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Estimation of Flood-Frequency Discharges for Rural, Unregulated Streams in West Virginia

Scientific Investigations Report 2010–5033

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

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By Jeffrey B. Wiley and John T. Atkins, Jr.

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Conversion Factors, Datums, Acronyms, and Abbreviations

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
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)
cubic foot per second per square mile [$(ft^3/s)/mi^2$]	0.01093	cubic meter per second per square kilometer [$(m^3/s)/km^2$]

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).

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

Acronyms

GLSNet USGS software for computing generalized least-square regression

LOESS Locally weighted regression

PeakFQ USGS software for computing flood-frequency discharges

S-PLUS Commercially available software for computing statistics

USGS U. S. Geological Survey

SWSTAT USGS software for computing surface-water statistics

Abbreviations

AOP Annual-occurrence probability

A_U Drainage area at the location of the unknown flood-frequency discharge

A_K Drainage area at the location of the known flood-frequency discharge

A_{US} Drainage area at the upstream location

A_{DS} Drainage area at the downstream location

AOP Annual-occurrence probability

DRNAREA Drainage area

EX Exponent for drainage-area ratios

E_Y Equivalent years of record

K Frequency factor

MSE Mean-square error

N Number of years of peak-discharge record

Q Discharge

Q_{DS} Flood-frequency discharge at the downstream location

Q_K Known flood-frequency discharge

Q_{KE} Regional equation evaluated at the location of the known flood-frequency discharge

Q_r Flood-frequency discharge determined from the appropriate regional equation

Q_s Flood-frequency discharge determined from systematic and historical record

Q_U Unknown flood-frequency discharge

Q_{UE} Regional equation evaluated at the location of the unknown flood-frequency discharge

Q_{US} Flood-frequency discharge at the upstream location

Q_w Discharge weighted by number of years of peak-discharge record at the gaging station and equivalent years of record for the appropriate regional equation

Q(n) Discharge for the n-year recurrence interval

R_{DS} Downstream limit of the ratio of drainage areas

$R_{U/K}$ Ratio of the drainage area at the location of the unknown flood-frequency discharge to the drainage area at the location of the known flood-frequency discharge

R_{US} Upstream limit of the ratio of drainage areas

S_P Standard deviation of the $\log_{10}$-transformed annual peak discharges

X Log_{10}-transformed annual peak discharges

X_{mean} Mean of the $\log_{10}$-transformed annual peak discharges

Estimation of Flood-Frequency Discharges for Rural, Unregulated Streams in West Virginia

By Jeffrey B. Wiley And John T. Atkins, Jr.

Abstract

Flood-frequency discharges were determined for 290 streamgage stations having a minimum of 9 years of record in West Virginia and surrounding states through the 2006 or 2007 water year. No trend was determined in the annual peaks used to calculate the flood-frequency discharges.

Multiple and simple least-squares regression equations for the 100-year (1-percent annual-occurrence probability) flood discharge with independent variables that describe the basin characteristics were developed for 290 streamgage stations in West Virginia and adjacent states. The regression residuals for the models were evaluated and used to define three regions of the State, designated as Eastern Panhandle, Central Mountains, and Western Plateaus. Exploratory data analysis procedures identified 44 streamgage stations that were excluded from the development of regression equations representative of rural, unregulated streams in West Virginia. Regional equations for the 1.1-, 1.5-, 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year flood discharges were determined by generalized least-squares regression using data from the remaining 246 streamgage stations. Drainage area was the only significant independent variable determined for all equations in all regions.

Procedures developed to estimate flood-frequency discharges on ungaged streams were based on (1) regional equations and (2) drainage-area ratios between gaged and ungaged locations on the same stream. The procedures are applicable only to rural, unregulated streams within the boundaries of West Virginia that have drainage areas within the limits of the stations used to develop the regional equations (from 0.21 to 1,461 square miles in the Eastern Panhandle, from 0.10 to 1,619 square miles in the Central Mountains, and from 0.13 to 1,516 square miles in the Western Plateaus). The accuracy of the equations is quantified by measuring the average prediction error (from 21.7 to 56.3 percent) and equivalent years of record (from 2.0 to 70.9 years).

Introduction

Many engineering projects are built within or adjacent to flood-prone areas. Information on past flooding and estimates of the magnitude and frequency of potential future floods are critical to the safe and economical design of hydraulic structures such as bridges, culverts, dams, flood dikes, and levees.

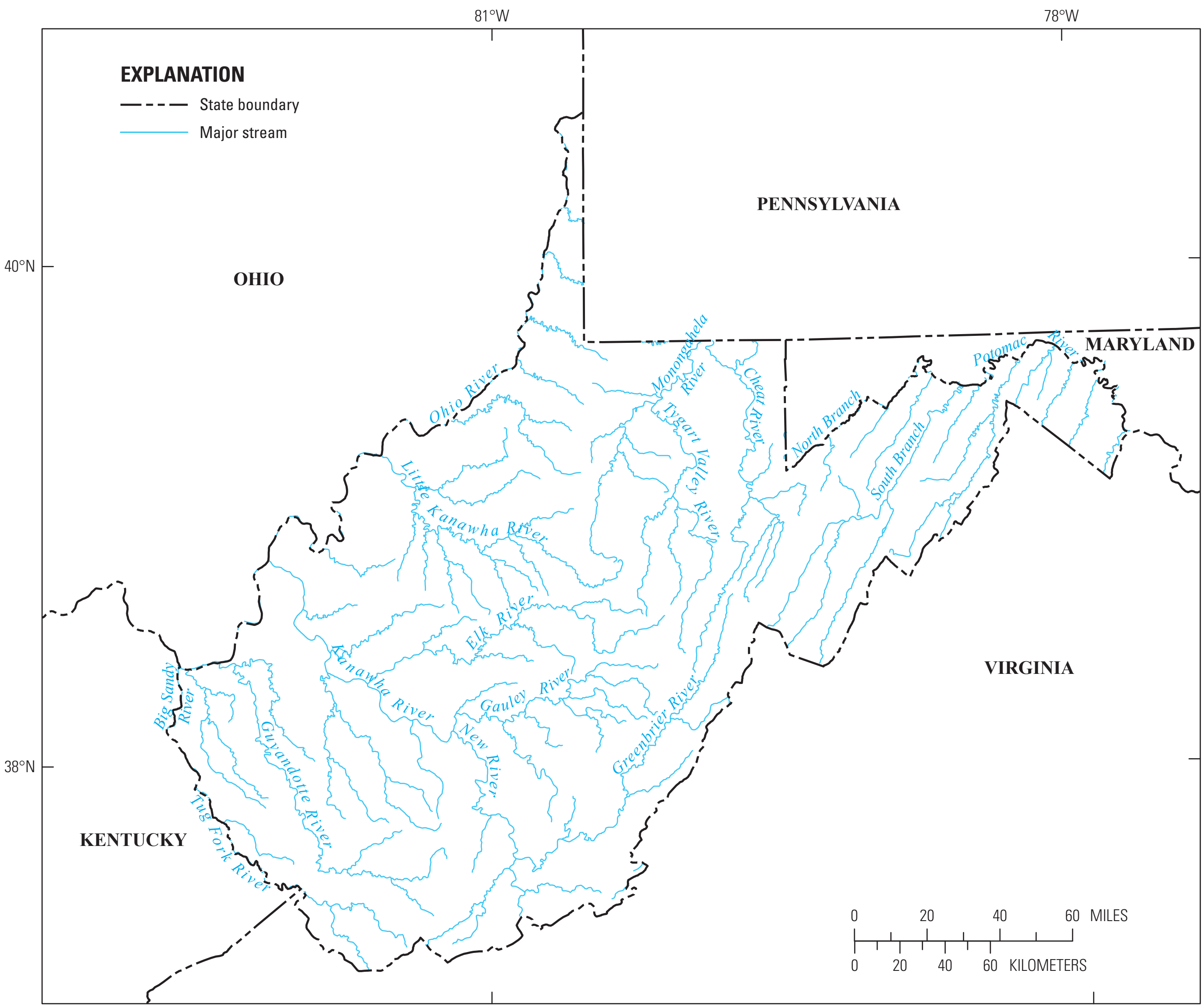
Regional Historical Floods

Before 1930, neither floods nor streamflow in West Virginia were systematically documented. Since 1930, data on regional flooding has been collected as part of the operation of a statewide streamgaging network supported by State and Federal funding. Local floods in small, ungaged watersheds remain only sparsely quantified. Major regional floods affecting parts of West Virginia occurred in 1844, 1877, 1878, 1888, 1889, 1912, 1918, 1932, 1936, 1949, 1963, 1967, 1977, 1984, 1985, and 1996. For floods prior to 1930, the regional extent is not defined, but rivers other than those identified in West Virginia may have been affected. Locations of selected West Virginia streams are shown in figure 1. A list of flood dates with a brief description of the flood and the report that documents the flood follows.

- **July 1844:** Flooding on the Cheat River was documented by Speer and Gamble (1965, p. 148). This flood was about equal in magnitude to those in July 1888 and May 1996.

- **November 1877:** Flooding on the South Branch Potomac River was documented by Tice (1968, p. 488, 490). This flood was about equal in magnitude to those in March 1936 and September 1996.

- **September 1878:** Flooding on the New River was documented by Speer and Gamble (1965, p. 284–288).



Base from U.S. Geological Survey 1:100,000 digital line graphics.
Universal Transverse Mercator projection, zone 17, NAD 83.

Figure 1. Selected streams used for identifying regional extent of historic floods in West Virginia.

- **July 1888:** Flooding on the Monongahela River was documented by Speer and Gamble (1965, p. 121, 138, 146–149). This flood was about equal in magnitude to those in July 1844 on the Cheat River and May 1996 on the Cheat and upper Monongahela Rivers.
- **May–June 1889:** Flooding on the North Branch Potomac River was documented by Tice (1968, p. 480, 490, 494, 497). This flood was about equal in magnitude to those in March 1936 and September 1996.
- **July 1912:** Flooding on the Tygart Valley River was documented by Speer and Gamble (1965, p. 118, 121, 127–128).
- **March 1918:** Flooding on the Greenbrier and Gauley Rivers was documented by Speer and Gamble (1965, p. 298, 310).
- **February 1932:** Flooding on the Tygart Valley, Greenbrier, and Gauley Rivers was documented by Speer and Gamble (1965, p. 119, 121, 129, 295, 298, 304, 307, 310).
- **March 1936:** Flooding was documented on the Potomac and Cheat Rivers. This flood, which was documented by Grover (1937) as having a regional extent including the upper Ohio, Potomac, and James Rivers (the James River in Virginia), was caused by four separate cyclonic storms passing over the northeastern United States, resulting in multiple peak discharges and superposition of later peak discharges on earlier peak discharges. This flood was about equal in magnitude to those in November 1877 on the South Branch Potomac River, May through June 1889 on the North Branch Potomac River, and September 1996 on the upper Potomac River (both North and South Branch).
- **June 1949:** Flooding on the South Branch Potomac River was documented by Tice (1968, p. 483–488).
- **March 1963:** Flooding was documented on the Big Sandy (including the Tug Fork in West Virginia), Guyandotte, Little Kanawha, Cheat, and Greenbrier Rivers. This flood, which was documented by Barnes (1964) as having affected the western slopes of the Appalachian Mountains from Alabama to West Virginia, was caused by three separate frontal storms in which rain fell on a snowpack and was followed by two additional storms.
- **March 1967:** Flooding was documented on the Kanawha and Monongahela Rivers. This flood was caused by 4 to 5 in. of rainfall over 3 days, augmented by runoff from melting snow (U.S. Geological Survey, 1991).
- **April 1977:** Flooding was documented on the Tug Fork and Guyandotte Rivers. This flood was documented by Runner (1979) and Runner and Chin (1980) as having affected northeastern Tennessee, southwestern Virginia, eastern Kentucky, and southern West Virginia. This flood resulted from a frontal storm that moved southeastward through the region, became stationary, then moved slowly northwestward drawing a warm moist maritime airmass from the Gulf of Mexico and combining to produce heavy rainfall. The highest peak discharges ever recorded on the Tug Fork and Guyandotte Rivers resulted from this storm.
- **May 1984:** Flooding was documented on the Tug Fork and Guyandotte Rivers (U.S. Geological Survey, 1991).
- **November 1985:** Flooding was documented on the Monongahela, Potomac, upper Little Kanawha, upper Elk, and upper Greenbrier Rivers. This flood was documented by Lescinsky (1987) and Carpenter (1990) as having affected eastern West Virginia, western and northern Virginia, southwestern Pennsylvania, and western Maryland. This flood resulted from a complex sequence of meteorological events. Hurricane Juan moved from the Gulf of Mexico through southern Mississippi, ultimately causing precipitation as far north as Michigan and generating less than 2 in. of rainfall in West Virginia. This rainfall was caused by a second low pressure system that developed from the hurricane remnants. The low pressure developed near the Tennessee-North Carolina border and traveled rapidly eastward to the Atlantic Ocean. A third low pressure system moved from the Gulf of Mexico into the Florida panhandle then moved slowly up the east coast of the United States, resulting in additional rainfall in West Virginia of up to 9 in. The highest peak discharges ever recorded on the upper Monongahela and Potomac Rivers resulted from this flood.
- **January 1996:** About 2 in. of rain fell on a 3 to 4 ft snowpack, resulting in flooding in the upper Potomac, upper Cheat, upper Elk, and Greenbrier Rivers.
- **May 1996:** A frontal storm caused flooding on the Cheat and upper Monongahela Rivers that was about equal in magnitude to flooding on the Cheat River in July 1844 and July 1888.
- **September 1996:** Tropical storm Fran caused regional flooding on the upper Potomac River. This flood was about equal in magnitude to that in November 1877 on the South Branch Potomac River, to that in May through June 1889 on the North Branch Potomac River, and to that in March 1936 on the upper Potomac River.

Description of Study Area

West Virginia can be differentiated into three physiographic provinces, the Appalachian Plateaus, Valley and Ridge, and Blue Ridge (Fenneman, 1938) (fig. 2). The movement of air masses across the State allows identification of two climatic regions, separated by a line defined as the Climatic Divide (Wiley, 2008) (fig. 1).

Generally, the part of the State west of the Climatic Divide is in the Appalachian Plateaus Physiographic Province, where altitudes range from about 2,500 to 4,861 ft (NAVD88) at Spruce Knob along the Climatic Divide to about 550 to 650 ft along the Ohio River. The part of West Virginia east of the Climatic Divide is in the Valley and Ridge Physiographic Province, except for the extreme eastern tip of the State, which is in the Blue Ridge Physiographic Province. Altitudes decrease eastward from the Climatic Divide to 274 ft at Harpers Ferry in the Eastern Panhandle (U.S. Geological Survey, 1990, 2006; National Oceanic and Atmospheric Administration, 2006a).

The Appalachian Plateaus Physiographic Province consists of consolidated, mostly noncarbonate sedimentary rocks that have a gentle slope from southeast to northwest near the Climatic Divide and are nearly flat-lying along the Ohio River. One exception is in the northeastern area of the province (west of the Climatic Divide), where the rocks are gently folded and some carbonate rock crops out (Fenneman, 1938). The rocks in the Appalachian Plateaus Physiographic Province have been eroded to form steep hills and deeply incised valleys; drainage patterns are dendritic.

The Valley and Ridge Physiographic Province in West Virginia consists of consolidated carbonate and noncarbonate sedimentary rocks that are folded sharply and extensively faulted (Fenneman, 1938). Northeast-trending valleys and ridges parallel the Climatic Divide; drainage patterns are trellis.

The Blue Ridge Physiographic Province within West Virginia consists predominantly of metamorphosed sandstone and shale (Fenneman, 1938). The province has high relief between mountains and wide valleys that parallel the Climatic Divide.

The climate of West Virginia is primarily continental, with mild summers and cold winters. Major weather systems generally approach from the west and southwest, although polar continental air masses of cold, dry air that approach from the north and northwest are not unusual. Air masses from the Atlantic Ocean sometimes affect the area east of the Climatic Divide and less frequently affect the area west of the Climatic Divide. Generally, tropical continental masses of hot, dry air from the southwest affect the climate west of the Climatic Divide. Tropical maritime masses of warm, moist air from the Gulf of Mexico affect the climate east of the Climatic Divide more than west of the Climatic Divide. Evaporation from local and upwind land surfaces, lakes, and reservoirs also provides a source of moisture that affects the climate of the State (U.S. Geological Survey, 1991; National Oceanic and Atmospheric Administration, 2006a).

Annual precipitation averages about 42 to 45 in. statewide with about 60 percent received from March through August. July is the wettest month, and September through November are the driest. Annual average precipitation in the State generally decreases northwestward from about 50 to 60 in. along the Climatic Divide to about 40 in. along the Ohio River, and increases from about 30 to 35 in. east of the Climatic Divide to about 40 in. in the extreme eastern tip of the State. Greater precipitation along and west of the Climatic Divide is a consequence of the higher elevations along the Divide and the general movement of weather systems approaching from the west and southwest. Annual average snowfall follows the general pattern of annual average precipitation, decreasing northwestward from about 36 to 100 in. along the Climatic Divide to about 20 to 30 in. along the Ohio River. Annual average snowfall ranges from 24 to 36 in. east of the Climatic Divide (U.S. Geological Survey, 1991; Natural Resources Conservation Service, 2006; National Oceanic and Atmospheric Administration, 2006a, 2006b).

Flooding across large drainage areas results from regional climatic events like frontal systems in winter and early spring, rainfall on snowpack in early spring, and tropical cyclones (hurricanes and tropical storms) in late summer or early fall. Generally, the most severe flooding across small drainage areas results from local intense thunderstorms in late spring through summer (Doll and others, 1963).

Previous Studies

Flood-frequency studies completed by Wiley and others (2000, 2002) used data for peak discharges from 267 rural, unregulated streamgage stations in West Virginia and adjacent states. Simple and multiple least-squares regression models were used to determine three regions in the State and to develop initial estimating equations with drainage area as the only significant independent variable. The final estimating equations were determined for the 1.1-, 1.2-, 1.3-, 1.4-, 1.5-, 1.6-, 1.7-, 1.8-, 1.9-, 2-, 2.5-, 3-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year flood discharges using a generalized least-squares regression model (Stedinger and Tasker, 1985; Tasker and Stedinger, 1989).

New procedures for transferring the flood-frequency discharges determined by Wiley and others (2000, 2002) to ungaged locations were presented by Wiley (2008, Appendix 1). These methods incorporated a comparison of discharge estimates determined using drainage-area ratios to discharge estimates determined by application of the flood-frequency equations. This current study repeats that analysis and supersedes the results presented in Wiley (2008, Appendix 1).

Atkins and others (2009) determined generalized skew coefficients applicable to West Virginia (WV skew) for use in determining flood-frequency discharges at streamgage stations. The WV skew coefficients supersede the United States skew coefficients (U.S. skew) determined by the Interagency Advisory Committee on Water Data (1982). Analysis of

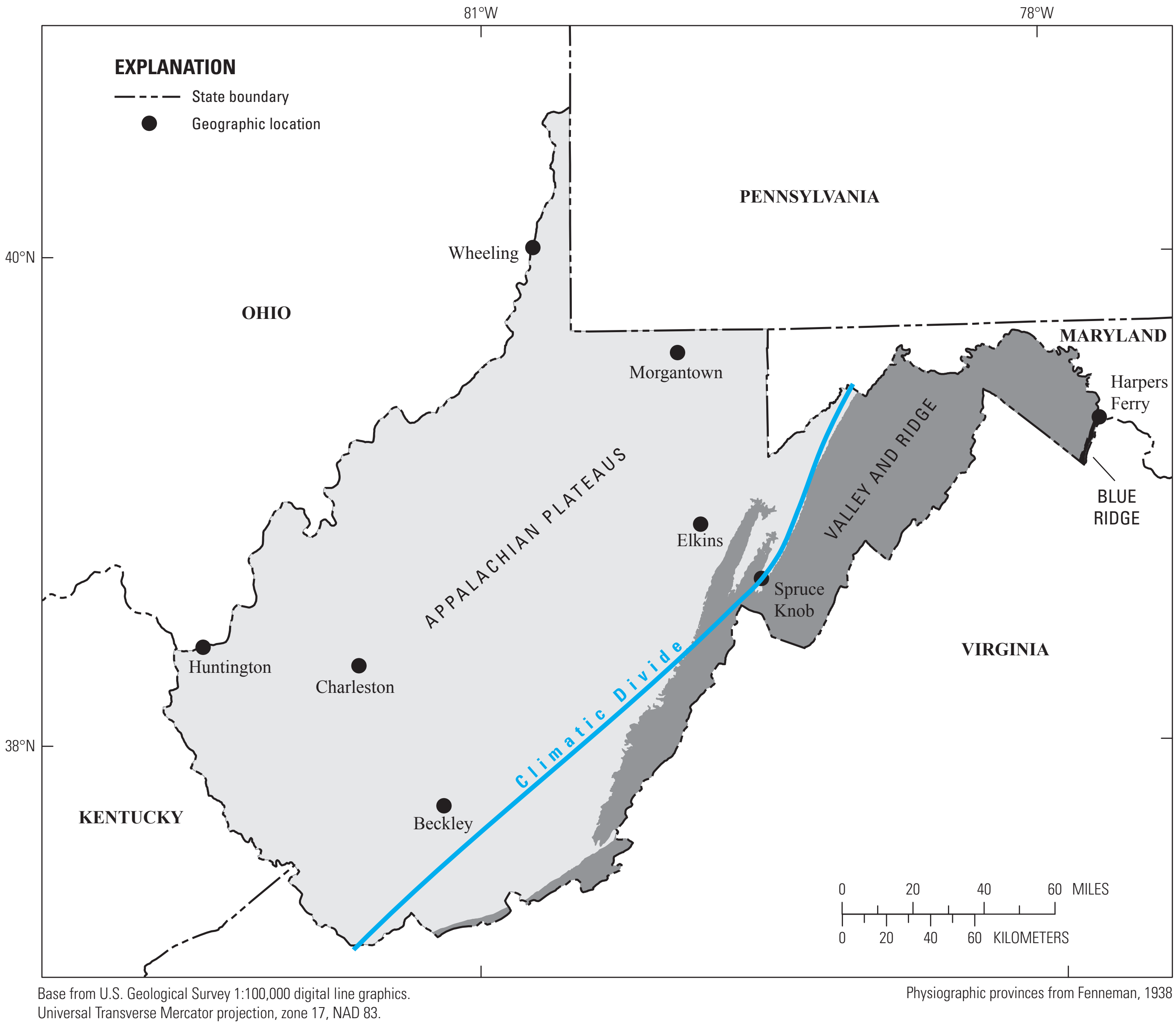


Figure 2. Appalachian Plateaus, Valley and Ridge, and Blue Ridge Physiographic Provinces, and Climatic Divide in West Virginia.

discharges at 147 rural, unregulated streams in West Virginia and adjacent states with streamgage stations followed guidelines established by the Interagency Advisory Committee on Water Data (1982), except that streamgage stations having 50 or more years of record were used instead of those with the recommended 25 years of record. The increased record length of 50 years was determined to be statistically significant when compared to the recommended 25 years. The generalized-skew analysis considered contouring, averaging, and regression of station skews; the best method was determined to be that with the smallest mean-square error (MSE). The contouring of station skews was found to be the best method for determining generalized skew for West Virginia, with a MSE of 0.2174 (Atkins and others, 2009). The MSE of 0.2174 is a significant improvement (28 percent reduction) over the MSE of 0.3025 for the U.S. skew, presented by the Interagency Advisory Committee on Water Data (1982).

Flood-frequency studies completed by Frye and Runner (1969, 1970, 1971) and Runner (1980a and b) for West Virginia lacked data on peak discharges at streamgage stations having drainage areas less than 50 mi^2. These studies found that the lack of data for small drainage areas could be overcome by (1) not using the flood-frequency estimating methods for small drainage areas, (2) limiting the flood-frequency discharge estimates to small recurrence intervals, (3) increasing the record lengths for small drainages by using a rainfall-runoff model, or (4) using a composite analysis of long-term data (primarily stations with a minimum of 40 years of record) with an analysis of long-term data combined with short-term data for small drainage areas.

Frye and Runner (1969) estimated flood-frequency discharges for rural, unregulated streams in West Virginia by using equations presented in U.S. Geological Survey Water Supply Papers 1672 (Tice, 1968) and 1675 (Speer and Gamble, 1965). The nationwide flood-frequency discharge equations in these publications were developed for regional or major river basins. The authors suggested that the equations only be used for drainage areas greater than 50 mi^2 in the Ohio River Basin and greater than 30 mi^2 in the Potomac River Basin.

Frye and Runner (1970) presented a method for estimating flood-frequency discharges using an analytical technique similar to that proposed by Benson (1962). Peak-discharge data from streamgage stations on rural, unregulated streams in West Virginia with a minimum of 10 years of record were analyzed. The authors suggested that the analytical techniques be used only for drainage areas greater than 50 mi^2 because adequate data were not available.

Frye and Runner (1971) presented a method for estimating the 2-, 5-, and 10-year flood discharges for rural, unregulated streams in the Ohio River Basin of West Virginia. Data from a network of small streams with an average record length of 6 years were correlated with long-term data from streamgage stations to estimate additional years of peak discharges. The equations were applicable only to streams with drainage areas between 1 and 50 mi^2.

Runner (1980a) presented equations for estimating the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year flood discharges for rural, unregulated streams in West Virginia. The estimating equations were used only for drainage areas of 0.3 to 2,000 mi^2. The flood-frequency discharges in this study were made using methods recommended by the Interagency Advisory Committee on Water Data (1976), including adjustments to station-frequency determinations by applying weighted regional and station skews. The peak-discharge data from 170 streamgage stations included data from Maryland and Virginia. Records of peak discharges for 15 stations with small drainage areas (ranging from 1.8 to 12.2 mi^2) were synthesized to greater than 40 years of record (Runner, 1980b) by use of a rainfall-runoff model developed by Dawdy and others (1972). On the basis of regression analyses using 12 basin characteristics as independent variables, regional flood-frequency discharge equations were developed separately for stations with more than 40 years of record (including 15 small drainage-area streamgage stations for which at least 40-year records were estimated) and for all 170 stations. Three regions were delineated using an analysis of the regression residuals, and drainage area was determined to be the only statistically significant independent variable. A composite of the equations for stations with greater than 40 years of record and all 170 streamgage stations was determined.

This Study

To provide flood-related information and estimates needed for the design of structures that will meet existing or proposed safety standards, yet not incur excessive costs because of overdesign, the U.S. Geological Survey (USGS), in cooperation with the West Virginia Department of Transportation, Division of Highways, revised previously developed equations for estimating the magnitude and frequency of flood discharges on rural, unregulated streams in West Virginia. The results of this study supersede those published by Wiley and others (2000, 2002).

This report presents newly revised equations for estimating the discharges of the 1.1-, 1.5-, 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year recurrence interval floods (flood-frequency discharges) on rural, unregulated streams in West Virginia. A flood frequency is the reciprocal of the annual-occurrence probability (AOP), in percent, where the 100-year flood frequency is equal to the 1-percent AOP. This report documents the information used to estimate flood-frequency discharges and includes a list of regional floods in West Virginia; a discussion of climatic conditions affecting flooding; a presentation of results from previous studies; and an inventory of data sources containing peak discharges, basin characteristics, and skew coefficients. The statistical methods are described, including an accounting of error, which provides project designers with the associated uncertainty of flood discharge estimates determined from applying flood-frequency discharge equations to West Virginia streams.

Development of Flood-Frequency Discharge Equations

Annual peak discharge data, basin characteristics data, and generalized West Virginia skew coefficients for 290 streamgages on rural, unregulated streams in West Virginia and adjacent states were analyzed to determine regional equations to be used to estimate the magnitude of flood discharges for selected recurrence intervals. Basin characteristics, generalized West Virginia skew coefficients, and flood-frequency discharges for streamgage stations in adjacent states developed for this study do not supersede values used by adjacent states. The equations for the 100-year recurrence interval (1-percent AOP) flood discharges were regionalized by plotting the areal distribution of residuals determined by use of multiple and simple least-squares regression models. Independent variables describe basin characteristics (such as drainage area, mean annual precipitation, and percent forest cover) for each station location. Areal distributions of residual plots from regressions of the 100-year discharges were used to select stations in adjacent states to represent flood discharges expected in West Virginia and to determine regional boundaries. The initial regional equations for the selected recurrence intervals were derived with the use of multiple and simple least-square regression models and by determining the significance of independent variables. The final regional equations were derived with the use of a generalized least-square regression model and independent variables from the initial regional equations.

Peak Discharges

Annual peak discharges at 290 streamgage stations on rural, unregulated streams with a minimum of 9 years of record through the 2007 water year (the period beginning October 1 of the previous year through September 30 of the indicated year) in West Virginia and through the 2006 (2007 for some stations in Maryland) water year for stations in adjacent states were available for this study (fig. 3; table 1, at end of this report). Guidelines established by the Interagency Advisory Committee on Water Data (1982) required that streamgage used in the analysis have a minimum of 10 years of record, but stations with 9 years of record were accepted because the addition of six stations with drainage areas less than 30 mi^2 was considered more beneficial to this study than adhering to the 10-year guideline. Annual-peak-discharge data are maintained in the U.S. Geological Survey's "Peak File" database available on the World Wide Web from the USGS United States NWIS-W Data Retrieval site (*http://waterdata.usgs.gov/*).

Peak discharges at the streamgage station Cheat River at Rowlesburg, identification number (ID) 121 in fig. 3 and streamgage station number (streamgage) 03070000 in table 1, are from a combination of records that include and exclude flow from the tributary stream Saltlick Creek. Peak-discharge data collected at Rowlesburg prior to the flood of November 5, 1985, include flow from Saltlick Creek for a drainage area of 974 mi^2. Peak-discharge data collected at Rowlesburg from November 6, 1985, through September 30, 1996, exclude flow from Saltlick Creek for a drainage area of 939 mi^2. Streamgage station ratings (relations between stream stage and discharge) were difficult to define accurately after November 5, 1985, because they were affected by scour throughout the range of stage. Peak discharges were not adjusted for the 4-percent difference in drainage area (typically necessary when records are combined) because the rating definition difficulties resulted in peak discharges with much greater than 4 percent uncertainties.

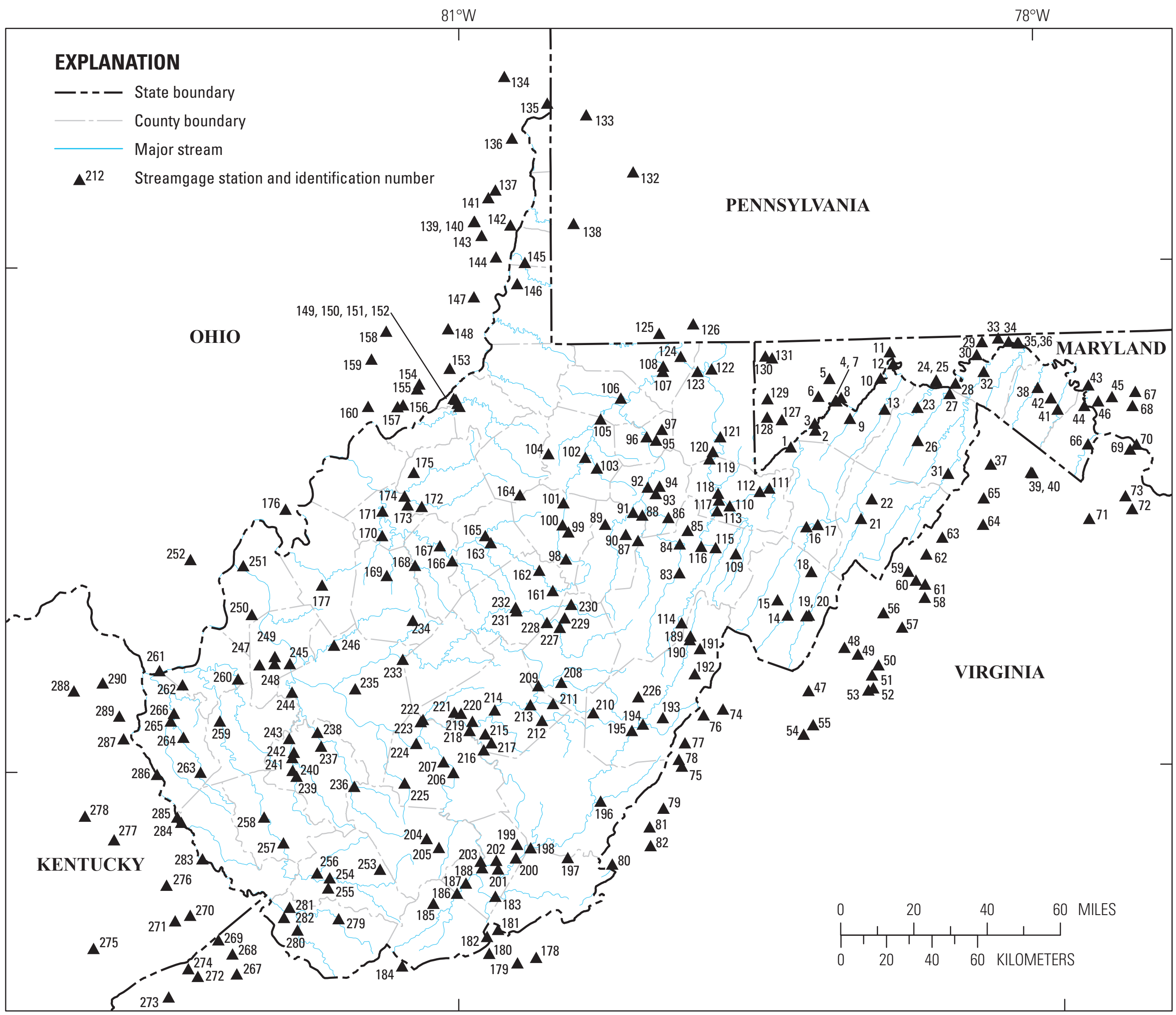
Peak discharges at the streamgage station Right Fork Holly River at Guardian (ID 229 and streamgage 03195100) for the 1979 to 1982 water years, and peak discharges at the station Left Fork Holly River near Replete (ID 230 and streamgage 03195250) for the 1979 to 1982 and 1987 to 2007 water years were provided by the U.S. Army Corps of Engineers, Huntington District (Phillip E. Anderson, oral and written commun., 1997 and 1998; Charlotte L. Hazelett, written commun., 2007).

Peak discharges at the streamgage station Fernow Watershed Number Four near Hendricks (ID 113 and streamgage 03067100) for the 1952 to 2006 water years were provided by the U.S. Forest Service, Fernow Experimental Forest (Frederica Wood, written commun., 2006 and 2007). No data were available for the 2007 water year at the time of this study.

Peak discharge records for the streamgage station Elk River below Webster Springs (ID 227 and streamgage 03194700) were lengthened using records for the station Elk River at Centralia (ID 228 and streamgage 03195000). Peak discharges at the station Twelvepole Creek below Wayne (ID 266 and streamgage 03207020) were lengthened using records for the station Twelvepole Creek at Wayne (ID 265 and streamgage 03207000). Peak discharges at the station Tug Fork at Kermit (ID 285 and streamgage 03214500) were lengthened using records for Tug Fork near Kermit (ID 284 and streamgage 03214000). Peak discharges at the station New River at Fayette (ID 207 and streamgage 03186000) were lengthened using records for New River at Caperton (ID 206 and streamgage 03185500); and peak discharges at the station Cheat River near Pisgah (ID 123 and streamgage 03071000) were lengthened using records for Cheat River near Morgantown (ID 124 and streamgage 03071500). Records were lengthened by estimating discharges using drainage-area ratios; the stations used to lengthen records were not considered in the regression analysis.

Basin Characteristics

Characteristics of the basins draining to the 290 streamgage stations on rural, unregulated streams in West Virginia and adjacent states (Paybins, 2008) were available for use as independent variables in the regression analysis.



Base from U.S. Geological Survey 1:100,000 digital line graphics for state boundaries and streams and from the West Virginia Department of Environmental Protection 1:24,000 digital data for county boundaries. Universal Transverse Mercator projection, zone 17, NAD 83.

Figure 3. The 290 U.S. Geological Survey streamgage stations in West Virginia and adjacent states considered in the estimation of flood-frequency discharges in West Virginia. (Identification numbers are cross-references with streamgage-station names and numbers in table 1.)

The 36 basin characteristics evaluated for use in this study are the following: drainage area (DRNAREA), in mi^2 (Mathes, 1977; Wilson, 1979; Mathes and others, 1982; Preston and Mathes, 1984; Stewart and Mathes, 1995; Wiley, 1997; Wiley and others, 2007); latitude of the basin centroid, in decimal degrees; longitude of the basin centroid, in decimal degrees; basin perimeter, in mi; basin slope, in ft/mi; basin relief, in ft; basin orientation, in degrees; channel length, in mi; valley length, in mi; channel slope, in ft/mi; stream length, in mi; mean basin elevation, in ft; 24-hour 2-year rainfall, in inches; annual precipitation, in inches; January minimum temperature, in degrees Fahrenheit; annual snow depth, in inches; forest cover, in percent; grassland cover, in percent; barren land cover, in percent; urban land cover, in percent; wetland cover, in percent; open-water cover, in percent; agriculture cover, in percent; impervious cover, in percent; basin width, in mi; shape factor, dimensionless; elongation ratio, dimensionless; rotundity of basin, dimensionless; compactness ratio, dimensionless; relative relief, in ft/mi; sinuosity ratio, dimensionless; stream density, in mi/mi^2; channel maintenance, in mi^2/mi; slope proportion, dimensionless; ruggedness number, in ft/mi; and slope ratio, dimensionless.

Correlation of Basin Characteristics

The basin characteristics were $\log_{10}$ transformed and evaluated for linear correlation by using a Pearson coefficient, or Pearson's r (Helsel and Hirsch, 2002). The numeral one was added to values of grassland cover, barren land cover, urban land cover, wetland cover, open-water cover, agriculture cover, and impervious cover to ensure that values were greater than zero for $\log_{10}$ transformation. To decrease values for regression analysis, 77 was subtracted from longitude of the basin centroid, and 37 was subtracted from latitude of the basin centroid.

Basin characteristics were considered highly correlated where the absolute value of the Pearson coefficient was greater than or equal to 0.80. The following characteristics were highly correlated within each group: drainage area, basin perimeter, channel length, valley length, basin width, stream length, compactness ratio, and slope proportion; channel slope, relative relief, and slope ratio; shape factor, elongation ratio, and rotundity of basin; basin relief and ruggedness number; valley length and basin relief; and urban land cover and impervious cover.

The Pearson coefficient was equal to the numeral one (singularity) for some combinations of basin characteristics including stream density and channel maintenance; shape factor, elongation ratio, and rotundity of basin; drainage area, basin width, shape factor, and rotundity of basin; and stream length, compactness ratio, relative relief, stream density, and ruggedness number. The characteristics elongation ratio, rotundity of basin, channel maintenance, and basin width were removed from consideration for regression because of singularity.

The number of basin characteristics considered for regression was reduced from 36 to 32 with the removal of the characteristics because of singularity. Additional characteristics having singularity were removed if they became significant in the regression analysis.

West Virginia Skew Coefficients

Atkins and others (2009) determined generalized skew coefficients applicable to West Virginia, the WV skew, to supersede the U.S. skew presented by the Interagency Advisory Committee on Water Data (1982) (table 1, at the end of this report). The generalized skew coefficient is a regional measure (of individual streamgage-station skews) of the fitness of annual-peak discharges to a Pearson Type III probability curve. The WV skew coefficients used in this current study do not supersede values used for studies in adjacent states but are applicable only to analyses in West Virginia. The difference between the WV- and U.S.-skew coefficients (WV skew minus U.S. skew) ranged from -0.493, unitless, for Brier Creek at Fanrock (ID 255 and streamgage 03202480) to 0.491, unitless, for Dry Fork at Hendricks (ID 110 and streamgage 03065000).

A direct relation was not observed between the difference between the WV- and U.S.-skew coefficients and the difference between the flood-frequency discharge calculations made using the WV- and U.S.-skew coefficients. (Skew coefficients are weighted and adjusted using systematic years of record, systematic skews, low- and high-outlier criterion, and historic years to determine flood frequencies.) The 100-year flood discharges determined in this study using the WV skew were compared to the 100-year flood discharges calculated using the U.S. skew. The differences in the 100-year flood discharges (discharge using WV skew minus discharge using U.S. skew, divided by discharge using WV skew, times 100) ranged from -23.8 percent for Marsh Fork at Maben (ID 253 and streamgage 03202245) to 13.3 percent for Job Run near Wymer (ID 109 and streamgage 03063950). An area of large negative differences was observed for the headwaters of the Coal, Guyandotte, and Tug Fork Rivers near the southern border of the State, and an area of large positive differences was observed for the headwaters of the South Branch Potomac River near the eastern border of the State. The difference for Brier Creek at Fanrock (ID 255 and streamgage 03202480) is -14.3 percent (-0.493, unitless, difference in skews discussed above), and the difference for Dry Fork at Hendricks (ID 110 and streamgage 03065000) is 3.8 percent (the 0.491, unitless, difference in skews discussed above); these streamgage stations are located near the southern and north-central areas of the State, respectively.

Flood-Frequency Discharges

The flood-frequency discharges at the 290 streamgage stations on rural, unregulated streams were determined following the guidelines established by the Interagency Advisory Committee on Water Data (1982). The U.S. Geological Survey computer program PeakFQ (Flynn and others, 2006) was used to compute the flood-frequency discharges. In the analysis of flood-frequency discharges for adjacent states, information from previous studies was used (Bisese, 1995; Dillow, 1996; Stuckey and Reed, 2000; Hodgkins and Martin, 2003; and Koltun, 2003) as a reference for determining flood-frequency discharges calculated with the WV skew for use in this current study.

The $\log_{10}$-transformed systematic (continuous record or broken record that can be statistically treated as a continuous record) annual-peak series for each streamgage station was fitted to the Pearson Type III probability curve. Regional general skew (WV skew) was obtained from the map developed by Atkins and others (2009). Regional general skew is weighted with station skew to determine a final adjustment to the Pearson Type III probability curve. Additionally, high-outlier, low-outlier, and historical peak assessments were made to adjust the annual-peak series. Mixed populations, such as floods from snowmelt and those from tropical storms or hurricanes, were not analyzed separately. Selected statistics from the flood-frequency discharge analyses for the 290 streamgage stations in West Virginia and adjacent states are listed in table 2 (at the end of this report). Flood-frequency discharges determined following the guidelines established by the Interagency Advisory Committee on Water Data (1982) for 10 recurrence intervals for the 290 streamgage stations in West Virginia and adjacent states are identified as Q_s in table 3 (also at the end of this report); the 10 recurrence intervals are the 1.1- (90-percent AOP), 1.5- (67-percent AOP), 2- (50-percent AOP), 5- (20-percent AOP), 10- (10-percent AOP), 25- (4-percent AOP), 50- (2-percent AOP), 100- (1-percent AOP), 200- (0.5-percent AOP), and 500-year (0.2-percent AOP).

The PeakFQ computer program does not output flood-frequency discharges for all the recurrence intervals needed for this study. However, subroutines within PeakFQ (the HARTIV subroutine with related subroutines and functions, originally developed by Kirby, 1980) were used to calculate the needed flood-frequency discharges. The 1.1-year and sometimes the 1.5-year flood discharges were computed for 15 streamgage stations using the PeakFQ subroutines; these discharges are footnoted in table 3 (at the end of this report). The identified subroutines within PeakFQ do not calculate discharge directly, but determine a frequency factor (*K* or "the *K* value") that is used to calculate the discharge. A short Fortran computer program (Wiley and others, 2002, Appendix 1) was used to calculate all the frequency factors using the Bulletin-17B weighting procedures and the WV skew (Atkins and others, 2009) (table 1, at the end of this report). The short computer program uses the current versions of computer subroutines contained in a library of USGS water-resources application programs (U.S. Geological Survey, 2001). The frequency factors are used to determine discharge by computing the antilog of discharge from the following modified equation (Interagency Advisory Committee on Water Data, 1982, equation 1, p. 9):

$$\mathrm{Log}_{10}\, Q = X_{\mathrm{mean}} + KS_P\,, \tag{1}$$

where

$$X_{\mathrm{mean}} = \sum X / N, \tag{2}$$

where

- X is the $\log_{10}$-transformed annual peak discharges (Bulletin-17B adjusted), in ft^3/s; and
- N is the number of years of peak-discharge record, unitless;
- K is the frequency factor, unitless; and
- S_P is the standard deviation of the $\log_{10}$-transformed annual peak discharges (Bulletin-17B adjusted), in ft^3/s:

$$\left[\sum (X - X_{\mathrm{mean}})^2 / (N-1)\right]^{0.5}. \tag{3}$$

Typically, the magnitude of a flood-frequency discharge increases with increasing drainage area. For floods with recurrence intervals greater than 10 years, however, the flood-frequency discharges calculated for the streamgage station Tygart Valley River near Dailey (ID 83 and streamgage 03050000) are greater than those for the station Tygart Valley River near Elkins (ID 84 and streamgage 03050500), although the drainage area for Tygart Valley River near Dailey (185 mi^2) is smaller than the drainage area for Tygart Valley River near Elkins (271 mi^2) (tables 2 and 3, at the end of this report). This inconsistency may be due to the wide floodplain along the river between Daily and Elkins, which contrasts with the more mountainous and narrower floodplains upstream from Daily and, therefore, increases the stream storage and attenuates the flood peak. The inconsistency also may occur because the frequency analysis for each station is based on different time periods, thus creating a time-sampling error.

Wiley and others (2000) investigated data for the streamgage station Poplar Fork at Teays (ID 248 and streamgage 03201410) for nonhomogeneity. The study concluded that the data for the period 1967 to 1978 indicate annual peaks were higher than those for 1992 to 1997, but collection of additional years of record would be necessary to resolve the question of nonhomogeneity. This current study determined that nonhomogeneity exists between the periods 1967 to 1978 and 1992 to 2007. It is hypothesized that excessive runoff from nearby impervious areas resulted in higher annual peaks for the period 1967 to 1978. The excessive runoff no longer affects annual peaks since the streamgage station was moved to a location upstream from the nearby impervious areas for the period 1992 to 2007. The flood-frequency discharges for Popular Fork at Teays were determined using only annual peaks for the period 1992 to 2007 because they better represent a rural, unregulated stream.

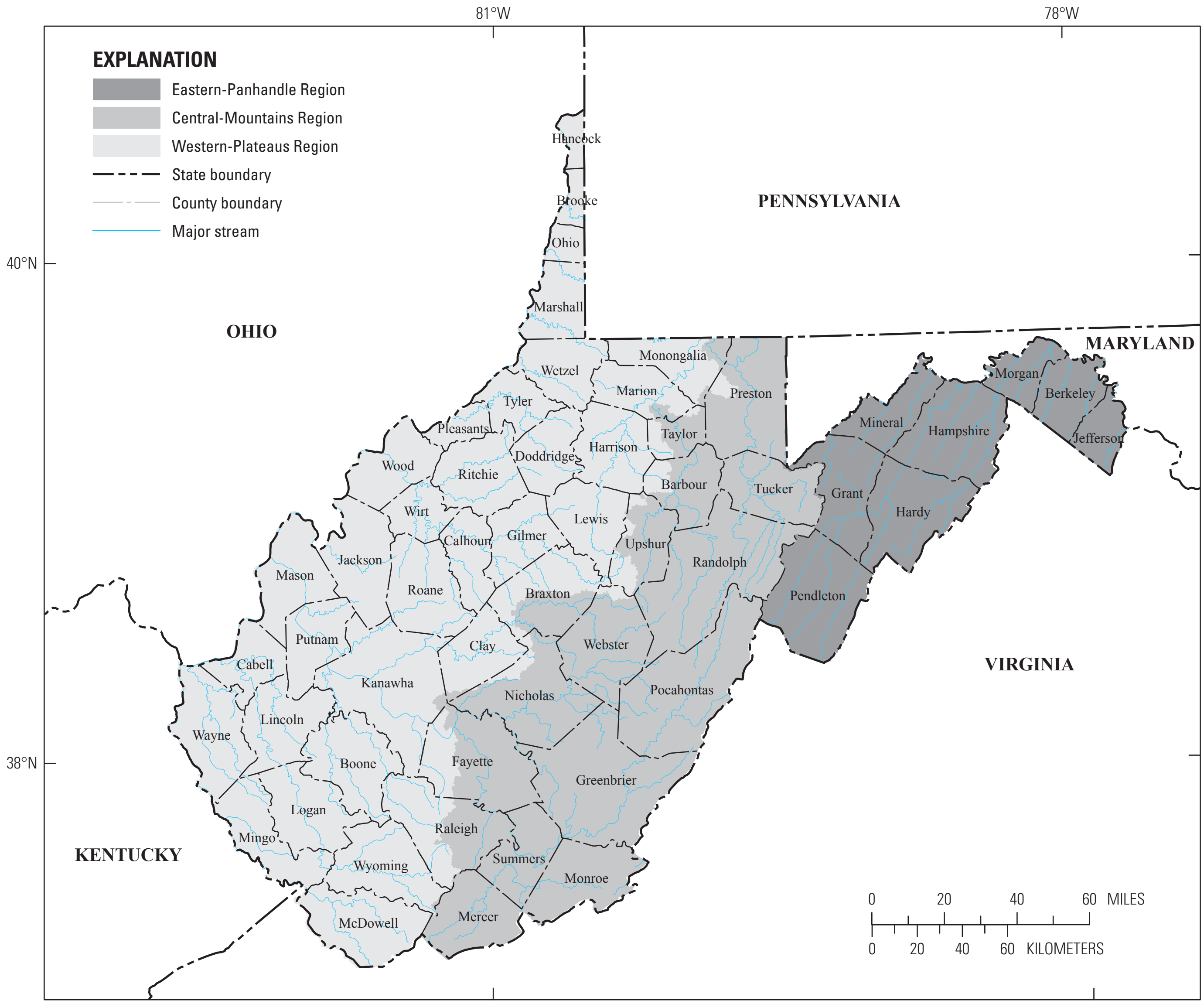
The randomness of the systematic annual-peak series was statistically tested to detect a trend using Kendall's test for correlation (Kendall, 1975; Hirsch and others, 1982). The computer program SWSTAT (Surface Water STATistics), version 4.1, dated February 25, 2002, (Lumb and others, 1990; A.M. Lumb, W.O. Thomas, Jr., and K.M. Flynn, USGS, written commun., titled "Users manual for SWSTAT, a computer program for interactive computation of surface-water statistics," June 15, 1995) was used to calculate Kendall's tau and the level of significance (the probability or p-value). For the Kendall's test for correlation, the hypothesis that there is no trend is tested. If the hypothesis fails to attain a particular level of significance, the hypothesis of no trend is rejected. For this study, the particular level of significance selected was 0.05, so a trend is determined for an annual-peak series if the level of significance is less than 0.05. Kendall's tau and the level of significance were determined for the annual-peak series of 246 streamgage stations (44 stations were eliminated from consideration as part of the regression analysis discussed later in this report) in West Virginia (table 2). Streamgage stations were further limited to the 125, those with a minimum of 30 years of record, to eliminate affects that might be due to natural climatic variations (U.S. Geological Survey, 2005). The annual-peak series for 12 streamgage stations (about 10 percent of the 125 stations) indicated a trend, 7 positive and 5 negative. If chance were the only factor, 6 streamgage stations would be expected to indicate a trend (about 5 percent of the 125 stations). Statistics indicate trends at twice as many streamgage stations as would be expected by chance, but the trends were nearly equally divided between stations with positive and negative values. Therefore, no significance could be determined for the trends indicated at the 12 stations.

Regional Regression of Flood-Frequency Discharges

Regression models with the 10 $\log_{10}$-transformed flood-frequency discharges as dependent variables and the 36 $\log_{10}$-transformed basin characteristics as potential independent variables were evaluated. The flood-frequency equations for the 100-year recurrence interval (1-percent AOP) were regionalized by plotting the areal distribution of residuals from the application of multiple and simple least-squares regression models. Regional regression procedures were performed using the computer program S-PLUS 7.0 (Insightful Corporation, 2005), a commercially available statistical computing package. Areal distributions of residual plots indicated three regions—Eastern Panhandle, Central Mountains, and Western Plateaus—with drainage area (DRNAREA) as the only significant independent variable (fig. 4). Initial equations for all flood-frequency discharges were determined using the regions determined by analysis of the 100-year flood, and the outcomes of all equations identified DRNAREA as the only significant independent variable. (A regional analysis of the 2-year floods agreed with the regional divisions determined by analysis of the 100-year floods.) The final regional equations were then developed from application of a generalized least-square (GLS) regression model (Stedinger and Tasker, 1985; Tasker and Stedinger, 1989) (U.S. Geological Survey computer program GLSNet, version 4.0) for the three regions with DRNAREA as the only independent variable (table 4).

The three regions—Eastern Panhandle, Central Mountains, and Western Plateaus (fig. 4)—are separated by topographic features. The boundary between the Eastern Panhandle and Central Mountains Regions follows the Potomac River Basin boundary. The Central Mountains Region (from northeast to southwest) contains the drainage areas of the Cheat River, Tygart Valley River (including the Buckhannon River), Elk River upstream from the confluence of Birch River, and the New and Gauley Rivers upstream of the Kanawha River. The Western Plateaus Region encompasses the remainder of the State.

Forty-four streamgage stations were removed from the regression analysis (table 1, at the end of this report), including 12 stations in West Virginia. Thirty-two stations in adjacent states were removed primarily because residual plots indicated that the stations were not representative of flows expected in West Virginia, except for Potomac River at Hancock (ID 34 and streamgage 01613000), Shepherdstown (ID 44 and streamgage 01618000), and Point Of Rocks (ID 70 and streamgage 01638500) in Maryland where the flood-frequency discharges at these streamgage stations with large drainage areas (4,075 to 9,651 mi^2) leveraged the regional regression equations, resulting in greater estimation errors for small drainage areas. The 12 streamgage stations removed from the regression analysis in West Virginia are Tuscarora Creek above Martinsburg (ID 42 and streamgage 01617000) because the station was located in a karst area of the State (equations developed in this current study are not applicable to karst areas of the state); Elk River at Centralia (ID 228 and streamgage 03195000) because the peak record for this station was used to lengthen the record for Elk River below Webster Springs (ID 227 and streamgage 03194700); Twelvepole Creek at Wayne (ID 265 and streamgage 03207000) because the peak record for this station was used to lengthen the record for Twelvepole Creek below Wayne (ID 266 and streamgage 03207020); Tug Fork near Kermit (ID 284 and streamgage 03214000) because the peak record for this station was used to lengthen the record for Tug Fork at Kermit (ID 285 and streamgage 03214500); New River at Caperton (ID 206 and streamgage 03185500) because the peak record for this station was used to lengthen the record for New River at Fayette (ID 207 and streamgage 03186000); Cheat River near Morgantown (ID 124 and streamgage 03071500) because the peak record for this station was used to lengthen the record for Cheat River near Pisgah (ID 123 and streamgage 03071000); and Potomac River at Paw Paw (ID 28 and streamgage 01610000), Shenandoah River at Millville (ID 66 and streamgage 01636500), New River at Bluestone Dam (ID 188 and streamgage 03180000), New River at



Base from U.S. Geological Survey 1:100,000 digital line graphics for state boundaries and streams and from the West Virginia Department of Environmental Protection 1:24,000 digital data for county boundaries. Universal Transverse Mercator projection, zone 17, NAD 83.

Figure 4. The Eastern Panhandle, Central Mountains, and Western Plateaus Regions of West Virginia for which equations for estimation of flood frequency discharges were developed in this study.

Table 4. Equations used to estimate selected flood-frequency discharges for streams in the Eastern Panhandle, Central Mountains, and Western Plateaus Regions of West Virginia.

[PK(n_n), peak discharge in cubic feet per second for the (n.n)-year recurrence interval; PK(n), peak discharge in cubic feet per second for the (n)-year recurrence interval; %, percent; AOP, annual-occurrence probability; DRNAREA, drainage area in square miles]

Equation	Standard error of the model, in percent	Average standard error of sampling, in percent	Average prediction error, in percent	Equivalent years of record, unitless
Eastern Panhandle Region (Range in DRNAREA from 0.21 to 1,461 for 57 streamgage stations)				
PK1_1(90%AOP) = 29.6 DRNAREA $^{0.818}$	43.4	10.3	44.8	3.4
PK1_5(67%AOP) = 46.4 DRNAREA $^{0.828}$	35.7	8.9	36.9	3.3
PK2(50%AOP) = 59.8 DRNAREA $^{0.832}$	32.1	8.6	33.4	4.1
PK5(20%AOP) = 105 DRNAREA $^{0.838}$	25.6	8.9	27.2	10.6
PK10(10%AOP) = 145 DRNAREA $^{0.842}$	22.5	9.5	24.5	19.1
PK25(4%AOP) = 204 DRNAREA $^{0.848}$	19.7	10.3	22.4	34.1
PK50(2%AOP) = 254 DRNAREA $^{0.852}$	18.6	11.1	21.7	46.1
PK100(1%AOP) = 307 DRNAREA $^{0.855}$	18.3	11.6	21.7	56.7
PK200(0.5%AOP) = 365 DRNAREA $^{0.859}$	18.4	12.4	22.4	64.7
PK500(0.2%AOP) = 447 DRNAREA $^{0.864}$	19.4	13.5	23.8	70.9
Central Mountains Region (Range in DRNAREA from 0.10 to 1,619 for 83 streamgage stations)				
PK1_1(90%AOP) = 33.4 DRNAREA $^{0.914}$	40.0	8.3	41.0	2.4
PK1_5(67%AOP) = 53.8 DRNAREA $^{0.887}$	34.6	7.3	35.4	2.0
PK2(50%AOP) = 69.4 DRNAREA $^{0.873}$	33.4	7.3	34.2	2.1
PK5(20%AOP) = 116 DRNAREA $^{0.845}$	34.1	8.0	35.1	3.2
PK10(10%AOP) = 153 DRNAREA $^{0.831}$	36.3	8.6	37.4	4.0
PK25(4%AOP) = 206 DRNAREA $^{0.816}$	39.9	9.8	41.2	4.8
PK50(2%AOP) = 250 DRNAREA $^{0.807}$	42.9	10.6	44.4	5.3
PK100(1%AOP) = 297 DRNAREA $^{0.800}$	46.2	11.3	47.9	5.6
PK200(0.5%AOP) = 347 DRNAREA $^{0.793}$	49.7	12.0	51.5	5.9
PK500(0.2%AOP) = 420 DRNAREA $^{0.785}$	54.3	13.1	56.3	6.1
Western Plateaus Region (Range in DRNAREA from 0.13 to 1,516 for 106 streamgage stations)				
PK1_1(90%AOP) = 56.9 DRNAREA $^{0.763}$	38.2	7.6	39.1	3.8
PK1_5(67%AOP) = 97.8 DRNAREA $^{0.741}$	33.4	6.5	34.1	2.8
PK2(50%AOP) = 129 DRNAREA $^{0.730}$	31.6	6.1	32.2	2.8
PK5(20%AOP) = 221 DRNAREA $^{0.710}$	29.3	6.5	30.0	4.4
PK10(10%AOP) = 292 DRNAREA $^{0.699}$	28.9	6.5	29.7	5.9
PK25(4%AOP) = 391 DRNAREA $^{0.688}$	29.4	7.3	30.3	7.9
PK50(2%AOP) = 472 DRNAREA $^{0.681}$	30.2	7.6	31.3	9.1
PK100(1%AOP) = 557 DRNAREA $^{0.674}$	31.4	8.0	32.5	10.1
PK200(0.5%AOP) = 647 DRNAREA $^{0.668}$	32.7	8.3	33.9	10.8
PK500(0.2%AOP) = 775 DRNAREA $^{0.661}$	34.8	8.9	36.1	11.4

Hinton (ID 203 and streamgage 03184500), New River at Fayette (ID 207 and streamgage 03186000), and Kanawha River at Kanawha Falls (ID 224 and streamgage 03193000) because the flood-frequency discharges at these stations with large drainage areas (4,602 to 8,371 mi^2) leveraged the regional regression equations, resulting in greater estimation errors for small drainage areas.

Accuracy of Flood-Frequency Discharge Equations

The accuracy of equations used to estimate discharge is quantified by calculating the average prediction error (Tasker and Stedinger, 1989; Hodge and Tasker, 1995) and equivalent years of record (Hardison, 1969, 1971). Average prediction error is the square root of the sum of the squared standard error of the model (the portion of the total error due to an imperfect model) and the average squared standard error of sampling (the portion of the total error due to estimating model parameters from a sample), in log units. The average prediction errors range from 21.7 to 56.3 percent (table 4). The average prediction error is within 3.4 percentage points of the standard error of the model for all regression equations, indicating that addition of the average standard error of sampling to the standard error of the model accounts for very little additional unexplained variance of the flood-frequency discharge estimate.

Also, the average prediction error is the square root of the average of individual squared standard errors of prediction. Individual standard errors of prediction for the regression equations shown in table 4 were computed over the entire range of applicable drainage areas and compared to the average prediction errors (fig. 5). The x-axis of figure 5 is not to scale because the minimum and maximum drainage areas are unequal among regions. The individual standard errors of prediction were computed using the matrices presented in Appendix 1 and methods described by Hodge and Tasker (1995, p. 37–42), Wiley and others (2000, Appendix 1), Wiley and others (2002, Appendix 2), and Koltun (2003, Appendix A). The individual standard errors of prediction increase for drainage areas less than and greater than about 100 mi^2 (where the individual standard errors are 1.0 percentage point less than average prediction error) for all regression equations. The maximum individual standard errors of prediction for the maximum drainage areas are within 0.5 percentage point of the average standard error of prediction for all regression equations. The maximum individual standard errors of prediction for the minimum drainage areas are less than 5.8 percentage points greater than the average prediction error for all regression equations. The individual standard errors of prediction are about equal (within 0.3 percentage point) to the average prediction error at 10 mi^2 for all regression equations. In summary, the individual standard errors of prediction are within 1.0 percentage point of the average prediction error for drainage areas greater than 10 mi^2, and the individual standard errors of prediction increase to a maximum of 5.8 percentage points greater than the average standard error of prediction for the minimum drainage areas.

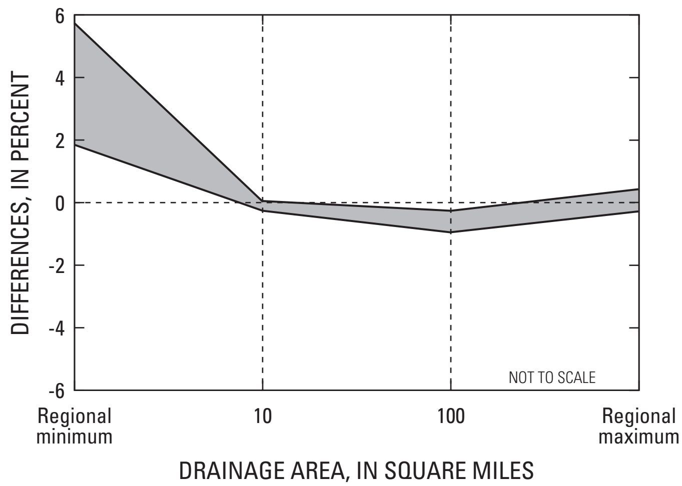


Figure 5. Range of differences (shaded) of the individual standard errors of the prediction from the average prediction errors for the indicated drainage areas. The graph represents all regional equations.

It is not necessary to compute the individual standard errors of prediction when using the regression equations developed in this study for drainage areas greater than or equal to about 10 mi^2 because the differences between the individual standard errors of prediction and average prediction error are insignificant (within 1.0 percentage point). Also, it is not necessary to compute the individual standard errors of prediction for drainage areas less than about 10 mi^2 if an additional error of up to 5.8 percentage points (the maximum of individual standard errors of prediction for the minimum drainage areas) is acceptable for the particular application.

Equivalent years of record (table 4) is an estimate of the number of systematic years of record that must be collected at a streamgage station to calculate flood-frequency discharges with an accuracy equal to that of the regional equation. The equivalent years of record ranged from 2.0 to 70.9 years. The equivalent years of record is not a direct measurement of accuracy between equations of flood-frequency discharges. A comparison of the equation for PK1_1 (90% AOP) to that for PK25 (4% AOP) in the Eastern Panhandle Region shows that the equivalent years of record increased 10 times (3.4 to 34.1), but the average prediction error decreased only by half (44.8 to 22.4). Equivalent years of record is a weighting factor that is applied when determining flood-frequency discharges at streamgage stations.

The high values for the equivalent years of record in the Eastern Panhandle Region are atypical compared to values for flood-frequency equations in surrounding states and the previous study in West Virginia. The atypical high values are probably due to (1) a good correlation with the distance between stations for weighting in the GLS regression compared to the correlations for other regions in this study; (2) unusually low residuals for short-term streamgage stations (less than 15 years) that have small drainage areas (less than 5 mi^2) compared to residuals for other regions in this study, the previous study in West Virginia, and regression studies for other hydrologic statistics conducted by the authors; and (3) the longer average record length for stations in the Eastern Panhandle Region (41) compared to average record lengths in the Central Mountains (39) and Western Plateaus (33).

Procedures For Estimating Flood-Frequency Discharges

Estimating procedures for the 1.1- (90-percent AOP), 1.5- (67-percent AOP), 2- (50-percent AOP), 5- (20-percent AOP), 10- (10-percent AOP), 25- (4-percent AOP), 50- (2-percent AOP), 100- (1-percent AOP), 200- (0.5-percent AOP), and 500-year (0.2-percent AOP) flood discharges were developed for streamgage stations and ungaged locations in West Virginia.

At a Streamgage Station

A flood-frequency discharge at a streamgage station is determined by reading the weighted (Q_w) value directly from table 3 (at the end of this report). This discharge was calculated by weighting (1) the discharge determined from the systematic and historical record (Q_s in table 3), using the guidelines established by the Interagency Advisory Committee on Water Data (1982) with the WV skew, and (2) the discharge determined by the appropriate regional regression equation (Q_r in table 3). The weighting technique considers (1) the number of years of peak-discharge record which equals the number of years of systematic record, plus the number of historical peaks, minus the number of high-outlier peaks (values from table 2, at the end of this report), and (2) the number of equivalent years of record (an estimate given in table 4 of the number of systematic years of record for a streamgage station necessary to calculate flood-frequency discharges with an accuracy equal to that of the regional regression equation). The following equation was used.

$$Q_w = (Q_s N + Q_r E_Y) / (N + E_Y) \, , \qquad (4)$$

where

- Q_w is the weighted discharge, in ft^3/s;
- Q_s is the flood-frequency discharge determined from the systematic and historical record using the guidelines established by the Interagency Advisory Committee on Water Data (1982), in ft^3/s;
- Q_r is the flood-frequency discharge determined from the appropriate regional equation, in ft^3/s;
- N is the number of years of peak-discharge record, unitless; and
- E_Y is the equivalent years of record, unitless.

No weighted value was calculated for one of the two streamgage stations on the same stream that were combined into a single time-series record; the flood-frequency discharge near (at) the streamgage station without a weighted value is to be determined using procedures for an ungaged location. No weighted value was calculated for Tuscarora Creek above Martinsburg (ID 42 and streamgage 01617000) because the streamgage station is located in a karst area of the State; the frequency discharge of the systematic record (Q_s) is to be used at this station.

At an Ungaged Location

Four different procedures are used to determine a flood-frequency discharge at an ungaged location (1) when the ungaged location is upstream from a streamgage station, (2) when the ungaged location is downstream from a streamgage station, (3) when the ungaged location is between two streamgage stations on the same stream, and (4) when the ungaged location is not on the same stream as a streamgage station. Two locations were considered to be on the same stream when the stream path from the downstream location to the basin divide followed the stream segment with the largest drainage area at each stream confluence and passed through the upstream location.

It is necessary to determine if the ungaged location is near a streamgage station, and arithmetic methods are used to quantify the definition of “near.” A drainage-area-ratio method for estimating statistics at ungaged locations has been used by several researchers, including Hayes (1991), Ries and Friesz (2000), Flynn (2003), and Wiley (2008). The ratio of the drainage areas ($R_{U/K}$) is defined as the ratio of the drainage area where the flood-frequency discharge is unknown (A_U) to the drainage area where the flood-frequency discharge is known (A_K). These researchers use arithmetic methods for determining the upstream and downstream limits of the range of drainage-area ratios over which flood-frequency discharges can be accurately estimated from those at a streamgage station using an equation similar to the following:

$$Q_U = Q_K \, (R_{U/K})^{EX} \, , \qquad (5)$$

where

- Q_U is the unknown flood-frequency discharge, in ft^3/s;
- Q_K is the known flood-frequency discharge, in ft^3/s;

$R_{U/K}$ is the ratio of the drainage area at the location of the unknown flood-frequency discharge (A_U) to the drainage area at the location of the known flood-frequency discharge (A_K), unitless; and

EX is the exponent for the particular flood-frequency discharge, unitless.

The 1.1-, 1.5-, 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year flood discharges at 88 pairs of streamgage stations located on the same stream in West Virginia and adjacent states (table 5, at the end of this report) were evaluated to quantify “near” for application of the drainage-area-ratio method in this study. Two computations, one upstream and one downstream, were made for each pair of stations. Ratios of the drainage areas for the 176 computations ranged from 0.038 to 26.4. Equation 5 was solved for the exponent (EX) as the dependent variable:

$$\mathrm{Log}_{10}\,(Q_U / Q_K) = EX\,(\mathrm{Log}_{10}\,(R_{U/K}))\;. \quad (6)$$

The exponent was evaluated for the 88 pairs of streamgage stations for each flood-frequency discharge using simple linear regression with no intercept (regression line goes through the graph origin). The values of the exponent (EX) for the flood-frequency discharges ranged from 0.68 to 0.79 (table 6).

The upstream and downstream limits for application of drainage-area ratios used to quantify the definition of “near” were determined by plotting the x-axis as the drainage-area ratios and the y-axis as the absolute percent differences between the flood-frequency discharges at the streamgage station (Q_w) and the flood-frequency discharges estimated by applying (1) the drainage-area-ratio method and (2) the regional equations (Q_r). S-PLUS 7.0 was used to construct locally weighted regression (LOESS) curves (a data-smoothing technique) through differences between flood-frequency discharges computed from streamgage-station records and the estimated values (selected LOESS parameters were “span = 0.5; degree = one, locally linear fitted; family = Symmetric, no feature for handling outlier distortions, strictly applying locally linear fitting”). The absolute percent differences for estimates of the 100-year flood made by applying the drainage-area-ratio method are lower than the estimates made by applying the regional equation at drainage-area ratios greater than about 0.40 (fig. 6). Similar results were determined for all flood frequencies estimated in this study, and absolute percent differences for all equations were combined to determine ratio limits applicable for all flood frequencies (fig. 7). The upstream limit used to quantify the definition of “near” for all flood frequencies was determined to be 0.40, and the downstream limit was set to the maximum ratios studied, 26.4, because no assessment could be made for ratios greater than 26.4 (table 6).

The downstream limit of 26.4 for application of drainage-area ratios determined in this study is much greater than values determined by Hayes (1991), Ries and Friesz (2000), and Flynn (2003), probably because the streamgage stations used to compute ratios in this study were limited to those on the same stream (the stream path from the downstream location to the basin divide followed the stream segment with the largest drainage area at each stream confluence and passed through the upstream location). The downstream limit of 26.4 determined in this study is much greater than the value of 4.76 determined by Wiley (2008), but both studies used LOESS plots to set the downstream limit to the maximum ratio studied.

The upstream limit of 0.40 for application of drainage-area ratios determined in this study was equal to that determined by Wiley (2008) for flood frequencies at and below the 10-year recurrence interval. The upstream limit of 0.21 for flood frequencies at and above the 25-year recurrence interval determined by Wiley (2008) is superseded by the value 0.40 determined in this study because more than three times as many pairs of stations were used to determine the value in this study (26 pairs compared to 88 pairs).

Table 6. Values of the exponent, and upstream and downstream limits of the drainage-area ratios used to quantify the definition of “near” for estimating selected flood-frequency discharges for ungaged locations in West Virginia.

[EX, exponent; R_{US}, upstream limit of the drainage-area ratio; R_{DS}, downstream limit of the drainage-area ratio; PK(n_n), peak discharge in cubic feet per second for the (n.n)-year recurrence interval; PK(n), peak discharge in cubic feet per second for the (n)-year recurrence interval; %, percent; AOP, annual-occurrence probability]

Statistic	EX	R_{US}	R_{DS}
PK1_1(90%AOP)	0.79	0.40	26.4
PK1_5(67%AOP)	.76	.40	26.4
PK2(50%AOP)	.75	.40	26.4
PK5(20%AOP)	.73	.40	26.4
PK10(10%AOP)	.72	.40	26.4
PK25(4%AOP)	.71	.40	26.4
PK50(2%AOP)	.70	.40	26.4
PK100(1%AOP)	.70	.40	26.4
PK200(0.5%AOP)	.69	.40	26.4
PK500(0.2%AOP)	.68	.40	26.4

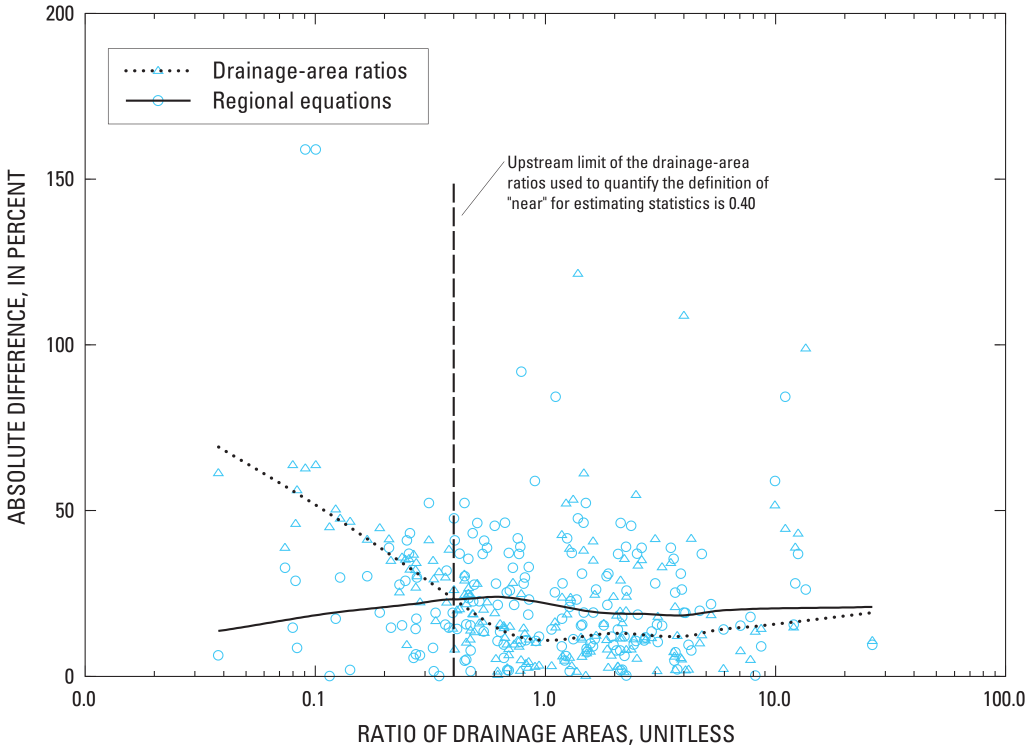


Figure 6. LOESS curves of the absolute difference between the 100-year (1-percent annual-occurrence probability) flood discharges determined at streamgage stations and values estimated from the (1) drainage-area ratio method and (2) regional equations, in relation to the ratios of the drainage areas.

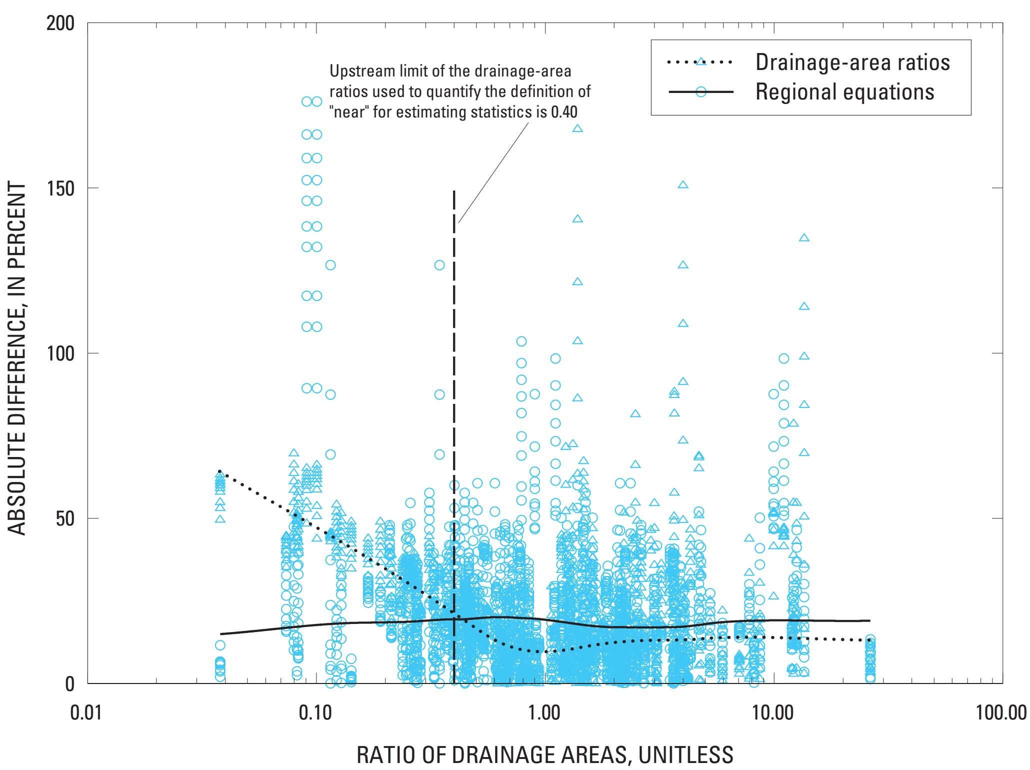


Figure 7. LOESS curves of the absolute difference between the 1.1- through 500-year (90- through 0.2-percent annual-occurrence probabilities) flood discharges determined at streamgage stations and values estimated from the (1) drainage-area ratio method and (2) regional equations, in relation to the ratios of the drainage areas.

Upstream From a Streamgage Station

This procedure is used when there is a streamgage station downstream from the ungaged location but none upstream on the same stream. The hydrologic assumption for this circumstance is that the conditions affecting flood-frequency discharges, such as land cover, basin topography, and climatic conditions, are unchanged upstream from the streamgage station. Mathematically, the values of flood-frequency discharges are proportioned by drainage area. It is suggested that a streamgage be established when $R_{U/K}$ is less than or equal to the upstream limit of the ratio of drainage areas (R_{US}) (table 6). The following equation is used to estimate flood-frequency discharges:

$$Q_U = Q_K (R_{U/K})^{EX} , \qquad (7)$$

where

- Q_U is the unknown flood-frequency discharge, in ft^3/s;
- Q_K is the known flood-frequency discharge (table 3), in ft^3/s;
- $R_{U/K}$ is the ratio of the drainage area at the location of the unknown flood-frequency discharge (A_U) to the drainage area at the location of the known flood-frequency discharge (A_K), unitless; and
- EX is the exponent for the particular flood-frequency discharge (table 6), unitless.

In this method, it is not assumed that the conditions affecting flood-frequency discharges change in the upstream direction toward the regional tendency. The critical situation for this assumption is where the unknown location approaches the headwaters of a stream. This assumption might be acceptable if the flood-frequency discharge at the known location is less than that estimated by applying the regional equation at the known location because the upstream estimate of the flood-frequency discharge would be greater, and therefore, more conservative from a flood inundation perspective than that determined using the method presented. However, this assumption would be unacceptable if the flood-frequency discharge at the known location is greater than that estimated by applying the regional equation because the upstream estimate of flood-frequency discharge would be less than that determined using the method presented, thus requiring an assumption of reducing unit inflow. The method presented would require establishing a streamgage station in order to reduce unit inflow when the known flood-frequency discharge is greater than that estimated using the regional equation.

Downstream From a Streamgage Station

This procedure is used when there is a streamgage station upstream from the ungaged location but none downstream on the same stream. The hydrologic assumption for this circumstance is that the conditions affecting flood-frequency discharges at the streamgage station change, in the downstream direction, toward those of the regional tendency. The conditions affecting flood-frequency discharges in the vicinity of the streamgage station could be atypical impervious land cover, unusual basin slope, uncommon basin orientation, or diversion of storm runoff that likely would not significantly affect flood-frequency discharges if the drainage area were larger and, therefore, conditions were more similar to the regional tendency. Mathematically, the value of a flood-frequency discharge is changed to that estimated by applying the regional equation as $R_{U/K}$ approaches the downstream limit of the ratio of drainage areas (R_{DS}) (table 6). It is suggested that a streamgage be established when $R_{U/K}$ is greater than or equal to R_{DS} . The flood-frequency discharge is estimated by applying the regional equation when $R_{U/K}$ is greater than or equal to R_{DS} , and the following equation is used to estimate the flood-frequency discharge when $R_{U/K}$ is less than R_{DS} :

$$Q_U = Q_{UE} + (Q_K - Q_{KE}) (R_{DS} - R_{U/K}) / (R_{DS} - 1) , \qquad (8)$$

when

$$R_{U/K} < R_{DS} \text{; and}$$

where

- Q_U is the unknown flood-frequency discharge, in ft^3/s;
- Q_{UE} is the regional equation (table 4) evaluated at the location of the unknown flood-frequency discharge, in ft^3/s;
- Q_K is the known flood-frequency discharge (table 3), in ft^3/s;
- Q_{KE} is the regional equation (table 4) evaluated at the location of the known flood-frequency discharge, in ft^3/s;
- R_{DS} is the downstream limit of the ratio of drainage areas (table 6), unitless; and
- $R_{U/K}$ is the ratio of the drainage area at the location of the unknown flood-frequency discharge (A_U) to the drainage area at the location of the known flood-frequency discharge (A_K), unitless.

Between Streamgage Stations

This procedure is used when there are streamgage stations both upstream and downstream from the ungaged location on the same stream. The hydrologic assumption for this circumstance is that the conditions affecting flood-frequency discharges are changing on the basis of the relation between the flood-frequency discharges at the streamgage stations, the ratios of the drainage areas, and differences between regional hydrologic conditions and those that affect flood-frequency discharges at the stations. It is suggested that a streamgage be established when $R_{U/K}$ is greater than R_{DS} and less than R_{US} , and when one of the values of the flood-frequency discharge at the upstream and downstream locations is greater than, and one of the values is less than, that estimated by applying the regional equation. Two alternative hydrologic assumptions are described in detail below.

Hydrologic Conditions Change Linearly between Streamgage Stations

This hydrologic assumption is that the conditions affecting flood-frequency discharges at the upstream streamgage station change linearly with drainage area to those at the downstream location when (1) both streamgage stations are near the ungaged location, or (2) both streamgage stations are not near the ungaged location, but the hydrologic conditions affecting flood-frequency discharges at the stations and ungaged location are consistent. The conditions affecting flood-frequency discharges between the upstream and downstream locations are well defined by streamgage stations when both are near the ungaged location; the conditions affecting flood-frequency discharges are consistent from the upstream to the downstream location when neither is near the ungaged location and the conditions at both stations are more similar to each other than to the regional hydrologic conditions. Mathematically, the value of flood-frequency discharges changes linearly with respect to drainage area from the upstream to the downstream value when (1) $R_{U/K}$ is less than R_{DS} at the upstream location and $R_{U/K}$ is greater than R_{US} at the downstream location; or (2) $R_{U/K}$ is greater than or equal to R_{DS} at the upstream location, $R_{U/K}$ is less than or equal to R_{US} at the downstream location, and the discharges of the flood frequencies at the upstream and downstream locations are both greater than or both less than those estimated by applying the regional equation. The following equation is used to estimate the flood-frequency discharge under the limitations described above:

$$Q_U = [Q_{US}\,(A_{DS} - A_U) + Q_{DS}\,(A_U - A_{US})] \,/\, (A_{DS} - A_{US})\,, \quad (9)$$

when

$R_{U/K} < R_{DS}$ at upstream location and
$R_{U/K} > R_{US}$ at downstream location,

or when

$R_{U/K} \geq R_{DS}$ at upstream location and
$R_{U/K} \leq R_{US}$ at downstream location; and

Q_{KE} at the upstream location > Q_{US} and
Q_{KE} at the downstream location > Q_{DS} or

Q_{KE} at the upstream location < Q_{US} and
Q_{KE} at the downstream location < Q_{DS} ; and

where

- Q_U is the unknown flood-frequency discharge, in ft^3/s;
- Q_{US} is the flood-frequency discharge at the upstream location (table 3), in ft^3/s;
- Q_{DS} is the flood-frequency discharge at the downstream location (table 3), in ft^3/s;
- Q_{KE} is the regional equation evaluated at the location of the known flood-frequency discharge, in ft^3/s;
- A_U is the drainage area at the location of the unknown flood-frequency discharge, in mi^2;
- A_{US} is the drainage area at the upstream location (table 2), in mi^2;
- A_{DS} is the drainage area at the downstream location (table 2), in mi^2;
- R_{US} is the upstream limit of the ratio of drainage areas (table 5), unitless; and
- R_{DS} is the downstream limit of the ratio of drainage areas (table 5), unitless.

Hydrologic Conditions Change Linearly to the Regional Hydrologic Conditions between Streamgage Stations

This hydrologic assumption is that the conditions affecting flood-frequency discharges at the streamgage station change linearly with drainage area to those represented by the regional equation when neither streamgage station is near the ungaged location and the hydrologic conditions affecting flood-frequency discharges at the two stations are inconsistent. The conditions affecting flood discharges can vary greatly as a result of factors such as (1) significant changes in land cover, basin topography, or climatic conditions; (2) input from a tributary stream that is hydrologically different from the stream on which the streamgage station is located or from regional hydrologic conditions; or (3) transfer of storm runoff into or out of the basin. Mathematically, the hydrologic conditions are inconsistent if one of the flood-frequency discharges at the upstream and downstream locations is greater than and one of the flood-frequency discharges is less than those estimated by applying the regional equation—that is, the flood-frequency discharge changes from a value greater than the flood-frequency discharge estimated by applying the regional equation at the upstream location to a value equal to the flood-frequency discharge estimated from the regional equation, and then to a value less than the flood-frequency discharge estimated from the regional equation at the downstream location, or the reverse. The regional equation (table 4) is applied to estimate the flood-frequency discharge if $R_{U/K}$ is greater than or equal to R_{DS} at the upstream location and $R_{U/K}$ is less than or equal to R_{US} at the downstream location. Equation 8 presented in the section "Downstream from a Streamgage Station" is used to estimate the flood-frequency discharge if $R_{U/K}$ is less than R_{DS} at the upstream location and $R_{U/K}$ is less than or equal to R_{US} at the downstream location. The following equation is used to estimate the flood-frequency discharge if $R_{U/K}$ is greater than or equal to R_{DS} at the upstream location and $R_{U/K}$ is greater than R_{US} at the downstream location:

$$Q_U = Q_{UE} + (Q_K - Q_{KE})\,(R_{U/K} - R_{US}) / (1 - R_{US})\ , \qquad (10)$$

when

$R_{U/K} \geq R_{DS}$ at upstream location and
$R_{U/K} > R_{US}$ at downstream location, and

where

Q_U	is the unknown flood-frequency discharge, in ft^3/s;
Q_{UE}	is the regional equation (table 4) evaluated at the location of the unknown flood-frequency discharge, in ft^3/s;
Q_K	is the known flood-frequency discharge (table 3), in ft^3/s;
Q_{KE}	is the regional equation (table 4) evaluated at the location of the known flood-frequency discharge, in ft^3/s;
R_{DS}	is the downstream limit of the ratio of drainage areas (table 5), unitless;
R_{US}	is the upstream limit of the ratio of drainage areas (table 5), unitless; and
$R_{U/K}$	is the ratio of the drainage area at the location of the unknown flood-frequency discharge (A_U) to the drainage area at the location of the known flood-frequency discharge (A_K), unitless.

Not on the Same Stream as a Streamgage Station

This procedure is used when there is no streamgage station on the same stream as the ungaged location. The hydrologic assumption for this circumstance is that the conditions affecting flood-frequency discharges are those represented by the regional equation. A streamgage station could be established when there is no streamgage station on the same stream as the ungaged location. Mathematically, the flood-frequency discharge is estimated by applying the regional equation (table 4).

Example Applications

Estimates of flood-frequency discharges are made by directly reading from table 3 when the location of interest is at a streamgage station, or using one of the four procedures at an ungaged location: (1) when the ungaged location is upstream from a streamgage station, (2) when the ungaged location is downstream from a streamgage station, (3) when the ungaged location is between two streamgage stations on the same stream, and (4) when the ungaged location is not on the same stream as a streamgage station.

- **At a streamgage station:** A flood-frequency discharge for a streamgage station is determined by reading the weighted (Q_w) value from table 3. For example, the 500-year flood discharge (PK500, 0.2-percent AOP) at the streamgage station Big Coal River at Ashford (ID 238 and streamgage 03198500) is given as 50,300 ft^3/s.

- **Upstream from a streamgage station:** The 50-year flood discharge (PK50, 2-percent AOP) for the South Fork South Branch Potomac River just downstream from the confluence of George Run in Pendleton County (Sugar Grove 7½-minute U.S. Geological Survey topographic map) and upstream from the streamgage station at Brandywine (ID 19 and streamgage 01607500) can be calculated using equation 7. The known 50-year flood discharge (Q_K) at the Brandywine streamgage station is 18,600 ft^3/s (the value for Q_w from table 3). The drainage area at the unknown location (A_U) is 84.56 mi^2 (Wiley and others, 2007, p. 29), and the drainage area at the known location (A_K) is 103 mi^2 (table 2). The exponent (EX) for the 50-year flood discharge is 0.70 (table 6). $R_{U/K}$ (which equals A_U / A_K) is calculated to be 0.82, which is greater than the upstream limit of the ratio of drainage areas, 0.40 (R_{US} from table 6), indicating that the installation of a streamgage station is not suggested. The 50-year flood discharge of the South Fork South Branch Potomac River just downstream from the confluence of George Run is calculated from equation 7 to be 16,200 ft^3/s.

- **Downstream from a streamgage station:** The 2-year flood discharge (PK2, 50-percent AOP) for Sand Run just downstream from the confluence of Laurel Fork in Upshur County (Century 7½-minute U.S. Geological Survey topographic map) and downstream from the streamgage station near Buckhannon (ID 90 and streamgage 03052500) can be calculated using equation 8. (No other streamgage station is present downstream from Sand Run near Buckhannon on the same stream.) The known 2-year flood discharge (Q_K) at the Buckhannon streamgage station is 794 ft^3/s (the value for Q_w from table 3). The drainage area at the unknown location (A_U) is 27.56 mi^2 (Stewart and Mathes, 1995, p. 19), and the drainage area at the known location (A_K) is 14.3 mi^2 (table 2). The result of the regional equation calculation at the unknown location (Q_{UE}) is 1,260 ft^3/s (Central Mountains Region determined from fig. 4, equation from table 4) and for the known location (Q_{KE}) is 708 ft^3/s. $R_{U/K}$ (which equals A_U / A_K) was calculated to be 1.93, which is less than the downstream limit of the ratio of drainage areas, 26.4 (R_{DS} from table 6). The drainage areas are within the limits of the regional equation from 0.10 to 1,619 mi^2 (table 4), indicating that the procedure is valid and that the installation of a streamgage station is not suggested. The 2-year flood discharge of Sand Run just downstream from the confluence of Laurel Fork was calculated from equation 8 to be 1,340 ft^3/s.

- **Between two streamgage stations on the same stream:** The 100-year flood discharge (PK100, 1-percent AOP) for the Greenbrier River just downstream from the confluence of Wolf Creek in Monroe County (Alderson 7½-minute U.S. Geological Survey topographic map), downstream from the streamgage station at Alderson (ID 198 and streamgage 03183500), and upstream from the streamgage station at Hilldale (ID 201 and streamgage 03184000) can be calculated using equation 9. The upstream 100-year flood discharge (Q_{US}) at the Alderson streamgage station is 80,400 ft^3/s, and the downstream 100-year flood discharge (Q_{DS}) at the Hilldale streamgage station is 85,400 ft^3/s (the values for Q_w from table 3). The drainage area at the unknown location (A_U) is 1,535.79 mi^2 (Mathes and others, 1982, p. 55), the upstream drainage area at the Alderson streamgage station (A_{US}) is 1,364 mi^2 (table 2), and the downstream drainage area at the Hilldale gaging station (A_{DS}) is 1,619 mi^2. $R_{U/K}$ (which equals A_U / A_K) at the upstream location was calculated to be 1.13, which is less than the downstream limit of the ratio of drainage areas, 26.4 (R_{DS} from table 6). $R_{U/K}$ at the downstream location was calculated to be 0.95, which is greater than the upstream limit of the ratio of drainage areas, 0.40 (R_{US} table 6), indicating that the procedure is valid and that installation of a streamgage is not suggested. The 100-year flood discharge of the Greenbrier River just downstream from the confluence of Wolf Creek was calculated from equation 9 to be 83,800 ft^3/s.

- **Not on the same stream as a streamgage station:** The 10-year flood discharge (PK10, 10-percent AOP) for Fishing Creek just downstream from the confluence of North and South Forks of Fishing Creek in Wetzel County (Pine Grove 7½-minute U.S. Geological Survey topographic map) can be calculated from the regional equation. (There are no streamgage stations on Fishing Creek or South Fork Fishing Creek that could have been on the same stream.) The streams are in the Western Plateaus Region (fig. 4), and the drainage area is 113.92 mi^2 (Wiley, 1997, page 30). The drainage area is within the limits of the regional equation from 0.13 to 1,516 mi^2 (table 4), indicating that the procedure is valid, but that installation of a streamgage station could improve the estimate. The 10-year flood discharge was calculated from the regression equation for the Western Plateaus Region (table 4) to be 8,000 ft^3/s.

Limitations of Procedures for Estimating Flood-Frequency Discharges

Procedures developed in this study are applicable only to rural, unregulated streams located within the boundaries of West Virginia. Procedures also are limited to the range of drainage areas used to develop the equations—from 0.21 to 1,461 mi^2 in the Eastern Panhandle Region, from 0.10 to 1,619 mi^2 in the Central Mountains Region, and from 0.13 to 1,516 mi^2 in the Western Plateaus Region. The procedures are not meant to be applied to urban areas with paved surfaces, concrete channels, or culverts that substantially increase runoff or decrease infiltration. The procedures are not meant to be applied to streams regulated by dams or with large lakes and ponds that substantially retain runoff. Procedures are not applicable to heavily mined areas if excessive runoff is diverted into or outside the basin, retained along strip benches, or retained underground. Procedures are not applicable to karst areas if excessive runoff is diverted into, outside, or deep within the basin through solution channels or other cavities in carbonate (limestone and dolomite) rocks. Jones (1997) describes the locations of karst areas in eastern counties of West Virginia, including parts of Monongalia, Preston, Barbour, Tucker, Grant, Mineral, Hardy, Hampshire, Morgan, Berkeley, Jefferson, Randolph, Pendleton, Pocahontas, Greenbrier, Summers, Monroe, and Mercer (counties are shown in fig. 4).

Summary

Flood-frequency discharges were determined for 290 streamgage stations on rural, unregulated streams in West Virginia and adjacent states that have a minimum of 9 years of record through the 2006 or 2007 water year. This study was conducted by the USGS, in cooperation with the West Virginia Department of Transportation, Division of Highways. West Virginia skew coefficients were used instead of the United States skew coefficients used in previous studies in West Virginia. Flood-frequency discharges and skew coefficients for stations in adjacent states are applicable only for determining estimates in West Virginia and do not supersede values used in the adjacent states.

The results of a correlation analysis of 36 log_{10}-transformed basin characteristics available for the 290 streamgage stations reduced the number of characteristics to 32 for consideration as independent variables in the regression analysis. Elongation ratio (ER), rotundity of basin (RB), channel maintenance (CM), and basin width (BW) were removed from consideration as independent variables because the Pearson's coefficient was equal to 1 (singularity) for this group of basin characteristics.

Regression analysis was conducted using log_{10}-transformed flood-frequency discharges as dependent variables and log_{10}-transformed basin characteristics as independent variables for 246 streamflow stations. Forty-four streamflow stations were excluded from the analysis because the (1) peak data were used to lengthen records for other nearby streamgage stations, (2) station is located in a karst area, (3) plot of the regression residual indicated the station was not representative of West Virginia, and (4) station has a large drainage area and leveraged the regression equation, affecting estimates for small drainage areas. Residuals from multiple and simple least-squares regression models of the 100-year (1-percent AOP) flood discharge with independent variables describing the basin characteristics were used to determine drainage area as the only significant independent variable and to delineate boundaries of three regions in West Virginia—Eastern Panhandle, Central Mountains, and Western Plateaus. Regional equations for the 1.1- (90-percent AOP), 1.5- (67-percent AOP), 2- (50-percent AOP), 5- (20-percent AOP), 10- (10-percent AOP), 25- (4-percent AOP), 50- (2-percent AOP), 100- (1-percent AOP), 200- (0.5-percent AOP), and 500-year (0.2-percent AOP) flood discharges were determined by executing a generalized least-squares regression model. Drainage area was the only significant independent variable determined for all equations in all regions.

The 246 streamgage stations were reduced to 125 for consideration in the trend analysis. For the trend analysis, streamgage stations with a minimum of 30 years of record were considered in order to eliminate effects that might be due to climate variability. Twelve streamgage stations indicated a trend, twice as many as would be expected by chance, but the stations were about equally divided between those having a positive trend and those having a negative trend. No significance was determined for the streamgage stations having a trend.

The accuracy of estimating equations was quantified by measuring the average prediction error and equivalent years of record. The average prediction error ranged from 21.7 to 56.3 percent, and the equivalent years of record ranged from 2.0 to 70.9 years.

Procedures for estimating flood-frequency discharges at a streamgage station and at an ungaged location are presented in the text of this report. The procedures for an ungaged location include a combination of (1) estimates based on drainage-area ratios between stations and ungaged locations on the same stream and (2) estimates from regional equations. Examples of the procedures are presented in the text.

Equations developed in this study are applicable only to rural, unregulated streams located within the boundaries of West Virginia. Equation application is limited to the range of drainage areas used in equation development—from 0.21 to 1,461 mi^2 in the Eastern Panhandle Region, from 0.10 to 1,619 mi^2 in the Central Mountains Region, and from 0.13 to 1,516 mi^2 in the Western Plateaus Region. The authors suggest using caution in evaluating the results if the equations are applied to heavily mined or karst areas.

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Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.

[Identification number refers to the number in figure 3; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; N., North; S., South; E., East; W., West; R., Right; Br., Branch; Fk., Fork; Cr., Creek; Trib., Tributary; Spgs., Springs; Rt., Route; bl, below; nr, near; U.S. skew, United States skew, the skew presented in Bulletin-17B by the Interagency Advisory Committee on Water Data (1982); WV skew, West Virginia skew determined by Atkins and others (2009); shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
1	01595000	North Branch Potomac River at Steyer	MD	0.594	0.337	0.257	0.376	3.531	0.245
2	01595300	Abram Creek at Oakmont	WV	.523	.348	.175	1.093	3.127	.193
3	01595500	North Br. Potomac River at Kitzmiller	MD	.568	.344	.224	.900	3.914	.232
4	01596000	North Br. Potomac River at Bloomington	MD	.549	.351	.198	.466	3.924	.259
5	01596500	Savage River near Barton	MD	.565	.335	.230	.639	3.194	.223
6	01597000	Crabtree Creek near Swanton	MD	.543	.334	.209	.722	2.714	.267
7	01598000	Savage River at Bloomington	MD	.553	.350	.203	.628	3.561	.259
8	01599000	Georges Creek at Franklin	MD	.535	.354	.181	.502	3.289	.234
9	01599500	New Creek near Keyser	WV	.475	.371	.104	.060	3.013	.302
10	01600000	North Branch Potomac River at Pinto	MD	.516	.366	.150	.500	4.215	.259
11	01601500	Wills Creek near Cumberland	MD	.595	.358	.237	.792	3.817	.255
12	01603000	N. Br. Potomac River near Cumberland	MD	.529	.365	.164	.697	4.270	.211
13	01604500	Patterson Creek near Headsville	WV	.430	.383	.047	.017	3.565	.300
14	01605500	South Branch Potomac River at Franklin	WV	.700	.419	.281	.450	3.681	.341
15	01605700	Reeds Creek Tributary near Franklin	WV	.800	.401	.399	.644	1.322	.229
16	01606000	N. Fk. S. Br. Potomac River at Cabins	WV	.824	.389	.435	.874	3.942	.251
17	01606500	S. Br. Potomac River near Petersburg	WV	.802	.396	.406	.719	4.149	.276
18	01606800	Brushy Run near Petersburg	WV	.689	.415	.274	.551	1.622	.377
19	01607500	S. Fk. S. Br. Potomac R. at Brandywine	WV	.659	.433	.226	.816	3.560	.329
20	01607510	Heavener Run near Brandywine	WV	.715	.435	.280	.500	1.512	.307
21	01608000	S. Fk. S. Br. Potomac R. near Moorefield	WV	.671	.423	.248	.621	3.805	.311
22	01608100	Williams Hollow near Moorefield	WV	.391	.419	-.028	.125	1.669	.142
23	01608500	S. Br. Potomac River near Springfield	WV	.691	.398	.293	.598	4.385	.295
24	01609000	Town Creek near Oldtown	MD	.510	.393	.117	.146	3.591	.255
25	01609500	Sawpit Run near Oldtown	MD	.425	.394	.031	.580	2.445	.193
26	01609650	Little Cacapon River at Frenchburg	WV	.303	.414	-.111	.198	3.034	.360
27	01609800	Little Cacapon River near Levels	WV	.322	.406	-.084	.324	3.593	.223

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
28	01610000	Potomac River at Paw Paw	WV	.457	.404	.053	.465	4.637	.214
29	01610150	Bear Creek at Forest Park	MD	.454	.395	.059	.213	2.585	.288
30	01610155	Sideling Hill Creek at Bellegrove	MD	.481	.399	.082	.169	3.569	.333
31	01610500	Cacapon River at Yellow Spring	WV	.242	.446	-.204	.085	3.875	.362
32	01611500	Cacapon River near Great Cacapon	WV	.306	.411	-.105	.025	4.115	.318
33	01612500	Little Tonoloway Creek near Hancock	MD	.246	.400	-.154	.225	2.730	.271
34	01613000	Potomac River at Hancock	MD	.435	.407	.028	.494	4.745	.240
35	01613150	Ditch Run near Hancock	MD	.391	.412	-.021	.322	2.387	.231
36	01613160	Potomac River Tributary near Hancock	MD	.418	.412	.006	.519	2.036	.166
37	01613900	Hogue Creek near Hayfield	VA	.411	.462	-.051	-.130	2.925	.348
38	01614000	Back Creek near Jones Springs	WV	.210	.445	-.235	.310	3.761	.250
39	01615000	Opequon Creek near Berryville	VA	.252	.488	-.236	.081	3.388	.315
40	01616000	Abrams Creek near Winchester	VA	.211	.487	-.276	-.020	2.734	.281
41	01616500	Opequon Creek near Martinsburg	WV	.218	.470	-.252	.157	3.659	.307
42	01617000	Tuscarora Creek above Martinsburg	WV	.243	.459	-.216	.294	2.235	.253
43	01617800	Marsh Run at Grimes	MD	.306	.481	-.175	.023	2.012	.339
44	01618000	Potomac River at Shepherdstown	MD	.318	.490	-.172	.322	4.837	.224
45	01619475	Dog Creek Tributary near Locust Grove	MD	.322	.507	-.185	.417	1.354	.360
46	01619500	Antietam Creek near Sharpsburg	MD	.363	.498	-.135	.288	3.428	.273
47	01620500	North River near Stokesville	VA	.560	.471	.089	.492	2.894	.398
48	01621000	Dry River at Rawley Springs	VA	.611	.477	.134	.911	3.393	.270
49	01621200	War Branch near Hinton	VA	.537	.490	.047	.464	2.759	.273
50	01621400	Blacks Run at Harrisonburg	VA	.453	.506	-.053	.585	2.691	.186
51	01621450	Blacks Run Tributary near Harrisonburg	VA	.462	.507	-.045	.728	1.644	.253
52	01622000	North River near Burketown	VA	.550	.514	.036	.587	3.861	.291
53	01622100	North River Tributary at Mount Crawford	VA	.445	.513	-.068	.243	1.778	.278
54	01622300	Buffalo Branch Trib. near Agusta Springs	VA	.340	.489	-.149	.320	1.733	.165

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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55	01622400	Buffalo Branch Tributary near Christian	VA	.378	.492	-.114	.511	1.760	.260
56	01632000	N. Fk. Shenandoah R. at Cootes Store	VA	.515	.482	.033	.010	3.909	.293
57	01632300	Long Meadow near Broadway	VA	.413	.499	-.086	.395	2.137	.407
58	01632900	Smith Creek near New Market	VA	.382	.496	-.114	-.010	3.328	.373
59	01632950	Crooked Run Tributary near Conicville	VA	.347	.474	-.127	.151	1.363	.198
60	01632970	Crooked Run near Mount Jackson	VA	.343	.482	-.139	.244	2.421	.363
61	01633000	N. Fk. Shenandoah R. at Mount Jackson	VA	.439	.489	-.050	.040	4.037	.292
62	01633500	Stony Creek at Columbia Furnace	VA	.336	.475	-.139	.300	3.327	.286
63	01633650	Pughs Run near Woodstock	VA	.243	.475	-.232	.224	2.059	.372
64	01634000	N. Fk. Shenandoah River near Strasburg	VA	.378	.489	-.111	.416	4.077	.314
65	01634500	Cedar Creek near Winchester	VA	.199	.476	-.277	.205	3.524	.340
66	01636500	Shenandoah River at Millville	WV	.359	.515	-.156	.154	4.524	.298
67	01637000	Little Catoctin Creek at Harmony	MD	.332	.522	-.190	.344	2.766	.405
68	01637500	Catoctin Creek near Middletown	MD	.336	.529	-.193	.141	3.402	.311
69	01638480	Catoctin Creek at Taylorstown	VA	.287	.554	-.267	-.070	3.584	.364
70	01638500	Potomac River at Point Of Rocks	MD	.228	.556	-.328	.236	5.018	.228
71	01643700	Goose Creek near Middleburg	VA	.247	.558	-.311	.101	3.596	.369
72	01644000	Goose Creek near Leesburg	VA	.268	.593	-.325	.341	3.880	.335
73	01644100	South Fork Sycolin Creek near Leesburg	VA	.286	.579	-.293	.228	2.599	.282
74	02009500	Cattail Run near Bolar	VA	.338	.416	-.078	.385	1.512	.101
75	02011400	Jackson River near Bacova	VA	.238	.413	-.175	.537	3.584	.245
76	02011460	Back Creek near Sunrise	VA	.419	.405	.014	.489	3.469	.226
77	02011480	Back Cr. at Rt. 600 near Mountain Grove	VA	.344	.404	-.060	.096	3.643	.177
78	02011500	Back Creek near Mountain Grove	VA	.258	.407	-.149	-.120	3.770	.200
79	02012500	Jackson River at Falling Spring	VA	.136	.417	-.281	-.260	4.003	.236
80	02012950	Sweet Spgs. Cr. Trib. at Sweet Chaylbeate	VA	.003	.413	-.410	-.140	1.562	.602
81	02013000	Dunlap Creek near Covington	VA	.015	.417	-.402	.068	3.725	.254

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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82	02014000	Potts Creek near Covington	VA	.001	.425	-.424	-.130	3.595	.241
83	03050000	Tygart Valley River near Dailey	WV	.546	.320	.226	.334	3.841	.170
84	03050500	Tygart Valley River near Elkins	WV	.587	.306	.281	.471	3.874	.137
85	03050650	Unnamed Run at Gilman	WV	.608	.306	.302	.758	1.700	.284
86	03051000	Tygart Valley River at Belington	WV	.579	.284	.295	.291	4.016	.139
87	03051500	Middle Fork River at Midvale	WV	.424	.276	.148	.278	3.695	.199
88	03052000	Middle Fork River at Audra	WV	.412	.265	.147	.231	3.789	.177
89	03052340	Mud Lick Run near Buckhannon	WV	.124	.246	-.122	.221	2.197	.191
90	03052500	Sand Run near Buckhannon	WV	.274	.265	.009	.356	2.916	.243
91	03053500	Buckhannon River at Hall	WV	.249	.257	-.008	-.210	3.870	.141
92	03054500	Tygart Valley River at Phillipi	WV	.432	.251	.181	.234	4.355	.152
93	03055020	Bonica Run on U.S. 250 near Phillipi	WV	.361	.260	.101	.070	1.828	.263
94	03055040	Bonica Run on Route 38 near Phillipi	WV	.363	.259	.104	.352	2.333	.271
95	03056250	Three Fork Creek near Grafton	WV	.375	.227	.148	.284	3.683	.176
96	03056500	Tygart Valley River at Fetterman	WV	.421	.219	.202	.328	4.498	.155
97	03056600	Right Fk. Wickwire Run near Grafton	WV	.319	.225	.094	.104	2.310	.230
98	03057300	West Fork River at Walkersville	WV	.086	.238	-.152	.072	3.197	.205
99	03057500	Skin Creek near Brownsville	WV	.042	.226	-.184	-.160	3.107	.130
100	03058000	West Fork R. blw Stonewall Jackson Dam nr Weston	WV	.034	.218	-.184	.126	3.507	.172
101	03058500	West Fork River at Butcherville	WV	.010	.205	-.195	-.060	3.781	.183
102	03059000	West Fork River at Clarksburg	WV	-.024	.191	-.215	-.310	3.993	.147
103	03059500	Elk Creek at Quiet Dell	WV	.135	.206	-.071	.029	3.423	.262
104	03060500	Salem Fork at Salem	WV	-.083	.165	-.248	-.190	2.908	.301
105	03061000	West Fork River at Enterprise	WV	-.001	.178	-.179	-.130	4.243	.179
106	03061500	Buffalo Creek at Barrackville	WV	.030	.178	-.148	-.060	3.714	.148
107	03062400	Cobun Creek at Morgantown	WV	.314	.190	.124	.575	2.700	.272
108	03062500	Deckers Creek at Morgantown	WV	.365	.187	.178	.363	3.195	.256

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109	03063950	Job Run near Wymer	WV	.817	.351	.466	.967	1.836	.318
110	03065000	Dry Fork at Hendricks	WV	.813	.322	.491	.959	4.136	.211
111	03065400	Blackwater River near Davis	WV	.689	.342	.347	.796	3.195	.204
112	03066000	Blackwater River at Davis	WV	.671	.337	.334	.721	3.416	.197
113	03067100	Fernow WS-4 near Hendricks	WV	.666	.316	.350	.316	.846	.239
114	03067500	Shavers Fork at Cheat Bridge	WV	.550	.345	.205	.304	3.615	.138
115	03068610	Taylor Run at Bowden	WV	.759	.334	.425	.439	2.379	.203
116	03068800	Shavers Fork below Bowden	WV	.682	.323	.359	.355	4.043	.172
117	03069000	Shavers Fork at Parsons	WV	.710	.311	.399	.846	3.957	.162
118	03069500	Cheat River near Parsons	WV	.795	.307	.488	.845	4.422	.187
119	03069850	Long Run near Parsons	WV	.519	.280	.239	.548	1.906	.185
120	03069880	Buffalo Creek near Rowlesburg	WV	.501	.279	.222	.210	3.032	.206
121	03070000	Cheat River at Rowlesburg	WV	.747	.276	.471	.596	4.541	.189
122	03070500	Big Sandy Creek near Rockville	WV	.476	.230	.246	.750	3.875	.176
123	03071000	Cheat River near Pisgah	WV	.617	.219	.398	.280	4.644	.200
124	03071500	Cheat River near Morgantown	WV	.611	.196	.415	-.010	4.665	.190
125	03072000	Dunkard Creek at Shannopin	PA	.114	.164	-.050	-.110	3.850	.199
126	03072590	Georges Creek at Smithfield	PA	.394	.188	.206	.290	2.826	.197
127	03075450	Little Youghiogheny R. Trib. at Deer Park	MD	.555	.316	.239	.099	1.370	.205
128	03075500	Youghiogheny River near Oakland	MD	.562	.303	.259	.385	3.636	.210
129	03075600	Toliver Run Tributary near Hoyes Run	MD	.548	.294	.254	.579	1.501	.284
130	03076505	Youghiogheny R. Trib. near Friendsville	MD	.541	.269	.272	.215	1.072	.143
131	03076600	Bear Creek at Friendsville	MD	.560	.276	.284	.057	3.192	.205
132	03085500	Chartiers Creek at Carnegie	PA	.108	.057	.051	.136	3.737	.223
133	03108000	Raccoon Creek at Moffatts Mill	PA	.055	.004	.051	.356	3.568	.220
134	03109000	Lisbon Creek at Lisbon	OH	.094	-.055	.149	.284	2.592	.237
135	03109500	Little Beaver Creek near East Liverpool	OH	.098	-.022	.120	.160	3.958	.202

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; N., North; S., South; E., East; W., West; R., Right; Br., Branch; Fk., Fork; Cr., Creek; Trib., Tributary; Spgs., Springs; Rt., Route; bl, below; nr, near; U.S. skew, United States skew, the skew presented in Bulletin-17B by the Interagency Advisory Committee on Water Data (1982); WV skew, West Virginia skew determined by Atkins and others (2009); shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
136	03110000	Yellow Creek near Hammondsville	OH	.015	-.025	.040	.391	3.497	.196
137	03110980	Consol Run at Bloomingdale	OH	-.015	-.013	-.002	-.040	.808	.331
138	03111150	Brush Run near Buffalo	PA	.049	.048	.001	-.110	2.721	.294
139	03111450	Branson Run at Georgetown	OH	-.034	-.012	-.022	.048	1.764	.293
140	03111455	South Fork Short Creek at Georgetown	OH	-.035	-.012	-.023	.005	2.352	.242
141	03111470	Little Piney Fork at Parlett	OH	-.019	-.013	-.006	.108	1.805	.367
142	03111500	Short Creek near Dillonvale	OH	-.029	.011	-.040	-.130	3.448	.211
143	03111540	Sloan Run Tributary near Harrisville	OH	-.040	-.002	-.038	-.060	1.686	.520
144	03111548	Wheeling Creek below Blaine	OH	-.045	.016	-.061	.008	3.426	.239
145	03112000	Wheeling Creek at Elm Grove	WV	.005	.036	-.031	-.040	3.955	.205
146	03113700	Little Grave Creek near Glendale	WV	-.036	.042	-.078	-.070	2.693	.333
147	03114000	Captina Creek at Armstrongs Mills	OH	-.066	.023	-.089	.000	3.785	.216
148	03114240	Wood Run near Woodsfield	OH	-.081	.026	-.107	-.130	1.805	.377
149	03114500	Middle Island Creek at Little	WV	-.105	.079	-.184	.090	4.132	.132
150	03114550	Buffalo Run near Friendly	WV	-.109	.071	-.180	-.250	2.307	.306
151	03114600	Little Buffalo Run near Friendly	WV	-.109	.073	-.182	-.190	2.401	.258
152	03114650	Buffalo Run near Little	WV	-.110	.076	-.186	-.340	2.905	.286
153	03115280	Trail Run near Antioch	OH	-.099	.051	-.150	.218	2.814	.218
154	03115400	Little Muskingum River at Bloomfield	OH	-.091	.041	-.132	.481	3.890	.230
155	03115410	Graham Run near Bloomfield	OH	-.099	.042	-.141	-.260	1.282	.383
156	03115500	Little Muskingum River at Fay	OH	-.093	.042	-.135	-.010	3.886	.194
157	03115510	Moss Run near Wingott	OH	-.095	.039	-.134	.196	2.359	.253
158	03115600	Barns Run near Summerfield	OH	-.059	-.007	-.052	.045	2.737	.357
159	03115710	Buffalo Run Tributary near Dexter City	OH	-.057	-.002	-.055	.252	1.646	.086
160	03150600	Tupper Creek at Devola	OH	-.057	.020	-.077	.173	2.153	.239
161	03151400	Little Kanawha River near Wildcat	WV	.181	.247	-.066	.450	3.708	.243
162	03151500	Little Kanawha River near Burnsville	WV	.144	.227	-.083	-.170	3.712	.135

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; N., North; S., South; E., East; W., West; R., Right; Br., Branch; Fk., Fork; Cr., Creek; Trib., Tributary; Spgs., Springs; Rt., Route; bl, below; nr, near; U.S. skew, United States skew, the skew presented in Bulletin-17B by the Interagency Advisory Committee on Water Data (1982); WV skew, West Virginia skew determined by Atkins and others (2009); shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
163	03152000	Little Kanawha River at Glenville	WV	.014	.181	-.167	-.010	3.986	.149
164	03152200	Buck Run near Leopold	WV	-.128	.171	-.299	.021	2.537	.247
165	03152500	Leading Creek near Glenville	WV	-.130	.173	-.303	-.300	3.783	.194
166	03153000	Steer Creek near Grantsville	WV	-.063	.166	-.229	-.260	3.838	.180
167	03153500	Little Kanawha River at Grantsville	WV	-.075	.147	-.222	-.270	4.301	.119
168	03154000	W. Fk. Little Kanawha River at Rocksdale	WV	-.097	.141	-.238	-.150	3.887	.175
169	03154250	Tanner Run at Spencer	WV	-.118	.127	-.245	-.080	2.824	.204
170	03154500	Reedy Creek near Reedy	WV	-.118	.098	-.216	.086	3.548	.146
171	03155000	Little Kanawha River at Palestine	WV	-.112	.084	-.196	-.210	4.466	.141
172	03155200	South Fork Hughes River at Macfarlan	WV	-.149	.111	-.260	-.290	3.911	.119
173	03155450	Big Island Run near Elizabeth	WV	-.138	.099	-.237	-.240	2.865	.246
174	03155500	Hughes River at Cisco	WV	-.146	.092	-.238	-.130	4.160	.164
175	03155525	Goose Creek near Petroleum	WV	-.130	.086	-.216	.084	3.274	.231
176	03159540	Shade River near Chester	OH	.051	.011	.040	.565	3.579	.182
177	03159700	Grasslick Run near Ripley	WV	-.077	.086	-.163	.270	2.191	.239
178	03171500	New River at Eggleston	VA	.370	.412	-.042	.674	4.543	.246
179	03173000	Walker Creek at Bane	VA	.034	.404	-.370	.005	3.833	.221
180	03175500	Wolf Creek near Narrows	VA	-.038	.385	-.423	-.420	3.722	.228
181	03176400	Rich Creek near Peterstown	WV	-.044	.381	-.425	-.160	3.162	.147
182	03176500	New River at Glen Lyn	VA	.307	.378	-.071	.584	4.608	.244
183	03177500	Indian Creek at Indian Mills	WV	-.039	.366	-.405	-.290	3.593	.084
184	03177700	Bluestone River at Bluefield	VA	-.090	.343	-.433	-.070	2.851	.146
185	03178500	Camp Creek near Camp Creek	WV	-.153	.335	-.488	-.240	3.153	.267
186	03179000	Bluestone River near Pipestem	WV	-.139	.344	-.483	-.460	3.901	.217
187	03179500	Bluestone River at Lilly	WV	-.140	.345	-.485	-.170	3.944	.152
188	03180000	New River at Bluestone Dam	WV	.205	.347	-.142	.567	4.693	.213
189	03180350	W. Fk. Greenbrier River Trib. at Durbin	WV	.635	.357	.278	.553	1.741	.191

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
190	03180500	Greenbrier River at Durbin	WV	.728	.359	.369	1.068	3.687	.210
191	03180530	Brush Run near Bartow	WV	.646	.370	.276	.380	1.862	.330
192	03180680	Cooper Run near Green Bank	WV	.488	.378	.110	.259	1.992	.266
193	03181900	Mack Butterball Hollow near Huntersville	WV	.231	.376	-.145	.043	1.019	.153
194	03182000	Knapp Creek at Marlinton	WV	.179	.367	-.188	.728	3.708	.163
195	03182500	Greenbrier River at Buckeye	WV	.439	.364	.075	.460	4.273	.181
196	03182700	Anthony Creek near Anthony	WV	.049	.381	-.332	.524	3.980	.165
197	03183000	Second Creek near Second Creek	WV	-.010	.388	-.398	.017	3.409	.232
198	03183500	Greenbrier River at Alderson	WV	.110	.364	-.254	-.140	4.527	.169
199	03183550	Griffith Creek near Alderson	WV	-.029	.356	-.385	-.270	2.441	.130
200	03183570	Buggar Lick at Pence Springs	WV	-.041	.361	-.402	.119	2.118	.296
201	03184000	Greenbrier River at Hilldale	WV	.090	.356	-.266	.127	4.568	.148
202	03184200	Big Creek near Bellepoint	WV	-.058	.352	-.410	.077	2.782	.361
203	03184500	New River at Hinton	WV	.013	.344	-.331	.206	4.898	.212
204	03185000	Piney Creek at Raleigh	WV	-.147	.305	-.452	.070	3.091	.235
205	03185020	Little Beaver Cr. Trib. near Shady Springs	WV	-.121	.316	-.437	-.310	1.472	.328
206	03185500	New River at Caperton	WV	-.015	.293	-.308	-.090	4.957	.189
207	03186000	New River at Fayette	WV	-.016	.281	-.297	-.160	4.975	.210
208	03186500	Williams River at Dyer	WV	.289	.301	-.012	.379	3.914	.188
209	03187000	Gauley River at Camden on Gauley	WV	.295	.289	.006	.254	4.057	.191
210	03187300	North Fk. Cranberry River near Hillsboro	WV	.244	.334	-.090	.343	2.911	.233
211	03187500	Cranberry River near Richwood	WV	.238	.307	-.069	.311	3.695	.189
212	03189000	Cherry River at Fenwick	WV	.175	.310	-.135	.656	3.944	.204
213	03189100	Gauley River near Craigsville	WV	.243	.295	-.052	.113	4.415	.195
214	03189500	Gauley River near Summersville	WV	.234	.279	-.045	.514	4.397	.172
215	03189650	Collison Creek near Nallen	WV	.090	.287	-.197	-.110	2.234	.231
216	03190000	Meadow River at Nallen	WV	.050	.296	-.246	.036	3.779	.149

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
217	03190100	Anglins Creek near Nallen	WV	.093	.296	-.203	.215	3.231	.372
218	03190400	Meadow River near Mount Lookout	WV	.056	.277	-.221	.276	3.958	.187
219	03190500	Meadow Creek near Summersville	WV	.078	.273	-.195	-.170	2.506	.155
220	03191400	Laurel Creek near Summersville	WV	.064	.262	-.198	.085	2.379	.348
221	03191500	Peters Creek near Lockwood	WV	.078	.258	-.180	.112	3.420	.279
222	03192000	Gauley River above Belva	WV	.164	.242	-.078	.319	4.624	.158
223	03192500	Gauley River at Belva	WV	.159	.242	-.083	.251	4.576	.198
224	03193000	Kanawha River at Kanawha Falls	WV	-.060	.253	-.313	-.070	5.089	.178
225	03193725	Little Fork at Mossy	WV	-.080	.269	-.349	.104	1.267	.203
226	03193830	Gilmer Run near Marlinton	WV	.304	.351	-.047	.621	2.393	.273
227	03194700	Elk River below Webster Springs	WV	.382	.270	.112	.500	4.082	.179
228	03195000	Elk River at Centralia	WV	.376	.260	.116	.143	4.049	.101
229	03195100	Right Fork Holly River at Guardian	WV	.274	.268	.006	.478	3.395	.187
230	03195250	Left Fork Holly River near Replete	WV	.276	.265	.011	.388	3.403	.187
231	03195500	Elk River at Sutton	WV	.307	.235	.072	.287	4.299	.159
232	03195600	Granny Creek at Sutton	WV	.062	.233	-.171	.199	2.961	.159
233	03197000	Elk River at Queen Shoals	WV	.176	.191	-.015	.418	4.446	.154
234	03197150	Ashleycamp Run near Left Hand	WV	-.080	.174	-.254	.029	2.347	.175
235	03197900	Elk Twomile Creek Trib. near Charleston	WV	-.077	.179	-.256	.060	1.840	.251
236	03198350	Clear Fork at Whitesville	WV	-.119	.241	-.360	.096	3.332	.391
237	03198450	Drawdy Creek near Peytona	WV	-.110	.196	-.306	.263	2.571	.275
238	03198500	Big Coal River at Ashford	WV	-.129	.184	-.313	.088	4.021	.232
239	03198780	Hunters Branch near Madison	WV	-.133	.201	-.334	-.120	2.081	.256
240	03198800	Low Gap Creek near Madison	WV	-.126	.195	-.321	-.230	1.864	.436
241	03199000	Little Coal River at Danville	WV	-.159	.186	-.345	-.070	3.965	.273
242	03199300	Rock Creek near Danville	WV	-.113	.183	-.296	-.260	2.622	.305
243	03199400	Little Coal River at Julian	WV	-.150	.171	-.321	.105	4.006	.241

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
244	03200500	Coal River at Tornado	WV	-.133	.140	-.273	-.290	4.300	.174
245	03200600	Little Scary Creek near Nitro	WV	-.058	.118	-.176	.049	1.926	.228
246	03201000	Pocatalico River at Sissonville	WV	-.099	.135	-.234	-.140	3.826	.189
247	03201405	Hurricane Creek at Hurricane	WV	-.035	.099	-.134	-.180	3.317	.183
248	03201410	Poplar Fork at Teays	WV	-.045	.108	-.153	-.040	2.955	.179
249	03201420	Long Branch near Teays	WV	-.040	.103	-.143	-.300	2.406	.155
250	03201440	Sixteenmile Creek near Pliny	WV	.007	.058	-.051	.302	2.490	.229
251	03201480	Threemile Creek Trib. near Point Pleasant	WV	.047	.019	.028	-.220	2.111	.323
252	03202000	Raccoon Creek at Adamsville	OH	.200	-.017	.217	.308	3.790	.191
253	03202245	Marsh Fork at Maben	WV	-.202	.290	-.492	.171	2.667	.239
254	03202400	Guyandotte River near Baileysville	WV	-.201	.265	-.466	-.030	3.911	.343
255	03202480	Brier Creek at Fanrock	WV	-.225	.268	-.493	-.310	2.541	.365
256	03202750	Clear Fork at Clear Fork	WV	-.216	.255	-.471	.042	3.638	.200
257	03203000	Guyandotte River at Man	WV	-.227	.223	-.450	-.340	4.294	.217
258	03203600	Guyandotte River at Logan	WV	-.228	.200	-.428	-.400	4.380	.252
259	03204000	Guyandotte River at Branchland	WV	-.215	.107	-.322	-.480	4.345	.201
260	03204500	Mud River near Milton	WV	-.052	.093	-.145	.250	3.808	.229
261	03205995	Sandusky Creek near Burlington	OH	.163	.030	.133	.335	2.066	.217
262	03206450	Fourpole Creek near Huntington	WV	.091	.055	.036	-.100	2.826	.337
263	03206600	East Fork Twelvepole Creek near Dunlow	WV	-.050	.124	-.174	-.160	3.244	.195
264	03206800	E. Fk. Twelvepole Creek near East Lynn	WV	-.017	.088	-.105	.199	3.536	.183
265	03207000	Twelvepole Creek at Wayne	WV	.005	.068	-.063	.000	3.811	.228
266	03207020	Twelvepole Creek below Wayne	WV	.008	.066	-.058	-.020	3.810	.224
267	03207400	Prater Creek at Vasant	VA	-.106	.251	-.357	-.190	2.922	.448
268	03207500	Levisa Fork near Grundy	VA	-.131	.238	-.369	-.390	3.955	.277
269	03207800	Levisa Fork at Big Rock	VA	-.133	.221	-.354	.000	3.946	.323
270	03207962	Dicks Fork at Phyllis	KY	-.069	.187	-.256	-.180	1.796	.369

Table 1. Identification numbers, station numbers, streamgage-station names, and skew coefficients and statistics for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	Streamgage-station name	State	WV skew, unitless	U.S. skew, unitless	Difference between WV and US skews, unitless	Weighted WV and station skews, unitless	Mean of log_{10}-transformed flood-frequency discharges, in cubic feet per second	Standard deviation of log_{10}-transformed flood-frequency discharges, in cubic feet per second
271	03208000	Levisa Fork below Fishtrap Dam	KY	-.131	.178	-.309	-.130	4.076	.216
272	03208500	Russel Fork at Haysi	VA	-.058	.223	-.281	-.240	4.099	.295
273	03208950	Cranes Nest River near Clintwood	VA	.034	.213	-.179	.189	3.402	.305
274	03209000	Pond R. blw. Flannagan Dam near Haysi	VA	.027	.213	-.186	-.100	3.970	.236
275	03209575	Bill D. Branch near Kite	KY	.132	.131	.001	.430	2.464	.203
276	03210000	Johns Crek near Meta	KY	-.064	.153	-.217	-.420	3.396	.247
277	03211500	Johns Creek near Van Lear	KY	.003	.085	-.082	-.110	3.627	.227
278	03212000	Paint Creek at Staffordsville	KY	.298	.047	.251	-.170	3.706	.303
279	03212750	Tug Fork at Welch	WV	-.183	.287	-.470	-.060	3.490	.336
280	03212980	Dry Fork at Beartown	WV	-.154	.269	-.423	-.310	3.718	.252
281	03213000	Tug Fork at Litwar	WV	-.183	.255	-.438	-.250	4.081	.261
282	03213500	Panther Creek near Panther	WV	-.177	.256	-.433	-.150	3.205	.385
283	03213700	Tug Fork at Williamson	WV	-.191	.169	-.360	.043	4.242	.268
284	03214000	Tug Fork near Kermit	WV	-.186	.133	-.319	-.050	4.380	.281
285	03214500	Tug Fork at Kermit	WV	-.180	.127	-.307	-.130	4.366	.268
286	03214900	Tug Fork at Glenhayes	WV	-.165	.087	-.252	-.040	4.275	.241
287	03215500	Blaine Creek at Yatesville	KY	.268	.039	.229	.116	3.784	.219
288	03216500	Little Sandy River at Grayson	KY	.370	-.024	.394	.270	4.007	.178
289	03216540	E. Fk. Little Sandy River near Fallsburg	KY	.258	.024	.234	.249	2.975	.168
290	03216563	Mile Branch near Rush	KY	.286	-.006	.292	.088	2.280	.185

Table 2. Flood-frequency statistics and drainage areas for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.

[Identification number refers to the number in figure 3; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; - -, no value; shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
1	01595000	MD	73.1	1955–2006	52	--	--	--	--	--	-0.130	0.175
2	01595300	WV	42.6	1955–1982	27	83	--	--	1	--	-.239	.083
3	01595500	MD	225	1950–2006	56	--	--	--	1	--	.071	.445
4	01596000	MD	287	1924–1950	25	--	--	--	--	--	-.093	.528
5	01596500	MD	49.1	1949–2006	58	--	--	--	1	--	-.056	.537
6	01597000	MD	16.7	1949–1981	33	--	--	--	1	--	-.030	.816
7	01598000	MD	115	1925–1950	24	--	--	--	--	--	-.007	.980
8	01599000	MD	72.4	1931–2007	77	--	--	--	--	--	-.081	.301
9	01599500	WV	46.5	1948–1969	21	--	--	--	--	--	-.100	.546
10	01600000	MD	598	1936–1950	15	--	--	--	--	--	-.495	.012
11	01601500	MD	247	1930–2006	77	--	--	--	2	--	.107	.169
12	01603000	MD	877	1930–1981	52	--	--	--	1	--	-.088	.360
13	01604500	WV	221	1939–2007	69	--	--	--	--	--	-.231	.005
14	01605500	WV	179	1936–2007	61	130	--	--	--	--	.104	.237
15	01605700	WV	0.23	1965–1977	13	--	--	--	--	--	.462	.033
16	01606000	WV	310	1940–2007	50	130	--	--	1	--	.065	.509
17	01606500	WV	651	1924–2007	80	130	--	--	3	--	.075	.325
18	01606800	WV	1.56	1965–1977	13	--	--	--	--	--	.308	.161
19	01607500	WV	103	1944–2007	64	130	--	--	2	--	-.187	.030
20	01607510	WV	1.04	1999–2007	9	--	--	--	--	--	-.143	.711
21	01608000	WV	277	1924–2007	78	130	--	--	1	--	-.092	.235
22	01608100	WV	0.21	1965–1977	13	--	--	--	--	--	.513	.017
23	01608500	WV	1,461	1900–2007	84	130	--	--	3	--	.046	.536
24	01609000	MD	148	1928–2005	26	--	--	--	--	--	-.052	.724
25	01609500	MD	5.08	1948–1976	25	--	--	--	--	1	.033	.833
26	01609650	WV	28.9	1999–2007	9	--	--	--	--	--	.000	1.000
27	01609800	WV	108	1967–1977	11	--	--	--	--	--	.309	.213
28	01610000	WV	3,114	1939–2006	68	--	--	--	1	--	--	--
29	01610150	MD	10.4	1965–1983	18	--	--	--	--	--	.046	.820

Table 2. Flood-frequency statistics and drainage areas for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
30	01610155	MD	102	1968–2006	18	--	--	--	--	--	-.033	.880
31	01610500	WV	306	1936–1951	14	67	36,000	--	1	--	-.143	.511
32	01611500	WV	675	1923–2007	84	119	--	--	1	--	-.018	.808
33	01612500	MD	16.9	1948–1964	17	--	--	--	--	--	-.015	.967
34	01613000	MD	4,075	1929–2006	75	--	--	--	1	--	--	--
35	01613150	MD	4.80	1965–1986	22	--	--	--	--	--	-.013	.955
36	01613160	MD	1.20	1965–1976	12	--	--	--	1	--	.089	.788
37	01613900	VA	15.9	1961–2006	46	--	--	--	--	1	.048	.643
38	01614000	WV	235	1929–2007	51	--	--	--	--	1	.036	.715
39	01615000	VA	58.2	1944–2006	58	--	--	--	--	--	.194	.032
40	01616000	VA	17.0	1950–1994	27	--	--	--	--	--	.396	.004
41	01616500	WV	273	1948–2007	60	--	--	--	--	--	.170	.056
42	01617000	WV	11.3	1949–2007	26	--	--	--	--	1	--	--
43	01617800	MD	18.9	1964–2007	43	--	--	--	--	--	--	--
44	01618000	MD	5,950	1929–2004	69	--	--	--	--	1	--	--
45	01619475	MD	0.10	1966–1976	11	--	--	--	--	--	--	--
46	01619500	MD	281	1928–2007	80	--	--	--	--	1	--	--
47	01620500	VA	17.3	1947–2006	60	--	--	--	--	--	--	--
48	01621000	VA	73.0	1943–1986	31	55	--	--	1	--	-.077	.552
49	01621200	VA	9.73	1949–1976	28	--	--	--	--	--	.063	.661
50	01621400	VA	5.44	1949–1961	13	40	--	--	1	--	-.282	.200
51	01621450	VA	0.67	1966–1975	10	25	--	--	1	--	.156	.592
52	01622000	VA	375	1927–2006	77	146	--	--	5	--	-.080	.305
53	01622100	VA	1.56	1966–1975	10	--	--	--	--	--	.511	.049
54	01622300	VA	0.54	1967–1976	10	--	--	--	--	--	--	--
55	01622400	VA	0.46	1967–2000	32	--	--	--	--	--	--	--
56	01632000	VA	210	1926–2006	81	172	--	--	12	--	.085	.262
57	01632300	VA	7.94	1950–1977	25	--	--	--	1	--	.051	.747
58	01632900	VA	93.6	1961–2006	45	--	--	--	--	--	.043	.681

Table 2. Flood-frequency statistics and drainage areas for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
59	01632950	VA	0.34	1966–1975	10	--	--	--	--	--	.533	.039
60	01632970	VA	6.60	1972–2006	35	--	--	--	--	--	-.166	.173
61	01633000	VA	508	1944–2006	62	172	--	--	1	--	.124	.157
62	01633500	VA	77.5	1947–1976	30	69	--	--	--	--	.074	.586
63	01633650	VA	3.43	1971–2006	36	--	--	--	1	--	-.178	.130
64	01634000	VA	770	1926–2006	80	138	--	--	1	--	.053	.488
65	01634500	VA	102	1938–2006	69	--	--	--	--	1	.211	.010
66	01636500	WV	3,041	1896–2007	90	138	--	--	4	--	--	--
67	01637000	MD	8.83	1948–1976	29	--	--	--	--	--	--	--
68	01637500	MD	66.9	1948–2006	59	--	--	--	--	--	--	--
69	01638480	VA	89.6	1971–2006	36	--	--	--	--	--	--	--
70	01638500	MD	9,651	1895–2007	113	--	--	--	--	--	--	--
71	01643700	VA	122	1966–2006	34	--	--	--	--	--	-.016	.906
72	01644000	VA	332	1910–2006	79	119	--	--	2	--	.096	.213
73	01644100	VA	2.06	1966–1977	12	--	--	--	--	--	--	--
74	02009500	VA	0.68	1966–1975	10	--	--	--	--	1	--	--
75	02011400	VA	157	1972–2006	34	91	--	--	1	--	--	--
76	02011460	VA	60.9	1975–2006	32	91	--	--	1	--	--	--
77	02011480	VA	88.6	1974–1984	11	--	--	--	--	--	-.345	.161
78	02011500	VA	134	1951–1984	34	--	--	--	--	--	.105	.389
79	02012500	VA	410	1925–1979	55	75	--	--	--	1	.238	.010
80	02012950	VA	0.86	1966–1995	26	--	--	--	--	--	-.217	.259
81	02013000	VA	162	1929–2006	78	--	--	--	--	--	.104	.180
82	02014000	VA	153	1929–2006	68	--	--	--	--	1	.114	.172
83	03050000	WV	185	1916–2007	80	--	--	--	--	--	.166	.030
84	03050500	WV	271	1945–2004	60	120	--	--	1	--	.112	.209
85	03050650	WV	0.46	1964–2006	22	--	--	--	1	1	-.104	.516
86	03051000	WV	406	1908–2007	100	120	--	--	2	--	.044	.516
87	03051500	WV	122	1916–1942	27	120	--	--	--	--	.157	.260

Table 2. Flood-frequency statistics and drainage areas for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
88	03052000	WV	148	1943–2007	56	120	--	--	--	--	.153	.097
89	03052340	WV	2.33	1966–2007	19	--	--	--	--	--	-.135	.441
90	03052500	WV	14.3	1947–2007	61	--	--	--	--	--	.121	.169
91	03053500	WV	277	1908–2007	93	--	--	--	--	--	.000	.997
92	03054500	WV	914	1941–2007	67	120	60,000	--	1	--	.151	.072
93	03055020	WV	0.60	1966–1977	12	--	--	--	--	--	-.091	.730
94	03055040	WV	3.15	1964–1977	14	--	--	--	--	--	-.121	.584
95	03056250	WV	96.8	1985–2007	23	--	--	--	--	--	.032	.853
96	03056500	WV	1,304	1908–1938	31	--	--	--	--	--	-.026	.852
97	03056600	WV	2.33	1965–1977	13	--	--	--	--	--	.077	.760
98	03057300	WV	28.8	1985–1999	15	--	--	--	--	--	.143	.488
99	03057500	WV	25.7	1946–1985	40	--	--	--	--	--	-.072	.521
100	03058000	WV	101	1947–1989	43	102	--	--	1	--	-.128	.229
101	03058500	WV	181	1916–1989	74	--	--	--	--	--	-.123	.124
102	03059000	WV	384	1924–1983	60	102	--	--	--	--	-.016	.858
103	03059500	WV	84.6	1944–1970	27	--	--	--	--	--	-.077	.588
104	03060500	WV	8.32	1952–1969	18	--	--	--	--	--	.013	.970
105	03061000	WV	759	1908–1989	65	--	--	--	--	--	-.002	.986
106	03061500	WV	116	1916–2007	83	--	--	--	--	--	-.013	.863
107	03062400	WV	11.0	1966–2002	37	42	--	--	1	--	-.188	.105
108	03062500	WV	63.2	1947–2007	36	--	--	--	--	--	-.159	.178
109	03063950	WV	1.08	1965–1977	12	--	--	--	1	--	.030	.945
110	03065000	WV	349	1941–2007	67	120	--	--	1	--	.132	.117
111	03065400	WV	54.7	1992–2007	12	--	--	--	--	--	-.121	.631
112	03066000	WV	85.9	1922–2007	86	--	--	--	1	--	.111	.133
113	03067100	WV	0.15	1952–2006	55	--	--	--	--	--	-.070	.455
114	03067500	WV	57.6	1922–2007	21	--	--	--	--	1	.329	.040
115	03068610	WV	5.06	1974–1998	16	--	--	--	--	--	.117	.558
116	03068800	WV	151	1974–2007	18	--	--	--	--	--	.137	.449

Table 2. Flood-frequency statistics and drainage areas for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
117	03069000	WV	213	1911–2001	74	--	--	--	1	--	.052	.513
118	03069500	WV	722	1914–2007	94	164	--	--	4	--	.160	.023
119	03069850	WV	0.95	1966–1977	12	--	--	--	1	--	-.030	.945
120	03069880	WV	12.2	1968–2007	24	--	--	--	--	--	-.355	.016
121	03070000	WV	939	1921–1996	74	164	--	--	2	--	.180	.024
122	03070500	WV	200	1910–2007	93	--	--	--	1	--	-.041	.564
123	03071000	WV	1,354	1903–1958	47	142	--	--	--	--	-.004	.978
124	03071500	WV	1,380	1903–1926	16	142	--	--	--	--	--	--
125	03072000	PA	229	1941–2006	66	--	--	--	--	--	.007	.943
126	03072590	PA	16.3	1964–1978	15	--	--	--	--	--	.067	.767
127	03075450	MD	0.57	1965–1976	12	--	--	--	--	--	--	--
128	03075500	MD	134	1936–2006	65	--	--	--	--	--	--	--
129	03075600	MD	0.53	1965–1986	22	--	--	--	1	--	--	--
130	03076505	MD	0.22	1965–1976	12	--	--	--	--	--	--	--
131	03076600	MD	48.9	1965–2007	43	--	--	--	--	--	--	--
132	03085500	PA	257	1916–2006	84	--	--	--	1	--	.078	.295
133	03108000	PA	178	1916–2006	80	--	--	--	1	--	-.155	.042
134	03109000	OH	6.19	1947–1981	35	--	--	--	--	--	-.032	.798
135	03109500	OH	496	1916–2006	91	--	--	--	--	--	-.141	.049
136	03110000	OH	147	1941–2006	66	--	--	--	--	--	-.189	.025
137	03110980	OH	0.04	1978–1987	10	--	--	--	--	--	--	--
138	03111150	PA	10.3	1961–1985	21	--	--	--	--	--	--	--
139	03111450	OH	1.31	1978–1990	11	--	--	--	--	--	-.200	.474
140	03111455	OH	10.9	1978–1990	11	--	--	--	--	--	--	--
141	03111470	OH	1.57	1978–1987	10	--	--	--	--	--	--	--
142	03111500	OH	123	1942–2006	65	--	--	--	--	1	--	--
143	03111540	OH	0.34	1978–1987	10	--	--	--	--	--	--	--
144	03111548	OH	97.7	1983–2006	23	--	--	--	--	--	.146	.342
145	03112000	WV	281	1941–1974	34	--	--	--	--	--	-.037	.767

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Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
146	03113700	WV	4.95	1970–1996	12	--	--	--	--	--	-.182	.451
147	03114000	OH	134	1927–2002	53	--	--	--	--	--	.009	.933
148	03114240	OH	0.53	1978–1987	10	--	--	--	--	--	-.333	.210
149	03114500	WV	458	1916–1997	78	--	--	--	--	--	.095	.219
150	03114550	WV	0.88	1966–1977	12	--	--	--	--	--	.212	.373
151	03114600	WV	1.22	1967–1977	11	--	--	--	--	--	-.018	1.000
152	03114650	WV	4.19	1969–2007	23	--	--	--	--	1	.079	.616
153	03115280	OH	5.45	1978–1987	10	--	--	--	1	--	-.022	1.000
154	03115400	OH	210	1959–2006	34	95	--	--	1	--	.066	.594
155	03115410	OH	0.13	1978–1987	10	--	--	--	--	--	-.071	.902
156	03115500	OH	258	1916–1935	20	--	--	--	--	--	.026	.897
157	03115510	OH	1.52	1978–1987	10	--	--	--	1	--	.444	.118
158	03115600	OH	3.46	1947–1979	33	--	--	--	--	--	--	--
159	03115710	OH	0.19	1978–1987	10	--	--	--	1	--	--	--
160	03150600	OH	0.99	1966–1980	15	--	--	--	--	--	-.238	.235
161	03151400	WV	112	1975–2007	31	--	--	--	--	--	.024	.865
162	03151500	WV	155	1939–1973	35	--	--	--	--	--	.045	.712
163	03152000	WV	387	1929–1979	51	--	--	--	--	--	-.045	.649
164	03152200	WV	2.91	1970–2006	21	--	--	--	--	--	.124	.450
165	03152500	WV	144	1938–1951	14	--	--	--	--	--	.462	.025
166	03153000	WV	166	1939–1975	37	--	--	--	--	1	.087	.456
167	03153500	WV	913	1929–1979	51	--	--	--	--	--	.067	.490
168	03154000	WV	205	1929–2000	66	--	--	--	--	--	-.129	.127
169	03154250	WV	2.82	1970–1998	13	--	--	--	--	--	.179	.428
170	03154500	WV	79.4	1952–1978	27	51	--	--	4	--	.217	.118
171	03155000	WV	1,516	1939–1979	41	--	--	--	--	1	.057	.605
172	03155200	WV	210	1938–1951	14	--	--	--	--	--	.330	.112
173	03155450	WV	3.52	1965–1998	17	--	--	--	--	--	.206	.266
174	03155500	WV	453	1930–1997	59	--	--	--	--	--	-.049	.592

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Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
175	03155525	WV	25.3	1998–2007	10	--	--	--	--	--	-.289	.283
176	03159540	OH	156	1966–2006	41	--	--	--	1	1	-.029	.796
177	03159700	WV	0.70	1965–1977	13	--	--	--	1	--	-.141	.541
178	03171500	VA	2,961	1915–1939	25	--	--	--	1	--	--	--
179	03173000	VA	299	1938–2006	69	--	--	--	--	--	-.044	.594
180	03175500	VA	223	1909–2006	77	--	--	--	--	--	-.027	.735
181	03176400	WV	50.6	1942–1951	10	--	--	--	--	--	.156	.589
182	03176500	VA	3,783	1915–1938	24	--	--	--	1	--	--	--
183	03177500	WV	189	1942–1951	10	--	--	--	--	1	.178	.530
184	03177700	VA	39.7	1966–1980	15	--	--	--	--	1	.333	.092
185	03178500	WV	32.0	1947–1998	29	56	5,000	--	1	--	.005	.985
186	03179000	WV	395	1951–2007	57	--	--	--	--	1	.070	.445
187	03179500	WV	438	1909–1948	27	--	--	--	--	--	.217	.118
188	03180000	WV	4,602	1924–1948	25	--	--	--	1	--	--	--
189	03180350	WV	1.13	1966–1977	12	--	--	--	--	--	.167	.492
190	03180500	WV	133	1944–2007	64	112	--	--	2	--	.118	.171
191	03180530	WV	1.28	1966–1977	11	--	--	--	--	--	.236	.350
192	03180680	WV	1.52	1965–1977	13	--	--	--	--	--	.205	.360
193	03181900	WV	0.10	1965–1977	13	--	--	--	--	1	-.167	.459
194	03182000	WV	108	1946–1998	19	90	21,000	--	1	--	.135	.441
195	03182500	WV	540	1930–2007	78	112	--	--	1	--	.138	.075
196	03182700	WV	144	1972–1982	11	90	--	--	--	--	-.309	.213
197	03183000	WV	80.8	1946–1998	30	--	--	--	--	--	.152	.246
198	03183500	WV	1,364	1896–2007	112	--	--	--	--	--	-.031	.635
199	03183550	WV	3.84	1966–1977	12	--	--	--	--	1	.136	.582
200	03183570	WV	2.31	1966–1977	12	--	--	--	--	--	.076	.783
201	03184000	WV	1,619	1936–2007	72	--	--	--	--	--	.047	.563
202	03184200	WV	8.27	1970–2007	17	--	--	--	--	1	-.191	.303
203	03184500	WV	6,256	1937–1948	12	--	--	--	1	--	--	--

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Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
204	03185000	WV	52.7	1952–2007	36	--	--	--	--	--	.021	.870
205	03185020	WV	0.62	1966–1977	12	--	--	--	--	--	.167	.492
206	03185500	WV	6,826	1929–1948	20	--	--	--	--	--	--	--
207	03186000	WV	6,850	1896–1948	35	63	--	--	--	--	--	--
208	03186500	WV	128	1930–2007	78	--	--	--	--	--	.121	.117
209	03187000	WV	236	1909–2000	77	106	42,000	--	1	--	.056	.473
210	03187300	WV	9.78	1969–1998	19	--	--	--	--	--	.275	.108
211	03187500	WV	80.4	1945–2007	49	--	--	--	--	--	.158	.111
212	03189000	WV	150	1930–1982	43	69	--	--	1	--	.171	.109
213	03189100	WV	529	1965–2007	41	76	--	--	2	--	.039	.728
214	03189500	WV	680	1909–1965	45	--	--	--	1	--	.100	.338
215	03189650	WV	2.78	1966–1977	12	--	--	--	--	--	.000	1.000
216	03190000	WV	287	1909–1971	51	--	--	--	--	--	.073	.455
217	03190100	WV	23.5	1999–2007	9	--	--	--	--	--	-.333	.251
218	03190400	WV	365	1967–2007	39	--	--	--	--	--	-.101	.371
219	03190500	WV	4.22	1966–1976	11	--	--	--	--	--	.291	.241
220	03191400	WV	3.88	1966–1998	17	33	1,800	--	1	--	.279	.127
221	03191500	WV	40.2	1946–2007	37	--	--	--	--	--	-.009	.948
222	03192000	WV	1,317	1929–1964	36	--	--	--	--	--	-.081	.496
223	03192500	WV	1,402	1909–1930	14	--	--	--	1	--	.341	.098
224	03193000	WV	8,371	1878–1948	71	--	--	--	--	--	--	--
225	03193725	WV	0.33	1966–1977	12	--	--	--	--	1	.242	.301
226	03193830	WV	1.80	1969–2007	18	--	--	--	1	--	.490	.005
227	03194700	WV	266	1930–2007	76	--	--	--	--	--	.173	.027
228	03195000	WV	281	1935–1963	29	--	--	--	--	--	--	--
229	03195100	WV	51.9	1975–1987	10	--	--	--	1	--	.022	1.000
230	03195250	WV	46.5	1975–2007	30	--	--	--	--	--	.149	.254
231	03195500	WV	542	1939–1960	22	29	--	--	--	--	.056	.735
232	03195600	WV	6.39	1966–2004	23	--	--	--	--	1	.146	.342

Table 2. Flood-frequency statistics and drainage areas for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; - -, no value; shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
233	03197000	WV	1,145	1929–1960	32	--	--	--	1	--	-.181	.149
234	03197150	WV	2.01	1966–2006	20	--	--	--	--	1	.179	.284
235	03197900	WV	0.49	1964–1975	12	--	--	--	--	--	.030	.945
236	03198350	WV	62.8	1997–2007	10	--	--	--	--	--	.067	.858
237	03198450	WV	7.75	1965–1998	18	--	--	--	--	--	.176	.325
238	03198500	WV	391	1909–2007	85	--	--	--	--	--	.019	.796
239	03198780	WV	1.97	1966–1977	12	--	--	--	--	--	-.152	.537
240	03198800	WV	1.28	1963–1977	14	--	--	--	--	--	-.022	.956
241	03199000	WV	269	1931–1984	54	--	--	--	--	--	-.020	.835
242	03199300	WV	12.2	1979–2006	14	--	--	--	--	--	-.209	.324
243	03199400	WV	318	1975–1984	10	--	--	--	--	--	.067	.858
244	03200500	WV	862	1909–2007	52	--	--	--	--	--	-.085	.377
245	03200600	WV	0.87	1966–1977	12	--	--	--	--	1	.258	.271
246	03201000	WV	238	1909–1999	54	--	--	--	--	--	-.029	.760
247	03201405	WV	26.8	1999–2007	9	--	--	--	--	--	-.111	.754
248	03201410	WV	8.47	1992–2007	16	--	--	--	--	1	-.167	.392
249	03201420	WV	2.05	1965–1977	13	--	--	--	--	1	-.346	.112
250	03201440	WV	1.04	1965–1977	13	--	--	--	--	--	-.026	.951
251	03201480	WV	0.70	1965–1977	13	--	--	--	--	--	-.436	.044
252	03202000	OH	585	1916–2006	83	--	--	--	--	--	--	--
253	03202245	WV	4.85	1978–2007	12	31	--	--	1	--	-.389	.175
254	03202400	WV	306	1969–2007	39	--	--	--	--	--	-.069	.545
255	03202480	WV	7.34	1970–2007	22	--	--	--	--	--	-.143	.367
256	03202750	WV	126	1975–2007	33	--	--	--	--	1	-.061	.631
257	03203000	WV	758	1929–1979	51	--	--	--	--	--	.064	.516
258	03203600	WV	833	1961–1979	19	--	--	--	--	--	.094	.600
259	03204000	WV	1,224	1916–1979	58	--	--	--	--	--	.065	.477
260	03204500	WV	256	1938–1980	43	--	--	--	--	--	.078	.470
261	03205995	OH	0.73	1978–2006	15	--	--	--	--	--	.114	.586

Table 2. Flood-frequency statistics and drainage areas for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; - -, no value; shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Drainage area, in square miles	Water years bounding systematic peaks	Number of years of record		Override of outlier thresholds		Number of peaks		Trend analysis	
					Systematic	Historic	High threshold discharge, in cubic feet per second	Low threshold discharge, in cubic feet per second	High outlier	Low outlier	Kendall's tau	Significance level
262	03206450	WV	4.02	1999–2007	9	--	--	--	--	--	-.179	.618
263	03206600	WV	38.5	1965–2007	43	--	--	--	--	--	.066	.537
264	03206800	WV	139	1962–1971	10	59	--	--	1	--	-.156	.592
265	03207000	WV	291	1916–1966	31	59	--	--	--	--	--	--
266	03207020	WV	300	1916–1971	36	59	--	--	--	--	-.108	.361
267	03207400	VA	20.0	1951–1977	27	--	--	--	--	1	-.128	.359
268	03207500	VA	239	1942–1995	43	--	--	--	--	--	-.142	.184
269	03207800	VA	297	1968–2006	39	--	--	--	--	--	-.100	.377
270	03207962	KY	0.82	1975–1984	9	--	--	--	--	--	.139	.675
271	03208000	KY	392	1938–1968	31	--	--	--	--	--	.062	.634
272	03208500	VA	286	1927–2006	80	--	--	--	--	--	-.051	.504
273	03208950	VA	66.5	1964–2006	42	--	--	--	1	--	-.026	.820
274	03209000	VA	221	1927–1965	39	--	--	--	--	--	-.165	.143
275	03209575	KY	3.17	1976–1986	11	--	--	--	1	--	-.236	.350
276	03210000	KY	56.3	1938–2006	66	--	--	--	--	--	-.079	.352
277	03211500	KY	206	1938–1949	12	--	--	--	--	1	-.030	.945
278	03212000	KY	103	1950–1981	32	--	--	--	--	--	-.137	.277
279	03212750	WV	174	1986–2007	22	--	--	--	--	--	.095	.554
280	03212980	WV	209	1986–2007	22	--	--	--	--	1	.212	.176
281	03213000	WV	504	1931–1986	56	--	--	--	--	--	.062	.506
282	03213500	WV	31.0	1947–2007	46	--	--	--	--	--	.133	.195
283	03213700	WV	936	1968–2007	40	--	--	--	--	1	-.033	.771
284	03214000	WV	1,188	1935–1985	51	--	--	--	--	--	--	--
285	03214500	WV	1,280	1916–2007	81	--	--	--	--	--	-.071	.350
286	03214900	WV	1,507	1977–1995	12	--	--	--	--	--	-.182	.451
287	03215500	KY	217	1916–1981	49	--	--	--	--	--	-.168	.089
288	03216500	KY	400	1937–1967	30	--	--	--	--	1	-.053	.695
289	03216540	KY	12.2	1973–1991	19	--	--	--	--	1	.175	.310
290	03216563	KY	0.94	1976–1987	12	--	--	--	--	1	.045	.891

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
1	01595000	MD	East	Q_s	1,700	2,600	3,280	5,390	7,130	9,760	12,100	14,700	17,700	22,300
				Q_r	993	1,620	2,120	3,840	5,390	7,780	9,820	12,100	14,600	18,200
				Q_w	1,640	2,530	3,170	5,080	6,590	8,890	10,900	13,200	15,800	19,800
2	01595300	WV	East	Q_s	818	1,050	1,240	1,870	2,430	3,350	4,220	5,280	6,550	8,670
				Q_r	638	1,030	1,360	2,440	3,420	4,920	6,200	7,610	9,150	11,400
				Q_w	799	1,050	1,250	1,990	2,750	4,080	5,290	6,650	8,180	10,500
3	01595500	MD	East	Q_s	4,440	6,160	7,580	12,400	16,800	24,100	31,200	39,900	50,600	68,600
				Q_r	2,490	4,100	5,410	9,850	13,900	20,200	25,600	31,600	38,200	48,200
				Q_w	4,280	6,010	7,390	11,900	15,900	22,500	28,400	35,200	43,200	55,800
4	01596000	MD	East	Q_s	4,050	6,270	8,020	13,600	18,500	26,100	33,100	41,200	50,700	65,800
				Q_r	3,040	5,020	6,620	12,100	17,000	24,800	31,500	38,900	47,100	59,500
				Q_w	3,900	6,100	7,790	13,100	17,800	25,300	32,000	39,500	48,000	60,900
5	01596500	MD	East	Q_s	847	1,200	1,480	2,350	3,100	4,260	5,300	6,530	7,960	10,200
				Q_r	717	1,160	1,520	2,750	3,850	5,550	7,000	8,590	10,300	12,900
				Q_w	839	1,200	1,480	2,410	3,270	4,710	6,010	7,500	9,160	11,700
6	01597000	MD	East	Q_s	250	376	481	840	1,180	1,740	2,290	2,970	3,810	5,230
				Q_r	297	477	622	1,110	1,550	2,230	2,790	3,420	4,090	5,090
				Q_w	254	384	494	898	1,300	1,970	2,570	3,240	3,990	5,140
7	01598000	MD	East	Q_s	1,790	2,690	3,420	5,860	8,050	11,600	15,000	19,000	23,900	32,000
				Q_r	1,440	2,350	3,090	5,610	7,890	11,400	14,400	17,800	21,500	27,000
				Q_w	1,740	2,640	3,370	5,780	7,970	11,500	14,600	18,100	22,100	28,100
8	01599000	MD	East	Q_s	1,010	1,490	1,860	3,000	3,960	5,440	6,750	8,270	10,000	12,700
				Q_r	985	1,600	2,110	3,810	5,340	7,720	9,740	12,000	14,400	18,100
				Q_w	1,010	1,490	1,870	3,090	4,220	6,080	7,790	9,730	11,900	15,200
9	01599500	WV	East	Q_s	425	760	1,020	1,850	2,520	3,530	4,400	5,360	6,430	8,020
				Q_r	686	1,110	1,460	2,630	3,680	5,300	6,680	8,200	9,870	12,300
				Q_w	455	801	1,080	2,080	3,030	4,560	5,880	7,340	8,920	11,200
10	01600000	MD	East	Q_s	7,960	12,200	15,600	26,600	36,100	51,200	65,000	81,300	100,000	131,000
				Q_r	5,620	9,330	12,300	22,600	32,000	46,800	59,600	73,800	89,700	114,000
				Q_w	7,410	11,600	14,800	24,700	33,600	48,000	60,700	75,200	91,400	116,000

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
11	01601500	MD	East	Q_s	3,310	4,820	6,070	10,400	14,400	21,100	27,600	35,600	45,600	62,400
				Q_r	2,690	4,430	5,840	10,600	15,000	21,800	27,700	34,200	41,400	52,300
				Q_w	3,280	4,800	6,060	10,400	14,500	21,300	27,600	35,000	43,500	57,000
12	01603000	MD	East	Q_s	10,500	14,500	17,600	27,300	35,500	48,200	59,700	73,100	88,600	113,000
				Q_r	7,590	12,600	16,800	30,800	43,700	63,900	81,500	101,000	123,000	156,000
				Q_w	10,300	14,400	17,500	27,900	37,700	54,400	69,800	87,400	107,000	138,000
13	01604500	WV	East	Q_s	1,520	2,730	3,670	6,560	8,910	12,300	15,300	18,400	22,000	27,100
				Q_r	2,460	4,040	5,330	9,700	13,700	19,900	25,200	31,100	37,600	47,500
				Q_w	1,560	2,780	3,750	6,940	9,840	14,600	18,900	23,700	28,900	36,600
14	01605500	WV	East	Q_s	1,840	3,270	4,520	9,070	13,500	21,200	28,800	38,400	50,300	70,600
				Q_r	2,070	3,390	4,470	8,130	11,500	16,600	21,100	26,000	31,400	39,600
				Q_w	1,850	3,280	4,520	8,920	13,000	19,300	25,000	31,500	39,000	50,900
15	01605700	WV	East	Q_s	11.2	16	19.8	31.9	42.3	58.7	73.6	91.1	112	145
				Q_r	8.9	13.7	17.6	30.7	42.1	58.9	72.7	87.5	103	125
				Q_w	10.8	15.6	19.4	31.5	42.2	58.8	73	88.5	105	130
16	01606000	WV	East	Q_s	4,500	6,430	8,050	13,700	18,900	27,900	36,700	47,700	61,500	84,900
				Q_r	3,240	5,350	7,060	12,900	18,200	26,500	33,600	41,500	50,300	63,600
				Q_w	4,420	6,370	7,980	13,500	18,700	27,400	35,300	44,500	55,200	72,200
17	01606500	WV	East	Q_s	6,660	10,200	13,100	23,200	32,900	49,300	65,300	85,300	110,000	153,000
				Q_r	5,950	9,880	13,100	24,000	34,000	49,600	63,200	78,400	95,200	121,000
				Q_w	6,630	10,200	13,100	23,300	33,100	49,400	64,500	82,200	103,000	136,000
18	01606800	WV	East	Q_s	14.7	27.1	38.7	84.2	133	223	319	446	613	915
				Q_r	42.6	67	86.6	153	211	298	371	450	534	656
				Q_w	17.8	31.7	45.7	107	170	271	356	449	550	701
19	01607500	WV	East	Q_s	1,510	2,440	3,280	6,550	10,000	16,500	23,500	32,800	45,200	68,200
				Q_r	1,310	2,150	2,820	5,120	7,190	10,400	13,200	16,200	19,500	24,500
				Q_w	1,500	2,430	3,250	6,340	9,320	14,200	18,600	23,800	30,000	40,400
20	01607510	WV	East	Q_s	[a]13.8	22.9	30.6	57.5	82.7	125	166	216	278	381
				Q_r	30.6	47.9	61.8	109	150	212	263	318	377	462
				Q_w	16.6	27	36.9	77.9	119	184	239	296	359	449

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
21	01608000	WV	East	Q_s	2,710	4,440	5,940	11,300	16,600	25,800	34,900	46,500	61,200	86,500
				Q_r	2,950	4,870	6,430	11,700	16,500	24,100	30,500	37,700	45,700	57,700
				Q_w	2,720	4,460	5,970	11,400	16,600	25,200	33,100	42,400	53,200	70,500
22	01608100	WV	East	Q_s	30.8	40.3	46.3	61.3	71.3	83.9	93.4	103	113	126
				Q_r	8.3	12.7	16.3	28.5	39	54.5	67.3	80.9	95.4	116
				Q_w	25.1	34	38.4	46.9	53.2	64.3	74.8	86.7	99.7	118
23	01608500	WV	East	Q_s	10,700	17,200	22,700	41,700	59,700	90,400	120,000	157,000	203,000	280,000
				Q_r	11,500	19,300	25,600	47,200	67,100	98,500	126,000	156,000	191,000	243,000
				Q_w	10,700	17,300	22,800	42,300	61,100	92,800	122,000	157,000	197,000	262,000
24	01609000	MD	East	Q_s	1,860	3,000	3,850	6,360	8,340	11,200	13,600	16,200	19,100	23,400
				Q_r	1,770	2,900	3,820	6,930	9,760	14,100	17,900	22,100	26,700	33,600
				Q_w	1,850	2,990	3,850	6,530	8,940	12,900	16,300	20,200	24,400	30,700
25	01609500	MD	East	Q_s	163	223	267	398	502	658	792	943	1,110	1,370
				Q_r	112	178	231	411	570	811	1,010	1,230	1,470	1,820
				Q_w	156	218	262	401	529	737	922	1,130	1,350	1,680
26	01609650	WV	East	Q_s	[a]381	[a]741	1,050	2,150	3,180	4,880	6,470	8,390	10,700	14,400
				Q_r	465	750	981	1,760	2,470	3,540	4,460	5,460	6,560	8,180
				Q_w	402	744	1,030	1,930	2,670	3,790	4,730	5,790	6,950	8,710
27	01609800	WV	East	Q_s	2,070	3,080	3,810	5,980	7,680	10,200	12,300	14,600	17,200	21,000
				Q_r	1,370	2,230	2,940	5,320	7,480	10,800	13,700	16,900	20,300	25,600
				Q_w	1,870	2,850	3,540	5,640	7,550	10,700	13,400	16,500	19,900	25,000
28	01610000	WV	East	Q_s	23,700	34,000	41,700	64,600	83,100	111,000	134,000	161,000	191,000	237,000
29	01610150	MD	East	Q_s	167	284	375	666	911	1,290	1,620	1,990	2,420	3,070
				Q_r	201	322	419	749	1,040	1,490	1,870	2,280	2,730	3,380
				Q_w	172	289	383	694	974	1,410	1,790	2,200	2,650	3,310
30	01610155	MD	East	Q_s	1,410	2,620	3,620	7,010	10,000	14,800	19,200	24,300	30,200	39,500
				Q_r	1,300	2,130	2,800	5,080	7,130	10,300	13,000	16,100	19,400	24,300
				Q_w	1,390	2,530	3,440	6,190	8,370	11,600	14,400	17,600	21,200	26,700

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
31	01610500	WV	East	Q_s	2,600	5,190	7,420	15,100	22,000	33,100	43,100	54,900	68,600	90,000
				Q_r	3,210	5,290	6,980	12,700	18,000	26,200	33,200	41,100	49,800	62,900
				Q_w	2,720	5,210	7,310	14,000	19,500	27,900	35,100	43,300	52,400	66,400
32	01611500	WV	East	Q_s	5,110	9,490	13,000	24,100	33,400	47,300	59,300	72,700	87,600	110,000
				Q_r	6,120	10,200	13,500	24,700	35,000	51,200	65,200	80,800	98,200	125,000
				Q_w	5,150	9,520	13,000	24,200	33,700	48,500	61,500	76,000	92,300	117,000
33	01612500	MD	East	Q_s	245	403	524	901	1,210	1,680	2,080	2,540	3,060	3,840
				Q_r	300	481	628	1,130	1,570	2,250	2,820	3,450	4,140	5,150
				Q_w	253	414	542	979	1,390	2,040	2,600	3,210	3,880	4,860
34	01613000	MD	East	Q_s	28,400	42,300	53,100	86,800	115,000	159,000	199,000	244,000	297,000	379,000
35	01613150	MD	East	Q_s	126	190	237	377	489	653	793	949	1,120	1,380
				Q_r	107	170	221	392	544	773	966	1,180	1,400	1,730
				Q_w	124	188	235	381	512	720	901	1,100	1,320	1,630
36	01613160	MD	East	Q_s	[a]68.4	89.9	105	148	180	226	263	304	349	414
				Q_r	34.4	53.9	69.6	123	169	239	297	359	426	523
				Q_w	60.2	82	96.1	137	174	235	288	346	409	500
37	01613900	VA	East	Q_s	298	604	856	1,660	2,320	3,310	4,130	5,040	6,040	7,480
				Q_r	285	458	597	1,070	1,490	2,130	2,680	3,270	3,920	4,880
				Q_w	297	593	832	1,530	2,050	2,750	3,340	3,990	4,710	5,790
38	01614000	WV	East	Q_s	2,820	4,400	5,590	9,250	12,200	16,700	20,600	25,000	29,900	37,400
				Q_r	2,580	4,250	5,610	10,200	14,400	20,900	26,600	32,800	39,700	50,100
				Q_w	2,800	4,390	5,590	9,420	12,800	18,400	23,400	29,000	35,300	44,700
39	01615000	VA	East	Q_s	973	1,780	2,420	4,480	6,220	8,860	11,200	13,800	16,700	21,100
				Q_r	824	1,340	1,760	3,170	4,450	6,410	8,090	9,930	12,000	15,000
				Q_w	964	1,750	2,370	4,240	5,710	7,830	9,640	11,700	13,900	17,400
40	01616000	VA	East	Q_s	237	411	544	935	1,240	1,680	2,040	2,420	2,840	3,440
				Q_r	301	484	631	1,130	1,580	2,260	2,840	3,470	4,160	5,170
				Q_w	243	418	554	985	1,370	1,980	2,500	3,080	3,710	4,610

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
41	01616500	WV	East	Q_s	1,870	3,320	4,480	8,230	11,400	16,300	20,700	25,700	31,300	40,000
				Q_r	2,920	4,810	6,350	11,600	16,300	23,800	30,200	37,300	45,100	57,000
				Q_w	1,920	3,390	4,590	8,700	12,500	18,900	24,600	31,100	38,300	49,000
42	01617000	WV	East	Q_s	83.3	131	167	278	368	504	621	754	903	1,130
43	01617800	MD	East	Q_s	37.9	73.3	103	198	280	406	516	641	781	994
44	01618000	MD	East	Q_s	36,200	53,900	66,900	105,000	135,000	180,000	217,000	258,000	304,000	373,000
45	01619475	MD	East	Q_s	8.2	15.1	21.3	44.3	67.2	108	148	199	263	373
46	01619500	MD	East	Q_s	1,220	2,000	2,600	4,510	6,110	8,570	10,700	13,200	16,100	20,500
47	01620500	VA	East	Q_s	257	499	727	1,640	2,630	4,500	6,490	9,140	12,600	19,000
48	01621000	VA	East	Q_s	1,220	1,770	2,250	3,980	5,680	8,680	11,700	15,600	20,600	29,300
				Q_r	992	1,620	2,120	3,830	5,380	7,770	9,810	12,100	14,500	18,200
				Q_w	1,190	1,750	2,230	3,940	5,560	8,180	10,500	13,200	16,200	20,900
49	01621200	VA	East	Q_s	266	422	547	956	1,320	1,900	2,430	3,060	3,800	5,000
				Q_r	191	305	397	708	986	1,410	1,760	2,150	2,570	3,190
				Q_w	257	409	526	884	1,180	1,620	2,000	2,430	2,920	3,650
50	01621400	VA	East	Q_s	293	396	471	691	866	1,120	1,340	1,590	1,860	2,280
				Q_r	118	188	245	435	604	860	1,080	1,310	1,560	1,930
				Q_w	246	345	407	569	706	932	1,130	1,360	1,610	1,990
51	01621450	VA	East	Q_s	22.2	32.6	41.1	69.8	96	139	181	231	293	396
				Q_r	21.3	33.3	42.9	75.3	104	146	181	218	258	316
				Q_w	22	32.7	41.5	72.1	100	144	181	221	265	329
52	01622000	VA	East	Q_s	3,250	5,190	6,810	12,400	17,700	26,600	35,200	45,800	58,800	80,800
				Q_r	3,790	6,270	8,290	15,100	21,400	31,200	39,600	49,000	59,400	75,200
				Q_w	3,270	5,230	6,880	12,700	18,400	28,000	36,800	47,200	59,100	77,900
53	01622100	VA	East	Q_s	26.9	44.6	58.5	102	138	194	243	298	362	459
				Q_r	42.6	67	86.6	153	211	298	371	450	534	656
				Q_w	29.8	48.6	64.6	123	178	265	338	416	500	620
54	01622300	VA	East	Q_s	33.7	45.2	53.0	73.8	88.8	109	125	143	161	187
55	01622400	VA	East	Q_s	a27.8	42.8	54.7	93.3	127	181	231	289	358	469

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
56	01632000	VA	East	Q_s	3,420	6,060	8,090	14,300	19,200	26,400	32,400	39,000	46,200	56,700
				Q_r	2,360	3,870	5,110	9,300	13,100	19,000	24,100	29,800	36,000	45,400
				Q_w	3,370	5,950	7,910	13,600	17,800	23,900	29,000	34,800	41,200	51,000
57	01632300	VA	East	Q_s	43.3	87.4	129	294	470	796	1,140	1,580	2,160	3,180
				Q_r	161	258	335	598	831	1,180	1,480	1,810	2,160	2,680
				Q_w	50.2	98.2	146	359	594	992	1,340	1,730	2,160	2,810
58	01632900	VA	East	Q_s	707	1,470	2,130	4,380	6,380	9,530	12,300	15,600	19,200	24,900
				Q_r	1,220	1,980	2,610	4,720	6,630	9,590	12,100	14,900	18,000	22,600
				Q_w	736	1,500	2,170	4,450	6,460	9,560	12,200	15,200	18,500	23,400
59	01632950	VA	East	Q_s	13	18.8	22.8	33.7	41.6	52.4	61	70	79.6	93.1
				Q_r	12.2	19	24.4	42.6	58.5	82	101	122	144	176
				Q_w	12.8	18.8	23.2	37.2	50.4	71.4	89.1	108	128	156
60	01632970	VA	East	Q_s	92.6	179	255	527	786	1,220	1,640	2,140	2,750	3,760
				Q_r	139	221	288	512	712	1,010	1,270	1,550	1,850	2,290
				Q_w	95.7	182	258	524	761	1,120	1,430	1,770	2,150	2,730
61	01633000	VA	East	Q_s	4,620	8,120	10,800	19,100	25,800	35,600	43,900	53,000	63,000	77,700
				Q_r	4,850	8,050	10,600	19,500	27,600	40,200	51,200	63,400	77,000	97,500
				Q_w	4,630	8,120	10,800	19,200	26,200	37,200	46,900	57,800	69,900	87,900
62	01633500	VA	East	Q_s	[a]934	1,560	2,050	3,650	5,030	7,190	9,120	11,400	14,000	18,000
				Q_r	1,040	1,700	2,230	4,030	5,660	8,170	10,300	12,700	15,300	19,200
				Q_w	943	1,570	2,070	3,740	5,250	7,670	9,810	12,200	14,800	18,800
63	01633650	VA	East	Q_s	39.1	77.3	111	233	350	547	736	966	1,240	1,700
				Q_r	81.2	129	167	296	410	582	726	882	1,050	1,300
				Q_w	41.3	80.2	115	245	367	562	731	917	1,120	1,440
64	01634000	VA	East	Q_s	4,910	8,420	11,400	21,500	30,900	46,600	61,500	79,600	102,000	138,000
				Q_r	6,820	11,400	15,000	27,600	39,100	57,200	72,900	90,400	110,000	140,000
				Q_w	4,980	8,530	11,600	22,200	32,500	49,800	65,800	84,300	105,000	139,000
65	01634500	VA	East	Q_s	1,250	2,340	3,250	6,400	9,250	13,900	18,100	23,200	29,100	38,600
				Q_r	1,300	2,130	2,800	5,080	7,130	10,300	13,000	16,100	19,400	24,300
				Q_w	1,250	2,330	3,220	6,190	8,720	12,500	15,800	19,500	23,700	30,200

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

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					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
66	01636500	WV	East	Q_s	14,000	24,500	32,800	59,200	81,400	115,000	145,000	178,000	216,000	274,000
67	01637000	MD	East	Q_s	184	375	553	1,260	1,990	3,320	4,690	6,450	8,710	12,700
68	01637500	MD	East	Q_s	1,020	1,830	2,480	4,580	6,370	9,130	11,600	14,300	17,500	22,300
69	01638480	VA	East	Q_s	1,300	2,690	3,870	7,780	11,100	16,300	20,800	25,800	31,400	39,800
70	01638500	MD	East	Q_s	54,000	81,800	102,000	161,000	207,000	272,000	327,000	387,000	453,000	549,000
71	01643700	VA	East	Q_s	1,340	2,710	3,890	8,030	11,800	18,000	23,600	30,300	38,100	50,500
				Q_r	1,510	2,470	3,250	5,900	8,290	12,000	15,200	18,700	22,600	28,400
				Q_w	1,360	2,690	3,810	7,430	10,300	14,600	18,200	22,200	26,800	33,800
72	01644000	VA	East	Q_s	2,920	5,260	7,260	14,300	20,900	31,900	42,300	55,100	70,600	96,000
				Q_r	3,430	5,660	7,470	13,600	19,300	28,100	35,600	44,000	53,400	67,500
				Q_w	2,940	5,280	7,270	14,200	20,500	30,600	39,600	50,000	61,900	80,700
73	01644100	VA	East	Q_s	176	295	387	680	925	1,300	1,630	2,000	2,420	3,070
74	02009500	VA	Central	Q_s	[a]24.4	29.1	32.0	39.3	44.2	50.4	55.0	59.7	64.5	71.0
75	02011400	VA	Central	Q_s	1,940	2,900	3,650	6,030	8,080	11,300	14,200	17,600	21,600	28,000
76	02011460	VA	Central	Q_s	1,560	2,280	2,820	4,490	5,860	7,950	9,780	11,900	14,300	18,000
77	02011480	VA	Central	Q_s	2,620	3,660	4,360	6,170	7,430	9,080	10,400	11,700	13,000	14,900
				Q_r	2,010	2,880	3,480	5,150	6,370	8,030	9,340	10,700	12,200	14,200
				Q_w	2,510	3,540	4,220	5,950	7,150	8,770	10,000	11,400	12,700	14,600
78	02011500	VA	Central	Q_s	3,240	4,860	5,940	8,700	10,600	12,900	14,700	16,500	18,300	20,700
				Q_r	2,940	4,150	5,000	7,310	8,990	11,300	13,000	14,900	16,900	19,600
				Q_w	3,220	4,820	5,890	8,580	10,400	12,700	14,500	16,300	18,100	20,500
79	02012500	VA	Central	Q_s	4,960	8,140	10,300	16,000	19,900	24,800	28,500	32,100	35,700	40,500
				Q_r	8,160	11,200	13,300	18,800	22,800	28,000	32,200	36,500	41,000	47,300
				Q_w	5,030	8,210	10,400	16,100	20,000	25,000	28,700	32,400	36,100	41,000
80	02012950	VA	Central	Q_s	[a]6.06	[a]20.6	37.7	118	211	386	566	795	1,080	1,560
				Q_r	29.1	47.1	60.8	102	135	182	221	263	308	373
				Q_w	7.3	22.4	39.7	116	194	329	457	611	794	1,090
81	02013000	VA	Central	Q_s	2,520	4,100	5,270	8,660	11,300	15,000	18,000	21,300	24,800	30,000
				Q_r	3,490	4,910	5,900	8,580	10,500	13,100	15,200	17,400	19,600	22,800
				Q_w	2,540	4,120	5,280	8,660	11,200	14,900	17,800	21,000	24,500	29,400

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
82	02014000	VA	Central	Q_s	1,920	3,130	3,980	6,290	7,940	10,100	11,800	13,500	15,300	17,800
				Q_r	3,310	4,670	5,610	8,180	10,000	12,500	14,500	16,600	18,800	21,800
				Q_w	1,950	3,160	4,020	6,350	8,030	10,200	12,000	13,700	15,500	18,000
83	03050000	WV	Central	Q_s	4,270	5,760	6,790	9,560	11,600	14,300	16,600	18,900	21,400	25,000
				Q_r	3,940	5,530	6,630	9,600	11,700	14,600	16,900	19,300	21,800	25,300
				Q_w	4,260	5,760	6,790	9,560	11,600	14,400	16,600	18,900	21,400	25,000
84	03050500	WV	Central	Q_s	5,090	6,410	7,300	9,670	11,400	13,700	15,500	17,400	19,400	22,300
				Q_r	5,590	7,760	9,250	13,300	16,100	20,000	23,000	26,200	29,500	34,100
				Q_w	5,100	6,440	7,350	9,800	11,600	14,000	15,900	17,900	20,000	23,000
85	03050650	WV	Central	Q_s	23.3	35.6	46.2	83.6	120	183	245	325	425	598
				Q_r	16.4	27	35.2	60.3	80.4	109	133	160	188	228
				Q_w	22.2	34.4	44.6	78.8	110	161	208	266	336	450
86	03051000	WV	Central	Q_s	6,970	8,930	10,200	13,500	15,800	18,700	21,000	23,300	25,800	29,100
				Q_r	8,080	11,100	13,200	18,700	22,600	27,800	31,900	36,200	40,700	46,900
				Q_w	6,990	8,960	10,200	13,600	15,900	19,000	21,300	23,800	26,300	29,700
87	03051500	WV	Central	Q_s	2,800	4,000	4,850	7,230	9,010	11,500	13,600	15,800	18,100	21,600
				Q_r	2,690	3,820	4,610	6,750	8,310	10,400	12,100	13,800	15,700	18,200
				Q_w	2,790	3,990	4,840	7,200	8,950	11,400	13,400	15,500	17,800	21,200
88	03052000	WV	Central	Q_s	3,690	5,100	6,060	8,630	10,500	13,000	15,000	17,000	19,200	22,300
				Q_r	3,210	4,540	5,450	7,950	9,760	12,200	14,100	16,100	18,300	21,200
				Q_w	3,670	5,080	6,040	8,600	10,400	12,900	14,900	17,000	19,200	22,200
89	03052340	WV	Central	Q_s	90.4	128	155	227	279	351	409	471	536	630
				Q_r	72.3	114	145	238	310	412	495	584	679	816
				Q_w	87.5	126	154	229	286	366	431	500	574	680
90	03052500	WV	Central	Q_s	412	631	797	1,300	1,720	2,340	2,880	3,500	4,190	5,260
				Q_r	380	570	708	1,100	1,400	1,810	2,140	2,490	2,860	3,390
				Q_w	411	629	794	1,290	1,690	2,290	2,810	3,390	4,040	5,030
91	03053500	WV	Central	Q_s	4,850	6,500	7,490	9,770	11,200	12,800	13,900	15,000	16,100	17,400
				Q_r	5,700	7,910	9,430	13,500	16,400	20,400	23,400	26,700	30,000	34,700
				Q_w	4,870	6,520	7,520	9,850	11,300	13,000	14,300	15,400	16,600	18,000

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
92	03054500	WV	Central	Q_s	14,600	19,300	22,300	30,200	35,700	43,000	48,500	54,300	60,300	68,600
				Q_r	17,000	22,800	26,700	37,100	44,300	54,000	61,500	69,300	77,400	88,700
				Q_w	14,700	19,400	22,400	30,400	36,000	43,400	49,100	55,000	61,100	69,600
93	03055020	WV	Central	Q_s	31.1	51.5	66.8	112	147	197	238	284	333	404
				Q_r	20.9	34.2	44.4	75.5	100	136	165	197	232	281
				Q_w	28.4	47.4	61.3	99.9	129	171	206	244	286	346
94	03055040	WV	Central	Q_s	99.4	160	208	359	489	691	871	1,080	1,320	1,700
				Q_r	95.2	149	189	307	398	527	631	743	863	1,030
				Q_w	98.6	158	205	347	463	635	784	951	1,140	1,420
95	03056250	WV	Central	Q_s	2,910	3,990	4,720	6,720	8,170	10,100	11,700	13,400	15,200	17,700
				Q_r	2,180	3,110	3,760	5,550	6,860	8,630	10,000	11,500	13,000	15,200
				Q_w	2,840	3,920	4,640	6,580	7,980	9,890	11,400	13,000	14,800	17,200
96	03056500	WV	Central	Q_s	20,200	26,600	30,900	42,200	50,200	61,000	69,500	78,500	87,900	101,000
				Q_r	23,500	31,300	36,500	50,000	59,500	72,100	81,900	92,000	103,000	117,000
				Q_w	20,300	26,800	31,100	42,600	50,900	62,000	70,700	79,800	89,400	103,000
97	03056600	WV	Central	Q_s	104	161	202	318	405	526	624	730	842	1,000
				Q_r	72	114	145	238	310	412	495	584	679	816
				Q_w	97	152	190	296	375	485	576	673	777	927
98	03057300	WV	West	Q_s	864	1,280	1,570	2,340	2,890	3,630	4,220	4,830	5,470	6,370
				Q_r	739	1,180	1,500	2,400	3,060	3,950	4,640	5,360	6,110	7,140
				Q_w	837	1,260	1,560	2,350	2,940	3,740	4,380	5,040	5,730	6,700
99	03057500	WV	West	Q_s	867	1,130	1,290	1,650	1,870	2,130	2,310	2,490	2,650	2,870
				Q_r	678	1,080	1,380	2,210	2,830	3,650	4,300	4,970	5,660	6,620
				Q_w	848	1,130	1,300	1,700	1,980	2,340	2,600	2,870	3,140	3,480
100	03058000	WV	West	Q_s	1,950	2,690	3,190	4,480	5,370	6,540	7,450	8,380	9,340	10,700
				Q_r	1,930	2,990	3,750	5,850	7,360	9,360	10,900	12,500	14,100	16,400
				Q_w	1,950	2,710	3,220	4,580	5,560	6,890	7,930	9,000	10,100	11,600
101	03058500	WV	West	Q_s	3,520	5,060	6,070	8,620	10,300	12,500	14,100	15,800	17,400	19,600
				Q_r	3,010	4,610	5,750	8,850	11,100	14,000	16,200	18,500	20,900	24,100
				Q_w	3,500	5,050	6,060	8,630	10,400	12,600	14,300	16,000	17,800	20,100

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
102	03059000	WV	West	Q_s	6,320	8,630	10,000	13,100	15,000	17,100	18,600	20,000	21,300	23,000
				Q_r	5,340	8,060	9,950	15,100	18,700	23,500	27,100	30,700	34,500	39,500
				Q_w	6,270	8,610	10,000	13,200	15,200	17,600	19,300	21,000	22,600	24,600
103	03059500	WV	West	Q_s	1,230	2,040	2,640	4,400	5,750	7,650	9,220	10,900	12,700	15,300
				Q_r	1,680	2,620	3,300	5,160	6,500	8,290	9,670	11,100	12,500	14,500
				Q_w	1,280	2,090	2,690	4,490	5,870	7,790	9,320	10,900	12,700	15,100
104	03060500	WV	West	Q_s	329	611	827	1,460	1,930	2,590	3,110	3,660	4,240	5,040
				Q_r	287	470	606	994	1,280	1,680	1,990	2,320	2,660	3,140
				Q_w	320	587	789	1,340	1,730	2,240	2,640	3,060	3,510	4,130
105	03061000	WV	West	Q_s	10,300	14,800	17,700	24,800	29,500	35,400	39,700	43,900	48,200	53,800
				Q_r	8,980	13,300	16,400	24,500	30,100	37,500	43,000	48,600	54,300	62,000
				Q_w	10,200	14,800	17,700	24,800	29,600	35,500	40,000	44,400	48,800	54,700
106	03061500	WV	West	Q_s	3,340	4,490	5,200	6,910	8,000	9,340	10,300	11,300	12,200	13,500
				Q_r	2,140	3,320	4,150	6,450	8,100	10,300	12,000	13,700	15,500	17,900
				Q_w	3,280	4,450	5,170	6,890	8,010	9,410	10,500	11,500	12,500	13,900
107	03062400	WV	West	Q_s	236	366	473	829	1,150	1,680	2,180	2,790	3,520	4,720
				Q_r	355	578	743	1,210	1,560	2,040	2,410	2,800	3,210	3,780
				Q_w	246	379	490	866	1,210	1,750	2,230	2,790	3,440	4,460
108	03062500	WV	West	Q_s	757	1,180	1,510	2,540	3,390	4,700	5,860	7,180	8,700	11,000
				Q_r	1,350	2,110	2,660	4,190	5,300	6,780	7,930	9,110	10,300	12,000
				Q_w	798	1,230	1,570	2,670	3,610	5,010	6,220	7,550	9,040	11,300
109	03063950	WV	Central	Q_s	29.9	46.1	61	120	183	303	435	615	861	1,320
				Q_r	35.8	57.6	74.2	124	164	220	266	316	369	446
				Q_w	31.1	48.1	63.5	121	176	270	360	472	609	841
110	03065000	WV	Central	Q_s	7,890	10,500	12,700	19,800	26,200	36,700	46,600	58,600	73,100	97,200
				Q_r	7,040	9,710	11,500	16,400	19,900	24,600	28,300	32,100	36,100	41,600
				Q_w	7,870	10,500	12,700	19,700	25,900	35,900	45,300	56,500	69,900	91,900
111	03065400	WV	Central	Q_s	906	1,220	1,470	2,260	2,930	3,980	4,940	6,060	7,390	9,500
				Q_r	1,290	1,880	2,290	3,430	4,270	5,410	6,330	7,280	8,300	9,720
				Q_w	959	1,290	1,570	2,460	3,210	4,340	5,320	6,420	7,670	9,570

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
112	03066000	WV	Central	Q_s	1,530	2,060	2,470	3,730	4,780	6,380	7,800	9,450	11,300	14,300
				Q_r	1,950	2,800	3,390	5,020	6,210	7,830	9,110	10,500	11,900	13,900
				Q_w	1,540	2,070	2,490	3,770	4,830	6,440	7,870	9,500	11,400	14,300
113	03067100	WV	Central	Q_s	3.5	5.4	6.8	11	14.4	19.5	23.8	28.7	34.1	42.3
				Q_r	5.89	10	13.2	23.4	31.7	43.8	54	65.1	77.2	94.7
				Q_w	3.63	5.6	7.08	11.8	15.7	21.6	26.7	32.3	38.6	47.9
114	03067500	WV	Central	Q_s	2,770	3,550	4,060	5,360	6,260	7,440	8,350	9,280	10,300	11,600
				Q_r	1,360	1,960	2,390	3,580	4,450	5,650	6,600	7,590	8,640	10,100
				Q_w	2,580	3,380	3,880	5,090	5,940	7,080	7,970	8,910	9,890	11,300
115	03068610	WV	Central	Q_s	135	191	231	350	443	578	693	821	963	1,180
				Q_r	147	227	286	458	590	775	925	1,090	1,260	1,500
				Q_w	137	195	238	369	474	626	754	893	1,050	1,270
116	03068800	WV	Central	Q_s	6,770	9,140	10,800	15,300	18,500	23,100	26,700	30,600	34,800	40,800
				Q_r	3,270	4,620	5,550	8,090	9,920	12,400	14,400	16,400	18,600	21,600
				Q_w	6,290	8,620	10,200	14,000	16,800	20,500	23,600	26,800	30,300	35,400
117	03069000	WV	Central	Q_s	5,880	7,430	8,600	12,100	14,900	19,100	22,800	26,900	31,600	38,800
				Q_r	4,480	6,260	7,500	10,800	13,200	16,400	19,000	21,600	24,400	28,300
				Q_w	5,840	7,400	8,570	12,000	14,800	19,000	22,500	26,600	31,100	38,000
118	03069500	WV	Central	Q_s	16,100	21,000	24,900	36,800	46,900	62,500	76,400	92,700	112,000	141,000
				Q_r	13,700	18,500	21,800	30,400	36,400	44,500	50,800	57,400	64,200	73,700
				Q_w	16,100	21,000	24,900	36,700	46,600	61,800	75,400	91,000	109,000	138,000
119	03069850	WV	Central	Q_s	48.1	65.1	77.4	113	142	183	218	256	300	365
				Q_r	31.8	51.4	66.3	111	147	198	240	285	333	403
				Q_w	43.8	62.2	75	113	143	188	226	267	313	380
120	03069880	WV	Central	Q_s	593	865	1,060	1,590	1,990	2,550	3,000	3,480	4,000	4,750
				Q_r	328	495	617	964	1,230	1,590	1,880	2,190	2,520	2,990
				Q_w	559	825	1,010	1,490	1,850	2,330	2,730	3,160	3,620	4,290
121	03070000	WV	Central	Q_s	20,600	27,900	33,300	49,300	62,000	80,800	97,000	115,000	136,000	167,000
				Q_r	17,400	23,400	27,400	37,900	45,300	55,200	62,800	70,800	79,000	90,600
				Q_w	20,500	27,800	33,200	48,900	61,400	79,700	95,300	113,000	132,000	162,000

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
122	03070500	WV	Central	Q_s	4,670	6,080	7,140	10,300	12,900	16,700	20,000	23,800	28,100	34,700
				Q_r	4,230	5,920	7,090	10,300	12,500	15,600	18,000	20,500	23,200	26,900
				Q_w	4,660	6,080	7,140	10,300	12,900	16,700	19,900	23,600	27,800	34,300
123	03071000	WV	Central	Q_s	24,800	35,500	43,100	64,300	80,300	103,000	121,000	141,000	162,000	194,000
				Q_r	24,300	32,300	37,700	51,700	61,400	74,400	84,400	94,800	106,000	121,000
				Q_w	24,800	35,400	43,000	63,800	79,300	101,000	119,000	137,000	158,000	187,000
124	03071500	WV	Central	Q_s	26,400	38,300	46,300	66,900	81,000	99,400	113,000	128,000	142,000	162,000
125	03072000	PA	West	Q_s	3,920	5,860	7,150	10,400	12,700	15,500	17,700	19,800	22,000	24,900
				Q_r	3,600	5,490	6,820	10,500	13,000	16,400	19,000	21,700	24,400	28,100
				Q_w	3,900	5,850	7,140	10,400	12,700	15,600	17,800	20,000	22,300	25,300
126	03072590	PA	West	Q_s	381	542	656	974	1,210	1,550	1,820	2,120	2,440	2,900
				Q_r	479	774	990	1,600	2,060	2,670	3,150	3,650	4,180	4,900
				Q_w	400	575	703	1,100	1,420	1,890	2,270	2,670	3,090	3,680
127	03075450	MD	Central	Q_s	12.9	19.0	23.2	34.8	43.1	54.4	63.3	72.7	82.6	96.5
128	03075500	MD	Central	Q_s	2,390	3,430	4,200	6,420	8,170	10,700	12,900	15,200	17,900	21,800
129	03075600	MD	Central	Q_s	14.4	22.9	29.8	53.6	75.5	112	147	190	243	330
130	03076505	MD	Central	Q_s	[a]7.79	10.1	11.7	15.5	18.1	21.5	24.1	26.8	29.5	33.2
131	03076600	MD	Central	Q_s	851	1,260	1,550	2,310	2,860	3,590	4,160	4,760	5,390	6,260
132	03085500	PA	West	Q_s	2,850	4,340	5,400	8,380	10,600	13,700	16,300	19,000	21,900	26,100
				Q_r	3,930	5,980	7,420	11,300	14,100	17,800	20,600	23,400	26,400	30,300
				Q_w	2,880	4,380	5,450	8,490	10,800	14,000	16,600	19,300	22,300	26,500
133	03108000	PA	West	Q_s	1,980	2,910	3,590	5,590	7,180	9,490	11,500	13,600	16,100	19,700
				Q_r	2,970	4,560	5,680	8,740	10,900	13,800	16,000	18,300	20,600	23,800
				Q_w	2,010	2,950	3,640	5,710	7,360	9,780	11,800	14,000	16,500	20,100
134	03109000	OH	West	Q_s	198	303	381	613	798	1,070	1,300	1,560	1,840	2,270
				Q_r	229	378	488	806	1,040	1,370	1,630	1,900	2,190	2,580
				Q_w	201	309	389	635	835	1,130	1,370	1,640	1,930	2,360
135	03109500	OH	West	Q_s	5,050	7,350	8,960	13,300	16,600	20,900	24,500	28,200	32,100	37,700
				Q_r	6,490	9,740	12,000	18,100	22,400	28,000	32,200	36,500	40,900	46,800
				Q_w	5,090	7,400	9,020	13,500	16,800	21,300	25,000	28,800	32,800	38,500

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
136	03110000	OH	West	Q_s	1,800	2,530	3,050	4,540	5,680	7,320	8,690	10,200	11,800	14,300
				Q_r	2,570	3,950	4,940	7,630	9,560	12,100	14,100	16,100	18,100	21,000
				Q_w	1,830	2,570	3,100	4,670	5,910	7,690	9,160	10,800	12,500	15,000
137	03110980	OH	West	Q_s	2.4	4.6	6.5	12.2	17.0	24.1	30.2	37.0	44.4	55.4
138	03111150	PA	West	Q_s	219	396	532	932	1,240	1,680	2,030	2,410	2,810	3,380
139	03111450	OH	West	Q_s	24.5	43.2	57.7	102	138	191	236	286	341	422
				Q_r	69.9	119	157	268	353	471	567	668	775	926
				Q_w	34	55.8	74.5	142	204	296	372	454	540	663
140	03111455	OH	West	Q_s	[a]110	[a]177	225	360	460	597	707	824	947	1,120
141	03111470	OH	West	Q_s	21.8	43.8	62.8	129	190	289	380	487	612	811
142	03111500	OH	West	Q_s	1,490	2,290	2,840	4,240	5,200	6,430	7,370	8,310	9,270	10,600
143	03111540	OH	West	Q_s	10.4	29.3	49.1	134	223	385	545	744	988	1,390
144	03111548	OH	West	Q_s	1,320	2,110	2,670	4,240	5,400	7,000	8,270	9,620	11,000	13,000
				Q_r	1,880	2,920	3,660	5,710	7,190	9,150	10,700	12,200	13,800	16,000
				Q_w	1,380	2,180	2,760	4,430	5,700	7,460	8,860	10,300	11,800	13,900
145	03112000	WV	West	Q_s	4,900	7,360	9,030	13,400	16,500	20,500	23,600	26,700	29,900	34,400
				Q_r	4,210	6,390	7,920	12,100	15,000	18,900	21,900	24,900	28,000	32,200
				Q_w	4,840	7,290	8,950	13,300	16,300	20,200	23,200	26,300	29,500	33,900
146	03113700	WV	West	Q_s	183	357	497	942	1,310	1,850	2,310	2,810	3,370	4,180
				Q_r	193	320	415	688	893	1,180	1,400	1,640	1,880	2,230
				Q_w	186	349	478	856	1,140	1,520	1,820	2,150	2,490	2,990
147	03114000	OH	West	Q_s	3,220	4,920	6,090	9,250	11,500	14,500	16,900	19,300	21,900	25,400
				Q_r	2,390	3,690	4,610	7,150	8,960	11,400	13,200	15,100	17,100	19,700
				Q_w	3,160	4,860	6,010	9,090	11,300	14,100	16,300	18,700	21,100	24,400
148	03114240	OH	West	Q_s	20.7	44.6	65	133	191	280	356	441	535	674
				Q_r	35	61.1	81.1	141	187	253	306	363	423	509
				Q_w	24.9	48.8	69.3	136	190	265	327	394	465	568
149	03114500	WV	West	Q_s	9,210	11,800	13,500	17,500	20,000	23,300	25,600	28,000	30,400	33,500
				Q_r	6,110	9,180	11,300	17,100	21,200	26,500	30,500	34,600	38,800	44,400
				Q_w	9,070	11,700	13,400	17,400	20,100	23,500	26,000	28,500	31,100	34,500

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
150	03114550	WV	West	Q_s	80.9	154	209	369	489	653	781	914	1,050	1,240
				Q_r	51.6	88.9	117	202	267	358	432	511	594	712
				Q_w	70.7	135	182	303	384	493	579	672	770	909
151	03114600	WV	West	Q_s	116	198	257	417	532	684	801	922	1,040	1,210
				Q_r	66	113	149	254	335	449	540	637	739	883
				Q_w	97	172	224	352	439	557	652	753	860	1,010
152	03114650	WV	West	Q_s	338	624	834	1,410	1,820	2,350	2,750	3,150	3,550	4,080
				Q_r	170	283	367	611	795	1,050	1,250	1,460	1,690	2,000
				Q_w	301	564	750	1,210	1,490	1,850	2,130	2,410	2,710	3,120
153	03115280	OH	West	Q_s	347	517	639	986	1,250	1,620	1,930	2,260	2,620	3,150
				Q_r	208	344	445	736	955	1,260	1,500	1,750	2,010	2,380
				Q_w	296	467	583	893	1,120	1,430	1,690	1,960	2,260	2,680
154	03115400	OH	West	Q_s	4,070	5,980	7,440	11,900	15,600	21,300	26,300	32,000	38,500	48,600
				Q_r	3,370	5,150	6,410	9,830	12,300	15,500	17,900	20,500	23,000	26,500
				Q_w	4,000	5,920	7,370	11,700	15,100	20,200	24,400	29,200	34,500	42,400
155	03115410	OH	West	Q_s	[a]6.06	13.5	19.9	40.6	57.7	82.7	103	126	150	184
				Q_r	12	21.5	29.1	51.9	70.1	96.2	118	141	166	201
				Q_w	7.81	15.6	22.4	44.8	63.3	89.8	111	135	159	195
156	03115500	OH	West	Q_s	4,340	6,350	7,690	11,200	13,600	16,700	19,100	21,600	24,100	27,500
				Q_r	3,940	6,000	7,440	11,400	14,200	17,800	20,600	23,500	26,400	30,400
				Q_w	4,280	6,310	7,660	11,200	13,700	17,000	19,500	22,100	24,800	28,400
157	03115510	OH	West	Q_s	[a]110	175	224	371	488	659	804	965	1,140	1,410
				Q_r	78	133	175	297	391	522	627	738	856	1,020
				Q_w	98	163	210	342	443	586	703	829	966	1,160
158	03115600	OH	West	Q_s	191	381	542	1,090	1,570	2,330	3,020	3,800	4,700	6,090
159	03115710	OH	West	Q_s	[a]34.5	40.4	43.9	52.2	57.4	63.7	68.3	72.8	77.3	83.3
160	03150600	OH	West	Q_s	71	111	140	225	291	385	463	549	642	779
				Q_r	56.5	97	128	219	290	389	469	553	643	769
				Q_w	67	108	137	223	290	386	466	551	642	774

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
161	03151400	WV	West	Q_s	2,580	3,890	4,900	8,040	10,700	14,700	18,300	22,400	27,200	34,600
				Q_r	2,080	3,230	4,050	6,290	7,910	10,100	11,700	13,400	15,100	17,500
				Q_w	2,530	3,840	4,830	7,820	10,200	13,700	16,700	19,900	23,600	29,100
162	03151500	WV	West	Q_s	3,440	4,540	5,190	6,700	7,620	8,710	9,480	10,200	10,900	11,800
				Q_r	2,670	4,110	5,130	7,920	9,930	12,600	14,600	16,700	18,800	21,700
				Q_w	3,370	4,510	5,190	6,820	7,890	9,260	10,300	11,300	12,300	13,600
163	03152000	WV	West	Q_s	6,230	8,350	9,690	12,900	15,000	17,600	19,500	21,400	23,300	25,800
				Q_r	5,370	8,100	10,000	15,200	18,800	23,600	27,200	30,900	34,600	39,700
				Q_w	6,180	8,340	9,700	13,100	15,300	18,200	20,400	22,500	24,700	27,600
164	03152200	WV	West	Q_s	166	269	344	556	715	937	1,120	1,310	1,510	1,800
				Q_r	129	216	281	472	616	816	976	1,140	1,320	1,570
				Q_w	158	261	334	538	688	897	1,060	1,240	1,430	1,700
165	03152500	WV	West	Q_s	3,380	5,100	6,200	8,880	10,600	12,700	14,100	15,600	17,000	18,700
				Q_r	2,530	3,890	4,860	7,520	9,430	11,900	13,900	15,900	17,900	20,700
				Q_w	3,200	4,900	5,980	8,570	10,300	12,400	14,000	15,700	17,300	19,500
166	03153000	WV	West	Q_s	4,010	5,850	7,010	9,790	11,500	13,700	15,200	16,600	18,000	19,800
				Q_r	2,810	4,330	5,390	8,320	10,400	13,200	15,300	17,500	19,700	22,700
				Q_w	3,900	5,740	6,900	9,640	11,400	13,600	15,200	16,800	18,400	20,400
167	03153500	WV	West	Q_s	14,000	18,000	20,200	25,300	28,200	31,500	33,800	35,900	37,800	40,300
				Q_r	10,300	15,300	18,700	27,900	34,300	42,600	48,800	55,100	61,500	70,100
				Q_w	13,800	17,900	20,100	25,400	28,600	32,500	35,200	37,900	40,400	43,600
168	03154000	WV	West	Q_s	4,580	6,540	7,790	10,800	12,800	15,300	17,000	18,800	20,500	22,800
				Q_r	3,310	5,060	6,290	9,660	12,100	15,200	17,700	20,100	22,700	26,100
				Q_w	4,510	6,480	7,730	10,800	12,800	15,300	17,100	18,900	20,800	23,200
169	03154250	WV	West	Q_s	363	547	671	992	1,210	1,500	1,710	1,930	2,160	2,460
				Q_r	126	211	275	461	603	799	955	1,120	1,290	1,540
				Q_w	273	447	554	791	941	1,140	1,310	1,480	1,660	1,920
170	03154500	WV	West	Q_s	2,310	3,050	3,520	4,680	5,450	6,420	7,150	7,880	8,620	9,620
				Q_r	1,600	2,500	3,150	4,930	6,220	7,930	9,260	10,600	12,000	14,000
				Q_w	2,230	3,010	3,490	4,710	5,550	6,670	7,530	8,400	9,300	10,500

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
171	03155000	WV	West	Q_s	19,200	25,700	29,600	38,500	43,900	50,300	54,800	59,000	63,100	68,300
				Q_r	15,200	22,300	27,100	40,000	48,900	60,300	68,900	77,500	86,200	98,000
				Q_w	18,900	25,500	29,500	38,600	44,400	51,400	56,500	61,400	66,300	72,500
172	03155200	WV	West	Q_s	5,700	7,330	8,260	10,300	11,500	12,800	13,700	14,500	15,300	16,200
				Q_r	3,370	5,150	6,410	9,830	12,300	15,500	17,900	20,500	23,000	26,500
				Q_w	5,170	6,960	7,960	10,200	11,700	13,600	15,100	16,500	18,000	19,900
173	03155450	WV	West	Q_s	350	585	748	1,180	1,490	1,880	2,170	2,470	2,770	3,170
				Q_r	149	249	323	540	704	930	1,110	1,300	1,500	1,780
				Q_w	291	507	649	981	1,190	1,460	1,670	1,890	2,120	2,450
174	03155500	WV	West	Q_s	8,870	12,400	14,600	19,900	23,300	27,500	30,600	33,600	36,500	40,400
				Q_r	6,060	9,110	11,200	17,000	21,000	26,300	30,300	34,300	38,500	44,100
				Q_w	8,710	12,300	14,500	19,700	23,100	27,400	30,500	33,600	36,800	40,900
175	03155525	WV	West	Q_s	955	1,480	1,860	2,930	3,730	4,830	5,730	6,680	7,700	9,150
				Q_r	670	1,070	1,370	2,190	2,790	3,610	4,250	4,910	5,600	6,550
				Q_w	864	1,380	1,730	2,680	3,340	4,240	4,950	5,710	6,500	7,630
176	03159540	OH	West	Q_s	2,290	3,080	3,650	5,310	6,610	8,510	10,100	11,900	13,900	16,900
				Q_r	2,680	4,130	5,160	7,960	9,970	12,600	14,700	16,700	18,900	21,800
				Q_w	2,320	3,130	3,720	5,500	6,930	9,020	10,800	12,700	14,700	17,800
177	03159700	WV	West	Q_s	78	120	151	245	319	427	520	623	737	908
				Q_r	43.3	75	99.4	172	227	306	370	438	510	612
				Q_w	65.9	108	137	219	280	367	440	520	606	733
178	03171500	VA	Central	Q_s	17,800	26,100	32,800	54,700	74,200	106,000	135,000	171,000	214,000	284,000
179	03173000	VA	Central	Q_s	3,540	5,460	6,800	10,400	13,100	16,600	19,400	22,300	25,300	29,600
				Q_r	6,110	8,460	10,100	14,400	17,500	21,700	24,900	28,300	31,900	36,900
				Q_w	3,590	5,510	6,860	10,600	13,200	16,800	19,700	22,600	25,700	30,000
180	03175500	VA	Central	Q_s	2,640	4,340	5,470	8,260	10,100	12,200	13,700	15,200	16,600	18,400
				Q_r	4,680	6,520	7,800	11,200	13,700	17,100	19,700	22,400	25,300	29,300
				Q_w	2,680	4,380	5,510	8,350	10,200	12,400	14,000	15,500	17,000	18,900

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
181	03176400	WV	Central	Q_s	937	1,260	1,460	1,930	2,220	2,570	2,820	3,060	3,300	3,600
				Q_r	1,210	1,750	2,140	3,210	4,000	5,080	5,940	6,840	7,800	9,140
				Q_w	982	1,330	1,560	2,180	2,620	3,200	3,630	4,070	4,510	5,090
182	03176500	VA	Central	Q_s	20,700	30,600	38,400	63,600	85,500	120,000	152,000	189,000	233,000	304,000
183	03177500	WV	Central	Q_s	[a]3,040	3,630	3,950	4,610	4,980	5,380	5,640	5,880	6,100	6,370
				Q_r	4,020	5,630	6,750	9,780	12,000	14,900	17,200	19,600	22,200	25,700
				Q_w	3,180	3,860	4,280	5,400	6,200	7,210	7,940	8,640	9,320	10,200
184	03177700	VA	Central	Q_s	461	616	713	942	1,090	1,270	1,400	1,520	1,650	1,810
				Q_r	965	1,410	1,730	2,610	3,270	4,170	4,880	5,640	6,430	7,560
				Q_w	510	679	795	1,130	1,370	1,690	1,940	2,180	2,420	2,740
185	03178500	WV	Central	Q_s	639	1,120	1,460	2,400	3,080	3,970	4,650	5,340	6,050	7,010
				Q_r	793	1,170	1,430	2,180	2,730	3,500	4,100	4,740	5,420	6,380
				Q_w	650	1,120	1,460	2,380	3,030	3,890	4,560	5,240	5,940	6,890
186	03179000	WV	Central	Q_s	4,120	6,640	8,270	12,200	14,700	17,600	19,600	21,500	23,300	25,600
				Q_r	7,880	10,800	12,900	18,200	22,100	27,200	31,200	35,400	39,800	45,900
				Q_w	4,200	6,720	8,370	12,400	15,000	18,100	20,200	22,300	24,200	26,700
187	03179500	WV	Central	Q_s	5,590	7,620	8,870	11,800	13,600	15,900	17,400	19,000	20,400	22,400
				Q_r	8,670	11,900	14,100	19,900	24,000	29,600	33,900	38,500	43,200	49,800
				Q_w	5,740	7,800	9,100	12,300	14,400	17,100	19,000	20,900	22,700	25,100
188	03180000	WV	Central	Q_s	27,300	38,600	47,100	73,100	94,500	127,000	156,000	188,000	226,000	284,000
189	03180350	WV	Central	Q_s	32.4	44.3	52.9	78.5	98.8	129	154	183	215	263
				Q_r	37.3	60	77.2	129	170	228	276	327	383	462
				Q_w	33.4	47	57.1	89.9	118	158	193	230	272	333
190	03180500	WV	Central	Q_s	2,840	3,730	4,470	6,990	9,300	13,100	16,800	21,400	27,000	36,400
				Q_r	2,920	4,120	4,970	7,260	8,930	11,200	13,000	14,800	16,800	19,500
				Q_w	2,840	3,740	4,480	7,000	9,280	13,000	16,500	20,800	26,000	34,700
191	03180530	WV	Central	Q_s	28.5	50.5	69.3	135	197	302	402	524	673	920
				Q_r	41.8	67	86	143	188	252	305	362	422	510
				Q_w	31.2	53.5	72.6	138	194	282	360	449	552	711

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

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192	03180680	WV	Central	Q_s	45.7	73.9	95.6	163	218	302	375	457	551	693
				Q_r	48.9	78	100	166	217	290	350	415	484	583
				Q_w	46.3	74.6	96.4	164	218	298	366	441	524	648
193	03181900	WV	Central	Q_s	6.7	9	10.4	14	16.4	19.4	21.7	23.9	26.2	29.3
				Q_r	4.07	6.98	9.28	16.6	22.6	31.5	38.9	47.1	55.9	68.8
				Q_w	5.93	8.52	10.1	14.8	18.3	23.4	27.6	31.9	36.4	42.8
194	03182000	WV	Central	Q_s	3,280	4,200	4,880	6,860	8,430	10,700	12,700	14,900	17,300	21,000
				Q_r	2,410	3,430	4,140	6,090	7,510	9,440	11,000	12,600	14,200	16,600
				Q_w	3,180	4,130	4,810	6,760	8,270	10,500	12,300	14,300	16,600	19,900
195	03182500	WV	Central	Q_s	11,300	15,300	18,200	26,300	32,600	41,400	48,800	56,900	65,800	78,800
				Q_r	10,500	14,300	16,900	23,700	28,600	35,100	40,200	45,500	51,000	58,700
				Q_w	11,300	15,300	18,200	26,200	32,400	41,100	48,400	56,300	64,900	77,600
196	03182700	WV	Central	Q_s	6,020	7,910	9,240	13,000	15,800	19,800	23,100	26,700	30,700	36,500
				Q_r	3,130	4,430	5,320	7,770	9,540	11,900	13,800	15,800	17,900	20,800
				Q_w	5,650	7,540	8,810	12,200	14,600	18,100	20,900	24,000	27,400	32,300
197	03183000	WV	Central	Q_s	1,290	2,030	2,560	4,020	5,090	6,560	7,720	8,950	10,200	12,100
				Q_r	1,850	2,650	3,210	4,770	5,900	7,450	8,670	9,950	11,300	13,200
				Q_w	1,320	2,060	2,600	4,080	5,170	6,670	7,850	9,090	10,400	12,200
198	03183500	WV	Central	Q_s	20,300	28,600	33,900	46,800	55,000	65,200	72,600	79,900	87,100	96,600
				Q_r	24,500	32,500	37,900	52,000	61,800	74,800	84,900	95,400	106,000	121,000
				Q_w	20,400	28,600	33,900	46,800	55,200	65,500	73,000	80,400	87,700	97,300
199	03183550	WV	Central	Q_s	187	246	280	357	402	454	490	523	555	594
				Q_r	114	178	225	363	469	619	741	871	1,010	1,210
				Q_w	169	232	269	358	421	504	568	632	697	784
200	03183570	WV	Central	Q_s	55.4	96.9	130	232	317	445	556	680	820	1,030
				Q_r	71.7	113	144	236	308	409	491	580	675	810
				Q_w	58.5	99.7	133	233	314	432	531	640	759	935
201	03184000	WV	Central	Q_s	24,000	31,700	36,700	49,200	57,500	68,200	76,200	84,400	92,700	104,000
				Q_r	28,600	37,900	44,100	60,100	71,300	86,100	97,500	109,000	122,000	139,000
				Q_w	24,100	31,800	36,800	49,400	57,900	68,800	77,100	85,400	93,900	106,000

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
202	03184200	WV	Central	Q_s	210	420	599	1,210	1,770	2,650	3,440	4,370	5,450	7,130
				Q_r	230	351	439	694	888	1,160	1,380	1,610	1,850	2,200
				Q_w	213	411	576	1,100	1,520	2,150	2,690	3,300	3,990	5,040
203	03184500	WV	Central	Q_s	42,700	63,200	77,700	119,000	149,000	192,000	227,000	265,000	306,000	365,000
204	03185000	WV	Central	Q_s	619	972	1,230	1,940	2,480	3,220	3,830	4,470	5,160	6,140
				Q_r	1,250	1,810	2,210	3,320	4,140	5,250	6,140	7,070	8,050	9,440
				Q_w	646	1,000	1,270	2,030	2,610	3,410	4,060	4,750	5,480	6,520
205	03185020	WV	Central	Q_s	11	22.1	30.8	56.4	75.8	102	123	144	167	197
				Q_r	21.6	35.2	45.7	77.6	103	140	170	203	238	288
				Q_w	12.9	24.3	33.5	61.8	84	115	140	166	193	232
206	03185500	WV	Central	Q_s	51,700	75,400	91,000	131,000	157,000	191,000	216,000	242,000	268,000	302,000
207	03186000	WV	Central	Q_s	50,500	77,600	95,700	142,000	174,000	214,000	244,000	274,000	304,000	345,000
208	03186500	WV	Central	Q_s	4,810	6,670	7,980	11,700	14,500	18,400	21,700	25,200	29,100	34,700
				Q_r	2,810	3,990	4,800	7,030	8,650	10,800	12,600	14,400	16,300	18,900
				Q_w	4,740	6,600	7,890	11,500	14,200	17,900	21,000	24,400	28,000	33,400
209	03187000	WV	Central	Q_s	6,570	9,290	11,200	16,400	20,200	25,500	29,800	34,400	39,200	46,300
				Q_r	4,920	6,860	8,200	11,800	14,400	17,900	20,600	23,500	26,400	30,600
				Q_w	6,520	9,230	11,100	16,200	19,900	25,100	29,200	33,600	38,300	45,100
210	03187300	WV	Central	Q_s	419	632	790	1,270	1,650	2,210	2,700	3,240	3,850	4,780
				Q_r	268	407	508	800	1,020	1,330	1,580	1,840	2,120	2,520
				Q_w	396	603	751	1,170	1,500	1,970	2,370	2,810	3,290	4,020
211	03187500	WV	Central	Q_s	2,890	4,040	4,850	7,090	8,760	11,100	13,000	15,000	17,200	20,400
				Q_r	1,840	2,640	3,200	4,750	5,880	7,420	8,630	9,910	11,300	13,200
				Q_w	2,840	3,980	4,770	6,930	8,520	10,700	12,500	14,400	16,500	19,500
212	03189000	WV	Central	Q_s	5,030	6,920	8,360	12,800	16,400	22,000	26,900	32,600	39,100	49,300
				Q_r	3,250	4,590	5,520	8,040	9,870	12,300	14,300	16,300	18,500	21,500
				Q_w	4,930	6,810	8,220	12,400	15,800	20,900	25,400	30,400	36,200	45,100
213	03189100	WV	Central	Q_s	14,700	21,300	25,800	37,800	46,400	58,000	67,100	76,600	86,600	101,000
				Q_r	10,300	14,000	16,600	23,300	28,100	34,500	39,500	44,700	50,100	57,700
				Q_w	14,500	21,000	25,500	37,000	45,100	56,000	64,500	73,500	82,900	96,000

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
214	03189500	WV	Central	Q_s	15,500	20,500	24,100	34,300	42,100	53,200	62,300	72,400	83,400	99,600
				Q_r	13,000	17,500	20,700	28,900	34,700	42,400	48,400	54,700	61,200	70,300
				Q_w	15,400	20,400	24,000	34,000	41,600	52,300	61,100	70,700	81,200	96,600
215	03189650	WV	Central	Q_s	86.2	137	173	269	336	425	494	564	637	736
				Q_r	85	133	169	276	359	475	571	672	781	937
				Q_w	85.9	136	172	270	343	442	521	603	689	810
216	03190000	WV	Central	Q_s	3,880	5,180	6,000	8,020	9,350	11,000	12,300	13,500	14,700	16,400
				Q_r	5,890	8,160	9,730	13,900	16,900	21,000	24,100	27,400	30,900	35,700
				Q_w	3,940	5,250	6,090	8,230	9,680	11,500	12,900	14,300	15,700	17,500
217	03190100	WV	Central	Q_s	581	1,150	1,650	3,460	5,190	8,100	10,900	14,300	18,300	25,000
				Q_r	598	886	1,090	1,680	2,110	2,720	3,200	3,710	4,240	5,010
				Q_w	585	1,090	1,520	2,840	3,890	5,450	6,800	8,340	10,100	12,800
218	03190400	WV	Central	Q_s	5,310	7,430	8,910	13,000	15,900	20,000	23,400	26,900	30,700	36,100
				Q_r	7,340	10,100	12,000	17,100	20,700	25,500	29,300	33,200	37,400	43,100
				Q_w	5,390	7,520	9,020	13,200	16,200	20,500	23,900	27,500	31,300	36,800
219	03190500	WV	Central	Q_s	202	278	324	434	504	587	646	704	760	833
				Q_r	124	193	244	393	508	668	799	939	1,090	1,300
				Q_w	182	260	307	423	505	615	700	788	878	1,000
220	03191400	WV	Central	Q_s	86.3	168	237	469	674	998	1,290	1,630	2,020	2,620
				Q_r	115	179	227	366	473	624	747	878	1,020	1,220
				Q_w	90.2	169	236	447	622	882	1,110	1,360	1,640	2,060
221	03191500	WV	Central	Q_s	1,160	1,970	2,600	4,490	6,020	8,280	10,200	12,300	14,700	18,200
				Q_r	977	1,430	1,750	2,640	3,300	4,210	4,930	5,690	6,500	7,630
				Q_w	1,150	1,940	2,550	4,310	5,680	7,660	9,310	11,100	13,100	16,100
222	03192000	WV	Central	Q_s	26,800	35,500	41,300	56,800	67,800	82,700	94,500	107,000	120,000	138,000
				Q_r	23,700	31,500	36,800	50,500	60,000	72,700	82,600	92,800	103,000	118,000
				Q_w	26,700	35,400	41,100	56,400	67,300	81,900	93,400	105,000	118,000	136,000
223	03192500	WV	Central	Q_s	21,300	30,500	37,000	54,900	68,300	86,900	102,000	118,000	136,000	161,000
				Q_r	25,100	33,300	38,900	53,200	63,200	76,500	86,800	97,500	109,000	124,000
				Q_w	21,600	30,700	37,200	54,700	67,500	85,000	98,900	114,000	129,000	152,000

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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224	03193000	WV	Central	Q_s	72,300	103,000	123,000	174,000	207,000	249,000	281,000	312,000	344,000	387,000
225	03193725	WV	Central	Q_s	10.2	15	18.3	27.3	33.8	42.6	49.5	56.8	64.5	75.2
				Q_r	12.1	20.1	26.3	45.6	61	83.5	102	122	144	176
				Q_w	10.6	16	19.8	31.8	41.4	55.2	66.5	78.5	91.3	109
226	03193830	WV	Central	Q_s	116	180	232	408	571	840	1,100	1,410	1,800	2,430
				Q_r	57	91	116	191	250	333	402	475	553	666
				Q_w	104	164	211	352	471	656	824	1,020	1,250	1,620
227	03194700	WV	Central	Q_s	7,320	9,850	11,700	16,800	20,800	26,500	31,200	36,400	42,100	50,600
				Q_r	5,490	7,630	9,100	13,100	15,900	19,700	22,700	25,800	29,100	33,600
				Q_w	7,270	9,800	11,600	16,700	20,600	26,100	30,700	35,700	41,200	49,400
228	03195000	WV	Central	Q_s	8,340	10,100	11,100	13,600	15,200	17,000	18,400	19,700	21,100	22,800
229	03195100	WV	Central	Q_s	1,470	2,010	2,400	3,520	4,380	5,630	6,670	7,820	9,090	11,000
				Q_r	1,230	1,790	2,180	3,280	4,090	5,190	6,060	6,980	7,960	9,330
				Q_w	1,420	1,970	2,360	3,460	4,300	5,480	6,460	7,520	8,660	10,300
230	03195250	WV	Central	Q_s	1,490	2,060	2,460	3,590	4,450	5,670	6,670	7,750	8,940	10,700
				Q_r	1,120	1,620	1,980	2,990	3,730	4,740	5,550	6,400	7,290	8,560
				Q_w	1,460	2,030	2,430	3,530	4,360	5,530	6,490	7,520	8,650	10,300
231	03195500	WV	Central	Q_s	12,600	16,800	19,600	26,900	32,100	39,000	44,500	50,200	56,200	64,700
				Q_r	10,500	14,300	16,900	23,800	28,700	35,200	40,300	45,600	51,100	58,800
				Q_w	12,500	16,700	19,400	26,600	31,700	38,500	43,900	49,500	55,400	63,700
232	03195600	WV	Central	Q_s	577	773	902	1,240	1,470	1,770	2,010	2,250	2,500	2,850
				Q_r	182	279	350	558	716	938	1,120	1,310	1,510	1,800
				Q_w	507	702	821	1,100	1,300	1,560	1,770	1,990	2,220	2,550
233	03197000	WV	West	Q_s	18,100	23,500	27,200	37,300	44,600	54,500	62,500	71,000	80,000	93,000
				Q_r	12,300	18,100	22,100	32,800	40,200	49,700	56,900	64,200	71,500	81,400
				Q_w	17,600	23,100	26,900	36,900	44,000	53,800	61,500	69,700	78,300	90,500
234	03197150	WV	West	Q_s	133	187	222	312	373	452	511	572	634	718
				Q_r	97	164	215	363	476	633	759	892	1,030	1,230
				Q_w	125	183	221	322	399	506	591	680	773	900

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
235	03197900	WV	West	Q_s	33.1	53.7	68.8	112	146	193	231	273	317	381
				Q_r	33	57.6	76.6	133	177	240	290	344	402	483
				Q_w	33.1	54.7	70.7	119	158	214	260	309	362	436
236	03198350	WV	West	Q_s	683	1,440	2,120	4,570	6,880	10,700	14,300	18,600	23,700	31,900
				Q_r	1,340	2,100	2,650	4,170	5,280	6,750	7,890	9,070	10,300	11,900
				Q_w	807	1,550	2,220	4,450	6,280	8,870	11,000	13,300	15,800	19,500
237	03198450	WV	West	Q_s	168	277	362	629	852	1,190	1,490	1,840	2,230	2,830
				Q_r	272	446	575	945	1,220	1,600	1,900	2,210	2,540	3,000
				Q_w	184	298	389	687	941	1,320	1,630	1,980	2,350	2,900
238	03198500	WV	West	Q_s	5,320	8,280	10,400	16,400	20,900	27,100	32,200	37,500	43,300	51,600
				Q_r	5,410	8,160	10,100	15,300	19,000	23,700	27,400	31,100	34,900	40,000
				Q_w	5,320	8,280	10,400	16,300	20,800	26,900	31,800	36,900	42,400	50,300
239	03198780	WV	West	Q_s	56.2	94.4	122	199	255	331	391	453	517	607
				Q_r	95.5	162	212	358	469	624	748	880	1,020	1,210
				Q_w	65.5	107	139	240	323	442	538	638	742	886
240	03198800	WV	West	Q_s	19.8	49	76	172	258	391	507	637	781	995
				Q_r	68.7	117	154	263	347	464	558	658	763	912
				Q_w	27.5	58.9	88.3	195	287	420	530	647	772	951
241	03199000	WV	West	Q_s	4,110	7,080	9,290	15,700	20,500	27,300	32,700	38,500	44,600	53,300
				Q_r	4,070	6,190	7,670	11,700	14,600	18,400	21,200	24,200	27,200	31,300
				Q_w	4,110	7,040	9,220	15,400	19,900	26,100	31,000	36,100	41,600	49,200
242	03199300	WV	West	Q_s	167	317	432	762	1,010	1,340	1,610	1,880	2,160	2,540
				Q_r	384	625	801	1,300	1,680	2,190	2,590	3,010	3,440	4,050
				Q_w	202	358	484	874	1,190	1,620	1,960	2,310	2,680	3,170
243	03199400	WV	West	Q_s	5,010	7,920	10,000	16,100	20,800	27,300	32,700	38,500	44,800	53,800
				Q_r	4,620	7,000	8,670	13,200	16,400	20,600	23,800	27,100	30,400	34,900
				Q_w	4,920	7,740	9,740	15,300	19,200	24,500	28,500	32,800	37,300	43,600
244	03200500	WV	West	Q_s	11,800	17,100	20,300	28,100	32,900	38,600	42,600	46,500	50,200	55,000
				Q_r	9,890	14,700	18,000	26,800	32,900	40,900	46,900	53,000	59,100	67,500
				Q_w	11,700	17,000	20,200	28,000	32,900	38,800	43,100	47,300	51,300	56,600

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
245	03200600	WV	West	Q_s	43.1	67	84	131	166	214	252	292	335	395
				Q_r	51.2	88.2	116	200	265	356	429	507	590	706
				Q_w	45.4	71.6	91	151	200	271	330	391	456	547
246	03201000	WV	West	Q_s	3,810	5,590	6,760	9,680	11,600	14,000	15,900	17,600	19,400	21,800
				Q_r	3,710	5,650	7,020	10,700	13,400	16,900	19,500	22,300	25,000	28,800
				Q_w	3,800	5,590	6,770	9,740	11,800	14,300	16,300	18,200	20,200	22,800
247	03201405	WV	West	Q_s	1,200	1,750	2,100	2,970	3,530	4,220	4,720	5,220	5,710	6,350
				Q_r	700	1,120	1,420	2,280	2,910	3,760	4,420	5,110	5,820	6,810
				Q_w	1,020	1,570	1,910	2,720	3,260	3,990	4,570	5,160	5,770	6,610
248	03201410	WV	West	Q_s	463	631	734	980	1,140	1,320	1,460	1,590	1,720	1,890
				Q_r	291	476	614	1,010	1,300	1,700	2,020	2,350	2,700	3,180
				Q_w	419	602	712	986	1,180	1,450	1,660	1,870	2,090	2,390
249	03201420	WV	West	Q_s	159	222	259	345	397	458	500	540	578	626
				Q_r	98	166	218	368	482	641	769	903	1,050	1,240
				Q_w	140	209	249	352	427	530	612	697	783	899
250	03201440	WV	West	Q_s	160	241	301	476	615	817	989	1,180	1,390	1,700
				Q_r	59	101	133	227	300	402	484	572	664	795
				Q_w	121	198	250	379	469	595	701	817	944	1,130
251	03201480	WV	West	Q_s	48.9	95.8	133	243	328	447	543	644	750	898
				Q_r	43.3	75	99.4	172	227	306	370	438	510	612
				Q_w	47.2	90.6	124	218	285	377	450	528	611	729
252	03202000	OH	West	Q_s	3,570	5,010	6,030	8,850	11,000	13,900	16,300	18,900	21,700	25,700
253	03202245	WV	West	Q_s	[a]232	[a]363	458	735	949	1,260	1,510	1,790	2,090	2,540
				Q_r	190	315	409	678	880	1,160	1,380	1,610	1,860	2,200
				Q_w	220	352	447	717	923	1,210	1,450	1,700	1,970	2,350
254	03202400	WV	West	Q_s	2,960	5,820	8,180	15,900	22,300	32,200	40,600	50,200	60,800	76,600
				Q_r	4,490	6,810	8,430	12,800	16,000	20,100	23,200	26,400	29,600	34,000
				Q_w	3,050	5,870	8,190	15,600	21,500	30,100	37,100	44,800	53,100	65,300

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
255	03202480	WV	West	Q_s	115	251	363	712	988	1,380	1,690	2,020	2,370	2,850
				Q_r	260	428	553	909	1,180	1,540	1,830	2,130	2,450	2,890
				Q_w	132	269	383	745	1,030	1,420	1,740	2,060	2,400	2,860
256	03202750	WV	West	Q_s	2,410	3,560	4,340	6,400	7,870	9,810	11,300	12,900	14,500	16,800
				Q_r	2,280	3,530	4,410	6,840	8,590	10,900	12,700	14,500	16,400	18,900
				Q_w	2,400	3,560	4,350	6,450	7,960	10,000	11,600	13,200	14,900	17,300
257	03203000	WV	West	Q_s	10,200	16,300	20,200	30,100	36,500	44,300	49,900	55,300	60,600	67,300
				Q_r	8,970	13,300	16,400	24,500	30,100	37,400	43,000	48,600	54,300	62,000
				Q_w	10,100	16,200	20,000	29,800	36,000	43,500	49,000	54,400	59,700	66,500
258	03203600	WV	West	Q_s	11,200	19,300	24,900	39,400	49,000	60,900	69,500	77,900	86,100	96,700
				Q_r	9,640	14,300	17,500	26,100	32,200	40,000	45,800	51,800	57,800	66,000
				Q_w	11,000	18,700	24,100	37,100	45,300	55,100	62,300	69,400	76,500	85,900
259	03204000	WV	West	Q_s	12,000	18,700	23,000	32,900	38,900	45,900	50,600	55,100	59,200	64,400
				Q_r	12,900	19,000	23,200	34,400	42,100	52,100	59,600	67,100	74,800	85,100
				Q_w	12,000	18,700	23,000	33,000	39,100	46,400	51,500	56,300	60,900	66,600
260	03204500	WV	West	Q_s	3,330	5,040	6,290	9,940	12,800	16,900	20,300	24,100	28,200	34,300
				Q_r	3,920	5,960	7,400	11,300	14,100	17,700	20,500	23,400	26,300	30,200
				Q_w	3,370	5,080	6,340	10,000	12,900	17,000	20,300	24,000	27,900	33,500
261	03205995	OH	West	Q_s	62.6	91.8	113	175	224	294	354	419	491	599
				Q_r	44.7	77.4	102	177	234	315	381	450	524	629
				Q_w	57.4	88.6	111	176	227	303	366	434	507	614
262	03206450	WV	West	Q_s	[a]246	484	678	1,290	1,790	2,530	3,160	3,850	4,600	5,700
				Q_r	165	274	356	593	772	1,020	1,220	1,420	1,640	1,940
				Q_w	215	414	567	968	1,230	1,580	1,870	2,170	2,500	2,970
263	03206600	WV	West	Q_s	980	1,460	1,770	2,560	3,090	3,750	4,230	4,720	5,200	5,850
				Q_r	923	1,460	1,860	2,950	3,750	4,820	5,660	6,520	7,410	8,650
				Q_w	975	1,460	1,780	2,600	3,160	3,900	4,460	5,020	5,590	6,350
264	03206800	WV	West	Q_s	2,020	2,830	3,390	4,870	5,940	7,380	8,520	9,720	11,000	12,800
				Q_r	2,460	3,790	4,740	7,330	9,200	11,700	13,600	15,500	17,500	20,200
				Q_w	2,090	2,940	3,540	5,260	6,590	8,440	9,910	11,400	13,000	15,200

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
265	03207000	WV	West	Q_s	3,300	5,160	6,480	10,100	12,700	16,200	19,000	22,000	25,000	29,300
266	03207020	WV	West	Q_s	3,330	5,180	6,470	9,980	12,500	15,900	18,500	21,300	24,200	28,200
				Q_r	4,420	6,710	8,310	12,700	15,700	19,800	22,900	26,000	29,200	33,600
				Q_w	3,400	5,250	6,560	10,200	12,800	16,400	19,200	22,100	25,000	29,200
267	03207400	VA	West	Q_s	219	551	863	2,010	3,070	4,760	6,270	8,000	9,960	12,900
				Q_r	560	901	1,150	1,850	2,370	3,070	3,620	4,190	4,790	5,610
				Q_w	247	578	888	1,980	2,920	4,290	5,420	6,650	8,000	9,960
268	03207500	VA	West	Q_s	3,890	7,090	9,390	15,500	19,800	25,200	29,200	33,100	37,000	42,100
				Q_r	3,720	5,670	7,040	10,800	13,400	16,900	19,600	22,300	25,100	28,900
				Q_w	3,880	7,010	9,250	15,100	19,000	23,900	27,500	31,000	34,600	39,300
269	03207800	VA	West	Q_s	3,400	6,410	8,840	16,500	22,900	32,500	40,700	49,800	60,000	75,100
				Q_r	4,390	6,660	8,250	12,600	15,600	19,700	22,700	25,800	29,000	33,400
				Q_w	3,460	6,420	8,810	16,200	22,000	30,200	37,000	44,400	52,400	64,000
270	03207962	KY	West	Q_s	20.8	44.3	64.1	128	182	261	328	402	481	597
				Q_r	48.9	84.4	112	192	254	341	412	487	567	679
				Q_w	28.4	53.7	75.8	151	213	302	374	451	532	648
271	03208000	KY	West	Q_s	6,260	9,710	12,100	18,200	22,400	27,900	32,000	36,200	40,500	46,300
				Q_r	5,420	8,180	10,100	15,300	19,000	23,800	27,400	31,200	34,900	40,100
				Q_w	6,180	9,600	12,000	17,900	21,900	27,100	31,100	35,100	39,200	44,800
272	03208500	VA	West	Q_s	5,190	9,590	12,900	22,400	29,400	38,900	46,300	54,000	61,900	72,800
				Q_r	4,260	6,470	8,030	12,200	15,200	19,200	22,100	25,200	28,300	32,500
				Q_w	5,150	9,490	12,700	21,800	28,300	36,800	43,400	50,200	57,200	66,800
273	03208950	VA	West	Q_s	1,040	1,830	2,470	4,520	6,280	9,010	11,400	14,200	17,400	22,300
				Q_r	1,400	2,200	2,770	4,350	5,490	7,020	8,210	9,430	10,700	12,400
				Q_w	1,060	1,850	2,490	4,510	6,180	8,670	10,800	13,200	15,800	19,800
274	03209000	VA	West	Q_s	4,630	7,440	9,410	14,800	18,600	23,600	27,600	31,600	35,800	41,600
				Q_r	3,500	5,350	6,650	10,200	12,700	16,000	18,600	21,200	23,800	27,400
				Q_w	4,530	7,300	9,220	14,300	17,800	22,300	25,800	29,400	33,100	38,200

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

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					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
275	03209575	KY	West	Q_s	164	232	282	425	538	702	841	995	1,170	1,420
				Q_r	137	230	299	501	654	865	1,030	1,210	1,400	1,660
				Q_w	156	232	286	449	582	775	934	1,100	1,290	1,550
276	03210000	KY	West	Q_s	1,180	2,020	2,590	4,050	5,000	6,180	7,010	7,820	8,600	9,600
				Q_r	1,230	1,940	2,450	3,860	4,890	6,260	7,330	8,420	9,560	11,100
				Q_w	1,180	2,020	2,580	4,040	5,000	6,180	7,050	7,900	8,730	9,810
277	03211500	KY	West	Q_s	2,150	3,410	4,270	6,590	8,210	10,300	12,000	13,700	15,400	17,700
				Q_r	3,320	5,080	6,320	9,700	12,100	15,300	17,700	20,200	22,700	26,200
				Q_w	2,360	3,640	4,560	7,220	9,220	11,900	14,000	16,100	18,300	21,200
278	03212000	KY	West	Q_s	2,060	3,820	5,180	9,170	12,200	16,500	19,900	23,500	27,400	32,700
				Q_r	1,960	3,040	3,810	5,930	7,460	9,490	11,100	12,700	14,300	16,600
				Q_w	2,050	3,760	5,060	8,740	11,400	14,900	17,600	20,500	23,500	27,600
279	03212750	WV	West	Q_s	1,140	2,230	3,110	5,930	8,270	11,700	14,700	18,000	21,600	27,000
				Q_r	2,920	4,480	5,580	8,600	10,800	13,600	15,800	18,000	20,300	23,400
				Q_w	1,290	2,390	3,300	6,260	8,690	12,200	15,000	18,000	21,200	25,800
280	03212980	WV	West	Q_s	2,440	4,170	5,380	8,570	10,700	13,500	15,600	17,600	19,700	22,300
				Q_r	3,360	5,130	6,380	9,800	12,200	15,400	17,900	20,400	23,000	26,400
				Q_w	2,540	4,250	5,470	8,730	11,000	13,900	16,200	18,400	20,600	23,500
281	03213000	WV	West	Q_s	5,500	9,490	12,300	20,100	25,500	32,700	38,100	43,600	49,200	56,700
				Q_r	6,570	9,850	12,100	18,300	22,600	28,300	32,600	36,900	41,300	47,300
				Q_w	5,550	9,500	12,300	20,000	25,300	32,200	37,400	42,700	48,000	55,300
282	03213500	WV	West	Q_s	508	1,120	1,640	3,400	4,920	7,220	9,200	11,400	13,800	17,400
				Q_r	782	1,250	1,580	2,530	3,220	4,150	4,880	5,640	6,420	7,490
				Q_w	525	1,130	1,640	3,310	4,680	6,640	8,260	10,000	11,900	14,700
283	03213700	WV	West	Q_s	7,950	13,300	17,400	29,300	38,600	51,900	62,900	74,800	87,700	106,000
				Q_r	10,500	15,600	19,100	28,400	34,900	43,300	49,600	56,000	62,500	71,200
				Q_w	8,090	13,400	17,500	29,200	38,200	50,700	60,800	71,500	82,900	99,300
284	03214000	WV	West	Q_s	10,400	18,200	24,100	41,400	54,700	73,500	88,800	105,000	123,000	148,000

Table 3. Flood-frequency discharges for the 290 U.S. Geological Survey streamgage stations on rural, unregulated streams in West Virginia and adjacent states.—Continued

[Identification number refers to the number in figure 3; %, percent; AOP, annual-occurrence probability; WV, West Virginia; MD, Maryland; VA, Virginia; OH, Ohio; PA, Pennsylvania; KY, Kentucky; East, Eastern Panhandle Region; Central, Central Mountains Region; West, Western Plateaus Region. Flood-frequency discharges are presented in the following estimate-type order: first line (Q_s), from the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009); second line (Q_r), from the regionalized regression equation; and third line (Q_w), from weighting (1) the systematic and historical record using guidelines established by the Interagency Advisory Committee on Water Data (1982) with the West Virginia skew (Atkins and others, 2009) and (2) the regionalized regression equation, using the number of years of peak discharge and equivalent years of record. Shading indicates the 44 streamgage stations removed from consideration as part of the regional regression analysis]

Identification number	Streamgage station number	State	Region	Estimate type	Flood discharge, in cubic feet per second									
					1.1-year (90% AOP)	1.5-year (67% AOP)	2-year (50% AOP)	5-year (20% AOP)	10-year (10% AOP)	25-year (4% AOP)	50-year (2% AOP)	100-year (1% AOP)	200-year (0.5% AOP)	500-year (0.2% AOP)
285	03214500	WV	West	Q_s	10,500	18,000	23,600	39,200	50,800	66,600	79,200	92,200	106,000	125,000
				Q_r	13,400	19,700	24,000	35,500	43,400	53,700	61,400	69,200	77,000	87,600
				Q_w	10,600	18,000	23,600	39,100	50,400	65,700	77,700	90,100	103,000	121,000
286	03214900	WV	West	Q_s	9,240	14,900	18,900	30,000	38,200	49,300	58,000	67,200	76,900	90,400
				Q_r	15,200	22,200	27,000	39,800	48,700	60,100	68,600	77,200	85,900	97,600
				Q_w	10,100	15,700	19,900	31,800	40,600	52,400	61,500	70,800	80,200	93,200
287	03215500	KY	West	Q_s	3,210	4,860	6,020	9,260	11,700	15,000	17,600	20,500	23,500	27,800
				Q_r	3,450	5,280	6,560	10,100	12,600	15,800	18,400	20,900	23,500	27,100
				Q_w	3,220	4,880	6,040	9,320	11,700	15,100	17,700	20,500	23,500	27,700
288	03216500	KY	West	Q_s	6,090	8,390	9,970	14,200	17,300	21,600	24,900	28,500	32,300	37,800
				Q_r	5,510	8,300	10,300	15,500	19,300	24,100	27,800	31,600	35,400	40,600
				Q_w	6,030	8,380	9,990	14,400	17,600	22,000	25,500	29,200	33,000	38,400
289	03216540	KY	West	Q_s	582	789	929	1,300	1,560	1,920	2,200	2,490	2,800	3,230
				Q_r	384	625	801	1,300	1,680	2,190	2,590	3,010	3,440	4,050
				Q_w	540	764	910	1,300	1,590	2,000	2,330	2,670	3,030	3,540
290	03216563	KY	West	Q_s	111	158	190	272	330	406	465	527	590	678
				Q_r	54	93	123	211	280	375	452	534	621	743
				Q_w	90	139	171	250	309	391	459	531	607	714

[a]Discharge was computed outside the PeakFQ computer program (Flynn and others, 2006) using the HARTIV subroutine (Kirby, 1980) and by computing the antilog of the discharge from equation 1 (Interagency Advisory Committee on Water Data, 1982, p. 9–10).

Table 5. Description of the 88 pairs of U.S. Geological Survey streamgage stations in West Virginia and adjacent states that were evaluated to quantify "near" for application of the drainage-area ratio method in this study.

[Identification number refers to the number in figure 3; MD, Maryland; WV, West Virginia; VA, Virginia; PA, Pennsylvania; OH, Ohio; KY, Kentucky; N., North; S., South; E., East; R., River; Br., Branch; Fk., Fork; nr, near; blw, below]

Pair number	Upstream station				Downstream station			
	Identification number	Streamgage station number	Station name	State	Identification number	Streamgage station number	Station name	State
1	1	01595000	North Branch Potomac River at Steyer	MD	3	01595500	North Br. Potomac River at Kitzmiller	MD
2	1	01595000	North Branch Potomac River at Steyer	MD	12	01603000	N. Br. Potomac River near Cumberland	MD
3	3	01595500	North Br. Potomac River at Kitzmiller	MD	4	01596000	North Br. Potomac River at Bloomington	MD
4	4	01596000	North Br. Potomac River at Bloomington	MD	10	01600000	North Branch Potomac River at Pinto	MD
5	4	01596000	North Br. Potomac River at Bloomington	MD	12	01603000	N. Br. Potomac River near Cumberland	MD
6	10	01600000	North Branch Potomac River at Pinto	MD	12	01603000	N. Br. Potomac River near Cumberland	MD
7	14	01605500	South Branch Potomac River at Franklin	WV	17	01606500	S. Br. Potomac River near Petersburg	WV
8	14	01605500	South Branch Potomac River at Franklin	WV	23	01608500	S. Br. Potomac River near Springfield	WV
9	17	01606500	S. Br. Potomac River near Petersburg	WV	23	01608500	S. Br. Potomac River near Springfield	WV
10	19	01607500	S. Fk. S. Br. Potomac R. at Brandywine	WV	21	01608000	S. Fk. S. Br. Potomac R. near Moorefield	WV
11	26	01609650	Little Cacapon River at Frenchburg	WV	27	01609800	Little Cacapon River near Levels	WV
12	31	01610500	Cacapon River at Yellow Spring	WV	32	01611500	Cacapon River near Great Cacapon	WV
13	39	01615000	Opequon Creek near Berryville	VA	41	01616500	Opequon Creek near Martinsburg	WV
14	56	01632000	N. Fk. Shenandoah R. at Cootes Store	VA	61	01633000	N. Fk. Shenandoah R. at Mount Jackson	VA
15	56	01632000	N. Fk. Shenandoah R. at Cootes Store	VA	64	01634000	N. Fk. Shenandoah River near Strasburg	VA
16	61	01633000	N. Fk. Shenandoah R. at Mount Jackson	VA	64	01634000	N. Fk. Shenandoah River near Strasburg	VA
17	71	01643700	Goose Creek near Middleburg	VA	72	01644000	Goose Creek near Leesburg	VA
18	77	02011480	Back Cr. at Rt. 600 near Mountain Grove	VA	78	02011500	Back Creek near Mountain Grove	VA
19	83	03050000	Tygart Valley River near Dailey	WV	84	03050500	Tygart Valley River near Elkins	WV
20	83	03050000	Tygart Valley River near Dailey	WV	96	03056500	Tygart Valley River at Fetterman	WV
21	84	03050500	Tygart Valley River near Elkins	WV	86	03051000	Tygart Valley River at Belington	WV
22	86	03051000	Tygart Valley River at Belington	WV	92	03054500	Tygart Valley River at Phillipi	WV
23	86	03051000	Tygart Valley River at Belington	WV	96	03056500	Tygart Valley River at Fetterman	WV
24	92	03054500	Tygart Valley River at Phillipi	WV	96	03056500	Tygart Valley River at Fetterman	WV
25	87	03051500	Middle Fork River at Midvale	WV	88	03052000	Middle Fork River at Audra	WV
26	93	03055020	Bonica Run on U.S. 250 near Phillipi	WV	94	03055040	Bonica Run on Route 38 near Phillipi	WV
27	98	03057300	West Fork River at Walkersville	WV	100	03058000	West Fork R. blw Stonewall Jackson Dam nr Weston	WV
28	98	03057300	West Fork River at Walkersville	WV	105	03061000	West Fork River at Enterprise	WV
29	100	03058000	West Fork R. blw Stonewall Jackson Dam nr Weston	WV	101	03058500	West Fork River at Butcherville	WV
30	101	03058500	West Fork River at Butcherville	WV	102	03059000	West Fork River at Clarksburg	WV

Table 5. Description of the 88 pairs of U.S. Geological Survey streamgage stations in West Virginia and adjacent states that were evaluated to quantify "near" for application of the drainage-area ratio method in this study.—Continued

[Identification number refers to the number in figure 3; MD, Maryland; WV, West Virginia; VA, Virginia; PA, Pennsylvania; OH, Ohio; KY, Kentucky; N., North; S., South; E., East; R., River; Br., Branch; Fk., Fork; nr, near; blw, below]

Pair number	Upstream station				Downstream station			
	Identification number	Streamgage station number	Station name	State	Identification number	Streamgage station number	Station name	State
31	101	03058500	West Fork River at Butcherville	WV	105	03061000	West Fork River at Enterprise	WV
32	102	03059000	West Fork River at Clarksburg	WV	105	03061000	West Fork River at Enterprise	WV
33	110	03065000	Dry Fork at Hendricks	WV	118	03069500	Cheat River near Parsons	WV
34	110	03065000	Dry Fork at Hendricks	WV	123	03071000	Cheat River near Pisgah	WV
35	118	03069500	Cheat River near Parsons	WV	121	03070000	Cheat River at Rowlesburg	WV
36	118	03069500	Cheat River near Parsons	WV	123	03071000	Cheat River near Pisgah	WV
37	121	03070000	Cheat River at Rowlesburg	WV	123	03071000	Cheat River near Pisgah	WV
38	111	03065400	Blackwater River near Davis	WV	112	03066000	Blackwater River at Davis	WV
39	114	03067500	Shavers Fork at Cheat Bridge	WV	116	03068800	Shavers Fork below Bowden	WV
40	114	03067500	Shavers Fork at Cheat Bridge	WV	118	03069500	Cheat River near Parsons	WV
41	116	03068800	Shavers Fork below Bowden	WV	118	03069500	Cheat River near Parsons	WV
42	154	03115400	Little Muskingum River at Bloomfield	OH	156	03115500	Little Muskingum River at Fay	OH
43	161	03151400	Little Kanawha River near Wildcat	WV	162	03151500	Little Kanawha River near Burnsville	WV
44	161	03151400	Little Kanawha River near Wildcat	WV	171	03155000	Little Kanawha River at Palestine	WV
45	162	03151500	Little Kanawha River near Burnsville	WV	163	03152000	Little Kanawha River at Glenville	WV
46	163	03152000	Little Kanawha River at Glenville	WV	167	03153500	Little Kanawha River at Grantsville	WV
47	163	03152000	Little Kanawha River at Glenville	WV	171	03155000	Little Kanawha River at Palestine	WV
48	167	03153500	Little Kanawha River at Grantsville	WV	171	03155000	Little Kanawha River at Palestine	WV
49	172	03155200	South Fork Hughes River at Macfarlan	WV	174	03155500	Hughes River at Cisco	WV
50	184	03177700	Bluestone River at Bluefield	VA	186	03179000	Bluestone River near Pipestem	WV
51	184	03177700	Bluestone River at Bluefield	VA	187	03179500	Bluestone River at Lilly	WV
52	186	03179000	Bluestone River near Pipestem	WV	187	03179500	Bluestone River at Lilly	WV
53	190	03180500	Greenbrier River at Durbin	WV	195	03182500	Greenbrier River at Buckeye	WV
54	190	03180500	Greenbrier River at Durbin	WV	201	03184000	Greenbrier River at Hilldale	WV
55	195	03182500	Greenbrier River at Buckeye	WV	198	03183500	Greenbrier River at Alderson	WV
56	195	03182500	Greenbrier River at Buckeye	WV	201	03184000	Greenbrier River at Hilldale	WV
57	198	03183500	Greenbrier River at Alderson	WV	201	03184000	Greenbrier River at Hilldale	WV
58	208	03186500	Williams River at Dyer	WV	209	03187000	Gauley River at Camden on Gauley	WV
59	209	03187000	Gauley River at Camden on Gauley	WV	213	03189100	Gauley River near Craigsville	WV
60	209	03187000	Gauley River at Camden on Gauley	WV	223	03192500	Gauley River at Belva	WV

Table 5. Description of the 88 pairs of U.S. Geological Survey streamgage stations in West Virginia and adjacent states that were evaluated to quantify "near" for application of the drainage-area ratio method in this study.—Continued

[Identification number refers to the number in figure 3; MD, Maryland; WV, West Virginia; VA, Virginia; PA, Pennsylvania; OH, Ohio; KY, Kentucky; N., North; S., South; E., East; R., River; Br., Branch; Fk., Fork; nr, near; blw, below]

Pair number	Upstream station				Downstream station			
	Identi-fication number	Streamgage station number	Station name	State	Identi-fication number	Streamgage station number	Station name	State
61	213	03189100	Gauley River near Craigsville	WV	214	03189500	Gauley River near Summersville	WV
62	214	03189500	Gauley River near Summersville	WV	222	03192000	Gauley River above Belva	WV
63	214	03189500	Gauley River near Summersville	WV	223	03192500	Gauley River at Belva	WV
64	222	03192000	Gauley River above Belva	WV	223	03192500	Gauley River at Belva	WV
65	216	03190000	Meadow River at Nallen	WV	218	03190400	Meadow River near Mount Lookout	WV
66	227	03194700	Elk River below Webster Springs	WV	231	03195500	Elk River at Sutton	WV
67	227	03194700	Elk River below Webster Springs	WV	233	03197000	Elk River at Queen Shoals	WV
68	231	03195500	Elk River at Sutton	WV	233	03197000	Elk River at Queen Shoals	WV
69	238	03198500	Big Coal River at Ashford	WV	244	03200500	Coal River at Tornado	WV
70	241	03199000	Little Coal River at Danville	WV	243	03199400	Little Coal River at Julian	WV
71	254	03202400	Guyandotte River near Baileysville	WV	257	03203000	Guyandotte River at Man	WV
72	254	03202400	Guyandotte River near Baileysville	WV	259	03204000	Guyandotte River at Branchland	WV
73	257	03203000	Guyandotte River at Man	WV	258	03203600	Guyandotte River at Logan	WV
74	257	03203000	Guyandotte River at Man	WV	259	03204000	Guyandotte River at Branchland	WV
75	258	03203600	Guyandotte River at Logan	WV	259	03204000	Guyandotte River at Branchland	WV
76	263	03206600	East Fork Twelvepole Creek near Dunlow	WV	264	03206800	E. Fk. Twelvepole Creek near East Lynn	WV
77	263	03206600	East Fork Twelvepole Creek near Dunlow	WV	266	03207020	Twelvepole Creek below Wayne	WV
78	264	03206800	E. Fk. Twelvepole Creek near East Lynn	WV	266	03207020	Twelvepole Creek below Wayne	WV
79	268	03207500	Levisa Fork near Grundy	VA	269	03207800	Levisa Fork at Big Rock	VA
80	268	03207500	Levisa Fork near Grundy	VA	271	03208000	Levisa Fork below Fishtrap Dam	KY
81	269	03207800	Levisa Fork at Big Rock	VA	271	03208000	Levisa Fork below Fishtrap Dam	KY
82	276	03210000	Johns Crek near Meta	KY	277	03211500	Johns Creek near Van Lear	KY
83	279	03212750	Tug Fork at Welch	WV	281	03213000	Tug Fork at Litwar	WV
84	279	03212750	Tug Fork at Welch	WV	286	03214900	Tug Fork at Glenhayes	WV
85	281	03213000	Tug Fork at Litwar	WV	283	03213700	Tug Fork at Williamson	WV
86	283	03213700	Tug Fork at Williamson	WV	285	03214500	Tug Fork at Kermit	WV
87	283	03213700	Tug Fork at Williamson	WV	286	03214900	Tug Fork at Glenhayes	WV
88	285	03214500	Tug Fork at Kermit	WV	286	03214900	Tug Fork at Glenhayes	WV

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Appendix 1

Appendix 1. Matrices Used to Compute Individual Standard Errors of Prediction

[PK(n_n), peak discharge for the (n.n)-year recurrence interval; PK(n), peak discharge for the (n)-year recurrence interval; %, percent; AOP, annual-occurrence probability; γ^2, standard error of the model squared; numbers are given in scientific notation where 0.32483E-01 is 0.032483]

Eastern Panhandle Region

PK1_1(90%AOP) γ^2 = 0.32483E-01

0.36765E-02	-0.13943E-02
-0.13943E-02	0.79153E-03

PK1_5(67%AOP) γ^2 = 0.22559E-01

0.26813E-02	-0.98579E-03
-0.98579E-03	0.55605E-03

PK2(50%AOP) γ^2 = 0.18489E-01

0.24610E-02	-0.86628E-03
-0.86628E-03	0.48293E-03

PK5(20%AOP) γ^2 = 0.11967E-01

0.24958E-02	-0.76020E-03
-0.76020E-03	0.41065E-03

PK10(10%AOP) γ^2 = 0.92526E-02

0.27016E-02	-0.75370E-03
-0.75370E-03	0.40192E-03

PK25(4%AOP) γ^2 = 0.71876E-02

0.30780E-02	-0.79872E-03
-0.79872E-03	0.42199E-03

PK50(2%AOP) γ^2 = 0.64308E-02

0.34417E-02	-0.86987E-03
-0.86987E-03	0.45750E-03

PK100(1%AOP) γ^2 = 0.61728E-02

0.38754E-02	-0.96990E-03
-0.96990E-03	0.50843E-03

PK200(0.5%AOP) γ^2 = 0.63080E-02

0.43778E-02	-0.10963E-02
-0.10963E-02	0.57352E-03

PK500(0.2%AOP) γ^2 = 0.69967E-02

0.51444E-02	-0.13012E-02
-0.13012E-02	0.68008E-03

Central Mountains Region

PK1_1(90%AOP) γ^2 = 0.27978E-01

0.26613E-02	-0.98361E-03
-0.98361E-03	0.47958E-03

PK1_5(67%AOP) γ^2 = 0.21308E-01

0.20667E-02	-0.75807E-03
-0.75807E-03	0.36705E-03

PK2(50%AOP) γ^2 = 0.19922E-01

0.20406E-02	-0.74156E-03
-0.74156E-03	0.35478E-03

PK5(20%AOP) γ^2 = 0.20745E-01

0.24841E-02	-0.88266E-03
-0.88266E-03	0.41029E-03

PK10(10%AOP) γ^2 = 0.23263E-01

0.29889E-02	-0.10523E-02
-0.10523E-02	0.48398E-03

PK25(4%AOP) γ^2 = 0.27815E-01

0.37621E-02	-0.13163E-02
-0.13163E-02	0.60165E-03

PK50(2%AOP) γ^2 = 0.31932E-01

0.44057E-02	-0.15382E-02
-0.15382E-02	0.70196E-03

PK100(1%AOP) γ^2 = 0.36527E-01

0.50907E-02	-0.17758E-02
-0.17758E-02	0.81032E-03

PK200(0.5%AOP) γ^2 = 0.41553E-01

0.58123E-02	-0.20274E-02
-0.20274E-02	0.92586E-03

PK500(0.2%AOP) γ^2 = 0.48810E-01

0.68170E-02	-0.23795E-02
-0.23795E-02	0.10887E-02

Western Plateaus Region

PK1_1(90%AOP) γ^2 = 0.25715E-01

0.21782E-02	-0.77332E-03
-0.77332E-03	0.38325E-03

PK1_5(67%AOP) γ^2 = 0.19963E-01

0.16074E-02	-0.56593E-03
-0.56593E-03	0.28053E-03

PK2(50%AOP) γ^2 = 0.17940E-01

0.14888E-02	-0.51918E-03
-0.51918E-03	0.25507E-03

PK5(20%AOP) γ^2 = 0.15490E-01

0.15374E-02	-0.52302E-03
-0.52302E-03	0.24868E-03

PK10(10%AOP) γ^2 = 0.15120E-01

0.17035E-02	-0.57249E-03
-0.57249E-03	0.26724E-03

PK25(4%AOP) γ^2 = 0.15624E-01

0.19906E-02	-0.66264E-03
-0.66264E-03	0.30467E-03

PK50(2%AOP) γ^2 = 0.16517E-01

0.22400E-02	-0.74298E-03
-0.74298E-03	0.33935E-03

PK100(1%AOP) γ^2 = 0.17743E-01

0.25100E-02	-0.83124E-03
-0.83124E-03	0.37818E-03

PK200(0.5%AOP) γ^2 = 0.19246E-01

0.27968E-02	-0.92609E-03
-0.92609E-03	0.42049E-03

PK500(0.2%AOP) γ^2 = 0.21600E-01

0.31977E-02	-0.10601E-02
-0.10601E-02	0.48102E-03

For additional information, write to:
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Charleston, WV 25301

or visit our Web site at:
http://wv.usgs.gov/

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