680	12,200	0	0	20	20
		35.416 88.361	45.5	9.7	2.40	1.19	3,810	5,400	6,540	8,030	9,160	10,300	13,100				
358	03594160	Indian Creek near Cerro Gordo; 1940-59					10,500	18,900	25,000	33,000	39,000	45,000	59,000	0	0	20	20
		35.307 88.125	201	10.0	2.41	1.26	10,400	18,400	24,100	31,700	37,500	43,500	57,800				
359	03594200	Eagle Creek near Clifton Junction; 1955-83					1,520	3,290	4,820	7,120	9,090	11,200	17,000	0	0	29	29
		35.339 87.973	19.0	32.1	2.40	1.16	1,550	3,270	4,710	6,830	8,600	10,500	15,700				
360	03594300	Cypress Creek trib near Pope; 1955-83					110	165	208	269	321	377	534	0	0	29	29
		35.619 87.956	0.75	23.0	2.39	1.03	114	176	227	301	362	429	607				
361	03594400	Cypress Creek at Pope; 1955-71					1,030	1,970	2,800	4,140	5,350	6,780	11,100	0	0	17	17
		35.615 87.990	16.8	28.6	2.39	1.15	1,100	2,080	2,920	4,210	5,350	6,640	10,400				
366	03594460	Cane Creek near Chesterfield; 1941-54					1,140	2,060	2,880	4,160	5,330	6,700	10,800	0	0	14	14
		35.614 88.273	22.2	14.5	2.40	1.16	1,310	2,380	3,250	4,560	5,680	6,950	10,600				
367	03594480	Turkey Creek near Decaturville; 1954-63					1,010	1,630	2,050	2,560	2,940	3,300	4,090	0	0	10	10
		35.575 88.139	8.4	13.2	2.39	1.12	995	1,600	2,020	2,580	3,000	3,430	4,450				
368	03596000	Duck River below Manchester; 1935-87					7,220	14,000	19,800	28,900	36,900	46,100	72,700	1	86	53	57
		35.471 86.122	107	13.9	2.36	1.23	7,200	13,500	18,700	26,500	33,400	41,200	63,900				
385	03602170	West Piney River at Hwy 70 near Dickson; 1984-99					443	741	959	1,250	1,480	1,720	2,300	0	0	16	16
		36.089 87.470	2.16	58.1	2.34	1.07	433	712	912	1,190	1,410	1,640	2,230				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2 (Peak discharge, in cubic feet per second)	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 2—Continued															
386	03602500	Piney River at Vernon; 1926-99					9,890	18,000	24,000	31,700	37,500	43,300	56,600	1	103	74	77
		35.871 87.501	202	11.5	2.38	1.26	9,930	18,000	23,700	31,300	37,000	42,800	56,100				
387	03603000	Duck River above Hurricane Mills; 1926-75					38,400	56,200	68,500	84,600	97,000	110,000	140,000	1	139	51	56
		35.930 87.74	2,557	1.9	2.35	1.37	39,000	57,900	70,800	87,500	100,000	113,000	144,000				
388	03603800	Chalk Creek near Waynesboro; 1960-74					576	1,060	1,480	2,160	2,780	3,510	5,740	0	0	15	15
		35.247 87.767	4.88	45.1	2.40	1.10	583	1,060	1,460	2,170	2,740	3,390	5,270				
389	03604000	Buffalo River near Flat Woods; 1921-99					15,200	27,300	37,100	51,500	63,700	77,000	113,000	1	103	79	81
		35.496 87.833	447	5.1	2.39	1.29	15,200	26,900	36,100	49,100	59,800	71,500	103,000				
390	03604070	Coon Creek trib near Hohenwald; 1967-94					85	153	202	268	317	366	482	0	0	28	28
		35.569 87.667	0.51	200.5	2.39	1.02	87	157	209	279	333	388	520				
391	03604080	Hugh Hollow Branch near Hohenwald; 1967-69, 1971-94					187	536	899	1,520	2,120	2,820	4,940	0	0	27	27
		35.583 87.677	1.52	105.6	2.39	1.06	194	526	840	1,330	1,770	2,270	3,740				
392	03604090	Coon Creek above Chop Hollow near Hohenwald; 1967-99					548	1,300	2,000	3,120	4,100	5,230	8,380	0	0	33	33
		35.589 87.686	6.02	73.9	2.39	1.11	563	1,310	1,980	2,990	3,870	4,860	7,550				
393	03604500	Buffalo River near Lobelville; 1928-94					16,500	28,800	38,500	52,100	63,200	75,200	106,000	1	98	67	70
		35.813 87.797	707	4.1	2.38	1.31	16,800	29,100	38,400	51,300	61,700	72,600	101,000				
394	03604800	Birdsong Creek near Holladay; 1941-68					4,810	7,460	9,160	11,200	12,600	14,000	17,000	0	0	28	28
		35.899 88.127	44.9	11.7	2.37	1.19	4,560	6,900	8,490	10,500	12,000	13,500	16,900				
395	03605555	Trace Creek above Denver; 1964-99					3,530	5,410	6,810	8,760	10,300	12,000	16,500	0	0	36	36
		36.052 87.907	31.9	19.8	2.35	1.18	3,460	5,290	6,640	8,520	10,100	11,700	16,000				
		Hydrologic area 3															
61	03425500	Spring Creek near Lebanon; 1955-89					5,510	7,720	9,130	10,900	12,100	13,400	16,100	0	0	35	35
		36.180 86.241	35.3	12.5	2.31	1.56	5,410	7,540	8,910	10,600	11,800	13,100	15,900				
62	03425700	Spencer Creek near Lebanon; 1955-92					777	1,380	1,820	2,420	2,870	3,340	4,460	0	0	38	38
		36.239 86.401	3.32	64.8	2.31	1.66	778	1,370	1,780	2,330	2,690	3,130	4,200				
63	03425800	Cedar Creek trib at Green Hill; 1955-57, 1959-83					181	294	373	475	552	629	810	0	0	28	28
		36.231 86.528	0.86	82.2	2.32	1.71	185	303	388	499	584	668	842				
64	03426000	Drakes Creek above Hendersonville; 1955-85					2,610	3,840	4,650	5,640	6,360	7,060	8,660	0	0	31	31
		36.371 86.617	19.2	32.1	2.31	1.59	2,630	3,900	4,740	5,800	6,570	7,330	9,060				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	2	5	10	25	50	100	500	Z	H	N	N_e
							Recurrence interval, in years; Peak discharge, in cubic feet per second							Parameters for effective record			
		Hydrologic area 3—Continued															
65	03426800	East Fork Stones River at Woodbury; 1963-87, 1989-99					3,950	6,070	7,610	9,690	11,300	13,000	17,300	1	97	36	42
		35.828 86.077	39.1	31.9	2.32	1.56	3,990	6,140	7,700	9,800	11,400	13,200	17,400				
66	03426874	Brawleys Fork below Bradyville; 1983-99					2,390	2,680	2,830	2,990	3,080	3,170	3,340	0	0	17	17
		35.746 86.171	15.4	37.9	2.35	1.59	2,390	2,810	3,090	3,440	3,690	3,920	4,390				
67	03427000	Bradley Creek at Lascassas; 1955-74					7,330	11,000	13,300	16,300	18,500	20,700	25,600	0	0	20	20
		35.927 86.290	37.0	16.5	2.32	1.56	6,840	10,100	12,100	14,800	16,700	18,700	23,300				
68	03427500	East Fork Stones River near Lascassas; 1952-58, 1963-99					16,800	22,600	26,100	30,300	33,200	35,900	41,800	1	97	44	49
		35.918 86.334	262	6.4	2.32	1.49	16,500	22,400	26,200	30,800	34,100	37,400	44,600				
69	03427690	Bushman Creek at Pitts Lane Ford near Compton; 1989-99					1,190	1,570	1,800	2,080	2,280	2,470	2,900	0	0	11	11
		35.896 86.348	9.67	13.2	2.32	1.61	1,260	1,760	2,110	2,560	2,890	3,210	3,910				
70	03427830	Short Creek trib near Christiana; 1966-75					60	99	129	169	201	235	320	0	0	10	10
		35.677 86.363	0.17	100.3	2.36	1.78	63	105	135	175	205	236	305				
71	03428000	West Fork Stones River near Murfreesboro; 1933-46, 1948-69					12,200	19,100	24,700	32,800	39,700	47,400	68,900	1	97	36	42
		35.822 86.417	122	10.3	2.36	1.52	11,900	18,500	23,700	31,200	37,500	44,700	64,400				
72	03428500	West Fork Stones River near Smyrna; 1966-99					14,200	22,900	29,600	39,200	47,300	56,000	79,500	1	97	34	40
		35.940 86.465	194	9.0	2.32	1.50	13,900	22,200	28,500	37,400	44,700	52,700	73,700				
73	03429000	Stones River near Smyrna; 1926-99					27,800	37,900	44,300	51,800	57,200	62,400	73,800	1	74	42	46
		36.000 86.460	571	5.1	2.32	1.46	27,100	37,200	43,700	51,700	57,500	63,200	76,300				
74	03429500	Stewart Creek near Smyrna; 1953-63, 1965-81					3,160	5,390	7,090	9,460	11,400	13,400	18,600	1	34	28	30
		35.998 86.505	62.1	6.6	2.32	1.54	3,330	5,720	7,530	10,000	12,000	14,000	19,200				
75	03430100	Stones River below J. Percy Priest Dam; 1939-67					31,000	42,300	50,000	59,900	67,500	75,200	93,800	1	74	29	35
		36.158 86.620	892	4.1	2.32	1.45	30,400	41,900	49,800	60,100	68,200	76,400	96,300				
76	03430118	McCrory Creek at Ironwood Drive at Donelson; 1977-99					1,320	2,050	2,530	3,100	3,510	3,890	4,720	0	0	23	23
		36.152 86.651	7.31	39.1	2.32	1.62	1,330	2,080	2,570	3,180	3,610	3,990	4,790				
77	03430400	Mill Creek at Nolensville; 1965-99					4,690	7,070	8,510	10,200	11,300	12,300	14,300	1	64	35	39
		35.959 86.675	12.0	30.6	2.33	1.60	4,500	6,700	8,020	9,550	10,600	11,600	13,700				
78	03430600	Mill Creek at Hobson Pike near Antioch; 1965-75					4,200	6,150	7,490	9,230	10,600	11,900	15,100	0	0	11	11
		36.021 86.681	43.0	16.1	2.33	1.56	4,400	6,570	8,110	10,100	11,600	13,100	16,800				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 3—Continued															
79	03431000	Mill Creek near Antioch; 1954-99					6,100	9,200	11,600	15,000	17,800	20,900	29,300	1	100	46	51
		36.082 86.681	64.0	11.4	2.32	1.54	6,100	9,220	11,600	14,900	17,600	20,500	28,300				
80	03431040	Sevenmile Creek at Blackman Rd near Nashville; 1965-99					1,630	2,630	3,480	4,840	6,070	7,530	12,000	1	79	35	40
		36.072 86.733	12.2	41.1	2.33	1.60	1,650	2,670	3,540	4,890	6,090	7,480	11,500				
81	03431060	Mill Creek at Thompson Lane near Woodbine; 1965-99					8,530	12,400	15,100	18,500	21,000	23,800	30,000	0	0	35	35
		36.118 86.719	93.4	9.5	2.32	1.53	8,470	12,400	15,100	18,500	21,100	23,800	30,200				
82	03431062	Mill Creek trib at Glenrose Ave at Woodbine; 1977-99					352	534	658	817	936	1,060	1,340	0	0	23	23
		36.117 86.727	1.17	84.5	2.32	1.70	351	534	660	824	948	1,070	1,330				
83	03431080	Sims Branch at Elm Hill Pike near Donelson; 1965, 1967-75					650	1,190	1,630	2,270	2,800	3,380	4,920	1	20	10	13
		36.152 86.684	3.92	57.8	2.32	1.65	687	1,250	1,660	2,230	2,680	3,040	4,360				
84	03431120	W F Browns Creek at General Bates Dr at Nashville; 1965-99					961	1,540	1,920	2,370	2,690	2,990	3,610	0	0	35	35
		36.108 86.785	3.3	77.1	2.33	1.66	955	1,530	1,890	2,320	2,630	2,930	3,530				
85	03431240	E F Browns Cr at Baird-Ward Paint Co at Nashville; 1965-98					310	456	555	683	778	875	1,100	0	0	34	34
		36.109 86.767	1.58	65.6	2.32	1.69	318	485	605	758	870	981	1,210				
86	03431340	Browns Creek at Factory Street at Nashville; 1965-84, 1986-99					2,170	3,360	4,170	5,210	5,980	6,760	8,590	0	0	34	34
		36.141 86.759	13.2	42.6	2.32	1.60	2,170	3,370	4,190	5,250	6,040	6,840	8,620				
87	03431490	Pages Branch at Avondale; 1977-99					833	1,490	2,000	2,710	3,270	3,870	5,380	0	0	23	23
		36.206 86.773	2.01	101.2	2.32	1.68	800	1,370	1,780	2,320	2,760	3,220	4,190				
88	03431517	Cummings Branch at Lickton; 1976-90					331	558	721	933	1,100	1,260	1,640	0	0	15	15
		36.307 86.800	2.4	86.0	2.32	1.67	358	624	824	1,090	1,260	1,450	1,850				
89	03431520	Claylick Creek at Lickton; 1965-85					1,000	1,760	2,340	3,160	3,830	4,530	6,350	0	0	21	21
		36.301 86.810	4.13	69.3	2.32	1.65	994	1,710	2,240	2,920	3,490	3,950	5,520				
90	03431550	Earthman Fork at Whites Creek; 1965-99					1,080	1,640	2,040	2,570	2,980	3,400	4,450	0	0	35	35
		36.265 86.831	6.29	48.4	2.32	1.63	1,090	1,670	2,090	2,640	3,070	3,510	4,460				
91	03431580	Ewing Creek at Knight Road near Bordeaux; 1965-82					3,000	4,230	5,140	6,380	7,380	8,450	11,200	0	0	18	18
		36.232 86.804	13.3	46.7	2.32	1.60	2,910	4,100	4,960	6,140	7,090	8,090	10,100				
92	03431600	Whites Creek at Tucker Road near Bordeaux; 1965-75					4,660	7,070	8,790	11,100	12,900	14,700	19,300	0	0	11	11
		36.212 86.825	51.6	21.5	2.32	1.55	4,940	7,600	9,520	11,900	13,700	15,600	20,100				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	2	5	10	25	50	100	500	Z	H	N	N_e
							Recurrence interval, in years; Peak discharge, in cubic feet per second							Parameters for effective record			
		Hydrologic area 3—Continued															
93	03431650	Vaughns Gap Branch at Percy Warner Blvd at Belle Meade; 1965-75					529	797	993	1,260	1,470	1,690	2,260	0	0	11	11
		36.095 86.877	2.66	83.3	2.33	1.66	559	869	1,080	1,380	1,610	1,850	2,350				
94	03431670	Richland Creek at Fransworth Dr at Belle Meade; 1965-75					1,800	2,300	2,630	3,040	3,360	3,680	4,440	0	0	11	11
		36.120 86.857	12.4	40.6	2.33	1.60	1,850	2,500	2,980	3,620	4,090	4,560	5,550				
95	03431700	Richland Creek at Charlotte Ave at Nashville; 1965-90, 1994-99					3,150	5,100	6,480	8,290	9,670	11,100	14,400	0	0	32	32
		36.151 86.854	24.3	33.0	2.32	1.58	3,180	5,120	6,490	8,270	9,630	11,000	14,300				
97	03432350	Harpeth River at Franklin; 1975-99					8,640	12,600	15,100	18,200	20,400	22,600	27,500	0	0	25	25
		35.921 86.866	176	3.9	2.34	1.50	8,570	12,600	15,400	18,900	21,500	24,100	30,000				
98	03432500	West Harpeth River near Leipers Fork; 1955-78					5,510	11,900	17,700	27,200	35,900	46,100	76,500	0	0	24	24
		35.899 86.967	66.9	10.4	2.35	1.54	5,620	11,300	15,700	22,000	27,500	33,800	52,500				
99	03432925	L Harpeth River at Granny White Pike at Brentwood; 1978-99					2,610	4,200	5,330	6,830	7,990	9,160	12,000	0	0	22	22
		36.025 86.819	22.0	18.4	2.33	1.58	2,660	4,270	5,420	6,940	8,110	9,310	12,200				
100	03433500	Harpeth River at Bellevue; 1921-29, 1932-99					12,400	18,100	22,000	27,100	31,000	35,000	44,500	1	97	77	79
		36.054 86.928	393	3.2	2.33	1.47	12,500	18,400	22,500	27,900	32,000	36,200	46,400				
328	03581500	West Fork Mulberry Creek at Mulberry; 1954-85					7,160	10,100	12,000	14,400	16,100	17,800	21,700	0	0	32	32
		35.209 86.463	41.2	16.4	2.38	1.56	6,860	9,660	11,500	14,000	15,800	17,600	21,700				
329	03582000	Elk River above Fayetteville; 1935-52					16,300	24,400	29,800	36,500	41,500	46,500	58,000	0	0	18	18
		35.134 86.540	827	3.4	2.38	1.45	17,400	26,400	32,800	41,100	47,300	53,500	68,200				
330	03582300	Norris Creek near Fayetteville; 1954-83					6,060	9,200	11,500	14,700	17,200	19,900	26,900	0	0	30	30
		35.165 86.545	42.6	16.6	2.38	1.56	5,920	8,910	11,100	14,200	16,600	19,200	25,900				
331	03583000	Bradshaw Creek at Frankewing; 1955-68					4,670	7,080	8,910	11,500	13,600	15,900	22,000	0	0	14	14
		35.193 86.845	36.5	20.3	2.39	1.56	4,580	6,950	8,710	11,200	13,100	15,300	20,000				
332	03583200	Chicken Creek at McBurg; 1955-89					2,670	4,100	4,990	6,050	6,780	7,470	8,930	0	0	35	35
		35.184 86.813	7.66	50.6	2.39	1.62	2,570	3,890	4,700	5,670	6,300	6,970	8,480				
333	03583300	Richland Creek near Cornersville; 1962-99					5,870	8,850	10,700	12,800	14,200	15,500	18,200	0	0	38	38
		35.319 86.872	47.5	16.0	2.38	1.55	5,820	8,750	10,700	12,900	14,500	16,000	19,100				
334	03583500	Weakley Creek near Bodenham; 1956-68					1,400	2,150	2,710	3,480	4,110	4,770	6,480	0	0	13	13
		35.252 87.169	24.4	67.9	2.40	1.58	1,580	2,520	3,200	4,180	4,950	5,750	7,470				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 3—Continued															
335	03584000	Richland Creek near Pulaski; 1935-75					16,400	29,500	40,500	57,300	72,000	88,900	137,000	1	134	41	47
		35.214 87.101	366	5.3	2.39	1.48	16,200	28,500	38,200	52,400	64,400	77,700	116,000				
336	03584500	Elk River near Prospect; 1905-07, 1919-52					32,100	49,800	63,400	82,600	98,500	116,000	162,000	1	72	37	42
		35.027 86.948	1,784	2.9	2.40	1.42	32,400	50,300	63,600	82,100	97,100	113,000	155,000				
369	03597000	Garrison Fork at Fairfield, 1954-68; 1970-85					7,150	11,600	15,200	20,400	24,800	29,800	43,400	0	0	31	31
		35.566 86.283	66.3	17.7	2.36	1.54	7,100	11,500	14,900	19,800	23,900	28,400	40,900				
370	03597300	Wartrace Creek above Bell Buckle; 1966-99					987	1,740	2,340	3,180	3,880	4,630	6,620	0	0	34	34
		35.629 86.356	4.99	49.6	2.36	1.64	986	1,730	2,290	3,090	3,690	4,380	6,210				
371	03597450	Kelly Creek trib near Bell Buckle; 1967-77, 1979-82					390	504	568	640	687	731	820	0	0	15	15
		35.609 86.320	0.73	132.0	2.36	1.72	366	475	542	626	687	746	842				
372	03597500	Wartrace Creek at Bell Buckle; 1954-83					3,890	5,450	6,400	7,500	8,260	8,970	10,500	0	0	30	30
		35.588 86.339	16.3	25.7	2.36	1.59	3,780	5,290	6,210	7,310	8,090	8,830	10,500				
373	03597550	Muse Branch near Bell Buckle; 1966-75					458	698	866	1,090	1,260	1,430	1,850	0	0	10	10
		35.567 86.324	1.86	58.1	2.36	1.68	463	713	890	1,120	1,300	1,480	1,870				
374	03597590	Wartrace Creek below County Road at Wartrace; 1990-99					4,860	7,390	9,200	11,600	13,500	15,400	20,300	0	0	10	10
		35.527 86.340	35.7	14.7	2.37	1.56	4,700	7,130	8,860	11,200	13,000	15,000	19,800				
375	03598000	Duck River near Shelbyville; 1935-75					17,600	28,000	35,900	47,000	56,200	66,000	92,100	1	185	41	46
		35.480 86.499	481	6.1	2.37	1.29	17,700	28,000	35,800	46,700	55,500	64,900	89,400				
376	03598200	Weakly Creek near Rover; 1955-83					979	1,660	2,200	2,990	3,660	4,390	6,400	0	0	29	29
		35.635 86.551	9.46	11.8	2.37	1.61	1,010	1,720	2,280	3,140	3,820	4,560	6,540				
377	03599000	Big Rock Creek at Lewisburg; 1954-68, 1996-99					4,170	6,600	8,480	11,200	13,400	15,800	22,300	1	144	19	26
		35.449 86.786	24.9	19.2	2.37	1.58	4,110	6,450	8,220	10,700	12,700	14,900	20,800				
378	03599200	East Rock Creek at Farmington; 1954-89					4,780	8,220	10,700	13,800	16,200	18,500	24,000	0	0	36	36
		35.501 86.714	43.1	10.2	2.37	1.56	4,720	7,930	10,100	13,000	15,200	17,400	22,700				
379	03599400	Little Flat Creek trib near Rally Hill; 1955-75					171	281	363	479	572	671	927	0	0	21	21
		35.687 86.829	0.63	72.8	2.37	1.72	174	288	374	490	581	676	898				
380	03599500	Duck River at Columbia; 1905-08, 1921-75					25,000	34,200	40,400	48,600	54,900	61,300	77,000	1	75	59	61
		35.618 87.032	1,208	2.7	2.37	1.44	25,200	34,800	41,500	50,500	57,400	64,500	82,200				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 3—Continued															
381	03600000	Rutherford Creek near Carters Creek; 1954-69					4,530	7,160	9,030	11,500	13,400	15,400	20,300	0	0	16	16
		35.673 86.978	68.8	9.7	2.37	1.54	4,780	7,780	9,990	12,800	15,000	17,100	22,400				
382	03600088	Carters Creek at Butler Rd at Carters Creek; 1987-99					2,450	2,800	3,010	3,240	3,400	3,550	3,860	0	0	13	13
		35.717 86.996	20.1	24.5	2.36	1.58	2,500	3,050	3,430	3,910	4,250	4,560	5,220				
383	03600500	Big Bigby Creek at Sandy Hook; 1954-79, 1981-87, 1989					2,230	3,860	5,050	6,640	7,870	9,130	12,200	0	0	34	34
		35.489 87.233	17.5	40.4	2.39	1.59	2,250	3,880	5,060	6,620	7,820	9,050	11,900				
384	03602000	Duck River at Centerville; 1920-55					33,000	44,800	52,200	61,100	67,500	73,700	87,600	1	75	36	41
		35.788 87.466	2,048	2.1	2.38	1.42	33,500	46,100	54,500	64,900	72,600	80,200	99,200				
		Hydrologic area 4															
362	03594415	Beech River near Lexington; 1953-63					999	1,380	1,620	1,890	2,090	2,270	2,660	0	0	11	11
		35.659 88.417	15.9	6.9	2.39	1.32	1,050	1,520	1,830	2,200	2,460	2,710	3,180				
363	03594430	Harmon Creek near Lexington; 1953-70					685	875	983	1,100	1,180	1,250	1,400	0	0	18	18
		35.638 88.354	6.87	19.0	2.39	1.50	721	965	1,130	1,310	1,430	1,540	1,740				
364	03594435	Piney Creek at Hwy 104 near Lexington; 1953-55, 1957-70					1,140	1,820	2,300	2,940	3,440	3,940	5,180	0	0	17	17
		35.596 88.368	19.2	16.2	2.40	1.28	1,240	2,020	2,580	3,320	3,890	4,470	5,850				
365	03594445	Beech River near Chesterfield; 1941-54, 1961-65					5,300	8,840	11,300	14,600	17,100	19,500	25,300	0	0	19	19
		35.624 88.273	115	3.8	2.39	0.97	5,060	8,090	10,100	12,700	14,800	16,900	22,100				
396	03606500	Big Sandy River at Bruceton; 1930-87					4,820	8,220	10,800	14,600	17,600	20,800	29,300	1	91	58	62
		36.039 88.228	205	3.7	2.36	0.89	4,930	8,400	11,100	14,700	17,700	20,900	29,100				
405	07024300	Beaver Creek at Huntingdon; 1954-94					3,270	4,860	5,920	7,270	8,280	9,280	11,600	0	0	41	41
		35.999 88.434	55.5	6.0	2.36	1.09	3,270	4,860	5,940	7,330	8,370	9,410	11,900				
406	07024500	South Fork Obion River near Greenfield; 1930-87, 1989-93, 1997-99					7,900	12,800	16,300	20,900	24,400	28,000	36,500	0	0	66	66
		36.118 88.811	383	3.8	2.36	0.81	8,040	13,100	16,700	21,400	25,100	28,800	37,700				
407	07025000	Rutherford Fork Obion River near Bradford; 1930-57					4,860	6,530	7,540	8,700	9,510	10,300	11,900	0	0	28	28
		36.053 88.878	201	4.8	2.36	0.89	5,110	7,320	8,900	10,900	12,400	13,700	16,700				
408	07025220	Cane Creek near Martin; 1955-83					1,530	2,990	4,240	6,130	7,760	9,580	14,600	0	0	29	29
		36.327 88.851	6.79	17.0	2.35	1.50	1,510	2,920	4,080	5,800	7,280	8,920	13,500				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 4—Continued															
409	07025225	Cane Creek trib near Martin; 1955-76					233	354	436	540	616	692	867	0	0	22	22
		36.312 88.847	0.76	37.5	2.35	2.10	235	360	446	555	636	715	898				
410	07025400	North Fork Obion River near Martin; 1939-67, 1997-99					8,880	14,700	19,100	25,500	30,700	36,400	51,400	0	0	32	32
		36.406 88.856	372	4.2	2.35	0.81	8,970	14,600	18,900	24,900	29,700	34,800	48,200				
411	07025500	North Fork Obion River near Union City; 1930-70, 1989-99					10,100	16,700	21,500	27,800	32,600	37,600	49,400	1	70	52	55
		36.400 88.995	480	3.7	2.35	0.78	10,200	16,700	21,400	27,700	32,400	37,300	49,100				
412	07026000	Obion River at Obion; 1930-58, 1967-95					24,800	37,200	45,500	56,000	63,700	71,400	89,100	1	95	58	62
		36.251 89.192	1,852	2.2	2.36	0.63	24,400	36,500	44,600	55,000	62,600	70,200	87,800				
413	07026300	Obion River near Bogota; 1937-77					21,500	32,400	39,900	49,300	56,400	63,500	80,000	1	77	39	44
		36.137 89.429	2,033	1.9	2.36	0.62	21,500	32,600	40,400	50,300	57,800	65,300	82,700				
414	07026500	Reelfoot Creek near Samburg; 1951-72					5,580	9,130	11,900	15,800	19,000	22,500	31,900	0	0	22	22
		36.442 89.296	110	3.7	2.35	0.98	5,160	8,030	10,200	13,300	15,900	18,700	26,300				
415	07027500	South Fork Forked Deer River at Jackson; 1930-73, 1989-91					8,830	15,000	20,100	27,800	34,400	41,900	63,200	0	0	47	47
		35.594 88.814	495	4.3	2.40	0.77	9,080	15,500	20,600	28,100	34,400	41,200	60,000				
416	07027800	South Fork Forked Deer River near Gates; 1954-77					10,600	18,400	24,200	32,000	38,200	44,500	59,900	0	0	24	24
		35.817 89.356	932	2.7	2.39	0.70	11,500	19,800	25,900	34,000	40,200	46,600	61,900				
417	07028000	S Fork Forked Deer River at Chestnut Bluff; 1930-57					14,100	23,300	29,800	38,400	44,900	51,500	67,100	0	0	28	28
		35.862 89.348	1,003	2.6	2.38	0.69	14,400	23,500	30,000	38,500	45,000	51,500	67,000				
418	07028500	North Fork Forked Deer River at Trenton; 1951-71, 1980-84					3,950	6,080	7,600	9,640	11,200	12,900	17,000	0	0	21	21
		35.980 88.926	73.5	6.4	2.39	1.04	3,940	6,040	7,530	9,520	11,100	12,700	16,700				
419	07028600	Cain Creek trib near Trenton; 1955-57, 1959-85					510	686	803	952	1,060	1,180	1,440	0	0	30	30
		35.938 88.941	0.95	57.5	2.39	2.03	502	675	789	934	1,040	1,140	1,410				
420	07028700	Cain Creek near Trenton; 1954-85					1,450	3,070	4,600	7,120	9,480	12,300	21,000	0	0	32	32
		35.966 88.954	14.4	11.1	2.39	1.34	1,460	3,020	4,410	6,640	8,680	11,100	18,200				
421	07028900	Middle Fork Forked Deer River near Spring Creek; 1954-57, 1959-78					3,070	5,940	8,510	12,600	16,500	20,900	34,600	0	0	24	24
		35.810 88.617	88.2	5.9	2.39	1.01	3,260	6,130	8,500	12,000	15,000	18,400	28,400				
422	07028930	Turkey Creek at Medina; 1967-75, 1997-99					1,630	2,240	2,630	3,100	3,450	3,780	4,550	0	0	12	12
		35.807 88.802	4.75	34.3	2.39	1.59	1,510	2,070	2,420	2,870	3,170	3,590	4,440				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 4—Continued															
423	07028940	Turkey Creek near Medina; 1962-82					2,820	4,010	4,800	5,820	6,570	7,330	9,130	0	0	16	16
		35.794 88.810	7.87	26.9	2.39	1.47	2,620	3,680	4,390	5,340	6,060	6,710	8,530				
424	07029000	Middle Fork Forked Deer River near Alamo; 1930-73					7,970	11,900	14,800	18,900	22,200	25,800	35,100	0	0	44	44
		35.851 89.067	369	3.9	2.39	0.81	8,140	12,400	15,700	20,300	24,000	27,800	37,700				
425	07029050	Nash Creek near Tigrett; 1955-78					1,050	1,380	1,590	1,860	2,050	2,240	2,690	0	0	24	24
		35.961 89.285	7.23	12.4	2.37	1.49	1,050	1,410	1,660	1,970	2,230	2,460	2,980				
426	07029090	Lewis Creek near Dyersburg; 1955-78, 1980-83, 1985-99					2,220	3,520	4,390	5,480	6,260	7,020	8,720	0	0	43	43
		36.054 89.362	25.5	12.1	2.37	1.22	2,230	3,540	4,420	5,520	6,330	7,130	8,920				
427	07029100	North Fork Forked Deer River at Dyersburg; 1944-77					10,900	16,000	19,400	23,600	26,700	29,800	36,700	0	0	34	34
		36.030 89.387	939	2.9	2.37	0.70	11,600	17,500	21,800	27,500	31,800	36,000	45,700				
430	07029275	Hatchie River near Pocahontas; 1941-58					7,250	11,800	15,300	20,200	24,300	28,700	40,300	0	0	12	12
		35.041 88.787	310	2.4	2.44	0.83	7,290	11,700	15,000	19,400	22,900	26,500	36,000				
432	07029370	Cypress Creek at Selmer; 1954-73, 1975					2,060	3,100	3,880	4,980	5,870	6,820	9,340	0	0	21	21
		35.168 88.589	44.1	8.0	2.41	1.12	2,140	3,330	4,230	5,440	6,390	7,390	9,950				
433	07029400	Hatchie River at Pocahontas; 1942-73, 1975-77					14,900	24,300	31,400	41,300	49,400	58,000	80,500	0	0	35	35
		35.057 88.801	837	2.5	2.44	0.71	14,800	23,800	30,500	39,500	46,700	54,200	75,600				
435	07029500	Hatchie River at Bolivar; 1930-79, 1981-87, 1989-99					18,400	30,800	40,000	52,600	62,700	73,200	99,800	0	0	68	68
		35.275 88.977	1,480	1.3	2.41	0.65	18,200	30,000	38,400	49,600	58,400	67,500	90,400				
436	07030000	Hatchie River near Stanton; 1930-58					23,300	35,700	44,400	55,800	64,500	73,400	94,800	0	0	29	29
		35.523 89.349	1,975	0.9	2.40	0.63	22,000	33,400	41,200	51,500	59,300	67,200	86,400				
437	07030050	Hatchie River at Rialto; 1939-74, 1976-77					21,800	33,300	41,000	50,700	57,900	65,100	81,700	0	0	38	38
		35.637 89.604	2,308	0.9	2.39	0.61	21,400	32,500	40,100	49,600	56,800	63,900	80,600				
438	07030100	Cane Creek at Ripley; 1958-70, 1986-99					3,100	4,550	5,500	6,700	7,570	8,430	10,400	0	0	27	27
		35.756 89.551	33.9	13.1	2.39	1.17	3,090	4,570	5,570	6,840	7,790	8,730	10,900				
439	07030240	Loosahatchie River near Arlington; 1970-99					9,970	15,400	19,200	24,200	28,000	31,800	41,000	0	0	30	30
		35.310 89.640	262	6.8	2.41	0.85	9,930	15,400	19,300	24,300	28,200	32,200	41,700				
440	07030270	Clear Creek near Arlington; 1954-56, 1959-84					3,770	4,260	4,530	4,820	5,010	5,180	5,540	0	0	29	29
		35.272 89.705	60.5	8.6	2.41	1.07	3,780	4,510	5,060	5,710	6,130	6,480	7,140				

Table 4. Selected basin characteristics and flood-frequency estimates for 297 gaging stations located in Tennessee—Continued

Site no.	Station no.	Station name; period of record / latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 4—Continued															
441	07030280	Loosahatchie River at Brunswick; 1939-64, 1966-76					15,100	22,800	28,000	34,700	39,700	44,800	56,700	0	0	37	37
		35.281 89.766	505	5.9	2.40	0.77	14,700	22,200	27,400	34,100	39,300	44,400	56,900				
443	07030500	Wolf River at Rossville; 1930-71					9,740	16,200	20,600	26,000	29,900	33,700	42,100	0	0	42	42
		35.054 89.541	503	3.0	2.43	0.77	9,840	16,300	20,800	26,400	30,600	34,700	45,100				
444	07031650	Wolf River at Germantown; 1970-86, 1991-95, 1997-99					10,400	16,400	20,800	26,900	31,700	36,800	49,900	0	0	24	24
		35.116 89.801	699	2.8	2.44	0.73	10,900	17,600	22,800	29,700	35,000	42,100	56,200				
445	07031700	Wolf River at Raleigh; 1937-73					12,200	20,300	26,000	33,700	39,700	45,800	60,500	1	39	37	38
		35.202 89.923	771	2.6	2.40	0.72	12,400	20,500	26,400	34,100	40,000	46,000	62,600				
446	07032200	Nonconnah Creek near Germantown; 1970-79, 1981-84, 1986-99					6,780	9,300	10,800	12,500	13,700	14,800	17,100	0	0	28	28
		35.050 89.819	68.2	8.3	2.44	1.05	6,520	8,790	10,200	11,900	13,100	14,300	17,000				
447	07032224	Johns Creek at Raines Rd at Memphis; 1975-82, 1984-85					4,210	5,850	6,980	8,460	9,600	10,700	13,600	0	0	10	10
		35.035 89.886	19.4	15.1	2.44	1.28	3,800	5,160	6,110	7,400	8,430	9,510	12,100				

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states

[Discharge values are Bulletin 17B station estimates (Interagency Advisory Committee on Water Data, 1982); See individual state's most recent flood-frequency report for weighted discharge estimates; CDA, contributing drainage area in square miles; CS, main-channel slope in feet per mile; CF, 2-year recurrence interval climate factor; PF, physiographic-region factor; Z, number of historic peaks and high outliers; H, total historical period in years; N, systematic record length in years; N_e, effective record length in years; See appendix C for description of computing effective record length; See figure 1 for station location]

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years Peak discharge, in cubic feet per second: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 1															
1	02384000	Conasauga River near Tennga, Ga.; 1930-31, 1938, 1940-47, 1951-76, 1990 35.010 84.730	108	73.0	2.33	0.82	9,620	13,400	15,600	18,000	19,600	21,000	23,900	0	0	39	39
2	02384500	Conasauga River near Eton, Ga.; 1954-58, 1963-98 34.830 84.850	252	25.7	2.35	0.87	9,290	15,300	20,000	26,700	32,100	38,100	53,900	1	48	41	42
3	02384540	Mill Creek near Crandall, Ga.; 1985-97 34.872 84.721	8.27	404	2.34	0.70	645	1,240	1,750	2,520	3,180	3,940	6,040	0	0	13	13
4	02384600	Pinhook Creek near Eton, Ga.; 1964-97 34.830 84.820	4.28	27.5	2.34	0.67	373	562	695	870	1,000	1,140	1,480	0	0	34	34
6	02385000	Coahulla Creek near Varnell, Ga.; 1940-43, 1951-61 34.900 84.920	86.7	3.51	2.35	0.81	3,290	5,370	6,950	9,160	11,000	12,900	17,800	1	72	15	22
7	02385500	Mill Creek at Dalton, Ga.; 1945-59 34.780 84.980	40.1	15.3	2.36	0.77	2,490	3,380	3,980	4,760	5,340	5,940	7,380	0	0	15	15
8	02385800	Holly Creek near Chatsworth, Ga.; 1961-98 34.720 84.770	64.0	52.0	2.37	0.79	3,530	5,830	7,670	10,400	12,700	15,300	22,400	1	48	38	40
9	02387000	Conasauga River at Tilton, Ga.; 1938-97 34.670 84.930	687	11.0	2.37	0.92	14,000	20,200	24,300	29,200	32,800	36,300	44,100	1	157	60	65
10	03160610	Old Field Creek near West Jefferson, N.C.; 1955-71 36.370 81.530	2.38	188	2.10	0.65	103	147	180	226	263	303	408	0	0	17	17
11	03161000	South Fork New River near Jefferson, N.C.; 1925-26, 1929-41, 1943-98 36.400 81.420	205	7.48	2.09	0.85	4,840	8,610	12,300	18,800	25,400	33,800	63,400	1	83	71	73
12	03162110	Buffalo Creek at Warrensville, N.C.; 1955-70 36.450 81.510	22.9	57.0	2.09	0.75	1,160	1,930	2,630	3,770	4,850	6,150	10,300	1	31	16	19

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years / Peak discharge, in cubic feet per second: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 1—Continued															
13	03162500	North Fork New River at Crumpler, N.C.; 1909-16, 1929-58, 1966 36.520 81.390	277	22.0	2.09	0.87	5,750	10,300	14,800	22,700	31,300	42,200	82,000	1	89	39	45
115	03452000	Sandymush Creek near Alexander, N.C.; 1943-55 35.730 82.670	79.5	42.2	2.21	0.81	2,020	3,060	3,880	5,070	6,080	7,200	10,300	0	0	13	13
116	03453000	Ivy Creek near Marshall, N.C.; 1935-74, 1994-98 35.770 82.620	158	44.7	2.21	0.84	4,040	6,590	8,660	11,800	14,400	17,400	26,000	0	0	44	44
117	03453500	French Broad River at Marshall, N.C.; 1943-98 35.790 82.660	1,332	4.71	2.21	0.96	20,100	30,500	37,600	46,700	53,600	60,600	77,100	1	208	56	59
118	03453880	Brush Creek at Walnut, N.C.; 1954-59, 1961-71 35.840 82.740	7.76	146	2.20	0.70	636	946	1,160	1,440	1,660	1,880	2,420	0	0	17	17
119	03454000	Big Laurel Creek near Stackhouse, N.C.; 1935-73 35.920 82.760	126	68.9	2.20	0.83	3,360	5,410	7,010	9,310	11,200	13,300	19,000	0	0	39	39
120	03454500	French Broad River at Hot Springs, N.C.; 1935-49 35.890 82.820	1,563	6.30	2.20	0.97	23,000	36,700	47,800	64,500	79,100	95,600	143,000	1	159	15	22
122	03459000	Jonathan Creek near Cove Creek, N.C.; 1931-73 35.620 83.010	65.3	64.6	2.21	0.80	1,950	2,720	3,230	3,890	4,390	4,900	6,110	0	0	43	43
123	03459500	Pigeon River near Hepco, N.C.; 1928-98 35.640 82.990	350	26.7	2.21	0.88	11,300	17,200	21,500	27,500	32,300	37,500	50,800	2	97	71	76
124	03460000	Cataloochee Creek near Cataloochee, N.C.; 1935-52, 1963-98 35.670 83.070	49.2	162	2.21	0.78	1,950	2,960	3,640	4,490	5,120	5,750	7,190	0	0	54	54
128	03461910	North Toe River at Newland, N.C.; 1955-73 36.080 81.930	9.21	138	2.16	0.70	367	429	468	516	551	585	664	0	0	19	19
129	03462000	North Toe River at Altapass, N.C.; 1935-58 35.900 82.030	104	34.7	2.17	0.82	2,760	4,490	6,000	8,390	10,600	13,200	21,200	1	42	24	28
130	03463300	South Toe River near Celo, N.C.; 1958-98 35.830 82.180	43.4	133	2.18	0.78	5,350	9,310	12,800	18,200	23,100	28,800	46,200	1	59	41	44
131	03463500	South Toe River at Newdale, N.C.; 1935-52 35.910 82.190	59.9	36.2	2.17	0.79	5,480	9,480	13,000	18,700	23,900	30,000	49,000	1	35	18	22

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	2	5	10	25	50	100	500	Z	H	N	N_e
							Recurrence interval, in years — Peak discharge, in cubic feet per second							Parameters for effective record			
		Hydrologic area 1—Continued															
132	03463910	Phipps Creek near Burnsville, N.C.; 1957-66, 1970-73 35.910 82.370	1.61	483	2.17	0.63	144	223	284	373	447	529	752	0	0	14	14
133	03464000	Cane River near Sioux, N.C.; 1934-73 36.010 82.330	157	30.6	2.17	0.84	4,730	8,420	11,800	17,400	22,600	29,000	49,600	1	81	40	45
134	03464500	Nolichucky River at Poplar, N.C.; 1926-55 36.070 82.340	608	29.0	2.17	0.91	15,400	24,800	32,600	44,500	55,000	67,000	102,000	1	40	30	32
155	03471500	S F Holston River at Riverside near Chilhowie, Va.; 1908-09, 1921-31, 1942-99 36.760 81.630	76.1	32.0	2.08	0.80	1,960	3,080	3,930	5,150	6,150	7,250	10,200	1	92	71	73
156	03472500	Beaverdam Creek at Damascus, Va.; 1948-95 36.630 81.790	56.0	56.9	2.09	0.79	2,100	3,130	3,880	4,890	5,680	6,520	8,630	0	0	48	48
157	03473000	S F Holston River near Damascus, Va.; 1932-99 36.650 81.840	301	23.2	2.09	0.88	6,580	9,710	12,100	15,600	18,600	21,800	30,800	1	133	68	72
158	03473500	M F Holston River at Groseclose, Va.; 1948-58, 1960-94 36.890 81.350	7.39	46.2	2.06	0.69	171	299	401	550	675	812	1,180	0	0	46	46
159	03474000	M F Holston River at Sevenmile Ford, Va.; 1942-99 36.810 81.620	132	24.3	2.07	0.83	3,330	5,320	6,890	9,170	11,100	13,200	19,100	0	0	58	58
160	03474500	M F Holston River at Chilhowie, Va.; 1907-09, 1921-31 36.800 81.680	155	21.5	2.08	0.84	3,840	6,250	8,230	11,200	13,800	16,800	25,400	0	0	14	14
161	03475000	M F Holston River near Meadowview, Va.; 1932-53, 1957, 1972, 1975, 1977-99 36.710 81.820	211	14.6	2.08	0.86	4,120	6,190	7,680	9,690	11,300	12,900	17,100	0	0	48	48
163	03478400	Beaver Creek at Bristol, Va.; 1958-99 36.630 82.130	27.7	40.0	2.10	0.75	372	630	844	1,170	1,450	1,780	2,710	0	0	42	42
164	03478910	Cove Creek at Sherwood, N.C.; 1955-72 36.260 81.780	23.1	116	2.15	0.75	1,040	2,030	2,960	4,520	6,010	7,830	13,700	1	57	18	24
165	03479000	Watauga River near Sugar Grove, N.C.; 1941-98 36.240 81.820	90.8	51.3	2.15	0.81	5,900	10,500	14,500	20,800	26,600	33,500	54,400	1	83	59	62
168	03481000	Elk River near Elk Park, N.C.; 1935-55 36.180 81.960	42.1	103	2.16	0.77	2,190	3,880	5,500	8,310	11,100	14,600	26,800	1	40	21	25
177	03487800	Lick Creek near Chatham Hill, Va.; 1966-99 36.960 81.470	25.5	39.1	2.06	0.75	1,260	1,760	2,090	2,490	2,780	3,070	3,720	0	0	34	34

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 1—Continued															
178	03488000	N F Holston River near Saltville, Va.; 1907-08, 1921-99 36.900 81.750	222	21.7	2.07	0.86	6,060	9,000	11,200	14,200	16,600	19,100	25,700	1	138	81	85
179	03488450	Brumley Creek at Brumley Gap, Va.; 1980-98 36.792 82.019	21.1	202	2.09	0.74	675	895	1,040	1,230	1,360	1,500	1,830	0	0	19	19
180	03488500	N F Holston River at Holston, Va.; 1952-77 36.770 82.070	402	17.7	2.09	0.89	10,100	15,400	19,600	25,500	30,500	36,000	50,900	0	0	26	26
181	03489800	Cove Creek near Shelleys, Va.; 1951-99 36.650 82.350	17.3	68.3	2.10	0.73	844	1,180	1,400	1,670	1,880	2,090	2,570	0	0	49	49
182	03489900	Big Moccasin Creek near Gate City, Va.; 1953-77 36.650 82.550	79.6	16.7	2.13	0.81	2,400	3,390	4,090	5,020	5,740	6,490	8,370	0	0	25	25
183	03490000	N F Holston River near Gate City, Va.; 1932-99 36.610 82.570	672	9.69	2.13	0.92	14,300	20,800	25,500	32,000	37,100	42,600	56,800	1	138	68	73
199	03503000	Little Tennessee River at Needmore, N.C.; 1945-82, 1984-98 35.340 83.530	436	10.0	2.27	0.90	9,800	13,700	16,100	19,100	21,100	23,100	27,500	0	0	53	53
200	03504000	Nantahala River near Rainbow Springs, N.C.; 1940-98 35.130 83.620	51.9	30.7	2.28	0.78	2,530	3,460	4,080	4,870	5,460	6,050	7,460	0	0	59	59
201	03506500	Nantahala River at Almond, N.C.; 1922-26, 1928-32, 1934-42 35.380 83.570	174	45.0	2.27	0.85	5,140	7,340	8,890	11,000	12,600	14,200	18,400	0	0	17	17
202	03507000	Little Tennessee River at Judson, N.C.; 1897-44 35.408 83.557	664	8.43	2.27	0.92	13,600	21,400	27,400	35,800	42,800	50,300	70,400	0	0	48	48
203	03511000	Oconaluftee River at Cherokee, N.C.; 1922-49 35.480 83.320	131	145	2.27	0.83	5,450	7,320	8,480	9,870	10,800	11,800	13,900	1	36	28	30
204	03512000	Oconaluftee River at Birdtown, N.C.; 1949-98 35.460 83.350	184	95.0	2.27	0.85	8,890	11,600	13,300	15,300	16,800	18,200	21,400	0	0	50	50
205	03513000	Tuckasegee River at Bryson City, N.C.; 1898-40 35.430 83.450	655	26.0	2.27	0.92	17,400	27,700	35,300	45,800	54,200	63,000	85,400	0	0	43	43
206	03513500	Noland Creek near Bryson City, N.C.; 1936-71 35.480 83.650	13.8	368	2.26	0.72	947	1,290	1,530	1,830	2,070	2,300	2,880	0	0	36	36

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years / Peak discharge, in cubic feet per second: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 1—Continued															
207	03514000	Hazel Creek at Proctor, N.C.; 1943-52 35.480 83.720	44.4	166	2.26	0.78	2,320	3,640	4,650	6,050	7,200	8,420	11,700	0	0	10	10
208	03516000	Snowbird Creek near Robbinsville, N.C.; 1943-52 35.310 83.860	42.0	138	2.35	0.77	2,890	4,120	5,040	6,330	7,390	8,520	11,500	0	0	10	10
217	03521500	Clinch River at Richlands, Va.; 1946-92, 1994-99 37.090 81.780	139	23.0	2.07	0.83	3,540	5,140	6,270	7,770	8,920	10,100	13,100	1	99	53	58
218	03523000	Big Cedar Creek near Lebanon, Va.; 1953-77, 1991-94 36.910 82.040	51.5	39.6	2.08	0.78	2,340	2,870	3,160	3,490	3,700	3,900	4,300	0	0	29	29
219	03524000	Clinch River at Cleveland, Va.; 1921-99 36.940 82.150	528	14.9	2.08	0.91	10,300	15,200	18,800	23,800	27,800	32,100	43,300	1	138	79	83
220	03524500	Guest River at Coeburn, Va.; 1950-99 36.930 82.460	87.3	13.1	2.11	0.81	2,690	4,240	5,440	7,160	8,600	10,200	14,400	1	138	50	56
221	03524900	Stony Creek at Ka, Va.; 1981-99 36.816 82.617	30.9	205	2.12	0.76	3,240	5,360	7,070	9,610	11,800	14,200	21,000	0	0	19	19
222	03525000	Stony Creek at Fort Blackmore, Va.; 1950-77 36.770 82.580	41.4	178	2.13	0.77	2,950	5,330	7,310	10,300	12,800	15,700	23,600	1	60	28	33
223	03526000	Copper Creek near Gate City, Va.; 1948-91, 1993-99 36.670 82.570	106	16.1	2.13	0.82	2,780	4,220	5,310	6,850	8,110	9,470	13,100	0	0	51	51
224	03527000	Clinch River at Speers Ferry, Va.; 1921-95 36.650 82.750	1,126	9.36	2.13	0.95	20,500	30,400	37,400	46,900	54,200	62,000	81,300	1	134	75	79
231	03529500	Powell River at Big Stone Gap, Va.; 1945-77, 1979-94 36.870 82.780	112	41.2	2.13	0.82	4,960	7,680	9,800	12,900	15,400	18,300	26,000	1	77	49	53
232	03530000	S F Powell River at Big Stone Gap, Va.; 1945-47, 1951-75, 1977 36.860 82.770	40.0	156	2.13	0.77	2,310	3,350	4,100	5,090	5,870	6,690	8,740	1	60	29	34
233	03530500	N F Powell River at Pennington Gap, Va.; 1945-77, 1979-95 36.770 83.030	70.0	59.4	2.14	0.80	3,890	5,980	7,650	10,100	12,200	14,500	21,100	1	78	50	54
234	03531000	Powell River near Pennington Gap, Va.; 1921-31 36.734 82.999	290	21.5	2.14	0.87	13,200	18,800	22,900	28,600	33,100	37,900	50,200	0	0	11	11
235	03531500	Powell River near Jonesville, Va.; 1932-98 36.660 83.090	319	16.8	2.14	0.88	11,200	16,900	21,300	27,500	32,700	38,300	53,600	1	132	67	71

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2 Peak discharge, in cubic feet per second	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 1—Continued															
269	03544947	Brier Creek near Hiawassee, Ga.; 1985-98 34.847 83.709	1.74	600	2.30	0.63	201	475	746	1,210	1,660	2,190	3,890	0	0	14	14
270	03545000	Hiwassee River at Presley, Ga.; 1942-98 34.900 83.720	45.5	60.9	2.30	0.78	1,970	3,110	3,940	5,050	5,930	6,830	9,090	0	0	57	57
271	03546000	Shooting Creek near Hayesville, N.C.; 1923, 1943-45, 1947-55 35.020 83.710	37.6	234	2.29	0.77	1,410	2,390	3,230	4,570	5,780	7,210	11,500	0	0	13	13
272	03548500	Hiwassee River above Murphy, N.C.; 1897-1917, 1919-41 35.080 84.000	406	92.0	2.31	0.89	11,500	15,800	18,600	21,900	24,300	26,600	31,700	0	0	44	44
273	03550000	Valley River at Tomotla, N.C.; 1905-09, 1915-17, 1919-98 35.140 83.980	104	60.3	2.31	0.82	4,160	6,490	8,310	11,000	13,200	15,700	22,500	1	101	88	90
274	03550500	Nottely River near Blairsville, Ga.; 1943-98 34.840 83.940	74.8	58.7	2.32	0.80	3,450	5,080	6,170	7,550	8,580	9,600	12,000	1	91	56	60
275	03554000	Nottely River near Ranger, N.C.; 1901-06, 1915-17, 1919-41 35.030 84.120	272	14.3	2.31	0.87	5,980	8,970	11,100	14,100	16,400	18,900	25,100	0	0	32	32
278	03558000	Toccoa River near Dial, Ga.; 1913-96 34.790 84.240	177	30.4	2.32	0.85	4,530	6,990	8,780	11,200	13,100	15,100	20,000	1	156	84	88
279	03559000	Toccoa River near Blue Ridge, Ga.; 1901-02, 1914-30 34.890 84.290	233	15.7	2.32	0.86	5,860	10,300	13,800	18,800	23,000	27,500	39,600	1	151	19	23
281	03560000	Fightingtown Creek at McCaysville, Ga.; 1943-71, 1973 34.980 84.390	70.9	29.3	2.32	0.80	2,460	3,780	4,850	6,470	7,880	9,490	14,100	1	48	30	33
296	03566660	Sugar Creek near Ringgold, Ga.; 1965-74 34.970 85.020	4.44	19.6	2.35	0.67	575	949	1,260	1,750	2,170	2,670	4,120	0	0	10	10
297	03566685	Little Chickamauga Creek near Ringgold, Ga.; 1964-75 34.840 85.140	35.5	12.3	2.36	0.77	1,910	3,490	4,820	6,860	8,640	10,700	16,500	0	0	12	12
298	03566687	Little Chickamauga Creek trib near Ringgold, Ga.; 1965-74 34.860 85.140	3.36	41.7	2.36	0.66	365	663	931	1,370	1,780	2,270	3,810	0	0	10	10
299	03566700	South Chickamauga Creek at Ringgold, Ga.; 1949-65 34.920 85.130	169	6.38	2.35	0.84	9,090	13,600	17,000	21,700	25,500	29,500	40,100	1	40	17	22

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years / Peak discharge, in cubic feet per second: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
		Hydrologic area 1—Continued															
300	03567200	West Chickamauga Creek near Kensington, Ga.; 1950-76 34.800 85.350	73.0	14.7	2.39	0.80	4,210	6,850	8,960	12,100	14,700	17,000	25,700	1	43	27	30
303	03568500	Chattanooga Creek near Flintstone, Ga.; 1951-74 34.970 85.330	50.6	14.9	2.35	0.78	2,890	4,330	5,380	6,810	7,950	9,150	12,200	0	0	24	24
304	03568933	Lookout Creek near New England, Ga.; 1980-98 34.898 85.463	149	7.62	2.36	0.84	6,760	11,300	14,900	20,200	24,600	29,600	43,100	0	0	19	19
310	03572110	Crow Creek at Bass, Ala.; 1975-96 34.934 85.918	131	31.8	2.38	0.83	9,070	12,500	14,900	18,000	20,300	22,700	28,600	0	0	22	22
311	03572900	Town Creek near Geraldine, Ala.; 1957-80 34.378 85.990	141	10.9	2.42	0.83	8,700	12,500	15,000	18,000	20,300	22,400	27,400	1	62	24	32
		Hydrologic area 2															
14	03312500	Barren River near Pageville, Ky.; 1940-63 36.852 86.077	514	4.30	2.26	1.30	19,100	33,200	44,700	61,800	76,500	92,800	138,000	0	0	24	24
15	03312795	Little Beaver Creek near Glasgow, Ky.; 1976-79, 1981-86 37.010 86.017	0.89	186	2.26	1.04	163	247	307	388	452	519	687	0	0	10	10
16	03313000	Barren River near Finney, Ky.; 1942-50, 1961-62 36.895 86.134	865	3.70	2.26	1.32	31,600	50,500	64,300	82,300	97,400	113,000	150,000	0	0	11	11
17	03313500	West Bays Fork at Scottsville, Ky.; 1951-83 36.748 86.196	7.47	47.2	2.27	1.12	1,430	2,010	2,451	3,070	3,590	4,150	5,680	1	47	33	36
19	03313700	West Fork Drakes Creek near Franklin, Ky.; 1969-98 36.719 86.546	91.0	9.06	2.30	1.22	6,100	9,180	11,400	14,300	16,600	19,000	25,000	1	62	30	35
20	03313800	Lick Creek near Franklin, Ky.; 1959-83 36.790 86.490	7.80	19.5	2.27	1.12	2,050	3,550	4,720	6,380	7,750	9,220	13,100	1	47	25	29
21	03314000	Drakes Creek near Alvaton, Ky.; 1940-82 36.895 86.381	358	6.60	2.27	1.28	16,300	27,500	37,000	51,900	65,300	80,900	127,000	1	46	43	44
22	03314500	Barren River at Bowling Green, Ky.; 1938-62 37.001 86.431	1,359	2.60	2.27	1.34	29,900	45,700	57,600	74,400	88,200	103,000	142,000	1	52	25	30
23	03316000	Mud River near Lewisburg, Ky.; 1940-83 37.004 86.907	80.8	7.10	2.28	1.21	5,230	7,300	8,700	10,500	11,900	13,300	16,600	0	0	44	44

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 2—Continued															
24	03400500	Poor Fork at Cumberland, Ky.; 1940-91 36.974 82.933	82.3	28.1	2.13	1.21	3,470	5,620	7,200	9,340	11,000	12,800	17,200	0	0	52	52
25	03400700	Clover Fork at Evarts, Ky.; 1960-78, 1981-86 36.866 83.194	82.4	42.4	2.14	1.21	5,690	9,640	12,700	17,200	21,000	25,000	36,000	0	0	25	25
26	03401000	Cumberland River near Harlan, Ky.; 1940-98 36.847 83.356	374	13.0	2.14	1.28	16,700	26,100	33,000	42,300	49,700	57,500	77,100	0	0	59	59
27	03401500	Yellow Creek bypass at Middlesboro, Ky.; 1941-83 36.631 83.729	35.3	123	2.18	1.18	3,130	4,670	5,860	7,340	8,590	9,900	13,300	0	0	42	42
28	03402000	Yellow Creek near Middlesboro, Ky.; 1941-98 36.668 83.689	60.6	74.4	2.18	1.20	4,170	6,320	7,910	10,100	11,700	13,800	18,700	0	0	58	58
29	03402020	Shillalah Creek near Page, Ky.; 1976-86 36.665 83.590	2.96	342	2.18	1.08	516	723	852	1,010	1,110	1,220	1,450	0	0	11	11
30	03403000	Cumberland River near Pineville, Ky.; 1939-75, 1977, 1979-91 36.813 83.766	809	8.20	2.17	1.32	27,600	39,800	48,200	59,300	67,900	76,700	98,200	1	63	51	52
31	03403910	Clear Fork at Saxton, Ky.; 1969-90, 1996-98 36.634 84.112	331	15.4	2.18	1.28	11,300	16,600	20,200	24,800	28,100	31,500	39,300	0	0	25	25
32	03404900	Lynn Camp Creek at Corbin, Ky.; 1957-98 36.951 84.094	53.8	10.3	2.18	1.20	2,270	3,530	4,540	6,020	7,280	8,690	12,600	0	0	42	42
33	03405000	Laurel River at Corbin, Ky.; 1923-24, 1943-73 36.969 84.127	201	5.80	2.18	1.25	6,620	10,300	13,000	16,600	19,500	22,400	29,700	0	0	33	33
34	03406000	Wood Creek near London, Ky.; 1954-86 37.161 84.112	3.89	49.2	2.17	1.09	305	468	570	688	769	843	999	0	0	33	33
40	03410500	South Fork Cumberland River near Stearns, Ky.; 1943-98 36.627 84.533	954	9.00	2.20	1.32	44,600	62,000	73,100	86,600	96,400	106,000	127,000	0	0	56	56
41	03411000	South Fork Cumberland River at Nevelsville, Ky.; 1916-31, 1933-50 36.840 84.583	1,271	8.00	2.19	1.34	49,800	70,600	84,300	101,000	114,000	126,000	155,000	1	59	34	38
42	03413200	Beaver Creek near Monticello, Ky.; 1969-83, 1991-98 36.797 84.896	43.4	20.2	2.22	1.19	3,150	5,520	7,400	10,100	12,300	14,800	21,300	0	0	23	23

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	2	5	10	25	50	100	500	Z	H	N	N_e
							Recurrence interval, in years — Peak discharge, in cubic feet per second							Parameters for effective record			
		Hydrologic area 2—Continued															
43	03414102	Bear Creek near Burksville, Ky.; 1976-86 36.771 85.275	3.52	49.4	2.23	1.09	540	988	1,350	1,890	2,340	2,830	4,170	0	0	11	11
104	03435140	Whippoorwill Creek near Claymour, Ky.; 1973-91 36.875 87.089	20.8	13.8	2.29	1.16	3,230	4,910	6,150	7,860	9,230	10,700	14,400	0	0	19	19
112	03437490	South Fork Little River trib near Hopkinsville, Ky.; 1977-86 36.858 87.428	1.41	27.1	2.29	1.05	260	431	554	718	844	972	1,280	0	0	10	10
113	03437500	South Fork Little River at Hopkinsville, Ky.; 1950-83 36.839 87.481	35.3	7.10	2.29	1.18	2,770	4,390	5,620	7,360	8,780	10,300	14,400	0	0	34	34
114	03438000	Little River near Cadiz, Ky.; 1940-98 36.778 87.722	150	3.60	2.33	1.24	6,550	10,500	13,800	18,800	23,100	28,000	42,200	1	60	59	60
312	03573000	Short Creek near Albertville, Ala.; 1946-58, 1961-64, 1966-69 34.301 86.181	91.6	8.10	2.44	1.22	6,370	10,100	13,100	17,500	21,300	25,500	37,300	1	28	21	23
313	03574500	Paint Rock River near Woodville, Ala.; 1936-99 34.624 86.306	320	14.8	2.43	1.27	16,700	26,400	33,400	42,800	50,200	57,800	76,700	1	133	64	69
315	03575000	Flint River near Chase, Ala.; 1929-81, 1983-94 34.819 86.481	342	8.00	2.42	1.28	16,100	30,400	41,700	58,000	71,400	85,800	123,000	1	133	65	70
316	03575700	Aldridge Creek near Farley, Ala.; 1961-64, 1985-99 34.624 86.541	14.1	19.7	2.43	1.14	1,920	2,990	3,780	4,840	5,680	6,560	8,790	1	39	19	22
317	03575830	Indian Creek near Madison, Ala.; 1959-99 34.697 86.700	49.0	15.2	2.43	1.19	2,790	4,820	6,460	8,890	11,000	13,300	19,600	1	133	40	46
318	03576148	Cotaco Creek at Florette, Ala.; 1966-80 34.414 86.688	136	3.10	2.44	1.24	5,730	9,340	12,100	16,000	19,200	22,700	31,800	1	18	15	16
319	03576250	Limestone Creek near Athens, Ala.; 1940-85, 1991, 1995-99 34.752 86.823	119	10.6	2.43	1.23	7,150	12,300	16,400	22,400	27,400	33,000	48,400	1	133	51	56
320	03576400	Piney Creek near Athens, Ala.; 1958-70 34.803 86.883	55.8	11.4	2.43	1.20	3,430	5,160	6,530	8,520	10,200	12,100	17,400	1	19	13	15
321	03576500	Flint Creek near Falkville, Ala.; 1953-73, 1991, 1993-99 34.373 86.934	86.3	19.2	2.45	1.22	5,960	8,690	10,500	12,600	14,200	15,700	19,100	0	0	28	28
322	03577000	West Flint Creek near Oakville, Ala.; 1941-58, 1960-69, 1991, 1993-98 34.476 87.142	87.6	2.80	2.44	1.22	3,280	5,060	6,310	7,960	9,230	10,500	13,700	0	0	35	35

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 2—Continued															
338	03586500	Big Nance Creek at Courtland, Ala.; 1936-40, 1946-81, 1988-99					6,330	9,470	11,600	14,300	16,400	18,400	23,200	1	133	53	58
		34.670 87.317	166	5.40	2.44	1.25											
344	03590000	Cypress Creek near Florence, Ala.; 1935-53					9,990	16,800	21,500	27,500	32,000	36,400	46,300	1	89	19	27
		34.808 87.700	209	19.8	2.44	1.26											
345	03591800	Bear Creek near Hackleburg, Ala.; 1957-79, 1981					7,570	11,800	14,700	18,400	21,100	23,800	30,100	1	114	24	31
		34.284 87.774	143	6.10	2.46	1.24											
346	03592000	Bear Creek near Red Bay, Ala.; 1914-20, 1959-81					4,990	8,460	11,500	16,200	20,500	25,500	40,800	1	114	30	37
		34.444 88.115	263	4.00	2.46	1.27											
347	03592200	Cedar Creek near Pleasant Site, Ala.; 1958-77					7,230	9,980	11,800	14,000	15,600	17,200	20,800	1	111	20	28
		34.549 88.019	189	4.80	2.45	1.25											
348	03592300	Little Bear Creek near Halltown, Ala.; 1951-77					3,620	5,500	6,830	8,590	9,960	11,400	14,800	1	111	27	34
		34.489 88.035	78.2	10.6	2.46	1.21											
349	03592500	Bear Creek at Bishop, Ala.; 1927-32, 1934-79					16,000	23,700	29,100	36,100	41,500	47,000	60,500	1	113	52	57
		34.656 88.122	667	3.80	2.45	1.31											
350	03592718	Little Yellow Creek East near Burnsville, Miss.; 1974-98					1,740	3,080	4,080	5,450	6,530	7,640	10,400	0	0	25	25
		34.834 88.285	24.7	13.9	2.44	1.16											
351	03592800	Yellow Creek near Doskie, Miss.; 1938-61, 1973-77					4,790	8,820	12,200	17,100	21,400	26,100	39,100	1	47	29	32
		34.900 88.290	143	5.50	2.44	1.24											
352	03593010	Chambers Creek opposite Kendrick, Miss.; 1940-61					2,320	4,610	6,470	9,160	11,400	13,700	19,900	0	0	22	22
		34.980 88.380	21.1	11.8	2.44	1.16											
		Hydrologic area 3															
337	03585300	Sugar Creek near Good Springs, Ala.; 1958-69					9,760	16,000	20,800	27,700	33,400	39,600	56,000	1	15	12	13
		34.944 87.156	152	11.5	2.42	1.51											
		Hydrologic area 4															
397	03610000	Clarks River at Murray, Ky.; 1952-82					5,810	10,500	14,600	21,000	26,800	33,400	53,000	0	0	31	31
		36.593 88.300	89.7	8.59	2.34	1.01											
398	03610200	Clarks River at Almo, Ky.; 1983-99					9,240	14,100	17,700	22,500	26,300	30,300	40,400	0	0	16	16
		36.692 88.274	134	7.45	2.34	0.95											

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	2	5	10	25	50	100	500	Z	H	N	N_e
							Recurrence interval, in years; Peak discharge, in cubic feet per second							Parameters for effective record			
		Hydrologic area 4—Continued															
399	03610500	Clarks River near Benton, Ky.; 1939-82 36.873 88.347	227	6.20	2.31	0.87	9,760	16,600	21,800	29,100	34,900	41,000	56,700	0	0	44	44
400	03610545	West Fork Clarks River near Brewers, Ky.; 1969-83, 1989-94 36.780 88.467	68.7	11.6	2.34	1.05	5,160	7,740	9,370	11,300	12,700	14,000	16,900	0	0	21	21
401	07022500	Perry Creek near Mayfield, Ky.; 1953-65, 1968-87 36.679 88.632	1.72	28.1	2.34	1.85	683	1,080	1,360	1,760	2,080	2,420	3,280	0	0	33	33
402	07023000	Mayfield Creek at Lovelaceville, Ky.; 1939-77 36.952 88.825	212	5.30	2.31	0.88	6,860	9,860	12,000	15,000	17,400	19,900	26,300	1	41	39	40
403	07023500	Obion Creek at Pryorsburg, Ky.; 1952-83 36.686 88.726	36.8	10.9	2.34	1.16	3,810	4,960	5,640	6,440	7,000	7,520	8,650	0	0	32	32
404	07024000	Bayou de Chien near Clinton, Ky.; 1940-82, 1985-98 36.629 88.964	68.7	8.00	2.34	1.05	3,160	4,680	5,680	6,910	7,810	8,680	10,700	0	0	57	57
428	07029252	Pool Branch near Ripley, Miss.; 1965-75 34.712 88.788	1.24	36.0	2.45	1.95	338	458	532	621	684	744	877	0	0	11	11
429	07029270	Hatchie River near Walnut, Miss.; 1947-80 34.944 88.786	272	4.40	2.44	0.85	7,150	12,000	15,600	20,600	24,500	28,700	39,200	0	0	34	34
431	07029300	Tuscumbia River Canal near Corinth, Miss.; 1950-79 34.931 88.598	278	3.90	2.44	0.85	8,340	14,300	18,700	24,600	29,300	34,100	46,100	0	0	30	30
434	07029412	Hurricane Creek near Walnut, Miss.; 1953, 1955-69 34.925 88.904	20.2	17.1	2.45	1.27	1,460	1,600	1,670	1,740	1,780	1,820	1,890	0	0	16	16
442	07030365	Wesley Branch near Walnut, Miss.; 1966-75, 1977 34.950 89.090	2.17	63.5	2.44	1.79	205	343	455	623	768	930	1,390	0	0	11	11
448	07269000	N Tippah Cr nr Ripley, Miss.; 1939-42, 1948, 1952-66, 1968-80, 1983-85, 1988-91 34.733 89.025	19.3	16.1	2.45	1.28	2,920	4,730	6,050	7,820	9,220	10,700	14,300	0	0	40	40
449	07269990	Tippah Creek near Potts Camp, Miss.; 1943-62 34.597 89.350	355	3.40	2.45	0.82	11,100	15,900	19,000	22,800	25,600	28,400	34,500	0	0	20	20
450	07276000	Coldwater River near Lewisburg, Miss.; 1940-58 34.841 89.827	213	4.20	2.45	0.88	10,600	17,700	22,100	27,400	31,000	34,400	41,300	0	0	19	19

Table 5. Selected basin characteristics and flood-frequency estimates for 156 gaging stations located in adjacent states—Continued

Site no.	Station no.	Station name; period of record latitude and longitude, in decimal degrees	CDA	CS	CF	PF	Recurrence interval, in years: 2	5	10	25	50	100	500	Parameters for effective record: Z	H	N	N_e
							Peak discharge, in cubic feet per second										
		Hydrologic area 4—Continued															
451	07277500	Coldwater River near Coldwater, Miss.; 1929-42					17,000	31,000	41,600	56,100	67,600	79,400	108,000	1	33	14	18
		34.721 89.989	634	3.20	2.45	0.75											
452	07277730	Senatobia Creek near Senatobia, Miss.; 1942-58					14,500	17,200	18,800	20,400	21,500	22,500	24,600	0	0	16	16
		34.617 89.942	82.0	10.3	2.45	1.02											
453	07279600	Arkabutla Creek near Arkabutla, Miss.; 1947-58					11,300	13,900	15,400	16,900	18,000	18,900	20,900	0	0	12	12
		34.652 90.163	98.1	7.50	2.45	0.99											

Appendixes

Appendix A. Calculation of the prediction error and prediction interval for flood-frequency predictions at unregulated sites in Tennessee

The value of the prediction error variance (MSE_s) at a site of interest can be estimated as follows: Denote the column vector of n logarithms, where log is the log (base 10) of observed peak-discharge characteristics at n sites in a region by Y. For example,

$$Y = \begin{bmatrix} \log Q_{50,1} \\ \log Q_{50,2} \\ '' \\ \log Q_{50,n} \end{bmatrix},$$

in which, $Q_{50,i}$ represents the observed 50-year peak at the ith gaging station in the region. Further, let X represent the (n by p) matrix of p-1 basin characteristics augmented by a column of ones at n gaging stations, and let B represent a column vector of p regression coefficients.

For example,

$$X = \begin{bmatrix} 1 & \log(CDA_1) & \log(CS_1) & \log(CF_1) \\ 1 & \log(CDA_2) & (\log CS_2) & (\log CF_2) \\ '' & '' & '' & '' \\ 1 & \log(CDA_n) & \log(CS_n) & \log(CF_n) \end{bmatrix},$$

$$B = \begin{bmatrix} a \\ b_{CDA} \\ b_{CS} \\ b_{CF} \end{bmatrix}.$$

The linear equation can be written as

$$Y = XB.$$

Sampling error variance, for a site *0* with basin characteristics x_0, is given by the equation

$$MSE_{s,0} = x_0\{X^T\Lambda^{-1}X\}^{-1}x_0^T,$$

in which Λ is the (n by n) covariance matrix associated with Y. The diagonal elements of Λ are model error variance, γ^2, plus the time-sampling error for each site i (i=1,2,3,....n), which is estimated as a function of a regional estimate of the standard deviation of annual peaks at site i, the recurrence interval of the dependent variable and the number of years of record at site i. Methodology for estimating Λ is given in Tasker and Stedinger (1989). The value of the model error variance, γ^2, for both the single-variable and multivariable regional-regression equations are given in appendix table A-1. The off-diagonal elements of Λ are the sample covariance of the estimated t-year peaks at sites i and j. These off-diagonal elements are estimated as a function of a regional estimate of the standard deviation of annual peaks at sites i and j, the recurrence interval of the dependent variable and the number of concurrent years of record at sites i and j (Tasker and Stedinger, 1989). The (p by p) matrices $\{X^T\Lambda^{-1}X\}^{-1}$ for both the single-variable and multivariable regional-regression equations are given in appendix tables A-2 and A-3, respectively. The prediction error variance, in log (base 10) units, at a site of interest can be estimated as

$$MSE_{p,0} = (\gamma^2 + MSE_{s,0}).$$

Furthermore, the standard error of prediction, in log (base 10) units, at a site of interest can be expressed as

$$RMSE_{p,0} = (\gamma^2 + MSE_{s,0})^{1/2}.$$

The prediction error and the negative and positive prediction-error departures, in percent of the predicted value in cubic feet per second, at a given site of interest can be calculated as

$$\%SE_P = 100[e^{5.302(MSE_{p,0})} - 1]^{1/2},$$

$$\%SE_{P(+\text{ departure})} = 100[10^{RMSE_{p,0}} - 1], \text{ and}$$

$$\%SE_{P(-\text{ departure})} = 100[10^{-RMSE_{p,0}} - 1].$$

Another useful measure of the quality of a flood-frequency prediction is the prediction interval. Let x_0 represent the row vector, augmented by a 1 as the first element, of log (base 10)-transformed basin characteristics at a site of interest. Let b represent the column vector of coefficients for the log (base 10) regression equation used to make a prediction. The predicted value, in log (base 10) units, is

$$y_0 = x_0 b.$$

A 100(1 - α) prediction interval for the log (base 10)-transformed value, $y_0 = \log_{10}(q_0)$, would be

$$10^{y_0 - T} \le q_0 \le 10^{y_0 + T},$$

where

$$T = t_{\alpha/2,n-p'}(RMSE_{p,0}),$$

where n is the number of gages used to develop the regression equation, p is the number of explanatory variables, p' equals p + 1, and $t_{\alpha/2,n-p'}$ is the critical value from a Student's t distribution for the α level of significance and n - p' degrees of freedom. The Student's t distribution is available in most statistics books.

Table A-1. Model error variance (γ^2) for the single-variable and multivariable regional-regression equations in tables 6 and 7

[These values can be used in computations of the prediction error and prediction interval as explained in this appendix. Numbers are given in scientific notation, for example, 0.31377E-01 = 0.31377 x 10^{-1} = 0.031377. RI, recurrence interval in years; HA, hydrologic area; see figure 1 for HA location; --, not applicable; CDA, contributing drainage area in square miles]

RI	Single-variable regional-regression equations: HA1 (CDA=0.20 to 9,000 mi²)	HA2 (CDA=0.47 to 2,557 mi²)	HA3 (CDA=0.17 to 30.2 mi²)	HA3 (CDA=30.21 to 2,048 mi²)	HA4 (CDA=0.76 to 2,308 mi²)	Multivariable regional-regression equations: HA1 (CDA=0.20 to 9,000 mi²)	HA2 (CDA=0.47 to 2,557 mi²)	HA3 (CDA=0.17 to 30.2 mi²)	HA3 (CDA=30.21 to 2,048 mi²)	HA4 (----)
2	0.31377E-01	0.17720E-01	0.19593E-01	0.12658E-01	0.25116E-01	0.26069E-01	0.15891E-01	0.20005E-01	0.12806E-01	--
5	0.30349E-01	0.15767E-01	0.19321E-01	0.13152E-01	0.23343E-01	0.25700E-01	0.13787E-01	0.19713E-01	0.13449E-01	--
10	0.31267E-01	0.16611E-01	0.19686E-01	0.14636E-01	0.24079E-01	0.27146E-01	0.14618E-01	0.20079E-01	0.15002E-01	--
25	0.33949E-01	0.18933E-01	0.20591E-01	0.17420E-01	0.26570E-01	0.30393E-01	0.16996E-01	0.21001E-01	0.17878E-01	--
50	0.36830E-01	0.21270E-01	0.21559E-01	0.20033E-01	0.29244E-01	0.33622E-01	0.19405E-01	0.21991E-01	0.20564E-01	--
100	0.40320E-01	0.23988E-01	0.22758E-01	0.23034E-01	0.32424E-01	0.37415E-01	0.22208E-01	0.23221E-01	0.23643E-01	--
500	0.50443E-01	0.31507E-01	0.26396E-01	0.31387E-01	0.41309E-01	0.48149E-01	0.29955E-01	0.26967E-01	0.32193E-01	--

Table A-2. Matrix $\{X^T\Lambda^{-1}X\}^{-1}$ for the single-variable regional-regression equations in table 6

[These matrices can be used in computations of the prediction error and prediction interval as explained in this appendix. Numbers are given in scientific notation, for example, 0.12582E-01 = 0.12582 x 10^{-1} = 0.012582. RI, recurrence interval in years; HA, hydrologic area; see figure 1 for HA location; CDA, contributing drainage area in square miles]

RI	Hydrologic area: HA1 (CDA=0.20 to 9,000 mi²)		HA2 (CDA=0.47 to 2,557 mi²)		HA3 (CDA=0.17 to 30.2 mi²)		HA3 (CDA=30.21 to 2,048 mi²)		HA4 (CDA=0.76 to 2,308 mi²)	
2	0.12582E-02	-0.46690E-03	0.15347E-02	-0.52817E-03	0.25104E-02	-0.15590E-02	0.39578E-02	-0.17034E-02	0.30529E-02	-0.11750E-02
	-0.46690E-03	0.23477E-03	-0.52817E-03	0.27021E-03	-0.15590E-02	0.15052E-02	-0.17034E-02	0.86375E-03	-0.11750E-02	0.60037E-03
5	0.13882E-02	-0.49753E-03	0.15708E-02	-0.51955E-03	0.25852E-02	-0.16006E-02	0.42430E-02	-0.18198E-02	0.29696E-02	-0.11310E-02
	-0.49753E-03	0.24364E-03	-0.51955E-03	0.25962E-03	-0.16006E-02	0.15412E-02	-0.18198E-02	0.92296E-03	-0.11310E-02	0.57658E-03
10	0.15629E-02	-0.54914E-03	0.17846E-02	-0.58243E-03	0.28200E-02	-0.17292E-02	0.48656E-02	-0.20793E-02	0.31910E-02	-0.12055E-02
	-0.54914E-03	0.26466E-03	-0.58243E-03	0.28809E-03	-0.17292E-02	0.16492E-02	-0.20793E-02	0.10529E-02	-0.12055E-02	0.61393E-03
25	0.18443E-02	-0.63743E-03	0.21585E-02	-0.69984E-03	0.32065E-02	-0.19431E-02	0.59361E-02	-0.25317E-02	0.36651E-02	-0.13753E-02
	-0.63743E-03	0.29300E-03	-0.69984E-03	0.34395E-03	-0.19431E-02	0.18320E-02	-0.25317E-02	0.12808E-02	-0.13753E-02	0.69968E-03
50	0.20857E-02	-0.71579E-03	0.24827E-02	-0.80465E-03	0.35326E-02	-0.21264E-02	0.68823E-02	-0.29357E-02	0.41136E-02	-0.15397E-02
	-0.71579E-03	0.33814E-03	-0.80465E-03	0.39478E-03	-0.21264E-02	0.19915E-02	-0.29357E-02	0.14856E-02	-0.15397E-02	0.78275E-03
100	0.23480E-02	-0.80261E-03	0.28324E-02	-0.91962E-03	0.38808E-02	-0.23250E-02	0.79270E-02	-0.33853E-02	0.46181E-02	-0.17267E-02
	-0.80261E-03	0.37770E-03	-0.91962E-03	0.45115E-03	-0.23250E-02	0.21699E-02	-0.33853E-02	0.17144E-02	-0.17267E-02	0.87726E-03
500	0.30281E-02	-0.10330E-02	0.37198E-02	-0.12179E-02	0.47630E-02	-0.28401E-02	0.10687E-01	-0.45859E-02	0.59513E-02	-0.22273E-02
	-0.10330E-02	0.48458E-03	-0.12179E-02	0.59926E-03	-0.28401E-02	0.26316E-02	-0.45859E-02	0.23290E-02	-0.22273E-02	0.11300E-02

Table A-3. Matrix $\{X^{T}\Lambda^{-1}X\}^{-1}$ for the multivariable regional-regression equations in table 7

[These matrices can be used in the computation of the prediction error and prediction interval as explained in this appendix. Numbers are given in scientific notation, for example, 0.93197E-01 = 0.93197 x 10^{-1} = 0.093197. RI, recurrence interval in years; HA, hydrologic area; see figure 1 for HA location; CDA, contributing drainage area in square miles; There are no multivariable regional-regression equations for hydrologic area 4.]

	Hydrologic area												
	HA1				HA2			HA3			HA3		
RI	(CDA=0.20 to 9,000 mi²)				(CDA=0.47 to 2,557 mi²)			(CDA=0.17 to 30.2 mi²)			(CDA=30.21 to 2,048 mi²)		
2	0.93197E-01	-0.15441E-02	-0.29363E-02	-0.24614	0.76949E-02	-0.17969E-02	-0.33375E-02	0.71914E-01	-0.16257E-01	-0.35509E-01	0.99052E-01	-0.26308E-01	-0.44057E-01
	-0.15441E-02	0.31751E-03	0.32177E-03	0.12442E-02	-0.17969E-02	0.52148E-03	0.69904E-03	-0.16257E-01	0.46364E-02	0.75099E-02	-0.26308E-01	0.73214E-02	0.11398E-01
	-0.29363E-02	0.32177E-03	0.89690E-03	0.28041E-02	-0.33375E-02	0.69904E-03	0.17829E-02	-0.35509E-01	0.75099E-02	0.18177E-01	-0.44057E-01	0.11398E-01	0.20414E-01
	-0.24614	0.12442E-02	0.28041E-02	0.68971									
5	0.10328	-0.15417E-02	-0.29005E-02	-0.27460	0.72572E-02	-0.16767E-02	-0.30935E-02	0.74185E-01	-0.16825E-01	-0.36619E-01	0.10611	-0.28179E-01	-0.47290E-01
	-0.15417E-02	0.33931E-03	0.34147E-03	0.98932E-03	-0.16767E-02	0.48396E-03	0.64266E-03	-0.16825E-01	0.47963E-02	0.77765E-02	-0.28179E-01	0.77470E-02	0.12232E-01
	-0.29005E-02	0.34147E-03	0.93001E-03	0.24319E-02	-0.30935E-02	0.64266E-03	0.16531E-02	-0.36619E-01	0.77765E-02	0.18738E-01	-0.47290E-01	0.12232E-01	0.21963E-01
	-0.27460	0.98932E-03	0.24319E-02	0.77322									
10	0.11915	-0.16555E-02	-0.31044E-02	-0.31815	0.80998E-02	-0.18632E-02	-0.34368E-02	0.79558E-01	-0.18099E-01	-0.39232E-01	0.12127	-0.32190E-01	-0.54068E-01
	-0.16555E-02	0.38000E-03	0.38225E-03	0.88139E-03	-0.18632E-02	0.53648E-03	0.71057E-03	-0.18099E-01	0.51595E-02	0.83586E-02	-0.32190E-01	0.88466E-02	0.13981E-01
	-0.31044E-02	0.38225E-03	0.10263E-02	0.23663E-02	-0.34368E-02	0.71057E-03	0.18389E-02	-0.39232E-01	0.83586E-02	0.20066E-01	-0.54068E-01	0.13981E-01	0.25128E-01
	-0.31815	0.88139E-03	0.23663E-02	0.89838									
25	0.14548	-0.18852E-02	-0.35352E-02	-0.38993	0.98122E-02	-0.22513E-02	-0.41592E-02	0.88674E-01	-0.20240E-01	-0.43668E-01	0.14789	-0.39242E-01	-0.65973E-01
	-0.18852E-02	0.45003E-03	0.45336E-03	0.80319E-03	-0.22513E-02	0.64721E-03	0.85646E-03	-0.20240E-01	0.57686E-02	0.93373E-02	-0.39242E-01	0.10780E-01	0.17055E-01
	-0.35352E-02	0.45336E-03	0.12022E-02	0.24392E-02	-0.41592E-02	0.85646E-03	0.22284E-02	-0.43668E-01	0.93373E-02	0.22321E-01	-0.65973E-01	0.17055E-01	0.30678E-01
	-0.38993	0.80319E-03	0.24392E-02	1.10360									
50	0.16832	-0.21028E-02	-0.39500E-02	-0.45198	0.11389E-01	-0.26114E-02	-0.48323E-02	0.96701E-01	-0.22115E-01	-0.47579E-01	0.17185	-0.45592E-01	-0.76698E-01
	-0.21028E-02	0.51230E-03	0.51692E-03	0.77694E-03	-0.26114E-02	0.75046E-03	0.99322E-03	-0.22115E-01	0.63009E-02	0.10196E-01	-0.45592E-01	0.12522E-01	0.19826E-01
	-0.39500E-02	0.51692E-03	0.13629E-02	0.25782E-02	-0.48323E-02	0.99322E-03	0.25905E-02	-0.47579E-01	0.10196E-01	0.24309E-01	-0.76698E-01	0.19826E-01	0.35680E-01
	-0.45198	0.77694E-03	0.25782E-02	1.28060									
100	0.19323	-0.23516E-02	-0.44278E-02	-0.51954	0.13146E-01	-0.30143E-02	-0.55864E-02	0.10559	-0.24185E-01	-0.51915E-01	0.19865	-0.52699E-01	-0.88712E-01
	-0.23516E-02	0.58141E-03	0.58765E-03	0.77182E-03	-0.30143E-02	0.86615E-03	0.11469E-02	-0.24185E-01	0.68880E-02	0.11145E-01	-0.52699E-01	0.14472E-01	0.22929E-01
	-0.44278E-02	0.58765E-03	0.15436E-02	0.27724E-02	-0.55864E-02	0.11469E-02	0.29957E-02	-0.51915E-01	0.11145E-01	0.26512E-01	-0.88712E-01	0.22929E-01	0.41285E-01
	-0.51954	0.77182E-03	0.27724E-02	1.47310									
500	0.25810	-0.30348E-02	-0.57482E-02	-0.69499	0.17778E-01	-0.40807E-02	-0.75882E-02	0.12932	-0.29694E-01	-0.63520E-01	0.27077	-0.71828E-01	-0.12109
	-0.30348E-02	0.76553E-03	0.77671E-03	0.82519E-03	-0.40807E-02	0.11732E-02	0.15561E-02	-0.29694E-01	0.84499E-02	0.13679E-01	-0.71828E-01	0.19723E-01	0.31297E-01
	-0.57482E-02	0.77671E-03	0.20320E-02	0.33973E-02	-0.75882E-02	0.15561E-02	0.40695E-02	-0.63520E-01	0.13679E-01	0.32410E-01	-0.12109	0.31297E-01	0.56410E-01
	-0.69499	0.82519E-03	0.33973E-02	1.97210									

Appendix B. Description of detailed output file produced by the region-of-influence method for Tennessee

An example of the region-of-influence method diagnostic output file for a hypothetical unregulated site is presented and discussed in this appendix. First, the region-of-influence method output file shows the 60 gaging stations in the region-of-influence for the site of interest (table B-1). The region-of-influence remains constant for each recurrence-interval discharge estimate (fig. 5) produced by the region-of-influence method. Next, for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year floods, the region-of-influence method output file provides significant regression coefficients, residuals and influence statistics for each station in the region-of-influence, and overall quality measures for the regression (table B-1).

Information provided in the region-of-influence method output file for each gaging station in the region-of-influence includes the station number, hydrologic area, latitude, longitude, and log (base 10)-transformed values of the explanatory basin characteristics for each station. The transformed explanatory basin characteristics in the region-of-influence method output file include *CDA*, *CS*, *PF*, and *CF*. Following this information, for each recurrence-interval regression, log (base 10)-transformed values of the significant regression coefficients, coefficient standard errors, and coefficient significance statistics are given; and for each station in the region-of-influence, log-Pearson Type III station estimates and regression-predicted discharge estimates, the standardized residual, and the leverage and *Cook's D* of the station values are tabulated. Standardized residual, leverage, and *Cook's D* are explained in the following paragraphs.

Dividing each residual by its standard deviation gives the scale-free standardized residual, which can be compared directly with all the other residuals. Standardized residuals approximately follow a Student's *t* distribution and should be randomly scattered above and below a line representing the standardized residual equal to zero. About 95 percent of the observations should fall between standardized residuals of -2 and +2. Observations having a standardized residual less than -2 or greater than +2 should be considered outliers and should only occur about 5 times in 100 observations, if normally distributed.

Leverage is used to identify outlying stations in a dataset. Leverage is an indicator of the potential influence that a station can exert on a regression equation. Stations that are far from the center of the explanatory-variable space are considered high leverage stations because of their great potential to influence the regression results. A suggested value to identify a station with high leverage is $2p'/n$ where p' is the number of coefficients in the regression equation, and n is the number of stations in the region-of-influence. In this study, the number of stations (n) in the region-of-influence is equal to 60. Stations with high leverage that exert a strong influence on the regression should be assessed for possible data errors or special conditions.

Cook's D for a station is a measure of the shift in the predicted values of discharge when the station is not used to estimate the regression coefficients. *Cook's D* shows the influence of the station on the regression estimates. A suggested cutoff value to flag influential stations is a value of *Cook's D* greater than $4/n$, where n is equal to 60 in this study. A large value of *Cook's D* does not mean that a station should not be present in the regression, but simply indicates that this station has a greater effect on the resulting regression than stations with smaller values of *Cook's D*. Stations having high values of *Cook's D* should be examined for possible data errors or special conditions.

The final information provided in the region-of-influence method output file for each recurrence-interval analysis are error statistics that describe the overall quality of the regression. The average sampling error variance is the overall average sampling error variance given by,

$$(1/n)\sum_{i=1}^{n} MSE_{s,i}.$$

This term is the same as the second term in eq. 4 of this report. The average sampling error variance is due to estimating regression-equation parameters from the basin characteristics and observed annual-peak flow records at the stations in the region-of-influence.

The model error variance, γ^2, is a characteristic inherent in the regression equation because at best, the regression equation is only a crude representation of the complex and interrelated hydrologic processes generating floods. Model error variance is an average value that is constant for all the sites in the region-of-influence.

The *PRESS* statistic was discussed in detail in the Region-of-Influence Method section of this report. This statistic is a validation-type estimator of error. For each station in the region-of-influence, leaving that station out of the regression, the prediction residuals are squared and summed. A smaller *PRESS* statistic indicates a better regression equation.

The maximum sampling error variance is the largest sampling error, $MSE_{s,i}$, for one of the stations in the region-of-influence. If the sampling error variance for the site of interest is larger than the maximum sampling error variance in the region-of-influence, then the regression equation likely is making an extrapolated estimate. When two hydrologic areas are specified for a site, two site sampling error variances exist, which may be different. If either of these values is larger than the maximum sampling error variance, then the regression equation likely is making an extrapolated estimate.

Hardison (1971) describes a method of expressing the errors associated with predicting streamflow characteristics as equivalent years of record (appendix D). Equivalent years of record is defined as the number of years of actual streamflow records needed to provide an estimate of equivalent accuracy to the regression-method estimate. The equivalent years of record for the region-of-influence method (table B-1; and appendix D) can be used in eq. 11 to estimate the weighted discharges given in table 4. When two hydrologic areas are specified for a site of interest, two equivalent year estimates exist, which may be substantially different. To produce a single value of equivalent years of record for use in eq. 11, weight the two values by their respective hydrologic-area percentages and add together.

Table B-1. Detailed output file produced by the region-of-influence method for Tennessee

[SITE ID, name of the site of interest; ID, gaging station number; HA, hydrologic area; MAP NO., gaging station number on figure 1; LOG, log (base 10)-transformed value; CDA, contributing drainage area, in square miles; CS, main-channel slope, in feet per mile; PF, dimensionless physiographic-region factor; CF, dimensionless climate factor; OBS, flood discharge, in cubic feet per second, computed using Bulletin 17B of the Interagency Advisory Committee on Water Data (1982); PRED, regression-predicted discharge, in cubic feet per second; STD RES, standardized residual]

DATA FOR TDOT VERSION 2.0.3 REGION-OF-INFLUENCE (ROI) METHOD FOR TENNESSEE:
SITE ID: Big River at Centerville, TN

ID	HA	LATITUDE	LONGITUDE	MAP NO.	LOG(CDA)	LOG(CS)	LOG(PF)	LOG(CF)
3602000.	3.	35.78800	87.46600	384.	3.31130	0.32634	0.15187	0.37672
3584500.	3.	35.02700	86.94800	336.	3.25140	0.45484	0.15332	0.37970
7026000.	4.	36.25100	89.19200	412.	3.26760	0.34635	-0.19877	0.37246
3599500.	3.	35.61800	87.03200	380.	3.08210	0.43616	0.15741	0.37447
7026300.	4.	36.13700	89.42900	413.	3.30810	0.26951	-0.20500	0.37281
7028000.	4.	35.86200	89.34800	417.	3.00130	0.41497	-0.15776	0.37741
7027800.	4.	35.81700	89.35600	416.	2.96940	0.43297	-0.15285	0.37780
7029100.	4.	36.03000	89.38700	427.	2.97270	0.45484	-0.15335	0.37548
3603000.	2.	35.93000	87.74300	387.	3.40770	0.27875	0.13713	0.37085
3582000.	3.	35.13400	86.54000	329.	2.91750	0.53403	0.16139	0.37678
7031700.	4.	35.20200	89.92300	445.	2.88710	0.41497	-0.14016	0.38106
3604500.	2.	35.81300	87.79700	393.	2.84940	0.61172	0.11741	0.37730
7029500.	4.	35.27500	88.97700	435.	3.17030	0.10037	-0.18377	0.38174
3434500.	2.	36.12200	87.09900	101.	2.82410	0.45332	0.11652	0.36950
7029400.	4.	35.05700	88.80100	433.	2.92270	0.39270	-0.14566	0.38794
7031650.	4.	35.11600	89.80100	444.	2.84450	0.44716	-0.13361	0.38683
7025500.	4.	36.40000	88.99500	411.	2.68120	0.56229	-0.10847	0.37101
3430100.	3.	36.15800	86.62000	75.	2.95040	0.61278	0.16060	0.36543
7027500.	4.	35.59400	88.81400	415.	2.69460	0.63043	-0.11053	0.37995
7030000.	4.	35.52300	89.34900	436.	3.29560	-0.04096	-0.20307	0.38011
7030050.	4.	35.63700	89.60400	437.	3.36320	-0.05061	-0.21349	0.37925
7277500.	4.	34.72100	89.98900	451.	2.80210	0.50515	-0.12708	0.38828
7030500.	4.	35.05400	89.54100	443.	2.70160	0.48144	-0.11160	0.38643
3571000.	1.	35.20600	85.49700	306.	2.58430	0.51720	-0.05113	0.37086
7029000.	4.	35.85100	89.06700	424.	2.56700	0.58659	-0.09089	0.37825
7024500.	4.	36.11800	88.81100	406.	2.58320	0.58092	-0.09338	0.37216
3433500.	3.	36.05400	86.92800	100.	2.59440	0.50786	0.16920	0.36780
3592500.	2.	34.65600	88.12200	349.	2.82410	0.57978	0.11652	0.38919
3604000.	2.	35.49600	87.83300	389.	2.65030	0.70586	0.11038	0.37904
7025400.	4.	36.40600	88.85600	410.	2.57050	0.62325	-0.09143	0.37085
3436100.	2.	36.55500	87.14200	109.	2.69720	0.62634	0.11203	0.36604
7030280.	4.	35.28100	89.76600	441.	2.70330	0.77305	-0.11187	0.38106
3598000.	3.	35.48000	86.49900	375.	2.68210	0.78604	0.16708	0.37469
3429000.	3.	36.00000	86.46000	73.	2.75660	0.70757	0.16528	0.36566
3567500.	1.	35.01400	85.20700	301.	2.63140	0.74663	-0.04818	0.37128
3584000.	3.	35.21400	87.10100	335.	2.56350	0.72591	0.16995	0.37866
3579100.	2.	35.28600	86.10600	325.	2.43930	0.62325	0.10292	0.37523
7029275.	4.	35.04100	88.78700	430.	2.49140	0.38202	-0.07924	0.38798
7269990.	4.	34.59700	89.35000	449.	2.55020	0.53148	-0.08830	0.38991
3314500.	2.	37.00100	86.43100	22.	3.13420	0.41497	0.12743	0.35540
3606500.	4.	36.03900	88.22800	396.	2.31180	0.57171	-0.05158	0.37369
3435500.	2.	36.58900	87.08900	105.	2.49000	0.64738	0.10471	0.36545
7029300.	4.	34.93100	88.59800	431.	2.44400	0.59106	-0.07195	0.38807
7029270.	4.	34.94400	88.78600	429.	2.43460	0.64345	-0.07049	0.38826
7025000.	4.	36.05300	88.87800	407.	2.30320	0.67761	-0.05026	0.37249
3313000.	2.	36.89500	86.13400	16.	2.93700	0.56820	0.12050	0.35491
3568000.	1.	35.08700	85.27900	302.	4.33040	0.64836	0.05826	0.37094
3432350.	3.	35.92100	86.86600	97.	2.24550	0.59106	0.17763	0.36863
3592000.	2.	34.44400	88.11500	346.	2.42000	0.60206	0.10224	0.39071
7030240.	4.	35.31000	89.64000	439.	2.41830	0.83251	-0.06799	0.38129
3588500.	2.	35.02400	87.57900	343.	2.54160	0.91169	0.10654	0.38087
2387000.	1.	34.67000	84.93000	9.	2.83700	1.04140	-0.03530	0.37404
7276000.	4.	34.84100	88.82700	450.	2.32840	0.62325	-0.05414	0.38868
3575000.	2.	34.81900	86.48100	315.	2.53400	0.90309	0.10627	0.38439
3427500.	3.	35.91800	86.33400	68.	2.41830	0.80346	0.17346	0.36568
3438000.	2.	36.77800	87.72200	114.	2.17610	0.55630	0.09362	0.36685
3312500.	2.	36.85200	86.07700	14.	2.71100	0.63347	0.11252	0.35496
3566000.	1.	35.28800	84.75200	293.	3.36140	1.06070	-0.00245	0.36423
3594445.	4.	35.62400	88.27300	365.	2.06070	0.57519	-0.01292	0.37929
3576148.	2.	34.41400	86.68800	318.	2.13350	0.49136	0.09212	0.38727

SUMMARY OF REGION-OF-INFLUENCE (ROI) REGRESSION FOR:
Big River at Centerville, TN
2 YR-PEAK

REGRESSION COEFFICIENTS

VARIABLE	COEFFICIENT	STANDARD ERROR	T FOR H0:BETA=0	PROB>|T|
CONSTANT	2.16270	0.12350	17.51106	
LOG(CDA)	0.68230	0.03563	19.15105	0.0001
LOG(CS)	0.18660	0.07046	2.64832	0.0105
LOG(PF)	0.67151	0.12460	5.38933	0.0001

Residuals and influence statistics

ID	LOG(OBS)	LOG(PRED)	STD RES	LEVERAGE	COOKS D
3602000.	4.51780	4.58487	-0.74541	0.10242	0.02160
3584500.	4.50700	4.56895	-0.67876	0.07980	0.01372
7026000.	4.39430	4.32332	0.80758	0.09759	0.02485
3599500.	4.39820	4.45270	-0.60976	0.06795	0.01080
7026300.	4.33170	4.33244	-0.00824	0.09161	0.00000
7028000.	4.14870	4.18197	-0.34806	0.03499	0.00277
7027800.	4.02690	4.16686	-1.43620	0.03302	0.04359
7029100.	4.03630	4.17286	-1.45340	0.03276	0.04788
3603000.	4.58390	4.63186	-0.54947	0.12483	0.01364
3582000.	4.21270	4.36133	-1.46445	0.03477	0.03961
7031700.	4.08760	4.11587	-0.30314	0.03625	0.00201
3604500.	4.21969	4.29983	-0.88118	0.03100	0.01244
7029500.	4.26580	4.22111	0.52245	0.12883	0.01404
3434500.	4.31760	4.25241	0.72698	0.04360	0.01129
7029400.	4.17390	4.13231	0.44367	0.03778	0.00446
7031650.	4.01750	4.09721	-0.81445	0.05073	0.01248
7025500.	4.00360	4.02416	-0.22476	0.03850	0.00098
3430100.	4.49110	4.39794	0.98942	0.04246	0.01979
7027500.	3.94570	4.04463	-1.07327	0.03384	0.02326
7030000.	4.36640	4.26727	1.12089	0.15871	0.08373
7030050.	4.33940	4.30459	0.40762	0.17426	0.01235
7277500.	4.22980	4.08349	1.43634	0.04813	0.03403
7030500.	3.98830	4.02089	-0.35031	0.02774	0.00237
3571000.	4.07620	3.98813	0.97444	0.04727	0.01605
7029000.	3.90160	3.96258	-0.65683	0.02384	0.00805
7024500.	3.89780	3.97090	-0.80700	0.03503	0.01274
3433500.	4.09380	4.14124	-0.53727	0.06605	0.00848
3592500.	4.20430	4.27601	-0.78042	0.03705	0.00968
3604000.	4.18310	4.17683	0.06939	0.03270	0.00008
7025400.	3.94860	3.97145	-0.23980	0.03108	0.00103
3436100.	4.32710	4.19510	1.41116	0.03576	0.02914
7030280.	4.17810	4.07628	1.09919	0.06086	0.03231
3598000.	4.24580	4.25156	-0.06257	0.04660	0.00008
3429000.	4.44450	4.28654	1.71113	0.04046	0.05898
3567500.	4.08950	4.06506	0.26891	0.05012	0.00135
3584000.	4.21560	4.16135	0.59003	0.04596	0.00750
3579100.	3.84840	4.01244	-1.71392	0.04231	0.05008
7029275.	3.86010	3.88065	-0.19005	0.03076	0.00069
7269990.	4.04520	3.94257	1.02129	0.02690	0.01701
3314500.	4.47500	4.46416	0.11431	0.06238	0.00031
3606500.	3.68300	3.81208	-1.43262	0.05500	0.04952
3435500.	4.14990	4.05273	1.05537	0.03669	0.01888
7029300.	3.92110	3.89221	0.30178	0.03178	0.00169
7029270.	3.85430	3.89655	-0.44677	0.03196	0.00382
7025000.	3.68690	3.82686	-1.45835	0.04187	0.04409
3313000.	4.49970	4.35355	1.31131	0.02008	0.01991
3568000.	5.31270	5.27742	0.48584	0.39145	0.03975
3432350.	3.93650	3.92437	0.12750	0.09107	0.00052
3592000.	3.69820	3.99486	-3.15554	0.05399	0.18588
7030240.	3.99850	3.92239	0.80540	0.07579	0.01658
3588500.	4.23840	4.13849	1.11793	0.06617	0.03097
2387000.	4.14700	4.26900	-1.43168	0.17020	0.11284
7276000.	4.02750	3.83130	1.94677	0.03512	0.06939
3575000.	4.20720	4.13152	0.84470	0.06377	0.01717
3427500.	4.22400	4.07910	1.59000	0.06495	0.06325
3438000.	3.81600	3.81412	0.02117	0.08578	0.00001
3312500.	4.28130	4.20617	0.75928	0.02200	0.00750
3566000.	4.54950	4.65246	-1.20192	0.23826	0.12045
3594445.	3.72400	3.66736	0.57274	0.06627	0.00941
3576148.	3.75820	3.77193	-0.13593	0.09108	0.00056

AVERAGE SAMPLING ERROR VARIANCE	0.0009
MODEL ERROR VARIANCE	0.0080
PRESS/N	0.0103
MAXIMUM SAMPLING ERROR VARIANCE	0.0036
HA 3 SITE	
SAMPLING ERROR VARIANCE	0.0011
EQUIVALENT YEARS	6.00
HA 2 SITE	
SAMPLING ERROR VARIANCE	0.0010
EQUIVALENT YEARS	6.06

SUMMARY OF REGION-OF-INFLUENCE (ROI) REGRESSION FOR:
Big River at Centerville, TN
5 YR-PEAK

REGRESSION COEFFICIENTS

VARIABLE	COEFFICIENT	STANDARD ERROR	T FOR H0:BETA=0	PROB>|T|
CONSTANT	2.49506	0.12947	19.27199	
LOG(CDA)	0.63607	0.03727	17.06451	0.0001
LOG(CS)	0.16605	0.07363	2.25513	0.0281
LOG(PF)	0.60373	0.13318	4.53316	0.0001

Residuals and influence statistics

ID	LOG(OBS)	LOG(PRED)	STD RES	LEVERAGE	COOKS D
3602000.	4.65090	4.74715	-1.02587	0.10174	0.04183
3584500.	4.69740	4.73126	-0.35588	0.08038	0.00387
7026000.	4.57040	4.51098	0.65398	0.10091	0.01728
3599500.	4.53370	4.62294	-0.96402	0.06799	0.02817
7026300.	4.51090	4.52022	-0.10042	0.09229	0.00043
7028000.	4.36730	4.37775	-0.10403	0.03298	0.00026
7027800.	4.26590	4.36341	-0.94850	0.03071	0.01945
7029100.	4.20480	4.36884	-1.66878	0.03059	0.06566
3603000.	4.74950	4.79166	-0.46588	0.12623	0.01011
3582000.	4.38710	4.53690	-1.38740	0.03287	0.03533
7031700.	4.30650	4.31574	-0.09488	0.03673	0.00021
3604500.	4.46222	4.47993	-0.18818	0.03093	0.00059
7029500.	4.48830	4.41730	0.80430	0.13247	0.03511
3434500.	4.49662	4.43700	0.64348	0.04305	0.00930
7029400.	4.38560	4.33136	0.55341	0.03767	0.00723
7031650.	4.21490	4.29794	-0.80421	0.05103	0.01246
7025500.	4.22330	4.22836	-0.05337	0.03924	0.00006
3430100.	4.62650	4.57042	0.56917	0.04159	0.00672
7027500.	4.17660	4.24696	-0.73377	0.03363	0.01137
7030000.	4.55280	4.46188	0.97917	0.15651	0.06475
7030050.	4.52220	4.49699	0.28325	0.17418	0.00613
7277500.	4.49120	4.28454	1.90777	0.04850	0.06044
7030500.	4.20970	4.22603	-0.16839	0.02749	0.00057
3571000.	4.24660	4.19386	0.56477	0.05001	0.00570
7029000.	4.07560	4.17037	-0.98012	0.02232	0.01871
7024500.	4.10800	4.17823	-0.74914	0.03524	0.01160
3433500.	4.25810	4.33175	-0.80842	0.06629	0.02028
3592500.	4.37500	4.45800	-0.87048	0.03840	0.01256
3604000.	4.43680	4.36468	0.77199	0.03320	0.00990
7025400.	4.16610	4.17836	-0.12279	0.03048	0.00028
3436100.	4.48850	4.38230	1.08941	0.03608	0.01797
7030280.	4.35690	4.27537	0.84229	0.06028	0.01943
3598000.	4.44680	4.43245	0.14976	0.04620	0.00050
3429000.	4.57920	4.46572	1.18097	0.04003	0.02914
3567500.	4.24790	4.26370	-0.16778	0.05121	0.00055
3584000.	4.46920	4.34876	1.25897	0.04594	0.03546
3579100.	4.09640	4.21225	-1.15353	0.04250	0.02308
7029275.	4.07140	4.09535	-0.20563	0.02825	0.00078
7269990.	4.20140	4.15210	0.46263	0.02694	0.00351
3314500.	4.65960	4.63446	0.25237	0.06265	0.00152
3606500.	3.91470	4.02931	-1.22802	0.05674	0.03802
3435500.	4.32290	4.24958	0.76656	0.03722	0.01034
7029300.	4.15470	4.10431	0.50134	0.03139	0.00476
7029270.	4.07870	4.10792	-0.29506	0.03116	0.00171
7025000.	3.81520	4.04222	-2.24921	0.04001	0.10602
3313000.	4.70340	4.53029	1.43806	0.01830	0.02302
3568000.	5.42180	5.39232	0.39391	0.39754	0.02689
3432350.	4.09860	4.12874	-0.30040	0.08983	0.00291
3592000.	3.92730	4.19604	-2.73454	0.05509	0.14307
7030240.	4.18860	4.13045	0.58587	0.07531	0.00884
3588500.	4.47940	4.32740	1.64385	0.06691	0.06892
2387000.	4.30640	4.45119	-1.64125	0.17277	0.15147
7276000.	4.24660	4.04688	1.86540	0.03403	0.06330
3575000.	4.48220	4.32097	1.73858	0.06463	0.07488
3427500.	4.35360	4.27140	0.86763	0.06563	0.01951
3438000.	4.02260	4.02810	-0.05970	0.08823	0.00012
3312500.	4.52130	4.39256	1.23248	0.02150	0.01991
3566000.	4.65510	4.80779	-1.69515	0.23482	0.23663
3594445.	3.94660	3.89351	0.50504	0.06431	0.00720
3576148.	3.97010	3.98932	-0.17806	0.08881	0.00094

AVERAGE SAMPLING ERROR VARIANCE	0.0010
MODEL ERROR VARIANCE	0.0084
PRESS/N	0.0114
MAXIMUM SAMPLING ERROR VARIANCE	0.0039
HA 3 SITE	
SAMPLING ERROR VARIANCE	0.0012
EQUIVALENT YEARS	7.70
HA 2 SITE	
SAMPLING ERROR VARIANCE	0.0011
EQUIVALENT YEARS	7.79

SUMMARY OF REGION-OF-INFLUENCE (ROI) REGRESSION FOR:
Big River at Centerville, TN
10 YR-PEAK

REGRESSION COEFFICIENTS

VARIABLE	COEFFICIENT	STANDARD ERROR	T FOR H0:BETA=0	PROB>|T|
CONSTANT	2.66925	0.13762	19.39567	
LOG(CDA)	0.61153	0.03955	15.46029	0.0001
LOG(CS)	0.15329	0.07807	1.96349	0.0546
LOG(PF)	0.58028	0.14424	4.02315	0.0002

Residuals and influence statistics

ID	LOG(OBS)	LOG(PRED)	STD RES	LEVERAGE	COOKS D
3602000.	4.71740	4.83234	-1.15744	0.10096	0.05431
3584500.	4.80190	4.81625	-0.14255	0.08095	0.00064
7026000.	4.65790	4.60522	0.55266	0.10424	0.01303
3599500.	4.60690	4.71223	-1.08242	0.06803	0.03695
7026300.	4.60050	4.61459	-0.14380	0.09303	0.00091
7028000.	4.47470	4.47668	-0.01851	0.03107	0.00001
7027800.	4.38430	4.46278	-0.71294	0.02851	0.01118
7029100.	4.28820	4.46786	-1.72092	0.02845	0.07220
3603000.	4.83570	4.87545	-0.41731	0.12764	0.00834
3582000.	4.47370	4.62889	-1.33157	0.03110	0.03225
7031700.	4.41560	4.41706	-0.01416	0.03728	0.00000
3604500.	4.58682	4.57363	0.13347	0.03083	0.00031
7029500.	4.60190	4.51671	0.92150	0.13611	0.04843
3434500.	4.58401	4.53336	0.52141	0.04245	0.00639
7029400.	4.49700	4.43223	0.62266	0.03761	0.00946
7031650.	4.31860	4.39974	-0.73383	0.05117	0.01055
7025500.	4.33210	4.33212	-0.00019	0.03994	0.00000
3430100.	4.69900	4.66062	0.36680	0.04071	0.00285
7027500.	4.30350	4.34956	-0.45497	0.03349	0.00455
7030000.	4.64760	4.56047	0.88023	0.15418	0.05281
7030050.	4.61260	4.59429	0.19437	0.17408	0.00296
7277500.	4.61910	4.38649	1.99006	0.04868	0.06585
7030500.	4.31330	4.33038	-0.16657	0.02725	0.00058
3571000.	4.33250	4.29922	0.33986	0.05265	0.00217
7029000.	4.17120	4.27621	-1.02716	0.02083	0.02130
7024500.	4.21250	4.28380	-0.72408	0.03545	0.01139
3433500.	4.34330	4.43182	-0.92793	0.06651	0.02816
3592500.	4.46360	4.55274	-0.88773	0.03976	0.01357
3604000.	4.56980	4.46222	1.09826	0.03373	0.02092
7025400.	4.28160	4.28366	-0.01934	0.02986	0.00001
3436100.	4.57300	4.47967	0.90507	0.03633	0.01276
7030280.	4.44690	4.37597	0.69076	0.05978	0.01334
3598000.	4.55490	4.52686	0.27691	0.04583	0.00177
3429000.	4.64590	4.55935	0.85252	0.03963	0.01569
3567500.	4.32780	4.36491	-0.37482	0.05223	0.00282
3584000.	4.60700	4.44678	1.58590	0.04591	0.05821
3579100.	4.22060	4.31620	-0.89372	0.04261	0.01403
7029275.	4.18410	4.20538	-0.16728	0.02603	0.00050
7269990.	4.27900	4.25899	0.17448	0.02701	0.00050
3314500.	4.76060	4.72345	0.34995	0.06294	0.00294
3606500.	4.03510	4.14068	-1.07601	0.05849	0.03036
3435500.	4.41540	4.35194	0.62923	0.03771	0.00720
7029300.	4.27120	4.21267	0.54652	0.03105	0.00575
7029270.	4.19320	4.21580	-0.21472	0.03042	0.00092
7025000.	3.87720	4.15242	-2.55403	0.03812	0.13753
3313000.	4.80800	4.62232	1.40944	0.01674	0.02123
3568000.	5.47590	5.45059	0.32331	0.40352	0.01862
3432350.	4.17830	4.23611	-0.53841	0.08845	0.00938
3592000.	4.05920	4.30076	-2.31630	0.05606	0.10472
7030240.	4.28450	4.23626	0.45591	0.07476	0.00537
3588500.	4.60540	4.42507	1.85734	0.06767	0.09037
2387000.	4.38510	4.54329	-1.70679	0.17538	0.16722
7276000.	4.34470	4.15724	1.62421	0.03298	0.04746
3575000.	4.62040	4.41895	2.06812	0.06556	0.10880
3427500.	4.41690	4.37192	0.44995	0.06628	0.00541
3438000.	4.14020	4.13959	0.00631	0.09067	0.00000
3312500.	4.65050	4.48949	1.43860	0.02110	0.02720
3566000.	4.70600	4.88600	-1.87227	0.23124	0.28477
3594445.	4.05500	4.01009	0.39609	0.06241	0.00434
3576148.	4.08280	4.10271	-0.17023	0.08654	0.00084

AVERAGE SAMPLING ERROR VARIANCE	0.0012
MODEL ERROR VARIANCE	0.0090
PRESS/N	0.0129
MAXIMUM SAMPLING ERROR VARIANCE	0.0044
HA 3 SITE	
SAMPLING ERROR VARIANCE	0.0014
EQUIVALENT YEARS	9.55
HA 2 SITE	
SAMPLING ERROR VARIANCE	0.0013
EQUIVALENT YEARS	9.67

Table B-1. Detailed output file produced by the region-of-influence method for Tennessee—Continued

SUMMARY OF REGION-OF-INFLUENCE (ROI) REGRESSION FOR:
Big River at Centerville, TN
25 YR-PEAK

REGRESSION COEFFICIENTS

VARIABLE	COEFFICIENT	STANDARD ERROR	T FOR H0:BETA=0	PROB>|T|
CONSTANT	3.01451	0.11606	25.97309	
LOG(CDA)	0.55710	0.04023	13.84938	0.0001
LOG(PF)	0.64210	0.15523	4.13650	0.0001

Residuals and influence statistics

ID	LOG(OBS)	LOG(PRED)	STD RES	LEVERAGE	COOKS D
3602000.	4.78620	4.95676	-1.52851	0.07540	0.09665
3584500.	4.91710	4.92432	-0.06466	0.07411	0.00016
7026000.	4.74780	4.70727	0.38769	0.10656	0.00880
3599500.	4.68680	4.83263	-1.35127	0.05296	0.06483
7026300.	4.69300	4.72583	-0.30304	0.08958	0.00529
7028000.	4.58420	4.58524	-0.00877	0.03073	0.00000
7027800.	4.50570	4.57063	-0.52879	0.02695	0.00815
7029100.	4.37370	4.57214	-1.71617	0.02708	0.09711
3603000.	4.92760	5.00100	-0.68583	0.09589	0.02240
3582000.	4.56280	4.74348	-1.37791	0.02531	0.04139
7031700.	4.52810	4.53292	-0.04223	0.03563	0.00006
3604500.	4.71807	4.67731	0.37591	0.03129	0.00335
7029500.	4.72110	4.66269	0.55773	0.08477	0.01594
3434500.	4.67264	4.66264	0.09288	0.02579	0.00020
7029400.	4.61640	4.54923	0.58198	0.03633	0.01063
7031650.	4.42960	4.51340	-0.67909	0.04856	0.01177
7025500.	4.44380	4.43857	0.04763	0.04018	0.00007
3430100.	4.77760	4.76131	0.14056	0.04023	0.00056
7027500.	4.44360	4.44471	-0.00991	0.02598	0.00000
7030000.	4.74670	4.72011	0.22972	0.07211	0.00262
7030050.	4.70520	4.75108	-0.41743	0.08738	0.01051
7277500.	4.74910	4.49397	1.94583	0.04853	0.08283
7030500.	4.41490	4.44792	-0.29129	0.02666	0.00235
3571000.	4.42160	4.42140	0.00186	0.04840	0.00000
7029000.	4.27670	4.38623	-0.97107	0.01955	0.02576
7024500.	4.31990	4.39366	-0.68269	0.03556	0.01387
3433500.	4.43350	4.56850	-1.27442	0.04568	0.05537
3592500.	4.55770	4.66264	-0.94924	0.03961	0.02027
3604000.	4.71190	4.56187	1.39796	0.03282	0.04573
7025400.	4.40600	4.38784	0.15404	0.02753	0.00059
3436100.	4.66330	4.58906	0.65204	0.03626	0.00877
7030280.	4.54020	4.44869	0.79359	0.01977	0.01684
3598000.	4.67230	4.61600	0.50318	0.03970	0.00747
3429000.	4.71450	4.65635	0.51944	0.03861	0.00785
3567500.	4.41110	4.44953	-0.35095	0.04190	0.00269
3584000.	4.75790	4.55177	1.85132	0.04589	0.10756
3579100.	4.34910	4.43954	-0.75998	0.03832	0.01261
7029275.	4.30580	4.35160	-0.31517	0.01384	0.00166
7269990.	4.35880	4.37854	-0.15363	0.02684	0.00050
3314500.	4.87180	4.84240	0.24733	0.05014	0.00160
3606500.	4.16280	4.26930	-0.98623	0.05791	0.03306
3435500.	4.51570	4.46893	0.42093	0.03774	0.00423
7029300.	4.39140	4.32987	0.51717	0.03092	0.00682
7029270.	4.31320	4.32557	-0.10606	0.02895	0.00030
7025000.	3.93970	4.26536	-2.71673	0.03558	0.20516
3313000.	4.91820	4.72809	1.27210	0.01572	0.02151
3568000.	5.53130	5.46439	0.74055	0.34623	0.10057
3432350.	4.25960	4.37954	-0.99205	0.06947	0.03467
3592000.	4.20930	4.42835	-1.89114	0.05004	0.08407
7030240.	4.38420	4.31810	0.55593	0.04920	0.00800
3588500.	4.73990	4.49885	2.22956	0.03500	0.12061
2387000.	4.46550	4.57234	-0.97240	0.03951	0.01761
7276000.	4.43760	4.27691	1.24192	0.03255	0.03599
3575000.	4.76370	4.49444	2.48508	0.03780	0.14997
3427500.	4.48090	4.47313	0.07050	0.06472	0.00018
3438000.	4.27290	4.28693	-0.13011	0.07205	0.00063
3312500.	4.79110	4.59706	1.55399	0.02115	0.04143
3566000.	4.75700	4.88558	-1.08665	0.05944	0.03054
3594445.	4.16450	4.15424	0.08030	0.05544	0.00021
3576148.	4.20440	4.26224	-0.43216	0.05214	0.00477

AVERAGE SAMPLING ERROR VARIANCE	0.0012
MODEL ERROR VARIANCE	0.0106
PRESS/N	0.0150
MAXIMUM SAMPLING ERROR VARIANCE	0.0045
HA 3 SITE	
SAMPLING ERROR VARIANCE	0.0015
EQUIVALENT YEARS	11.43
HA 2 SITE	
SAMPLING ERROR VARIANCE	0.0014
EQUIVALENT YEARS	11.55

SUMMARY OF REGION-OF-INFLUENCE (ROI) REGRESSION FOR:
Big River at Centerville, TN
50 YR-PEAK

REGRESSION COEFFICIENTS

VARIABLE	COEFFICIENT	STANDARD ERROR	T FOR H0:BETA=0	PROB>|T|
CONSTANT	3.12463	0.12333	25.33606	
LOG(CDA)	0.54137	0.04272	12.67242	0.0001
LOG(PF)	0.63463	0.16686	3.80344	0.0004

Residuals and influence statistics

ID	LOG(OBS)	LOG(PRED)	STD RES	LEVERAGE	COOKS D
3602000.	4.82940	5.01366	-1.55510	0.07490	0.10091
3584500.	4.99360	4.98215	0.09660	0.07428	0.00037
7026000.	4.80410	4.76747	0.33180	0.10855	0.00664
3599500.	4.73940	4.89309	-1.34694	0.05276	0.06571
7026300.	4.75120	4.78545	-0.29822	0.09005	0.00523
7028000.	4.65220	4.64933	0.02256	0.02978	0.00002
7027800.	4.58160	4.63518	-0.40824	0.02578	0.00488
7029100.	4.42710	4.63665	-1.70346	0.02584	0.09713
3603000.	4.98680	5.05649	-0.61537	0.09642	0.01829
3582000.	4.61850	4.80651	-1.33546	0.02429	0.03854
7031700.	4.59860	4.59868	-0.00064	0.03590	0.00000
3604500.	4.80197	4.74173	0.52585	0.03128	0.00669
7029500.	4.79700	4.72432	0.65774	0.08641	0.02287
3434500.	4.72744	4.72747	-0.00025	0.02532	0.00000
7029400.	4.69390	4.61446	0.64717	0.03641	0.01335
7031650.	4.50150	4.57977	-0.59339	0.04844	0.00904
7025500.	4.51360	4.50732	0.05399	0.04057	0.00009
3430100.	4.82910	4.82382	0.04283	0.03971	0.00005
7027500.	4.53670	4.51327	0.19771	0.02584	0.00113
7030000.	4.80970	4.77990	0.24147	0.07145	0.00292
7030050.	4.76290	4.80989	-0.40265	0.08721	0.00995
7277500.	4.82970	4.56096	1.90942	0.04849	0.07949
7030500.	4.47590	4.51638	-0.33644	0.02653	0.00319
3571000.	4.47790	4.49125	-0.11767	0.04957	0.00034
7029000.	4.34690	4.45665	-0.91716	0.01871	0.02337
7024500.	4.38720	4.46384	-0.67142	0.03570	0.01376
3433500.	4.49150	4.63655	-1.29804	0.04558	0.05901
3592500.	4.61820	4.72747	-0.93387	0.04035	0.01997
3604000.	4.80390	4.62948	1.54021	0.03320	0.05681
7025400.	4.48710	4.45820	0.23009	0.02718	0.00134
3436100.	4.72160	4.65592	0.54361	0.03637	0.00617
7030280.	4.59910	4.51713	0.66881	0.01913	0.01214
3598000.	4.74940	4.68268	0.56232	0.03962	0.00949
3429000.	4.75730	4.72187	0.29844	0.03844	0.00264
3567500.	4.46370	4.51862	-0.47436	0.04275	0.00503
3584000.	4.85760	4.62030	2.01046	0.04589	0.12901
3579100.	4.42990	4.51052	-0.63573	0.03820	0.00884
7029275.	4.38540	4.42312	-0.24037	0.01315	0.00095
7269990.	4.40870	4.44920	-0.29412	0.02685	0.00182
3314500.	4.94550	4.90227	0.34115	0.05020	0.00305
3606500.	4.24500	4.34344	-0.86221	0.05892	0.02574
3435500.	4.58140	4.53910	0.35944	0.03802	0.00313
7029300.	4.46680	4.40208	0.51029	0.03074	0.00667
7029270.	4.38960	4.39792	-0.06704	0.02857	0.00012
7025000.	3.97810	4.33962	-2.82640	0.03449	0.22205
3313000.	4.98860	4.79112	1.22217	0.01497	0.01936
3568000.	5.56590	5.50596	0.62900	0.34945	0.07360
3432350.	4.31000	4.45301	-1.10687	0.06857	0.04308
3592000.	4.31150	4.49964	-1.52753	0.05032	0.05518
7030240.	4.44710	4.39068	0.44508	0.04899	0.00515
3588500.	4.82680	4.56820	2.26467	0.03541	0.12704
2387000.	4.51560	4.63810	-1.05458	0.04051	0.02114
7276000.	4.49150	4.35080	1.01350	0.03194	0.02372
3575000.	4.85400	4.56391	2.53433	0.03839	0.15915
3427500.	4.52050	4.54392	-0.20053	0.06516	0.00146
3438000.	4.36280	4.36213	0.00590	0.07305	0.00000
3312500.	4.88350	4.66370	1.64635	0.02099	0.04636
3566000.	4.78820	4.94285	-1.22616	0.05896	0.03875
3594445.	4.23210	4.23204	0.00045	0.05437	0.00000
3576148.	4.28380	4.33811	-0.37721	0.05109	0.00356

AVERAGE SAMPLING ERROR VARIANCE	0.0014
MODEL ERROR VARIANCE	0.0116
PRESS/N	0.0168
MAXIMUM SAMPLING ERROR VARIANCE	0.0051
HA 3 SITE	
SAMPLING ERROR VARIANCE	0.0017
EQUIVALENT YEARS	12.73
HA 2 SITE	
SAMPLING ERROR VARIANCE	0.0016
EQUIVALENT YEARS	12.87

Table B-1. Detailed output file produced by the region-of-influence method for Tennessee—Continued

```
SUMMARY OF REGION-OF-INFLUENCE (ROI) REGRESSION FOR:
 Big River at Centerville, TN
   100   YR-PEAK

 REGRESSION COEFFICIENTS
  VARIABLE       COEFFICIENT   STANDARD ERROR   T FOR H0:BETA=0    PROB>|T|

  CONSTANT            3.22370       0.13101       24.60718
  LOG(CDA)            0.52702       0.04537       11.61526         0.0001
  LOG(PF)             0.63238       0.17864        3.54000         0.0008

 Residuals and influence statistics
   ID         LOG(OBS)   LOG(PRED)     STD RES     LEVERAGE    COOKS D

   3602000.     4.86750     5.06487    -1.56826     0.07455     0.10308
   3584500.     5.06380     5.03422     0.23503     0.07441     0.00217
   7026000.     4.85350     4.82010     0.28596     0.10991     0.00502
   3599500.     4.78730     4.94758    -1.32641     0.05265     0.06448
   7026300.     4.80240     4.83751    -0.28818     0.09039     0.00495
   7028000.     4.71150     4.70569     0.04291     0.02915     0.00006
   7027800.     4.64800     4.69198    -0.31406     0.02501     0.00289
   7029100.     4.47380     4.69341    -1.67850     0.02500     0.09503
   3603000.     5.04000     5.10635    -0.55292     0.09679     0.01488
   3582000.     4.66740     4.86335    -1.30061     0.02365     0.03625
   7031700.     4.66060     4.65663     0.03076     0.03612     0.00003
   3604500.     4.87683     4.79965     0.63661     0.03129     0.00992
   7029500.     4.86450     4.77831     0.73756     0.08755     0.02932
   3434500.     4.77509     4.78575    -0.08867     0.02501     0.00019
   7029400.     4.76380     4.67192     0.70395     0.03650     0.01592
   7031650.     4.56630     4.63832    -0.51170     0.04831     0.00672
   7025500.     4.57480     4.56816     0.05388     0.04081     0.00009
   3430100.     4.87600     4.88019    -0.03193     0.03937     0.00003
   7027500.     4.62230     4.57392     0.38477     0.02577     0.00433
   7030000.     4.86560     4.83214     0.25462     0.07101     0.00326
   7030050.     4.81350     4.86118    -0.38463     0.08713     0.00917
   7277500.     4.89980     4.62011     1.85714     0.04838     0.07479
   7030500.     4.52760     4.57693    -0.38614     0.02646     0.00424
   3571000.     4.52770     4.55335    -0.21375     0.05031     0.00114
   7029000.     4.41140     4.51909    -0.84776     0.01815     0.02013
   7024500.     4.44630     4.52605    -0.66006     0.03579     0.01349
   3433500.     4.54350     4.69801    -1.30776     0.04551     0.06086
   3592500.     4.67250     4.78575    -0.91333     0.04086     0.01927
   3604000.     4.88670     4.69027     1.64024     0.03348     0.06526
   7025400.     4.56060     4.52059     0.29930     0.02695     0.00227
   3436100.     4.77420     4.71603     0.45344     0.03640     0.00432
   7030280.     4.65110     4.57766     0.56373     0.01871     0.00869
   3598000.     4.81960     4.74289     0.60930     0.03960     0.01124
   3429000.     4.79490     4.78101     0.11026     0.03834     0.00036
   3567500.     4.51030     4.58004    -0.56880     0.04327     0.00731
   3584000.     4.94870     4.68220     2.12809     0.04589     0.14587
   3579100.     4.50110     4.57435    -0.54248     0.03807     0.00642
   7029275.     4.45760     4.48661    -0.17211     0.01272     0.00048
   7269990.     4.45260     4.51187    -0.40264     0.02688     0.00339
   3314500.     5.01310     4.95608     0.42251     0.05025     0.00468
   3606500.     4.31870     4.40945    -0.75056     0.05962     0.01969
   3435500.     4.64110     4.60220     0.31173     0.03820     0.00237
   7029300.     4.53320     4.46624     0.49570     0.03064     0.00629
   7029270.     4.45760     4.46221    -0.03493     0.02833     0.00003
   7025000.     4.01130     4.40576    -2.89349     0.03370     0.23197
   3313000.     5.05140     4.84777     1.17209     0.01449     0.01745
   3568000.     5.59620     5.54276     0.53051     0.35167     0.05286
   3432350.     4.35410     4.51946    -1.19959     0.06789     0.05043
   3592000.     4.40710     4.56375    -1.19625     0.05043     0.03387
   7030240.     4.50290     4.45520     0.35330     0.04876     0.00324
   3588500.     4.90490     4.63055     2.27037     0.03572     0.12908
   2387000.     4.55950     4.69654    -1.11408     0.04114     0.02383
   7276000.     4.53610     4.41658     0.80484     0.03153     0.01480
   3575000.     4.93370     4.62638     2.53677     0.03882     0.16115
   3427500.     4.55490     4.60789    -0.42789     0.06544     0.00670
   3438000.     4.44640     4.42976     0.13769     0.07374     0.00072
   3312500.     4.96770     4.72361     1.71309     0.02091     0.04993
   3566000.     4.81510     4.99368    -1.32964     0.05858     0.04536
   3594445.     4.29080     4.30157    -0.07335     0.05364     0.00017
   3576148.     4.35580     4.40636    -0.32765     0.05038     0.00264


 AVERAGE SAMPLING ERROR VARIANCE       0.0016
 MODEL ERROR VARIANCE                  0.0129
 PRESS/N                               0.0189
 MAXIMUM SAMPLING ERROR VARIANCE       0.0057
 HA 3 SITE
   SAMPLING ERROR VARIANCE             0.0020
   EQUIVALENT YEARS                     13.67
 HA 2 SITE
   SAMPLING ERROR VARIANCE             0.0018
   EQUIVALENT YEARS                     13.83
```

SUMMARY OF REGION-OF-INFLUENCE (ROI) REGRESSION FOR:
Big River at Centerville, TN
500 YR-PEAK

REGRESSION COEFFICIENTS

VARIABLE	COEFFICIENT	STANDARD ERROR	T FOR H0:BETA=0	PROB>|T|
CONSTANT	3.42382	0.14995	22.83372	
LOG(CDA)	0.49760	0.05196	9.57586	0.0001
LOG(PF)	0.64048	0.20618	3.10643	0.0030

Residuals and influence statistics

ID	LOG(OBS)	LOG(PRED)	STD RES	LEVERAGE	COOKS D
3602000.	4.94240	5.16880	-1.57014	0.07420	0.10328
3584500.	5.21010	5.13992	0.48674	0.07458	0.00932
7026000.	4.95010	4.92248	0.20727	0.11127	0.00267
3599500.	4.88640	5.05830	-1.24557	0.05263	0.05718
7026300.	4.90300	4.93864	-0.25566	0.09078	0.00393
7028000.	4.82660	4.81623	0.06660	0.02854	0.00014
7027800.	4.77770	4.80350	-0.16003	0.02427	0.00075
7029100.	4.56490	4.80482	-1.59813	0.02417	0.08613
3603000.	5.14740	5.20733	-0.43701	0.09723	0.00933
3582000.	4.76300	4.97894	-1.24119	0.02314	0.03246
7031700.	4.78210	4.77068	0.07725	0.03650	0.00019
3604500.	5.02666	4.91689	0.79325	0.03134	0.01543
7029500.	4.99920	4.88367	0.86682	0.08878	0.04106
3434500.	4.86696	4.90373	-0.26814	0.02474	0.00177
7029400.	4.90600	4.78487	0.80895	0.03669	0.02102
7031650.	4.69790	4.75368	-0.34415	0.04800	0.00301
7025500.	4.69410	4.68852	0.03962	0.04097	0.00005
3430100.	4.97220	4.99481	-0.15025	0.03906	0.00064
7027500.	4.80070	4.69387	0.74238	0.02578	0.01613
7030000.	4.97680	4.93366	0.28571	0.07057	0.00411
7030050.	4.91210	4.96062	-0.34161	0.08716	0.00728
7277500.	5.03530	4.73676	1.71663	0.04800	0.06292
7030500.	4.62390	4.69666	-0.49721	0.02646	0.00702
3571000.	4.62590	4.67703	-0.37348	0.05089	0.00349
7029000.	4.54590	4.64295	-0.66715	0.01759	0.01243
7024500.	4.56190	4.64942	-0.63444	0.03586	0.01250
3433500.	4.64820	4.82317	-1.29887	0.04547	0.06053
3592500.	4.78190	4.90373	-0.85961	0.04144	0.01704
3604000.	5.05470	4.81331	1.76744	0.03379	0.07588
7025400.	4.71070	4.64435	0.43225	0.02675	0.00469
3436100.	4.88070	4.83771	0.29263	0.03630	0.00179
7030280.	4.75380	4.69734	0.37791	0.01836	0.00389
3598000.	4.96410	4.86545	0.68450	0.03967	0.01420
3429000.	4.86820	4.90137	-0.23003	0.03834	0.00158
3567500.	4.60250	4.70235	-0.71305	0.04369	0.01146
3584000.	5.13750	4.80827	2.29711	0.04595	0.17007
3579100.	4.64120	4.70354	-0.40185	0.03784	0.00348
7029275.	4.60540	4.61279	-0.03783	0.01233	0.00002
7269990.	4.53840	4.63625	-0.57617	0.02697	0.00681
3314500.	5.15370	5.06502	0.57182	0.05030	0.00849
3606500.	4.46740	4.54114	-0.53388	0.06031	0.00996
3435500.	4.76380	4.72992	0.23745	0.03836	0.00137
7029300.	4.66320	4.59388	0.44661	0.03059	0.00505
7029270.	4.59300	4.59014	0.01890	0.02812	0.00001
7025000.	4.07480	4.53771	-2.95261	0.03277	0.23816
3313000.	5.17710	4.96246	1.06476	0.01407	0.01397
3568000.	5.65540	5.61595	0.34359	0.35404	0.02238
3432350.	4.43940	4.65496	-1.35832	0.06699	0.06393
3592000.	4.61100	4.69350	-0.54925	0.05028	0.00706
7030240.	4.61300	4.58363	0.18934	0.04828	0.00092
3588500.	5.06320	4.75676	2.22204	0.03610	0.12358
2387000.	4.64470	4.81291	-1.19736	0.04160	0.02742
7276000.	4.61550	4.54776	0.39515	0.03111	0.00349
3575000.	5.09070	4.75281	2.44343	0.03930	0.14938
3427500.	4.62110	4.73827	-0.82698	0.06565	0.02508
3438000.	4.62400	4.56661	0.41552	0.07447	0.00650
3312500.	5.14130	4.84489	1.80658	0.02090	0.05457
3566000.	4.86640	5.09489	-1.48081	0.05804	0.05560
3594445.	4.40360	4.44095	-0.22039	0.05291	0.00148
3576148.	4.50300	4.54446	-0.23230	0.04965	0.00129

AVERAGE SAMPLING ERROR VARIANCE	0.0021
MODEL ERROR VARIANCE	0.0165
PRESS/N	0.0247
MAXIMUM SAMPLING ERROR VARIANCE	0.0075
HA 3 SITE	
SAMPLING ERROR VARIANCE	0.0026
EQUIVALENT YEARS	14.73
HA 2 SITE	
SAMPLING ERROR VARIANCE	0.0024
EQUIVALENT YEARS	14.91

Appendix C. Computing effective record length when historical information is available

Often, the systematically recorded data at a gaging station are adjusted for historical information about unusually large floods that might have occurred outside the period of record. Historical information can be used to improve flood-frequency estimates at sites of interest. To incorporate historical information into flood-frequency estimates, an effective record length is computed at the gaged site to account for the additional accuracy introduced by the historical record. This appendix describes the method used in this study to compute effective record length (N_e) given systematic record length (N), total historical period (H), and probability threshold (P_H). The P_H is estimated by the term $1-Z/H$, where Z is the number of observed historical peaks and/or high outliers. Values for Z, H, N, and N_e for 297 gaging stations in Tennessee are provided in table 4 and for 156 gaging stations in adjacent states in table 5.

Notation

H is the total historical period, in years.
N is the systematic record length, in years.
W equals (H - N) is the number of historic years that are not part of the systematic record.
Z is the number of historic peaks and/or high outliers.

Calculations

Let $H^* = \text{minimum}(W{,}200)$,
$P_H = 1-Z/H$,
$P^* = \ln(P_H/(1-P_H))$, where ln is the natural logarithm,
$A = \text{maximum}[(0.55-0.1(P^*)), 0]$,
$N_e = A(H^*) + N$.

The adjustment method described above is empirically derived from simulations reported in Stedinger and Cohn (1985) and Tasker and Thomas (1978). This method can be used to estimate the effective record lengths given in tables 4 and 5 to within plus or minus 1 year.

Appendix D. Calculation of equivalent years of record for regression-predicted peak discharges

The uncertainty in a flood-frequency prediction can be expressed as the number of years of record at a site needed to achieve an estimate of equal accuracy. The equivalent years of record (Hardison, 1971) can be calculated at a site of interest by equating the variance of prediction, *Vp*, to the variance of the Pearson III quantile estimated from a sample of annual peaks, *Var(y)*. The variance of a predicted response at site k with p basin characteristics $x_k = (1, x_{k,1}, x_{k,2}, ..., x_{k,p})$ is given by:

$$Vp = \hat{\gamma}^2 + x_k X' \hat{\Lambda}^{-1} X^{-1} x'_k .$$

The sample variance of the Pearson quantile, *Var(y)*, estimated from N years of annual peaks is approximated by:

$$Var(y) = \frac{\sigma^2}{N}\left[1 + \frac{k^2}{2}(1 + 0.75g^2) + kg\right] ,$$

Bobee (1973), where σ is the standard deviation of logs of annual peaks, k is the Pearson III standard deviate for a given recurrence interval, and g is the skew coefficient for logs of annual peaks. Substituting regional skew for g and a regional estimate of σ into the above equation, equating it to *Vp*, and solving for N provides for an equivalent number of years of record as a measure of accuracy. Calculation of equivalent years of record for sites of interest in Tennessee can be accomplished by using the flood-frequency computer application for Tennessee. Equivalent years of record for a discharge estimate computed by the region-of-influence method is provided in the detailed output file for this method (example in table B-1). These values can be used in eq. 11 to obtain weighted discharge estimates at gaging stations in Tennessee.