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Methods for Estimating Annual Exceedance Probability Discharges for Streams in Arkansas, Based on Data Through Water Year 2013

Scientific Investigations Report 2016–5081

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

Front cover:

Top, Flood of April 25, 2011, at U.S. Geological Survey (USGS) streamflow-gaging station 07048490, Town Branch tributary at Highway 16 at Fayetteville, Arkansas. Photograph by D.M. Wagner, Lower Mississippi-Gulf Water Science Center.

Bottom, Flood of April 25, 2011, at USGS streamflow-gaging station 07048600, White River near Fayetteville, Arkansas. Photograph by K.M. Hubbs, Lower Mississippi-Gulf Water Science Center.

Back cover:

Top, B.K. Martin, hydrologic technician in the Little Rock office of the USGS Lower Mississippi-Gulf Water Science Center, measuring streamflow with an acoustic doppler current profiler during flood of March 19, 2008, at USGS streamflow-gaging station 07056000, Buffalo River near St. Joe, Arkansas. Photograph by W.E. Baldwin, USGS Lower Mississippi-Gulf Water Science Center.

Bottom, Flood of May 3, 2011, at USGS streamflow-gaging station 07069000, Black River at Pocahontas, Arkansas. Photograph by D.M. Wagner, Lower Mississippi-Gulf Water Science Center.

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Conversion Factors

Inch/Pound to International System of Units

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)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	0.001233	cubic hectometer (hm^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Hydraulic gradient	
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)

Datum

Vertical coordinate information is referenced to the North American Vertical Datum of 1988 (NAVD 88).

Horizontal coordinate information is referenced to the USGS Albers Equal Area Conic projection, North American Datum of 1983 (NAD 83).

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

Supplemental Information

Water year is a one-year period from October 1 to September 30, defined by the year in which it ends; for example, the 2013 water year is the period October 1, 2012–September 30, 2013.

Abbreviations

AEP	Annual exceedance probability
AEPD	Annual exceedance probability discharge
AHTD	Arkansas State Highway and Transportation Department
ALVM	Quaternary alluvial deposits
ANCOVA	Analysis of covariance
AVP	Average variance of prediction
BSHAPE	Basin shape factor
B-WLS/B-GLS	Bayesian weighted least-squares/Bayesian generalized-least squares regression
C_p	Mallow's criterion to assess the fit of a model when different numbers of parameters are used
CSG	Crest-stage gage
DAR	Drainage area ratio
DRNAREA	Drainage area
EGLS	Estimated generalized least squares
ELEV	Mean basin elevation
EMA	Expected Moments Algorithm
EMA/MGB	Expected Moments Algorithm/Multiple Grubbs-BeckEVRError Variance Ratio
GIS	Geographic information system
GLS	Generalized least squares
HUC	Hydrologic unit code
LC11DVOPN	Percentage of basin in open development
LC11PAST	Percentage of basin in cultivated pasture
LP3	log-Pearson type 3
MBV*	Misrepresentation of Beta Variance
MEV	Model error variance
MGB	Multiple Grubbs-Beck test
MSE	Mean squared error
NWIS	National Water Information System
OLS	Ordinary least-squares
OSW	U.S. Geological Survey Office of Surface Water
PH	Historical period
PILF	Potentially influential low floods
PRECIP	Mean annual precipitation
PRESS	Predicted residual sum of squares
PRL	Pseudo record length
Pseudo-R^2	Pseudo coefficient of determination

R^2	Coefficient of determination
R^2adj	Adjusted coefficient of determination
RCP	Regulation control point
RRE	Regional regression equation
SD	Standardized distance
SEM	Standard error of the model
S_p	Standard error of prediction
SLPFM	Slope of the longest flow path in basin
SOILINDEX	Soil hydrologic group
UPZ	Upper Paleozoic
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WLS	Weighted least-squares
WREG	Weighted-multiple-linear regression program

Methods for Estimating Annual Exceedance Probability Discharges for Streams in Arkansas, Based on Data Through Water Year 2013

By Daniel M. Wagner[1], Joshua D. Krieger[2], and Andrea G. Veilleux[3]

Abstract

In 2013, the U.S. Geological Survey initiated a study to update regional skew, annual exceedance probability discharges, and regional regression equations used to estimate annual exceedance probability discharges for ungaged locations on streams in the study area with the use of recent geospatial data, new analytical methods, and available annual peak-discharge data through the 2013 water year. An analysis of regional skew using Bayesian weighted least-squares/Bayesian generalized-least squares regression was performed for Arkansas, Louisiana, and parts of Missouri and Oklahoma. The newly developed constant regional skew of -0.17 was used in the computation of annual exceedance probability discharges for 281 streamgages used in the regional regression analysis. Based on analysis of covariance, four flood regions were identified for use in the generation of regional regression models. Thirty-nine basin characteristics were considered as potential explanatory variables, and ordinary least-squares regression techniques were used to determine the optimum combinations of basin characteristics for each of the four regions. Basin characteristics in candidate models were evaluated based on multicollinearity with other basin characteristics (variance inflation factor < 2.5) and statistical significance at the 95-percent confidence level ($p \leq 0.05$). Generalized least-squares regression was used to develop the final regression models for each flood region. Average standard errors of prediction of the generalized least-squares models ranged from 32.76 to 59.53 percent, with the largest range in flood region D. Pseudo coefficients of determination of the generalized least-squares models ranged from 90.29 to 97.28 percent, with the largest range also in flood region D. The regional regression equations apply only to locations on streams in Arkansas where annual peak discharges are not substantially affected by regulation, diversion, channelization, backwater, or urbanization. The applicability and accuracy of the regional regression equations depend on the basin characteristics measured for an ungaged location on a stream being within range of those used to develop the equations.

Introduction

The development of reliable estimates of the magnitude and frequency of floods is one of the most common uses of annual peak-discharge data. The safe and economical design of bridges, culverts, dams, levees, and other structures on or near streams, the effective management of flood plains, and flood insurance rates are all dependent upon these estimates. In Arkansas, streamflow-gaging stations (hereafter referred to as “streamgages”) operated by the U.S. Geological Survey (USGS) and the U.S. Army Corps of Engineers (USACE), Little Rock District, are the primary sources of long-term, annual peak-discharge data. Because such long-term data are available for relatively few locations, accurate and easy-to-use methods are needed to estimate annual exceedance probability discharges (AEPDs) for ungaged locations on streams. Multiple linear regression analyses are used to statistically relate AEPDs, which are computed using annual peak-discharge data from streamgages, to physical, climatic, and land-use characteristics of the associated stream basins; a set of equations is developed from these relations that can then be used to estimate AEPDs for ungaged locations on streams having basin characteristics within the range used to develop the equations.

Since the publication of the last flood-frequency report for Arkansas (Hodge and Tasker, 1995), 20 years of additional annual peak-discharge data have been collected, and a number of improvements associated with data analyses have been made. More geospatial data are available for computing basin characteristics—Bayesian weighted least-squares/Bayesian generalized least-squares regression (Veilleux, 2009, 2011; Veilleux and others, 2011, 2012) is available for revision of the generalized (regional) skew map from Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) and the Expected Moments Algorithm (Cohn and others, 1997, 2001) has been developed to estimate AEPDs. In addition,

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AEPDs for dams and streamgages operated by the USACE and USGS, respectively, on rivers with substantial regulation and large rivers with drainage areas greater than 3,000 square miles (mi^2) have not been officially updated in nearly 30 years (Neely, 1987). The USGS, in cooperation with the Arkansas State Highway and Transportation Department (AHTD) and USACE, in 2013 initiated a study to update the regional skew, AEPDs, and regression equations using recent geospatial data, new analytical methods, and available annual peak-discharge data through the 2013 water year (a water year being the period of October 1 through September 30 designated by the calendar year in which it ends).

Purpose and Scope

The purposes of this report are (1) to present regression equations for each of four flood regions that can be used to estimate AEPDs for ungaged streams in Arkansas based upon physical, climatic, and land-use characteristics of their drainage basins and (2) to present the 50-, 20-, 10-, 4-, 2-, 1-, and 0.2-percent AEPDs (hereafter referred to as the "$Q_{50\text{-percent }(\%)}$," "$Q_{20\%}$," "$Q_{10\%}$," "$Q_{4\%}$," "$Q_{2\%}$," "$Q_{1\%}$," and "$Q_{0.2\%}$," respectively) for 281 streamgages used in the development of the regression equations (fig. 1). These seven statistics are equivalent to annual recurrence intervals of 2, 5, 10, 25, 50, 100, and 500 years, respectively. The methods used in site selection, computation of AEPDs, and development of the regression equations and accuracy, limitations, and applications of the regression equations are also presented. Data used in support of this report are available from the USGS National Water Information System (http://waterdata.usgs.gov/nwis).

An analysis of regional skew using Bayesian weighted least-squares/Bayesian generalized-least squares regression (hereafter referred to as "B-WLS/B-GLS") (Veilleux, 2009, 2011; Veilleux and others, 2011, 2012) was performed by the USGS Office of Surface Water for Arkansas, Louisiana, and parts of southern Missouri and eastern Oklahoma using annual peak-discharge records from 210 streamgages (app. 1). The constant regional skew of -0.17 was used in the computation of AEPDs for streamgages that were used in the regional regression analysis. Data used in support of the regional skew analysis are available from the USGS National Water Information System (http://waterdata.usgs.gov/nwis).

The $Q_{50\%}$, $Q_{20\%}$, $Q_{10\%}$, $Q_{4\%}$, $Q_{2\%}$, and $Q_{1\%}$ were computed for 15 USACE dams and 21 streamgages operated by the USGS that serve as regulation control points (RCPs) in the White, Arkansas, and Red River Basins in Arkansas (app. 2). Data used in support of the computation of AEPDs for USACE dams and RCPs are available from the USGS National Water Information System (http://waterdata.usgs.gov/nwis) and the USACE Little Rock District (http://www.swl.usace.army.mil). The AEPDs for USACE dams and RCPs in the Saint Francis and Upper Ouachita River Basins were not computed; AEPDs for streamgages operated by the USGS in the Saint Francis River Basin, computed using annual peak-discharges through the 2011 water year, were published in a recent report (Westerman and others, 2013), and data necessary to compute AEPDs for USACE dams and RCPs in the Ouachita River Basin were not available from USACE, Vicksburg District, which provides AEPDs on an as-needed basis.

Description of Study Area

The study area includes the State of Arkansas and parts of Louisiana, Missouri, and Oklahoma (fig. 2). The area is characterized by diverse topography and contains parts of six physiographic sections: the Springfield-Salem Plateaus, Boston Mountains, Arkansas Valley, Ouachita Mountains, West Gulf Coastal Plain, and Mississippi Alluvial Plain. Physiographic sections in the northwestern part of the State are rugged, with elevations greater than 2,500 feet (ft) found in the Boston and Ouachita Mountains and Arkansas Valley, but those in the southeastern part of the State are relatively flat; elevations in the Mississippi Alluvial Plain and West Gulf Coastal Plain range from 56 to 500 ft (Hodge and Tasker, 1995). Streams in the Ozark Plateaus province (which includes the Springfield-Salem Plateaus and Boston Mountains sections) and the southern half of the Ouachita Mountains section tend to have sustained flows during dry seasons, whereas streams in the Arkansas Valley and the northern half of the Ouachita Mountains generally go dry (Hunrichs, 1983).

The climate in Arkansas is mild and moderately humid. For the period 1951–2011, mean annual precipitation for the State was 49.8 inches (in.), ranging from 44 in. in the Springfield-Salem Plateaus near the Missouri State line and the Arkansas Valley near the Oklahoma State line to 64 in. in the Ouachita Mountains (Pugh and Westerman, 2014). For the same period, mean total annual runoff for the State was 17.8 in., ranging from 13 in. in the Springfield-Salem Plateaus to 26 in. in the Ouachita Mountains.

Previous Investigations

This is the fourth in a series of reports that have used linear regression techniques to relate flood quantiles of Arkansas streams to basin characteristics. The first (Patterson, 1971) presented AEPDs for 154 continuous-record streamgages and 105 crest-stage gages (CSGs) with 5 or more years of record using annual peak-discharge data through the 1968 water year. Eight basin characteristics were measured for each streamgage. Using 252 of the 259 streamgages having drainage areas less than 3,000 mi^2, Patterson defined two flood regions for Arkansas: (1) region A included most of the Mississippi Alluvial Plain in Arkansas, and (2) region B included the rest of the State.

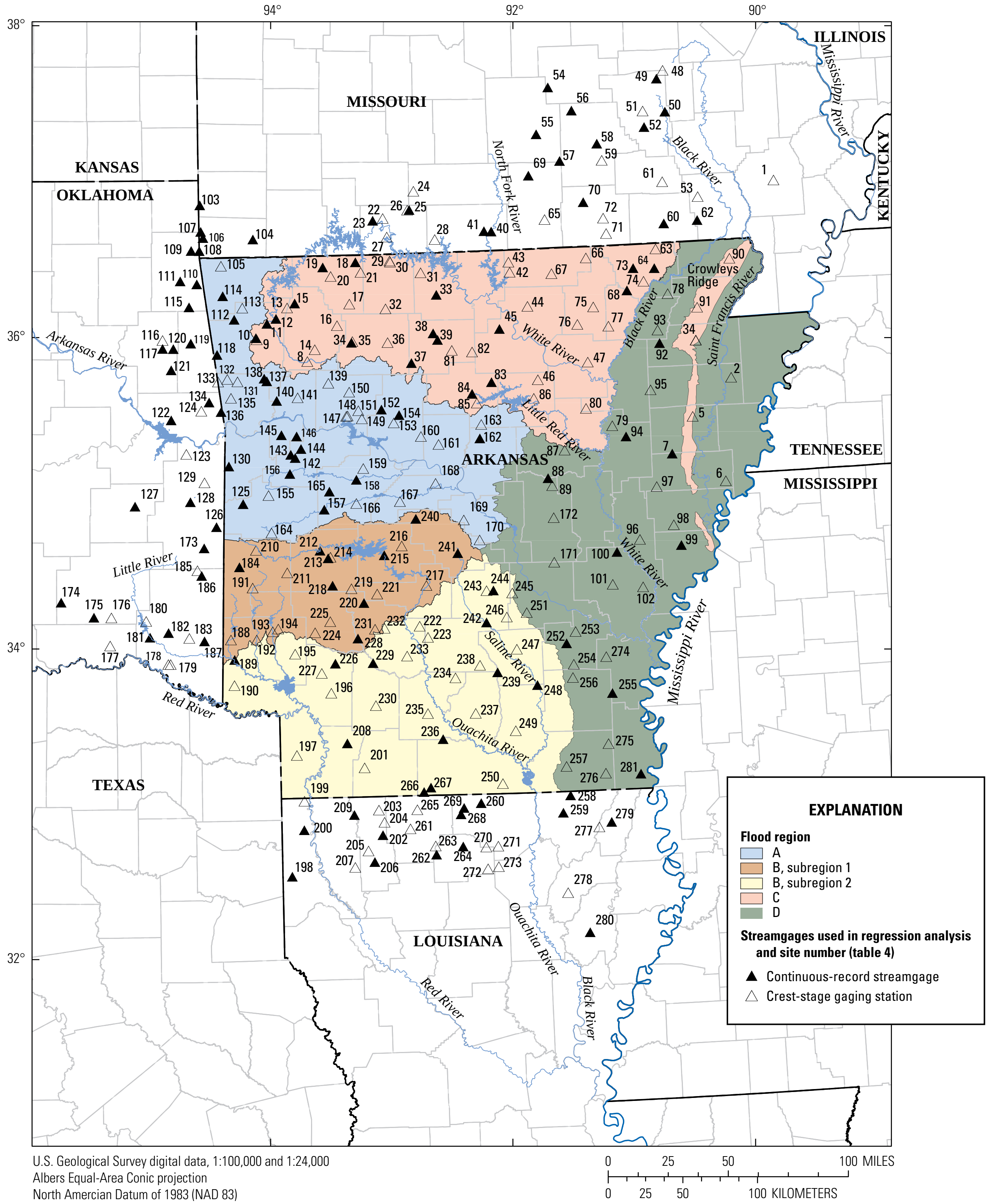


Figure 1. Flood regions in Arkansas and U.S. Geological Survey streamgages on unregulated streams in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.

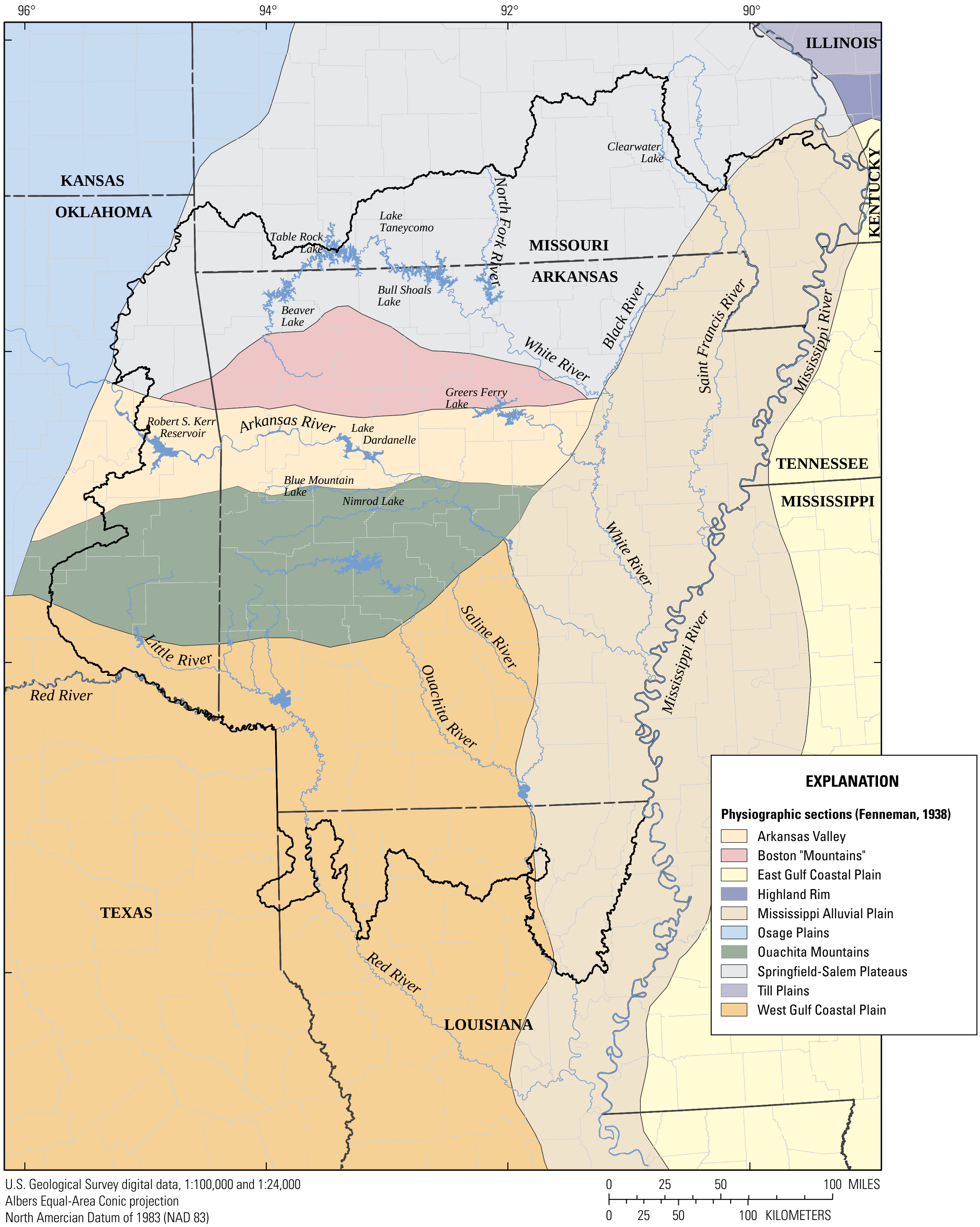


Figure 2. Location of the study area and physiographic sections in Arkansas and the surrounding region.

The second report (Neely, 1987) presented AEPDs for 160 continuous-record streamgages and 94 CSGs having 10 or more years of annual peak-discharge data through the 1984 water year. Five basin characteristics were measured for each streamgage. The two flood regions from the previous report (Patterson, 1971) and 200 of the 254 streamgages that were free of substantial regulation and had drainage areas less than 3,000 mi^2 were used. Neely also presented methods for computing flood frequency for ungaged streams in urban areas from a nationwide urban flood frequency report (Sauer and others, 1983) and presented an alternate procedure for computing flood frequency for sites on ungaged streams using the hydraulic radius as one of the basin characteristics.

The third report (Hodge and Tasker, 1995) presented AEPDs for 97 continuous-record and 107 CSGs having 10 or more years of annual peak-discharge data through the 1993 water year. Five basin characteristics were measured for each streamgage. Based on analysis of covariance, Hodge and Tasker defined four flood regions using the 204 streamgages that were free of substantial regulation and had drainage areas less than 3,000 mi^2. These regions differed from those used in the two previous reports in that they were bounded mostly by major river basin divides. The final equations were generated using estimated generalized-least-squares (EGLS) regression techniques, which improved upon ordinary-least-squares regression techniques used by Patterson (1971) and Neely (1987) because EGLS regression accounts for differences in sampling errors in the observed flow records resulting from differing record lengths and for sample cross correlation of annual peak discharges between streamgages. Hodge and Tasker also presented the region of influence method, which was found to produce better overall results (by comparison of root mean square error of the method with that of the regional regression equation method) than the regional regression equations for 3 of the 4 regions.

Methods

Selection of Streamgages Used in Development of Regional Regression Equations

To develop the regional regression equations (hereafter referred to as “RREs”), data from streamgages operated by the USGS in Arkansas with a minimum of 10 years of annual peak-discharge record through the 2013 water year were considered. To improve the applicability of the regression equations in areas near the Arkansas border, streamgages in parts of northern Louisiana, southern Missouri, and eastern Oklahoma with a minimum of 10 years of annual peak-discharge record through the 2013 water year were also considered. Candidate streamgages were screened for anthropogenic effects such as regulation, diversion, channelization, or urbanization in their basins, redundancy between gages, and for statistically significant ($p \leq 0.05$) trends in their annual peak discharge records.

Candidate streamgages for which 10 percent or more of their associated drainage basins were impounded and that had at least 100 acre-feet per square mile (acre-ft/mi^2) of flood storage capacity in the basins (Benson, 1963) were considered to be affected by regulation and not used in the development of the regression equations, except for four that had 10 or more years of preregulation annual peak discharges. Because large rivers such as the Mississippi, Arkansas, Red, White, Black, Saint Francis, and Ouachita Rivers have floodflow characteristics that differ from those of smaller tributary streams (Neely, 1987; Hodge and Tasker, 1995), three streamgages on the Black River—07069000, Black River at Pocahontas, Ark.; 07072500, Black River at Black Rock, Ark.; and 07074420, Black River at Elgin Ferry, Ark.—that did not meet the criteria for regulation but had drainage areas greater than 3,000 mi^2 were removed from the dataset.

Candidate streamgages were screened for urbanization, channelization, and diversion. Thirty-five streamgages with greater than 5 percent impervious surface in their associated basins (Xian and others, 2011) were considered urbanized and removed from the dataset (table 1). One streamgage, 07046600, Right hand chute of Little River at Rivervale, Ark., was removed for extensive channelization and diversion.

Candidate streamgages were screened for redundancy, which occurs when the drainage basin of one streamgage is contained inside the basin of another (that is, nested), and the two basins are of similar size. Instead of providing two independent spatial observations that depict how drainage basin characteristics are related to AEPDs, the two basins will have the same hydrologic response to a given storm, and thus represent only one spatial observation. When pairs of streamgages in basins are redundant, a statistical analysis using both streamgages incorrectly represents the information in the regional dataset (Gruber and Stedinger, 2008). To determine if two streamgages were redundant and thus represented the same hydrologic conditions, two types of information were considered: (1) the standardized distance between nested streamgages, and (2) the ratio of the basin drainage areas. The standardized distance between the centroids of the basins is defined as

$$SD_{ij} = \frac{D_{ij}}{\sqrt{0.5\left(DRNAREA_i + DRNAREA_j\right)}} \tag{1}$$

where

SD_{ij} is the standardized distance between centroids of basin *i* and basin *j*, unitless;

D_{ij} is the distance between centroids of basin *i* and basin *j*, in miles;

$DRNAREA_i$ is the geographic information system (GIS)-derived drainage area at site *i*, in square miles; and

$DRNAREA_j$ is the GIS-derived drainage area at site *j*, in square miles.

Table 1. U.S. Geological Survey streamgages in study area having greater than a 5-percent impervious surface in their associated basins that were not used in the regional regression analysis.

[USGS, U.S. Geological Survey; No., number; AR, Arkansas; trib, tributary; Hwy, Highway; MO, Missouri; St, Street; OK, Oklahoma; Ck, Creek; nr, near; LA, Louisiana]

USGS streamgage number	USGS streamgage name[1]	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Basin covered by impervious surface (percent)[2]
07046530	Ditch No. 42 at Hickman, AR	35.95396277	-89.73313610	37.20
07047860	Higginbotham Creek at Jonesboro, AR	35.81340857	-90.70816800	28.42
070479475	Spring Creek near Palestine, AR	35.01564720	-90.79288990	7.97
07048480	College Branch at MLK Blvd at Fayetteville, AR	36.05694444	-94.17611110	34.19
07048490	Town Branch trib at Hwy 16 at Fayetteville, AR	36.04833330	-94.16222220	38.48
07057300	Dodd Creek tributary near Mountain Home, AR	36.31812297	-92.40043730	7.20
07060670	Hughes Creek near Mountain View, AR	35.86285220	-92.14654160	5.97
07063200	Pike Creek tributary near Poplar Bluff, MO	36.78394356	-90.43177850	33.59
07076630	Key Branch near Searcy, AR	35.24647378	-91.78375020	5.57
07077655	Christian Creek at GE Drive at Jonesboro, AR	35.84146347	-90.72594640	17.19
07194809	Niokaska Creek at Township St at Fayetteville, AR	36.08472220	-94.13472220	13.47
07194880	Osage Creek near Cave Springs, AR	36.28146620	-94.22798380	23.72
07195000	Osage Creek near Elm Springs, AR	36.22194444	-94.28833330	13.07
07195400	Illinois River at Hwy. 16 near Siloam Springs, AR	36.14472220	-94.49472220	6.24
07195430	Illinois River South of Siloam Springs, AR	36.10861110	-94.53333330	5.67
07195500	Illinois River near Watts, OK	36.13008185	-94.57216450	5.24
07195865	Sager Creek near West Siloam Springs, OK	36.20174844	-94.60522070	11.83
07249447	Mill Creek at Fort Smith, AR	35.34286994	-94.42243740	35.17
07249457	May Branch at Free Ferry Road at Fort Smith, AR	35.37509115	-94.39771420	25.29
07263580	Rock Creek at 36th Street at Little Rock, AR	34.72416667	-92.35888890	7.13
07263590	Coleman Creek at Little Rock, AR	34.75203637	-92.33404100	40.25
07263910	Cypress Branch near Jacksonville, AR	34.90786680	-92.18209260	28.68
07264000	Bayou Meto near Lonoke, AR	34.73666667	-91.91583330	5.95
07264050	Bayou Two Prairie near Furlow, AR	34.85897810	-91.98014210	5.39
07340530	Mill Slough tributary near Lockesburg, AR	33.96789314	-94.19047670	6.46
07344280	Nix Creek at east 12th street at Texarkana, AR	33.43456949	-94.02602090	31.46
07346800	East Fork Kelley Bayou tributary at Kiblah, AR	33.04930020	-93.89573490	6.80
07348630	Barlow Branch tributary near McNeil, AR	33.31234868	-93.23127870	22.81
07348635	Big Creek tributary at Magnolia, AR	33.26429486	-93.23238950	51.73
07357860	Stokes Creek at Kimery Road at Hot Springs, AR	34.47675620	-93.08129130	30.82
07363050	Holly Creek tributary near Benton, AR	34.53453767	-92.55349350	8.03
07364125	Cane Creek at Star City, AR	33.95510130	-91.84291130	5.27
07364550	Caney Creek tributary near El Dorado, AR	33.18957456	-92.60793120	16.98
07365100	Cypress Ck nr Unionville, LA	32.65986817	-92.58764800	6.25
07365400	Middle Fk Bayou D’Arbonne trib nr Bernice, LA	32.81403314	-92.69598609	6.12

[1]Station names have been modified from U.S. Geological Survey National Water Information System (NWIS).

[2]Data from National Land Cover Database, 2011.

The drainage area ratio (DAR) was used to determine if two nested basins are sufficiently similar in size to conclude they are essentially the same basin for the purposes of developing a regional hydrologic model (Veilleux, 2009). If the DAR is large enough, even if a pair of streamgages is nested, they will reflect different hydrologic responses because storms of different sizes and durations will affect each streamgage differently. The DAR is defined as

$$DAR = Max\left[\frac{DRNAREA_i}{DRNAREA_j}, \frac{DRNAREA_j}{DRNAREA_i}\right] \quad (2)$$

where

DAR is the Max (maximum) of the two values in brackets,

$DRNAREA_i$ is the GIS-derived drainage area at site i, and

$DRNAREA_j$ is the GIS-derived drainage area at site j.

For this study, 45 pairs of streamgages having SD less than or equal to 0.50 and DAR less than or equal to 5 (Gruber and Stedinger, 2008) were considered to be redundant. One streamgage from each pair was removed from the dataset based on the length and quality of the annual peak discharge records and hydrologic judgement (table 2).

Annual peak-discharge records of candidate streamgages were analyzed for trends using the Mann-Kendall test, which has been included in version 7.0 and later of the PeakFQ program (Veilleux and others, 2014). Trends in the annual peak-discharge record could bias the AEP analyses because an assumption of probability analyses is that annual peak discharges are independent and stationary with time. The Mann-Kendall test for Kendall's tau computes the monotonic relation between peak discharge and time (water years) (Helsel and Hirsch, 2002). Statistically significant ($p \leq 0.05$) trends were detected in the annual peak-discharge records of 22 stations. Because the results of the test are sensitive to multiyear sequences of larger or smaller annual peak discharges if they occur near the beginning or end of the period of record used in the test, stations with statistically significant trends were retested after removing as much as 5 percent of the annual peak-discharge record from the beginning or end of the record, or a combination of the two, based on the assumption that if a significant trend was not identified using 95 percent of the record, then there probably is no trend (Eash and others, 2013). After retesting, 8 of the 22 stations did not indicate a statistically significant trend in 95 percent of the annual peak-discharge record. The remaining 14 stations that still showed a significant trend in their annual peak-discharge record were not considered for use in the development of the RREs (table 3).

Selection and Determination of Basin Characteristics

The physical processes controlling floods vary from one stream to another and from one flood region to another but are generally related to precipitation intensity and drainage area. The peak discharge of a given stream is a function of many interrelated factors, including surficial geology, soil type, and land cover; routing of the flood related to basin shape, channel length, and slope; and surface storage in wetlands, lakes, and flood plains (Eash and others, 2013). Basin characteristics considered as potential explanatory variables in the regression analysis were selected on the basis of their theoretical relation to peak discharges, results of previous flood frequency studies in Arkansas and other similar hydrologic areas, the ability to quantify the basin characteristics using GIS, and the availability of digital datasets. Thirty-nine basin characteristics were measured for streamgages that were evaluated for use in the development of the regression equations (app. 3). The names of basin characteristics (available at http://streamstatsags.cr.usgs.gov/ss_defs/basin_char_defs.aspx) used in this study were selected to maintain consistency with those used in the USGS StreamStats Web-based GIS tool (Ries, 2002; Ries and others, 2004, 2008). The basin characteristics used in this study can be separated into three categories: morphometric (physical or shape), climatic/hydrologic, and soils and land use/land cover.

Morphometric characteristics used to delineate accurate stream networks and basin boundaries were derived from two primary GIS layers: (1) the 1:24,000-scale USGS National Hydrography Dataset (NHD) (http://nhd.usgs.gov/; Simley and Carswell, 2009), and (2) the 10-meter USGS National Elevation Dataset (NED) (http://ned.usgs.gov/; Gesch and others, 2009). From these layers, the drainage area; length and slope of the longest flow path; relief; and the maximum, minimum, and mean elevations were computed for each stream basin. The basin shape factor, computed as the ratio of the square of the length of the longest flow path to the drainage area of the basin, affects the magnitude and arrival time of a peak discharge; a basin with an elongated shape will have a longer duration hydrograph and lower peak discharge than a circular basin (Southard and Veilleux, 2014). Processing of the GIS layers that is needed to facilitate determination of basin characteristics was performed using Arc Hydro Tools, version 2.0, a set of utilities developed to operate in the ArcGIS, version 10.3.1, environment (Esri, 2009) and is described in detail by Eash and others (2013).

Mean annual precipitation for the period 1971–2000 was averaged by basin using coverages developed from Parameter-Elevation Regressions on Independent Slopes Model (PRISM) data (PRISM Climate Group, 2013; Pugh and Westerman, 2014). The 10-year recurrence interval, 24-hour duration precipitation was averaged by basin using the annual maximum series of the National Oceanic Atmospheric Administration (NOAA) Atlas 14 precipitation frequency estimates (National Oceanic Atmospheric Administration, 2014; available at http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_gis.html). A mosaic of volumes 8 (Midwestern States) and 9 (Southeastern States) of Atlas 14 was created using ArcGIS and clipped to the study area boundary.

Table 2. U.S. Geological Survey streamgages in the study area that were not used in the regional regression analysis because of redundancy with other streamgages.

[USGS, U.S. Geological Survey; GIS, geographic information system; mi^2, square mile; AR, Arkansas; MO, Missouri; nr, near; OK, Oklahoma; blw, below; LA, Louisiana; Byu, Bayou; Ck, Creek; >, greater than; mi, mile]

Redundant streamgage (not used in regional regression analyses)							
USGS streamgage number	USGS streamgage name[1]	GIS-derived drainage area (mi^2)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Latitude of basin centroid (decimal degrees)	Longitude of basin centroid (decimal degrees)
07047950	L'Anguille River at Palestine, AR	788	34.97277778	-90.88555560	35.34565250	-90.86433758
07048550	West Fork White River east of Fayetteville, AR	123	36.05388889	-94.08305560	35.93103059	-94.14392251
07050000	White River at Beaver, AR	1,250	36.47229276	-93.76547210	36.07694655	-93.89666290
07056700	Buffalo River near Harriet, AR	1,070	36.06777778	-92.57750000	35.93884726	-93.02234514
07058500	North Fork River at Tecumseh, MO	1,160	36.58761110	-92.28885560	36.86744067	-92.27218063
07062500	Black River at Leeper, MO	991	37.05872220	-90.68700000	37.38312858	-90.93753497
07063000	Black River at Poplar Bluff, MO	1,250	36.75958330	-90.38811110	37.29264079	-90.86653497
07064000	Black River at Corning, AR	1,750	36.40194000	-90.54139000	37.12967794	-90.74190769
07065495	Jacks Fork at Alley Spring, MO	304	37.14816667	-91.44308330	37.08526909	-91.72884899
07066500	Current River near Eminence, MO	1,280	37.18393686	-91.25846540	37.26536994	-91.57256450
07067000	Current River at Van Buren, MO	1,670	36.99138889	-91.01350000	37.22199900	-91.47619027
07069220	Spring River near Mammoth Springs, AR	260	36.46034098	-91.52680730	36.64806315	-91.65580033
07069305	Spring River at Town Branch Bridge at Hardy, AR	845	36.31361110	-91.48277780	36.52017159	-91.70531111
07071500	Eleven Point River near Bardley, MO	784	36.64869444	-91.20083330	36.85449646	-91.54257086
07073000	Strawberry River near Evening Shade, AR	215	36.09895876	-91.60847400	36.23083299	-91.80643705
07073500	Piney Fork at Evening Shade, AR	99.8	36.08062574	-91.61097390	36.08273569	-91.76355462
07075500	South Fork Little Red River nr Clinton, AR	317	35.56674428	-92.38348990	35.62808341	-92.60972322
07076000	Little Red River near Heber Springs, AR	1,150	35.51722220	-91.99722220	35.67199407	-92.37517748
07077100	Big Creek near Boydsville, AR	1.72	36.37006107	-90.33065850	36.39511530	-90.33570074
07077555	Cache River near Cotton Plant, AR	1,160	35.03555556	-91.32250000	35.92303385	-90.82354560
07188885	Indian Creek near Lanagan, MO	238	36.59927778	-94.44963890	36.74566198	-94.25199096
07191160	Spavinaw Creek near Maysville, AR	88.8	36.36452259	-94.55132990	36.37916379	-94.41709868
07191179	Spavinaw Creek near Cherokee City, AR	103	36.34202350	-94.58772000	36.37359540	-94.42982834
071912213	Spavinaw Creek near Colcord, OK	162	36.32000000	-94.68522380	36.35234212	-94.49326495
07198000	Illinois River near Gore, OK	1,620	35.57000000	-95.06884580	36.01078507	-94.57369306
07249300	James Fork near Midland, AR	43.8	35.07426365	-94.33910330	35.01260692	-94.34483046
07249800	Lee Creek at Short, OK	147	35.56000000	-94.53194440	35.73858311	-94.35110650
07250935	Jones Creek at Winfrey, AR	20.5	35.73583330	-94.10305560	35.78603594	-94.07325248
07261250	Cadron Creek West of Conway, AR	756	35.11472220	-92.52472220	35.30124618	-92.32718609
07338500	Little River blw Lukfata Creek, nr Idabel, OK	1,230	33.94000000	-94.75854820	34.29907719	-95.01659738
07341200	Saline River near Lockesburg, AR	253	33.96222220	-94.06166670	34.15390600	-94.03531000
07346450	Black Bayou at Rodessa, LA	180	32.95921200	-93.99392300	33.07283136	-94.10735992
07346500	Black Byu nr Hosston, LA	235	32.88203900	-93.89706900	33.03712371	-94.07187760
07347000	Kelly Byu nr Hosston, LA	103	32.85770200	-93.86972000	33.03249264	-93.90900793
07348700	Bayou Dorcheat near Springhill, LA	580	32.99391500	-93.39622700	33.27590241	-93.33244107
07348720	Byu Dorcheat nr Sarepta, LA	701	32.92350200	-93.37372900	33.23279387	-93.32051783
07348740	Byu Dorcheat nr Cotton Valley, LA	793	32.84365800	-93.35400600	33.19690418	-93.32069895
07359700	Caddo River at Glenwood, AR	202	34.32140556	-93.55289170	34.41528459	-93.69399046
07361000	Little Missouri River near Murfreesboro, AR	382	34.04872059	-93.72018250	34.23536607	-93.82356789
07363400	Hurricane Creek below Sheridan, AR	262	34.22861110	-92.37250000	34.43483903	-92.37533919
07364133	Bayou Bartholomew at Garrett Bridge, AR	401	33.86638889	-91.65611110	34.07880848	-91.88813420
07364185	Bayou Bartholomew near Portland, AR	1,140	33.23555556	-91.53555560	33.77031635	-91.72220873
07364190	Bayou Bartholomew at Wilmot, AR	1,170	33.07095765	-91.57789870	33.75413513	-91.71789747
07364740	Byu De Loutre nr Farmerville, LA	241	32.87384800	-92.39430500	33.05672680	-92.53137609
07367680	Boeuf River near Eudora, AR	571	33.12416667	-91.34777780	33.63441337	-91.46051552

Table 2. U.S. Geological Survey streamgages in the study area that were not used in the regional regression analysis because of redundancy with other streamgages.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square mile; AR, Arkansas; MO, Missouri; nr, near; OK, Oklahoma; blw, below; LA, Louisiana; Byu, Bayou; Ck, Creek; >, greater than; mi, mile]

Retained streamgage (used in regional regression analyses)				Redundancy screening values			
USGS streamgage number	GIS-derived drainage area (mi^2)	Latitude of basin centroid (decimal degrees)	Longitude of basin centroid (decimal degrees)	Distance between basin centroids (mi)	Standardized distance	Drainage area ratio	Comments
07047942	534	35.43911194	-90.82199833	6.66	0.26	1.48	Occasionally experiences backwater from the Saint Francis and Mississippi Rivers; used upstream gage 07047942, L'Anguille River at Colt, AR
07048000	83	35.88462158	-94.14261988	3.46	0.34	1.48	Discontinued upstream gage 07048000, West Fork White River near Greenland, AR has longer period of record
07048600	399	35.89192523	-93.98410662	13.36	0.47	3.13	Discontinued streamgage; active upstream gage 07048600, White River near Fayetteville, AR has longer period of record
07056000	828	35.93049777	-93.11611382	5.25	0.17	1.29	Upstream gage 07056000, Buffalo River near St. Joe, AR has longer period of record
07057500	562	36.85712320	-92.10873699	9.06	0.31	2.06	Discontinued streamgage; active upstream gage 07057500, North Fork River near Tecumseh, MO has longer period of record
07061500	492	37.33877453	-90.79012754	8.80	0.32	2.01	Located on regulated reach of Black River; upstream gage 07061500, Black River near Annapolis, MO is located on unregulated reach of Black River and has longer period of record
07061500	492	37.33877453	-90.79012754	5.03	0.17	2.54	Located on regulated reach of Black River; upstream gage 07061500, Black River near Annapolis, MO is located on unregulated reach of Black River and has longer period of record
07061500	492	37.33877453	-90.79012754	14.75	0.44	3.56	Located on regulated reach of Black River; upstream gage 07061500, Black River near Annapolis, MO is located on unregulated reach of Black River and has longer period of record
07066000	404	37.09368450	-91.65445319	4.16	0.22	1.33	Downstream gage 07066000, Jacks Fork near Eminence, MO has longer period of record
07068000	2,050	37.14957614	-91.38541153	13.22	0.32	1.60	Discontinued streamgage; active downstream gage 07068000, Current River near Doniphan, MO has longer period of record
07068000	2,050	37.14957614	-91.38541153	7.45	0.17	1.23	Downstream gage 07068000, Current River near Doniphan, MO has period of record of similar length and is one of few on unregulated streams with drainage area >2,000 mi²
07069500	1,160	36.46806664	-91.60521146	12.75	0.48	4.46	Downstream gage 07069500, Spring River at Imboden, AR has longer period of record
07069500	1,160	36.46806664	-91.60521146	6.94	0.22	1.37	Downstream gage 07069500, Spring River at Imboden, AR has longer period of record
07072000	1,120	36.76629959	-91.45990070	7.72	0.25	1.43	Downstream gage 07072000, Eleven Point River near Ravenden Springs, AR has period of record of similar length

Table 2. U.S. Geological Survey streamgages in the study area that were not used in the regional regression analysis because of redundancy with other streamgages.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square mile; AR, Arkansas; MO, Missouri; nr, near; OK, Oklahoma; blw, below; LA, Louisiana; Byu, Bayou; Ck, Creek; >, greater than; mi, mile]

Retained streamgage (used in regional regression analyses)				Redundancy screening values			
USGS streamgage number	GIS-derived drainage area (mi²)	Latitude of basin centroid (decimal degrees)	Longitude of basin centroid (decimal degrees)	Distance between basin centroids (mi)	Standardized distance	Drainage area ratio	Comments
07074000	473	36.17279050	-91.71577445	6.54	0.35	2.20	Discontinued streamgage; active downstream gage 07074000, Strawberry River near Poughkeepsie, AR has longer period of record
07074000	473	36.17279050	-91.71577445	6.77	0.40	4.74	Discontinued streamgage; active downstream gage 07074000, Strawberry River near Poughkeepsie, AR has longer period of record
07075300	148	35.58058123	-92.65214622	3.65	0.24	2.14	Discontinued streamgage; active upstream gage 07075300, South Fork of Little Red River at Clinton, AR has longer period of record
07075000	302	35.77201977	-92.49576117	9.67	0.36	3.81	Discontinued streamgage; active streamgage 07075000 on upstream tributary Middle Fork of Little Red River at Shirley, AR has longer period of record
07077200	1.57	36.39699088	-90.33615710	0.03	0.02	1.10	Streamgage 07077200, Big Creek tributary near Boydsville, AR has longer period of record and a smaller gap in the 1980s
07077500	1,030	36.01439332	-90.76454083	7.04	0.21	1.13	Upstream gage 07077500, Cache River at Patterson, AR has longer period of record
07189000	853	36.59443513	-94.23578375	10.40	0.45	3.58	Streamgage 07189000, Elk River near Tiff City, MO has longer period of record
07191220	132	36.36258676	-94.45915211	2.44	0.23	1.49	Downstream gage 07191220, Spavinaw Creek near Sycamore, OK has longer period of record
07191220	132	36.36258676	-94.45915211	1.77	0.16	1.28	Downstream gage 07191220, Spavinaw Creek near Sycamore, OK has longer period of record
07191220	132	36.36258676	-94.45915211	2.02	0.17	1.23	Upstream gage 07191220, Spavinaw Creek near Sycamore, OK has longer period of record
07196500	950	36.12733844	-94.45073927	10.24	0.29	1.71	Located on regulated reach of Illinois River; upstream gage 07196500, Illinois River near Tahlequah, OK has longer period of record
07249400	147	35.07711043	-94.31486969	4.48	0.46	3.36	Discontinued streamgage; active downstream gage 07249400, James Fork near Hackett, AR has longer period of record
07249985	434	35.68611827	-94.43492616	5.84	0.32	2.95	Downstream gage 07249985, Lee Creek near Short, OK has longer period of record
07250965	55.7	35.76885262	-94.03132104	2.73	0.44	2.72	Used downstream gage 07250965, Frog Bayou at Winfrey, AR
07261000	172	35.42069117	-92.25086253	9.34	0.43	4.40	Upstream gage 07261000, Cadron Creek near Guy, AR has longer period of record

Table 2. U.S. Geological Survey streamgages in the study area that were not used in the regional regression analysis because of redundancy with other streamgages.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square mile; AR, Arkansas; MO, Missouri; nr, near; OK, Oklahoma; blw, below; LA, Louisiana; Byu, Bayou; Ck, Creek; >, greater than; mi, mile]

Retained streamgage (used in regional regression analyses)				Redundancy screening values			
USGS streamgage number	GIS-derived drainage area (mi^2)	Latitude of basin centroid (decimal degrees)	Longitude of basin centroid (decimal degrees)	Distance between basin centroids (mi)	Standardized distance	Drainage area ratio	Comments
07337500	648	34.37908588	-95.11705130	7.96	0.26	1.90	Located on regulated reach of Little River; upstream gage 07337500, Little River near Wright City, OK has a longer period of pre-regulation record
07341000	120	34.23608521	-94.04466025	5.74	0.42	2.11	Located on regulated reach of Saline River; upstream gage 07341000, Saline River near Dierks, AR has longer period of pre-regulation record
07347500	369	33.02133529	-94.00948920	6.64	0.40	2.05	Downstream gage 07347500, Black Bayou nr Gilliam, LA has longer period of record
07347500	369	33.02133529	-94.00948920	3.68	0.21	1.57	Downstream gage 07347500, Black Bayou nr Gilliam, LA has longer period of record
07347500	369	33.02133529	-94.00948920	5.86	0.38	3.58	Downstream gage 07347500, Black Bayou nr Gilliam, LA has longer period of record
07349000	1,087	33.08429182	-93.31001031	13.19	0.46	1.87	Redundant with streamgage 07349000, Bayou Dorcheat near Minden, LA, that has longer period of record
07349000	1,087	33.08429182	-93.31001031	10.38	0.35	1.55	Redundant with streamgage 07349000, Bayou Dorcheat near Minden, LA, that has longer period of record
07349000	1,087	33.08429182	-93.31001031	7.63	0.25	1.37	Redundant with streamgage 07349000, Bayou Dorcheat near Minden, LA, that has longer period of record
07359610	132	34.44383745	-93.70047316	2.11	0.16	1.53	Discontinued streamgage; used active upstream gage 07359610, Caddo River near Caddo Gap, AR
07360800	120	34.13837582	-93.85175324	7.10	0.45	3.18	Streamgage 07360800, Muddy Fork Creek near Murfreesboro, AR has longer period of record
07363300	204	34.47420747	-92.37699613	2.77	0.18	1.28	Discontinued streamgage 07363300, Hurricane Ck nr Sheridan, AR has longer period of record
07364150	608	33.98209665	-91.80049545	7.99	0.36	1.52	Downstream gage 07364150, Bayou Bartholomew at McGehee, AR has longer period of record
07364500	1,620	33.57486274	-91.72730618	13.82	0.37	1.42	Downstream gage 07364500, Bayou Bartholomew near Beekman, LA has longer period of record
07364500	1,620	33.57486274	-91.72730618	12.45	0.33	1.38	Downstream gage 07364500, Bayou Bartholomew near Beekman, LA has longer period of record
07364700	156	33.10215314	-92.58119142	4.50	0.32	1.54	Upstream gage 07364700, Bayou De Loutre nr Laran, LA has longer period of record
07369680	528	33.61341402	-91.29098339	9.85	0.42	1.08	Streamgage 07369680, Bayou Macon near Eudora, AR has longer period of record with fewer gaps

[1]Station names have been modified from U.S. Geological Survey National Water Information System (NWIS).

Table 3. U.S. Geological Survey streamgages in the study area that were not used in the regression analysis because of statistically significant ($p \leq 0.05$) trends in their annual peak-discharge records.

[≤, less than or equal to; USGS, U.S. Geological Survey; ft³/s, cubic feet per second; MO, Missouri; AR, Arkansas; <, less than; no., number; LA, Louisiana; Ck, Creek; Fk, Fork]

USGS streamgage number	USGS streamgage name[1]	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Kendall's tau	*p*-value	Sen slope (ft³/s)
07041000	Little River Ditch 81 near Kennett, MO	36.23654444	-89.98235830	0.252	0.008	19.258
07042000	Little River Ditch 1 near Kennett, MO	36.23644167	-89.98084170	0.260	0.006	43.443
07042500	Little River Ditch 251 near Lilbourn, MO	36.55520000	-89.66988330	0.444	<0.001	57.222
07077700	Bayou DeView near Morton, AR	35.25194444	-91.11194440	-0.336	<0.001	-31.000
07195450	Ballard Creek at Summers, AR	35.97841490	-94.49910700	0.373	0.011	147.833
07263295	Maumelle River at Williams Junction, AR	34.87611110	-92.77444440	0.388	0.009	181.964
07339800	Pepper Creek near DeQueen, AR	34.04566960	-94.30381560	0.400	0.004	79.000
07342350	McKinney Bayou near Garland, AR	33.41290210	-93.80768150	0.368	0.001	72.727
07359710	Rock Creek near Glenwood, AR	34.30954310	-93.53935340	-0.524	0.008	-226.000
07360200	Little Missouri River near Langley, AR	34.31166667	-93.89972220	0.420	0.007	406.000
07362715	Big Creek near Crow, AR	34.61675830	-92.72655490	-0.467	0.013	-150.000
07364830	Bayou D'Arbonne trib. no. 2 near Homer, LA	32.79991800	-93.02120100	-0.600	0.013	-2.600
07364900	Big Ck near Vienna, LA	32.63126500	-92.72474000	-0.606	0.007	-224.000
07365500	Middle Fk Byu D'Arbonne near Bernice, LA	32.76397300	-92.65830300	-0.292	0.025	-114.074

[1]Station names have been modified from U.S. Geological Survey National Water Information System (NWIS).

Soils and land use/land cover characteristics were obtained from three sources. The soil hydrologic group was computed using the Natural Resources Conservation Service (NRCS) State Soil Geographic database (STATSGO) (Schwarz and Alexander, 1995; U.S. Department of Agriculture, 2001). Percentages of urban (developed), forest, vegetation, and open water land-use/land-cover types were computed for each basin using the 2011 National Land Cover Database (NLCD) (Homer and others, 2015; available at http://www.mrlc.gov/nlcd11_data.php). For each basin, the percentages of low, medium, high, and open development and deciduous and evergreen forest were computed. Percentage of impervious surface was computed for each basin using the Preferred NLCD 2011 Percent Developed Imperviousness layer (Xian and others, 2011; available at http://www.mrlc.gov/nlcd11_data.php). Surficial geology was computed from a national coverage of surficial geology by Reed and Bush (2005).

Multicollinearity between basin characteristics was initially evaluated using the cor() function in the USGSwsStats package (Lorenz, 2013) for R (R Core Team, 2014). The function compares all possible pairs of basin characteristics and computes Pearson's correlation coefficients (also known as Pearson's r) for each pair. For pairs of characteristics with a correlation coefficient $0.75 < r < -0.75$, only one of the characteristics was considered for use in the regression analyses.

Annual Exceedance Probability Analyses

An AEP is an estimate of the likelihood of a flood of a specific magnitude happening in any one year (Eash and others, 2013). AEPs have traditionally been reported as flood recurrence intervals expressed in years; for example, because a flood having a 1-percent chance of being exceeded during any particular year (an AEP of 0.01) might be expected to occur, on average, once during any 100-year period (the recurrence interval), a flood having a 1-percent, or 0.01, AEP is commonly referred to as the "100-year flood." However, because of confusion resulting when more than one "100-year flood" occurs in a period of less than 100 years, the scientific and engineering community has, in recent years, begun expressing the likelihood of occurrence of flood discharges as a probability instead of a recurrence interval and that nomenclature is used in this report.

Standard methods for estimating AEPs were established in March 1982 by the U.S. Interagency Committee on Water Data (now the Advisory Committee on Water Information, Subcommittee on Hydrology; see http://acwi.gov/hydrology). The Committee recommended that a log-Pearson Type III (LP3) distribution be fit to the logarithms (base 10) of the annual peak discharges as described in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). The Expected Moments Algorithm (EMA) method for fitting the LP3 distribution to the logarithms of annual peak-discharge data has since been developed by the USGS (Cohn and others, 1997, 2001; Griffis and others, 2004) and used in several flood-frequency studies (Parrett and others, 2010; Eash and others, 2013; Southard and Veilleux, 2014). In 2013, the Hydrologic Frequency Analysis Work Group (HFAWG) of the Advisory Committee on Water Information (ACWI), Subcommittee on Hydrology issued a memorandum recommending revisions to Bulletin 17B, amongst them the adoption of the EMA method for estimating AEPs (Advisory Committee on Water Information, Subcommittee on Hydrology, Hydrologic Frequency Analysis Work Group, written comm., 2013).

In this study, the $Q_{50\%}$, $Q_{20\%}$, $Q_{10\%}$, $Q_{4\%}$, $Q_{2\%}$, $Q_{1\%}$, and $Q_{0.2\%}$ for 281 streamgages on unregulated streams that were used in the regional regression analyses were estimated using EMA, and the $Q_{50\%}$, $Q_{20\%}$, $Q_{10\%}$, $Q_{4\%}$, $Q_{2\%}$, and $Q_{1\%}$ for 15 USACE dams, and 21 USGS-operated streamgages downstream from the dams that are used as RCPs were estimated using either graphical methods or EMA (app. 2). Computations using EMA were facilitated by use of the USGS PeakFQ software package, version 7.1 (Veilleux and others, 2014). Computations using graphical methods were facilitated by use of the USACE Hydrologic Engineering Center's Statistical Software Package (HEC–SSP; U.S. Army Corps of Engineers, 2010).

Bulletin 17B Analysis

In 1982, the U.S. Interagency Advisory Committee on Water Data established standard methods for estimating AEPDs. The methods outlined in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) use a LP3 distribution to compute AEPDs. Fitting the distribution requires computing the mean, standard deviation, and skew coefficient of the logarithms of the annual peak-discharge record, which describes the midpoint, slope and curvature of the annual exceedance-probability curve, respectively (Eash and others, 2013). The estimates of AEPDs were computed using the following equation

$$\log Q_p = \overline{X} + K_p S \qquad (3)$$

where

Q_p is the P-percent AEPD, in cubic feet per second;

$\overline{X}$ is the mean of the logarithms of the annual peak discharges;

K_p is a factor based on the skew coefficient and the given percentage of annual exceedance probability and is obtained from appendix 3 in Bulletin 17B; and

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

Skew Coefficient

The skew coefficient measures the asymmetry of the probability distribution of a set of annual peak discharges, which is strongly affected by the presence of high or low outliers, amongst other factors; large positive station skew coefficients typically result from high outliers and large negative station skew coefficients typically result from low outliers (Southard and Veilleux, 2014). Being sensitive to extreme flood events, the station skew coefficient for short records may not provide an accurate estimate of the population skew coefficient; therefore, the Committee in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) recommends that the skew coefficient calculated from the annual peak discharge record at a streamgage (the station skew) be weighted with a regional skew coefficient (the regional skew) determined from an analysis of selected long-term streamgages in the study area. The weighted skew coefficient (the weighted skew) was determined using the following equation:

$$G_w = \frac{MSE_R\left(G_s\right) + MSE_S\left(G_R\right)}{MSE_R + MSE_S} \qquad (4)$$

where

G_w is the weighted skew,

G_s is the station skew,

G_R is the regional skew,

MSE_R is the mean square error of the regional skew, and

MSE_S is the mean square error of the station skew.

Standard Grubbs-Beck Test

Bulletin 17B recommends use of the standard Grubbs-Beck test for detecting outliers. The test calculates a one-sided, 10-percent significance-level critical value based on a log-normal distribution of annual peak-discharge data for a streamgage. If the station skew is between -0.4 and +0.4, tests for both high and low outliers are made based on the mean, standard deviation, and skew of the systematic record before any adjustments are made. If the station skew is greater than +0.4, the test for high outliers is considered first and, if necessary, adjustments are made; if the station skew is less than -0.4, the test for low outliers is considered first (Interagency Advisory Committee on Water Data, 1982). Annual peak discharges that were identified as low outliers were truncated from the record, and a conditional probability adjustment was applied in the AEP analysis; low outliers can have a large influence on the extreme magnitude flood events that are of interest, and removing them from the analysis was important.

Historic Peaks

Historic peak discharges are those that are not part of the systematic record. Often, historic peaks are also high outliers.

Bulletin 17B recommends that the number of historic peaks (Z) in the longer period (H) be assigned a weight of 1.0; the remaining peaks (N) in the systematic record (L) are assigned a weight of (H-Z)/(N+L) based on the assumption that their distribution is representative of the (H-Z) remaining years of the historical period. Although the adjustment for historical peaks and those for low and high outliers generally improve estimates of AEPDs, the EMA method integrates low and high outliers and historical flood peaks more efficiently (Cohn and others, 1997).

Expected Moments Algorithm Analysis

For streamgages that have systematic annual peak-discharge records for complete periods, no low outliers, and no historical flood peaks, the EMA method produces estimates of the three LP3 statistics (mean, standard deviation, and skew coefficient) that are identical to those produced by the standard LP3 method described in Bulletin 17B. However, the EMA method improves upon the standard LP3 method by the integration of censored and interval peak-discharge data into the analysis (Cohn and others, 1997).

Censored and Interval Peak-Discharge Data

There are two types of censored peak-discharge data: (1) annual peak discharges at CSGs for which the discharge is only known to be less than a minimum recordable value, and (2) historical annual peak discharges that are only known to not have exceeded a recorded historical peak (Eash and others, 2013). In EMA, interval discharges were used to characterize peak discharges known to be greater or less than a specific value, peak discharges that could only be reliably estimated within a certain range, or to characterize missing data in periods of systematic record.

Multiple Grubbs-Beck Test for Potentially Influential Low Floods

The multiple Grubbs-Beck (MGB) test is used by EMA to identify not just low outliers but also other potentially influential low floods (PILFs) (Cohn and others, 2013). Although low outliers are typically one or two homogeneous values in a dataset that do not conform to the trend of the other observations, PILFs have a magnitude that is much smaller than the flood quantile of interest, occur below a statistically significant break in the flood-frequency plot, and have excessive influence on the estimated frequency of large floods. Similar to the standard Grubbs-Beck test, the MGB test calculates a one-sided, 10-percent significance-level critical value based on a log-normal distribution of the annual peak-discharge data. The MGB test is performed so that groups of ordered data are examined and excluded from the dataset when the critical value is calculated. If the critical value is greater than the smallest value in the example, then all values are determined to be low outliers (Eash and others, 2013); the MGB test can identify low outliers for as much as 50 percent of the annual peak-discharge record. The number of PILFs identified by the MGB test for each of the 281 streamgages for which EMA analyses were conducted are listed in table 4 (at end of report).

Generalized (Regional) Skew Analysis

The skew coefficient calculated from the annual peak discharge record at a streamgage (the station skew coefficient) is sensitive to extreme flood events; therefore, the station skew coefficient for short records may not provide an accurate estimate of the population skew coefficient. The Interagency Advisory Committee on Water Data (1982) recommends that the skew coefficient be weighted with a regional skew determined from an analysis of selected long-term streamgages in the study area.

The national generalized skew map published in Bulletin 17B was created using streamgage data through the 1973 water year (Interagency Advisory Committee on Water Data, 1982, pl. 1). Forty additional years of data have since been collected, and the more rigorous B-WLS/B-GLS method is now available to generate more accurate estimates of regional skew coefficients (Veilleux, 2009, 2011; Veilleux and others, 2011). The method relates observed skewness coefficient estimators to basin characteristics in conjunction with diagnostic statistics. The method was recently applied in Iowa (Eash and others, 2013) and Missouri (Southard and Veilleux, 2014) to update the regional skew maps for those States.

For this study, 452 streamgages in Arkansas, Louisiana, southern Missouri, and eastern Oklahoma with 20 or more years of annual peak-discharge records and minimal or no regulation, diversion, channelization, backwater, or urbanization were used to update the regional skew to a constant value of -0.17 (app. 1). Basin characteristics used in the development of the regional skew model were drainage area (square miles), mean basin elevation (feet), main channel length (miles), main channel slope (feet per mile) computed at points 10 and 85 percent of the channel length from the gage to the basin divide, basin shape factor, mean annual precipitation (inches) for the period 1971–2000, percentage of the basin in urban land use, and percentage of the basin in forest. Basin characteristics for streamgages in Arkansas and Louisiana were computed as described above (see “Basin Characteristics”), those for streamgages in southern Missouri were obtained from Southard and Veilleux (2014), and those for streamgages in Oklahoma were computed using Oklahoma StreamStats (Smith and Esralew, 2010).

Development of Regional Regression Equations

Ordinary Least Squares Regression

Ordinary least squares (OLS) regression techniques were used to select the basin characteristics for use as explanatory variables and to evaluate the flood regions used in the study.

Criteria for OLS regression include (1) a linear relation between the independent, or explanatory, variable (the basin characteristic) and the dependent, or response, variable (the *P*-percent AEPD); (2) homoscedasticity (constant variance in the dependent variable across the range of the independent variable) about the regression line; and (3) normality of residuals (Southard and Veilleux, 2014). To meet these criteria, all variables were transformed to base-10 logarithms except for variables expressed in percent, such as land-cover characteristics. The model used in the regression analysis is of the form:

$$Q_p = aA^bB^c \tag{5}$$

where

Q_p is the dependent variable, the *P*-percent AEPD, in cubic feet per second;

A,B are independent (explanatory) variables; and

a,b,c are regression coefficients.

If the dependent variable, Q_p, and the independent variables, *A* and *B*, are logarithmically transformed, the model takes the following form:

$$\log Q_p = \log(a) + b(\log A) + c(\log B) \tag{6}$$

where the variables are as previously defined.

Preliminary OLS regression equations were developed for the $Q_{1\%}$ using 24 explanatory variables (basin characteristics) and the $Q_{1\%}$ for 281 streamgages in the study area. The $Q_{1\%}$ was selected for optimizing the selection of explanatory variables because it is the AEPD most often used by water managers, engineers, and planners (Eash and others, 2013). The allReg() function contained within the “smwrStats” package (Lorenz, 2013) for R (R Core Team, 2014) was used to determine the best 1-, 2-, 3-, 4-, and 5-variable OLS regression models for the entire study area. Candidate regression models were evaluated on the basis of maximizing the coefficient of determination (R^2) and adjusted coefficient of determination (R^2_{adj}) while minimizing residual standard error, Mallow’s C_p, and the predicted residual sum of squares (PRESS). Explanatory variables in candidate models were evaluated on the basis of multicollinearity with other explanatory variables and statistical significance in the OLS regression models. Multicollinearity was evaluated using the variance inflation factor (VIF), which provides an index of how much the variance of an estimated regression coefficient is increased because of multicollinearity (Helsel and Hirsch, 2002); for this study, it was desirable to keep the VIF for all explanatory variables below 2.5. Statistical significance was determined using a 95-percent confidence level ($p \leq 0.05$).

Determination of Flood Regions

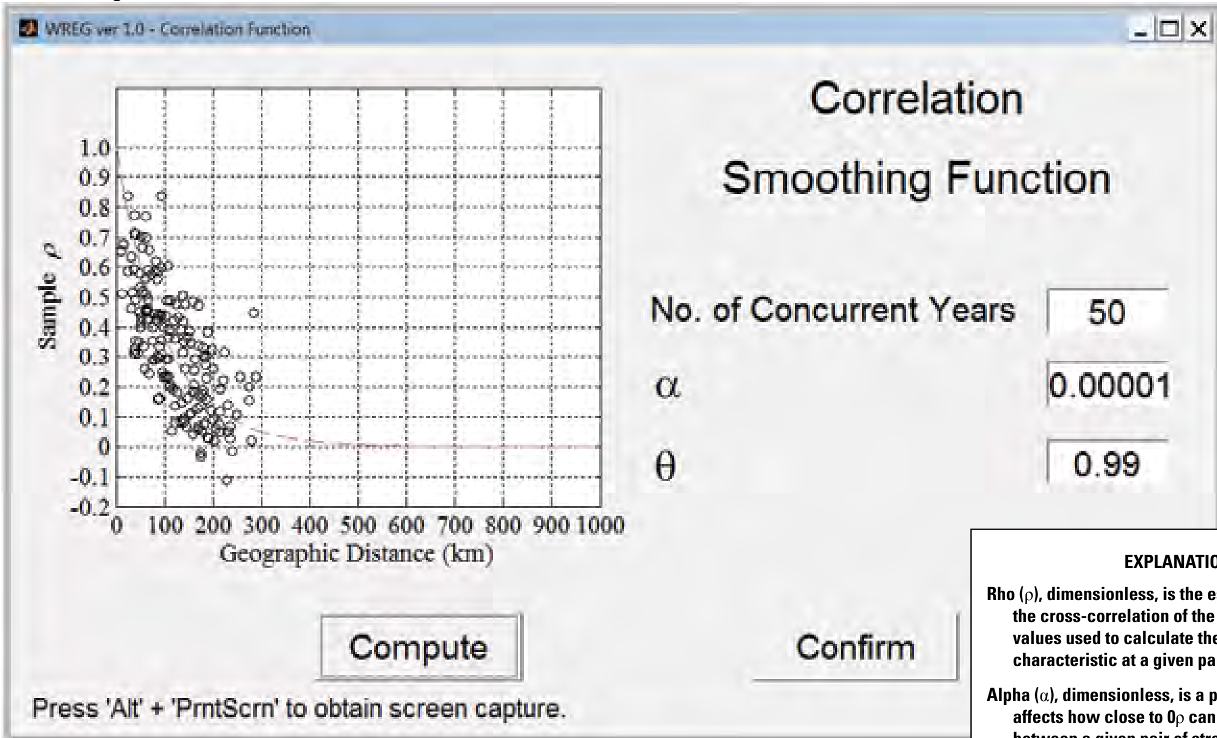
In developing regional regression models of flood frequency, subdividing a large study area into subregions of relatively homogeneous flood hydrology can reduce model error (Eash and others, 2013). Previous flood frequency investigations in Arkansas have subdivided the State into two or four flood regions (Patterson, 1971; Neely, 1987; Hodge and Tasker, 1995). In this study, the flood regions used in the previous investigations and the physiographic sections in the State were considered as possible regions.

Residuals (the differences between predicted AEPDs and those computed from observed data) from the preliminary OLS regression analyses were mapped to identify spatial trends in the predictive accuracy of the equations. Differences in plotted residual values were compared against flood regions used in the three previous investigations (Patterson, 1971; Neely, 1987; Hodge and Tasker, 1995) and the physiographic regions in the study area (fig. 3) to determine potential flood regions. Analysis of covariance (ANCOVA) regression (Helsel and Hirsch, 2002) was also used to test each flood region for statistically significant differences by comparing the intercept for each region’s regression model to that for the rest of the study area by assigning a location-indicator variable for each region. Each location-indicator variable was set to one if the streamgage was in that particular region or zero if not in the region. A two-variable OLS regression using drainage area and the location indicator as explanatory variables was performed for the $Q_{1\%}$ in each of the regions under consideration. If the *p*-value of the location indicator variable was less than or equal to 0.05, the flood region was considered to be independent of the study area model.

Generalized Least-Squares Regression

Generalized least-squares (GLS) multiple-linear regression was used to compute the final regression coefficients and measures of accuracy for the regression equations. The GLS is a method that weights data from streamgages in the regression analysis according to differences in streamflow reliability (record length), variability (record variance), and spatial cross correlations of concurrent streamflow among streamgages. Compared to OLS regression, GLS regression provides improved estimates of streamflow statistics and increases the predictive accuracy of the regression equations (Stedinger and Tasker, 1985). The weighted-multiple-linear regression (WREG) program (Eng and others, 2009) was used to perform the GLS regressions. A correlation smoothing function is used by WREG to compute a weighting matrix for the streamgages in each flood region (fig. 3). The smoothing function relates the correlation between annual peak discharges at the two streamgages to the geographic distance between them.

A. **Flood region A**



EXPLANATION

Rho (ρ), dimensionless, is the estimated value for the cross-correlation of the time series of flow values used to calculate the streamflow characteristic at a given pair of streamgages

Alpha (α), dimensionless, is a parameter that affects how close to 0ρ can get as the distance between a given pair of streamgages increases

Theta (θ), dimensionless, is a parameter that affects how quickly ρ decreases as the distance between a given pair of streamgages increases

B. **Flood region B, subregion 1**

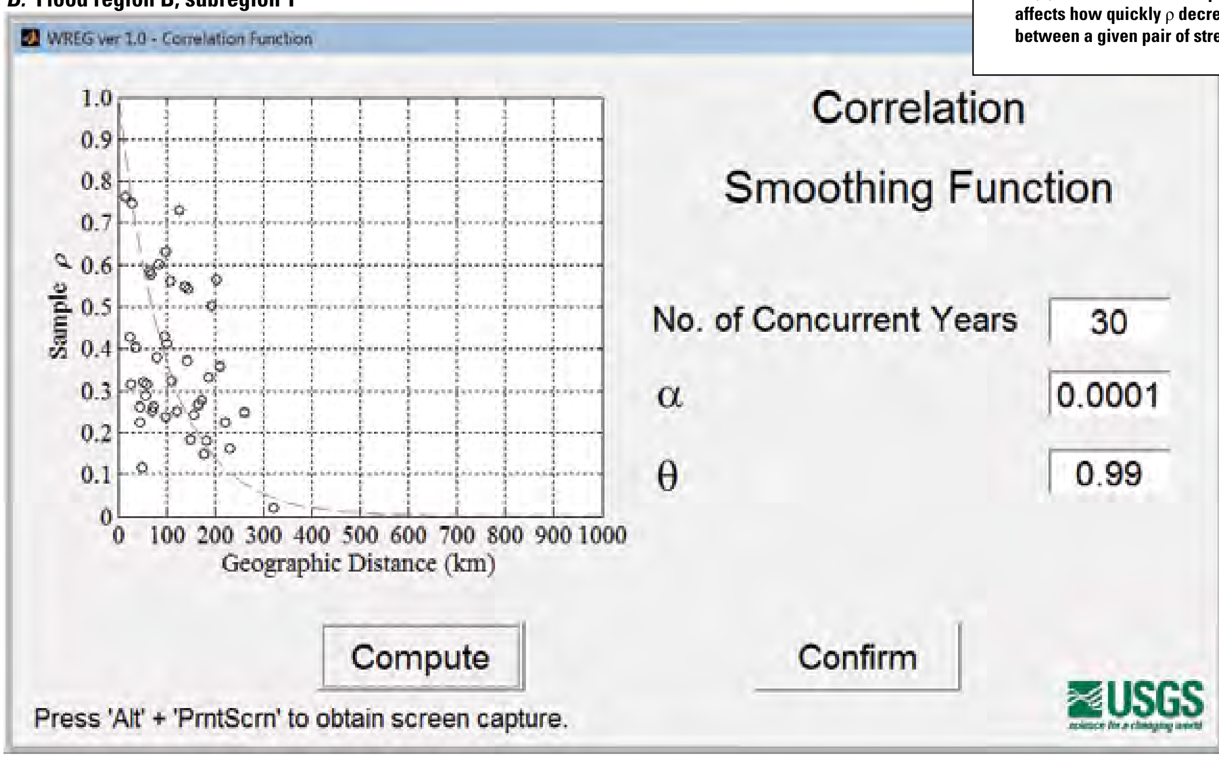
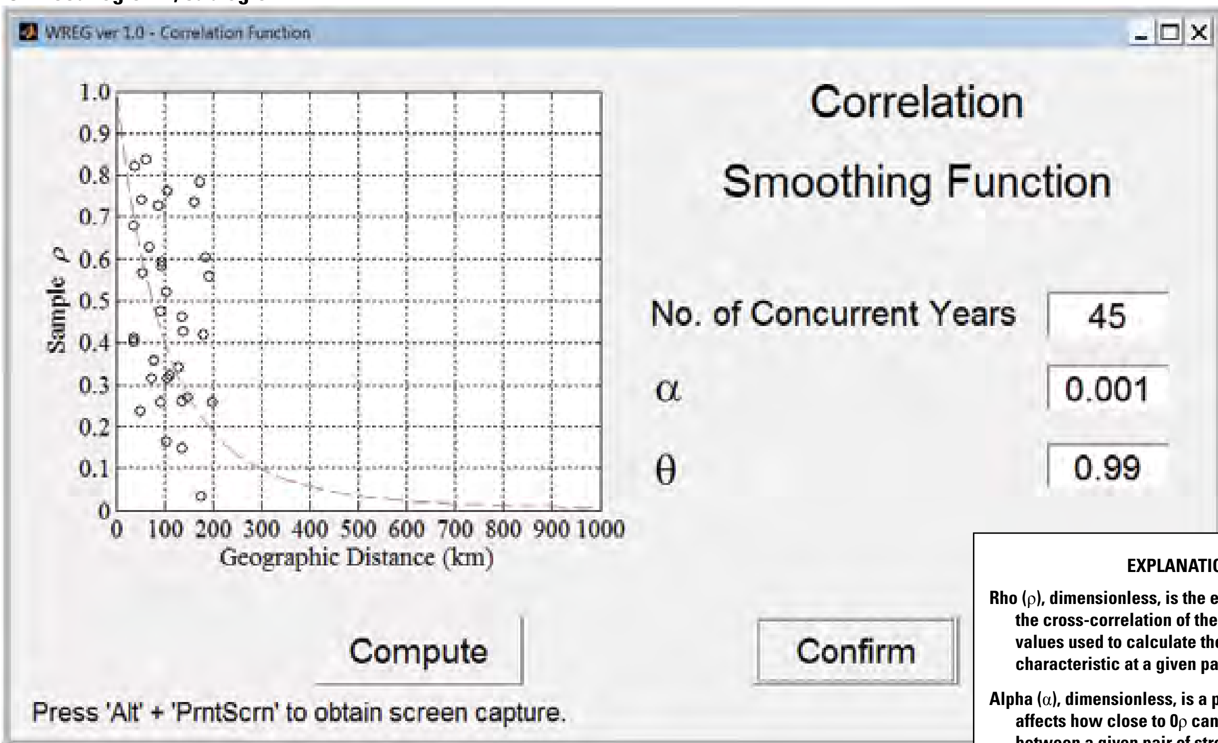


Figure 3. Screen captures from weighted-multiple-linear regression (WREG) program of the correlation smoothing functions for *A*, flood region A; *B*, flood region B, subregion 1; *C*, flood region B, subregion 2; *D*, flood region C; and *E*, flood region D in Arkansas.

C. **Flood region B, subregion 2**



EXPLANATION

Rho (ρ), dimensionless, is the estimated value for the cross-correlation of the time series of flow values used to calculate the streamflow characteristic at a given pair of streamgages

Alpha (α), dimensionless, is a parameter that affects how close to 0ρ can get as the distance between a given pair of streamgages increases

Theta (θ), dimensionless, is a parameter that affects how quickly ρ decreases as the distance between a given pair of streamgages increases

D. **Flood region C**

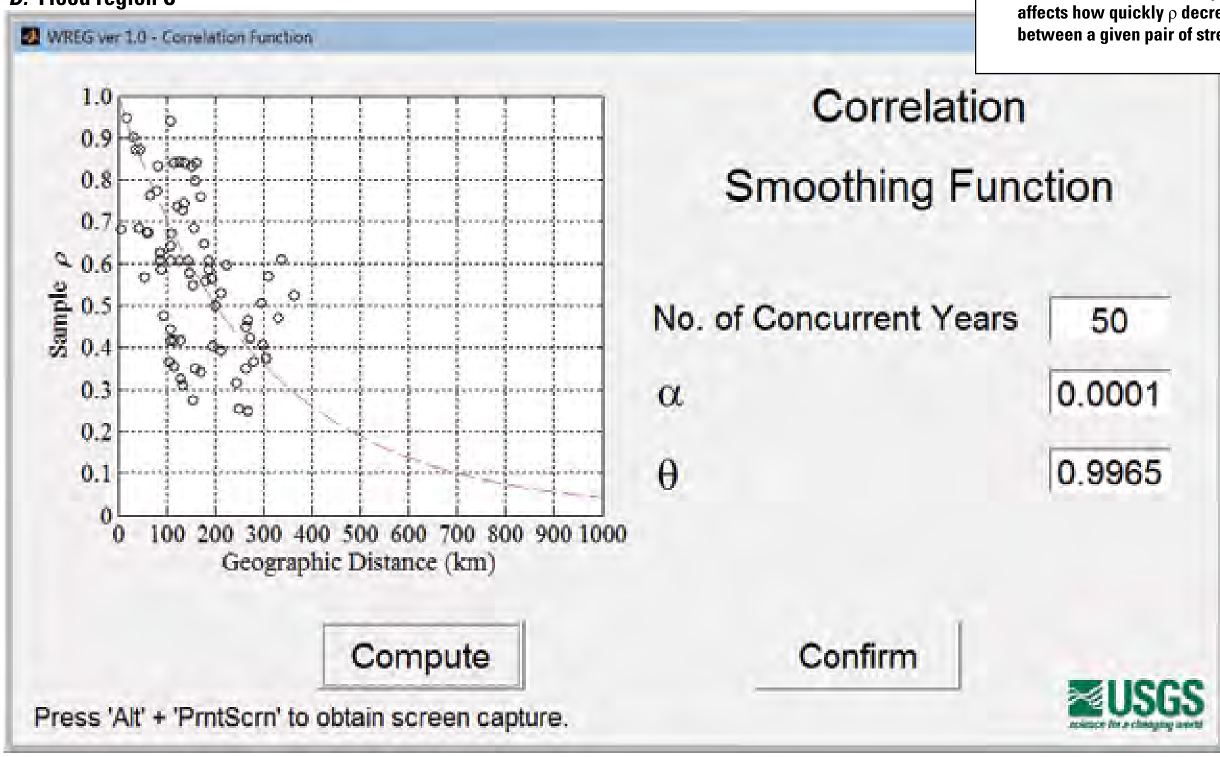


Figure 3. Screen captures from weighted-multiple-linear regression (WREG) program of the correlation smoothing functions for *A*, flood region A; *B*, flood region B, subregion 1; *C*, flood region B, subregion 2; *D*, flood region C; and *E*, flood region D in Arkansas.—Continued

E. **Flood region D**

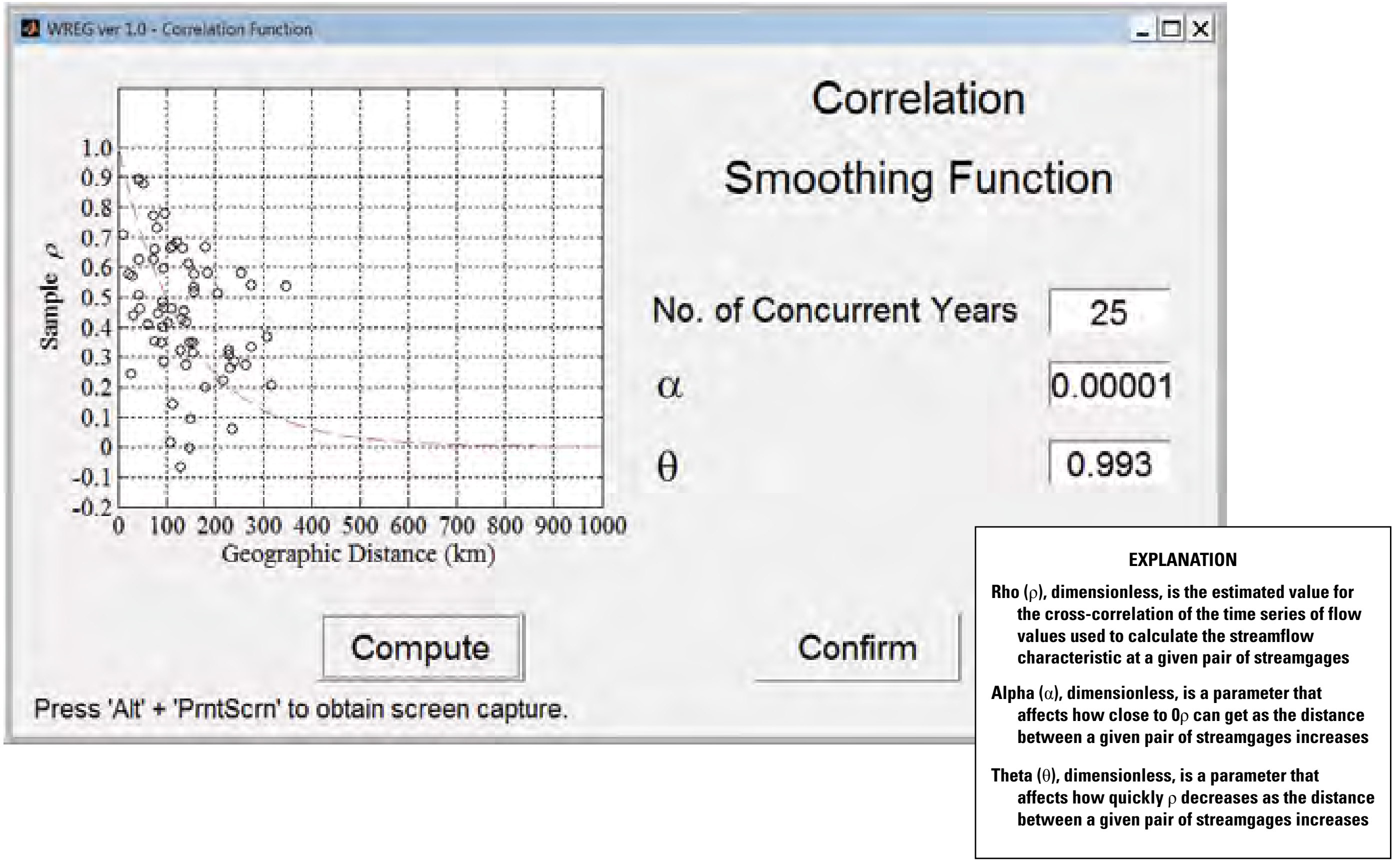


Figure 3. Screen captures from weighted-multiple-linear regression (WREG) program of the correlation smoothing functions for *A*, flood region A; *B*, flood region B, subregion 1; *C*, flood region B, subregion 2; *D*, flood region C; and *E*, flood region D in Arkansas.—Continued

Final GLS regression models were selected on the basis of minimizing the mean squared error (MSE) of the unweighted residuals, standard error of the model (SEM), standard error of prediction (S_p), the model error variance (MEV), and the average variance of prediction (AVP), while maximizing the pseudo coefficient of determination (pseudo-R^2) for the $Q_{1\%}$ model. All explanatory variables were logarithmically transformed using base-10 logarithms, except for land-use/land-cover and surficial geology characteristics that are expressed in percent, which were transformed by dividing the value by 100 and adding 1 so that transformed values ranged from 1 to 2, and soil hydrologic group (SOILINDEX), which ranged in value between 1 and 4, was not transformed.

Computation of Weighted Estimates of Annual Exceedance Probability Discharges

Guidelines in Bulletin 17B (Interagency Committee on Water Data, 1982) state that the uncertainty of an annual peak-discharge statistic can be reduced by combining the at-site estimate with an independent regional estimate to obtain a weighted estimate of the statistic for the site. The at-site EMA and RRE estimates of a given AEPD and the variances of the at-site and regression estimates (table 5, at end of report) are needed to compute the weighted estimate using the following equation:

$$Y_{weighted,i} = \frac{Y_{site,i} * V_{reg,i} + Y_{reg,i} * V_{site,i}}{V_{site,i} + V_{reg,i}}, \qquad (7)$$

where

$Y_{weighted,i}$ is the weighted estimate for site *i*, in log units;

$Y_{site,i}$ is the at-site estimate of the selected AEPD at site *i*, in log units;

$V_{site,i}$ is the variance of the at-site estimate at site *i*, in log units; and

$V_{reg,i}$ is the variance of the regression estimate at site *i*, in log units.

The EMA variance is obtained from the USGS program PeakFQ and the RRE variance is obtained from the WREG program. A 95-percent confidence interval for the weighted estimate (in cubic feet per second) can be calculated as:

$$95\%_{CI\,upper,i} = 10^{\left(Y_{weighted,i} + 1.96\sqrt{V_{weighted,i}}\right)}, \qquad (8)$$

$$95\%_{CI\,lower,i} = 10^{\left(Y_{weighted,i} - 1.96\sqrt{V_{weighted,i}}\right)},$$

where

$95\%_{CI\,upper,i}$ is the upper 95 percent confidence interval for the weighted estimate of the selected AEPD at site *i*;

$Y_{weighted,i}$ is the weighted estimate for site *i*, in log units;

$V_{weighted,i}$ is the variance of the weighted estimate at site *i*, in log units; and

$95\%_{CI\,lower,i}$ is the lower 95 percent confidence interval for the weighted estimate of the selected AEPD at site *i*.

The variance of the weighted estimate for site *i* (in log units) can be calculated as

$$V_{weighted,i} = \frac{V_{site,i} * V_{reg,i}}{V_{site,i} + V_{reg,i}}, \qquad (9)$$

where

$V_{weighted,i}$ is the weighted estimate for site *i*, in log units;

$V_{site,i}$ is the variance of the at-site estimate at site *i*, in log units; and

$V_{reg,i}$ is the variance of the regression estimate at site *i*, in log units.

Estimating Annual Exceedance Probability Discharges for Streams in Arkansas

Final Flood Regions

Based on the results from OLS and ANCOVA regressions, four flood regions were selected for use in the generation of regional regression models (fig. 1, table 6). The ANCOVA regression indicated that the physiographic sections (fig. 2), region B used by Patterson (1971) and Neely (1987), and 3 of the 4 flood regions (A, C, and D) used by Hodge and Tasker (1995) were all statistically independent, but that region B used by Hodge and Tasker was not. The best OLS models for the regions used by Hodge and Tasker yielded slightly better performance metrics than those for the physiographic sections or region B used by Patterson and Neely; therefore, it was desirable to use the same flood regions used by Hodge and Tasker. Because region B used by Hodge and Tasker encompassed parts of two physiographic sections (the Ouachita Mountains and the West Gulf Coastal Plain), the region was divided into subregion 1 (Ouachita Mountains) and subregion 2 (West Gulf Coastal Plain). The *p*-values associated with the region locator variables used in the ANCOVA regressions indicated that the subregions were statistically independent, and performance metrics for the best OLS regression model for each subregion were as good as or better than those for region B in its entirety. The boundary between the two subregions was drawn along the boundaries of 12-digit hydrologic unit code regions (HUCs) near the transition between the Ouachita Mountains and West Gulf Coastal Plain physiographic sections; the mean basin elevation (ELEV) was greater than or equal to 500 feet (ft) for streamgages in subregion 1 (the Ouachita Mountains) and less than 500 ft for streamgages in subregion 2 (the West Gulf Coastal Plain). For locations in region B, the ELEV is determined first, and based on the result, the equations for the appropriate subregion are used to compute AEPDs.

Final Regional Regression Equations

To minimize predictive inconsistencies between estimates of different AEPDs, basin characteristics determined to be significant in the OLS regression models of the $Q_{1\%}$ (table 6) were used to develop the final GLS regression equations for all seven AEPDs in each of the four flood regions (table 7). All basin characteristics used in the final GLS regression equations were statistically significant ($p \leq 0.05$), with the exception of one characteristic in each of the regression models of the $Q_{50\%}$ and $Q_{20\%}$ for flood regions A and C.

For region A, the basin characteristic ELEV was not statistically significant in the initial regression equations for the $Q_{50\%}$ (p_{ELEV}=0.86) and $Q_{20\%}$ (p_{ELEV}=0.061). For the $Q_{50\%}$, the model performed better without the insignificant variable; for the $Q_{20\%}$, the model performed better with the insignificant variable. The ELEV was not used in the final regression model of the $Q_{50\%}$ but was retained in the final regression model of the $Q_{20\%}$.

For region C, the basin characteristic basin shape factor (BSHAPE) was not statistically significant in the initial regression equations for the $Q_{50\%}$ (p_{BSHAPE}=0.715) and $Q_{20\%}$ (p_{BSHAPE}=0.103). Performance metrics indicated that for both AEPDs the model performed better without the insignificant variable, which was not used in either of the final regression models.

Table 6. Diagnostics of best ordinary least squares (OLS) and analysis of covariance (ANCOVA) regression models of the 1-percent annual exceedance probability discharge (AEPD) for tested flood regions.

[R^2, coefficient of determination; R^2_{adj}, adjusted coefficient of determination; C_p, Mallow's C_p; PRESS, predicted residual sum of squares; p_n, *p*-value of nth explanatory variable; VIF_n, variance inflation factor of nth explanatory variable; logDRNAREA, base 10 logarithm of drainage area; logELEV, base 10 logarithm of mean basin elevation; logSLPFM, base 10 logarithm of slope of longest flow path in basin; logBSHAPE, base 10 logarithm of basin shape factor; logPRECIP, base 10 logarithm of mean annual precipitation; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; WET_HER_EMR, percentage of basin in emergent herbaceous wetlands; shaded rows represent the current study regions; --, not applicable]

Flood region	Explanatory variables	Description of flood region	Residual standard error	R^2	R^2_{Adj}	C_p	PRESS
A (fig. 1)	logDRNAREA + logELEV	68 streamgages in Arkansas River Basin upstream from Mississippi Alluvial Plain	0.208	0.938	0.936	-10.34	3.07
B (Hodge and Tasker, 1995)	logDRNAREA + logSLPFM	92 streamgages in Ouachita/Lower Red River Basins	0.218	0.923	0.921	35.17	4.51
B, subregion 1 (fig. 1)	logDRNAREA + logBSHAPE	36 streamgages from region B with ELEV ≥ 500 ft	0.195	0.944	0.941	22.00	1.58
Ouachita Mountains (fig. 1)	logDRNAREA + logSLPFM	62 streamgages south of Arkansas River from regions A, B	0.196	0.941	0.939	32.17	2.53
B, subregion 2 (fig. 1)	logDRNAREA+logPRECIP+SOILINDEX +(LC11DVOPN/100 + 1)+(ALVM/100 + 1)	56 streamgages from region B with ELEV <500 ft	0.191	0.934	0.928	0.27	2.16
Ozark Plateaus (Springfield-Salem Plateaus and Boston "Mountains," fig. 2)	logDRNAREA + logBSHAPE + (LC11PAST/100 + 1) + (UPZ/100 + 1)	127 streamgages north of Arkansas River from regions A, C including Crowleys Ridge	0.212	0.944	0.942	0.86	5.90
C (fig. 1)	logDRNAREA + logBSHAPE + (LC11PAST/100 + 1) + (UPZ/100 + 1)	83 streamgages in White River Basin upstream from Mississippi Alluvial Plain and including Crowleys Ridge	0.193	0.954	0.952	0.41	3.26
Region B used by Patterson (1971) and Neely (1987)	logDRNAREA+logSLPFM+logBSHAPE+ (WET_HER_EMR/100 + 1)	243 streamgages not in Mississippi Alluvial Plain	0.212	0.935	0.934	11.16	11.30
D (Mississippi Alluvial Plain, fig. 1)	logDRNAREA + logSLPFM + logBSHAPE	38 streamgages in Mississippi Alluvial Plain	0.205	0.924	0.917	-6.22	1.72

Table 6. Diagnostics of best ordinary least squares (OLS) and analysis of covariance (ANCOVA) regression models of the 1-percent annual exceedance probability discharge (AEPD) for tested flood regions.—Continued

[R^2, coefficient of determination; R^2_{adj}, adjusted coefficient of determination; C_p, Mallow’s C_p; PRESS, predicted residual sum of squares; p_n, *p*-value of nth explanatory variable; VIF_n, variance inflation factor of nth explanatory variable; logDRNAREA, base 10 logarithm of drainage area; logELEV, base 10 logarithm of mean basin elevation; logSLPFM, base 10 logarithm of slope of longest flow path in basin; logBSHAPE, base 10 logarithm of basin shape factor; logPRECIP, base 10 logarithm of mean annual precipitation; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; WET_HER_EMR, percentage of basin in emergent herbaceous wetlands; shaded rows represent the current study regions; --, not applicable]

Flood region	$p_{intercept}$	p_1	p_2	p_3	p_4	p_5	VIF_1	VIF_2	VIF_3	VIF_4	VIF_5	*p*-value, region locator variable (ANCOVA regression)
A (fig. 1)	0.0085	<0.0001	0.0013	--	--	--	1.11	1.11	--	--	--	<0.0001
B (Hodge and Tasker, 1995)	<0.0001	<0.0001	<0.0001	--	--	--	2.02	2.02	--	--	--	0.5200
B, subregion 1 (fig. 1)	<0.0001	<0.0001	0.0150	--	--	--	1.40	1.40	--	--	--	0.0002
Ouachita Mountains (fig. 1)	<0.0001	<0.0001	0.0008	--	--	--	3.55	3.55	--	--	--	0.0001
B, subregion 2 (fig. 1)	0.0044	<0.0001	0.0032	0.0007	0.0064	0.0054	1.05	1.22	1.25	1.18	1.16	0.0061
Ozark Plateaus (Springfield-Salem Plateaus and Boston “Mountains,” fig. 2)	<0.0001	<0.0001	0.0004	0.0034	0.0019	--	1.96	1.96	1.02	1.04	--	<0.0001
C (fig. 1)	<0.0001	<0.0001	0.0013	0.0169	0.0001	--	2.26	2.26	1.04	1.03	--	<0.0001
Region B used by Patterson (1971) and Neely (1987)	0.0054	<0.0001	<0.0001	0.0094	0.0117	--	3.08	2.65	1.89	1.14	--	<0.0001
D (Mississippi Alluvial Plain, fig. 1)	<0.0001	<0.0001	<0.0001	0.0200	--	--	2.06	1.45	2.34	--	--	<0.0001

Table 7. Final generalized least squares (GLS) regression equations for estimating annual exceedance probability discharges (AEPDs) for unregulated streams in Arkansas and performance metrics of GLS regression models.

[MSE, mean squared error of unweighted residuals; ft^3/s, cubic feet per second; AVP, average variance of prediction; S_p, average standard error of prediction; Pseudo-R^2, pseudo coefficient of determination; MEV, model error variance; SEM, average standard error of model; $Q_{X\%}$, annual exceedance-probability discharge of X percent; DRNAREA, drainage area determined using geographic information system, in square miles; ELEV, mean basin elevation (feet); ≥, greater than or equal to; BSHAPE, basin shape factor; <, less than; PRECIP, mean annual precipitation (inches); SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin (feet per mile)]

Annual exceedance probability discharge equation	MSE (log ft³/s)	AVP (log ft³/s)[1]	S_p (percent)	Pseudo-R^2 (percent)	MEV (log ft³/s)[1]	SEM (percent)	Values from Hodge & Tasker (1995)	
							S_p (percent)	SEM (percent)
Flood region A—68 streamgages								
[2]$Q_{50\%}=(10^{2.322})(DRNAREA^{0.732})$	0.035	0.032	42.82	95.37	0.030	41.38	42.00	40.00
[1]$Q_{20\%}=(10^{1.822})(DRNAREA^{0.714})(ELEV^{0.273})$	0.024	0.021	33.98	97.06	0.018	32.09	32.00	30.00
$Q_{10\%}=(10^{1.603})(DRNAREA^{0.706})(ELEV^{0.400})$	0.023	0.019	32.76	97.28	0.017	30.66	31.00	28.00
$Q_{4\%}=(10^{1.379})(DRNAREA^{0.696})(ELEV^{0.532})$	0.026	0.020	33.18	97.26	0.017	30.76	32.00	29.00
$Q_{2\%}=(10^{1.245})(DRNAREA^{0.689})(ELEV^{0.613})$	0.029	0.022	34.98	96.98	0.019	32.32	34.00	31.00
$Q_{1\%}=(10^{1.126})(DRNAREA^{0.683})(ELEV^{0.684})$	0.034	0.024	36.77	96.71	0.020	33.86	37.00	34.00
$Q_{0.2\%}=(10^{0.903})(DRNAREA^{0.672})(ELEV^{0.821})$	0.047	0.034	44.21	95.36	0.029	40.79	45.00	42.00
Flood region B, subregion 1—36 streamgages with ELEV ≥ 500 ft								
$Q_{50\%}=(10^{2.850})(DRNAREA^{0.761})(BSHAPE^{-0.462})$	0.026	0.025	37.80	97.09	0.022	35.26	[3]42.00	[3]40.00
$Q_{20\%}=(10^{3.171})(DRNAREA^{0.737})(BSHAPE^{-0.510})$	0.026	0.026	38.12	96.83	0.022	35.40	[3]39.00	[3]37.00
$Q_{10\%}=(10^{3.329})(DRNAREA^{0.723})(BSHAPE^{-0.526})$	0.028	0.027	39.10	96.56	0.023	36.10	[3]38.00	[3]36.00
$Q_{4\%}=(10^{3.490})(DRNAREA^{0.707})(BSHAPE^{-0.535})$	0.031	0.030	41.39	96.02	0.025	37.97	[3]38.00	[3]36.00
$Q_{2\%}=(10^{3.589})(DRNAREA^{0.696})(BSHAPE^{-0.537})$	0.035	0.031	42.43	95.73	0.026	38.71	[3]39.00	[3]36.00
$Q_{1\%}=(10^{3.674})(DRNAREA^{0.686})(BSHAPE^{-0.536})$	0.038	0.034	44.67	95.18	0.029	40.61	[3]40.00	[3]37.00
$Q_{0.2\%}=(10^{3.839})(DRNAREA^{0.665})(BSHAPE^{-0.525})$	0.047	0.042	46.86	93.75	0.035	45.05	[3]43.00	[3]40.00
Flood region B, subregion 2—56 streamgages with ELEV < 500 ft								
$Q_{50\%}=(DRNAREA^{0.605})(PRECIP^{4.208})10^{(0.479(SOILINDEX)+5.175(0.01*LC11DVOPN+1)-0.314(0.01*ALVM+1)-11.495)}$	0.027	0.025	37.54	95.89	0.021	34.27	[3]42.00	[3]40.00
$Q_{20\%}=(DRNAREA^{0.608})(PRECIP^{5.309})10^{(0.412(SOILINDEX)+4.380(0.01*LC11DVOPN+1)-0.284(0.01*ALVM+1)-12.141)}$	0.022	0.019	32.56	96.85	0.015	29.25	[3]39.00	[3]37.00
$Q_{10\%}=(DRNAREA^{0.610})(PRECIP^{5.745})10^{(0.380(SOILINDEX)+4.085(0.01*LC11DVOPN+1)-0.269(0.01*ALVM+1)-12.376)}$	0.023	0.019	32.81	96.84	0.015	29.14	[3]38.00	[3]36.00
$Q_{4\%}=(DRNAREA^{0.611})(PRECIP^{6.102})10^{(0.348(SOILINDEX)+3.862(0.01*LC11DVOPN+1)-0.254(0.01*ALVM+1)-12.546)}$	0.028	0.020	33.32	96.81	0.015	29.13	[3]38.00	[3]36.00
$Q_{2\%}=(DRNAREA^{0.612})(PRECIP^{6.261})10^{(0.329(SOILINDEX)+3.805(0.01*LC11DVOPN+1)-0.247(0.01*ALVM+1)-12.626)}$	0.032	0.022	34.95	96.55	0.017	30.34	[3]39.00	[3]36.00
$Q_{1\%}=(DRNAREA^{0.612})(PRECIP^{6.383})10^{(0.312(SOILINDEX)+3.809(0.01*LC11DVOPN+1)-0.242(0.01*ALVM+1)-12.719)}$	0.037	0.025	37.66	96.04	0.019	32.64	[3]40.00	[3]37.00
$Q_{0.2\%}=(DRNAREA^{0.612})(PRECIP^{6.593})10^{(0.280(SOILINDEX)+3.879(0.01*LC11DVOPN+1)-0.233(0.01*ALVM+1)-12.917)}$	0.051	0.031	42.02	95.23	0.023	36.10	[3]43.00	[3]40.00

Table 7. Final generalized least squares (GLS) regression equations for estimating annual exceedance probability discharges (AEPDs) for unregulated streams in Arkansas and performance metrics of GLS regression models.—Continued

[MSE, mean squared error of unweighted residuals; ft^3/s, cubic feet per second; AVP, average variance of prediction; S_p, average standard error of prediction; Pseudo-R^2, pseudo coefficient of determination; MEV, model error variance; SEM, average standard error of model; $Q_{X\%}$, annual exceedance-probability discharge of X percent; DRNAREA, drainage area determined using geographic information system, in square miles; ELEV, mean basin elevation (feet); $\geq$, greater than or equal to; BSHAPE, basin shape factor; <, less than; PRECIP, mean annual precipitation (inches); SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin (feet per mile)]

Annual exceedance probability discharge equation	MSE (log ft^3/s)	AVP (log ft^3/s)[1]	S_p (percent)	Pseudo-R^2 (percent)	MEV (log ft^3/s)[1]	SEM (percent)	Values from Hodge & Tasker (1995)	
							S_p (percent)	SEM (percent)
Flood region C—83 streamgages								
[4]$Q_{50\%}=(DRNAREA^{0.666})10^{(2.636-0.297(0.01*LC11PAST+1)+0.111(0.01*UPZ+1))}$	0.046	0.045	52.01	93.80	0.041	49.55	42.00	41.00
[5]$Q_{20\%}=(DRNAREA^{0.675})10^{(2.893-0.307(0.01*LC11PAST+1)+0.127(0.01*UPZ+1))}$	0.034	0.032	43.18	95.75	0.029	40.69	38.00	37.00
$Q_{10\%}=(DRNAREA^{0.725})(BSHAPE^{-0.321})10^{(3.159-0.272(0.01*LC11PAST+1)+0.136(0.01*UPZ+1))}$	0.031	0.028	40.16	96.46	0.024	37.08	37.00	35.00
$Q_{4\%}=(DRNAREA^{0.745})(BSHAPE^{-0.416})10^{(3.329-0.258(0.01*LC11PAST+1)+0.142(0.01*UPZ+1))}$	0.033	0.028	39.71	96.65	0.023	36.15	36.00	34.00
$Q_{2\%}=(DRNAREA^{0.757})(BSHAPE^{-0.474})10^{(3.434-0.249(0.01*LC11PAST+1)+0.147(0.01*UPZ+1))}$	0.035	0.029	40.45	96.61	0.024	36.51	35.00	33.00
$Q_{1\%}=(DRNAREA^{0.768})(BSHAPE^{-0.522})10^{(3.522-0.242(0.01*LC11PAST+1)+0.152(0.01*UPZ+1))}$	0.038	0.032	42.66	96.31	0.026	38.35	35.00	33.00
$Q_{0.2\%}=(DRNAREA^{0.789})(BSHAPE^{-0.616})10^{(3.692-0.224(0.01*LC11PAST+1)+0.160(0.01*UPZ+1))}$	0.047	0.036	45.76	95.93	0.029	40.65	37.00	35.00
Flood region D—38 streamgages								
$Q_{50\%}=(10^{2.183})(DRNAREA^{0.678})(SLPFM^{0.239})(BSHAPE^{-0.324})$	0.020	0.020	33.06	96.41	0.017	30.76	33.00	31.00
$Q_{20\%}=(10^{2.310})(DRNAREA^{0.694})(SLPFM^{0.344})(BSHAPE^{-0.348})$	0.020	0.020	33.31	96.40	0.017	30.90	31.00	29.00
$Q_{10\%}=(10^{2.374})(DRNAREA^{0.702})(SLPFM^{0.399})(BSHAPE^{-0.359})$	0.024	0.024	36.91	95.67	0.021	34.20	33.00	30.00
$Q_{4\%}=(10^{2.441})(DRNAREA^{0.709})(SLPFM^{0.457})(BSHAPE^{-0.370})$	0.031	0.031	42.45	94.46	0.027	39.29	37.00	34.00
$Q_{2\%}=(10^{2.483})(DRNAREA^{0.713})(SLPFM^{0.494})(BSHAPE^{-0.376})$	0.036	0.037	46.64	93.48	0.032	43.13	41.00	38.00
$Q_{1\%}=(10^{2.520})(DRNAREA^{0.716})(SLPFM^{0.527})(BSHAPE^{-0.381})$	0.042	0.043	50.69	92.51	0.037	46.82	45.00	41.00
$Q_{0.2\%}=(10^{2.594})(DRNAREA^{0.722})(SLPFM^{0.592})(BSHAPE^{-0.391})$	0.057	0.057	59.53	90.29	0.050	54.84	56.00	51.00

[1]Explanatory variable ELEV is not statistically significant in the model (p=0.061); however, model diagnostics were improved by including the variable in the model.

[2]Explanatory variable ELEV is not statistically significant in the model (p=0.860).

[3]Value is for entire region B in Hodge and Tasker (1995).

[4]Explanatory variable BSHAPE is not statistically significant in the model (p=0.715).

[5]Explanatory variable BSHAPE is not statistically significant in the model (p=0.103).

Depending on the flood region, as many as five physical, climatic, or soils and land use/land cover basin characteristics were statistically significant (tables 7; 8, at end of report). For all four flood regions, drainage area (DRNAREA) was a statistically significant ($p \leq 0.05$) basin characteristic in the regression models of each of the seven modeled AEPDs. In all GLS regression models, the magnitude of AEPDs was positively correlated with drainage area. Among the other statistically significant basin characteristics were mean basin elevation (ELEV), BSHAPE, the slope of the longest flow path in the basin (SLPFM), mean annual precipitation (PRECIP), SOILINDEX, percentage of the basin in open development (LC11DVOPN), percentage of the basin in cultivated pasture (LC11PAST), percentage of surficial geology in the basin as Quaternary alluvial deposits (ALVM), and percentage of surficial geology in the basin as upper Paleozoic units (UPZ).

Region A

Drainage area and the mean basin elevation were the most important basin characteristics for estimating AEPDs in flood region A (tables 7, 8)—the region that contains part of the Arkansas River Basin upstream from the Mississippi Alluvial Plain (figs. 1, 2). The magnitude of AEPDs in flood region A was positively correlated with both drainage area and mean basin elevation. The S_p and SEM were lowest for the $Q_{10\%}$ and greatest for the $Q_{0.2\%}$. For all AEPDs, the S_p and SEM were similar to the values from Hodge and Tasker (1995) (table 7).

Region B

Subregion 1

Drainage area and basin shape factor were the most important basin characteristics for estimating AEPDs in flood region B, subregion 1 (tables 7, 8). The subregion contains the part of region B used by Hodge and Tasker (1995) that is mostly within the Ouachita Mountains physiographic section (figs. 1, 2). The magnitudes of AEPDs in the subregion were positively correlated with drainage area and negatively correlated with the basin shape factor (the square of the length of the longest flow path in a stream basin divided by the drainage area of the stream basin). The S_p and SEM were lowest for the $Q_{50\%}$ and greatest for the $Q_{0.2\%}$. Depending on the AEPD, the S_p and SEM were similar to or slightly greater than the values from region B in Hodge and Tasker (1995) (table 7).

Subregion 2

Drainage area, mean annual precipitation, soil index, the percentage of a basin in open development, and the percentage of the surficial geology in Quaternary alluvium were the most important basin characteristics for estimating AEPDs in the flood region B, subregion 2 (tables 7, 8). Subregion 2 contains the part of region B used by Hodge and Tasker (1995) that is within the West Gulf Coastal Plain physiographic section (figs. 1, 2). The magnitudes of AEPDs of streams in the region were positively correlated with drainage area, mean annual precipitation, soil index, and the percentage of open development in the basin and negatively correlated with the percentage of surficial geology in the basin as Quaternary alluvium. The S_p and SEM were lowest for the $Q_{20\%}$, $Q_{10\%}$, and $Q_{4\%}$ and greatest for the $Q_{0.2\%}$. For all AEPDs, the S_p and SEM were less than the values from region B in Hodge and Tasker (1995) (table 7).

Region C

Drainage area, basin shape factor, the percentage of the basin in cultivated pasture, and the percentage of surficial geology in the basin as upper Paleozoic units were the most important basin characteristics for estimating AEPDs in flood region C (tables 7, 8)—the region contains part of the White River Basin upstream from the Mississippi Alluvial Plain and includes Crowleys Ridge (fig. 1). The magnitudes of AEPDs in region C were positively correlated with drainage area and the percentage of surficial geology in the basin as upper Paleozoic units and negatively correlated with basin shape factor and cultivated pasture. The S_p and SEM were lowest for the $Q_{4\%}$ and greatest for the $Q_{50\%}$. For all AEPDs, the S_p and SEM were slightly greater than the values from region B in Hodge and Tasker (1995) (table 7).

Region D

Drainage area, the slope of the longest flow path in the basin, and the basin shape factor were the most important basin characteristics for estimating AEPDs in flood region D (tables 7, 8); the region represents the Mississippi Alluvial Plain in eastern Arkansas with the exception of Crowleys Ridge (figs. 1 and 2). The magnitudes of AEPDs in the region were positively correlated with drainage area and the slope of the longest flow path in the basin and negatively correlated with basin shape factor. The S_p and SEM were lowest for the $Q_{50\%}$ and greatest for the $Q_{0.2\%.}$ For all AEPDs, the S_p and SEM were slightly greater than the values from region D in Hodge and Tasker (1995) (table 7).

Annual Exceedance Probability Discharges

For all 281 USGS streamgages used in the development of the RREs, the $Q_{50\%}$, $Q_{20\%}$, $Q_{10\%}$, $Q_{4\%}$, $Q_{2\%}$, $Q_{1\%}$, and $Q_{0.2\%}$ computed using EMA, RREs, and weighted methods are provided (table 9, at end of report). The at-site $Q_{1\%}$ values (computed using EMA) were plotted against the predicted $Q_{1\%}$ values (computed using the RREs); all four regions show a fairly uniform distribution around the line of equality (fig. 4). For USACE dams and USGS streamgages on rivers with

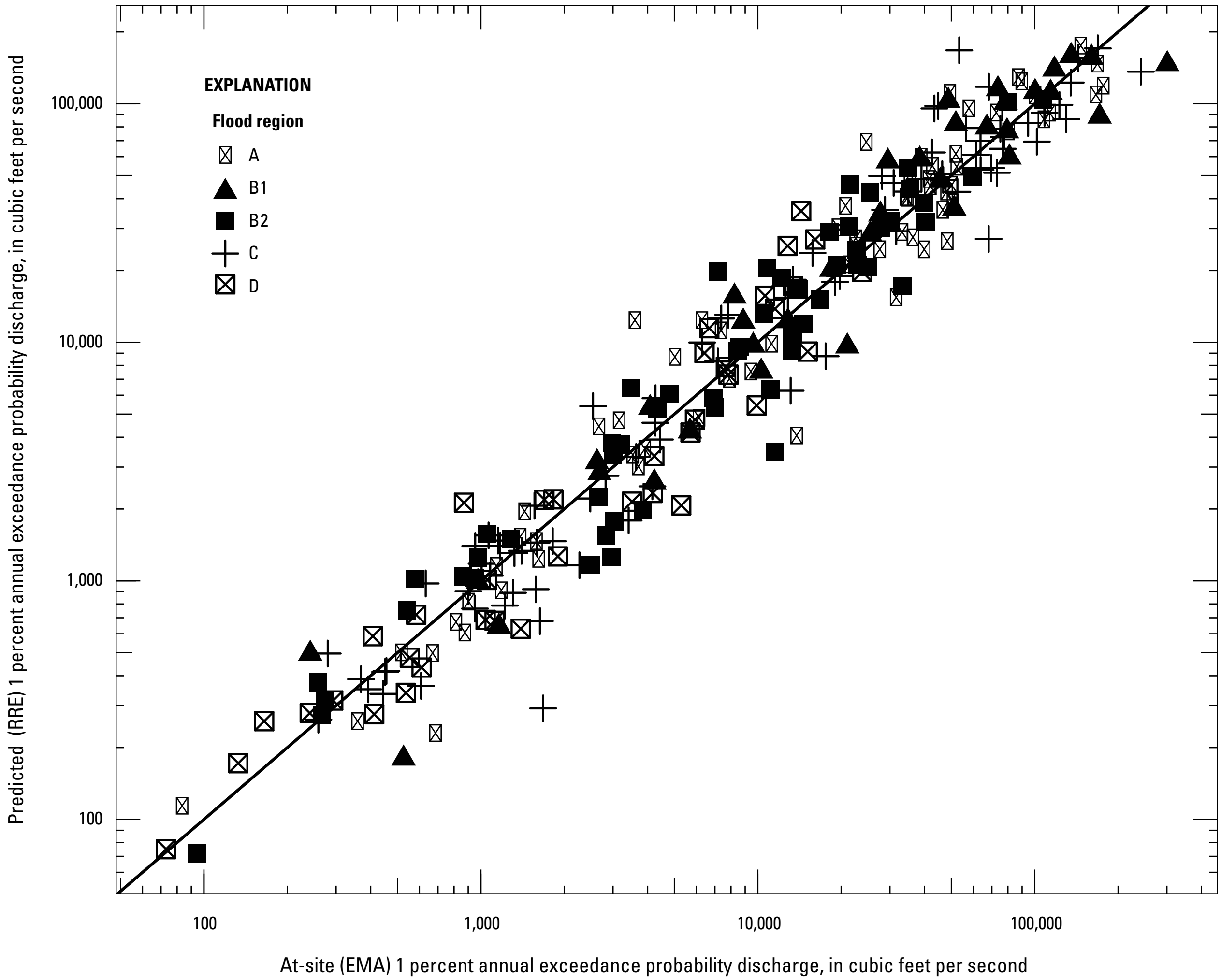


Figure 4. Relation between at site (Expected Moments Algorithm [EMA]) 1 percent annual exceedance probability discharges and predicted (regional regression equation [RRE]) 1 percent annual exceedance probability discharges for flood regions in Arkansas.

substantial upstream regulation, the $Q_{50\%}$, $Q_{20\%}$, $Q_{10\%}$, $Q_{4\%}$, $Q_{2\%}$, and $Q_{1\%}$ were computed using the graphical or EMA/MGB method and are provided in appendix 2 (table 2–1).

Accuracy and Limitations of Regression Equations

Accuracy and limitations of the regression equations are affected by several factors. The RREs developed in this study apply only to stream sites in Arkansas where annual peak discharges are not substantially affected by regulation, diversion, channelization, backwater, or urbanization; for locations near the State boundary, differences exist between AEPDs estimated using regression equations for Arkansas or those of neighboring States. Hydrologic and engineering judgement should be used when estimating AEPDs for these locations. The applicability and accuracy of the RREs depend on values of the basin characteristics measured for an ungaged location being within range of those used to develop the equations (table 10). Ideally, basin characteristics for ungaged locations should be measured using the same GIS datasets and measurement methods used in this study; the USGS StreamStats Web-based GIS tool, version 3.0 (available at http://water.usgs.gov/osw/streamstats/), includes the same GIS data layers and measurement methods used to develop the regression equations and facilitates computation of basin characteristics and AEPDs for gaged and ungaged locations (Ries, 2007). If basin characteristics are determined using manual methods, the accuracy of the regression equations cannot be guaranteed.

Table 10. Ranges of basin characteristics used to develop regional regression equations for Arkansas.

[GIS, geographic information system; mi^2, square miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in., inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvium]

Flood region (fig. 1)	Statistic	GIS-derived drainage area (mi^2)	SLPFM (ft/mi)	BSHAPE	ELEV (ft)	PRECIP (in.)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
A	minimum	0.04	--	--	380.51	--	--	--	--	--	--
	maximum	1,250	--	--	1,832.27	--	--	--	--	--	--
B	minimum	0.10	--	2.94	493.94	--	--	--	--	--	--
subregion 1	maximum	2,680	--	15.06	1,527.44	--	--	--	--	--	--
B	minimum	0.04	--	--	168.88	49.36	2.2	0	--	--	0
subregion 2	maximum	2,090	--	--	500.55	56.55	3.8	10.89	--	--	100
C	minimum	0.09	--	1.97	--	--	--	--	0	0	--
	maximum	2,050	--	15.09	--	--	--	--	87.51	100	--
D	minimum	0.15	0.36	3.12	--	--	--	--	--	--	--
	maximum	1,620	31.74	75.97	--	--	--	--	--	--	--

For all four flood regions, the S_p and SEM for the regression equations in this study are generally larger than those published in the previous study (Hodge and Tasker, 1995) (table 7); however, direct comparison of the two studies is inappropriate because basin characteristics used in the previous study were computed using manual methods, and basin characteristics used in this study were computed using GIS methods. When StreamStats was implemented, the GIS methods used within StreamStats to compute basin characteristics resulted in values that were biased in comparison to published values; therefore, the resulting annual peak-discharge estimates were also biased high. Even after adjusting the basin characteristics for bias, differences between annual peak-discharge estimates determined using StreamStats and those determined using the published basin characteristics were as large as 40 percent. Errors associated with the annual peak-discharge estimates determined using GIS methods were actually larger than the published standard errors of prediction (S_p) (see “Notes on peak-flow estimates” at http://water.usgs.gov/osw/streamstats/arkansas.html).

A measure of the uncertainty associated with the regression estimates of AEPDs is the prediction interval, the probability that the actual value of an estimated AEPD will be within a given margin of error (Helsel and Hirsch, 2002). The prediction interval determines the range of discharge values predicted for selected statistics given a confidence level and the S_p. For a 90-percent prediction interval, the true AEPD has a 90-percent probability of being within the prediction interval. StreamStats uses the 90-percent prediction interval as part of the computation of AEPDs for ungaged stream sites. The following equation can be used to compute the 90-percent prediction interval of an AEPD (modified from Tasker and Driver, 1988):

$$\frac{Q}{T} < Q < QT \tag{10}$$

where

Q is the AEPD predicted for the ungaged site from the regression equation, and the following equation can be used to compute T:

$$T = 10^{[t_{(1-\alpha/2,n-p)}S_i]} \tag{11}$$

where

$t_{(1-\alpha/2,n-p)}$ is the critical value, t, from the student's t-distribution at alpha level α (α=0.10 for the 90-percent prediction intervals, critical values may be obtained in many statistics textbooks or from the World Wide Web);

n-p is the degrees of freedom with n streamgages included in the regression analysis and p parameters in the equation (the number of explanatory variables plus one); and

S_i is the standard error of prediction for site i, and the following equation can be used to compute S_i:

$$S = [MEV + X_i U X'_i]^{0.5} \quad (12)$$

where

MEV is the model error variance from GLS regression equations developed in this study;

X_i is the row vector for the streamgage i, starting with the number 1, followed by the logarithmic values of the basin characteristics used in the regression;

U is the covariance matrix for the regression coefficients; and

X'_i is the matrix algebra transpose of X_i.

S_i represents the sum of the model error and the sampling error for site i. The $X_i U X'_i$ term in equation 12 is also referred to as the sampling error variance. The values of $t_{(1-\alpha/2,n-p)}$ and U needed to determine the 90-percent prediction intervals for AEPDs obtained using the regression equations in table 7 are provided (table 11, at end of report).

Applications of Regional Regression Equations

Streamgage Locations

For streamgage locations, the at-site estimate of the AEPD of interest should be computed using EMA with the MGB test for PILFs, the regional regression estimate computed using the appropriate regional equation (table 7), and a weighted estimate computed using equation 7. For the 281 USGS streamgages used in this study, the regional regression estimates are provided (table 9).

Ungaged Locations on Gaged Streams

For ungaged locations on gaged streams, if the ratio of the drainage area at the ungaged location is between 0.5 and 1.5 times the drainage area at the streamgage, a drainage area ratio can be used. This area-weighting procedure is not applicable when the drainage area ratio is less than 0.5 or greater than 1.5 or when basin characteristics change substantially between sites (Ries, 2007; Zarriello and others, 2012; Eash and others, 2013; Southard and Veilleux, 2014). To obtain a drainage area-weighted AEPD, $Q_{P(u)aw}$, for a P-percent annual exceedance probability at the ungaged site, the weighted estimate for an upstream or downstream streamgage, $Q_{P(g)w}$, must first be determined using equation 7. The drainage area-weighted AEPD for the ungaged site, $Q_{P(u)aw}$, is then computed using the following equation:

$$Q_{P(u)aw} = \left(\frac{A_{(u)}}{A_{(g)}}\right)^b Q_{P(g)w}, \quad (13)$$

where

$Q_{P(u)aw}$ is the drainage area-weighted estimate of flood discharge for the selected P-percent AEP for the ungaged site, u, in cubic feet per second;

$A_{(u)}$ is the drainage area of the ungaged site, in square miles;

$A_{(g)}$ is the drainage area of the upstream or downstream streamgage, in square miles;

$Q_{P(g)w}$ is the weighted estimate of flood discharge for the selected P-percent AEP for the upstream or downstream streamgage, in cubic feet per second; and

b is the exponent of drainage area from the appropriate RRE.

To define the regional exponent, b, for area-weighted estimates, a GLS analysis was performed using drainage area as the only explanatory variable (basin characteristic). Regional exponents ranged from 0.714 to 0.732 for flood region A, 0.619 to 0.723 for flood region B1, 0.634 to 0.637 for flood region B2, 0.674 to 0.710 for flood region C, and 0.537 to 0.569 for flood region D (table 12).

If the ungaged location is between two streamgages on the same stream, StreamStats uses the area-weighted estimates (eq. 13) from both streamgages and weights them based on the proximity of the streamgages to the ungaged site to obtain final weighted estimates for the ungaged site (Ries, 2007; Ries and others, 2008; see also http://streamstats.usgs.gov/ungaged2.html). Hydrologic judgment should be used to determine which of the two estimates (or an average or some interpolation thereof) is most appropriate (Eash and others, 2013). Consideration should be given to differences in basin characteristics between the ungaged location and the two streamgages, differences in the length or quality of the annual peak-discharge records of the two streamgages, and the hydrologic conditions during the period of record for each streamgage.

Locations on Ungaged Streams

For locations on ungaged streams, the RREs for the appropriate region and AEPD of interest should be used. A 90-percent confidence interval can be computed as previously described. It is not possible to compute weighted estimates (eq. 7) for locations on ungaged streams.

Table 12. Regional exponents and constants determined from regional regression of log-transformed drainage area for use in drainage area ratio method to estimate annual exceedance probability discharges (AEPDs) for ungaged locations on gaged streams.

[Drainage area ratio is computed using equation 13]

Annual exceedance probability discharge (percent)	Flood region A		Flood region B, subregion 1		Flood region B, subregion 2	
	Exponent b	Constant	Exponent b	Constant	Exponent b	Constant
50	0.732	2.322	0.723	2.499	0.634	2.225
20	0.730	2.607	0.694	2.787	0.635	2.493
10	0.728	2.754	0.678	2.934	0.636	2.628
4	0.724	2.909	0.661	3.089	0.637	2.768
2	0.721	3.008	0.650	3.188	0.636	2.857
1	0.719	3.096	0.640	3.275	0.636	2.935
0.2	0.714	3.270	0.619	3.450	0.635	3.089

Annual exceedance probability discharge (percent)	Flood region C		Flood region D	
	Exponent b	Constant	Exponent b	Constant
50	0.674	2.404	0.569	2.140
20	0.684	2.674	0.562	2.320
10	0.690	2.811	0.558	2.413
4	0.696	2.953	0.553	2.510
2	0.700	3.042	0.549	2.572
1	0.703	3.120	0.545	2.627
0.2	0.710	3.272	0.537	2.738

Summary

Multiple-linear regression was used to statistically relate annual exceedance probability discharges (AEPDs), computed using annual peak-discharge data from streamgages, to physical, climatic, and land-use characteristics of the associated stream basins; from these relations, a set of equations was developed to estimate AEPDs for locations on ungaged streams having basin characteristics within the range used to develop the equations. Since the publication of the last flood-frequency report for Arkansas in 1995, 20 years of additional annual peak-discharge data have been collected, the Expected Moments Algorithm (EMA) method has been developed for estimation of AEPDs, and more geospatial data have become available for computing basin characteristics. The ability to easily compute physical basin characteristics using the geographic information system (GIS) and the availability of recent digital climatic and land-use/land-cover datasets allowed for the greater number of basin characteristics to be easily generated and considered as potential explanatory variables in this study. For example, the 1995 report considered only seven basin characteristics as potential explanatory variables, while in this study 39 basin characteristics were considered. Depending on the flood region, drainage area and as many as four other physical, climatic, or land-use/land-cover basin characteristics were determined to be statistically significant explanatory variables in this study. The combinations of basin characteristics used by Hodge and Tasker were also considered, but with the exception of flood region D, performance metrics for the ordinary least-squares (OLS) regression models using those combinations were not as good as those for the selected models in this study.

The four flood regions used in the previous flood frequency report were selected for use in the generation of the final generalized least squares (GLS) regional regression models. The analysis of covariance (ANCOVA) regression indicated that three of the four flood regions, region A (the

Arkansas River Basin), region C (the White River Basin), and region D (the Mississippi Alluvial Plain), were statistically independent; however, region B (the Ouachita-Lower Red River Basin) had to be divided into subregions 1 (the Ouachita Mountains) and 2 (the West Gulf Coastal Plain) to obtain two statistically independent subregions. Although ANCOVA regression indicated that the physiographic sections and the regions used in previous studies by Patterson and Neely were also statistically independent, OLS regression models for the selected regions yielded better performance metrics. Average standard errors of prediction (Sp) of the final GLS regression models ranged from 32.76 to 59.53 percent, with the largest range (33.06 to 59.53 percent) in flood region D. The pseudo coefficients of determination (pseudo-R^2) of the GLS models ranged from 90.29 to 97.28 percent, with the largest range (90.29 to 96.41 percent) also in flood region D. For all four flood regions, the average standard errors of prediction in this study are generally larger than those published in the Hodge and Tasker study; however, direct comparison of the two studies is inappropriate because basin characteristics used in the previous study were computed using manual methods, while basin characteristics used in this study were computed using more accurate, GIS-based methods.

The regional regression equations presented in this study apply only to locations on streams in Arkansas where annual peak discharges are not substantially affected by regulation, diversion, channelization, backwater, or urbanization. The applicability and accuracy of the regional regression equations depend on the basin characteristics measured for an ungaged location on a stream being within range of basin characteristics used to develop the equations. The regional regression equations can be used to weight at-site estimates of AEPDs at streamgage locations and to compute AEPDs for ungaged locations on both gaged and ungaged streams.

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Tables 4, 5, 8, 9, and 11

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi²)	GIS drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
1	07040040	C	08020203	0.38	0.35	36.85972222	-89.93611111	1955	1979	25
2	[1]07047200	D	08020204	2.16	1.91	35.61277778	-90.37500000	1962	1985	24
3	07047820	C	08020203	1.38	1.38	35.86444444	-90.64055556	1960	1997	38
4	07047823	C	08020203	0.36	0.35	35.86416667	-90.64083333	1987	2004	18
5	07047880	C	08020203	0.08	0.09	35.37638889	-90.70055556	1963	2003	41
6	07047924	D	08020203	0.48	0.53	34.95194444	-90.46666667	1963	1982	20
7	07047942	D	08020205	535	534.28	35.14472222	-90.87805556	1971	2013	43
8	07047975	C	11010001	1.23	1.19	35.82555556	-93.76361111	1961	1981	21
9	07047990	C	11010001	0.67	0.68	35.97277778	-94.16555556	1960	1986	27
10	07048000	C	11010001	83.1	82.95	35.98277778	-94.17250000	1946	1983	38
11	07048600	C	11010001	400	399.13	36.07305556	-94.08111111	1964	2013	50
12	07048800	C	11010001	138	139.79	36.10416667	-94.00750000	1999	2013	15
13	07048900	C	11010001	1.07	1.02	36.17333333	-93.91638889	1960	2003	44
14	07048940	C	11010001	22.4	22.43	35.90138889	-93.70111111	1961	1982	22
15	07049000	C	11010001	263	264.73	36.20000000	-93.85500000	1943	2013	71
16	07050200	C	11010001	2.75	2.78	36.05166667	-93.51750000	1961	1981	21
17	07050285	C	11010001	82.3	82.1	36.18861111	-93.41416667	1988	2004	17
18	07050400	C	11010001	0.73	0.74	36.36833333	-93.55916667	1961	1980	20
19	07050500	C	11010001	527	528.72	36.42722222	-93.62083333	1927	2013	87
20	07053207	C	11010001	104	102.79	36.38944444	-93.31583333	1995	2013	19
21	07053250	C	11010001	52.8	52.6	36.45444444	-93.35611111	1994	2013	20
22	07053810	C	11010003	191	196.01	36.71750000	-93.20666667	1995	2013	19
23	07053950	C	11010003	0.65	0.61	36.73111111	-93.12500000	1959	1980	22
24	07054047	C	11010003	25.5	25.42	36.89861111	-92.86805556	1997	2013	17
25	07054080	C	11010003	298	298.48	36.77944444	-92.90722222	1995	2013	19
26	07054100	C	11010003	0.83	0.88	36.77916667	-92.92361111	1958	1979	22
27	07054200	C	11010003	0.33	0.32	36.61000000	-93.09638889	1955	1979	25
28	07054300	C	11010003	0.23	0.19	36.58472222	-92.70833333	1957	1979	23
29	07054400	C	11010003	3.41	3.39	36.45666667	-93.07944444	1962	1983	22
30	07054410	C	11010003	133	132.96	36.44944444	-93.07500000	1995	2013	19
31	07054450	C	11010003	0.85	0.85	36.37444444	-92.83111111	1962	2004	43
32	07055550	C	11010003	4.36	4.27	36.15027778	-93.12305556	1961	1986	26
33	[2]07055607	C	11010003	398	402.45	36.23027778	-92.70944444	1985	2013	29
34	07055646	C	11010005	57.4	58.77	35.93888889	-93.40500000	1994	2013	20
35	07055650	C	11010005	8.35	8.33	35.94722222	-93.39777778	1963	1983	21
36	07055800	C	11010005	6.15	6.13	35.93333333	-93.11277778	1962	1983	22
37	07055875	C	11010005	67.4	67.26	35.79722222	-92.92888889	1996	2013	18

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
1	24	0	24	0	190.0	1	2.5773	0.1911	-0.232	-0.275	0.063	-11.132
2	24	0	24	0	134.0	4	2.2163	0.0914	-0.253	-0.33	0.026	-2.817
3	32	0	32	0	0	0	2.6962	0.2208	-0.119	-0.026	0.846	-1.450
4	15	0	15	0	0	0	2.1166	0.2321	-0.198	0.086	0.692	2.000
5	36	2	34	0	0	0	1.6969	0.3030	0.076	0.112	0.357	0.250
6	20	0	20	0	0	0	2.0419	0.3178	-0.054	0.163	0.330	3.118
7	43	0	43	0	0	0	3.7455	0.2565	-0.248	0.006	0.967	3.103
8	21	0	21	0	0	0	2.2929	0.3559	-0.211	0.024	0.904	0.163
9	27	0	27	0	0	0	2.2187	0.4415	-0.235	0.162	0.243	4.850
10	38	0	38	0	0	0	3.9329	0.3370	-0.129	-0.073	0.530	-53.571
11	50	0	50	0	0	0	4.3863	0.3021	-0.003	0.048	0.627	71.034
12	15	0	15	0	0	0	4.0134	0.5093	0.069	0.124	0.553	165.714
13	40	3	37	0	0	0	2.1896	0.3181	0.088	0.009	0.948	0.107
14	22	0	22	0	0	0	3.4691	0.3632	-0.135	0.004	1.000	0.000
15	55	0	54	1	0	0	4.1227	0.2812	-0.223	0.050	0.596	44.444
16	21	0	21	0	0	0	2.7711	0.4055	-0.173	-0.019	0.928	-6.667
17	17	0	17	0	0	0	3.9786	0.2990	-0.197	0.000	1.000	8.081
18	20	0	20	0	0	0	2.2777	0.2739	-0.151	0.063	0.721	1.417
19	76	0	75	1	5,340.0	3	4.2293	0.3035	-0.072	-0.019	0.816	-14.286
20	17	0	17	0	0	0	3.8259	0.3517	-0.048	0.044	0.837	87.083
21	20	0	20	0	0	0	3.2412	0.4428	-0.056	-0.116	0.496	-30.429
22	18	0	18	0	4,070.0	1	3.9981	0.3139	-0.076	0.190	0.289	433.333
23	22	0	22	0	0	0	2.2690	0.3016	-0.063	-0.048	0.778	-0.636
24	17	2	15	0	0	0	2.8242	0.6505	-0.210	0.114	0.584	1.125
25	19	0	19	0	6,230.0	4	4.0402	0.3114	-0.184	0.170	0.327	330.000
26	22	0	22	0	130.0	6	2.3441	0.3630	-0.233	-0.152	0.334	-8.571
27	24	0	24	0	107.0	12	2.0143	0.2358	-0.099	-0.043	0.785	-0.450
28	22	0	22	0	0	0	2.0375	0.3170	-0.336	-0.065	0.692	-0.625
29	21	0	20	1	480.0	1	3.0631	0.2872	0.005	0.205	0.217	40.278
30	19	0	19	0	0	0	3.9395	0.4575	-0.070	0.228	0.184	833.333
31	43	0	43	0	58.0	1	2.4161	0.3239	-0.096	-0.034	0.753	-0.476
32	25	0	25	0	250.0	2	2.7836	0.3165	-0.002	0.000	1.000	0.000
33	29	0	29	0	0	0	3.9588	0.3718	-0.045	-0.015	0.925	-16.250
34	20	1	19	0	0	0	3.9836	0.3334	-0.252	-0.018	0.944	-70.000
35	21	0	21	0	0	0	3.1377	0.4511	-0.215	0.200	0.216	49.375
36	21	0	20	1	200.0	1	3.0104	0.4194	-0.214	0.132	0.436	29.896
37	18	0	18	0	0	0	3.9903	0.3127	-0.057	0.039	0.850	73.333

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi^2)	GIS drainage area (mi^2)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
38	07056000	C	11010005	829	828.2	35.98305556	-92.74722222	1915	2013	99
39	07056515	C	11010005	83.1	78.51	35.94000000	-92.71333333	2000	2013	14
40	07057500	C	11010006	561	562.17	36.62277778	-92.24805556	1945	2013	69
41	07058000	C	11010006	570	568.94	36.62722222	-92.30583333	1945	2013	69
42	07058980	C	11010006	68.2	68.41	36.42277778	-92.11833333	1995	2013	19
43	07059450	C	11010006	51.9	52.08	36.35750000	-92.11250000	1999	2013	15
44	07060600	C	11010004	1.25	1.24	36.13388889	-91.98000000	1961	1985	25
45	07060710	C	11010004	58.1	58.68	35.99166667	-92.21388889	1966	2013	48
46	07060830	C	11010004	0.27	0.26	35.66000000	-91.92083333	1963	1983	21
47	07061100	C	11010004	3.90	3.93	35.75888889	-91.51444444	1962	1985	24
48	07061260	C	11010007	16.2	15.87	37.60388889	-90.78861111	1997	2013	17
49	07061270	C	11010007	52.2	52.24	37.55250000	-90.84222222	2002	2013	12
50	07061500	C	11010007	484	491.59	37.33805556	-90.78861111	1939	2013	75
51	07061800	C	11010007	1.00	1.01	37.34972222	-90.97055556	1955	1979	25
52	07061900	C	11010007	139	139.16	37.24722222	-90.96527778	1994	2013	20
53	07063470	C	11010007	59.0	59.41	36.78305556	-90.55972222	1997	2014	18
54	07064300	C	11010008	1.72	1.92	37.53000000	-91.73694444	1957	1979	23
55	07064500	C	11010008	8.36	8.53	37.23277778	-91.85000000	1935	1979	45
56	07064533	C	11010008	295	294.76	37.37555556	-91.55277778	2002	2013	12
57	07065200	C	11010008	185	184.91	37.05611111	-91.66805556	2002	2013	12
58	[1]07066000	C	11010008	398	403.72	37.15388889	-91.35805556	1895	2013	119
59	07066800	C	11010008	0.88	0.9	37.04583333	-91.32500000	1958	1990	33
60	07068000	C	11010008	2,038	2,050.26	36.62194444	-90.84750000	1904	2013	110
61	07068200	C	11010008	1.23	1.28	36.89027778	-90.84166667	1958	1982	25
62	[3]07068510	C	11010008	194	194.18	36.63166667	-90.57527778	1940	2013	74
63	07068870	C	11010009	0.19	0.17	36.46277778	-90.92388889	1961	1981	21
64	07068890	C	11010009	229	229.09	36.33916667	-90.94250000	1965	1979	15
65	07069100	C	11010010	2.27	2.13	36.69305556	-91.80166667	1955	1979	25
66	07069250	C	11010010	0.48	0.47	36.42666667	-91.49083333	1961	2004	44
67	07069290	C	11010010	2.28	2.28	36.33694444	-91.77555556	1961	1981	21
68	07069500	C	11010010	1,180	1,160.84	36.20555556	-91.17166667	1915	2013	99
69	07070000	C	11010011	4.91	4.93	36.97027778	-91.92750000	1956	1967	12
70	07070500	C	11010011	361	357.7	36.78472222	-91.49194444	1951	1976	26
71	07071750	C	11010011	5.69	5.55	36.57694444	-91.31833333	1997	2014	18
72	07071800	C	11010011	4.24	4.08	36.67638889	-91.33611111	1956	1979	24
73	07072000	C	11010011	1,130	1,118.07	36.34638889	-91.11416667	1930	2013	84
74	07072200	C	11010011	1.33	1.28	36.25888889	-91.03388889	1961	1985	25

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
38	75	0	74	1	0	0	4.5625	0.3100	-0.224	0.049	0.544	90.000
39	14	0	14	0	0	0	3.9902	0.3173	-0.256	0.077	0.743	164.167
40	69	0	69	0	0	0	4.1151	0.3566	0.066	0.082	0.322	53.566
41	59	0	59	0	2,610.0	1	4.0703	0.3543	-0.204	0.055	0.543	48.571
42	19	1	18	0	3,770.0	5	3.6434	0.1319	-0.089	0.098	0.596	93.333
43	15	2	13	0	0	0	3.2823	0.2322	-0.148	0.179	0.428	56.650
44	25	0	25	0	128.0	1	2.4025	0.2952	0.124	-0.097	0.513	-1.955
45	47	0	47	0	0	0	3.6551	0.4326	-0.332	0.126	0.216	47.727
46	21	0	21	0	0	0	1.7325	0.4173	-0.276	0.181	0.263	1.544
47	24	0	24	0	0	0	2.8960	0.3117	-0.126	-0.072	0.637	-7.398
48	16	0	16	0	0	0	3.2798	0.4177	-0.210	0.283	0.137	138.636
49	11	0	11	0	0	0	3.8351	0.2810	-0.112	0.200	0.436	178.571
50	75	0	75	0	0	0	4.2805	0.3393	-0.298	0.004	0.960	3.429
51	25	8	17	0	90.0	1	2.1176	0.1535	-0.081	0.110	0.562	1.464
52	20	0	20	0	0	0	3.3203	0.8093	-0.354	0.232	0.163	226.944
53	17	1	16	0	2,360.0	1	3.7794	0.2796	-0.268	0.283	0.137	393.571
54	23	0	23	0	0	0	2.1073	0.3167	-0.053	0.237	0.119	4.500
55	33	0	31	2	0	0	3.2985	0.3573	-0.114	0.103	0.424	19.111
56	12	0	12	0	0	0	3.7504	0.5197	-0.168	0.152	0.537	548.333
57	12	0	12	0	0	0	4.1165	0.3088	-0.213	0.030	0.945	291.071
58	94	2	92	0	5,070.0	17	4.0671	0.3815	-0.331	0.176	0.013	87.977
59	33	0	33	0	0	0	2.0053	0.4173	-0.257	0.021	0.877	0.000
60	97	0	95	2	12,500.0	17	4.4242	0.3369	-0.294	0.082	0.242	86.957
61	25	0	25	0	0	0	2.2162	0.4510	-0.297	-0.173	0.234	-6.132
62	41	0	41	0	0	0	3.8606	0.4086	-0.052	0.102	0.351	61.225
63	21	0	21	0	79.0	1	2.1436	0.1926	-0.022	-0.119	0.468	-1.667
64	15	0	15	0	0	0	4.1728	0.3363	-0.229	0.048	0.843	175.714
65	25	0	25	0	0	0	2.5468	0.1760	0.067	-0.1	0.498	-2.153
66	38	1	37	0	0	0	2.3759	0.2981	0.011	-0.197	0.089	-3.770
67	21	0	21	0	210.0	1	2.7224	0.3205	-0.117	-0.271	0.091	-25.401
68	78	0	77	1	4,680.0	1	4.4180	0.3320	0.007	0.019	0.805	16.065
69	12	0	12	0	178.0	2	2.5267	0.3282	-0.154	-0.212	0.373	-28.567
70	26	0	26	0	3,650.0	4	3.7950	0.2714	0.034	0.172	0.225	76.667
71	18	1	17	0	0	0	2.4447	0.6226	-0.276	0.353	0.052	41.271
72	24	5	19	0	0	0	2.5735	0.3648	-0.098	0.029	0.889	1.667
73	82	0	82	0	0	0	4.0906	0.3405	0.211	0.015	0.844	6.250
74	25	0	25	0	0	0	2.7765	0.1659	-0.133	0.007	0.981	0.000

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi²)	GIS drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
75	07074000	C	11010012	473	472.63	36.11111111	-91.44944444	1937	2013	77
76	07074200	C	11010012	1.22	1.19	36.00333333	-91.58500000	1961	1983	23
77	07074250	C	11010012	34.9	34.9	35.98277778	-91.33666667	1963	1983	21
78	07074550	D	11010013	6.24	6.08	36.17916667	-90.84138889	1961	1981	21
79	07074855	D	11010013	5.54	5.97	35.34361111	-91.34388889	1962	1981	20
80	07074865	C	11010013	8.35	8.38	35.46250000	-91.54694444	1989	2004	16
81	07074900	C	11010014	0.26	0.24	35.87055556	-92.60222222	1961	1986	26
82	07074950	C	11010014	1.58	1.58	35.85555556	-92.44000000	1961	1983	23
83	07075000	C	11010014	302	301.57	35.65666667	-92.29277778	1935	2013	79
84	07075300	C	11010014	148	148.46	35.58694444	-92.45138889	1962	2013	52
85	07075600	C	11010014	1.36	1.32	35.52666667	-92.41722222	1964	2004	41
86	07075800	C	11010014	0.26	0.17	35.54250000	-91.95944444	1964	2004	41
87	07076820	D	08020301	5.00	4.99	35.20111111	-91.73222222	1961	1981	21
88	07076850	D	08020301	166	155.32	35.02500000	-91.87305556	1962	1976	15
89	07076870	D	08020301	23.0	23.05	34.97666667	-91.84388889	1961	2004	44
90	07077200	C	08020302	1.58	1.57	36.37555556	-90.33222222	1962	2004	43
91	07077340	C	08020302	0.68	0.66	36.07388889	-90.61527778	1963	1986	24
92	07077380	D	08020302	701	690.81	35.85750000	-90.93305556	1938	2013	76
93	07077430	D	08020302	0.25	0.26	35.94138889	-90.94250000	1963	2004	42
94	07077500	D	08020302	1,040	1,033.19	35.26972222	-91.23638889	1921	2013	93
95	07077680	D	08020302	7.93	7.86	35.56166667	-91.02361111	1961	1980	20
96	07077860	D	08020303	10.0	10.41	34.60500000	-91.17000000	1962	1983	22
97	07077920	D	08020304	31.1	34.29	34.93944444	-91.01527778	1961	2004	44
98	07077940	D	08020304	38.0	36.22	34.68777778	-90.89583333	1962	2003	42
99	07077950	D	08020304	448.	373.95	34.55555556	-90.84555556	1971	1993	23
100	07078000	D	08020402	175.	176.43	34.53194444	-91.35555556	1936	1954	19
101	07078170	D	08020303	1.51	1.87	34.32583333	-91.40166667	1961	1980	20
102	07078210	D	08020303	0.20	0.39	34.30055556	-91.16250000	1963	1986	24
103	07188500	A	11070206	42.0	40.74	36.84111111	-94.60833333	1943	1975	33
104	07188653	A	11070208	141	141.82	36.61583333	-94.18222222	2001	2013	13
105	07188900	A	11070208	0.96	0.99	36.44750000	-94.44333333	1961	1981	21
106	07189000	A	11070208	851	852.57	36.63138889	-94.58666667	1940	2013	74
107	07189100	A	11070208	60.8	91.8	36.67083333	-94.60388889	2001	2013	13
108	07189540	A	11070206	8	7.99	36.54722222	-94.61777778	1998	2013	16
109	07189542	A	11070206	48.7	48.65	36.54888889	-94.68361111	1998	2013	16
110	07191220	A	11070209	132	131.58	36.33472222	-94.64138889	1960	2013	54
111	07191222	A	11070209	59.1	59.11	36.35527778	-94.77611111	1999	2013	15

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
75	77	0	77	0	0	0	4.1748	0.2877	-0.002	-0.021	0.788	-11.010
76	22	0	21	1	285.0	3	2.7635	0.2612	-0.291	0.029	0.880	1.893
77	21	0	21	0	0	0	3.4770	0.3388	-0.012	0.019	0.928	7.179
78	21	0	21	0	57.0	1	2.3293	0.4421	-0.094	-0.176	0.277	-6.868
79	20	0	20	0	0	0	2.4984	0.2215	-0.060	-0.084	0.626	-4.808
80	15	0	15	0	0	0	3.0546	0.4343	-0.205	0.210	0.298	60.000
81	26	0	26	0	50.0	4	1.9699	0.2689	-0.179	0.154	0.280	2.500
82	23	0	23	0	0	0	2.4616	0.4127	-0.251	0.103	0.509	5.385
83	76	6	69	1	0	0	4.3727	0.3063	-0.063	0.112	0.175	159.279
84	52	0	52	0	2,930.0	2	3.9947	0.3114	-0.168	0.050	0.608	36.643
85	37	1	36	0	0	0	2.4219	0.3135	0.041	0.098	0.406	2.776
86	38	0	38	0	10.0	1	1.6727	0.3990	-0.249	-0.071	0.537	-0.304
87	21	0	21	0	370.0	1	2.8854	0.2059	-0.213	-0.176	0.276	-12.722
88	15	0	15	0	0	0	3.7767	0.3058	-0.251	0.067	0.767	143.750
89	44	0	44	0	0	0	3.2744	0.3757	-0.320	-0.004	0.976	-0.514
90	40	0	40	0	0	0	2.5714	0.2150	-0.313	0.073	0.514	1.690
91	24	0	24	0	0	0	2.4279	0.2620	-0.219	-0.203	0.172	-6.083
92	64	0	64	0	0	0	3.6610	0.1261	0.072	0.136	0.114	15.472
93	39	0	39	0	0	0	1.5617	0.2773	0.151	0.073	0.521	0.130
94	83	2	81	0	0	0	3.7973	0.1859	0.042	-0.128	0.092	-20.711
95	20	0	20	0	285.0	5	2.5030	0.0798	-0.177	0.263	0.111	7.656
96	22	0	22	0	330.0	7	2.5634	0.1070	-0.156	-0.117	0.463	-3.706
97	44	0	44	0	290.0	5	2.6957	0.1925	-0.287	-0.196	0.063	-5.405
98	31	0	31	0	1,420.0	14	3.1625	0.0945	-0.204	0.047	0.721	3.846
99	23	0	23	0	1,820.0	2	3.5030	0.1858	-0.278	0.162	0.291	50.000
100	19	0	19	0	0	0	3.3611	0.2804	-0.282	-0.047	0.806	-25.385
101	20	0	20	0	145.0	2	2.2629	0.0796	-0.119	0.137	0.417	0.764
102	24	0	24	0	0	0	1.8336	0.2735	0.143	-0.062	0.691	-0.424
103	29	2	27	0	0	0	2.9428	0.6659	-0.021	0.071	0.617	9.250
104	13	0	13	0	0	0	3.7870	0.4209	-0.099	0.282	0.200	516.250
105	21	0	21	0	90.0	9	2.0484	0.4829	-0.224	0.190	0.238	5.650
106	74	0	74	0	17,900.0	30	4.3286	0.3326	-0.258	0.034	0.674	36.667
107	13	0	13	0	0	0	3.6909	0.4014	-0.054	0.090	0.714	197.250
108	16	0	16	0	0	0	2.8906	0.3492	-0.076	0.117	0.558	24.675
109	16	0	16	0	0	0	3.2000	0.5047	-0.127	0.233	0.224	85.814
110	54	0	54	0	3,900.0	25	3.6189	0.4269	-0.181	0.011	0.911	1.156
111	15	0	15	0	0	0	3.5284	0.5918	-0.150	0.162	0.428	134.167

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi^2, square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi^2)	GIS drainage area (mi^2)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
112	07194800	A	11110103	167	167.47	36.10305556	-94.34444444	1980	2013	34
113	07195200	A	11110103	0.37	0.37	36.17722222	-94.27777778	1959	1979	21
114	07195800	A	11110103	14.2	14.86	36.25611111	-94.43361111	1961	2013	53
115	07196000	A	11110103	116	115.63	36.18638889	-94.70666667	1956	2013	58
116	07196380	A	11110103	3.59	3.85	35.97694444	-94.92333333	1965	1975	11
117	07196500	A	11110103	950	950.44	35.92277778	-94.92333333	1916	2013	98
118	07196900	A	11110103	40.6	41.09	35.88000000	-94.48638889	1958	2013	56
119	07196973	A	11110103	25.0	24.98	35.95472222	-94.69611111	1994	2003	10
120	07197000	A	11110103	312	311.61	35.92111111	-94.83833333	1945	2013	69
121	07197360	A	11110103	90.2	90.22	35.78500000	-94.85611111	1998	2013	16
122	07245500	A	11110104	182	181.17	35.46444444	-94.86194444	1942	1976	35
123	07246610	A	11110104	0.90	0.91	35.24444444	-94.74305556	1965	1976	12
124	07246630	A	11110104	5.32	5.49	35.52083333	-94.61944444	1964	1984	21
125	07247000	A	11110105	203	203.58	34.91888889	-94.29944444	1935	2013	79
126	07247250	A	11110105	94.3	94.32	34.77361111	-94.51194444	1993	2013	21
127	07247500	A	11110105	120	120.41	34.91250000	-95.15555556	1935	2013	79
128	07248500	A	11110105	993	993.67	34.93750000	-94.71500000	1939	1984	46
129	07249000	A	11110105	1,240	1,250.59	35.05972222	-94.60277778	1923	1945	23
130	07249400	A	11110105	147	146.68	35.16250000	-94.40694444	1958	2013	56
131	07249490	A	11110104	93.5	92.63	35.70333333	-94.32694444	1988	2004	17
132	07249500	A	11110104	35.3	34.83	35.72222222	-94.40777778	1950	2004	55
133	07249650	A	11110104	8.15	8.4	35.70638889	-94.48250000	1962	1981	20
134	07249920	A	11110104	102	97.42	35.57305556	-94.55694444	2001	2013	13
135	07249950	A	11110104	0.34	0.32	35.60000000	-94.38027778	1962	2004	43
136	[4]07249985	A	11110104	420	434.2	35.51722222	-94.46416667	1931	2013	83
137	07250965	A	11110201	54.2	55.65	35.72222222	-94.11361111	2001	2013	13
138	07250974	A	11110201	6.9	6.98	35.70444444	-94.09166667	2002	2013	12
139	07251790	A	11110201	70.2	83.2	35.68361111	-93.59944444	1988	2004	17
140	07252000	A	11110201	373	373.73	35.57694444	-94.01527778	1928	2013	86
141	07252200	A	11110201	0.46	0.46	35.59527778	-93.84694444	1961	1986	26
142	07252500	A	11110202	4.23	4.08	35.20888889	-93.87805556	1955	1970	16
143	07254000	A	11110202	2.76	1.84	35.22916667	-93.91388889	1955	1972	18
144	07254500	A	11110202	5.81	5.1	35.26500000	-93.83027778	1955	1970	16
145	07255100	A	11110202	4.49	5.24	35.35611111	-93.98333333	1956	1970	15
146	07256000	A	11110202	53.0	53.03	35.34666667	-93.86305556	1955	1970	16
147	07256490	A	11110202	NA	7.01	35.47083333	-93.45250000	1993	2004	12
148	07256500	A	11110202	61.1	61.33	35.46833333	-93.46305556	1927	2013	87

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
112	21	0	21	0	0	0	4.0412	0.4180	-0.107	0.114	0.487	156.587
113	21	0	21	0	63.0	8	1.9171	0.3997	-0.215	-0.038	0.833	-0.356
114	53	0	53	0	0	0	2.8665	0.4909	-0.041	0.038	0.696	1.831
115	54	0	54	0	0	0	3.5863	0.5084	-0.225	0.005	0.964	2.000
116	11	0	11	0	0	0	2.7062	0.6355	-0.196	0.273	0.276	76.250
117	81	0	79	2	0	0	4.2918	0.3536	-0.149	0.020	0.793	21.429
118	56	0	56	0	8,430.0	28	3.9219	0.2394	-0.243	0.054	0.562	35.683
119	10	0	10	0	1,430.0	4	3.1957	0.1865	-0.150	0.378	0.152	192.500
120	67	1	66	0	3,640.0	3	4.1685	0.3403	-0.304	0.058	0.493	56.897
121	16	0	16	0	3,200.0	1	3.7103	0.2063	-0.012	0.108	0.589	82.500
122	35	13	22	0	0	0	4.1115	0.4109	-0.074	0.303	0.051	712.143
123	12	0	12	0	0	0	2.4247	0.2206	-0.153	0.121	0.631	10.750
124	21	0	21	0	0	0	2.8967	0.3204	-0.373	-0.295	0.065	-51.042
125	76	47	29	0	0	0	4.0290	0.2907	-0.216	0.116	0.388	167.500
126	21	0	21	0	0	0	4.0863	0.3282	-0.297	0.100	0.546	329.000
127	76	51	25	0	0	0	3.8232	0.3889	-0.081	-0.097	0.513	-87.083
128	46	35	11	0	0	0	4.4392	0.3627	-0.148	0.091	0.755	450.000
129	15	0	12	3	0	0	4.4034	0.3450	-0.151	0.030	0.945	202.083
130	56	0	56	0	0	0	3.8293	0.2756	-0.149	0.082	0.373	34.498
131	17	2	15	0	0	0	3.8830	0.3957	-0.220	0.171	0.400	610.000
132	55	0	55	0	0	0	3.6838	0.4018	-0.158	-0.044	0.642	-17.000
133	20	0	20	0	0	0	3.0922	0.3512	-0.241	0.116	0.495	45.609
134	13	0	13	0	0	0	3.9295	0.2958	-0.057	0.077	0.760	198.864
135	41	0	41	0	0	0	1.5350	0.5324	-0.193	0.089	0.418	0.406
136	72	0	72	0	0	0	4.3867	0.2932	-0.157	-0.010	0.907	-12.731
137	13	0	13	0	3,140.0	1	3.8548	0.2765	-0.174	0.231	0.300	332.143
138	12	0	12	0	0	0	3.0744	0.4522	-0.230	-0.061	0.837	-34.471
139	17	0	17	0	0	0	3.9361	0.3171	-0.083	0.338	0.064	559.524
140	76	0	75	1	5,240.0	2	4.3050	0.3023	-0.329	0.117	0.138	106.667
141	26	0	26	0	51.0	1	2.1892	0.2834	-0.098	0.074	0.612	1.333
142	16	0	16	0	0	0	2.9061	0.3074	-0.286	-0.033	0.893	-14.875
143	18	0	18	0	396.0	6	2.6882	0.2205	-0.212	-0.124	0.495	-6.900
144	16	0	16	0	0	0	2.9264	0.2755	-0.194	-0.033	0.893	-4.250
145	15	0	15	0	0	0	2.8625	0.3766	-0.326	0.105	0.621	29.833
146	16	0	16	0	1,680.0	2	3.4885	0.2427	-0.107	0.017	0.964	40.000
147	12	1	11	0	579.0	1	3.0034	0.2149	-0.153	0.273	0.276	81.600
148	63	0	61	2	1,410.0	6	3.6818	0.3540	-0.385	-0.002	0.990	-0.900

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi²)	GIS drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
149	[5]07257006	A	11110202	306	297.36	35.50583333	-93.18138889	1949	2013	65
150	07257060	A	11110202	0.20	0.18	35.62361111	-93.43388889	1964	1983	20
151	07257100	A	11110202	0.19	0.23	35.50277778	-93.36555556	1962	2004	43
152	07257200	A	11110202	154	154.91	35.45000000	-93.33805556	1979	2013	35
153	07257500	A	11110202	241	241.58	35.46638889	-93.04111111	1943	2013	71
154	07257700	A	11110202	7.05	7.07	35.41777778	-93.08583333	1961	1986	26
155	07258200	A	11110204	0.92	0.9	34.97194444	-94.09611111	1961	2003	43
156	07258500	A	11110204	241	240.75	35.10694444	-93.92361111	1939	2013	75
157	07260000	A	11110204	81.4	81.84	34.98694444	-93.61305556	1927	2013	87
158	[6]07260500	A	11110204	764	761.72	35.05861111	-93.39555556	1917	2013	97
159	07260630	A	11110204	1.85	1.85	35.13027778	-93.33861111	1961	1983	23
160	07260673	A	11110203	222	221.6	35.32472222	-92.87305556	1979	2013	35
161	07260679	A	11110203	0.09	0.04	35.26944444	-92.73305556	1967	2003	37
162	07261000	A	11110205	169	172.41	35.29861111	-92.40388889	1955	2013	59
163	07261050	A	11110205	0.29	0.31	35.38861111	-92.38805556	1961	1983	23
164	07261300	A	11110206	2.33	2.3	34.73027778	-94.07861111	1960	1981	22
165	[1]07261500	A	11110206	410	410.01	34.87250000	-93.65722222	1939	2013	75
166	07261800	A	11110206	1.04	1.05	34.90777778	-92.40166667	1963	2004	42
167	[1]07263000	A	11110206	210	209.9	34.91194444	-93.05611111	1942	2013	72
168	07263100	A	11110206	1.47	1.48	35.02055556	-92.76833333	1962	2004	43
169	07263400	A	11110207	15.0	15.02	34.78000000	-92.55416667	1963	2004	42
170	07263530	A	11110207	32.4	31.98	34.64750000	-92.43611111	1979	1993	15
171	07263860	D	08020401	2.75	3.49	34.48555556	-91.85361111	1963	1979	17
172	07264100	D	08020402	8.41	8.38	34.77222222	-91.84277778	1961	1986	26
173	07335700	B1	11140105	39.6	39.63	34.63833333	-94.61250000	1966	2013	48
174	07336000	B1	11140105	68.0	68.27	34.29861111	-95.74444444	1956	1984	29
175	07336500	B1	11140105	1,423	1,416.08	34.20055556	-95.48416667	1916	1972	57
176	07336520	B1	11140105	19.4	17.57	34.19722222	-95.35000000	1964	1985	22
177	07336710	B2	11140105	3.39	3.34	34.01944444	-95.36083333	1964	1974	11
178	07336780	B2	11140106	7.53	7.6	33.89555556	-94.88750000	1964	1973	10
179	07336785	B2	11140106	2.96	2.9	33.89555556	-94.90638889	1965	1976	12
180	07337220	B1	11140107	1.99	1.98	34.17416667	-95.07583333	1964	1974	11
181	[6]07337500	B1	11140107	645	648.28	34.06944444	-95.04638889	1930	1989	60
182	07337900	B1	11140107	320	320.28	34.09750000	-94.90194444	1961	2013	53
183	07338520	B1	11140107	9.10	8.94	34.06250000	-94.73944444	1964	1985	22
184	07338700	B1	11140108	15.9	16.1	34.51444444	-94.33722222	1963	1983	21
185	07338750	B1	11140108	322	322.36	34.46222222	-94.63500000	1993	2013	21

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
149	64	0	63	1	0	0	4.3642	0.3201	-0.064	0.112	0.196	139.412
150	20	0	20	0	0	0	1.6877	0.2968	-0.072	-0.105	0.537	-0.591
151	43	3	40	0	0	0	1.6848	0.3275	-0.143	-0.027	0.816	-0.100
152	35	0	35	0	5,870.0	5	3.9636	0.1973	0.007	0.052	0.670	35.000
153	67	0	66	1	0	0	4.2710	0.2981	-0.008	0.092	0.278	75.000
154	26	0	26	0	130.0	2	2.8105	0.5275	-0.254	-0.129	0.366	-16.846
155	42	6	36	0	0	0	2.2888	0.2949	-0.068	0.187	0.111	2.833
156	75	0	75	0	9,950.0	25	4.0937	0.2235	-0.177	0.035	0.661	17.021
157	69	0	68	1	1,810.0	1	3.8173	0.2627	-0.199	-0.029	0.731	-11.662
158	97	66	31	0	0	0	4.1762	0.3465	-0.077	0.105	0.414	161.538
159	21	0	20	1	324.0	4	2.6916	0.2583	-0.007	0.179	0.284	12.679
160	35	0	35	0	0	0	3.7341	0.3836	0.018	0.173	0.147	128.125
161	32	3	29	0	13.0	1	1.5568	0.2356	-0.257	0.059	0.666	0.250
162	59	0	59	0	0	0	3.9166	0.2312	-0.379	-0.017	0.855	-6.000
163	22	0	21	1	0	0	2.0027	0.3016	-0.017	0.233	0.147	2.719
164	22	0	22	0	0	0	2.6171	0.4546	-0.005	0.186	0.236	16.667
165	75	0	75	0	0	0	4.4183	0.3144	-0.166	0.170	0.031	200.000
166	42	0	42	0	0	0	2.3770	0.3349	0.115	0.006	0.965	0.000
167	72	0	72	0	6,320.0	2	4.2615	0.2316	-0.064	0.190	0.019	119.138
168	43	1	42	0	300.0	15	2.5580	0.2313	-0.202	0.130	0.229	4.000
169	36	0	36	0	500.0	1	3.2957	0.3648	-0.191	-0.186	0.114	-42.105
170	14	0	14	0	0	0	3.4858	0.1717	-0.064	-0.033	0.913	-23.333
171	17	0	17	0	380.0	8	2.5895	0.1121	-0.214	0.184	0.322	5.833
172	26	0	26	0	440.0	3	2.9225	0.1991	-0.308	0.151	0.290	7.500
173	48	0	48	0	2,630.0	1	3.9538	0.2757	-0.290	0.069	0.494	43.750
174	29	0	29	0	0	0	3.5563	0.1845	-0.019	-0.032	0.822	-11.250
175	48	0	47	1	0	0	4.5320	0.1881	-0.165	0.074	0.469	113.333
176	22	0	22	0	0	0	3.3914	0.3173	-0.175	0.134	0.398	67.500
177	11	0	11	0	0	0	2.8988	0.2009	-0.100	0.200	0.436	57.500
178	10	0	10	0	1,540.0	1	3.3440	0.1640	-0.025	-0.044	0.928	-37.500
179	12	0	12	0	680.0	3	2.8915	0.1242	-0.056	0.030	0.945	1.000
180	11	0	11	0	0	0	2.6528	0.3327	-0.055	0.200	0.436	31.000
181	47	21	26	0	0	0	4.4822	0.2542	-0.130	0.222	0.118	766.667
182	53	0	53	0	0	0	4.4474	0.2402	-0.014	0.060	0.534	85.893
183	22	0	22	0	0	0	3.2408	0.2964	-0.241	0.247	0.114	69.000
184	21	0	21	0	0	0	3.3057	0.2921	0.004	0.229	0.156	80.000
185	20	0	20	0	18,400.0	1	4.4686	0.1354	-0.086	0.121	0.475	403.125

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi^2, square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi^2)	GIS drainage area (mi^2)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
186	07338780	B1	11140108	0.85	0.65	34.49666667	-94.66833333	1965	1984	20
187	07339000	B1	11140108	800	799.7	34.04166667	-94.61972222	1915	2013	99
188	07339500	B1	11140109	182	183.36	34.04750000	-94.41277778	1947	2013	67
189	[6]07340000	B1	11140109	2,660	2,679.37	33.91944444	-94.38666667	1915	2013	99
190	07340200	B2	11140109	10.7	10.65	33.75361111	-94.39111111	1962	1983	22
191	07340300	B1	11140109	89.6	89.12	34.38000000	-94.23638889	1961	2013	53
192	07340500	B1	11140109	361	361.24	34.04500000	-94.21250000	1938	2013	76
193	[6]07341000	B1	11140109	124	120.23	34.09611111	-94.08500000	1920	2013	94
194	07341100	B1	11140109	9.46	9.39	34.11277778	-94.04027778	1961	1983	23
195	07341260	B2	11140109	5.82	5.81	33.94388889	-93.91250000	1989	2004	16
196	07341700	B2	11140201	12.9	12.92	33.69250000	-93.63666667	1963	1982	20
197	07344320	B2	11140302	1.44	1.45	33.29777778	-93.91611111	1961	1983	23
198	07344450	B2	11140304	80.5	81.03	32.51666667	-93.97222222	1956	2013	58
199	07346950	B2	11140304	73.0	72.98	33.00138889	-93.86527778	1969	1983	15
200	07347500	B2	11140304	364	368.58	32.81527778	-93.87083333	1943	1971	29
201	07348615	B2	11140203	NA	227.74	33.20666667	-93.39916667	1969	1980	12
202	07348725	B2	11140203	33.1	32.56	32.93194444	-93.29166667	1966	2013	48
203	07348760	B2	11140203	49.8	49.54	32.85277778	-93.25138889	1954	1983	30
204	07348800	B2	11140203	66.9	66.59	32.76944444	-93.26666667	1954	1977	24
205	07348950	B2	11140203	0.08	0.04	32.67222222	-93.38055556	1957	1968	12
206	07349000	B2	11140203	1,097	1,086.8	32.59722222	-93.33166667	1929	2013	85
207	07349200	B2	11140203	35.1	39.65	32.56805556	-93.48611111	1951	1965	15
208	07349430	B2	11140205	236	235.88	33.36666667	-93.52222222	1927	1978	52
209	07349500	B2	11140205	546	551.77	32.90500000	-93.48277778	1905	2013	109
210	07355800	B1	08040101	0.65	0.64	34.62083333	-94.20416667	1961	2004	44
211	07355900	B1	08040101	0.19	0.17	34.47305556	-93.96055556	1964	1983	20
212	07356000	B1	08040101	414	413.88	34.61000000	-93.69750000	1942	2013	72
213	07356500	B1	08040101	61.0	61.08	34.56027778	-93.63583333	1950	1978	29
214	07356700	B1	08040101	1.85	1.74	34.56583333	-93.61750000	1961	1983	23
215	07357000	B1	08040101	1,100	1,102.49	34.60000000	-93.20555556	1923	1950	28
216	07357700	B1	08040101	3.84	3.86	34.62583333	-93.05250000	1961	1986	26
217	07359520	B1	08040102	2.95	2.98	34.36694444	-92.86694444	1962	1981	20
218	07359610	B1	08040102	136	132.01	34.38277778	-93.60611111	1989	2013	25
219	07359750	B1	08040102	2.32	2.28	34.36111111	-93.45833333	1962	1983	22
220	07359800	B1	08040102	312	301.56	34.26666667	-93.36250000	1927	1970	44
221	07359805	B1	08040102	7.62	7.68	34.32138889	-93.25666667	1989	2004	16
222	07360100	B2	08040102	74.2	74.19	34.10750000	-92.93111111	1989	2004	16

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
186	20	0	20	0	0	0	2.3072	0.2936	0.027	0.279	0.091	7.641
187	85	44	39	2	0	0	4.5627	0.2763	-0.301	0.197	0.079	591.176
188	66	36	29	1	0	0	4.1417	0.3672	0.063	0.135	0.311	146.033
189	85	45	38	2	0	0	4.6652	0.2202	-0.069	0.009	0.950	50.000
190	21	0	20	1	0	0	3.1806	0.2858	-0.293	0.132	0.435	38.231
191	47	0	46	1	0	0	4.1615	0.2826	-0.250	-0.048	0.643	-66.667
192	76	38	38	0	0	0	4.4401	0.2676	-0.008	0.014	0.910	41.667
193	76	38	37	1	0	0	3.9761	0.3393	-0.028	0.128	0.272	122.652
194	23	0	23	0	0	0	3.2891	0.4275	-0.289	0.154	0.316	65.333
195	12	4	8	0	0	0	2.9878	0.1198	-0.201	0.429	0.174	85.000
196	20	0	20	0	0	0	3.3291	0.2704	0.033	-0.221	0.183	-68.080
197	23	0	23	0	148.0	3	2.4422	0.2595	-0.144	0.178	0.245	6.286
198	47	16	31	0	0	0	3.4538	0.3877	-0.114	-0.03	0.825	-10.000
199	15	0	15	0	0	0	2.9285	0.3504	-0.067	0.162	0.428	41.571
200	29	10	19	0	0	0	3.5073	0.2874	0.016	-0.099	0.576	-61.667
201	12	0	12	0	0	0	3.6173	0.3878	-0.123	-0.045	0.891	-15.476
202	48	0	48	0	919.0	6	3.2745	0.3156	0.122	0.016	0.880	1.502
203	25	0	25	0	1,230.0	4	3.3060	0.2809	0.021	-0.197	0.175	-61.143
204	24	0	24	0	0	0	3.1977	0.4112	-0.255	0.022	0.901	6.040
205	12	0	12	0	0	0	1.0331	0.3691	-0.108	0.197	0.409	0.800
206	82	1	80	1	1,590.0	2	3.9238	0.3615	-0.255	-0.032	0.675	-15.917
207	15	0	15	0	800.0	3	3.1459	0.2832	-0.187	-0.2	0.322	-73.750
208	24	3	21	0	0	0	3.5004	0.3707	-0.173	0.200	0.216	112.409
209	77	2	75	0	1,200.0	3	3.6138	0.2917	-0.263	-0.083	0.295	-18.788
210	44	2	42	0	66.0	1	2.2783	0.2328	-0.063	0.144	0.182	1.333
211	20	0	20	0	17.0	1	1.5965	0.2773	0.069	0.105	0.537	0.369
212	72	0	72	0	0	0	4.3639	0.2356	-0.157	0.045	0.583	39.828
213	29	0	29	0	2,920.0	3	3.8189	0.2845	-0.135	-0.054	0.694	-36.000
214	22	0	21	1	0	0	2.6252	0.3666	-0.100	0.014	0.952	1.114
215	15	0	14	1	0	0	4.6536	0.2486	-0.173	0.033	0.913	225.000
216	26	0	26	0	0	0	2.8034	0.3726	-0.159	-0.102	0.480	-7.500
217	20	0	20	0	0	0	2.4503	0.4565	-0.044	-0.105	0.538	-7.250
218	25	0	25	0	0	0	4.3057	0.2618	0.002	-0.047	0.761	-68.137
219	22	0	22	0	0	0	2.8841	0.3912	-0.239	0.078	0.632	3.308
220	30	0	28	2	0	0	4.4013	0.2281	-0.184	0.011	0.953	52.500
221	14	0	14	0	0	0	2.9989	0.4793	-0.076	0.341	0.101	130.000
222	15	0	15	0	0	0	3.0903	0.1971	-0.075	-0.133	0.519	-32.143

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi²)	GIS drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
223	07360150	B2	08040102	0.42	0.43	34.03305556	-92.86805556	1961	1981	21
224	07360800	B1	08040103	120	119.71	34.08333333	-93.75194444	1940	1980	41
225	07361020	B1	08040103	0.16	0.06	34.15277778	-93.63138889	1963	1986	24
226	07361180	B2	08040103	17.7	16.38	33.82083333	-93.70777778	1963	2003	41
227	07361200	B2	08040103	144	143.56	33.88194444	-93.59972222	1940	1980	41
228	07361500	B1	08040103	178	178.85	34.03888889	-93.41805556	1905	2013	109
229	07361600	B1	08040103	1,079	1,072.22	33.87805556	-93.30444444	1938	1980	43
230	07361680	B2	08040103	1.48	1.47	33.60527778	-93.29194444	1961	1986	26
231	07361760	B2	08040103	9.22	9.11	34.09638889	-93.28138889	1989	2004	16
232	07361780	B2	08040103	3.36	3.49	34.10055556	-93.20666667	1962	1981	20
233	07361800	B2	08040103	258	256.99	33.91722222	-93.03555556	1940	1980	41
234	07361894	B2	08040102	9.01	9.14	33.76694444	-92.66444444	1989	2004	16
235	07362050	B2	08040201	10.3	10.19	33.54388889	-92.88833333	1961	1981	21
236	07362100	B2	08040201	385	384.27	33.37527778	-92.77666667	1939	2013	75
237	07362330	B2	08040201	13.6	12.39	33.53472222	-92.51527778	1962	2004	43
238	07362450	B2	08040201	5.02	5.04	33.84250000	-92.46916667	1962	1981	20
239	07362500	B2	08040201	240	240.54	33.79222222	-92.33333333	1938	2013	76
240	07362587	B1	08040203	27.0	26.56	34.79750000	-92.93388889	1990	2013	24
241	07363000	B1	08040203	550	549.02	34.56777778	-92.61027778	1927	2013	87
242	07363200	B2	08040203	1,120	1,121.57	34.11611111	-92.40555556	1938	2013	76
243	07363300	B2	08040203	204	204.3	34.31944444	-92.34444444	1960	1995	36
244	07363330	B2	08040203	4.86	4.85	34.32027778	-92.39527778	1960	1981	22
245	07363430	B2	08040203	0.66	0.66	34.29916667	-92.19361111	1961	1981	21
246	07363435	B2	08040203	77.0	78.13	34.14555556	-92.24416667	1988	2004	17
247	07363450	B2	08040203	0.28	0.27	33.93666667	-92.17527778	1964	1986	23
248	07363500	B2	08040204	2,100	2,092.3	33.70083333	-92.02583333	1927	2013	87
249	[1]07364030	B2	08040204	0.36	0.34	33.41333333	-92.20916667	1963	2004	42
250	07364070	B2	08040202	5.62	5.63	33.07555556	-92.32583333	1963	1983	21
251	07364110	D	08040205	0.75	0.76	34.16888889	-92.08666667	1961	2004	44
252	07364120	D	08040205	215	213.96	33.96111111	-91.78472222	1942	1980	39
253	07364128	D	08040205	102	106.61	34.03388889	-91.70972222	1991	2004	14
254	07364140	D	08040205	15.8	35.98	33.82472222	-91.73500000	1993	2004	12
255	07364150	D	08040205	576	608.23	33.62777778	-91.44583333	1930	2013	84
256	07364165	D	08040205	18.8	18.23	33.73888889	-91.74750000	1963	1983	21
257	07364260	D	08040205	20.9	21.07	33.17000000	-91.82777778	1962	1983	22
258	07364300	D	08040205	271	274.25	32.98194444	-91.80555556	1956	1979	24
259	07364500	D	08040205	1,645	1,622.29	32.87222222	-91.86777778	1927	1980	54

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
223	21	0	21	0	0	0	1.8919	0.4080	0.117	-0.043	0.809	-0.592
224	41	0	41	0	0	0	4.0377	0.2788	-0.043	0.099	0.369	71.169
225	24	0	24	0	0	0	1.8581	0.3601	-0.001	-0.069	0.655	-0.515
226	36	1	35	0	3,420.0	14	3.5815	0.1832	-0.200	-0.151	0.206	-47.826
227	41	0	41	0	0	0	3.8598	0.2878	-0.102	-0.068	0.537	-43.611
228	64	0	62	2	0	0	4.0842	0.2185	-0.196	0.059	0.500	26.087
229	43	32	11	0	0	0	4.4991	0.3180	-0.194	0.073	0.815	600.000
230	24	0	24	0	48.0	1	2.3323	0.3962	-0.199	0.159	0.286	6.292
231	16	0	16	0	0	0	2.8624	0.1892	-0.040	-0.092	0.652	-6.905
232	20	0	20	0	0	0	2.6760	0.2229	-0.020	-0.147	0.381	-8.125
233	41	0	41	0	0	0	4.2288	0.1794	-0.029	0.202	0.064	125.658
234	15	1	14	0	0	0	2.5100	0.2743	-0.231	0.154	0.476	13.889
235	21	0	21	0	0	0	2.5710	0.4526	-0.159	-0.143	0.381	-17.000
236	75	0	75	0	0	0	3.8048	0.3969	0.011	-0.019	0.816	-5.000
237	42	0	42	0	0	0	2.9435	0.3972	-0.202	0.144	0.182	12.500
238	20	0	20	0	0	0	2.7995	0.3649	-0.260	-0.111	0.516	-11.384
239	63	0	62	1	0	0	3.6800	0.3809	-0.300	0.126	0.148	41.714
240	24	0	24	0	2,550.0	1	3.8031	0.2289	-0.184	0.116	0.442	51.250
241	77	0	76	1	0	0	4.4527	0.2760	-0.236	-0.041	0.603	-50.581
242	76	10	66	0	6,700.0	3	4.3501	0.3012	-0.197	0.140	0.098	168.421
243	35	0	34	1	5,450.0	13	3.8471	0.3486	-0.115	-0.109	0.374	-93.333
244	22	0	22	0	0	0	2.6280	0.4149	-0.215	0.009	0.977	0.714
245	21	0	21	0	0	0	2.0707	0.4091	-0.045	0.100	0.546	3.389
246	15	3	12	0	0	0	3.1055	0.3091	-0.098	-0.076	0.783	-33.125
247	23	0	23	0	0	0	1.6189	0.4767	-0.431	0.016	0.937	0.167
248	77	0	76	1	0	0	4.3437	0.3131	-0.237	-0.051	0.521	-57.282
249	38	0	38	0	20.0	9	1.6235	0.4115	-0.275	0.243	0.033	1.526
250	21	0	21	0	0	0	2.5131	0.2576	-0.245	0.195	0.226	6.147
251	41	4	37	0	0	0	2.1281	0.3178	-0.132	0.053	0.656	0.659
252	32	0	32	0	0	0	3.2198	0.1924	-0.322	-0.044	0.733	-2.500
253	14	0	14	0	1,350.0	3	3.1778	0.0626	-0.160	-0.253	0.227	-23.636
254	11	0	11	0	2,250.0	1	3.6156	0.2512	-0.027	-0.073	0.815	-93.750
255	77	0	75	2	1,960.0	7	3.5151	0.1658	-0.297	0.098	0.213	9.231
256	21	0	21	0	300.0	1	2.9540	0.3085	0.018	0.071	0.672	11.339
257	22	0	22	0	250.0	2	2.8153	0.3266	-0.215	0.268	0.085	37.500
258	24	0	24	0	0	0	3.6612	0.4131	-0.237	0.123	0.413	133.000
259	53	1	52	0	4,610.0	5	3.8400	0.1377	-0.197	-0.013	0.900	-2.654

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code	Published drainage area (mi²)	GIS drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	Beginning year	Ending year	Historic period length (years)
260	07364700	B2	08040202	141	156.21	32.95527778	-92.49972222	1956	1977	22
261	07364800	B2	08040206	30.0	30.45	32.80833333	-93.05555556	1954	1983	30
262	07364860	B2	08040206	0.93	0.91	32.63611111	-92.87222222	1954	1967	14
263	[1]07364870	B2	08040206	47.0	46.05	32.68888889	-92.85833333	1966	2013	48
264	[1]07365000	B2	08040206	355	363.72	32.68055556	-92.65277778	1933	1968	36
265	07365300	B2	08040206	43.9	43.93	32.92777778	-92.99444444	1954	1983	30
266	07365800	B2	08040206	180	179.63	33.03805556	-92.94055556	1956	2004	49
267	07365900	B2	08040206	50.4	50.38	33.06694444	-92.88388889	1956	1978	23
268	07366000	B2	08040206	462	460.38	32.88750000	-92.65694444	1941	1983	43
269	07366200	B2	08040206	208	169.04	32.92916667	-92.63277778	1956	2013	58
270	07366350	B2	08040206	29.0	29.22	32.67222222	-92.47222222	1954	1983	30
271	07366360	B2	08040206	0.18	0.16	32.67500000	-92.37916667	1957	1968	12
272	07366403	B2	08040206	0.54	0.57	32.53194444	-92.46527778	1966	2007	42
273	[1]07366420	B2	08040206	113	111.06	32.54166667	-92.37916667	1966	2013	48
274	07367658	D	08050001	0.94	1.31	33.86305556	-91.47944444	1961	1986	26
275	07367670	D	08050001	3.24	2.44	33.30416667	-91.49361111	1961	1983	23
276	07367740	D	08050001	1.86	2.2	33.11527778	-91.52527778	1963	1985	23
277	07367800	D	08050001	1,052	967.7	32.77166667	-91.59583333	1947	1977	31
278	07368300	D	08050001	0.42	0.15	32.35694444	-91.85694444	1966	1981	16
279	07368500	D	08050001	42.0	36.88	32.79861111	-91.50138889	1941	1977	37
280	07369250	D	08050001	0.35	0.4	32.09861111	-91.70833333	1955	1967	13
281	07369680	D	08050002	500	527.88	33.10027778	-91.25444444	1932	2013	82

[1]Annual peak-discharge record for station had statistically significant ($p \leq 0.05$) trend. Station was retested using 95 percent of the annual peak-discharge record, the results of which indicated no trend ($p > 0.05$). Values in table indicate results using all of the annual peak-discharge record.

[2]Includes annual peak-discharge records from former station 07055608, Crooked Creek at Yellville, Arkansas.

[3]Includes annual peak-discharge records from former station 07058500, Little Black River at Fairdealing, Missouri.

[4]Includes annual peak-discharge records from former station 07250000, Lee Creek near Van Buren, Arkansas.

[5]Includes annual peak-discharge records from former station 07257000, Big Piney Creek near Dover, Arkansas.

[6]Annual peak-discharge records from preregulation period used in regression analysis.

Table 4. Expected-Moments Algorithm information for U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; mi², square miles; GIS, geographic information system; MGB, multiple Grubbs-Beck test; PILF, potentially influential low flood; EMA, Expected Moments Algorithm; ≤, less than or equal to]

Site number (fig. 1)	Number of annual peaks	Peaks not used	Systematic peaks	Historic peaks	MGB PILF threshold	Number of PILFs	EMA moments using weighted skew			Results of Mann-Kendall test		
							Mean	Standard deviation	Skew	Kendall's tau	*p*-value	Sen slope
260	22	0	22	0	0	0	3.4195	0.3986	0.136	-0.022	0.910	-7.500
261	25	1	24	0	0	0	3.0927	0.4671	-0.176	-0.04	0.804	-14.222
262	14	3	11	0	0	0	2.2361	0.3830	-0.105	-0.055	0.876	-3.500
263	48	0	48	0	801.0	4	3.4428	0.3760	-0.167	0.231	0.021	51.339
264	29	1	28	0	2,300.0	1	3.7753	0.3169	-0.027	0.278	0.040	215.431
265	25	0	25	0	960.0	3	3.3961	0.3632	-0.076	0.077	0.607	34.286
266	45	0	45	0	0	0	3.6932	0.4171	-0.009	0.124	0.233	53.250
267	23	0	23	0	0	0	3.3311	0.4176	0.028	0.150	0.328	45.000
268	43	0	43	0	0	0	3.7599	0.3734	-0.160	-0.068	0.530	-35.000
269	58	0	58	0	0	0	3.5488	0.3552	-0.197	0.053	0.564	11.778
270	25	0	25	0	0	0	2.9422	0.6241	-0.209	-0.013	0.944	-1.160
271	12	0	12	0	0	0	1.4813	0.4310	-0.141	-0.136	0.582	-1.508
272	41	0	41	0	0	0	2.1714	0.3531	0.074	0.196	0.072	2.000
273	48	0	48	0	0	0	3.5997	0.3839	-0.105	0.200	0.045	57.587
274	26	0	26	0	0	0	2.1926	0.1480	-0.052	-0.086	0.552	-0.750
275	23	0	23	0	0	0	2.4139	0.2002	-0.144	0.249	0.101	6.667
276	23	0	23	0	165.0	3	2.3586	0.1257	-0.146	-0.055	0.731	-0.750
277	31	17	14	0	0	0	4.0188	0.1693	-0.072	0.341	0.098	415.556
278	16	5	11	0	26.0	3	1.5204	0.1656	-0.217	-0.145	0.585	-0.500
279	37	9	28	0	592.0	1	3.0206	0.1464	-0.180	-0.045	0.752	-4.410
280	13	0	13	0	0	0	1.9501	0.2110	0.033	0.256	0.246	3.071
281	76	9	66	1	0	0	3.4244	0.1456	-0.259	-0.025	0.773	-1.250

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
1	07040040	Delaware Creek tributary near Bloomfield, MO	C	0.0016	0.046	0.001546218	0.0018	0.033	0.001706897	0.0023	0.030	0.002136223
2	07047200	Ditch no. 45 near Lepanto, AR	D	0.0004	0.022	0.000392857	0.0004	0.022	0.000392857	0.0005	0.027	0.000490909
3	07047820	Murray Creek near Jonesboro, AR	C	0.0016	0.044	0.001543860	0.0019	0.031	0.001790274	0.0025	0.028	0.002295082
4	07047823	Murray Creek tributary near Jonesboro, AR	C	0.0034	0.045	0.003161157	0.0037	0.032	0.003316527	0.0046	0.028	0.003950920
5	07047880	Pope Creek tributary at Birdeye, AR	C	0.0029	0.047	0.002731463	0.0038	0.034	0.003417989	0.0052	0.029	0.004409357
6	07047924	Crooked Bayou tributary at State Highway 149 at Hughes, AR	D	0.0053	0.020	0.004189723	0.0070	0.020	0.005185185	0.0094	0.024	0.006754491
7	07047942	L'Anguille River near Colt, AR	D	0.0016	0.019	0.001475728	0.0018	0.020	0.001651376	0.0023	0.024	0.002098859
8	07047975	Dog Branch at St. Paul, AR	C	0.0063	0.047	0.005555347	0.0071	0.034	0.005873479	0.0091	0.029	0.006926509
9	07047990	West Fork White River tributary near Greenland, AR	C	0.0076	0.046	0.006522388	0.0084	0.033	0.006695652	0.0107	0.028	0.007741602
10	07048000	West Fork White River at Greenland, AR	C	0.0032	0.045	0.002987552	0.0037	0.032	0.003316527	0.0049	0.028	0.004170213
11	07048600	White River near Fayetteville, AR	C	0.0020	0.045	0.001914894	0.0026	0.033	0.002410112	0.0035	0.029	0.003123077
12	07048800	Richland Creek at Goshen, AR	C	0.0180	0.045	0.012857143	0.0243	0.032	0.013811723	0.0329	0.028	0.015126437
13	07048900	Whitener Branch tributary near Spring Valley, AR	C	0.0029	0.050	0.002741021	0.0039	0.036	0.003518797	0.0053	0.032	0.004546917
14	07048940	War Eagle Creek near Witter, AR	C	0.0063	0.045	0.005526316	0.0074	0.032	0.006010152	0.0096	0.029	0.007212435
15	07049000	War Eagle Creek near Hindsville, AR	C	0.0016	0.045	0.001545064	0.0017	0.032	0.001614243	0.0021	0.028	0.001953488
16	07050200	Maxwell Creek at Kingston, AR	C	0.0082	0.045	0.006936090	0.0094	0.032	0.007265700	0.0121	0.029	0.008537713
17	07050285	Osage Creek at Osage, AR	C	0.0055	0.045	0.004900990	0.0062	0.032	0.005193717	0.0079	0.030	0.006253298
18	07050400	Freeman Branch at Berryville, AR	C	0.0039	0.044	0.003582463	0.0046	0.032	0.004021858	0.0059	0.027	0.004841945
19	07050500	Kings River near Berryville, AR	C	0.0013	0.045	0.001263499	0.0015	0.032	0.001432836	0.0020	0.028	0.001866667
20	07053207	Long Creek at Denver, AR	C	0.0076	0.045	0.006501901	0.0100	0.032	0.007619048	0.0135	0.028	0.009108434
21	07053250	Yocum Creek near Oak Grove, AR	C	0.0104	0.047	0.008515679	0.0139	0.034	0.009866388	0.0189	0.029	0.011442589
22	07053810	Bull Creek near Walnut Shade, MO	C	0.0058	0.044	0.005124498	0.0070	0.032	0.005743590	0.0094	0.028	0.007037433
23	07053950	Ingenthron Hollow near Forsyth, MO	C	0.0044	0.045	0.004008097	0.0057	0.032	0.004838196	0.0077	0.027	0.005991354
24	07054047	Little Beaver Creek near Ava, MO	C	0.0342	0.044	0.019242967	0.0327	0.031	0.015913658	0.0422	0.028	0.016831909
25	07054080	Beaver Creek at Bradleyville, MO	C	0.0058	0.045	0.005137795	0.0061	0.032	0.005123360	0.0084	0.028	0.006461538
26	07054100	Cedar Hollow at Bradleyville, MO	C	0.0072	0.045	0.006206897	0.0070	0.032	0.005743590	0.0097	0.028	0.007204244
27	07054200	Yanell Branch near Kirbyville, MO	C	0.0078	0.045	0.006647727	0.0027	0.032	0.002489914	0.0033	0.029	0.002962848
28	07054300	Gray Branch at Lutie, MO	C	0.0048	0.048	0.004363636	0.0049	0.034	0.004282776	0.0064	0.030	0.005274725
29	07054400	Charley Creek near Omaha, AR	C	0.0043	0.044	0.003917184	0.0057	0.031	0.004814714	0.0077	0.027	0.005991354
30	07054410	Bear Creek near Omaha, AR	C	0.0115	0.044	0.009117117	0.0141	0.031	0.009691796	0.0185	0.027	0.010978022
31	07054450	East Sugarloaf Creek tributary near Lead Hill, AR	C	0.0026	0.045	0.002457983	0.0031	0.032	0.002826211	0.0041	0.027	0.003559486

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
32	07055550	Crooked Creek tributary near Dog Patch, AR	C	0.0042	0.048	0.003862069	0.0056	0.035	0.004827586	0.0077	0.031	0.006167959
33	07055607	Crooked Creek at Kelly Crossing at Yellville, AR	C	0.0051	0.045	0.004580838	0.0067	0.032	0.005540052	0.0092	0.028	0.006924731
34	07055646	Buffalo River near Boxley, AR	C	0.0060	0.046	0.005307692	0.0065	0.033	0.005430380	0.0082	0.028	0.006342541
35	07055650	Smith Creek near Boxley, AR	C	0.0101	0.046	0.008281640	0.0114	0.033	0.008472973	0.0145	0.028	0.009552941
36	07055800	Dry Branch near Vendor, AR	C	0.0091	0.045	0.007569316	0.0102	0.032	0.007734597	0.0131	0.028	0.008924574
37	07055875	Richland Creek near Witts Spring, AR	C	0.0057	0.046	0.005071567	0.0075	0.033	0.006111111	0.0101	0.030	0.007556110
38	07056000	Buffalo River near St. Joe, AR	C	0.0014	0.046	0.001358650	0.0014	0.033	0.001343023	0.0017	0.029	0.001605863
39	07056515	Bear Creek near Silver Hill, AR	C	0.0074	0.045	0.006354962	0.0082	0.032	0.006527363	0.0103	0.028	0.007530026
40	07057500	North Fork River near Tecumseh, MO	C	0.0020	0.045	0.001914894	0.0026	0.032	0.002404624	0.0036	0.028	0.003189873
41	07058000	Bryant Creek near Tecumseh, MO	C	0.0023	0.045	0.002188161	0.0025	0.032	0.002318841	0.0032	0.028	0.002871795
42	07058980	Bennetts River at Vidette, AR	C	0.0013	0.045	0.001263499	0.0012	0.032	0.001156627	0.0017	0.027	0.001599303
43	07059450	Big Creek near Elizabeth, AR	C	0.0043	0.044	0.003917184	0.0050	0.032	0.004324324	0.0064	0.027	0.005173653
44	07060600	Band Mill Creek near Brockwell, AR	C	0.0037	0.044	0.003412998	0.0050	0.031	0.004305556	0.0071	0.027	0.005621701
45	07060710	North Sylamore Creek near Fifty Six, AR	C	0.0043	0.044	0.003917184	0.0044	0.031	0.003853107	0.0054	0.027	0.004500000
46	07060830	Wolf Bayou near Drasco, AR	C	0.0087	0.048	0.007365079	0.0094	0.034	0.007364055	0.0118	0.030	0.008468900
47	07061100	Gibbs Creek at Sulphur Rock, AR	C	0.0043	0.045	0.003924949	0.0050	0.032	0.004324324	0.0065	0.028	0.005275362
48	07061260	East Fork Black River near Ironton, MO	C	0.0112	0.044	0.008927536	0.0125	0.032	0.008988764	0.0158	0.029	0.010227679
49	07061270	East Fork Black River near Lesterville, MO	C	0.0071	0.044	0.006113503	0.0083	0.032	0.006590571	0.0107	0.030	0.007886978
50	07061500	Black River near Annapolis, MO	C	0.0017	0.045	0.001638116	0.0017	0.032	0.001614243	0.0022	0.029	0.002044872
51	07061800	Brawley Hollow near Centerville, MO	C	0.0015	0.045	0.001451613	0.0018	0.032	0.001704142	0.0024	0.028	0.002210526
52	07061900	Logan Creek at Ellington, MO	C	0.0340	0.044	0.019179487	0.0353	0.032	0.016784547	0.0437	0.027	0.016688826
53	07063470	Tenmile Creek near Poplar Bluff, MO	C	0.0049	0.044	0.004408998	0.0052	0.031	0.004453039	0.0066	0.028	0.005341040
54	07064300	Fudge Hollow near Licking, MO	C	0.0046	0.044	0.004164609	0.0061	0.032	0.005123360	0.0082	0.027	0.006289773
55	07064500	Big Creek near Yukon, MO	C	0.0043	0.044	0.003917184	0.0047	0.031	0.004081232	0.0058	0.030	0.004860335
56	07064533	Current River above Akers, MO	C	0.0232	0.044	0.015190476	0.0268	0.032	0.014585034	0.0342	0.028	0.015395498
57	07065200	Jacks Fork near Mountain View, MO	C	0.0082	0.044	0.006911877	0.0092	0.032	0.007145631	0.0117	0.029	0.008336609
58	07066000	Jacks Fork at Eminence, MO	C	0.0017	0.045	0.001638116	0.0019	0.032	0.001793510	0.0023	0.027	0.002119454
59	07066800	Sycamore Creek near Winona, MO	C	0.0053	0.044	0.004730223	0.0058	0.032	0.004910053	0.0077	0.028	0.006039216
60	07068000	Current River at Doniphan, MO	C	0.0013	0.046	0.001264271	0.0014	0.033	0.001343023	0.0017	0.028	0.001602694
61	07068200	North Prong Little Black River at Hunter, MO	C	0.0085	0.044	0.007123810	0.0091	0.032	0.007085158	0.0114	0.028	0.008101523
62	07068510	Little Black River below Fairdealing, MO	C	0.0043	0.044	0.003917184	0.0051	0.032	0.004398922	0.0066	0.027	0.005303571
63	07068870	Fourche River tributary at Middlebrook, AR	C	0.0019	0.046	0.001824635	0.0025	0.033	0.002323944	0.0034	0.028	0.003031847

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
64	07068890	Fourche River above Pocahontas, AR	C	0.0078	0.044	0.006625483	0.0087	0.032	0.006840295	0.0110	0.027	0.007815789
65	07069100	Adams Branch near West Plains, MO	C	0.0013	0.045	0.001263499	0.0017	0.032	0.001614243	0.0023	0.027	0.002119454
66	07069250	Brush Creek near Mammoth Spring, AR	C	0.0026	0.046	0.002460905	0.0034	0.033	0.003082418	0.0046	0.029	0.003970238
67	07069290	Miller Creek near Salem, AR	C	0.0052	0.044	0.004650407	0.0062	0.032	0.005193717	0.0082	0.028	0.006342541
68	07069500	Spring River at Imboden, AR	C	0.0016	0.045	0.001545064	0.0019	0.032	0.001793510	0.0025	0.028	0.002295082
69	07070000	Kings Creek near Willow Springs, MO	C	0.0101	0.044	0.008214418	0.0107	0.031	0.007954436	0.0145	0.027	0.009433735
70	07070500	Eleven Point River near Thomasville, MO	C	0.0031	0.045	0.002900208	0.0040	0.032	0.003555556	0.0056	0.028	0.004666667
71	07071750	Louse Creek near Alton, MO	C	0.0237	0.044	0.015403250	0.0257	0.031	0.014051146	0.0324	0.028	0.015019868
72	07071800	Williams Spring Branch near Alton, MO	C	0.0074	0.044	0.006334630	0.0089	0.031	0.006914787	0.0118	0.028	0.008301508
73	07072000	Eleven Point River near Ravenden Springs, AR	C	0.0016	0.045	0.001545064	0.0021	0.032	0.001970674	0.0031	0.028	0.002790997
74	07072200	Hubble Creek near Pocahontas, AR	C	0.0012	0.046	0.001169492	0.0014	0.033	0.001343023	0.0018	0.028	0.001691275
75	07074000	Strawberry River near Poughkeepsie, AR	C	0.0012	0.045	0.001168831	0.0015	0.032	0.001432836	0.0021	0.028	0.001953488
76	07074200	Dry Branch tributary near Sidney, AR	C	0.0034	0.044	0.003156118	0.0036	0.032	0.003235955	0.0047	0.027	0.004003155
77	07074250	Reeds Creek near Strawberry, AR	C	0.0057	0.044	0.005046278	0.0076	0.031	0.006103627	0.0102	0.027	0.007403226
78	07074550	Village Creek near Okean, AR	D	0.0098	0.018	0.006345324	0.0119	0.019	0.007317152	0.0158	0.022	0.009195767
79	07074855	Cypress Creek tributary near Augusta, AR	D	0.0026	0.018	0.002271845	0.0034	0.018	0.002859813	0.0046	0.022	0.003804511
80	07074865	Glaise Creek near Bradford, AR	C	0.0130	0.045	0.010086207	0.0147	0.032	0.010072805	0.0187	0.028	0.011211991
81	07074900	Trace Creek tributary near Marshall, AR	C	0.0030	0.047	0.002820000	0.0034	0.034	0.003090909	0.0046	0.029	0.003970238
82	07074950	Tick Creek near Leslie, AR	C	0.0078	0.045	0.006647727	0.0085	0.032	0.006716049	0.0108	0.029	0.007869347
83	07075000	Middle Fork of Little Red River at Shirley, AR	C	0.0015	0.045	0.001451613	0.0018	0.033	0.001706897	0.0025	0.029	0.002301587
84	07075300	South Fork of Little Red River at Clinton, AR	C	0.0020	0.045	0.001914894	0.0023	0.033	0.002150142	0.0030	0.028	0.002709677
85	07075600	Choctaw Creek tributary near Choctaw, AR	C	0.0029	0.046	0.002728016	0.0038	0.033	0.003407609	0.0052	0.028	0.004385542
86	07075800	Dill Branch tributary near Ida, AR	C	0.0045	0.047	0.004106796	0.0049	0.034	0.004282776	0.0063	0.029	0.005175637
87	07076820	Gum Springs Creek near Higginson, AR	D	0.0021	0.022	0.001917012	0.0024	0.023	0.002173228	0.0031	0.027	0.002780731
88	07076850	Cypress Bayou near Beebe, AR	D	0.0065	0.020	0.004905660	0.0071	0.020	0.005239852	0.0090	0.024	0.006545455
89	07076870	Pigeon Roost Creek at Butlerville, AR	D	0.0034	0.020	0.002905983	0.0036	0.021	0.003073171	0.0045	0.025	0.003813559
90	07077200	Big Creek tributary near Boydsville, AR	C	0.0012	0.045	0.001168831	0.0013	0.032	0.001249249	0.0016	0.028	0.001513514
91	07077340	Sugar Creek tributary near Walcott, AR	C	0.0030	0.045	0.002812500	0.0034	0.032	0.003073446	0.0043	0.028	0.003727554
92	07077380	Cache River at Egypt, AR	D	0.0003	0.020	0.000295567	0.0004	0.020	0.000392157	0.0005	0.024	0.000489796
93	07077430	Willow Ditch near Egypt, AR	D	0.0021	0.020	0.001900452	0.0029	0.020	0.002532751	0.0040	0.025	0.003448276
94	07077500	Cache River at Patterson, AR	D	0.0005	0.019	0.000487179	0.0006	0.019	0.000581633	0.0008	0.023	0.000773109
95	07077680	Three Mile Creek near Amagon, AR	D	0.0004	0.019	0.000391753	0.0004	0.019	0.000391753	0.0005	0.023	0.000489362

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
96	07077860	Boat Gunwale Slash tributary near Holly Grove, AR	D	0.0007	0.018	0.000673797	0.0006	0.018	0.000580645	0.0009	0.022	0.000864629
97	07077920	Big Creek at Goodwin, AR	D	0.0009	0.018	0.000857143	0.0010	0.018	0.000947368	0.0013	0.022	0.001227468
98	07077940	Spring Creek near Aubrey, AR	D	0.0006	0.019	0.000581633	0.0003	0.019	0.000295337	0.0005	0.024	0.000489796
99	07077950	Big Creek at Poplar Grove, AR	D	0.0016	0.019	0.001475728	0.0017	0.019	0.001560386	0.0022	0.023	0.002007937
100	07078000	LaGrue Bayou near Stuttgart, AR	D	0.0043	0.018	0.003470852	0.0047	0.018	0.003726872	0.0058	0.022	0.004589928
101	07078170	Little LaGrue Bayou tributary near DeWitt, AR	D	0.0003	0.019	0.000295337	0.0004	0.019	0.000391753	0.0005	0.024	0.000489796
102	07078210	Tarleton Creek tributary at Ethel, AR	D	0.0033	0.020	0.002832618	0.0045	0.020	0.003673469	0.0062	0.025	0.004967949
103	07188500	Lost Creek at Seneca, MO	A	0.0173	0.031	0.011103520	0.0228	0.020	0.010654206	0.0310	0.019	0.011780000
104	07188653	Big Sugar Creek near Powell, MO	A	0.0141	0.031	0.009691796	0.0170	0.020	0.009189189	0.0220	0.019	0.010195122
105	07188900	Butler Creek tributary near Gravette, AR	A	0.0207	0.032	0.012569260	0.0120	0.022	0.007764706	0.0173	0.021	0.009485640
106	07189000	Elk River near Tiff City, MO	A	0.0023	0.032	0.002145773	0.0018	0.020	0.001651376	0.0026	0.019	0.002287037
107	07189100	Buffalo Creek at Tiff City, MO	A	0.0128	0.031	0.009059361	0.0170	0.020	0.009189189	0.0227	0.018	0.010039312
108	07189540	Cave Springs Branch near South West City, MO	A	0.0079	0.031	0.006295630	0.0097	0.020	0.006531987	0.0126	0.019	0.007575949
109	07189542	Honey Creek near South West City, MO	A	0.0166	0.031	0.010810924	0.0196	0.020	0.009898990	0.0253	0.018	0.010517321
110	07191220	Spavinaw Creek near Sycamore, OK	A	0.0071	0.031	0.005776903	0.0039	0.020	0.003263598	0.0062	0.019	0.004674603
111	07191222	Beaty Creek near Jay, OK	A	0.0242	0.031	0.013590580	0.0283	0.020	0.011718427	0.0364	0.018	0.012044118
112	07194800	Illinois River at Savoy, AR	A	0.0087	0.031	0.006793451	0.0104	0.020	0.006842105	0.0136	0.019	0.007926380
113	07195200	Brush Creek tributary near Tontitown, AR	A	0.0123	0.033	0.008960265	0.0084	0.023	0.006152866	0.0123	0.022	0.007889213
114	07195800	Flint Creek at Springtown, AR	A	0.0049	0.031	0.004231198	0.0064	0.021	0.004905109	0.0087	0.019	0.005967509
115	07196000	Flint Creek near Kansas, OK	A	0.0052	0.031	0.004453039	0.0057	0.020	0.004435798	0.0072	0.019	0.005221374
116	07196380	Steely Hollow near Tahlequah, OK	A	0.0378	0.032	0.017329513	0.0429	0.020	0.013640700	0.0544	0.019	0.014081744
117	07196500	Illinois River near Tahlequah, OK	A	0.0017	0.032	0.001614243	0.0017	0.020	0.001566820	0.0022	0.019	0.001971698
118	07196900	Baron Fork at Dutch Mills, AR	A	0.0025	0.031	0.002313433	0.0011	0.020	0.001042654	0.0018	0.019	0.001644231
119	07196973	Peacheater Creek at Christie, OK	A	0.0067	0.031	0.005509284	0.0038	0.020	0.003193277	0.0047	0.019	0.003767932
120	07197000	Baron Fork at Eldon, OK	A	0.0019	0.032	0.001793510	0.0020	0.020	0.001818182	0.0025	0.019	0.002209302
121	07197360	Caney Creek near Barber, OK	A	0.0028	0.031	0.002568047	0.0037	0.020	0.003122363	0.0051	0.018	0.003974026
122	07245500	Sallisaw Creek near Sallisaw, OK	A	0.0081	0.031	0.006421995	0.0098	0.020	0.006577181	0.0129	0.018	0.007514563
123	07246610	Pecan Creek near Spiro, OK	A	0.0042	0.033	0.003725806	0.0049	0.021	0.003972973	0.0062	0.020	0.004732824
124	07246630	Big Black Fox Creek near Long, OK	A	0.0051	0.032	0.004398922	0.0052	0.020	0.004126984	0.0064	0.019	0.004787402
125	07247000	Poteau River at Cauthron, AR	A	0.0031	0.031	0.002818182	0.0034	0.020	0.002905983	0.0044	0.018	0.003535714
126	07247250	Black Fork below Big Creek near Page, OK	A	0.0054	0.031	0.004598901	0.0057	0.020	0.004435798	0.0072	0.019	0.005221374
127	07247500	Fourche Maline near Red Oak, OK	A	0.0064	0.031	0.005304813	0.0077	0.020	0.005559567	0.0101	0.018	0.006469751

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
128	07248500	Poteau River near Wister, OK	A	0.0123	0.032	0.008884876	0.0144	0.020	0.008372093	0.0184	0.019	0.009347594
129	07249000	Poteau River at Poteau, OK	A	0.0064	0.032	0.005333333	0.0065	0.021	0.004963636	0.0084	0.019	0.005824818
130	07249400	James Fork near Hackett, AR	A	0.0015	0.031	0.001430769	0.0017	0.020	0.001566820	0.0022	0.018	0.001960396
131	07249490	Lee Creek near Lee Creek, AR	A	0.0106	0.031	0.007899038	0.0116	0.021	0.007472393	0.0147	0.019	0.008287834
132	07249500	Cove Creek near Lee Creek, AR	A	0.0032	0.031	0.002900585	0.0036	0.021	0.003073171	0.0047	0.019	0.003767932
133	07249650	Mountain Fork near Evansville, AR	A	0.0064	0.031	0.005304813	0.0071	0.021	0.005306050	0.0090	0.020	0.006206897
134	07249920	Little Lee Creek near Nicut, OK	A	0.0070	0.031	0.005710526	0.0092	0.020	0.006301370	0.0123	0.018	0.007306931
135	07249950	Webber Creek tributary near Cedarville, AR	A	0.0074	0.033	0.006044554	0.0083	0.022	0.006026403	0.0107	0.021	0.007088328
136	07249985	Lee Creek near Short, OK	A	0.0013	0.032	0.001249249	0.0014	0.020	0.001308411	0.0018	0.019	0.001644231
137	07250965	Frog Bayou at Winfrey, AR	A	0.0065	0.031	0.005373333	0.0078	0.022	0.005758389	0.0099	0.020	0.006622074
138	07250974	Jack Creek near Winfrey, AR	A	0.0176	0.031	0.011226337	0.0196	0.022	0.010365385	0.0247	0.021	0.011350109
139	07251790	Mulberry River near Oark, AR	A	0.0062	0.031	0.005166667	0.0075	0.021	0.005526316	0.0098	0.020	0.006577181
140	07252000	Mulberry River near Mulberry, AR	A	0.0013	0.032	0.001249249	0.0013	0.021	0.001224215	0.0016	0.019	0.001475728
141	07252200	North Fork White Oak Creek tributary near Watalula, AR	A	0.0033	0.033	0.003000000	0.0039	0.022	0.003312741	0.0052	0.020	0.004126984
142	07252500	Sixmile Ck subwatershed no. 6 near Chismville, AR	A	0.0061	0.032	0.005123360	0.0066	0.020	0.004962406	0.0083	0.019	0.005776557
143	07254000	Sixmile Creek subwatershed no. 5 near Chismville, AR	A	0.0039	0.032	0.003476323	0.0030	0.020	0.002608696	0.0043	0.019	0.003506438
144	07254500	Sixmile Creek subwatershed no. 2 near Culksville, AR	A	0.0049	0.032	0.004249322	0.0056	0.020	0.004375000	0.0071	0.019	0.005168582
145	07255100	Sixmile Creek subwatershed no. 23 near Branch, AR	A	0.0098	0.032	0.007502392	0.0103	0.021	0.006910543	0.0128	0.019	0.007647799
146	07256000	Hurricane Creek near Caulksville, AR	A	0.0039	0.031	0.003464183	0.0046	0.021	0.003773438	0.0062	0.019	0.004674603
147	07256490	Greenbrier Creek at Clarksville, AR	A	0.0045	0.031	0.003929577	0.0050	0.020	0.004000000	0.0067	0.019	0.004953307
148	07256500	Spadra Creek at Clarksville, AR	A	0.0020	0.031	0.001878788	0.0019	0.020	0.001735160	0.0022	0.018	0.001960396
149	07257006	Big Piney Creek at Highway 164 near Dover, AR	A	0.0018	0.032	0.001704142	0.0021	0.021	0.001909091	0.0028	0.019	0.002440367
150	07257060	Mikes Creek tributary near Ozone, AR	A	0.0046	0.034	0.004051813	0.0056	0.026	0.004607595	0.0074	0.025	0.005709877
151	07257100	Minnow Creek tributary near Hagerville, AR	A	0.0029	0.034	0.002672087	0.0033	0.022	0.002869565	0.0043	0.020	0.003539095
152	07257200	Little Piney Creek near Lamar, AR	A	0.0012	0.031	0.001155280	0.0016	0.020	0.001481481	0.0022	0.018	0.001960396
153	07257500	Illinois Bayou near Scottsville, AR	A	0.0015	0.031	0.001430769	0.0018	0.020	0.001651376	0.0025	0.019	0.002209302
154	07257700	McCoy Creek near Dover, AR	A	0.0113	0.031	0.008281324	0.0126	0.020	0.007730061	0.0163	0.019	0.008773371
155	07258200	Pack Saddle Creek tributary near Waldron, AR	A	0.0026	0.033	0.002410112	0.0031	0.021	0.002701245	0.0041	0.020	0.003402490
156	07258500	Petit Jean River near Booneville, AR	A	0.0008	0.031	0.000779874	0.0009	0.020	0.000861244	0.0012	0.019	0.001128713
157	07260000	Dutch Creek at Waltreak, AR	A	0.0010	0.031	0.000968750	0.0011	0.020	0.001042654	0.0013	0.018	0.001212435

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
158	07260500	Petit Jean River at Danville, AR	A	0.0041	0.032	0.003634349	0.0050	0.020	0.004000000	0.0066	0.019	0.004898438
159	07260630	Jake Creek near Chickalah, AR	A	0.0038	0.032	0.003396648	0.0045	0.021	0.003705882	0.0065	0.019	0.004843137
160	07260673	West Fork Point Remove Creek near Hattieville, AR	A	0.0045	0.031	0.003929577	0.0059	0.020	0.004555985	0.0080	0.018	0.005538462
161	07260679	East Fork Point Remove Creek tributary near Saint Vincent, AR	A	0.0020	0.036	0.001894737	0.0022	0.024	0.002015267	0.0028	0.023	0.002496124
162	07261000	Cadron Creek near Guy, AR	A	0.0010	0.031	0.000968750	0.0010	0.020	0.000952381	0.0012	0.018	0.001125000
163	07261050	Pine Mountain Creek tributary near Damascus, AR	A	0.0045	0.033	0.003960000	0.0059	0.021	0.004605948	0.0080	0.020	0.005714286
164	07261300	Tan-A-Hill Creek near Boles, AR	A	0.0099	0.032	0.007560859	0.0130	0.022	0.008171429	0.0176	0.021	0.009575130
165	07261500	Fourche LaFave River Near Gravelly, AR	A	0.0014	0.032	0.001341317	0.0016	0.020	0.001481481	0.0021	0.019	0.001890995
166	07261800	Brogan Creek near Rover, AR	A	0.0029	0.032	0.002659026	0.0038	0.021	0.003217742	0.0053	0.020	0.004189723
167	07263000	South Fourche LaFave River near Hollis, AR	A	0.0008	0.031	0.000779874	0.0010	0.020	0.000952381	0.0013	0.018	0.001212435
168	07263100	Fourche LaFave River tributary near Perryville, AR	A	0.0018	0.032	0.001704142	0.0015	0.021	0.001400000	0.0022	0.020	0.001981982
169	07263400	Little Maumelle River at Ferndale, AR	A	0.0039	0.031	0.003464183	0.0044	0.020	0.003606557	0.0055	0.019	0.004265306
170	07263530	Fourche Creek at Red Gate, AR	A	0.0022	0.031	0.002054217	0.0027	0.021	0.002392405	0.0035	0.019	0.002955556
171	07263860	Mile Branch near Tomberlin, AR	D	0.0017	0.019	0.001560386	0.0008	0.019	0.000767677	0.0010	0.023	0.000958333
172	07264100	White Oak Branch near Lonoke, AR	D	0.0016	0.019	0.001475728	0.0017	0.019	0.001560386	0.0022	0.023	0.002007937
173	07335700	Kiamichi River near Big Cedar, OK	B1	0.0017	0.026	0.001595668	0.0018	0.026	0.001683453	0.0023	0.027	0.002119454
174	07336000	Tenmile Creek near Miller, OK	B1	0.0012	0.025	0.001145038	0.0016	0.025	0.001503759	0.0022	0.026	0.002028369
175	07336500	Kiamichi River near Belzoni, OK	B1	0.0008	0.025	0.000775194	0.0009	0.025	0.000868726	0.0011	0.026	0.001055351
176	07336520	Frazier Creek near Oleta, OK	B1	0.0048	0.024	0.004000000	0.0055	0.024	0.004474576	0.0071	0.025	0.005529595
177	07336710	Rock Creek near Sawyer, OK	B2	0.0038	0.030	0.003372781	0.0045	0.023	0.003763636	0.0059	0.024	0.004735786
178	07336780	Perry Creek near Idabel, OK	B2	0.0029	0.026	0.002608997	0.0036	0.020	0.003050847	0.0050	0.020	0.004000000
179	07336785	Bokchito Creek near Garvin, OK	B2	0.0018	0.026	0.001683453	0.0016	0.020	0.001481481	0.0023	0.021	0.002072961
180	07337220	Big Branch near Ringold, OK	B1	0.0104	0.028	0.007583333	0.0137	0.029	0.009304450	0.0182	0.031	0.011467480
181	07337500	Little River near Wright City, OK	B1	0.0026	0.024	0.002345865	0.0031	0.025	0.002758007	0.0040	0.026	0.003466667
182	07337900	Glover River near Glover, OK	B1	0.0012	0.024	0.001142857	0.0015	0.024	0.001411765	0.0021	0.025	0.001937269
183	07338520	Yanubbee Creek near Broken Bow, OK	B1	0.0042	0.026	0.003615894	0.0046	0.026	0.003908497	0.0059	0.028	0.004873156
184	07338700	Twomile Creek near Hatfield, AR	B1	0.0043	0.024	0.003646643	0.0056	0.025	0.004575163	0.0076	0.026	0.005880952
185	07338750	Mountain Fork at Smithville, OK	B1	0.0010	0.024	0.000960000	0.0011	0.024	0.001051793	0.0015	0.025	0.001415094
186	07338780	Mountain Fork tributary near Smithville, OK	B1	0.0045	0.029	0.003895522	0.0060	0.030	0.005000000	0.0080	0.032	0.006400000
187	07339000	Mountain Fork near Eagletown, OK	B1	0.0018	0.024	0.001674419	0.0017	0.025	0.001591760	0.0021	0.026	0.001943060
188	07339500	Rolling Fork near De Queen, AR	B1	0.0049	0.024	0.004069204	0.0064	0.024	0.005052632	0.0086	0.025	0.006398810
189	07340000	Little River near Horatio, AR	B1	0.0013	0.025	0.001235741	0.0015	0.025	0.001415094	0.0018	0.026	0.001683453

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS stream-gage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
190	07340200	West Flat Creek near Foremen, AR	B2	0.0042	0.026	0.003615894	0.0045	0.020	0.003673469	0.0056	0.020	0.004375000
191	07340300	Cossatot River near Vandervoort, AR	B1	0.0019	0.024	0.001760618	0.0019	0.024	0.001760618	0.0024	0.025	0.002189781
192	07340500	Cossatot River near De Queen, AR	B1	0.0020	0.024	0.001846154	0.0026	0.024	0.002345865	0.0036	0.025	0.003146853
193	07341000	Saline River near Dierks, AR	B1	0.0032	0.025	0.002836879	0.0037	0.025	0.003222997	0.0048	0.027	0.004075472
194	07341100	Rock Creek near Dierks, AR	B1	0.0083	0.024	0.006167183	0.0089	0.025	0.006563422	0.0112	0.026	0.007827957
195	07341260	Dillard Creek near Nashville, AR	B2	0.0018	0.023	0.001669355	0.0021	0.018	0.001880597	0.0026	0.018	0.002271845
196	07341700	Caney Creek near Hope, AR	B2	0.0038	0.025	0.003298611	0.0051	0.019	0.004020747	0.0068	0.019	0.005007752
197	07344320	Mill Creek tributary near Fouke, AR	B2	0.0031	0.025	0.002758007	0.0037	0.020	0.003122363	0.0049	0.020	0.003935743
198	07344450	Paw Paw Bayou near Greenwood, LA	B2	0.0051	0.024	0.004206186	0.0061	0.018	0.004556017	0.0080	0.018	0.005538462
199	07346950	Kelly Bayou near Ida, LA	B2	0.0085	0.027	0.006464789	0.0104	0.020	0.006842105	0.0136	0.021	0.008254335
200	07347500	Black Bayou near Gilliam, LA	B2	0.0045	0.029	0.003895522	0.0060	0.022	0.004714286	0.0081	0.023	0.005990354
201	07348615	Bayou Dorcheat near Bussey, AR	B2	0.0129	0.023	0.008264624	0.0154	0.017	0.008080247	0.0198	0.018	0.009428571
202	07348725	Indian Creek at Shongaloo, LA	B2	0.0022	0.024	0.002015267	0.0031	0.018	0.002644550	0.0043	0.018	0.003470852
203	07348760	Black Bayou at Leton, LA	B2	0.0035	0.023	0.003037736	0.0044	0.017	0.003495327	0.0062	0.017	0.004543103
204	07348800	Flat Lick Bayou near Leton, LA	B2	0.0074	0.023	0.005598684	0.0081	0.018	0.005586207	0.0102	0.018	0.006510638
205	07348950	Brushy Creek tributary near Minden, LA	B2	0.0117	0.032	0.008567506	0.0140	0.025	0.008974359	0.0181	0.026	0.010671202
206	07349000	Bayou Dorcheat near Minden, LA	B2	0.0018	0.024	0.001674419	0.0019	0.018	0.001718593	0.0023	0.018	0.002039409
207	07349200	Clarke Bayou near Haughton, LA	B2	0.0060	0.028	0.004941176	0.0063	0.022	0.004897527	0.0086	0.022	0.006183007
208	07349430	Bodcau Creek at Stamps, AR	B2	0.0069	0.023	0.005307692	0.0079	0.017	0.005393574	0.0101	0.017	0.006335793
209	07349500	Bodcau Bayou near Sarepta, LA	B2	0.0012	0.025	0.001145038	0.0013	0.019	0.001216749	0.0017	0.019	0.001560386
210	07355800	Lewis Creek tributary near Mena, AR	B1	0.0014	0.027	0.001330986	0.0018	0.028	0.001691275	0.0025	0.030	0.002307692
211	07355900	Big Fork tributary at Big Fork, AR	B1	0.0040	0.029	0.003515152	0.0054	0.030	0.004576271	0.0073	0.032	0.005944020
212	07356000	Ouachita River near Mount Ida, AR	B1	0.0008	0.024	0.000774194	0.0010	0.024	0.000960000	0.0012	0.025	0.001145038
213	07356500	South Fork Ouachita River at Mount Ida, AR	B1	0.0030	0.023	0.002653846	0.0035	0.024	0.003054545	0.0047	0.025	0.003956229
214	07356700	Barnes Branch near Mount Ida, AR	B1	0.0067	0.026	0.005327217	0.0080	0.026	0.006117647	0.0104	0.028	0.007583333
215	07357000	Ouachita River near Mountain Pine, AR	B1	0.0041	0.025	0.003522337	0.0039	0.025	0.003373702	0.0046	0.026	0.003908497
216	07357700	Glazypeau Creek at Mountain Valley, AR	B1	0.0056	0.026	0.004607595	0.0065	0.027	0.005238806	0.0084	0.028	0.006461538
217	07359520	Jackson Creek near Malvern, AR	B1	0.0109	0.027	0.007765172	0.0144	0.028	0.009509434	0.0194	0.029	0.011623967
218	07359610	Caddo River near Caddo Gap, AR	B1	0.0029	0.024	0.002587361	0.0038	0.024	0.003280576	0.0052	0.026	0.004333333
219	07359750	Little Sugarloaf Creek near Bonnerdale, AR	B1	0.0073	0.027	0.005746356	0.0081	0.027	0.006230769	0.0102	0.029	0.007545918
220	07359800	Caddo River near Alpine, AR	B1	0.0016	0.024	0.001500000	0.0016	0.024	0.001500000	0.0020	0.025	0.001851852
221	07359805	Valley Creek at Point Cedar	B1	0.0169	0.026	0.010242424	0.0201	0.026	0.011336226	0.0259	0.027	0.013219282

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
222	07360100	L'Eau Frais Creek at Joan, AR	B2	0.0027	0.023	0.002416342	0.0033	0.018	0.002788732	0.0043	0.018	0.003470852
223	07360150	Pearson Creek tributary near Dalark, AR	B2	0.0083	0.025	0.006231231	0.0113	0.019	0.007085809	0.0154	0.019	0.008505814
224	07360800	Muddy Fork Creek near Murfreesboro, AR	B1	0.0020	0.024	0.001846154	0.0026	0.024	0.002345865	0.0036	0.025	0.003146853
225	07361020	Prairie Creek tributary near Kirby, AR	B1	0.0057	0.032	0.004838196	0.0075	0.033	0.006111111	0.0101	0.035	0.007838137
226	07361180	South Fork Ozan Creek near Ozan, AR	B2	0.0015	0.024	0.001411765	0.0011	0.019	0.001039801	0.0016	0.019	0.001475728
227	07361200	Ozan Creek near Mccaskill, AR	B2	0.0022	0.024	0.002015267	0.0026	0.018	0.002271845	0.0034	0.018	0.002859813
228	07361500	Antoine River at Antoine, AR	B1	0.0008	0.023	0.000773109	0.0008	0.024	0.000774194	0.0010	0.025	0.000961538
229	07361600	Little Missouri River near Boughton, AR	B1	0.0095	0.024	0.006805970	0.0108	0.024	0.007448276	0.0136	0.025	0.008808290
230	07361680	Middle Caney Creek tributary near Rosston, AR	B2	0.0069	0.024	0.005359223	0.0079	0.018	0.005490347	0.0102	0.019	0.006636986
231	07361760	Bell Creek near Hollywood, AR	B2	0.0023	0.023	0.002090909	0.0031	0.018	0.002644550	0.0041	0.018	0.003339367
232	07361780	Bradshaw Creek near Hollywood, AR	B2	0.0026	0.024	0.002345865	0.0034	0.019	0.002883929	0.0046	0.019	0.003703390
233	07361800	Terre Noire Creek near Gurdon, AR	B2	0.0008	0.023	0.000773109	0.0011	0.017	0.001033149	0.0015	0.017	0.001378378
234	07361894	Mill Creek near Holly Springs, AR	B2	0.0053	0.023	0.004307420	0.0057	0.017	0.004268722	0.0072	0.018	0.005142857
235	07362050	Ross Creek near Camden, AR	B2	0.0102	0.023	0.007066265	0.0119	0.018	0.007163880	0.0153	0.018	0.008270270
236	07362100	Smackover Creek near Smackover, AR	B2	0.0023	0.023	0.002090909	0.0029	0.017	0.002477387	0.0041	0.017	0.003303318
237	07362330	Dunn Creek near Hampton, AR	B2	0.0040	0.028	0.003500000	0.0045	0.021	0.003705882	0.0058	0.022	0.004589928
238	07362450	Cooks Creek near Fordyce, AR	B2	0.0069	0.024	0.005359223	0.0076	0.018	0.005343750	0.0096	0.019	0.006377622
239	07362500	Moro Creek near Fordyce, AR	B2	0.0024	0.023	0.002173228	0.0024	0.018	0.002117647	0.0029	0.018	0.002497608
240	07362587	Alum Fork Saline River near Reform, AR	B1	0.0023	0.024	0.002098859	0.0026	0.025	0.002355072	0.0034	0.026	0.003006803
241	07363000	Saline River at Benton, AR	B1	0.0011	0.024	0.001051793	0.0012	0.024	0.001142857	0.0014	0.025	0.001325758
242	07363200	Saline River near Sheridan, AR	B2	0.0015	0.023	0.001408163	0.0017	0.018	0.001553299	0.0022	0.018	0.001960396
243	07363300	Hurricane Ck near Sheridan, AR	B2	0.0053	0.023	0.004307420	0.0044	0.017	0.003495327	0.0065	0.017	0.004702128
244	07363330	West Fork Big Creek at Sheridan, AR	B2	0.0082	0.023	0.006044872	0.0092	0.018	0.006088235	0.0117	0.018	0.007090909
245	07363430	East Fork Derrieusseaux Creek near Pine Bluff, AR	B2	0.0084	0.025	0.006287425	0.0110	0.019	0.006966667	0.0149	0.019	0.008351032
246	07363435	Derrieusseaux Creek near Grapevine, AR	B2	0.0082	0.023	0.006044872	0.0096	0.018	0.006260870	0.0121	0.018	0.007235880
247	07363450	Varnell Creek near Rison, AR	B2	0.0115	0.028	0.008151899	0.0102	0.022	0.006968944	0.0120	0.022	0.007764706
248	07363500	Saline River near Rye, AR	B2	0.0014	0.024	0.001322835	0.0014	0.018	0.001298969	0.0018	0.018	0.001636364
249	07364030	L'Aigle Creek tributary near Hermitage, AR	B2	0.0050	0.030	0.004285714	0.0053	0.023	0.004307420	0.0070	0.024	0.005419355
250	07364070	Bear Creek near Strong, AR	B2	0.0033	0.026	0.002928328	0.0036	0.020	0.003050847	0.0046	0.021	0.003773438
251	07364110	Nevins Creek tributary near Pine Bluff, AR	D	0.0027	0.022	0.002404858	0.0031	0.022	0.002717131	0.0040	0.027	0.003483871
252	07364120	Bayou Bartholomew near Star City, AR	D	0.0012	0.021	0.001135135	0.0013	0.021	0.001224215	0.0016	0.025	0.001503759
253	07364128	Deep Bayou near Grady, AR	D	0.0003	0.018	0.000295082	0.0003	0.019	0.000295337	0.0005	0.022	0.000488889

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Annual exceedance probability discharge								
				50 Percent			20 Percent			10 Percent		
				EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
254	07364140	Ables Creek near Tyro, AR	D	0.0061	0.021	0.004726937	0.0078	0.021	0.005687500	0.0107	0.026	0.007580381
255	07364150	Bayou Bartholomew near McGehee, AR	D	0.0004	0.022	0.000392857	0.0004	0.022	0.000392857	0.0005	0.026	0.000490566
256	07364165	Upper Cutoff Creek near Monticello, AR	D	0.0047	0.020	0.003805668	0.0063	0.021	0.004846154	0.0086	0.025	0.006398810
257	07364260	Hanks Creek near Hamburg, AR	D	0.0051	0.019	0.004020747	0.0058	0.019	0.004443548	0.0076	0.023	0.005712418
258	07364300	Chemin-A-Haut Bayou near Beekman, LA	D	0.0075	0.019	0.005377358	0.0083	0.019	0.005776557	0.0105	0.023	0.007208955
259	07364500	Bayou Bartholomew near Beekman, LA	D	0.0004	0.022	0.000392857	0.0005	0.022	0.000488889	0.0006	0.027	0.000586957
260	07364700	Bayou De Loutre near Laran, LA	B2	0.0076	0.023	0.005712418	0.0104	0.018	0.006591549	0.0143	0.018	0.007969040
261	07364800	Bayou D’arbonne at Homer, LA	B2	0.0092	0.024	0.006650602	0.0105	0.018	0.006631579	0.0136	0.018	0.007746835
262	07364860	Sugar Creek tributary at Lake Foursome near Arcadia, LA	B2	0.0138	0.026	0.009015075	0.0165	0.020	0.009041096	0.0212	0.021	0.010549763
263	07364870	Sugar Creek near Arcadia, LA	B2	0.0032	0.024	0.002823529	0.0037	0.019	0.003096916	0.0048	0.019	0.003831933
264	07365000	Bayou D’arbonne near Dubach, LA	B2	0.0038	0.024	0.003280576	0.0050	0.019	0.003958333	0.0069	0.019	0.005061776
265	07365300	Middle Fk Bayou D’arbonne near Colquitt, LA	B2	0.0056	0.023	0.004503497	0.0069	0.018	0.004987952	0.0092	0.018	0.006088235
266	07365800	Cornie Bayou near Three Creeks, AR	B2	0.0042	0.023	0.003551471	0.0054	0.018	0.004153846	0.0074	0.018	0.005244094
267	07365900	Three Creeks near Three Creeks, AR	B2	0.0080	0.023	0.005935484	0.0105	0.017	0.006490909	0.0142	0.018	0.007937888
268	07366000	Corney Bayou near Lillie, LA	B2	0.0035	0.024	0.003054545	0.0040	0.018	0.003272727	0.0052	0.018	0.004034483
269	07366200	Little Corney Bayou near Lillie, LA	B2	0.0024	0.023	0.002173228	0.0026	0.018	0.002271845	0.0034	0.018	0.002859813
270	07366350	Stowe Creek near Farmerville, LA	B2	0.0164	0.024	0.009742574	0.0184	0.019	0.009347594	0.0236	0.019	0.010525822
271	07366360	Bayou D’arbonne Lake tributary near Downsville, LA	B2	0.0161	0.028	0.010222222	0.0188	0.022	0.010137255	0.0242	0.022	0.011523810
272	07366403	Bayou Choudrant tributary near Tremont, LA	B2	0.0033	0.033	0.003000000	0.0043	0.026	0.003689769	0.0059	0.027	0.004841945
273	07366420	Bayou Choudrant near Calhoun, LA	B2	0.0033	0.024	0.002901099	0.0039	0.019	0.003235808	0.0051	0.019	0.004020747
274	07367658	Cypress Creek Canal no. 19 tributary near Dumas, AR	D	0.0009	0.019	0.000859296	0.0012	0.019	0.001128713	0.0016	0.023	0.001495935
275	07367670	Wards Bayou tributary at Montrose, AR	D	0.0018	0.019	0.001644231	0.0021	0.020	0.001900452	0.0028	0.024	0.002507463
276	07367740	Camp Bayou near Parkdale, AR	D	0.0007	0.019	0.000675127	0.0009	0.019	0.000859296	0.0011	0.023	0.001049793
277	07367800	Boeuf River near Oak Grove, LA	D	0.0021	0.019	0.001890995	0.0026	0.019	0.002287037	0.0034	0.023	0.002962121
278	07368300	Muddy Bayou tributary near Alto, LA	D	0.0030	0.022	0.002640000	0.0028	0.022	0.002483871	0.0038	0.027	0.003331169
279	07368500	Big Colewa Bayou near Oak Grove, LA	D	0.0008	0.018	0.000765957	0.0009	0.019	0.000859296	0.0012	0.023	0.001140496
280	07369250	Turkey Ck tributary at Potato Research Pond at Chase, LA	D	0.0035	0.019	0.002955556	0.0047	0.020	0.003805668	0.0063	0.024	0.004990099
281	07369680	Bayou Macon at Eudora, AR	D	0.0003	0.019	0.000295337	0.0003	0.019	0.000295337	0.0004	0.023	0.000393162

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
1	0.0033	0.029	0.002962848	0.0042	0.030	0.003684211	0.0054	0.034	0.004659898	0.0087	0.038	0.007079229
2	0.0008	0.035	0.000782123	0.0010	0.042	0.000976744	0.0013	0.048	0.001265720	0.0021	0.064	0.002033283
3	0.0037	0.027	0.003254072	0.0048	0.028	0.004097561	0.0063	0.031	0.005235925	0.0107	0.035	0.008194748
4	0.0065	0.027	0.005238806	0.0084	0.028	0.006461538	0.0106	0.031	0.007899038	0.0170	0.035	0.011442308
5	0.0079	0.028	0.006161560	0.0106	0.029	0.007762626	0.0139	0.032	0.009690632	0.0241	0.037	0.014594108
6	0.0139	0.031	0.009596882	0.0182	0.037	0.012199275	0.0232	0.043	0.015069486	0.0382	0.057	0.022871849
7	0.0033	0.031	0.002982507	0.0044	0.037	0.003932367	0.0058	0.043	0.005110656	0.0102	0.057	0.008651786
8	0.0129	0.028	0.008831296	0.0166	0.030	0.010686695	0.0211	0.033	0.012870610	0.0343	0.037	0.017799439
9	0.0153	0.028	0.009893764	0.0200	0.029	0.011836735	0.0257	0.032	0.014253033	0.0428	0.036	0.019553299
10	0.0072	0.027	0.005684211	0.0096	0.028	0.007148936	0.0126	0.031	0.008958716	0.0217	0.036	0.013538995
11	0.0055	0.029	0.004623188	0.0075	0.030	0.006000000	0.0100	0.033	0.007674419	0.0178	0.038	0.012121864
12	0.0479	0.028	0.017670619	0.0620	0.029	0.019758242	0.0784	0.032	0.022724638	0.1254	0.036	0.027970260
13	0.0082	0.031	0.006484694	0.0110	0.033	0.008250000	0.0146	0.036	0.010387352	0.0253	0.041	0.015645551
14	0.0138	0.029	0.009350467	0.0179	0.030	0.011210856	0.0228	0.033	0.013483871	0.0374	0.037	0.018599462
15	0.0031	0.027	0.002780731	0.0042	0.028	0.003652174	0.0055	0.031	0.004671233	0.0098	0.036	0.007703057
16	0.0173	0.029	0.010835853	0.0224	0.030	0.012824427	0.0285	0.033	0.015292683	0.0464	0.038	0.020890995
17	0.0112	0.030	0.008155340	0.0143	0.031	0.009785872	0.0180	0.034	0.011769231	0.0287	0.039	0.016533235
18	0.0084	0.027	0.006406780	0.0109	0.028	0.007845758	0.0138	0.030	0.009452055	0.0224	0.034	0.013503546
19	0.0030	0.027	0.002700000	0.0041	0.028	0.003576324	0.0056	0.031	0.004743169	0.0104	0.035	0.008017621
20	0.0197	0.027	0.011389722	0.0255	0.028	0.013345794	0.0324	0.031	0.015842271	0.0525	0.035	0.021000000
21	0.0279	0.029	0.014219684	0.0365	0.030	0.016466165	0.0467	0.033	0.019336261	0.0764	0.037	0.024927690
22	0.0136	0.027	0.009044335	0.0176	0.028	0.010807018	0.0221	0.031	0.012902072	0.0353	0.036	0.017823282
23	0.0115	0.027	0.008064935	0.0151	0.028	0.009809745	0.0194	0.030	0.011781377	0.0322	0.035	0.016770833
24	0.0613	0.027	0.018744054	0.0796	0.029	0.021255985	0.1008	0.031	0.023708649	0.1601	0.036	0.029391127
25	0.0125	0.027	0.008544304	0.0163	0.028	0.010302483	0.0206	0.031	0.012375969	0.0326	0.035	0.016878698
26	0.0148	0.027	0.009559809	0.0195	0.028	0.011494737	0.0248	0.031	0.013777778	0.0393	0.036	0.018788845
27	0.0067	0.028	0.005406340	0.0105	0.029	0.007708861	0.0151	0.032	0.010259023	0.0282	0.036	0.015813084
28	0.0092	0.029	0.006984293	0.0119	0.030	0.008520286	0.0150	0.033	0.010312500	0.0237	0.038	0.014596434
29	0.0113	0.026	0.007876676	0.0148	0.027	0.009559809	0.0189	0.030	0.011595092	0.0308	0.034	0.016160494
30	0.0266	0.027	0.013399254	0.0344	0.028	0.015435897	0.0437	0.030	0.017788331	0.0708	0.035	0.023421550
31	0.0061	0.027	0.004975831	0.0083	0.028	0.006402204	0.0109	0.030	0.007995110	0.0190	0.035	0.012314815

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
32	0.0115	0.030	0.008313253	0.0152	0.031	0.010199134	0.0195	0.035	0.012522936	0.0325	0.039	0.017727273
33	0.0139	0.027	0.009176039	0.0185	0.028	0.011139785	0.0241	0.031	0.013558984	0.0409	0.035	0.018860343
34	0.0115	0.027	0.008064935	0.0148	0.028	0.009682243	0.0187	0.031	0.011663984	0.0302	0.036	0.016422961
35	0.0206	0.027	0.011684874	0.0266	0.028	0.013641026	0.0338	0.031	0.016169753	0.0549	0.036	0.021742574
36	0.0185	0.028	0.011139785	0.0237	0.029	0.013041746	0.0299	0.032	0.015457189	0.0480	0.037	0.020894118
37	0.0148	0.029	0.009799087	0.0192	0.030	0.011707317	0.0245	0.033	0.014060870	0.0399	0.038	0.019463415
38	0.0025	0.028	0.002295082	0.0034	0.029	0.003043210	0.0046	0.032	0.004021858	0.0085	0.036	0.006876404
39	0.0142	0.027	0.009305825	0.0180	0.028	0.010956522	0.0225	0.031	0.013037383	0.0351	0.035	0.017524964
40	0.0057	0.027	0.004706422	0.0079	0.028	0.006161560	0.0107	0.031	0.007954436	0.0196	0.036	0.012690647
41	0.0046	0.027	0.003930380	0.0062	0.028	0.005076023	0.0082	0.031	0.006484694	0.0147	0.035	0.010352113
42	0.0027	0.027	0.002454545	0.0036	0.028	0.003189873	0.0047	0.031	0.004081232	0.0075	0.035	0.006176471
43	0.0090	0.026	0.006685714	0.0114	0.027	0.008015625	0.0142	0.030	0.009638009	0.0222	0.034	0.013430605
44	0.0108	0.026	0.007630435	0.0143	0.027	0.009348668	0.0184	0.030	0.011404959	0.0306	0.034	0.016105263
45	0.0079	0.027	0.006111748	0.0106	0.028	0.007689119	0.0140	0.031	0.009644444	0.0247	0.035	0.014480737
46	0.0167	0.029	0.010597374	0.0215	0.030	0.012524272	0.0272	0.033	0.014910299	0.0441	0.038	0.020411693
47	0.0095	0.028	0.007093333	0.0123	0.029	0.008636804	0.0158	0.032	0.010577406	0.0261	0.036	0.015130435
48	0.0221	0.028	0.012351297	0.0282	0.029	0.014297203	0.0354	0.033	0.017078947	0.0562	0.037	0.022311159
49	0.0151	0.029	0.009929705	0.0192	0.030	0.011707317	0.0239	0.034	0.014034542	0.0372	0.039	0.019039370
50	0.0033	0.028	0.002952077	0.0045	0.029	0.003895522	0.0061	0.032	0.005123360	0.0112	0.037	0.008597510
51	0.0034	0.028	0.003031847	0.0044	0.029	0.003820359	0.0055	0.032	0.004693333	0.0087	0.036	0.007006711
52	0.0610	0.027	0.018715909	0.0782	0.028	0.020617702	0.0988	0.031	0.023596302	0.1590	0.035	0.028685567
53	0.0093	0.027	0.006917355	0.0119	0.028	0.008350877	0.0148	0.030	0.009910714	0.0233	0.034	0.013825480
54	0.0123	0.027	0.008450382	0.0162	0.027	0.010125000	0.0209	0.030	0.012318271	0.0348	0.034	0.017197674
55	0.0083	0.030	0.006501305	0.0108	0.031	0.008009569	0.0140	0.034	0.009916667	0.0238	0.040	0.014921630
56	0.0477	0.027	0.017240964	0.0602	0.028	0.019111111	0.0748	0.031	0.021916824	0.1159	0.036	0.027468071
57	0.0161	0.028	0.010222222	0.0204	0.029	0.011975709	0.0252	0.032	0.014097902	0.0390	0.037	0.018986842
58	0.0032	0.027	0.002860927	0.0043	0.028	0.003727554	0.0057	0.030	0.004789916	0.0104	0.034	0.007963964
59	0.0114	0.027	0.008015625	0.0150	0.028	0.009767442	0.0193	0.031	0.011894632	0.0322	0.035	0.016770833
60	0.0024	0.028	0.002210526	0.0032	0.028	0.002871795	0.0043	0.031	0.003776204	0.0080	0.036	0.006545455
61	0.0162	0.027	0.010125000	0.0211	0.028	0.012032587	0.0269	0.031	0.014402418	0.0444	0.036	0.019880597
62	0.0097	0.026	0.007064426	0.0131	0.027	0.008820449	0.0173	0.030	0.010972516	0.0305	0.034	0.016077519
63	0.0050	0.028	0.004242424	0.0065	0.029	0.005309859	0.0084	0.032	0.006653465	0.0137	0.036	0.009923541

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
64	0.0154	0.027	0.009806604	0.0196	0.028	0.011529412	0.0245	0.031	0.013684685	0.0385	0.035	0.018333333
65	0.0035	0.027	0.003098361	0.0046	0.027	0.003930380	0.0060	0.030	0.005000000	0.0100	0.034	0.007727273
66	0.0070	0.028	0.005600000	0.0095	0.029	0.007155844	0.0125	0.032	0.008988764	0.0218	0.037	0.013717687
67	0.0119	0.027	0.008259640	0.0154	0.028	0.009935484	0.0195	0.031	0.011970297	0.0313	0.036	0.016742942
68	0.0038	0.027	0.003331169	0.0053	0.028	0.004456456	0.0073	0.031	0.005908616	0.0136	0.035	0.009794239
69	0.0214	0.026	0.011738397	0.0277	0.027	0.013672761	0.0348	0.030	0.016111111	0.0540	0.034	0.020863636
70	0.0085	0.027	0.006464789	0.0112	0.028	0.008000000	0.0144	0.031	0.009832599	0.0238	0.035	0.014166667
71	0.0454	0.027	0.016930939	0.0579	0.028	0.018873108	0.0727	0.031	0.021732883	0.1153	0.035	0.026849634
72	0.0172	0.027	0.010506787	0.0223	0.028	0.012413519	0.0282	0.031	0.014766892	0.0455	0.036	0.020098160
73	0.0051	0.027	0.004289720	0.0073	0.028	0.005790368	0.0100	0.031	0.007560976	0.0188	0.035	0.012230483
74	0.0026	0.028	0.002379085	0.0033	0.029	0.002962848	0.0043	0.032	0.003790634	0.0071	0.036	0.005930394
75	0.0033	0.027	0.002940594	0.0047	0.028	0.004024465	0.0063	0.031	0.005235925	0.0117	0.035	0.008768737
76	0.0067	0.027	0.005367953	0.0085	0.028	0.006520548	0.0107	0.031	0.007954436	0.0170	0.035	0.011442308
77	0.0151	0.026	0.009552311	0.0198	0.027	0.011423077	0.0254	0.030	0.013754513	0.0419	0.034	0.018769433
78	0.0230	0.029	0.012826923	0.0297	0.035	0.016066461	0.0377	0.040	0.019407979	0.0609	0.053	0.028338016
79	0.0067	0.029	0.005442577	0.0088	0.034	0.006990654	0.0113	0.040	0.008810916	0.0185	0.053	0.013713287
80	0.0262	0.027	0.013296992	0.0334	0.028	0.015231270	0.0418	0.031	0.017799451	0.0658	0.035	0.022847222
81	0.0067	0.029	0.005442577	0.0087	0.030	0.006744186	0.0110	0.033	0.008250000	0.0178	0.037	0.012018248
82	0.0153	0.028	0.009893764	0.0198	0.030	0.011927711	0.0253	0.033	0.014320755	0.0414	0.037	0.019538265
83	0.0040	0.028	0.003500000	0.0055	0.029	0.004623188	0.0075	0.032	0.006075949	0.0137	0.036	0.009923541
84	0.0044	0.028	0.003802469	0.0060	0.029	0.004971429	0.0079	0.031	0.006295630	0.0140	0.036	0.010080000
85	0.0079	0.028	0.006161560	0.0107	0.028	0.007741602	0.0141	0.031	0.009691796	0.0243	0.036	0.014507463
86	0.0091	0.028	0.006867925	0.0119	0.029	0.008437653	0.0155	0.032	0.010442105	0.0264	0.037	0.015406940
87	0.0044	0.036	0.003920792	0.0057	0.042	0.005018868	0.0072	0.049	0.006277580	0.0115	0.065	0.009771242
88	0.0125	0.032	0.008988764	0.0158	0.038	0.011159851	0.0198	0.044	0.013655172	0.0311	0.058	0.020244669
89	0.0065	0.032	0.005402597	0.0087	0.038	0.007079229	0.0115	0.045	0.009159292	0.0200	0.059	0.014936709
90	0.0023	0.027	0.002119454	0.0031	0.028	0.002790997	0.0041	0.031	0.003621083	0.0071	0.035	0.005902613
91	0.0061	0.027	0.004975831	0.0079	0.028	0.006161560	0.0102	0.031	0.007674757	0.0167	0.035	0.011305609
92	0.0008	0.031	0.000779874	0.0011	0.037	0.001068241	0.0015	0.043	0.001449438	0.0026	0.057	0.002486577
93	0.0063	0.032	0.005263708	0.0086	0.038	0.007012876	0.0114	0.045	0.009095745	0.0200	0.059	0.014936709
94	0.0013	0.030	0.001246006	0.0019	0.036	0.001804749	0.0025	0.042	0.002359551	0.0047	0.055	0.004329983
95	0.0008	0.030	0.000779221	0.0011	0.036	0.001067385	0.0014	0.042	0.001354839	0.0022	0.056	0.002116838

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
96	0.0014	0.029	0.001335526	0.0020	0.035	0.001891892	0.0025	0.040	0.002352941	0.0041	0.053	0.003805604
97	0.0018	0.029	0.001694805	0.0024	0.034	0.002241758	0.0031	0.040	0.002877030	0.0053	0.053	0.004818182
98	0.0009	0.031	0.000874608	0.0013	0.036	0.001254692	0.0017	0.042	0.001633867	0.0028	0.056	0.002666667
99	0.0032	0.030	0.002891566	0.0041	0.035	0.003670077	0.0052	0.041	0.004614719	0.0083	0.054	0.007194222
100	0.0082	0.029	0.006392473	0.0105	0.035	0.008076923	0.0133	0.040	0.009981238	0.0213	0.053	0.015193809
101	0.0008	0.031	0.000779874	0.0010	0.036	0.000972973	0.0012	0.042	0.001166667	0.0020	0.056	0.001931034
102	0.0094	0.032	0.007265700	0.0125	0.038	0.009405941	0.0162	0.044	0.011840532	0.0272	0.058	0.018516432
103	0.0464	0.019	0.013480122	0.0616	0.021	0.015661017	0.0800	0.023	0.017864078	0.1350	0.032	0.025868263
104	0.0310	0.019	0.011780000	0.0394	0.021	0.013698675	0.0491	0.024	0.016120383	0.0769	0.033	0.023090992
105	0.0302	0.021	0.012386719	0.0428	0.024	0.015377246	0.0571	0.026	0.017865223	0.0957	0.036	0.026159453
106	0.0042	0.019	0.003439655	0.0056	0.021	0.004421053	0.0072	0.023	0.005483444	0.0118	0.033	0.008691964
107	0.0326	0.019	0.012003876	0.0419	0.021	0.013988871	0.0526	0.023	0.016002646	0.0832	0.032	0.023111111
108	0.0180	0.019	0.009243243	0.0232	0.021	0.011022624	0.0292	0.023	0.012865900	0.0465	0.033	0.019301887
109	0.0359	0.019	0.012424408	0.0460	0.021	0.014417910	0.0579	0.023	0.016461063	0.0921	0.032	0.023748590
110	0.0111	0.019	0.007006645	0.0156	0.021	0.008950820	0.0206	0.023	0.010866972	0.0340	0.033	0.016746269
111	0.0513	0.019	0.013864865	0.0654	0.021	0.015895833	0.0820	0.023	0.017961905	0.1296	0.032	0.025663366
112	0.0195	0.019	0.009623377	0.0253	0.021	0.011475162	0.0322	0.023	0.013416667	0.0525	0.033	0.020263158
113	0.0206	0.023	0.010866972	0.0286	0.025	0.013339552	0.0375	0.028	0.016030534	0.0615	0.039	0.023865672
114	0.0136	0.020	0.008095238	0.0188	0.022	0.010137255	0.0251	0.024	0.012268839	0.0450	0.034	0.019367089
115	0.0108	0.019	0.006885906	0.0146	0.021	0.008612360	0.0194	0.023	0.010523585	0.0345	0.032	0.016601504
116	0.0751	0.020	0.015793901	0.0945	0.022	0.017845494	0.1168	0.024	0.019909091	0.1794	0.033	0.027872881
117	0.0033	0.019	0.002811659	0.0046	0.021	0.003773438	0.0062	0.023	0.004883562	0.0116	0.033	0.008582960
118	0.0034	0.020	0.002905983	0.0048	0.022	0.003940299	0.0065	0.024	0.005114754	0.0108	0.034	0.008196429
119	0.0077	0.019	0.005479401	0.0109	0.021	0.007175549	0.0146	0.023	0.008930851	0.0250	0.032	0.014035088
120	0.0037	0.019	0.003096916	0.0050	0.021	0.004038462	0.0067	0.023	0.005188552	0.0120	0.032	0.008727273
121	0.0076	0.019	0.005428571	0.0098	0.021	0.006681818	0.0125	0.023	0.008098592	0.0199	0.032	0.012269750
122	0.0187	0.019	0.009424403	0.0243	0.021	0.011264901	0.0311	0.023	0.013221811	0.0511	0.032	0.019677497
123	0.0087	0.020	0.006062718	0.0110	0.022	0.007333333	0.0137	0.024	0.008721485	0.0212	0.034	0.013057971
124	0.0090	0.019	0.006107143	0.0115	0.021	0.007430769	0.0146	0.023	0.008930851	0.0236	0.032	0.013582734
125	0.0063	0.019	0.004731225	0.0083	0.021	0.005948805	0.0107	0.023	0.007302671	0.0180	0.032	0.011520000
126	0.0101	0.019	0.006594502	0.0130	0.021	0.008029412	0.0165	0.023	0.009607595	0.0267	0.033	0.014758794
127	0.0148	0.019	0.008319527	0.0194	0.020	0.009847716	0.0249	0.022	0.011680171	0.0413	0.032	0.018030014

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
128	0.0256	0.019	0.010905830	0.0322	0.021	0.012710526	0.0399	0.023	0.014589825	0.0614	0.033	0.021463983
129	0.0123	0.019	0.007466454	0.0162	0.021	0.009145161	0.0208	0.023	0.010922374	0.0343	0.033	0.016818722
130	0.0033	0.019	0.002811659	0.0045	0.021	0.003705882	0.0060	0.023	0.004758621	0.0106	0.032	0.007962441
131	0.0205	0.020	0.010123457	0.0261	0.022	0.011937630	0.0327	0.024	0.013841270	0.0518	0.034	0.020526807
132	0.0071	0.020	0.005239852	0.0096	0.022	0.006683544	0.0128	0.024	0.008347826	0.0227	0.034	0.013611993
133	0.0127	0.021	0.007913947	0.0164	0.023	0.009573604	0.0208	0.025	0.011353712	0.0336	0.035	0.017142857
134	0.0177	0.019	0.009163488	0.0227	0.021	0.010908467	0.0286	0.023	0.012748062	0.0451	0.032	0.018718547
135	0.0157	0.022	0.009161804	0.0210	0.024	0.011200000	0.0276	0.026	0.013388060	0.0479	0.037	0.020875147
136	0.0027	0.019	0.002364055	0.0037	0.021	0.003145749	0.0049	0.023	0.004039427	0.0091	0.032	0.007085158
137	0.0138	0.021	0.008327586	0.0173	0.023	0.009873449	0.0213	0.026	0.011708245	0.0326	0.036	0.017107872
138	0.0341	0.021	0.012996370	0.0430	0.024	0.015402985	0.0532	0.026	0.017464646	0.0822	0.036	0.025035533
139	0.0140	0.021	0.008400000	0.0180	0.023	0.010097561	0.0227	0.025	0.011897275	0.0364	0.035	0.017843137
140	0.0023	0.020	0.002062780	0.0031	0.022	0.002717131	0.0042	0.024	0.003574468	0.0077	0.034	0.006278177
141	0.0075	0.021	0.005526316	0.0099	0.023	0.006920973	0.0127	0.026	0.008532300	0.0210	0.036	0.013263158
142	0.0115	0.019	0.007163934	0.0146	0.021	0.008612360	0.0183	0.023	0.010191283	0.0289	0.033	0.015407108
143	0.0070	0.019	0.005115385	0.0095	0.022	0.006634921	0.0123	0.024	0.008132231	0.0199	0.033	0.012413989
144	0.0101	0.019	0.006594502	0.0128	0.021	0.007952663	0.0161	0.023	0.009470588	0.0256	0.032	0.014222222
145	0.0177	0.020	0.009389920	0.0224	0.022	0.011099099	0.0279	0.024	0.012901734	0.0437	0.034	0.019122265
146	0.0090	0.020	0.006206897	0.0116	0.022	0.007595238	0.0146	0.024	0.009077720	0.0230	0.034	0.013719298
147	0.0095	0.019	0.006333333	0.0121	0.021	0.007676737	0.0151	0.023	0.009115486	0.0231	0.033	0.013588235
148	0.0030	0.019	0.002590909	0.0040	0.020	0.003333333	0.0053	0.022	0.004271062	0.0097	0.032	0.007443645
149	0.0042	0.020	0.003471074	0.0058	0.022	0.004589928	0.0078	0.024	0.005886792	0.0141	0.033	0.009878981
150	0.0107	0.027	0.007663130	0.0138	0.030	0.009452055	0.0176	0.033	0.011478261	0.0286	0.046	0.017635389
151	0.0064	0.021	0.004905109	0.0086	0.023	0.006259494	0.0112	0.025	0.007734807	0.0194	0.036	0.012606498
152	0.0033	0.019	0.002811659	0.0045	0.021	0.003705882	0.0058	0.023	0.004631944	0.0100	0.032	0.007619048
153	0.0040	0.019	0.003304348	0.0055	0.021	0.004358491	0.0074	0.023	0.005598684	0.0135	0.033	0.009580645
154	0.0233	0.019	0.010465721	0.0301	0.021	0.012369863	0.0382	0.023	0.014356209	0.0621	0.032	0.021117960
155	0.0062	0.020	0.004732824	0.0082	0.022	0.005973510	0.0108	0.024	0.007448276	0.0185	0.034	0.011980952
156	0.0018	0.019	0.001644231	0.0024	0.021	0.002153846	0.0031	0.023	0.002731801	0.0054	0.032	0.004620321
157	0.0019	0.019	0.001727273	0.0026	0.020	0.002300885	0.0036	0.022	0.003093750	0.0066	0.032	0.005471503

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
158	0.0097	0.019	0.006421603	0.0128	0.021	0.007952663	0.0166	0.023	0.009641414	0.0282	0.033	0.015205882
159	0.0100	0.020	0.006666667	0.0132	0.022	0.008250000	0.0169	0.024	0.009916870	0.0271	0.034	0.015080196
160	0.0122	0.019	0.007429487	0.0164	0.021	0.009208556	0.0215	0.023	0.011112360	0.0372	0.032	0.017202312
161	0.0040	0.023	0.003407407	0.0052	0.026	0.004333333	0.0067	0.028	0.005406340	0.0110	0.040	0.008627451
162	0.0018	0.019	0.001644231	0.0024	0.021	0.002153846	0.0032	0.023	0.002809160	0.0058	0.032	0.004910053
163	0.0118	0.021	0.007554878	0.0155	0.023	0.009259740	0.0198	0.025	0.011049107	0.0327	0.035	0.016905465
164	0.0260	0.021	0.011617021	0.0342	0.024	0.014103093	0.0440	0.026	0.016342857	0.0729	0.036	0.024099174
165	0.0032	0.019	0.002738739	0.0044	0.021	0.003637795	0.0060	0.023	0.004758621	0.0109	0.032	0.008130536
166	0.0083	0.020	0.005865724	0.0113	0.022	0.007465465	0.0150	0.024	0.009230769	0.0264	0.034	0.014860927
167	0.0020	0.019	0.001809524	0.0028	0.021	0.002470588	0.0038	0.023	0.003261194	0.0069	0.032	0.005676093
168	0.0036	0.020	0.003050847	0.0048	0.022	0.003940299	0.0062	0.025	0.004967949	0.0101	0.035	0.007838137
169	0.0079	0.019	0.005579926	0.0103	0.021	0.006910543	0.0134	0.023	0.008467033	0.0227	0.033	0.013448833
170	0.0050	0.020	0.004000000	0.0064	0.022	0.004957746	0.0080	0.024	0.006000000	0.0126	0.034	0.009193133
171	0.0018	0.030	0.001698113	0.0027	0.036	0.002511628	0.0037	0.042	0.003400438	0.0065	0.055	0.005813008
172	0.0031	0.030	0.002809668	0.0041	0.035	0.003670077	0.0051	0.041	0.004535792	0.0083	0.054	0.007194222
173	0.0033	0.030	0.002972973	0.0044	0.032	0.003868132	0.0058	0.035	0.004975490	0.0102	0.043	0.008244361
174	0.0033	0.029	0.002962848	0.0045	0.030	0.003913043	0.0058	0.033	0.004932990	0.0099	0.041	0.007974460
175	0.0016	0.029	0.001516340	0.0021	0.030	0.001962617	0.0028	0.033	0.002581006	0.0050	0.040	0.004444444
176	0.0101	0.028	0.007422572	0.0131	0.030	0.009118329	0.0167	0.032	0.010973306	0.0274	0.040	0.016261128
177	0.0082	0.025	0.006174699	0.0104	0.027	0.007508021	0.0128	0.031	0.009059361	0.0198	0.039	0.013132653
178	0.0073	0.021	0.005416961	0.0095	0.023	0.006723077	0.0119	0.026	0.008163588	0.0185	0.032	0.011722772
179	0.0038	0.021	0.003217742	0.0051	0.023	0.004174377	0.0067	0.027	0.005367953	0.0109	0.033	0.008193622
180	0.0260	0.034	0.014733333	0.0332	0.036	0.017271676	0.0414	0.040	0.020343980	0.0645	0.049	0.027845815
181	0.0058	0.028	0.004804734	0.0076	0.030	0.006063830	0.0098	0.032	0.007502392	0.0162	0.039	0.011445652
182	0.0033	0.028	0.002952077	0.0045	0.029	0.003895522	0.0060	0.031	0.005027027	0.0108	0.038	0.008409836
183	0.0083	0.031	0.006547074	0.0107	0.032	0.008018735	0.0137	0.036	0.009923541	0.0223	0.044	0.014799397
184	0.0112	0.028	0.008000000	0.0147	0.030	0.009865772	0.0189	0.033	0.012017341	0.0311	0.040	0.017496484
185	0.0022	0.028	0.002039735	0.0028	0.029	0.002553459	0.0036	0.031	0.003225434	0.0058	0.038	0.005031963
186	0.0118	0.036	0.008887029	0.0155	0.038	0.011009346	0.0198	0.042	0.013456311	0.0326	0.051	0.019887560
187	0.0030	0.028	0.002709677	0.0041	0.030	0.003607038	0.0055	0.032	0.004693333	0.0097	0.039	0.007767967
188	0.0129	0.027	0.008729323	0.0172	0.029	0.010796537	0.0224	0.031	0.013003745	0.0381	0.038	0.019024967
189	0.0027	0.029	0.002470032	0.0035	0.030	0.003134328	0.0047	0.033	0.004114058	0.0081	0.040	0.006735967

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
190	0.0078	0.021	0.005687500	0.0100	0.023	0.006969697	0.0127	0.026	0.008532300	0.0205	0.032	0.012495238
191	0.0035	0.028	0.003111111	0.0047	0.029	0.004044510	0.0061	0.032	0.005123360	0.0108	0.039	0.008457831
192	0.0055	0.028	0.004597015	0.0074	0.029	0.005895604	0.0098	0.032	0.007502392	0.0171	0.038	0.011793103
193	0.0071	0.029	0.005703601	0.0095	0.031	0.007271605	0.0125	0.034	0.009139785	0.0221	0.041	0.014359746
194	0.0159	0.029	0.010269488	0.0205	0.030	0.012178218	0.0261	0.033	0.014573604	0.0427	0.040	0.020652963
195	0.0035	0.019	0.002955556	0.0043	0.020	0.003539095	0.0053	0.023	0.004307420	0.0079	0.029	0.006208672
196	0.0100	0.019	0.006551724	0.0131	0.021	0.008067449	0.0168	0.024	0.009882353	0.0276	0.030	0.014375000
197	0.0072	0.020	0.005294118	0.0093	0.022	0.006536741	0.0118	0.026	0.008116402	0.0189	0.032	0.011882122
198	0.0117	0.018	0.007090909	0.0154	0.020	0.008700565	0.0200	0.023	0.010697674	0.0338	0.028	0.015313916
199	0.0194	0.022	0.010309179	0.0249	0.024	0.012220859	0.0313	0.027	0.014495712	0.0497	0.034	0.020188769
200	0.0119	0.024	0.007955432	0.0155	0.026	0.009710843	0.0198	0.030	0.011927711	0.0323	0.037	0.017245310
201	0.0277	0.018	0.010910284	0.0350	0.019	0.012314815	0.0435	0.022	0.014610687	0.0676	0.027	0.019293869
202	0.0067	0.018	0.004882591	0.0091	0.020	0.006254296	0.0122	0.023	0.007971591	0.0218	0.028	0.012257028
203	0.0095	0.018	0.006218182	0.0126	0.019	0.007575949	0.0161	0.022	0.009296588	0.0264	0.027	0.013348315
204	0.0146	0.018	0.008061350	0.0189	0.020	0.009717224	0.0242	0.023	0.011792373	0.0397	0.028	0.016419498
205	0.0254	0.028	0.013318352	0.0322	0.030	0.015530547	0.0401	0.035	0.018688415	0.0623	0.044	0.025787394
206	0.0035	0.018	0.002930233	0.0048	0.020	0.003870968	0.0065	0.023	0.005067797	0.0120	0.028	0.008400000
207	0.0127	0.023	0.008182073	0.0164	0.025	0.009903382	0.0207	0.029	0.012078471	0.0322	0.036	0.016997067
208	0.0144	0.017	0.007796178	0.0186	0.019	0.009398936	0.0236	0.022	0.011385965	0.0384	0.027	0.015853211
209	0.0025	0.020	0.002222222	0.0034	0.022	0.002944882	0.0045	0.025	0.003813559	0.0083	0.030	0.006501305
210	0.0038	0.033	0.003407609	0.0052	0.035	0.004527363	0.0069	0.039	0.005862745	0.0121	0.048	0.009663894
211	0.0108	0.036	0.008307692	0.0142	0.038	0.010337165	0.0181	0.042	0.012648918	0.0295	0.052	0.018822086
212	0.0019	0.028	0.001779264	0.0026	0.029	0.002386076	0.0035	0.032	0.003154930	0.0064	0.039	0.005497797
213	0.0068	0.027	0.005431953	0.0089	0.029	0.006810026	0.0114	0.031	0.008334906	0.0188	0.038	0.012577465
214	0.0149	0.031	0.010063181	0.0194	0.032	0.012077821	0.0247	0.036	0.014649094	0.0403	0.044	0.021034401
215	0.0062	0.029	0.005107955	0.0079	0.030	0.006253298	0.0099	0.033	0.007615385	0.0162	0.040	0.011530249
216	0.0122	0.031	0.008754630	0.0159	0.033	0.010730061	0.0204	0.036	0.013021277	0.0340	0.044	0.019179487
217	0.0286	0.033	0.015321429	0.0375	0.035	0.018103448	0.0479	0.038	0.021189756	0.0787	0.047	0.029426412
218	0.0077	0.028	0.006039216	0.0102	0.029	0.007545918	0.0132	0.032	0.009345133	0.0221	0.039	0.014106383
219	0.0145	0.032	0.009978495	0.0188	0.034	0.012106061	0.0239	0.037	0.014520525	0.0389	0.046	0.021076561
220	0.0029	0.028	0.002627832	0.0038	0.029	0.003359756	0.0050	0.031	0.004305556	0.0088	0.038	0.007145299
221	0.0365	0.030	0.016466165	0.0465	0.032	0.018955414	0.0582	0.035	0.021856223	0.0919	0.043	0.029293551

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
222	0.0061	0.018	0.004556017	0.0078	0.020	0.005611511	0.0098	0.023	0.006871951	0.0155	0.028	0.009977011
223	0.0230	0.020	0.010697674	0.0303	0.022	0.012745698	0.0390	0.025	0.015234375	0.0645	0.030	0.020476190
224	0.0056	0.028	0.004666667	0.0076	0.029	0.006021858	0.0100	0.032	0.007619048	0.0175	0.039	0.012079646
225	0.0151	0.040	0.010961887	0.0199	0.042	0.013502423	0.0257	0.047	0.016614856	0.0430	0.058	0.024693069
226	0.0027	0.019	0.002364055	0.0037	0.021	0.003145749	0.0048	0.024	0.004000000	0.0077	0.029	0.006084469
227	0.0050	0.018	0.003913043	0.0067	0.020	0.005018727	0.0089	0.023	0.006416928	0.0154	0.028	0.009935484
228	0.0014	0.027	0.001330986	0.0019	0.028	0.001779264	0.0025	0.031	0.002313433	0.0046	0.038	0.004103286
229	0.0188	0.028	0.011247863	0.0237	0.029	0.013041746	0.0293	0.032	0.015295269	0.0450	0.039	0.020892857
230	0.0145	0.019	0.008223881	0.0188	0.021	0.009919598	0.0239	0.024	0.011974948	0.0389	0.029	0.016614138
231	0.0060	0.019	0.004560000	0.0078	0.020	0.005611511	0.0099	0.023	0.006920973	0.0159	0.029	0.010269488
232	0.0068	0.020	0.005074627	0.0089	0.021	0.006250836	0.0114	0.025	0.007829670	0.0188	0.030	0.011557377
233	0.0023	0.018	0.002039409	0.0031	0.019	0.002665158	0.0041	0.022	0.003455939	0.0073	0.027	0.005746356
234	0.0100	0.018	0.006428571	0.0127	0.020	0.007767584	0.0159	0.023	0.009401028	0.0251	0.028	0.013235405
235	0.0218	0.018	0.009859296	0.0283	0.020	0.011718427	0.0360	0.023	0.014033898	0.0586	0.028	0.018946882
236	0.0065	0.018	0.004775510	0.0091	0.019	0.006153025	0.0123	0.022	0.007889213	0.0227	0.027	0.012331992
237	0.0085	0.023	0.006206349	0.0114	0.025	0.007829670	0.0149	0.029	0.009842825	0.0259	0.035	0.014885057
238	0.0135	0.019	0.007892308	0.0174	0.021	0.009515625	0.0220	0.024	0.011478261	0.0355	0.029	0.015961240
239	0.0042	0.018	0.003405405	0.0058	0.020	0.004496124	0.0078	0.023	0.005824675	0.0142	0.028	0.009421801
240	0.0049	0.029	0.004191740	0.0064	0.030	0.005274725	0.0081	0.033	0.006503650	0.0132	0.040	0.009924812
241	0.0021	0.028	0.001953488	0.0029	0.029	0.002636364	0.0040	0.032	0.003555556	0.0073	0.039	0.006149028
242	0.0032	0.018	0.002716981	0.0044	0.020	0.003606557	0.0058	0.023	0.004631944	0.0106	0.028	0.007689119
243	0.0108	0.017	0.006604317	0.0146	0.019	0.008255952	0.0190	0.022	0.010195122	0.0309	0.026	0.014119508
244	0.0167	0.018	0.008662824	0.0216	0.020	0.010384615	0.0275	0.023	0.012524752	0.0449	0.028	0.017245542
245	0.0220	0.020	0.010476190	0.0288	0.022	0.012472441	0.0370	0.025	0.014919355	0.0610	0.031	0.020554348
246	0.0166	0.018	0.008635838	0.0210	0.020	0.010243902	0.0259	0.023	0.012182004	0.0402	0.028	0.016504399
247	0.0187	0.023	0.010314149	0.0272	0.026	0.013293233	0.0386	0.030	0.016880466	0.0759	0.036	0.024418231
248	0.0027	0.018	0.002347826	0.0037	0.020	0.003122363	0.0050	0.023	0.004107143	0.0091	0.028	0.006867925
249	0.0103	0.025	0.007294618	0.0134	0.027	0.008955446	0.0171	0.031	0.011020790	0.0279	0.039	0.016264574
250	0.0065	0.021	0.004963636	0.0084	0.024	0.006222222	0.0107	0.027	0.007663130	0.0174	0.033	0.011392857
251	0.0060	0.035	0.005121951	0.0080	0.042	0.006720000	0.0106	0.049	0.008714765	0.0184	0.065	0.014340528
252	0.0023	0.033	0.002150142	0.0030	0.039	0.002785714	0.0039	0.045	0.003588957	0.0066	0.060	0.005945946
253	0.0007	0.029	0.000683502	0.0009	0.035	0.000877437	0.0011	0.040	0.001070560	0.0018	0.053	0.001740876

Table 5. Variance of prediction values for 281 U.S. Geological Survey streamgages used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, variance of weighted estimate computed using equation 7; MO, Missouri; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana; Ck, Creek; Fk, Fork]

Site number (fig. 1)	Annual exceedance probability discharge											
	4 Percent			2 Percent			1 Percent			0.2 Percent		
	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted	EMA	RRE	Weighted
254	0.0156	0.034	0.010693548	0.0201	0.040	0.013377704	0.0252	0.047	0.016404432	0.0391	0.062	0.023978239
255	0.0007	0.034	0.000685879	0.0010	0.041	0.000976190	0.0013	0.047	0.001265010	0.0024	0.063	0.002311927
256	0.0126	0.032	0.009040359	0.0166	0.039	0.011643885	0.0212	0.045	0.014410876	0.0349	0.059	0.021928647
257	0.0109	0.030	0.007995110	0.0140	0.036	0.010080000	0.0177	0.042	0.012452261	0.0284	0.055	0.018729017
258	0.0150	0.030	0.010000000	0.0194	0.036	0.012606498	0.0248	0.042	0.015592814	0.0408	0.055	0.023423800
259	0.0009	0.035	0.000877437	0.0011	0.042	0.001071926	0.0015	0.048	0.001454545	0.0026	0.064	0.002498498
260	0.0214	0.018	0.009776650	0.0283	0.020	0.011718427	0.0365	0.023	0.014109244	0.0609	0.028	0.019181102
261	0.0195	0.019	0.009623377	0.0254	0.021	0.011495690	0.0326	0.024	0.013823322	0.0538	0.029	0.018842995
262	0.0296	0.022	0.012620155	0.0373	0.024	0.014603589	0.0462	0.028	0.017433962	0.0712	0.034	0.023011407
263	0.0070	0.019	0.005115385	0.0094	0.021	0.006493421	0.0124	0.025	0.008288770	0.0217	0.030	0.012591876
264	0.0103	0.020	0.006798680	0.0137	0.021	0.008291066	0.0178	0.025	0.010397196	0.0301	0.030	0.015024958
265	0.0134	0.018	0.007681529	0.0175	0.020	0.009333333	0.0223	0.023	0.011322296	0.0365	0.028	0.015844961
266	0.0114	0.018	0.006979592	0.0156	0.020	0.008764045	0.0208	0.023	0.010922374	0.0367	0.027	0.015555730
267	0.0211	0.018	0.009713555	0.0278	0.020	0.011631799	0.0358	0.023	0.014003401	0.0596	0.027	0.018581986
268	0.0077	0.019	0.005479401	0.0103	0.020	0.006798680	0.0135	0.023	0.008506849	0.0235	0.028	0.012776699
269	0.0051	0.018	0.003974026	0.0069	0.020	0.005130112	0.0092	0.023	0.006571429	0.0164	0.028	0.010342342
270	0.0338	0.020	0.012565056	0.0439	0.022	0.014655539	0.0562	0.025	0.017302956	0.0928	0.031	0.023237480
271	0.0339	0.023	0.013702988	0.0429	0.026	0.016188679	0.0534	0.030	0.019208633	0.0828	0.037	0.025572621
272	0.0090	0.028	0.006810811	0.0123	0.031	0.008806005	0.0162	0.036	0.011172414	0.0285	0.044	0.017296552
273	0.0077	0.020	0.005559567	0.0104	0.022	0.007061728	0.0138	0.025	0.008891753	0.0243	0.030	0.013425414
274	0.0024	0.030	0.002222222	0.0031	0.036	0.002854220	0.0041	0.041	0.003727273	0.0069	0.055	0.006130856
275	0.0040	0.031	0.003542857	0.0052	0.037	0.004559242	0.0066	0.043	0.005721774	0.0109	0.056	0.009124066
276	0.0017	0.030	0.001608833	0.0022	0.035	0.002069892	0.0027	0.041	0.002533181	0.0044	0.054	0.004068493
277	0.0048	0.030	0.004137931	0.0061	0.036	0.005216152	0.0076	0.042	0.006435484	0.0120	0.055	0.009850746
278	0.0057	0.035	0.004901720	0.0074	0.041	0.006268595	0.0093	0.048	0.007790576	0.0145	0.064	0.011821656
279	0.0017	0.029	0.001605863	0.0022	0.035	0.002069892	0.0029	0.040	0.002703963	0.0048	0.054	0.004408163
280	0.0090	0.031	0.006975000	0.0116	0.037	0.008831276	0.0145	0.043	0.010843478	0.0230	0.057	0.016387500
281	0.0007	0.030	0.000684039	0.0009	0.035	0.000877437	0.0012	0.041	0.001165877	0.0022	0.054	0.002113879

[1]Station names have been modified from U.S. Geological Survey National Water Information System (NWIS).

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code (HUC)	Published drainage area (mi^2)	GIS-derived drainage area (mi^2)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	LFPLENGTH (mi)	SLPFM (ft/mi)
1	07040040	C	08020203	0.38	0.35	36.85972222	-89.93611111	0.84	101.46
2	07047200	D	08020204	2.16	1.91	35.61277778	-90.37500000	3.13	0.36
3	07047820	C	08020203	1.38	1.38	35.86444444	-90.64055556	3.21	34.88
4	07047823	C	08020203	0.36	0.35	35.86416667	-90.64083333	1.38	65.31
5	07047880	C	08020203	0.08	0.09	35.37638889	-90.70055556	0.48	222.74
6	07047924	D	08020203	0.48	0.53	34.95194444	-90.46666667	1.39	8.88
7	07047942	D	08020205	535	534	35.14472222	-90.87805556	68.57	3.17
8	07047975	C	11010001	1.23	1.19	35.82555556	-93.76361111	2.05	377.23
9	07047990	C	11010001	0.67	0.68	35.97277778	-94.16555556	1.69	334.03
10	07048000	C	11010001	83.1	83	35.98277778	-94.17250000	22.60	42.90
11	07048600	C	11010001	400	399	36.07305556	-94.08111111	48.45	25.35
12	07048800	C	11010001	138	140	36.10416667	-94.00750000	29.71	41.12
13	07048900	C	11010001	1.07	1.02	36.17333333	-93.91638889	1.80	64.74
14	07048940	C	11010001	22.4	22.4	35.90138889	-93.70111111	9.05	99.79
15	07049000	C	11010001	263	265	36.20000000	-93.85500000	50.90	23.68
16	07050200	C	11010001	2.75	2.78	36.05166667	-93.51750000	2.75	233.33
17	07050285	C	11010001	82.3	82.1	36.18861111	-93.41416667	17.18	60.71
18	07050400	C	11010001	0.73	0.74	36.36833333	-93.55916667	1.59	290.75
19	07050500	C	11010001	527	529	36.42722222	-93.62083333	87.37	16.85
20	07053207	C	11010001	104	103	36.38944444	-93.31583333	30.43	38.35
21	07053250	C	11010001	52.8	52.6	36.45444444	-93.35611111	19.04	47.55
22	07053810	C	11010003	191	196	36.71750000	-93.20666667	33.17	21.17
23	07053950	C	11010003	0.65	0.61	36.73111111	-93.12500000	1.41	322.25
24	07054047	C	11010003	25.5	25.4	36.89861111	-92.86805556	10.08	66.72
25	07054080	C	11010003	298	298	36.77944444	-92.90722222	45.77	18.05
26	07054100	C	11010003	0.83	0.88	36.77916667	-92.92361111	1.55	210.47
27	07054200	C	11010003	0.33	0.32	36.61000000	-93.09638889	1.45	200.34
28	07054300	C	11010003	0.23	0.19	36.58472222	-92.70833333	0.78	267.81
29	07054400	C	11010003	3.41	3.39	36.45666667	-93.07944444	4.14	162.83
30	07054410	C	11010003	133	133	36.44944444	-93.07500000	28.39	29.09
31	07054450	C	11010003	0.85	0.85	36.37444444	-92.83111111	1.70	264.11
32	07055550	C	11010003	4.36	4.27	36.15027778	-93.12305556	4.14	60.80
33	07055607	C	11010003	398	402	36.23027778	-92.70944444	64.76	25.23
34	07055646	C	11010005	57.4	58.8	35.93888889	-93.40500000	22.30	56.52
35	07055650	C	11010005	8.35	8.33	35.94722222	-93.39777778	6.74	170.62
36	07055800	C	11010005	6.15	6.13	35.93333333	-93.11277778	4.69	289.48
37	07055875	C	11010005	67.4	67.3	35.79722222	-92.92888889	16.50	73.67
38	07056000	C	11010005	829	828	35.98305556	-92.74722222	101.16	18.82
39	07056515	C	11010005	83.1	78.5	35.94000000	-92.71333333	25.57	51.78
40	07057500	C	11010006	561	562	36.62277778	-92.24805556	63.01	16.11

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	BSHAPE	ELEV (ft)	PRECIP (in)	LC11IMP (percent)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
1	1.97	546.71	48.73	0.93	2.6	5.12	52.75	0.00	0.00
2	5.13	220.31	48.89	0.54	3.7	4.30	0.00	0.00	100.00
3	7.42	326.80	47.58	3.29	2.8	22.06	23.74	0.00	100.00
4	5.48	313.60	47.55	2.15	2.8	16.74	15.37	0.00	100.00
5	2.58	383.45	49.86	0.69	2.8	14.65	0.00	0.00	16.27
6	3.63	202.23	53.03	2.16	3.9	12.71	0.00	0.00	100.00
7	8.80	253.54	49.33	0.81	3.3	4.52	2.84	0.00	70.14
8	3.53	1,942.66	55.12	0.14	2.6	1.23	0.03	100.00	0.00
9	4.18	1,507.48	48.32	1.30	2.6	6.11	28.60	100.00	0.00
10	6.15	1,706.01	50.57	1.13	2.6	4.12	22.68	100.00	0.00
11	5.88	1,688.22	51.14	1.34	2.6	4.06	20.63	100.00	0.00
12	6.31	1,590.94	49.19	0.42	2.6	3.16	35.82	100.00	0.00
13	3.19	1,376.35	47.03	0.47	2.7	1.59	87.51	100.00	0.00
14	3.65	1,914.50	52.90	0.11	2.6	2.57	13.11	100.00	0.00
15	9.78	1,610.56	48.82	0.64	2.5	3.74	35.13	100.00	0.00
16	2.72	1,647.71	48.77	0.82	2.6	5.39	28.22	100.00	0.00
17	3.59	1,884.05	49.48	0.25	2.6	3.25	18.09	100.00	0.00
18	3.44	1,366.47	45.98	4.94	3.1	6.58	30.16	0.00	0.00
19	14.43	1,584.94	47.88	0.50	2.6	3.48	25.97	79.40	0.00
20	9.01	1,492.47	46.16	0.46	2.5	3.30	36.01	100.00	0.00
21	6.89	1,298.06	45.27	1.03	2.5	3.59	72.21	90.45	0.00
22	5.61	1,162.59	44.55	0.65	2.7	2.97	18.25	69.93	0.00
23	3.28	988.46	43.57	1.51	3.0	7.26	17.91	0.00	0.00
24	3.99	1,269.12	44.41	0.20	2.5	3.16	40.43	0.00	0.00
25	7.02	1,207.08	44.07	0.54	2.7	3.58	38.03	3.66	0.00
26	2.75	1,002.48	43.74	0.31	3.0	2.17	5.28	0.00	0.00
27	6.46	856.74	43.23	1.28	2.9	3.69	14.67	0.00	0.00
28	3.10	926.21	44.14	2.30	2.5	5.69	72.21	0.00	0.00
29	5.06	1,034.21	42.85	0.53	3.0	2.68	27.43	0.00	0.00
30	6.06	1,177.28	44.40	0.51	2.6	3.30	33.58	42.19	0.00
31	3.42	1,031.19	44.97	0.05	2.8	0.30	12.20	0.00	0.00
32	4.01	1,281.75	46.08	0.58	2.6	3.95	79.49	100.00	0.00
33	10.42	1,111.19	45.86	1.27	2.6	4.13	47.89	65.65	0.00
34	8.46	1,999.77	50.15	0.09	2.6	1.93	4.12	100.00	0.00
35	5.44	1,880.62	50.01	0.20	2.6	3.87	5.70	100.00	0.00
36	3.60	1,471.15	48.92	0.34	2.5	3.29	17.50	100.00	0.00
37	4.04	1,688.97	50.73	0.12	2.6	2.25	2.13	100.00	0.00
38	12.35	1,467.68	48.66	0.23	2.6	2.92	11.34	100.00	0.00
39	8.32	1,296.53	47.05	0.59	2.7	3.52	28.29	100.00	0.00
40	7.06	1,073.87	44.56	0.29	2.6	3.18	27.02	0.00	0.00

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code (HUC)	Published drainage area (mi²)	GIS-derived drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	LFPLENGTH (mi)	SLPFM (ft/mi)
41	07058000	C	11010006	570	569	36.62722222	-92.30583333	68.47	15.84
42	07058980	C	11010006	68.2	68.4	36.42277778	-92.11833333	23.42	23.43
43	07059450	C	11010006	51.9	52.1	36.35750000	-92.11250000	23.37	20.79
44	07060600	C	11010004	1.25	1.24	36.13388889	-91.98000000	2.23	102.44
45	07060710	C	11010004	58.1	58.9	35.99166667	-92.21388889	17.09	49.50
46	07060830	C	11010004	0.27	0.26	35.66000000	-91.92083333	1.04	81.72
47	07061100	C	11010004	3.90	3.93	35.75888889	-91.51444444	3.86	52.79
48	07061260	C	11010007	16.2	15.9	37.60388889	-90.78861111	6.78	98.47
49	07061270	C	11010007	52.2	52.2	37.55250000	-90.84222222	12.44	66.12
50	07061500	C	11010007	484	492	37.33805556	-90.78861111	53.85	15.70
51	07061800	C	11010007	1.00	1.01	37.34972222	-90.97055556	1.56	180.10
52	07061900	C	11010007	139	139	37.24722222	-90.96527778	28.81	22.22
53	07063470	C	11010007	59.0	59.4	36.78305556	-90.55972222	26.79	19.44
54	07064300	C	11010008	1.72	1.92	37.53000000	-91.73694444	2.86	57.97
55	07064500	C	11010008	8.36	8.53	37.23277778	-91.85000000	4.35	61.60
56	07064533	C	11010008	295	295	37.37555556	-91.55277778	42.03	16.58
57	07065200	C	11010008	185	185	37.05611111	-91.66805556	28.57	24.67
58	07066000	C	11010008	398	404	37.15388889	-91.35805556	61.04	15.24
59	07066800	C	11010008	0.88	0.9	37.04583333	-91.32500000	1.63	77.91
60	07068000	C	11010008	2,038	2,050	36.62194444	-90.84750000	156.79	7.24
61	07068200	C	11010008	1.23	1.28	36.89027778	-90.84166667	1.81	67.68
62	07068510	C	11010008	194	194	36.63166667	-90.57527778	44.62	12.58
63	07068870	C	11010009	0.19	0.17	36.46277778	-90.92388889	0.76	164.53
64	07068890	C	11010009	229	229	36.33916667	-90.94250000	39.51	14.52
65	07069100	C	11010010	2.27	2.13	36.69305556	-91.80166667	3.30	45.22
66	07069250	C	11010010	0.48	0.47	36.42666667	-91.49083333	1.01	214.52
67	07069290	C	11010010	2.28	2.28	36.33694444	-91.77555556	2.56	93.75
68	07069500	C	11010010	1,180	1,160	36.20555556	-91.17166667	116.79	8.16
69	07070000	C	11010011	4.91	4.93	36.97027778	-91.92750000	4.85	59.70
70	07070500	C	11010011	361	358	36.78472222	-91.49194444	53.32	16.32
71	07071750	C	11010011	5.69	5.55	36.57694444	-91.31833333	4.40	87.42
72	07071800	C	11010011	4.24	4.08	36.67638889	-91.33611111	3.43	77.09
73	07072000	C	11010011	1,130	1,120	36.34638889	-91.11416667	123.24	9.64
74	07072200	C	11010011	1.33	1.28	36.25888889	-91.03388889	2.60	50.22
75	07074000	C	11010012	473	473	36.11111111	-91.44944444	82.53	8.55
76	07074200	C	11010012	1.22	1.19	36.00333333	-91.58500000	1.92	74.56
77	07074250	C	11010012	34.9	34.9	35.98277778	-91.33666667	15.09	27.31
78	07074550	D	11010013	6.24	6.08	36.17916667	-90.84138889	5.84	1.87
79	07074855	D	11010013	5.54	5.97	35.34361111	-91.34388889	6.43	3.22
80	07074865	C	11010013	8.35	8.38	35.46250000	-91.54694444	7.55	38.25

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	BSHAPE	ELEV (ft)	PRECIP (in)	LC11IMP (percent)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
41	8.24	1,076.35	44.04	0.23	2.4	3.57	25.72	0.10	0.00
42	8.02	900.08	45.44	0.33	2.7	3.28	51.37	0.00	0.00
43	10.49	850.33	45.84	0.54	2.6	4.08	40.90	0.00	0.00
44	4.01	707.19	46.21	0.74	2.5	3.27	27.94	0.00	0.00
45	4.98	950.29	47.30	0.25	2.6	2.65	1.48	24.17	0.00
46	4.19	1,054.69	51.11	1.40	2.6	6.81	64.43	100.00	0.00
47	3.79	459.75	48.27	0.87	2.6	4.19	37.84	99.97	0.00
48	2.90	1,287.83	46.26	0.07	2.4	1.53	1.71	0.00	0.00
49	2.96	1,211.91	46.00	0.12	2.5	1.72	2.32	0.00	0.00
50	5.89	1,084.11	46.48	0.21	2.5	2.70	3.39	0.00	0.00
51	2.43	989.59	47.37	0.14	2.3	2.08	3.82	0.00	0.00
52	5.96	1,003.58	46.37	0.29	2.3	3.25	9.25	0.00	0.00
53	12.08	627.95	47.80	0.36	2.4	3.14	13.10	0.00	0.00
54	4.26	1,275.22	44.94	0.20	2.4	3.70	44.53	0.00	0.00
55	2.22	1,346.36	44.85	0.28	2.5	4.12	40.62	0.00	0.00
56	5.99	1,197.78	44.98	0.23	2.3	3.44	19.37	0.00	0.00
57	4.41	1,223.84	45.62	0.17	2.4	3.36	19.96	0.00	0.00
58	9.23	1,108.19	45.60	0.29	2.4	3.49	16.89	0.00	0.00
59	2.97	1,093.97	45.70	0.26	2.5	3.91	26.25	0.00	0.00
60	11.99	976.34	46.14	0.26	2.4	3.21	12.03	0.00	0.00
61	2.57	764.75	47.89	0.91	2.5	12.07	16.91	0.00	0.00
62	10.25	564.15	48.25	0.24	2.4	2.77	13.50	0.00	5.15
63	3.30	461.02	48.59	0.28	2.6	5.28	1.20	0.00	0.00
64	6.81	497.78	48.19	0.25	2.6	3.12	23.68	0.00	0.00
65	5.11	1,034.13	46.08	0.41	2.6	3.83	47.96	0.00	0.00
66	2.19	669.42	45.40	1.30	2.6	12.51	0.00	0.00	0.00
67	2.87	767.31	46.51	0.54	2.6	5.02	7.25	0.00	0.00
68	11.75	743.85	46.20	0.71	2.6	4.27	29.27	0.00	0.00
69	4.77	1,304.85	45.72	0.16	2.6	2.99	31.59	0.00	0.00
70	7.94	1,056.94	46.33	0.56	2.5	3.74	37.12	0.00	0.00
71	3.49	698.13	46.15	0.16	2.6	3.05	37.11	0.00	0.00
72	2.88	819.44	46.35	0.46	2.6	4.75	17.30	0.00	0.00
73	13.58	855.28	46.40	0.39	2.5	3.45	28.18	0.00	0.00
74	5.26	465.87	48.57	2.03	2.6	14.36	65.49	0.00	0.00
75	14.41	666.99	47.17	0.65	2.6	4.88	31.85	0.00	0.00
76	3.08	640.32	48.05	1.50	2.5	6.68	17.08	0.00	0.00
77	6.52	434.48	48.10	0.63	2.5	3.88	27.05	0.00	0.00
78	5.61	273.78	48.53	0.45	3.8	4.87	0.00	0.00	100.00
79	6.93	218.69	49.82	0.24	3.1	3.90	0.00	0.00	100.00
80	6.80	553.38	49.34	0.88	2.6	3.33	24.60	100.00	0.00

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code (HUC)	Published drainage area (mi²)	GIS-derived drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	LFPLENGTH (mi)	SLPFM (ft/mi)
81	07074900	C	11010014	0.26	0.24	35.87055556	-92.60222222	0.97	510.80
82	07074950	C	11010014	1.58	1.58	35.85555556	-92.44000000	2.15	147.94
83	07075000	C	11010014	302	302	35.65666667	-92.29277778	67.47	21.27
84	07075300	C	11010014	148	148	35.58694444	-92.45138889	41.79	30.81
85	07075600	C	11010014	1.36	1.32	35.52666667	-92.41722222	2.61	168.99
86	07075800	C	11010014	0.26	0.17	35.54250000	-91.95944444	0.78	176.57
87	07076820	D	08020301	5.00	4.99	35.20111111	-91.73222222	4.98	31.73
88	07076850	D	08020301	166	155	35.02500000	-91.87305556	36.20	7.84
89	07076870	D	08020301	23.0	23.05	34.97666667	-91.84388889	9.97	12.11
90	07077200	C	08020302	1.58	1.57	36.37555556	-90.33222222	3.24	60.14
91	07077340	C	08020302	0.68	0.66	36.07388889	-90.61527778	1.69	83.70
92	07077380	D	08020302	701	691	35.85750000	-90.93305556	80.45	0.99
93	07077430	D	08020302	0.25	0.26	35.94138889	-90.94250000	1.28	4.09
94	07077500	D	08020302	1,040	1,030	35.26972222	-91.23638889	149.27	0.83
95	07077680	D	08020302	7.93	7.86	35.56166667	-91.02361111	8.05	0.74
96	07077860	D	08020303	10.0	10.4	34.60500000	-91.17000000	7.54	2.16
97	07077920	D	08020304	31.1	34.3	34.93944444	-91.01527778	19.03	1.24
98	07077940	D	08020304	38.0	36.2	34.68777778	-90.89583333	12.22	2.60
99	07077950	D	08020304	448	374	34.55555556	-90.84555556	70.78	0.81
100	07078000	D	08020402	175	176	34.53194444	-91.35555556	43.58	1.37
101	07078170	D	08020303	1.51	1.87	34.32583333	-91.40166667	4.20	3.28
102	07078210	D	08020303	0.20	0.39	34.30055556	-91.16250000	1.36	8.78
103	07188500	A	11070206	42.0	40.7	36.84111111	-94.60833333	15.96	25.75
104	07188653	A	11070208	141	142	36.61583333	-94.18222222	32.95	20.55
105	07188900	A	11070208	0.96	0.99	36.44750000	-94.44333333	2.19	118.26
106	07189000	A	11070208	851	853	36.63138889	-94.58666667	75.23	11.91
107	07189100	A	11070208	60.8	91.8	36.67083333	-94.60388889	25.52	19.45
108	07189540	A	11070206	8	7.99	36.54722222	-94.61777778	4.84	39.78
109	07189542	A	11070206	48.7	48.7	36.54888889	-94.68361111	17.27	29.14
110	07191220	A	11070209	132	132	36.33472222	-94.64138889	29.60	16.48
111	07191222	A	11070209	59.1	59.1	36.35527778	-94.77611111	19.60	24.04
112	07194800	A	11110103	167	167	36.10305556	-94.34444444	27.82	31.07
113	07195200	A	11110103	0.37	0.37	36.17722222	-94.27777778	1.00	84.79
114	07195800	A	11110103	14.2	14.9	36.25611111	-94.43361111	6.75	40.13
115	07196000	A	11110103	116	116	36.18638889	-94.70666667	29.38	20.07
116	07196380	A	11110103	3.59	3.85	35.97694444	-94.92333333	3.27	103.28
117	07196500	A	11110103	950	950	35.92277778	-94.92333333	112.26	10.74
118	07196900	A	11110103	40.6	41.1	35.88000000	-94.48638889	12.37	49.37
119	07196973	A	11110103	25.0	25	35.95472222	-94.69611111	12.95	33.49
120	07197000	A	11110103	312	312	35.92111111	-94.83833333	47.02	21.37

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	BSHAPE	ELEV (ft)	PRECIP (in)	LC11IMP (percent)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
81	3.84	1,285.41	46.01	0.45	3.1	1.60	7.87	100.00	0.00
82	2.92	1,511.65	50.50	1.48	2.6	1.80	40.68	100.00	0.00
83	15.09	1,279.42	50.53	0.44	2.6	2.89	15.94	100.00	0.00
84	11.76	1,139.41	51.82	0.31	2.6	2.79	9.74	100.00	0.00
85	5.13	681.34	51.75	1.45	2.6	5.71	42.98	100.00	0.00
86	3.57	822.35	51.24	0.05	2.6	0.00	23.52	100.00	0.00
87	4.97	304.27	50.65	3.59	2.9	19.32	44.49	96.51	3.48
88	8.44	299.61	50.37	1.60	3.0	6.70	42.77	78.72	9.52
89	4.31	257.30	50.36	0.59	3.1	5.63	46.16	0.00	100.00
90	6.71	418.94	47.96	0.11	2.5	3.91	49.11	0.00	0.00
91	4.31	459.99	48.64	1.79	2.3	7.14	0.31	0.00	100.00
92	9.37	302.98	48.15	0.48	3.5	4.14	4.62	0.00	71.07
93	6.13	259.61	48.70	0.13	3.8	3.15	0.00	0.00	100.00
94	21.56	277.92	48.48	0.49	3.5	3.86	3.11	0.00	80.66
95	8.23	230.15	49.13	0.21	3.7	2.87	0.00	0.00	100.00
96	5.46	178.13	51.14	0.47	3.6	3.90	0.30	0.00	100.00
97	10.56	208.81	50.69	0.58	3.6	4.20	0.00	0.00	100.00
98	4.12	201.50	52.60	0.39	3.4	4.68	0.00	0.00	100.00
99	13.39	196.37	51.27	0.59	3.5	4.70	0.08	0.00	100.00
100	10.76	213.17	50.36	0.67	3.7	4.41	0.04	0.00	100.00
101	9.45	195.73	50.91	0.48	3.9	4.93	0.00	0.00	100.00
102	4.75	182.82	51.84	0.18	3.4	4.98	0.00	0.00	100.00
103	6.25	1,086.96	45.10	1.00	2.6	4.00	57.61	4.73	0.00
104	7.65	1,326.94	46.44	0.66	2.4	5.01	38.10	100.00	0.00
105	4.83	1,171.52	46.90	1.92	2.4	8.86	3.80	100.00	0.00
106	6.63	1,201.04	45.88	1.25	2.4	6.16	37.82	92.98	0.00
107	7.09	1,103.46	44.87	1.86	2.5	5.14	46.49	32.97	0.00
108	2.93	1,021.62	45.66	2.35	2.6	5.10	82.02	100.00	0.00
109	6.13	1,050.52	46.06	0.93	2.5	4.32	71.80	100.00	0.00
110	6.66	1,205.98	47.20	1.20	2.4	4.87	51.45	100.00	0.00
111	6.49	1,058.63	46.76	0.71	2.5	4.27	61.71	100.00	0.00
112	4.62	1,302.08	48.10	1.65	2.6	5.51	53.15	100.00	0.00
113	2.64	1,276.45	46.78	2.33	2.7	3.05	78.45	100.00	0.00
114	3.06	1,329.81	47.62	0.48	2.4	5.07	65.16	100.00	0.00
115	7.46	1,164.59	47.84	3.02	2.5	6.24	51.07	100.00	0.00
116	2.78	972.24	47.82	0.31	2.3	4.79	17.23	100.00	0.00
117	13.26	1,178.32	47.62	3.95	2.5	6.79	44.74	100.00	0.00
118	3.72	1,338.26	50.14	0.57	2.6	3.56	48.17	100.00	0.00
119	6.72	1,073.33	48.65	0.43	2.4	4.73	34.26	100.00	0.00
120	7.09	1,136.38	49.42	0.48	2.4	4.22	37.83	100.00	0.00

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code (HUC)	Published drainage area (mi²)	GIS-derived drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	LFPLENGTH (mi)	SLPFM (ft/mi)
121	07197360	A	11110103	90.2	90.2	35.78500000	-94.85611111	22.54	42.81
122	07245500	A	11110104	182	181	35.46444444	-94.86194444	40.61	26.40
123	07246610	A	11110104	0.90	0.91	35.24444444	-94.74305556	2.49	73.68
124	07246630	A	11110104	5.32	5.49	35.52083333	-94.61944444	4.45	64.63
125	07247000	A	11110105	203	204	34.91888889	-94.29944444	36.13	20.26
126	07247250	A	11110105	94.3	94.3	34.77361111	-94.51194444	24.02	69.54
127	07247500	A	11110105	120	120	34.91250000	-95.15555556	32.63	26.97
128	07248500	A	11110105	993	994	34.93750000	-94.71500000	86.78	9.72
129	07249000	A	11110105	1,240	1,250	35.05972222	-94.60277778	105.02	8.43
130	07249400	A	11110105	147	147	35.16250000	-94.40694444	29.13	64.00
131	07249490	A	11110104	93.5	92.6	35.70333333	-94.32694444	22.00	59.40
132	07249500	A	11110104	35.3	34.8	35.72222222	-94.40777778	15.11	62.62
133	07249650	A	11110104	8.15	8.4	35.70638889	-94.48250000	6.87	128.13
134	07249920	A	11110104	102	97.4	35.57305556	-94.55694444	25.33	25.39
135	07249950	A	11110104	0.34	0.32	35.60000000	-94.38027778	1.38	198.77
136	07249985	A	11110104	420	434	35.51722222	-94.46416667	57.52	28.37
137	07250965	A	11110201	54.2	55.7	35.72222222	-94.11361111	17.13	84.14
138	07250974	A	11110201	6.9	7	35.70444444	-94.09166667	6.00	220.30
139	07251790	A	11110201	70.2	83.2	35.68361111	-93.59944444	18.52	74.15
140	07252000	A	11110201	373	374	35.57694444	-94.01527778	61.60	30.64
141	07252200	A	11110201	0.46	0.46	35.59527778	-93.84694444	1.01	313.94
142	07252500	A	11110202	4.23	4.08	35.20888889	-93.87805556	5.69	65.96
143	07254000	A	11110202	2.76	1.84	35.22916667	-93.91388889	2.95	112.91
144	07254500	A	11110202	5.81	5.1	35.26500000	-93.83027778	5.93	95.64
145	07255100	A	11110202	4.49	5.24	35.35611111	-93.98333333	3.70	31.86
146	07256000	A	11110202	53.0	53	35.34666667	-93.86305556	16.32	29.70
147	07256490	A	11110202	NA	7.01	35.47083333	-93.45250000	7.46	49.25
148	07256500	A	11110202	61.1	61.3	35.46833333	-93.46305556	17.99	95.31
149	07257006	A	11110202	306	297	35.50583333	-93.18138889	49.63	38.37
150	07257060	A	11110202	0.20	0.18	35.62361111	-93.43388889	0.84	521.81
151	07257100	A	11110202	0.19	0.23	35.50277778	-93.36555556	1.37	390.19
152	07257200	A	11110202	154	155	35.45000000	-93.33805556	36.56	42.78
153	07257500	A	11110202	241	242	35.46638889	-93.04111111	37.40	39.12
154	07257700	A	11110202	7.05	7.07	35.41777778	-93.08583333	7.69	88.41
155	07258200	A	11110204	0.92	0.9	34.97194444	-94.09611111	2.51	177.31
156	07258500	A	11110204	241	241	35.10694444	-93.92361111	38.57	21.71
157	07260000	A	11110204	81.4	81.8	34.98694444	-93.61305556	33.31	25.13
158	07260500	A	11110204	764	762	35.05861111	-93.39555556	93.28	11.91
159	07260630	A	11110204	1.85	1.85	35.13027778	-93.33861111	2.85	217.79
160	07260673	A	11110203	222	222	35.32472222	-92.87305556	35.99	46.15

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	BSHAPE	ELEV (ft)	PRECIP (in)	LC11IMP (percent)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
121	5.63	998.18	48.98	1.00	2.5	4.38	46.71	100.00	0.00
122	9.10	955.54	49.34	0.34	2.5	3.22	22.96	100.00	0.00
123	6.81	543.17	47.50	1.27	3.2	6.40	60.45	100.00	0.00
124	3.60	769.40	48.39	0.57	2.6	6.29	21.43	100.00	0.00
125	6.41	870.03	52.17	0.92	2.9	4.12	21.26	100.00	0.00
126	6.12	1,294.47	59.75	0.32	2.9	3.39	3.99	100.00	0.00
127	8.84	884.19	49.88	0.78	3.0	3.07	19.60	100.00	0.00
128	7.57	857.77	52.17	0.52	2.9	3.36	14.27	100.00	0.00
129	8.82	834.75	49.13	0.62	2.9	3.56	17.72	100.00	0.00
130	5.78	752.72	49.40	0.78	2.9	3.42	32.76	100.00	0.00
131	5.22	1,510.46	51.94	0.24	2.6	2.51	9.61	100.00	0.00
132	6.55	1,395.06	51.89	0.17	2.6	2.40	14.46	100.00	0.00
133	5.62	1,407.20	52.05	0.14	2.6	3.55	15.76	100.00	0.00
134	6.58	1,057.59	49.81	0.16	2.6	2.72	9.54	100.00	0.00
135	5.87	995.12	49.81	0.66	2.6	7.98	1.99	100.00	0.00
136	7.62	1,124.99	50.25	0.21	2.6	2.62	12.29	100.00	0.00
137	5.27	1,737.00	53.56	0.18	2.6	1.76	12.28	100.00	0.00
138	5.15	1,530.00	53.44	0.09	2.6	1.32	9.17	100.00	0.00
139	4.12	1,639.69	52.31	0.20	2.6	3.43	3.47	100.00	0.00
140	10.15	1,453.73	51.96	0.18	2.6	3.12	4.62	100.00	0.00
141	2.21	920.79	49.82	1.65	2.6	8.97	65.29	100.00	0.00
142	7.94	734.82	48.56	1.27	2.8	4.08	18.18	100.00	0.00
143	4.75	614.41	47.33	0.63	2.6	1.52	9.93	100.00	0.00
144	6.89	715.11	48.01	1.05	2.6	4.56	11.48	100.00	0.00
145	2.61	461.57	46.24	0.49	3.1	2.47	82.20	100.00	0.00
146	5.02	501.21	46.14	0.94	3.0	2.70	67.26	100.00	0.00
147	7.94	557.82	48.68	4.46	2.9	9.99	39.90	100.00	0.00
148	5.28	897.40	50.06	1.50	2.8	5.48	24.93	100.00	0.00
149	8.28	1,396.53	51.12	0.14	2.6	2.32	2.74	100.00	0.00
150	3.84	1,832.27	53.03	0.11	2.6	1.61	0.00	100.00	0.00
151	7.94	556.57	48.93	1.98	2.9	10.96	25.29	100.00	0.00
152	8.63	1,083.01	50.67	0.32	2.7	3.44	13.95	100.00	0.00
153	5.79	1,260.07	50.43	0.13	2.6	1.86	5.67	100.00	0.00
154	8.36	860.86	48.36	0.37	2.8	2.88	27.60	100.00	0.00
155	6.97	818.32	50.27	0.38	2.6	3.84	0.00	100.00	0.00
156	6.18	746.54	49.36	0.62	2.8	2.84	24.79	100.00	0.00
157	13.56	901.27	54.25	0.32	2.8	2.86	9.76	100.00	0.00
158	11.42	766.13	50.78	0.64	2.7	2.79	19.22	100.00	0.00
159	4.40	529.20	49.64	0.46	2.9	2.83	30.23	100.00	0.00
160	5.84	750.86	49.76	0.49	2.8	3.14	19.58	100.00	0.00

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code (HUC)	Published drainage area (mi²)	GIS-derived drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	LFPLENGTH (mi)	SLPFM (ft/mi)
161	07260679	A	11110203	0.09	0.04	35.26944444	-92.73305556	0.38	128.68
162	07261000	A	11110205	169	172	35.29861111	-92.40388889	52.87	13.08
163	07261050	A	11110205	0.29	0.31	35.38861111	-92.38805556	1.13	62.53
164	07261300	A	11110206	2.33	2.3	34.73027778	-94.07861111	3.62	412.99
165	07261500	A	11110206	410	410	34.87250000	-93.65722222	65.83	30.45
166	07261800	A	11110206	1.04	1.05	34.90777778	-92.40166667	2.03	365.80
167	07263000	A	11110206	210	210	34.91194444	-93.05611111	40.13	31.73
168	07263100	A	11110206	1.47	1.48	35.02055556	-92.76833333	3.12	138.05
169	07263400	A	11110207	15.0	15	34.78000000	-92.55416667	8.14	49.38
170	07263530	A	11110207	32.4	32	34.64750000	-92.43611111	14.04	25.98
171	07263860	D	08020401	2.75	3.49	34.48555556	-91.85361111	3.35	4.30
172	07264100	D	08020402	8.41	8.38	34.77222222	-91.84277778	6.02	3.56
173	07335700	B1	11140105	39.6	39.6	34.63833333	-94.61250000	12.74	135.90
174	07336000	B1	11140105	68.0	68.3	34.29861111	-95.74444444	30.58	21.30
175	07336500	B1	11140105	1,423	1,416	34.20055556	-95.48416667	136.95	16.25
176	07336520	B1	11140105	19.4	17.6	34.19722222	-95.35000000	10.31	47.81
177	07336710	B2	11140105	3.39	3.34	34.01944444	-95.36083333	4.08	36.27
178	07336780	B2	11140106	7.53	7.6	33.89555556	-94.88750000	4.65	25.96
179	07336785	B2	11140106	2.96	2.9	33.89555556	-94.90638889	4.29	27.81
180	07337220	B1	11140107	1.99	1.98	34.17416667	-95.07583333	2.41	69.63
181	07337500	B1	11140107	645	648	34.06944444	-95.04638889	92.75	20.13
182	07337900	B1	11140107	320	320	34.09750000	-94.90194444	52.16	28.05
183	07338520	B1	11140107	9.10	8.94	34.06250000	-94.73944444	5.87	66.02
184	07338700	B1	11140108	15.9	16.1	34.51444444	-94.33722222	12.22	70.80
185	07338750	B1	11140108	322	322	34.46222222	-94.63500000	51.02	38.24
186	07338780	B1	11140108	0.85	0.65	34.49666667	-94.66833333	2.66	83.05
187	07339000	B1	11140108	800	800	34.04166667	-94.61972222	101.40	22.50
188	07339500	B1	11140109	182	183	34.04750000	-94.41277778	43.08	30.19
189	07340000	B1	11140109	2,660	2,680	33.91944444	-94.38666667	167.72	11.64
190	07340200	B2	11140109	10.7	10.7	33.75361111	-94.39111111	8.61	11.41
191	07340300	B1	11140109	89.6	89.1	34.38000000	-94.23638889	23.63	60.09
192	07340500	B1	11140109	361	361	34.04500000	-94.21250000	63.51	29.02
193	07341000	B1	11140109	124	120	34.09611111	-94.08500000	42.55	36.86
194	07341100	B1	11140109	9.46	9.39	34.11277778	-94.04027778	7.64	46.33
195	07341260	B2	11140109	5.82	5.81	33.94388889	-93.91250000	4.63	45.29
196	07341700	B2	11140201	12.9	12.9	33.69250000	-93.63666667	7.96	16.43
197	07344320	B2	11140302	1.44	1.45	33.29777778	-93.91611111	2.09	30.74
198	07344450	B2	11140304	80.5	81	32.51666667	-93.97222222	22.98	9.60
199	07346950	B2	11140304	73.0	73	33.00138889	-93.86527778	17.96	11.43
200	07347500	B2	11140304	364	369	32.81527778	-93.87083333	54.33	5.20

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	BSHAPE	ELEV (ft)	PRECIP (in)	LC11IMP (percent)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
161	3.19	380.51	49.63	3.86	2.9	0.82	21.80	100.00	0.00
162	16.21	735.05	51.27	1.07	2.9	3.44	37.34	100.00	0.00
163	4.01	705.58	51.33	3.07	2.9	2.46	67.63	100.00	0.00
164	5.69	1,342.33	60.92	0.03	2.9	0.47	0.00	100.00	0.00
165	10.57	973.40	55.45	0.32	2.8	3.02	7.17	100.00	0.00
166	3.89	881.38	0.76	0.76	2.9	5.79	0.00	100.00	0.00
167	7.67	886.90	54.92	0.30	2.8	3.91	1.86	100.00	0.00
168	6.56	468.68	50.15	0.18	2.9	2.35	2.76	100.00	0.00
169	4.41	563.83	52.39	0.50	2.9	3.97	0.18	81.33	0.00
170	6.16	480.68	53.45	1.71	2.7	5.84	2.02	0.21	0.00
171	3.21	214.28	50.46	0.26	2.8	4.55	0.00	0.00	100.00
172	4.32	234.20	50.09	2.54	3.7	8.86	0.01	0.00	100.00
173	4.09	1,527.44	62.19	0.12	2.8	1.50	1.25	50.37	0.00
174	13.69	697.11	48.09	0.31	3.0	3.02	27.47	51.10	0.00
175	13.24	863.11	51.28	0.30	2.9	2.82	14.85	43.02	0.00
176	6.05	688.58	50.82	0.10	3.3	1.20	0.09	100.00	0.00
177	4.99	487.50	49.36	0.73	3.8	6.86	80.95	0.00	0.00
178	2.85	467.70	51.07	1.97	3.4	7.20	42.38	0.00	0.00
179	6.35	486.78	51.13	0.87	2.7	6.17	79.21	0.00	0.00
180	2.94	575.45	52.09	0.50	3.1	4.51	0.00	0.00	0.00
181	13.27	923.14	53.88	0.31	2.8	3.32	3.20	60.32	0.00
182	8.49	910.88	55.31	0.58	2.8	5.82	4.61	31.37	0.00
183	3.86	596.14	53.73	1.16	2.6	8.39	8.14	0.00	0.00
184	9.27	1,298.32	60.00	0.26	2.6	2.83	1.22	0.00	0.00
185	8.07	1,147.62	58.76	0.50	2.8	3.36	10.82	47.95	0.00
186	10.90	943.74	56.00	3.35	2.6	19.71	0.00	0.00	0.00
187	12.85	1,041.31	57.22	0.48	2.7	3.92	6.92	26.67	0.00
188	10.12	847.75	56.35	0.71	2.9	4.95	8.07	0.00	0.00
189	10.49	829.14	55.02	0.88	3.0	4.40	13.52	0.00	2.72
190	6.96	416.41	50.81	0.50	3.8	3.42	22.46	0.00	0.00
191	6.26	1,319.04	61.97	0.10	2.6	1.94	0.57	0.00	0.00
192	11.16	925.22	58.71	0.44	2.8	4.08	6.08	0.00	0.00
193	15.06	788.95	59.05	0.58	2.9	4.78	8.53	0.00	0.00
194	6.22	597.52	56.85	0.59	2.9	6.16	1.90	2.56	0.00
195	3.69	500.55	55.24	1.41	2.8	4.53	73.59	0.00	0.00
196	4.90	353.23	53.89	3.68	3.6	5.89	45.93	0.00	0.00
197	3.01	295.24	51.40	0.82	3.1	2.62	18.73	0.00	0.00
198	6.52	276.18	53.07	1.49	3.2	6.71	6.73	0.00	0.00
199	4.42	278.58	51.28	1.22	2.6	4.79	10.92	0.00	26.32
200	8.01	260.82	50.97	1.77	2.5	4.35	12.84	0.00	17.59

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code (HUC)	Published drainage area (mi²)	GIS-derived drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	LFPLENGTH (mi)	SLPFM (ft/mi)
201	07348615	B2	11140203	NA	228	33.20666667	-93.39916667	38.92	4.73
202	07348725	B2	11140203	33.1	32.6	32.93194444	-93.29166667	14.72	10.91
203	07348760	B2	11140203	49.8	49.5	32.85277778	-93.25138889	17.62	9.50
204	07348800	B2	11140203	66.9	66.6	32.76944444	-93.26666667	17.71	13.58
205	07348950	B2	11140203	0.08	0.04	32.67222222	-93.38055556	0.38	64.08
206	07349000	B2	11140203	1,097	1,087	32.59722222	-93.33166667	105.15	2.45
207	07349200	B2	11140203	35.1	39.7	32.56805556	-93.48611111	14.42	3.24
208	07349430	B2	11140205	236	236	33.36666667	-93.52222222	34.85	5.05
209	07349500	B2	11140205	546	552	32.90500000	-93.48277778	91.57	2.70
210	07355800	B1	08040101	0.65	0.64	34.62083333	-94.20416667	2.22	287.35
211	07355900	B1	08040101	0.19	0.17	34.47305556	-93.96055556	1.02	315.20
212	07356000	B1	08040101	414	414	34.61000000	-93.69750000	69.12	19.19
213	07356500	B1	08040101	61.0	61.1	34.56027778	-93.63583333	22.53	36.64
214	07356700	B1	08040101	1.85	1.74	34.56583333	-93.61750000	3.19	143.56
215	07357000	B1	08040101	1,100	1,100	34.60000000	-93.20555556	128.39	12.36
216	07357700	B1	08040101	3.84	3.86	34.62583333	-93.05250000	3.92	154.99
217	07359520	B1	08040102	2.95	2.98	34.36694444	-92.86694444	6.00	82.47
218	07359610	B1	08040102	136	132	34.38277778	-93.60611111	27.93	52.90
219	07359750	B1	08040102	2.32	2.28	34.36111111	-93.45833333	2.93	266.31
220	07359800	B1	08040102	312	302	34.26666667	-93.36250000	56.32	29.62
221	07359805	B1	08040102	7.62	7.68	34.32138889	-93.25666667	5.68	110.99
222	07360100	B2	08040102	74.2	74.2	34.10750000	-92.93111111	28.58	11.63
223	07360150	B2	08040102	0.42	0.43	34.03305556	-92.86805556	1.14	55.13
224	07360800	B1	08040103	120	120	34.08333333	-93.75194444	28.19	18.11
225	07361020	B1	08040103	0.16	0.06	34.15277778	-93.63138889	0.69	262.35
226	07361180	B2	08040103	17.7	16.4	33.82083333	-93.70777778	8.48	16.33
227	07361200	B2	08040103	144	144	33.88194444	-93.59972222	29.30	13.50
228	07361500	B1	08040103	178	179	34.03888889	-93.41805556	40.00	15.42
229	07361600	B1	08040103	1,079	1,072	33.87805556	-93.30444444	106.20	17.06
230	07361680	B2	08040103	1.48	1.47	33.60527778	-93.29194444	1.93	62.04
231	07361760	B2	08040103	9.22	9.11	34.09638889	-93.28138889	9.24	39.77
232	07361780	B2	08040103	3.36	3.49	34.10055556	-93.20666667	4.20	33.32
233	07361800	B2	08040103	258	257	33.91722222	-93.03555556	53.72	11.30
234	07361894	B2	08040102	9.01	9.14	33.76694444	-92.66444444	7.47	20.50
235	07362050	B2	08040201	10.3	10.2	33.54388889	-92.88833333	7.19	26.39
236	07362100	B2	08040201	385	384	33.37527778	-92.77666667	50.21	5.92
237	07362330	B2	08040201	13.6	12.4	33.53472222	-92.51527778	9.15	9.98
238	07362450	B2	08040201	5.02	5.04	33.84250000	-92.46916667	4.63	41.47
239	07362500	B2	08040201	240	241	33.79222222	-92.33333333	58.82	5.36
240	07362587	B1	08040203	27.0	26.6	34.79750000	-92.93388889	11.79	61.58

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	BSHAPE	ELEV (ft)	PRECIP (in)	LC11IMP (percent)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
201	6.65	309.78	53.59	0.92	3.0	2.43	7.41	0.00	10.83
202	6.66	296.91	54.32	1.46	3.4	5.64	2.63	0.00	0.00
203	6.27	304.07	54.89	1.33	3.1	4.55	1.23	0.00	0.00
204	4.71	296.59	55.45	0.80	3.0	3.82	0.69	0.00	0.00
205	3.57	203.84	54.79	1.21	3.6	0.00	11.01	0.00	100.00
206	10.17	274.50	53.82	1.41	3.1	2.98	5.34	0.00	24.87
207	5.24	222.52	54.80	1.04	3.6	1.14	4.13	0.00	100.00
208	5.15	322.48	53.53	0.78	3.1	3.24	13.16	0.00	10.49
209	15.19	281.24	53.12	0.97	3.2	3.18	8.49	0.00	61.26
210	7.72	1,191.91	59.66	0.42	2.9	1.87	14.96	85.74	0.00
211	6.21	1,227.29	62.67	0.08	2.2	0.86	0.00	0.00	0.00
212	11.54	1,137.34	59.68	0.78	2.7	3.37	19.35	27.30	0.00
213	8.31	871.72	56.85	0.41	2.8	2.63	4.99	0.00	0.00
214	5.84	747.96	56.53	0.16	2.8	2.32	0.83	0.00	0.00
215	14.95	949.09	57.43	0.52	2.6	3.29	9.50	29.39	0.00
216	3.98	804.26	57.71	1.05	2.6	5.42	0.88	0.00	0.00
217	12.08	493.94	55.90	0.30	2.7	3.46	0.28	0.00	32.70
218	5.91	963.34	59.14	0.37	2.7	2.60	10.74	0.00	0.00
219	3.76	749.03	58.42	0.79	2.8	4.60	25.55	0.00	0.00
220	10.51	843.25	57.98	0.58	2.7	3.23	14.18	0.00	0.00
221	4.20	715.58	56.73	0.24	2.7	4.39	0.56	0.00	0.00
222	11.01	370.98	54.54	0.89	2.9	2.07	5.96	0.00	0.00
223	3.02	342.54	54.04	1.00	2.8	4.59	59.98	0.00	0.00
224	6.63	581.84	56.28	0.49	2.9	4.46	6.92	48.50	0.00
225	6.99	623.36	57.43	2.94	2.9	11.12	16.97	100.00	0.00
226	4.39	403.45	53.63	0.49	3.7	3.95	37.42	0.00	0.00
227	5.97	410.96	54.61	0.52	3.5	3.39	38.31	0.00	0.00
228	8.94	540.56	57.17	0.50	2.9	4.42	4.48	51.61	0.00
229	10.52	553.13	56.74	0.51	3.1	3.86	13.67	23.26	0.00
230	2.53	359.27	53.68	1.50	3.0	2.50	7.95	0.00	0.00
231	9.37	396.91	55.30	0.38	2.9	3.19	0.00	40.62	0.00
232	5.05	319.85	55.00	0.28	3.4	2.69	0.00	0.00	0.00
233	11.23	318.69	54.71	0.48	3.3	3.41	11.76	19.33	10.51
234	6.11	248.65	53.90	0.78	3.0	2.43	5.03	0.00	18.75
235	5.08	206.67	53.49	1.21	2.9	2.96	5.45	0.00	2.85
236	6.56	228.37	53.87	0.84	3.1	2.49	1.69	0.00	0.00
237	6.75	189.66	54.23	0.99	3.6	1.96	1.39	0.00	100.00
238	4.24	321.67	54.17	0.93	3.4	1.77	0.00	0.00	0.00
239	14.38	270.60	53.94	1.51	3.3	1.44	1.86	0.00	0.00
240	5.24	1,151.02	59.86	0.22	2.9	3.46	0.04	100.00	0.00

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	USGS streamgage number	Flood region (fig. 1)	8-Digit hydrologic unit code (HUC)	Published drainage area (mi²)	GIS-derived drainage area (mi²)	Latitude of streamgage (decimal degrees)	Longitude of streamgage (decimal degrees)	LFPLENGTH (mi)	SLPFM (ft/mi)
241	07363000	B1	08040203	550	549	34.56777778	-92.61027778	68.05	17.99
242	07363200	B2	08040203	1,120	1,120	34.11611111	-92.40555556	139.76	9.57
243	07363300	B2	08040203	204	204	34.31944444	-92.34444444	49.14	8.75
244	07363330	B2	08040203	4.86	4.85	34.32027778	-92.39527778	4.19	26.61
245	07363430	B2	08040203	0.66	0.66	34.29916667	-92.19361111	1.39	78.89
246	07363435	B2	08040203	77.0	78.1	34.14555556	-92.24416667	28.11	8.15
247	07363450	B2	08040203	0.28	0.27	33.93666667	-92.17527778	0.92	42.87
248	07363500	B2	08040204	2,100	2,092	33.70083333	-92.02583333	202.73	6.85
249	07364030	B2	08040204	0.36	0.34	33.41333333	-92.20916667	0.82	45.70
250	07364070	B2	08040202	5.62	5.63	33.07555556	-92.32583333	4.86	24.68
251	07364110	D	08040205	0.75	0.76	34.16888889	-92.08666667	1.65	31.74
252	07364120	D	08040205	215	214	33.96111111	-91.78472222	92.08	2.17
253	07364128	D	08040205	102	107	34.03388889	-91.70972222	29.76	1.56
254	07364140	D	08040205	15.8	36	33.82472222	-91.73500000	12.73	16.45
255	07364150	D	08040205	576	608	33.62777778	-91.44583333	191.03	1.29
256	07364165	D	08040205	18.8	18.2	33.73888889	-91.74750000	8.61	12.75
257	07364260	D	08040205	20.9	21.1	33.17000000	-91.82777778	10.52	6.63
258	07364300	D	08040205	271	274	32.98194444	-91.80555556	48.21	2.91
259	07364500	D	08040205	1,645	1622	32.87222222	-91.86777778	351.08	0.84
260	07364700	B2	08040202	141	156	32.95527778	-92.49972222	30.83	6.23
261	07364800	B2	08040206	30.0	30.5	32.80833333	-93.05555556	11.58	15.64
262	07364860	B2	08040206	0.93	0.91	32.63611111	-92.87222222	1.47	88.59
263	07364870	B2	08040206	47.0	46.1	32.68888889	-92.85833333	13.89	19.42
264	07365000	B2	08040206	355	364	32.68055556	-92.65277778	50.88	5.63
265	07365300	B2	08040206	43.9	43.9	32.92777778	-92.99444444	13.12	13.26
266	07365800	B2	08040206	180	180	33.03805556	-92.94055556	46.74	5.37
267	07365900	B2	08040206	50.4	50.4	33.06694444	-92.88388889	20.34	9.39
268	07366000	B2	08040206	462	460	32.88750000	-92.65694444	79.24	3.91
269	07366200	B2	08040206	208	169	32.92916667	-92.63277778	37.87	6.15
270	07366350	B2	08040206	29.0	29.2	32.67222222	-92.47222222	13.71	15.09
271	07366360	B2	08040206	0.18	0.16	32.67500000	-92.37916667	0.69	109.23
272	07366403	B2	08040206	0.54	0.57	32.53194444	-92.46527778	1.76	55.51
273	07366420	B2	08040206	113	111	32.54166667	-92.37916667	22.52	10.22
274	07367658	D	08050001	0.94	1.31	33.86305556	-91.47944444	2.25	4.60
275	07367670	D	08050001	3.24	2.44	33.30416667	-91.49361111	2.76	1.99
276	07367740	D	08050001	1.86	2.2	33.11527778	-91.52527778	3.12	3.22
277	07367800	D	08050001	1,052	968	32.77166667	-91.59583333	152.41	0.90
278	07368300	D	08050001	0.42	0.15	32.35694444	-91.85694444	1.14	3.51
279	07368500	D	08050001	42.0	36.9	32.79861111	-91.50138889	18.06	0.92
280	07369250	D	08050001	0.35	0.4	32.09861111	-91.70833333	1.16	4.53
281	07369680	D	08050002	500	528	33.10027778	-91.25444444	99.97	1.06

Table 8. Basin characteristics for 281 U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma that were used in the regional regression analysis.—Continued

[USGS, U.S. Geological Survey; GIS, geographic information system; mi², square miles; LFPLENGTH, length of longest flow path in basin; mi, miles; SLPFM, slope of longest flow path in basin; ft/mi, feet per mile; BSHAPE, basin shape factor; ELEV, mean basin elevation; ft, feet; PRECIP, mean annual precipitation (basin average); in, inches; LC11IMP, percentage of basin covered by impervious surface; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage surficial geology in basin as upper Paleozoic units; ALVM, percentage of surficial geology in basin as Quaternary alluvial deposits]

Site number (fig. 1)	BSHAPE	ELEV (ft)	PRECIP (in)	LC11IMP (percent)	SOILINDEX	LC11DVOPN (percent)	LC11PAST (percent)	UPZ (percent)	ALVM (percent)
241	8.43	640.02	55.80	0.92	2.8	5.81	4.15	19.45	0.00
242	17.41	462.03	54.59	1.31	3.0	4.34	5.30	9.52	0.00
243	11.82	338.99	53.54	2.57	3.1	3.81	7.66	0.00	1.50
244	3.61	293.62	53.10	2.98	3.1	6.04	3.31	0.00	0.00
245	2.90	355.71	52.91	1.86	3.0	2.27	0.02	0.00	0.00
246	10.11	284.78	53.03	0.90	3.1	1.71	1.69	0.00	0.00
247	3.15	242.41	53.62	0.31	2.8	0.00	11.91	0.00	0.00
248	19.64	359.62	54.24	1.37	3.1	3.18	4.68	5.10	3.47
249	1.95	168.88	54.98	1.68	2.8	3.58	4.45	0.00	100.00
250	4.19	170.08	55.85	0.84	3.0	0.04	0.00	0.00	0.00
251	3.54	266.08	53.25	1.58	3.5	6.38	0.00	0.00	100.00
252	39.63	229.48	53.10	4.12	3.3	4.27	2.23	0.00	93.61
253	8.30	191.82	52.85	2.22	3.4	3.49	0.35	0.00	100.00
254	4.50	292.00	53.21	1.04	2.9	1.02	10.55	0.00	9.32
255	60.00	206.64	53.03	2.22	3.3	3.30	2.52	0.00	89.55
256	4.07	284.63	53.91	0.81	2.9	0.82	11.22	0.00	0.00
257	5.25	168.81	56.41	1.44	3.4	1.06	11.31	0.00	100.00
258	8.47	152.56	56.65	1.62	3.4	0.68	4.39	0.00	100.00
259	75.97	177.14	54.80	1.49	3.3	2.12	3.45	0.00	93.32
260	6.08	199.91	55.35	3.92	3.0	2.47	2.03	0.00	0.00
261	4.40	302.68	56.10	2.12	3.0	4.34	2.33	0.00	0.00
262	2.37	292.52	56.55	1.62	2.9	2.00	3.29	0.00	0.00
263	4.19	286.66	56.52	0.87	3.0	3.04	8.38	0.00	0.00
264	7.11	253.05	56.46	1.51	2.8	3.25	4.37	0.00	0.00
265	3.92	291.05	55.63	1.97	3.1	4.87	1.50	0.00	0.00
266	12.16	248.87	54.21	0.58	3.1	1.86	1.75	0.00	0.00
267	8.21	239.53	54.68	1.17	3.1	2.21	1.58	0.00	0.00
268	13.64	222.28	54.96	0.73	3.1	1.67	1.68	0.00	0.00
269	8.48	197.22	55.15	1.91	3.0	2.51	2.30	0.00	0.00
270	6.43	214.57	56.22	1.79	2.7	3.03	8.47	0.00	0.00
271	2.87	195.09	56.22	1.70	2.5	2.71	0.00	0.00	0.00
272	5.46	168.52	56.37	4.87	2.2	10.89	5.78	0.00	0.00
273	4.56	198.97	56.30	2.40	2.6	4.26	3.46	0.00	0.00
274	3.87	162.62	52.43	4.89	2.8	8.78	0.00	0.00	100.00
275	3.12	125.56	57.28	1.67	3.0	4.31	0.00	0.00	100.00
276	4.44	115.25	57.18	3.34	2.8	4.52	0.00	0.00	100.00
277	24.00	125.99	55.32	0.84	3.4	4.07	0.35	0.00	100.00
278	8.51	74.89	58.10	0.28	3.0	9.57	0.00	0.00	100.00
279	8.85	100.66	56.57	0.71	3.6	5.63	1.28	0.00	100.00
280	3.32	72.41	57.48	3.85	3.6	13.75	0.00	0.00	100.00
281	18.93	135.06	53.45	0.54	3.5	4.03	0.51	0.00	100.00

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
1	07040040	Delaware Creek tributary near Bloomfield, MO	C	EMA	384	549	656	787	882	975	1,185
				RRE	98	175	285	412	520	632	931
				Weighted	367	517	618	737	827	919	1,133
2	07047200	Ditch no. 45 near Lepanto, AR	D	EMA	166	196	214	233	246	258	282
				RRE	109	127	138	150	157	165	181
				Weighted	165	194	212	231	243	255	278
3	07047820	Murray Creek near Jonesboro, AR	C	EMA	501	764	946	1,185	1,366	1,550	1,995
				RRE	297	543	603	783	925	1,066	1,409
				Weighted	492	749	912	1,127	1,290	1,455	1,839
4	07047823	Murray Creek tributary near Jonesboro, AR	C	EMA	133	206	256	321	370	419	536
				RRE	126	228	259	336	397	456	601
				Weighted	132	208	256	324	376	428	556
5	07047880	Pope Creek tributary at Birdeye, AR	C	EMA	49	89	122	171	214	262	395
				RRE	57	102	136	183	221	259	354
				Weighted	49	90	124	174	216	261	378
6	07047924	Crooked Bayou tributary at State Highway 149 at Hughes, AR	D	EMA	110	204	280	391	484	586	862
				RRE	110	178	228	296	350	407	546
				Weighted	110	197	264	359	435	516	718
7	07047942	L'Anguille River near Colt, AR	D	EMA	5,703	9,203	11,660	14,860	17,280	19,730	25,540
				RRE	7,017	11,137	14,117	17,969	20,907	23,839	30,959
				Weighted	5,796	9,349	11,857	15,134	17,633	20,179	26,297
8	07047975	Dog Branch at St. Paul, AR	C	EMA	202	394	549	775	961	1,162	1,685
				RRE	409	778	1,091	1,525	1,890	2,270	3,237
				Weighted	220	443	647	959	1,223	1,509	2,307
9	07047990	West Fork White River tributary near Greenland, AR	C	EMA	172	393	591	900	1,171	1,475	2,312
				RRE	231	436	576	791	970	1,153	1,619
				Weighted	179	401	587	860	1,084	1,322	1,905
10	07048000	West Fork White River at Greenland, AR	C	EMA	87,12	16,540	22,900	32,190	39,950	48,400	70,850
				RRE	5,910	11,630	17,188	24,994	31,706	38,992	58,237
				Weighted	8,490	15,947	21,942	30,520	37,661	45,469	65,814
11	07048600	White River near Fayetteville, AR	C	EMA	24,340	43,710	59,340	82,200	101,500	122,600	179,800
				RRE	17,064	34,074	55,173	83,089	107,644	134,932	208,993
				Weighted	23,975	42,922	58,877	82,341	102,700	125,363	188,640
12	07048800	Richland Creek at Goshen, AR	C	EMA	10,180	27,560	46,750	82,610	119,700	167,500	332,700
				RRE	7,647	15,074	22,921	33,741	43,124	53,386	80,859
				Weighted	9,381	21,241	31,809	46,948	59,706	74,365	110,854

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
13	07048900	Whitener Branch tributary near Spring Valley, AR	C	EMA	153	285	398	570	720	891	1,378
				RRE	203	378	583	843	1,069	1,306	1,943
				Weighted	155	293	420	619	795	995	1,571
14	07048940	War Eagle Creek near Witter, AR	C	EMA	3,001	5,983	8,491	12,240	15,430	18,950	28,510
				RRE	2,641	5,147	8,360	12,406	15,937	19,779	30,065
				Weighted	2,954	5,816	8,458	12,293	15,618	19,284	29,281
15	07049000	War Eagle Creek near Hindsville, AR	C	EMA	13,590	23,010	29,900	39,150	46,360	53,770	71,860
				RRE	11,756	23,310	31,775	45,433	57,038	69,621	102,530
				Weighted	13,523	23,025	30,027	39,755	47,631	55,905	77,538
16	07050200	Maxwell Creek at Kingston, AR	C	EMA	606	1,304	1,918	2,861	3,681	4,600	7,140
				RRE	593	1,130	1,839	2,705	3,459	4,265	6,419
				Weighted	604	1,262	1,894	2,802	3,584	4,442	6,734
17	07050285	Osage Creek at Osage, AR	C	EMA	9,737	17,090	22,640	30,290	36,360	42,720	58,630
				RRE	6,057	11,930	20,869	31,886	41,687	52,563	82,406
				Weighted	9,246	16,122	22,259	30,716	37,964	45,899	67,732
18	07050400	Freeman Branch at Berryville, AR	C	EMA	192	323	420	552	657	765	1,037
				RRE	188	341	472	652	801	952	1,339
				Weighted	192	325	429	574	695	820	1,148
19	07050500	Kings River near Berryville, AR	C	EMA	17,100	30,600	41,290	56,620	69,300	83,010	119,200
				RRE	18,822	37,350	45,979	63,870	78,712	94,654	135,327
				Weighted	17,146	30,874	41,587	57,306	70,436	84,694	122,716
20	07053207	Long Creek at Denver, AR	C	EMA	6,742	13,270	18,830	27,270	34,600	42,810	65,700
				RRE	6,223	12,233	16,340	23,112	28,830	34,968	50,893
				Weighted	6,664	13,015	17,981	25,432	31,718	38,604	56,366
21	07053250	Yocum Creek near Oak Grove, AR	C	EMA	1,759	4,121	6,396	10,180	13,710	17,900	30,570
				RRE	3,035	5,859	8,477	12,262	15,511	19,007	28,346
				Weighted	1,942	4,564	7,148	11,153	14,671	18,541	29,053
22	07053810	Bull Creek near Walnut Shade, MO	C	EMA	10,050	18,340	24,990	34,620	42,650	51,370	74,590
				RRE	10,002	19,637	30,899	45,856	58,830	73,053	111,238
				Weighted	10,044	18,566	26,359	38,038	48,287	59,478	90,911
23	07053950	Ingenthron Hollow near Forsyth, MO	C	EMA	187	334	450	617	755	905	1,301
				RRE	179	326	450	620	759	901	1,261
				Weighted	186	333	450	618	756	903	1,282
24	07054047	Little Beaver Creek near Ava, MO	C	EMA	703	2,384	4,384	8,215	12,180	17,230	34,000
				RRE	1,844	3,446	5,481	8,045	10,237	12,578	18,876
				Weighted	1,072	2,880	5,014	8,097	10,723	13,544	21,029

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
25	07054080	Beaver Creek at Bradleyville, MO	C	EMA	11,210	20,170	27,080	36,740	44,520	52,750	73,650
				RRE	9,759	18,684	28,001	40,909	51,884	63,750	95,507
				Weighted	11,034	19,924	27,290	38,011	47,099	56,893	83,483
26	07054100	Cedar Hollow at Bradleyville, MO	C	EMA	228	449	629	890	1,105	1,336	1,935
				RRE	250	456	672	945	1,171	1,404	2,003
				Weighted	231	450	640	909	1,132	1,366	1,970
27	07054200	Yanell Branch near Kirbyville, MO	C	EMA	104	163	206	262	306	351	462
				RRE	119	216	231	295	344	392	508
				Weighted	106	167	208	268	316	364	482
28	07054300	Gray Branch at Lutie, MO	C	EMA	113	203	269	358	426	496	663
				RRE	57	101	140	193	236	280	393
				Weighted	106	186	240	309	360	415	542
29	07054400	Charley Creek near Omaha, AR	C	EMA	1,156	2,017	2,700	3,685	4,505	5,399	7,789
				RRE	527	970	1,279	1,755	2,144	2,542	3,557
				Weighted	1,078	1,800	2,287	2,943	3,464	4,035	5,366
30	07054410	Bear Creek near Omaha, AR	C	EMA	8,807	21,180	33,290	53,620	72,750	95,540	165,000
				RRE	6,479	12,503	18,948	27,729	35,251	43,394	65,147
				Weighted	8,264	17,962	26,473	38,654	48,794	59,834	88,595
31	07054450	East Sugarloaf Creek tributary near Lead Hill, AR	C	EMA	263	489	672	938	1,160	1,402	2,046
				RRE	233	425	585	807	989	1,174	1,644
				Weighted	261	483	660	912	1,118	1,337	1,894
32	07055550	Crooked Creek tributary near Dog Patch, AR	C	EMA	607	1,122	1,546	2,175	2,712	3,308	4,942
				RRE	556	1,051	1,608	2,337	2,968	3,639	5,443
				Weighted	603	1,112	1,558	2,219	2,794	3,423	5,164
33	07055607	Crooked Creek at Kelley Crossing at Yellville, AR	C	EMA	9,154	18,730	27,130	40,170	51,680	64,760	102,000
				RRE	13,043	25,558	34,971	50,089	62,886	76,734	113,208
				Weighted	9,490	19,766	28,888	43,299	55,877	69,748	107,894
34	07055646	Buffalo River near Boxley, AR	C	EMA	9,946	18,520	25,170	34,470	41,930	49,770	69,490
				RRE	5,334	10,508	13,575	18,906	23,357	28,097	40,121
				Weighted	9,256	16,871	21,885	28,809	34,250	40,137	54,088
35	07055650	Smith Creek near Boxley, AR	C	EMA	1,425	3,321	5,063	7,816	10,260	13,040	20,830
				RRE	1,436	2,779	3,757	5,250	6,502	7,821	11,181
				Weighted	1,427	3,172	4,573	6,579	8,216	9,988	14,305
36	07055800	Dry Branch near Vendor, AR	C	EMA	1,060	2,328	3,446	5,162	6,651	8,312	12,860
				RRE	1,080	2,079	3,190	4,625	5,859	7,178	10,652
				Weighted	1,063	2,265	3,362	4,941	6,282	7,743	11,562

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s) 50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
37	07055875	Richland Creek near Witts Spring, AR	C	EMA	9,845	17,960	24,490	34,000	41,970	50,650	73,910
				RRE	5,915	11,673	19,217	28,769	37,144	46,348	71,088
				Weighted	9,307	16,583	23,039	32,134	40,016	48,770	72,451
38	07056000	Buffalo River near St. Joe, AR	C	EMA	37,510	67,020	89,450	120,400	145,000	170,700	234,900
				RRE	29,566	59,556	78,231	111,076	138,785	168,980	246,911
				Weighted	37,247	66,699	88,789	119,607	144,335	170,483	237,148
39	07056515	Bear Creek near Silver Hill, AR	C	EMA	10,090	18,220	24,390	32,880	39,600	46,600	63,960
				RRE	5,483	10,770	14,471	20,463	25,520	30,941	44,971
				Weighted	9,257	16,367	21,195	27,922	33,345	39,227	53,618
40	07057500	North Fork River near Tecumseh, MO	C	EMA	12,920	25,940	37,540	55,890	72,440	91,600	147,900
				RRE	15,891	30,634	46,848	68,998	87,910	108,501	163,779
				Weighted	13,034	26,266	38,499	57,981	75,592	95,668	153,314
41	07058000	Bryant Creek near Tecumseh, MO	C	EMA	12,090	23,520	32,800	46,240	57,360	69,350	100,600
				RRE	16,166	31,177	45,351	65,809	83,088	101,786	151,385
				Weighted	12,262	24,005	33,908	48,678	61,346	75,146	113,526
42	07058980	Bennetts River at Vidette, AR	C	EMA	4,419	5,688	6,473	7,417	8,090	8,741	10,200
				RRE	3,308	6,223	8,385	11,789	14,612	17,582	25,344
				Weighted	4,383	5,707	6,573	7,736	8,654	9,583	11,977
43	07059450	Big Creek near Elizabeth, AR	C	EMA	1,941	3,014	3,766	4,750	5,502	6,267	8,111
				RRE	2,964	5,574	6,740	9,157	11,113	13,140	18,283
				Weighted	2,016	3,275	4,210	5,623	6,779	7,950	11,182
44	07060600	Band Mill Creek near Brockwell, AR	C	EMA	249	445	608	854	1,067	1,306	1,980
				RRE	269	490	662	911	1,115	1,322	1,852
				Weighted	250	451	619	870	1,083	1,312	1,918
45	07060710	North Sylamore Creek near Fifty Six, AR	C	EMA	4,775	10,580	15,560	22,960	29,170	35,890	53,430
				RRE	4,469	8,568	12,888	18,663	23,556	28,801	42,580
				Weighted	4,747	10,306	15,079	21,908	27,507	33,515	48,641
46	07060830	Wolf Bayou near Drasco, AR	C	EMA	56	122	179	264	336	415	623
				RRE	96	177	229	312	381	451	629
				Weighted	61	132	192	281	354	431	626
47	07061100	Gibbs Creek at Sulphur Rock, AR	C	EMA	799	1,446	1,955	2,679	3,273	3,911	5,569
				RRE	699	1,334	2,001	2,880	3,634	4,434	6,542
				Weighted	790	1,430	1,964	2,729	3,377	4,077	5,959
48	07061260	East Fork Black River near Ironton, MO	C	EMA	1,970	4,314	6,380	9,550	12,300	15,370	23,780
				RRE	1,756	3,297	5,500	8,141	10,409	12,839	19,346
				Weighted	1,925	4,000	6,055	8,901	11,328	14,003	20,998

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
49	07061270	East Fork Black River near Lesterville, MO	C	EMA	6,924	11,830	15,550	20,700	24,840	29,210	40,330
				RRE	3,866	7,337	12,911	19,538	25,314	31,608	48,752
				Weighted	6,385	10,722	14,808	20,295	25,024	30,177	44,242
50	07061500	Black River near Annapolis, MO	C	EMA	19,830	37,140	50,470	68,920	83,560	98,830	136,600
				RRE	17,082	33,069	52,238	77,469	99,099	122,729	186,076
				Weighted	19,723	36,923	50,593	69,775	85,496	102,317	146,772
51	07061800	Brawley Hollow near Centerville, MO	C	EMA	131	176	205	240	266	292	350
				RRE	276	506	780	1,112	1,390	1,678	2,428
				Weighted	134	186	228	283	331	377	510
52	07061900	Logan Creek at Ellington, MO	C	EMA	2,333	10,270	20,990	43,040	66,860	97,830	202,300
				RRE	7,081	13,536	20,092	29,077	36,656	44,787	66,216
				Weighted	3,785	11,871	20,430	32,795	42,950	53,975	80,997
53	07063470	Tenmile Creek near Poplar Bluff, MO	C	EMA	6,193	10,410	13,450	17,470	20,550	23,680	31,190
				RRE	3,913	7,415	8,435	11,235	13,468	15,768	21,462
				Weighted	5,915	9,915	12,305	15,602	18,117	20,703	26,792
54	07064300	Fudge Hollow near Licking, MO	C	EMA	128	236	324	452	560	678	996
				RRE	321	585	804	1,115	1,372	1,634	2,312
				Weighted	140	273	400	600	784	973	1,525
55	07064500	Big Creek near Yukon, MO	C	EMA	2,020	3,991	5,647	8,125	10,240	12,580	18,950
				RRE	890	1,647	2,994	4,546	5,908	7,377	11,433
				Weighted	1,878	3,552	5,095	7,164	8,884	10,766	15,694
56	07064533	Current River above Akers, MO	C	EMA	5,820	15,540	25,500	42,630	58,960	78,550	138,400
				RRE	10,893	20,913	32,443	47,794	60,905	75,138	113,273
				Weighted	7,226	17,792	29,110	45,859	60,281	76,122	118,781
57	07065200	Jacks Fork near Mountain View, MO	C	EMA	13,410	23,940	31,950	43,030	51,870	61,120	84,310
				RRE	7,953	15,203	25,433	38,221	49,309	61,422	94,395
				Weighted	12,353	21,632	29,922	41,208	50,797	61,253	89,343
58	07066000	Jacks Fork at Eminence, MO	C	EMA	12,250	24,710	34,720	48,950	60,470	72,630	103,200
				RRE	13,661	26,318	36,028	51,219	63,862	77,403	112,668
				Weighted	12,299	24,797	34,821	49,186	60,911	73,372	105,344
59	07066800	Sycamore Creek near Winona, MO	C	EMA	105	229	336	498	636	788	1,194
				RRE	220	400	584	821	1,018	1,221	1,745
				Weighted	114	249	379	578	749	932	1,432
60	07068000	Current River at Doniphan, MO	C	EMA	27,580	51,450	69,800	95,160	115,300	136,300	188,200
				RRE	41,681	81,572	110,927	158,661	198,483	241,665	354,419
				Weighted	27,895	52,424	71,676	99,079	121,906	146,148	211,155

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
61	07068200	North Prong Little Black River at Hunter, MO	C	EMA	173	398	599	907	1,173	1,466	2,255
				RRE	296	541	838	1,199	1,502	1,817	2,644
				Weighted	189	426	660	1,007	1,304	1,620	2,462
62	07068510	Little Black River below Fairdealing, MO	C	EMA	7,313	16,050	24,100	37,040	48,810	62,480	102,600
				RRE	8,587	16,447	20,931	29,002	35,602	42,567	60,332
				Weighted	7,418	16,104	23,442	34,658	44,029	54,298	79,819
63	07068870	Fourche River tributary at Middlebrook, AR	C	EMA	139	202	245	301	344	387	492
				RRE	86	155	197	264	317	369	500
				Weighted	136	198	239	295	339	383	494
64	07068890	Fourche River above Pocahontas, AR	C	EMA	15,330	28,770	39,320	54,220	66,290	79,080	111,600
				RRE	8,942	17,112	25,244	36,603	46,201	56,530	83,904
				Weighted	14,135	25,746	34,586	47,009	57,133	68,188	96,111
65	07069100	Adams Branch near West Plains, MO	C	EMA	350	494	593	722	821	922	1,169
				RRE	336	613	800	1,094	1,335	1,579	2,204
				Weighted	350	499	607	757	881	1,008	1,350
66	07069250	Brush Creek near Mammoth Spring, AR	C	EMA	237	423	573	792	976	1,180	1,729
				RRE	170	310	474	672	836	1,006	1,444
				Weighted	233	411	558	766	939	1,128	1,617
67	07069290	Miller Creek near Salem, AR	C	EMA	535	985	1,346	1,864	2,293	2,757	3,977
				RRE	464	856	1,306	1,864	2,333	2,821	4,094
				Weighted	527	963	1,337	1,864	2,307	2,782	4,031
68	07069500	Spring River at Imboden, AR	C	EMA	26,160	49,810	69,780	100,000	126,200	155,600	237,800
				RRE	25,363	49,188	66,353	94,537	118,019	143,335	209,603
				Weighted	26,132	49,775	69,493	99,309	124,861	153,184	229,548
69	07070000	Kings Creek near Willow Springs, MO	C	EMA	342	638	873	1,212	1,490	1,790	2,571
				RRE	657	1,213	1,666	2,320	2,859	3,416	4,852
				Weighted	386	752	1,094	1,625	2,073	2,533	3,796
70	07070500	Eleven Point River near Thomasville, MO	C	EMA	6,215	10,540	13,930	18,760	22,770	27,120	38,680
				RRE	10,975	21,022	30,514	44,185	55,728	68,166	101,225
				Weighted	6,447	11,380	15,875	23,031	29,405	36,329	57,095
71	07071750	Louse Creek near Alton, MO	C	EMA	297	944	1,667	2,973	4,259	5,828	10,700
				RRE	685	1,263	1,938	2,792	3,513	4,270	6,277
				Weighted	398	1,077	1,807	2,858	3,741	4,686	7,107
72	07071800	Williams Spring Branch near Alton, MO	C	EMA	379	762	1,089	1,584	2,012	2,489	3,806
				RRE	639	1,181	1,867	2,705	3,415	4,162	6,139
				Weighted	409	840	1,278	1,951	2,544	3,180	4,970

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
73	07072000	Eleven Point River near Ravenden Springs, AR	C	EMA	11,990	23,610	34,190	51,370	67,280	86,140	144,000
				RRE	24,922	48,329	62,063	87,120	107,778	129,914	187,177
				Weighted	12,295	24,675	36,284	55,867	74,166	95,220	157,819
74	07072200	Hubble Creek near Pocahontas, AR	C	EMA	602	826	969	1,146	1,274	1,400	1,687
				RRE	212	384	491	667	810	954	1,324
				Weighted	586	801	930	1,094	1,216	1,338	1,621
75	07074000	Strawberry River near Poughkeepsie, AR	C	EMA	14,960	26,120	34,960	47,680	58,270	69,790	100,500
				RRE	13,697	26,334	31,876	43,787	53,469	63,699	89,767
				Weighted	14,926	26,130	34,735	47,240	57,554	68,722	97,696
76	07074200	Dry Branch tributary near Sidney, AR	C	EMA	597	968	1,228	1,562	1,813	2,065	2,654
				RRE	282	515	749	1,052	1,303	1,562	2,230
				Weighted	566	908	1,141	1,444	1,679	1,922	2,507
77	07074250	Reeds Creek near Strawberry, AR	C	EMA	3,004	5,785	8,142	11,710	14,810	18,290	28,000
				RRE	2,496	4,692	6,406	8,993	11,133	13,378	19,192
				Weighted	2,941	5,551	7,624	10,628	13,126	15,847	22,730
78	07074550	Village Creek near Okean, AR	D	EMA	216	505	778	1,227	1,640	2,125	3,561
				RRE	344	486	581	698	785	869	1,067
				Weighted	255	498	689	956	1,169	1,377	1,869
79	07074855	Cypress Creek tributary near Augusta, AR	D	EMA	316	484	603	761	883	1,009	1,318
				RRE	361	538	660	817	935	1,054	1,337
				Weighted	321	492	612	771	893	1,019	1,323
80	07074865	Glaise Creek near Bradford, AR	C	EMA	1,173	2,653	3,988	6,074	7,910	9,980	15,750
				RRE	1,267	2,442	3,120	4,296	5,273	6,294	8,882
				Weighted	1,193	2,585	3,615	5,122	6,344	7,659	10,837
81	07074900	Trace Creek tributary near Marshall, AR	C	EMA	95	157	203	265	313	363	484
				RRE	133	250	317	426	517	608	834
				Weighted	97	164	216	290	350	413	578
82	07074950	Tick Creek near Leslie, AR	C	EMA	301	650	951	1,404	1,789	2,213	3,346
				RRE	374	707	1,104	1,601	2,030	2,484	3,689
				Weighted	311	662	990	1,471	1,881	2,327	3,523
83	07075000	Middle Fork of Little Red River at Shirley, AR	C	EMA	23,760	42,790	57,950	79,840	98,030	117,800	170,200
				RRE	14,619	29,151	34,264	46,847	57,215	68,284	96,042
				Weighted	23,391	41,949	55,583	74,693	89,966	106,213	145,365
84	07075300	South Fork of Little Red River at Clinton, AR	C	EMA	10,080	18,150	24,420	33,210	40,330	47,890	67,210
				RRE	9,514	18,877	23,085	31,800	39,020	46,717	66,102
				Weighted	10,055	18,197	24,288	33,015	40,102	47,649	66,898

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
85	07075600	Choctaw Creek tributary near Choctaw, AR	C	EMA	262	484	668	944	1,182	1,447	2,186
				RRE	326	616	797	1,093	1,339	1,592	2,236
				Weighted	265	496	687	975	1,223	1,491	2,206
86	07075800	Dill Branch tributary near Ida, AR	C	EMA	48	102	148	216	274	336	502
				RRE	95	177	229	310	377	444	613
				Weighted	51	109	160	236	301	368	546
87	07076820	Gum Springs Creek near Higginson, AR	D	EMA	781	1,149	1,393	1,699	1,924	2,147	2,661
				RRE	616	1,171	1,634	2,315	2,888	3,514	5,184
				Weighted	765	1,151	1,416	1,757	2,020	2,287	2,942
88	07076850	Cypress Bayou near Beebe, AR	D	EMA	6,159	10,890	14,440	19,260	23,050	26,980	36,650
				RRE	3,822	6,546	8,640	11,496	13,767	16,117	22,045
				Weighted	5,479	9,530	12,553	16,661	19,812	22,993	30,691
89	07076870	Pigeon Roost Creek at Butlerville, AR	D	EMA	1,970	3,936	5,511	7,745	9,554	11,460	16,270
				RRE	1,446	2,556	3,428	4,649	5,638	6,680	9,354
				Weighted	1,883	3,695	5,126	7,106	8,660	10,268	14,143
90	07077200	Big Creek tributary near Boydsville, AR	C	EMA	382	568	689	838	946	1,051	1,286
				RRE	272	495	584	773	925	1,077	1,456
				Weighted	379	565	683	833	944	1,054	1,313
91	07077340	Sugar Creek tributary near Walcott, AR	C	EMA	273	447	571	734	860	988	1,296
				RRE	213	389	487	651	783	915	1,242
				Weighted	269	441	559	718	842	969	1,278
92	07077380	Cache River at Egypt, AR	D	EMA	4,566	5,844	6,662	7,672	8,411	9,142	10,840
				RRE	6,197	8,727	10,390	12,376	13,802	15,151	18,259
				Weighted	4,587	5,890	6,723	7,765	8,532	9,299	11,089
93	07077430	Willow Ditch near Egypt, AR	D	EMA	35	62	83	115	142	172	257
				RRE	48	69	84	103	118	133	168
				Weighted	36	63	83	113	137	163	231
94	07077500	Cache River at Patterson, AR	D	EMA	6,251	8,980	10,870	13,340	15,240	17,190	21,960
				RRE	5,959	8,126	9,525	11,159	12,322	13,409	15,881
				Weighted	6,243	8,953	10,822	13,241	15,078	16,952	21,407
95	07077680	Three Mile Creek near Amagon, AR	D	EMA	320	372	401	434	456	476	519
				RRE	290	370	419	476	516	554	638
				Weighted	319	372	401	435	458	478	523
96	07077860	Boat Gunwale Slash tributary near Holly Grove, AR	D	EMA	368	451	499	555	594	630	709
				RRE	518	749	906	1,103	1,249	1,393	1,731
				Weighted	373	458	511	573	618	660	756

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
97	07077920	Big Creek at Goodwin, AR	D	EMA	506	724	862	1,030	1,150	1,266	1,525
				RRE	821	1,125	1,323	1,561	1,733	1,898	2,277
				Weighted	518	741	883	1,055	1,182	1,303	1,582
98	07077940	Spring Creek near Aubrey, AR	D	EMA	1,465	1,749	1,911	2,095	2,218	2,334	2,577
				RRE	1,380	2,093	2,589	3,224	3,701	4,175	5,306
				Weighted	1,462	1,754	1,923	2,121	2,258	2,387	2,667
99	07077950	Big Creek at Poplar Grove, AR	D	EMA	3,248	4,585	5,431	6,454	7,184	7,888	9,453
				RRE	3,471	4,698	5,484	6,403	7,056	7,667	9,054
				Weighted	3,265	4,594	5,436	6,449	7,170	7,863	9,399
100	07078000	Lagrue Bayou near Stuttgart, AR	D	EMA	2,367	3,982	5,140	6,665	7,831	9,013	11,830
				RRE	2,538	3,606	4,317	5,182	5,813	6,419	7,826
				Weighted	2,399	3,901	4,956	6,305	7,311	8,281	10,509
101	07078170	Little LaGrue Bayou tributary near DeWitt, AR	D	EMA	183	213	231	250	263	276	302
				RRE	149	217	263	323	367	412	518
				Weighted	182	213	232	252	265	279	308
102	07078210	Tarleton Creek tributary at Ethel, AR	D	EMA	67	115	154	211	260	315	465
				RRE	82	130	166	215	253	293	391
				Weighted	69	118	156	212	258	309	440
103	07188500	Lost Creek at Seneca, MO	A	EMA	881	3,191	6,233	12,700	20,090	30,320	69,610
				RRE	3,166	6,316	8,998	13,027	16,425	20,064	30,038
				Weighted	1,393	4,591	7,826	12,931	17,288	22,002	35,287
104	07188653	Big Sugar Creek near Powell, MO	A	EMA	6,222	13,900	20,980	32,310	42,550	54,380	88,700
				RRE	7,890	16,251	23,511	34,512	43,838	53,910	81,814
				Weighted	6,702	14,935	22,302	33,658	43,386	54,064	83,824
105	07188900	Butler Creek tributary near Gravette, AR	A	EMA	116	287	451	716	957	1,235	2,030
				RRE	208	454	672	1,020	1,328	1,667	2,627
				Weighted	146	337	540	882	1,181	1,518	2,448
106	07189000	Elk River near Tiff City, MO	A	EMA	22,020	40,910	55,540	75,910	92,220	109,300	152,200
				RRE	29,329	56,919	80,153	114,055	141,919	171,438	251,633
				Weighted	22,447	42,041	58,047	81,716	100,981	121,682	173,751
107	07189100	Buffalo Creek at Tiff City, MO	A	EMA	4,949	10,710	15,960	24,340	31,900	40,640	66,100
				RRE	5,739	11,328	16,065	23,115	29,014	35,308	52,497
				Weighted	5,168	10,990	16,018	23,559	29,947	36,852	55,967
108	07189540	Cave Springs Branch near South West City, MO	A	EMA	785	1,534	2,164	3,111	3,923	4,826	7,306
				RRE	962	1,942	2,782	4,060	5,151	6,327	9,561
				Weighted	818	1,657	2,392	3,541	4,526	5,615	8,551

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
109	07189542	Honey Creek near South West City, MO	A	EMA	1,625	4,243	6,912	11,510	15,920	21,220	37,580
				RRE	3,605	7,103	10,061	14,474	18,177	22,127	32,907
				Weighted	2,146	5,476	8,607	13,371	17,437	21,865	34,053
110	07191220	Spavinaw Creek near Sycamore, OK	A	EMA	4,283	9,581	14,350	21,820	28,410	35,870	56,750
				RRE	7,469	15,007	21,463	31,134	39,263	47,978	71,924
				Weighted	4,751	10,309	15,844	24,876	32,611	41,154	64,001
111	07191222	Beaty Creek near Jay, OK	A	EMA	3,493	10,720	18,910	34,140	49,620	69,110	133,200
				RRE	4,157	8,178	11,578	16,641	20,883	25,405	37,742
				Weighted	3,770	9,148	13,619	20,208	25,772	31,632	48,448
112	07194800	Illinois River at Savoy, AR	A	EMA	11,190	24,830	37,320	57,210	75,100	95,670	155,000
				RRE	8,911	18,205	26,239	38,357	48,592	59,616	90,075
				Weighted	10,645	22,329	32,219	46,723	59,200	72,602	111,067
113	07195200	Brush Creek tributary near Tontitown, AR	A	EMA	85	180	262	385	491	607	920
				RRE	101	230	347	538	710	903	1,455
				Weighted	89	192	290	451	598	762	1,218
114	07195800	Flint Creek at Springtown, AR	A	EMA	741	1,908	3,114	5,234	7,307	9,852	17,980
				RRE	1,513	3,248	4,786	7,188	9,277	11,565	17,998
				Weighted	817	2,160	3,564	5,951	8,157	10,693	17,990
115	07196000	Flint Creek near Kansas, OK	A	EMA	4,030	10,440	16,760	27,270	36,990	48,340	81,580
				RRE	6,795	13,555	19,320	27,932	35,158	42,888	64,078
				Weighted	4,344	11,062	17,428	27,508	36,227	45,764	71,974
116	07196380	Steely Hollow near Tahlequah, OK	A	EMA	533	1,763	3,207	5,954	8,784	12,380	24,270
				RRE	563	1,137	1,627	2,377	3,019	3,711	5,616
				Weighted	549	1,307	1,939	2,883	3,694	4,557	7,050
117	07196500	Illinois River near Tahlequah, OK	A	EMA	19,980	39,050	54,820	78,040	97,590	119,000	176,100
				RRE	31,757	61,192	85,886	121,772	151,173	182,250	266,485
				Weighted	20,453	40,449	57,435	83,351	105,574	130,273	196,134
118	07196900	Baron Fork at Dutch Mills, AR	A	EMA	8,543	13,360	16,670	20,910	24,090	27,280	34,740
				RRE	3,186	6,726	9,838	14,638	18,769	23,267	35,836
				Weighted	7,937	12,890	15,926	19,854	23,037	26,370	35,001
119	07196973	Peacheater Creek at Christie, OK	A	EMA	1,586	2,259	2,701	3,254	3,661	4,063	4,996
				RRE	2,213	4,439	6,339	9,206	11,635	14,242	21,400
				Weighted	1,683	2,516	3,199	4,392	5,435	6,612	9,456
120	07197000	Baron Fork at Eldon, OK	A	EMA	15,330	28,760	39,090	53,360	64,690	76,480	105,600
				RRE	14,039	27,327	38,521	54,966	68,570	83,007	122,262
				Weighted	15,255	28,627	39,023	53,619	65,419	77,906	109,905

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
121	07197360	Caney Creek near Barber, OK	A	EMA	5,138	7,657	9,428	11,770	13,570	15,430	20,000
				RRE	5,666	10,886	15,245	21,651	26,960	32,578	47,787
				Weighted	5,180	8,089	10,483	14,009	16,883	20,075	27,930
122	07245500	Sallisaw Creek near Sallisaw, OK	A	EMA	13,080	28,750	43,120	66,100	86,870	110,900	180,800
				RRE	9,439	17,696	24,508	34,365	42,434	50,905	73,658
				Weighted	12,225	24,509	34,060	47,785	59,150	70,881	104,086
123	07246610	Pecan Creek near Spiro, OK	A	EMA	269	409	505	629	723	818	1,045
				RRE	196	346	466	639	782	931	1,321
				Weighted	260	396	495	632	742	857	1,143
124	07246630	Big Black Fox Creek near Long, OK	A	EMA	825	1,481	1,961	2,597	3,084	3,577	4,740
				RRE	730	1,374	1,904	2,686	3,340	4,030	5,882
				Weighted	811	1,458	1,946	2,625	3,172	3,747	5,195
125	07247000	Poteau River at Cauthron, AR	A	EMA	10,950	18,890	24,790	32,800	39,090	45,610	61,690
				RRE	10,280	18,747	25,632	35,458	43,416	51,702	73,761
				Weighted	10,887	18,869	24,953	33,443	40,270	47,462	65,789
126	07247250	Black Fork below Big Creek near Page, OK	A	EMA	12,660	23,240	31,270	42,270	50,930	59,910	81,960
				RRE	5,853	12,063	17,454	25,642	32,600	40,117	60,948
				Weighted	11,291	20,094	26,640	35,538	42,943	50,669	71,791
127	07247500	Fourche Maline near Red Oak, OK	A	EMA	6,737	14,190	20,810	31,130	40,280	50,690	80,290
				RRE	6,999	12,942	17,806	24,814	30,536	36,520	52,519
				Weighted	6,781	13,831	19,676	28,188	35,145	42,592	63,211
128	07248500	Poteau River near Wister, OK	A	EMA	28,060	55,820	79,040	113,600	142,900	175,100	261,900
				RRE	32,808	57,922	78,055	106,080	128,309	151,197	211,565
				Weighted	29,305	56,690	78,554	109,221	133,882	159,533	227,954
129	07249000	Poteau River at Poteau, OK	A	EMA	25,830	49,660	69,120	97,530	121,300	147,100	215,500
				RRE	38,823	67,753	90,821	122,705	147,852	173,650	241,469
				Weighted	27,645	53,444	75,155	106,740	132,220	159,160	228,366
130	07249400	James Fork near Hackett, AR	A	EMA	6,857	11,560	15,060	19,830	23,600	27,540	37,380
				RRE	8,087	14,260	19,192	26,131	31,696	37,432	52,543
				Weighted	6,909	11,752	15,463	20,656	24,861	29,345	40,685
131	07249490	Lee Creek near Lee Creek, AR	A	EMA	7,898	16,580	23,990	35,080	44,510	54,870	82,640
				RRE	5,776	12,421	18,330	27,488	35,390	44,035	68,345
				Weighted	7,293	14,961	21,333	31,006	39,303	48,332	73,687
132	07249500	Cove Creek near Lee Creek, AR	A	EMA	4,947	10,580	15,540	23,170	29,820	37,290	58,020
				RRE	2,823	6,045	8,901	13,339	17,181	21,382	33,182
				Weighted	4,694	9,748	13,914	20,049	25,221	30,731	46,390

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s) 50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
133	07249650	Mountain Fork near Evansville, AR	A	EMA	1,277	2,461	3,406	4,753	5,853	7,024	10,020
				RRE	997	2,195	3,273	4,980	6,483	8,143	12,850
				Weighted	1,224	2,391	3,364	4,837	6,107	7,512	11,318
134	07249920	Little Lee Creek near Nicut, OK	A	EMA	8,556	15,110	20,260	27,630	33,720	40,290	57,600
				RRE	5,994	11,682	16,471	23,552	29,450	35,717	52,764
				Weighted	8,013	13,933	18,627	25,582	31,430	37,687	54,720
135	07249950	Webber Creek tributary near Cedarville, AR	A	EMA	35	97	160	269	373	498	876
				RRE	91	194	284	426	552	690	1,076
				Weighted	42	117	194	326	448	589	984
136	07249985	Lee Creek near Short, OK	A	EMA	24,790	43,200	57,180	76,540	92,050	108,400	149,700
				RRE	17,897	34,536	48,492	68,872	85,649	103,402	151,538
				Weighted	24,477	42,572	56,370	75,541	91,062	107,505	150,105
137	07250965	Frog Bayou at Winfrey, AR	A	EMA	7,291	12,290	15,980	20,980	24,910	28,990	39,110
				RRE	3,978	8,969	13,528	20,769	27,141	34,212	54,429
				Weighted	6,564	11,317	15,123	20,896	25,844	31,235	45,762
138	07250974	Jack Creek near Winfrey, AR	A	EMA	1,235	2,878	4,382	6,749	8,842	11,210	17,810
				RRE	870	1,968	2,969	4,577	6,007	7,598	12,154
				Weighted	1,088	2,406	3,551	5,307	6,899	8,633	13,654
139	07251790	Mulberry River near Oark, AR	A	EMA	8,720	16,000	21,860	30,350	37,430	45,120	65,600
				RRE	5,340	11,765	17,559	26,648	34,563	43,285	68,021
				Weighted	8,036	14,756	20,340	28,811	36,143	44,237	66,823
140	07252000	Mulberry River near Mulberry, AR	A	EMA	20,960	36,560	47,880	62,870	74,350	86,000	113,700
				RRE	16,037	33,279	48,330	71,112	90,385	111,223	169,106
				Weighted	20,742	36,360	47,915	63,674	76,165	89,358	122,347
141	07252200	North Fork White Oak Creek tributary near Watalula, AR	A	EMA	156	268	354	473	570	672	935
				RRE	119	246	355	526	676	838	1,288
				Weighted	152	265	354	486	600	722	1,052
142	07252500	Sixmile Ck subwatershed no. 6 near Chismville, AR	A	EMA	833	1,473	1,947	2,587	3,085	3,598	4,842
				RRE	587	1,098	1,516	2,132	2,647	3,188	4,640
				Weighted	788	1,369	1,804	2,405	2,897	3,410	4,747
143	07254000	Sixmile Creek subwatershed no. 5 near Chismville, AR	A	EMA	496	751	923	1,142	1,305	1,467	1,846
				RRE	328	592	804	1,114	1,370	1,637	2,346
				Weighted	474	728	900	1,134	1,324	1,523	2,020
144	07254500	Sixmile Creek subwatershed no. 2 near Caulksville, AR	A	EMA	861	1,447	1,876	2,453	2,904	3,370	4,514
				RRE	692	1,278	1,755	2,455	3,036	3,645	5,271
				Weighted	836	1,408	1,842	2,454	2,953	3,481	4,836

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
145	07255100	Sixmile Creek subwatershed no. 23 near Branch, AR	A	EMA	763	1,527	2,138	3,004	3,703	4,440	6,292
				RRE	706	1,156	1,502	1,982	2,365	2,752	3,747
				Weighted	749	1,393	1,855	2,471	2,953	3,433	4,701
146	07256000	Hurricane Creek near Caulksville, AR	A	EMA	3,111	4,942	6,261	8,023	9,396	10,810	14,310
				RRE	3,840	6,172	7,953	10,368	12,255	14,147	18,993
				Weighted	3,185	5,143	6,641	8,688	10,298	11,968	16,042
147	07256490	Greenbrier Creek at Clarksville, AR	A	EMA	1,021	1,534	1,884	2,334	2,673	3,014	3,821
				RRE	873	1,498	1,989	2,684	3,246	3,821	5,323
				Weighted	1,001	1,527	1,911	2,445	2,870	3,311	4,380
148	07256500	Spadra Creek at Clarksville, AR	A	EMA	5,064	9,646	13,130	17,870	21,560	25,350	34,440
				RRE	4,271	8,027	11,125	15,639	19,359	23,271	33,785
				Weighted	5,012	9,493	12,895	17,548	21,177	24,932	34,287
149	07257006	Big Piney Creek at Highway 164 near Dover, AR	A	EMA	23,320	43,110	59,180	82,700	102,500	124,100	182,200
				RRE	13,566	27,959	40,472	59,371	75,337	92,569	140,324
				Weighted	22,657	41,446	56,361	78,077	96,123	115,490	168,498
150	07257060	Mikes Creek tributary near Ozone, AR	A	EMA	49	86	116	158	193	230	328
				RRE	60	152	241	395	540	707	1,206
				Weighted	50	95	137	205	267	340	540
151	07257100	Minnow Creek tributary near Hagerville, AR	A	EMA	49	91	125	174	214	258	372
				RRE	72	131	178	249	308	370	535
				Weighted	51	95	133	189	236	288	422
152	07257200	Little Piney Creek near Lamar, AR	A	EMA	9,192	13,480	16,470	20,400	23,420	26,530	34,140
				RRE	8,417	16,375	23,070	32,940	41,133	49,833	73,480
				Weighted	9,162	13,676	17,086	21,899	25,867	30,121	40,976
153	07257500	Illinois Bayou near Scottsville, AR	A	EMA	18,680	33,270	44,960	61,960	76,220	91,800	133,700
				RRE	11,652	23,438	33,543	48,643	61,301	74,869	112,161
				Weighted	18,277	32,321	43,454	59,407	72,851	87,355	127,052
154	07257700	McCoy Creek near Dover, AR	A	EMA	680	1,819	2,955	4,857	6,619	8,680	14,710
				RRE	879	1,697	2,380	3,401	4,260	5,172	7,645
				Weighted	728	1,771	2,674	3,991	5,106	6,283	9,551
155	07258200	Pack Saddle Creek tributary near Waldron, AR	A	EMA	195	345	461	628	765	912	1,299
				RRE	194	384	544	789	998	1,222	1,836
				Weighted	195	350	474	663	822	999	1,467
156	07258500	Petit Jean River near Booneville, AR	A	EMA	12,600	19,210	23,750	29,580	33,980	38,410	48,890
				RRE	11,623	20,267	27,140	36,731	44,369	52,213	72,810
				Weighted	12,574	19,254	23,939	30,139	34,923	39,836	51,784

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
157	07260000	Dutch Creek at Waltreak, AR	A	EMA	6,699	10,980	14,060	18,140	21,300	24,530	32,370
				RRE	5,276	9,875	13,661	19,161	23,679	28,423	41,157
				Weighted	6,649	10,919	14,033	18,231	21,561	25,043	33,727
158	07260500	Petit Jean River at Danville, AR	A	EMA	15,160	29,440	41,420	59,360	74,710	91,740	138,400
				RRE	27,007	46,453	61,840	83,019	99,686	116,716	161,279
				Weighted	16,188	32,252	45,929	66,486	83,332	101,483	148,509
159	07260630	Jake Creek near Chickalah, AR	A	EMA	491	811	1,053	1,391	1,664	1,956	2,710
				RRE	329	571	760	1,033	1,255	1,484	2,083
				Weighted	471	762	969	1,260	1,497	1,745	2,411
160	07260673	West Fork Point Remove Creek near Hattieville, AR	A	EMA	5,408	11,390	16,850	25,590	33,540	42,810	70,210
				RRE	10,938	19,132	25,656	34,779	42,055	49,534	69,192
				Weighted	5,913	12,818	19,177	28,852	37,038	45,936	69,661
161	07260679	East Fork Point Remove Creek tributary near Saint Vincent, AR	A	EMA	36	57	71	88	101	114	145
				RRE	20	34	44	60	73	86	121
				Weighted	35	55	67	83	96	108	139
162	07261000	Cadron Creek near Guy, AR	A	EMA	8,536	13,010	15,920	19,480	22,040	24,510	29,990
				RRE	9,103	15,900	21,308	28,875	34,918	41,128	57,440
				Weighted	8,553	13,135	16,213	20,155	23,105	26,110	33,135
163	07261050	Pine Mountain Creek tributary near Damascus, AR	A	EMA	100	180	244	338	416	501	732
				RRE	89	172	242	347	437	533	794
				Weighted	99	178	243	341	424	515	761
164	07261300	Tan-A-Hill Creek near Boles, AR	A	EMA	414	999	1,583	2,583	3,544	4,709	8,370
				RRE	386	859	1,287	1,971	2,580	3,255	5,177
				Weighted	407	945	1,440	2,224	2,941	3,734	6,068
165	07261500	Fourche LaFave River near Gravelly, AR	A	EMA	26,730	48,430	65,350	89,200	108,600	129,200	182,000
				RRE	17,162	31,867	43,949	61,274	75,342	90,060	129,475
				Weighted	26,238	46,952	62,820	84,500	101,935	119,905	166,916
166	07261800	Brogan Creek near Rover, AR	A	EMA	234	453	645	946	1,217	1,528	2,442
				RRE	218	438	625	913	1,161	1,429	2,164
				Weighted	233	451	641	936	1,198	1,489	2,316
167	07263000	South Fourche LaFave River near Hollis, AR	A	EMA	18,360	28,650	36,030	45,910	53,610	61,580	81,330
				RRE	10,513	19,261	26,393	36,592	44,866	53,491	76,489
				Weighted	18,104	28,113	35,282	44,929	52,499	60,363	80,449
168	07263100	Fourche LaFave River tributary near Perryville, AR	A	EMA	367	568	706	884	1,018	1,153	1,471
				RRE	280	471	619	829	999	1,173	1,623
				Weighted	362	561	697	875	1,015	1,157	1,504

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s) 50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
169	07263400	Little Maumelle River at Ferndale, AR	A	EMA	2,029	4,033	5,691	8,125	10,160	12,380	18,260
				RRE	1,525	2,589	3,421	4,587	5,523	6,478	8,962
				Weighted	1,965	3,723	5,077	6,869	8,313	9,754	13,663
170	07263530	Fourche Creek at Red Gate, AR	A	EMA	3,074	4,274	5,066	6,062	6,800	7,536	9,261
				RRE	2,652	4,252	5,473	7,131	8,430	9,732	13,064
				Weighted	3,044	4,271	5,127	6,262	7,137	8,034	10,164
171	07263860	Mile Branch near Tomberlin, AR	D	EMA	392	484	537	598	640	680	764
				RRE	345	535	670	847	983	1,121	1,455
				Weighted	388	486	542	610	659	708	818
172	07264100	White Oak Branch near Lonoke, AR	D	EMA	856	1,237	1,480	1,774	1,985	2,188	2,641
				RRE	543	830	1,033	1,296	1,495	1,696	2,181
				Weighted	826	1,197	1,434	1,723	1,927	2,127	2,575
173	07335700	Kiamichi River near Big Cedar, OK	B1	EMA	9,269	15,440	19,830	25,580	29,940	34,350	44,780
				RRE	6,074	10,883	14,541	19,612	23,590	27,692	38,065
				Weighted	9,032	15,094	19,353	24,915	29,090	33,314	43,407
174	07336000	Tenmile Creek near Miller, OK	B1	EMA	3,605	5,149	6,199	7,551	8,575	9,612	12,100
				RRE	5,258	8,775	11,413	15,095	18,004	21,046	28,984
				Weighted	3,668	5,317	6,501	8,105	9,446	10,807	14,341
175	07336500	Kiamichi River near Belzoni, OK	B1	EMA	34,440	49,150	58,800	70,840	79,680	88,410	108,600
				RRE	53,662	83,404	104,022	131,102	151,253	171,520	221,555
				Weighted	34,917	50,062	60,177	73,157	83,092	93,113	117,554
176	07336520	Frazier Creek near Oleta, OK	B1	EMA	2,516	4,579	6,189	8,459	10,300	12,260	17,280
				RRE	2,730	4,894	6,573	8,950	10,853	12,850	18,045
				Weighted	2,550	4,636	6,272	8,586	10,465	12,459	17,587
177	07336710	Rock Creek near Sawyer, OK	B2	EMA	798	1,172	1,426	1,752	1,998	2,246	2,836
				RRE	963	1,348	1,630	2,006	2,323	2,656	3,500
				Weighted	815	1,199	1,464	1,812	2,084	2,359	3,044
178	07336780	Perry Creek near Idabel, OK	B2	EMA	2,212	3,036	3,580	4,264	4,772	5,280	6,473
				RRE	1,280	1,958	2,466	3,152	3,729	4,343	5,922
				Weighted	2,094	2,840	3,323	3,944	4,440	4,966	6,265
179	07336785	Bokchito Creek near Garvin, OK	B2	EMA	781	991	1,122	1,278	1,389	1,497	1,740
				RRE	275	481	644	875	1,070	1,284	1,849
				Weighted	730	939	1,062	1,206	1,325	1,452	1,766
180	07337220	Big Branch near Ringold, OK	B1	EMA	452	858	1,194	1,694	2,119	2,590	3,874
				RRE	723	1,415	1,982	2,813	3,499	4,231	6,172
				Weighted	513	1,007	1,440	2,110	2,695	3,324	5,048

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
181	07337500	Little River near Wright City, OK	B1	EMA	30,740	49,840	63,720	82,350	96,920	112,000	149,200
				RRE	29,579	46,839	59,057	75,367	87,701	100,233	131,618
				Weighted	30,625	49,500	63,078	81,107	94,982	109,123	143,810
182	07337900	Glover River near Glover, OK	B1	EMA	28,050	44,630	56,860	73,570	86,870	100,900	136,400
				RRE	21,259	34,981	44,863	58,136	68,238	78,505	104,112
				Weighted	27,682	43,995	55,825	71,766	84,098	96,876	128,485
183	07338520	Yanubbee Creek near Broken Bow, OK	B1	EMA	1,789	3,112	4,094	5,423	6,464	7,539	10,180
				RRE	2,009	3,741	5,108	7,059	8,632	10,285	14,577
				Weighted	1,818	3,199	4,255	5,734	6,950	8,213	11,487
184	07338700	Twomile Creek near Hatfield, AR	B1	EMA	2,021	3,561	4,789	6,571	8,062	9,690	14,070
				RRE	2,097	3,692	4,930	6,696	8,121	9,628	13,609
				Weighted	2,032	3,585	4,821	6,606	8,081	9,667	13,866
185	07338750	Mountain Fork at Smithville, OK	B1	EMA	29,550	38,290	43,740	50,300	55,000	59,560	69,840
				RRE	21,871	36,070	46,293	60,009	70,439	81,029	107,384
				Weighted	29,196	38,190	43,881	50,951	56,211	61,498	73,934
186	07338780	Mountain Fork tributary near Smithville, OK	B1	EMA	202	358	483	666	821	991	1,452
				RRE	169	319	445	635	797	976	1,479
				Weighted	197	351	475	658	814	986	1,462
187	07339000	Mountain Fork near Eagletown, OK	B1	EMA	37,720	62,850	80,660	103,900	121,500	139,200	181,000
				RRE	35,222	55,580	69,909	88,942	103,266	117,770	153,912
				Weighted	37,540	62,360	79,802	102,349	119,148	135,828	175,249
188	07339500	Rolling Fork near De Queen, AR	B1	EMA	13,730	28,150	41,180	62,010	80,960	103,000	168,600
				RRE	12,823	21,204	27,330	35,677	42,119	48,736	65,521
				Weighted	13,572	26,520	37,078	51,861	63,477	75,251	105,039
189	07340000	Little River near Horatio, AR	B1	EMA	46,530	71,000	88,250	111,000	128,600	146,600	190,800
				RRE	97,081	150,267	186,440	233,080	267,149	300,950	382,591
				Weighted	48,253	74,078	92,629	118,240	138,808	160,352	214,517
190	07340200	West Flat Creek near Foremen, AR	B2	EMA	1,565	2,657	3,442	4,477	5,269	6,073	7,988
				RRE	1,457	2,249	2,825	3,580	4,188	4,805	6,335
				Weighted	1,550	2,577	3,296	4,214	4,915	5,624	7,297
191	07340300	Cossatot River near Vandervoort, AR	B1	EMA	14,900	25,250	32,760	42,780	50,520	58,440	77,610
				RRE	9,245	15,918	20,885	27,699	32,993	38,434	52,183
				Weighted	14,387	24,410	31,493	40,763	47,605	54,648	71,209
192	07340500	Cossatot River near De Queen, AR	B1	EMA	27,570	46,280	60,650	80,870	97,380	115,100	161,300
				RRE	20,533	33,250	42,385	54,684	64,066	73,638	97,704
				Weighted	26,952	44,808	57,975	75,838	89,434	103,657	138,059

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
193	07341000	Saline River near Dierks, AR	B1	EMA	9,498	18,280	25,700	36,880	46,540	57,340	87,330
				RRE	7,740	12,685	16,342	21,401	25,363	29,483	40,165
				Weighted	9,280	17,439	24,002	33,136	40,363	47,951	66,531
194	07341100	Rock Creek near Dierks, AR	B1	EMA	2,040	4,504	6,638	9,847	12,570	15,560	23,480
				RRE	1,673	3,041	4,118	5,662	6,914	8,237	11,724
				Weighted	1,939	4,063	5,749	8,095	9,862	11,749	16,405
195	07341260	Dillard Creek near Nashville, AR	B2	EMA	981	1,229	1,376	1,545	1,662	1,773	2,011
				RRE	544	1,050	1,460	2,039	2,521	3,038	4,396
				Weighted	940	1,209	1,386	1,613	1,789	1,961	2,378
196	07341700	Caney Creek near Hope, AR	B2	EMA	2,126	3,599	4,748	6,390	7,747	9,217	13,120
				RRE	2,258	3,668	4,721	6,122	7,271	8,470	11,519
				Weighted	2,143	3,613	4,741	6,296	7,561	8,902	12,327
197	07344320	Mill Creek tributary near Fouke, AR	B2	EMA	280	459	589	764	901	1,043	1,393
				RRE	192	338	450	604	729	861	1,196
				Weighted	269	438	559	718	846	982	1,316
198	07344450	Paw Paw Bayou near Greenwood, LA	B2	EMA	2,892	6,054	8,823	13,090	16,830	21,030	32,800
				RRE	4,661	7,820	10,262	13,580	16,371	19,321	26,971
				Weighted	3,144	6,459	9,243	13,281	16,629	20,217	29,471
199	07346950	Kelly Bayou near Ida, LA	B2	EMA	855	1,677	2,371	3,418	4,320	5,326	8,104
				RRE	1,314	2,447	3,375	4,692	5,809	7,004	10,154
				Weighted	948	1,908	2,724	3,965	5,023	6,170	9,265
200	07347500	Black Bayou near Gilliam, LA	B2	EMA	3,210	5,610	7,518	10,280	12,590	15,110	21,880
				RRE	3,021	5,733	7,982	11,181	13,911	16,822	24,513
				Weighted	3,184	5,636	7,636	10,570	13,068	15,769	23,070
201	07348615	Bayou Dorcheat near Bussey, AR	B2	EMA	4,219	8,825	12,850	19,030	24,430	30,500	47,410
				RRE	3,953	7,581	10,514	14,575	17,917	21,372	30,243
				Weighted	4,121	8,210	11,568	16,189	19,982	24,084	34,384
202	07348725	Indian Creek at Shongaloo, LA	B2	EMA	1,854	3,452	4,818	6,919	8,772	10,890	16,970
				RRE	3,179	5,413	7,120	9,419	11,312	13,293	18,371
				Weighted	1,940	3,688	5,195	7,523	9,498	11,669	17,570
203	07348760	Black Bayou at Leton, LA	B2	EMA	2,018	3,484	4,641	6,306	7,692	9,200	13,230
				RRE	2,643	4,884	6,662	9,111	11,136	13,267	18,780
				Weighted	2,091	3,735	5,112	7,161	8,915	10,739	15,732
204	07348800	Flat Lick Bayou near Leton, LA	B2	EMA	1,641	3,531	5,155	7,591	9,662	11,930	17,990
				RRE	2,649	5,115	7,110	9,885	12,181	14,597	20,866
				Weighted	1,844	3,961	5,791	8,544	10,813	13,230	19,625

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
205	07348950	Brushy Creek tributary near Minden, LA	B2	EMA	11	22	31	46	58	72	111
				RRE	18	34	47	65	79	94	129
				Weighted	13	26	37	54	68	83	121
206	07349000	Bayou Dorcheat near Minden, LA	B2	EMA	8,693	17,050	23,770	33,410	41,300	49,720	71,330
				RRE	11,161	21,264	29,455	40,740	50,052	59,602	84,117
				Weighted	8,846	17,413	24,355	34,506	42,865	51,746	74,947
207	07349200	Clarke Bayou near Haughton, LA	B2	EMA	1,428	2,435	3,182	4,197	4,997	5,828	7,887
				RRE	1,273	2,481	3,455	4,797	5,855	6,919	9,588
				Weighted	1,399	2,445	3,256	4,401	5,321	6,260	8,649
208	07349430	Bodcau Creek at Stamps, AR	B2	EMA	3,244	6,533	9,292	13,390	16,860	20,670	30,890
				RRE	4,955	9,205	12,597	17,254	21,091	25,058	35,234
				Weighted	3,577	7,284	10,408	15,041	18,835	22,835	33,371
209	07349500	Bodcau Bayou near Sarepta, LA	B2	EMA	4,233	7,283	9,517	12,510	14,830	17,200	22,960
				RRE	6,439	12,066	16,611	22,881	28,018	33,269	46,709
				Weighted	4,315	7,522	9,962	13,378	16,148	19,021	26,780
210	07355800	Lewis Creek tributary near Mena, AR	B1	EMA	190	298	375	479	560	644	852
				RRE	196	376	527	755	949	1,162	1,754
				Weighted	190	302	385	502	600	704	985
211	07355900	Big Fork tributary at Big Fork, AR	B1	EMA	39	67	89	122	150	180	261
				RRE	79	158	227	332	424	526	814
				Weighted	42	76	106	154	199	249	394
212	07356000	Ouachita River near Mount Ida, AR	B1	EMA	23,440	36,620	45,870	57,990	67,250	76,670	99,370
				RRE	22,423	36,134	45,949	59,136	69,174	79,402	105,090
				Weighted	23,406	36,600	45,874	58,062	67,406	76,935	100,157
213	07356500	South Fork Ouachita River at Mount Ida, AR	B1	EMA	6,689	11,480	15,100	20,110	24,120	28,330	39,000
				RRE	6,084	10,428	13,693	18,224	21,785	25,481	34,981
				Weighted	6,616	11,340	14,868	19,715	23,550	27,534	37,621
214	07356700	Barnes Branch near Mount Ida, AR	B1	EMA	427	861	1,233	1,796	2,282	2,825	4,324
				RRE	478	907	1,258	1,778	2,212	2,681	3,950
				Weighted	437	872	1,240	1,790	2,255	2,765	4,141
215	07357000	Ouachita River near Mountain Pine, AR	B1	EMA	45,790	73,230	92,740	118,500	138,300	158,600	207,600
				RRE	41,934	65,187	81,428	102,926	119,045	135,351	175,992
				Weighted	45,226	72,089	90,944	115,595	134,045	152,903	197,947
216	07357700	Glazypeau Creek at Mountain Valley, AR	B1	EMA	650	1,317	1,880	2,722	3,439	4,231	6,372
				RRE	1,045	1,983	2,739	3,835	4,733	5,687	8,206
				Weighted	707	1,426	2,051	2,999	3,815	4,709	7,115

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
217	07359520	Jackson Creek near Malvern, AR	B1	EMA	284	684	1,079	1,748	2,382	3,144	5,492
				RRE	514	930	1,267	1,763	2,178	2,626	3,857
				Weighted	337	759	1,151	1,755	2,274	2,844	4,402
218	07359610	Caddo River near Caddo Gap, AR	B1	EMA	20,210	33,570	43,770	58,090	69,750	82,220	114,700
				RRE	12,803	21,897	28,599	37,711	44,730	51,900	69,843
				Weighted	19,239	31,665	40,773	52,921	62,135	71,883	95,860
219	07359750	Little Sugarloaf Creek near Bonnerdale, AR	B1	EMA	793	1,649	2,368	3,434	4,331	5,308	7,894
				RRE	719	1,385	1,929	2,725	3,383	4,085	5,957
				Weighted	777	1,584	2,245	3,195	3,966	4,790	6,939
220	07359800	Caddo River near Alpine, AR	B1	EMA	25,610	39,360	48,840	61,070	70,300	79,600	101,600
				RRE	18,400	30,011	38,391	49,700	58,350	67,185	89,422
				Weighted	25,086	38,699	47,977	59,901	68,799	77,747	99,190
221	07359805	Valley Creek at Point Cedar	B1	EMA	1,012	2,535	4,065	6,687	9,194	12,220	21,580
				RRE	1,721	3,204	4,378	6,061	7,422	8,857	12,605
				Weighted	1,247	2,808	4,215	6,336	8,099	9,995	14,961
222	07360100	L'Eau Frais Creek at Joan, AR	B2	EMA	1,238	1,807	2,194	2,693	3,070	3,451	4,363
				RRE	2,004	3,961	5,558	7,787	9,618	11,528	16,448
				Weighted	1,302	2,041	2,625	3,523	4,229	4,948	7,001
223	07360150	Pearson Creek tributary near Dalark, AR	B2	EMA	76	170	262	419	569	751	1,331
				RRE	103	193	264	365	449	540	777
				Weighted	82	178	263	389	496	614	922
224	07360800	Muddy Fork Creek near Murfreesboro, AR	B1	EMA	10,960	18,750	24,760	33,240	40,170	47,590	66,930
				RRE	11,270	19,214	25,083	33,092	39,285	45,632	61,612
				Weighted	10,984	18,795	24,800	33,215	39,985	47,116	65,236
225	07361020	Prairie Creek tributary near Kirby, AR	B1	EMA	72	145	208	307	395	495	783
				RRE	34	69	100	149	193	242	383
				Weighted	64	126	177	252	314	384	577
226	07361180	South Fork Ozan Creek near Ozan, AR	B2	EMA	3,870	5,461	6,488	7,751	8,668	9,565	11,600
				RRE	2,263	3,734	4,825	6,265	7,423	8,606	11,571
				Weighted	3,750	5,349	6,340	7,548	8,469	9,398	11,594
227	07361200	Ozan Creek near Mccaskill, AR	B2	EMA	7,323	12,690	16,800	22,570	27,230	32,190	44,940
				RRE	6,814	12,026	16,029	21,365	25,684	30,077	41,156
				Weighted	7,279	12,604	16,675	22,302	26,834	31,586	43,559
228	07361500	Antoine River at Antoine, AR	B1	EMA	12,340	18,610	22,870	28,290	32,330	36,380	45,850
				RRE	13,324	22,177	28,651	37,458	44,245	51,202	68,779
				Weighted	12,372	18,716	23,069	28,684	32,981	37,320	47,902

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
229	07361600	Little Missouri River near Boughton, AR	B1	EMA	32,310	58,780	79,320	108,100	131,400	156,000	218,600
				RRE	48,292	76,400	96,010	121,796	141,012	160,315	207,769
				Weighted	36,210	63,763	84,840	113,406	135,639	158,048	212,729
230	07361680	Middle Caney Creek tributary near Rosston, AR	B2	EMA	221	466	677	995	1,268	1,569	2,384
				RRE	205	385	527	725	885	1,054	1,489
				Weighted	217	440	620	868	1,070	1,287	1,821
231	07361760	Bell Creek near Hollywood, AR	B2	EMA	730	1,052	1,271	1,553	1,766	1,982	2,500
				RRE	682	1,334	1,860	2,599	3,206	3,849	5,518
				Weighted	726	1,089	1,364	1,757	2,088	2,420	3,309
232	07361780	Bradshaw Creek near Hollywood, AR	B2	EMA	475	730	914	1,160	1,353	1,553	2,051
				RRE	610	1,105	1,484	1,997	2,408	2,833	3,906
				Weighted	487	777	1,005	1,331	1,606	1,875	2,629
233	07361800	Terre Noire Creek near Gurdon, AR	B2	EMA	16,970	23,990	28,720	34,760	39,310	43,890	54,810
				RRE	7,277	13,389	18,208	24,748	30,088	35,563	49,514
				Weighted	16,494	23,155	27,678	33,447	37,863	42,463	53,637
234	07361894	Mill Creek near Holly Springs, AR	B2	EMA	331	553	714	928	1,093	1,262	1,671
				RRE	547	1,051	1,455	2,021	2,482	2,965	4,208
				Weighted	364	650	875	1,225	1,503	1,789	2,586
235	07362050	Ross Creek near Camden, AR	B2	EMA	382	901	1,389	2,178	2,894	3,721	6,118
				RRE	605	1,147	1,582	2,189	2,688	3,215	4,578
				Weighted	440	992	1,475	2,184	2,771	3,404	5,028
236	07362100	Smackover Creek near Smackover, AR	B2	EMA	6,369	13,760	20,600	31,710	41,910	53,870	89,640
				RRE	6,745	12,719	17,496	24,036	29,404	34,916	48,995
				Weighted	6,402	13,603	19,957	29,463	37,366	46,112	68,026
237	07362330	Dunn Creek near Hampton, AR	B2	EMA	905	1,910	2,775	4,079	5,197	6,431	9,774
				RRE	687	1,293	1,774	2,436	2,958	3,487	4,818
				Weighted	874	1,783	2,528	3,549	4,356	5,225	7,235
238	07362450	Cooks Creek near Fordyce, AR	B2	EMA	653	1,289	1,802	2,538	3,141	3,785	5,438
				RRE	641	1,161	1,560	2,100	2,529	2,970	4,076
				Weighted	650	1,250	1,717	2,346	2,847	3,371	4,640
239	07362500	Moro Creek near Fordyce, AR	B2	EMA	5,001	10,110	14,270	20,230	25,100	30,290	43,530
				RRE	5,620	10,475	14,295	19,455	23,620	27,831	38,427
				Weighted	5,056	10,152	14,273	20,081	24,759	29,647	41,741
240	07362587	Alum Fork Saline River near Reform, AR	B1	EMA	6,459	9,944	12,350	15,450	17,800	20,160	25,770
				RRE	3,995	7,142	9,558	12,945	15,631	18,427	25,613
				Weighted	6,193	9,639	11,989	15,060	17,398	19,806	25,731

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
241	07363000	Saline River at Benton, AR	B1	EMA	29,080	48,700	62,900	81,790	96,380	111,300	147,400
				RRE	32,144	52,228	66,487	85,422	99,674	114,055	149,543
				Weighted	29,208	48,862	63,085	82,038	96,675	111,603	147,736
242	07363200	Saline River near Sheridan, AR	B2	EMA	22,910	40,360	53,590	71,830	86,350	101,600	139,700
				RRE	15,211	28,665	39,539	54,519	67,038	80,062	113,830
				Weighted	22,343	39,186	51,844	68,902	82,497	96,840	132,060
243	07363300	Hurricane Creek near Sheridan, AR	B2	EMA	7,142	13,880	19,470	27,760	34,780	42,510	63,370
				RRE	5,192	9,485	12,886	17,543	21,395	25,394	35,674
				Weighted	6,728	12,835	17,369	23,227	28,160	33,481	46,385
244	07363330	West Fork Big Creek at Sheridan, AR	B2	EMA	439	956	1,410	2,103	2,701	3,366	5,182
				RRE	688	1,181	1,562	2,087	2,525	2,994	4,212
				Weighted	494	1,027	1,468	2,095	2,608	3,158	4,561
245	07363430	East Fork Derrieusseaux Creek near Pine Bluff, AR	B2	EMA	118	260	391	603	796	1,021	1,683
				RRE	116	214	291	399	485	577	813
				Weighted	117	242	343	486	601	726	1,039
246	07363435	Derrieusseaux Creek near Grapevine, AR	B2	EMA	1,290	2,328	3,149	4,325	5,296	6,342	9,087
				RRE	2,194	4,106	5,621	7,698	9,389	11,127	15,542
				Weighted	1,483	2,836	3,975	5,703	7,101	8,542	12,468
247	07363450	Varnell Creek near Rison, AR	B2	EMA	45	106	159	239	305	376	556
				RRE	44	88	124	174	215	258	369
				Weighted	45	100	146	207	255	304	421
248	07363500	Saline River near Rye, AR	B2	EMA	22,700	40,750	54,470	73,370	88,370	104,000	143,000
				RRE	20,491	38,732	53,434	73,539	90,183	107,229	150,959
				Weighted	22,572	40,601	54,375	73,392	88,651	104,569	144,912
249	07364030	L'aigle Creek tributary near Hermitage, AR	B2	EMA	43	94	137	201	255	314	469
				RRE	41	86	124	179	224	273	403
				Weighted	43	92	134	194	244	299	440
250	07364070	Bear Creek near Strong, AR	B2	EMA	333	540	685	874	1,018	1,164	1,509
				RRE	408	839	1,191	1,684	2,079	2,489	3,532
				Weighted	341	578	757	1,021	1,225	1,444	2,024
251	07364110	Nevins Creek tributary near Pine Bluff, AR	D	EMA	136	249	339	467	573	686	982
				RRE	192	357	492	691	858	1,040	1,521
				Weighted	141	260	356	495	611	739	1,082
252	07364120	Bayou Bartholomew near Star City, AR	D	EMA	1,699	2,421	2,876	3,423	3,811	4,183	5,003
				RRE	2,117	3,068	3,719	4,526	5,127	5,715	7,093
				Weighted	1,719	2,455	2,921	3,486	3,893	4,288	5,179

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
253	07364128	Deep Bayou near Grady, AR	D	EMA	1,512	1,702	1,807	1,923	2,000	2,071	2,218
				RRE	2,024	2,910	3,504	4,236	4,771	5,291	6,502
				Weighted	1,519	1,716	1,834	1,959	2,044	2,124	2,298
254	07364140	Ables Creek near Tyro, AR	D	EMA	4,137	6,720	8,647	11,300	13,430	15,670	21,410
				RRE	2,075	3,810	5,213	7,217	8,864	10,621	15,207
				Weighted	3,542	5,763	7,461	9,814	11,688	13,681	18,757
255	07364150	Bayou Bartholomew near McGehee, AR	D	EMA	3,337	4,535	5,268	6,135	6,742	7,318	8,575
				RRE	3,318	4,586	5,422	6,420	7,146	7,838	9,426
				Weighted	3,337	4,536	5,271	6,141	6,751	7,332	8,605
256	07364165	Upper Cutoff Creek near Monticello, AR	D	EMA	897	1,634	2,238	3,133	3,895	4,738	7,054
				RRE	1,272	2,255	3,029	4,117	4,999	5,930	8,325
				Weighted	959	1,760	2,418	3,384	4,196	5,091	7,502
257	07364260	Hanks Creek near Hamburg, AR	D	EMA	671	1,239	1,681	2,303	2,805	3,336	4,686
				RRE	1,105	1,822	2,358	3,079	3,646	4,230	5,681
				Weighted	746	1,356	1,828	2,488	3,019	3,579	5,004
258	07364300	Chemin-A-Haut Bayou near Beekman, LA	D	EMA	4,760	10,300	15,100	22,370	28,590	35,460	53,970
				RRE	4,429	6,898	8,661	10,923	12,638	14,344	18,457
				Weighted	4,664	9,118	12,686	17,615	21,481	25,340	34,174
259	07364500	Bayou Bartholomew near Beekman, LA	D	EMA	6,991	9,059	10,310	11,790	12,830	13,820	15,990
				RRE	5,396	7,200	8,359	9,695	10,649	11,535	13,538
				Weighted	6,959	9,013	10,263	11,732	12,769	13,745	15,886
260	07364700	Bayou De Loutre near Laran, LA	B2	EMA	2,573	5,651	8,626	13,670	18,490	24,350	42,920
				RRE	4,050	7,935	11,083	15,442	19,014	22,715	32,221
				Weighted	2,880	6,399	9,638	14,606	18,795	23,334	35,266
261	07364800	Bayou D'Arbonne at Homer, LA	B2	EMA	1,278	3,085	4,807	7,614	10,170	13,140	21,780
				RRE	1,927	3,701	5,129	7,116	8,757	10,493	15,004
				Weighted	1,432	3,299	4,943	7,358	9,370	11,543	17,096
262	07364860	Sugar Creek Tr at Lake Foursome near Arcadia, LA	B2	EMA	174	363	527	780	1,002	1,251	1,948
				RRE	161	328	464	656	811	977	1,404
				Weighted	169	347	494	706	881	1,073	1,561
263	07364870	Sugar Creek near Arcadia, LA	B2	EMA	2,840	5,780	8,269	11,990	15,170	18,660	28,120
				RRE	2,070	4,142	5,837	8,207	10,154	12,201	17,502
				Weighted	2,736	5,474	7,708	10,827	13,399	16,208	23,045
264	07365000	Bayou D'Arbonne near Dubach, LA	B2	EMA	5,981	11,030	15,150	21,240	26,390	32,070	47,520
				RRE	6,533	13,316	18,958	26,890	33,486	40,404	58,437
				Weighted	6,054	11,471	16,083	23,013	28,992	35,304	52,706

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
265	07365300	Middle Fork Bayou D'Arbonne near Colquitt, LA	B2	EMA	2,516	5,047	7,219	10,530	13,400	16,620	25,580
				RRE	2,761	5,130	7,012	9,605	11,748	14,008	19,866
				Weighted	2,562	5,070	7,148	10,125	12,602	15,278	22,170
266	07365800	Cornie Bayou near Three Creeks, AR	B2	EMA	4,941	110,80	16,880	26,440	35,310	45,810	77,520
				RRE	4,056	7,772	10,751	14,839	18,173	21,595	30,312
				Weighted	4,793	10,209	14,801	21,134	26,393	32,052	45,130
267	07365900	Three Creeks near Three Creeks, AR	B2	EMA	2,134	4,808	7,371	11,650	15,670	20,480	35,260
				RRE	2,032	3,891	5,376	7,421	9,085	10,807	15,206
				Weighted	2,107	4,435	6,413	9,133	11,413	13,877	19,765
268	07366000	Corney Bayou near Lillie, LA	B2	EMA	5,887	11,930	17,050	24,700	31,220	38,410	57,870
				RRE	7,025	13,862	19,422	27,091	33,362	39,788	56,200
				Weighted	6,021	12,260	17,555	25,367	31,932	38,914	57,102
269	07366200	Little Corney Bayou near Lillie, LA	B2	EMA	3,635	7,091	9,906	13,990	17,390	21,060	30,660
				RRE	4,067	7,969	11,137	15,529	19,136	22,878	32,501
				Weighted	3,674	7,196	10,092	14,316	17,822	21,564	31,328
270	07366350	Stowe Creek near Farmerville, LA	B2	EMA	920	2,970	5,330	9,739	14,220	19,830	38,090
				RRE	1,103	2,295	3,296	4,727	5,918	7,191	10,533
				Weighted	990	2,616	4,084	6,184	7,930	9,827	14,533
271	07366360	Bayou D'Arbonne Lake tributary near Downsville, LA	B2	EMA	31	70	106	163	215	274	445
				RRE	40	84	121	175	219	267	394
				Weighted	34	76	114	170	217	269	409
272	07366403	Bayou Choudrant tributary near Tremont, LA	B2	EMA	146	293	423	628	813	1,028	1,657
				RRE	160	306	428	608	766	948	1,454
				Weighted	147	295	424	623	799	1,002	1,574
273	07366420	Bayou Choudrant near Calhoun, LA	B2	EMA	4,040	8,406	12,220	18,100	23,240	29,030	45,250
				RRE	2,849	5,840	8,350	11,931	14,944	18,169	26,695
				Weighted	3,873	7,900	11,274	16,120	20,169	24,573	35,732
274	07367658	Cypress Creek Canal no. 19 tributary near Dumas, AR	D	EMA	156	207	240	281	310	339	406
				RRE	170	260	323	407	471	536	694
				Weighted	157	210	245	289	320	353	431
275	07367670	Wards Bayou tributary at Montrose, AR	D	EMA	262	383	464	567	644	721	902
				RRE	227	323	387	467	526	584	720
				Weighted	259	377	455	555	628	701	869
276	07367740	Camp Bayou near Parkdale, AR	D	EMA	230	291	329	373	404	433	499
				RRE	212	314	384	475	543	611	774
				Weighted	229	292	331	378	411	442	516

Table 9. Annual exceedance probability discharges for 281 U.S. Geological Survey streamgages used in regional regression analysis based on data through the 2013 water year.—Continued

[USGS, U.S. Geological Survey; ft^3/s, cubic feet per second; MO, Missouri; EMA, Expected Moments Algorithm; RRE, regional regression equations; weighted, weighted estimate computed using equation 7; no., number; AR, Arkansas; OK, Oklahoma; LA, Louisiana]

Site number (fig. 1)	USGS streamgage number	USGS streamgage name[1]	Flood region (fig. 1)	Method	Annual exceedance probability discharge (ft^3/s)						
					50 percent	20 percent	10 percent	4 percent	2 percent	1 percent	0.2 percent
277	07367800	Boeuf River near Oak Grove, LA	D	EMA	10,490	14,520	17,160	20,470	22,910	25,340	31,000
				RRE	5,613	7,692	9,041	10,624	11,756	12,818	15,239
				Weighted	9,857	13,451	15,801	18,700	20,799	22,827	27,298
278	07368300	Muddy Bayou tributary rear Alto, LA	D	EMA	33	45	53	62	69	75	89
				RRE	28	40	48	58	65	73	91
				Weighted	32	44	52	61	68	75	89
279	07368500	Big Colewa Bayou near Oak Grove, LA	D	EMA	1,059	1,396	1,604	1,852	2,028	2,196	2,571
				RRE	851	1,136	1,317	1,531	1,683	1,828	2,155
				Weighted	1,049	1,383	1,588	1,833	2,006	2,169	2,534
280	07369250	Turkey Creek tributary at Potato Research Pond at Chase, LA	D	EMA	88	134	166	209	243	279	367
				RRE	80	120	148	184	213	241	310
				Weighted	87	131	162	203	235	269	350
281	07369680	Bayou Macon at Eudora, AR	D	EMA	2,696	3,536	4,042	4,634	5,046	5,436	6,282
				RRE	4,180	5,804	6,868	8,134	9,046	9,910	11,893
				Weighted	2,714	3,563	4,079	4,694	5,120	5,530	6,441

[1]Station names have been modified from U.S. Geological Survey National Water Information System (NWIS).

Table 11. Values needed to determine the 90-percent prediction intervals for annual exceedance probability discharges (AEPDs) obtained from regional regression equations for Arkansas.

[Regional regression equations are presented in table 6; $t_{(1-\alpha/2,n-p)}$, the critical value from Students t-distribution for the 90-percent probability used in equation 11; MEV, regression model error variance used in equation 12; U, covariance matrix as used in equation 12; Intercept, y-axis intercept of regression equation; DRNAREA, geographic information system drainage area, in square miles; ELEV, mean basin elevation, in feet; BSHAPE, basin shape factor; PRECIP, mean annual precipitation, in inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvium; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin, in feet per mile]

Annual exceedance probability discharge	$t_{(1-\alpha/2,n-p)}$	MEV	U			
Region A (Arkansas River Basin)						
$Q_{50\%}$	1.668	0.030		Intercept	DRNAREA	
			Intercept	0.0026466960	-0.0008394193	
			DRNAREA	-0.0008394193	0.0005251942	
$Q_{20\%}$	1.669	0.018		Intercept	DRNAREA	ELEV
			Intercept	0.1689156900	0.0023770937	-0.0586610750
			DRNAREA	0.0023770937	0.0004297459	-0.0010574191
			ELEV	-0.0586610750	-0.0010574191	0.0206397690
$Q_{10\%}$	1.669	0.017		Intercept	DRNAREA	ELEV
			Intercept	0.1734177300	0.0025715481	-0.0604115690
			DRNAREA	0.0025715481	0.0004361433	-0.0011354995
			ELEV	-0.0604115690	-0.0011354995	0.0213349260
$Q_{4\%}$	1.669	0.017		Intercept	DRNAREA	ELEV
			Intercept	0.1951526000	0.0030226560	-0.0681551570
			DRNAREA	0.0030226560	0.0004837719	-0.0013252189
			ELEV	-0.0681551570	-0.0013252189	0.0241409140
$Q_{2\%}$	1.669	0.019		Intercept	DRNAREA	ELEV
			Intercept	0.2234483900	0.0035072788	-0.0780843160
			DRNAREA	0.0035072788	0.0005491763	-0.0015323804
			ELEV	-0.0780843160	-0.0015323804	0.0276744610
$Q_{1\%}$	1.669	0.020		Intercept	DRNAREA	ELEV
			Intercept	0.2522635900	0.0040019445	-0.0881979110
			DRNAREA	0.0040019445	0.0006161220	-0.0017439682
			ELEV	-0.0881979110	-0.0017439682	0.0312747130
$Q_{0.2\%}$	1.669	0.029		Intercept	DRNAREA	ELEV
			Intercept	0.3529364600	0.0055613025	-0.1232671100
			DRNAREA	0.0055613025	0.0008540016	-0.0024155878
			ELEV	-0.1232671100	-0.0024155878	0.0436413430

Table 11. Values needed to determine the 90-percent prediction intervals for annual exceedance probability discharges (AEPDs) obtained from regional regression equations for Arkansas.—Continued

[Regional regression equations are presented in table 6; $t_{(1-\alpha/2,n-p)}$, the critical value from Students t-distribution for the 90-percent probability used in equation 11; MEV, regression model error variance used in equation 12; U, covariance matrix as used in equation 12; Intercept, y-axis intercept of regression equation; DRNAREA, geographic information system drainage area, in square miles; ELEV, mean basin elevation, in feet; BSHAPE, basin shape factor; PRECIP, mean annual precipitation, in inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvium; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin, in feet per mile]

Annual exceedance probability discharge	$t_{(1-\alpha/2,n-p)}$	MEV	U			
			Region B, subregion 1 (Ouachita Mountains)			
$Q_{50\%}$	1.692	0.022		Intercept	DRNAREA	BSHAPE
			Intercept	0.0204951810	0.0003222785	-0.0213118040
			DRNAREA	0.0003222785	0.0008850256	-0.0022405285
			BSHAPE	-0.0213118040	-0.0022405285	0.0277163450
$Q_{20\%}$	1.692	0.022		Intercept	DRNAREA	BSHAPE
			Intercept	0.0213613570	0.0002759124	-0.0220404390
			DRNAREA	0.0002759124	0.0009570473	-0.0023827172
			BSHAPE	-0.0220404390	-0.0023827172	0.0288797120
$Q_{10\%}$	1.692	0.023		Intercept	DRNAREA	BSHAPE
			Intercept	0.0233569320	0.0002055870	-0.0237856200
			DRNAREA	0.0002055870	0.0010646096	-0.0025779438
			BSHAPE	-0.0237856200	-0.0025779438	0.0311964760
$Q_{4\%}$	1.692	0.025		Intercept	DRNAREA	BSHAPE
			Intercept	0.0271408610	0.0001309024	-0.0272859080
			DRNAREA	0.0001309024	0.0012553710	-0.0029593108
			BSHAPE	-0.0272859080	-0.0029593108	0.0358040760
$Q_{2\%}$	1.692	0.026		Intercept	DRNAREA	BSHAPE
			Intercept	0.0294907850	0.0000343444	-0.0292914800
			DRNAREA	0.0000343444	0.0013780860	-0.0031666526
			BSHAPE	-0.0292914800	-0.0031666526	0.0384188851
$Q_{1\%}$	1.692	0.029		Intercept	DRNAREA	BSHAPE
			Intercept	0.0329944800	-0.0000074037	-0.0326248460
			DRNAREA	-0.0000074037	0.0015519871	-0.0035344234
			BSHAPE	-0.0326248460	-0.0035344234	0.0428189900

Table 11. Values needed to determine the 90-percent prediction intervals for annual exceedance probability discharges (AEPDs) obtained from regional regression equations for Arkansas.—Continued

[Regional regression equations are presented in table 6; $t_{(1-\alpha/2,n-p)}$, the critical value from Students t-distribution for the 90-percent probability used in equation 11; MEV, regression model error variance used in equation 12; U, covariance matrix as used in equation 12; Intercept, y-axis intercept of regression equation; DRNAREA, geographic information system drainage area, in square miles; ELEV, mean basin elevation, in feet; BSHAPE, basin shape factor; PRECIP, mean annual precipitation, in inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvium; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin, in feet per mile]

Annual exceedance probability discharge	$t_{(1-\alpha/2,n-p)}$	MEV	U						
$Q_{0.2\%}$	1.692	0.035		Intercept	DRNAREA	BSHAPE			
			Intercept	0.0413948800	-0.0000984186	-0.0406521320			
			DRNAREA	-0.0000984186	0.0019726758	-0.0044333423			
			BSHAPE	-0.0406521320	-0.0044333423	0.0534569100			
Region B, subregion 2 (West Gulf Coastal Plain)									
$Q_{50\%}$	1.676	0.021		Intercept	DRNAREA	PRECIP	SOILINDEX	LC11DVOPN	ALVM
			Intercept	15.4165760000	0.0022875563	-7.3246402000	-0.0106979460	-2.2927335000	-0.0235299400
			DRNAREA	0.0022875563	0.0004617545	-0.0030746748	-0.0002262749	0.0024091212	0.0004386855
			PRECIP	-7.3246402000	-0.0030746748	3.9133557000	0.0432996030	0.4075633900	-0.0017089317
			SOILINDEX	-0.0106979460	-0.0002262749	0.0432996030	0.0052091874	0.0168314330	-0.0012588263
			LC11DVOPN	-2.2927335000	0.0024091212	0.4075633900	0.0168314330	1.4514484000	0.0208231910
			ALVM	-0.0235299400	0.0004386855	-0.0017089317	-0.0012588263	0.0208231910	0.0073444606
$Q_{20\%}$	1.676	0.015		Intercept	DRNAREA	PRECIP	SOILINDEX	LC11DVOPN	ALVM
			Intercept	13.1326960000	0.0029207513	-6.3625334000	-0.0871479720	-1.7679156000	-0.0157931960
			DRNAREA	0.0029207513	0.0003878490	-0.0032030541	-0.0002026209	0.0021049064	0.0003723216
			PRECIP	-6.3625334000	-0.0032030541	3.4517718000	0.0352794450	0.2776530600	-0.0028808990
			SOILINDEX	-0.0871479720	-0.0002026209	0.0352794450	0.0042776791	0.0135463230	-0.0010071926
			LC11DVOPN	-1.7679156000	0.0021049064	0.2776530600	0.0135463230	1.1774179000	0.0160544240
			ALVM	-0.0157931960	0.0003723216	-0.0028808990	-0.0010071926	0.0160544240	0.0060171382
$Q_{10\%}$	1.676	0.015		Intercept	DRNAREA	PRECIP	SOILINDEX	LC11DVOPN	ALVM
			Intercept	14.3975800000	0.0038403898	-7.0450728000	-0.0938189220	-1.8326658000	-0.0139353150
			DRNAREA	0.0038403898	0.0004169905	-0.0038922071	-0.0002234062	0.0023431740	0.0003985861
			PRECIP	-7.0450728000	-0.0038922071	3.8488811000	0.0381646470	0.2680109700	-0.0043453467
			SOILINDEX	-0.0938189220	-0.0002234062	0.0381646470	0.0045852581	0.0142821040	-0.0010592567
			LC11DVOPN	-1.8326658000	0.0023431740	0.2680109700	0.0142821040	1.2524882000	0.0163710800
			ALVM	-0.0139353150	0.0003985861	-0.0043453467	-0.0010592567	0.0163710800	0.0064337446

Table 11. Values needed to determine the 90-percent prediction intervals for annual exceedance probability discharges (AEPDs) obtained from regional regression equations for Arkansas.—Continued

[Regional regression equations are presented in table 6; $t_{(1-\alpha/2,n-p)}$, the critical value from Students t-distribution for the 90-percent probability used in equation 11; MEV, regression model error variance used in equation 12; U, covariance matrix as used in equation 12; Intercept, y-axis intercept of regression equation; DRNAREA, geographic information system drainage area, in square miles; ELEV, mean basin elevation, in feet; BSHAPE, basin shape factor; PRECIP, mean annual precipitation, in inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvium; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin, in feet per mile]

Annual exceedance probability discharge	$t_{(1-\alpha/2,n-p)}$	MEV	U						
$Q_{4\%}$	1.676	0.015		Intercept	DRNAREA	PRECIP	SOILINDEX	LC11DVOPN	ALVM
			Intercept	16.3290350000	0.0051690606	-8.0784164000	-0.1044652500	-1.9442024000	-0.0115202980
			DRNAREA	0.0051690606	0.0004620910	-0.0049171053	-0.0002540411	0.0027299803	0.0004375924
			PRECIP	-8.0784164000	-0.0049171053	4.4457790000	0.0428130320	0.2594211400	-0.0063278122
			SOILINDEX	-0.1044652500	-0.0002540411	0.0428130320	0.0050661071	0.0154207610	-0.0011503897
			LC11DVOPN	-1.9442024000	0.0027299803	0.2594211400	0.0154207430	1.3689177000	0.0168888290
			ALVM	-0.0115202980	0.0004375924	-0.0063278122	-0.0011503897	0.0168888290	0.0070600125
Region B, subregion 2 (West Gulf Coastal Plain)—Continued									
$Q_{2\%}$	1.676	0.017		Intercept	DRNAREA	PRECIP	SOILINDEX	LC11DVOPN	ALVM
			Intercept	18.6386230000	0.0063241418	-9.2562905000	-0.1187756000	-2.1653653000	-0.0109190450
			DRNAREA	0.0063241418	0.0005203089	-0.0058488614	-0.0002888047	0.0031149996	0.0004894731
			PRECIP	-9.2562905000	-0.0058488614	5.1049723000	0.0489315450	0.2807799100	-0.0079798694
			SOILINDEX	-0.1187756000	-0.0002888047	0.0489315450	0.0057231083	0.0171860010	-0.0012903941
			LC11DVOPN	-2.1653653000	0.0031149996	0.2807799100	0.0171860010	1.5383222000	0.0184647840
			ALVM	-0.0109190450	0.0004894731	-0.0079798694	-0.0012903941	0.0184647840	0.0079385458
$Q_{1\%}$	1.676	0.019		Intercept	DRNAREA	PRECIP	SOILINDEX	LC11DVOPN	ALVM
			Intercept	21.7881790000	0.0076434952	-10.8267130000	-0.1391719100	-2.5217369000	-0.0114773420
			DRNAREA	0.0076434952	0.0006025355	-0.0069354230	-0.0003357077	0.0035779857	0.0005643553
			PRECIP	-10.8267130000	-0.0069354230	5.9705865000	0.0575566080	0.3288740700	-0.0098417906
			SOILINDEX	-0.1391719100	-0.0003357077	0.0575566080	0.0066702272	0.0198581020	-0.0014983140
			LC11DVOPN	-2.5217369000	0.0035779857	0.3288740700	0.0198581020	1.7894204000	0.0212394280
			ALVM	-0.0147734200	0.0005643553	-0.0098417906	-0.0014983140	0.0212394280	0.0092281114
$Q_{0.2\%}$	1.676	0.023		Intercept	DRNAREA	PRECIP	SOILINDEX	LC11DVOPN	ALVM
			Intercept	28.0141710000	0.0106626620	-13.9705740000	-0.1787427000	-3.1659104000	-0.0107248850
			DRNAREA	0.0106626620	0.0007607080	-0.0093207560	-0.0004295010	0.0044999613	0.0007059275
			PRECIP	-13.9705740000	-0.0093207560	7.7162266000	0.0745022540	0.4062445900	-0.0140282770
			SOILINDEX	-0.0178742740	-0.0004295010	0.0745022540	0.0084834840	0.0247301230	-0.0018927986
			LC11DVOPN	-3.1659104000	0.0044999613	0.4062445900	0.0247301230	2.2591334000	0.0258901830
			ALVM	-0.0107248850	0.0007059275	-0.0140282770	-0.0018927986	0.0258901830	0.0116318320

Table 11. Values needed to determine the 90-percent prediction intervals for annual exceedance probability discharges (AEPDs) obtained from regional regression equations for Arkansas.—Continued

[Regional regression equations are presented in table 6; $t_{(1-\alpha/2,n-p)}$, the critical value from Students t-distribution for the 90-percent probability used in equation 11; MEV, regression model error variance used in equation 12; U, covariance matrix as used in equation 12; Intercept, y-axis intercept of regression equation; DRNAREA, geographic information system drainage area, in square miles; ELEV, mean basin elevation, in feet; BSHAPE, basin shape factor; PRECIP, mean annual precipitation, in inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvium; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin, in feet per mile]

Annual exceedance probability discharge	$t_{(1-\alpha/2,n-p)}$	MEV	U					
			Region C (White River Basin)					
$Q_{50\%}$	1.664	0.041		Intercept	DRNAREA	LC11PAST	UPZ	
			Intercept	0.0288364020	-0.0007706785	-0.0175142340	-0.0029426173	
			DRNAREA	-0.0007706785	0.0004834280	0.0002487483	-0.0000956358	
			LC11PAST	-0.0175142340	0.0002487483	0.0144335720	-0.0007458975	
			UPZ	-0.0029426173	-0.0000956358	-0.0007458975	0.0030055074	
			Region C (White River Basin)—Continued					
$Q_{20\%}$	1.664	0.029		Intercept	DRNAREA	LC11PAST	UPZ	
			Intercept	0.0218343600	-0.0005973840	-0.0126323000	-0.0025013656	
			DRNAREA	-0.0005973840	0.0003679295	0.0001945519	-0.0000712936	
			LC11PAST	-0.0126323000	0.0001945519	0.0104210580	-0.0005358469	
			UPZ	-0.0025013656	-0.0000712936	-0.0005358469	0.0024679207	
$Q_{10\%}$	1.665	0.024		Intercept	DRNAREA	BSHAPE	LC11PAST	UPZ
			Intercept	0.0241746120	0.0007023561	-0.0086247021	-0.0101661760	-0.0024292115
			DRNAREA	0.0007023561	0.0006870592	-0.0025137145	0.0004433994	-0.0000354192
			BSHAPE	-0.0086247021	-0.0025137145	0.0176324940	-0.0019079682	-0.0002119536
			LC11PAST	-0.0101661760	0.0004433994	-0.0019079682	0.0093634134	-0.0004365030
			UPZ	-0.0024292115	-0.0000354192	-0.0002119536	-0.0004365030	0.0024311380
$Q_{4\%}$	1.665	0.023		Intercept	DRNAREA	BSHAPE	LC11PAST	UPZ
			Intercept	0.0253647850	0.0007762236	-0.0092543200	-0.0100395440	-0.0027300151
			DRNAREA	0.0007762236	0.0007089625	-0.0026031261	0.0004614011	-0.0000383902
			BSHAPE	-0.0092543200	-0.0026031261	0.0182308760	-0.0019611578	-0.0002090249
			LC11PAST	-0.0100395440	0.0004614011	-0.0019611578	0.0093408016	-0.0004539275
			UPZ	-0.0027300151	-0.0000383902	-0.0002090249	-0.0004539275	0.0026851253
$Q_{2\%}$	1.665	0.024		Intercept	DRNAREA	BSHAPE	LC11PAST	UPZ
			Intercept	0.0272426890	0.0008536550	-0.0100416730	-0.0104499880	-0.0030299100
			DRNAREA	0.0008536550	0.0007548692	-0.0027769196	0.0004941199	-0.0000413857
			BSHAPE	-0.0100416730	-0.0027769196	0.0194376440	-0.0020850316	-0.0002217935
			LC11PAST	-0.0104499880	0.0004941199	-0.0020850316	0.0097792790	-0.0004876486
			UPZ	-0.0030299100	-0.0000413857	-0.0002217935	-0.0004876486	0.0029591420

Table 11. Values needed to determine the 90-percent prediction intervals for annual exceedance probability discharges (AEPDs) obtained from regional regression equations for Arkansas.—Continued

[Regional regression equations are presented in table 6; $t_{(1-\alpha/2,n-p)}$, the critical value from Students t-distribution for the 90-percent probability used in equation 11; MEV, regression model error variance used in equation 12; U, covariance matrix as used in equation 12; Intercept, y-axis intercept of regression equation; DRNAREA, geographic information system drainage area, in square miles; ELEV, mean basin elevation, in feet; BSHAPE, basin shape factor; PRECIP, mean annual precipitation, in inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvium; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin, in feet per mile]

Annual exceedance probability discharge	$t_{(1-\alpha/2,n-p)}$	MEV	U					
$Q_{1\%}$	1.665	0.026		Intercept	DRNAREA	BSHAPE	LC11PAST	UPZ
			Intercept	0.0305609840	0.0009634298	-0.0112892360	-0.0115861970	-0.0034632360
			DRNAREA	0.0009634298	0.0008445151	-0.0031097630	0.0005560496	-0.0000461843
			BSHAPE	-0.0112892360	-0.0031097630	0.0217549830	-0.0023352285	-0.0002505809
			LC11PAST	-0.0115861970	0.0005560496	-0.0023352285	0.0108714750	-0.0005460720
			UPZ	-0.0034632360	-0.0000461843	-0.0002505809	-0.0005460720	0.0033659537
Region C (White River Basin)—Continued								
$Q_{0.2\%}$	1.665	0.029		Intercept	DRNAREA	BSHAPE	LC11PAST	UPZ
			Intercept	0.0363393290	0.0011678696	-0.0135386120	-0.0132981230	-0.0042742144
			DRNAREA	0.0011678696	0.0009947716	-0.0036679920	0.0006624756	-0.0000535276
			BSHAPE	-0.0135386120	-0.0036679920	0.0256539180	-0.0027523304	-0.0003064042
			LC11PAST	-0.0132981230	0.0006624756	-0.0027523304	0.0125706320	-0.0006463527
			UPZ	-0.0042742144	-0.0000535276	-0.0003064042	-0.0006463527	0.0041219198
Region D (Mississippi Alluvial Plain)								
$Q_{50\%}$	1.691	0.017		Intercept	DRNAREA	SLPFM	BSHAPE	
			Intercept	0.0084990146	0.0004251826	-0.0031685734	-0.0074819929	
			DRNAREA	0.0004251826	0.0007692788	0.0002296465	-0.0016844497	
			SLPFM	-0.0031685734	0.0002296465	0.0036380977	0.0017747042	
			BSHAPE	-0.0074819929	-0.0016844497	0.0017747042	0.0097245700	
$Q_{20\%}$	1.691	0.017		Intercept	DRNAREA	SLPFM	BSHAPE	
			Intercept	0.0087122423	0.0004207547	-0.0032145005	-0.0076224860	
			DRNAREA	0.0004207547	0.0007939730	0.0002457137	-0.0017261023	
			SLPFM	-0.0032145005	0.0002457137	0.0037967281	0.0017802343	
			BSHAPE	-0.0076224860	-0.0017261023	0.0017802343	0.0099192357	
$Q_{10\%}$	1.691	0.021		Intercept	DRNAREA	SLPFM	BSHAPE	
			Intercept	0.0106202070	0.0005083952	-0.0039404741	-0.0092842811	
			DRNAREA	0.0005083952	0.0009740114	0.0003079049	-0.0021121903	
			SLPFM	-0.0039404741	0.0003079049	0.0046717292	0.0021645695	
			BSHAPE	-0.0092842811	-0.0021121903	0.0021645695	0.0120978570	

Table 11. Values needed to determine the 90-percent prediction intervals for annual exceedance probability discharges (AEPDs) obtained from regional regression equations for Arkansas.—Continued

[Regional regression equations are presented in table 6; $t_{(1-\alpha/2,n-p)}$, the critical value from Students t-distribution for the 90-percent probability used in equation 11; MEV, regression model error variance used in equation 12; U, covariance matrix as used in equation 12; Intercept, y-axis intercept of regression equation; DRNAREA, geographic information system drainage area, in square miles; ELEV, mean basin elevation, in feet; BSHAPE, basin shape factor; PRECIP, mean annual precipitation, in inches; SOILINDEX, mean soil hydrologic group in basin; LC11DVOPN, percentage of basin in open development; ALVM, percentage of surficial geology in basin as Quaternary alluvium; LC11PAST, percentage of basin in cultivated pasture; UPZ, percentage of surficial geology in basin as upper Paleozoic units; SLPFM, slope of longest flow path in basin, in feet per mile]

Annual exceedance probability discharge	$t_{(1-\alpha/2,n-p)}$	MEV	U				
$Q_{4\%}$	1.691	0.027		Intercept	DRNAREA	SLPFM	BSHAPE
			Intercept	0.0138173650	0.0006587369	-0.0051646332	-0.0120802620
			DRNAREA	0.0006587369	0.0012744276	0.0004090550	-0.0027593857
			SLPFM	-0.0051646332	0.0004090550	0.0061203421	0.0028182805
			BSHAPE	-0.0120802620	-0.0027593857	0.0028182805	0.0157606970
			Region D (Mississippi Alluvial Plain)—Continued				
$Q_{2\%}$	1.691	0.032		Intercept	DRNAREA	SLPFM	BSHAPE
			Intercept	0.0164304370	0.0007818341	-0.0061655085	-0.0143664260
			DRNAREA	0.0007818341	0.0015197320	0.0004909482	-0.0032881495
			SLPFM	-0.0061655085	0.0004909482	0.0073010382	0.0033540989
			BSHAPE	-0.0143664260	-0.0032881495	0.0033540989	0.0187553650
$Q_{1\%}$	1.691	0.037		Intercept	DRNAREA	SLPFM	BSHAPE
			Intercept	0.0191032230	0.0009075496	-0.0071878952	-0.0167042490
			DRNAREA	0.0009075496	0.0017706638	0.0005744736	-0.0038289370
			SLPFM	-0.0071878952	0.0005744736	0.0085089135	0.0039016383
			BSHAPE	-0.0167042490	-0.0038289370	0.0039016383	0.0218178520
$Q_{0.2\%}$	1.691	0.050		Intercept	DRNAREA	SLPFM	BSHAPE
			Intercept	0.0253634480	0.0012001873	-0.0095781773	-0.0221755500
			DRNAREA	0.0012001873	0.0023586356	0.0007690832	-0.0050950535
			SLPFM	-0.0095781773	0.0007690832	0.0113381180	0.0051826894
			BSHAPE	-0.0221755500	-0.0050950535	0.0051826894	0.0289864870

Appendixes

Appendix 1. Regional Skewness Regression Analysis for Arkansas, Louisiana, southern Missouri, and eastern Oklahoma

By Andrea G. Veilleux

Introduction to Statistical Analysis of Regional Skew

For the log-transformation of annual peak discharges, Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) recommends using a weighted average of the station skew coefficient and a regional skew coefficient to help improve estimates of annual exceedance probability discharges (AEPDs) (see eq. 3 in report). Bulletin 17B supplies a national map, but also encourages hydrologists to develop more specific local relations. Since the map was first published in 1976, nearly 40 years of annual peak-discharge data have been collected, and better spatial estimation procedures have been developed (Stedinger and Griffis, 2008).

Tasker and Stedinger (1986) developed a weighted least-squares (WLS) procedure for estimating regional skew coefficients based on sample skew coefficients for the logarithms of annual peak-discharge data. Their method of regional analysis of skewness estimators accounts for the precision of the skew-coefficient estimate for each streamgage or station, which depends on the length of record for each streamgage and the accuracy of an ordinary least-squares (OLS) regional mean skewness. More recently, Reis and others (2005), Gruber and others (2007), and Gruber and Stedinger (2008) developed a Bayesian generalized least-squares (B-GLS) regression model for regional skewness analyses. The Bayesian methodology allows for the computation of a posterior distribution of both the regression parameters and the model error variance. As shown in Reis and others (2005), for cases in which the model error variance is small compared to the sampling error of the station estimates, the Bayesian posterior distribution provides a more reasonable description of the model error variance than the generalized least-squares (GLS) method-of-moments and the maximum likelihood point estimates (Veilleux, 2011). The WLS regression accounts for the precision of the regional model and the effect of the record length on the variance of skew-coefficient estimators, but the GLS regression model also considers the cross correlations among the skew-coefficient estimators. In some studies, the cross correlations have had a large effect on the precision attributed to different parameter estimates (Feaster and others, 2009; Gotvald and others, 2009, Weaver and others, 2009; Parrett and others, 2010).

Because of complications introduced by the use of the expected moments algorithm (EMA) with multiple Grubbs-Beck censoring of low outliers (Cohn and others, 1997) and large cross correlations between annual peak discharges at pairs of streamflow-gaging stations (hereafter referred to as “streamgages”), an alternate regression procedure was developed to provide stable and defensible results for regional skewness (Veilleux, 2011; Lamontagne and others, 2012; Veilleux and others, 2012;). This alternate procedure is referred to as the Bayesian WLS/Bayesian GLS (B-WLS/B-GLS) regression framework (Veilleux, 2011; Veilleux and others, 2011; Veilleux and others, 2012). The B-WLS/B-GLS uses an OLS analysis to fit an initial regional skewness model that is then used to generate a stable regional skew-coefficient estimate for each site. The stable regional estimate is the basis for computing the variance of each station skew-coefficient estimator employed in the WLS analysis. The B-WLS is then used to generate estimators of the regional skew-coefficient model parameters; finally, B-GLS is used to estimate the precision of those WLS parameter estimators, to estimate the model error variance and the precision of that variance estimator, and to compute various diagnostic statistics.

In this study, EMA with the Multiple Grubbs-Beck test (EMA/MGB) for potentially influential low floods (PILFs) was used to estimate the station skew and its mean square error. Because EMA/MGB allows for the censoring of PILFs as well as the use of estimated interval discharges for missing, censored, and historic data, it complicates the calculations of effective record length (and effective concurrent record length) used to describe the precision of sample estimators because the peak discharges are no longer solely represented by single values. To properly account for these complications, the new B-WLS/B-GLS procedure was employed. The steps of this alternative procedure are described in the sections below.

Methodology for Regional Skewness Model

This section provides a brief description of the B-WLS/B-GLS methodology as it appears in Veilleux and others (2012). A more detailed description is provided by Veilleux (2011) and Veilleux and others (2011).

Ordinary Least-Squares Analysis

The first step in the B-WLS/B-GLS regional skewness analysis is the estimation of a regional skewness model using OLS. The OLS regional regression yields parameters ($\hat{\beta}_{OLS}$) and a model that can be used to generate unbiased and relatively stable regional estimates of the skewness for all streamgages:

$$\tilde{\mathbf{y}}_{OLS} = \mathbf{X}\hat{\beta}_{OLS} \qquad (1\text{–}1)$$

where

- $\mathbf{X}$ is an ($n \times k$) matrix of basin characteristics;
- $\tilde{\mathbf{y}}_{OLS}$ are the estimated regional skewness values;
- n is the number of streamgages; and
- k is the number of basin parameters including a column of ones to estimate the constant.

These estimated regional skewness values, $\tilde{\mathbf{y}}_{OLS}$, are then used to calculate unbiased station-regional skewness variances using the equations reported in Griffis and Stedinger (2009). These station-regional skewness variances are based on the regional OLS estimator of the skewness coefficient instead of the station skewness estimator, thus making the weights in the subsequent steps relatively independent of the station skewness estimates.

Weighted Least-Squares Analysis

A B-WLS analysis is used to develop estimators of the regression coefficients for each regional skewness model (Veilleux, 2011; Veilleux and others, 2011). The WLS analysis explicitly reflects variations in record length but intentionally neglects cross correlations thereby avoiding the problems experienced with GLS parameter estimators (Veilleux, 2011; Veilleux and others, 2011).

Generalized Least-Squares Analysis

After the regression model coefficients ($\hat{\beta}_{WLS}$) are determined with a WLS analysis, the precision of the fitted model and the precision of the regression coefficients are estimated using a B-GLS analysis (Veilleux, 2011; Veilleux and others, 2011). Precision metrics include the standard error of the regression parameters, $SE(\hat{\beta}_{WLS})$, the model error variance, $\sigma^2_{\delta,B-GLS}$, pseudo coefficient of determination, pseudo-R^2_{δ}, and the average variance of prediction at a streamgage that is not used in the regional model, AVP_{new}.

Data Analysis

This regional skew study is based on annual peak-discharge data from 452 streamgages in Arkansas and Louisiana as well as parts of the surrounding States of Missouri and Oklahoma. The annual peak-discharge data through September 2013 used in support of this study were downloaded from the USGS National Water Information System (http://waterdata.usgs.gov/nwis). In addition to the annual peak-discharge data, five basin characteristics for each of the 452 sites were available as explanatory variables in the regional study. The basin characteristics included hydrologic unit codes (HUCs, hydrologic regions as defined in Seaber and others, 1987), drainage area, mean basin elevation, mean annual precipitation, and basin slope.

The regional skew is not valid in the following 8-digit HUCs in southern Louisiana: 08070100, 08070204, 08070300, 08080101, 08080102, 08080103, 08080202, 08080206, 08090100, 08090202, 08090203, 08090302, 08090301 and part of 12040201 (fig. 1–1B). Streams in these HUC regions are either tidally influenced or subject to regulation, diversion, or backwater.

Station Skewness Estimators

To estimate the station logarithm base10 (log) skew coefficient, G, and its mean square error, MSE_G, the skew study used the results of the EMA/MGB analysis described in the body of this report (Cohn and others, 1997; Griffis and others, 2004). The EMA provides a straightforward and efficient method for the incorporation of historical information and censored data, such as those from a crest-stage gaging station (CSG), contained in the record of annual peak discharges for a streamgage. For this analysis, PeakFQ version 7.1 (Veilleux and others, 2014, available at http://water.usgs.gov/software/PeakFQ/), which combines EMA/MGB, was used to generate the station log estimates of G and the corresponding MSE_G, assuming a log-Pearson Type III distribution and generally employing MGB for PILF screening. The EMA estimates, based on annual peak-discharge data through September 30, 2013, of G and MSE_G are listed in table 1–1 (available online at http://dx.doi.org/10.3133/sir20165081) for the 452 streamgages evaluated for use in this regional skew study (see sections "Expected Moments Algorithm Analysis" and "Multiple Grubbs-Beck test for Potentially Influential Low Floods" in the main part of this report for more detail regarding EMA and MGB).

Pseudo Record Length

Because the dataset includes censored data and historic information, the effective record length used to compute the precision of the skewness estimators is a calculation used to take into account the availability of historic information and censored values. While historic information and censored peaks provide valuable information, they often provide less information than an equal number of years with systematically recorded peaks (Stedinger and Cohn, 1986). The following calculations provide a pseudo record length, P_{RL}, associated with skew, which appropriately accounts for all peak-discharge data types available for a site.

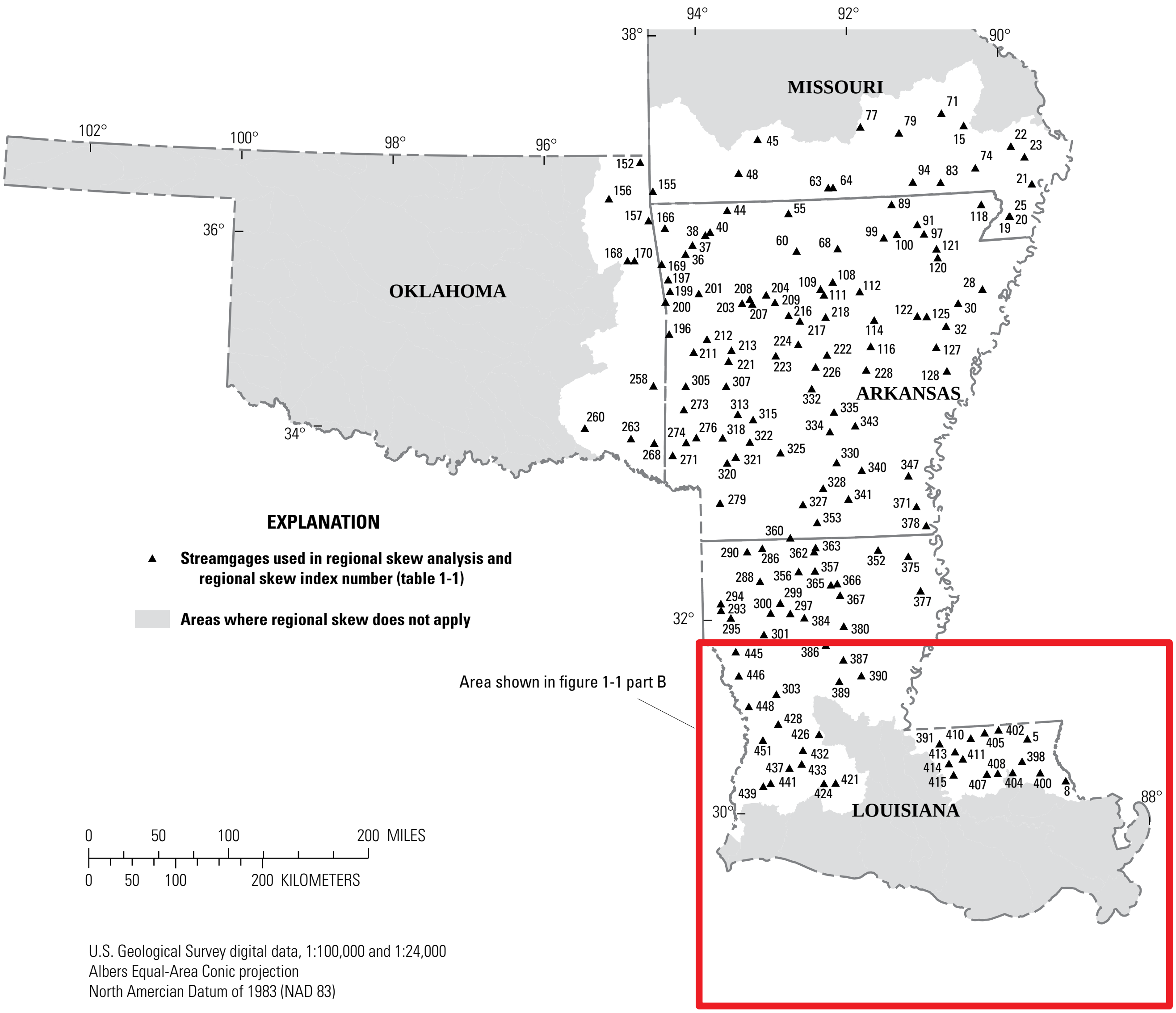

Figure 1–1. U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma used in regional skew analysis and areas in Louisiana, Missouri, and Oklahoma where regional skew does not apply.

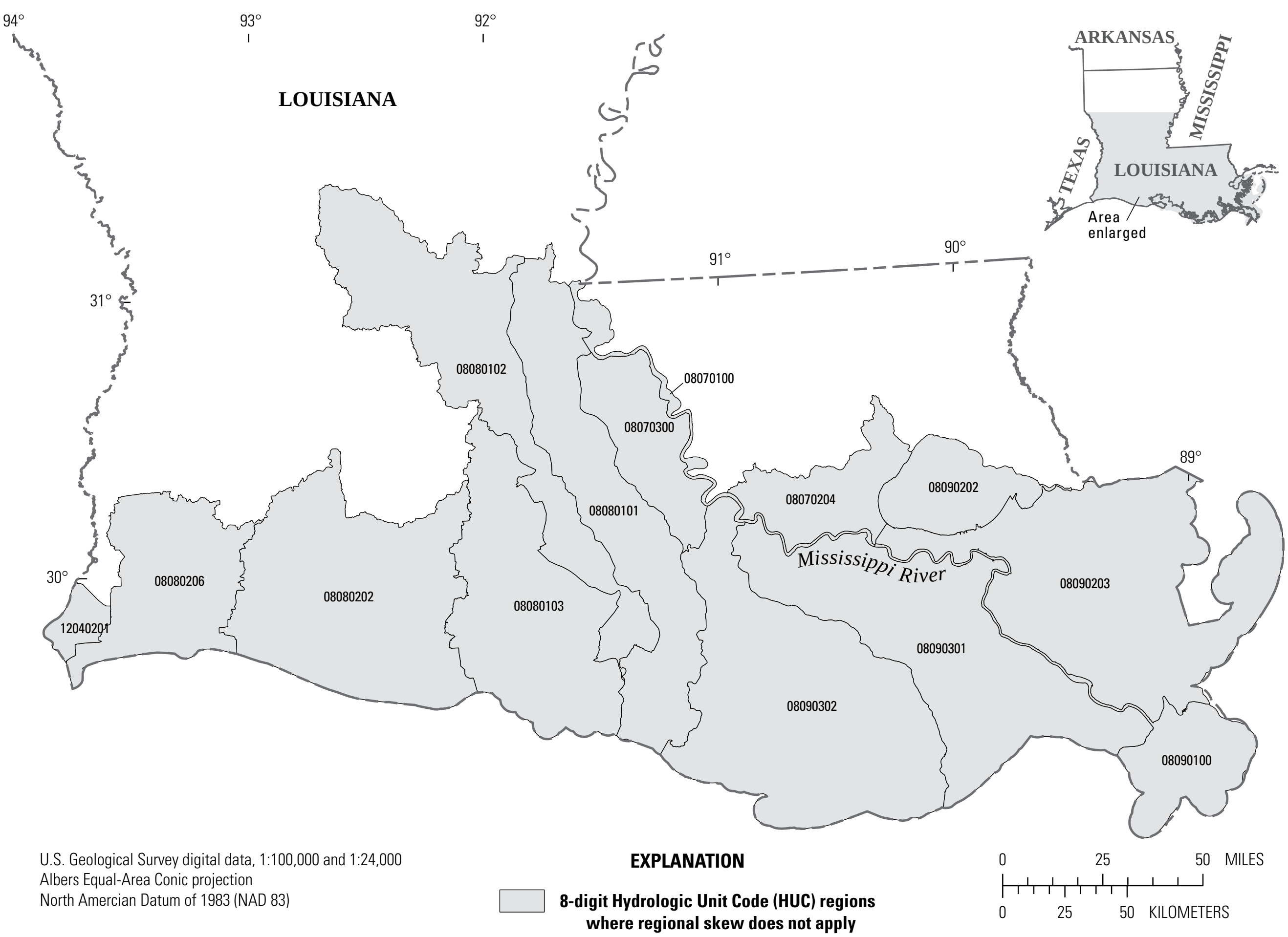

Figure 1–1. Map showing U.S. Geological Survey streamgages in Arkansas, Louisiana, Missouri, and Oklahoma used in regional skew analysis and areas in Louisiana, Missouri, and Oklahoma where regional skew does not apply.—Continued

The P_{RL} is defined in terms of the number of years of systematic record that would be required to yield the same mean square error of the skew ($MSE(\tilde{G})$) as the combination of historical and systematic record actually available at a streamgage; thus, the P_{RL} of the skew is a ratio of the MSE of the at-site skew when only the systematic record is analyzed ($MSE(\hat{G}_S)$) versus the MSE of the at-site skew when the all of the data, including historic and censored data, are analyzed ($MSE(\hat{G}_C)$).

$$P_{RL} = \frac{P_s * MSE\left(\hat{G}_S\right)}{MSE\left(\hat{G}_C\right)} \tag{1–2}$$

where

P_{RL} is the pseudo record length for the entire record at the streamgage, in years;

P_s is the number of systematic peaks in the record;

$MSE(\hat{G}_S)$ is the estimated MSE of the skew when only the systematic record is analyzed; and

$MSE(\hat{G}_C)$ is the estimated MSE of the skew when all of the data, including historic and censored data, are analyzed.

As the P_{RL} is an estimate, the following conditions must also be met to ensure a valid approximation. The P_{RL} must be nonnegative. If P_{RL} is greater than P_H (the length of the historical period), then P_{RL} should be set to equal P_H. Also, if P_{RL} is less than P_S, then P_{RL} is set to P_S. This ensures that the P_{RL} will not be larger than the complete P_H or less than the number of P_S.

As stated in Bulletin 17B, the skew coefficient of the station skew is sensitive to extreme events, and more accurate estimates can be obtained from longer records. Thus, after ensuring adequate spatial and hydrologic coverage, those streamgages that did not have a minimum of 35 years of P_{RL} were removed from the regional skew study. Of the 452 streamgages, 141 were removed because their P_{RL} was less than 25 years, 67 were removed because their P_{RL} was between 25 and 29 years, and 34 were removed because their P_{RL} was between 30 and 34 years; thus, data from 210 streamgages remained from which to build a regional skewness model for the study area.

Redundant Sites

Redundancy results when the drainage basins of two streamgages are nested, meaning that one basin is contained inside the other and the two basins are of similar size. Instead of providing two independent spatial observations that depict how drainage basin characteristics are related to skew (or AEPs), these two basins will have the same hydrologic response to a given storm and thus represent only one spatial observation. When streamgages in basins (streamgage pairs) are redundant, a statistical analysis using both streamgages incorrectly represents the information in the regional dataset (Gruber and Stedinger, 2008). To determine if two sites are redundant and thus represent the same hydrologic conditions, two types of information are considered: (1) whether their basins are nested, and (2) the ratio of the basin drainage areas.

The standardized distance (*SD*), is used to determine the likelihood that the basins are nested. The *SD* between two basin centroids is defined as:

$$SD_{ij} = \frac{D_{ij}}{\sqrt{0.5\left(DRNAREA_i + DRNAREA_j\right)}} \tag{1–3}$$

where

D_{ij} is the distance between centroids of basin *i* and basin *j*, in miles; and

$DRNAREA_i$ is the drainage area at site *i*, in square miles; and

$DRNAREA_j$ is the drainage area at site *j*, in square miles.

The drainage area ratio (*DAR*) is used to determine if two nested basins are sufficiently similar in size to conclude that they are, or are at least in large part, the same watershed for the purposes of developing a regional hydrologic model. The *DAR* is defined as (Veilleux and others, 2009):

$$DAR = Max\left[\frac{DRNAREA_i}{DRNAREA_j}, \frac{DRNAREA_j}{DRNAREA_i}\right] \tag{1–4}$$

where

DAR is the *Max* (maximum) of the two values in brackets;

$DRNAREA_i$ is the drainage area at site *i*, in square miles; and

$DRNAREA_j$ is the drainage area at site *j*, in square miles.

Two basins might be expected to have possible redundancy if the basin sizes are similar and the basins are nested. Previous studies suggest that streamgage pairs having *SD* less than or equal to 0.50 and *DAR* less than or equal to 5 were likely to have possible redundancy problems for purposes of determining regional skew. If *DAR* is large enough, even if the streamgage pairs are nested, they will reflect different hydrologic responses because storms of different sizes and durations will affect each streamgage differently. All possible combinations of streamgage pairs from the 210 streamgages were considered in the redundancy analysis. All streamgage pairs identified as redundant were then investigated to determine if, in fact, one streamgage of the pair is nested inside the other. For streamgage pairs that are nested, one streamgage from the pair was removed from the regional skew analysis. Streamgages removed from the Arkansas-Louisiana regional skew study because of redundancy are identified in table 1–1.

From the 76 identified possible redundant streamgage-pairs, 63 were determined to be redundant but only 30 streamgages were actually removed from the analyses as the same streamgages appeared in multiple streamgage pairs. Thus, of the 210 streamgages, 30 were removed because of redundancy, which left 180 streamgages to use in the Arkansas-Louisiana regional skew study (fig. 1–1A, table 1–1).

Unbiasing the Station Estimators

The station skewness estimates were unbiased by using the correction factor developed by Tasker and Stedinger (1986) and employed in Reis and others (2005). The unbiased station skewness estimator using the P_{RL} is

$$\hat{\gamma}_i = \left[1 + \frac{6}{P_{RL,i}}\right] G_i \tag{1–5}$$

where

- $\hat{\gamma}_i$ is the unbiased station sample skewness estimate for site *i*,
- $P_{RL,i}$ is the pseudo record length, in years, for site *i* as calculated in equation 1–2, and
- G_i is the traditional biased station skewness estimator for site *i* from the flood frequency analysis.

The variance of the unbiased station skewness includes the correction factor developed by Tasker and Stedinger (1986):

$$Var\left[\hat{\gamma}_i\right] = \left[1 + \frac{6}{P_{RL,i}}\right]^2 Var\left[G_i\right] \tag{1–6}$$

where

- $Var\left[G_i\right]$ is calculated using (Griffis and Stedinger, 2009).

$$Var\left(\hat{G}\right) = \left[\frac{6}{P_{RL}} + a\left(P_{RL}\right)\right] * \left[1 + \left(\frac{9}{6} + b\left(P_{RL}\right)\right)\hat{G}^2 + \left(\frac{15}{48} + c\left(P_{RL}\right)\right)\hat{G}^4\right] \tag{1–7}$$

where

$$a\left(P_{RL}\right) = -\frac{17.75}{P_{RL}^{\;2}} + \frac{50.06}{P_{RL}^{\;3}};$$

$$b\left(P_{RL}\right) = \frac{3.92}{P_{RL}^{\;0.3}} - \frac{31.10}{P_{RL}^{\;0.6}} + \frac{34.86}{P_{RL}^{\;0.9}}; \text{ and}$$

$$c\left(P_{RL}\right) = -\frac{7.31}{P_{RL}^{\;0.59}} + \frac{45.90}{P_{RL}^{\;1.18}} - \frac{86.50}{P_{RL}^{\;1.77}}.$$

Estimating the Mean Square Error of the Skewness Estimator

There are several possible ways to estimate MSE_G. The approach used by EMA (taken from eq. 55 in Cohn and others, 2001) generates a first order estimate of the MSE_G, which should perform well when interval data are present. Another option is to use the Griffis and Stedinger (2009) formula in equation 1–7 (the variance is equated to the MSE), employing either the systematic record length or the length of the whole historical period (H_p); however, this method does not account for censored data, and can lead to inaccurate and underestimated MSE_G. This issue has been addressed by using the P_{RL} instead of the length of the H_p; the P_{RL} reflects the impact of the censored data and the number of recorded systematic peaks. Thus, the unbiased Griffis and Stedinger (2009) MSE_G was used in the regional skewness model because it is more stable and relatively independent of the station skewness estimator. This methodology was used in previous regional skew studies (Eash and others, 2013; Southard and Veilleux, 2014).

Cross-Correlation Models

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

$$\hat{\rho}\left(\hat{\gamma}_i, \hat{\gamma}_j\right) = Sign\left(\hat{\rho}_{ij}\right) cf_{ij} \left|\hat{\rho}_{ij}\right|^k \tag{1–8}$$

where

- $\hat{\rho}_{ij}$ is the cross-correlation of concurrent annual peak discharge for two streamgages;
- k is a constant between 2.8 and 3.3; and
- cf_{ij} is a factor that accounts for the sample size difference between stations and their concurrent record length and is defined as follows:

$$cf_{ij} = CY_{ij} / \sqrt{\left(P_{RL,i}\right)\left(P_{RL,j}\right)} \tag{1–9}$$

where

- CY_{ij} is the pseudo record length of the period of concurrent record; and
- $P_{RL,i}$ and $P_{RL,j}$ are the pseudo record length corresponding to sites *i* and *j*, respectively (see eq. 1–2).

Pseudo Concurrent Record Length

After calculating the P_{RL} for each streamgage in the study, the pseudo concurrent record length between pairs of sites can be calculated. Because of the use of censored data and historic data, the effective concurrent record length calculation is more complex than determining in which years the two streamgages both have recorded systematic peaks.

The years of historical period in common between the two streamgages are first determined. For the years in common, with beginning year YB_{ij} and ending year YE_{ij}, the following equation is used to calculate the concurrent years of record between site *i* and site *j*.

$$CY_{ij} = \left(YE_{ij} - YB_{ij} + 1\right)\left(\frac{P_{RL,i}}{H_{p,i}}\right)\left(\frac{P_{RL,j}}{H_{p,j}}\right) \qquad (1\text{–}10)$$

The computed pseudo concurrent record length depends upon the years of historical period in common between the two streamgages, as well as the ratios of the P_{RL} to the H_p for each of the two streamgages.

Arkansas-Louisiana Study Area Cross-Correlation Model of Concurrent Annual Peak Discharge

A cross-correlation model for the logarithm of the annual peak discharges in the Arkansas-Louisiana study area was developed using 49 sites with at least 70 years of concurrent systematic peaks (zero flows not included). Various models relating the cross correlation of the concurrent annual peak discharge at two sites, ρ_{ij}, to various basin characteristics were considered. A logit model, termed the Fisher Z Transformation (Z = log[(1+*r*)/(1-*r*)]), provided a convenient transformation of the sample correlations r_{ij} from the (-1, +1) range to the (-∞ +∞) range. The adopted models for estimating the cross correlations of concurrent annual peak discharge at two stations, which used the distance between basin centroids, D_{ij}, as the only explanatory variable, are

$$\rho_{ij} = \frac{\exp\left(2Z_{ij}\right) - 1}{\exp\left(2Z_{ij}\right) + 1} \qquad (1\text{–}11)$$

where

$$Z_{ij} = exp\left(0.47 - 0.054\left(\frac{D_{ij}^{0.58} - 1}{0.58}\right)\right)$$

An OLS regression analysis based on 1,057 streamgage pairs indicated that this model is as accurate as having 106 years of concurrent annual peaks from which to calculate cross correlation. Figure 1–2 shows the fitted relation between Z and distance between basin centroids together with the plotted sample data from the 1,057 streamgage pairs of data. Figure 1–3 shows the functional relation between the untransformed cross correlation and distance between basin centroids together with the plotted sample data from the 1,057 streamgage pairs of data. The cross-correlation model was used to estimate streamgage-to-streamgage cross correlations for concurrent annual peak discharges at all pairs of streamgages in the regional skew study.

Arkansas-Louisiana Regional Skew Study Results

The results of the Arkansas-Louisiana regional skew study using the B-WLS/B-GLS regression methodology are provided below. All of the available basin characteristics (drainage area, mean basin elevation, mean annual precipitation, basin slope, and HUC subregions) were initially considered as explanatory variables in the regression analysis for regional skew.

The best regional skew model is classified as having the smallest model error variance, σ_δ^2 and largest pseudo-R_δ^2. The pseudo-R_δ^2 describes the estimated fraction of the variability in the true skewness from streamgage-to-streamgage explained by each model (Gruber and others, 2007; Parrett and others, 2011). The addition of any of the available basin characteristics did not produce a pseudo-R_δ^2 greater than 9 percent. This indicates that the inclusion of a basin characteristic as an explanatory variable in the regression did not help explain the variability in the true skewness. The addition of a basin characteristic is not warranted as the increased model complexity provides only a small gain in model precision. Thus, the CONSTANT model is chosen as the best regional skewness model for the Arkansas-Louisiana study area. Table 1–2 (available online at http://dx.doi.org/10.3133/sir20165081) provides the final results for the constant skewness model, denoted CONSTANT, for the Arkansas-Louisiana study area using 180 streamgages with at least 35 years of pseudo record length.

The CONSTANT model, -0.17, is chosen as the best regional skewness model for the Arkansas-Louisiana study area. A constant model does not explain any variability in the true skews, so the pseudo-R_δ^2 equals 0. The posterior mean of the model error variance, σ_δ^2, for the CONSTANT model is σ_δ^2 = 0.11. The average sampling error variance (ASEV) in table 1–2 is the average error in the regional skewness estimator at the sites in the dataset. The average variance of prediction at a new site (AVP_{new}) corresponds to the MSE used in Bulletin 17B to describe the precision of the generalized skewness. The CONSTANT model has an AVP_{new}, equal to 0.12, which corresponds to an effective record length of 59 years.

It is important to note that this regional skew model is not valid in the following 8-digit HUCs in southern Louisiana: 08070100, 08070204, 08070300, 08080101, 08080102, 08080103, 08080202, 08080206, 08090100, 08090202,

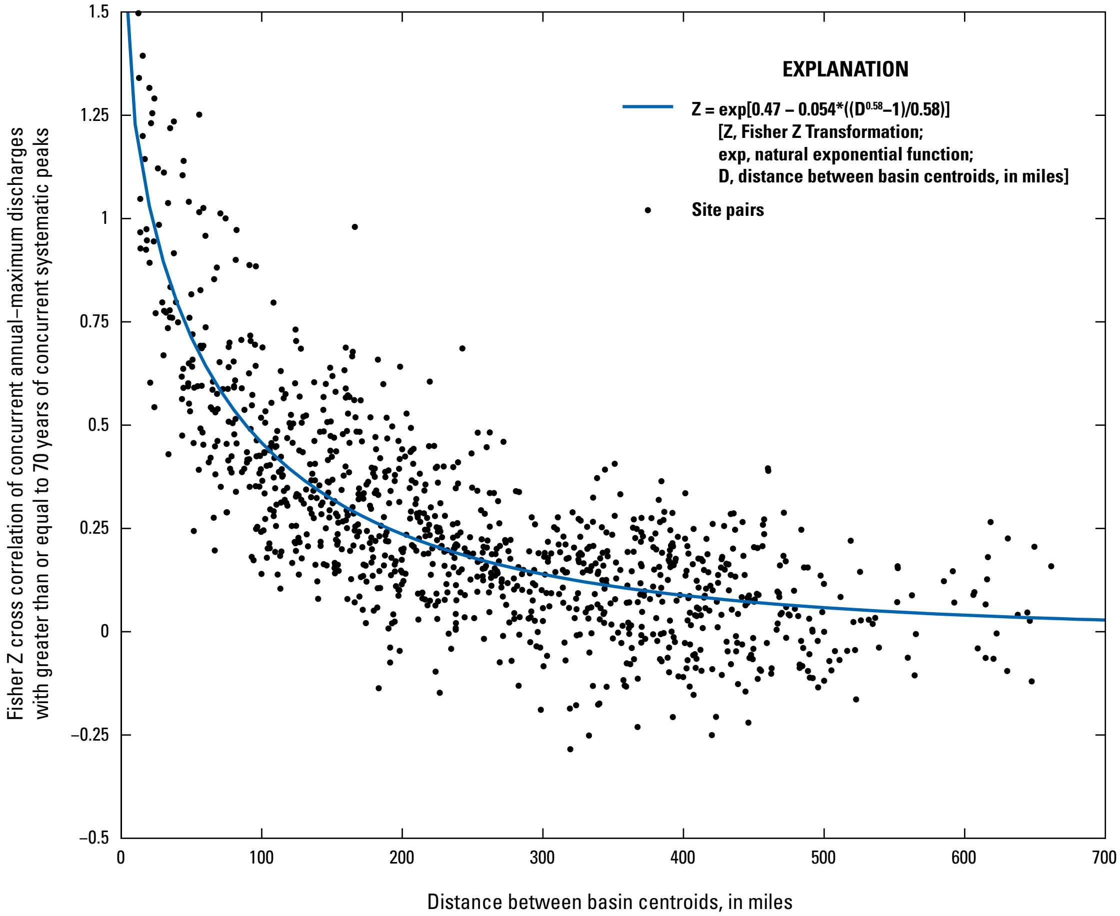

Figure 1–2. Relation between Fisher Z transformed cross correlation of logs of annual peak discharge and distance between basin centroids for Arkansas-Louisiana regional skew study.

08090203, 08090302, 08090301 and part of 12040201 (fig. 1–1B). Streams in these HUC regions in southern Louisiana are either tidally influenced or subject to regulation, diversion, or backwater.

Bayesian Weighted Least-Squares/Bayesian Generalized Least-Squares Regression Diagnostics

To determine if a model is a good representation of the data and which regression parameters, if any, should be included in a regression model, diagnostic statistics have been developed to evaluate how well a model fits a regional hydrologic dataset (Griffis, 2006; Gruber and others, 2007). In this study, the goal was to determine the set of possible explanatory variables that best fit annual peak discharges for the Arkansas-Louisiana study area affording the most accurate skew predictions but also keeping the model as simple as possible. This section presents the diagnostic statistics for a B-WLS/B-GLS analysis and discusses the specific values obtained for the Arkansas-Louisiana regional skew study.

Table 1–3 (available online at http://dx.doi.org/10.3133/sir20165081) presents a pseudo analysis of variance (pseudo ANOVA) table for the Arkansas-Louisiana regional skew analysis. The table contains regression diagnostics/goodness-of-fit statistics. In particular, the table shows how much of the variation in the observations can be attributed to the regional model, and how much of the residual variation can be attributed to model error and sampling error, respectively. Difficulties arise in determining these quantities. The model errors cannot be resolved because the values of the sampling errors, η_i, for each site, i, are not known. However, the total sampling error sum of squares can be described by its mean value, $\sum_{i=1}^{n} Var[\hat{\gamma}_i]$. Because there are n equations, the total variation because of the model error δ for a model with k parameters has a mean equal to $n\sigma_\delta^2(k)$; thus, the residual variation attributed to the sampling error is $\sum_{i=1}^{n} Var[\hat{\gamma}_i]$, and the residual variation attributed to the model error is $n\sigma_\delta^2(k)$. This division of the variation in the observations is referred to as a Pseudo ANOVA because the contributions of the three sources of error are estimated or constructed, rather than

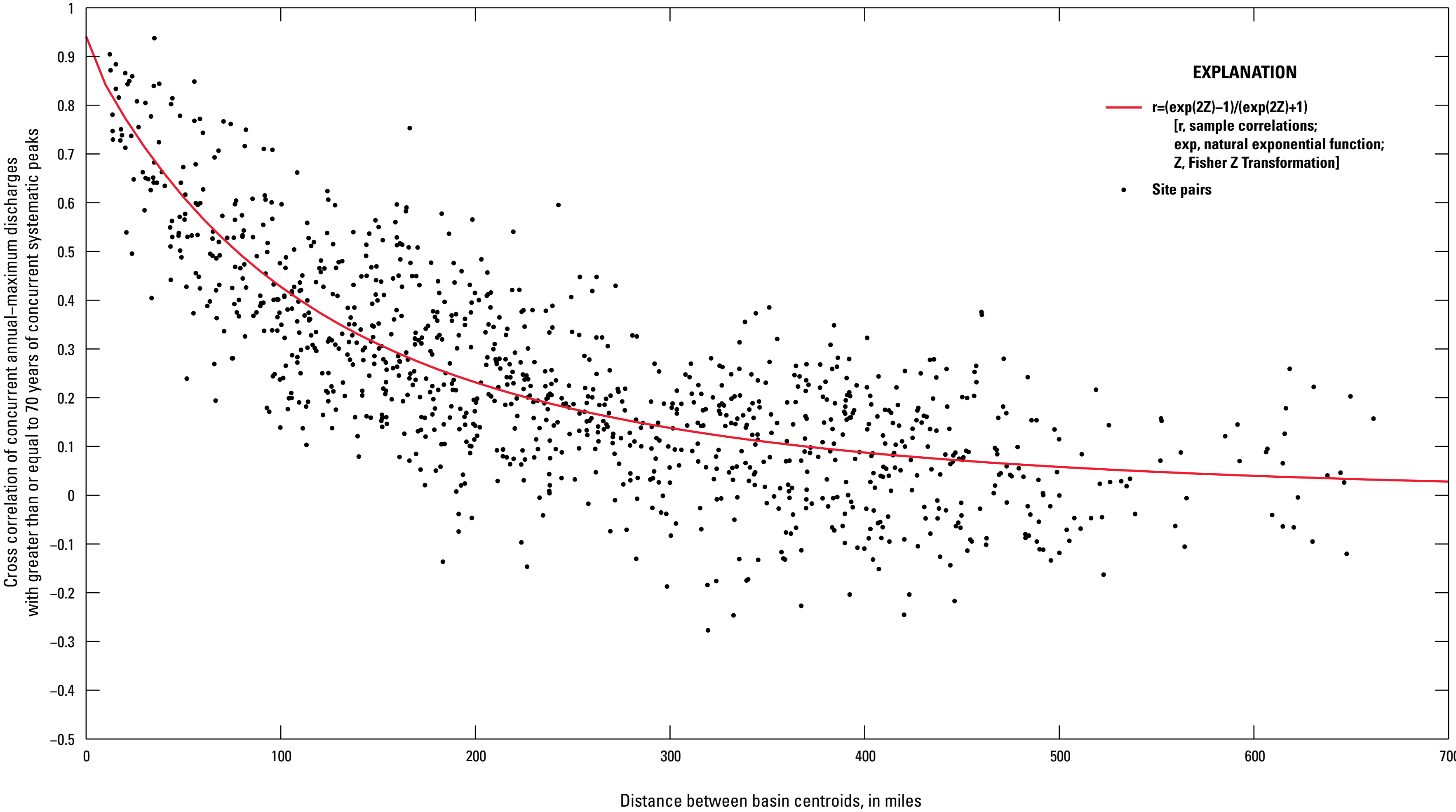

Figure 1–3. Relation between untransformed cross correlation of logs of annual peak discharge and distance between basin centroids for Arkansas-Louisiana regional skew study.

being determined from the computed residual errors and the observed model predictions, while also ignoring the effect of correlation among the sampling errors.

For a model with no parameters other than the mean (that is, the constant skew model), the estimated model error variance, $\sigma_\delta^2(0)$, describes all of the anticipated variation in $\gamma_i = \mu + \delta_i$, where μ is the mean of the estimated station sample skews; thus, the total expected sum of squares variation because of model error, δ_i, and because of sampling error $\eta_i = \hat{\gamma}_i - \gamma_i$, in expectation should equal $n\sigma_\delta^2(0) + \sum_{i=1}^{n} Var(\hat{\gamma}_i)$. The expected sum of squares attributed to a regional skew model with k parameters should then equal $n[\sigma_\delta^2(0) - \sigma_\delta^2(k)]$, because the sum of the model error variance $n\sigma_\delta^2(k)$ and the variance explained by the model must sum to $n\sigma_\delta^2(0)$. Table 1–3 considers a model with k = 0 (a constant model). The CONSTANT model does not have any explanatory variables, thus the variation attributed to the models is 0.

The ratio of the average sampling error variance to the model error variance is called the Error Variance Ratio (EVR) and is a modeling diagnostic used to evaluate if a simple OLS regression is sufficient or if a more sophisticated WLS or GLS analysis is appropriate. Generally, an EVR greater than 0.20 indicates that the sampling variance is not negligible when compared to the model error variance, suggesting the need for a WLS or GLS regression analysis. The EVR is calculated as

$$EVR = \frac{\mathrm{SS}(\text{sampling error})}{\mathrm{SS}(\text{model error})} = \frac{\sum_{i=1}^{n} Var\left(\hat{\gamma}_i\right)}{n\sigma_\delta^2(k)} \quad (1\text{–}12)$$

For the Arkansas-Louisiana regional skew study area, EVR had a value of 1.2 for the CONSTANT model (table 1–3). The sampling variability in the sample skewness estimators was larger than the error in the regional model; thus, an OLS model that neglects sampling error in the station skewness estimators may not provide a statistically reliable analysis of the data. Given the variation of record lengths from streamgage to streamgage, it is important to use a WLS or GLS analysis to evaluate the final precision of the model rather than a simpler OLS analysis.

The Misrepresentation of the Beta Variance (MBV*) statistic is used to determine whether a WLS regression is sufficient or a GLS regression is appropriate to determine the precision of the estimated regression parameters (Griffis, 2006; Veilleux, 2011). The MBV* describes the error produced by a WLS regression analysis in its evaluation of the precision of b_0^{WLS}, which is the estimator of the constant β_0^{WLS}, because the covariance among the estimated station skews, $\hat{\gamma}_i$, generally has its greatest impact on the precision of the constant term (Stedinger and Tasker, 1985). If the MBV* is substantially greater than 1, then a GLS error analysis should be employed. The MBV* is calculated as

$$MBV^* = \frac{Var\left[b_0^{WLS} \mid GLS\ analysis\right]}{Var\left[b_0^{WLS} \mid WLS\ analysis\right]} = \frac{w^T \Lambda w}{\sum_{i=1}^{n} w_i} \ where\ w_i = \frac{1}{\sqrt{\Lambda_{ii}}} \quad (1\text{–}13)$$

For the Arkansas-Louisiana regional skew study areas, MBV* had a value of 4.6 for the CONSTANT model (table 1–3). This is a large value indicating that the cross correlation among the skewness estimators affected the precision with which the regional average skew coefficient could be estimated. If a WLS precision analysis was used for the estimated constant parameter in the CONSTANT model, the variance would be underestimated by a factor of 4.6, and a WLS analysis would misrepresent the variance of the constant in the CONSTANT model; moreover, a WLS model would have resulted in underestimation of the variance of prediction, given that the sampling error in the constant term in both models was sufficiently large enough to make an appreciable contribution to the average variance of prediction.

Leverage and Influence

Leverage and influence diagnostics statistics can be used to identify rogue observations and to effectively address lack of fit when estimating skew coefficients. Leverage identifies those streamgages in the analysis where the observed values have a large effect on the fitted (or predicted) values (Hoaglin and Welsch, 1978). Generally, leverage takes into consideration whether an observation, or explanatory variable, is unusual, and thus likely to have a large effect on the estimated regression coefficients and predictions. Unlike leverage, which highlights points that have the ability or potential to affect the fit of the regression, influence attempts to describe those points that have an unusual impact on the regression analysis (Belsley and others, 1980; Cook and Weisberg, 1982; Tasker and Stedinger, 1989). An influential observation is one with an unusually large residual that has a disproportionate effect on the fitted regression relations. Influential observations often have high leverage. For a detailed description of the equations used to determine leverage and influence for a B-WLS/B-GLS analysis see Veilleux (2011) and Veilleux and others (2011).

For the B-WLS/B-GLS CONSTANT regional skew models for Arkansas-Louisiana, no streamgages had high leverage. The differences in leverage values for the constant model reflect the variation in record lengths among sites.

Ten streamgages in the B-WLS/B-GLS CONSTANT regional skew models for Arkansas-Louisiana have high influence and thus have an unusual impact on the fitted regression relation. The 10 streamgages with high influence are USGS streamgages 07041000, 07047880, 07063000, 07066000, 07232500, 07256500, 07364550, 07375222, 07377500, and 08012000. The streamgages with the five largest, in magnitude, residuals are among these 10 streamagages.

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Appendix 2. Flood Frequency at U.S. Army Corps of Engineers Dams and Regulation Control Points (RCPs) in Arkansas

Introduction

The major river basins of the State of Arkansas (that is, the Arkansas, White, and Red River Basins) contain large reservoirs developed for navigation, power generation, and flood control. These reservoirs regulate streams by capturing tributary inflow during rainfall events and releasing that water as downstream conditions allow. Without the regulation provided by the dams, downstream flood crests would be higher, cover a greater areal extent, and cause more damage.

After rivers downstream from the dams begin receding, water is released in a controlled fashion following predetermined reservoir control plans. Flood storage evacuation is determined by consulting seasonal guide curves and taking into consideration the downstream river channel capacity based on river stages at downstream gaging stations operated by the U.S. Geological Survey, known as regulation control points (RCPs). Over the last several decades, changes in water usage for agriculture, hydroelectric power, water supply, and environmental flows have necessitated changes to the reservoir control plans; therefore, for a flood frequency analysis of annual peak discharges at dams and RCPs to be meaningful in the present, it must address how the current reservoir control plans affect the response of the river systems to the hydrologic record. To properly analyze the frequency of annual peak discharges at dams and RCPs in Arkansas, the current reservoir control plans were applied to the historical period of record and modeled using RiverWare reservoir simulation software (Hula, 2000; Daylor and others, 2006; Avance and others, 2010). RiverWare output is a daily average discharge; the maximum daily average was selected for each year and the resulting time series of annual maximum daily average discharges were used to estimate annual exceedance probability discharges (AEPDs). Given the large size of the river basins and the controlled nature of dam releases, the peak instantaneous release is typically the same as or very close to the daily average release; therefore, the annual maximum daily average discharge was considered appropriate for use in computation of AEPDs.

The purpose of this appendix is to present AEPDs for 15 USACE dams and 21 RCPs in the White, Arkansas, and Red River Basins (fig. 2–1). The AEPDs were computed using RiverWare model output of the current reservoir control plan scenarios as well as for dams and RCPs in the White River Basin, the unregulated scenarios (table 2–1). The AEPDs for the current reservoir control plan scenarios were computed using both the graphical method in the USACE Hydrologic Engineering Center’s Statistical Software Package (HEC–SSP) and the Expected Moments Algorithm (EMA) with the Multiple Grubbs-Beck (MGB) test for Potentially Influential Low Floods (PILFs). The AEPDs for the unregulated scenarios were computed using EMA with the MGB test for PILFs. The periods of record output by the RiverWare models and used in the computation of AEPDs were (1) for dams and RCPs in the White River Basin, calendar years 1940–2011; (2) for dams on the main stem of the Arkansas River, calendar years 1940–2008; and (3) for dams in the Red River Basin and RCPs on the main stem of the Red River, calendar years 1938–2007. For Blue Mountain and Nimrod Dams in the Arkansas River Basin, the USACE systematic record of daily observations of dam releases ending with the 2013 water year were used to compute AEPDs. For RCPs in the Arkansas and Red River Basins, the USGS systematic record of instantaneous annual peak discharges ending with the 2013 water year were used to compute AEPDs (table 2–1, available online at http://dx.doi.org/10.3133/sir20165081).

Methods

Annual Peak Discharge Data

Arkansas River Basin

Data for dams in the Arkansas River Basin were derived from two different sources. RiverWare model “REDCOE_643_BaseModel_62413,” developed by USACE, Tulsa District (Daylor and others, 2006; Avance and others, 2010), was used to generate annual peak discharges for the current regulation plan scenario at three dams on the main stem of the Arkansas River: (1) Lock and Dam Number 13; (2) Lock and Dam Number 10; and (3) Lock and Dam Number 7 (table 2–1). The RiverWare model outputs a daily time step for calendar years 1940–2008. Blue Mountain and Nimrod Dams were not modeled using RiverWare. Complete records of daily observation of releases through the 2013 water year were available for both dams, and since their inception, neither dam has had a substantial change to its regulation plan.

RiverWare simulations of the current regulation plan scenario were not available for RCPs on the Petit Jean and Fourche LaFave Rivers (downstream from Blue Mountain and Nimrod Dams, respectively). The AEPDs for these streamgages were computed with EMA using instantaneous annual peak discharges from the regulated part of the systematic record ending with the 2013 water year (table 2–1).

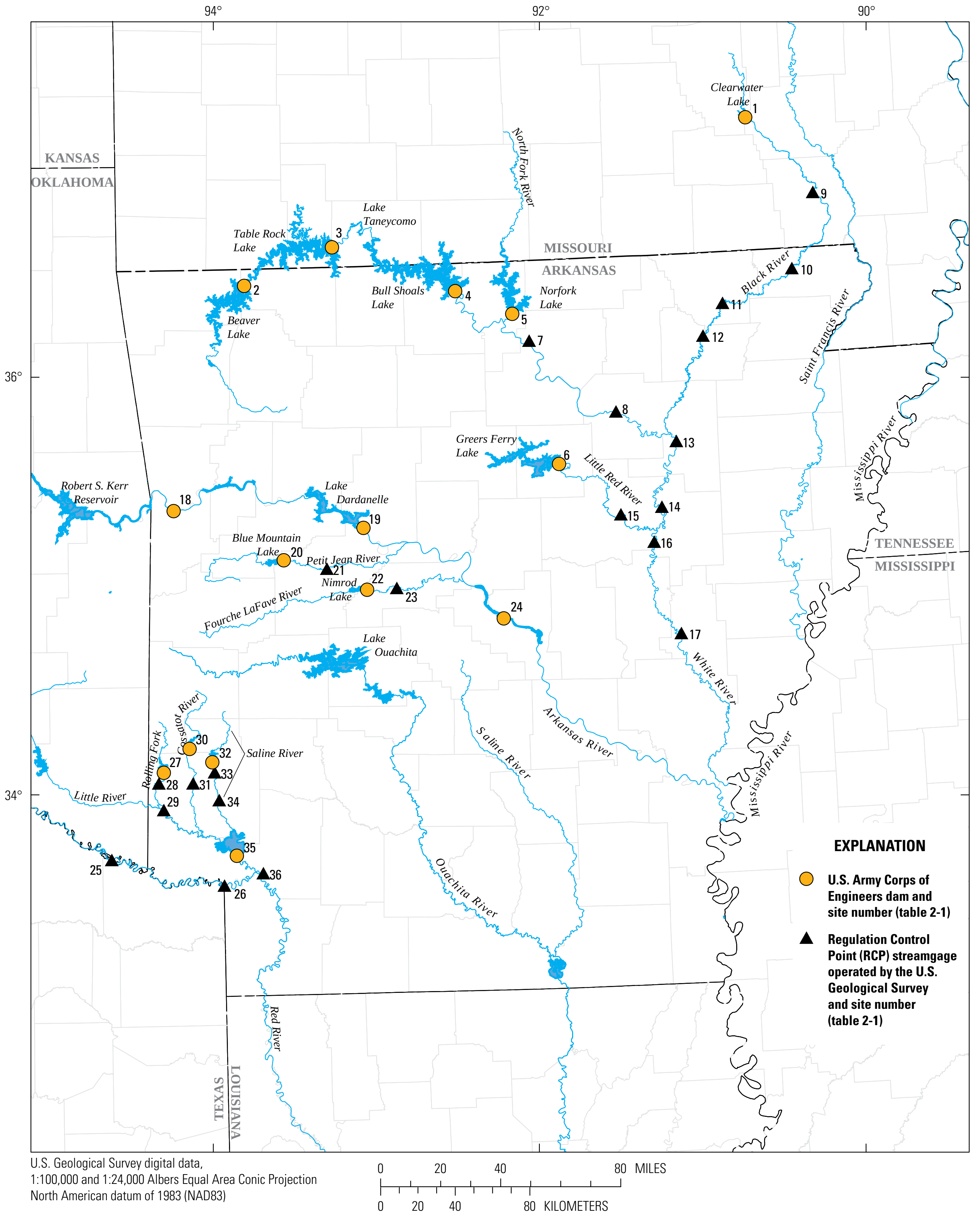

Figure 2–1. U.S. Army Corps of Engineers dams and streamflow-gaging stations operated by the U.S. Geological Survey that serve as regulation control points (RCPs) for which annual exceedance probability discharges (AEPDs) were computed.

White River Basin

RiverWare model “RW-W14x03,” developed by USACE, Little Rock District (U.S. Army Corps of Engineers, 2013), was used to generate annual peak discharges corresponding to both the current regulation plan and unregulated scenarios for all dams and RCPs along the regulated reaches of the White and Black Rivers (table 2–1). The model simulates a daily time step for calendar years 1940–2011. This model has undergone substantive improvement over the previous model runs; namely, increasing the level of detail describing release behavior during moderately high flood pool conditions was increased (Daylor and others, 2006; Avance and others, 2010).

Red River Basin

RiverWare model “RW-643BASE_62413,” developed by USACE, Tulsa District (Daylor and others, 2006; Avance and others, 2010) was used to generate annual peak discharges for De Queen, Gillham, and Dierks Dams and for RCPs along the regulated reaches of the Red and Little Rivers (table 2–1). The model simulates a daily time step for calendar years 1938–2007.

RiverWare simulations of the current regulation plan were not available for RCPs on regulated reaches of the Rolling Fork and Cossatot and Saline Rivers (downstream from De Queen, Gillham, and Dierks Dams, respectively); therefore, AEPDs for these streamgages were computed using instantaneous annual peak discharges from the regulated part of the USGS systematic record ending with the 2013 water year (table 2–1).

Annual Exceedance-Probability Analyses

With respect to floods, annual exceedance probability is an estimate of the likelihood of a flood of a specific magnitude happening in any one year (Eash and others, 2013). Annual exceedance probabilities (AEPs) have traditionally been reported as flood recurrence intervals expressed in years; for example, because a flood having a 1-percent chance of being exceeded during any particular year (an AEP of 0.01) might be expected to occur, on average, once during any 100-year period (the recurrence interval), a flood having a 1-percent, or 0.01, AEP is commonly referred to as a “100-year flood;” however, because of confusion resulting when more than one “100-year flood” occurs in a period of less than 100 years, the scientific and engineering community has in recent years, begun expressing the likelihood of occurrence of flood discharges as a probability instead of a recurrence interval, and that nomenclature is used in this report.

Standard methods for estimating AEPs were established in March 1982 by the U.S. Interagency Committee on Water Data (now the Advisory Committee on Water Information, Subcommittee on Hydrology; see http://acwi.gov/hydrology). The Committee recommended that a log-Pearson Type 3 (LP3) distribution be fit to the logarithms (base 10) of the annual peak discharges as described in Bulletin 17B (Interagency Committee on Water Data, 1982). The EMA method for fitting the LP3 distribution to the logarithms of annual peak-discharge data has since been developed by the USGS (Cohn and others, 1997, 2001; Griffis and others, 2004) and used in several flood-frequency studies (Parrett and others, 2010; Eash and others, 2013; Southard and Veilleux, 2014). In 2013, the Hydrologic Frequency Analysis Work Group of the Advisory Committee on Water Information, The Subcommittee on Hydrology issued a memorandum recommending revisions to Bulletin 17B, amongst them the adoption of the EMA method for estimating AEPs (Advisory Committee on Water Information, Subcommittee on Hydrology, Hydrologic Frequency Analysis Work Group, written comm., 2013).

In this study, the 50-, 20-, 10-, 4-, 2-, 1-, and 0.2-percent AEPDs (hereafter referred to as the “$Q_{50\text{-percent }(\%)}$,” “$Q_{20\%}$,” “$Q_{10\%}$,” “$Q_{4\%}$,” “$Q_{2\%}$,” and “$Q_{1\%}$,”) for USACE dams and RCPs were estimated using the graphical method, EMA, or both. Computations using the graphical method were facilitated by use of HEC–SSP (U.S. Army Corps of Engineers, 2010). Computations using EMA were facilitated by use of the USGS PeakFQ software package, version 7.1.28513 (Veilleux and others, 2014).

Graphical Method

Releases from dams are controlled in order to maintain regulating stages at downstream control points in accordance with reservoir operation plans; this often results in flat zones, or benches, in annual peak discharge frequency curves. In example, for most reservoir and downstream conditions, releases from Beaver Dam are limited to approximately 8,000 cubic feet per second (ft^3/s). Regardless if the inflow is 9,000 ft^3/s or 15,000 ft^3/s, the release is 8,000 ft^3/s. The result is that most flood peaks are reduced to 8,000 ft^3/s, and the duration of release at 8,000 ft^3/s is longer than the duration of the unregulated hydrograph at 8,000 ft^3/s. The resulting annual peak discharge frequency curve has a bench of approximately 8,000 ft^3/s for AEPDs in the range of 25–60 percent (fig. 2–2). For some dams, releases are subject to seasonal pool elevations or other variable operational limits that result in multiple benches in the annual peak discharge frequency curve. Such benches skew the results of conventional LP3 analyses, yielding inaccurate estimates of AEPDs; therefore, the USACE HEC–SSP (U.S. Army Corps of Engineers, 2010) was used to perform graphical frequency analysis to estimate AEPDs for dams and RCPs in the White, Arkansas, and Red River Basins. For comparison, AEPDs were also estimated using EMA. The graphical method first ranks, for the simulated period of record, the annual peak-discharges in descending order and then calculates the plotting positions using the Weibull method (Helsel and Hirsch, 2002). Once the positions have been plotted, a best fit frequency curve representing the trend of the data points is manually drawn using hydrologic judgment. To define the upper ends of the frequency curves, previous frequency reports and the statistical reports output by the RiverWare models were used to create temporary plotting points. French curves were then used to best fit these points to the plotted data.

A

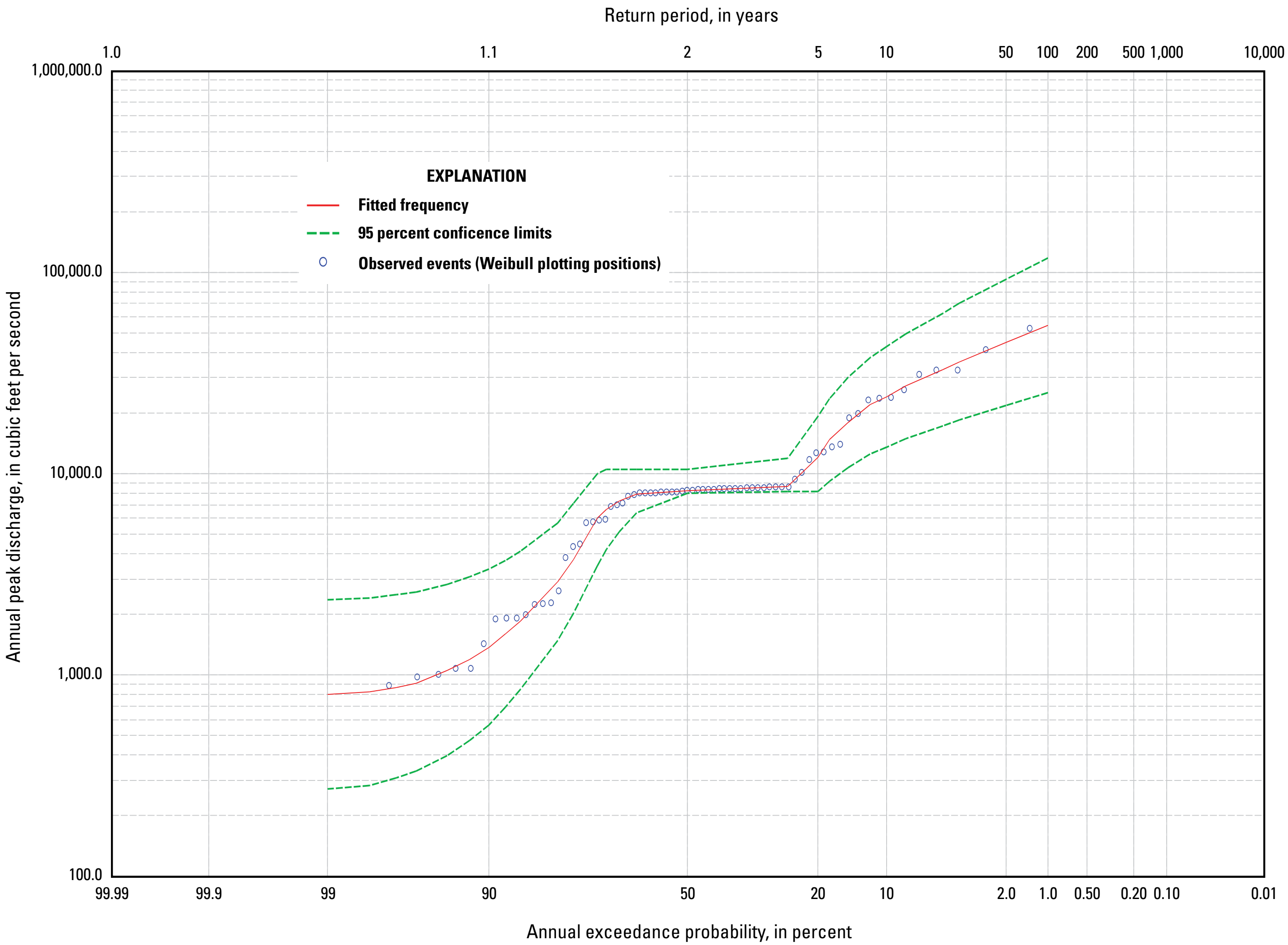

Figure 2–2. Modified screen captures of annual peak discharge frequency curves for Beaver Dam (site number 2, fig. 2–1) generated using *A*, graphical method in the U.S. Army Corps of Engineers Hydrologic Engineering Center's Statistical Software Package (HEC–SSP) and *B*, the Expected Moments Algorithm (EMA) method in the PeakFQ program showing benches in the range of annual exceedance probabilities from 20 to 50 percent.

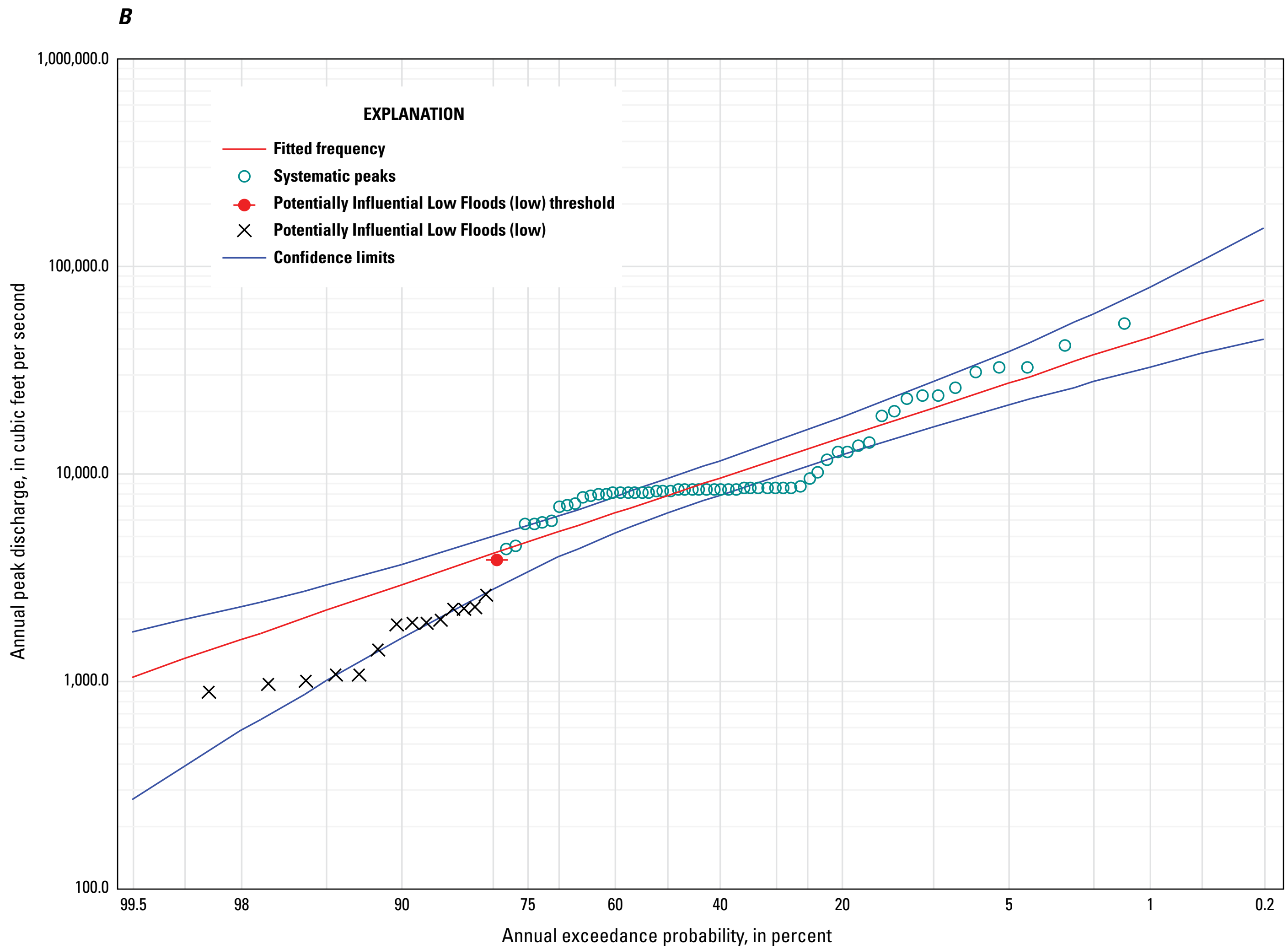

Figure 2–2. Modified screen captures of annual peak discharge frequency curves for Beaver Dam (site number 2, fig. 2–1) generated using *A*, graphical method in the U.S. Army Corps of Engineers Hydrologic Engineering Center's Statistical Software Package (HEC–SSP) and *B*, the Expected Moments Algorithm (EMA) method in the PeakFQ program showing benches in the range of annual exceedance probabilities from 20 to 50 percent.—Continued

In 1982, the U.S. Interagency Committee on Water Data established standard methods for estimating AEPDs. The methods outlined in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) use a LP3 distribution to compute AEPDs. Fitting the distribution requires computing the mean, standard deviation, and skew coefficient of the logarithms of the annual peak-discharge record, which describe the midpoint, slope, and curvature of the annual exceedance-probability curve, respectively (Eash and others, 2013). The estimates of AEPDs were computed using the following equation:

$$logQ_p = \bar{X} + K_p S \tag{2–1}$$

where

Q_p is the P-percent AEPD, in cubic feet per second;

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

K_p is a factor based on the skew coefficient and the given percentage of the AEP and is obtained from appendix 3 in Bulletin 17B; and

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

Skew Coefficient

The skew coefficient measures the asymmetry of the probability distribution of a set of annual peak discharges, which is strongly affected by the presence of high or low outliers, amongst other factors; large positive station skew coefficients typically result from high outliers and large negative station skew coefficients typically result from low outliers (Southard and Veilleux, 2014). Being sensitive to extreme flood events, the station skew coefficient for short records may not provide an accurate estimate of the population, or true, skew coefficient; therefore, in Bulletin 17B, the Interagency Advisory Committee on Water Data (1982) recommends that the skew coefficient calculated from the annual peak discharge record at a streamgage (the station skew) be weighted with a regional skew coefficient (the regional skew) determined from an analysis of selected long-term streamgages in the study area. The weighted skew coefficient (the weighted skew) is determined using the following equation:

$$G_w = \frac{MSE_R\left(G_S\right) + MSE_S\left(G_R\right)}{MSE_R + MSE_S} \tag{2–2}$$

where

G_w is the weighted skew,

G_s is the station skew,

G_R is the regional skew,

MSE_R is the mean square error of the regional skew, and

MSE_S is the mean square error of the station skew.

Because dams and RCPs in the White, Arkansas, and Red River Basins are subject to unique regulation plans, the station skew coefficient was used in the estimation of AEPDs corresponding to the current regulation plans. A weighted skew computed using a newly generated regional skew of -0.17 (app. 1) was used in the estimation of AEPDs corresponding to the unregulated scenario at all dams and RCPs, with the exception of Bull Shoals Dam and RCPs on the White River downstream from Bull Shoals Dam. Preregulation data from those streamgages were not used to generate the regional skew, and thus the station skew was used.

Standard Grubbs-Beck Test

Bulletin 17B recommends use of the standard Grubbs-Beck test for detecting outliers. The test calculates a one-sided, 10 percent significance-level critical value based on a log-normal distribution of annual peak-discharge data for a streamgage. If the station skew is between -0.4 and +0.4, tests for both high and low outliers are made based on the mean, standard deviation, and skew of the systematic record before any adjustments are made. If the station skew is greater than +0.4, the test for high outliers is considered first and, if necessary, adjustments are made; if the station skew is less than -0.4, the test for low outliers is considered first (Interagency Advisory Committee on Water Data, 1982). Annual peak discharges that were identified as low outliers were truncated from the record, and a conditional probability adjustment was applied in the AEP analysis; low outliers can have a large influence on the extreme magnitude flood events that are of interest; therefore, removing them from the analysis was important.

Historic Peaks

Historic peak discharges are those that are not part of the systematic record. Often, historic peaks are also high outliers. Bulletin 17B recommends that the number of historic peaks (Z) in the longer period (H) be assigned a weight of 1.0; the remaining peaks (N) in the systematic record (L) are assigned a weight of (H-Z)/(N+L) based on the assumption that their distribution is representative of the (H-Z) remaining years of the historical period (Interagency Advisory Committee on Water Data, 1982). Although the adjustment for historical peaks and those for low and high outliers generally improve estimates of AEPDs, the EMA method integrates low and high outliers and historical flood peaks more efficiently (Cohn and others, 1997).

Expected Moments Algorithm Analysis

For streamgages that have systematic annual peak-discharge records for complete periods, no low outliers, and no historical flood peaks, the EMA method produces estimates of the three LP3 statistics (mean, standard deviation, and skew coefficient) that are identical to those produced by the standard LP3 method described in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). However, the EMA method improves upon the standard LP3 method by allowing for the integration of censored and interval peak-discharge data into the analysis (Cohn and others, 1997).

Censored and Interval Peak-Discharge Data

There are two types of censored peak-discharge data: (1) annual peak discharges at crest-stage gages (CSGs) for which the discharge is only known to be less than a minimum recordable value; and (2) historical annual peak discharges that are only known to not have exceeded a recorded historical peak (Eash and others, 2013). In EMA, interval discharges were used to characterize peak discharges known to be greater or less than a specific value, peak discharges that could only be reliably estimated within a certain range, or to characterize missing data in periods of systematic record.

Multiple Grubbs-Beck Test for Potentially Influential Low Floods

To identify not just low outliers but also other PILFs, EMA uses the MGB test (Cohn and others, 2013). While low outliers are typically one or two homogeneous values in a dataset that do not conform to the trend of the other observations, PILFs have a magnitude that is much smaller than the flood quantile of interest, occur below a statistically significant break in the flood-frequency plot, and have excessive influence on the estimated frequency of large floods. Similar to the standard Grubbs-Beck test, the MGB test calculates a one-sided, 10 percent significance-level critical value based on a log-normal distribution of the annual peak-discharge data. The MGB test is performed so that groups of ordered data are examined and excluded from the dataset when the critical value is calculated. If the critical value is greater than the smallest value in the example, then all values are determined to be low outliers (Eash and others, 2013); the MGB test can identify low outliers for as much as 50 percent of the annual peak-discharge record. The number of PILFs identified by the MGB test is listed in table 2–1.

Results and Discussion

For most dams in the White, Arkansas, and Red River Basins, with respect to the current regulation plan scenario, the graphical method yielded fitted frequency curves that were superior to the EMA fitted frequency curves. Benches in the frequency curves and high outliers are a better fit using the graphical method (fig. 2–2). The exceptions are Trimble, Dardanelle, and Murray Lock and Dams on the main stem of the Arkansas River; these dams are far downstream from flood control reservoirs (Keystone and Eufaula Lakes) in the Arkansas River Basin in Oklahoma and are designed primarily for navigational purposes and offer little or no flood control; therefore, they do not exhibit distinct benches in the annual peak discharge frequency curve, and the graphical and EMA methods yield similar results for all AEPDs except the $Q_{1\%}$ and $Q_{2\%}$, which are a better fit using the graphical method. Five of 15 dams analyzed (Bull Shoals, Blue Mountain, Nimrod, De Queen, and Dierks Dams) and one RCP (USGS 07063000, Black River at Poplar Bluff, MO) had station skew values outside acceptable limits for EMA analysis (-1.4–1.4) (table 2–1), rendering AEPDs estimated using EMA for these locations questionable at best. The EMA analysis of the current regulation plan scenario was impossible for Clearwater Lake and Gillham Dams because of a lack of variability in the annual peak daily average discharges (table 2–1). For most RCPs, the graphical and EMA methods yielded similar results for the $Q_{50\%}$, $Q_{20\%}$, $Q_{10\%}$, and $Q_{4\%}$ (the 2-, 5-, 10-, and 25-year recurrence intervals, respectively), but differences were noticeably greater for the $Q_{2\%}$ and $Q_{1\%}$ (the 50- and 100-year recurrence intervals, respectively) (table 2–1).

For dams and RCPs in the White River Basin, AEPDs were estimated for annual peak discharges corresponding to the unregulated or “no dam” scenario in RiverWare, and the results were compared with AEPDs corresponding to the current regulation plan scenario and were estimated using the graphical method. An estimated percentage of reduction of the $Q_{1\%}$ (the 100-year flood) was computed as the ratio of the difference between the $Q_{1\%}$ corresponding to the unregulated and current regulation plan scenarios to the $Q_{1\%}$ corresponding to the unregulated scenario, expressed as a percentage (table 2–1). The results indicate that substantial reduction of the $Q_{1\%}$ is provided by dams in the White River Basin. For Clearwater Dam and RCPs on the Black River downstream from the dam, the reduction ranged from 95 percent at the dam (located on the upper Black River in southeastern Missouri) to 31 percent at Poplar Bluff, Mo. (42.4 miles [mi] downstream), to no reduction at Black Rock, Ark. (188.1 mi downstream). For Norfork Dam on the North Fork of the White River, the reduction was 58 percent. For Greers Ferry Dam and one RCP on the Little Red River, the reduction was 83 percent at the dam and 69 percent at Judsonia, Ark. (53.8 mi downstream). For dams on the main stem of the White River, the reductions were 53 percent at Beaver Dam, 58 percent at Table Rock Dam, and 50 percent at Bull Shoals Dam. Reductions at RCPs on the main stem of the White River ranged from a high of 49 percent at Calico Rock, Ark. (62 mi downstream from Bull Shoals Dam and 22.8 mi downstream from Norfork Dam), to a low of 11 percent at Augusta, Ark. (255.5 mi downstream from Bull Shoals Dam).

Accuracy and Limitations

Because of the highly regulated nature of releases from dams in the White, Arkansas, and Red River Basins, and because RiverWare model output was used to compute AEPDs for most dams and RCPs, there are inherent limitations to the applicability of the results. The AEPDs are not transferrable to other locations in the respective river basins by a drainage area ratio or other means and are subject to revision as more annual peak-discharge data become available and changes are made to the regulation plans or RiverWare models. Estimates of percentage of reduction of the $Q_{1\%}$ at dams and RCPs in the White River Basin are provided for comparison between locations in the basin and do not indicate an exact amount of flood reduction at any location for any given flood event. The magnitude of flooding experienced during a particular flood event at a given location in the White River Basin is affected by numerous factors, including, but not limited to the areal extent and intensity of precipitation, antecedent pool elevations in the various reservoirs in the basin, antecedent flow conditions in contributing or intervening unregulated tributaries, and seasonal pool elevations or other variable seasonal regulation factors.

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Appendix 3. Description of Basin Characteristics Measured for Use in Regional Regression Analysis (modified from Breaker, 2015)

Physical Characteristics

Basin perimeter distance (PERIMMI) in miles, is the distance around the boundary of the basin.

Basin shape factor (BSHAPE) dimensionless, is the ratio of the square of the basin length (LFPLENGTH) to the total drainage area of the basin (DRNAREA).

Drainage area (DRNAREA) in square miles, is the area measured in a horizontal plane that is enclosed by a drainage divide.

Longest flow path length (LFPLENGTH), in miles, is the maximum flow distance within a basin from the start of overland flow to the outlet.

Maximum basin elevation (ELEVMAX) in feet, is the maximum elevation of the basin computed from the National Elevation Dataset (Gesch and others, 2009) 10 meter grid.

Minimum basin elevation (MINBELEV) in feet, is the minimum elevation of the basin computed from the National Elevation Dataset (Gesch and others, 2009) 10 meter grid.

Mean basin elevation (ELEV) in feet, is the average elevation of the basin as determined from the National Elevation Dataset (Gesch and others, 2009) 10 meter grid.

Outlet elevation (OUTLETELEV) in feet, is the elevation at the gage location computed from the National Elevation Dataset (Gesch and others, 2009) 10 meter grid.

Relief (RELIEF) in feet, is the maximum basin elevation minus the minimum basin elevation computed from the National Elevation Dataset (Gesch and others, 2009) 10 meter grid.

Relative Relief (RELRELF) in feet per mile, is the ratio of the relief of a drainage basin to its perimeter.

Slope (SLPFM) in feet per mile, is the change in elevation between points at the beginning and end of the longest flow path through the basin.

Slope 1085 (CSL1085FM) in feet per mile, is the stream slope computed as the change in elevation between points at 10 and 85 percent of length along the longest flow path from the outlet, determined by geographic information system (GIS), divided by length between the points.

Land-Use/Land-Cover Characteristics

The following characteristics were calculated from the 2011 National Land Cover Database (Homer and others, 2015; see also http://www.mrlc.gov/nlcd11_leg.php).

Percent deciduous forest (LC11DECID) Percentage of a basin dominated by areas where trees generally greater than 5 meters tall account for greater than 20 percent of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

Percent evergreen forest (LC11EVERG) Percentage of a basin dominated by areas where trees generally greater than 5 meters tall account for greater than 20 percent of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

Percent open development (LC11DVOPN) Percentage of a basin dominated by areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes.

Percent low development (LC11DVLO) Percentage of a basin dominated by areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20 to 49 percent of total cover. These areas most commonly include single-family housing units.

Percent medium development (LC11DVMD) Percentage of a basin dominated by areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover. These areas most commonly include single-family housing units.

Percent high development (LC11DEVHI) Percentage of a basin dominated by highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial. Impervious surfaces account for 80 to 100 percent of the total cover.

Percent impervious surface (LC11IMP) Percentage of a basin that is covered by impervious material.

Percent open water (LC11WATER): Percentage of a basin dominated by areas of open water, generally with less than 25 percent cover of vegetation or soil.

Percent wet woodland vegetation (LC11WDWET) Percentage of a basin covered in areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Percent barren land (LC11BARE) Percentage of a basin covered in areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Vegetation generally accounts for less than 15 percent of total cover.

Percent shrub/scrub (LC11SHRUB) Percentage of a basin dominated by areas of shrubs; less than 5 meters tall with shrub canopy typically greater than 20 percent of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

Percent grassland/herbaceous (LC11HERB) Percentage of a basin dominated by gramanoid or herbaceous vegetation, generally greater than 80 percent of total vegetation. These areas are not subject to intensive management such as tilling but can be utilized for grazing.

Percent pasture/hay (LC11PAST) Percentage of a basin dominated by areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

Percent cultivated crops (LC11CROP) Percentage of a basin dominated by areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This classification also includes all land being actively tilled.

Percent emergent herbaceous wetlands (LC11AEMWET) Percentage of a basin dominated by areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

Surficial Geology Characteristics

Percent Cretaceous (K) Percentage of a basin in which Cretaceous sedimentary rocks dominate the surface of the basin as computed from GIS grid data created by Reed and Bush (2005).

Percent lower Paleozoic (lPz) Percentage of the basin in which lower Paleozoic sedimentary rocks dominate the surface of the basin as computed from GIS grid data created by Reed and Bush (2005).

Percent middle Paleozoic (mPz) Percentage of the basin in which Middle Paleozoic sedimentary rocks dominate the surface of the basin as computed from GIS grid data created by Reed and Bush (2005).

Percent Ordovician and Mississippian Percentage of the basin in which Mississippian and Ordovician-age rocks dominate the surface of the basin as computed from GIS grid data from Haley and others (1993).

Percent Paleogene (pgT) Percentage of the basin in which Paleogene sedimentary rocks dominate the surface of the basin as computed from GIS grid data created by Reed and Bush (2005).

Percent Quaternary (ALVM) Percentage of the basin in which Quaternary deposits dominate the surface of the basin as computed from GIS grid data created by Reed and Bush (2005).

Percent upper Paleozoic (UPZ) Percentage of the basin in which upper Paleozoic sedimentary rocks dominate the surface of the basin as computed from GIS grid data created by Reed and Bush (2005).

Percent Middle Proterozoic (Yv) Percentage of the basin in which Middle Proterozoic volcanic rocks dominate the surface of the basin as computed from GIS grid data created by Reed and Bush (2005).

Soil Characteristics

Soil hydrologic group (SOILINDEX) dimensionless, percentage of drainage basin in hydrologic soil group as computed from STATe Soil GeOgraphic (STATSGO) grid data (Schwarz and Alexander, 1995; U.S. Department of Agriculture, 2001).

Climatic Characteristics

Mean annual precipitation 1971–2000 (PRECIP) in inches, is the average annual precipitation for the basin as determined from PRISM (PRISM Climate Group, 2013) data for 1971–2000.

November–April precipitation 1961–1990 (PRENOVAPR) in inches, is the total precipitation for the basin during the months of November–April determined from PRISM (PRISM Climate Group, 2013) data for 1961–1990.

24-hour duration, 10-year recurrence interval precipitation (I24H10Y) in inches, is averaged by basin using the annual maximum series of the National Oceanic Atmospheric Administration (NOAA) Atlas 14 Precipitation Frequency Estimates (National Oceanic Atmospheric Administration, 2014), a mosaic of volumes 8 (Midwestern States) and 9 (Southeastern States) of Atlas 14.

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