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North Carolina Department of Transportation, Division of Highways (Hydraulics Unit)) and the
North Carolina Department of Crime Control and Public Safety, Division of Emergency Management (Floodplain Mapping Program)

Magnitude and Frequency of Rural Floods in the Southeastern United States, through 2006: Volume 2, North Carolina

Scientific Investigations Report 2009–5158

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

Covers. **Front**—French Broad River downstream from the U.S. Geological Survey continuous-record streamgaging station (03453500) at Marshall in Madison County, western North Carolina, during flooding caused by rainfall from Hurricane Frances, September 9, 2004 *(Photographs by personnel of the U.S. Geological Survey, North Carolina Water Science Center)*

Back—Little Tennessee River downstream from the U.S. Geological Survey continuous-record streamgaging station (03503000) at Needmore in Swain County, western North Carolina, during flooding caused by rainfall from Hurricane Ivan, September 19, 2004 *(Photograph by Bentley T. Walton, U.S. Geological Survey, North Carolina Water Science Center, Asheville Field Office)*

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By J. Curtis Weaver, Toby D. Feaster, and Anthony J. Gotvald

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U.S. Department of the Interior
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Conversion Factors

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Precipitation	
inch per year (in/yr)	25.4	millimeter per year (mm/yr)

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 North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Elevation, as used in this report, refers to distance above the vertical datum.

Magnitude and Frequency of Rural Floods in the Southeastern United States, through 2006: Volume 2, North Carolina

By J. Curtis Weaver, Toby D. Feaster, and Anthony J. Gotvald

Abstract

Reliable estimates of the magnitude and frequency of floods are required for the economical and safe design of transportation and water-conveyance structures. A multistate approach was used to update methods for estimating the magnitude and frequency of floods in rural, ungaged basins in North Carolina, South Carolina, and Georgia that are not substantially affected by regulation, tidal fluctuations, or urban development. In North Carolina, annual peak-flow data available through September 2006 were available for 584 sites; 402 of these sites had a total of 10 or more years of systematic record that is required for at-site, flood-frequency analysis. Following data reviews and the computation of 20 physical and climatic basin characteristics for each station as well as at-site flood-frequency statistics, annual peak-flow data were identified for 363 sites in North Carolina suitable for use in this analysis. Among these 363 sites, 19 sites had records that could be divided into unregulated and regulated/channelized annual peak discharges, which means peak-flow records were identified for a total of 382 cases in North Carolina. Considering the 382 cases, at-site flood-frequency statistics are provided for 333 unregulated cases (also used for the regression database) and 49 regulated/channelized cases. The flood-frequency statistics for the 333 unregulated sites were combined with data for sites from South Carolina, Georgia, and adjacent parts of Alabama, Florida, Tennessee, and Virginia to create a database of 943 sites considered for use in the regional regression analysis.

Flood-frequency statistics were computed by fitting logarithms (base 10) of the annual peak flows to a log-Pearson Type III distribution. As part of the computation process, a new generalized skew coefficient was developed by using a Bayesian generalized least-squares regression model.

Exploratory regression analyses using ordinary least-squares regression completed on the initial database of 943 sites resulted in defining five hydrologic regions for North Carolina, South Carolina, and Georgia. Stations with drainage areas less than 1 square mile were removed from the database, and a procedure to examine for basin redundancy (based on drainage area and periods of record) also resulted in the removal of some stations from the regression database.

Flood-frequency estimates and basin characteristics for 828 gaged stations were combined to form the final database that was used in the regional regression analysis. Regional regression analysis, using generalized least-squares regression, was used to develop a set of predictive equations that can be used for estimating the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent chance exceedance flows for rural ungaged, basins in North Carolina, South Carolina, and Georgia. The final predictive equations are all functions of drainage area and the percentage of drainage basin within each of the five hydrologic regions. Average errors of prediction for these regression equations range from 34.0 to 47.7 percent.

Discharge estimates determined from the systematic records for the current study are, on average, larger in magnitude than those from a previous study for the highest percent chance exceedances (50 and 20 percent) and tend to be smaller than those from the previous study for the lower percent chance exceedances when all sites are considered as a group. For example, mean differences for sites in the Piedmont hydrologic region range from positive 0.5 percent for the 50-percent chance exceedance flow to negative 4.6 percent for the 0.2-percent chance exceedance flow when stations are grouped by hydrologic region. Similarly for the same hydrologic region, median differences range from positive 0.9 percent for the 50-percent chance exceedance flow to negative 7.1 percent for the 0.2-percent chance exceedance flow. However, mean and median percentage differences between the estimates from the previous and current studies vary substantially depending on the region and whether or not additional data were collected.

Introduction

Reliable estimates of the magnitude and frequency of floods are required for the design of transportation and water-conveyance structures, such as roads, bridges, culverts, dams, and levees. Federal, State, regional, and local officials

need these estimates to effectively plan and manage land use and water resources, protect lives and property in flood-prone areas, and determine flood-insurance rates.

Estimates of the magnitude and frequency of floods are needed at locations where streamgaging (or gaged) stations monitor streamflow continuously as well as at ungaged sites, where streamflow information is not available for use in determining the estimates. A process known as regionalization—where flood-frequency information determined for a group of gaged stations within a hydrologic region forms the basis of estimates for ungaged sites within the region—is used to estimate the magnitude and frequency of floods for ungaged sites. Historically, these hydrologic regions have been determined by each State, which often leads to differences in hydrologic regions at State boundaries. These differences cause some discontinuity and confusion on which flood-frequency techniques and results are most appropriate for drainage basins near or crossing State boundaries. In this study, a multistate approach with hydrologic regions that cross State boundaries is used in order to maintain continuity at the State boundaries.

Purpose and Scope

The purpose of this report, prepared in cooperation with the North Carolina, South Carolina, and Georgia Departments of Transportation (NCDOT, SCDOT, and GDOT, respectively) and the Floodplain Mapping Program within the North Carolina Department of Crime Control and Public Safety, is to present methods for estimating the magnitude and frequency of floods on rural streams in North Carolina, South Carolina, and Georgia. The data in this report are based on flood-frequency analyses of annual peak-flow data at streamflow-monitoring stations through the 2006 water year[1]. The report presents flood-frequency statistics at the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent chance exceedance levels determined for 333 rural, gaged stations in North Carolina with unregulated flow conditions; discusses the procedures used and results arising from the development of updated generalized skew; describes techniques used to develop regression equations for use in estimating the magnitude of floods (specifically, peak flows or discharges) for the stated range in percent chance exceedance at ungaged sites in North Carolina, South Carolina, and Georgia; provides regional equations for estimating the magnitude and frequency of peak discharges for rural, ungaged, non-regulated streams in North Carolina, South Carolina, and Georgia; describes the accuracy and limitations of the equations; and presents example applications of the methods.

At-site flood-frequency statistics are tabulated for 49 sites in North Carolina with regulated (47) or channelized (2) flow conditions. No flood-frequency statistics or regional relations for estimating flood peak discharges are provided in this report for basins that are considered urban (that is, having greater than 10 percent impervious area during the period of data collection) or otherwise affected by development.

This report focuses on the gaged stations in North Carolina that were used in the study. Two additional volumes present similar information for the gaged stations in Georgia (volume 1) and South Carolina (volume 3) that were used in the study. Many of the descriptions for standard definitions, processing methods, and analytical techniques described in this report were taken directly from Ries and Dillow (2006), Feaster and Tasker (2002), and Pope and others (2001).

Previous Studies in North Carolina

Flood-frequency characteristics have been studied in North Carolina at various points during past decades. As additional years of annual peak-flow data are accumulated at gaged stations, the at-site flood-frequency statistics and flood prediction relations are updated—commonly on a 10- to 20-year interval—by the U.S. Geological Survey (USGS) for respective States. This section provides a brief history of flood-frequency studies in North Carolina since the 1960s. Information in this section is replicated in whole or part from Gunter and others (1987) and Pope and others (2001).

Three reports by Speer and Gamble (1964a, 1964b, 1965), each covering a portion of North Carolina, presented methods for estimating flood magnitudes for various recurrence intervals (Gunter and others, 1987). The methods, however, were applicable only to rural basins greater than about 150 square miles (mi^2) in size. Beginning in 1952, crest-stage stations were established at 120 sites in rural basins generally less than 50 mi^2 in size. Crest-stage stations are partial-record sites used to measure annual peak flows. Records for these and other gaging stations through 1963 were used by Hinson (1965) to develop statewide flood relations for rural basins less than 150 mi^2 in size. Jackson (1976) used 10 additional years of record to better define statewide flood prediction relations, especially for basins less than 50 mi^2 in size. Generally, results of these studies were applicable to rural basins in North Carolina with the exception of streams subject to regulation, tide effect, urbanization, channel improvement, and those streams with basins covering less than 0.5 mi^2.

Gunter and others (1987) used data from 254 gaged stations on rural streams in North Carolina with 10 or more years of record along with basin and climatic variables to develop regional relations for estimating peak discharges at ungaged sites having recurrence intervals from 2 to 100 years. Annual peak-flow data through the 1984 water year were used in their study. The regional relations were developed for three hydrologic areas of the State: (1) Blue Ridge–Piedmont, (2) Coastal Plain, and (3) Sand Hills. Drainage area was the only basin characteristic used in the relations developed by Gunter and others (1987).

[1] The water year is the annual period from October 1 through September 30 and is designated by the year in which the period ends. For example, the 2006 water year is from October 1, 2005, through September 30, 2006.

Pope and others (2001) updated the flood-frequency statistics for North Carolina based on annual peak-flow data through the 1996 water year, including 12 additional years of peak-flow data collected since Gunter and others (1987). Pope and others (2001) also used 64 gaged stations that were not included in Gunter and others (1987). The 12 intervening years (1985–96) included several years of pronounced drought (1985–88) as well as years in which maximum peaks of record were recorded (1992–93, 1996) for North Carolina streams. Two methods were developed by Pope and others (2001) for estimating peak flows with 0.2 through 50 percent chance exceedance. Regional regression analysis was used to develop a set of relations—based on use of drainage area as the explanatory variable—for rural, ungaged basins in the (1) Blue Ridge–Piedmont, (2) Coastal Plain, and (3) Sand Hills hydrologic areas. A region-of-influence (ROI) method also was developed to estimate peak discharges. In this method, regression techniques are used to develop a unique relation between flood discharges and basin characteristics for a subset of gaged stations with similar basin characteristics in the ungaged basin. This interactively developed relation for the ungaged site can then be used to predict the T-year recurrence interval peak flows. Comparison of the regression diagnostics for the two methods did not indicate the ROI method to be substantially better than the regional regression analysis; therefore, Pope and others (2001) considered the regional regression to be the primary method for computing peak discharges at ungaged sites.

Nationwide, numerous reports are available that describe the effects of urban development on floods; however, relatively few reports include predictive techniques that are applicable to North Carolina streams (Gunter and others, 1987). Putnam (1972) determined that urban development in the State's Piedmont Province substantially affected flood flows and presented relations, including indices of lag time and impervious cover, to account for the increase in peak discharge caused by urbanization. Sauer and others (1983) developed relations for a nationwide application. Their technique uses the flood magnitude for rural streams as a base; parameters reflective of the degree of urban development are used to adjust the flood magnitude from rural to urban conditions. Gunter and others (1987) presented an analysis of the applicability of these nationwide relations to the Coastal Plain and Piedmont Provinces of North Carolina.

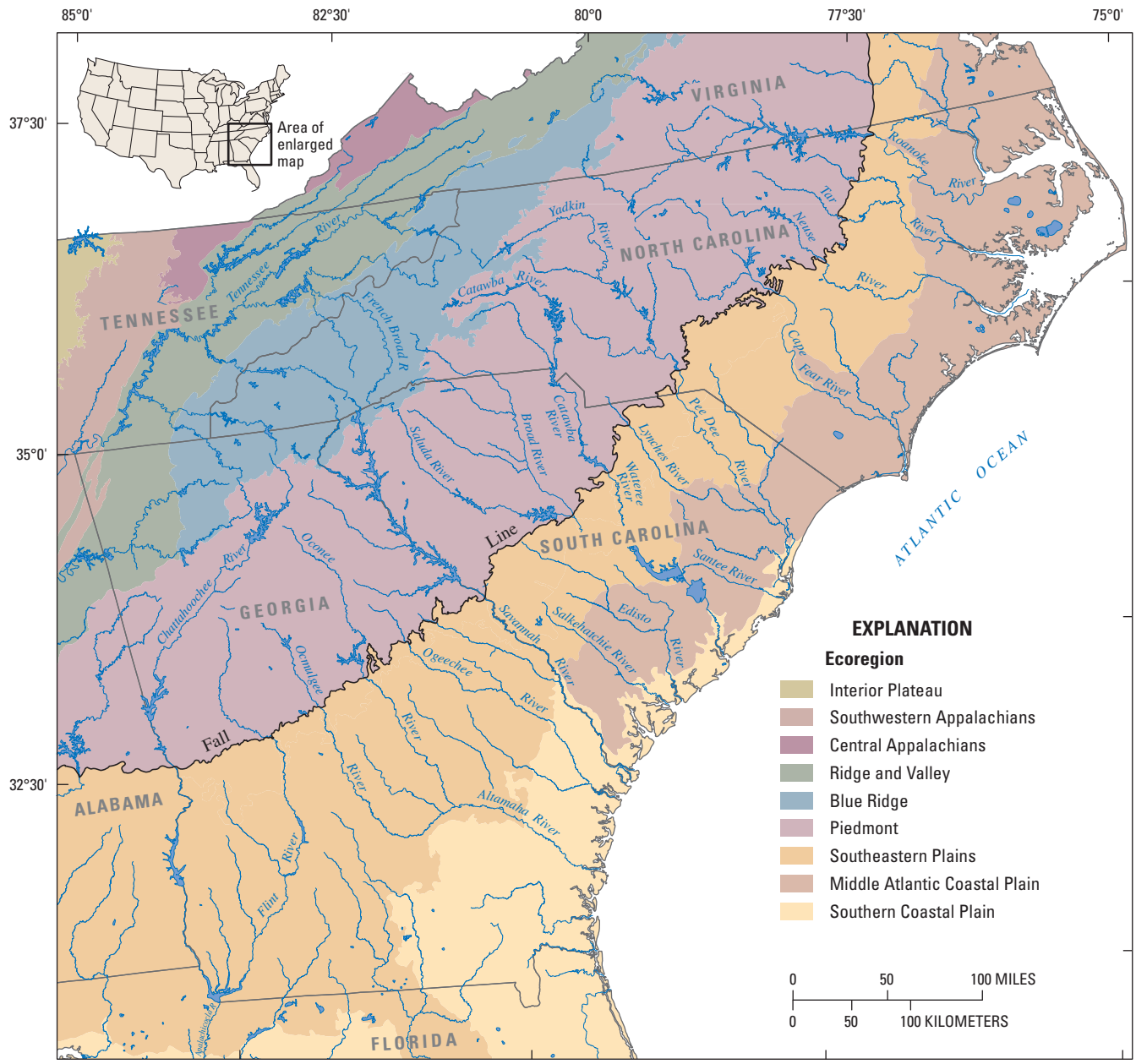
The most recent study of flood-frequency characteristics in urban basins in North Carolina was completed by Robbins and Pope (1996). In that study, concurrent records of rainfall and runoff data collected in small, urban basins were used to calibrate rainfall-runoff models. Historic rainfall records were used with the calibrated models to synthesize a long-term record of annual peak flow used for determining the flood-frequency distributions and corresponding statistics. Flood-frequency statistics were developed for 32 small, urban basins in the Blue Ridge–Piedmont, Coastal Plain, and Sand Hills hydrologic areas of the State. Drainage areas for the basins ranged from 0.04 to 41.0 mi^2. A generalized least-squares regression analysis was used to develop a relation where drainage area, impervious area, and rural flood discharge were determined to be the most significant basin characteristics.

Description of Study Area

The study area includes all of North Carolina, South Carolina, and Georgia, covering an area of about 142,500 mi^2 within seven U.S. Environmental Protection Agency (USEPA) level III ecoregions—Southwestern Appalachians, Blue Ridge, Ridge and Valley, Piedmont, Southeastern Plains, Southern Coastal Plain, and Middle Atlantic Coastal Plain (fig. 1; U.S. Environmental Protection Agency, 2007). The ecoregions represent areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources. The ecoregions provide a spatial framework for the research, assessment, management, and monitoring of ecosystems and ecosystem components. The ecoregions were determined from an analysis of the spatial patterns and the composition of biotic and abiotic phenomena that include geology, physiography, vegetation, climate, soils, land use, wildlife, and hydrology (Griffith and others, 2002). The Fall Line separates the higher elevation Southwestern Appalachians, Blue Ridge, Ridge and Valley, and Piedmont ecoregions from the low lying Southeastern Plains, Southern Coastal Plain, and Middle Atlantic Coastal Plain ecoregions.

The Southwestern Appalachians ecoregion is composed of open, low mountains. The eastern boundary of this ecoregion, along the more abrupt escarpment where it meets the Ridge and Valley ecoregion, is relatively smooth and only slightly notched by small, eastward-flowing streams. The Ridge and Valley is composed of roughly parallel ridges and valleys that have a variety of widths, heights, and geologic materials. Springs and caves are relatively numerous in this ecoregion, and present-day forests cover about 50 percent of the ecoregion. The Blue Ridge ecoregion varies from narrow ridges to hilly plateaus to more massive mountainous areas. The mostly forested slopes; high-gradient, cool, clear streams; and rugged terrain overlie primarily metamorphic rocks, with minor areas of igneous and sedimentary geology. The Piedmont ecoregion is composed of a transitional area between the mostly mountainous ecoregions of the Appalachians to the northwest and the relatively flat Coastal Plain to the southeast. The Piedmont ecoregion is a complex mosaic of metamorphic and igneous rocks of Precambrian and Paleozoic age, with moderately dissected irregular plains and some hills. The soils tend to be finer textured than in the coastal plain regions to the south. Once largely cultivated, much of this ecoregion has reverted to pine and hardwood forests, with increasing conversion to urban and suburban land cover (Omernik, 1987).

The Southeastern Plains ecoregion is composed of irregular plains made up of a mixture of cropland, pasture, woodland, and forest. The sand, silt, and clay geology of this ecoregion contrasts with the older rocks of the Piedmont ecoregion. Elevations and relief are greater than in the



Base modified from U.S. Geological Survey 1:100,000-scale digital data
Ecoregions from U.S. Environmental Protection Agency 1:7,500,000-scale digital data (2002; revised Omernik, 1987)

Figure 1. Study area and ecoregions in North Carolina, South Carolina, Georgia, and the surrounding States.

Southern Coastal Plain ecoregion but generally are less than in much of the Piedmont. Streams in this area have relatively low gradient and sandy bottoms. The Southern Coastal Plain ecoregion consists of mostly flat plains, but it is a heterogeneous ecoregion containing barrier islands, coastal lagoons, marshes, and swampy lowlands along the Gulf and Atlantic coasts. This ecoregion is lower in elevation with less relief and wetter soils than the Southeastern Plains ecoregion. The Middle Atlantic Coastal Plain ecoregion consists of low-elevation flat plains, with many swamps, marshes, and estuaries. The low terraces, marshes, dunes, barrier islands, and beaches are underlain by unconsolidated sediments. Poorly drained soils are common, and the ecoregion has a mix of coarse and finer textured soils compared to the mostly coarse soils in the majority of the Southeastern Plains ecoregion. The Middle Atlantic Coastal Plain ecoregion typically is lower, flatter, and more poorly drained than the Southern Coastal Plain ecoregion (Omernik, 1987).

The average annual precipitation for the study area ranges from 40 to 60 inches per year with the exception of the southern portion of the Blue Ridge ecoregion, which receives up to 80 inches or more of precipitation per year (Natural

Resources Conservation Service, 2008). Precipitation in the study area is associated with the movement of warm and cold fronts from November through April and isolated summer thunderstorms from May through October. Occasionally, tropical storms or hurricanes that enter along the Atlantic and Gulf coasts produce unusually heavy amounts of rainfall. The mean annual air temperature in the study area ranges from 55 degrees Fahrenheit (°F) in northern North Carolina to 68 °F in southern Georgia (National Oceanic and Atmospheric Administration, 2008). Normal daily mean temperatures in North Carolina range from the 30s in the higher elevations to the 50s at the coast during January and from the 70s to 80s, respectively, during July (State Climate Office of North Carolina, n.d.).

Acknowledgments

The authors gratefully acknowledge the leadership and guidance provided by Larry R. Bohman, Surface-Water Specialist with the USGS Eastern Region, South. Mr. Bohman often took the lead in coordinating meetings among the three USGS Water Science Centers involved in this study and served as liaison with the USGS Office of Surface Water. Mr. Bohman provided valuable technical guidance and other support throughout the entire study. Additionally, the authors acknowledge the valuable guidance and assistance in flood-frequency estimation and statistical regionalization procedures provided by Dr. Timothy A. Cohn of the USGS Office of Surface Water. We also acknowledge the participation of Dr. Jery R. Stedinger and Andrea M. Gruber of Cornell University in Ithaca, New York, for their significant contributions in developing the generalized skew coefficient for the study area.

The peak-flow data used in the analyses described in this report were collected throughout North Carolina, South Carolina, Georgia, and adjoining States at gaged stations operated in cooperation with a variety of Federal, State, and local agencies. The authors also acknowledge the dedicated work of the USGS field-office staff in collecting, processing, and storing the peak-flow data necessary for the completion of this study.

The authors acknowledge Dave Henderson of the Hydraulics Unit within the North Carolina Department of Transportation and John Dorman of the North Carolina Floodplain Mapping Program within the Emergency Management Division of the Department of Crime Control and Public Safety. Their foresight and leadership in areas of flood-frequency issues as well as their assistance and support in the completion of this study has improved the understanding of flood-frequency characteristics in North Carolina.

Data Compilation

The first step in the regionalization of flood-frequency estimates for rural streams is the compilation of a list of all rural, gaged stations with 10 or more years of annual peak-flow record. It is important that the peak-flow data are reviewed for quality assurance and quality control (QA/QC) as well as for homogeneity or absence of trends over time, which implies relatively constant watershed conditions during the period of record. Once peak-flow records are compiled and reviewed, then basin characteristics need to be computed for each of the gaged stations. In North Carolina, annual peak-flow data available through the 2006 water year were available for 584 sites, of which 402 sites had a total of 10 or more years of systematic-peak record, including some sites with record that can be divided into unregulated and regulated/channelized annual peak discharges.

Annual peak-flow data were identified for 363 sites in North Carolina. Among the 363 sites, 19 sites had record that could be divided into unregulated and regulated/channelized annual peak discharges, which means peak-flow records were identified for a total of 382 cases[2] for North Carolina. Also among the 363 sites, 30 sites had record containing only regulated/channelized flow, and 314 sites had records unaffected by any known regulation/channelization. Considering the 382 cases, at-site flood-frequency statistics are provided for 333 unregulated cases (also used for the regression database) and 49 regulated/channelized cases. Compared to the previous flood-frequency study for North Carolina (Pope and others, 2001), this study represents an additional 16 sites with unregulated conditions and 8 sites with regulated conditions. The additional sites represent new sites with sufficient data now available for analysis, several sites inadvertently omitted in the previous study, and some sites where the presence of unregulated or regulated flow conditions were re-evaluated. Additionally, 33 sites identified in the previous North Carolina report did not have sufficient record to allow for determination of at-site flood-frequency statistics. In the current report, only sites with sufficient peak-flow record are included in the determination and publication of at-site flood-frequency statistics.

The intervening years since the previous study by Pope and others (2001), which used data through the 1996 water year, were marked by several major flooding events and a period of severe drought in North Carolina. Flooding occurred during September 1999 in the Coastal Plain following the passage of Hurricane Floyd (Bales and others, 2000) and during September 2004 in the Blue Ridge region following the passage of Hurricanes Frances and Ivan within a 2-week period. Much of North Carolina—in particular, the western Piedmont—was affected by severe drought conditions from 1998 through 2002 (Weaver, 2005). During this period, a number of long-term sites (25+ years of record) had new record minimum and(or) maximum annual peak flows. Additional peak-flow data since the previous study (Pope and others, 2001) are available at 129 long-term sites. Among these 129 sites, new record minimum or maximum annual peak flows were set during the 1997–2006 water years at 50 and 37 sites, respectively, and both minimum and maximum new records were set at 8 sites.

[2] The term "case" is used instead of site to allow for an accounting of those sites where the total period of record can be divided into periods of unregulated and regulated/channelized peak discharges, thus making for the occurrence of two cases at one site subject to flow analysis.

Peak-Flow Data

Gaged stations with annual peak-flow record are either continuous-record sites or crest-stage sites. At continuous-record sites, the water-surface elevation, or stage, of the stream is recorded at fixed intervals, typically 15 minutes. At crest-stage sites, only the crest, or highest, stage that occurs between site visits is recorded. Regardless of the type of gage, measurements of flow, or discharge, are determined throughout the range of recorded stages, and a relation between stage and discharge is developed for the gaged location. Using this stage-discharge relation (or rating), discharges for all recorded stages are determined. The highest peak discharge that occurs during a given year is the annual peak flow for the year, and the list of annual peak flows is the annual peak-flow record. The peak-flow records for gaged stations are available from the USGS National Water Information System database at http://nwis.waterdata.usgs.gov/usa/nwis/peak/.

Gaged stations in North Carolina, South Carolina, and Georgia, as well as adjacent parts of Alabama, Florida, Tennessee, and Virginia were investigated for possible use in this study. Stations were not used in the analysis if less than 10 years of annual peak-flow data were available, or if peak flows at the stations were substantially affected by flow regulation downstream from dams, flood-retarding reservoirs, tides, or urbanization. The peak-flow records for rural stations that met these criteria then were compiled and reviewed for QA/AC by using computer programs that were developed with commercial statistical software to automate the reviews. Details on these computer programs are available in Feaster and Tasker (2002). The Kendall's tau statistic was chosen to assess the significance of time trends for each station (Helsel and Hirsch, 1992). If it was determined that a station record was not homogeneous, the entire record for that station was not considered for the study. However, if a significant portion of the record was found to be homogeneous, then only the homogenous portion of the record was considered for the study. The QA/QC analysis resulted in the selection of 943 stations that were considered for use in this study (fig. 2, p. 43; table 1, p. 53). The 943 gaged stations consist of 357 stations in Georgia, 333 in North Carolina, 82 in South Carolina, 72 in Virginia, 41 in Tennessee, 35 in Alabama, and 23 in Florida.

Physical and Climatic Basin Characteristics

Peak-flow information can be estimated at ungaged sites through multiple regression analysis that relates streamflow characteristics (such as the 1-percent chance exceedance flow) to selected physical and climatic basin characteristics for each gaged drainage basin. Drainage-basin boundaries are needed for each site before the basin characteristics can be determined. Drainage-basin boundaries for this study were generated using two different geographical information system (GIS) methods. In Georgia, basin boundaries for gaged stations were generated from National Elevation Dataset (NED) digital elevation models (DEMs) at 30-meter (m) resolution (or 10-m when available; U.S. Geological Survey, 1999a). In South Carolina, basin boundaries for gaged stations were manually delineated on-screen by using topographic contours visible on 1:24,000-scale digital raster graphics (DRGs) for reference. In North Carolina, basin boundaries for gaged stations were generated by using a Light Detection and Ranging (LIDAR)-derived DEM, with 3-m resolution, available from the North Carolina Floodplain Mapping Program (2003). To improve boundary delineations, the DEMs were processed to conform to streams in the high-resolution National Hydrography Dataset (NHD; U.S. Geological Survey, 1999b).

Basin characteristics were selected for use as potential explanatory variables in the regression analyses on the basis of the theoretical relation to flood flows and the ability to measure basin characteristics by using digital datasets and GIS technology. Twenty basin characteristics were computed and considered for this study (table 2). Characteristics computed were drainage area, basin perimeter, mean basin slope, basin shape factor, main channel length, main channel slope, minimum basin elevation, maximum basin elevation, mean basin elevation, percentage of basin that is impervious, percentage of basin that is forested, mean annual precipitation, 2-year 24-hour precipitation, 10-year 24-hour precipitation, 25-year 24-hour precipitation, 50-year 24-hour precipitation, 100-year 24-hour precipitation, soil drainage index, hydrologic soil index, and drainage density. The names, unit of measures, method of measurements, and source data for the measured basin characteristics that were considered for use in this study are listed in table 2.

As a means of quality assurance, the drainage areas computed by GIS were compared to the previously published and existing drainage-area information on file for the 483 sites in North Carolina where basin characteristics were computed. The GIS-measured and previous drainage areas agreed closely for many sites, but differences of greater than 5 percent were found for 88 basins. For basins with differences greater than 5 percent, the GIS boundaries were closely examined and a judgment was made for selecting the most appropriate drainage area. For basins within Piedmont and Blue Ridge regions, GIS basins generally were considered superior in accuracy to the existing drainage basins, and drainage areas were correspondingly revised to GIS-measured values. For basins within the Coastal Plain region, GIS basins generally were not as superior, and existing drainage-area information was used for most basins in this region. Among the 88 basins examined, revisions to drainage areas were made for 60 basins. For basins where differences were less than 5 percent, existing drainage-area information was used. The drainage areas listed in a table presented in the subsequent Estimation of Flood Magnitude and Frequency at Ungaged Sites section of this report are those used for this study, and revised drainage areas are listed for 50 of 333 sites in the table (indicated by the asterisk appearing beside the revised drainage areas).

Table 2. Basin characteristics considered for use in the regional regression analysis.

[DEM, digital elevation model; DRG, digital raster graphic; USGS, U.S. Geological Survey; NED, National Elevation Dataset; m, meter; LIDAR, Light Detection and Ranging; %, percent; STATSGO, State Soil Geographic]

Name	Units	Method	Source data
Drainage area	Square miles	For Georgia, North Carolina, Alabama, Tennessee, and Florida stations: Area within the watershed boundary, which is represented as a polygon of cells that flow to the streamgage location based on the primary down-slope flow direction of the DEM For South Carolina and Virginia stations: Area within the watershed boundary, which is digitized on screen using the 1:24,000-scale DRG contours	For Georgia, Alabama, Tennessee, and Florida stations: USGS NED DEM at 10- and 30-m resolution (http://ned.usgs.gov), conditioned to conform with National Hydrography Dataset streams, 1:24,000 scale (http://nhd.usgs.gov/) For South Carolina and Virginia stations: USGS DRG, 1:24,000-scale (http://topomaps.usgs.gov/drg/) For North Carolina stations: LIDAR-derived DEM at 3-m resolution (http://ncfloodmaps.com/lidar.htm)
Main channel length	Miles	Length of the longest flow path in a drainage area based on steepest descent as defined by the flow direction grid	DEM data used to create the watershed boundaries as defined in the drainage area source data section of this table
Basin perimeter	Miles	Length of watershed boundary perimeter	Watershed boundaries as defined in the drainage area method section of this table
Main channel slope	Feet per mile	Difference in the DEM elevation at points corresponding to 10% and 85% of the main channel divided by the main channel length between those two points	DEM data used to create the watershed boundaries as defined in the drainage area source data section of this table Main channel length as defined above in the main channel length method section of this table
Mean basin slope	Percent	Mean of the DEM percent slope grid values within the watershed boundary	DEM data used to create the watershed boundaries as defined in the drainage area source data section of this table
Basin shape factor	Dimensionless	Main channel length squared divided by drainage area	Drainage area as defined in the drainage area method section of this table Main channel length as defined in the main channel length method section of this table
Mean basin elevation	Feet	Area-weighted average	DEM data used to create the watershed boundaries as defined in the drainage area source data section of this table
Maximum basin elevation	Feet	Maximum elevation value of the DEM within the watershed boundary	DEM data used to create the watershed boundaries as defined in the drainage area source data section of this table
Minimum basin elevation	Feet	Minimum elevation value of the DEM within the watershed boundary	DEM data used to create the watershed boundaries as defined in the drainage area source data section of this table
Percent impervious	Percent	(Impervious surface area/drainage area)*100	National Land-Cover Dataset 2001 Impervious Surface, 30-m resolution (http://www.mrlc.gov/nlcd.php)
Percent forested	Percent	(Forested area/drainage area)*100	National Land-Cover Dataset 2001, 30-m resolution (http://www.mrlc.gov/nlcd.php)
Mean annual precipitation	Inches	Area-weighted average	PRISM (http://prism.oregonstate.edu)

Table 2. Basin characteristics considered for use in the regional regression analysis.—Continued

[DEM, digital elevation model; DRG, digital raster graphic; USGS, U.S. Geological Survey; NED, National Elevation Dataset; m, meter; LIDAR, Light Detection and Ranging; %, percent; STATSGO, State Soil Geographic]

Name	Units	Method	Source data
24 hour, 2-, 10-, 25-, 50-, and 100-year maximum precipitation	Inches	Area-weighted average	For Georgia, Alabama, and Florida stations: Derived from Hershfield (1961) For North Carolina, South Carolina, Tennessee, and Virginia stations: National Oceanic and Atmospheric Administration Atlas 14, Volume 2 (http://hdsc.nws.noaa.gov/hdsc/pfds/index.html
Soil drainage index	Dimensionless	Area-weighted average	STATSGO data (http://www.ncgc.nrcs.usda.gov/products/datasets/statsgo/)
Hydrologic soil index	Dimensionless	Area-weighted average	STATSGO data (http://www.ncgc.nrcs.usda.gov/products/datasets/statsgo/)
Drainage density	Miles per square mile	Total length of all streams divided by drainage area	National Hydrography Dataset, 1:24,000 scale (http://nhd.usgs.gov)

Estimation of Flood Magnitude and Frequency at Gaged Stations

A frequency analysis of water-year peak-flow data at a gaged station provides an estimate of the flood magnitude and frequency at that specific site. Flood-frequency discharges in previous USGS reports were expressed as T-year floods based on the *recurrence interval* for that flood quantile (for example, the "100-year flood"). The use of recurrence interval terminology is now discouraged because it sometimes causes confusion to the general public. The term is sometimes interpreted to imply that there is a set time interval between floods of a particular magnitude, when in fact floods are random processes that are best understood using probabilistic terms. Misunderstandings with the T-year recurrence interval terminology primarily have to do with the number of times that a peak discharge of certain magnitude could (and has been observed to) occur during the T-year period. While the T-year recurrence interval flood is statistically expected to occur, *on average*, once during the T-year period, it may occur multiple times during the period or not at all.

In North Carolina, an example of this misunderstanding followed the catastrophic flooding that occurred over parts of the Blue Ridge region during September 2004 following copious rainfall amounts associated with the passages of two tropical systems. Within a 2-week period, peak discharges exceeding the 100-year recurrence interval flood occurred on 2 separate days at some gaged stations in the Pigeon River basin located west of Asheville (U.S. Geological Survey, 2004). Hearing that peak discharges from both events were "greater than the 100-year flood" resulted in confusion to some people as to how two events of such magnitude could occur within 2 weeks of each other.

The terminology associated with flood-frequency characterization is undergoing a shift away from the *T-year recurrence interval flood* to the *P-percent chance exceedance flood (or peak flow)*. The use of percent chance exceedance flood is now recommended because it conveys the probability, or odds, of a flood of a given magnitude being equaled or exceeded in any given year. For example, a 1-percent chance exceedance flood (formerly known as the "100-year flood") corresponds to the flow magnitude that has a probability of 0.01 of being equaled or exceeded in any given year (table 3). That is, a flow with an exceedance probability of 0.01 has a 1 percent chance of being exceeded in any given year. The percent chance P is computed as the inverse of the recurrence interval T multiplied by 100 (for example, 1/100 x 100).

Table 3. T-year recurrence interval with corresponding annual exceedance probability and P-percent chance exceedance for flood-frequency flow estimates.

T-year recurrence interval	Annual exceedance probability	P-percent chance exceedance
2	0.5	50
5	0.2	20
10	0.10	10
25	0.04	4
50	0.02	2
100	0.01	1
200	0.005	0.5
500	0.002	0.2

Flood Frequency

Flood-frequency statistics for gaged stations are computed by fitting the series of annual peak flows to a known statistical distribution. For this study, flood-frequency statistics were computed by fitting logarithms (base 10) of the annual peak flows to a log-Pearson Type III distribution, which follows the guidelines and computational methods described in Bulletin 17B of the Hydrology Subcommittee of the Interagency Advisory Committee on Water Data (1982). Fitting the distribution requires calculating the logarithms of the mean, standard deviation, and skew coefficient of the annual peak-flow record, which describe the mid-point, slope, and curvature of the peak-flow frequency curve, respectively. Estimates of the P-percent chance exceedance flows are computed by inserting the three statistics of the frequency distribution into the equation:

$$\log Q_P = \bar{X} + KS, \quad (1)$$

where

Q_P is the P-percent chance exceedance flow, in cubic feet per second;

$\bar{X}$ is the mean of the logarithms of the annual peak flows;

K is a factor based on the skew coefficient and the given percent chance exceedance; and

S is the standard deviation of the logarithms of the annual peak flows, which is a measure of the degree of variation of the annual values about the mean value.

Values for K are published for a wide range of percent chance exceedance and regionalized skew coefficients in Appendix 3 of Bulletin 17B (Interagency Advisory Committee on Water Data, 1982).

A series of water-year peak flows at a station may include outliers, which are annual peak flows that are substantially higher or lower than other peak flows in the series. The station record also may include information about peak flows that occurred outside of the period of systematic record. These peak flows are known as historic peaks and often occur during an extended period of time, longer than the period of systematically collected record. Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) provides guidelines for detecting and interpreting outliers and historic data points and provides computational methods for making appropriate corrections to the distribution to account for the presence of such outliers. In some cases, outliers may be 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, 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 systematically collected record can be thought of as a sample, or small portion, 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 specific measure and the given sample of the population.

The USGS computer program PEAKFQWin (version 5.2) was used to compute the flood-frequency estimates for the 943 gaged stations considered for this study. PEAKFQWin automates many of the analysis procedures recommended in Bulletin 17B, including (1) identifying and adjusting for high and low outliers as well as historical periods, (2) weighting the station skews with a generalized skew, and (3) fitting a log-Pearson Type III distribution to the annual peak-flow data. The PEAKFQWin program and associated documentation can be downloaded from the Web at http://water.usgs.gov/software/PeakFQ. The station skew coefficients were weighted with a new generalized skew coefficient that was developed for this study. Station skew coefficients and the generalized skew coefficient used for this study are explained in the following sections. The final flood-frequency estimates from the Bulletin 17B analysis for the 333 rural, gaged stations in North Carolina are listed in table 4 (column G; p. 74).

Skew Coefficient

The skew coefficient measures the symmetry of the distribution of a set of peak flows about the median of the distribution. The skew coefficient is zero when the mean and median (defined as the 50th percentile value in a sample) and mode (defined as the most common value in a sample) of the annual series are equal, positive when the mode and median are less than the mean, and negative when the median and mode exceed the mean (fig. 3). The skew coefficient is strongly influenced by the presence of high or low outliers. Large positive skews typically are the result of high outliers, and large negative skews typically are the result of low outliers. The station skew coefficient, which is calculated using the annual peak-flow record for a gaged station, is sensitive to extreme events; therefore, the station skew coefficient for short records may not provide an accurate estimate of the population or true skew coefficient.

Bulletin 17B recommends using a weighted average of the station skew coefficient with a generalized or regional skew coefficient because a weighted skew coefficient improves the accuracy of the skew coefficient used to fit peak-flow records to a log-Pearson Type III distribution (Interagency Advisory Committee on Water Data, 1982). The generalized skew coefficient is the skew coefficient associated with a defined region and is calculated by using the station skew coefficients for stations with longer annual peak-flow record within the region. The weighted skew coefficient for a given site is computed as the weighted average of the generalized skew coefficient and the station skew coefficient, with

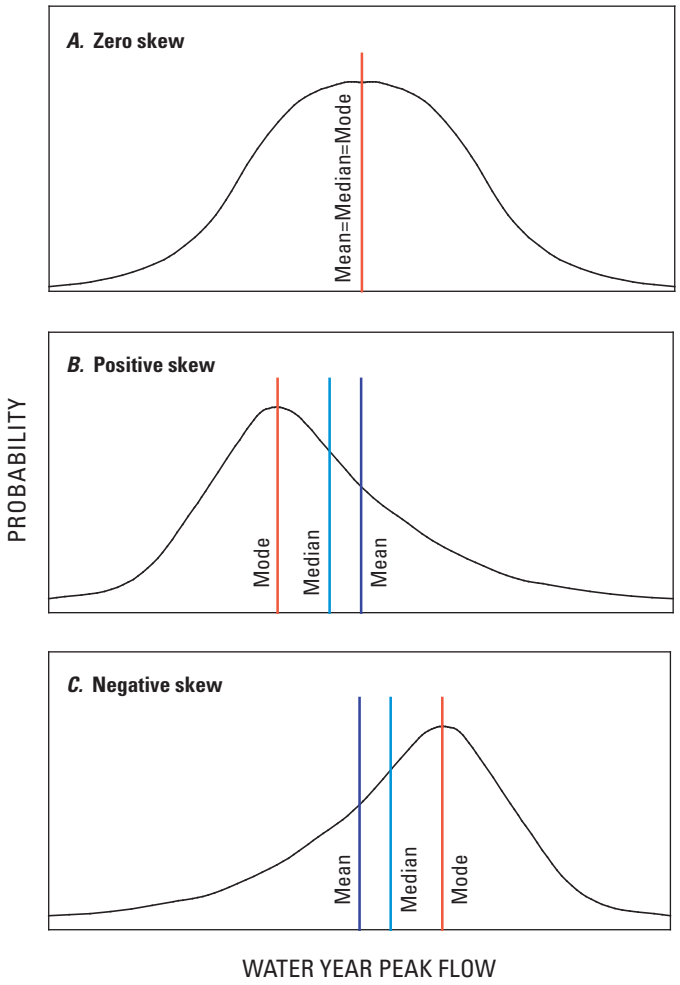


Figure 3. Examples of distributions with *(A)* zero skew, *(B)* positive skew, and *(C)* negative skew (modified from Feaster and Tasker, 2002).

weights assigned according to the mean square error of each component skew value. Flood-frequency estimates for all sites with unregulated flow records were computed by using the weighted skew method.

Generalized Skew Analysis

During the development of standardized flood-frequency techniques in the late 1970s and early 1980s, a nationwide generalized skew study was conducted and documented in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). Station skew coefficients for long-term gaging stations throughout the Nation were computed and used to produce a map of isolines of generalized skew; however, the map was prepared at a national scale using data and methods that are now more than 30 years old. In order to generate more accurate generalized skew coefficients, three methods are described in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) for developing generalized skews using skew coefficients computed from gaged stations with long-term peak-flow record (25 or more years of record): (1) plot station skew coefficients on a map and construct skew isolines, (2) use regression techniques to develop a skew prediction equation that would relate station skew coefficients to some set of basin characteristics, or (3) use the arithmetic mean of station skew coefficients from long-term gaged stations in the area.

A generalized skew coefficient analysis using methods 1 and 2 was performed as part of this study. The initial dataset for the generalized skew coefficient analysis included 489 gaged stations that are located in the study area. These 489 gaged stations have 25 or more years of annual peak-flow record. The station skew coefficients for these stations were plotted at the centroid of the watershed for each station in order to develop a skew isoline map. The map was reviewed to determine if any geographic or topographic trends were visually apparent. No clearly definable patterns were found, so regression techniques were then used to develop a skew prediction equation using station skew as the response variable. A Bayesian generalized least-squares (GLS) regression model was used for the generalized skew coefficient regression analysis as suggested by Reis and others (2005) and Gruber and others (2007), both of which made use of the methods proposed by Martins and Stedinger (2002). The current study also uses the methods from Martins and Stedinger (2002) except that the distance between basin centroids was used instead of the distance between gaged stations.

Annual peak flows of basins are cross-correlated because a single large storm event can cause the annual peak in several basins. One advantage of GLS is that it takes this cross-correlation among the basins into account. The GLS statistical analysis depends on the estimated cross-correlations of the peak flows at different pairs of stations. The cross-correlation generally is estimated as a function of distances between gaging stations or, in the case of this study, distances between centroids of the gaged basins.

If the watersheds of two stations are nested so that one is contained within the other, the cross-correlation between the concurrent peak flows would be larger than if the basins were not nested. This leads to errors in the estimation of cross-correlations for non-nested basins, which leads to incorrect model errors. A screening metric was developed to determine the redundant station pairs that represent the same watershed. Details on the screening metric used are found in the appendix of this report.

After running the screening metric on all 489 stations, 92 stations were removed from the generalized skew coefficient regression analysis because of redundancy. Also, an additional 55 stations were removed because of censored peak-flow data, which are peak flows that are less than the minimum recordable peak flow at a station (that is, the peak flow for the annual period does not reach the bottom of the rod used for capturing high water marks at the crest-stage site). A total of 342 stations were used for the final Bayesian GLS regression analysis of skew. A map of the 342 stations in included in the appendix.

Based on the Bayesian GLS regression analysis, a constant generalized skew value of –0.019[3] was determined to be the most reasonable approach to predicting the generalized skew in the study area (Andrea M. Gruber and Dr. Jery R. Stedinger, Cornell University, Ithaca, New York, written commun., February 6, 2008). More complicated Bayesian GLS models with additional explanatory variables were evaluated but resulted in very modest improvements in accuracy. A detailed description of the accuracy of these models is available in the appendix. The modest improvements in the more complicated models were not justified because of the increased complexity associated with the additional explanatory variables. The mean square error (MSE) associated with the constant generalized skew model is 0.143 and is equivalent to a record length of 39 years. This is a significant improvement over the skew map MSE value of 0.302 in Bulletin 17B, which is equivalent to 17 years of record. The generalized skew value of –0.019 with an associated MSE of 0.143 was used to compute the flood-frequency estimates for the 943 gaged stations with 10 or more years of record according to methods recommended in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). The appendix of this report provides additional details of the generalized skew coefficient regression analysis used for this study.

Gaged Stations Affected by Regulation

Many of the larger North Carolina rivers, including the Roanoke, Neuse, Cape Fear, Yadkin–Pee Dee River, and Catawba Rivers, are regulated by reservoirs (table 5). Flows from reservoirs are regulated for in-stream water use downstream from the reservoirs, power generation, maintenance of lake levels for recreation, and flood control (Feaster and Tasker, 2002). Regulation procedures may change as flow requirements change. During extremely large floods, the relative effects of storage are diminished and operations are directed more toward preventing dam failure than toward flood control and protection of downstream property. Consequently, flood frequencies for regulated streams are dependent on many more factors than unregulated streams and are, therefore, quite complex and beyond the scope of this report. For informational purposes, at-site flood-frequency statistics are provided for 49 sites located on streams known to be affected by regulated (47 sites) or channelized (2 sites) flow conditions (table 6; fig. 4).

The determination of whether flows at a site are affected by regulation requires careful consideration during data reviews. Several factors must be assessed, including (1) gage location directly downstream from a large reservoir, (2) substantial or appreciable control by human-induced operations, and (3) at least 10 percent of basin area being controlled (William Kirby, U.S. Geological Survey, oral commun., 2003). Another threshold for consideration is whether the usable storage exceeds about 100 acre-feet per square mile drainage area at the gaging station (Benson, 1962).

During the data reviews for this study, three sites were changed from the regulated to unregulated category or from the unregulated to regulated category in response to further examination of flow conditions upstream from the sites. The gaged station at Tar River at NC [highway] 97 at Rocky Mount (site 94, table 1) is located downstream from the Tar River Reservoir and was considered affected by regulation by Pope and others (2001). Information received from the owners of the reservoir indicate the reservoir was not designed for flood-control operations and that the intent is to keep water spilling over the dam at all times (Paul Blount, City of Rocky Mount, written commun., September 24, 2006). On the basis of available impoundment information, the usable storage was computed to be less than 15 acre-feet per square mile drainage area at the gaging station; thus, the site was added to the database of unregulated sites used in the rural regression analyses. A gaged station on Swift Creek near McCullars Crossroads within the Raleigh metropolitan area (site 14r, table 5) was considered unregulated by Pope and others (2001). Because this site is located 0.1 mile downstream from Lake Wheeler, annual peak-flow records were considered regulated in the current study. Finally, annual peak-flow record for a gaged station on the Swannanoa River at Biltmore (site 844, table 1) was divided into periods of unregulated and regulated records in the previous study (Pope and others, 2001). However, information to support the presence of regulated flow conditions at this site could not be substantiated, and the entire peak-flow record was considered unregulated in the current study.

As described previously, flood-frequency estimates for all sites with unregulated flow records were computed by using the weighted skew method. Flood-frequency estimates for sites with regulated flow record were computed by fitting the recorded annual regulated peak flows to the log-Pearson Type III distribution and using the "at-site" computed sample skew. Computed sample skew coefficients for the regulated flow record were used because regulated peak-flow records typically are not representative of regional or generalized conditions. Although flood-frequency estimates for regulated sites are presented in this report, more detailed, site-specific analyses of flood frequency at many regulated sites are available from the U.S. Army Corps of Engineers. Following the determination and tabulation (table 6) of at-site flood-frequency estimates for sites with regulated/channelized record, these sites were excluded from further analysis.

[3] Regional skew value of –0.019 was rounded from the initial value of –0.0186 (used in determination of at-site flood-frequency statistics) provided during the study.

Table 5. Descriptions of streamgaging stations in North Carolina affected by regulated or channelized flow conditions and where flood-frequency statistics were determined using available annual peak-flow record through the 2006 water year.

[USGS, U.S. Geological Survey; mi², square miles; *, duplicate station number for sites having separate period of regulated or channelized flow; SR, secondary road. Map identification number shown in parentheses is used for unregulated portion of record in flood-frequency and rural regressions development (see fig. 4)]

Map identification number (fig. 4)	USGS station number	Station name	Drainage area, mi²	Latitude	Longitude	Period of analysis	Number of systematic peaks
1r (24)	02053500 *	Ahoskie Creek at Ahoskie, NC (channelized period)	63.3	36°16′49″	76°59′58″	1964–2006	43
2r (52)	02068500 *	Dan River near Francisco, NC (regulated period)	129	36°30′54″	80°18′11″	1939–2006	64
3r (65)	02074000 *	Smith River at Eden, NC (regulated period)	538	36°31′32″	79°45′56″	1950–2006	57
4r	02077303	Hyco River below Afterbay Dam near McGehees Mill, NC (regulated period)	202	36°31′21″	78°59′51″	1974–2006	33
5r	02077670	Mayo Creek near Bethel Hill, NC (regulated period)	53.5	36°32′27″	78°52′19″	1978–2006	29
6r (81)	02080500 *	Roanoke River at Roanoke Rapids, NC (regulated period)	8,384	36°27′36″	77°38′01″	1956–2006	51
7r	02082506	Tar River below Tar River Reservoir near Rocky Mount, NC (regulated period)	777	35°54′02″	77°51′56″	1973–2006	34
8r	02084160	Chicod Creek at SR 1760 near Simpson, NC (channelized period)	45	35°33′42″	77°13′51″	1982–2006	20
9r	0208524975	Little River below Little River tributary at Fairntosh, NC (regulated period)	98.9	36°06′48″	78°51′35″	1996–2006	11
10r	02086500	Flat River at Dam near Bahama, NC (regulated period)	168	36°08′55″	78°49′44″	1928–2006	54
11r (127)	02087183 *	Neuse River near Falls, NC (regulated period)	771	35°56′24″	78°34′51″	1981–2006	26
12r (129)	02087500 *	Neuse River near Clayton, NC (regulated period)	1,150	35°38′50″	78°24′19″	1981–2006	26
13r (130)	02087570 *	Neuse River at Smithfield, NC (regulated period)	1,206	35°30′45″	78°20′58″	1981–1990	10
14r	0208758850	Swift Creek near McCullars Crossroads, NC (regulated period)	35.8	35°41′37″	78°41′32″	1989–2006	18
15r (139)	02089000 *	Neuse River near Goldsboro, NC (regulated period)	2,399	35°20′15″	77°59′51″	1981–2006	26
16r (141)	02089500 *	Neuse River at Kinston, NC (regulated period)	2,692	35°15′28″	77°35′08″	1981–2006	26
17r (142)	02090380 *	Contentnea Creek near Lucama, NC (regulated period)	161	35°41′28″	78°06′35″	1977–2006	30
18r	02090500	Contentnea Creek near Wilson, NC (regulated period)	236	35°41′10″	77°56′50″	1931–1954	24
19r	02094500	Reedy Fork near Gibsonville, NC (regulated period)	131	36°10′23″	79°36′51″	1929–2006	77
20r	02097517	Morgan Creek near Chapel Hill, NC (regulated period)	41	35°53′36″	79°01′11″	1983–2006	24
21r	02098198	Haw River below B. Everett Jordan Dam near Moncure, NC (regulated period)	1,689	35°39′07″	79°04′02″	1980–1992	13
22r	02102192	Buckhorn Creek near Corinth, NC (regulated period)	76.3	35°33′35″	78°58′25″	1981–2006	26
23r (195)	02102500 *	Cape Fear River at Lillington, NC (regulated period)	3,464	35°24′22″	78°48′48″	1981–2006	26
24r (206)	02105500 *	Cape Fear River at Wilm O Huske Lock near Tarheel, NC (regulated period)	4,852	34°50′45″	78°49′14″	1981–2006	24
25r (209)	02105769 *	Cape Fear River at Lock #1 near Kelly, NC (regulated period)	5,255	34°24′16″	78°17′37″	1981–2006	26
26r (236)	02112000 *	Yadkin River at Wilkesboro, NC (regulated period)	504	36°09′09″	81°08′44″	1962–2006	45
27r	02112250	Yadkin River at Elkin, NC (regulated period)	869	36°14′28″	80°50′48″	1964–2006	41
28r	02113500	Yadkin River at Siloam, NC (regulated period)	1,226	36°16′55″	80°33′46″	1977–1987	11
29r	02115360	Yadkin River at Enon, NC (regulated period)	1,694	36°07′54″	80°26′38″	1964–2006	42
30r (253)	02116500 *	Yadkin River at Yadkin College, NC (regulated period)	2,280	35°51′24″	80°23′13″	1962–2006	45
31r	02119400	Third Creek near Stony Point, NC (regulated period)	4.84	35°52′04″	81°04′00″	1957–1969	13
32r (260)	02120500 *	Third Creek at Cleveland, NC (regulated period)	87.4	35°45′00″	80°41′00″	1955–1971	17
33r	02122500	Yadkin River at High Rock, NC (regulated period)	4,000	35°35′46″	80°13′59″	1942–1961	19

Table 5. Descriptions of streamgaging stations in North Carolina affected by regulated or channelized flow conditions and where flood-frequency statistics were determined using available annual peak-flow record through the 2006 water year.—Continued

[USGS, U.S. Geological Survey; mi^2, square miles; *, duplicate station number for sites having separate period of regulated or channelized flow; SR, secondary road. Map identification number shown in parentheses is used for unregulated portion of record in flood-frequency and rural regressions development (see fig. 4)]

Map identification number (fig. 4)	USGS station number	Station name	Drainage area, mi^2	Latitude	Longitude	Period of analysis	Number of systematic peaks
34r	02129000	Pee Dee River near Rockingham, NC (regulated period)	6,863	34°56′45″	79°52′11″	1928–2006	79
35r	0213903612	Catawba River at Calvin, NC (regulated period)	508	35°44′22″	81°43′45″	1992–2006	15
36r	02142500	Catawba River at Catawba, NC (regulated period)	1,535	35°43′00″	81°03′59″	1936–1962	27
37r	02148500	Broad River near Chimney Rock, NC (regulated period)	97	35°25′29″	82°10′54″	1928–1958	31
38r	0345577330	West Fork Pigeon River near Retreat, NC (regulated period)	33.5	35°25′36″	82°55′11″	1989–2006	18
39r	03456100	West Fork Pigeon River at Bethel, NC (regulated period)	58.4	35°27′50″	82°54′00″	1955–2006	52
40r	03460795	Pigeon River below Power Plant near Waterville, NC (regulated period)	538	35°47′01″	83°06′43″	1997–2006	10
41r	03500500	Cullasaja River at Highlands, NC (regulated period)	14.9	35°04′14″	83°13′57″	1928–1971	44
42r	03505500	Nantahala River at Nantahala, NC (regulated period)	144	35°17′55″	83°39′21″	1943–1982	39
43r	03508000	Tuckasegee River at Tuckasegee, NC (regulated period)	143	35°16′55″	83°07′37″	1941–2006	39
44r (900)	03510500 *	Tuckasegee River at Dillsboro, NC (regulated period)	347	35°22′00″	83°15′37″	1941–2006	44
45r (903)	03513000 *	Tuckasegee River at Bryson City, NC (regulated period)	655	35°25′39″	83°26′49″	1941–2006	62
46r	03515000	Little Tennessee River at Fontana Dam, NC (regulated period)	1,571	35°26′45″	83°48′20″	1945–1954	10
47r	03547000	Hiwassee River below Chatuge Dam near Hayesville, NC (regulated period)	190	35°01′45″	83°47′45″	1943–1974	32
48r	03548000	Hiwassee River below Hayesville, NC (regulated period)	252	35°04′47″	83°49′54″	1935–1945	11
49r (922)	03548500 *	Hiwassee River above Murphy, NC (regulated period)	406	35°04′53″	84°00′10″	1942–2004	63

Table 6. Flood-frequency statistics at streamgaging stations in North Carolina affected by regulated or channelized flow conditions.

[USGS, U.S. Geological Survey; mi², square miles; c, channelized flow conditions. Map identification number shown in parentheses is used for unregulated portion of record in flood-frequency and rural regressions development (see table 1)]

Map identification number (fig. 2, 4)	USGS station number	Drainage area (mi²)	50-percent chance exceedance	20-percent chance exceedance	10-percent chance exceedance	4-percent chance exceedance	2-percent chance exceedance	1-percent chance exceedance	0.5-percent chance exceedance	0.2-percent chance exceedance	Period of analysis	Number of systematic peaks
1r (24) c	02053500	63.3	982	1,580	2,220	3,430	4,740	6,520	8,930	13,500	1964–2006	43
2r (52)	02068500	129	4,090	7,400	9,930	13,400	16,200	19,100	22,100	26,300	1939–2006	64
3r (65)	02074000	538	9,780	14,600	18,200	23,200	27,300	31,700	36,400	43,300	1950–2006	57
4r	02077303	202	3,780	7,330	9,600	12,100	13,700	15,100	16,300	17,700	1974–2006	33
5r	02077670	53.5	420	983	1,500	2,320	3,050	3,870	4,790	6,180	1978–2006	29
6r (81)	02080500	8,384	22,500	29,100	34,600	42,700	49,700	57,700	66,700	80,500	1956–2006	51
7r	02082506	777	7,210	10,700	13,500	17,800	21,600	25,900	30,800	38,500	1973–2006	34
8r c	02084160	45	1,640	2,680	3,380	4,230	4,840	5,430	5,990	6,700	1982–2006	20
9r	0208524975	98.9	5,040	9,630	13,400	18,900	23,600	28,700	34,300	42,400	1996–2006	11
10r	02086500	168	6,590	10,300	12,800	16,000	18,500	21,000	23,500	26,800	1928–2006	54
11r (127)	02087183	771	4,560	5,990	6,860	7,870	8,590	9,260	9,910	10,700	1981–2006	26
12r (129)	02087500	1,150	7,130	10,400	13,100	17,100	20,600	24,500	29,100	36,100	1981–2006	26
13r (130)	02087570	1,206	7,630	10,400	11,700	13,000	13,700	14,300	14,700	15,200	1981–1990	10
14r	0208758850	35.8	1,310	2,360	3,470	5,590	7,880	11,000	15,200	23,300	1989–2006	18
15r (139)	02089000	2,399	10,300	16,200	21,100	28,600	35,200	42,900	51,800	65,600	1981–2006	26
16r (141)	02089500	2,692	10,500	16,100	20,400	26,600	31,900	37,600	44,000	53,400	1981–2006	26
17r (142)	02090380	161	1,990	3,750	5,610	9,150	13,000	18,100	25,200	38,300	1977–2006	30
18r	02090500	236	2,410	3,810	4,750	5,920	6,760	7,590	8,400	9,450	1931–1954	24
19r	02094500	131	2,300	3,810	4,910	6,380	7,510	8,680	9,870	11,500	1929–2006	77
20r	02097517	41	1,650	2,640	3,260	3,970	4,450	4,890	5,290	5,780	1983–2006	24
21r	02098198	1,689	14,800	17,000	17,600	18,000	18,200	18,200	18,300	18,300	1980–1992	13
22r	02102192	76.3	848	1,620	2,290	3,350	4,300	5,400	6,670	8,650	1981–2006	26
23r (195)	02102500	3,464	27,400	36,300	41,700	48,000	52,300	56,500	60,400	65,400	1981–2006	26
24r (206)	02105500	4,852	29,000	35,500	39,600	44,600	48,300	51,800	55,400	60,100	1981–2006	24
25r (209)	02105769	5,255	24,800	34,100	40,700	49,600	56,600	64,000	71,700	82,600	1981–2006	26
26r (236)	02112000	504	6,840	9,160	10,600	12,400	13,700	14,900	16,100	17,700	1962–2006	45
27r	02112250	869	15,000	20,900	24,200	27,700	29,900	31,800	33,500	35,500	1964–2006	41
28r	02113500	1,226	28,000	35,300	39,200	43,300	45,900	48,100	50,200	52,500	1977–1987	11
29r	02115360	1,694	34,000	50,700	59,000	66,800	71,200	74,500	77,100	79,700	1964–2006	42
30r (253)	02116500	2,280	30,300	44,700	53,000	62,100	67,900	73,000	77,500	82,800	1962–2006	45
31r	02119400	4.84	63.2	68.3	70.9	73.6	75.3	76.9	78.3	79.9	1957–1969	13
32r (260)	02120500	87.4	1,500	1,830	2,050	2,310	2,490	2,680	2,860	3,100	1955–1971	17
33r	02122500	4,000	41,300	51,800	58,100	65,300	70,200	74,900	79,400	85,000	1942–1961	19
34r	02129000	6,863	72,700	107,000	132,000	167,000	195,000	226,000	258,000	306,000	1928–2006	79

Table 6. Flood-frequency statistics at streamgaging stations in North Carolina affected by regulated or channelized flow conditions.—Continued

[USGS, U.S. Geological Survey; mi², square miles; c, channelized flow conditions. Map identification number shown in parentheses is used for unregulated portion of record in flood-frequency and rural regressions development (see table 1)]

Map identification number (fig. 2, 4)	USGS station number	Drainage area (mi²)	50-percent chance exceed-ance	20-percent chance exceed-ance	10-percent chance exceed-ance	4-percent chance exceed-ance	2-percent chance exceed-ance	1-percent chance exceed-ance	0.5-percent chance exceed-ance	0.2-percent chance exceed-ance	Period of analysis	Number of systematic peaks
35r	0213903612	508	5,380	9,550	13,400	19,800	25,800	33,200	42,300	57,300	1992–2006	15
36r	02142500	1,535	20,500	39,400	58,400	92,700	128,000	174,000	233,000	339,000	1936–1962	27
37r	02148500	97	3,020	7,990	13,100	22,100	30,900	41,500	54,300	74,900	1928–1958	31
38r	0345577330	33.5	3,440	5,170	6,550	8,600	10,400	12,400	14,600	18,000	1989–2006	18
39r	03456100	58.4	4,190	6,520	8,390	11,200	13,500	16,200	19,200	23,700	1955–2006	52
40r	03460795	538	11,500	20,900	28,800	40,800	51,400	63,300	76,700	97,100	1997–2006	10
41r	03500500	14.9	975	1,600	2,160	3,070	3,920	4,950	6,200	8,250	1928–1971	44
42r	03505500	144	2,800	4,370	5,530	7,120	8,390	9,740	11,200	13,200	1943–1982	39
43r	03508000	143	4,130	7,300	9,750	13,200	16,000	19,000	22,200	26,700	1941–2006	39
44r (900)	03510500	347	7,590	11,900	15,200	20,100	24,100	28,600	33,500	40,800	1941–2006	44
45r (903)	03513000	655	16,600	23,500	27,900	33,400	37,400	41,400	45,200	50,300	1941–2006	62
46r	03515000	1,571	10,800	17,500	22,400	29,200	34,500	40,100	46,100	54,400	1945–1954	10
47r	03547000	190	1,640	2,090	2,470	3,070	3,600	4,220	4,940	6,070	1943–1974	32
48r	03548000	252	4,590	7,360	9,130	11,200	12,700	14,100	15,300	16,900	1935–1945	11
49r (922)	03548500	406	8,590	12,300	14,600	17,200	19,100	20,800	22,500	24,600	1942–2004	63

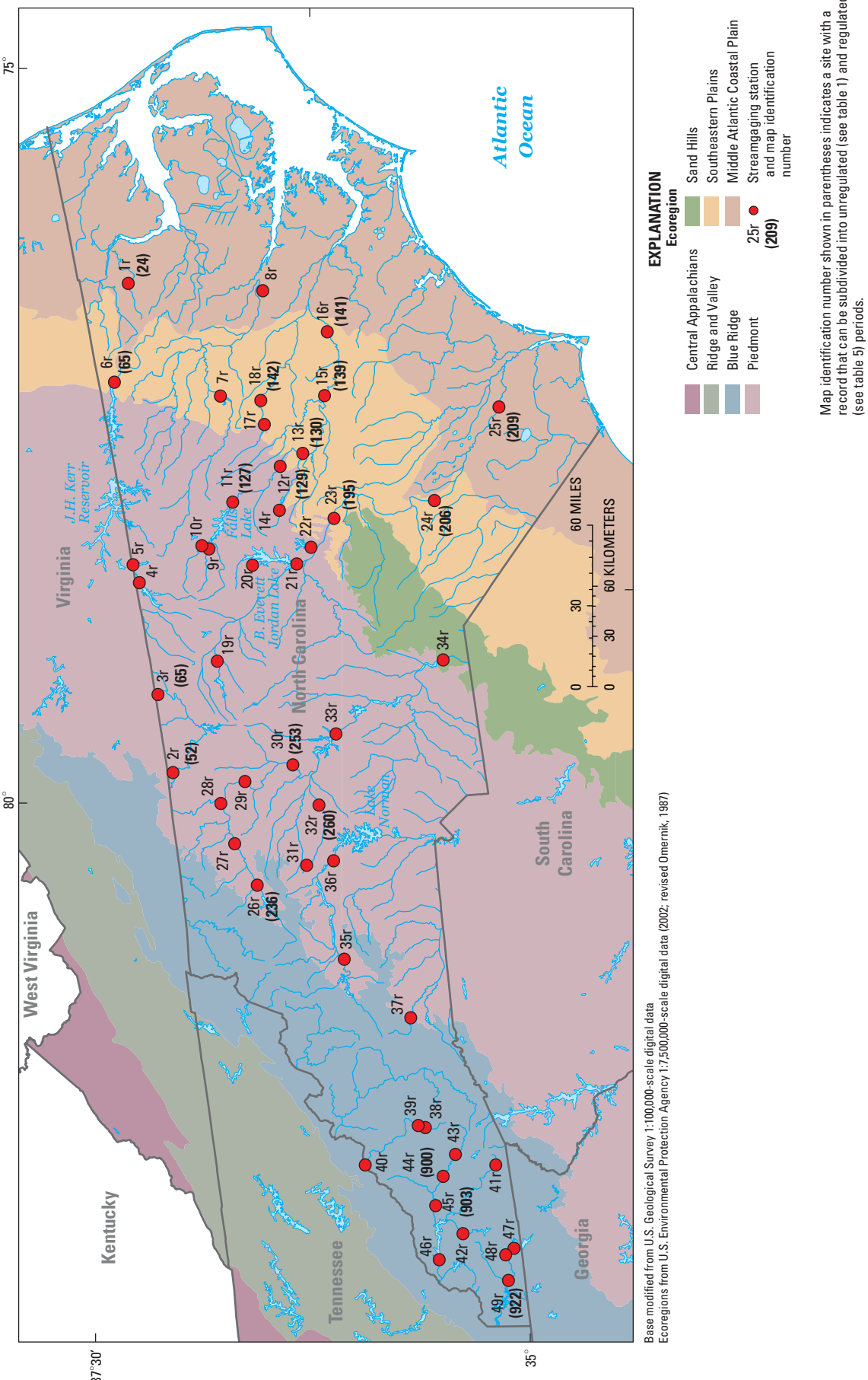


Figure 4. Locations of streamgaging stations on streams in North Carolina affected by regulated or channelized flow conditions, 2006.

Estimation of Flood Magnitude and Frequency at Ungaged Sites

A regional regression analysis was used to develop a set of equations for use in estimating the magnitude and frequency of floods for rural, ungaged sites in North Carolina, South Carolina, and Georgia. These equations relate the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent chance exceedance flows computed from available records for gaged stations to measured physical and climatic basin characteristics of the drainage basins. All 943 rural, gaged stations used in the flood-frequency analysis were considered for use in the regional regression analysis (fig. 2, p. 43; table 1, p. 53).

Regression Analysis

Ordinary least-squares (OLS) regression techniques were used in the exploratory analysis to determine the best regression models for all combinations of basin characteristics and the development of the hydrologic regions that define the study area. In OLS regression, linear relations between the explanatory and response variables are necessary; thus, variables sometimes must be transformed in order to create linear relations. For example, the relation between arithmetic values of basin drainage area and P-percent chance exceedance flow typically is curvilinear; however, the relation between the logarithms of drainage area and the logarithms of P-percent chance exceedance flow normally is linear. Homoscedasticity (a constant variance in the response variable over the range of the explanatory variables) about the regression line and normality of the residuals also are requirements for OLS regression. Transformation of the P-percent chance exceedance flow and the explanatory variables to logarithms enhances the homoscedasticity of the data about the regression line. Homoscedasticity and normality of residuals were examined in residual plots.

Selection of the explanatory variables for each hydrologic region was based on all-possible-subsets (APS) regression methods (Neter and others, 1985). The final explanatory variables for each hydrologic region were selected on the basis of several factors, including (1) standard error of the estimate, (2) Mallow's *Cp* statistic, (3) statistical significance of the explanatory variables, (4) coefficient of determination (r^2), and (5) ease of measurement of explanatory variables. Multicollinearity in the candidate exploratory variables was also assessed by the variance inflation factor (VIF) and the correlation between explanatory variables.

Generalized least-squares (GLS) regression methods, as described by Stedinger and Tasker (1985), were used to determine the final regional P-percent chance exceedance flow regression equations, using the USGS computer program GLSNET (G.D. Tasker, K.M. Flynn, A.M. Lumb, and W.O. Thomas, Jr., U.S. Geological Survey, written commun., 1995). In order to remove the redundancy associated with gaging stations that represent the same watershed for the regional GLS regression analysis, two stations on the same stream where the percentage change in drainage area from one station to the other was within 50 percent were flagged as redundant pair stations. If the peak-flow record of the station with the shorter period of record from the redundant pair completely overlapped the period of record of the station with the longer peak-flow record, then the station with the shorter peak-flow record was omitted from the analysis. However, if the peak-flow record of the station with the shorter record was outside of the period of record of the longer record station, then both stations were used in the analysis. Finally, if only a portion of the period of record for both stations had a significant overlap (10 or more years), then the record for the longer record station was extended by using the Maintenance of Variance Extension (MOVE.1) method of correlation analysis (Hirsch, 1982), and the station with the shorter record was removed from the analysis. Table 1 lists the five stations for which the MOVE.1 method was used for record extension. In North Carolina, the MOVE.1 method was used for three stations (sites 257, 324, and 824; table 1), and the corresponding adjacent stations (sites 259, 323, and 825) were omitted from the regional regression analysis. A total of 52 stations in the study area were omitted from the regional regression analysis because of redundant record, leaving a total of 891 stations.

Regionalization of Flood-Frequency Estimates

An OLS regression analysis was performed on the 891 remaining rural, gaged stations in order to determine the need for hydrologic regions within the study area. All response (P-percent chance exceedance flows) and explanatory variables (basin characteristics) were transformed to logarithms (base 10) prior to the regression analyses to (1) obtain linear relations between the response variables and the explanatory variables and (2) achieve equal variance about the regression line. A value of 1 was added to the percentage of forested and impervious area basin characteristics to facilitate transformation to logarithms. The standard errors of estimate using varying combinations of explanatory variables ranged from 60 to 69 percent for the 1-percent chance exceedance flow estimate when using only one hydrologic region for the entire study area. Regression residuals also were plotted at the centroid of the respective drainage area in order to determine geographical patterns of bias. The large errors of estimate as well as the plots of the regression residuals indicated that the study area needed to be subdivided into hydrologic regions. Of the seven USEPA Level III ecoregions (figs. 1, 2) identified within the study area, six were used as the initial hydrologic regions for the regression analysis (no sites were within the Southwestern Appalachian ecoregion in northwest Georgia). For each ecoregion, sites that are within 75 percent or more of the ecoregion were grouped together.

The APS regression methods were then conducted on each of the six groups of sites in order to determine the

candidate explanatory variables for each ecoregion. Results of the APS analysis indicated that the addition of other variables with drainage area did not reduce the standard error of estimate by more than 3 percent. This small reduction was not considered sufficient to warrant the use of additional explanatory variables in the model, thus drainage area was selected as the only basin characteristic for further analysis.

An OLS regression analysis was run for each group of sites by using the following regression model:

$$Q_P = a_0 (DA)^{b_0}, \quad (2)$$

where

Q_P is the P-percent chance exceedance flow, in cubic feet per second;
DA is the drainage area, in square miles; and
a_0 and b_0 are the regression coefficients.

The regression model was logarithmically transformed to the following linear form:

$$\log Q_P = \log a_0 + b_0 (\log DA). \quad (3)$$

The residuals from the OLS analysis were plotted for each USEPA Level III ecoregion to determine the need for dividing the ecoregions into subregions and(or) for the possibility of combining ecoregions to form a hydrologic region. The residuals plots indicated that ecoregions adequately defined the study area with the exception of the Southeastern Plains. An apparent narrow region of negative bias residuals was visible in the plots at the northern edge of the Southeastern Plains ecoregion. This narrow region of low residuals coincides with the USEPA Level IV Sand Hills ecoregion; therefore, the Sand Hills ecoregion (hydrologic region 3) was added to the group of existing Level III ecoregions to help define this area. Additionally, there was an area with positive bias residuals in the southwestern corner of the Georgia Southeastern Plains. This area was documented in previous Georgia flood-frequency reports (Stamey and Hess, 1993; Price, 1978) and corresponds to the lower portion of the USEPA Level IV Tifton Uplands ecoregion; therefore, a separate and fifth hydrologic region was developed for this area of positive residuals. Finally, the residuals plot indicated positive bias residuals in the Alabama portion of the Southeastern Plains ecoregion. Because the Alabama sites in the Southeastern Plains were not representative of the sites in the Southeastern Plains within the study area, these 15 sites were omitted from the regression analysis. The Chattahoochee River separates the Alabama Southeastern Plains ecoregion from the Georgia Southeastern Plains ecoregion; therefore, this hydrologic divide justifies separating these areas into different hydrologic regions.

The regression coefficients, a_0 and b_0, from the OLS analysis for the Southwestern Appalachians, Ridge and Valley, and Piedmont ecoregions were not significantly different at the 95-percent probability level, and these three ecoregions were combined to form hydrologic region 1 (fig. 5, p. 45). Similarly, the regression coefficients for the Southeastern Plains, Southern Coastal Plain, and Mid-Atlantic Coastal Plain ecoregions were not significantly different at the 95-percent probability level, and these three ecoregions likewise were combined to form hydrologic region 4. The Blue Ridge ecoregion was designated as hydrologic region 2. The OLS regression analysis again was completed for each of the five proposed hydrologic regions within the study area. The residuals from the analyses were plotted on a map of the five hydrologic regions, and no geographical bias was noted; therefore, the five hydrologic regions were used for the final GLS analysis (fig. 5, p. 45).

Considerable variability in the predicted P-percent chance exceedance flow for stations with drainage areas less than 1 mi^2 was observed in the OLS regression analyses for each of the five hydrologic regions. This variability can be attributed, in part, to the difficulty in measuring peak flows for stations with small drainage basins. For small drainage basins, the flow of the stream changes rapidly over time. These rapidly changing flow conditions make it difficult to measure the flow accurately, thus increasing the uncertainty in the documented flood peaks. In addition to measurement errors, runoff hydrology and hydraulics likely are different for small watersheds, which typically are sensitive to land use and to high-intensity rainfalls of short duration. For larger watersheds, such sensitivities are suppressed and floods are influenced to a larger degree by channel and basin storage effects. Because of the lack of sufficient data in some regions and the variability and uncertainty of the data for small watersheds, the 44 stations with drainage areas less than 1 mi^2 were omitted from the final regional regression analysis.

Additionally, there was only one gaged station with a drainage area greater than 9,000 mi^2 for use in the regional regression analysis. This site has a drainage area of 13,600 mi^2 (site 548, table 1, p. 53) and was omitted from the final regional regression analysis because of the lack of data points needed to develop the regression analysis model for a drainage area larger than 8,930 mi^2 (site 886, table 1, p. 53).

Two undefined regions are in the study area (fig. 5, p. 45). The first undefined region is the Upper Three Runs River basin near the midwestern boundary of South Carolina. Large sand deposits at the upper end of this basin affect the rainfall runoff. The Upper Three Runs gaged stations (sites 428, 429, 430; fig. 5, p. 45) have smaller magnitude peaks when compared to other surrounding basins because of the substantial amounts of rainfall runoff being stored in the sand deposits (Feaster and Tasker, 2002). The second undefined area is composed of basins within the Okefenokee Swamp in southeastern Georgia. This area has no gaged stations to define the magnitude and frequency of floods for the basins that drain into the swamp.

A total of 828 sites were available for use in developing the rural flood-frequency relations for North Carolina, South Carolina, and Georgia (943 initial sites minus 52 sites for redundancy, 44 sites with drainage areas less than 1 mi^2,

15 sites in coastal Alabama region, 3 sites in Upper Three Runs basin in South Carolina, and 1 site in Georgia with drainage area at 13,600 mi^2). The distribution of systematic peak-flow record lengths for the 828 stations used in the regional regression analyses is shown in figure 6. Drainage areas and percentage of basin in the various hydrologic regions for the 333 sites in North Carolina included in the regression database are listed in table 7, p. 88.

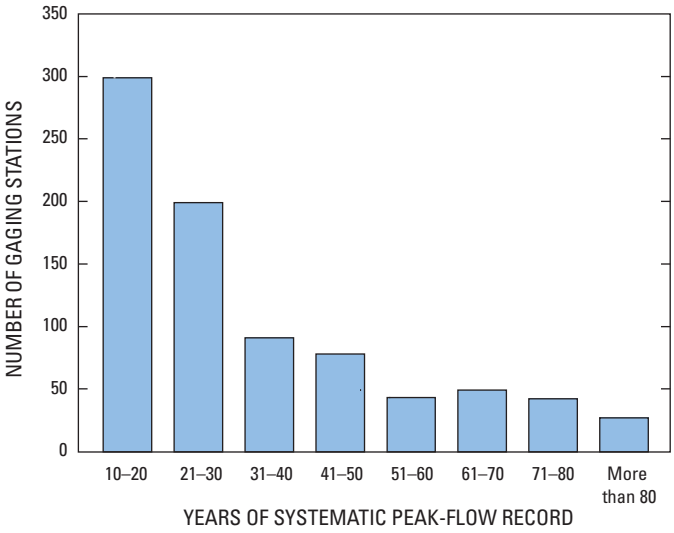


Figure 6. Distribution of systematic peak-flow record lengths for rural streamgaging stations used in the regional regression analysis.

Regional Regression Equations

When grouping sites into hydrologic regions, sites that drain from more than one region typically are omitted from the regional regression analysis. For this study, 83 of the 828 sites have substantial drainage from more than one region. Griffis and Stedinger (2007b) showed that a pooled regression model approach that combines data across regions increases the number of sites and information available for model estimation. They used qualitative indicator variables of 1 or 0 for each region as explanatory variables in the regional regression equation. A similar approach was used by Feaster and Tasker (2002) to distinguish between States for two of the hydrologic regions included in their study. A linear regression model that incorporates the regional indicator variables is as follows:

$$\log Q_P = a_1(d_1) + a_2(d_2) + \ldots + a_n(d_n) + b_0 \log DA, \quad (4)$$

where

d_1, d_2,…, and d_n are the indicator variables for hydrologic regions 1, 2,…, and n; and

a_1, a_2,...a_n, and b_0 are regression coefficients.

If the drainage basin of a station is within a given hydrologic region, then a value of 1 is used as a qualitative variable to indicate the basin is within the region, otherwise, a zero is used if the basin is not within that hydrologic region. Although this approach is useful for regions with a small sample of sites, the approach still does not incorporate sites with drainage basins that are within multiple hydrologic regions. In order to incorporate these sites in the regional regression analysis, a modified version of the Griffis and Stedinger's (2007b) pooled regional regression approach was used for the current study. This modified approach uses the percentage of the basin within the hydrologic regions as explanatory variables instead of the qualitative indicator variables. With this approach, all the stations in the study region are pooled in the regional regression analysis so that no sites are omitted because of multiple regions within a basin. The hydrologic model for this modified approach has the following linear form for n number of hydrologic regions:

$$\log Q_P = a_1(PCT_1) + a_2(PCT_2) + \ldots + a_n(PCT_n) + b_0 \log DA, \quad (5)$$

where

PCT_1, PCT_2,…, and PCT_n are the basin percentages in hydrologic regions 1, 2,…, and n.

Using this model assumes that the slope or b_0 coefficient is constant for every region. In order to test the significance of the differences of slopes for each region, cross products of the explanatory variables were added to the equation. For n number of hydrologic regions, the hydrologic model has the following linear form:

$$\log Q_P = a_1(PCT_1) + a_2(PCT_2) + \ldots\ a_n(PCT_n) + b_0 \log DA + b_1[(\log DA)(PCT_1)] + b_2[(\log DA)(PCT_2)] + \ldots\ b_n[(\log DA)(PCT_n)], \quad (6)$$

where

b_1, b_2,…, and b_n are regression coefficients.

To test the significance of the slope difference for each region, the coefficient of one of the cross products is set to zero, and the significance of the differences in slopes (b_1, b_2, …, and b_n coefficients) is tested at the 95-percent probability level.

A GLS analysis was run on the final 828 rural, gaged stations considered for the regional regression analysis using equation 6. The slope differences for hydrologic regions 2 and 3 were found to be significant at the 95-percent probability level for the $Q_{50\%}$ through $Q_{0.2\%}$ chance exceedance flows. Additionally, the slope differences for hydrologic region 1 were found to be significant at the 95-percent probability level for only the $Q_{50\%}$ peak flow. A slope adjustment factor was included in the final regression equations for hydrologic regions 2 and 3. However, because inclusion of the slope

adjustment factor for hydrologic region 1 did not significantly reduce the standard error of estimate for the $Q_{50\%}$ equation, no slope adjustment factor for hydrologic region 1 was included in the $Q_{50\%}$ equation, which allowed for consistency in variables used in the final regression equations. The results of the analyses are a single P-percent chance exceedance flow estimate equation for the entire study area, which is composed of five hydrologic regions (fig. 5). Four of the five hydrologic regions are located in North Carolina (figs. 7*A*, *B*, p. 47–49).

The final regional regression equations for the 50- through 0.2-percent chance exceedance flows are:

$$Q_{50\%} = 10^{[0.0220(PCT_1)+0.0204(PCT_2)+0.0141(PCT_3)+0.0178(PCT_4)+0.0196(PCT_5)]} DA^{[0.649+0.00130(PCT_2)+0.00109(PCT_3)]} \quad (7)$$

$$Q_{20\%} = 10^{[0.0247(PCT_1)+0.0232(PCT_2)+0.0165(PCT_3)+0.0209(PCT_4)+0.0230(PCT_5)]} DA^{[0.627+0.00122(PCT_2)+0.00117(PCT_3)]} \quad (8)$$

$$Q_{10\%} = 10^{[0.0260(PCT_1)+0.0246(PCT_2)+0.0177(PCT_3)+0.0224(PCT_4)+0.0247(PCT_5)]} DA^{[0.617+0.00119(PCT_2)+0.00123(PCT_3)]} \quad (9)$$

$$Q_{4\%} = 10^{[0.0273(PCT_1)+0.0260(PCT_2)+0.0189(PCT_3)+0.0239(PCT_4)+0.0265(PCT_5)]} DA^{[0.606+0.00118(PCT_2)+0.00130(PCT_3)]} \quad (10)$$

$$Q_{2\%} = 10^{[0.0282(PCT_1)+0.0268(PCT_2)+0.0196(PCT_3)+0.0249(PCT_4)+0.0276(PCT_5)]} DA^{[0.600+0.00118(PCT_2)+0.00135(PCT_3)]} \quad (11)$$

$$Q_{1\%} = 10^{[0.0289(PCT_1)+0.0276(PCT_2)+0.0202(PCT_3)+0.0258(PCT_4)+0.0286(PCT_5)]} DA^{[0.594+0.00119(PCT_2)+0.00139(PCT_3)]} \quad (12)$$

$$Q_{0.5\%} = 10^{[0.0295(PCT_1)+0.0282(PCT_2)+0.0208(PCT_3)+0.0265(PCT_4)+0.0295(PCT_5)]} DA^{[0.589+0.00120(PCT_2)+0.00144(PCT_3)]} \quad (13)$$

$$Q_{0.2\%} = 10^{[0.0303(PCT_1)+0.0290(PCT_2)+0.0214(PCT_3)+0.0274(PCT_4)+0.0306(PCT_5)]} DA^{[0.583+0.00121(PCT_2)+0.00149(PCT_3)]} \quad (14)$$

where

$Q_{50\%}$, $Q_{20\%}$,…, and $Q_{0.2\%}$ are the peak flows for floods with percent chance exceedances of 50 percent, 20 percent,…, and 0.2 percent, in cubic feet per second;

PCT_1, PCT_2, PCT_3, PCT_4, and PCT_5 are the basin percentages in hydrologic regions 1, 2, 3, 4, and 5; and

DA is the drainage area, in square miles.

These equations allow for the computation of P-percent chance exceedance flows for rural, ungaged sites that drain one or more hydrologic regions. It is important to note that the sum of the basin percentages in the five hydrologic regions must equal 100 percent when using equations 7–14. For ungaged sites that are entirely within one hydrologic region, equations 7–14 can be reduced to the simpler forms listed in table 8.

Figure 8 provides a visual comparison of 1-percent chance exceedance flow regression lines for basins located wholly within a hydrologic region and for a basin transitioning from the Ridge and Valley–Piedmont to Blue Ridge hydrologic regions. The coefficients for the constant and for drainage area represent the intercept and slope, respectively, of the relation between drainage area and discharge for each percent chance exceedance. The use of basin percentages in the regression coefficients allows for a smooth transition for drainage basins that do not lie wholly within one hydrologic region. For example, the slopes for the hydrologic regions 2 and 3 regression lines are visibly different from the slopes for the regression lines for the three remaining hydrologic regions (fig. 8*A*). As a result, the final equations include a "slope adjustment factor" for hydrologic regions 2 and 3 (Blue Ridge and Sand Hills regions, respectively). The transition from a hydrologic region represented by the "base"slope (for example, 0.594 for the 1-percent chance exceedance flow in equation 12) to a basin wholly within the Blue Ridge region is depicted in figure 8*B*. Note that the slope of the regression line becomes visibly steeper as a basin goes from 100 percent in the Piedmont–Ridge and Valley region to a basin that is 100 percent in the Blue Ridge region.

Table 8. Regional flood-frequency equations for rural, ungaged streams with drainage basins that are within one hydrologic region.

[*DA*, the drainage area in square miles]

Percent chance exceedance	Hydrologic region (shown in figures 5 and 7)				
	1	2	3	4	5
50	$158(DA)^{0.649}$	$110(DA)^{0.779}$	$25.7(DA)^{0.758}$	$60.3(DA)^{0.649}$	$91.2(DA)^{0.649}$
20	$295(DA)^{0.627}$	$209(DA)^{0.749}$	$44.7(DA)^{0.744}$	$123(DA)^{0.627}$	$200(DA)^{0.627}$
10	$398(DA)^{0.617}$	$288(DA)^{0.736}$	$58.9(DA)^{0.740}$	$174(DA)^{0.617}$	$295(DA)^{0.617}$
4	$537(DA)^{0.606}$	$398(DA)^{0.724}$	$77.6(DA)^{0.736}$	$245(DA)^{0.606}$	$447(DA)^{0.606}$
2	$661(DA)^{0.600}$	$479(DA)^{0.718}$	$91.2(DA)^{0.735}$	$309(DA)^{0.600}$	$575(DA)^{0.600}$
1	$776(DA)^{0.594}$	$575(DA)^{0.713}$	$105(DA)^{0.733}$	$380(DA)^{0.594}$	$724(DA)^{0.594}$
0.5	$891(DA)^{0.589}$	$661(DA)^{0.709}$	$120(DA)^{0.733}$	$447(DA)^{0.589}$	$891(DA)^{0.589}$
0.2	$1{,}072(DA)^{0.583}$	$794(DA)^{0.704}$	$138(DA)^{0.732}$	$550(DA)^{0.583}$	$1{,}148(DA)^{0.583}$

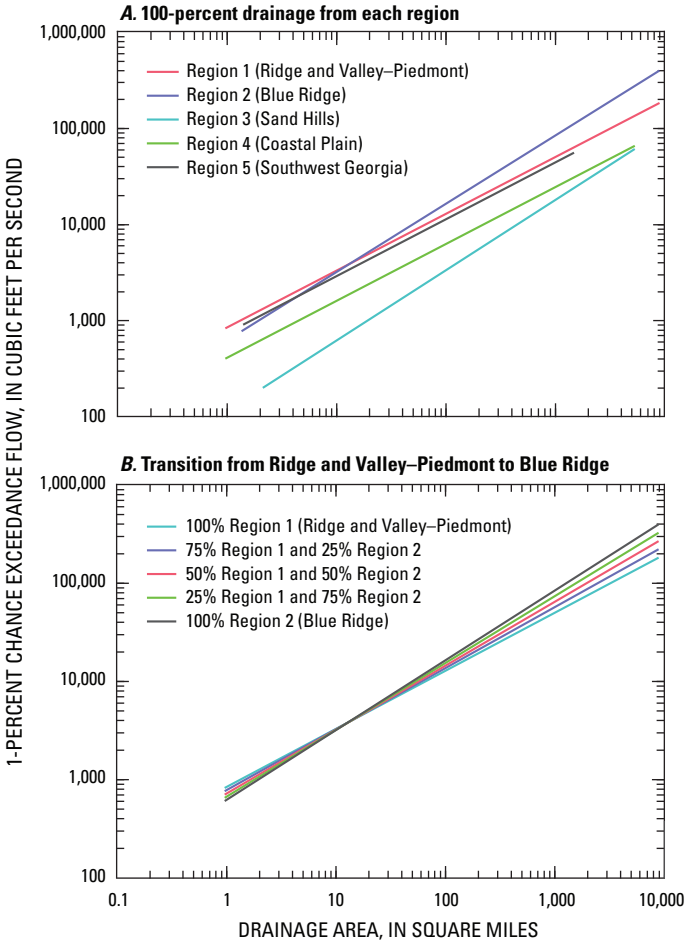


Figure 8. Rural flood-frequency relations *(A)* by region for basins located wholly within a hydrologic region and *(B)* for a basin transition from the Piedmont to the Blue Ridge hydrologic region.

Accuracy and Limitations

When applying regression equations, users are advised not to interpret the empirical results as exact. Regression equations are statistical models that must be interpreted and applied within the limits of the data and with the understanding that the results are best-fit estimates with an associated scatter or variance. The development and use of a regression equation raises questions about how well the predicted values are representative of true values. Errors in the model (that is, differences between the predicted and observed values) can be examined to determine parameters that describe the accuracy of a regression equation, which depends on both the model error and the sampling error. Model error measures the ability of a set of explanatory variables to estimate the values of peak-flow characteristics calculated from the station records used to develop the equation. The model error depends on the number and predictive power of the explanatory variables in a regression equation. Sampling error measures the ability of a finite number of stations with a finite number of recorded annual peak flows to describe the true characteristics of the entire peak-flow record for a station. The sampling error depends on the number and record length of stations used in the analysis and decreases as the number of stations and record lengths increase.

A measure of the uncertainty in a regression equation estimate for a site, *i*, is the variance of prediction, $V_{p,i}$. The $V_{p,i}$ is the sum of the model error variance and sampling error variance and is computed using the following equation:

$$V_{p,i} = \gamma^2 + MSE_{s,i}, \quad (15)$$

where

γ^2 is the model error variance, and

$MSE_{s,i}$ is the sampling mean square error for site *i*.

Assuming that the explanatory variables for the gaged stations in a regression analysis are representative of all stations in the region, the average accuracy of prediction for a regression equation can be determined by computing the average variance of prediction, *AVP*, for *n* number of stations:

$$AVP = \gamma^2 + \left(\frac{1}{n}\right)\sum_{i=1}^{n} MSE_{s,i}. \quad (16)$$

A more traditional measure of the accuracy of P-percent chance exceedance flow regression equations is the standard error of prediction, S_p, which is simply the square root of the variance of prediction. The average standard error of prediction for a regression equation can be computed in percent error using *AVP*, in log units, and the following transformation formula:

$$S_{p,ave} = 100\left[10^{2.3026(AVP)} - 1\right]^{0.5}, \quad (17)$$

where

$S_{p,ave}$ is the average standard error of prediction, in percent.

Approximately two-thirds of the estimates obtained from a regression equation for ungaged sites will have errors less than the standard error of prediction. The average variance of prediction and standard error of prediction for the final set of regional regression equations are listed in table 9.

Table 9. Average variance of prediction and standard error of prediction for the regional regression equations.

Percent chance exceedance	Average variance of prediction (log units)	Average standard error of prediction (percent)
50	0.021	34.5
20	0.021	34
10	0.022	35.1
4	0.025	37.5
2	0.028	39.6
1	0.031	41.9
0.5	0.034	44.3
0.2	0.039	47.7

Previous USGS flood-frequency reports also have expressed the accuracy of regional regression equations in terms of equivalent years of record, which is an estimate of the number of years of station record that would be needed at an ungaged site to produce peak-flow estimates with accuracy equal to that of the associated regression equation. The equivalent year of record concept, while relatively easy to grasp, can sometimes misconstrue the relation between flood-frequency estimates and associated variances. Using variances provides a more accurate characterization of the underlying uncertainty of the various flow estimates.

Users of the regression models may be interested in a measure of uncertainty at a particular site as opposed to the uncertainty statistics based on station data used to generate the regression models. One such measure of uncertainty at a particular ungaged site is the confidence interval of a prediction, or prediction interval. Prediction interval is the minimum and maximum value between which a stated probability that the true value of the response variable exists. Tasker and Driver (1988) determined that a 100 (1–α) prediction interval for the true value of a streamflow statistic for an ungaged site from the regression equation can be computed as follows:

$$Q / C < Q < Q \times C, \quad (18)$$

where

Q is the streamflow characteristic for the ungaged site, and

C is confidence or prediction interval computed as:

$$C = 10^{Z_{(a/2)}S_{p,i}}, \quad (19)$$

where

$Z_{(\alpha/2)}$ is the normal critical value at a particular alpha-level α, which equals 0.05 for a 95-percent prediction interval, divided by 2 and is equal to 1.96 for an α of 0.05; and

$S_{p,i}$ is the standard error of prediction and is computed as:

$$S_{p,i} = \left[\gamma^2 + x_i U x_i'\right]^{0.5}, \quad (20)$$

where

γ^2 is the model error variance;

x_i is a row vector of variables logDA, PCT_1, PCT_2, PCT_3, PCT_5, logDA*PCT_2, and logDA*PCT_3 for site i, augmented by a 1 as the first element;

U is the covariance matrix for the regression coefficients; and

x_i' is the transpose of x_i (Ludwig and Tasker, 1993).

The values for γ^2 and U are presented in table 10.

The procedure necessary to obtain the prediction intervals for P-percent chance exceedance flow estimates is explained in the following example computation of the 2-percent chance exceedance flow for a hypothetical ungaged site on Dan River near Francisco, North Carolina (site 52, table 1, p. 53):

1. Obtain the drainage area and hydrologic region percentages for the ungaged site (DA = 129 mi^2, PCT_1 = 43.6, PCT_2 = 56.4, PCT_3 = 0.0, PCT_4 = 0.0, PCT_5 = 0.0).

2. Compute $Q_{2\%\,(g)r}$ using equation 11 $Q_{2\%(g)r} = 10^{[0.0282(43.6)+0.0268(56.4)+0.0196(0)+0.0249(0)+0.0276(0)]}129^{[0.600+0.00118(56.4)+0.00135(0)]} = 14{,}100$ ft^3/s.

3. Determine the x_i vector (x_i = {1, $\log_{10}$(129), 43.6, 56.4, 0.0, 0.0, ($\log_{10}$(129))(56.4),0.0}).

4. Compute the standard error of prediction using equation 20 with γ^2 and U for the 2-percent chance exceedance flow from table 10; $S_{p,i}$=(0.0265+0.00059610$^{0.5}$=0.1646.

5. Compute C using equation 19; C=10$^{(1.96 * 0.1646)}$ = 2.101.

6. Compute the 95-percent prediction interval using equation 18 (14,100 / 2.101) < $Q_{2\%(u)\,r}$ < (14,100 × 2.101) or 6,710 ft^3/s < $Q_{2\%(u)r}$ < 29,600 ft^3/s.

This prediction-interval example may not be clear to readers unfamiliar with the matrix algebra computations necessary for solution. To assist users who wish to compute the 95-percent prediction intervals at an ungaged site, a spreadsheet program has been developed and posted at http://pubs.usgs.gov/sir/2009/5158/. Instructions for proper application of the program are self-explanatory and are embedded within the spreadsheet.

The following limitations should be recognized when using the final regional regression equations in North Carolina:

1. The ranges of explanatory variables used to develop the regional regression equations are shown in figure 9. For all sites with drainage basins that are within one hydrologic region, accuracy estimates and use of the relations are considered appropriate for drainage areas that range in size from 1 mi^2 to 9,000 mi^2. The relations also appear to be valid from 1 mi^2 to 9,000 mi^2 for most percentages within each hydrologic region (based on fig. 9) even though some gaps (blank areas in the graphs) occur where the accuracy and applicability of the relations have not been verified with observed data.

2. The methods are not appropriate (or applicable) for sites where the watershed is affected substantially by regulation from impoundments, channelization, levees, or other manmade structures.

3. The methods are not appropriate (or applicable) for sites on streams in urban areas (impervious area greater than 10 percent) unless the effects of urbanization are insignificant.

4. The methods do not apply where flooding is influenced by extreme ocean storm surge or tidal events.

5. The methods should be used with caution in the Upper Three Runs basin in Aiken and Barnwell Counties in the western part of the Sand Hills ecoregion (hydrologic region 3). The regional equations tend to produce flows that may be considerably higher than those obtained using observed flow records for the Upper Three Runs basin. To obtain flows for the Upper Three Runs basin, either the station percent-chance exceedance flow can be used or the flow at an ungaged site can be adjusted by drainage area, using an appropriate Upper Three Runs gaging station as an index station. In addition, the methods are not valid for basins in the Okefenokee Swamp in southeastern Georgia where the magnitude and frequency relations are undefined.

Table 10. Values needed to determine 95-percent prediction intervals for the regression equations.

[γ^2, the regression model error variance used in equation 20; *U*, the covariance matrix used in equation 20]

Percent chance exceedance	γ^2	*U*							
50	0.0206	8.13E–04	–1.74E–04	–2.13E–06	–4.53E–06	–3.22E–06	–1.45E–06	1.05E–06	9.32E–07
		–1.74E–04	7.43E–05	–7.87E–08	1.05E–06	1.32E–06	4.09E–08	–6.20E–07	–8.26E–07
		–2.13E–06	–7.87E–08	3.77E–08	3.61E–08	1.65E–08	1.05E–08	–2.78E–09	4.12E–09
		–4.53E–06	1.05E–06	3.61E–08	2.07E–07	3.85E–08	1.09E–08	–7.82E–08	–9.11E–09
		–3.22E–06	1.32E–06	1.65E–08	3.85E–08	6.75E–07	3.55E–09	–1.62E–08	–3.26E–07
		–1.45E–06	4.09E–08	1.05E–08	1.09E–08	3.55E–09	1.34E–07	3.56E–10	4.36E–09
		1.05E–06	–6.20E–07	–2.78E–09	–7.82E–08	–1.62E–08	3.56E–10	4.31E–08	9.36E–09
		9.32E–07	–8.26E–07	4.12E–09	–9.11E–09	–3.26E–07	4.36E–09	9.36E–09	1.87E–07
20	0.0200	8.86E–04	–1.83E–04	–2.42E–06	–4.93E–06	–3.32E–06	–1.47E–06	1.14E–06	9.59E–07
		–1.83E–04	7.68E–05	–9.06E–08	1.07E–06	1.32E–06	3.69E–08	–6.43E–07	–8.35E–07
		–2.42E–06	–9.06E–08	4.27E–08	4.13E–08	1.93E–08	1.07E–08	–2.90E–09	4.07E–09
		–4.93E–06	1.07E–06	4.13E–08	2.24E–07	4.09E–08	1.11E–08	–8.14E–08	–9.06E–09
		–3.32E–06	1.32E–06	1.93E–08	4.09E–08	6.98E–07	3.32E–09	–1.65E–08	–3.33E–07
		–1.47E–06	3.69E–08	1.07E–08	1.11E–08	3.32E–09	1.47E–07	3.53E–10	4.35E–09
		1.14E–06	–6.43E–07	–2.90E–09	–8.14E–08	–1.65E–08	3.53E–10	4.44E–08	9.40E–09
		9.59E–07	–8.35E–07	4.07E–09	–9.06E–09	–3.33E–07	4.35E–09	9.40E–09	1.90E–07
10	0.0212	9.97E–04	–2.04E–04	–2.87E–06	–5.70E–06	–3.78E–06	–1.64E–06	1.31E–06	1.07E–06
		–2.04E–04	8.52E–05	–1.12E–07	1.18E–06	1.45E–06	3.97E–08	–7.21E–07	–9.20E–07
		–2.87E–06	–1.12E–07	5.07E–08	4.90E–08	2.35E–08	1.20E–08	–3.26E–09	4.29E–09
		–5.70E–06	1.18E–06	4.90E–08	2.59E–07	4.70E–08	1.25E–08	–9.16E–08	–1.00E–08
		–3.78E–06	1.45E–06	2.35E–08	4.70E–08	7.82E–07	3.60E–09	–1.82E–08	–3.70E–07
		–1.64E–06	3.97E–08	1.20E–08	1.25E–08	3.60E–09	1.72E–07	3.60E–10	4.67E–09
		1.31E–06	–7.21E–07	–3.26E–09	–9.16E–08	–1.82E–08	3.60E–10	4.94E–08	1.03E–08
		1.07E–06	–9.20E–07	4.29E–09	–1.00E–08	–3.70E–07	4.67E–09	1.03E–08	2.10E–07
4	0.0239	1.18E–03	–2.38E–04	–3.58E–06	–6.97E–06	–4.58E–06	–1.94E–06	1.59E–06	1.28E–06
		–2.38E–04	1.00E–04	–1.45E–07	1.38E–06	1.69E–06	4.60E–08	–8.57E–07	–1.08E–06
		–3.58E–06	–1.45E–07	6.33E–08	6.10E–08	3.02E–08	1.43E–08	–3.86E–09	4.74E–09
		–6.97E–06	1.38E–06	6.10E–08	3.17E–07	5.72E–08	1.49E–08	–1.09E–07	–1.19E–08
		–4.58E–06	1.69E–06	3.02E–08	5.72E–08	9.31E–07	4.21E–09	–2.13E–08	–4.37E–07
		–1.94E–06	4.60E–08	1.43E–08	1.49E–08	4.21E–09	2.13E–07	3.91E–10	5.32E–09
		1.59E–06	–8.57E–07	–3.86E–09	–1.09E–07	–2.13E–08	3.91E–10	5.85E–08	1.21E–08
		1.28E–06	–1.08E–06	4.74E–09	–1.19E–08	–4.37E–07	5.32E–09	1.21E–08	2.47E–07
2	0.0265	1.33E–03	–2.69E–04	–4.17E–06	–8.04E–06	–5.29E–06	–2.21E–06	1.84E–06	1.46E–06
		–2.69E–04	1.13E–04	–1.72E–07	1.56E–06	1.92E–06	5.16E–08	–9.77E–07	–1.22E–06
		–4.17E–06	–1.72E–07	7.38E–08	7.11E–08	3.56E–08	1.64E–08	–4.39E–09	5.16E–09
		–8.04E–06	1.56E–06	7.11E–08	3.66E–07	6.59E–08	1.71E–08	–1.25E–07	–1.37E–08
		–5.29E–06	1.92E–06	3.56E–08	6.59E–08	1.06E–06	4.77E–09	–2.42E–08	–4.97E–07
		–2.21E–06	5.16E–08	1.64E–08	1.71E–08	4.77E–09	2.48E–07	4.26E–10	5.94E–09
		1.84E–06	–9.77E–07	–4.39E–09	–1.25E–07	–2.42E–08	4.26E–10	6.65E–08	1.36E–08
		1.46E–06	–1.22E–06	5.16E–09	–1.37E–08	–4.97E–07	5.94E–09	1.36E–08	2.80E–07

Table 10. Values needed to determine 95-percent prediction intervals for the regression equations.—Continued

[γ^2, the regression model error variance used in equation 20; *U*, the covariance matrix used in equation 20]

Percent chance exceedance	γ^2	*U*							
1	0.0294	1.50E–03	–3.01E–04	–4.79E–06	–9.19E–06	–6.05E–06	–2.51E–06	2.10E–06	1.66E–06
		–3.01E–04	1.28E–04	–2.00E–07	1.76E–06	2.16E–06	5.74E–08	–1.11E–06	–1.37E–06
		–4.79E–06	–2.00E–07	8.49E–08	8.16E–08	4.14E–08	1.86E–08	–4.95E–09	5.64E–09
		–9.19E–06	1.76E–06	8.16E–08	4.18E–07	7.54E–08	1.95E–08	–1.42E–07	–1.56E–08
		–6.05E–06	2.16E–06	4.14E–08	7.54E–08	1.21E–06	5.40E–09	–2.73E–08	–5.62E–07
		–2.51E–06	5.74E–08	1.86E–08	1.95E–08	5.40E–09	2.85E–07	4.71E–10	6.63E–09
		2.10E–06	–1.11E–06	–4.95E–09	–1.42E–07	–2.73E–08	4.71E–10	7.52E–08	1.54E–08
		1.66E–06	–1.37E–06	5.64E–09	–1.56E–08	–5.62E–07	6.63E–09	1.54E–08	3.16E–07
0.5	0.0326	1.67E–03	–3.36E–04	–5.44E–06	–1.04E–05	–6.86E–06	–2.83E–06	2.38E–06	1.87E–06
		–3.36E–04	1.43E–04	–2.30E–07	1.98E–06	2.43E–06	6.33E–08	–1.25E–06	–1.54E–06
		–5.44E–06	–2.30E–07	9.65E–08	9.26E–08	4.74E–08	2.10E–08	–5.55E–09	6.17E–09
		–1.04E–05	1.98E–06	9.26E–08	4.74E–07	8.54E–08	2.20E–08	–1.60E–07	–1.76E–08
		–6.86E–06	2.43E–06	4.74E–08	8.54E–08	1.36E–06	6.07E–09	–3.07E–08	–6.33E–07
		–2.83E–06	6.33E–08	2.10E–08	2.20E–08	6.07E–09	3.24E–07	5.23E–10	7.40E–09
		2.38E–06	–1.25E–06	–5.55E–09	–1.60E–07	–3.07E–08	5.23E–10	8.46E–08	1.72E–08
		1.87E–06	–1.54E–06	6.17E–09	–1.76E–08	–6.33E–07	7.40E–09	1.72E–08	3.55E–07
0.2	0.0373	1.91E–03	–3.85E–04	–6.33E–06	–1.21E–05	–8.00E–06	–3.27E–06	2.78E–06	2.18E–06
		–3.85E–04	1.65E–04	–2.69E–07	2.29E–06	2.81E–06	7.08E–08	–1.45E–06	–1.78E–06
		–6.33E–06	–2.69E–07	1.12E–07	1.08E–07	5.56E–08	2.45E–08	–6.39E–09	6.94E–09
		–1.21E–05	2.29E–06	1.08E–07	5.52E–07	9.93E–08	2.57E–08	–1.85E–07	–2.05E–08
		–8.00E–06	2.81E–06	5.56E–08	9.93E–08	1.58E–06	7.02E–09	–3.54E–08	–7.33E–07
		–3.27E–06	7.08E–08	2.45E–08	2.57E–08	7.02E–09	3.79E–07	6.04E–10	8.52E–09
		2.78E–06	–1.45E–06	–6.39E–09	–1.85E–07	–3.54E–08	6.04E–10	9.80E–08	1.99E–08
		2.18E–06	–1.78E–06	6.94E–09	–2.05E–08	–7.33E–07	8.52E–09	1.99E–08	4.11E–07

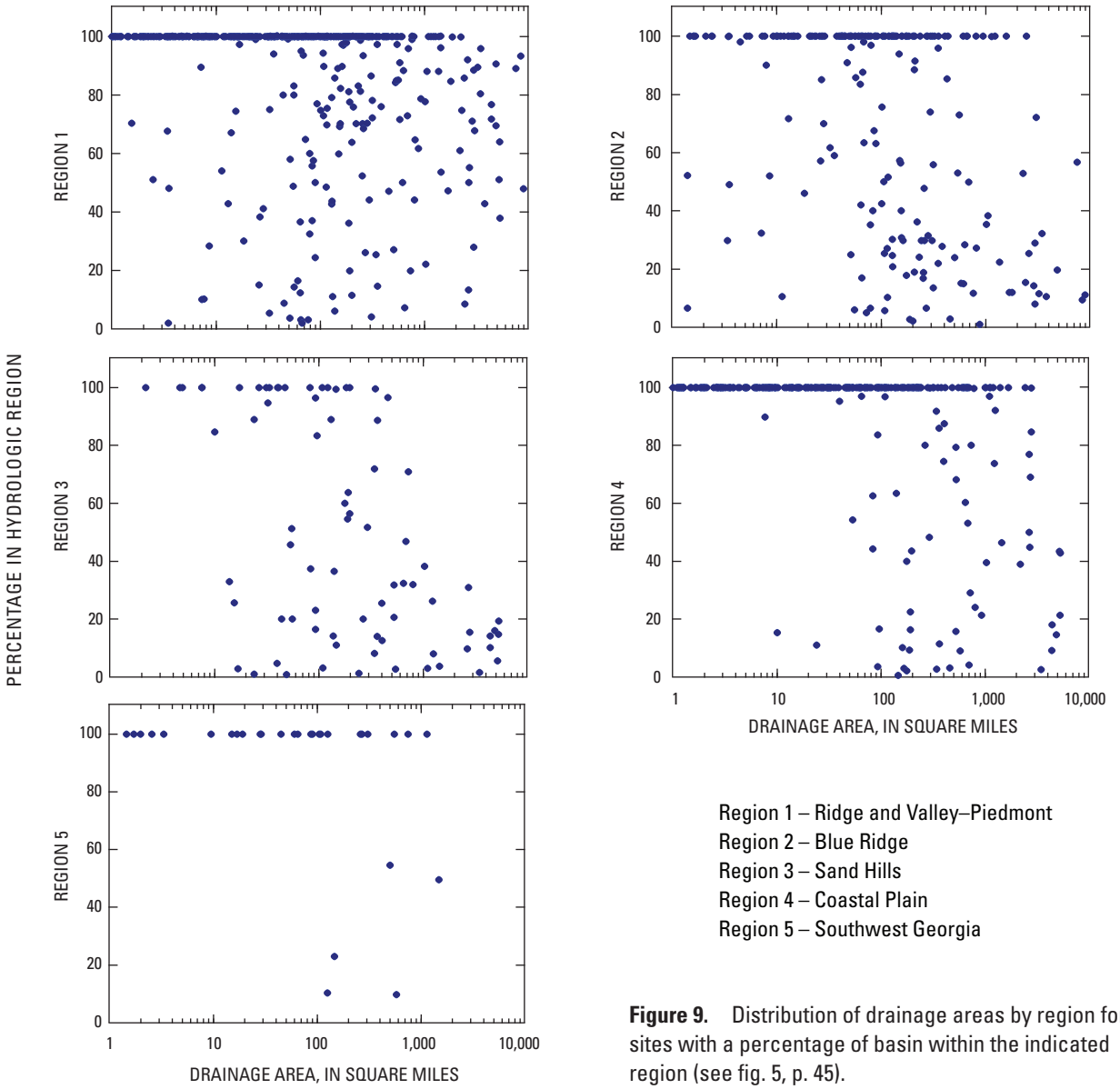


Figure 9. Distribution of drainage areas by region for sites with a percentage of basin within the indicated region (see fig. 5, p. 45).

Analysis of Gaged Basins within Multiple Hydrologic Regions

A comparison of the actual P-percent chance exceedance flows and predicted P-percent chance exceedance flows was made for all 828 stations used in the regression analysis. The actual P-percent chance exceedance flows are the peak-flow statistics that are determined using the log-Pearson Type III analysis of the annual peaks, and the predicted P-percent chance exceedance flows are the estimates from the regression equations. The purpose of the comparison was to analyze how well the final regional regression equations predicted the P-percent chance exceedance flows for stations with drainage basins that are within multiple hydrologic regions.

The actual and predicted 1-percent chance exceedance flow for gaged stations with a portion of the drainage basin within hydrologic region 1 is shown in figure 10. The stations are grouped in 25-percent increments from 1 to 100 percent of the drainage basin within hydrologic region 1 (Ridge and Valley–Piedmont). The points appear to be equally scattered around the one-to-one line for all percentage ranges. Thus, there does not appear to be any over- or underprediction of the P-percent chance exceedance flows for stations having at least some of the basin in hydrologic region 1. The plots for all five hydrologic regions exhibited similar scatter around the one-to-one line for the $Q_{50\%}$ through $Q_{0.2\%}$ equations, which indicates the model works well for stations with drainage basins that are within multiple regions.

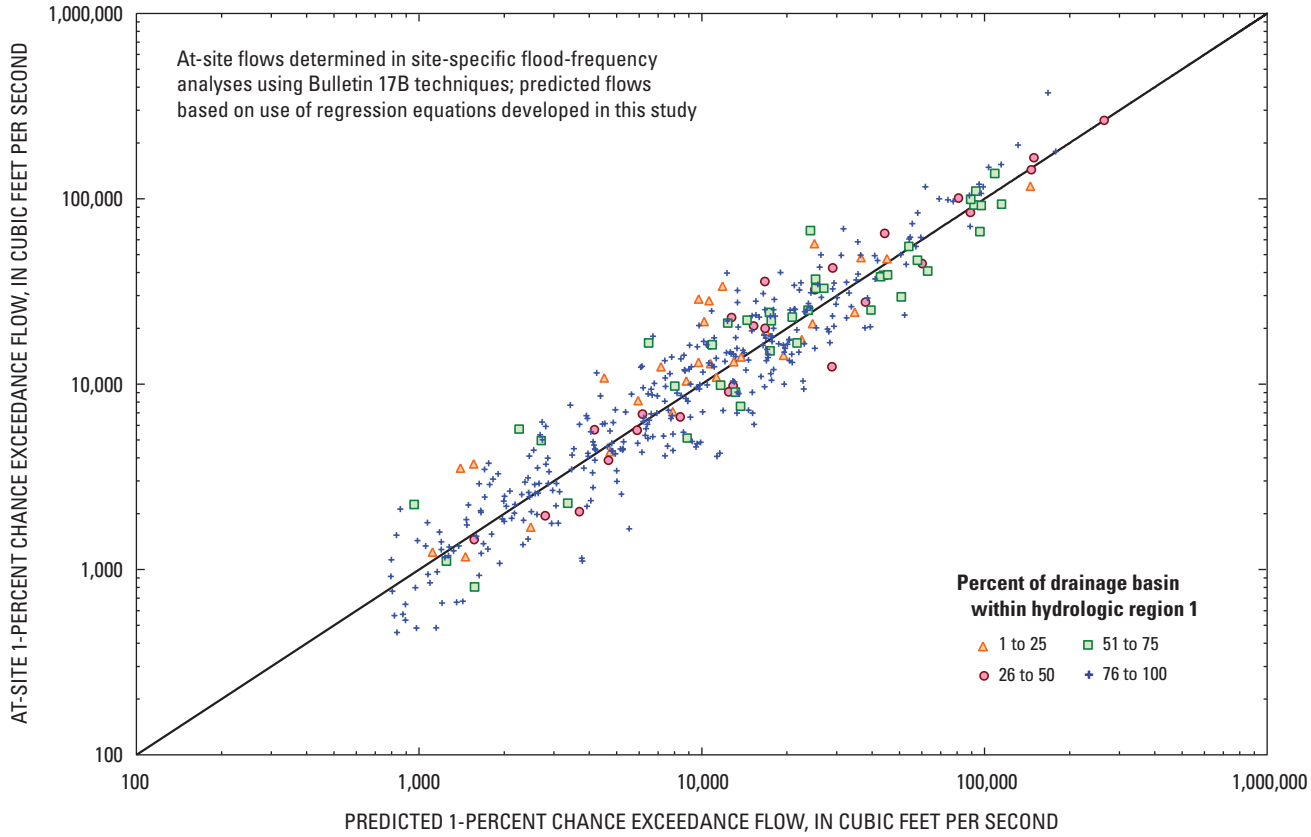


Figure 10. At-site and predicted 1-percent chance exceedance flows for rural streamgaging stations with a portion of the drainage basin within hydrologic region 1 (Ridge and Valley–Piedmont).

Comparison of Results with Previous North Carolina Study

With the development of updated at-site flood-frequency statistics and regional regression relations, the question that commonly arises is how results compare between previous and updated analyses. During the current study, two comparisons were made between the previous and updated analyses for North Carolina sites. The first comparison was between the statistics obtained from the systematic records (specifically, the at-site flood-frequency estimates based on weighted skew coefficient) in this report and those from the previous North Carolina flood-frequency report (Pope and others, 2001) for stations used in both reports (table 11). The second comparison was between predicted peak discharges based on the regression equations provided in both reports (table 12). Comparisons were made by determining the percentage difference from the previous to updated results—positive percentage differences indicate updated results that are higher than the previous results, negative percentage differences indicate updated results that are lower than the previous results.

For the flood-frequency statistics obtained from the systematic records, the mean and median percentage differences from this study and the previous study were computed for all stations by hydrologic region in North Carolina (table 11). Differences in estimates from regression equations in this study and the previous study were computed for all stations and are provided in three forms: (1) percentage differences shown between 10-, 1-, and 0.2-percent chance exceedance flows computed using varying drainage areas (table 12), (2) graphs showing the regression lines for drainage area and predicted 1-percent chance exceedance flows by hydrologic region or areas presented in each report (fig. 11), and (3) graphs showing the predicted peak discharges based on the regional regression relations provided in each report (fig. 12).

Estimates determined from the systematic records for this study typically are larger in discharge than those from the previous study for the highest percent chance exceedances (50 and 20 percent) and tend to be smaller than those from the previous study for the lower percent chance exceedance when all stations are considered as a group in each hydrologic region. For example, mean differences for the Piedmont stations range from positive 0.5 percent for the 50-percent chance exceedance to negative 4.6 percent for the 0.2-percent chance exceedance (table 11). Similarly for the same hydrologic region, median differences range from positive 0.9 percent for the 50-percent chance exceedance to negative 7.1 percent for the 0.2-percent chance exceedance. Many stations in North Carolina—particularly in the Coastal Plain and Blue Ridge

Table 11. Mean and median percentage differences between at-site flood-frequency statistics computed from the systematic records for streamgaging stations included in this study and the previous study (Pope and others, 2001).

[Mean and median percentage differences are presented by hydrologic region. Hydrologic regions are shown in figures 5 and 7. Negative and positive percent values indicate lower and higher predicted discharges, respectively, by use of updated methods compared to methods provided in previous study]

P-percent chance exceedance	Blue Ridge		Piedmont		Coastal Plain		Sand Hills	
	Mean percent difference	Median percent difference	Mean percent difference	Median percent difference	Mean percent difference	Median percent difference	Mean percent difference	Median percent difference
All stations								
50	–1.5%	–0.3%	0.5%	0.9%	2.2%	1.6%	0.7%	1.2%
20	–0.5%	0.0%	0.6%	0.4%	2.6%	0.7%	–0.1%	0.6%
10	–0.1%	–0.3%	0.0%	–0.6%	2.2%	–0.6%	–1.3%	–0.7%
4	0.1%	–0.6%	–0.9%	–1.9%	1.3%	–2.3%	–3.5%	–3.7%
2	0.2%	–1.1%	–1.7%	–3.0%	0.6%	–3.4%	–5.1%	–5.7%
1	0.2%	–1.4%	–2.6%	–4.2%	–0.2%	–4.9%	–6.8%	–6.6%
0.5	0.2%	–2.0%	–3.4%	–5.4%	–0.9%	–6.1%	-8.6%	–8.6%
0.2	0.2%	–2.4%	–4.6%	–7.1%	–1.8%	–8.1%	–10.9%	–11.0%
Stations with no additional record since previous study								
50	0.9%	0.9%	1.3%	1.1%	2.0%	1.5%	1.5%	1.7%
20	0.7%	0.2%	0.5%	0.4%	1.8%	0.6%	0.6%	0.6%
10	0.4%	–0.2%	–0.6%	–0.6%	0.9%	–0.7%	–0.7%	–0.7%
4	0.1%	–0.9%	–2.3%	–1.9%	–0.5%	–2.6%	–3.0%	–3.1%
2	–0.3%	–1.5%	–3.6%	–3.0%	–1.5%	–3.9%	–4.7%	–4.8%
1	–0.7%	–1.9%	–4.9%	–4.2%	–2.7%	–5.6%	–6.4%	–6.6%
0.5	–0.9%	–2.6%	–6.2%	–5.5%	–3.8%	–7.2%	–8.2%	–8.6%
0.2	–1.3%	–3.5%	–8.0%	–7.1%	–5.2%	–9.2%	–10.5%	–11.0%
Stations with additional record since previous study								
50	–5.2%	–3.5%	–0.7%	–0.9%	4.5%	2.8%	–0.9%	–1.5%
20	–2.4%	–1.0%	0.9%	0.0%	10.1%	6.6%	–1.2%	0.9%
10	–1.1%	–0.9%	1.3%	–1.1%	13.6%	9.4%	–2.3%	–1.1%
4	0.2%	–0.3%	1.4%	–1.5%	17.5%	12.4%	–4.3%	–5.3%
2	1.0%	–0.1%	1.4%	–2.8%	20.5%	14.1%	–5.9%	–7.9%
1	1.6%	0.3%	1.2%	–3.9%	23.4%	16.8%	–7.6%	–10.4%
0.5	2.1%	0.7%	1.2%	–5.2%	26.2%	19.0%	–9.3%	–12.6%
0.2	2.6%	1.6%	1.0%	–7.3%	29.9%	22.1%	–11.8%	–14.8%

hydrologic regions—have experienced major flooding since completion of the previous study, which could lead to the expectation that flood-frequency estimates would increase rather than decrease. However, the decrease in the lower percent chance exceedance estimates may partly be explained by (1) additional record for many of the stations and (2) the updated generalized skew value used for this study, which is lower than values used in the previous study (Pope and others, 2001). During the current study, the updated generalized skew value was applied to the dataset used in the previous study (through the 1996 water year) as a comparison check. The resulting at-site estimates for the 1-percent chance exceedance flows were lower than the previously published values by an average of about 6.7 percent.

As indicated in table 11, mean percentage differences between the estimates from the previous and updated studies vary depending on the hydrologic region and whether or not additional data were collected. When considering only those stations *with no additional record* since the previous study, the pattern of mean and median percentage differences is consistent among the hydrologic regions; that is, higher estimates for the 50- and 20-percent chance exceedance statistics trending to lower estimates for the lower percent chance exceedance. When considering the stations *with additional record* since

Table 12. Predicted 10-, 1-, and 0.2-percent chance exceedance flows based on regional relations in this study and in the previous study (Pope and others, 2001) for Blue Ridge, Piedmont, Coastal Plain, and Sand Hills hydrologic regions.

[mi², square miles; ft³/s, cubic feet per second. Discharges predicted using updated relations presume 100 percent of basin is within indicated hydrologic region. Hydrologic regions are shown in figures 5 and 7]

Drainage area, mi²	10-percent chance exceedance peak discharge, ft³/s			1-percent chance exceedance peak discharge, ft³/s			0.2-percent chance exceedance peak discharge, ft³/s		
	Previous study	Updated	Percent difference	Previous study	Updated	Percent difference	Previous study	Updated	Percent difference
Blue Ridge hydrologic region									
1	334	288	–13.8	745	575	–22.8	1,160	794	–31.6
10	1,530	1,570	2.6	3,140	2,970	–5.4	4,670	4,020	–13.9
50	4,450	5,130	15.3	8,590	9,360	9.0	12,400	12,500	0.8
100	7,040	8,550	21.4	13,200	15,300	15.9	18,800	20,300	8.0
500	20,400	28,000	37.3	36,200	48,300	33.4	49,800	63,100	26.7
1,000	32,300	46,600	44.3	55,900	79,300	41.9	75,800	103,000	35.9
5,000	93,900	152,000	61.9	153,000	250,000	63.4	201,000	319,000	58.7
9,000	139,000	235,000	69.1	221,000	380,000	71.9	286,000	483,000	68.9
Piedmont hydrologic region									
1	334	398	19.2	745	776	4.2	1,160	1,070	–7.8
10	1,530	1,650	7.8	3,140	3,050	–2.9	4,670	4,100	–12.2
50	4,450	4,450	0.0	8,590	7,930	–7.7	12,400	10,500	–15.3
100	7,040	6,820	–3.1	13,200	12,000	–9.1	18,800	15,700	–16.5
500	20,400	18,400	–9.8	36,200	31,100	–14.1	49,800	40,100	–19.5
1,000	32,300	28,200	–12.7	55,900	47,000	–15.9	75,800	60,100	–20.7
5,000	93,900	76,300	–18.7	153,000	122,000	–20.3	201,000	154,000	–23.4
9,000	139,000	110,000	–20.9	221,000	173,000	–21.7	286,000	216,000	–24.5
Coastal Plain hydrologic region									
1	188	174	–7.4	468	380	–18.8	773	550	–28.8
10	775	719	–7.2	1,720	1,490	–13.4	2,670	2,100	–21.3
50	2,080	1,940	–6.7	4,280	3,880	–9.3	6,370	5,380	–15.5
100	3,190	2,980	–6.6	6,340	5,860	–7.6	9,250	8,050	–13.0
500	8,590	8,040	–6.4	15,800	15,200	–3.8	22,000	20,600	–6.4
1,000	13,200	12,300	–6.8	23,300	23,000	–1.3	32,000	30,800	–3.8
5,000	35,400	33,300	–5.9	58,100	59,900	3.1	76,200	78,800	3.4
Sand Hills hydrologic region									
1	73	59	–19.2	143	105	–26.6	210	138	–34.3
10	363	324	–10.7	697	566	–18.8	1,010	745	–26.2
50	1,110	1,060	–4.5	2,110	1,840	–12.8	3,050	2,420	–20.7
100	1,810	1,780	–1.7	3,400	3,060	–10.0	4,900	4,020	–18.0
500	5,550	5,850	5.4	10,300	9,960	–3.3	14,700	13,100	–10.9
1,000	8,990	9,770	8.7	16,600	16,600	0.0	23,700	21,700	–8.4

the previous study, however, all mean and median percentage differences for stations in the Coastal Plain hydrologic region are positive (means ranging from 4.5 to 29.9 percent), meaning that at-site statistics determined in this study are higher than those determined in the previous study. These differences are reflective of the major flooding that occurred in eastern North Carolina during 1999. However, the major flooding that occurred in western North Carolina during 2004 did not result in higher at-site statistics for all percent chance exceedances. The magnitude in percentage differences for the Blue Ridge hydrologic region (means ranging from –5.2 to 2.6 percent) are generally more comparable with those noted for the Piedmont (means ranging from –7.3 to 1.4 percent) and Sand Hills (means ranging from –0.9 to –11.8 percent) hydrologic regions.

To compare differences between the regression estimates from the current study and those from the previous study, peak discharges were predicted using varying ranges of drainage area for each of the hydrologic regions (table 12; figs. 11, 12). Varying magnitudes and directions of changes were noted by hydrologic region for all stations. Somewhat of a discontinuity exists in making such comparisons because the Blue Ridge

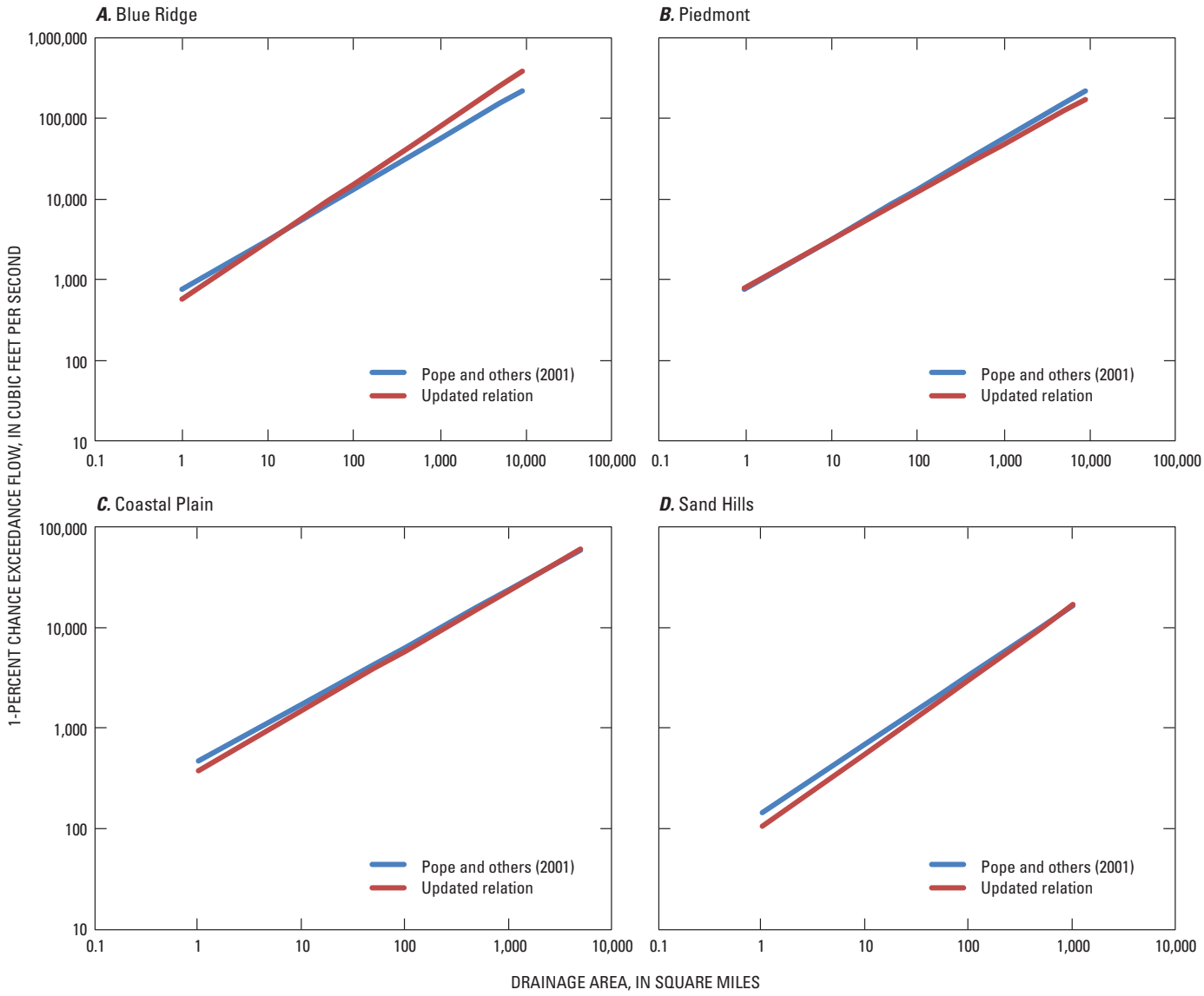


Figure 11. Drainage area and predicted 1-percent chance exceedance flows in *(A)* Blue Ridge, *(B)* Piedmont, *(C)* Coastal Plain, and *(D)* Sand Hills hydrologic regions in this study and corresponding regions in the previous study (Pope and others, 2001).

and Piedmont hydrologic areas in the previous study (Pope and others, 2001) were combined into one regional relation for each percent chance exceedance. In terms of absolute values, the largest percentage differences generally are for the stations in the Blue Ridge hydrologic region with drainage areas at 500 mi^2 or more (ranging from 37.3 to 71.9 percent, table 12). However, for stations in the Piedmont hydrologic region, the percentage differences are negative for drainage areas at 100 mi^2 or more. Thus, relations presented in this report for the Blue Ridge hydrologic region predict higher peak discharges (for the higher drainage areas) than those based on the previous Blue Ridge–Piedmont relation developed by Pope and others (2001). Conversely, the updated relations for the Piedmont hydrologic region predict lower peak discharges (for the higher drainage areas) than those predicted using the same previous relation. This pattern is echoed in the graphs shown in figures 11 and 12.

Errors associated with the regression equations cannot be directly compared between the two studies because the same stations, explanatory variables, and hydrologic regions or areas were not used. A comparison, however, can be made to help understand differences between the results. Average standard errors of prediction associated with the regression equations developed in this study (34.0 to 47.7 percent) are smaller than the standard errors of prediction derived from the three sets of equations developed in the previous study

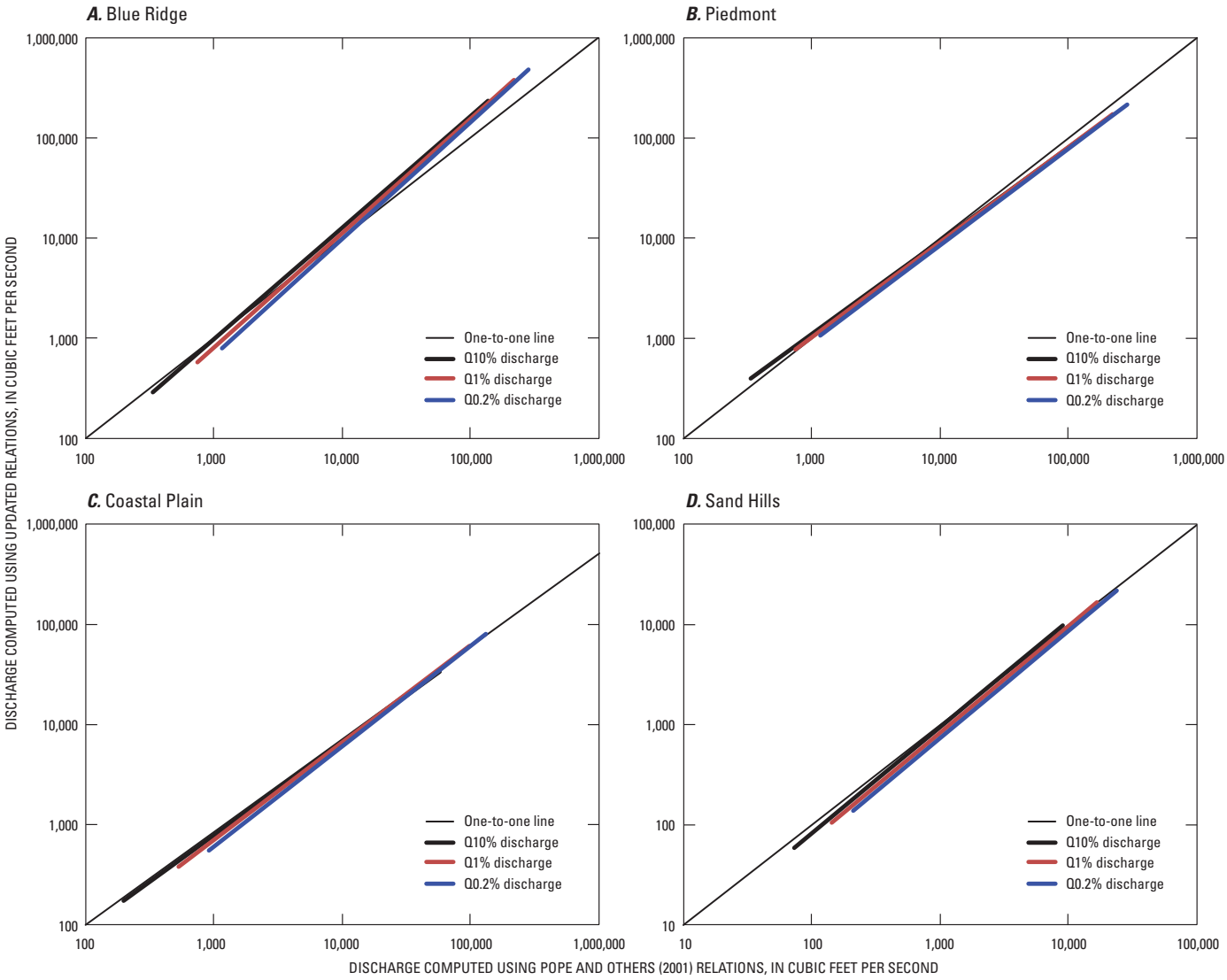


Figure 12. Predicted 10-, 1-, and 0.2-percent chance exceedance flows based on regional relations in this study and in the previous study (Pope and others, 2001) for *(A)* Blue Ridge, *(B)* Piedmont, *(C)* Coastal Plain, and *(D)* Sand Hills hydrologic regions.

for the Blue Ridge (41.2 to 51.6 percent), Coastal Plain (37.9 to 47.3 percent), and Sand Hills (38.4 to 65.1 percent) hydrologic areas.

Maximum Floods

In a flood-frequency analysis, it is inherent that for floods with a specified probability of recurrence (such as the 1-percent chance exceedance flows), the regression curve is a best-fit line for linear regression (or a best-fit plane for multiple regression) through a series of statistically specified percent chance exceedance flows from some number of gaged locations in a given region. The regression curve is fit so that the variance about the curve is minimized; therefore, roughly half of the data points will be above the regression line and half below. For many engineering design projects, this level of uncertainty is acceptable and often is compensated for by including a factor of safety in the design process. In certain projects that include concerns about high risk, the assessment of maximum measured floods is another tool that can be used to evaluate the reasonableness of a flood-frequency estimate.

Crippen and Bue (1977) developed envelope curves from maximum flood data for 17 regions in the conterminous United States (fig. 13). Crippen (1982) later provided equations that described the envelope curves. The curves were not associated with specific probabilities or frequencies, but were provided as a tool to help assess the maximum flood that might be expected in the regions for a given drainage area size. Costa (1987) developed an envelope curve of the maximum rainfall-runoff floods in the United States, but his dataset did not include any stations in the Southeast.

Maximum peak flows were plotted against drainage area using data from the stations included in the current study, and an envelope curve was drawn to depict the most extreme

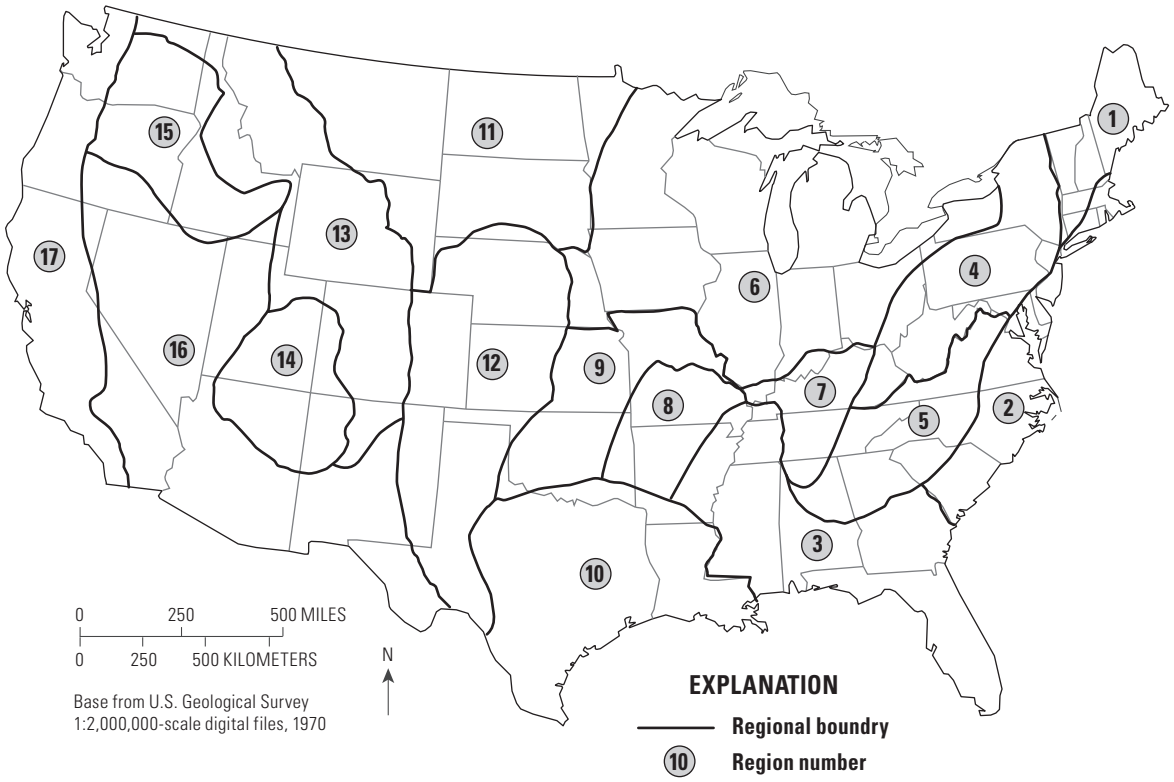


Figure 13. Flood-region boundaries within the conterminous United States (modified from Crippen and Bue [1977] as published by Kenney and others [2007]).

floods (figs. 14 and 15). The stations were grouped on the basis of having at least 75 percent of the basin draining either above or below the Fall Line, which allows for comparisons with the Crippen (1982) curves. The stations above the Fall Line include data from the Ridge and Valley, Blue Ridge, and Piedmont ecoregions and the stations below the Fall Line include data from the Coastal Plain ecoregions. In addition, a few stations that currently are regulated but had significantly large floods recorded prior to regulation also were included. Like the Crippen (1982) curves, the envelope curves generated from the maximum flow data included in this study indicate maximum flood-discharge potential for a range of drainage areas for the given regions.

Application of Methods

The best estimates of flood frequencies for a site typically are obtained through a weighted combination of estimates produced from more than one method. Tasker (1975) demonstrated that if two independent estimates of a streamflow statistic are available, a properly weighted average of the independent estimates will provide an estimate that is more accurate than either of the independent estimates. Improved flood-frequency estimates can be determined for North Carolina gaged stations by weighting estimates determined from the Bulletin 17B analysis with estimates obtained from the regression equations provided in this report. Improved estimates can be determined for ungaged sites on the same stream in North Carolina by weighting the estimates obtained from the regression equations with estimates that were determined based on the flow of an upstream or downstream gaged station. The following sections describe the weighting process for gaged stations and ungaged sites in more detail and provide example calculations. The results are rounded to three significant figures.

Estimation for a Gaged Station

The Interagency Advisory Committee on Water Data (1982) recommends that better estimates of flood-frequency statistics for a gaged station can be obtained by combining (weighting) at-site flow estimates determined from the log-Pearson Type III analysis of the annual peaks with flow estimates obtained for the station from regression equations. Optimal weighted flow estimates can be obtained if the variance of prediction for each of the two estimates is known or can be estimated accurately. The variance of prediction can be thought of as a measure of the uncertainty in either the at-site estimate or the regional regression results. If the two estimates can be assumed to be independent and are weighted in inverse proportion to the associated variances, the variance of the

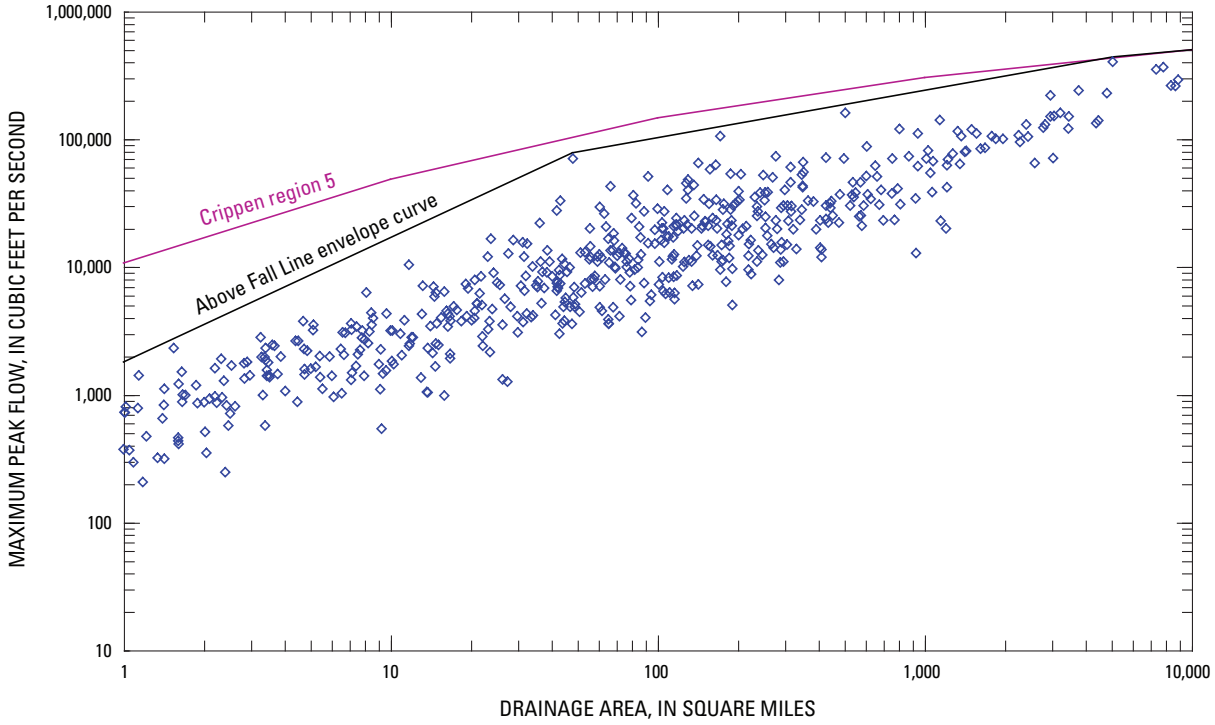


Figure 14. Maximum flood flow and drainage area for streams located above the Fall Line in North Carolina, South Carolina, and Georgia.

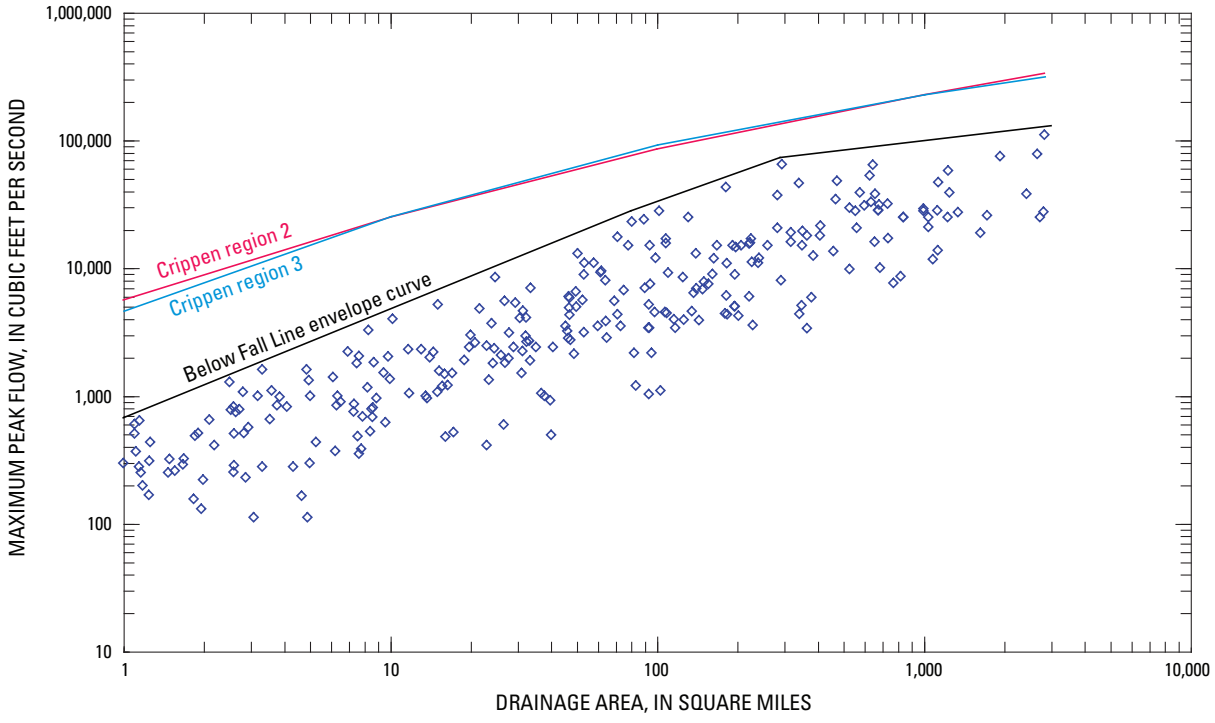


Figure 15. Maximum flood flow and drainage area for streams located below the Fall Line in North Carolina, South Carolina, and Georgia.

weighted estimate will be less than the variance of either of the independent estimates.

The variance of prediction corresponding to the at-site flow estimate from the log-Pearson Type III analysis is computed using the asymptotic formula given in Cohn and others (2001) with the addition of the mean-squared error of generalized skew (Griffis and others, 2004). This variance varies as a function of the length of record, the fitted log-Pearson Type III distribution parameters (mean, standard deviation, and weighted skew), and the accuracy of the method used to determine the generalized skew component of the weighted skew. The variance of prediction for the at-site estimate generally decreases with length of record and the quality of the log-Pearson Type III distribution fit. The variance of prediction values for the at-site flow estimates for the 333 gaged stations located in North Carolina are listed in table 13, p. 96.

The variance of prediction from the regional regression equations is a function of the regression equations and the values of the independent variables used to develop the flow estimate from the regression equations. This variance generally increases as the values of the independent variables move further from the mean values of the independent variables. The average variance of prediction values for the regional regression equations used in this study are listed in table 9.

Once the variances have been computed, the two independent flow estimates can be weighted using the following equation:

$$\log Q_{P(g)w} = \frac{V_{p,P(g)r}\log Q_{P(g)s} + V_{p,P(g)s}\log Q_{P(g)r}}{V_{p,P(g)s} + V_{p,P(g)r}}, \quad (21)$$

where

$Q_{P(g)w}$ is the weighted estimate of peak flow for any P-percent chance exceedance for a gaged station, in cubic feet per second;

$V_{p,P(g)r}$ is the variance of prediction at the gaged station derived from the applicable regional regression equations for the selected P-percent chance exceedance (from table 9), in log units;

$Q_{P(g)s}$ is the estimate of peak flow at the gaged station from the log-Pearson Type III analysis for the selected P-percent chance exceedance, in cubic feet per second;

$V_{p,P(g)s}$ is the variance of prediction at the gaged station from the log-Pearson Type III analysis for the selected P-percent chance exceedance (from table 13, p. 96), in log units; and

$Q_{P(g)r}$ is the peak-flow estimate for the P-percent chance exceedance at the gaged station derived from the applicable regional regression equations 7–14, in cubic feet per second.

The weighted (best) flow estimates were computed using equation 21 along with the variance of prediction values from tables 9 and 13 for the 333 gaged stations in North Carolina. The weighted flow estimates for the 333 gaged stations are listed in table 4 (p. 74).

When the variance of prediction corresponding to one of the estimates is high, the uncertainty is also high and so the weight for that estimate is relatively small. Conversely, when the variance of prediction is low, the uncertainty is also low and so the weight is correspondingly large. The variance of prediction associated with the weighted estimate, $V_{p,P(g)w}$, is computed using the following equation:

$$V_{p,P(g)w} = \frac{V_{p,P(g)s}V_{p,P(g)r}}{V_{p,P(g)s} + V_{p,P(g)r}}. \quad (22)$$

The variance of prediction values associated with the weighted estimates are listed in table 13.

An example of the application of the procedure described above is the following computation of the weighted 1-percent chance exceedance flow for the site on Yadkin River at Yadkin College, North Carolina (station number 02116500, site 253, tables 1, 4, 7, and 13):

1. Obtain the at-site estimate of the 1-percent chance exceedance flow at the site based on the systematic flood peaks from table 4 ($Q_{1\%(g)s}$ = 92,700 ft^3/s);

2. Obtain drainage area and hydrologic region percentages from table 7 (DA = 2,280 mi^2, PCT_1 = 74.7, PCT_2 = 25.3, PCT_3 = 0, PCT_4 =70, and PCT_5 = 0);

3. Compute $Q_{1\%(g)r}$ using equation 12 ($Q_{1\%(g)r} = 10^{[0.0289(74.7) + 0.0276(25.3) + 0.0202(0) + 0.0258(0) + 0.0286(0)]} 2{,}280^{[0.594 + 0.00119(25.3) + 0.00139(0)]}$ = 89,700 ft^3/s);

4. Obtain the variance of prediction for the at-site estimate for the 1-percent chance exceedance flow from table 13 ($V_{1\%(g)s}$ = 0.0060);

5. Obtain the variance of prediction for the 1-percent chance exceedance flow regression equation from table 9 ($V_{1\%(g)r}$ = 0.0305);

6. Compute the weighted 1-percent chance exceedance flow for the station using equation 21 (log $Q_{1\%(g)w}$ = ((0.0305)(log92,700) + (0.00603)(log89,700)) / (0.0305 + 0.00603) = 4.965, and $Q_{1\%(g)w}$ = 92,200 ft^3/s); and

7. Compute the weighted 1-percent chance exceedance variance for the station using equation 22 ($V_{p,1\%(g)w}$ = (0.0305 x 0.00603) / (0.0305 + 0.00603) = 0.00503).

Previous USGS flood-frequency reports used the equivalent years of record associated with the regression equations along with the length of record at the gaged station to weight

the flow estimates obtained from the regional regression equation and the log-Pearson Type III analysis. However, the length of record often fails to account for the true variance of log-Pearson Type III flood-frequency estimates. For example, although longer record lengths generally result in decreased variance, record length fails to account for the improvement in information content provided by the generalized skew or the addition of historic peaks. Furthermore, flood-frequency distributions computed from two different gaged-station records of the same length may not be of equal reliability owing to differences in underlying variances of the peak-flow records. For example, smaller drainage areas may have flashier, more highly varied records, or may be more difficult to accurately gage than a large basin, hence the log-Pearson Type III distributions could be expected to have larger variances. More importantly, the equivalent year of record concept, while relatively easy to grasp, can sometimes misconstrue the relation between flood-frequency estimates and associated variances. Using variances provides a more accurate characterization of the underlying uncertainty of the various flow estimates.

Estimation for an Ungaged Site near a Gaged Station

Sauer (1974) presented the following method to improve flood-frequency estimates for an ungaged site near a gaged station, on the same stream, that has 10 or more years of peak-flow record. To obtain a weighted peak-flow estimate ($Q_{P(u)w}$) for P-percent chance exceedance at the ungaged site, the weighted flow estimate for an upstream or downstream gaged station ($Q_{P(g)w}$) must first be determined by using the equation provided in the previous section. The weighted estimate for the ungaged site ($Q_{P(u)w}$) is then computed using the following equation:

$$Q_{P(u)w} = \left[\left(\frac{2\Delta A}{A_{(g)}}\right) + \left(1 - \frac{2\Delta A}{A_{(g)}}\right)\left(\frac{Q_{P(g)w}}{Q_{P(g)r}}\right)\right] Q_{P(u)r}, \qquad (23)$$

where

$Q_{P(u)w}$ is the weighted estimate of peak flow for the selected P-percent chance exceedance at the ungaged site, in cubic feet per second;

ΔA is the absolute value of the difference between the drainage areas of the gaged station and the ungaged site, in square miles;

$A_{(g)}$ is the drainage area for the gaged station, in square miles; and

$Q_{P(u)r}$ is the peak-flow estimate derived from the applicable regional equations 7–14 for the selected P-percent chance exceedance at the ungaged site, in cubic feet per second.

Use of equation 23 gives full weight to the regression equation estimates when the drainage area for the ungaged site is equal to 0.5 or 1.5 times the drainage area for the gaged station and increasing weight to the gaged station estimates as the drainage area ratio approaches 1. The weighting procedure must not be applied when the drainage area ratio for the ungaged site and gaged station is less than 0.5 or greater than 1.5.

An example application of this procedure is the computation of the weighted 1-percent chance exceedance flow, and its associated equivalent years of record, for a hypothetical ungaged site on the Yadkin River located above the USGS station at Yadkin College, NC (station number 02116500, site 253, table 1), cited in the previous section. The regulated streamgage at Yadkin River at Enon, NC (station number 02115360, site 29r, table 5), is used as a hypothetical unregulated and ungaged site for purposes of this example:

1. Calculate the value of $Q_{1\%\,(g)w}$ for the gaged station (see example in previous section, $Q_{1\%\,(g)w}$ = 92,200 ft^3/s);
2. Obtain the drainage areas for both the gaged and ungaged sites (A_g = 2,280 mi^2 and A_u = 1,694 mi^2);
3. Determine the hydrologic region percentages for the ungaged site (the following percentages were determined during the study for site 29r during the study and are not provided in any table in this report: PCT_1 = 66, PCT_2 = 34, PCT_3 = 0, PCT_4 = 0, PCT_5 = 0);
4. Compute $Q_{1\%\,(u)r}$ for the ungaged site using equation 12 ($Q_{1\%\,(u)r} = 10^{[0.0289(66) + 0.0276(34) + 0.0202(0) + 0.0258(0) + 0.0286(0)]} 1{,}694^{[0.594 + 0.00119(34) + 0.00139(0)]} = 78{,}400$ ft^3/s);
5. Compute $Q_{1\%\,(g)r}$ for the gaged station using equation 12 ($Q_{1\%\,(g)r}$ = 89,700 ft^3/s);
6. Compute ΔA, where ΔA = 2,280 – 1,694 = 586 mi^2; and
7. Compute the weighted estimate for the ungaged site, $Q_{1\%(u)w}$ using equation 23 ($Q_{1\%(u)w}$ = [((2 * 586) / 2,280) + ((1 – ((2 * 586) / 2,280)) * (92,200/89,700))] * 78,400 = 79,500 ft^3/s).

For an ungaged site that is located between two gaged stations on the same stream, two flow estimates can be made using the methods and criteria outlined in this section. In addition to evaluating the differences in hydrologic regions of the two gaged stations compared to the hydrologic region(s) for the ungaged site, additional hydrologic judgment may be necessary to determine which of the two estimates (or some interpolation thereof) is most appropriate. Other factors that might be considered when evaluating the two estimates include differences in the length of record for the two gaged stations and the hydrologic conditions that existed during the data-collection period for each gaged station (that is, does the time series represent a climatic period that was predominately wet or dry?).

Summary and Conclusions

The U.S. Geological Survey Water Science Center offices in North Carolina, South Carolina, and Georgia conducted an update of flood-frequency statistics and regional relations in cooperation with the Departments of Transportation in the three States and with the North Carolina Floodplain Mapping Program within the Department of Crime Control and Public Safety. This report presents methods for determining flood magnitude and frequency at rural, gaged stations and rural, ungaged sites in the three States. For this study, 828 gaged stations in or near these three States were used in the regional regression analysis. Stations used for this study have 10 years or more of peak-flow record, are within a rural basin, and are not significantly affected by regulation, tidal fluctuations, or urban development. By using a multistate analysis, continuity in hydrologic regions and regression equations at State boundaries is maintained to minimize confusion on which flood-frequency techniques and results are most appropriate for drainage basins near or crossing State boundaries.

In North Carolina, annual peak-flow data available through the 2006 water year were available for 584 sites, of which 402 sites had a total of 10 or more years record of systematic record. Following data reviews and the computation of 20 physical and climatic basin characteristics for each station as well as at-site flood-frequency statistics, annual peak-flow data were identified for 363 sites in North Carolina for use in this study. Flood-frequency statistics were computed by fitting logarithms (base 10) of the annual peak flows to a log-Pearson Type III distribution, following the guidelines and computational methods described in Bulletin 17B of the Hydrology Subcommittee on the Interagency Advisory Committee on Water Data. Among these 363 sites, 19 sites have records that can be divided into unregulated and regulated/channelized annual peak discharges, which means peak-flow records were identified for a total of 382 cases of peak-flow records in North Carolina for this report. Considering the 382 cases, at-site flood-frequency statistics are provided for 333 unregulated cases (used for the regression database) and 49 regulated or channelized cases.

An analysis of station skew coefficients resulted in an updated generalized skew coefficient that is defined for the entire study area. The generalized skew value of –0.019 was determined by using a Bayesian generalized least-squares (GLS) regression model. The mean square error (MSE) for the generalized skew value is 0.143, which is substantially less than the 0.3025 MSE for the generalized skew map previously published in Bulletin 17B. However, this MSE is higher than the MSE values (0.038 for Blue Ridge–Piedmont/Coastal Plain areas and 0.062 for Sand Hills area) computed with the generalized skew coefficients determined in the previous flood-frequency study in North Carolina. The generalized skew coefficient was weighted with the station skew coefficient, and the weighted skew coefficient was used with the log-Pearson Type III analysis to compute the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent chance exceedance flows at each gaged station.

The flood-frequency statistics for the 333 sites with sufficient and unregulated record were combined with data for sites from South Carolina, Georgia, and adjacent parts of Alabama, Florida, Tennessee, and Virginia to create a database of 943 sites considered for use in the regional regression analysis. Further adjustments were made to the database by removing redundant sites based on a procedure to compare drainage areas and periods of records for pairs of stations on the same stream. Ordinary least-squares (OLS) regression techniques were used in the exploratory analysis to determine the best regression models for all combinations of basin characteristics and the development of the hydrologic regions that define the study area. Following examination of scatter plots for the sites in each of the potential hydrologic regions, all sites with drainage areas less than 1 square mile were removed from the regression database because of the lack of sufficient data in some regions and the variability and uncertainty of the data for small watersheds. After the removal of these and a small number of other sites for varying reasons, a total of 828 sites were available for use in developing the rural flood-frequency relations for North Carolina, South Carolina, and Georgia.

Regional regression analysis, using GLS regression, was used to develop a set of predictive equations that can be used to estimate the 50-, 20-, 10-, 4-, 2-, 1-, 0.5-, and 0.2-percent chance exceedance flows for rural, ungaged sites in North Carolina, South Carolina, and Georgia. The predictive equations are all functions of drainage area and the percentage of drainage basin within each of the five hydrologic regions defined in the study area. By including hydrologic region percentages in the regional regression analysis, gaged stations with drainage basins with multiple regions can be used in the development of the equations. Also, the predictive equations can be used to estimate the P-percent chance exceedance flows for ungaged sites that have a drainage basin within multiple hydrologic regions. Average errors of prediction for these equations ranged from 34.0 to 47.7 percent.

A comparison was made between estimates obtained from the systematic records (specifically, the at-site flood-frequency estimates based on weighted skew coefficient) and the regression equations in this report and those from the previous North Carolina flood-frequency report (Pope and others, 2001) for stations that were used in both reports. Estimates determined from the systematic records for the current study typically are larger in discharge than those from the previous study for the higher percent chance exceedances (50 and 20 percent) and tend to be smaller than those from the previous study for the lower percent chance exceedance when all stations are considered as a group in each hydrologic region. For example, mean differences for the Piedmont stations range from positive 0.5 percent for the 50-percent chance exceedance flow to negative 4.6 percent for the 0.2-percent chance exceedance flow when stations are grouped by hydrologic region. Similarly for the same hydrologic region, median differences

range from positive 0.9 percent for the 50-percent chance exceedance flow to negative 7.1 percent for the 0.2-percent chance exceedance flow. Mean and median percentage differences between the estimates from the previous and current studies, however, vary substantially depending on the region and whether or not additional data were collected. To compare differences between the regression estimates from the current study and those in the previous study, peak discharges were predicted using varying ranges of drainage area for each of the hydrologic regions. Varying magnitudes and directions of changes were noted for all stations by hydrologic region. Average standard errors of prediction associated with the regression equations developed in this study (34.0 to 47.7 percent) are smaller than the standard errors of prediction derived from the three sets of equations developed in the previous study.

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Figures 2, 5, and 7*A*

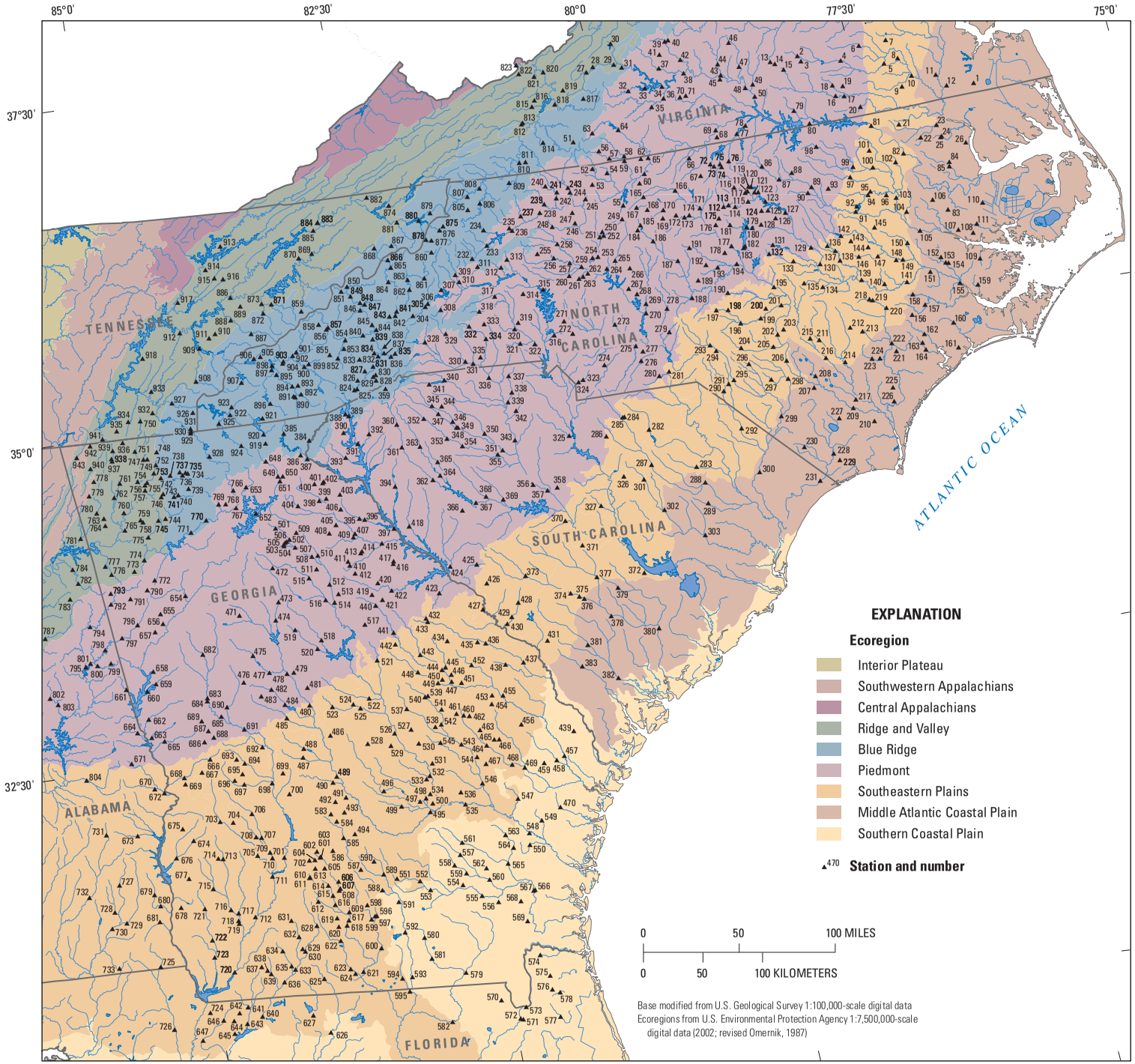

Figure 2. Locations of rural streamgaging stations in North Carolina, South Carolina, Georgia, and surrounding States that were considered for use in the regional regression analysis, 2006.

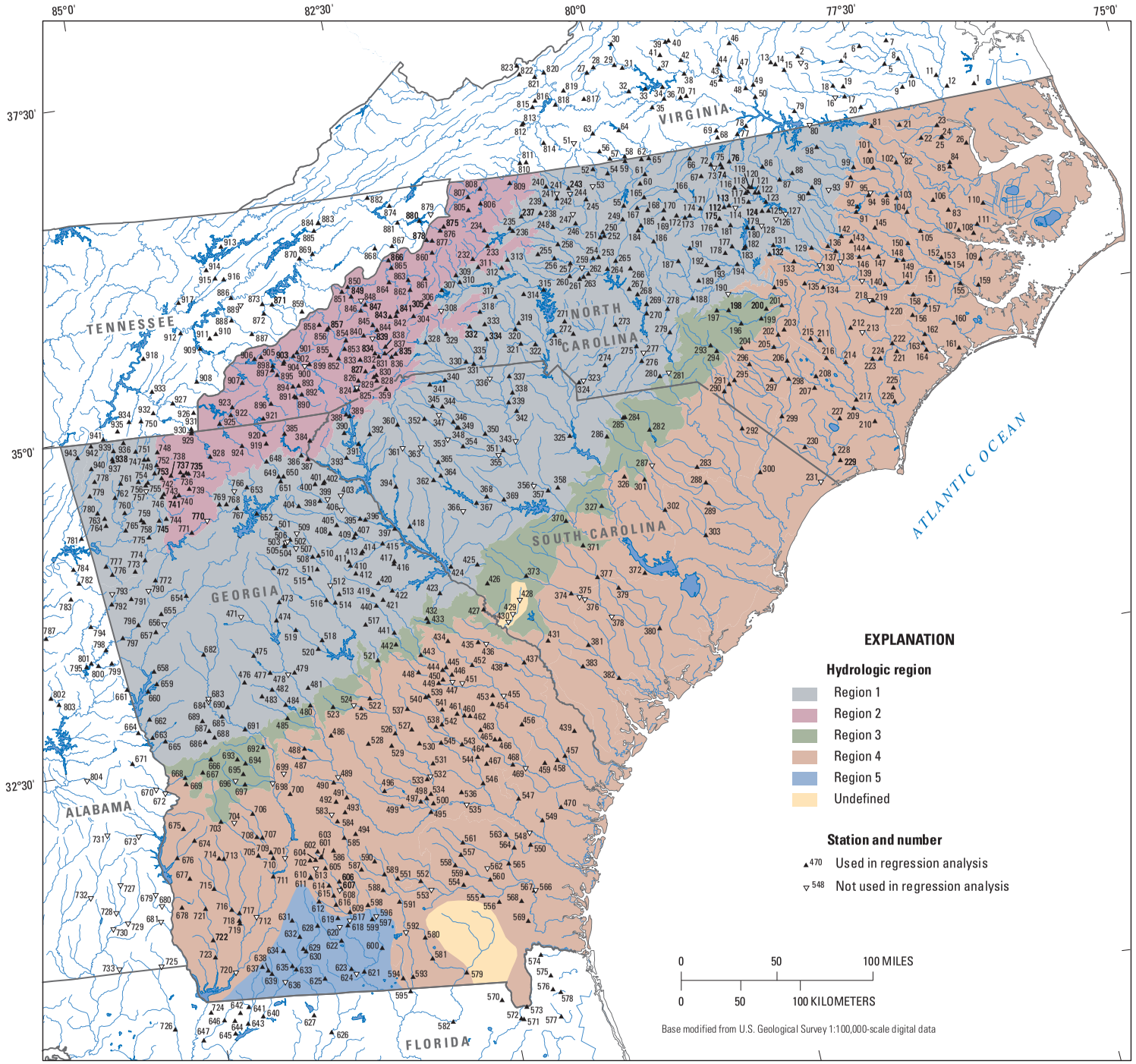

Figure 5. Hydrologic regions and locations of rural stream-gaging stations in the study area used in the regional regression analysis, 2006.

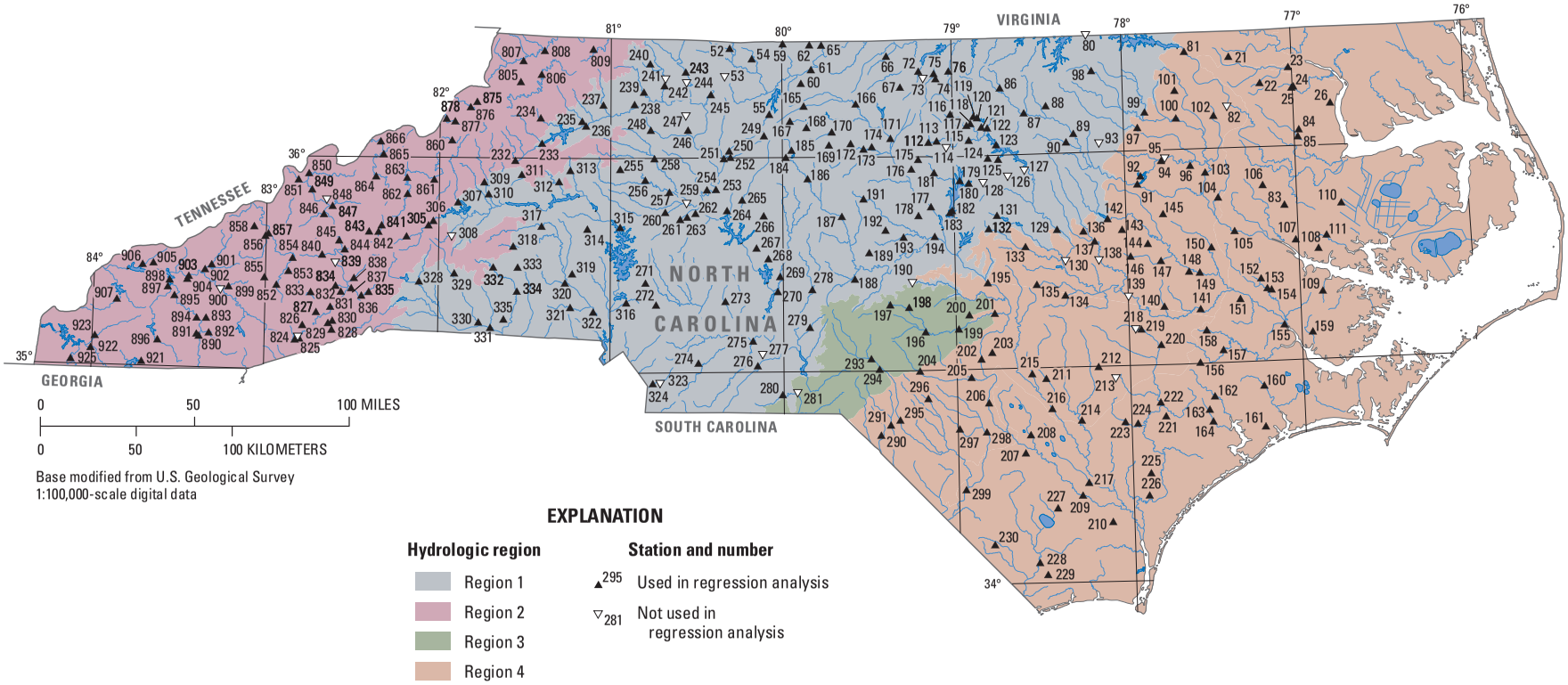

Figure 7*A*. Hydrologic regions and locations of streamgaging stations in North Carolina used in the regional regression analysis.

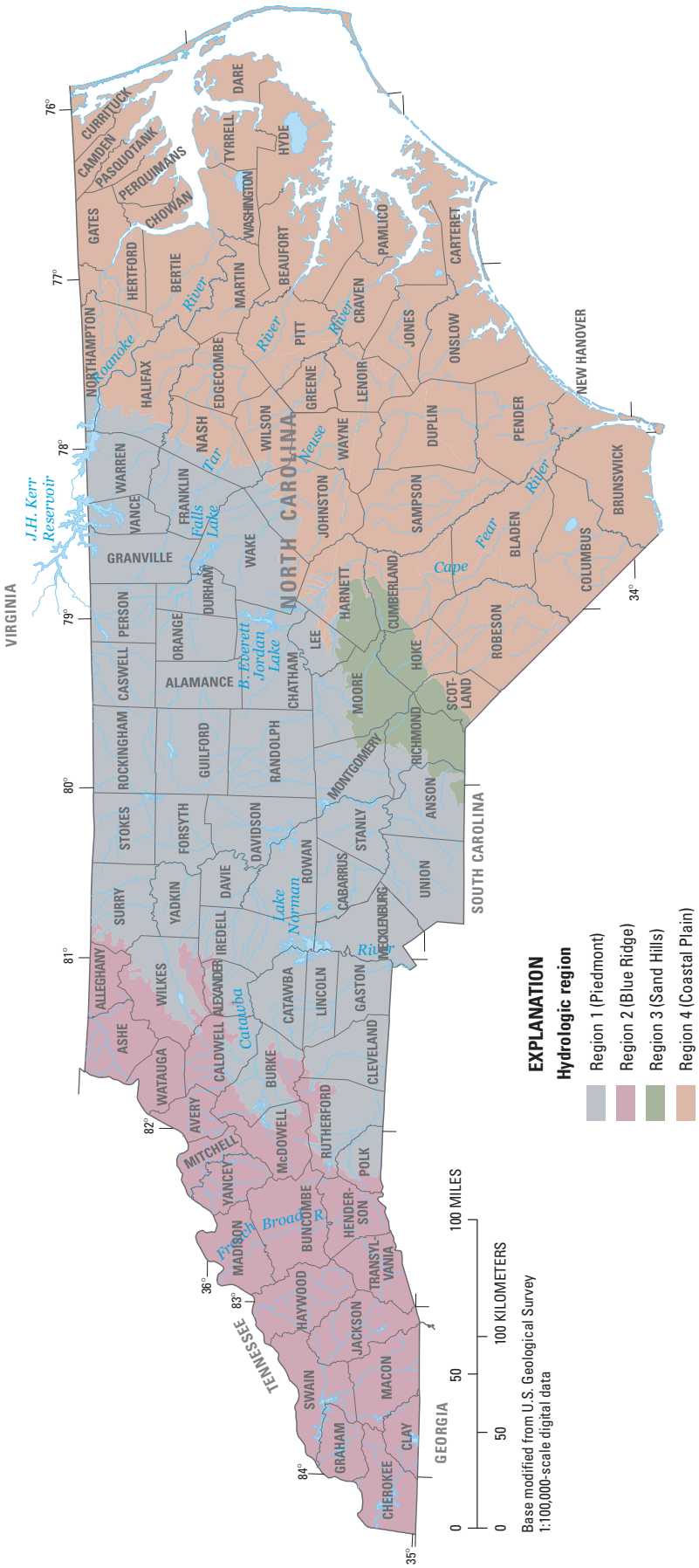

Figure 7*B*. Counties and hydrologic regions in North Carolina.

Tables 1, 4, 7, and 13

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.

[Sites in North Carolina shown in blue font. USGS, U.S. Geological Survey; 1, station not used in regression analysis; 2, peaks at indicated station were combined with peaks at adjacent nearby station on same stream; c, peak-flow record available for station includes channelization or urbanization periods that were not used in the regression analysis; h, peak-flow record adjusted for historical period; m, extended record using MOVE1 analysis; r, peak-flow record available for station includes regulated period that was not used in the regression analysis]

Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
1	02043500	Cypress Swamp at Cypress Chapel, VA	36°37′25″	76°36′06″	VA	1954-1996	37
2	02044000[h]	Nottoway River near Burkeville, VA	37°04′41″	78°11′49″	VA	1947-1995	49
3	02044200[1]	Falls Creek tributary near Victoria, VA	37°02′05″	78°10′25″	VA	1968-2005	38
4	02044500[h]	Nottoway River near Rawlings, VA	36°59′01″	77°47′59″	VA	1951-2005	55
5	02045500	Nottoway River near Stony Creek, VA	36°54′01″	77°23′59″	VA	1930-2005	76
6	02046000[h]	Stony Creek near Dinwiddie, VA	37°04′02″	77°36′09″	VA	1947-2005	59
7	02046400	Jones Hole Swamp tributary near Carson, VA	37°04′14″	77°20′29″	VA	1967-1976	10
8	02046500	Anderson Branch at Sussex, VA	36°55′11″	77°15′44″	VA	1949-1983	26
9	02046900	Musgrave Branch near Drewryville, VA	36°42′14″	77°16′28″	VA	1966-1975	10
10	02047000[h]	Nottoway River near Sebrell, VA	36°46′14″	77°09′58″	VA	1942-2005	64
11	02049700	Cypress Swamp near Burdette, VA	36°44′30″	76°56′17″	VA	1950-1976	27
12	02050050	Blackwater River tributary near Holland, VA	36°38′45″	76°51′28″	VA	1967-2005	39
13	02050400	North Meherrin River near Briery, VA	37°04′21″	78°27′44″	VA	1966-1975	10
14	02050500	North Meherrin River near Keysville, VA	37°03′06″	78°25′19″	VA	1949-1973	21
15	02051000	North Meherrin River near Lunenburg, VA	36°59′51″	78°20′59″	VA	1947-2005	57
16	02051400[1]	Saddletree Creek near Lawrenceville, VA	36°43′52″	77°54′38″	VA	1958-1976	19
17	02051500[h]	Meherrin River near Lawrenceville, VA	36°43′01″	77°49′54″	VA	1928-2005	78
18	02051600	Great Creek near Cochran, VA	36°48′47″	77°55′18″	VA	1958-1995	38
19	02051650	Rocky Run near Dolphin, VA	36°47′36″	77°49′34″	VA	1966-1975	10
20	02052500[h]	Fountains Creek near Brink, VA	36°36′56″	77°41′59″	VA	1954-1996	43
21	02053110	Wildcat Swamp near Jackson, NC	36°25′49″	77°22′23″	NC	1953-1971	19
22	02053170	Cutawhiskie Creek at NC 35 near Woodland, NC	36°18′07″	77°11′44″	NC	1953-1971	19
23	02053200[h]	Potecasi Creek near Union, NC	36°22′15″	77°01′32″	NC	1958-2006	48
24	02053500[c]	Ahoskie Creek at Ahoskie, NC	36°16′49″	76°59′58″	NC	1951-1963	13
25	02053510	Ahoskie Creek tributary at Poortown, NC	36°16′30″	77°00′37″	NC	1964-1973	10
26	02053550	Chinkapin Creek near Colerain, NC	36°11′53″	76°47′13″	NC	1953-1971	19
27	02054500[h]	Roanoke River at Lafayette, VA	37°14′11″	80°12′33″	VA	1944-2005	62
28	02054530	Roanoke River at Glenvar, VA	37°16′04″	80°08′22″	VA	1992-2005	14
29	02055000[h]	Roanoke River at Roanoke, VA	37°15′30″	79°56′19″	VA	1899-2005	107
30	02055100	Tinker Creek near Daleville, VA	37°25′03″	79°56′07″	VA	1957-2005	49
31	02056650	Back Creek near Dundee, VA	37°13′39″	79°52′05″	VA	1975-2005	31
32	02056900	Blackwater River near Rocky Mount, VA	37°02′43″	79°50′39″	VA	1977-2005	29
33	02057000	Blackwater River near Union Hall, VA	37°02′36″	79°41′06″	VA	1925-1964	40
34	02057500	Roanoke River near Toshes, VA	37°02′04″	79°31′17″	VA	1926-1963	38
35	02058000	Snow Creek at Sago, VA	36°53′51″	79°39′04″	VA	1935-1944	10
36	02058400	Pigg River near Sandy Level, VA	36°56′46″	79°31′29″	VA	1931-2005	75
37	02059500	Goose Creek near Huddleston, VA	37°10′24″	79°31′13″	VA	1926-2005	78
38	02060500[r]	Roanoke River at Altavista, VA	37°06′17″	79°17′43″	VA	1931-1961	31
39	02061000	Big Otter River near Bedford, VA	37°21′51″	79°25′09″	VA	1944-1960	17
40	02061150	Chestnut Branch near Forest, VA	37°22′11″	79°23′15″	VA	1960-1976	17
41	02061300	Nininger Creek near Bedford, VA	37°16′27″	79°29′30″	VA	1949-1974	26
42	02061500	Big Otter River near Evington, VA	37°12′31″	79°18′13″	VA	1937-2005	69
43	02062500[h,r]	Roanoke River at Brookneal, VA	37°02′29″	78°57′01″	VA	1924-1962	38
44	02064000[h]	Falling River near Naruna, VA	37°07′37″	78°57′35″	VA	1930-2005	69
45	02065100	Snake Creek near Brookneal, VA	37°00′43″	78°57′51″	VA	1967-1995	25
46	02065300	Right Hand Fork near Appomattox, VA	37°16′13″	78°49′13″	VA	1967-1995	29

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.—Continued

[Sites in North Carolina shown in blue font. USGS, U.S. Geological Survey; 1, station not used in regression analysis; 2, peaks at indicated station were combined with peaks at adjacent nearby station on same stream; c, peak-flow record available for station includes channelization or urbanization periods that were not used in the regression analysis; h, peak-flow record adjusted for historical period; m, extended record using MOVE1 analysis; r, peak-flow record available for station includes regulated period that was not used in the regression analysis]

Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
47	02065500	Cub Creek at Phenix, VA	37°04′46″	78°45′49″	VA	1947-2005	59
48	02066000[h,r]	Roanoke River at Randolph, VA	36°54′55″	78°44′27″	VA	1901-1962	61
49	02066500	Roanoke Creek at Saxe, VA	36°55′50″	78°39′55″	VA	1947-1972	25
50	02067000	Roanoke River near Clover, VA	36°50′18″	78°40′01″	VA	1930-1952	23
51	02067810[l]	Maple Swamp Branch near Meadows of Dan, VA	36°44′10″	80°26′27″	VA	1970-1979	10
52	02068500[h,r]	Dan River near Francisco, NC	36°30′54″	80°18′11″	NC	1925-1938	13
53	02068610[l]	Hog Rock Creek near Moores Springs, NC	36°23′53″	80°19′45″	NC	1955-1971	15
54	02068660	Little Snow Creek near Lawsonville, NC	36°27′54″	80°10′27″	NC	1954-1971	18
55	02069030	Belews Creek near Kernersville, NC	36°12′20″	80°04′24″	NC	1954-1971	17
56	02069600	Anglin Branch near Stuart, VA	36°38′15″	80°12′54″	VA	1967-1976	10
57	02069700	South Mayo River near Nettleridge, VA	36°34′15″	80°07′46″	VA	1963-2005	43
58	02070000	North Mayo River near Spencer, VA	36°34′05″	79°59′14″	VA	1929-2005	77
59	02070500[h]	Mayo River near Price, NC	36°32′02″	79°59′29″	NC	1930-2006	55
60	02070810	Jacobs Creek near Wentworth, NC	36°20′54″	79°53′13″	NC	1954-1973	18
61	02071000[h]	Dan River near Wentworth, NC	36°24′45″	79°49′34″	NC	1940-2006	67
62	02071410	Matrimony Creek near Leaksville, NC	36°31′39″	79°50′07″	NC	1958-1973	15
63	02071530	Smith River at Smith Riv Church near Woolwine, VA	36°46′42″	80°14′57″	VA	1995-2005	11
64	02072500[r]	Smith River at Bassett, VA	36°46′12″	80°00′03″	VA	1938-1949	12
65	02074000[r]	Smith River at Eden, NC	36°31′32″	79°45′56″	NC	1940-1949	10
66	02075160	Moon Creek near Yanceyville, NC	36°28′14″	79°23′04″	NC	1954-1989	21
67	02075230	South Country Line Creek near Hightowers, NC	36°19′29″	79°18′19″	NC	1954-1976	23
68	02075450	Little Winns Creek near Turbeville, VA	36°35′21″	79°05′19″	VA	1958-1974	17
69	02075500	Dan River at Paces, VA	36°38′32″	79°05′22″	VA	1901-2005	87
70	02076400	Whitethorn Creek tributary at Gretna, VA	36°56′01″	79°22′09″	VA	1966-1975	10
71	02076500	Georges Creek near Gretna, VA	36°56′12″	79°18′41″	VA	1950-1997	48
72	02077200	Hyco Creek near Leasburg, NC	36°23′52″	79°11′48″	NC	1965-2006	39
73	02077210[l,h]	Kilgore Creek tributary near Leasburg, NC	36°22′39″	79°09′56″	NC	1954-1971	13
74	02077240[h]	Double Creek near Roseville, NC	36°21′45″	79°05′47″	NC	1965-1982	16
75	02077250[r]	South Hyco Creek near Roseville, NC	36°23′10″	79°06′25″	NC	1967-1976	10
76	02077310	Storys Creek near Roxboro, NC	36°23′49″	79°01′13″	NC	1954-1971	18
77	02077500[r]	Hyco River near Denniston, VA	36°35′17″	78°53′55″	VA	1930-1964	18
78	02078000	Hyco River near Omega, VA	36°38′10″	78°48′19″	VA	1934-1950	17
79	02079640	Allen Creek near Boydton, VA	36°40′47″	78°19′36″	VA	1962-2005	40
80	02079720[l]	Smith Creek tributary near South Hill, VA	36°33′51″	78°12′09″	VA	1966-1975	10
81	02080500[h,r]	Roanoke River at Roanoke Rapids, NC	36°27′36″	77°38′01″	NC	1912-1949	38
82	02081000[l,h]	Roanoke River near Scotland Neck, NC	36°12′33″	77°23′02″	NC	1940-1949	10
83	02081060	Smithwick Creek tributary near Williamston, NC	35°43′52″	77°04′41″	NC	1953-1971	19
84	02081110	White Oak Swamp near Windsor, NC	36°04′47″	76°58′35″	NC	1953-1971	14
85	0208111310	Cashie River at SR1257 near Windsor, NC	36°02′52″	76°59′03″	NC	1988-2006	19
86	02081210	Shelton Creek near Oxford, NC	36°18′48″	78°43′15″	NC	1954-1971	18
87	02081500	Tar River near Tar River, NC	36°11′39″	78°34′59″	NC	1940-2006	67
88	02081710	Long Creek at Kittrell, NC	36°13′31″	78°27′14″	NC	1954-1976	20
89	02081747	Tar River at US 401 at Louisburg, NC	36°05′35″	78°17′46″	NC	1964-2006	43
90	02081800	Cedar Creek near Louisburg, NC	36°03′15″	78°20′23″	NC	1954-1975	22
91	02082000[h]	Tar River near Nashville, NC	35°50′58″	77°55′50″	NC	1929-1970	42
92	02082500	Sapony Creek near Nashville, NC	35°53′11″	77°54′39″	NC	1951-1970	20

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
93	02082540[l]	Wildcat Branch near Mapleville, NC	36°03′30″	78°08′38″	NC	1953-1963	11
94	02082585[h]	Tar River at NC 97 at Rocky Mount, NC	35°57′17″	77°47′14″	NC	1977-2006	30
95	02082610[l]	Tar River near Rocky Mount, NC	35°58′39″	77°45′34″	NC	1964-1973	10
96	02082630	Harts Mill Run near Tarboro, NC	35°55′41″	77°37′09″	NC	1953-1971	18
97	02082770[h]	Swift Creek at Hilliardston, NC	36°06′44″	77°55′12″	NC	1964-2006	43
98	02082835	Fishing Creek near Warrenton, NC	36°23′01″	78°10′53″	NC	1954-1976	22
99	02082950[h]	Little Fishing Creek near White Oak, NC	36°11′00″	77°52′34″	NC	1959-2006	47
100	02083000[h]	Fishing Creek near Enfield, NC	36°09′02″	77°41′35″	NC	1915-2006	92
101	02083090	Beaverdam Swamp near Heathsville, NC	36°16′50″	77°41′47″	NC	1953-1971	19
102	02083410	Deep Creek near Scotland Neck, NC	36°09′27″	77°28′23″	NC	1953-1973	21
103	02083500[h]	Tar River at Tarboro, NC	35°53′40″	77°31′59″	NC	1897-2006	105
104	02083800[h]	Conetoe Creek near Bethel, NC	35°46′34″	77°27′44″	NC	1957-2000	44
105	02084000[h]	Tar River at Greenville, NC	35°37′00″	77°22′22″	NC	1997-2006	10
106	02084240	Collie Swamp near Everetts, NC	35°49′35″	77°12′02″	NC	1953-1976	24
107	02084500	Herring Run near Washington, NC	35°34′04″	77°01′08″	NC	1951-1980	30
108	02084520	Upper Goose Creek near Yeatsville, NC	35°31′26″	76°53′22″	NC	1953-1973	21
109	02084540	Durham Creek at Edward, NC	35°19′26″	76°52′27″	NC	1966-2004	39
110	02084557	Van Swamp near Hoke, NC	35°43′51″	76°44′46″	NC	1978-2006	29
111	02084570	Acre Swamp near Pinetown, NC	35°35′03″	76°50′22″	NC	1953-1969	17
112	02084909	Sevenmile Creek near Efland, NC	36°03′56″	79°08′39″	NC	1988-2004	17
113	02085000	Eno River at Hillsborough, NC	36°04′16″	79°05′44″	NC	1928-2006	64
114	02085020[l]	Stony Creek tributary near Hillsboro, NC	36°03′02″	79°02′13″	NC	1953-1971	19
115	02085070	Eno River near Durham, NC	36°04′20″	78°54′28″	NC	1964-2006	43
116	02085190	North Fork Little River tributary near Rougemont, NC	36°11′42″	79°00′51″	NC	1954-1976	23
117	0208521324[2]	Little River at SR1461 near Orange Factory, NC	36°08′30″	78°55′09″	NC	1962-2006	45
118	0208524090	Mountain Creek at SR1617 near Bahama, NC	36°08′59″	78°53′48″	NC	1995-2006	11
119	02085500	Flat River at Bahama, NC	36°10′58″	78°52′44″	NC	1926-2006	81
120	02086000	Dial Creek near Bahama, NC	36°10′37″	78°51′23″	NC	1926-1991	47
121	0208650112	Flat River tributary near Willardville, NC	36°07′55″	78°50′00″	NC	1989-2006	14
122	02086624	Knap Of Reeds Creek near Butner, NC	36°07′41″	78°47′54″	NC	1983-2006	14
123	02087000[h]	Neuse River near Northside, NC	36°02′55″	78°44′58″	NC	1928-1980	53
124	0208700780	Little Lick Creek above SR1814 near Oak Grove, NC	35°59′12″	78°47′57″	NC	1983-1995	13
125	02087030	Lick Creek near Durham, NC	35°58′51″	78°44′18″	NC	1954-1971	18
126	02087140[l]	Lower Barton Creek tributary near Raleigh, NC	35°54′45″	78°40′54″	NC	1954-1971	18
127	02087183[1,2,h,r]	Neuse River near Falls, NC	35°56′24″	78°34′51″	NC	1960-1980	21
128	02087240[l,h]	Stirrup Iron Creek tributary near Nelson, NC	35°53′07″	78°49′36″	NC	1954-1973	20
129	02087500[h,r]	Neuse River near Clayton, NC	35°38′50″	78°24′19″	NC	1928-1980	53
130	02087570[l,h,r]	Neuse River at Smithfield, NC	35°30′45″	78°20′58″	NC	1917-1980	48
131	02087580[c]	Swift Creek near Apex, NC	35°43′08″	78°45′08″	NC	1954-1971	18
132	02087910	Middle Creek near Holly Springs, NC	35°39′29″	78°48′05″	NC	1954-1971	18
133	02088000	Middle Creek near Clayton, NC	35°34′15″	78°35′26″	NC	1940-2006	66
134	02088140	Stone Creek near Newton Grove, NC	35°20′25″	78°21′53″	NC	1953-1971	19
135	02088210	Hannah Creek near Benson, NC	35°23′37″	78°31′47″	NC	1953-1971	19
136	02088420	Long Branch near Selma, NC	35°38′12″	78°15′05″	NC	1953-1971	19
137	02088470	Little River near Kenly, NC	35°35′21″	78°11′17″	NC	1965-1989	25
138	02088500[l,h]	Little River near Princeton, NC	35°30′41″	78°09′37″	NC	1931-2006	76

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
139	02089000[1,r]	Neuse River near Goldsboro, NC	35°20′15″	77°59′51″	NC	1930-1980	51
140	0208925200	Bear Creek at Mays Store, NC	35°16′29″	77°47′40″	NC	1988-2006	19
141	02089500[r]	Neuse River at Kinston, NC	35°15′28″	77°35′08″	NC	1928-1980	53
142	02090380[r]	Contentnea Creek near Lucama, NC	35°41′28″	78°06′35″	NC	1965-1976	12
143	02090560	Lee Swamp tributary near Lucama, NC	35°38′22″	78°01′36″	NC	1953-1971	19
144	02090625	Turner Swamp near Eureka, NC	35°34′15″	77°52′46″	NC	1969-1987	19
145	02090780	Whiteoak Swamp tributary near Wilson, NC	35°42′25″	77°47′10″	NC	1953-1971	19
146	02090960	Nahunta Swamp near Pikeville, NC	35°30′50″	77°58′52″	NC	1953-2003	22
147	02091000	Nahunta Swamp near Shine, NC	35°29′20″	77°48′22″	NC	1955-2006	52
148	02091430	Shepherd Run near Snow Hill, NC	35°26′07″	77°38′41″	NC	1953-1971	19
149	02091500[h]	Contentnea Creek at Hookerton, NC	35°25′44″	77°34′57″	NC	1929-2006	78
150	02091700	Little Contentnea Creek near Farmville, NC	35°32′41″	77°30′40″	NC	1957-1987	31
151	02091810	Halfmoon Creek near Fort Barnwell, NC	35°17′59″	77°21′13″	NC	1953-1965	12
152	02091970	Creeping Swamp near Vanceboro, NC	35°23′31″	77°13′45″	NC	1972-1985	14
153	02092000	Swift Creek near Vanceboro, NC	35°20′43″	77°11′44″	NC	1951-1989	39
154	02092020	Palmetto Swamp near Vanceboro, NC	35°20′19″	77°10′15″	NC	1953-1976	24
155	02092120	Bachelor Creek near New Bern, NC	35°10′25″	77°06′13″	NC	1953-1971	19
156	02092290	Rattlesnake Branch near Comfort, NC	35°00′32″	77°35′49″	NC	1953-1971	19
157	02092500[h]	Trent River near Trenton, NC	35°03′51″	77°27′41″	NC	1952-2006	55
158	02092520	Vine Swamp near Kinston, NC	35°09′30″	77°33′15″	NC	1953-1971	19
159	02092620	Upper Broad Creek tributary near Grantsboro, NC	35°08′07″	76°56′30″	NC	1953-1973	21
160	02092720	White Oak River at Belgrade, NC	34°53′31″	77°14′01″	NC	1953-1973	21
161	02092780	Bell Swamp near Hubert, NC	34°42′05″	77°14′00″	NC	1953-1970	18
162	02093000[h]	New River near Gum Branch, NC	34°50′57″	77°31′10″	NC	1950-2006	43
163	02093040	Southwest Creek tributary near Jacksonville, NC	34°47′19″	77°33′07″	NC	1954-1973	19
164	02093070	Southwest Creek near Jacksonville, NC	34°43′57″	77°32′01″	NC	1953-1973	20
165	02093290	Haw River near Summerfield, NC	36°14′32″	79°52′19″	NC	1954-1971	18
166	02093500[h]	Haw River near Benaja, NC	36°15′00″	79°33′59″	NC	1929-1971	43
167	02093800[h]	Reedy Fork near Oak Ridge, NC	36°10′21″	79°57′10″	NC	1956-2006	51
168	02094000[h]	Horsepen Creek at Battle Ground, NC	36°08′34″	79°51′23″	NC	1926-1959	30
169	02095000[c,h]	South Buffalo Creek near Greensboro, NC	36°03′36″	79°43′33″	NC	1929-1958	29
170	02095500[c]	North Buffalo Creek near Greensboro, NC	36°07′14″	79°42′29″	NC	1929-1990	62
171	02096500	Haw River at Haw River, NC	36°05′14″	79°21′58″	NC	1929-2006	78
172	02096660	Rock Creek near Whitsett, NC	36°03′55″	79°35′56″	NC	1954-1971	17
173	02096700	Big Alamance Creek near Elon College, NC	36°02′21″	79°31′28″	NC	1958-1980	23
174	02096740	Gun Branch near Alamance, NC	36°02′58″	79°28′34″	NC	1954-1973	19
175	02096846	Cane Creek near Orange Grove, NC	35°59′14″	79°12′22″	NC	1989-2006	18
176	02096850	Cane Creek near Teer, NC	35°56′35″	79°14′45″	NC	1960-1973	14
177	02096960[2,h]	Haw River near Bynum, NC	35°45′55″	79°08′09″	NC	1928-2006	78
178	02097010	Robeson Creek near Pittsboro, NC	35°43′30″	79°12′32″	NC	1954-1976	23
179	02097314	New Hope Creek near Blands, NC	35°53′06″	78°57′55″	NC	1983-2006	20
180	0209741955	Northeast Creek at SR1100 near Genlee, NC	35°52′20″	78°54′47″	NC	1983-2006	20
181	02097464	Morgan Creek near White Cross, NC	35°55′25″	79°06′54″	NC	1989-2006	17
182	02097910	White Oak Creek near Wilsonville, NC	35°44′48″	79°00′43″	NC	1954-1971	18
183	02098000	New Hope River near Pittsboro, NC	35°44′13″	79°01′35″	NC	1950-1973	24
184	02098500	West Fork Deep River near High Point, NC	36°00′15″	79°58′41″	NC	1924-1966	42

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
185	02099000	East Fork Deep River near High Point, NC	36°02′14″	79°56′44″	NC	1929-2006	74
186	02099500	Deep River near Randleman, NC	35°54′13″	79°51′10″	NC	1929-2004	75
187	02100500[h]	Deep River at Ramseur, NC	35°43′35″	79°39′20″	NC	1923-2006	84
188	02101000	Bear Creek at Robbins, NC	35°26′01″	79°34′59″	NC	1940-1971	32
189	02101030	Falls Creek near Bennett, NC	35°33′21″	79°29′55″	NC	1954-1973	20
190	02101480[l]	Sugar Creek near Tramway, NC	35°25′29″	79°14′49″	NC	1954-1973	20
191	0210166029	Rocky River at SR1300 near Crutchfield Crossroads, NC	35°48′25″	79°31′39″	NC	1989-2006	18
192	02101800	Tick Creek near Mount Vernon Springs, NC	35°39′35″	79°24′06″	NC	1959-2006	36
193	02101890	Bear Creek near Goldston, NC	35°37′34″	79°17′53″	NC	1952-1971	19
194	02102000	Deep River at Moncure, NC	35°37′37″	79°06′58″	NC	1931-2006	76
195	02102500[h,r]	Cape Fear River at Lillington, NC	35°24′22″	78°48′48″	NC	1924-1980	57
196	02102908	Flat Creek near Inverness, NC	35°10′58″	79°10′39″	NC	1969-2006	38
197	02102910	Dunhams Creek tributary near Carthage, NC	35°18′42″	79°22′52″	NC	1954-1971	18
198	02102930	Crane Creek near Vass, NC	35°17′54″	79°16′18″	NC	1954-1971	18
199	02103000	Little River at Manchester, NC	35°11′36″	78°59′08″	NC	1939-2006	15
200	02103390	South Prong Anderson Creek near Lillington, NC	35°15′32″	78°55′26″	NC	1953-1971	19
201	02103500	Little River at Linden, NC	35°15′47″	78°46′34″	NC	1928-1971	44
202	02104000	Cape Fear River at Fayetteville, NC	35°03′02″	78°51′30″	NC	1889-1959	71
203	02104080	Reese Creek near Fayetteville, NC	35°04′50″	78°47′44″	NC	1953-1971	17
204	02104220	Rockfish Creek at Raeford, NC	34°59′59″	79°12′53″	NC	1989-2006	18
205	02104500	Rockfish Creek near Hope Mills, NC	34°57′58″	78°55′03″	NC	1939-1954	16
206	02105500[r]	Cape Fear River at Wilm O Huske Lock near Tarheel, NC	34°50′45″	78°49′14″	NC	1941-1980	36
207	02105570	Browns Creek near Elizabethtown, NC	34°36′33″	78°36′56″	NC	1953-1973	18
208	02105630	Turnbull Creek near Elizabethtown, NC	34°41′33″	78°35′01″	NC	1949-1971	19
209	02105769[r]	Cape Fear River at Lock #1 near Kelly, NC	34°24′16″	78°17′37″	NC	1970-1980	11
210	02105900	Hood Creek near Leland, NC	34°16′43″	78°07′31″	NC	1953-2006	34
211	02106000	Little Coharie Creek near Roseboro, NC	34°57′14″	78°29′16″	NC	1951-1991	41
212	02106240	Turkey Creek near Turkey, NC	35°00′12″	78°11′05″	NC	1955-1973	18
213	02106410[l]	Stewarts Creek tributary near Warsaw, NC	34°57′26″	78°04′41″	NC	1955-1971	16
214	02106500[h]	Black River near Tomahawk, NC	34°45′18″	78°17′19″	NC	1952-2006	55
215	02106910[h]	Big Swamp near Roseboro, NC	34°58′39″	78°34′06″	NC	1953-1973	20
216	02107000	South River near Parkersburg, NC	34°48′46″	78°27′25″	NC	1952-1986	35
217	02107500	Colly Creek near Kelly, NC	34°27′49″	78°15′25″	NC	1951-1971	21
218	02107590[l]	Northeast Cape Fear River tributary near Mount Olive, NC	35°11′07″	77°57′33″	NC	1954-1971	18
219	02107600	Northeast Cape Fear River near Seven Springs, NC	35°10′21″	77°55′55″	NC	1959-1975	17
220	02107620	Mathews Creek near Pink Hill, NC	35°05′50″	77°49′09″	NC	1953-1969	16
221	02107980	Limestone Creek near Beulaville, NC	34°45′49″	77°48′14″	NC	1953-1971	19
222	02108000[h]	Northeast Cape Fear River near Chinquapin, NC	34°49′44″	77°49′56″	NC	1941-2006	66
223	02108500	Rockfish Creek near Wallace, NC	34°44′33″	78°02′21″	NC	1955-1981	27
224	02108548	Little Rockfish Creek at Wallace, NC	34°44′03″	77°58′02″	NC	1977-1992	16
225	02108610	Pike Creek near Burgaw, NC	34°30′01″	77°53′57″	NC	1953-1971	18
226	02108630	Turkey Creek near Castle Hayne, NC	34°23′48″	77°54′47″	NC	1953-1971	19
227	02108960	Buckhead Branch near Bolton, NC	34°20′53″	78°26′18″	NC	1953-1971	19
228	02109500	Waccamaw River at Freeland, NC	34°05′42″	78°32′54″	NC	1940-2006	67
229	02109640	Wet Ash Swamp near Ash, NC	34°02′18″	78°30′13″	NC	1953-1971	18
230	02110020	Mill Branch near Tabor City, NC	34°11′00″	78°48′07″	NC	1953-1971	18

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.—Continued

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
231	02110500[l]	Waccamaw River near Longs, SC	33°54′46″	78°42′54″	SC	1951-2006	57
232	02111000[h]	Yadkin River at Patterson, NC	35°59′27″	81°33′30″	NC	1940-2006	66
233	02111180[h]	Elk Creek at Elkville, NC	36°04′17″	81°24′11″	NC	1966-2006	41
234	02111340	S Prong Lewis Fork Creek near N Wilkesboro, NC	36°11′23″	81°24′39″	NC	1955-1971	16
235	02111500[h]	Reddies River at North Wilkesboro, NC	36°10′30″	81°10′08″	NC	1940-2006	65
236	02112000[h,r]	Yadkin River at Wilkesboro, NC	36°09′09″	81°08′44″	NC	1904-1961	48
237	02112120[h]	Roaring River near Roaring River, NC	36°15′01″	81°02′40″	NC	1965-2006	42
238	02112247	Elkin River at Elkin, NC	36°15′12″	80°51′44″	NC	1971-1980	10
239	02112360[h]	Mitchell River near State Road, NC	36°18′41″	80°48′26″	NC	1965-2006	42
240	02112410	Fisher River near Bottom, NC	36°26′35″	80°46′11″	NC	1954-1971	16
241	02112500[l]	Fisher River near Dobson, NC	36°23′05″	80°40′19″	NC	1922-1933	12
242	02113000[h]	Fisher River near Copeland, NC	36°20′28″	80°41′09″	NC	1922-2006	85
243	02113850[h]	Ararat River at Ararat, NC	36°24′16″	80°33′42″	NC	1965-2006	42
244	02114010[l,h]	Ararat River at Dam near Pilot Mountain, NC	36°22′00″	80°32′59″	NC	1953-1968	16
245	02114450	Little Yadkin River at Dalton, NC	36°17′57″	80°24′53″	NC	1961-2006	46
246	02115500	Forbush Creek near Yadkinville, NC	36°08′00″	80°32′59″	NC	1941-1971	31
247	02115520[l]	Logan Creek near Smithtown, NC	36°12′50″	80°33′31″	NC	1954-1971	18
248	02115540	South Deep Creek near Yadkinville, NC	36°08′00″	80°45′59″	NC	1954-1966	13
249	02115830	Smith Creek near Kernersville, NC	36°06′19″	80°06′18″	NC	1954-1971	18
250	02115856	Salem Creek near atwood, NC	36°02′10″	80°18′34″	NC	1972-1982	11
251	02115860	Muddy Creek near Muddy Creek, NC	36°00′01″	80°20′25″	NC	1965-1991	19
252	02115900	South Fork Muddy Creek near Clemmons, NC	36°00′22″	80°18′06″	NC	1965-1991	19
253	02116500[h,r]	Yadkin River at Yadkin College, NC	35°51′24″	80°23′13″	NC	1929-1961	33
254	02117030	Humpy Creek near Fork, NC	35°51′17″	80°26′23″	NC	1969-1983	15
255	02117410	Mcclelland Creek near Statesville, NC	35°57′04″	80°56′45″	NC	1954-1976	22
256	02117500	Rocky Creek at Turnersburg, NC	35°54′00″	80°47′59″	NC	1941-1971	31
257	02118000[m]	South Yadkin River near Mocksville, NC	35°50′42″	80°39′32″	NC	1939-2006	68
258	02118500	Hunting Creek near Harmony, NC	36°00′02″	80°44′44″	NC	1952-2006	55
259	02119000[l,h]	South Yadkin River at Cooleemee, NC	35°48′10″	80°33′21″	NC	1929-1965	37
260	02120500[r]	Third Creek at Cleveland, NC	35°45′01″	80°40′59″	NC	1941-1954	14
261	02120780	Second Creek near Barber, NC	35°43′04″	80°35′45″	NC	1980-2006	27
262	02120820	Deal Branch near Salisbury, NC	35°44′44″	80°30′24″	NC	1954-1971	15
263	02121000	Yadkin River near Salisbury, NC	35°43′41″	80°33′19″	NC	1896-1927	30
264	02121180	North Potts Creek at Linwood, NC	35°45′28″	80°19′23″	NC	1980-1990	11
265	02121500	Abbotts Creek at Lexington, NC	35°48′25″	80°14′05″	NC	1941-2006	33
266	02121940	Flat Swamp Creek near Lexington, NC	35°43′59″	80°06′36″	NC	1954-1971	18
267	02122560	Cabin Creek near Jackson Hill, NC	35°34′57″	80°09′11″	NC	1954-1971	17
268	02122720	Beaverdam Creek tributary near Denton, NC	35°31′58″	80°05′03″	NC	1954-1971	18
269	02123500[h]	Uwharrie River near Eldorado, NC	35°26′57″	80°01′02″	NC	1939-1971	32
270	02123567	Dutchmans Creek near Uwharrie, NC	35°22′45″	80°01′49″	NC	1982-2004	20
271	02124060	N Prong Clarke Creek near Huntersville, NC	35°25′14″	80°47′53″	NC	1954-1973	20
272	02124130	Mallard Creek near Charlotte, NC	35°19′06″	80°44′15″	NC	1954-1971	18
273	02125000	Big Bear Creek near Richfield, NC	35°20′05″	80°20′08″	NC	1955-2006	52
274	02125410	Chinkapin Creek near Monroe, NC	35°02′49″	80°29′32″	NC	1953-1971	18
275	02126000[h]	Rocky River near Norwood, NC	35°08′56″	80°10′33″	NC	1930-2006	77
276	02127000[h]	Brown Creek near Polkton, NC	35°02′01″	80°08′59″	NC	1936-1971	36

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
277	02127390[l]	Palmetto Branch at Ansonville, NC	35°06′04″	80°07′10″	NC	1953-1971	17
278	02128000	Little River near Star, NC	35°23′14″	79°49′53″	NC	1955-2006	51
279	02128260	Cheek Creek near Pekin, NC	35°12′38″	79°50′48″	NC	1954-1971	18
280	02129440	South Fork Jones Creek near Morven, NC	34°53′52″	80°00′23″	NC	1954-1971	18
281	02129530[l]	Little Creek tributary near Pee Dee, NC	34°55′08″	79°54′37″	NC	1955-1971	11
282	02130900	Black Creek near Mcbee, SC	34°30′51″	80°10′59″	SC	1960-2006	46
283	02131110	Jeffries Creek above Florence, SC	34°10′41″	79°48′33″	SC	1968-2006	38
284	02131309	Fork Creek at Jefferson, SC	34°38′20″	80°23′19″	SC	1977-1997	21
285	02131320	Little Fork Creek at Jefferson, SC	34°38′14″	80°24′22″	SC	1990-2000	10
286	02131472	Hanging Rock Creek near Kershaw, SC	34°30′59″	80°34′58″	SC	1981-2005	24
287	02131500[l]	Lynches River near Bishopville, SC	34°15′01″	80°12′49″	SC	1943-2006	59
288	02132000[h]	Lynches River at Effingham, SC	34°03′06″	79°45′14″	SC	1928-2006	79
289	02132100	Two Mile Br near Lake City, SC	33°53′39″	79°45′37″	SC	1976-2003	28
290	02132230	Bridge Creek tributary at Johns, NC	34°42′13″	79°26′33″	NC	1953-1973	18
291	02132320	Big Shoe Heel Creek near Laurinburg, NC	34°45′02″	79°23′12″	NC	1988-2006	17
292	02132500	Little Pee Dee River near Dillon, SC	34°24′18″	79°20′24″	SC	1940-2006	66
293	02133500	Drowning Creek near Hoffman, NC	35°03′40″	79°29′38″	NC	1940-2006	67
294	02133590	Beaverdam Creek near Aberdeen, NC	35°00′43″	79°26′49″	NC	1953-1971	18
295	02133624	Lumber River near Maxton, NC	34°46′22″	79°19′55″	NC	1988-2006	18
296	02133960	Raft Swamp near Red Springs, NC	34°52′17″	79°10′11″	NC	1953-1971	15
297	02134380	Tenmile Swamp near Lumberton, NC	34°43′35″	78°59′30″	NC	1953-1973	18
298	02134480	Big Swamp near Tarheel, NC	34°42′37″	78°50′11″	NC	1986-2006	21
299	02134500[h]	Lumber River at Boardman, NC	34°26′33″	78°57′37″	NC	1930-2006	77
300	02135000	Little Pee Dee River at Galivants Ferry, SC	34°03′26″	79°14′49″	SC	1942-2006	65
301	02135300	Scape Ore Swamp near Bishopville, SC	34°09′03″	80°18′17″	SC	1969-2006	38
302	02135500	Black River near Gable, SC	33°54′01″	80°09′54″	SC	1952-1992	36
303	02136000[h]	Black River at Kingstree, SC	33°39′41″	79°50′09″	SC	1928-2006	79
304	02137000[h]	Mill Creek at Old Fort, NC	35°37′59″	82°11′13″	NC	1961-1975	15
305	02137727	Catawba River near Pleasant Gardens, NC	35°41′09″	82°03′37″	NC	1981-2006	26
306	02138000[h]	Catawba River near Marion, NC	35°42′26″	82°01′59″	NC	1942-1981	40
307	02138500[h]	Linville River near Nebo, NC	35°47′41″	81°53′24″	NC	1923-2006	84
308	02138680[l]	White Branch near Marion, NC	35°38′46″	81°55′17″	NC	1955-1971	14
309	02140980	Carroll Creek near Collettsville, NC	35°53′21″	81°44′17″	NC	1955-1971	17
310	02140991	Johns River at Arneys Store, NC	35°50′01″	81°42′43″	NC	1986-2006	21
311	02141130	Zacks Fork Creek near Lenoir, NC	35°55′32″	81°31′12″	NC	1967-1976	10
312	02141890	Duck Creek near Taylorsville, NC	35°53′34″	81°18′08″	NC	1954-1971	18
313	02142000	Lower Little River near All Healing Springs, NC	35°56′44″	81°14′13″	NC	1954-2006	51
314	02142480	Hagan Creek near Catawba, NC	35°40′20″	81°08′11″	NC	1954-1971	15
315	0214253830	Norwood Creek near Troutman, NC	35°40′50″	80°56′43″	NC	1984-2006	22
316	02142900	Long Creek near Paw Creek, NC	35°19′43″	80°54′35″	NC	1966-2006	41
317	02143000[h]	Henry Fork near Henry River, NC	35°41′04″	81°24′12″	NC	1926-2006	70
318	02143040[h]	Jacob Fork at Ramsey, NC	35°35′26″	81°34′01″	NC	1962-2006	45
319	02143310	Lithia Inn Branch near Lincolnton, NC	35°27′47″	81°13′26″	NC	1954-1968	14
320	02143500[h]	Indian Creek near Laboratory, NC	35°25′14″	81°15′55″	NC	1952-2006	55
321	02144000	Long Creek near Bessemer City, NC	35°18′23″	81°14′05″	NC	1954-2006	53
322	02145000[h]	South Fork Catawba River at Lowell, NC	35°17′07″	81°06′04″	NC	1943-2006	52

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
323	02146890[l]	E F Twelve Mile Creek near Waxhaw, NC	34°57′47″	80°42′39″	NC	1954-1972	18
324	02146900[m]	Twelve Mile Creek near Waxhaw, NC	34°57′07″	80°45′21″	NC	1961-2004	44
325	02147500	Rocky Creek at Great Falls, SC	34°33′56″	80°55′11″	SC	1952-2006	50
326	02148090	Swift Creek near Camden, SC	34°11′50″	80°28′57″	SC	1990-2004	12
327	02148300	Colonels Creek near Leesburg, SC	34°00′26″	80°43′57″	SC	1968-2006	15
328	02149000[h]	Cove Creek near Lake Lure, NC	35°25′24″	82°06′42″	NC	1952-2006	55
329	02150420	Camp Creek near Rutherfordton, NC	35°27′47″	81°54′28″	NC	1955-1971	17
330	02151000	Second Broad River at Cliffside, NC	35°14′08″	81°45′56″	NC	1926-1997	72
331	02151500	Broad River near Boiling Springs, NC	35°12′39″	81°41′51″	NC	1926-2006	80
332	02152100	First Broad River near Casar, NC	35°29′35″	81°40′56″	NC	1960-2006	46
333	02152420	Big Knob Creek near Fallston, NC	35°29′34″	81°32′24″	NC	1953-1971	18
334	02152500[h]	First Broad River near Lawndale, NC	35°22′50″	81°32′39″	NC	1940-1980	41
335	02152610	Sugar Branch near Boiling Springs, NC	35°15′00″	81°37′14″	NC	1954-1987	34
336	02153500[l]	Broad River near Gaffney, SC	35°05′20″	81°34′19″	SC	1939-1990	54
337	02153780	Clarks Fork Creek near Smyrna, SC	35°04′45″	81°23′16″	SC	1981-2006	24
338	02153800	Bullock Creek near Sharon, SC	34°57′13″	81°22′57″	SC	1991-2006	16
339	02153840	Bells Creek near Sharon, SC	34°53′09″	81°25′50″	SC	1991-2006	12
340	02154500	North Pacolet River at Fingerville, SC	35°07′15″	81°59′09″	SC	1931-2006	74
341	02154790	South Pacolet River near Campobello, SC	35°06′23″	82°07′46″	SC	1989-2006	18
342	021563931	Turkey Creek near Lowrys, SC	34°48′47″	81°22′09″	SC	1991-2006	16
343	02156500[l]	Broad River near Carlisle, SC	34°35′43″	81°25′16″	SC	1939-2006	69
344	02157000	North Tyger River near Fairmont, SC	34°55′45″	82°02′39″	SC	1951-1988	38
345	02157500	Middle Tyger River at Lyman, SC	34°56′35″	82°07′59″	SC	1939-2005	51
346	02158000[m]	North Tyger River near Moore, SC	34°48′10″	81°57′56″	SC	1935-1978	41
347	02158500[l]	South Tyger River near Reidville, SC	34°52′35″	82°05′09″	SC	1935-1978	41
348	02159000[m]	South Tyger River near Woodruff, SC	34°45′21″	81°56′18″	SC	1935-1978	44
349	02159500[l]	Tyger River near Woodruff, SC	34°45′15″	81°55′29″	SC	1929-1956	28
350	02160000	Fairforest Creek near Union, SC	34°40′45″	81°41′24″	SC	1940-2006	65
351	02160105	Tyger River near Delta, SC	34°32′07″	81°32′53″	SC	1974-2006	32
352	02160326	Enoree River at Pelham, SC	34°51′23″	82°13′34″	SC	1994-2006	13
353	02160390[l]	Enoree River near Woodruff, SC	34°41′00″	82°02′23″	SC	1994-2006	14
354	02160500	Enoree River near Enoree, SC	34°36′38″	81°54′34″	SC	1930-1993	77
355	02160700[l]	Enoree River at Whitmire , SC	34°30′33″	81°35′53″	SC	1974-2006	34
356	02161000[1,2]	Broad River at Alston, SC	34°14′36″	81°19′10″	SC	1897-2006	38
357	02161500	Broad River at Richtex, SC	34°11′06″	81°11′47″	SC	1926-1983	58
358	02162010	Cedar Creek near Blythewood, SC	34°11′45″	81°06′12″	SC	1967-1996	29
359	02162350	Middle Saluda River near Cleveland, SC	35°07′12″	82°32′15″	SC	1981-2006	24
360	02162500	Saluda River near Greenville, SC	34°50′32″	82°28′50″	SC	1942-2006	62
361	02163000[1]	Saluda River near Pelzer, SC	34°40′05″	82°27′54″	SC	1930-1993	62
362	02163500	Saluda River near Ware Shoals, SC	34°23′30″	82°13′24″	SC	1939-2006	68
363	02164110[l]	Reedy River above Fork Shoals, SC	34°39′10″	82°17′51″	SC	1994-2006	14
364	02165000	Reedy River near Ware Shoals, SC	34°25′02″	82°09′05″	SC	1940-2002	63
365	02165200	South Rabon Creek near Gray Court, SC	34°31′12″	82°09′25″	SC	1968-2006	30
366	02166970[l]	Ninety-Six Creek near Ninety-Six, SC	34°07′57″	81°59′47″	SC	1981-2001	21
367	02167000[h,r]	Saluda River at Chappells, SC	34°10′28″	81°51′50″	SC	1927-1939	13
368	02167450	Little River near Silverstreet, SC	34°12′34″	81°45′47″	SC	1991-2006	16

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
369	02167582	Bush River near Prosperity, SC	34°10′08″	81°36′37″	SC	1991-2006	16
370	02169550	Congaree Creek at Cayce, SC	33°56′16″	81°04′39″	SC	1960-1980	21
371	02169630	Big Beaver Creek near St. Matthews, SC	33°44′13″	80°57′29″	SC	1967-1993	27
372	02169960	Lake Marion tributary near Vance, SC	33°27′27″	80°26′31″	SC	1976-2004	26
373	02172500	South Fork Edisto River near Montmorenci, SC	33°34′36″	81°30′49″	SC	1940-1993	49
374	02173000[h]	South Fork Edisto River near Denmark, SC	33°23′36″	81°07′59″	SC	1932-2006	73
375	02173030[l]	South Fork Edisto River near Cope, SC	33°21′33″	81°03′34″	SC	1992-2006	15
376	02173051[1]	South Fork Edisto River near Bamberg, SC	33°20′14″	81°01′07″	SC	1992-2006	15
377	02173500[h]	North Fork Edisto River at Orangeburg, SC	33°29′01″	80°52′24″	SC	1939-2006	68
378	02174000[1,h]	Edisto River near Branchville, SC	33°10′36″	80°48′04″	SC	1946-2006	61
379	02174250	Cow Castle Creek near Bowman, SC	33°22′44″	80°41′59″	SC	1971-2006	22
380	02175000[h]	Edisto River near Givhans, SC	33°01′41″	80°23′29″	SC	1939-2006	68
381	02175500	Salkehatchie River near Miley, SC	32°59′21″	81°03′09″	SC	1952-2006	55
382	02176000	Combahee River near Yemassee, SC	32°42′26″	80°49′34″	SC	1952-1966	15
383	02176500	Coosawhatchie River near Hampton, SC	32°50′11″	81°07′54″	SC	1952-2006	55
384	02177000	Chattooga River near Clayton, GA	34°48′50″	83°18′22″	GA	1915-2006	81
385	02178400[h]	Tallulah River near Clayton, GA	34°53′25″	83°31′50″	GA	1965-2006	42
386	02181800[h]	Little Panther Creek near Tallulah Falls, GA	34°42′48″	83°24′07″	GA	1956-1974	19
387	02182000	Panther Creek near Toccoa, GA	34°40′40″	83°20′43″	GA	1927-1978	51
388	02184500	Whitewater River at Jocassee, SC	34°58′19″	82°56′24″	SC	1952-1967	16
389	02185000	Keowee River near Jocassee, SC	34°57′21″	82°54′41″	SC	1950-1967	18
390	02185200	Little River near Walhalla, SC	34°50′11″	82°58′48″	SC	1967-2004	37
391	02185500	Keowee River near Newry, SC	34°44′20″	82°51′50″	SC	1940-1961	22
392	02186000	Twelvemile Creek near Liberty, SC	34°48′05″	82°44′55″	SC	1955-2006	27
393	02186645	Coneross Creek near Seneca, SC	34°38′57″	82°59′30″	SC	1989-2003	15
394	02187910	Rocky River near Starr, SC	34°22′59″	82°34′38″	SC	1989-2006	17
395	02188500[h]	Beaverdam Creek at Dewy Rose, GA	34°10′52″	82°56′38″	GA	1943-1977	35
396	02188600	Beaverdam Creek above Elberton, GA	34°10′07″	82°53′48″	GA	1987-2006	12
397	02189000[h,r]	Savannah River near Calhoun Falls, SC	34°04′15″	82°38′29″	SC	1897-1935	37
398	02189020[h]	Indian Creek near Carnesville, GA	34°21′19″	83°17′16″	GA	1964-1976	13
399	02189030[l]	Stephens Creek tributary at Carnesville, GA	34°21′51″	83°13′16″	GA	1964-1976	13
400	02189600	Bear Creek near Mize, GA	34°29′07″	83°18′38″	GA	1957-1969	13
401	02190100	Toms Creek near Eastanollee, GA	34°29′01″	83°14′02″	GA	1957-1969	13
402	02190200	Toms Creek tributary near Avalon, GA	34°29′35″	83°13′23″	GA	1955-1969	14
403	02190800[l]	Double Branch at Bowersville, GA	34°22′51″	83°05′28″	GA	1960-1975	16
404	02191200	Hudson River at Homer, GA	34°20′15″	83°29′17″	GA	1951-1979	29
405	02191270	Scull Shoal Creek near Danielsville, GA	34°09′30″	83°09′51″	GA	1964-1975	12
406	02191280[l]	Mill Shoal Creek near Royston, GA	34°16′13″	83°06′08″	GA	1964-1987	24
407	02191300[h]	Broad River above Carlton, GA	34°04′24″	83°00′12″	GA	1898-2006	108
408	02191600	Double Branch near Danielsville, GA	34°06′06″	83°14′11″	GA	1964-1976	13
409	02191750	Fork Creek at Carlton, GA	34°02′55″	83°01′16″	GA	1964-1975	12
410	02191890[h]	Brooks Creek near Lexington, GA	33°50′30″	83°05′22″	GA	1964-1975	12
411	02191910	Trouble Creek at Lexington, GA	33°52′24″	83°05′60″	GA	1959-1978	18
412	02191930	Buffalo Creek near Lexington, GA	33°46′40″	83°03′01″	GA	1964-2006	43
413	02191960[h]	Macks Creek near Lexington, GA	33°55′24″	82°58′30″	GA	1959-1975	17
414	02191970[h]	Little Macks Creek near Lexington, GA	33°56′09″	82°57′41″	GA	1959-1985	27

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.—Continued

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
415	02192000[h]	Broad River near Bell, GA	33°58′27″	82°46′12″	GA	1927-2006	75
416	02192400	Anderson Mill Creek near Danburg, GA	33°48′35″	82°41′35″	GA	1964-1975	12
417	02192420	Anderson Mill Creek tributary near Danburg, GA	33°49′42″	82°41′12″	GA	1964-1975	12
418	02192500	Little River near Mt. Carmel, SC	34°04′17″	82°30′02″	SC	1940-2006	64
419	02193300	Stephens Creek near Crawfordville, GA	33°36′05″	82°55′28″	GA	1961-1975	13
420	02193340	Kettle Creek near Washington, GA	33°40′57″	82°51′29″	GA	1987-2006	20
421	02193400	Harden Creek near Sharon, GA	33°33′10″	82°50′15″	GA	1964-1975	12
422	02193500	Little River near Washington, GA	33°36′46″	82°44′33″	GA	1950-2006	39
423	02195150	Kiokee Creek at Appling, GA	33°32′33″	82°18′55″	GA	1984-2006	23
424	02196000[h]	Stevens Creek near Modoc, SC	33°43′45″	82°10′54″	SC	1940-2006	62
425	02196250	Horn Creek near Colliers (Edgefield), SC	33°42′55″	81°56′22″	SC	1981-1994	14
426	02196689	Little Horse Creek near Graniteville, SC	33°33′49″	81°52′26″	SC	1990-2006	13
427	02197000[h,r]	Savannah River at Augusta, GA	33°22′26″	81°56′34″	SC	1876-1951	80
428	02197300[l]	Upper Three Runs near New Ellenton, SC	33°23′06″	81°36′59″	SC	1967-2002	36
429	02197310[l]	Upper Three Runs above Road C at Savannah River Plant, SC	33°17′09″	81°41′39″	SC	1975-2002	26
430	02197315[l]	Upper Three Runs at Road A at Savannah River Plant, SC	33°14′21″	81°44′41″	SC	1975-2002	27
431	02197410	Miller Creek tributary near Baldoc, SC	33°04′09″	-82°35′35″	SC	1977-1998	20
432	02197520[h]	Brier Creek near Thomson, GA	33°22′07″	82°28′05″	GA	1968-1993	25
433	02197550	Little Brier Creek near Thomson, GA	33°20′25″	82°27′28″	GA	1952-1967	16
434	02197600	Brushy Creek near Wrens, GA	33°10′38″	82°18′20″	GA	1959-2005	46
435	02197810[h]	Walnut Branch near Waynesboro, GA	33°08′12″	82°02′09″	GA	1965-1974	10
436	02197830[l,h]	Brier Creek near Waynesboro, GA	33°07′06″	81°57′49″	GA	1952-1994	27
437	02198000[h]	Brier Creek at Millhaven, GA	32°56′01″	81°39′04″	GA	1938-2006	69
438	02198100	Beaverdam Creek near Sardis, GA	32°56′16″	81°48′55″	GA	1987-2006	19
439	02198690	Ebenezer Creek at Springfield, GA	32°21′57″	81°17′50″	GA	1990-2006	17
440	02199700	South Fork Ogeechee River near Crawfordville, GA	33°31′00″	82°54′22″	GA	1951-1969	19
441	02200000[h]	Ogeechee River at Jewell, GA	33°17′49″	82°46′39″	GA	1984-2006	23
442	02200100[h]	Little Ogeechee River at Hamburg, GA	33°12′26″	82°46′37″	GA	1951-1976	25
443	02200400	Rocky Comfort Creek near Grange, GA	33°06′10″	82°34′01″	GA	1979-2006	27
444	02200500[h]	Ogeechee River near Louisville, GA	32°58′04″	82°23′25″	GA	1936-1966	31
445	02200900	Big Creek near Louisville, GA	32°59′01″	82°21′22″	GA	1951-1976	26
446	02200930	Spring Creek near Louisville, GA	32°55′21″	82°18′48″	GA	1965-2006	42
447	02200950[1,h]	Ogeechee River near Wadley, GA	32°52′12″	82°19′10″	GA	1970-1987	18
448	02201000[h]	Williamson Swamp Creek at Davisboro, GA	32°58′33″	82°36′35″	GA	1979-2006	28
449	02201110[h]	Nails Creek near Bartow, GA	32°52′26″	82°26′33″	GA	1965-1974	10
450	02201160	Boggy Gut Creek near Wadley, GA	32°53′43″	82°24′01″	GA	1965-1974	10
451	02201250[l,h]	Seals Creek tributary near Midville, GA	32°51′05″	82°13′57″	GA	1964-1974	11
452	02201350[h]	Buckhead Creek near Waynesboro, GA	32°58′22″	82°07′14″	GA	1963-1983	21
453	02201800[h]	Richardson Creek near Millen, GA	32°43′24″	81°58′34″	GA	1963-1983	21
454	02201830	Sculls Creek near Millen, GA	32°39′35″	81°59′28″	GA	1965-1975	11
455	02202000[1,h]	Ogeechee River at Scarboro, GA	32°42′39″	81°52′45″	GA	1936-2002	67
456	02202300	Mill Creek near Statesboro, GA	32°28′29″	81°45′16″	GA	1963-1974	12
457	02202500[h]	Ogeechee River near Eden, GA	32°11′30″	81°24′57″	GA	1936-2006	71
458	02202600	Black Creek near Blitchton, GA	32°10′05″	81°29′17″	GA	1980-2006	27
459	02202605	Mill Creek near Pembroke, GA	32°09′40″	81°36′14″	GA	1979-1996	18
460	02202800[h]	Canoochee Creek near Swainsboro, GA	32°36′20″	82°15′20″	GA	1951-1976	26

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
461	02202810[h]	Hughes Prong near Swainsboro, GA	32°37′30″	82°19′03″	GA	1965-1975	11
462	02202820[h]	Reedy Creek near Twin City, GA	32°35′41″	82°12′22″	GA	1965-1974	10
463	02202850[h]	Reedy Branch near Metter, GA	32°28′44″	82°07′44″	GA	1965-1974	10
464	02202865	Canoochee River near Metter, GA	32°21′21″	82°05′24″	GA	1970-1986	17
465	02202900[h]	Fifteenmile Creek near Metter, GA	32°23′34″	82°00′54″	GA	1963-1983	21
466	02202910[h]	Tenmile Creek tributary at Pulaski, GA	32°23′19″	81°58′16″	GA	1965-1987	23
467	02202950[h]	Cypress Flat Creek near Collins, GA	32°13′10″	82°07′13″	GA	1965-1974	10
468	02203000[h]	Canoochee River near Claxton, GA	32°11′06″	81°53′19″	GA	1938-2006	69
469	02203280[1,h]	Canoochee River near Daisy, GA	32°08′55″	81°46′53″	GA	1903-1986	38
470	02203559	Peacock Creek at Mcintosh, GA	31°48′50″	81°31′12″	GA	1967-1977	11
471	02204135[1]	Camp Creek tributary near Stockbridge, GA	33°34′35″	84°08′51″	GA	1977-2006	30
472	02208200	Beaverdam Creek tributary at Bold Springs, GA	33°53′59″	83°47′36″	GA	1965-1975	11
473	02208450	Alcovy River above Covington, GA	33°38′24″	83°46′45″	GA	1973-2006	33
474	02209000[h]	Alcovy River below Covington, GA	33°30′21″	83°49′30″	GA	1929-1965	25
475	02211300[h]	Towaliga River near Jackson, GA	33°15′50″	84°04′17″	GA	1961-1983	23
476	02211459	Big Towaliga Creek near Barnesville, GA	33°04′20″	84°11′04″	GA	1969-1981	13
477	02211500[h]	Towaliga River near Forsyth, GA	33°07′17″	83°56′36″	GA	1929-1966	25
478	02212500[1,h]	Ocmulgee River at Juliette, GA	33°05′50″	83°47′10″	GA	1916-1988	20
479	02212600	Falling Creek near Juliette, GA	33°05′59″	83°43′25″	GA	1965-2006	42
480	02213000[h]	Ocmulgee River at Macon, GA	32°50′19″	83°37′14″	GA	1893-2006	114
481	02213050[h]	Walnut Creek near Gray, GA	32°58′20″	83°37′08″	GA	1962-1994	33
482	02213350[h]	Tobesofkee Creek below Forsyth, GA	32°59′37″	83°56′41″	GA	1963-1987	24
483	02213400[h]	Little Tobesofkee Creek near Forsyth, GA	32°57′10″	84°02′33″	GA	1951-1961	11
484	02213470[h]	Tobesofkee Creek above Macon, GA	32°52′02″	83°50′24″	GA	1967-1978	12
485	02214000[h]	Echeconnee Creek near Macon, GA	32°45′55″	83°50′22″	GA	1938-1978	34
486	02214280	Savage Creek near Bullard, GA	32°35′34″	83°28′11″	GA	1979-2006	28
487	02214500	Big Indian Creek at Perry, GA	32°27′21″	83°44′21″	GA	1944-1977	34
488	02214820	Mossy Creek near Perry , GA	32°31′15″	83°43′23″	GA	1979-2006	25
489	02215000[1,h]	Ocmulgee River at Hawkinsville, GA	32°16′51″	83°27′40″	GA	1909-1996	86
490	02215100	Tucsawhatchee Creek near Hawkinsville, GA	32°14′22″	83°30′06″	GA	1984-2006	23
491	02215220	Ocmulgee River tributary near Abbeville, GA	32°06′54″	83°24′12″	GA	1965-1975	11
492	02215230[h]	Cedar Creek near Pineview, GA	32°05′35″	83°30′12″	GA	1965-1975	11
493	02215245	Folsom Creek tributary near Rochelle, GA	32°00′20″	83°26′07″	GA	1964-2006	43
494	02215280	Ball Creek tributary near Rochelle, GA	31°49′58″	83°22′05″	GA	1960-1977	18
495	02215500[h]	Ocmulgee River at Lumber City, GA	31°55′13″	82°40′26″	GA	1909-2006	98
496	02215800	Gum Swamp Creek near Chauncey, GA	32°07′28″	83°03′37″	GA	1984-2006	23
497	02216000[h]	Little Ocmulgee River at Towns, GA	32°00′29″	82°45′10″	GA	1938-1978	39
498	02216100[h]	Alligator Creek near Alamo, GA	32°01′36″	82°41′43″	GA	1951-1966	16
499	02216180	Turnpike Creek near Mcrae, GA	31°59′29″	82°55′19″	GA	1983-2006	24
500	02216610	Tillman Mill Creek near Lumber City, GA	31°58′54″	82°38′31″	GA	1966-1985	20
501	02217000	Allen Creek at Talmo, GA	34°11′34″	83°43′11″	GA	1952-1974	23
502	02217200	Middle Oconee River near Jefferson, GA	34°05′46″	83°36′23″	GA	1951-1965	15
503	02217250[1]	Buffalo Creek tributary near Jefferson, GA	34°05′00″	83°38′01″	GA	1964-1976	13
504	02217380	Mulberry River near Winder, GA	34°03′08″	83°39′49″	GA	1983-2006	23
505	02217400	Mulberry River tributary near Winder, GA	34°03′53″	83°39′45″	GA	1965-2006	42
506	02217450[1,h]	Mulberry River tributary near Jefferson, GA	34°04′38″	83°38′53″	GA	1965-1974	10

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
507	02217475[l]	Middle Oconee River near Arcade, GA	34°01′54″	83°33′48″	GA	1987-2006	20
508	02217500[h]	Middle Oconee River near Athens, GA	33°56′48″	83°25′22″	GA	1929-2006	71
509	02217660[l]	Little Curry Creek near Jefferson, GA	34°08′25″	83°32′09″	GA	1964-1976	13
510	02217900	North Oconee River at Athens, GA	33°56′55″	83°22′04″	GA	1929-1972	31
511	02218100	Porters Creek at Watkinsville, GA	33°50′56″	83°23′42″	GA	1964-1975	12
512	02218300[l,h]	Oconee River near Penfield, GA	33°43′16″	83°17′44″	GA	1970-2006	37
513	02218450[h]	Town Creek near Greensboro, GA	33°38′29″	83°13′36″	GA	1964-1987	24
514	02218500[h]	Oconee River near Greensboro, GA	33°34′52″	83°16′22″	GA	1904-1991	83
515	02219000	Apalachee River near Bostwick, GA	33°47′17″	83°28′27″	GA	1945-2006	33
516	02219500	Apalachee River near Buckhead, GA	33°36′31″	83°20′58″	GA	1901-1978	49
517	02220550	Whitten Creek near Sparta, GA	33°23′12″	83°01′34″	GA	1961-1986	26
518	02220900[h]	Little River near Eatonton, GA	33°18′50″	83°26′14″	GA	1971-2006	36
519	02221000[h]	Murder Creek near Monticello, GA	33°24′56″	83°39′43″	GA	1952-1976	25
520	02221525[h]	Murder Creek below Eatonton, GA	33°15′08″	83°28′53″	GA	1978-2006	29
521	02223082[h]	Buffalo Creek near Linton, GA	33°06′28″	82°57′34″	GA	1984-2006	23
522	02223200[h]	Commissioner Creek at Toomsboro, GA	32°49′54″	83°04′43″	GA	1949-1976	28
523	02223300[h]	Big Sandy Creek near Jeffersonville, GA	32°48′16″	83°25′04″	GA	1959-1971	13
524	02223349[l]	Big Sandy Creek tributary near Irwinton, GA	32°48′13″	83°13′40″	GA	1977-2006	30
525	02223360	Big Sandy Creek near Irwinton, GA	32°45′60″	83°10′05″	GA	1970-1987	18
526	02223500[h]	Oconee River at Dublin, GA	32°32′41″	82°53′41″	GA	1894-2006	113
527	02223700	Indian Branch tributary near Scott, GA	32°33′23″	82°44′32″	GA	1965-1975	11
528	02224000	Rocky Creek near Dudley, GA	32°29′39″	83°08′49″	GA	1952-1976	25
529	02224100[h]	Turkey Creek near Dublin, GA	32°27′22″	82°56′32″	GA	1984-2006	23
530	02224200	Mercer Creek near Soperton, GA	32°26′39″	82°41′29″	GA	1965-1975	11
531	02224400	Cypress Creek near Tarrytown, GA	32°16′50″	82°35′44″	GA	1965-1975	11
532	02224500[l,h]	Oconee River near Mount Vernon, GA	32°11′29″	82°37′59″	GA	1938-1996	58
533	02224650	Peterson Creek at Glenwood, GA	32°10′09″	82°40′00″	GA	1965-1974	10
534	02224800	Oconee River tributary near Glenwood, GA	32°03′17″	82°39′08″	GA	1965-1974	10
535	02225000[l,h]	Altamaha River near Baxley, GA	31°56′21″	82°21′12″	GA	1928-2006	47
536	02225100[h]	Cobb Creek near Lyons, GA	32°02′07″	82°22′46″	GA	1951-1966	16
537	02225150[h]	Ohoopee River near Wrightsville, GA	32°42′51″	82°45′19″	GA	1963-1983	21
538	02225180	Mulepen Creek near Adrian, GA	32°32′59″	82°31′25″	GA	1965-1974	10
539	02225200	Little Ohoopee River near Wrightsville, GA	32°47′21″	82°33′01″	GA	1951-1976	26
540	02225210[h]	Hurricane Branch near Wrightsville, GA	32°47′01″	82°34′41″	GA	1965-1974	10
541	02225240	Crooked Creek near Kite, GA	32°40′23″	82°26′42″	GA	1965-1974	10
542	02225250[h]	Little Ohoopee River near Swainsboro, GA	32°33′45″	82°28′02″	GA	1970-2006	29
543	02225300[h]	Ohoopee River near Oak Park, GA	32°23′30″	82°18′48″	GA	1951-1986	22
544	02225330	Beaver Creek near Cobbtown, GA	32°16′53″	82°11′26″	GA	1965-2006	41
545	02225350	Reedy Creek tributary near Soperton, GA	32°25′36″	82°29′51″	GA	1965-1988	24
546	02225500[h]	Ohoopee River near Reidsville, GA	32°04′43″	82°10′38″	GA	1904-2006	73
547	02225850	Beards Creek near Glennville, GA	31°55′27″	81°52′57″	GA	1966-1987	22
548	02226000[l,h]	Altamaha River at Doctortown, GA	31°39′17″	81°49′40″	GA	1925-2006	82
549	02226030[h]	Doctors Creek near Ludowici, GA	31°44′08″	81°42′07″	GA	1966-1987	22
550	02226100	Penholoway Creek near Jesup, GA	31°34′01″	81°50′17″	GA	1959-2000	42
551	02226190[h]	Little Creek near Willacoochee, GA	31°27′25″	83°03′02″	GA	1965-1987	23
552	02226200[h]	Satilla River near Douglas, GA	31°24′50″	82°51′02″	GA	1951-1976	26

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.—Continued

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
553	02226300[l,h]	Satilla River near Pearson, GA	31°20′12″	82°46′07″	GA	1953-1965	13
554	02226465	Dryden Creek near Dixie Union, GA	31°20′24″	82°28′42″	GA	1978-1988	11
555	02226500[h]	Satilla River near Waycross, GA	31°14′18″	82°19′28″	GA	1937-2006	70
556	02226580[h]	Big Creek near Hoboken, GA	31°10′29″	82°11′16″	GA	1966-1987	22
557	02227000[h]	Hurricane Creek near Alma, GA	31°34′04″	82°27′50″	GA	1952-1987	35
558	02227100[h]	Little Hurricane Creek near Alma, GA	31°29′45″	82°31′40″	GA	1948-1962	15
559	02227200[h]	Little Hurricane Creek below Alma, GA	31°25′26″	82°25′58″	GA	1948-1978	31
560	02227290[h]	Alabaha River near Blackshear, GA	31°21′05″	82°14′15″	GA	1953-1987	21
561	02227400[h]	Big Satilla Creek near Alma, GA	31°39′29″	82°25′56″	GA	1948-1978	31
562	02227422[l]	Crooked Creek tributary near Bristol, GA	31°26′26″	82°15′02″	GA	1976-2006	31
563	02227430[h]	Little Satilla Creek at Odum, GA	31°40′05″	82°02′26″	GA	1949-1978	30
564	02227470[h]	Little Satilla Creek near Jesup, GA	31°33′49″	81°59′10″	GA	1949-1965	17
565	02227500[h]	Little Satilla River near Offerman, GA	31°27′05″	82°03′16″	GA	1951-2006	56
566	02227990[l]	Satilla River tributary at Atkinson, GA	31°13′33″	81°51′09″	GA	1977-2006	29
567	02228000[h]	Satilla River at Atkinson, GA	31°13′14″	81°51′56″	GA	1931-2006	76
568	02228050	Buffalo Creek at Hickox, GA	31°09′22″	81°59′28″	GA	1966-1987	22
569	02228055	Satilla River tributary near Winokur, GA	30°59′60″	81°57′29″	GA	1980-1989	10
570	02229000	Middle Prong St. Marys River at Taylor, FL	30°26′11″	82°17′14″	FL	1956-2001	38
571	02230000	Turkey Creek at Macclenny, FL	30°16′09″	82°07′20″	FL	1956-1982	27
572	02230500	South Prong St. Marys River at Glen St. Mary, FL	30°16′41″	82°08′39″	FL	1950-1971	22
573	02231000	St. Marys River near Macclenny, FL	30°21′32″	82°04′53″	FL	1927-2004	78
574	02231250	Little St. Marys River near Hilliard, FL	30°43′56″	81°53′34″	FL	1961-1989	29
575	02231268	Alligator Creek at Callahan, FL	30°33′60″	81°50′00″	FL	1982-2004	23
576	02231280	Thomas Creek near Crawford, FL	30°27′40″	81°49′56″	FL	1965-2004	40
577	02246300	Ortega River at Jacksonville, FL	30°14′51″	81°47′48″	FL	1965-2003	39
578	02246600	Trout River at Dinsmore, FL	30°25′52″	81°46′06″	FL	1961-1993	25
579	02314500	Suwannee River at Fargo, GA	30°40′50″	82°33′38″	GA	1928-2006	73
580	02314600[h]	Suwannoochee Creek at Dupont, GA	30°59′10″	82°52′50″	GA	1952-1976	25
581	02314700[h]	Suwannoochee Creek near Thelma, FL	30°49′19″	82°50′27″	GA	1963-1987	25
582	02315500	Suwannee River at White Springs, FL	30°19′33″	82°44′17″	FL	1907-2006	81
583	02315650[l]	Alapaha River tributary near Pitts, GA	32°00′21″	83°33′27″	GA	1965-1975	11
584	02315670	Alapaha River tributary near Rochelle, GA	31°56′41″	83°30′52″	GA	1965-1975	10
585	02315700	Alapaha River at Rebecca, GA	31°48′56″	83°28′26″	GA	1951-1977	27
586	02315900[h]	Deep Creek near Ashburn, GA	31°43′50″	83°34′60″	GA	1951-1976	26
587	02315980[h]	Jacks Creek near Ocilla, GA	31°33′39″	83°21′28″	GA	1960-1975	16
588	02316000[h]	Alapaha River near Alapaha, GA	31°23′04″	83°11′33″	GA	1938-2006	43
589	02316200[h]	Willacoochee River near Ocilla, GA	31°30′07″	83°09′43″	GA	1950-1977	28
590	02316220[h]	Little Brushy Creek near Ocilla, GA	31°36′31″	83°13′56″	GA	1966-1975	10
591	02316260	Alapaha River tributary near Willacoochee, GA	31°16′51″	83°03′45″	GA	1965-1975	11
592	02316390[l,h]	Alapaha River at Lakeland, GA	31°02′47″	83°02′37″	GA	1970-1987	18
593	02317500[h]	Alapaha River at Statenville, GA	30°42′15″	83°01′60″	GA	1928-2006	79
594	02317600[h]	Alapahoochee River near Statenville, GA	30°42′14″	83°07′18″	GA	1984-2006	23
595	02317620	Alapaha River near Jennings, FL	30°35′54″	83°04′24″	FL	1977-2001	13
596	02317700[h]	Withlacoochee River near Nashville, GA	31°11′55″	83°16′21″	GA	1951-1977	27
597	02317710[l,h]	Withlacoochee River tributary near Nashville, GA	31°11′55″	83°17′17″	GA	1960-1987	28
598	02317730[h]	New River tributary near Nashville, GA	31°17′19″	83°20′36″	GA	1960-1975	16

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.—Continued

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
599	02317734[h]	New River near Nashville, GA	31°10′38″	83°19′20″	GA	1970-1987	18
600	023177483[h]	Withlacoochee River near Bemiss, GA	30°57′10″	83°16′07″	GA	1977-2006	25
601	02317760	Little River near Ashburn, GA	31°41′33″	83°42′08″	GA	1965-1975	11
602	02317765	Newell Branch near Worth, GA	31°44′21″	83°43′30″	GA	1965-1975	11
603	02317770[h]	Newell Branch near Ashburn, GA	31°41′47″	83°41′51″	GA	1965-1975	11
604	02317775[h]	Daniels Creek near Ashburn, GA	31°40′41″	83°45′06″	GA	1965-1987	23
605	02317780[h]	Lime Sink Creek near Sycamore, GA	31°36′21″	83°40′31″	GA	1965-1984	20
606	02317795[h]	Mill Creek near Tifton, GA	31°29′37″	83°34′04″	GA	1965-1975	11
607	02317800[h]	Little River near Tifton, GA	31°26′22″	83°33′38″	GA	1951-1973	23
608	02317810[l]	Arnold Creek tributary near Tifton, GA	31°25′31″	83°34′23″	GA	1965-2002	37
609	02317830[h]	Little River near Lenox, GA	31°15′16″	83°30′32″	GA	1968-1978	11
610	02317840	Warrior Creek near Sylvester, GA	31°33′11″	83°48′53″	GA	1965-1975	11
611	02317845	Warrior Creek tributary near Sylvester, GA	31°32′55″	83°49′11″	GA	1965-1975	11
612	02317870	Warrior Creek near Sumner, GA	31°21′46″	83°46′11″	GA	1966-1987	22
613	02317890[l]	Little Creek near Sylvester, GA	31°36′49″	83°45′29″	GA	1965-1975	11
614	02317900[h]	Ty Ty Creek at Ty Ty, GA	31°28′23″	83°39′47″	GA	1951-1978	28
615	02317905[h]	Little Creek near Omega, GA	31°23′36″	83°37′60″	GA	1965-1975	11
616	02317910[h]	Ty Ty Creek tributary at Crosland, GA	31°19′18″	83°37′24″	GA	1960-1974	15
617	02317980[l,h]	Little River near Sparks, GA	31°11′35″	83°31′22″	GA	1961-1979	19
618	02318000[h]	Little River near Adel, GA	31°09′20″	83°32′37″	GA	1941-2006	42
619	02318015	Bull Creek near Norman Park, GA	31°13′14″	83°37′20″	GA	1965-1975	11
620	02318020[l]	Bull Creek tributary near Ellenton, GA	31°09′20″	83°37′06″	GA	1960-1975	16
621	02318500[h]	Withlacoochee River near Quitman, GA	30°47′35″	83°27′13″	GA	1928-2006	36
622	02318600[h]	Okapilco Creek near Berlin, GA	31°02′49″	83°37′02″	GA	1963-1984	22
623	02318700	Okapilco Creek near Quitman, GA	30°49′32″	83°33′45″	GA	1980-2006	27
624	02318725[l,h]	Okapilco Creek at Quitman, GA	30°47′11″	83°31′33″	GA	1970-1986	13
625	02326200[h]	Aucilla River near Boston, GA	30°46′45″	83°48′12″	GA	1962-1984	23
626	02326500	Aucilla River at Lamont, FL	30°22′12″	83°48′25″	FL	1951-2001	40
627	02326598	Caney Creek near Monticello, FL	30°30′53″	83°56′24″	FL	1969-1981	13
628	02327200[h]	Ochlockonee River at Moultrie, GA	31°10′59″	83°48′32″	GA	1951-1977	27
629	02327350	Ochlockonee River tributary near Coolidge, GA	31°01′25″	83°57′35″	GA	1965-2006	42
630	02327355[h]	Ochlockonee River near Coolidge, GA	31°00′08″	83°56′21″	GA	1981-2006	26
631	02327400[h]	Sallys Branch tributary near Sale City, GA	31°14′47″	84°01′40″	GA	1966-1975	10
632	02327415	Little Ochlockonee River near Moultrie, GA	31°07′02″	83°58′42″	GA	1981-2006	24
633	02327500[h]	Ochlockonee River near Thomasville, GA	30°52′33″	84°02′44″	GA	1937-2006	51
634	02327550[h]	Barnetts Creek near Meigs, GA	31°01′33″	84°08′14″	GA	1965-1987	21
635	02327700[h]	Barnetts Creek near Thomasville, GA	30°54′19″	84°04′34″	GA	1951-1977	27
636	02327810[l,h]	Ochlockonee River near Cairo, GA	30°47′31″	84°09′16″	GA	1970-1987	18
637	02327860	Popple Branch near Whigham, GA	30°55′36″	84°20′18″	GA	1977-2002	26
638	02327900[h]	Wolf Creek near Whigham, GA	30°53′37″	84°17′26″	GA	1951-1977	27
639	02328000[h]	Tired Creek near Cairo, GA	30°51′55″	84°15′46″	GA	1944-1979	36
640	02329000	Ochlockonee River near Havana, FL	30°33′15″	84°23′03″	FL	1926-2006	81
641	02329490	Willacoochee Creek near Quincy, FL	30°38′14″	84°30′02″	FL	1975-1990	15
642	02329534[h]	Quincy Creek at Quincy, FL	30°36′01″	84°34′50″	FL	1975-1992	18
643	02329600	Little River near Midway, FL	30°30′45″	84°31′25″	FL	1965-2006	41
644	02329700	Rocky Comfort Creek near Quincy, FL	30°32′45″	84°38′09″	FL	1965-1981	17

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
645	02329877	Ocklawaha Creek near Wetumpka, FL	30°27′01″	84°38′36″	FL	1975-1990	15
646	02330050	Telogia Creek near Greensboro, FL	30°33′35″	84°43′36″	FL	1965-1986	22
647	02330100	Telogia Creek near Bristol, FL	30°25′36″	84°55′40″	FL	1903-2006	53
648	02330450[h]	Chattahoochee River at Helen, GA	34°42′03″	83°43′44″	GA	1981-2006	26
649	02331000	Chattahoochee River near Leaf, GA	34°34′37″	83°38′09″	GA	1940-1999	60
650	02331500[h]	Soque River near Demorest, GA	34°34′23″	83°35′27″	GA	1905-1965	34
651	02331600	Chattahoochee River near Cornelia, GA	34°32′27″	83°37′22″	GA	1940-2006	67
652	02333000[h]	Chattahoochee River near Gainesville, GA	34°19′17″	83°52′46″	GA	1938-1955	18
653	02333500[h]	Chestatee River near Dahlonega, GA	34°31′41″	83°56′23″	GA	1929-2006	71
654	02337000[h]	Sweetwater Creek near Austell, GA	33°46′22″	84°36′53″	GA	1904-2006	72
655	02337400[h]	Dog River near Douglasville, GA	33°39′36″	84°51′41″	GA	1951-1977	27
656	02337448[l]	Hurricane Creek tributary near Fairplay, GA	33°35′03″	84°50′54″	GA	1977-2006	30
657	02337500	Snake Creek near Whitesburg, GA	33°31′46″	84°55′42″	GA	1955-2001	47
658	02338660	New River near Corinth, GA	33°14′07″	84°59′16″	GA	1979-2006	28
659	02338840	Yellowjacket Creek below Hogansville, GA	33°08′22″	84°58′31″	GA	1979-2006	13
660	02339000[h]	Yellowjacket Creek near La Grange, GA	33°05′27″	85°03′40″	GA	1951-1971	21
661	02339225	Wehadkee Creek below Rock Mills, AL	33°07′20″	85°14′57″	AL	1979-1990	12
662	02340250[h]	Flat Shoal Creek near West Point, GA	32°52′53″	85°04′41″	GA	1948-2006	29
663	02340500	Mountain Oak Creek near Hamilton, GA	32°44′28″	85°04′08″	GA	1944-1973	30
664	02340750[h]	Osanippa Creek near Fairfax, AL	32°47′20″	85°11′30″	AL	1953-1974	22
665	02341220	Mulberry Creek near Mulberry Grove, GA	32°42′11″	84°57′29″	GA	1984-2006	22
666	02341600	Juniper Creek near Geneva, GA	32°31′42″	84°34′14″	GA	1963-2006	44
667	02341723	Pine Knot Creek near Juniper, GA	32°26′15″	84°39′25″	GA	1979-2006	27
668	02341800	Upatoi Creek near Columbus, GA	32°24′49″	84°49′12″	GA	1969-2006	38
669	02341900	Ochillee Creek near Cussetta, GA	32°21′54″	84°49′02″	GA	1979-2006	28
670	02342150[l,h]	Uchee Creek near Seale, AL	32°21′17″	85°05′44″	AL	1951-1970	20
671	02342200	Phelps Creek near Opelika, AL	32°33′49″	85°16′36″	AL	1959-1974	16
672	02342500[l,h]	Uchee Creek near Fort Mitchell, AL	32°19′01″	85°00′54″	AL	1947-2003	57
673	02342933[l,h]	South Fork Cowikee Creek near Batesville, AL	32°01′04″	85°17′45″	AL	1964-2005	41
674	02343200[h]	Pataula Creek near Lumpkin, GA	31°56′04″	84°48′12″	GA	1949-1978	30
675	02343219	Bluff Springs Branch near Lumpkin, GA	32°01′53″	84°53′18″	GA	1977-2006	30
676	02343225[h]	Pataula Creek near Georgetown, GA	31°49′07″	84°58′26″	GA	1951-1978	28
677	02343244[h]	Cemochechobee Creek near Coleman, GA	31°39′12″	84°53′02″	GA	1984-2006	22
678	02343267[h]	Temple Creek near Blakely, GA	31°26′35″	84°58′60″	GA	1978-2006	28
679	02343275[l,h]	Abbie Creek near Abbeville, AL	31°33′43″	85°12′18″	AL	1951-1990	25
680	02343300[l,h]	Abbie Creek near Haleburg, AL	31°28′25″	85°09′45″	AL	1958-1993	35
681	02343700[l]	Stevenson Creek near Headland, AL	31°21′19″	85°11′05″	AL	1960-1974	15
682	02344700	Line Creek near Senoia, GA	33°19′09″	84°31′20″	GA	1965-2006	42
683	02345000[l,h]	Flint River near Molena, GA	32°59′21″	84°31′45″	GA	1900-1953	41
684	02345500[l]	Flint River near Woodbury, GA	32°57′59″	84°31′58″	GA	1900-1927	28
685	02346180[h]	Flint River near Thomaston, GA	32°50′20″	84°25′27″	GA	1900-1994	73
686	02346193[h]	Scott Creek near Talbotton, GA	32°39′48″	84°36′06″	GA	1969-1987	19
687	02346195[h]	Lazer Creek near Talbotton, GA	32°44′33″	84°33′20″	GA	1981-2006	24
688	02346210[h]	Kimbrough Creek near Talbotton, GA	32°41′19″	84°30′48″	GA	1969-1987	19
689	02346217	Coleoatchee Creek near Manchester, GA	32°49′20″	84°36′16″	GA	1969-2006	37
690	02346500[h]	Potato Creek near Thomaston, GA	32°54′15″	84°21′45″	GA	1938-1973	36

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
691	02347500[h]	Flint River near Carsonville, GA	32°43′17″	84°13′57″	GA	1913-2006	88
692	02348300[h]	Patsiliga Creek near Reynolds, GA	32°34′21″	84°05′27″	GA	1963-1984	22
693	02348485[h]	Whitewater Creek near Butler, GA	32°30′15″	84°20′03″	GA	1979-2002	22
694	02349000[h]	Whitewater Creek near Butler, GA	32°28′01″	84°15′58″	GA	1944-1977	34
695	02349030	Cedar Creek near Rupert, GA	32°23′22″	84°17′49″	GA	1979-2005	27
696	02349330[l]	Buck Creek tributary near Tazewell, GA	32°20′50″	84°22′26″	GA	1977-2006	30
697	02349350	Buck Creek near Ellaville, GA	32°18′36″	84°17′36″	GA	1979-2006	28
698	02349605[l,h]	Flint River near Montezuma, GA	32°17′35″	84°02′37″	GA	1905-2006	102
699	02349695[l]	Horsehead Creek near Montezuma, GA	32°21′28″	83°56′12″	GA	1977-2006	30
700	02349900	Turkey Creek at Byromville, GA	32°11′44″	83°54′08″	GA	1951-2006	56
701	02350512[l,h]	Flint River near Oakfield, GA	31°43′30″	84°01′07″	GA	1929-2006	49
702	02350520[h]	Abrams Creek tributary near Doles, GA	31°40′47″	83°48′04″	GA	1965-1975	11
703	02350600[h]	Kinchafoonee Creek at Preston, GA	32°03′09″	84°32′54″	GA	1948-2006	51
704	02350685[l]	Choctahatchee Creek tributary near Plains, GA	32°02′03″	84°26′01″	GA	1977-2006	29
705	02350900[h]	Kinchafoonee Creek near Dawson, GA	31°45′52″	84°15′12″	GA	1948-2006	41
706	02351500	Muckalee Creek near Americus, GA	32°04′59″	84°15′29″	GA	1963-2006	26
707	02351700	Muckalee Creek near Smithville, GA	31°53′44″	84°11′52″	GA	1951-1966	16
708	02351800[h]	Muckaloochee Creek at Smithville, GA	31°54′20″	84°14′44″	GA	1948-1978	29
709	02351890[h]	Muckalee Creek near Leesburg, GA	31°46′34″	84°08′22″	GA	1980-2006	27
710	02351900[h]	Muckalee Creek near Leesburg, GA	31°43′56″	84°07′30″	GA	1951-1986	22
711	02352500	Flint River at Albany, GA	31°35′39″	84°08′39″	GA	1893-2006	114
712	02353000[l,h]	Flint River at Newton, GA	31°18′25″	84°20′20″	GA	1938-2006	69
713	02353100	Ichawaynochaway Creek near Graves, GA	31°46′17″	84°33′44″	GA	1963-1990	22
714	02353200	Little Ichawaynochaway Creek near Shellman, GA	31°46′46″	84°36′13″	GA	1951-1962	12
715	02353400[h]	Pachitla Creek near Edison, GA	31°33′18″	84°40′51″	GA	1948-2006	49
716	02353500[h]	Ichawaynochaway Creek at Milford, GA	31°22′58″	84°32′47″	GA	1906-2006	69
717	02354500[h]	Chickasawhatchee Creek at Elmodel, GA	31°21′02″	84°28′57″	GA	1940-2006	49
718	02354800	Ichawaynochaway Creek near Elmodel, GA	31°17′38″	84°29′31″	GA	1996-2006	11
719	02355000[h]	Ichawaynochaway Creek near Newton, GA	31°16′21″	84°29′19″	GA	1938-1947	10
720	02356000[l,h]	Flint River at Bainbridge, GA	30°54′42″	84°34′48″	GA	1905-2006	98
721	02356100	Spring Creek near Arlington, GA	31°24′48″	84°46′33″	GA	1951-1980	25
722	02356640	Spring Creek at Colquitt, GA	31°10′16″	84°44′31″	GA	1981-2006	24
723	02357000	Spring Creek near Iron City, GA	31°02′25″	84°44′24″	GA	1938-2006	65
724	02358600	Flat Creek near Chattahoochee, FL	30°37′44″	84°50′06″	FL	1961-1982	21
725	02358785[l,h]	Cowarts Creek near Cottonwood, AL	31°01′01″	85°13′21″	AL	1971-1994	11
726	02359000	Chipola River near Altha, FL	30°32′03″	85°09′55″	FL	1913-2006	72
727	02360000[l,h]	West Fork Choctawhatchee River at Blue Springs, AL	31°39′50″	85°30′18″	AL	1944-1971	28
728	02360275[l,h]	Judy Creek near Ozark, AL	31°27′48″	85°34′20″	AL	1951-1994	29
729	02360500[l,h]	East Fork Choctawhatchee River near Midland City, AL	31°22′24″	85°28′38″	AL	1953-1990	17
730	02361000[l,h]	Choctawhatchee River near Newton, AL	31°20′35″	85°36′38″	AL	1922-2005	76
731	02362610[l,h]	Pea River near Midway, AL	32°03′01″	85°34′21″	AL	1973-1994	12
732	02363000[l,h]	Pea River near Ariton, AL	31°35′42″	85°46′59″	AL	1939-2005	66
733	02365310[l]	Grants Branch tributary near Fadette, AL	31°02′22″	85°35′11″	AL	1972-1981	10
734	02379500[h]	Cartecay River near Ellijay, GA	34°41′03″	84°27′31″	GA	1938-1986	48
735	02380000[h]	Ellijay River at Ellijay, GA	34°41′33″	84°28′45″	GA	1919-1972	22
736	02380500[h]	Coosawattee River near Ellijay, GA	34°40′30″	84°30′31″	GA	1939-2006	64

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.—Continued

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
737	02381100	Mountaintown Creek tributary near Ellijay, GA	34°42′04″	84°31′54″	GA	1965-1974	10
738	02381300[h]	Fir Creek near Ellijay, GA	34°41′06″	84°37′23″	GA	1966-1987	22
739	02381600[h]	Fausett Creek near Talking Rock, GA	34°34′13″	84°28′08″	GA	1966-2006	41
740	02381900[h]	Ball Creek near Talking Rock, GA	34°31′52″	84°34′11″	GA	1965-1974	10
741	02382200[h]	Talking Rock Creek near Hinton, GA	34°31′22″	84°36′40″	GA	1964-2006	42
742	02382600[h]	Sugar Creek near Chatsworth, GA	34°40′26″	84°42′40″	GA	1965-1974	10
743	02382800[h]	Dry Creek at Oakman, GA	34°33′13″	84°42′27″	GA	1965-1974	10
744	02382900[h]	Pine Log Creek near Rydal, GA	34°22′02″	84°42′45″	GA	1964-1974	11
745	02383000[h]	Rock Creek near Fairmount, GA	34°21′32″	84°46′46″	GA	1952-1974	23
746	02383200[h]	Redbud Creek near Ranger, GA	34°31′57″	84°43′39″	GA	1964-1974	11
747	02384500	Conasauga River near Eton, GA	34°49′40″	84°51′03″	GA	1954-2006	49
748	02384540	Mill Creek near Crandall, GA	34°52′19″	84°43′17″	GA	1985-2006	22
749	02384600	Pinhook Creek near Eton, GA	34°49′34″	84°48′54″	GA	1964-2006	43
750	02384900	Coahulla Creek near Cleveland, TN	35°07′00″	84°50′18″	TN	1955-1985	31
751	02385000[h]	Coahulla Creek near Varnell, GA	34°53′43″	84°55′15″	GA	1940-1962	16
752	02385700[h]	Rock Creek near Chatsworth, GA	34°46′33″	84°44′33″	GA	1965-1974	10
753	02385800[h]	Holly Creek near Chatsworth, GA	34°43′00″	84°46′12″	GA	1961-2006	46
754	02387000[h]	Conasauga River at Tilton, GA	34°40′00″	84°55′42″	GA	1938-2006	69
755	02387100[h]	Polecat Creek near Spring Place, GA	34°39′08″	84°50′33″	GA	1964-1974	11
756	02387200[h]	Beamer Creek near Spring Place, GA	34°38′03″	84°51′52″	GA	1964-1974	11
757	02387300[l]	Dead Mans Branch near Resaca, GA	34°35′44″	84°52′11″	GA	1965-1987	23
758	02387560[h]	Oothkalooga Creek tributary at Adairsville, GA	34°21′34″	84°55′20″	GA	1965-1974	10
759	02387570[h]	Oothkalooga Creek at Adairsville, GA	34°22′40″	84°56′34″	GA	1964-1974	11
760	02387700	Rocky Creek at Curryville, GA	34°26′44″	85°05′12″	GA	1965-1974	10
761	02387800[h]	Bailey Creek near Villanow, GA	34°40′10″	85°05′40″	GA	1965-1974	10
762	02388000[h]	West Armuchee Creek near Subligna, GA	34°34′04″	85°09′37″	GA	1961-1981	21
763	02388200[h]	Storey Mill Creek near Summerville, GA	34°25′14″	85°16′35″	GA	1966-1987	22
764	02388300	Heath Creek near Rome, GA	34°21′57″	85°16′17″	GA	1969-1990	22
765	02388400[h]	Dozier Creek near Shannon, GA	34°18′53″	85°05′47″	GA	1965-1974	10
766	02388900[l]	Etowah River near Dahlonega, GA	34°30′56″	84°03′40″	GA	1950-2006	29
767	02389000[h]	Etowah River near Dawsonville, GA	34°22′57″	84°03′21″	GA	1940-1980	39
768	02389300[h]	Shoal Creek near Dawsonville, GA	34°25′13″	84°08′47″	GA	1959-1974	16
769	02390000	Amicalola Creek near Dawsonville, GA	34°25′32″	84°12′43″	GA	1940-2006	14
770	02391000[l]	Etowah River near Ball Ground, GA	34°19′05″	84°20′35″	GA	1908-1921	11
771	02392000	Etowah River at Canton, GA	34°14′24″	84°29′41″	GA	1892-2006	115
772	02394400[h]	Pumpkinvine Creek below Dallas, GA	33°54′59″	84°52′41″	GA	1951-1977	27
773	02394820[h]	Euharlee Creek at Rockmart, GA	33°59′55″	85°03′09″	GA	1984-2006	23
774	02394950[h]	Hills Creek near Taylorsville, GA	34°04′32″	84°57′02″	GA	1960-1974	15
775	02395120	Two Run Creek near Kingston, GA	34°14′34″	84°53′23″	GA	1981-2006	26
776	02397410[h]	Cedar Creek at Cedartown, GA	33°59′45″	85°15′53″	GA	1949-1997	27
777	02397500[h]	Cedar Creek near Cedartown, GA	34°03′41″	85°18′47″	GA	1943-2006	36
778	02397750[h]	Duck Creek above Lafayette, GA	34°42′16″	85°19′51″	GA	1965-1974	10
779	02397830	Harrisburg Creek near Hawkins, GA	34°36′02″	85°23′21″	GA	1980-2006	27
780	02398000	Chattooga River at Summerville, GA	34°27′59″	85°20′10″	GA	1938-2006	69
781	02398300[h]	Chattooga River above Gaylesville, AL	34°17′25″	85°30′33″	AL	1949-2005	48
782	02400000	Terrapin Creek near Piedmont, AL	33°57′23″	85°34′38″	AL	1945-1963	19

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
783	02400033	Nances Creek near White Plains, AL	33°50′43″	85°39′60″	AL	1971-1981	11
784	02400100[h]	Terrapin Creek at Ellisville, AL	34°03′54″	85°36′51″	AL	1963-2005	41
785	02401000[h]	Big Wills Creek near Reece City, AL	34°05′53″	86°02′17″	AL	1943-2005	54
786	02401500	Big Canoe Creek near Gadsden, AL	33°54′11″	86°06′36″	AL	1938-1965	28
787	02404000[h]	Choccolocco Creek near Jenifer, AL	33°34′14″	85°55′50″	AL	1904-1979	55
788	02404400[h]	Choccolocco Creek at Jackson Shoal near Lincoln, AL	33°32′54″	86°05′49″	AL	1961-2005	42
789	02404500[h]	Choccolocco Creek near Lincoln, AL	33°33′38″	86°07′35″	AL	1939-1963	25
790	02411735[l]	Mcclendon Creek tributary near Dallas, GA	33°50′58″	84°57′20″	GA	1977-2006	29
791	02411800[h]	Little River near Buchanan, GA	33°47′51″	85°07′03″	GA	1960-1985	26
792	02411900[h]	Tallapoosa River at Tallapoosa, GA	33°46′27″	85°17′60″	GA	1951-1977	27
793	02411902[l]	Mann Creek tributary near Tallapoosa, GA	33°51′16″	85°17′28″	GA	1977-2006	29
794	02412000	Tallapoosa River near Heflin, AL	33°37′22″	85°30′48″	AL	1953-2005	53
795	02412500[h]	Tallapoosa River near Ofelia, AL	33°19′34″	85°35′31″	AL	1939-1970	32
796	02413000	Little Tallapoosa River at Carrollton, GA	33°35′50″	85°04′49″	GA	1936-1965	29
797	02413200[h]	Little Tallapoosa River near Bowden, GA	33°30′46″	85°14′03″	GA	1949-1977	29
798	02413300	Little Tallapoosa River near Newell, AL	33°26′14″	85°23′57″	AL	1976-2005	30
799	02413400[h]	Wedowee Creek above Wedowee, AL	33°19′56″	85°21′39″	AL	1960-1972	13
800	02413475[h]	Wedowee Creek near Wedowee Al, AL	33°19′30″	85°29′02″	AL	1951-1975	25
801	02413500[h]	Little Tallapoosa River near Wedowee, AL	33°20′57″	85°32′43″	AL	1938-1979	34
802	02414800[h]	Harbuck Creek near Hackneyville, AL	33°07′08″	85°56′41″	AL	1951-1970	20
803	02415000[h]	Hillabee Creek near Hackneyville, AL	33°03′55″	85°52′41″	AL	1953-2005	41
804	02419000[l,h]	Uphapee Creek near Tuskegee, AL	32°28′36″	85°41′42″	AL	1940-2005	65
805	03160610	Old Field Creek near West Jefferson, NC	36°21′29″	81°31′45″	NC	1955-1971	17
806	03161000[h]	South Fork New River near Jefferson, NC	36°23′36″	81°24′25″	NC	1925-2006	79
807	03162110[h]	Buffalo Creek at Warrensville, NC	36°27′22″	81°30′50″	NC	1955-1971	17
808	03162500[h]	North Fork New River at Crumpler, NC	36°30′15″	81°23′24″	NC	1909-1966	39
809	03162880	Vile Creek near Sparta, NC	36°30′39″	81°06′15″	NC	1955-1971	17
810	03164000	New River near Galax, VA	36°38′50″	80°58′44″	VA	1930-2005	76
811	03165000[h]	Chestnut Creek at Galax, VA	36°38′45″	80°55′09″	VA	1945-2005	61
812	03166800	Glade Creek at Grahams Forge, VA	36°55′51″	80°54′01″	VA	1976-1995	20
813	03167000	Reed Creek at Grahams Forge, VA	36°56′20″	80°53′14″	VA	1909-2005	87
814	03167700	Beaverdam Creek at Rt 1009 at Hillsville, VA	36°46′05″	80°43′32″	VA	1971-1995	24
815	03168500	Peak Creek at Pulaski, VA	37°02′50″	80°46′34″	VA	1927-1961	17
816	03168750	Thorne Springs Branch near Dublin, VA	37°05′30″	80°44′33″	VA	1957-2005	49
817	03169350	Brush Creek at Terrys Fork, VA	37°02′44″	80°16′44″	VA	1957-1976	20
818	03170000	Little River at Graysontown, VA	37°02′15″	80°33′24″	VA	1929-2005	77
819	03171150	Crab Creek tributary near Christiansburg, VA	37°07′56″	80°27′31″	VA	1957-1976	20
820	03171500[h,r]	New River at Eggleston, VA	37°17′22″	80°37′00″	VA	1915-1939	24
821	03173000[h]	Walker Creek at Bane, VA	37°16′05″	80°42′34″	VA	1938-2005	68
822	03175500	Wolf Creek near Narrows, VA	37°18′20″	80°50′59″	VA	1909-2005	76
823	03176500[h,r]	New River at Glen Lyn, VA	37°22′22″	80°51′38″	VA	1915-1938	24
824	03439000[m]	French Broad River at Rosman, NC	35°08′36″	82°49′29″	NC	1936-2006	71
825	03439500[l]	French Broad at Calvert, NC	35°08′55″	82°47′58″	NC	1925-1955	31
826	03440000	Catheys Creek near Brevard, NC	35°12′40″	82°46′59″	NC	1945-2004	29
827	03441000	Davidson River near Brevard, NC	35°16′23″	82°42′21″	NC	1921-2006	83
828	03441440	Little River above High Falls near Cedar Mt, NC	35°11′32″	82°36′48″	NC	1963-1990	28

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
829	03441500[h]	Little River near Penrose, NC	35°13′23″	82°38′06″	NC	1943-1955	13
830	03442000[h]	Crab Creek near Penrose, NC	35°14′02″	82°36′38″	NC	1943-1955	13
831	03443000	French Broad River at Blantyre, NC	35°17′57″	82°37′26″	NC	1921-2006	86
832	03444000[h]	Boylston Creek near Horseshoe, NC	35°22′10″	82°33′49″	NC	1943-1955	13
833	03444500	South Fork Mills River at The Pink Beds, NC	35°21′58″	82°44′21″	NC	1927-1973	31
834	03446000[h]	Mills River near Mills River, NC	35°23′53″	82°35′42″	NC	1925-2006	74
835	03446410[l]	Laurel Branch near Edneyville, NC	35°22′15″	82°24′09″	NC	1955-1966	12
836	03446500[h]	Clear Creek near Hendersonville, NC	35°21′14″	82°26′39″	NC	1946-1955	10
837	03447000[h]	Mud Creek at Naples, NC	35°23′14″	82°30′13″	NC	1939-1955	17
838	03447500[h]	Cane Creek at Fletcher, NC	35°26′08″	82°29′22″	NC	1926-1958	18
839	03448000[l]	French Broad River at Bent Creek, NC	35°30′07″	82°35′32″	NC	1935-1986	52
840	03448500[h]	Hominy Creek at Candler, NC	35°32′28″	82°40′34″	NC	1943-1977	35
841	0344894205[h]	North Fork Swannanoa River near Walkertown, NC	35°41′00″	82°19′59″	NC	1989-2006	18
842	03449000[r]	N Fork Swannanoa River near Black Mountain, NC	35°39′11″	82°21′03″	NC	1926-1952	27
843	03450000	Beetree Creek near Swannanoa, NC	35°39′11″	82°24′19″	NC	1927-2006	70
844	03451000[h]	Swannanoa River at Biltmore, NC	35°34′06″	82°32′41″	NC	1921-2006	78
845	03451500[h]	French Broad River at Asheville, NC	35°36′32″	82°34′41″	NC	1896-2006	111
846	03452000	Sandymush Creek near Alexander, NC	35°43′49″	82°40′10″	NC	1943-1955	13
847	03453000[h]	Ivy River near Marshall, NC	35°46′11″	82°37′15″	NC	1935-2006	52
848	03453500[l,h]	French Broad River at Marshall, NC	35°47′11″	82°39′39″	NC	1943-2006	64
849	03453880	Brush Creek at Walnut, NC	35°50′40″	82°44′30″	NC	1954-1971	17
850	03454000	Big Laurel Creek near Stackhouse, NC	35°55′11″	82°45′42″	NC	1935-1973	39
851	03454500[h]	French Broad River at Hot Springs, NC	35°53′23″	82°49′16″	NC	1935-1949	15
852	03455500	W F Pigeon River above Lake Logan near Hazelwood, NC	35°23′46″	82°56′15″	NC	1955-2006	52
853	03456500	East Fork Pigeon River near Canton, NC	35°27′42″	82°52′11″	NC	1955-2006	52
854	03456991[2,h]	Pigeon River near Canton, NC	35°31′23″	82°50′48″	NC	1908-2006	81
855	03457500	Allen Creek near Hazelwood, NC	35°25′49″	83°00′29″	NC	1950-1973	24
856	03459000	Jonathan Creek near Cove Creek, NC	35°37′22″	83°00′26″	NC	1931-1973	43
857	03459500[h]	Pigeon River near Hepco, NC	35°38′06″	82°59′24″	NC	1928-2006	79
858	03460000	Cataloochee Creek near Cataloochee, NC	35°40′03″	83°04′25″	NC	1935-2006	62
859	03461200	Cosby Creek above Cosby, TN	35°46′58″	83°13′03″	TN	1959-1987	29
860	03461910	North Toe River at Newland, NC	36°05′01″	81°55′44″	NC	1955-1973	19
861	03462000[h]	North Toe River at Altapass, NC	35°53′59″	82°01′49″	NC	1935-1958	24
862	03463300	South Toe River near Celo, NC	35°49′53″	82°11′03″	NC	1958-2006	49
863	03463500[h]	South Toe River at Newdale, NC	35°54′22″	82°11′18″	NC	1935-1952	18
864	03463910	Phipps Creek near Burnsville, NC	35°54′40″	82°22′09″	NC	1957-1973	14
865	03464000[h]	Cane River near Sioux, NC	36°00′52″	82°19′39″	NC	1934-1971	38
866	03464500[h]	Nolichucky River at Poplar, NC	36°04′28″	82°20′41″	NC	1926-1955	30
867	03465000	North Indian Creek near Unicoi, TN	36°10′35″	82°17′35″	TN	1945-1984	39
868	03465500[h]	Nolichucky River at Embreeville, TN	36°10′35″	82°27′27″	TN	1921-2006	86
869	03467000	Lick Creek at Mohawk, TN	36°12′05″	83°02′52″	TN	1947-2006	28
870	03467500[h]	Nolichucky River near Morristown, TN	36°10′49″	83°10′32″	TN	1921-1982	61
871	03469160	East Fork Little Pigeon Rivernear Sevierville, TN	35°51′55″	83°29′17″	TN	1954-1982	29
872	03469500	West Prong Little Pigeon River near Pigeon Forge, TN	35°48′21″	83°34′28″	TN	1947-1982	32
873	03470000[h]	Little Pigeon River at Sevierville, TN	35°52′42″	83°34′40″	TN	1920-1982	63
874	03477000[h,r]	South Fork Holston River at Bluff City, TN	36°28′38″	82°15′46″	TN	1901-1950	50

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Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
875	03478910[h]	Cove Creek at Sherwood, NC	36°15′50″	81°47′02″	NC	1955-1972	18
876	03479000[h]	Watauga River near Sugar Grove, NC	36°14′21″	81°49′20″	NC	1940-2006	67
877	03480540[l]	Peavine Branch near Banner Elk, NC	36°10′20″	81°54′41″	NC	1953-1963	11
878	03481000[h]	Elk River near Elk Park, NC	36°11′01″	81°57′44″	NC	1935-1955	21
879	03482000	Roan Creek near Neva, TN	36°22′37″	81°53′13″	TN	1943-1985	40
880	03483000[h]	Watauga River at Butler, TN	36°19′59″	82°00′15″	TN	1921-1948	28
881	03485500[h]	Doe River at Elizabethton, TN	36°20′40″	82°12′36″	TN	1912-1982	66
882	03487550[h]	Reedy Creek at Orebank, TN	36°33′42″	82°27′34″	TN	1964-2006	42
883	03491000	Big Creek near Rogersville, TN	36°25′34″	82°57′07″	TN	1942-2006	59
884	03491200	Big Creek tributary near Rogersville, TN	36°25′30″	82°57′17″	TN	1955-1985	31
885	03491500	Holston River near Rogersville, TN	36°22′18″	83°00′12″	TN	1902-1941	40
886	03497000[h,r]	Tennessee River at Knoxville, TN	35°57′17″	83°51′42″	TN	1890-1941	48
887	03497300	Little River above Townsend, TN	35°39′52″	83°42′41″	TN	1964-2006	43
888	03498500[h]	Little River near Maryville, TN	35°47′08″	83°53′05″	TN	1951-2006	56
889	03498700[l]	Nails Creek near Knoxville, TN	35°52′49″	83°46′47″	TN	1955-1985	31
890	03500000	Little Tennessee River near Prentiss, NC	35°09′00″	83°22′47″	NC	1945-2006	62
891	03500240[h]	Cartoogechaye Creek near Franklin, NC	35°09′32″	83°23′39″	NC	1962-2006	45
892	03501000[h]	Cullasaja River at Cullasaja, NC	35°09′59″	83°19′25″	NC	1908-1971	52
893	03501760	Coon Creek near Franklin, NC	35°14′04″	83°20′28″	NC	1957-1973	17
894	03502000[h]	Little Tennessee River at Iotla, NC	35°14′03″	83°23′42″	NC	1929-1945	17
895	03503000	Little Tennessee River at Needmore, NC	35°20′11″	83°31′37″	NC	1945-2006	61
896	03504000	Nantahala River near Rainbow Springs, NC	35°07′39″	83°37′07″	NC	1940-2006	67
897	03506500	Nantahala River at Almond, NC	35°22′32″	83°33′59″	NC	1923-1943	19
898	03507000	Little Tennessee River at Judson, NC	35°24′30″	83°33′26″	NC	1897-1944	48
899	03509000[2]	Scott Creek above Sylva, NC	35°23′02″	83°12′51″	NC	1929-1995	50
900	03510500[1,h,r]	Tuckasegee River at Dillsboro, NC	35°22′00″	83°15′37″	NC	1928-1940	13
901	03511000	Oconaluftee River at Cherokee, NC	35°29′04″	83°18′56″	NC	1922-1949	28
902	03512000[h]	Oconaluftee River at Birdtown, NC	35°27′41″	83°21′13″	NC	1949-2006	58
903	03513000[r]	Tuckasegee River at Bryson City, NC	35°25′39″	83°26′49″	NC	1898-1940	43
904	03513410[l]	Jenkins Branch tributary at Bryson City, NC	35°24′50″	83°27′20″	NC	1957-1971	13
905	03513500	Noland Creek near Bryson City, NC	35°29′05″	83°30′15″	NC	1936-1971	36
906	03514000	Hazel Creek at Proctor, NC	35°28′38″	83°42′58″	NC	1943-1952	10
907	03516000	Snowbird Creek near Robbinsville, NC	35°18′40″	83°51′35″	NC	1943-1952	10
908	03518500[h]	Tellico River at Tellico Plains, TN	35°21′43″	84°16′44″	TN	1926-2006	62
909	03519500	Little Tennessee River at Mcghee, TN	35°36′16″	84°12′42″	TN	1905-1944	40
910	03519610	Baker Creek tributary near Binfield, TN	35°41′56″	84°02′46″	TN	1967-2002	33
911	03519640	Baker Creek near Greenback, TN	35°40′21″	84°06′28″	TN	1966-1998	33
912	03520100	Sweetwater Creek near Loudon, TN	35°44′17″	84°22′25″	TN	1954-1982	29
913	03528400	White Creek near Sharps Chapel, TN	36°20′43″	83°53′40″	TN	1935-1970	36
914	03534500	Buffalo Creek at Norris, TN	36°11′06″	84°03′40″	TN	1948-1982	31
915	03535000	Bullrun Creek near Halls Crossroads, TN	36°06′52″	83°59′17″	TN	1958-2006	35
916	03535180	Willow Fork near Halls Crossroads, TN	36°05′59″	83°54′27″	TN	1967-2006	40
917	03538250	East Fork Poplar Creek near Oak Ridge, TN	35°57′58″	84°21′30″	TN	1961-1988	28
918	03543500	Sewee Creek near Decatur, TN	35°34′53″	84°44′53″	TN	1935-1994	60
919	03544947	Brier Creek near Hiawassee, GA	34°50′05″	83°42′34″	GA	1984-2006	23
920	03545000	Hiwassee River at Presley, GA	34°54′17″	83°43′01″	GA	1942-2001	60

Table 1. Summary of rural streamgaging stations in and near North Carolina, South Carolina, and Georgia that were considered for use in the regional regression analysis, 2006.—Continued

[Sites in North Carolina shown in blue font. USGS, U.S. Geological Survey; 1, station not used in regression analysis; 2, peaks at indicated station were combined with peaks at adjacent nearby station on same stream; c, peak-flow record available for station includes channelization or urbanization periods that were not used in the regression analysis; h, peak-flow record adjusted for historical period; m, extended record using MOVE1 analysis; r, peak-flow record available for station includes regulated period that was not used in the regression analysis]

Map identification number (fig. 2)	USGS station number	Station name	Latitude	Longitude	State	Systematic period of record	Number of systematic peaks
921	03546000	Shooting Creek near Hayesville, NC	35°01′29″	83°42′27″	NC	1923-1955	13
922	03548500[r]	Hiwassee River above Murphy, NC	35°04′53″	84°00′10″	NC	1897-1941	44
923	03550000[h]	Valley River at Tomotla, NC	35°08′20″	83°58′50″	NC	1905-2006	96
924	03550500[h]	Nottely River near Blairsville, GA	34°50′28″	83°56′10″	GA	1943-2000	58
925	03554000[r]	Nottely River near Ranger, NC	35°01′37″	84°06′55″	NC	1901-1941	32
926	03556000	Turtletown Creek at Turtletown, TN	35°07′60″	84°20′36″	TN	1935-1971	37
927	03557000[h]	Hiwassee River near Reliance, TN	35°13′20″	84°31′34″	TN	1901-1939	33
928	03558000[h]	Toccoa River near Dial, GA	34°47′24″	84°14′24″	GA	1913-1996	84
929	03560000[h]	Fightingtown Creek at Mccaysville, GA	34°58′53″	84°23′12″	GA	1943-1973	31
930	03560500	Davis Mill Creek at Copperhill, TN	34°59′43″	84°22′56″	TN	1950-1994	35
931	03561000	North Potato Creek near Ducktown, TN	35°00′54″	84°22′58″	TN	1935-1970	36
932	03565300	South Chestuee Creek near Benton, TN	35°10′02″	84°42′58″	TN	1958-1987	30
933	03565500	Oostanaula Creek near Sanford, TN	35°19′39″	84°42′18″	TN	1955-2006	38
934	03566200	Brymer Creek near Mcdonald, TN	35°07′20″	84°56′60″	TN	1955-1985	31
935	03566420	Wolftever Creek near Ooltewah, TN	35°03′44″	85°03′59″	TN	1965-2006	39
936	03566660[h]	Sugar Creek near Ringgold, GA	34°58′14″	85°01′29″	GA	1965-1974	10
937	03566685[h]	Little Chickamauga Creek near Ringgold, GA	34°50′32″	85°08′28″	GA	1964-1975	12
938	03566687[h]	Little Chickamauga Creek tributary near Ringgold, GA	34°51′36″	85°08′40″	GA	1965-1974	10
939	03566700[h]	South Chickamauga Creek at Ringgold, GA	34°55′07″	85°07′32″	GA	1949-1965	17
940	03567200[h]	West Chickamauga Creek near Kensington, GA	34°48′10″	85°20′52″	GA	1950-1976	27
941	03567500	South Chickamauga Creek near Chickamauga, TN	35°00′51″	85°12′24″	TN	1929-1994	64
942	03568500	Chattanooga Creek near Flintstone, GA	34°58′20″	85°19′40″	GA	1951-1974	24
943	03568933	Lookout Creek near New England, GA	34°53′51″	85°27′47″	GA	1980-2006	27

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi², site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	50-percent chance exceedance			20-percent chance exceedance			10-percent chance exceedance			4-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02053110 (21)	53	64	55	101	130	108	141	183	153	201	259	222
02053170 (22)	346	299	335	650	578	630	892	797	863	1,240	1,100	1,190
02053200 (23)	2,010	2,030	2,010	3,220	3,670	3,240	4,200	4,910	4,250	5,670	6,540	5,760
02053500 (24)	836	889	847	1,390	1,660	1,460	1,810	2,250	1,930	2,400	3,030	2,610
02053510 (25)	211	96	204	253	192	249	279	270	278	308	378	314
02053550 (26)	222	249	228	428	484	444	608	670	629	892	923	905
02068500 (52)	4,610	4,310	4,570	7,600	7,140	7,520	10,000	9,220	9,830	13,600	11,900	13,100
02068610 (53)	129	< 1 mi²	< 1 mi²	186	< 1 mi²	< 1 mi²	226	< 1 mi²	< 1 mi²	279	< 1 mi²	< 1 mi²
02068660 (54)	624	476	606	949	854	934	1,180	1,130	1,170	1,500	1,500	1,500
02069030 (55)	881	915	887	1,510	1,610	1,530	2,020	2,110	2,050	2,800	2,760	2,780
02070500 (59)	6,590	5,960	6,550	11,300	9,800	11,200	15,200	12,500	14,900	21,100	16,000	20,400
02070810 (60)	879	966	894	1,560	1,690	1,590	2,130	2,220	2,160	3,010	2,900	2,970
02071000 (61)	17,900	15,500	17,800	25,100	24,600	25,100	29,800	31,000	29,900	35,700	38,800	35,800
02071410 (62)	979	795	940	1,660	1,400	1,590	2,170	1,840	2,070	2,910	2,420	2,730
02074000 (65)	15,200	10,000	13,800	24,400	16,200	21,600	31,400	20,600	27,100	41,400	25,900	34,100
02075160 (66)	844	1,530	966	1,660	2,630	1,880	2,350	3,430	2,650	3,390	4,450	3,760
02075230 (67)	906	538	866	1,380	961	1,320	1,740	1,270	1,650	2,250	1,680	2,110
02077200 (72)	1,960	1,900	1,950	3,800	3,250	3,710	5,310	4,220	5,090	7,530	5,460	6,980
02077210 (73)	44	< 1 mi²	< 1 mi²	78	< 1 mi²	< 1 mi²	106	< 1 mi²	< 1 mi²	148	< 1 mi²	< 1 mi²
02077240 (74)	732	585	703	1,270	1,040	1,210	1,710	1,380	1,610	2,360	1,820	2,150
02077250 (75)	2,020	2,170	2,070	3,770	3,700	3,740	5,250	4,800	5,030	7,520	6,190	6,770
02077310 (76)	178	237	183	261	435	278	316	584	345	385	782	434
02080500 (81)	78,100	58,600	78,000	103,000	89,200	103,000	121,000	110,000	120,000	144,000	134,000	143,000
02081000 (82)	50,900	57,900	51,100	77,900	88,400	78,400	99,400	109,000	100,000	131,000	133,000	131,000
02081060 (83)	73	119	83	149	238	173	216	332	252	317	464	373
02081110 (84)	643	403	598	1,010	772	954	1,280	1,060	1,220	1,660	1,450	1,590
0208111310 (85)	1,900	1,260	1,660	4,320	2,320	3,410	6,610	3,120	4,770	10,300	4,190	6,580
02081210 (86)	1,050	1,190	1,060	1,510	2,060	1,570	1,840	2,700	1,960	2,290	3,510	2,490
02081500 (87)	5,180	4,390	5,140	8,210	7,310	8,160	10,400	9,360	10,400	13,500	11,900	13,300
02081710 (88)	347	573	388	684	1,020	773	996	1,350	1,120	1,510	1,780	1,630
02081747 (89)	6,090	8,080	6,200	9,720	13,200	9,980	12,500	16,700	12,900	16,500	21,100	17,100
02081800 (90)	1,230	1,950	1,310	2,000	3,330	2,160	2,550	4,330	2,800	3,270	5,590	3,670
02082000 (91)	6,680	10,700	6,790	9,690	17,300	9,970	11,900	21,900	12,400	15,000	27,600	15,900
02082500 (92)	934	931	934	1,640	1,730	1,660	2,190	2,340	2,230	2,980	3,150	3,030
02082540 (93)	58	< 1 mi²	< 1 mi²	116	< 1 mi²	< 1 mi²	168	< 1 mi²	< 1 mi²	249	< 1 mi²	< 1 mi²
02082585 (94)	8,350	10,900	8,370	11,400	17,700	11,400	13,400	22,600	13,600	16,100	28,500	16,400
02082610 (95)	7,790	10,700	8,000	10,200	17,500	10,800	11,600	22,300	12,700	13,500	28,200	15,200
02082630 (96)	268	243	265	400	473	409	495	655	520	624	903	676
02082770 (97)	1,920	4,240	2,000	3,400	7,080	3,580	4,710	9,090	5,030	6,790	11,600	7,370
02082835 (98)	1,160	1,870	1,270	2,180	3,210	2,400	3,070	4,170	3,380	4,480	5,390	4,810
02082950 (99)	2,490	4,460	2,550	4,280	7,430	4,430	5,850	9,530	6,120	8,370	12,200	8,820
02083000 (100)	4,670	7,940	4,750	7,630	13,100	7,830	10,100	16,700	10,400	13,700	21,100	14,300
02083090 (101)	211	259	222	423	503	447	617	694	646	934	957	945
02083410 (102)	391	307	368	812	593	735	1,200	817	1,040	1,840	1,120	1,470
02083500 (103)	14,100	16,000	14,100	21,000	26,000	21,100	26,300	33,100	26,500	33,700	41,800	34,200
02083800 (104)	844	1,020	856	1,480	1,890	1,520	2,040	2,560	2,120	2,930	3,440	3,040
02084000 (105)	15,500	16,300	15,500	22,000	26,800	22,100	26,800	34,100	27,000	33,500	43,200	33,900
02084240 (106)	680	557	661	1,170	1,060	1,150	1,560	1,440	1,530	2,130	1,960	2,080

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	2-percent chance exceedance			1-percent chance exceedance			0.5-percent chance exceedance			0.2-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02053110 (21)	253	325	282	311	400	350	376	470	421	473	578	527
02053170 (22)	1,530	1,360	1,460	1,840	1,650	1,760	2,170	1,910	2,050	2,650	2,320	2,480
02053200 (23)	6,950	7,970	7,090	8,400	9,490	8,580	10,000	10,900	10,200	12,600	12,900	12,600
02053500 (24)	2,870	3,720	3,180	3,370	4,470	3,800	3,900	5,140	4,420	4,650	6,170	5,340
02053510 (25)	329	474	341	348	581	368	367	680	395	391	833	432
02053550 (26)	1,150	1,150	1,150	1,440	1,390	1,410	1,780	1,620	1,690	2,300	1,970	2,100
02068500 (52)	16,600	14,100	15,700	20,000	16,300	18,500	23,800	18,300	21,400	29,400	21,400	25,500
02068610 (53)	320	< 1 mi^2	< 1 mi^2	363	< 1 mi^2	< 1 mi^2	407	< 1 mi^2	< 1 mi^2	469	< 1 mi^2	< 1 mi^2
02068660 (54)	1,750	1,830	1,770	2,010	2,120	2,040	2,280	2,420	2,320	2,660	2,880	2,740
02069030 (55)	3,470	3,340	3,420	4,230	3,860	4,060	5,090	4,380	4,720	6,390	5,180	5,710
02070500 (59)	26,300	18,900	24,900	32,200	21,600	29,800	38,900	24,200	34,900	49,200	28,200	42,300
02070810 (60)	3,790	3,510	3,670	4,690	4,060	4,370	5,710	4,600	5,100	7,290	5,430	6,190
02071000 (61)	40,000	45,600	40,200	44,300	51,600	44,600	48,500	57,300	49,000	54,000	66,100	54,800
02071410 (62)	3,500	2,930	3,270	4,140	3,400	3,810	4,820	3,850	4,360	5,800	4,560	5,170
02074000 (65)	49,600	30,600	39,800	58,500	34,800	45,400	68,100	38,800	50,900	82,000	44,900	59,000
02075160 (66)	4,290	5,360	4,720	5,300	6,170	5,690	6,430	6,960	6,690	8,100	8,200	8,150
02075230 (67)	2,670	2,040	2,490	3,120	2,370	2,880	3,620	2,700	3,290	4,350	3,210	3,890
02077200 (72)	9,400	6,560	8,520	11,400	7,540	10,000	13,700	8,490	11,600	16,900	9,970	13,800
02077210 (73)	186	< 1 mi^2	< 1 mi^2	228	< 1 mi^2	< 1 mi^2	277	< 1 mi^2	< 1 mi^2	351	< 1 mi^2	< 1 mi^2
02077240 (74)	2,920	2,210	2,610	3,530	2,560	3,070	4,220	2,910	3,540	5,240	3,460	4,240
02077250 (75)	9,510	7,430	8,240	11,800	8,530	9,650	14,300	9,590	11,100	18,200	11,300	13,200
02077310 (76)	435	959	507	484	1,120	580	533	1,280	655	596	1,540	764
02080500 (81)	162,000	156,000	161,000	180,000	175,000	180,000	200,000	192,000	199,000	227,000	218,000	226,000
02081000 (82)	159,000	155,000	158,000	189,000	174,000	186,000	223,000	191,000	217,000	275,000	217,000	260,000
02081060 (83)	406	581	480	505	710	600	617	829	723	784	1,010	906
02081110 (84)	1,970	1,790	1,910	2,300	2,170	2,250	2,660	2,510	2,600	3,170	3,030	3,110
0208111310 (85)	13,700	5,130	8,050	17,700	6,140	9,590	22,300	7,040	11,000	29,400	8,420	13,200
02081210 (86)	2,630	4,240	2,940	2,990	4,890	3,400	3,370	5,530	3,880	3,890	6,530	4,580
02081500 (87)	15,900	14,200	15,700	18,400	16,200	18,100	21,100	18,200	20,600	24,900	21,200	24,200
02081710 (88)	1,990	2,170	2,080	2,570	2,520	2,540	3,260	2,860	3,020	4,380	3,400	3,740
02081747 (89)	19,800	25,000	20,700	23,300	28,300	24,300	27,200	31,600	28,200	32,900	36,600	33,900
02081800 (90)	3,820	6,720	4,380	4,380	7,720	5,110	4,950	8,690	5,850	5,720	10,200	6,920
02082000 (91)	17,500	32,600	18,800	20,100	36,900	21,900	22,900	41,100	25,300	27,000	47,500	30,200
02082500 (92)	3,620	3,870	3,710	4,320	4,630	4,440	5,080	5,320	5,180	6,160	6,380	6,260
02082540 (93)	322	< 1 mi^2	< 1 mi^2	405	< 1 mi^2	< 1 mi^2	501	< 1 mi^2	< 1 mi^2	647	< 1 mi^2	< 1 mi^2
02082585 (94)	18,200	33,800	18,700	20,400	38,500	21,100	22,600	43,000	23,500	25,700	49,800	27,000
02082610 (95)	14,800	33,500	17,200	16,100	38,100	19,200	17,300	42,500	21,100	19,000	49,400	23,900
02082630 (96)	725	1,120	809	831	1,360	956	943	1,580	1,110	1,100	1,920	1,330
02082770 (97)	8,710	13,900	9,540	11,000	15,800	12,000	13,700	17,700	14,700	18,000	20,700	18,800
02082835 (98)	5,750	6,490	6,060	7,220	7,450	7,330	8,920	8,390	8,640	11,600	9,860	10,600
02082950 (99)	10,700	14,500	11,300	13,400	16,500	14,100	16,700	18,500	17,100	21,900	21,600	21,800
02083000 (100)	16,900	25,100	17,700	20,500	28,700	21,600	24,500	32,000	25,700	30,700	37,200	32,000
02083090 (101)	1,230	1,190	1,210	1,580	1,440	1,500	2,000	1,680	1,800	2,670	2,030	2,250
02083410 (102)	2,440	1,390	1,840	3,140	1,690	2,240	3,970	1,960	2,640	5,300	2,370	3,220
02083500 (103)	39,900	49,500	40,600	46,600	56,600	47,500	53,900	63,100	54,900	64,600	73,000	65,800
02083800 (104)	3,740	4,220	3,860	4,690	5,060	4,810	5,820	5,820	5,820	7,610	6,970	7,330
02084000 (105)	38,900	51,300	39,600	44,700	58,800	45,800	51,000	65,700	52,400	60,100	76,200	61,900
02084240 (106)	2,610	2,420	2,550	3,140	2,910	3,060	3,720	3,360	3,580	4,580	4,050	4,340

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi², site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	50-percent chance exceedance			20-percent chance exceedance			10-percent chance exceedance			4-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02084500 (107)	249	261	250	400	508	411	510	701	533	658	966	704
02084520 (108)	106	78	99	194	158	185	264	222	252	367	313	348
02084540 (109)	448	499	453	792	949	812	1,080	1,300	1,120	1,530	1,770	1,590
02084557 (110)	186	461	194	256	879	276	304	1,200	338	365	1,640	425
02084570 (111)	632	574	619	1,160	1,080	1,140	1,600	1,480	1,560	2,260	2,010	2,160
02084909 (112)	1,100	883	1,070	1,650	1,550	1,630	2,050	2,040	2,050	2,610	2,670	2,620
02085000 (113)	2,790	2,400	2,770	4,340	4,080	4,330	5,480	5,280	5,470	7,040	6,800	7,020
02085020 (114)	89	< 1 mi²	< 1 mi²	166	< 1 mi²	< 1 mi²	229	< 1 mi²	< 1 mi²	324	< 1 mi²	< 1 mi²
02085070 (115)	4,880	3,930	4,780	8,430	6,570	8,220	11,000	8,430	10,600	14,300	10,800	13,700
02085190 (116)	158	161	158	274	299	279	369	403	377	509	544	520
0208521324 (117)	3,450	2,680	3,380	5,810	4,540	5,680	7,480	5,860	7,300	9,670	7,540	9,360
0208524090 (118)	734	611	685	1,490	1,090	1,300	2,140	1,440	1,760	3,140	1,890	2,370
02085500 (119)	6,910	4,080	6,790	10,800	6,800	10,600	13,600	8,730	13,300	17,500	11,100	16,900
02086000 (120)	339	434	346	607	782	625	832	1,040	861	1,180	1,380	1,220
0208650112 (121)	136	173	152	362	320	338	608	432	493	1,060	581	706
02086624 (122)	2,140	1,820	2,060	3,800	3,120	3,580	5,160	4,050	4,730	7,170	5,250	6,290
02087000 (123)	8,510	9,350	8,540	13,200	15,200	13,300	16,900	19,200	17,000	22,000	24,200	22,300
0208700780 (124)	889	711	860	1,340	1,260	1,320	1,640	1,660	1,650	2,040	2,180	2,070
02087030 (125)	701	871	704	829	1,530	842	904	2,010	929	993	2,630	1,040
02087140 (126)	111	< 1 mi²	< 1 mi²	196	< 1 mi²	< 1 mi²	263	< 1 mi²	< 1 mi²	359	< 1 mi²	< 1 mi²
02087183 (127)	6,920	11,800	7,000	9,650	19,100	9,880	11,700	24,100	12,100	14,400	30,200	15,200
02087240 (128)	50	< 1 mi²	< 1 mi²	86	< 1 mi²	< 1 mi²	114	< 1 mi²	< 1 mi²	155	< 1 mi²	< 1 mi²
02087500 (129)	9,740	15,300	9,830	13,300	24,500	13,500	15,700	30,800	16,000	18,800	38,400	19,500
02087570 (130)	8,760	15,400	8,820	11,400	24,500	11,600	13,300	30,900	13,600	15,800	38,600	16,400
02087580 (131)	1,410	1,140	1,370	2,110	1,990	2,090	2,610	2,610	2,610	3,290	3,400	3,310
02087910 (132)	543	644	562	985	1,140	1,020	1,350	1,510	1,400	1,900	1,990	1,940
02088000 (133)	1,500	1,820	1,520	2,850	3,210	2,890	4,060	4,230	4,080	5,970	5,550	5,890
02088140 (134)	575	523	563	1,120	992	1,080	1,610	1,350	1,510	2,420	1,850	2,140
02088210 (135)	140	114	132	297	228	270	447	319	387	701	446	558
02088420 (136)	504	249	416	1,040	481	811	1,500	663	1,110	2,210	912	1,510
02088470 (137)	1,650	3,850	1,800	2,630	6,530	2,970	3,370	8,440	3,920	4,380	10,900	5,310
02088500 (138)	2,290	3,830	2,330	3,670	6,530	3,770	4,780	8,490	4,960	6,410	11,000	6,750
02089000 (139)	12,700	17,200	12,800	18,300	27,900	18,700	22,500	35,400	23,200	28,200	44,600	29,400
0208925200 (140)	845	838	843	1,660	1,560	1,630	2,400	2,120	2,290	3,630	2,870	3,250
02089500 (141)	13,500	17,300	13,600	19,800	28,200	20,100	24,400	35,900	24,900	30,600	45,300	31,600
02090380 (142)	1,780	3,880	2,070	2,870	6,530	3,550	3,720	8,410	4,800	4,910	10,800	6,620
02090560 (143)	176	144	170	296	285	294	386	397	388	510	553	521
02090625 (144)	123	98	116	253	196	232	373	275	330	568	385	473
02090780 (145)	129	119	126	260	237	252	376	332	359	558	463	514
02090960 (146)	400	407	401	697	779	713	946	1,070	977	1,330	1,460	1,370
02091000 (147)	1,120	1,040	1,110	2,040	1,930	2,030	2,870	2,600	2,830	4,240	3,500	4,050
02091430 (148)	70	77	64	126	157	136	185	220	197	273	310	288
02091500 (149)	4,100	5,280	4,140	6,780	9,160	6,890	8,900	12,000	9,090	12,000	15,600	12,300
02091700 (150)	1,430	1,140	1,410	2,150	2,110	2,150	2,680	2,850	2,700	3,410	3,830	3,470
02091810 (151)	348	168	268	717	332	514	1,050	462	699	1,570	641	951
02091970 (152)	510	512	510	1,010	972	993	1,440	1,330	1,390	2,130	1,810	1,960
02092000 (153)	1,960	1,770	1,950	3,110	3,210	3,120	3,940	4,310	3,980	5,050	5,750	5,140
02092020 (154)	528	474	514	1,150	902	1,070	1,740	1,230	1,530	2,710	1,680	2,190

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi², site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	2-percent chance exceedance			1-percent chance exceedance			0.5-percent chance exceedance			0.2-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02084500 (107)	774	1,200	847	895	1,460	1,000	1,020	1,690	1,170	1,200	2,050	1,400
02084520 (108)	452	393	430	545	482	519	646	565	609	793	693	744
02084540 (109)	1,930	2,180	2,000	2,390	2,630	2,470	2,920	3,040	2,960	3,730	3,670	3,710
02084557 (110)	411	2,030	500	458	2,450	582	506	2,830	669	571	3,420	797
02084570 (111)	2,840	2,480	2,670	3,490	2,990	3,240	4,210	3,450	3,800	5,310	4,160	4,640
02084909 (112)	3,050	3,230	3,100	3,520	3,740	3,590	4,020	4,240	4,090	4,730	5,010	4,830
02085000 (113)	8,280	8,160	8,270	9,600	9,350	9,560	11,000	10,500	10,900	13,000	12,300	12,800
02085020 (114)	406	< 1 mi²	< 1 mi²	496	< 1 mi²	< 1 mi²	597	< 1 mi²	< 1 mi²	746	< 1 mi²	< 1 mi²
02085070 (115)	16,900	12,900	16,100	19,400	14,700	18,400	22,000	16,400	20,600	25,400	19,200	23,700
02085190 (116)	629	669	643	762	785	771	910	902	907	1,130	1,080	1,110
0208521324 (117)	11,300	9,030	10,900	13,000	10,300	12,500	14,700	11,600	14,000	16,900	13,600	16,000
0208524090 (118)	4,020	2,300	2,890	5,010	2,670	3,390	6,130	3,030	3,890	7,800	3,600	4,640
02085500 (119)	20,500	13,300	19,700	23,600	15,200	22,500	26,900	17,000	25,300	31,400	19,800	29,300
02086000 (120)	1,480	1,680	1,520	1,820	1,950	1,860	2,210	2,230	2,210	2,800	2,650	2,740
0208650112 (121)	1,530	715	889	2,120	839	1,070	2,870	963	1,250	4,140	1,160	1,520
02086624 (122)	8,880	6,310	7,580	10,800	7,250	8,840	12,900	8,170	10,100	16,000	9,600	12,000
02087000 (123)	26,300	28,600	26,600	31,000	32,400	31,200	36,000	36,100	36,000	43,400	41,700	43,000
0208700780 (124)	2,330	2,650	2,420	2,630	3,070	2,750	2,930	3,480	3,100	3,330	4,130	3,590
02087030 (125)	1,050	3,190	1,120	1,110	3,690	1,200	1,170	4,180	1,270	1,240	4,950	1,380
02087140 (126)	439	< 1 mi²	< 1 mi²	526	< 1 mi²	< 1 mi²	619	< 1 mi²	< 1 mi²	754	< 1 mi²	< 1 mi²
02087183 (127)	16,700	35,700	17,900	19,100	40,300	20,800	21,700	44,700	24,000	25,400	51,700	28,600
02087240 (128)	190	< 1 mi²	< 1 mi²	228	< 1 mi²	< 1 mi²	270	< 1 mi²	< 1 mi²	332	< 1 mi²	< 1 mi²
02087500 (129)	21,200	45,300	22,300	23,600	51,000	25,100	26,100	56,600	28,200	29,600	65,200	32,400
02087570 (130)	17,700	45,500	18,700	19,800	51,300	21,100	21,900	56,900	23,800	25,000	65,600	27,600
02087580 (131)	3,810	4,110	3,880	4,350	4,740	4,460	4,920	5,360	5,050	5,710	6,320	5,910
02087910 (132)	2,380	2,410	2,390	2,910	2,800	2,860	3,500	3,180	3,340	4,390	3,770	4,050
02088000 (133)	7,720	6,710	7,460	9,760	7,840	9,180	12,200	8,890	11,000	15,900	10,500	13,700
02088140 (134)	3,180	2,280	2,680	4,080	2,750	3,280	5,140	3,170	3,870	6,860	3,830	4,760
02088210 (135)	944	558	705	1,240	683	868	1,600	798	1,030	2,180	976	1,280
02088420 (136)	2,830	1,130	1,840	3,520	1,370	2,180	4,300	1,590	2,510	5,460	1,920	3,000
02088470 (137)	5,200	13,000	6,520	6,060	15,000	7,810	6,990	16,800	9,170	8,300	19,700	11,200
02088500 (138)	7,800	13,200	8,310	9,340	15,200	10,000	11,100	17,200	12,000	13,700	20,100	14,800
02089000 (139)	32,700	52,900	34,600	37,600	60,300	40,200	42,800	67,200	46,100	50,200	77,800	54,700
0208925200 (140)	4,790	3,520	4,080	6,170	4,230	4,990	7,820	4,870	5,890	10,500	5,840	7,230
02089500 (141)	35,600	53,700	37,100	40,800	61,500	42,900	46,400	68,500	49,100	54,400	79,400	58,000
02090380 (142)	5,900	12,900	8,190	6,970	14,800	9,810	8,130	16,600	11,500	9,810	19,400	14,000
02090560 (143)	608	691	633	712	843	755	821	984	879	974	1,200	1,060
02090625 (144)	748	482	595	961	591	732	1,210	691	868	1,610	847	1,070
02090780 (145)	720	579	648	907	708	797	1,120	828	947	1,450	1,010	1,170
02090960 (146)	1,660	1,810	1,720	2,040	2,190	2,100	2,470	2,530	2,500	3,130	3,060	3,090
02091000 (147)	5,510	4,300	5,130	7,040	5,150	6,330	8,880	5,920	7,600	11,900	7,090	9,490
02091430 (148)	349	389	367	433	478	456	526	560	544	663	688	678
02091500 (149)	14,600	18,800	15,100	17,400	22,100	18,100	20,600	25,000	21,300	25,300	29,400	26,100
02091700 (150)	3,990	4,700	4,120	4,610	5,620	4,810	5,270	6,460	5,540	6,210	7,730	6,600
02091810 (151)	2,030	799	1,160	2,570	974	1,400	3,190	1,130	1,620	4,140	1,380	1,960
02091970 (152)	2,740	2,230	2,450	3,450	2,690	2,990	4,270	3,110	3,520	5,520	3,750	4,300
02092000 (153)	5,920	7,020	6,080	6,820	8,370	7,080	7,750	9,580	8,110	9,040	11,400	9,570
02092020 (154)	3,610	2,080	2,760	4,670	2,510	3,360	5,930	2,900	3,950	7,920	3,500	4,830

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	50-percent chance exceedance			20-percent chance exceedance			10-percent chance exceedance			4-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02092120 (155)	869	576	803	1,590	1,090	1,440	2,220	1,490	1,940	3,220	2,020	2,650
02092290 (156)	217	172	208	390	340	376	539	472	517	772	655	723
02092500 (157)	1,880	1,680	1,870	3,320	3,060	3,300	4,580	4,100	4,520	6,560	5,480	6,380
02092520 (158)	236	199	227	438	390	425	604	541	584	852	749	812
02092620 (159)	142	123	135	367	245	307	616	342	454	1,090	478	664
02092720 (160)	606	796	650	1,300	1,490	1,370	1,990	2,020	2,000	3,190	2,730	2,950
02092780 (161)	122	170	134	264	335	289	402	466	430	642	647	645
02093000 (162)	1,540	1,150	1,520	2,810	2,120	2,760	3,930	2,870	3,820	5,720	3,850	5,420
02093040 (163)	114	60	97	217	123	186	300	174	253	419	245	345
02093070 (164)	777	510	702	1,580	969	1,350	2,310	1,320	1,870	3,500	1,800	2,590
02093290 (165)	480	1,320	553	764	2,290	919	967	2,990	1,210	1,240	3,890	1,640
02093500 (166)	1,670	4,410	1,790	3,020	7,330	3,320	4,190	9,400	4,710	6,040	12,000	6,940
02093800 (167)	936	1,130	945	1,690	1,970	1,700	2,260	2,570	2,280	3,060	3,360	3,090
02094000 (168)	658	954	676	1,130	1,670	1,180	1,520	2,190	1,610	2,140	2,870	2,280
02095000 (169)	1,650	1,560	1,640	2,890	2,690	2,870	3,960	3,510	3,880	5,630	4,550	5,360
02095500 (170)	2,110	1,650	2,080	3,600	2,840	3,530	4,830	3,700	4,690	6,680	4,800	6,350
02096500 (171)	11,500	10,100	11,400	17,600	16,400	17,500	22,200	20,700	22,100	28,600	26,100	28,400
02096660 (172)	1,290	903	1,190	2,340	1,590	2,110	3,210	2,080	2,790	4,480	2,730	3,700
02096700 (173)	3,840	3,470	3,820	5,380	5,810	5,410	6,340	7,480	6,430	7,480	9,570	7,680
02096740 (174)	226	393	277	570	710	629	933	945	939	1,590	1,260	1,390
02096846 (175)	688	588	674	1,090	1,050	1,090	1,400	1,380	1,400	1,840	1,830	1,840
02096850 (176)	1,860	1,550	1,810	2,880	2,680	2,840	3,600	3,490	3,580	4,560	4,530	4,550
02096960 (177)	24,600	16,400	24,500	36,200	26,100	36,000	44,500	32,800	44,200	55,600	40,900	55,000
02097010 (178)	179	224	185	315	413	332	423	554	450	578	743	621
02097314 (179)	2,150	2,630	2,260	4,470	4,460	4,470	6,560	5,760	6,240	9,860	7,400	8,680
0209741955 (180)	1,370	1,150	1,330	2,350	2,000	2,270	3,120	2,610	2,990	4,240	3,410	3,970
02097464 (181)	644	628	639	1,410	1,120	1,290	2,140	1,470	1,800	3,370	1,940	2,510
02097910 (182)	839	1,230	873	1,250	2,140	1,350	1,540	2,800	1,710	1,930	3,650	2,210
02098000 (183)	3,950	6,210	4,070	5,640	10,200	5,930	6,780	13,000	7,240	8,210	16,500	8,990
02098500 (184)	1,590	1,510	1,590	2,600	2,600	2,600	3,390	3,380	3,390	4,540	4,390	4,520
02099000 (185)	1,760	911	1,710	2,890	1,600	2,800	3,710	2,100	3,570	4,800	2,750	4,580
02099500 (186)	4,660	3,640	4,630	7,150	6,090	7,110	8,950	7,830	8,890	11,400	10,000	11,300
02100500 (187)	11,600	7,080	11,500	16,900	11,600	16,800	20,800	14,800	20,500	26,000	18,700	25,600
02101000 (188)	6,360	3,220	5,840	11,700	5,360	10,100	16,500	6,880	13,300	24,200	8,810	17,500
02101030 (189)	528	353	500	864	639	819	1,120	852	1,060	1,480	1,130	1,370
02101480 (190)	148	< 1 mi^2	< 1 mi^2	268	< 1 mi^2	< 1 mi^2	363	< 1 mi^2	< 1 mi^2	496	< 1 mi^2	< 1 mi^2
0210166029 (191)	404	582	432	704	1,040	773	950	1,370	1,060	1,320	1,810	1,480
02101800 (192)	1,080	939	1,060	1,960	1,650	1,910	2,670	2,160	2,570	3,700	2,830	3,480
02101890 (193)	2,950	1,830	2,800	4,490	3,130	4,260	5,630	4,070	5,310	7,180	5,260	6,680
02102000 (194)	21,500	17,000	21,400	29,400	27,000	29,300	35,100	33,900	35,100	42,800	42,300	42,800
02102500 (195)	41,800	30,200	41,600	57,100	47,100	56,800	68,100	58,600	67,700	82,900	72,500	82,300
02102908 (196)	119	119	119	195	202	195	250	264	252	325	345	328
02102910 (197)	92	47	80	169	80	137	235	105	178	339	138	233
02102930 (198)	886	388	768	1,500	644	1,260	1,970	837	1,590	2,620	1,090	2,010
02103000 (199)	2,740	2,180	2,670	3,900	3,500	3,850	4,680	4,500	4,650	5,660	5,800	5,680
02103390 (200)	122	119	122	200	201	200	260	263	260	345	344	345
02103500 (201)	3,590	2,700	3,540	5,560	4,330	5,450	7,080	5,570	6,910	9,260	7,180	8,930
02104000 (202)	46,000	29,500	45,600	63,800	46,100	63,200	76,400	57,600	75,600	93,300	71,500	91,900

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	2-percent chance exceedance			1-percent chance exceedance			0.5-percent chance exceedance			0.2-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02092120 (155)	4,120	2,490	3,260	5,180	3,000	3,920	6,410	3,470	4,590	8,350	4,170	5,560
02092290 (156)	981	817	904	1,220	995	1,110	1,500	1,160	1,310	1,940	1,410	1,620
02092500 (157)	8,370	6,690	8,010	10,500	7,980	9,840	13,000	9,130	11,800	16,900	10,900	14,700
02092520 (158)	1,060	932	1,010	1,300	1,130	1,220	1,550	1,320	1,440	1,930	1,610	1,760
02092620 (159)	1,590	597	842	2,250	730	1,040	3,100	853	1,230	4,610	1,040	1,510
02092720 (160)	4,360	3,360	3,770	5,820	4,030	4,660	7,620	4,650	5,560	10,700	5,580	6,880
02092780 (161)	876	807	835	1,170	983	1,050	1,520	1,150	1,260	2,110	1,400	1,590
02093000 (162)	7,370	4,720	6,820	9,300	5,650	8,380	11,600	6,490	10,000	15,200	7,770	12,500
02093040 (163)	518	309	421	624	380	503	738	447	584	902	550	704
02093070 (164)	4,600	2,230	3,200	5,900	2,690	3,850	7,440	3,110	4,490	9,870	3,750	5,430
02093290 (165)	1,450	4,700	2,000	1,660	5,410	2,380	1,890	6,110	2,790	2,200	7,210	3,380
02093500 (166)	7,720	14,300	8,980	9,670	16,300	11,300	12,000	18,200	13,700	15,500	21,200	17,500
02093800 (167)	3,700	4,060	3,740	4,370	4,680	4,410	5,080	5,300	5,110	6,060	6,250	6,100
02094000 (168)	2,690	3,470	2,880	3,330	4,010	3,520	4,060	4,550	4,230	5,210	5,380	5,280
02095000 (169)	7,130	5,480	6,630	8,870	6,310	7,950	10,900	7,110	9,320	14,100	8,370	11,400
02095500 (170)	8,280	5,780	7,740	10,100	6,640	9,190	12,200	7,490	10,700	15,300	8,810	12,900
02096500 (171)	33,800	30,900	33,500	39,300	34,900	38,700	45,300	38,800	44,300	53,900	44,900	52,200
02096660 (172)	5,570	3,300	4,450	6,760	3,820	5,190	8,080	4,320	5,920	10,000	5,110	7,010
02096700 (173)	8,290	11,400	8,620	9,070	13,100	9,550	9,810	14,700	10,500	10,800	17,100	11,700
02096740 (174)	2,240	1,530	1,760	3,070	1,780	2,130	4,100	2,030	2,510	5,840	2,430	3,090
02096846 (175)	2,200	2,220	2,200	2,580	2,580	2,580	3,000	2,930	2,970	3,600	3,480	3,550
02096850 (176)	5,300	5,450	5,350	6,060	6,270	6,130	6,850	7,080	6,930	7,930	8,330	8,080
02096960 (177)	64,400	48,200	63,500	73,500	54,300	72,200	83,100	60,100	81,200	96,500	69,300	93,700
02097010 (178)	707	912	769	847	1,070	923	998	1,220	1,080	1,220	1,460	1,320
02097314 (179)	12,800	8,870	10,700	16,300	10,200	12,700	20,200	11,400	14,700	26,300	13,400	17,600
0209741955 (180)	5,180	4,120	4,780	6,210	4,750	5,590	7,330	5,370	6,420	8,960	6,340	7,640
02097464 (181)	4,520	2,360	3,110	5,910	2,740	3,680	7,560	3,110	4,260	10,200	3,690	5,120
02097910 (182)	2,240	4,400	2,630	2,550	5,080	3,080	2,880	5,740	3,540	3,330	6,770	4,210
02098000 (183)	9,280	19,600	10,400	10,400	22,300	11,800	11,400	24,900	13,300	12,900	28,900	15,300
02098500 (184)	5,510	5,300	5,470	6,590	6,090	6,460	7,770	6,880	7,510	9,530	8,100	9,050
02099000 (185)	5,650	3,330	5,350	6,530	3,850	6,110	7,440	4,360	6,870	8,680	5,160	7,920
02099500 (186)	13,300	12,000	13,100	15,200	13,700	15,100	17,300	15,300	17,000	20,200	17,900	19,800
02100500 (187)	30,100	22,200	29,500	34,500	25,100	33,600	39,100	28,000	37,900	45,700	32,500	43,900
02101000 (188)	31,300	10,500	20,800	39,700	12,000	24,000	49,700	13,400	27,100	65,600	15,700	31,600
02101030 (189)	1,770	1,380	1,640	2,080	1,610	1,910	2,410	1,840	2,180	2,890	2,200	2,590
02101480 (190)	604	< 1 mi^2	< 1 mi^2	719	< 1 mi^2	< 1 mi^2	841	< 1 mi^2	< 1 mi^2	1,010	< 1 mi^2	< 1 mi^2
0210166029 (191)	1,630	2,200	1,840	1,980	2,550	2,220	2,370	2,900	2,610	2,960	3,450	3,200
02101800 (192)	4,570	3,420	4,230	5,530	3,950	4,990	6,570	4,480	5,770	8,110	5,300	6,900
02101890 (193)	8,410	6,330	7,800	9,720	7,270	8,920	11,100	8,190	10,100	13,100	9,630	11,700
02102000 (194)	48,900	49,700	48,900	55,300	56,000	55,400	62,100	62,100	62,100	71,700	71,400	71,700
02102500 (195)	94,800	84,900	94,000	107,000	95,100	106,000	121,000	105,000	119,000	139,000	120,000	137,000
02102908 (196)	384	404	388	446	462	449	511	531	515	600	608	602
02102910 (197)	433	162	273	541	186	313	667	214	358	863	245	413
02102930 (198)	3,150	1,280	2,320	3,710	1,460	2,620	4,300	1,670	2,940	5,140	1,910	3,340
02103000 (199)	6,380	6,770	6,460	7,100	7,680	7,230	7,820	8,820	8,060	8,780	10,100	9,130
02103390 (200)	415	403	411	492	461	480	574	530	556	695	607	655
02103500 (201)	11,100	8,390	10,500	13,100	9,530	12,200	15,300	10,900	14,100	18,500	12,500	16,600
02104000 (202)	107,000	83,800	105,000	120,000	94,100	118,000	135,000	104,000	131,000	156,000	120,000	150,000

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi², site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	50-percent chance exceedance			20-percent chance exceedance			10-percent chance exceedance			4-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02104080 (203)	177	265	192	320	514	364	440	710	515	621	978	745
02104220 (204)	600	809	620	887	1,330	932	1,070	1,720	1,150	1,300	2,230	1,430
02104500 (205)	2,130	2,130	2,130	3,630	3,610	3,620	4,820	4,730	4,790	6,540	6,180	6,410
02105500 (206)	36,800	29,400	36,600	45,600	46,100	45,600	51,000	57,700	51,200	57,500	71,800	58,000
02105570 (207)	148	323	201	386	623	488	651	858	760	1,160	1,180	1,170
02105630 (208)	491	860	565	1,010	1,600	1,180	1,490	2,180	1,740	2,300	2,940	2,600
02105769 (209)	32,900	29,400	32,400	47,600	46,200	47,300	57,800	58,100	57,900	71,200	72,400	71,500
02105900 (210)	794	443	731	1,510	845	1,360	2,120	1,160	1,860	3,030	1,580	2,540
02106000 (211)	868	1,140	888	1,490	2,110	1,550	1,980	2,840	2,090	2,710	3,820	2,900
02106240 (212)	410	360	398	772	692	749	1,060	950	1,030	1,480	1,300	1,410
02106410 (213)	58	< 1 mi²	< 1 mi²	97	< 1 mi²	< 1 mi²	128	< 1 mi²	< 1 mi²	172	< 1 mi²	< 1 mi²
02106500 (214)	4,240	4,140	4,240	7,420	7,320	7,410	10,100	9,680	10,100	14,200	12,700	14,000
02106910 (215)	554	575	558	1,110	1,090	1,110	1,640	1,480	1,580	2,510	2,020	2,270
02107000 (216)	2,000	2,840	2,040	3,000	5,090	3,130	3,720	6,780	3,950	4,680	8,970	5,090
02107500 (217)	493	1,260	537	734	2,320	842	906	3,120	1,090	1,140	4,190	1,460
02107590 (218)	33	< 1 mi²	< 1 mi²	70	< 1 mi²	< 1 mi²	102	< 1 mi²	< 1 mi²	151	< 1 mi²	< 1 mi²
02107600 (219)	957	738	916	1,600	1,380	1,550	2,090	1,880	2,030	2,770	2,550	2,700
02107620 (220)	139	235	166	310	458	367	481	633	553	780	874	834
02107980 (221)	1,090	797	1,010	2,110	1,490	1,900	3,030	2,020	2,610	4,470	2,740	3,610
02108000 (222)	4,960	3,820	4,920	8,100	6,780	8,030	10,700	8,990	10,500	14,500	11,800	14,200
02108500 (223)	1,530	943	1,440	2,610	1,750	2,450	3,460	2,380	3,220	4,700	3,200	4,270
02108548 (224)	284	229	282	347	446	350	383	617	391	423	852	440
02108610 (225)	136	70	105	336	142	232	530	200	331	851	282	468
02108630 (226)	327	272	309	732	528	643	1,140	728	924	1,870	1,000	1,320
02108960 (227)	417	375	410	703	719	706	927	987	942	1,250	1,350	1,280
02109500 (228)	3,970	4,150	3,980	6,700	7,340	6,750	8,930	9,720	9,010	12,300	12,800	12,300
02109640 (229)	425	364	410	802	700	771	1,120	961	1,060	1,590	1,320	1,480
02110020 (230)	153	136	148	325	271	305	482	378	436	732	526	625
02111000 (232)	1,230	1,500	1,250	2,530	2,590	2,540	3,780	3,420	3,730	5,920	4,540	5,620
02111180 (233)	3,280	2,330	3,200	6,900	3,950	6,520	10,400	5,170	9,440	16,300	6,810	13,700
02111340 (234)	458	804	505	769	1,420	891	1,020	1,890	1,230	1,390	2,540	1,740
02111500 (235)	3,410	3,440	3,410	5,550	5,750	5,560	7,240	7,470	7,250	9,680	9,720	9,680
02112000 (236)	12,700	12,400	12,700	21,600	19,800	21,400	29,200	25,100	28,700	41,300	32,000	39,400
02112120 (237)	5,670	4,290	5,570	11,100	7,120	10,800	15,800	9,200	15,000	22,800	11,900	20,900
02112247 (238)	3,280	1,620	2,990	4,650	2,780	4,240	5,600	3,620	5,090	6,830	4,710	6,180
02112360 (239)	3,340	2,920	3,330	5,210	4,920	5,200	6,410	6,370	6,410	7,860	8,260	7,880
02112410 (240)	1,830	2,160	1,860	2,660	3,680	2,780	3,230	4,800	3,440	3,970	6,250	4,350
02112500 (241)	4,760	3,660	4,640	6,560	6,130	6,500	7,750	7,890	7,780	9,280	10,100	9,430
02113000 (242)	5,310	3,900	5,260	8,770	6,510	8,640	11,600	8,380	11,300	15,800	10,800	15,200
02113850 (243)	6,410	5,740	6,390	10,900	9,450	10,800	14,100	12,100	14,000	18,400	15,400	18,200
02114010 (244)	8,020	6,560	7,910	13,300	10,800	13,100	17,100	13,700	16,800	22,000	17,400	21,400
02114450 (245)	3,020	1,810	2,870	5,400	3,110	5,090	7,180	4,040	6,680	9,590	5,230	8,720
02115500 (246)	1,160	1,180	1,160	1,710	2,060	1,730	2,090	2,690	2,140	2,600	3,510	2,700
02115520 (247)	223	< 1 mi²	< 1 mi²	361	< 1 mi²	< 1 mi²	458	< 1 mi²	< 1 mi²	586	< 1 mi²	< 1 mi²
02115540 (248)	1,600	1,020	1,420	2,910	1,790	2,480	4,010	2,340	3,250	5,640	3,060	4,260
02115830 (249)	208	249	216	398	456	415	570	611	585	849	817	834
02115856 (250)	2,690	2,390	2,680	3,300	4,070	3,340	3,650	5,260	3,740	4,050	6,780	4,230
02115860 (251)	4,290	4,710	4,350	7,080	7,820	7,220	9,190	10,000	9,370	12,100	12,700	12,300

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi², site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	2-percent chance exceedance			1-percent chance exceedance			0.5-percent chance exceedance			0.2-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02104080 (203)	779	1,210	948	957	1,470	1,180	1,160	1,710	1,420	1,460	2,080	1,780
02104220 (204)	1,470	2,610	1,640	1,630	2,980	1,860	1,790	3,420	2,090	2,000	3,910	2,380
02104500 (205)	7,980	7,370	7,730	9,550	8,550	9,100	11,300	9,790	10,600	13,800	11,400	12,500
02105500 (206)	62,100	84,200	63,100	66,600	94,800	68,000	71,000	105,000	72,900	76,700	121,000	79,500
02105570 (207)	1,690	1,460	1,530	2,390	1,770	1,930	3,300	2,050	2,320	4,920	2,480	2,900
02105630 (208)	3,080	3,610	3,360	4,020	4,330	4,200	5,150	4,990	5,050	6,990	5,990	6,320
02105769 (209)	81,500	84,900	82,500	92,100	95,900	93,300	103,000	107,000	104,000	118,000	122,000	120,000
02105900 (210)	3,820	1,950	3,090	4,710	2,360	3,680	5,700	2,730	4,270	7,190	3,300	5,120
02106000 (211)	3,330	4,680	3,610	4,020	5,610	4,400	4,780	6,440	5,240	5,920	7,710	6,480
02106240 (212)	1,830	1,610	1,730	2,200	1,950	2,080	2,600	2,260	2,430	3,170	2,740	2,940
02106410 (213)	208	< 1 mi²	< 1 mi²	247	< 1 mi²	< 1 mi²	289	< 1 mi²	< 1 mi²	350	< 1 mi²	< 1 mi²
02106500 (214)	17,800	15,400	17,400	21,900	18,200	21,100	26,600	20,700	25,100	33,800	24,500	30,900
02106910 (215)	3,350	2,490	2,870	4,360	3,000	3,540	5,590	3,460	4,200	7,590	4,170	5,190
02107000 (216)	5,430	10,900	6,060	6,220	12,900	7,100	7,040	14,800	8,200	8,180	17,500	9,790
02107500 (217)	1,320	5,130	1,780	1,500	6,140	2,140	1,700	7,040	2,520	1,970	8,420	3,090
02107590 (218)	194	< 1 mi²	< 1 mi²	241	< 1 mi²	< 1 mi²	294	< 1 mi²	< 1 mi²	371	< 1 mi²	< 1 mi²
02107600 (219)	3,340	3,130	3,260	3,940	3,770	3,870	4,580	4,340	4,480	5,510	5,220	5,380
02107620 (220)	1,080	1,090	1,080	1,440	1,320	1,360	1,900	1,530	1,630	2,660	1,860	2,050
02107980 (221)	5,790	3,370	4,450	7,320	4,040	5,360	9,090	4,660	6,250	11,900	5,590	7,570
02108000 (222)	17,800	14,300	17,300	21,500	17,000	20,800	25,700	19,300	24,400	32,100	22,900	29,900
02108500 (223)	5,730	3,930	5,140	6,860	4,710	6,060	8,090	5,420	7,000	9,900	6,500	8,360
02108548 (224)	450	1,060	475	475	1,290	511	498	1,500	545	527	1,820	590
02108610 (225)	1,150	355	580	1,490	436	700	1,890	512	815	2,500	629	987
02108630 (226)	2,590	1,240	1,660	3,500	1,510	2,040	4,640	1,750	2,400	6,570	2,130	2,950
02108960 (227)	1,520	1,670	1,570	1,800	2,020	1,880	2,120	2,350	2,210	2,570	2,840	2,690
02109500 (228)	15,100	15,500	15,200	18,400	18,300	18,400	22,000	20,800	21,700	27,500	24,600	26,600
02109640 (229)	2,000	1,630	1,830	2,450	1,970	2,210	2,960	2,290	2,600	3,720	2,770	3,160
02110020 (230)	960	658	787	1,230	803	966	1,530	937	1,140	2,010	1,140	1,410
02111000 (232)	8,000	5,340	7,250	10,600	6,320	9,100	13,700	7,160	11,000	18,900	8,460	13,900
02111180 (233)	21,900	8,000	17,200	28,800	9,420	21,000	37,200	10,600	24,700	51,100	12,500	30,100
02111340 (234)	1,710	3,000	2,160	2,070	3,560	2,640	2,460	4,050	3,140	3,060	4,810	3,880
02111500 (235)	11,700	11,400	11,700	14,000	13,400	13,900	16,400	15,000	16,200	20,100	17,700	19,600
02112000 (236)	52,300	37,300	48,400	65,100	43,200	58,200	80,100	48,300	68,400	104,000	56,100	83,200
02112120 (237)	28,900	14,000	25,700	35,800	16,300	30,600	43,300	18,300	35,600	54,700	21,400	42,500
02112247 (238)	7,770	5,660	7,070	8,740	6,520	7,940	9,730	7,350	8,820	11,100	8,650	10,100
02112360 (239)	8,890	9,800	8,940	9,870	11,300	9,960	10,800	12,800	11,000	12,000	15,000	12,300
02112410 (240)	4,540	7,440	5,090	5,120	8,630	5,850	5,710	9,730	6,630	6,510	11,400	7,750
02112500 (241)	10,400	12,100	10,800	11,600	13,900	12,100	12,700	15,600	13,400	14,300	18,200	15,400
02113000 (242)	19,400	12,800	18,400	23,400	14,700	21,700	28,000	16,500	25,300	34,900	19,300	30,500
02113850 (243)	21,800	18,300	21,500	25,300	20,900	24,800	28,800	23,300	28,100	33,600	27,200	32,600
02114010 (244)	25,700	20,700	25,000	29,500	23,600	28,500	33,400	26,300	32,000	38,500	30,600	36,700
02114450 (245)	11,500	6,290	10,300	13,400	7,230	11,700	15,400	8,150	13,200	18,200	9,570	15,200
02115500 (246)	3,000	4,230	3,160	3,410	4,880	3,640	3,830	5,520	4,130	4,420	6,510	4,840
02115520 (247)	684	< 1 mi²	< 1 mi²	784	< 1 mi²	< 1 mi²	886	< 1 mi²	< 1 mi²	1,020	< 1 mi²	< 1 mi²
02115540 (248)	7,050	3,700	5,110	8,630	4,280	5,930	10,400	4,840	6,750	13,000	5,720	7,970
02115830 (249)	1,110	1,000	1,050	1,410	1,170	1,270	1,780	1,340	1,500	2,360	1,610	1,860
02115856 (250)	4,320	8,130	4,590	4,580	9,320	4,940	4,830	10,500	5,280	5,130	12,300	5,740
02115860 (251)	14,500	15,200	14,700	17,000	17,300	17,100	19,700	19,400	19,600	23,500	22,500	23,100

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi², site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	50-percent chance exceedance			20-percent chance exceedance			10-percent chance exceedance			4-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02115900 (252)	1,270	1,820	1,330	1,960	3,120	2,090	2,440	4,050	2,670	3,090	5,240	3,460
02116500 (253)	30,300	28,100	30,200	44,100	43,800	44,000	54,300	54,600	54,300	68,600	68,000	68,500
02117030 (254)	96	164	110	182	304	215	254	410	305	364	553	438
02117410 (255)	231	180	228	318	334	319	373	450	379	439	606	454
02117500 (256)	2,720	3,360	2,770	4,270	5,630	4,390	5,370	7,270	5,570	6,810	9,370	7,150
02118000 (257)	4,000	6,840	4,090	6,490	11,200	6,700	8,390	14,300	8,730	11,100	18,100	11,600
02118500 (258)	4,940	4,560	4,920	7,680	7,560	7,670	9,500	9,710	9,510	11,800	12,500	11,800
02119000 (259)	6,930	10,400	7,020	10,100	16,800	10,400	12,600	21,300	13,100	15,900	26,900	16,900
02120500 (260)	1,440	2,880	1,560	2,090	4,870	2,370	2,540	6,280	3,000	3,140	8,060	3,900
02120780 (261)	2,570	3,500	2,630	3,920	5,880	4,110	4,950	7,560	5,270	6,410	9,670	6,940
02120820 (262)	577	382	522	1,050	691	928	1,420	919	1,230	1,950	1,220	1,620
02121000 (263)	54,400	35,900	52,900	79,900	55,400	77,700	97,300	68,900	94,200	119,000	85,200	115,000
02121180 (264)	577	689	600	940	1,220	1,010	1,210	1,610	1,330	1,590	2,120	1,770
02121500 (265)	4,300	4,510	4,320	6,970	7,500	7,030	8,880	9,600	8,970	11,400	12,200	11,500
02121940 (266)	454	537	462	687	960	722	857	1,270	921	1,090	1,680	1,200
02122560 (267)	857	866	858	957	1,520	962	1,010	2,000	1,020	1,070	2,620	1,090
02122720 (268)	398	316	380	716	575	675	989	768	910	1,410	1,020	1,240
02123500 (269)	7,900	6,990	7,870	10,900	11,500	11,000	13,000	14,600	13,100	15,800	18,400	16,000
02123567 (270)	390	353	382	721	640	701	986	853	946	1,370	1,140	1,290
02124060 (271)	577	365	526	1,080	660	948	1,510	879	1,270	2,190	1,170	1,710
02124130 (272)	1,680	1,130	1,630	2,430	1,970	2,370	2,950	2,580	2,890	3,660	3,370	3,600
02125000 (273)	4,750	2,150	4,580	7,190	3,670	6,930	8,870	4,750	8,520	11,000	6,130	10,500
02125410 (274)	1,440	598	1,260	2,340	1,060	2,020	3,000	1,410	2,540	3,890	1,850	3,200
02126000 (275)	33,600	17,200	33,200	47,900	27,400	47,400	57,100	34,300	56,400	68,200	42,800	67,200
02127000 (276)	2,180	3,340	2,250	4,110	5,620	4,250	5,860	7,230	6,040	8,690	9,260	8,810
02127390 (277)	180	< 1 mi²	< 1 mi²	286	< 1 mi²	< 1 mi²	362	< 1 mi²	< 1 mi²	463	< 1 mi²	< 1 mi²
02128000 (278)	4,500	3,270	4,430	6,940	5,490	6,840	8,670	7,070	8,540	11,000	9,060	10,800
02128260 (279)	1,030	633	948	1,750	1,100	1,570	2,350	1,440	2,040	3,270	1,880	2,670
02129440 (280)	852	944	859	1,220	1,650	1,260	1,480	2,160	1,560	1,820	2,830	1,970
02129530 (281)	17	< 1 mi²	< 1 mi²	29	< 1 mi²	< 1 mi²	38	< 1 mi²	< 1 mi²	53	< 1 mi²	< 1 mi²
02132230 (290)	109	194	122	196	380	233	269	528	332	378	731	486
02132320 (291)	418	926	465	652	1,640	762	822	2,180	1,000	1,050	2,890	1,360
02133500 (293)	1,320	1,330	1,320	2,340	2,150	2,320	3,250	2,780	3,180	4,720	3,590	4,480
02133590 (294)	79	83	79	117	140	119	143	184	148	176	241	186
02133624 (295)	1,710	2,300	1,750	2,380	3,740	2,490	2,820	4,830	2,990	3,350	6,240	3,650
02133960 (296)	474	644	486	651	1,210	695	768	1,640	848	916	2,220	1,060
02134380 (297)	236	366	247	347	703	378	423	965	479	521	1,320	620
02134480 (298)	1,380	2,050	1,480	2,400	3,710	2,620	3,190	4,970	3,550	4,310	6,610	4,880
02134500 (299)	4,970	5,970	5,000	7,870	10,100	7,940	10,000	13,300	10,100	12,900	17,200	13,100
02137000 (304)	1,110	1,160	1,120	1,810	2,010	1,830	2,380	2,670	2,420	3,240	3,560	3,300
02137727 (305)	5,380	4,740	5,270	9,730	7,820	9,340	13,200	10,100	12,400	18,100	13,200	16,600
02138000 (306)	6,950	6,050	6,890	12,400	9,870	12,100	17,300	12,700	16,600	25,300	16,500	23,300
02138500 (307)	4,430	2,880	4,320	8,680	4,840	8,240	12,700	6,320	11,600	19,400	8,300	16,700
02138680 (308)	58	< 1 mi²	< 1 mi²	94	< 1 mi²	< 1 mi²	120	< 1 mi²	< 1 mi²	157	< 1 mi²	< 1 mi²
02140980 (309)	233	216	229	422	400	416	579	546	568	814	746	787
02140991 (310)	7,670	6,580	7,380	15,900	10,700	14,100	23,300	13,800	19,300	34,900	17,800	26,100
02141130 (311)	460	600	494	782	1,070	867	1,030	1,430	1,170	1,370	1,910	1,590
02141890 (312)	954	1,060	969	1,560	1,850	1,610	2,030	2,440	2,130	2,710	3,240	2,860

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	2-percent chance exceedance			1-percent chance exceedance			0.5-percent chance exceedance			0.2-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02115900 (252)	3,590	6,300	4,120	4,100	7,240	4,790	4,630	8,160	5,480	5,350	9,590	6,490
02116500 (253)	80,200	79,400	80,100	92,700	89,700	92,200	106,000	99,300	105,000	126,000	114,000	123,000
02117030 (254)	458	680	555	564	799	676	681	917	803	857	1,100	992
02117410 (255)	487	744	513	533	874	571	578	1,000	630	637	1,200	712
02117500 (256)	7,930	11,100	8,420	9,060	12,800	9,730	10,200	14,400	11,100	11,800	16,900	13,000
02118000 (257)	13,200	21,500	14,100	15,600	24,500	16,700	18,100	27,300	19,500	21,700	31,800	23,500
02118500 (258)	13,500	14,800	13,600	15,100	17,000	15,300	16,700	19,000	17,000	18,800	22,200	19,300
02119000 (259)	18,700	31,800	20,100	21,700	36,100	23,600	24,900	40,200	27,300	29,700	46,500	32,800
02120500 (260)	3,600	9,660	4,670	4,080	11,000	5,450	4,580	12,400	6,290	5,270	14,500	7,500
02120780 (261)	7,600	11,600	8,380	8,890	13,200	9,880	10,300	14,800	11,500	12,300	17,300	13,800
02120820 (262)	2,390	1,490	1,950	2,870	1,740	2,280	3,380	1,980	2,600	4,120	2,360	3,080
02121000 (263)	136,000	99,400	130,000	153,000	112,000	145,000	170,000	124,000	160,000	192,000	142,000	180,000
02121180 (264)	1,890	2,570	2,150	2,210	2,980	2,530	2,560	3,380	2,920	3,040	4,010	3,500
02121500 (265)	13,400	14,600	13,600	15,400	16,600	15,600	17,400	18,600	17,700	20,200	21,700	20,600
02121940 (266)	1,270	2,040	1,440	1,460	2,370	1,690	1,660	2,700	1,950	1,950	3,210	2,330
02122560 (267)	1,110	3,180	1,140	1,150	3,670	1,180	1,180	4,160	1,220	1,220	4,930	1,280
02122720 (268)	1,790	1,250	1,520	2,230	1,460	1,810	2,730	1,670	2,100	3,510	1,990	2,540
02123500 (269)	17,900	21,900	18,300	20,100	24,800	20,600	22,400	27,700	23,000	25,500	32,200	26,500
02123567 (270)	1,690	1,390	1,570	2,030	1,620	1,850	2,400	1,850	2,140	2,940	2,200	2,550
02124060 (271)	2,790	1,430	2,070	3,470	1,660	2,430	4,260	1,900	2,800	5,470	2,260	3,340
02124130 (272)	4,220	4,070	4,180	4,800	4,700	4,770	5,410	5,310	5,380	6,260	6,270	6,260
02125000 (273)	12,700	7,360	12,000	14,300	8,440	13,400	16,000	9,500	14,900	18,300	11,200	16,800
02125410 (274)	4,600	2,250	3,720	5,330	2,620	4,220	6,090	2,970	4,710	7,150	3,530	5,430
02126000 (275)	76,200	50,400	74,900	83,900	56,700	82,300	91,400	62,800	89,400	101,000	72,300	98,700
02127000 (276)	11,300	11,100	11,300	14,500	12,600	13,900	18,200	14,200	16,700	24,200	16,600	20,900
02127390 (277)	542	< 1 mi^2	< 1 mi^2	624	< 1 mi^2	< 1 mi^2	708	< 1 mi^2	< 1 mi^2	824	< 1 mi^2	< 1 mi^2
02128000 (278)	12,800	10,800	12,500	14,600	12,400	14,200	16,500	13,900	16,000	19,100	16,200	18,500
02128260 (279)	4,060	2,260	3,190	4,960	2,600	3,700	5,990	2,950	4,230	7,550	3,470	5,000
02129440 (280)	2,080	3,420	2,310	2,350	3,950	2,660	2,630	4,470	3,030	3,020	5,280	3,570
02129530 (281)	65	< 1 mi^2	< 1 mi^2	79	< 1 mi^2	< 1 mi^2	94	< 1 mi^2	< 1 mi^2	117	< 1 mi^2	< 1 mi^2
02132230 (290)	473	910	625	579	1,110	784	699	1,290	949	878	1,570	1,200
02132320 (291)	1,230	3,480	1,650	1,420	4,090	1,980	1,610	4,690	2,330	1,890	5,530	2,820
02133500 (293)	6,090	4,200	5,580	7,720	4,770	6,740	9,660	5,470	8,040	12,800	6,250	9,810
02133590 (294)	200	283	216	226	324	246	251	371	278	285	426	320
02133624 (295)	3,740	7,320	4,160	4,120	8,340	4,670	4,500	9,570	5,220	5,000	11,000	5,940
02133960 (296)	1,030	2,720	1,230	1,140	3,270	1,420	1,250	3,770	1,610	1,400	4,520	1,890
02134380 (297)	596	1,640	740	672	1,980	871	749	2,300	1,010	854	2,780	1,210
02134480 (298)	5,220	8,050	6,010	6,190	9,590	7,250	7,230	11,000	8,530	8,710	13,100	10,400
02134500 (299)	15,300	20,600	15,600	17,700	24,000	18,200	20,300	27,300	21,000	23,900	31,900	24,900
02137000 (304)	3,980	4,200	4,030	4,820	4,970	4,860	5,770	5,640	5,720	7,210	6,680	7,000
02137727 (305)	22,200	15,400	19,800	26,500	18,100	23,200	31,200	20,400	26,600	37,900	23,900	31,300
02138000 (306)	32,800	19,300	28,900	41,800	22,600	35,000	52,600	25,400	41,300	70,200	29,800	50,500
02138500 (307)	25,900	9,730	20,700	33,800	11,500	25,200	43,400	12,900	29,600	59,300	15,200	36,100
02138680 (308)	185	< 1 mi^2	< 1 mi^2	216	< 1 mi^2	< 1 mi^2	248	< 1 mi^2	< 1 mi^2	293	< 1 mi^2	< 1 mi^2
02140980 (309)	1,020	892	960	1,240	1,070	1,160	1,500	1,220	1,350	1,870	1,460	1,640
02140991 (310)	45,300	20,800	31,300	57,300	24,300	36,900	71,000	27,300	42,100	92,000	31,900	49,600
02141130 (311)	1,650	2,280	1,930	1,950	2,700	2,300	2,270	3,070	2,660	2,720	3,650	3,210
02141890 (312)	3,270	3,850	3,460	3,880	4,530	4,110	4,540	5,130	4,770	5,510	6,070	5,750

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	50-percent chance exceedance			20-percent chance exceedance			10-percent chance exceedance			4-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02142000 (313)	1,370	1,440	1,380	2,450	2,480	2,460	3,330	3,270	3,320	4,620	4,300	4,560
02142480 (314)	861	631	814	1,440	1,120	1,350	1,890	1,480	1,760	2,550	1,950	2,310
0214253830 (315)	546	570	550	1,010	1,020	1,010	1,380	1,340	1,370	1,930	1,770	1,870
02142900 (316)	1,350	974	1,330	2,040	1,700	2,010	2,550	2,240	2,520	3,260	2,930	3,220
02143000 (317)	4,800	3,180	4,710	8,430	5,330	8,210	11,300	6,930	10,900	15,500	9,010	14,700
02143040 (318)	2,080	1,360	2,050	3,370	2,360	3,320	4,360	3,120	4,280	5,760	4,120	5,610
02143310 (319)	203	167	190	416	310	370	608	417	511	917	563	708
02143500 (320)	2,060	2,480	2,070	3,530	4,200	3,570	4,750	5,440	4,800	6,570	7,000	6,610
02144000 (321)	1,370	1,500	1,380	2,300	2,580	2,320	3,060	3,370	3,090	4,190	4,370	4,220
02145000 (322)	9,400	11,000	9,440	14,100	17,600	14,200	17,400	22,300	17,600	21,900	28,100	22,300
02146890 (323)	2,380	1,790	2,340	3,200	3,070	3,190	3,780	3,980	3,800	4,540	5,160	4,630
02146900 (324)	2,970	2,650	2,950	4,570	4,480	4,570	5,740	5,780	5,740	7,330	7,440	7,340
02149000 (328)	3,030	3,090	3,030	4,680	5,190	4,690	5,770	6,740	5,800	7,130	8,780	7,200
02150420 (329)	616	821	642	974	1,450	1,040	1,230	1,920	1,340	1,550	2,550	1,750
02151000 (330)	4,870	5,800	4,900	7,590	9,530	7,670	9,580	12,200	9,720	12,300	15,600	12,500
02151500 (331)	17,000	15,700	17,000	26,400	24,800	26,300	33,000	31,300	32,900	41,800	39,400	41,600
02152100 (332)	2,910	2,610	2,880	5,130	4,400	5,050	6,810	5,750	6,670	9,120	7,530	8,850
02152420 (333)	1,080	974	1,060	1,680	1,700	1,690	2,140	2,240	2,160	2,790	2,930	2,830
02152500 (334)	6,980	5,540	6,930	10,300	9,120	10,300	12,900	11,700	12,800	16,600	15,000	16,400
02152610 (335)	358	201	337	606	371	572	789	499	740	1,040	670	959
03160610 (805)	105	149	108	148	280	159	179	385	199	218	529	257
03161000 (806)	4,850	6,930	4,920	8,530	11,300	8,690	11,800	14,500	12,100	17,300	18,800	17,500
03162110 (807)	1,150	1,210	1,160	1,920	2,100	1,940	2,550	2,790	2,590	3,510	3,710	3,560
03162500 (808)	5,990	8,760	6,110	10,300	14,100	10,600	14,000	18,100	14,500	20,000	23,400	20,500
03162880 (809)	194	195	194	322	364	333	425	498	449	577	681	618
03439000 (824)	4,160	2,930	4,130	6,120	4,920	6,070	7,540	6,430	7,480	9,470	8,440	9,390
03439500 (825)	4,710	4,060	4,660	7,190	6,720	7,140	9,030	8,740	8,990	11,600	11,400	11,500
03440000 (826)	682	745	691	1,260	1,320	1,270	1,730	1,760	1,730	2,420	2,360	2,400
03441000 (827)	2,740	1,960	2,710	4,280	3,340	4,240	5,380	4,390	5,330	6,850	5,790	6,770
03441440 (828)	1,530	1,420	1,520	2,440	2,450	2,440	3,120	3,240	3,140	4,070	4,300	4,110
03441500 (829)	1,720	1,990	1,730	2,550	3,400	2,590	3,110	4,470	3,190	3,820	5,900	3,960
03442000 (830)	532	705	540	860	1,250	887	1,130	1,670	1,180	1,540	2,240	1,640
03443000 (831)	6,710	9,230	6,780	10,800	14,800	10,900	14,100	19,000	14,400	19,100	24,500	19,700
03444000 (832)	479	895	498	722	1,570	778	909	2,100	1,010	1,180	2,800	1,370
03444500 (833)	657	659	657	1,120	1,170	1,130	1,510	1,570	1,520	2,090	2,110	2,100
03446000 (834)	2,400	2,890	2,410	3,850	4,860	3,880	4,960	6,350	5,010	6,550	8,330	6,650
03446410 (835)	81	< 1 mi^2	< 1 mi^2	109	< 1 mi^2	< 1 mi^2	128	< 1 mi^2	< 1 mi^2	150	< 1 mi^2	< 1 mi^2
03446500 (836)	1,430	2,020	1,450	2,330	3,450	2,370	3,040	4,530	3,110	4,080	5,980	4,220
03447000 (837)	3,120	4,240	3,170	5,750	7,020	5,840	8,170	9,110	8,260	12,100	11,900	12,100
03447500 (838)	1,760	2,770	1,790	2,900	4,660	2,960	3,870	6,090	4,000	5,400	8,000	5,650
03448000 (839)	10,800	17,600	10,900	15,500	27,500	15,900	18,900	34,900	19,600	23,400	44,600	24,700
03448500 (840)	2,010	3,320	2,040	3,600	5,550	3,670	5,010	7,240	5,140	7,290	9,490	7,500
0344894205 (841)	1,310	880	1,280	2,210	1,550	2,150	2,940	2,060	2,840	4,030	2,760	3,830
03449000 (842)	1,900	1,300	1,790	3,640	2,240	3,260	5,240	2,970	4,430	7,850	3,950	6,050
03450000 (843)	238	414	246	418	749	437	566	1,010	600	789	1,370	853
03451000 (844)	2,840	4,860	2,870	5,190	8,000	5,260	7,280	10,400	7,400	10,600	13,500	10,800
03451500 (845)	14,500	22,800	14,600	21,900	35,400	22,100	27,500	44,700	27,800	35,400	56,800	35,900
03452000 (846)	2,060	3,310	2,190	3,080	5,540	3,440	3,840	7,220	4,460	4,880	9,460	5,940

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	2-percent chance exceedance			1-percent chance exceedance			0.5-percent chance exceedance			0.2-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
02142000 (313)	5,700	5,110	5,570	6,890	5,980	6,660	8,200	6,760	7,780	10,100	7,990	9,400
02142480 (314)	3,100	2,370	2,780	3,700	2,750	3,250	4,360	3,120	3,720	5,340	3,710	4,440
0214253830 (315)	2,380	2,160	2,300	2,870	2,500	2,720	3,410	2,850	3,150	4,190	3,380	3,790
02142900 (316)	3,840	3,540	3,790	4,470	4,090	4,390	5,130	4,630	5,020	6,090	5,470	5,930
02143000 (317)	19,100	10,600	17,700	22,900	12,400	20,800	27,100	13,900	24,000	33,200	16,400	28,600
02143040 (318)	6,900	4,880	6,660	8,140	5,750	7,790	9,460	6,510	8,950	11,400	7,700	10,600
02143310 (319)	1,200	692	875	1,530	813	1,040	1,910	933	1,210	2,500	1,120	1,460
02143500 (320)	8,150	8,400	8,180	9,930	9,620	9,870	11,900	10,800	11,700	15,000	12,700	14,400
02144000 (321)	5,170	5,270	5,190	6,280	6,060	6,220	7,520	6,840	7,330	9,410	8,050	8,950
02145000 (322)	25,400	33,200	26,100	29,100	37,600	30,000	33,000	41,900	34,000	38,400	48,500	39,800
02146890 (323)	5,130	6,200	5,300	5,730	7,130	6,000	6,360	8,030	6,720	7,240	9,440	7,760
02146900 (324)	8,580	8,920	8,630	9,900	10,200	9,960	11,300	11,500	11,300	13,300	13,400	13,300
02149000 (328)	8,120	10,400	8,240	9,090	12,100	9,290	10,000	13,600	10,300	11,300	16,000	11,700
02150420 (329)	1,800	3,040	2,070	2,050	3,570	2,420	2,310	4,060	2,770	2,650	4,810	3,270
02151000 (330)	14,500	18,500	14,800	16,700	21,200	17,200	19,100	23,700	19,700	22,500	27,600	23,300
02151500 (331)	48,500	46,200	48,300	55,300	52,700	55,100	62,400	58,600	61,900	72,000	67,900	71,400
02152100 (332)	11,000	8,870	10,500	12,900	10,400	12,300	14,900	11,700	14,000	17,600	13,800	16,400
02152420 (333)	3,320	3,540	3,390	3,890	4,090	3,960	4,500	4,630	4,550	5,400	5,470	5,430
02152500 (334)	19,600	17,700	19,400	23,000	20,400	22,600	26,700	22,800	25,900	32,100	26,600	30,900
02152610 (335)	1,230	822	1,130	1,430	964	1,300	1,640	1,100	1,470	1,920	1,330	1,720
03160610 (805)	249	634	304	280	761	357	313	872	411	358	1,050	492
03161000 (806)	22,300	21,900	22,200	28,400	25,600	27,700	35,700	28,800	33,600	47,600	33,700	42,500
03162110 (807)	4,340	4,380	4,360	5,300	5,180	5,260	6,380	5,870	6,180	8,030	6,950	7,560
03162500 (808)	25,400	27,100	25,700	31,800	31,700	31,700	39,300	35,600	38,100	51,300	41,600	47,700
03162880 (809)	706	815	755	850	977	912	1,010	1,120	1,070	1,250	1,340	1,300
03439000 (824)	11,000	9,890	10,900	12,600	11,600	12,500	14,400	13,100	14,200	16,800	15,500	16,600
03439500 (825)	13,600	13,300	13,600	15,800	15,700	15,800	18,100	17,700	18,000	21,500	20,800	21,300
03440000 (826)	3,000	2,800	2,940	3,650	3,320	3,530	4,360	3,780	4,120	5,410	4,490	4,990
03441000 (827)	7,990	6,810	7,880	9,170	8,040	9,040	10,400	9,100	10,200	12,100	10,700	11,900
03441440 (828)	4,830	5,070	4,890	5,650	6,000	5,740	6,520	6,800	6,600	7,770	8,040	7,850
03441500 (829)	4,350	6,930	4,560	4,870	8,180	5,180	5,390	9,260	5,810	6,090	10,900	6,680
03442000 (830)	1,890	2,660	2,030	2,300	3,160	2,490	2,760	3,590	2,980	3,470	4,270	3,720
03443000 (831)	23,600	28,500	24,200	28,600	33,300	29,300	34,300	37,300	34,900	43,000	43,600	43,200
03444000 (832)	1,400	3,310	1,680	1,640	3,930	2,040	1,910	4,460	2,430	2,300	5,290	3,010
03444500 (833)	2,600	2,500	2,570	3,190	2,970	3,110	3,850	3,380	3,660	4,870	4,020	4,490
03446000 (834)	7,860	9,770	8,000	9,290	11,500	9,480	10,800	13,000	11,100	13,100	15,300	13,400
03446410 (835)	167	< 1 mi^2	< 1 mi^2	183	< 1 mi^2	< 1 mi^2	200	< 1 mi^2	< 1 mi^2	221	< 1 mi^2	< 1 mi^2
03446500 (836)	4,970	7,030	5,150	5,940	8,300	6,210	7,020	9,380	7,350	8,640	11,100	9,060
03447000 (837)	15,900	13,900	15,500	20,400	16,300	19,400	25,900	18,400	23,500	34,800	21,600	29,800
03447500 (838)	6,780	9,380	7,120	8,410	11,100	8,860	10,300	12,500	10,800	13,400	14,700	13,700
03448000 (839)	27,000	51,500	28,900	30,700	59,900	33,400	34,600	67,100	38,200	40,100	78,000	45,000
03448500 (840)	9,400	11,100	9,620	11,900	13,100	12,100	14,900	14,700	14,900	19,700	17,300	19,100
0344894205 (841)	4,980	3,260	4,630	6,030	3,870	5,510	7,220	4,400	6,420	9,010	5,220	7,750
03449000 (842)	10,300	4,660	7,300	13,200	5,510	8,680	16,700	6,250	10,000	22,400	7,400	12,000
03450000 (843)	981	1,630	1,070	1,200	1,940	1,330	1,440	2,210	1,600	1,810	2,640	2,010
03451000 (844)	13,700	15,800	13,900	17,300	18,500	17,500	21,600	20,800	21,500	28,400	24,400	27,700
03451500 (845)	41,800	65,500	42,500	48,600	76,100	49,800	56,000	85,000	57,600	66,800	98,800	68,900
03452000 (846)	5,720	11,100	7,140	6,620	13,000	8,490	7,570	14,700	9,860	8,930	17,300	11,900

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	50-percent chance exceedance			20-percent chance exceedance			10-percent chance exceedance			4-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
03453000 (847)	4,070	5,660	4,100	6,530	9,260	6,600	8,540	12,000	8,680	11,600	15,600	11,900
03453500 (848)	19,000	29,800	19,100	30,100	45,700	30,300	38,200	57,500	38,500	49,000	72,800	49,600
03453880 (849)	639	552	628	947	988	953	1,160	1,330	1,190	1,430	1,790	1,500
03454000 (850)	3,390	4,740	3,470	5,430	7,820	5,620	6,980	10,100	7,290	9,140	13,200	9,680
03454500 (851)	23,300	33,800	23,400	37,100	51,700	37,400	48,200	64,800	48,600	64,600	81,900	65,400
03455500 (852)	3,970	1,450	3,830	5,860	2,510	5,610	7,230	3,320	6,860	9,110	4,400	8,500
03456500 (853)	4,240	2,360	4,090	7,010	4,000	6,710	9,120	5,250	8,640	12,100	6,910	11,200
03456991 (854)	7,610	4,860	7,560	12,000	8,000	11,900	15,500	10,400	15,400	20,800	13,500	20,400
03457500 (855)	764	876	772	1,110	1,540	1,150	1,370	2,050	1,440	1,710	2,750	1,850
03459000 (856)	1,960	2,840	1,980	2,720	4,780	2,780	3,230	6,250	3,340	3,870	8,200	4,090
03459500 (857)	10,900	10,500	10,900	16,900	16,800	16,900	21,400	21,500	21,400	27,600	27,700	27,600
03460000 (858)	1,850	2,280	1,860	2,840	3,870	2,890	3,550	5,070	3,620	4,470	6,680	4,620
03461910 (860)	369	620	372	430	1,100	439	467	1,480	482	510	1,990	536
03462000 (861)	2,830	4,090	2,890	4,530	6,770	4,690	5,900	8,800	6,190	7,930	11,500	8,460
03463300 (862)	5,330	2,060	4,920	9,660	3,510	8,550	13,400	4,620	11,300	19,300	6,090	15,000
03463500 (863)	5,600	2,690	5,370	9,630	4,530	9,040	13,000	5,930	11,900	18,300	7,790	15,900
03463910 (864)	147	159	148	225	298	237	282	409	307	360	562	409
03464000 (865)	4,930	5,630	4,960	9,000	9,220	9,020	12,800	11,900	12,700	19,000	15,500	18,300
03464500 (866)	15,700	16,200	15,700	25,100	25,400	25,100	32,800	32,300	32,700	44,200	41,300	43,900
03478910 (875)	1,060	1,270	1,080	2,050	2,190	2,070	2,930	2,910	2,930	4,350	3,870	4,240
03479000 (876)	5,770	3,720	5,640	10,600	6,180	10,200	14,800	8,050	14,000	21,500	10,500	19,400
03480540 (877)	16	< 1 mi^2	< 1 mi^2	24	< 1 mi^2	< 1 mi^2	29	< 1 mi^2	< 1 mi^2	36	< 1 mi^2	< 1 mi^2
03481000 (878)	2,230	2,020	2,220	3,730	3,430	3,700	5,000	4,520	4,940	6,970	5,960	6,800
03500000 (890)	3,230	5,150	3,290	5,080	8,460	5,240	6,550	11,000	6,830	8,680	14,200	9,200
03500240 (891)	1,890	2,560	1,920	2,930	4,320	3,000	3,740	5,660	3,860	4,890	7,440	5,140
03501000 (892)	2,920	3,540	2,940	4,730	5,900	4,800	6,250	7,680	6,370	8,580	10,100	8,780
03501760 (893)	131	158	138	259	297	270	362	408	377	508	559	527
03502000 (894)	6,230	9,880	6,330	9,070	15,800	9,320	11,100	20,300	11,600	14,000	26,100	14,800
03503000 (895)	9,660	12,500	9,720	13,600	19,800	13,700	16,100	25,300	16,400	19,200	32,400	19,700
03504000 (896)	2,450	2,380	2,440	3,390	4,020	3,410	4,030	5,280	4,070	4,860	6,950	4,950
03506500 (897)	4,840	6,100	4,950	7,070	9,960	7,360	8,630	12,900	9,160	10,700	16,700	11,600
03507000 (898)	13,800	17,300	13,900	21,200	27,200	21,600	26,900	34,400	27,500	35,000	44,000	36,100
03509000 (899)	1,490	2,350	1,510	2,150	3,970	2,210	2,600	5,210	2,700	3,180	6,860	3,360
03510500 (900)	6,720	10,400	6,770	9,800	16,700	9,950	12,200	21,400	12,500	15,700	27,500	16,300
03511000 (901)	5,550	4,890	5,530	7,270	8,050	7,300	8,380	10,400	8,480	9,770	13,600	10,000
03512000 (902)	8,390	6,370	8,360	11,200	10,400	11,200	13,000	13,400	13,000	15,000	17,400	15,100
03513000 (903)	17,400	17,100	17,400	27,700	26,900	27,600	35,300	34,100	35,200	45,600	43,500	45,300
03513410 (904)	20	< 1 mi^2	< 1 mi^2	37	< 1 mi^2	< 1 mi^2	52	< 1 mi^2	< 1 mi^2	74	< 1 mi^2	< 1 mi^2
03513500 (905)	951	847	947	1,290	1,490	1,300	1,530	1,990	1,550	1,820	2,660	1,870
03514000 (906)	2,340	2,110	2,290	3,660	3,580	3,640	4,620	4,700	4,650	5,950	6,200	6,040
03516000 (907)	2,930	2,020	2,800	4,150	3,430	4,010	5,010	4,520	4,890	6,160	5,960	6,100
03546000 (921)	1,450	1,850	1,520	2,410	3,160	2,600	3,200	4,160	3,500	4,360	5,500	4,800
03548500 (922)	11,500	11,800	11,500	15,800	18,800	15,900	18,600	24,000	18,800	22,000	30,800	22,400
03550000 (923)	4,050	4,090	4,050	6,290	6,770	6,310	8,040	8,800	8,070	10,600	11,500	10,600
03554000 (925)	6,010	8,640	6,150	8,980	13,900	9,310	11,100	17,900	11,700	14,000	23,000	15,000

Table 4. Flood-frequency statistics for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; discharges are in cubic feet per second; number shown in parentheses beside USGS station number is map identification number (see fig. 2); G, estimated from the Bulletin 17B analysis of the streamgaging station; R, estimated from the regression equation; W, weighted estimate using equation 21; <1 mi^2, site not determined due to drainage area less than 1 square mile; br, site not included in regression analyses because of basin redundancy with adjacent site on same stream]

USGS station number	2-percent chance exceedance			1-percent chance exceedance			0.5-percent chance exceedance			0.2-percent chance exceedance		
	G	R	W	G	R	W	G	R	W	G	R	W
03453000 (847)	14,300	18,100	14,600	17,300	21,300	17,800	20,800	23,900	21,200	26,100	28,000	26,500
03453500 (848)	57,500	83,800	58,300	66,300	97,200	67,500	75,400	108,000	77,000	88,100	126,000	90,400
03453880 (849)	1,640	2,120	1,740	1,850	2,530	2,000	2,060	2,880	2,260	2,340	3,420	2,630
03454000 (850)	10,900	15,400	11,600	12,800	18,100	13,800	14,800	20,400	16,000	17,700	23,900	19,300
03454500 (851)	78,700	94,200	79,600	94,500	109,000	95,600	112,000	122,000	113,000	139,000	141,000	139,000
03455500 (852)	10,600	5,180	9,740	12,200	6,130	11,000	13,800	6,940	12,400	16,200	8,210	14,200
03456500 (853)	14,500	8,110	13,200	17,100	9,560	15,300	19,800	10,800	17,400	23,800	12,700	20,300
03456991 (854)	25,300	15,800	24,600	30,400	18,500	29,200	36,100	20,800	34,100	44,700	24,400	41,500
03457500 (855)	1,980	3,250	2,190	2,270	3,850	2,560	2,570	4,380	2,950	3,000	5,190	3,520
03459000 (856)	4,360	9,620	4,670	4,840	11,300	5,290	5,330	12,800	5,930	5,990	15,100	6,830
03459500 (857)	32,500	32,100	32,500	37,800	37,500	37,800	43,500	42,000	43,300	51,600	49,100	51,300
03460000 (858)	5,180	7,850	5,400	5,910	9,250	6,240	6,660	10,500	7,100	7,690	12,300	8,300
03461910 (860)	540	2,360	577	569	2,810	618	596	3,200	659	632	3,800	715
03462000 (861)	9,680	13,400	10,400	11,600	15,800	12,600	13,900	17,800	14,900	17,200	20,900	18,300
03463300 (862)	24,700	7,160	17,700	30,900	8,450	20,600	38,100	9,560	23,400	49,500	11,300	27,500
03463500 (863)	22,900	9,140	19,000	28,200	10,800	22,300	34,300	12,200	25,700	43,800	14,300	30,500
03463910 (864)	422	674	491	488	808	585	558	926	679	658	1,110	819
03464000 (865)	24,900	18,100	23,200	32,100	21,200	28,800	40,900	23,800	34,600	55,300	27,900	43,300
03464500 (866)	54,100	47,700	53,100	65,200	55,600	63,400	77,700	62,200	74,200	96,700	72,400	90,100
03478910 (875)	5,640	4,560	5,330	7,160	5,400	6,560	8,940	6,120	7,830	11,700	7,240	9,690
03479000 (876)	27,600	12,300	23,900	34,700	14,500	28,700	43,000	16,300	33,700	56,100	19,200	40,800
03480540 (877)	41	< 1 mi^2	< 1 mi^2	47	< 1 mi^2	< 1 mi^2	52	< 1 mi^2	< 1 mi^2	60	< 1 mi^2	< 1 mi^2
03481000 (878)	8,750	7,010	8,360	10,800	8,270	10,100	13,200	9,350	12,000	17,000	11,000	14,700
03500000 (890)	10,500	16,600	11,200	12,500	19,500	13,500	14,700	22,000	16,000	18,000	25,800	19,600
03500240 (891)	5,860	8,740	6,210	6,920	10,300	7,420	8,080	11,600	8,700	9,800	13,700	10,600
03501000 (892)	10,700	11,800	10,800	13,000	13,800	13,200	15,800	15,600	15,700	20,100	18,400	19,500
03501760 (893)	627	671	645	753	805	777	887	922	904	1,080	1,110	1,090
03502000 (894)	16,300	30,300	17,500	18,700	35,400	20,500	21,300	39,700	23,600	25,000	46,400	28,200
03503000 (895)	21,400	37,600	22,200	23,600	43,800	24,700	25,800	49,100	27,300	28,700	57,300	30,800
03504000 (896)	5,490	8,160	5,640	6,130	9,610	6,350	6,790	10,900	7,100	7,690	12,800	8,130
03506500 (897)	12,300	19,400	13,500	13,900	22,800	15,700	15,600	25,600	17,800	17,900	30,000	20,900
03507000 (898)	41,700	50,900	43,100	49,000	59,200	50,800	57,000	66,200	58,900	68,600	77,100	70,600
03509000 (899)	3,610	8,050	3,880	4,040	9,500	4,420	4,470	10,700	4,990	5,060	12,700	5,790
03510500 (900)	18,600	31,900	19,500	21,900	37,300	23,200	25,500	41,800	27,300	30,900	48,800	33,400
03511000 (901)	10,800	15,900	11,200	11,800	18,600	12,400	12,800	20,900	13,600	14,200	24,600	15,400
03512000 (902)	16,400	20,200	16,500	17,800	23,700	18,000	19,100	26,700	19,300	20,700	31,200	21,200
03513000 (903)	53,800	50,400	53,200	62,300	58,600	61,600	71,300	65,600	70,100	83,900	76,300	82,000
03513410 (904)	95	< 1 mi^2	< 1 mi^2	118	< 1 mi^2	< 1 mi^2	145	< 1 mi^2	< 1 mi^2	187	< 1 mi^2	< 1 mi^2
03513500 (905)	2,040	3,150	2,130	2,260	3,740	2,400	2,490	4,250	2,670	2,800	5,040	3,060
03514000 (906)	7,000	7,290	7,120	8,120	8,600	8,330	9,290	9,730	9,490	11,000	11,500	11,200
03516000 (907)	7,060	7,010	7,050	8,000	8,270	8,100	8,990	9,350	9,120	10,400	11,000	10,600
03546000 (921)	5,350	6,470	5,840	6,470	7,640	7,030	7,710	8,650	8,190	9,580	10,200	9,930
03548500 (922)	24,500	35,700	25,100	26,800	41,700	27,900	29,200	46,700	30,600	32,200	54,500	34,300
03550000 (923)	12,700	13,400	12,700	15,000	15,800	15,100	17,600	17,800	17,600	21,300	20,900	21,300
03554000 (925)	16,200	26,800	17,600	18,500	31,300	20,500	20,900	35,200	23,500	24,300	41,100	27,700

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.

[USGS, U.S. Geological Survey; mi2, square mile; *, indicates that drainage area has been revised as a result of this study]

Map identification number (figs. 2 and 5)	USGS station number	Drainage area (mi^2)	Percentage of drainage basin in:				
			Hydrologic Region 1 (Ridge and Valley–Piedmont)	Hydrologic Region 2 (Blue Ridge)	Hydrologic Region 3 (Sand Hills)	Hydrologic Region 4 (Coastal Plain)	Hydrologic Region 5 (Southwest Georgia)
21	02053110	1.09*	0.0	0.0	0.0	100.0	0.0
22	02053170	11.8	0.0	0.0	0.0	100.0	0.0
23	02053200	225	0.0	0.0	0.0	100.0	0.0
24	02053500	63.3	0.0	0.0	0.0	100.0	0.0
25	02053510	2.04*	0.0	0.0	0.0	100.0	0.0
26	02053550	8.9	0.0	0.0	0.0	100.0	0.0
52	02068500	129	43.6	56.4	0.0	0.0	0.0
53	02068610	0.31	100.0	0.0	0.0	0.0	0.0
54	02068660	5.44	100.0	0.0	0.0	0.0	0.0
55	02069030	14.9	100.0	0.0	0.0	0.0	0.0
59	02070500	242	81.2	18.8	0.0	0.0	0.0
60	02070810	16.2	100.0	0.0	0.0	0.0	0.0
61	02071000	1053	88.1	11.9	0.0	0.0	0.0
62	02071410	12	100.0	0.0	0.0	0.0	0.0
65	02074000	538	84.8	15.2	0.0	0.0	0.0
66	02075160	32.8*	100.0	0.0	0.0	0.0	0.0
67	02075230	6.57*	100.0	0.0	0.0	0.0	0.0
72	02077200	45.9	100.0	0.0	0.0	0.0	0.0
73	02077210	0.25*	100.0	0.0	0.0	0.0	0.0
74	02077240	7.47	100.0	0.0	0.0	0.0	0.0
75	02077250	56.5	100.0	0.0	0.0	0.0	0.0
76	02077310	1.86*	100.0	0.0	0.0	0.0	0.0
81	02080500	8384	93.3	6.5	0.0	0.2	0.0
82	02081000	8671	90.3	6.2	0.0	3.5	0.0
83	02081060	2.86*	0.0	0.0	0.0	100.0	0.0
84	02081110	18.7*	0.0	0.0	0.0	100.0	0.0
85	0208111310	108	0.0	0.0	0.0	100.0	0.0
86	02081210	22.2	100.0	0.0	0.0	0.0	0.0
87	02081500	167	100.0	0.0	0.0	0.0	0.0
88	02081710	7.25*	100.0	0.0	0.0	0.0	0.0
89	02081747	427	100.0	0.0	0.0	0.0	0.0
90	02081800	47.8	100.0	0.0	0.0	0.0	0.0
91	02082000	701	95.8	0.0	0.0	4.2	0.0
92	02082500	64.8	3.1	0.0	0.0	96.9	0.0
93	02082540	0.32*	100.0	0.0	0.0	0.0	0.0
94	02082585	925	78.7	0.0	0.0	21.3	0.0
95	02082610	930	76.8	0.0	0.0	23.2	0.0
96	02082630	8.58	0.0	0.0	0.0	100.0	0.0
97	02082770	166	96.9	0.0	0.0	3.1	0.0
98	02082835	45	100.0	0.0	0.0	0.0	0.0
99	02082950	177	97.8	0.0	0.0	2.2	0.0
100	02083000	526	84.2	0.0	0.0	15.8	0.0
101	02083090	9.44	0.0	0.0	0.0	100.0	0.0
102	02083410	12.3*	0.0	0.0	0.0	100.0	0.0
103	02083500	2183	61.0	0.0	0.0	39.0	0.0
104	02083800	78.1	0.0	0.0	0.0	100.0	0.0

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.—Continued

[USGS, U.S. Geological Survey; mi2, square mile; *, indicates that drainage area has been revised as a result of this study]

Map identification number (figs. 2 and 5)	USGS station number	Drainage area (mi^2)	Percentage of drainage basin in:				
			Hydrologic Region 1 (Ridge and Valley–Piedmont)	Hydrologic Region 2 (Blue Ridge)	Hydrologic Region 3 (Sand Hills)	Hydrologic Region 4 (Coastal Plain)	Hydrologic Region 5 (Southwest Georgia)
105	02084000	2660	50.0	0.0	0.0	50.0	0.0
106	02084240	30.8*	0.0	0.0	0.0	100.0	0.0
107	02084500	9.59	0.0	0.0	0.0	100.0	0.0
108	02084520	1.49	0.0	0.0	0.0	100.0	0.0
109	02084540	26	0.0	0.0	0.0	100.0	0.0
110	02084557	23	0.0	0.0	0.0	100.0	0.0
111	02084570	32.2	0.0	0.0	0.0	100.0	0.0
112	02084909	14.1	100.0	0.0	0.0	0.0	0.0
113	02085000	66	100.0	0.0	0.0	0.0	0.0
114	02085020	0.8	100.0	0.0	0.0	0.0	0.0
115	02085070	141	100.0	0.0	0.0	0.0	0.0
116	02085190	1.02	100.0	0.0	0.0	0.0	0.0
117	0208521324	78.2	100.0	0.0	0.0	0.0	0.0
118	0208524090	8	100.0	0.0	0.0	0.0	0.0
119	02085500	149	100.0	0.0	0.0	0.0	0.0
120	02086000	4.73*	100.0	0.0	0.0	0.0	0.0
121	0208650112	1.14	100.0	0.0	0.0	0.0	0.0
122	02086624	43	100.0	0.0	0.0	0.0	0.0
123	02087000	535	100.0	0.0	0.0	0.0	0.0
124	0208700780	10.1	100.0	0.0	0.0	0.0	0.0
125	02087030	13.8	100.0	0.0	0.0	0.0	0.0
126	02087140	0.7	100.0	0.0	0.0	0.0	0.0
127	02087183	771	100.0	0.0	0.0	0.0	0.0
128	02087240	0.25	100.0	0.0	0.0	0.0	0.0
129	02087500	1150	99.9	0.0	0.0	0.1	0.0
130	02087570	1206	96.8	0.0	0.0	3.2	0.0
131	02087580	21	100.0	0.0	0.0	0.0	0.0
132	02087910	8.67*	100.0	0.0	0.0	0.0	0.0
133	02088000	83.5	55.7	0.0	0.0	44.3	0.0
134	02088140	27.9	0.0	0.0	0.0	100.0	0.0
135	02088210	2.68*	0.0	0.0	0.0	100.0	0.0
136	02088420	7.64	10.2	0.0	0.0	89.8	0.0
137	02088470	191	77.5	0.0	0.0	22.5	0.0
138	02088500	232	63.7	0.0	0.0	36.3	0.0
139	02089000	2399	62.2	0.0	0.0	37.8	0.0
140	0208925200	57.7	0.0	0.0	0.0	100.0	0.0
141	02089500	2692	55.2	0.0	0.0	44.8	0.0
142	02090380	161	89.8	0.0	0.0	10.2	0.0
143	02090560	3.82*	0.0	0.0	0.0	100.0	0.0
144	02090625	2.1	0.0	0.0	0.0	100.0	0.0
145	02090780	2.85*	0.0	0.0	0.0	100.0	0.0
146	02090960	19	0.0	0.0	0.0	100.0	0.0
147	02091000	80.4	0.0	0.0	0.0	100.0	0.0
148	02091430	1.47	0.0	0.0	0.0	100.0	0.0
149	02091500	733	19.9	0.0	0.0	80.1	0.0
150	02091700	93.3	0.0	0.0	0.0	100.0	0.0

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.—Continued

[USGS, U.S. Geological Survey; mi2, square mile; *, indicates that drainage area has been revised as a result of this study]

Map identification number (figs. 2 and 5)	USGS station number	Drainage area (mi^2)	Percentage of drainage basin in:				
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151	02091810	4.87	0.0	0.0	0.0	100.0	0.0
152	02091970	27	0.0	0.0	0.0	100.0	0.0
153	02092000	182	0.0	0.0	0.0	100.0	0.0
154	02092020	24	0.0	0.0	0.0	100.0	0.0
155	02092120	32.4*	0.0	0.0	0.0	100.0	0.0
156	02092290	5.05*	0.0	0.0	0.0	100.0	0.0
157	02092500	168	0.0	0.0	0.0	100.0	0.0
158	02092520	6.3	0.0	0.0	0.0	100.0	0.0
159	02092620	3*	0.0	0.0	0.0	100.0	0.0
160	02092720	53.3	0.0	0.0	0.0	100.0	0.0
161	02092780	4.95	0.0	0.0	0.0	100.0	0.0
162	02093000	94	0.0	0.0	0.0	100.0	0.0
163	02093040	1	0.0	0.0	0.0	100.0	0.0
164	02093070	26.9	0.0	0.0	0.0	100.0	0.0
165	02093290	26.3	100.0	0.0	0.0	0.0	0.0
166	02093500	168	100.0	0.0	0.0	0.0	0.0
167	02093800	20.6	100.0	0.0	0.0	0.0	0.0
168	02094000	15.9	100.0	0.0	0.0	0.0	0.0
169	02095000	34	100.0	0.0	0.0	0.0	0.0
170	02095500	37.1	100.0	0.0	0.0	0.0	0.0
171	02096500	606	100.0	0.0	0.0	0.0	0.0
172	02096660	14.6	100.0	0.0	0.0	0.0	0.0
173	02096700	116	100.0	0.0	0.0	0.0	0.0
174	02096740	4.06*	100.0	0.0	0.0	0.0	0.0
175	02096846	7.54	100.0	0.0	0.0	0.0	0.0
176	02096850	33.7	100.0	0.0	0.0	0.0	0.0
177	02096960	1275	100.0	0.0	0.0	0.0	0.0
178	02097010	1.71*	100.0	0.0	0.0	0.0	0.0
179	02097314	75.9	100.0	0.0	0.0	0.0	0.0
180	0209741955	21.1	100.0	0.0	0.0	0.0	0.0
181	02097464	8.35	100.0	0.0	0.0	0.0	0.0
182	02097910	23.6	100.0	0.0	0.0	0.0	0.0
183	02098000	285	100.0	0.0	0.0	0.0	0.0
184	02098500	32.1	100.0	0.0	0.0	0.0	0.0
185	02099000	14.8	100.0	0.0	0.0	0.0	0.0
186	02099500	125	100.0	0.0	0.0	0.0	0.0
187	02100500	349	100.0	0.0	0.0	0.0	0.0
188	02101000	137	85.8	0.0	14.2	0.0	0.0
189	02101030	3.43*	100.0	0.0	0.0	0.0	0.0
190	02101480	0.85	100.0	0.0	0.0	0.0	0.0
191	0210166029	7.42	100.0	0.0	0.0	0.0	0.0
192	02101800	15.5	100.0	0.0	0.0	0.0	0.0
193	02101890	43.2	100.0	0.0	0.0	0.0	0.0
194	02102000	1434	96.0	0.0	3.8	0.2	0.0
195	02102500	3464	95.8	0.0	1.6	2.6	0.0
196	02102908	7.63	0.0	0.0	100.0	0.0	0.0

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.—Continued

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197	02102910	2.19	0.0	0.0	100.0	0.0	0.0
198	02102930	32.4	5.4	0.0	94.6	0.0	0.0
199	02103000	348	0.5	0.0	99.5	0.0	0.0
200	02103390	7.56	0.0	0.0	100.0	0.0	0.0
201	02103500	459	0.4	0.0	96.5	3.1	0.0
202	02104000	4395	76.6	0.0	14.2	9.2	0.0
203	02104080	9.79*	0.0	0.0	0.0	100.0	0.0
204	02104220	93.1	0.0	0.0	96.3	3.7	0.0
205	02104500	292	0.0	0.0	51.7	48.3	0.0
206	02105500	4852	69.4	0.0	16.0	14.6	0.0
207	02105570	13.3*	0.0	0.0	0.0	100.0	0.0
208	02105630	60.1	0.0	0.0	0.0	100.0	0.0
209	02105769	5255	63.9	0.0	14.8	21.3	0.0
210	02105900	21.6	0.0	0.0	0.0	100.0	0.0
211	02106000	92.8	0.0	0.0	0.0	100.0	0.0
212	02106240	15.7	0.0	0.0	0.0	100.0	0.0
213	02106410	0.46	0.0	0.0	0.0	100.0	0.0
214	02106500	676	0.0	0.0	0.0	100.0	0.0
215	02106910	32.3	0.0	0.0	0.0	100.0	0.0
216	02107000	379	0.0	0.0	0.0	100.0	0.0
217	02107500	108*	0.0	0.0	0.0	100.0	0.0
218	02107590	0.56*	0.0	0.0	0.0	100.0	0.0
219	02107600	47.5	0.0	0.0	0.0	100.0	0.0
220	02107620	8.13*	0.0	0.0	0.0	100.0	0.0
221	02107980	53.5*	0.0	0.0	0.0	100.0	0.0
222	02108000	599	0.0	0.0	0.0	100.0	0.0
223	02108500	69.3	0.0	0.0	0.0	100.0	0.0
224	02108548	7.8	0.0	0.0	0.0	100.0	0.0
225	02108610	1.26*	0.0	0.0	0.0	100.0	0.0
226	02108630	10.2	0.0	0.0	0.0	100.0	0.0
227	02108960	16.7*	0.0	0.0	0.0	100.0	0.0
228	02109500	680	0.0	0.0	0.0	100.0	0.0
229	02109640	16	0.0	0.0	0.0	100.0	0.0
230	02110020	3.52*	0.0	0.0	0.0	100.0	0.0
232	02111000	28.8	0.0	100.0	0.0	0.0	0.0
233	02111180	50.9*	3.8	96.2	0.0	0.0	0.0
234	02111340	12.9*	0.0	100.0	0.0	0.0	0.0
235	02111500	89.2	24.3	75.7	0.0	0.0	0.0
236	02112000	504	27.0	73.0	0.0	0.0	0.0
237	02112120	128	42.7	57.3	0.0	0.0	0.0
238	02112247	35.5	94.0	6.0	0.0	0.0	0.0
239	02112360	78.8	60.0	40.0	0.0	0.0	0.0
240	02112410	51.2*	58.0	42.0	0.0	0.0	0.0
241	02112500	116*	77.7	22.3	0.0	0.0	0.0
242	02113000	128	79.2	20.8	0.0	0.0	0.0
243	02113850	231	83.1	16.9	0.0	0.0	0.0

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.—Continued

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			Hydrologic Region 1 (Ridge and Valley–Piedmont)	Hydrologic Region 2 (Blue Ridge)	Hydrologic Region 3 (Sand Hills)	Hydrologic Region 4 (Coastal Plain)	Hydrologic Region 5 (Southwest Georgia)
244	02114010	287	86.4	13.6	0.0	0.0	0.0
245	02114450	42.8	100.0	0.0	0.0	0.0	0.0
246	02115500	22.1	100.0	0.0	0.0	0.0	0.0
247	02115520	0.9	100.0	0.0	0.0	0.0	0.0
248	02115540	17.7*	100.0	0.0	0.0	0.0	0.0
249	02115830	2*	100.0	0.0	0.0	0.0	0.0
250	02115856	65.6	100.0	0.0	0.0	0.0	0.0
251	02115860	186	100.0	0.0	0.0	0.0	0.0
252	02115900	42.9	100.0	0.0	0.0	0.0	0.0
253	02116500	2280	74.7	25.3	0.0	0.0	0.0
254	02117030	1.05	100.0	0.0	0.0	0.0	0.0
255	02117410	1.22*	100.0	0.0	0.0	0.0	0.0
256	02117500	101	74.6	25.4	0.0	0.0	0.0
257	02118000	306	86.5	13.5	0.0	0.0	0.0
258	02118500	155	70.2	29.8	0.0	0.0	0.0
259	02119000	569	84.5	15.5	0.0	0.0	0.0
260	02120500	87.4	100.0	0.0	0.0	0.0	0.0
261	02120780	118	100.0	0.0	0.0	0.0	0.0
262	02120820	3.88	100.0	0.0	0.0	0.0	0.0
263	02121000	3450	80.3	19.7	0.0	0.0	0.0
264	02121180	9.62	100.0	0.0	0.0	0.0	0.0
265	02121500	174	100.0	0.0	0.0	0.0	0.0
266	02121940	6.56	100.0	0.0	0.0	0.0	0.0
267	02122560	13.7	100.0	0.0	0.0	0.0	0.0
268	02122720	2.9	100.0	0.0	0.0	0.0	0.0
269	02123500	342	100.0	0.0	0.0	0.0	0.0
270	02123567	3.44	100.0	0.0	0.0	0.0	0.0
271	02124060	3.61	100.0	0.0	0.0	0.0	0.0
272	02124130	20.7	100.0	0.0	0.0	0.0	0.0
273	02125000	55.6	100.0	0.0	0.0	0.0	0.0
274	02125410	7.73*	100.0	0.0	0.0	0.0	0.0
275	02126000	1372	100.0	0.0	0.0	0.0	0.0
276	02127000	110	99.9	0.0	0.1	0.0	0.0
277	02127390	0.91*	100.0	0.0	0.0	0.0	0.0
278	02128000	106	100.0	0.0	0.0	0.0	0.0
279	02128260	15.4	74.4	0.0	25.6	0.0	0.0
280	02129440	16.7	97.2	0.0	2.8	0.0	0.0
281	02129530	0.14	0.0	0.0	100.0	0.0	0.0
290	02132230	6.05*	0.0	0.0	0.0	100.0	0.0
291	02132320	83.3	0.0	0.0	37.4	62.6	0.0
293	02133500	183	0.0	0.0	100.0	0.0	0.0
294	02133590	4.66	0.0	0.0	100.0	0.0	0.0
295	02133624	365	0.0	0.0	88.6	11.4	0.0
296	02133960	39.8	0.0	0.0	4.8	95.2	0.0
297	02134380	16.1	0.0	0.0	0.0	100.0	0.0
298	02134480	229	0.0	0.0	0.0	100.0	0.0

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.—Continued

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299	02134500	1228	0.0	0.0	26.2	73.8	0.0
304	02137000	20.6*	0.0	100.0	0.0	0.0	0.0
305	02137727	126	0.0	100.0	0.0	0.0	0.0
306	02138000	172	0.0	100.0	0.0	0.0	0.0
307	02138500	66.7	2.0	98.0	0.0	0.0	0.0
308	02138680	0.5	31.1	68.9	0.0	0.0	0.0
309	02140980	2.38	0.1	99.9	0.0	0.0	0.0
310	02140991	201	11.5	88.5	0.0	0.0	0.0
311	02141130	8.58*	28.4	71.6	0.0	0.0	0.0
312	02141890	18.4	30.0	70.0	0.0	0.0	0.0
313	02142000	28.2	41.1	58.9	0.0	0.0	0.0
314	02142480	8.4*	100.0	0.0	0.0	0.0	0.0
315	0214253830	7.18	100.0	0.0	0.0	0.0	0.0
316	02142900	16.4	100.0	0.0	0.0	0.0	0.0
317	02143000	83.2	36.9	63.1	0.0	0.0	0.0
318	02143040	25.7	15.0	85.0	0.0	0.0	0.0
319	02143310	1.08*	100.0	0.0	0.0	0.0	0.0
320	02143500	69.2	100.0	0.0	0.0	0.0	0.0
321	02144000	31.8	100.0	0.0	0.0	0.0	0.0
322	02145000	628	88.3	11.7	0.0	0.0	0.0
323	02146890	41.8	100.0	0.0	0.0	0.0	0.0
324	02146900	76.5	100.0	0.0	0.0	0.0	0.0
328	02149000	79	32.4	67.6	0.0	0.0	0.0
329	02150420	13	42.9	57.1	0.0	0.0	0.0
330	02151000	220	70.2	29.8	0.0	0.0	0.0
331	02151500	875	61.7	38.3	0.0	0.0	0.0
332	02152100	60.5	16.5	83.5	0.0	0.0	0.0
333	02152420	16.4	100.0	0.0	0.0	0.0	0.0
334	02152500	200	63.8	36.2	0.0	0.0	0.0
335	02152610	1.44*	100.0	0.0	0.0	0.0	0.0
805	03160610	1.48*	0.0	100.0	0.0	0.0	0.0
806	03161000	205	0.0	100.0	0.0	0.0	0.0
807	03162110	21.8	0.0	100.0	0.0	0.0	0.0
808	03162500	277	0.0	100.0	0.0	0.0	0.0
809	03162880	2.1	0.0	100.0	0.0	0.0	0.0
824	03439000	67.9	0.0	100.0	0.0	0.0	0.0
825	03439500	103	0.0	100.0	0.0	0.0	0.0
826	03440000	11.7	0.0	100.0	0.0	0.0	0.0
827	03441000	40.4	0.0	100.0	0.0	0.0	0.0
828	03441440	26.8	0.0	100.0	0.0	0.0	0.0
829	03441500	41.4	0.0	100.0	0.0	0.0	0.0
830	03442000	10.9	0.0	100.0	0.0	0.0	0.0
831	03443000	296	0.0	100.0	0.0	0.0	0.0
832	03444000	14.8	0.0	100.0	0.0	0.0	0.0
833	03444500	9.99	0.0	100.0	0.0	0.0	0.0
834	03446000	66.7	0.0	100.0	0.0	0.0	0.0

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.—Continued

[USGS, U.S. Geological Survey; mi2, square mile; *, indicates that drainage area has been revised as a result of this study]

Map identification number (figs. 2 and 5)	USGS station number	Drainage area (mi²)	Percentage of drainage basin in:				
			Hydrologic Region 1 (Ridge and Valley–Piedmont)	Hydrologic Region 2 (Blue Ridge)	Hydrologic Region 3 (Sand Hills)	Hydrologic Region 4 (Coastal Plain)	Hydrologic Region 5 (Southwest Georgia)
835	03446410	0.59*	0.0	100.0	0.0	0.0	0.0
836	03446500	42.2	0.0	100.0	0.0	0.0	0.0
837	03447000	109	0.0	100.0	0.0	0.0	0.0
838	03447500	63.1	0.0	100.0	0.0	0.0	0.0
839	03448000	676	0.0	100.0	0.0	0.0	0.0
840	03448500	79.8	0.0	100.0	0.0	0.0	0.0
841	0344894205	14.5	0.0	100.0	0.0	0.0	0.0
842	03449000	23.8	0.0	100.0	0.0	0.0	0.0
843	03450000	5.46	0.0	100.0	0.0	0.0	0.0
844	03451000	130	0.0	100.0	0.0	0.0	0.0
845	03451500	945	0.0	100.0	0.0	0.0	0.0
846	03452000	79.5	0.0	100.0	0.0	0.0	0.0
847	03453000	158	0.0	100.0	0.0	0.0	0.0
848	03453500	1332	0.0	100.0	0.0	0.0	0.0
849	03453880	7.96	0.0	100.0	0.0	0.0	0.0
850	03454000	126	0.0	100.0	0.0	0.0	0.0
851	03454500	1567	0.0	100.0	0.0	0.0	0.0
852	03455500	27.6	0.0	100.0	0.0	0.0	0.0
853	03456500	51.5	0.0	100.0	0.0	0.0	0.0
854	03456991	130	0.0	100.0	0.0	0.0	0.0
855	03457500	14.4	0.0	100.0	0.0	0.0	0.0
856	03459000	65.3	0.0	100.0	0.0	0.0	0.0
857	03459500	350	0.0	100.0	0.0	0.0	0.0
858	03460000	49.2	0.0	100.0	0.0	0.0	0.0
860	03461910	9.24	0.0	100.0	0.0	0.0	0.0
861	03462000	104	0.0	100.0	0.0	0.0	0.0
862	03463300	43.3	0.0	100.0	0.0	0.0	0.0
863	03463500	60.8	0.0	100.0	0.0	0.0	0.0
864	03463910	1.61	0.0	100.0	0.0	0.0	0.0
865	03464000	157	0.0	100.0	0.0	0.0	0.0
866	03464500	608	0.0	100.0	0.0	0.0	0.0
875	03478910	23.1	0.0	100.0	0.0	0.0	0.0
876	03479000	92.1	0.0	100.0	0.0	0.0	0.0
877	03480540	0.55*	0.0	100.0	0.0	0.0	0.0
878	03481000	42	0.0	100.0	0.0	0.0	0.0
890	03500000	140	0.0	100.0	0.0	0.0	0.0
891	03500240	57.1	0.0	100.0	0.0	0.0	0.0
892	03501000	86.5	0.0	100.0	0.0	0.0	0.0
893	03501760	1.6	0.0	100.0	0.0	0.0	0.0
894	03502000	323	0.0	100.0	0.0	0.0	0.0
895	03503000	436	0.0	100.0	0.0	0.0	0.0
896	03504000	51.9	0.0	100.0	0.0	0.0	0.0
897	03506500	174	0.0	100.0	0.0	0.0	0.0
898	03507000	664	0.0	100.0	0.0	0.0	0.0
899	03509000	51	0.0	100.0	0.0	0.0	0.0
900	03510500	347	0.0	100.0	0.0	0.0	0.0

Table 7. Explanatory variables used in the regional regression equations for stations in North Carolina.—Continued

[USGS, U.S. Geological Survey; mi2, square mile; *, indicates that drainage area has been revised as a result of this study]

Map identification number (figs. 2 and 5)	USGS station number	Drainage area (mi^2)	Percentage of drainage basin in:				
			Hydrologic Region 1 (Ridge and Valley–Piedmont)	Hydrologic Region 2 (Blue Ridge)	Hydrologic Region 3 (Sand Hills)	Hydrologic Region 4 (Coastal Plain)	Hydrologic Region 5 (Southwest Georgia)
901	03511000	131	0.0	100.0	0.0	0.0	0.0
902	03512000	184	0.0	100.0	0.0	0.0	0.0
903	03513000	655	0.0	100.0	0.0	0.0	0.0
904	03513410	0.46	0.0	100.0	0.0	0.0	0.0
905	03513500	13.8	0.0	100.0	0.0	0.0	0.0
906	03514000	44.4	0.0	100.0	0.0	0.0	0.0
907	03516000	42	0.0	100.0	0.0	0.0	0.0
921	03546000	37.6	0.0	100.0	0.0	0.0	0.0
922	03548500	406	0.0	100.0	0.0	0.0	0.0
923	03550000	104	0.0	100.0	0.0	0.0	0.0
925	03554000	272	0.0	100.0	0.0	0.0	0.0

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
02053110 (21)	0.006	0.005	0.008	0.006	0.011	0.007	0.016	0.010	0.021	0.012	0.027	0.014	0.034	0.017	0.046	0.021
02053170 (22)	0.006	0.005	0.007	0.005	0.009	0.007	0.014	0.009	0.018	0.011	0.023	0.013	0.029	0.015	0.038	0.019
02053200 (23)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.013	0.010
02053500 (24)	0.006	0.004	0.007	0.005	0.010	0.007	0.014	0.009	0.018	0.011	0.023	0.013	0.029	0.015	0.037	0.019
02053510 (25)	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.004	0.006	0.005
02053550 (26)	0.006	0.005	0.008	0.006	0.012	0.008	0.018	0.011	0.025	0.013	0.032	0.016	0.041	0.019	0.055	0.023
02068500 (52)	0.003	0.003	0.004	0.004	0.006	0.005	0.010	0.007	0.013	0.009	0.018	0.011	0.023	0.014	0.031	0.017
02068610 (53)	0.002	< 1 mi²	0.003	< 1 mi²	0.005	< 1 mi²	0.007	< 1 mi²	0.009	< 1 mi²	0.012	< 1 mi²	0.015	< 1 mi²	0.020	< 1 mi²
02068660 (54)	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.016	0.011	0.021	0.014
02069030 (55)	0.004	0.004	0.007	0.005	0.009	0.007	0.015	0.009	0.020	0.012	0.026	0.014	0.033	0.017	0.044	0.021
02070500 (59)	0.001	0.001	0.001	0.001	0.002	0.002	0.004	0.003	0.005	0.005	0.008	0.006	0.010	0.008	0.015	0.011
02070810 (60)	0.005	0.004	0.007	0.005	0.010	0.007	0.016	0.010	0.022	0.012	0.029	0.015	0.037	0.018	0.049	0.022
02071000 (61)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003
02071410 (62)	0.005	0.004	0.007	0.005	0.009	0.006	0.013	0.009	0.017	0.011	0.022	0.013	0.027	0.015	0.036	0.019
02074000 (65)	0.006	0.005	0.008	0.006	0.012	0.008	0.017	0.010	0.023	0.012	0.029	0.015	0.036	0.017	0.047	0.021
02075160 (66)	0.006	0.005	0.008	0.006	0.010	0.007	0.015	0.009	0.020	0.012	0.026	0.014	0.033	0.017	0.044	0.021
02075230 (67)	0.002	0.002	0.003	0.003	0.004	0.004	0.007	0.005	0.010	0.007	0.013	0.009	0.017	0.011	0.023	0.014
02077200 (72)	0.003	0.003	0.004	0.003	0.005	0.004	0.008	0.006	0.010	0.008	0.014	0.010	0.018	0.012	0.025	0.015
02077210 (73)	0.005	< 1 mi²	0.007	< 1 mi²	0.010	< 1 mi²	0.015	< 1 mi²	0.021	< 1 mi²	0.027	< 1 mi²	0.035	< 1 mi²	0.046	< 1 mi²
02077240 (74)	0.005	0.004	0.006	0.005	0.009	0.006	0.014	0.009	0.018	0.011	0.024	0.013	0.030	0.016	0.040	0.020
02077250 (75)	0.010	0.007	0.014	0.008	0.020	0.010	0.030	0.013	0.039	0.016	0.049	0.019	0.061	0.022	0.078	0.026
02077310 (76)	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.005	0.008	0.007	0.010	0.008	0.014	0.010
02080500 (81)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002
02081000 (82)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007	0.012	0.009
02081060 (83)	0.008	0.006	0.009	0.006	0.013	0.008	0.018	0.011	0.024	0.013	0.031	0.015	0.039	0.018	0.052	0.022
02081110 (84)	0.004	0.003	0.005	0.004	0.008	0.006	0.011	0.008	0.015	0.010	0.019	0.012	0.024	0.014	0.032	0.017
0208111310 (85)	0.010	0.007	0.013	0.008	0.017	0.010	0.025	0.012	0.032	0.015	0.042	0.018	0.053	0.021	0.070	0.025
02081210 (86)	0.002	0.002	0.003	0.003	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.013	0.010	0.018	0.012
02081500 (87)	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.009	0.007
02081710 (88)	0.006	0.005	0.009	0.006	0.013	0.008	0.021	0.011	0.029	0.014	0.038	0.017	0.049	0.020	0.066	0.024
02081747 (89)	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.004	0.006	0.005	0.008	0.007	0.011	0.008	0.015	0.011
02081800 (90)	0.003	0.003	0.004	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.011	0.008	0.014	0.010	0.019	0.013
02082000 (91)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.008

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
02082500 (92)	0.004	0.004	0.006	0.004	0.008	0.006	0.011	0.008	0.015	0.010	0.019	0.012	0.024	0.014	0.032	0.018
02082540 (93)	0.012	< 1 mi²	0.016	< 1 mi²	0.022	< 1 mi²	0.033	< 1 mi²	0.042	< 1 mi²	0.054	< 1 mi²	0.066	< 1 mi²	0.086	< 1 mi²
02082585 (94)	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003
02082610 (95)	0.002	0.002	0.003	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.007	0.012	0.009
02082630 (96)	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.012	0.009	0.015	0.011	0.020	0.013
02082770 (97)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.004	0.007	0.005	0.009	0.007	0.013	0.009	0.018	0.012
02082835 (98)	0.005	0.004	0.007	0.005	0.010	0.007	0.016	0.010	0.021	0.012	0.028	0.015	0.036	0.017	0.048	0.022
02082950 (99)	0.001	0.001	0.001	0.001	0.002	0.002	0.004	0.003	0.006	0.005	0.009	0.007	0.012	0.009	0.017	0.012
02083000 (100)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.009
02083090 (101)	0.007	0.005	0.010	0.007	0.014	0.009	0.022	0.012	0.029	0.014	0.039	0.017	0.049	0.020	0.066	0.024
02083410 (102)	0.007	0.005	0.010	0.007	0.013	0.008	0.021	0.011	0.028	0.014	0.037	0.017	0.047	0.020	0.063	0.024
02083500 (103)	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.006
02083800 (104)	0.002	0.002	0.003	0.002	0.004	0.004	0.007	0.006	0.011	0.008	0.015	0.010	0.020	0.012	0.028	0.016
02084000 (105)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005
02084240 (106)	0.003	0.003	0.005	0.004	0.006	0.005	0.010	0.007	0.013	0.009	0.017	0.011	0.022	0.013	0.030	0.017
02084500 (107)	0.002	0.002	0.003	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.012	0.009	0.016	0.011
02084520 (108)	0.005	0.004	0.006	0.005	0.008	0.006	0.012	0.008	0.016	0.010	0.021	0.012	0.026	0.015	0.035	0.018
02084540 (109)	0.002	0.002	0.003	0.003	0.005	0.004	0.008	0.006	0.011	0.008	0.015	0.010	0.020	0.012	0.027	0.016
02084557 (110)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.004	0.007	0.005	0.009	0.007
02084570 (111)	0.006	0.005	0.008	0.006	0.011	0.007	0.017	0.010	0.022	0.012	0.029	0.015	0.036	0.018	0.048	0.021
02084909 (112)	0.003	0.002	0.004	0.003	0.005	0.004	0.008	0.006	0.011	0.008	0.014	0.010	0.018	0.012	0.023	0.015
02085000 (113)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.002	0.004	0.003	0.005	0.004	0.006	0.005	0.009	0.007
02085020 (114)	0.006	< 1 mi²	0.007	< 1 mi²	0.010	< 1 mi²	0.015	< 1 mi²	0.020	< 1 mi²	0.026	< 1 mi²	0.032	< 1 mi²	0.043	< 1 mi²
02085070 (115)	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.013	0.010
02085190 (116)	0.004	0.003	0.005	0.004	0.007	0.005	0.011	0.008	0.015	0.010	0.019	0.012	0.025	0.014	0.033	0.018
0208521324 (117)	0.002	0.002	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.012	0.009
0208524090 (118)	0.013	0.008	0.016	0.009	0.021	0.011	0.031	0.014	0.040	0.016	0.050	0.019	0.062	0.022	0.079	0.026
02085500 (119)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006
02086000 (120)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.009	0.007	0.012	0.009	0.016	0.011	0.023	0.014
0208650112 (121)	0.019	0.010	0.025	0.011	0.035	0.013	0.052	0.017	0.068	0.020	0.087	0.023	0.109	0.026	0.143	0.030
02086624 (122)	0.006	0.005	0.009	0.006	0.012	0.008	0.018	0.010	0.024	0.013	0.030	0.015	0.038	0.018	0.050	0.022
02087000 (123)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.009
0208700780 (124)	0.004	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.008	0.013	0.009	0.016	0.011	0.021	0.014

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
02087030 (125)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003
02087140 (126)	0.005	< 1 mi²	0.006	< 1 mi²	0.009	< 1 mi²	0.013	< 1 mi²	0.017	< 1 mi²	0.022	< 1 mi²	0.027	< 1 mi²	0.036	< 1 mi²
02087183 (127)	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.005	0.005	0.008	0.006
02087240 (128)	0.004	< 1 mi²	0.005	< 1 mi²	0.007	< 1 mi²	0.010	< 1 mi²	0.014	< 1 mi²	0.018	< 1 mi²	0.024	< 1 mi²	0.031	< 1 mi²
02087500 (129)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004
02087570 (130)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.004
02087580 (131)	0.003	0.002	0.003	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.012	0.008	0.015	0.010	0.020	0.013
02087910 (132)	0.005	0.004	0.007	0.005	0.010	0.007	0.015	0.009	0.020	0.012	0.026	0.014	0.034	0.017	0.044	0.021
02088000 (133)	0.002	0.002	0.002	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.012	0.008	0.016	0.011	0.022	0.014
02088140 (134)	0.006	0.005	0.009	0.006	0.013	0.008	0.021	0.011	0.029	0.014	0.038	0.017	0.048	0.020	0.065	0.024
02088210 (135)	0.008	0.006	0.011	0.007	0.016	0.009	0.025	0.013	0.034	0.015	0.045	0.018	0.058	0.021	0.077	0.026
02088420 (136)	0.008	0.006	0.010	0.007	0.013	0.008	0.019	0.011	0.024	0.013	0.031	0.015	0.040	0.018	0.052	0.022
02088470 (137)	0.002	0.002	0.003	0.003	0.004	0.004	0.007	0.005	0.009	0.007	0.012	0.009	0.015	0.010	0.020	0.013
02088500 (138)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.002	0.004	0.003	0.005	0.005	0.007	0.006	0.010	0.008
02089000 (139)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.008
0208925200 (140)	0.006	0.005	0.009	0.006	0.014	0.008	0.022	0.012	0.030	0.014	0.039	0.017	0.050	0.020	0.068	0.025
02089500 (141)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007
02090380 (142)	0.005	0.004	0.007	0.005	0.010	0.007	0.015	0.009	0.020	0.012	0.025	0.014	0.032	0.016	0.041	0.020
02090560 (143)	0.004	0.003	0.005	0.004	0.007	0.005	0.010	0.007	0.013	0.009	0.016	0.011	0.020	0.013	0.027	0.016
02090625 (144)	0.007	0.006	0.010	0.007	0.014	0.009	0.022	0.012	0.030	0.014	0.039	0.017	0.049	0.020	0.066	0.024
02090780 (145)	0.007	0.005	0.009	0.006	0.013	0.008	0.019	0.011	0.026	0.013	0.033	0.016	0.042	0.019	0.056	0.023
02090960 (146)	0.004	0.003	0.005	0.004	0.008	0.006	0.013	0.008	0.017	0.011	0.023	0.013	0.029	0.016	0.040	0.020
02091000 (147)	0.002	0.002	0.003	0.003	0.004	0.004	0.008	0.006	0.011	0.008	0.016	0.010	0.021	0.013	0.030	0.017
02091430 (148)	0.009	0.006	0.010	0.007	0.013	0.008	0.019	0.011	0.025	0.013	0.032	0.016	0.040	0.018	0.053	0.022
02091500 (149)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.008
02091700 (150)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.007	0.011	0.008	0.015	0.011
02091810 (151)	0.012	0.008	0.016	0.009	0.021	0.011	0.031	0.014	0.041	0.016	0.052	0.019	0.065	0.022	0.084	0.026
02091970 (152)	0.009	0.006	0.012	0.008	0.017	0.010	0.025	0.012	0.033	0.015	0.043	0.018	0.053	0.021	0.070	0.025
02092000 (153)	0.002	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.013	0.009
02092020 (154)	0.007	0.005	0.009	0.006	0.013	0.008	0.020	0.011	0.026	0.013	0.035	0.016	0.044	0.019	0.059	0.023
02092120 (155)	0.005	0.004	0.008	0.006	0.011	0.007	0.018	0.010	0.024	0.013	0.032	0.016	0.040	0.018	0.054	0.023
02092290 (156)	0.005	0.004	0.007	0.005	0.010	0.007	0.016	0.010	0.022	0.012	0.030	0.015	0.038	0.018	0.051	0.022
02092500 (157)	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.004	0.007	0.005	0.009	0.007	0.013	0.009	0.018	0.012

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
02092520 (158)	0.006	0.004	0.007	0.005	0.010	0.007	0.015	0.009	0.019	0.011	0.025	0.014	0.032	0.016	0.042	0.020
02092620 (159)	0.011	0.007	0.017	0.009	0.024	0.011	0.037	0.015	0.051	0.018	0.067	0.021	0.086	0.024	0.116	0.029
02092720 (160)	0.007	0.005	0.011	0.007	0.016	0.009	0.026	0.013	0.035	0.015	0.046	0.018	0.060	0.022	0.081	0.026
02092780 (161)	0.009	0.006	0.013	0.008	0.018	0.010	0.029	0.013	0.039	0.016	0.052	0.019	0.066	0.022	0.089	0.027
02093000 (162)	0.001	0.001	0.001	0.001	0.002	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.016	0.011
02093040 (163)	0.006	0.005	0.008	0.006	0.010	0.007	0.014	0.009	0.018	0.011	0.023	0.013	0.029	0.016	0.039	0.019
02093070 (164)	0.007	0.005	0.009	0.006	0.013	0.008	0.021	0.011	0.028	0.014	0.037	0.017	0.047	0.020	0.062	0.024
02093290 (165)	0.003	0.003	0.004	0.003	0.005	0.004	0.008	0.006	0.010	0.008	0.013	0.009	0.017	0.011	0.022	0.014
02093500 (166)	0.002	0.002	0.002	0.002	0.004	0.003	0.006	0.005	0.009	0.007	0.012	0.009	0.017	0.011	0.023	0.015
02093800 (167)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.008
02094000 (168)	0.002	0.002	0.003	0.002	0.004	0.003	0.007	0.005	0.010	0.007	0.013	0.009	0.018	0.012	0.025	0.015
02095000 (169)	0.002	0.002	0.003	0.003	0.004	0.004	0.007	0.006	0.011	0.008	0.015	0.010	0.019	0.012	0.027	0.016
02095500 (170)	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.004	0.006	0.005	0.009	0.007	0.012	0.009	0.017	0.012
02096500 (171)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007
02096660 (172)	0.006	0.005	0.008	0.006	0.010	0.007	0.016	0.010	0.020	0.012	0.026	0.014	0.033	0.017	0.044	0.021
02096700 (173)	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.004	0.006	0.005	0.008	0.007
02096740 (174)	0.012	0.008	0.017	0.009	0.023	0.011	0.035	0.015	0.047	0.017	0.061	0.020	0.078	0.024	0.103	0.028
02096846 (175)	0.003	0.003	0.004	0.004	0.006	0.005	0.010	0.007	0.013	0.009	0.017	0.011	0.021	0.013	0.029	0.016
02096850 (176)	0.004	0.003	0.005	0.004	0.006	0.005	0.009	0.007	0.012	0.008	0.015	0.010	0.019	0.012	0.025	0.015
02096960 (177)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003
02097010 (178)	0.004	0.003	0.005	0.004	0.007	0.005	0.010	0.007	0.014	0.009	0.018	0.011	0.023	0.014	0.030	0.017
02097314 (179)	0.008	0.006	0.010	0.007	0.013	0.008	0.020	0.011	0.026	0.013	0.034	0.016	0.043	0.019	0.057	0.023
0209741955 (180)	0.004	0.003	0.005	0.004	0.007	0.006	0.011	0.008	0.015	0.010	0.019	0.012	0.025	0.014	0.033	0.018
02097464 (181)	0.010	0.007	0.013	0.008	0.019	0.010	0.028	0.013	0.038	0.016	0.049	0.019	0.062	0.022	0.081	0.026
02097910 (182)	0.002	0.002	0.003	0.003	0.004	0.004	0.007	0.005	0.009	0.007	0.011	0.008	0.014	0.010	0.019	0.013
02098000 (183)	0.002	0.001	0.002	0.002	0.002	0.002	0.004	0.003	0.005	0.004	0.006	0.005	0.008	0.007	0.011	0.008
02098500 (184)	0.002	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.018	0.012
02099000 (185)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007
02099500 (186)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.004	0.007	0.006
02100500 (187)	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.003	0.003	0.005	0.004
02101000 (188)	0.003	0.003	0.005	0.004	0.007	0.005	0.012	0.008	0.016	0.010	0.022	0.013	0.029	0.016	0.040	0.020
02101030 (189)	0.003	0.003	0.004	0.004	0.006	0.005	0.009	0.007	0.012	0.008	0.016	0.010	0.020	0.013	0.027	0.016
02101480 (190)	0.005	< 1 mi²	0.006	< 1 mi²	0.008	< 1 mi²	0.012	< 1 mi²	0.015	< 1 mi²	0.019	< 1 mi²	0.025	< 1 mi²	0.032	< 1 mi²

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
0210166029 (191)	0.005	0.004	0.006	0.005	0.009	0.006	0.014	0.009	0.019	0.011	0.024	0.014	0.031	0.016	0.041	0.020
02101800 (192)	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.017	0.011	0.024	0.015
02101890 (193)	0.003	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.016	0.011	0.022	0.014
02102000 (194)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.005
02102500 (195)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005
02102908 (196)	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.014	0.010
02102910 (197)	0.005	0.004	0.008	0.006	0.011	0.008	0.018	0.010	0.024	0.013	0.032	0.016	0.041	0.018	0.055	0.023
02102930 (198)	0.004	0.004	0.005	0.004	0.007	0.005	0.011	0.007	0.014	0.009	0.018	0.011	0.023	0.014	0.030	0.017
02103000 (199)	0.002	0.002	0.003	0.003	0.004	0.003	0.006	0.005	0.007	0.006	0.009	0.007	0.011	0.009	0.015	0.011
02103390 (200)	0.003	0.003	0.005	0.004	0.007	0.005	0.010	0.007	0.013	0.009	0.018	0.011	0.022	0.013	0.030	0.017
02103500 (201)	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.008	0.015	0.011
02104000 (202)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005
02104080 (203)	0.006	0.004	0.008	0.006	0.011	0.007	0.017	0.010	0.022	0.012	0.029	0.015	0.036	0.018	0.048	0.021
02104220 (204)	0.003	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.005	0.008	0.007	0.010	0.008	0.014	0.010
02104500 (205)	0.005	0.004	0.007	0.005	0.009	0.006	0.014	0.009	0.018	0.011	0.023	0.013	0.029	0.016	0.039	0.019
02105500 (206)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003
02105570 (207)	0.013	0.008	0.020	0.010	0.028	0.012	0.044	0.016	0.059	0.019	0.077	0.022	0.099	0.025	0.131	0.030
02105630 (208)	0.007	0.005	0.011	0.007	0.015	0.009	0.024	0.012	0.033	0.015	0.043	0.018	0.055	0.021	0.074	0.025
02105769 (209)	0.003	0.003	0.005	0.004	0.006	0.005	0.009	0.007	0.012	0.008	0.015	0.010	0.019	0.012	0.024	0.015
02105900 (210)	0.003	0.003	0.004	0.004	0.006	0.005	0.009	0.007	0.013	0.009	0.017	0.011	0.022	0.013	0.030	0.017
02106000 (211)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.015	0.010	0.020	0.013
02106240 (212)	0.007	0.005	0.008	0.006	0.010	0.007	0.014	0.009	0.019	0.011	0.024	0.013	0.030	0.016	0.040	0.020
02106410 (213)	0.005	< 1 mi²	0.006	< 1 mi²	0.008	< 1 mi²	0.013	< 1 mi²	0.017	< 1 mi²	0.021	< 1 mi²	0.027	< 1 mi²	0.036	< 1 mi²
02106500 (214)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.015	0.011
02106910 (215)	0.006	0.005	0.009	0.006	0.013	0.008	0.021	0.011	0.029	0.014	0.039	0.017	0.050	0.020	0.068	0.025
02107000 (216)	0.001	0.001	0.002	0.002	0.002	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.012	0.009
02107500 (217)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.010	0.008	0.013	0.009	0.017	0.012
02107590 (218)	0.009	< 1 mi²	0.011	< 1 mi²	0.014	< 1 mi²	0.020	< 1 mi²	0.027	< 1 mi²	0.034	< 1 mi²	0.042	< 1 mi²	0.056	< 1 mi²
02107600 (219)	0.004	0.004	0.006	0.004	0.008	0.006	0.011	0.008	0.015	0.010	0.019	0.012	0.024	0.014	0.032	0.017
02107620 (220)	0.010	0.007	0.016	0.009	0.022	0.011	0.035	0.014	0.047	0.017	0.061	0.020	0.078	0.024	0.103	0.028
02107980 (221)	0.006	0.005	0.009	0.006	0.012	0.008	0.019	0.011	0.026	0.013	0.034	0.016	0.043	0.019	0.058	0.023
02108000 (222)	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.002	0.004	0.003	0.005	0.005	0.007	0.006	0.011	0.008
02108500 (223)	0.003	0.003	0.004	0.003	0.005	0.004	0.008	0.006	0.011	0.008	0.015	0.010	0.019	0.012	0.026	0.016

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
02108548 (224)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004
02108610 (225)	0.013	0.008	0.016	0.009	0.020	0.011	0.029	0.013	0.038	0.016	0.049	0.019	0.061	0.022	0.080	0.026
02108630 (226)	0.009	0.006	0.013	0.008	0.019	0.010	0.031	0.014	0.042	0.017	0.055	0.020	0.071	0.023	0.095	0.027
02108960 (227)	0.004	0.003	0.005	0.004	0.007	0.005	0.011	0.008	0.015	0.010	0.019	0.012	0.024	0.014	0.032	0.018
02109500 (228)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.010	0.008	0.015	0.011
02109640 (229)	0.006	0.005	0.008	0.006	0.011	0.007	0.016	0.010	0.022	0.012	0.028	0.015	0.035	0.017	0.047	0.021
02110020 (230)	0.009	0.006	0.011	0.007	0.015	0.009	0.023	0.012	0.030	0.014	0.039	0.017	0.050	0.020	0.066	0.024
02111000 (232)	0.002	0.001	0.002	0.002	0.003	0.003	0.006	0.005	0.009	0.007	0.012	0.009	0.017	0.011	0.024	0.015
02111180 (233)	0.002	0.002	0.002	0.002	0.003	0.003	0.006	0.005	0.009	0.007	0.012	0.009	0.016	0.011	0.023	0.015
02111340 (234)	0.004	0.004	0.006	0.005	0.009	0.006	0.014	0.009	0.019	0.011	0.025	0.014	0.032	0.016	0.042	0.020
02111500 (235)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.008
02112000 (236)	0.001	0.001	0.002	0.002	0.003	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.015	0.011	0.022	0.014
02112120 (237)	0.002	0.001	0.002	0.002	0.002	0.002	0.004	0.003	0.005	0.005	0.008	0.006	0.010	0.008	0.014	0.010
02112247 (238)	0.003	0.003	0.004	0.004	0.006	0.005	0.009	0.007	0.012	0.008	0.015	0.010	0.018	0.012	0.024	0.015
02112360 (239)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.004
02112410 (240)	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.008	0.013	0.010	0.017	0.012
02112500 (241)	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.013	0.009	0.016	0.012
02113000 (242)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.009
02113850 (243)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006
02114010 (244)	0.002	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.007	0.006	0.010	0.008
02114450 (245)	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.007	0.011	0.008	0.015	0.011
02115500 (246)	0.001	0.001	0.002	0.002	0.002	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.012	0.009
02115520 (247)	0.004	< 1 mi²	0.004	< 1 mi²	0.006	< 1 mi²	0.008	< 1 mi²	0.010	< 1 mi²	0.013	< 1 mi²	0.017	< 1 mi²	0.022	< 1 mi²
02115540 (248)	0.008	0.006	0.010	0.007	0.014	0.009	0.021	0.011	0.027	0.014	0.035	0.016	0.044	0.019	0.057	0.023
02115830 (249)	0.006	0.005	0.009	0.006	0.013	0.008	0.021	0.011	0.029	0.014	0.038	0.017	0.049	0.020	0.065	0.024
02115856 (250)	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.003	0.004	0.004	0.006	0.005
02115860 (251)	0.004	0.003	0.005	0.004	0.006	0.005	0.010	0.007	0.013	0.009	0.016	0.011	0.021	0.013	0.027	0.016
02115900 (252)	0.003	0.002	0.003	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.011	0.008	0.014	0.010	0.019	0.013
02116500 (253)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.009
02117030 (254)	0.008	0.006	0.010	0.007	0.013	0.008	0.020	0.011	0.026	0.013	0.033	0.016	0.042	0.019	0.055	0.023
02117410 (255)	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.004	0.006	0.005	0.008	0.007
02117500 (256)	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.014	0.010
02118000 (257)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.007	0.006	0.010	0.008

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
02118500 (258)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.005	0.005	0.007	0.006
02119000 (259)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.009
02120500 (260)	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.016	0.011	0.021	0.013
02120780 (261)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.014	0.010	0.020	0.013
02120820 (262)	0.007	0.005	0.008	0.006	0.011	0.007	0.016	0.010	0.021	0.012	0.026	0.014	0.033	0.017	0.043	0.020
02121000 (263)	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008
02121180 (264)	0.006	0.005	0.008	0.006	0.011	0.007	0.015	0.009	0.020	0.012	0.025	0.014	0.031	0.016	0.040	0.020
02121500 (265)	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.011	0.008	0.014	0.010
02121940 (266)	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.016	0.011	0.022	0.014
02122560 (267)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
02122720 (268)	0.005	0.004	0.007	0.005	0.011	0.007	0.017	0.010	0.023	0.013	0.030	0.015	0.039	0.018	0.052	0.022
02123500 (269)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.005	0.005	0.007	0.006
02123567 (270)	0.005	0.004	0.007	0.005	0.009	0.006	0.013	0.008	0.017	0.010	0.022	0.013	0.027	0.015	0.036	0.019
02124060 (271)	0.005	0.004	0.007	0.005	0.010	0.007	0.016	0.010	0.022	0.012	0.029	0.015	0.036	0.018	0.049	0.022
02124130 (272)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.014	0.010	0.018	0.012
02125000 (273)	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006
02125410 (274)	0.004	0.003	0.005	0.004	0.006	0.005	0.009	0.007	0.012	0.008	0.015	0.010	0.019	0.012	0.025	0.015
02126000 (275)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003
02127000 (276)	0.002	0.002	0.002	0.002	0.004	0.003	0.006	0.005	0.009	0.007	0.013	0.009	0.018	0.012	0.025	0.015
02127390 (277)	0.004	< 1 mi²	0.004	< 1 mi²	0.006	< 1 mi²	0.008	< 1 mi²	0.011	< 1 mi²	0.014	< 1 mi²	0.018	< 1 mi²	0.023	< 1 mi²
02128000 (278)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007
02128260 (279)	0.004	0.003	0.006	0.005	0.009	0.006	0.014	0.009	0.019	0.011	0.026	0.014	0.033	0.017	0.044	0.021
02129440 (280)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.007	0.006	0.010	0.007	0.012	0.009	0.016	0.011
02129530 (281)	0.007	< 1 mi²	0.010	< 1 mi²	0.014	< 1 mi²	0.021	< 1 mi²	0.028	< 1 mi²	0.036	< 1 mi²	0.044	< 1 mi²	0.058	< 1 mi²
02132230 (290)	0.005	0.004	0.007	0.005	0.010	0.007	0.015	0.009	0.020	0.012	0.027	0.014	0.034	0.017	0.045	0.021
02132320 (291)	0.003	0.003	0.004	0.003	0.006	0.004	0.008	0.006	0.011	0.008	0.014	0.010	0.018	0.012	0.023	0.015
02133500 (293)	0.001	0.001	0.002	0.002	0.003	0.003	0.006	0.005	0.008	0.006	0.012	0.009	0.016	0.011	0.023	0.014
02133590 (294)	0.002	0.002	0.003	0.003	0.004	0.003	0.006	0.005	0.007	0.006	0.010	0.007	0.012	0.009	0.016	0.011
02133624 (295)	0.002	0.002	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.005	0.008	0.007	0.011	0.008
02133960 (296)	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.013	0.010
02134380 (297)	0.002	0.002	0.003	0.003	0.004	0.003	0.006	0.005	0.008	0.006	0.010	0.007	0.012	0.009	0.016	0.011
02134480 (298)	0.004	0.003	0.005	0.004	0.007	0.005	0.010	0.007	0.013	0.009	0.017	0.011	0.022	0.013	0.029	0.017
02134500 (299)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
02137000 (304)	0.002	0.002	0.003	0.002	0.004	0.003	0.007	0.005	0.009	0.007	0.013	0.009	0.017	0.011	0.024	0.015
02137727 (305)	0.004	0.003	0.005	0.004	0.006	0.005	0.009	0.007	0.012	0.009	0.016	0.011	0.021	0.013	0.028	0.016
02138000 (306)	0.001	0.001	0.002	0.002	0.003	0.003	0.006	0.005	0.009	0.007	0.012	0.009	0.017	0.011	0.024	0.015
02138500 (307)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.008	0.006	0.011	0.008	0.016	0.011	0.022	0.014
02138680 (308)	0.005	< 1 mi²	0.006	< 1 mi²	0.008	< 1 mi²	0.011	< 1 mi²	0.015	< 1 mi²	0.019	< 1 mi²	0.024	< 1 mi²	0.031	< 1 mi²
02140980 (309)	0.006	0.005	0.008	0.006	0.011	0.007	0.016	0.010	0.021	0.012	0.028	0.014	0.035	0.017	0.046	0.021
02140991 (310)	0.007	0.005	0.009	0.006	0.012	0.008	0.019	0.011	0.025	0.013	0.032	0.016	0.041	0.018	0.054	0.023
02141130 (311)	0.008	0.006	0.010	0.007	0.013	0.008	0.019	0.011	0.025	0.013	0.031	0.015	0.038	0.018	0.048	0.022
02141890 (312)	0.004	0.003	0.005	0.004	0.007	0.005	0.011	0.008	0.014	0.009	0.019	0.012	0.024	0.014	0.032	0.017
02142000 (313)	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.018	0.012
02142480 (314)	0.005	0.004	0.007	0.005	0.009	0.006	0.014	0.009	0.018	0.011	0.024	0.013	0.030	0.016	0.040	0.020
0214253830 (315)	0.005	0.004	0.006	0.005	0.008	0.006	0.012	0.008	0.016	0.010	0.020	0.012	0.026	0.015	0.034	0.018
02142900 (316)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.013	0.010
02143000 (317)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.007	0.006	0.011	0.008
02143040 (318)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007
02143310 (319)	0.010	0.007	0.014	0.008	0.019	0.010	0.028	0.013	0.037	0.016	0.047	0.019	0.059	0.022	0.078	0.026
02143500 (320)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007	0.012	0.009
02144000 (321)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.018	0.012
02145000 (322)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.005	0.007	0.006
02146890 (323)	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.014	0.010
02146900 (324)	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.007	0.011	0.009
02149000 (328)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.003	0.003	0.005	0.004
02150420 (329)	0.004	0.003	0.004	0.004	0.005	0.004	0.008	0.006	0.010	0.007	0.013	0.009	0.016	0.011	0.021	0.014
02151000 (330)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007
02151500 (331)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005
02152100 (332)	0.002	0.002	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.008	0.007	0.011	0.008	0.015	0.011
02152420 (333)	0.003	0.003	0.004	0.003	0.006	0.005	0.009	0.007	0.012	0.009	0.016	0.011	0.021	0.013	0.027	0.016
02152500 (334)	0.001	0.001	0.001	0.001	0.001	0.001	0.003	0.002	0.004	0.003	0.005	0.005	0.007	0.006	0.010	0.008
02152610 (335)	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.012	0.009	0.016	0.012
03160610 (805)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.007	0.006	0.010	0.007	0.012	0.009	0.016	0.011
03161000 (806)	0.001	0.001	0.001	0.001	0.002	0.002	0.004	0.004	0.007	0.005	0.009	0.007	0.013	0.009	0.019	0.013
03162110 (807)	0.002	0.002	0.003	0.003	0.005	0.004	0.008	0.006	0.012	0.008	0.016	0.010	0.021	0.013	0.028	0.016
03162500 (808)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.008	0.006	0.011	0.008	0.015	0.010	0.021	0.013

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
03162880 (809)	0.006	0.004	0.008	0.006	0.012	0.008	0.018	0.010	0.024	0.013	0.031	0.015	0.039	0.018	0.051	0.022
03439000 (824)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006
03439500 (825)	0.002	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.012	0.009	0.016	0.011
03440000 (826)	0.004	0.003	0.005	0.004	0.006	0.005	0.009	0.007	0.013	0.009	0.017	0.011	0.022	0.013	0.029	0.017
03441000 (827)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.003	0.003	0.005	0.004	0.007	0.006
03441440 (828)	0.002	0.002	0.003	0.003	0.004	0.003	0.006	0.005	0.008	0.006	0.011	0.008	0.014	0.010	0.019	0.013
03441500 (829)	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.005	0.005	0.007	0.006
03442000 (830)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.008	0.014	0.010	0.019	0.013
03443000 (831)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.009	0.007	0.012	0.009
03444000 (832)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.008	0.006	0.010	0.008	0.013	0.010	0.019	0.013
03444500 (833)	0.002	0.002	0.004	0.003	0.005	0.004	0.009	0.006	0.012	0.008	0.016	0.011	0.022	0.013	0.030	0.017
03446000 (834)	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005
03446410 (835)	0.002	< 1 mi²	0.003	< 1 mi²	0.004	< 1 mi²	0.005	< 1 mi²	0.007	< 1 mi²	0.008	< 1 mi²	0.010	< 1 mi²	0.013	< 1 mi²
03446500 (836)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.009	0.007
03447000 (837)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.004	0.007	0.005	0.010	0.007	0.013	0.009	0.019	0.013
03447500 (838)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.008	0.014	0.010
03448000 (839)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007
03448500 (840)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.003	0.004	0.004	0.006	0.005	0.009	0.007	0.013	0.010
0344894205 (841)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.010	0.008	0.015	0.011
03449000 (842)	0.004	0.003	0.006	0.005	0.009	0.006	0.015	0.009	0.021	0.012	0.028	0.015	0.037	0.018	0.051	0.022
03450000 (843)	0.001	0.001	0.002	0.002	0.002	0.002	0.004	0.004	0.006	0.005	0.008	0.006	0.011	0.008	0.015	0.011
03451000 (844)	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.007
03451500 (845)	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003
03452000 (846)	0.003	0.003	0.005	0.004	0.007	0.005	0.010	0.007	0.014	0.009	0.018	0.011	0.022	0.013	0.029	0.017
03453000 (847)	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.009	0.007
03453500 (848)	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003
03453880 (849)	0.003	0.002	0.003	0.003	0.004	0.004	0.006	0.005	0.008	0.006	0.010	0.008	0.013	0.009	0.017	0.012
03454000 (850)	0.002	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.009	0.007	0.011	0.008	0.015	0.011
03454500 (851)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.006	0.005
03455500 (852)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007
03456500 (853)	0.001	0.001	0.002	0.002	0.002	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.010
03456991 (854)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.005
03457500 (855)	0.002	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.012	0.009	0.016	0.011

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi², not computed due to site drainage area less than 1 mi²; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
03459000 (856)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.006	0.005
03459500 (857)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.005
03460000 (858)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.004	0.005	0.005	0.008	0.006
03461910 (860)	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003
03462000 (861)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.008	0.014	0.010	0.019	0.013
03463300 (862)	0.002	0.002	0.003	0.002	0.004	0.004	0.007	0.005	0.010	0.007	0.014	0.010	0.018	0.012	0.026	0.015
03463500 (863)	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.009	0.019	0.013
03463910 (864)	0.003	0.003	0.005	0.004	0.007	0.005	0.010	0.007	0.013	0.009	0.017	0.011	0.021	0.013	0.028	0.016
03464000 (865)	0.001	0.001	0.002	0.002	0.003	0.002	0.005	0.004	0.008	0.006	0.011	0.008	0.015	0.010	0.022	0.014
03464500 (866)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.006	0.005	0.009	0.007	0.012	0.009
03478910 (875)	0.002	0.002	0.003	0.003	0.004	0.004	0.007	0.005	0.010	0.007	0.014	0.009	0.018	0.012	0.026	0.015
03479000 (876)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.004	0.006	0.005	0.008	0.007	0.011	0.009	0.016	0.011
03480540 (877)	0.004	< 1 mi²	0.005	< 1 mi²	0.007	< 1 mi²	0.010	< 1 mi²	0.013	< 1 mi²	0.016	< 1 mi²	0.020	< 1 mi²	0.025	< 1 mi²
03481000 (878)	0.001	0.001	0.002	0.002	0.003	0.002	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.010	0.019	0.013
03500000 (890)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.013	0.010
03500240 (891)	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.005	0.004	0.007	0.005	0.009	0.007	0.012	0.009
03501000 (892)	0.001	0.001	0.001	0.001	0.002	0.002	0.004	0.003	0.006	0.005	0.008	0.007	0.011	0.009	0.016	0.011
03501760 (893)	0.008	0.006	0.009	0.006	0.012	0.008	0.016	0.010	0.021	0.012	0.027	0.014	0.033	0.017	0.043	0.020
03502000 (894)	0.001	0.001	0.001	0.001	0.002	0.001	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.008
03503000 (895)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.003	0.003	0.004	0.004
03504000 (896)	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.003	0.003	0.005	0.004
03506500 (897)	0.002	0.002	0.003	0.002	0.004	0.003	0.006	0.005	0.008	0.006	0.010	0.007	0.012	0.009	0.016	0.012
03507000 (898)	0.001	0.001	0.002	0.001	0.002	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.010	0.007	0.013	0.010
03509000 (899)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.004	0.007	0.006
03510500 (900)	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.005	0.008	0.006
03511000 (901)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.004	0.006	0.005
03512000 (902)	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002
03513000 (903)	0.001	0.001	0.002	0.002	0.002	0.002	0.004	0.003	0.005	0.004	0.007	0.006	0.009	0.007	0.013	0.009
03513410 (904)	0.008	< 1 mi²	0.011	< 1 mi²	0.016	< 1 mi²	0.024	< 1 mi²	0.032	< 1 mi²	0.041	< 1 mi²	0.052	< 1 mi²	0.068	< 1 mi²
03513500 (905)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.004	0.007	0.006
03514000 (906)	0.005	0.004	0.007	0.005	0.010	0.007	0.015	0.009	0.019	0.011	0.024	0.013	0.029	0.016	0.038	0.019
03516000 (907)	0.003	0.003	0.005	0.004	0.007	0.005	0.010	0.007	0.013	0.009	0.017	0.011	0.021	0.013	0.027	0.016
03546000 (921)	0.005	0.004	0.008	0.006	0.011	0.007	0.017	0.010	0.023	0.013	0.030	0.015	0.038	0.018	0.050	0.022

Table 13. Variance of prediction values for streamgaging stations in North Carolina that were considered for use in the regression equations.—Continued

[USGS, U.S. Geological Survey; variances are in log units; number shown in parentheses beside USGS station number is map identification number (see figure 2); G, computed from the Bulletin 17B analysis of the streamgaging station; W, weighted using equation 22; <1 mi^2, not computed due to site drainage area less than 1 mi^2; br, site not included in regression analyses due to basin redundancy with adjacent site on same stream. Variance values associated with regression estimates are shown in table 9]

USGS station number	50-percent chance exceedance		20-percent chance exceedance		10-percent chance exceedance		4-percent chance exceedance		2-percent chance exceedance		1-percent chance exceedance		0.5-percent chance exceedance		0.2-percent chance exceedance	
	G	W	G	W	G	W	G	W	G	W	G	W	G	W	G	W
03548500 (922)	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.002	0.002	0.003	0.003	0.004	0.003	0.005	0.005
03550000 (923)	0.000	0.000	0.001	0.001	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.005	0.008	0.006
03554000 (925)	0.001	0.001	0.002	0.002	0.003	0.002	0.004	0.003	0.005	0.005	0.007	0.006	0.009	0.007	0.013	0.010

Appendix

Development of Generalized Skew Coefficient

By Andrea M. Gruber and Dr. Jery R. Stedinger, Cornell University, Ithaca, New York

Tasker and Stedinger (1986) developed a weighted least-squares (WLS) procedure for estimating generalized skew coefficients based on sample skew coefficients corresponding to the logarithms of peak-flow data. They illustrated how a regional analysis of skewness estimators must take into account the precision of the skewness estimator for each gaged station, which depends on the length of record for each station. More recently, Reis and others (2005) and Gruber and others (2007) developed a Bayesian generalized least-squares (GLS) regression model. While WLS regression accounts for the precision of the regional model and the effect of record length on the variance of skewness estimators, GLS regression also considers the cross-correlation of the skewness estimators, which is an important distinction. The new Bayesian GLS regression procedures have other advantages, including a description of the precision of the estimated model error variance, a pseudo-analysis of variance, and better diagnostic statistics.

The basic GLS model for generalized skew when k explanatory variables are included is as follows:

$$g = X\beta + \varepsilon, \tag{A1}$$

where

- g is a (n x 1) vector of the estimated station skew coefficients for every station,
- X is a (n x m) matrix of k basin characteristics with a column of ones corresponding to a constant in the model, $m = k+1$,
- β is a (m x 1) vector of model coefficients, and
- ε is the (n x 1) vector of model and sampling errors where $E[\varepsilon] = 0$ and Λ is the covariance matrix $E[\varepsilon\,\varepsilon^T]$.

Following Reis and others (2005), the matrix Λ can be written as $\sigma_\delta^2 I + \Sigma(g)$ wherein σ_δ^2 is the model error variance describing the precision with which the proposed model $X\beta$ can predict the true skews, which are denoted γ_i, and the matrix $\Sigma(g)$ contains the sampling variances and covariances of the skewness estimators g_i. The GLS estimator of β is:

$$\hat{\beta} = \left(X^T \Lambda^{-1} X\right)^{-1} X^T \Lambda^{-1} g. \tag{A2}$$

One wants to find a model with a small value of σ_δ^2, where the value of $\Sigma(g)$ is determined by the length of record at each gaged station and the cross-correlation of the concurrent flows.

A critical step in GLS analysis is estimation of the cross correlation of the skewness estimators g_i. Martins and Stedinger (2002) used Monte Carlo experiments to derive a relation between the cross-correlation of the skew-coefficient estimators at two stations i and j as a function of the cross-correlation of concurrent annual maximum flows, ρ_{ij}:

$$\hat{\rho}\left(g_i, g_j\right) = Sign\left(\rho_{ij}\right) cf_{ij} \left|\rho_{ij}\right|^{\kappa}, \tag{A3}$$

where

- $\rho(g_i, g_j)$ is the cross-correlation of the skew-coefficient estimators at two stations i and j,
- g_i and g_j are the station skew coefficients for sites i and j,
- ρ_{ij} is the cross-correlation of concurrent annual maximum flows for two gaged stations,

$$cf_{ij} = n_{ij} / \sqrt{\left(n_{ij} + n_i\right)\left(n_{ij} + n_j\right)},$$

- n_{ij} is the length of the period of concurrent record,
- n_i and n_j are the numbers of non-concurrent observations corresponding to sites i and j, respectively, and
- κ is a constant between 2.8 and 3.3.

The factor cf_{ij} accounts for the sample-size difference between stations and the concurrent record lengths.

Data Compilation

The annual peak-flow data from 489 gaged stations compiled for this Bayesian GLS regression study of generalized skew are located in seven States in the southeastern United States. As shown in table B1, most stations are in Georgia, North Carolina, and South Carolina. The locations of the streamgages employed in the study are shown in figure B1. Symbols indicate to which of nine U.S. Environmental Protection Agency (USEPA) ecoregions each gage was assigned:

Blue Ridge, Central Appalachians, Middle Atlantic Coastal Plain, Piedmont, Ridge and Valley, Sand Hills, Southeastern Plains, Southern Coastal Plain, and Southwestern Appalachians (U.S. Environmental Protection Agency, 2007).

Table A1. Number of streamgaging stations, by State, used in the study.

State	Number of gaged stations
Alabama	25
Florida	19
Georgia	169
North Carolina	127
South Carolina	38
Tennessee	64
Virginia	47

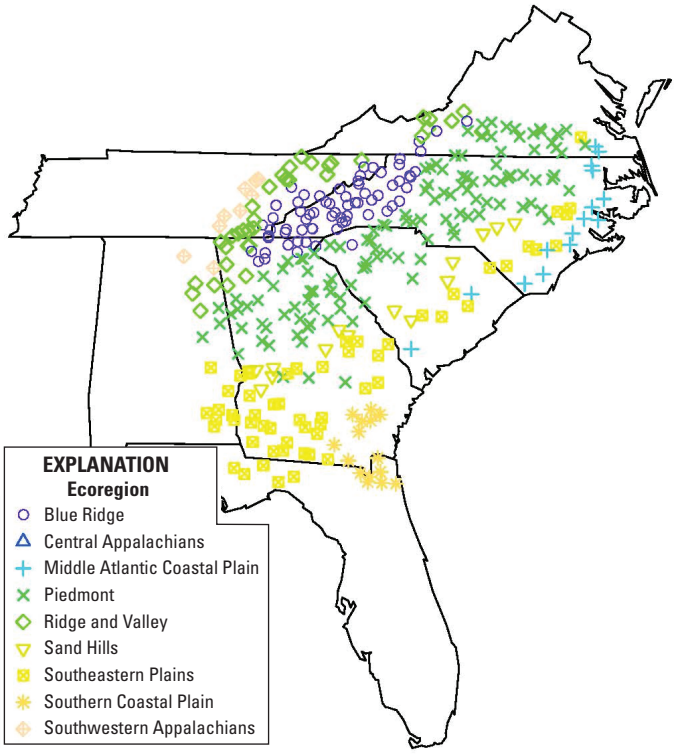

Figure A1. Locations of streamgaging stations used in the generalized skew study (courtesy of Timothy A. Cohn, U.S. Geological Survey, Office of Surface Water).

The following 20 basin characteristics were computed for the stations and considered in the current study: drainage area, basin perimeter, mean basin slope, basin shape factor, main channel length, main channel slope, minimum basin elevation, maximum basin elevation, mean basin elevation, percentage of basin that is impervious, percentage of basin that is forested, mean annual precipitation, 2-year 24-hour precipitation, 10-year 24-hour precipitation, 25-year 24-hour precipitation, 50-year 24-hour precipitation, 100-year 24-hour precipitation, soil drainage index, hydrologic soil index, and drainage density.

Analysis of pairs of gaged stations with concurrent records greater than 30 years revealed many station pairs with very large cross-correlations. Cross-correlations at 13 pairs of stations were in excess of 0.98. Among 489 stations, 38 pairs had 30 concurrent years of flows and a sample correlation greater than 0.95. These results indicate a physical redundancy. A normalized distance *ND* was defined to be

$$ND = \frac{D_{ij}}{\left[A_i A_j\right]^{1/4}}, \tag{A4}$$

where

D_{ij} is the distance between centroids of basin i and basin j, and

A_i and A_j are the drainage areas for basin i and basin j.

The fourth root is required to make *ND* dimensionless. The drainage area ratio (*DAR*) is

$$DAR = Max\left[\frac{A_i}{A_j}, \frac{A_j}{A_i}\right]. \tag{A5}$$

Simple examples indicate that station pairs with *ND* less than (<) 0.5 and *DAR* <5 are likely to be physically nested, and observed cross-correlations are consistent with this hypothesis. A screening analysis of all 489 gaged stations flagged station pairs with *ND* <0.5 and *DAR* <5 as redundant pair stations. If the station with the smaller drainage area had 30 years or more of record, the station with the larger drainage area was removed from the analysis. Similarly, if the smaller station had less than 30 years of record and the record length of the smaller station was greater than the record length of the larger station by 5 or more years, the station with the larger drainage area was removed from the analysis. Otherwise, the station with the smaller drainage area was removed.

Of the 489 gaged stations, 92 stations were removed from the analysis because of redundancy. In addition, 59 stations had censored data (observations recorded at less than a recording threshold), so these stations were not used in the analysis. Thus, in addition to the 92 redundant stations removed from the study, some of which also had censored data, 55 stations were removed because they contained censored data, leaving a total of 342 stations that were used in the generalized skew coefficient study.

Cross Correlation of Concurrent Flows

As stated in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982), the log-Pearson Type III distribution is recommended to define annual flood series. This distribution is characterized by three parameters—the mean, the standard deviation, and the skew. Reis and others (2005) illustrate how regional regression models can be developed for generalized skew estimators that can be used in conjunction with station skews to produce a weighted skew estimator as noted in Bulletin 17B. The GLS regression framework requires that the correlations among skew estimators be specified to reflect the sampling characteristics of the estimators. As noted above, Martins and Stedinger (2002) provided approximations for the cross-correlation of the skewness estimators as a function of the cross-correlation of concurrent annual peak flows used to compute the skewness coefficients and characteristics of the record lengths.

A relation was derived between the cross-correlation of the concurrent annual peak flows ρ_{ij} and covariates, including the distance between the centroids D_{ij} of two basins. A number of different functional forms were explored using these different covariates. The adopted model for the cross-correlations of concurrent annual peak flows at two stations as a function of the distance between the centroids is

$$\rho_{ij} = \frac{\exp\left(2Z_{ij}\right)-1}{\exp\left(2Z_{ij}\right)+1}, \qquad \text{(A6)}$$

where

$$Z_{ij} = 0.136 + \exp\left(0.290 - 0.042D_{ij}^{0.609}\right).$$

Based on 1,317 station pairs with at least 70 concurrent years of record, a regression analysis indicated that this model is as accurate as having 150 years of concurrent annual peak flows to estimate a cross-correlation. For the current study, the distance between centroids of the drainage basins is used instead of the distance between gaged stations, which generally has been employed in other studies. The distance between the centroids is thought to be a better measure of separation.

Bayesian GLS Regression

After identifying and screening redundant gaged stations and developing a model of the cross-correlations of annual peak flows, Bayesian GLS regression was used on the remaining 342 gaged stations to identify the best regional estimators of the generalized skew coefficients. The results for the three best Bayesian GLS skew regression models and the constant Bayesian GLS skew regression model for the 342 stations are listed in table B2. Model B-GLS C is the constant model; model B-GLS 1 includes a constant and an indicator for the Blue Ridge ecoregion; model B-GLS 2 includes a constant and an indicator for the Middle Atlantic Coastal Plain eco-region; and model B-GLS 3 includes a constant and an indicator for both the Blue Ridge and Middle Atlantic Coastal Plain ecoregions.

Table A2. Summary statistics for the Bayesian GLS models for generalized skew coefficient.

[σ_δ^2, model error variance; *ASV*, average sampling variance; AVP_{new}, average variance of prediction for a new site; pseudo R^2, coefficient of determination appropriate for generalized least-squares regression; standard errors and Bayesian p-values, in percent (%), are in parentheses; —, not applicable]

Model	Coefficients			σ_δ^2	*ASV*	AVP_{new}	Pseudo R^2
	Constant	Blue Ridge ecoregion	Middle Atlantic Coastal Plain ecoregion				
B-GLS C	–0.019 (0.063)	—	—	0.139 (0.021)	0.004	0.143	0.0%
B-GLS 1	0.003 (0.063)	0.003 (0.001) (0.6%)	—	0.134 (0.021)	0.006	0.140	3.3%
B-GLS 2	–0.021 (0.063)	—	0.005 (0.002) (0.3%)	0.134 (0.021)	0.005	0.139	3.6%
B-GLS 3	0.003 (0.063)	0.003 (0.001) (0.3%)	0.005 (0.002) (0.2%)	0.129 (0.034)	0.007	0.136	6.9%

None of the available explanatory variables was of much value in explaining the variation of skew from site to site. The indicators for the Blue Ridge and Middle Atlantic Coastal Plain had only marginal values, with a pseudo R^2 together of only 6.9 percent. The pseudo R^2 values describe the fraction of the variability in the true skews explained by each model (Gruber and others, 2007). A constant model does not explain any variability so the pseudo R^2 is equal to 0.0 percent. Analysis of the spatial pattern of the sample skews did not reveal any pattern that appeared to be statistically significant. Figure B2 displays the data in a way that would allow one to see the relations between the sample skew estimators, physiographic province, and drainage area. No relations are evident, which reaffirms the conclusions of the statistical analysis.

The generalized skew model recommended by the current study is the constant model with a generalized skew coefficient equal to –0.019 and corresponding mean square error (MSE) of prediction that is equal to 0.143. Because the generalized skew regression model is constant, the variance of prediction also is constant.

As shown in table B2, the posterior mean of the model error variance, σ_δ^2, for the constant model is 0.139 with a standard error of 0.021. This standard error of the model error variance is much smaller than those obtained in previous Bayesian GLS studies because of the large number of stations used in the current study. The constant model has an average variance of prediction (AVP) at a new station equal to 0.143. Setting this AVP equal to the mean square error of a biased sample skewness estimator yields an effective record length (ERL) of about 39 years. The AVP corresponds to the MSE given in Bulletin 17B to describe the precision of the generalized skew. The low AVP is a substantial improvement over the skew map value with a MSE of 0.302 in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) and a corresponding effective record length of 17 years.

The use of B-GLS is important. A sensitivity analysis revealed that Bayesian weighted least-squares (B-WLS) would have overestimated the precision (sampling error variance) of the estimated constant skew by a factor of 5.4. Thus, to neglect the cross-correlation of the skewness estimators would have resulted in a major distortion in the estimated precision of the overall average skew and the differences among ecoregions. On average, the variance of the sample station skewness estimators (g) was more than twice as large as the variance (σ_δ^2) of the regional model errors.

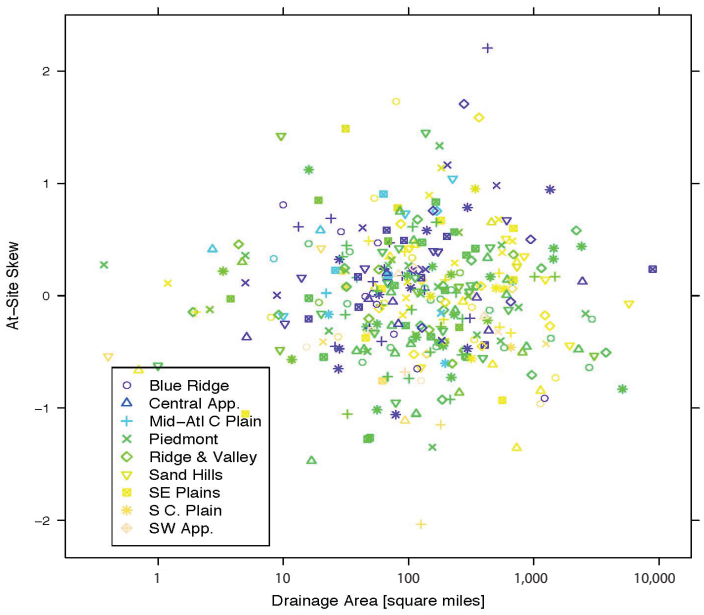

Figure A2. Relation of station skews to basin drainage area by U.S. Environmental Protection Agency ecoregion (courtesy of Timothy A. Cohn, U.S. Geological Survey, Office of Surface Water).

Conclusions

Based on a Bayesian generalized least-squares analysis of the selected 342 stations, a constant generalized skew was selected for the Southeast described by the following equation:

$$\hat{\gamma} = -0.019 \qquad \text{(A7)}$$

with a MSE of 0.143. More complicated models were evaluated but resulted in very modest improvements in accuracy. Thus, the more complicated models did not seem justified in view of the increased complexity. The constant model with a MSE of 0.143 is a definite improvement when compared with the Bulletin 17B skew map which reported a MSE of 0.302. Much of the difference occurs because the GLS analysis correctly reflects the difference between the sampling error in station skew coefficient estimators and the precision of the regional model (Hardison, 1971; Stedinger and Tasker, 1985; and Tasker and Stedinger, 1986).

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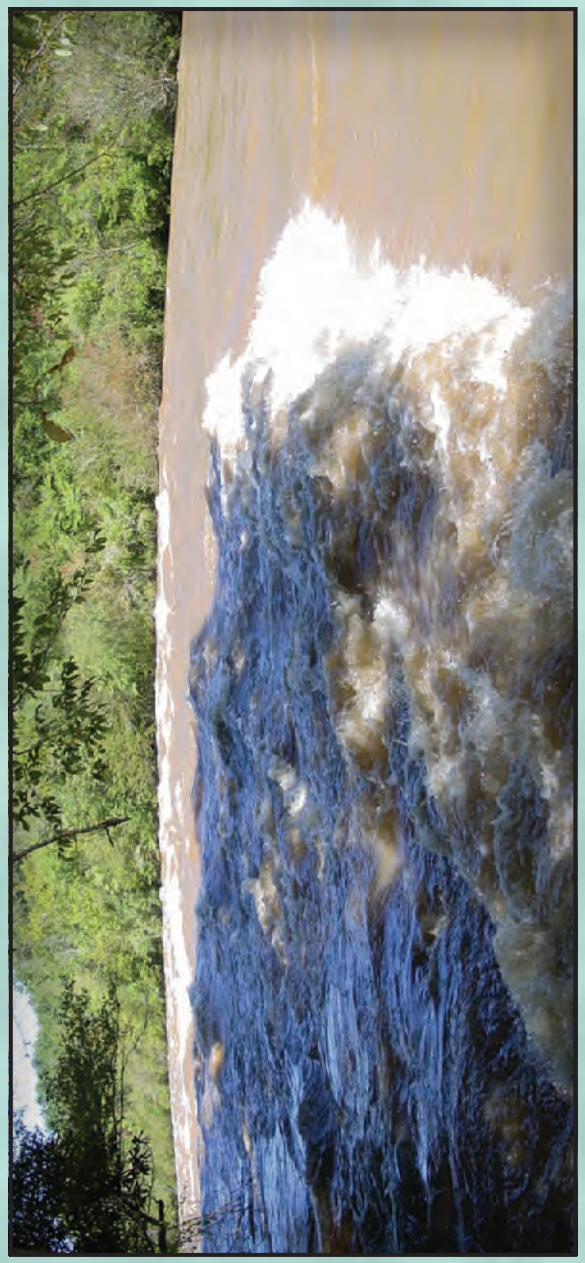
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