In cooperation with the Texas Department of Transportation

Effects of Regulation on L-moments of Annual Peak Streamflow in Texas

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16. Abstract

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For this report, the State was divided into three regions. Four regression equations to estimate the L-moments of natural annual peak-streamflow data for ungaged sites were derived for each region from data for 367 streamflow-gaging stations in natural basins. The explanatory variables in the equations are contributing drainage area, basin shape factor, and stream slope.

The effects of regulation on the L-moments of annual peak-streamflow data were determined by analysis of maximum and normal storage-capacity data from reservoirs for 96 streamflow-gaging stations in variously regulated basins. The results indicate that as potential flood storage (defined by the difference between total maximum and normal capacity) in a basin increases, the mean annual peak streamflow decreases nonlinearly. Evidence strongly indicates (despite contrary expectation) that the higher L-moments (coefficient of L-variation, L-skew, and L-kurtosis) are unaffected by regulation.

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U.S. GEOLOGICAL SURVEY
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Abstract

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INTRODUCTION

Estimates of peak-streamflow frequency are useful for flood-plain management, for objective assessment of flood risk, and for cost-effective design of hydraulic structures. Peak-streamflow frequency refers to peak streamflows that have recurrence intervals of 2, 5, 10, 25, 50, 100, 250, and 500 years. Several techniques exist to estimate peak-streamflow frequency for gaged and ungaged stream sites in natural (unregulated) watersheds (basins) in Texas (Asquith and Slade, 1997, 1999). Although such techniques are sometimes applicable for gaged sites, the techniques are of questionable applicability for ungaged stream sites whose watersheds are affected by human-produced regulation, principally through the construction of dams. To address this situation, the U.S. Geological Survey (USGS), in cooperation with the Texas Department of Transportation (TxDOT), in 1998 began an investigation of flood characteristics as expressed by the L-moments of annual peak streamflow in regulated basins in Texas.

Historically, a natural basin in Texas has been defined by the USGS as a basin with less than 10-percent impervious cover, less than 10 percent of its drainage area controlled by reservoirs, and no other human-related factors that would affect peak streamflow. Impervious cover is not a consideration for this report. At present (2001), the degree of actual control (regulation) in a given part of a basin is assessed by USGS personnel on a more qualitative than quantitative basis. A regulated basin thus was initially identified for this investigation as a basin for which 10 percent or more of the drainage area of the basin is affected or controlled by reservoirs. In some other states the USGS uses a 10-percent change in the annual peak streamflow to define a regulated basin. Benson (1962, 1964) determined that about 100 acre-feet per square mile (acre-ft/mi^2) of flood storage in the drainage area reduces the annual peak streamflow by about 10 percent in humid areas, and that about 50 acre-ft/mi^2 of flood storage reduces the annual peak streamflow by about 10 percent in arid areas.

The criterion of 10 percent or more of the drainage area controlled by reservoirs was used as a starting point for the investigation. Such a simple classification scheme, though easy to implement in practice, is fraught with problems. Regulation in reality encompasses a wide spectrum of human influences on annual peak streamflow. For example, a specific reservoir or suite of reservoirs might dramatically alter low flows and mid-range flows but leave higher flows, such as the annual peaks, largely unaffected. Appreciable effort was spent during the course of the investigation to scientifically and statistically differentiate between the various degrees of regulation on annual peak streamflow in a given basin without regard to how regulation might influence other flows. In this report, "regulated" and its variants refer to the entire spectrum of human influence on peak streamflow, and "natural" refers to the unregulated end-member of the regulation spectrum. It is unknown whether the unregulated end-member fully applies for basins considered in this investigation because of widespread modification of watershed hydrology by dams throughout Texas.

To clarify, the popular binary designation of a watershed as either natural or regulated is not sufficient to accurately express the degree of regulation because of the presence of complex arrangements of flow-altering structures in the majority of basins across the entire range of drainage areas in Texas. Such structures include contour-plowing of agricultural lands for erosion control and enhanced water retention, bulldozed earthen embankments on the smallest of usually dry tributaries forming "Texas stock tanks," low-head dams built nearly as high as the tops of stream banks, small floodwater-retarding structures, constant-level recreational and water-supply reservoirs, and colossal flood-control reservoirs on many of the rivers in Texas.

The USGS, in cooperation with TxDOT, has comprehensively researched peak-streamflow frequency for streams having natural basins defined by the 10-percent controlled drainage area criterion in Texas (Asquith and Slade, 1995, 1997, 1999; Judd and others, 1996; and Slade and Asquith, 1996). During these natural peak-streamflow investigations, procedures were developed to estimate the 2-, 5-, 10-, 25-, 50-, and 100-year recurrence interval peak streamflow. Two dominant limitations of the natural peak-streamflow investigations are: (1) The USGS streamflow-gaging network in Texas lacks sufficient representation for small drainage basins (less than about 50 square miles [mi^2]), resulting in considerable potential error in peak-streamflow frequency estimates for small basins; and (2) many of the moderate-to-large watersheds in Texas (greater than about 200 mi^2) are controlled or regulated to variable extents by dams, flood-detention structures, and flood-retention structures. Therefore, the peak-streamflow data from many stations were excluded from the natural peak-streamflow investigations, and the applicability of resulting peak-streamflow frequency estimation procedures to natural basins is limited.

To address the first limitation of the investigations, the USGS, in cooperation with TxDOT, comprehensively researched heavy precipitation in Texas, including the depths for various durations and recurrence intervals or recurrence periods (Asquith, 1998a, 1999; Asquith and Famiglietti, 2000; and Lanning-Rush and others, 1998). Precipitation characteristics can be used, with appropriate statistical or simulation models, to estimate peak-streamflow characteristics for streams in small watersheds. The investigation of flooding characteristics for regulated basins in Texas presented in this report addresses the second limitation of the natural peak-streamflow investigations.

Peak streamflow in regulated basins is affected by runoff from the unregulated part of the basin and by runoff from the regulated part of the basin. The regulated runoff is affected by discharges from dams or reservoirs and by the quantity, type, and spatial distribution of flood-detention or flood-retention structures, commonly termed "small floodwater-retarding structures." Small floodwater-retarding structures is a broad term and includes all identified small-to-moderate-size dams in Texas whether or not the original purpose for their construction was flood control. Peak streamflows from reservoirs represent controlled discharges (releases) and uncontrolled discharges through pipes, spillways, or other structures. Controlled releases often are dictated by flood-management practices and water-supply concerns, which might have opposing objectives. There are more than 200 major reservoirs in Texas—those having maximum storage capacities in excess of 10,000 acre-feet (acre-ft). This total also includes a few off-channel and diversion-oriented reservoirs.

The characteristics of regulated basins are difficult to assess and incorporate into procedures for peak-streamflow frequency estimation because of the inherent difficulties in quantifying the aggregate influence of all controls in a given basin. The effect of reservoirs on downstream peak streamflow can range from negligible to the complete suppression of the flood hydrograph; also, reservoir releases can artificially create flood-like hydrographs. Reservoir influence varies for the same reservoir or for a suite of reservoirs because of factors including storage conditions at the time of a flood, management decisions (if applicable) regarding reservoir operation, and magnitude and timing of peaks from the unregulated part of the basin. Thorough consideration of these factors, often in conjunction with streamflow-routing models, is required for the most accurate estimates of peak-streamflow frequency. Investigations encompassing the variety of possible reservoir influences are expensive. Also such investigations would be limited to watersheds that have a sufficient record of unregulated peak streamflow upstream from or coincident with a reservoir site, definable operating rules for the reservoir, and repetitive management practices. In such cases, the unregulated record can be converted to regulated record using hydraulic routing. This method commonly is used by the U.S. Army Corps of Engineers and others. Unfortunately, few basins have all the required data. As a result, an alternative approach was developed that uses readily available data.

Purpose and Scope

The purpose of this report is to document, quantify, and predict effects of regulation on annual peak streamflow in Texas through analysis of the changes in the L-moment statistics of the annual peak streamflow. The data for the study were limited to the USGS peak-streamflow database in Texas and related basin characteristics and limited to the Texas Natural Resource Conservation Commission (TNRCC) inventory of dams. The inventory of dams was acquired by the USGS in September 1997.

U.S. Geological Survey Streamflow Data

Streamflow statistics from the USGS database of annual peak-streamflow data of natural basins (10-percent or less controlled drainage area) are used in later sections of this report. The 367 stations in natural basins identified for this report have an average record length of about 30 years. The stations all have at least 10 or more years of natural annual peak-streamflow data through 1997, are part of the Texas streamflow-gaging network, and are a subset of the natural stations used by Asquith and Slade (1997). The 367-station subset was chosen because about 190 of the approximately 560 stations identified by Asquith and Slade (1997) have less than 10 years of data and typically are in very small watersheds (less than about 10 mi^2). These small watersheds have very short record, often have relatively more error in the basin characteristic estimates, and the stage-discharge relation for the station often is theoretical (R.M. Slade, Jr., U.S. Geological Survey, oral commun., 2000). One station, 07300500 Salt Fork Red River at Mangum, Okla. (not part of the Texas network), was included because it has more than 60 years of peak-streamflow data and is located near a part of Texas where data are sparse.

The locations of the natural stations are shown on plate 1 and in figure 1. The stations are identified in table 1 (at end of report) along with pertinent streamflow statistics that are discussed in later sections of this report. Also shown on plate 1 and in figure 1 is a three-region delineation of Texas. These regions (northeast, southeast, and west) were selected on the basis of regional boundaries used by Asquith and Slade (1995, 1997), consideration of reservoir density, and (most importantly) density and locations of regulated streamflow-gaging stations. The regions are used in analyses discussed in later sections of this report titled, “Estimating L-moments of Natural Annual Peak Streamflow” and “Quantifying Regulation Effects on L-moments of Natural Annual Peak Streamflow.”

The USGS database of annual peak-streamflow data also contains about 330 stations on regulated streams with an average record length of about 26 years. “Regulated” at this point in the report continues to refer to the historical 10-percent controlled drainage area criterion. Numerous USGS stations have both natural and regulated record. About 192 stations have 10 or more years of regulated record through 1997. The average period of record for these stations is about 28 years. However, only 96 stations, which are a subset of the 192 regulated stations, were suitable for study—details are provided in later sections of this report. The mean period of regulated record for the 96 regulated stations is about 34 years. The locations of the 96 regulated stations are shown on plate 1 and in figure 2. These stations (listed in table 2, at end of report, along with pertinent streamflow statistics and discussed in later sections of this report) are located in every major river basin in

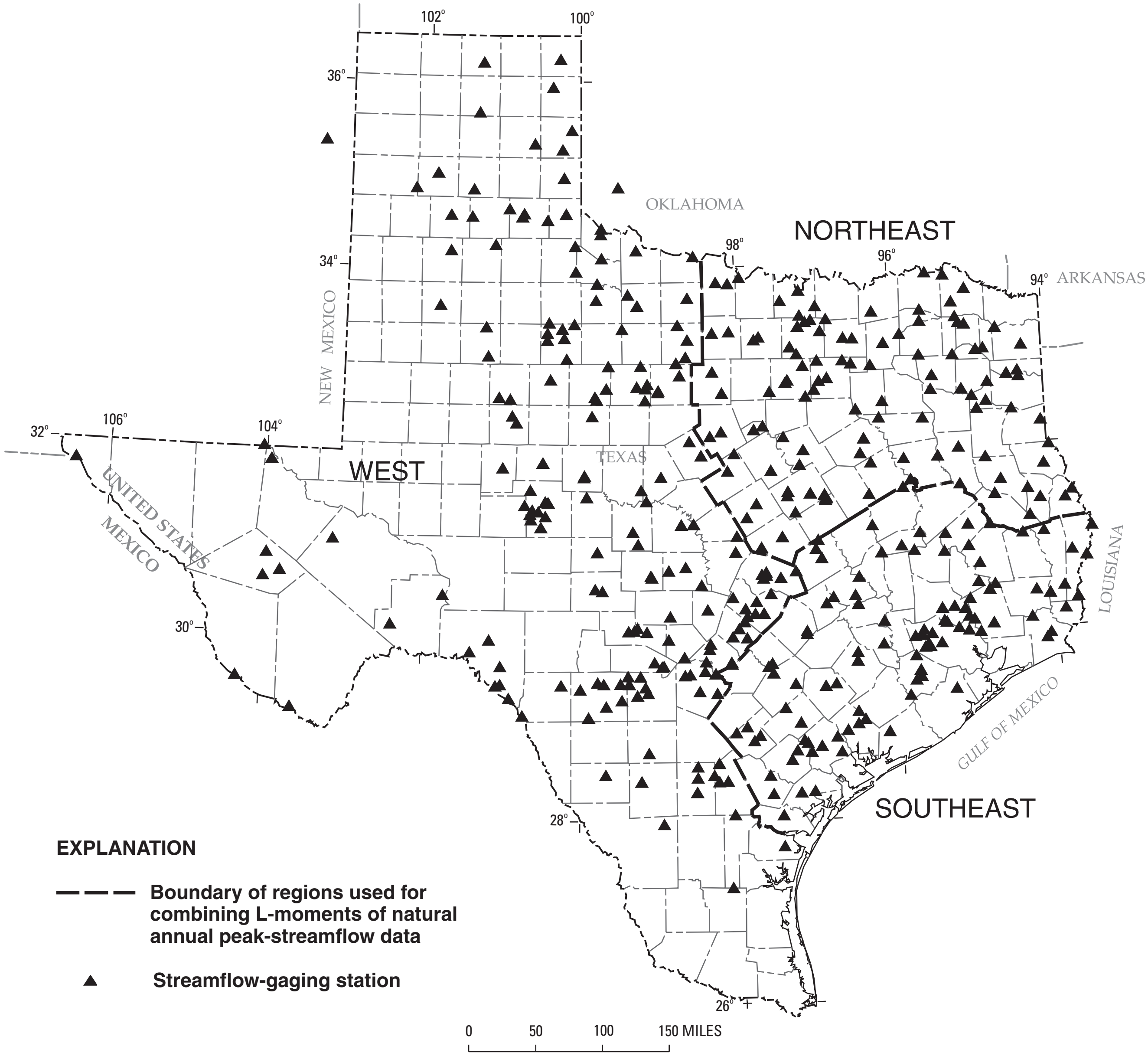

Figure 1. Location of 367 streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion).

Texas and are distributed around the State. Because the data for these stations represent the combined influence or synthesis of the reservoir effects (regulation) and unmodified runoff from natural areas, the database can be used to assess regulated peak-streamflow frequency throughout much of the State.

Three physical basin characteristics were selected for the investigation: contributing drainage area, basin shape factor, and stream slope. The same basin characteristics were used by Asquith and Slade (1997). The contributing drainage area is expressed in square miles. The stream length for stream slope and basin shape factor computation is defined from the *longest mapped channel* from the station to the headwaters, on the basis of quadrangle maps prepared by the USGS (scale, 1:100,000). The basin shape factor is the ratio of the stream length to the contributing drainage area, which mathematically represents the square of the ratio of the longest stream length to the mean width of the basin. The basin shape factor is dimensionless. The stream

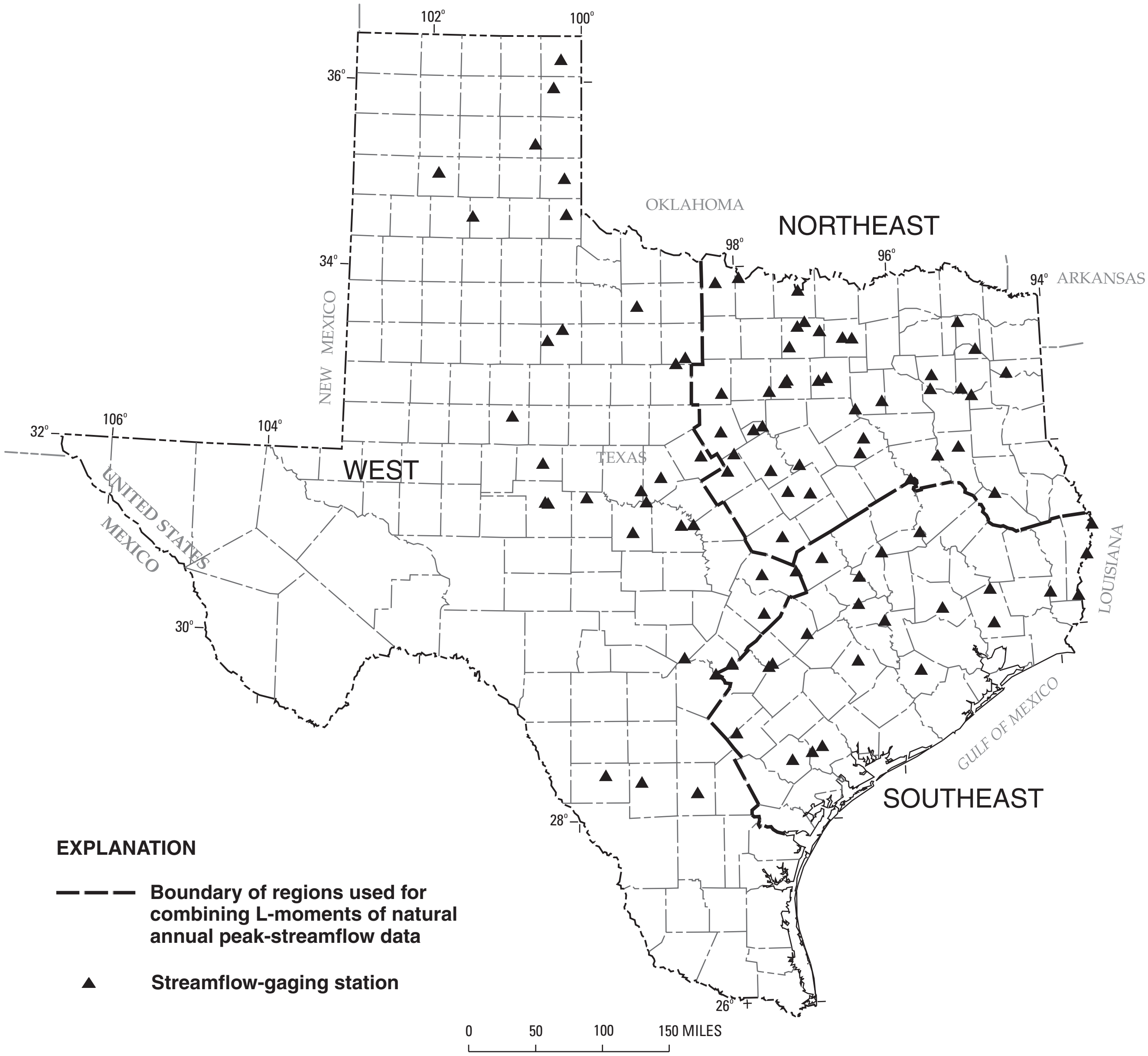

Figure 2. Location of 96 streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion) that have static periods of regulation suitable for comparative analysis.

slope, expressed in feet per mile, is the ratio of the difference in elevation of the longest mapped channel between the station and the headwaters to the length of the longest mapped channel.

Texas Natural Resource Conservation Commission Inventory of Dams

Another database pertinent to this investigation is maintained by the TNRCC; this database contains about 50 characteristics for each permitted dam in Texas. Some of the pertinent characteristics and the primary ones used for this report include:

Dam number—The TNRCC Dam Safety Team seven-character identification number.

Dam name—The official or most widely recognized name of the dam. The dam name is not necessarily the same as, or related to, the name of the impounded reservoir. These names can change with time.

Reservoir name—The official or most widely recognized name of the reservoir.

Latitude and longitude—Latitude and longitude of the dam at its maximum section.

County—Name of the county where the dam is located.

Dam purpose—The purpose for which the reservoir is used. Some examples are water supply, domestic and livestock, irrigation, recreation, flood control, and fish and wildlife. For purposes of this study only dams having a flood-control purpose are separately identified; all others are lumped as non-flood control.

Year completed—The year that the original main dam structure was completed, which can have little relation to the year that the reservoir was initially filled.

Maximum capacity—The maximum capacity of the reservoir, which is defined as the total storage space in a reservoir below the maximum attainable water-surface elevation, rounded to the nearest whole acre-foot.

Normal capacity—The normal capacity of the reservoir, which is defined as the total storage space in a reservoir below the normal retention level or the lowest ungaged/ungated outlet (normal water level), rounded to the nearest whole acre-foot.

Surface area—The surface area of the reservoir at its normal retention level, in acres.

Drainage area—The contributing drainage area of the watershed upstream of the dam, in square miles.

The total number of dams in the inventory exceeds 7,300. Not all the data fields pertinent to this study were complete; for example latitude, longitude, and other important information might be missing. Excluding dams with extensive missing data resulted in 7,035 dams included in the database for this study. As part of the preparation of the dam database, it was determined that 17 of the 7,035 dams had incorrect latitude and longitude; these values were easily revised. The locations of the 7,035 dams are shown on plate 2; the dams are differentiated on the basis of maximum capacity (greater than or less than 10,000 acre-ft) and on whether flood control is one of the purposes for the dam.

A check to determine whether each of the 7,035 dams plotted on a map within its identified county indicated that only 59 dams were not in the identified county. Incorrectly located dams represent a very small fraction of the total number of dams, and associated capacities also were a very small fraction of the total storage and surface area values for the State. For example, the mean maximum capacity of the incorrectly located dams is 631 acre-ft—a very small amount. The locations of the 59 dams could not be easily corrected and were not corrected for this study.

For a small number of dams, the fields for maximum capacity and normal capacity are missing or zero. For a moderate number of dams, the surface area and drainage area are missing or zero. These missing values computationally were considered as zero—it was preferable to leave a dam in the analysis when at least one of either maximum or normal capacity, or surface area, was greater than zero. Of the 7,035 dams, 237 have missing maximum capacity, 113 have missing normal capacity, and 2,324 have missing surface area. The statewide total maximum capacity is about 98.6 million acre-ft, total normal capacity is about 41.5 million acre-ft, and total surface area is about 1.25 million acres. The statewide totals are all underestimated because of missing data. The total surface area is the most underestimated. Reservoir surface area is not considered further in this report.

Finally, 217 dams have maximum capacities exceeding 10,000 acre-ft. These are referred to as "large" dams. Because this very small subset of dams has a disproportionate influence on streamflow, particular care was taken to verify the data fields. The large dams and their ancillary information are listed in table 3 (at end of report). A questionnaire was mailed to the owner/operator of each large dam in August 1998 to verify, update, or correct the information contained in the TNRCC inventory of dams. A summary of the results of the questionnaire is listed in table 3. The database for this study was revised, but the source TNRCC dam database was not revised using the revisions prior to the completion of this study.

Approach

The basic approach for the study is outlined below. Further details are provided throughout the remainder of the report.

1. *Estimate L-moments of natural annual peak streamflow*—A standard regional regression technique, following the model of Asquith and Slade (1997), was used to develop equations from the 367 streamflow-gaging stations in natural basins to estimate the L-moments of natural annual peak streamflow for ungaged sites. L-moment statistics are introduced later in the

section titled "Peak-Streamflow Frequency Analysis." Separate equations were developed for the northeast, southeast, and west regions previously identified (pls. 1, 2; figs. 1, 2).

2. *Quantify regulation effects on L-moments of annual peak streamflow*—The effects of regulation on L-moments of natural annual peak streamflow were assessed by comparison of changes in L-moments to changes in regulation—that is, changes in upstream dam (reservoir) statistics—for 96 selected regulated streamflow-gaging stations. The changes in regulation were determined between consecutive static (unchanging) or acceptably static (minimally changing) time periods of dam influence.
3. *Adjust L-moments of natural annual peak streamflow for regulation*—Apply the results of step 2 to adjust L-moments estimated from step 1 for the estimated effects of regulation.

STUDY METHODS

This section outlines the four themes of analysis used. The themes are the statistical methods used to perform peak-streamflow frequency analysis, the variables representing regulation, the use of comparisons of annual peak streamflow for consecutive static or minimally changing periods of regulation, and the statistical method used in the analysis of trends in annual peak streamflow between static periods of regulation.

Peak-Streamflow Frequency Analysis

It has long been recognized that accurately estimating the magnitude and frequency of extreme hydrologic phenomena, such as peak-streamflow frequency, is difficult. The principal difficulty is that datasets generally are much shorter than the recurrence intervals (frequency) required by the objectives of a study. Quantile estimates (such as the 99-percent nonexceedance or 100-year flood) for large recurrence intervals commonly cannot be derived directly from the data. Thus, it is necessary to rely on a parametric probability distribution, which, when fitted to the data at the station, provides extrapolation to large recurrence intervals. A parametric probability distribution is exactly defined by a specified number of parameters—the number of parameters depends on the particular distribution. A probability distribution is fitted to the data by equating the moments of the data to the theoretical moments of a distribution, which in turn provides estimates of the parameters. The quantile accuracy of a particular distribution is directly related to the accuracy of the parameter estimates. Parameter accuracy in turn is directly related to the accuracy of the moment estimates. The identification of a suitable statistical distribution for estimating the peak-streamflow frequency is important. A comprehensive investigation of suitable distributions for Texas annual peak streamflow is beyond the scope of this report. However, some discussion of a candidate distribution is provided.

A fundamental element of a peak-streamflow frequency analysis is the statistical summarization of the recorded annual peak streamflow for a particular station. Traditionally, the peak-streamflow data have been statistically summarized by the product moments of the data (arithmetic mean, standard deviation or variance, skew, and kurtosis). The mathematical definitions of the product moments are widely known and require no formal definition here. However, these statistics are not always satisfactory for environmental datasets such as annual peak streamflow because the sample estimates of those statistics often exhibit large bias and sampling variance (Kirby, 1974; Wallis and others, 1974). To mitigate these problems, for this study, L-moment statistics, or L-moments, were used to summarize the data for each station (Stedinger and others, 1993). L-moments have many advantages over the product moments. Specifically, L-moments are less sensitive to the presence of outliers in the data, exhibit less bias, are more accurate in small samples, and do not require logarithmic transformation of the data for peak-streamflow frequency application. Hosking (1990) provides the definitive work on L-moment statistics. Hosking and Wallis (1997) provide the definitive work on application of L-moments for frequency analysis, including peak-streamflow frequency. L-moments are a relatively new development in the statistical sciences, thus a formal definition is provided here:

If $X_1, X_2, \ldots, X_n$ are n independent and identically distributed continuous random variables having a cumulative distribution function $F(x)$, then the ordered values $X_{1:n} \leq X_{2:n} \leq \ldots \leq X_{n:n}$ are known as the order statistics (David, 1981) of the random sample X_1, X_2, $\ldots$, X_n. Clarification of the $X_{j:n}$ notation might be needed: n represents the sample size, and j represents the sequence order of a given sample when the entire sample is sorted in ascending order. The theoretical expectation of the jth order statistic from a sample of size n can be expressed in terms of the inverse cumulative distribution of $F(x)$, $x(F)$, as:

$$E[X_{j:\mathrm{n}}] = \frac{n!}{(j-1)!(n-j)!} \int_0^1 x(F)^{j-1}(1-F)^{n-j} dF. \quad (1)$$

In equation 1, the inverse cumulative distribution function is substituted for x. By taking linear combinations of the order statistic expectations, the L-moments are derived from the following equation:

$$\lambda_{r+1} = \frac{1}{r+1} \sum_{k=0}^{r} (-1)^k \binom{r}{k} E[X_{(r-k+1):(r+1)}]. \quad (2)$$

From equation 2, the first four L-moments (λ_r) are defined as:

$$\lambda_1 = E[X_{1:1}]; \quad (3)$$

$$\lambda_2 = \frac{1}{2}\{E[X_{2:2}] - E[X_{1:2}]\}; \quad (4)$$

$$\lambda_3 = \frac{1}{3}\{E[X_{3:3}] - 2E[X_{2:3}] + E[X_{1:3}]\}; \text{ and} \quad (5)$$

$$\lambda_4 = \frac{1}{4}\{E[X_{4:4}] - 3(E[X_{3:4}] + 3E[Q_{2:4}] - E[Q_{1:4}]\}. \quad (6)$$

The first L-moment is simply the mean. The second L-moment is one-half the expected difference between two randomly drawn samples, which measures dispersion of the data similar to the standard deviation. A very important property of the L-moment is that the first four L-moments can be formulated into values that are analogous—that is, they can be interpreted similarly—to the first four product moments. Summary L-moments of a sample are defined by the following:

$$\lambda_1 \equiv \text{mean}; \quad \lambda_2 \equiv \text{L-scale};$$
$$\tau_2 = \frac{\lambda_2}{\lambda_1} \equiv \text{coefficient of L-variation (L–CV)};$$
$$\tau_3 = \frac{\lambda_3}{\lambda_2} \equiv \text{L-skew; and } \tau_4 = \frac{\lambda_4}{\lambda_2} \equiv \text{L-kurtosis.} \quad (7)$$

The τ_2 (often shown in the literature as just τ), τ_3, and τ_4 statistics are sometimes known as the "L-moment ratios," but for brevity here they are referred to as "L-moments."

The theoretical L-moments of a distribution with an expressible known inverse cumulative distribution, are calculated from:

$$\lambda_{r+1} = \int_0^1 x \left\{ \sum_{k=0}^{r} (-1)^{r-k} \binom{r}{k} \binom{r+k}{k} F^k \right\} dF. \quad (8)$$

In equation 8, $x(F)$ is substituted for x.

To fit a distribution to data that have been summarized by L-moments, the L-moments of the data are equated to the theoretical L-moments of a probability distribution. Numerous distributions are compatible with L-moment theory such as the three-parameter generalized extreme value, generalized Pareto, Pearson Type III distributions, and four-parameter kappa distribution. The kappa distribution is a potentially attractive model for Texas annual peak-streamflow magnitude and frequency. Because the kappa distribution has four parameters instead of the usual three parameters common in distributions used in frequency analysis (for example, Asquith, 1998a; Interagency Advisory Committee on Water Data, 1982), it is a more flexible distribution and is therefore better able to model the distribution of annual peak streamflow for a station.

The flexibility of the kappa distribution is an important issue. The shapes of the distributions of regulated peak streamflow vary widely from site to site and often are quite different from those distributions suggested by experience or extreme-value theory in natural basins. The author did much exploratory research using the widely accepted technique of L-moment ratio diagrams (Vogel and Fennessey, 1993) and found that, on the diagrams, the regulated peak streamflow τ_3 and τ_4 pairs typically varied from the 3-parameter generalized Pareto distribution to above the 3-parameter generalized logistic distribution. The 4-parameter kappa distribution is capable of assuming the shape of either of these distributions and the solution space between them. The kappa does not have a solution above the generalized logistic distribution—this fact has important ramifications on the analysis. The additional flexibility of the kappa distribution comes at the sometimes substantial cost of having to estimate a fourth parameter, which usually cannot be done reliably with single-station data. Therefore, a regionalization technique that pools or combines annual peak-streamflow data from numerous stations should be used to estimate the L-moments.

The kappa distribution is well documented by Hosking (1994) and Hosking and Wallis (1997, p. 202–204). The kappa distribution has the following form

$$Q(T) = \xi + \frac{\alpha}{\kappa}\left\{1 - \left[\frac{1-F^h}{h}\right]^{\kappa}\right\}, \tag{9}$$

where

$Q(T)$ = T-year peak streamflow associated with nonexceedance probability,

F = $1 - 1/T$, and

ξ, α, κ, h = location, scale, shape 1, and shape 2 parameters of the kappa distribution.

Hosking (1996) provides Fortran algorithms to facilitate parameter estimation using the L-moments for numerous distributions including the kappa. These algorithms could be used to make estimates of peak-streamflow frequency.

Variables Representing Regulation

Numerous characteristics or variables directly affect the degree of regulation of annual peak streamflow in a given basin. Other variables indirectly affect the degree of regulation, and others are useful surrogates for indeterminable variables. Some variables directly affecting the degree of regulation include the presence of active flood-control dams (such as TX01087 Mansfield Dam, Austin, Tex., which impounds Lake Travis), the fraction of total basin drainage area that is controlled, the flood-storage capacity of dams in the basin, and management practices if applicable. Some variables indirectly affecting the degree of regulation include the spatial distribution of passive flood control (such as small floodwater-retarding structures), the proximity of active flood control to the outlet or given stream site of the basin (amount of intervening unregulated drainage area), and the meteorological mechanisms that generate floods.

Meteorological mechanisms that generate floods include the duration, intensity, and areal extent of storms. Because of the sometimes incredibly intense and areally restricted nature of storms in Texas (Asquith, 1998a, 1999), even small unregulated areas of otherwise regulated basins can produce peak streamflow of approximately natural proportions and recurrence intervals. Use of all the identified variables is outside the scope of this investigation, even if some could be reliably quantified. Therefore, this investigation relied on variables available from the TNRCC inventory of dams to assess the effects of regulation on annual peak streamflow.

Three of the variables available from the inventory of dams are maximum capacity, normal capacity, and reservoir surface area. A fourth variable computed for this investigation is the difference between maximum capacity and normal capacity. This variable is a surrogate for the *potential flood storage* of a dam. Potential flood storage is a hypothetical value and therefore is only a rough estimate of the total flood-controlling capacity in a watershed. The differences between maximum and normal capacity likely underestimate the potential flood storage for reservoirs in western parts of Texas. Western reservoirs often operate below normal capacity. Complicating matters further, regulation has universally increased since the beginning of recorded Texas history, and each watershed has a unique history and extent of dam construction. Therefore, only static time periods of dam influence are suitable for analysis.

Comparison of Annual Peak Streamflow for Static Periods of Regulation

Not all of the 192 stations in Texas that have 10 or more years of regulated record are suitable for the extended statistical analysis required to meet the objectives of this investigation. The regulated stations that are most pertinent for this investigation are those with periods of record that have two or more consecutive static or minimally changing periods of regulation. Of the 192 stations, 96 were identified as meeting this criterion. For each of the 192 original regulated stations, a time series of cumulative changes in the maximum capacity, normal capacity, and reservoir surface area was generated. An example time series for station 08136500 Concho River at Paint Rock, Tex. (see table 2) is shown in figure 3. The changes in regulation for a particular station are not always as distinct as those shown for the Concho River at Paint Rock. For many regulated stations, less abrupt or gradual changes in regulation have occurred. Stations with gradual changes in regulation (judged subjectively) were not used.

The period of annual peak-streamflow record for the Paint Rock station, 1916–97, is indicated in the bottom graph of figure 3. The record for the station was designated as regulated (beginning in 1931) by the 10-percent criterion because of the construction of Nasworthy Dam (TX03139), which was built in about 1930. Three static periods of regulation are identified

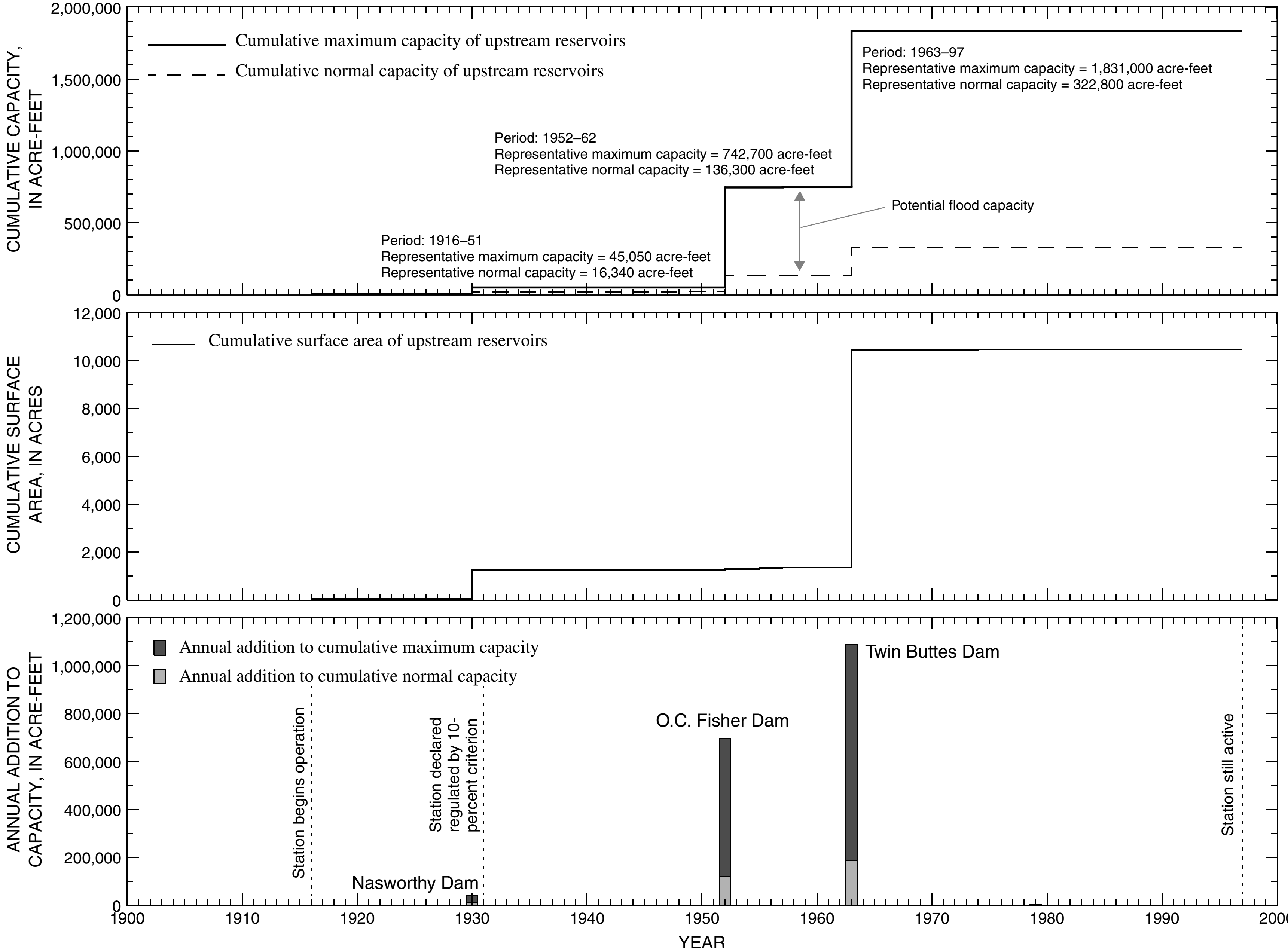

Figure 3. Example of time series of cumulative changes in regulation for station 08136500 Concho River at Paint Rock, Texas.

(1916–51, 1952–1962, and 1963–97). It was decided, through exploratory analysis of peak-streamflow data for this station and for several others throughout the State, that the original 10-percent criterion defining regulation is probably too small to identify changes due to regulation. Preliminary analysis indicated that Nasworthy Dam did not appreciably affect annual peak streamflow for the station. Hence, the periods 1916–30 and 1931–1951 were combined. A similar combining of record was done for some of the 95 remaining regulated stations. (Such combining of record was *not* done for the natural peak-streamflow frequency analysis, which relied entirely on the 10-percent controlled drainage area criterion, in the section, "Estimating L-moments of Natural Annual Peak Streamflow.") It was assumed that the representative maximum and normal capacities shown in figure 3 are representative of the respective static periods. The representative maximum and normal capacities were almost always the average or near average values for the time period as dictated by the temporal distribution of dam construction and availability of peak-streamflow data.

The example cumulative regulation time series shown in figure 3 also has the station record identified. For the Paint Rock station, there are three static periods. A requirement for a station to be suitable for analysis is that the length of each static period is sufficiently long for reliable statistical analysis. This requirement improves the accuracy of comparisons of statistics of two consecutive periods. The static periods were arbitrarily designated on the basis of hydrologic judgment and comparison to nearby stations. Considerable attention was given to the selection of static periods. A representative maximum capacity and normal capacity for each period was determined. Preliminary analysis indicated that surface area of the reservoir at normal capacity provided no additional information about the effects of regulation and therefore is excluded from the remainder of this report. The 96 selected stations, the associated static periods, and maximum and normal capacities are listed in table 2.

The most succinct measure of the effects of regulation is the change or potential change in the L-moments of annual peak streamflow. If the L-moments do not change with a change in regulation characteristics, then the logical conclusion is that the change in regulation does not affect annual peak streamflow. (It is possible that a given degree of regulation affects only parts of the hydrologic regime, such as low flows, even if the larger [greater than median or 2-year] annual peak streamflows are apparently unaffected.) However, if the annual peak-streamflow statistics do change, then the logical conclusion is that the given degree of regulation does affect the peak streamflow.

To quantify the effects of regulation, the changes in L-moments of annual peak streamflow for each available pair of consecutive static periods were determined. The changes in the L-moments of the streamflow, such as the changes in mean peak streamflow, were related to changes in reservoir characteristics (hence, degree of regulation). For each of the regulated stations with two or more static periods of regulation, the L-moments of the streamflow for each static period were estimated. Subsequently, the change in the L-moments between two consecutive static periods as well as the change in reservoir characteristics were calculated. Also, a statistical test, the Mann-Kendall test (see the following section of this report) was done along the annual peak-streamflow time series of each pair of consecutive static periods.

Analysis of Trends

The Mann-Kendall test, or Kendall correlation (Helsel and Hirsch, 1992; Hollander and Wolfe, 1973), was used to indicate whether the annual peak streamflows for a station have historical trends with time. The Mann-Kendall test is a nonparametric, rank-based hypothesis test. That is, no assumption of normally distributed data is required, and the test is based on the ranks of the data rather than on the actual data. The data are tested to determine whether the null hypothesis—that there is no trend in the data—is supported by the strength of the evidence provided by the data. The outcome of the test is a decision whether or not to reject the null hypothesis in favor of an alternative hypothesis. The alternative hypothesis is that there is a downward trend in the data. The Mann-Kendall test commonly is used in a two-tailed fashion—that is, either upward or downward trends are of interest. However, for the case of streamflow that is potentially affected by regulation, a logical expectation is that potential trends in annual peak streamflow are downward. Therefore, a one-tailed test was used in the analysis of trends in annual peak streamflow. The decision to reject the null hypothesis in favor of the alternate hypothesis is made on the basis of the p-value from the test. The p-value indicates the strength of the evidence against the null hypothesis; the smaller the p-value, the stronger the evidence against the null hypothesis. Downward trends were identified as significant for this report if a computed p-value was less than or equal to 0.10. The Mann-Kendall test was chosen over rank-sum nonparametric tests because the Mann-Kendall test is sensitive to both discrete and gradual changes in a random variable (peak streamflow) in time. Regulation is a temporal changing feature of many basins considered here; hence the Mann-Kendall test is preferred.

EFFECTS OF REGULATION ON L-MOMENTS OF ANNUAL PEAK STREAMFLOW

Estimating L-moments of Natural Annual Peak Streamflow

A multiple weighted least-squares regression was done for each of the designated northeast, southeast, and west regions. Multiple regression analysis establishes a mathematical relation between one dependent and two or more independent variables. The mean, L–CV, L-skew, and L-kurtosis were used as dependent variables; and the contributing drainage area, basin shape factor, and stream slope basin characteristics were used as independent variables. Logarithmic transformations of the mean and the independent variables were used to increase the linearity of the relation between the dependent and independent variables.

A step-forward weighted least-squares (WLS) regression procedure (Statware, Inc., 1990) was used to develop equations to estimate the L-moments for stream sites in natural basins in Texas. The 367 natural streamflow-gaging stations previously identified (table 1) were used. In WLS regression, each datapoint is given a weight that is representative of the relative accuracy of the dependent variable. Greater weights are assigned to values that have greater accuracy. Because the sampling variance (error) of the L-moments decreases with increasing sample size, the number of natural annual peak-streamflow years for each station was used as the weighting variable. The equations to estimate the L-moments of natural annual peak streamflow for each region are listed in table 4 (at end of report). Diagnostic statistics, R-squared, and standard error, are reported in table 4. The residuals for each equation were analyzed (results not presented in this report), and the results indicate that each equation has no substantial bias for the range of independent variables included.

For the equations estimating the mean annual peak streamflow, each basin characteristic is included. The p-values for each coefficient are less than 0.10, except for the basin shape factor for the northeast region (p-value = 0.37). Shape factor was retained in the northeast equation for consistency with mean equations for the other two regions.

For the northeast region L–CV equation, the coefficient on drainage area had a p-value of 0.04, and the other coefficient p-values were greater than 0.70. For the southeast region L–CV equation, all three basin characteristics are included. The p-value for each coefficient was less than 0.06. For the west region L–CV equation, contributing drainage area and basin shape factor are included. The p-value for each coefficient is less than 0.11, not 0.10 as described for the mean or L-skew equations.

No independent variables were significant for estimating L-skew for the northeast region. Therefore, the regional mean value was used. The regional standard deviation for L-skew provides a means for assessing relative error. For the southeast region L-skew equation, contributing drainage area and stream slope are included. The p-value for each coefficient is less than 0.10. Only basin shape factor, with a p-value of 0.01, is included for the west region L-skew equation.

No independent variables were significant for estimating L-kurtosis for any of the three regions. Therefore, the regional mean value was used. The regional standard deviation for L-kurtosis provides a means for assessing relative error.

The largest errors were for the west region equations. This is likely because the west region is the largest region and, therefore, has the greatest heterogeneity among watersheds. Also, semiarid areas such as the west region show more year-to-year variation in annual peak streamflow than do more humid areas, which is evident because the west region L–CV (0.551) is greater than the L–CV (0.434 and 0.462) for the other two regions.

The equations can be used to estimate the L-moments of the annual peak streamflow for gaged and ungaged sites in their respective regions. From the estimates of the L-moments, estimates of the parameters for a distribution can be derived. To illustrate application, suppose the kappa distribution is suitable for northeast region station 08018730 Burke Creek near Yantis, Tex., with a contributing drainage area, basin shape factor, and stream slope of 33.1 mi^2, 2.88, and 10.41 feet per mile (ft/mi), respectively. The natural L-moments are 2,670 cubic feet per second (ft^3/s); 0.449; 0.315; and 0.203 for the mean, L–CV, L-skew, and L-kurtosis, respectively. The corresponding parameters of the kappa distribution are 1,226 ft^3/s; 1,609 ft^3/s; -0.148; and 0.327 for ξ, α, κ, and h, respectively. The 2-year peak thus is 2,020 ft^3/s, and the 100-year peak is 11,800 ft^3/s. For comparison, the 2-year and 100-year peaks from the regional regression equations of Asquith and Slade (1997) are 1,680 and 11,350 ft^3/s, respectively. The equations and L-moment compatible distributions such as the kappa distribution provide an alternative to other methods, principally Asquith and Slade (1997, 1999) and a *substantially independent* method from the Asquith and Slade reports to estimate natural peak-streamflow frequency for stream sites in Texas. It is unknown to what extent the natural L-moment based peak-streamflow frequency estimates might differ from those derived using the methods of Asquith and Slade (1997) or (1999) or derived specifically from gaged data. Substantial variation among estimates from the methods is expected.

Quantifying Regulation Effects on L-moments of Natural Annual Peak Streamflow

Quantifying the effects of regulation on annual peak streamflow is a difficult problem. The degree of regulation can be extremely site specific for many streams and provide “limited” to “no” statistical transferability. For other regulated sites, however, streamflow statistics and statistics reflecting the effects of regulation on peak streamflow are transferable. For a stream site that has passive flood control, the effect of regulation would be to *systematically* reduce the mean annual peak streamflow, to potentially reduce the variability (L-scale, therefore L–CV) of the annual peak streamflows, and to possibly alter the higher moment ratios (L-skew and L-kurtosis). The amount of systematic reduction or other changes in the L-moments might correlate to changes in regulation (reservoir characteristics). If suitable correlations exist, then the degree of regulation is statistically transferable to sites that have similar regulation.

However, for a stream site that has active flood control, regulation would affect all the streamflow statistics in unpredictable and potentially temporally changing ways; although for Texas, it might be expected that the mean and the variability of the annual peak streamflow would be reduced because of competing water-supply and flood-control regulatory actions. Water-supply actions, including those associated with irrigation, tend to increase the smaller annual peaks, and flood-control actions tend to decrease the larger annual peaks. Thus the variability is reduced by this two-tailed compression of the peak-streamflow distribution. Transferability of the relation between annual peak-streamflow statistics and active flood control is, therefore, more limited.

Because of highly site-specific characteristics of regulation, any attempt to generalize the relation between degree of regulation and annual peak streamflow should be approached with caution. Though the analysis presented in this section provides (to the author’s knowledge) the first statewide regional assessment of regulation on annual peak streamflow, the assessment is made difficult by factors such as proximity of the stream site to active flood-control dams, degree of direct influence of mankind on the hydrologic regime, and unpredictable characteristics of the basin.

For each of the static or near-static periods of regulation (discussed in a previous section in this report), the change in maximum capacity, change in normal capacity, and change in the difference between maximum and normal capacity (potential flood storage) are graphed as a function of drainage area upstream of each site (fig. 4a, b, c). Because of the large range in drainage areas, the reservoir-characteristic changes were divided by contributing drainage area to standardize the regulation variables for contributing drainage area. The units of the reservoir-characteristic changes thus are acre-feet per square mile. The three graphs in figure 4 also indicate the stations that have Mann-Kendall p-values less than 0.10 (trend) and those that do not (no trend). An apparent downward trend of each ordinate (vertical axis) is a product of plotting a function of Area^{-1} against Area. The Mann-Kendall test indicates (fig. 4c), as expected, that changes in the difference between maximum and normal capacity generally are greater for those stations (with the same drainage area) that have a trend than for those that do not have a trend.

Similar plots for each region are shown in figures 5–7. For each of the regions, the change in maximum capacity and change in difference between maximum and normal capacity shows the most contrast between trend and no-trend stations. Some regional differences are that the drainage areas for the southeast region stations generally are larger. Most of the stations in the semiarid west region have trends, whereas most stations in the other two regions do not. Since runoff rates are much smaller in the west, a reservoir of a given size controls a larger portion of the runoff in the west. Stated another way, the effectiveness of a reservoir is a

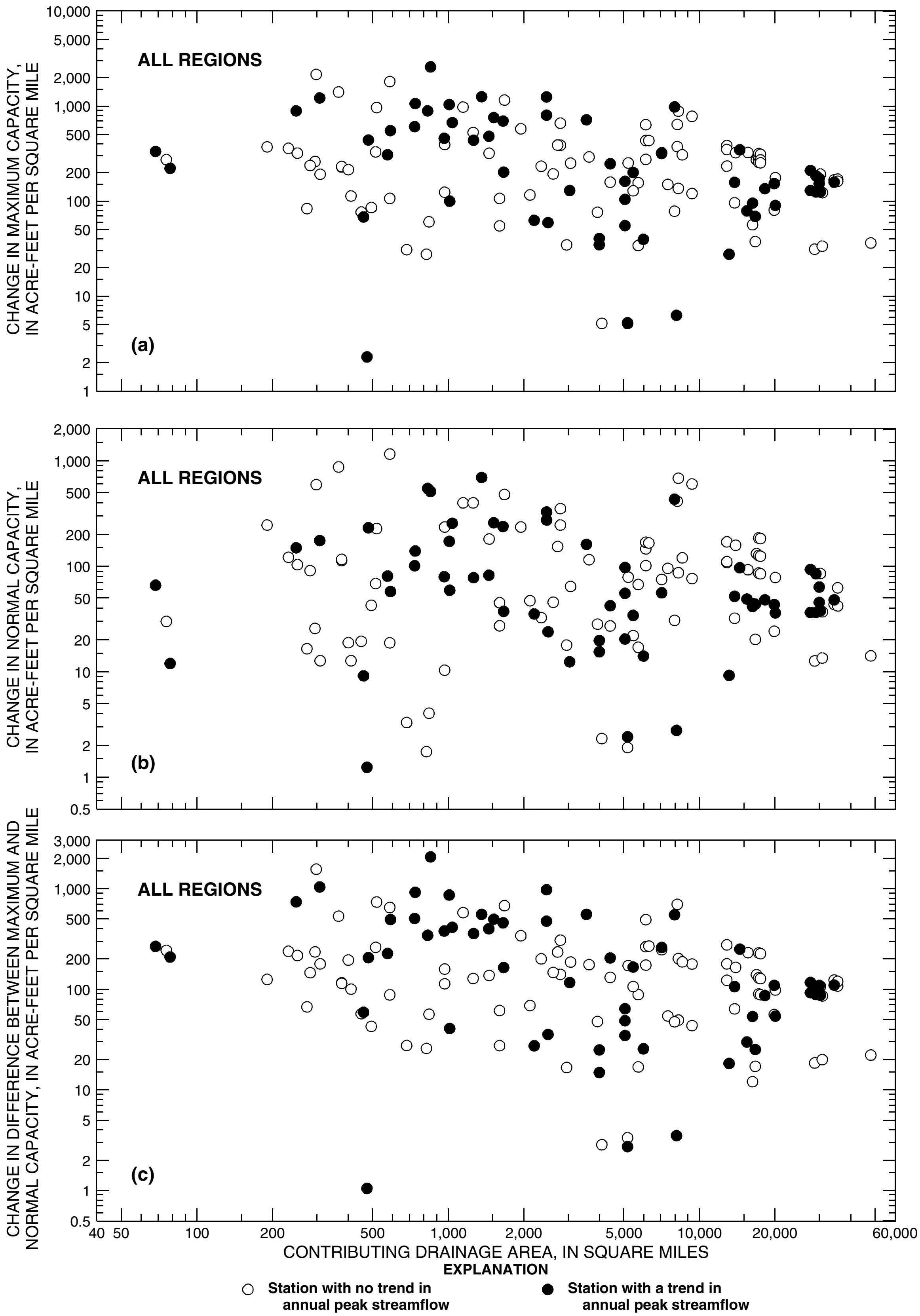

Figure 4. Relation between (a) change in maximum capacity, (b) change in normal capacity, and (c) change in difference between maximum and normal capacity to contributing drainage area in all regions.

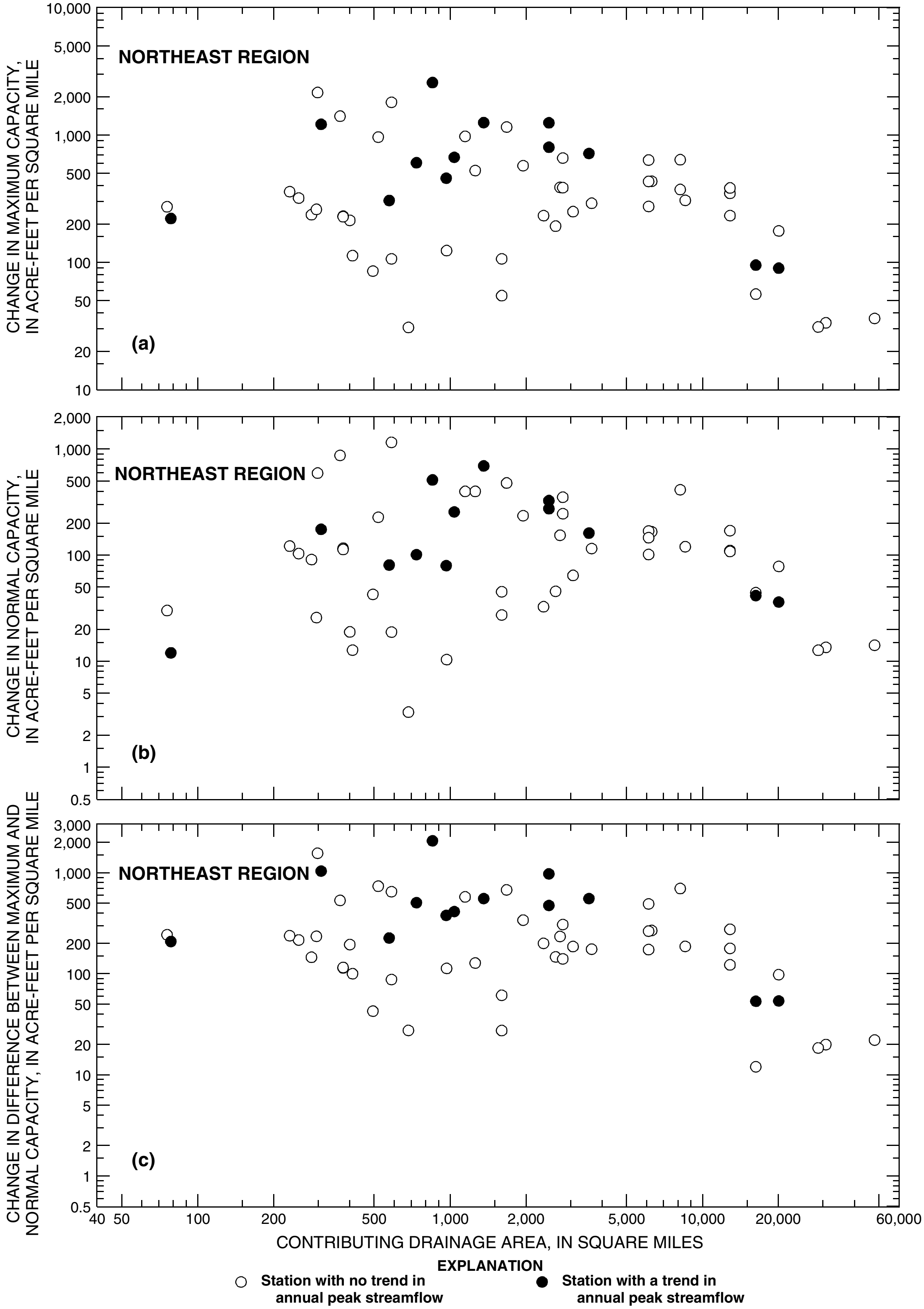

Figure 5. Relation between (a) change in maximum capacity, (b) change in normal capacity, and (c) change in difference between maximum and normal capacity to contributing drainage area in northeast region.

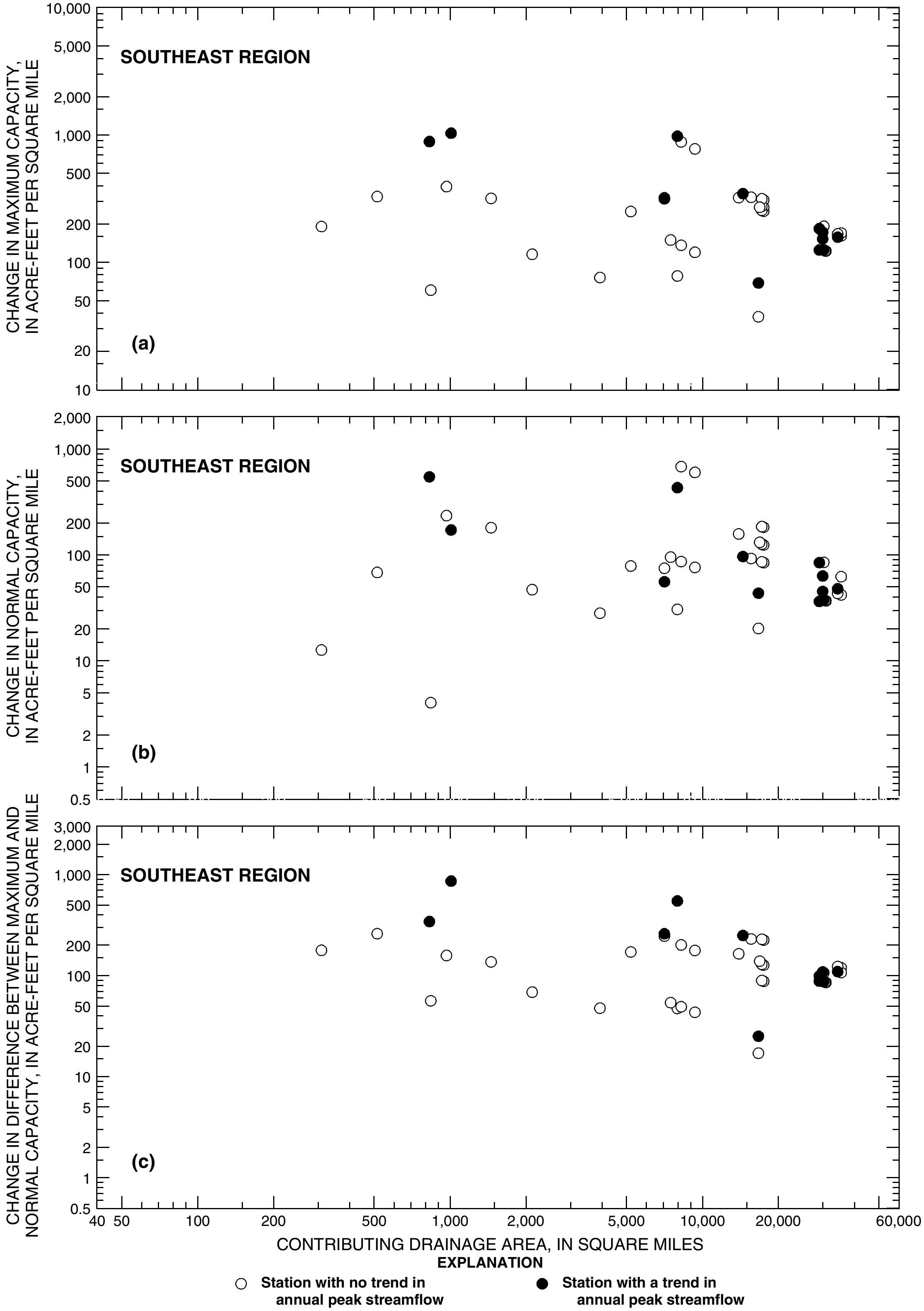

Figure 6. Relation between (a) change in maximum capacity, (b) change in normal capacity, and (c) change in difference between maximum and normal capacity to contributing drainage area in southeast region.

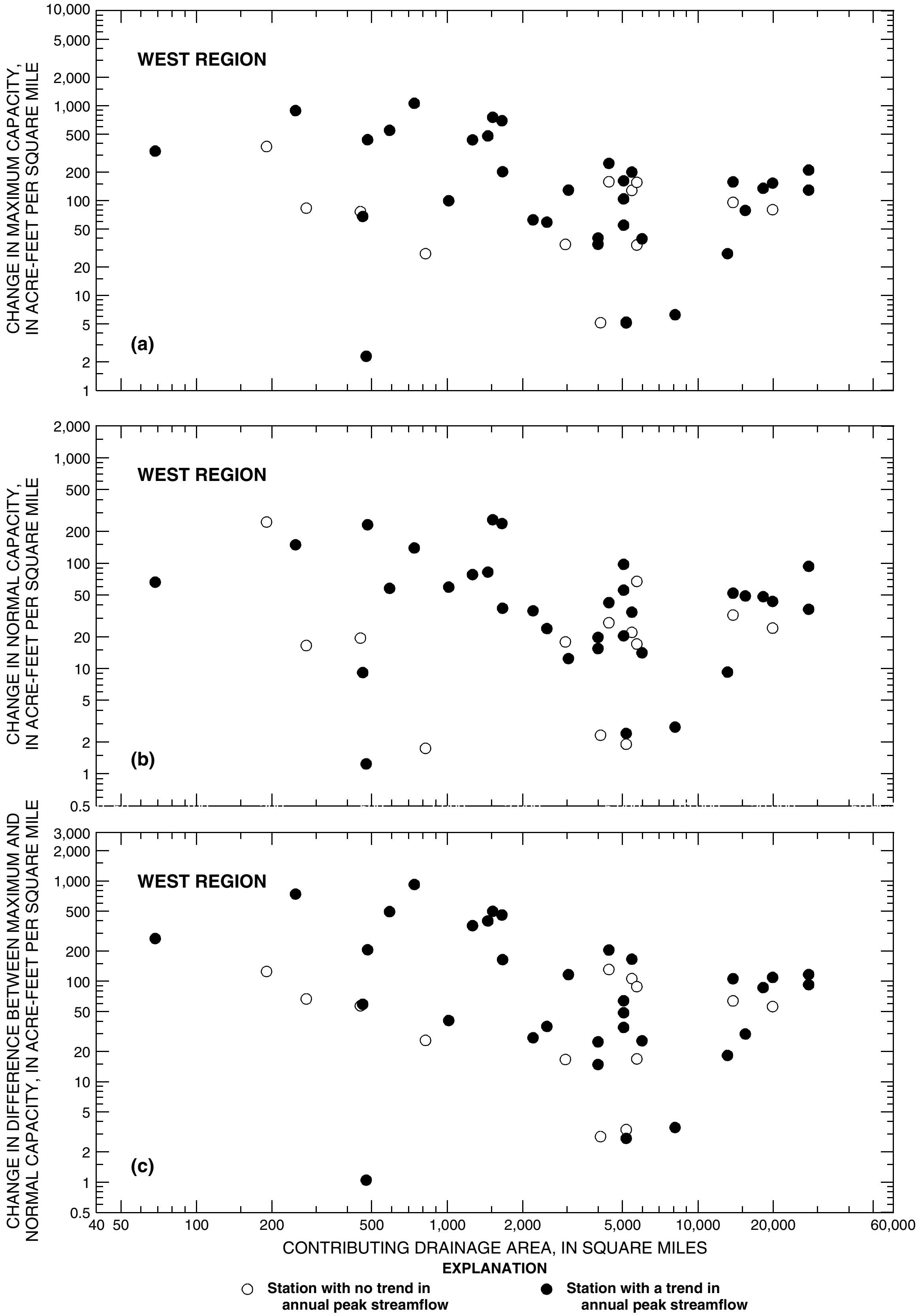

Figure 7. Relation between (a) change in maximum capacity, (b) change in normal capacity, and (c) change in difference between maximum and normal capacity to contributing drainage area in west region.

function of its capacity to expected runoff volumes, and runoff volumes are low (relative to the east) in west Texas. In conclusion, reservoirs in the west region affect peak streamflow to a greater degree than those in the northeast or southeast regions.

Adjusting L-moments of Natural Annual Peak Streamflow for Potential Regulation Effects

To adjust the L-moments and L-moment ratios of natural annual peak streamflow for potential effects of regulation (whether estimated from the equations [table 4] or through other methods), considerable exploratory analysis of the change in L-moments and their relation to change in regulation was required. This section documents the most important aspects of the analysis and presents graphs showing the relation between change in L-moments and change in maximum capacity, change in normal capacity, change in difference between maximum and normal capacity, and contributing drainage area (figs. 8–13).

The relations between change in the mean annual peak streamflow to change in maximum capacity and to change in normal capacity are shown in figure 8. The relation between change in mean annual peak streamflow and change in the difference between maximum and normal capacity is shown in figure 11a. In each figure, the change in mean peak is graphed as a function of one of the three types of reservoir-characteristic changes. Also in each figure, the region for each point is indicated and whether a trend in annual peak streamflow exists for two consecutive static reservoir periods.

Clearly, a decreasing relation between change in the mean and degree of regulation (as evidenced by trends in the three reservoir-characteristic changes) exists. Few points plot above the zero-change line. Only one of the points that plot above the zero-change line was from data having a trend. The points that have trends generally show greater decreases in the mean peak with regulation than points that do not have trends. The change in normal capacity (fig. 8b) does not indicate as strong a mean-peak-to-regulation relation as does the maximum capacity (fig. 8a). The change in normal capacity also does not show as strong a relation as does the change in difference between maximum and normal capacity (fig. 11a). Accordingly, the normal capacity is not considered further.

The change in difference between maximum and normal capacity (fig. 11a) was selected rather than the change in maximum capacity (fig. 8a) to estimate the change in mean annual peak streamflow for ungaged sites for a specific region and for change in regulation. The relation between mean annual peak streamflow and change in regulation is better defined in figure 11a. It would be expected, on a conceptual basis, that potential flood storage in a basin (difference between maximum and normal capacity per square mile) would have a more direct influence on annual peak streamflow than maximum or normal capacity alone does.

Two graphically fitted line segments in figure 11a reflect the approximate relation between change in mean annual peak streamflow and potential flood storage. The equations for the lines are shown on the figure. For potential flood storage values less than about 20 acre-ft/mi^2, the change in the mean is zero. For potential flood storage greater than about 400 acre-ft/mi^2, the results of this report are considered not applicable.

Figure 9 shows the relation between change in L–CV of annual peak streamflow to change in maximum capacity (fig. 9a) and change in normal capacity (fig. 9b). The relation between change in L–CV and change in the difference between maximum and normal capacity is shown in figure 11b. The region for each point is indicated and whether a trend was detected in annual peak streamflow for two consecutive static reservoir periods. From the figures (9a, b; 11b), it is evident that little-to-no functional relation exists between the change in L–CV and the change in regulation. Thus, the magnitude of L–CV probably is not influenced by regulation. This conclusion is consistent for each region, whether or not a trend was detected. However, a closer inspection of the figures indicates that an argument could be made that a very subtle decreasing relation between change in L–CV and change in regulation might exist. This is only partially consistent with a logical assessment of the effects of regulation on L-moments of annual peak streamflow and requires some additional discussion.

A decrease in L–CV with regulation might be expected because a decrease in L–CV implies a decrease in relative variability of the annual peak streamflow, which reflects the peak-streamflow buffering capability of reservoirs when they are used for competing flood-control and water-supply objectives. What is not consistent with a decreasing relation between L–CV and regulation is that the relation would not be expected to exist above the zero-change line (positive changes in L–CV). Factors that cause a positive change in L–CV include either a decrease in the

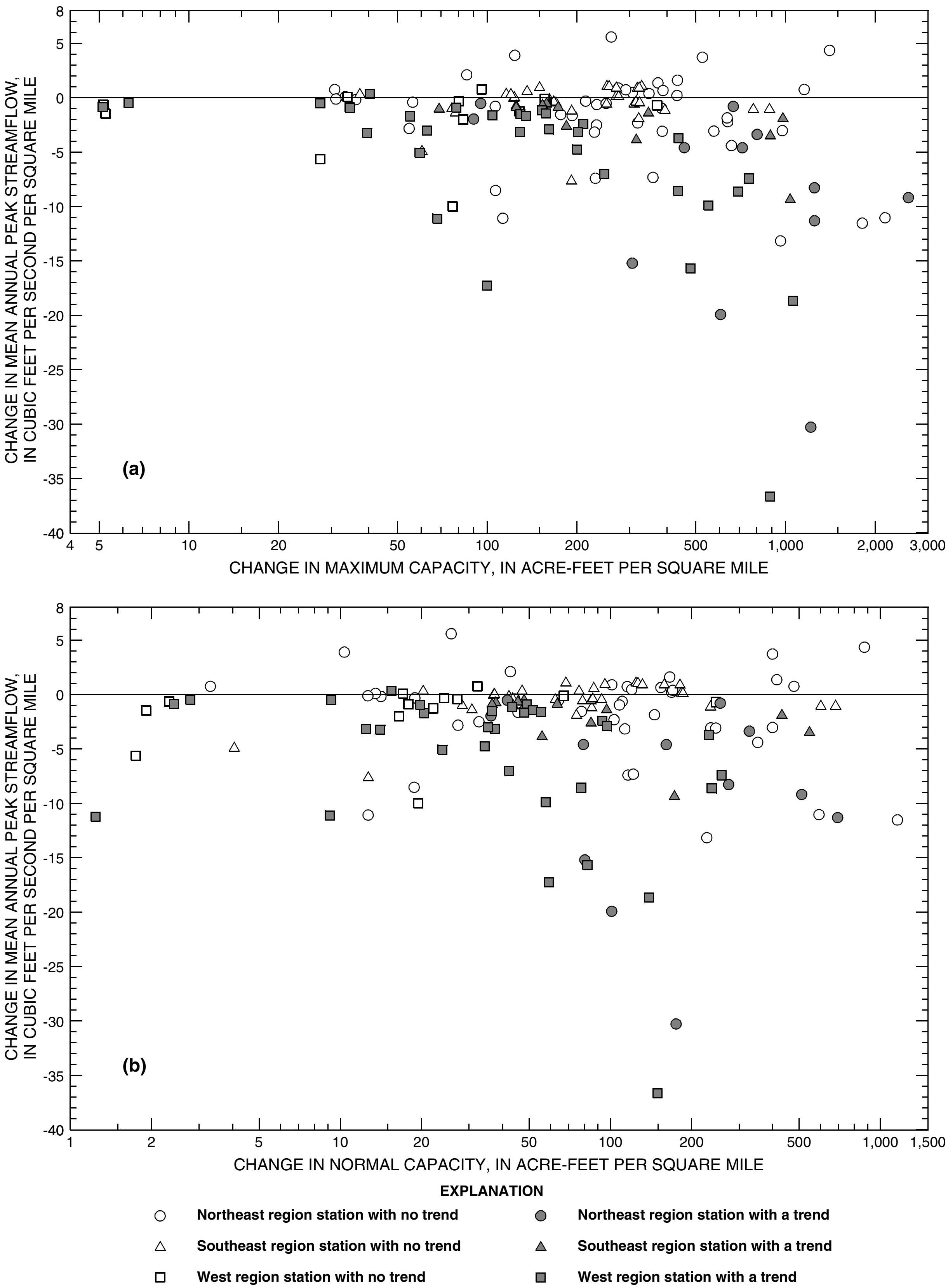

Figure 8. Relation between change in mean annual peak streamflow to (a) change in maximum capacity and (b) change in normal capacity

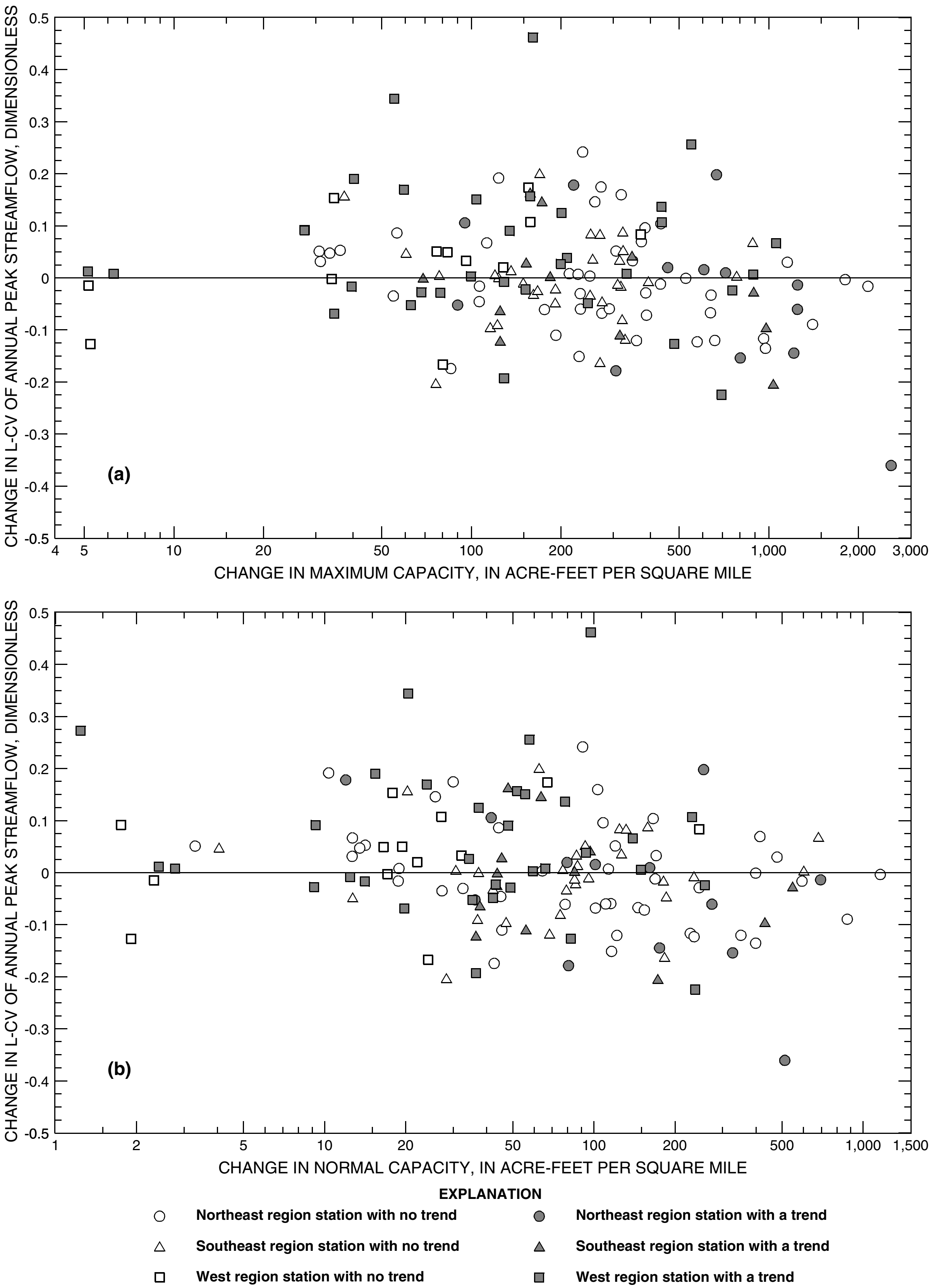

Figure 9. Relation between change in L–CV of annual peak streamflow to (a) change in maximum capacity and (b) change in normal capacity.

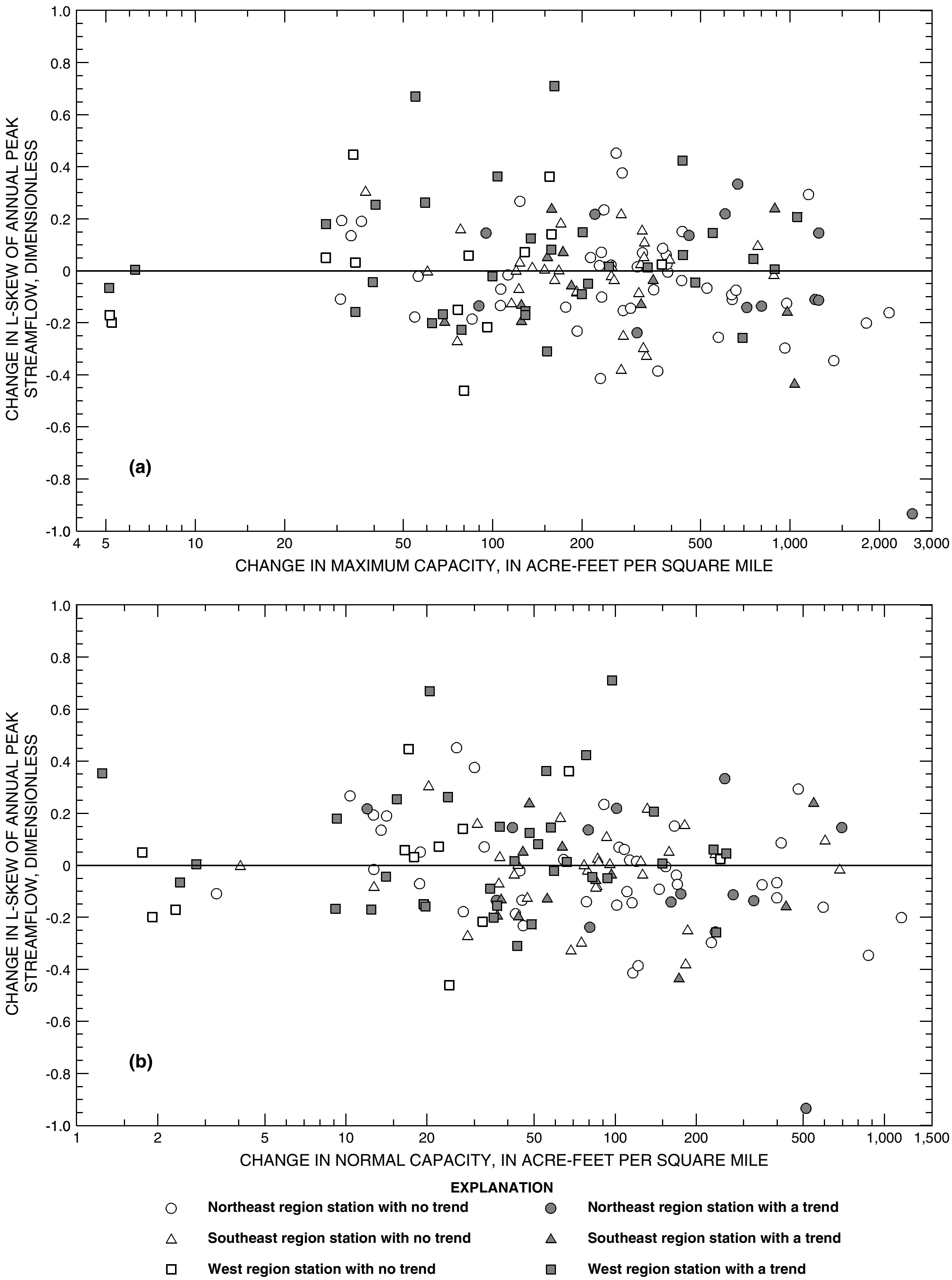

Figure 10. Relation between change in L-skew of annual peak streamflow to (a) change in maximum capacity and (b) change in normal capacity.

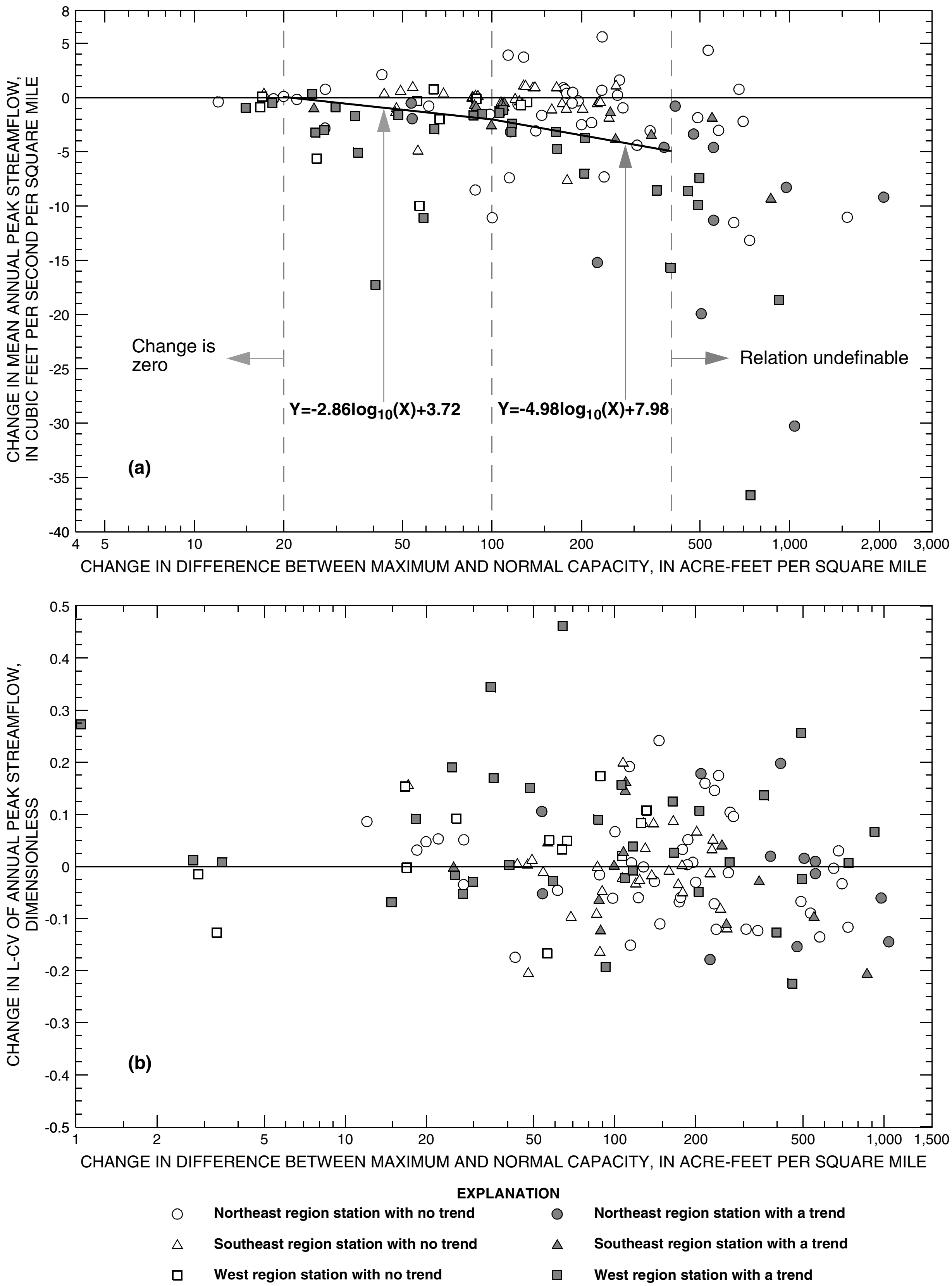

Figure 11. Relation between (a) change in mean annual peak streamflow and (b) change in L–CV of annual peak streamflow to change in difference between maximum and normal capacity.

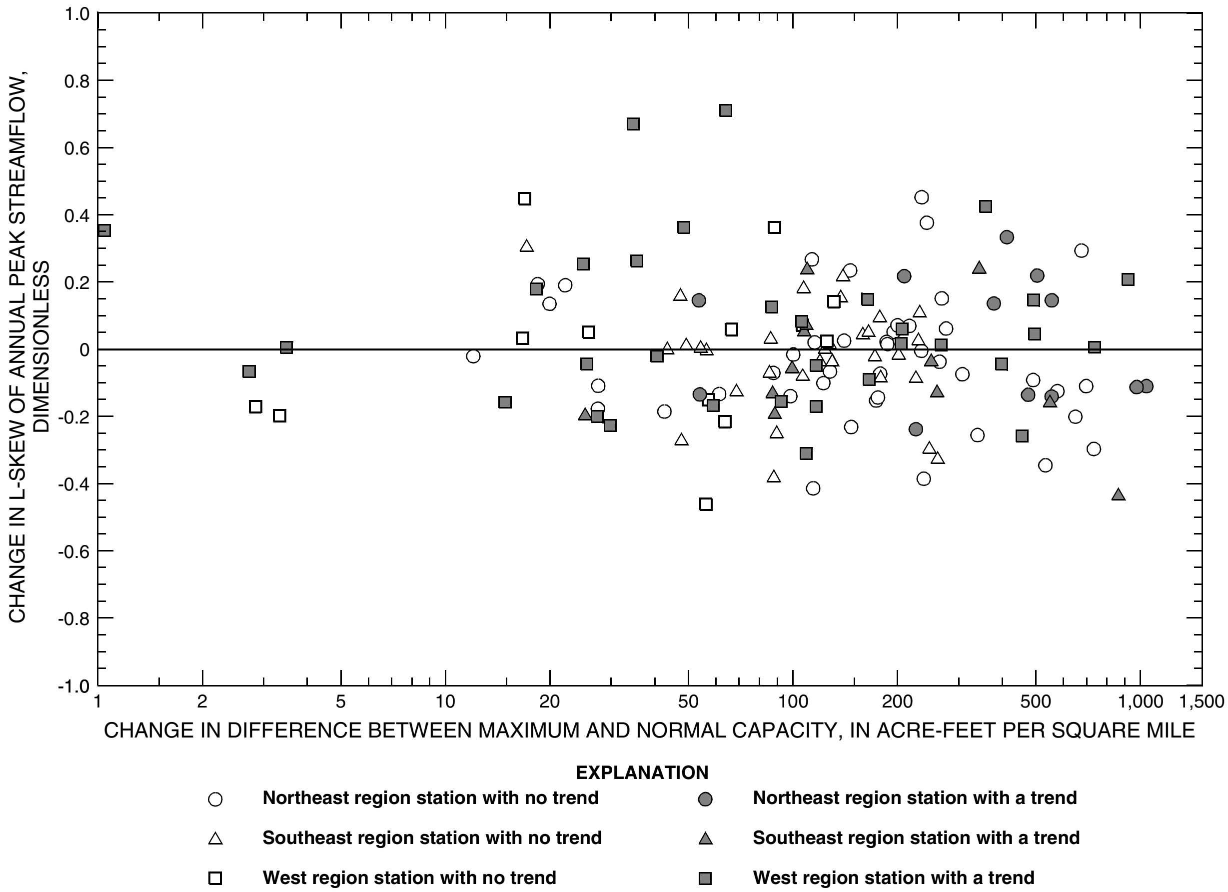

Figure 12. Relation between change in L-skew of annual peak streamflow and change in difference between maximum and normal capacity.

mean, an increase in the L-scale (variation), or both. Regulation is often thought to decrease the mean, which could increase L–CV if the natural or "background" variation remains constant. Natural variation is an inherent function of precipitation variability. Whether a trend was detected provides little additional insight. The author concluded, for purposes of application, that there is negligible or no relation of L–CV to regulation.

The relation between change in L-skew of annual peak streamflow to change in maximum capacity and change in normal capacity is shown in figure 10, and the relation between change in the L-skew of annual peak streamflow and change in the difference between maximum and normal capacity is shown in figure 12. In each figure, the change in L-skew is graphed as a function of one of the three types of reservoir-characteristic changes. Also, the region for each point is indicated and whether a trend was detected in annual peak streamflow for two consecutive static reservoir periods. From the figures, it is evident that little or no functional relation exists between the change in L-skew, hence magnitude of L-skew, and changes in regulation. This holds true for each region, whether or not a trend was detected. On the basis of the data available, the conclusion is that the degree of regulation in a particular basin has negligible influence on the L-skew for the basin. Similar results were seen for L-kurtosis, and the same conclusion was made (results not presented here).

Additional comparisons between change in the mean and L–CV of annual peak streamflow and contributing drainage area are needed to assess the effects of basin scale on these statistics. Figure 13 provides the comparison. As with figures 8–12, the region for each point is indicated and whether a trend was detected in annual peak streamflow for two consecutive static reservoir periods. From figure 13a, it is apparent that a strong nonlinear decreasing-magnitude-with-increasing-area relation exists in points having trends for drainage areas as large as about 8,000 mi^2. Specifically, the largest changes in the mean occur for the

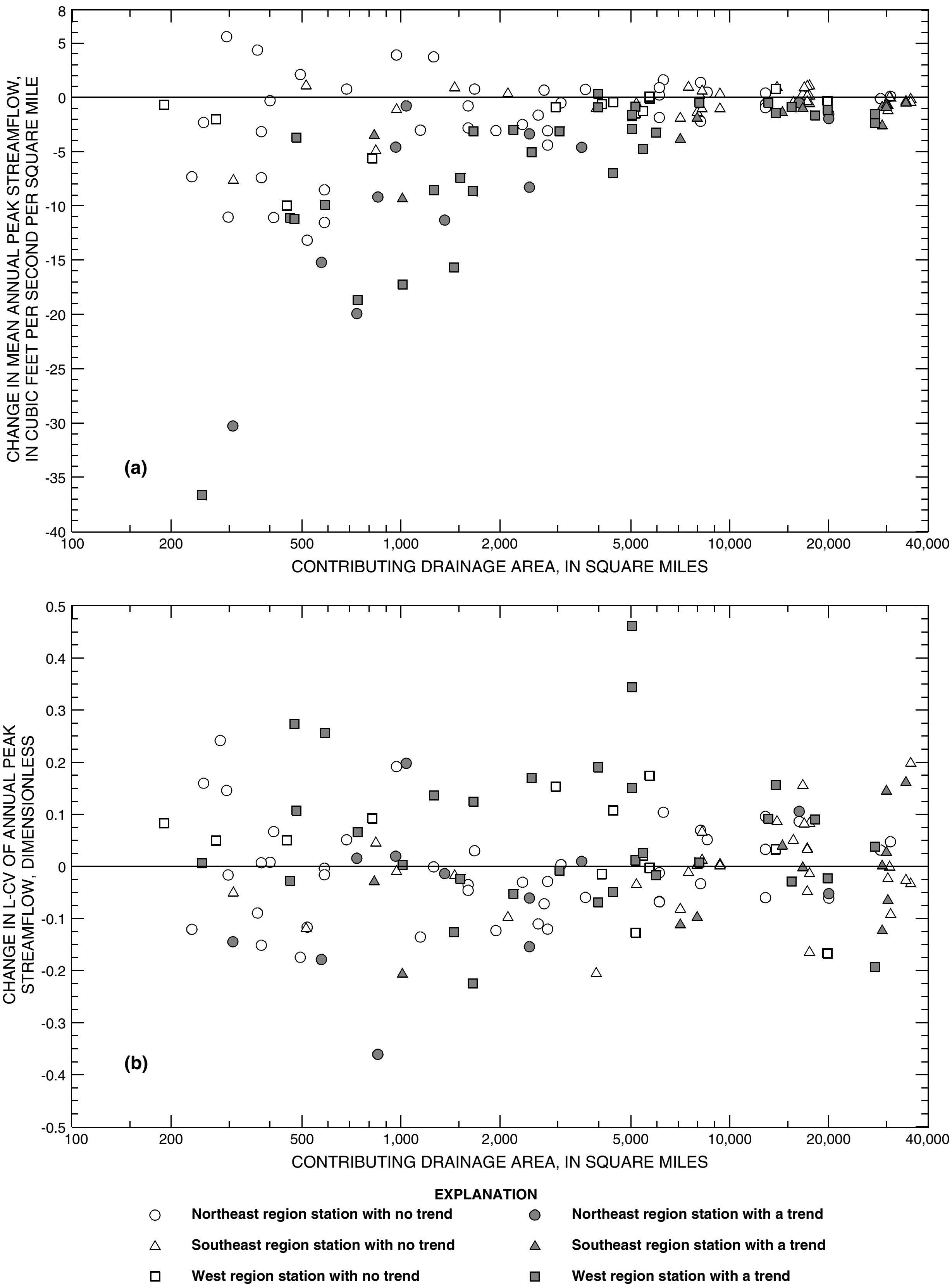

Figure 13. Relation between (a) change in mean annual peak streamflow and (b) change in L–CV of annual peak streamflow to contributing drainage area.

smallest basins. It is not apparent from figure 13a whether a similar relation exists for points without a trend. This observation is important because the drainage area is on the horizontal axis, and the inverse of area is on the vertical axis. Figure 13b indicates little or no functional relation between change in L–CV and contributing drainage area. This lack of relation is consistent with previous L–CV graphs.

Changes in reservoir characteristics are estimated for an ungaged site by determining the maximum and normal capacity for current conditions and assuming that the reservoir characteristics are zero for the natural condition. For example, consider a hypothetical 1,000-mi^2 basin in the southeast region with a basin shape factor of 30, a slope of 10 ft/mi, and a potential flood storage of about 200 acre-ft/mi^2 (current potential flood storage = 200,000 acre-ft). The peak streamflow for such a basin might have been influenced by regulation on the basis of inspection of how 1,000 mi^2 and 200 acre-ft/mi^2 would plot in figure 6c. For this example, it is assumed that consideration of regulation effects is warranted. From figure 11a, the applicable equation ($-4.98\log_{10}[200]+7.98$) produces a reduction in the mean of about 3.5 cubic feet per second per square mile ($ft^3/s\text{-}mi^2$).

SUMMARY

Estimates of peak-streamflow frequency are useful for flood-plain management, for objective assessment of flood risk, and for cost-effective design of hydraulic structures. Peak-streamflow frequency refers to peak streamflows that have recurrence intervals of 2, 5, 10, 25, 50, 100, 250, and 500 years. Numerous techniques exist to estimate peak-streamflow frequency for gaged and ungaged stream sites in natural (unregulated) watersheds in Texas. However, such techniques are of questionable applicability for stream sites in watersheds affected by human-produced regulation, principally through the construction of dams. To address this situation, the USGS, in cooperation with TxDOT, has investigated flood characteristics in regulated basins in Texas.

Historically, a natural basin in Texas has been defined by the USGS as a basin with less than 10-percent impervious cover, less than 10 percent of its drainage area controlled by reservoirs, and no other human-related factors that would affect peak streamflow. A regulated basin, therefore, was initially defined as a basin for which 10 percent or more of the drainage area of the basin is affected or controlled by reservoirs.

The State was divided into three regions. These regions (northeast, southeast, and west) were selected on the basis of regional boundaries used in a previous, related study, consideration of reservoir density, and density and locations of regulated streamflow-gaging stations. Four regression equations were derived for each region from data for 367 streamflow-gaging stations in basins designated as natural by the 10-percent criterion to estimate the L-moments of annual peak-streamflow data for ungaged sites. The stations used all have 10 or more years of natural annual peak-streamflow data through 1997 and have an average period of record of about 30 years. Four of the resulting 12 equations are constants. The independent variables in the equations are contributing drainage area, basin shape factor, and stream slope. A natural peak-streamflow frequency curve can be subsequently produced by fitting a distribution to the estimated natural L-moments.

The TNRCC database of dams was used to produce statistics reflecting the effects of regulation on peak streamflow. Some of the characteristics used in this investigation included number of the dam, name of the dam, reservoir name, latitude and longitude, county, purpose of the dam, year completed, maximum capacity, normal capacity, surface area, and drainage area. The total number of dams in the database exceeds 7,300. However, not all the data fields pertinent to this investigation were complete—latitude, longitude, and other important information sometimes were missing. Excluding dams with extensive missing data resulted in 7,035 dams used in the analysis. The statewide total maximum capacity is about 98.6 million acre-ft, total normal capacity is about 41.5 million acre-ft, and total surface area is about 1.25 million acres. Four variables were used to represent regulation in a basin. Three of the variables are maximum capacity, normal capacity, and surface area, the values of which were taken directly from the inventory of dams. The fourth variable, potential flood storage, was computed as the difference between maximum capacity and normal capacity. Potential flood storage is a hypothetical number and, therefore, is only a rough estimate of the total flood-controlling capacity in a basin.

The USGS database of annual peak streamflow contains data from about 330 stations in basins designated as regulated by the 10-percent criterion. Many stations have both natural and regulated record. About

192 stations have 10 or more years of regulated record through 1997. The average period of record for these stations is about 28 years. For each of the 192 original regulated stations, a time series of cumulative changes in the maximum capacity, normal capacity, and surface area (cumulative changes in regulation) was generated. The stations that are most pertinent are those with periods of record that have two or more consecutive static or minimally changing periods of regulation. Of the 192 stations, 96 were identified as meeting this criterion. The mean period of regulated record for those 96 stations is about 34 years. A representative maximum-capacity and normal-capacity value for each station and for each static period was determined.

The effects of regulation were quantified by the changes in L-moments of annual peak streamflow for each available pair of consecutive static periods. The change in the L-moments of the streamflow were related to changes in reservoir characteristics (therefore, degree of regulation). For each of the regulated stations with two or more static periods of regulation, the L-moments of the streamflow for each static period were estimated. Subsequently, the change in the L-moments between two consecutive static periods as well as the change in reservoir characteristics were calculated. Also, the Mann-Kendall test was done on the annual peak-streamflow time series of each pair of consecutive static periods to indicate trends in annual peak streamflow with time.

Analysis of the relations between the L-moment and the variables representing regulation indicates that L-moments other than the mean are negligibly affected by regulation. The analysis indicated that as potential flood storage in a basin increases, the mean annual peak streamflow decreases nonlinearly.

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Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)

[Seq., sequence; mi^2, square miles; ft/mi, feet per mile; ft^3/s, cubic feet per second; W, west; NE, northeast; SE, southeast]

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak streamflow	Contributing drainage area (mi^2)	Basin shape factor (dimensionless)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
1	07227100	Revuelto Creek near Logan, New Mexico	35°20'24"	103°23'24"	W	38	786	5.07	13.20	7,701	3,095.4	0.407	0.196
2	07227920	Dixon Creek near Borger, Texas	35°39'53"	101°21'02"	W	15	134	5.56	23.55	1,486	687.8	.145	-.019
3	07228000	Canadian River near Canadian, Texas	35°56'06"	100°22'13"	W	26	18,178	14.64	16.65	39,515	17,154.3	.263	.053
4	07233500	Palo Duro Creek near Spearman, Texas	36°12'08"	101°18'20"	W	35	440	13.98	10.17	3,711	2,024.7	.479	.301
5	07295500	Tierra Blanca Creek above Buffalo Lake near Umbarger, Texas	34°50'55"	102°10'32"	W	21	538	27.85	9.73	2,165	1,360.7	.507	.345
6	07297910	Prairie Dog Town Fork Red River near Wayside, Texas	34°50'15"	101°24'49"	W	30	930	47.93	11.24	14,104	7,304.1	.427	.237
7	07298000	North Tule Draw at Reservoir near Tulia, Texas	34°33'34"	101°42'33"	W	31	65	19.65	10.65	1,712	1,060.0	.476	.281
8	07298500	Prairie Dog Town Fork Red River near Brice, Texas	34°37'40"	100°56'25"	W	11	1,581	40.80	10.98	25,957	8,113.6	.133	-.034
9	07299200	Prairie Dog Town Fork Red River near Lakeview, Texas	34°34'23"	100°44'43"	W	16	2,023	35.33	10.87	27,975	11,231.7	.477	.302
10	07299300	Little Red River near Turkey, Texas	34°32'27"	100°46'13"	W	14	139	9.47	34.35	2,605	491.7	-.154	.108
11	07299500	Prairie Dog Town Fork Red River near Estelline, Texas	34°30'20"	100°26'10"	W	12	2,524	33.12	10.67	26,730	9,412.4	.179	.096
12	07299540	Prairie Dog Town Fork Red River near Childress, Texas	34°34'09"	100°11'37"	W	14	2,956	32.13	10.38	31,103	14,529.1	.392	.139
13	07299570	Red River near Quanah, Texas	34°24'47"	99°44'03"	W	19	3,552	33.79	9.87	27,051	10,463.8	.296	.171
14	07299670	Groesbeck Creek at SH 6 near Quanah, Texas	34°21'16"	99°44'24"	W	36	303	5.84	10.22	3,613	2,097.8	.457	.219
15	07300000	Salt Fork Red River near Wellington, Texas	34°57'27"	100°13'14"	W	15	1,013	7.59	16.72	33,088	19,882.9	.522	.314
16	07300500	Salt Fork Red River at Mangum, Oklahoma	34°51'30"	99°30'30"	W	60	1,357	12.84	13.80	16,782	7,311.3	.324	.164
17	07301300	North Fork Red River near Shamrock, Texas	35°15'51"	100°14'29"	W	34	703	18.50	9.61	5,824	2,574.4	.392	.295
18	07301410	Sweetwater Creek near Kelton, Texas	35°28'23"	100°07'14"	W	36	267	7.66	15.89	701	303.7	.294	.234
19	07307500	Quitaque Creek near Quitaque, Texas	34°14'24"	101°07'03"	W	14	35	17.25	25.10	1,539	785.1	.534	.404
20	07307800	Pease River near Childress, Texas	34°13'39"	100°04'24"	W	33	2,195	5.35	16.22	8,427	3,158.9	.272	.183
21	07308000	Pease River near Crowell, Texas	34°05'45"	99°43'47"	W	23	2,478	8.02	13.66	44,217	14,584.6	.176	.175
22	07308200	Pease River near Vernon, Texas	34°10'44"	99°16'40"	W	36	2,929	10.97	11.60	13,122	5,534.3	.228	.069
23	07308500	Red River near Burkburnett, Texas	34°06'36"	98°31'53"	W	38	14,634	14.79	8.36	41,897	18,346.6	.401	.283
24	07311600	North Wichita River near Paducah, Texas	33°57'02"	100°03'52"	W	24	540	6.92	14.49	4,012	2,007.2	.360	.235
25	07311700	North Wichita River near Truscott, Texas	33°49'14"	99°47'10"	W	37	937	9.82	11.12	6,783	3,354.0	.453	.280
26	07311800	South Fork Wichita River near Benjamin, Texas	33°38'39"	99°48'02"	W	37	584	18.24	9.63	4,534	1,943.5	.429	.166
27	07311900	Wichita River near Seymour, Texas	33°42'01"	99°23'18"	W	20	1,874	12.85	7.57	10,290	2,990.8	.220	.154

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak stream-flow	Contri-buting drainage area (mi^2)	Basin shape factor (dimen-sion-less)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
28	07314500	Little Wichita River near Archer City, Texas	33°39'45"	98°36'46"	W	15	481	12.68	5.42	4,687	2,296.3	0.562	0.345
29	07315200	East Fork Little Wichita River near Henrietta, Texas	33°48'46"	98°05'05"	NE	30	178	5.51	8.90	4,683	3,164.9	.575	.294
30	07332600	Bois d'Arc Creek near Randolph, Texas	33°28'32"	96°12'52"	NE	23	72	4.49	10.41	9,057	2,412.0	-.016	.177
31	07335500	Red River at Arthur City, Texas	33°52'30"	95°30'06"	NE	13	38,595	10.39	7.03	119,823	54,530.8	.443	.230
32	07336750	Little Pine Creek near Kanawha, Texas	33°50'26"	95°15'55"	NE	12	75.4	5.10	6.53	8,466	3,951.3	.473	.390
33	07336800	Pecan Bayou near Clarksville, Texas	33°41'07"	94°59'41"	NE	16	100	7.57	5.48	5,352	2,239.0	.378	.428
34	07342470	South Sulphur River near Commerce, Texas	33°13'11"	95°51'45"	NE	12	189	6.10	6.57	11,743	2,628.2	.353	.527
35	07342500	South Sulphur River near Cooper, Texas	33°21'20"	95°35'39"	NE	49	527	8.00	4.75	15,849	5,116.9	.236	.155
36	07343000	North Sulphur River near Cooper, Texas	33°28'29"	95°35'15"	NE	48	276	6.18	6.83	36,351	8,644.3	.091	.246
37	07343200	Sulphur River near Talco, Texas	33°23'10"	95°07'56"	NE	35	1,365	8.75	3.54	33,231	8,605.5	.142	.134
38	07343300	Cuthand Creek near Bogata, Texas	33°32'51"	95°10'22"	NE	11	69	6.07	7.85	6,306	2,716.4	.450	.409
39	07343500	White Oak Creek near Talco, Texas	33°19'20"	95°05'33"	NE	23	494	9.65	3.94	15,002	6,255.3	.266	.151
40	07343800	White Oak Creek below Talco, Texas	33°18'00"	95°01'00"	NE	13	579	9.97	3.76	27,737	9,279.7	.395	.463
41	07344000	Sulphur River near Darden, Texas	33°15'00"	94°37'00"	NE	47	2,774	11.12	2.63	35,289	13,706.1	.260	.181
42	07344486	Brushy Creek at Scroggins, Texas	32°58'32"	95°11'03"	NE	19	23.4	1.77	24.49	2,529	1,334.7	.436	.287
43	07344500	Big Cypress Creek near Pittsburg, Texas	33°01'15"	94°52'55"	NE	22	366	3.70	6.87	11,815	5,959.4	.480	.336
44	07345000	Boggy Creek near Daingerfield, Texas	33°02'10"	94°47'15"	NE	34	72	4.25	6.94	4,458	2,409.3	.527	.370
45	07346000	Big Cypress Creek near Jefferson, Texas	32°44'58"	94°29'55"	NE	45	850	6.88	4.29	10,413	5,390.5	.428	.238
46	07346045	Black Cypress Bayou at Jefferson, Texas	32°46'40"	94°21'26"	NE	29	365	7.80	3.75	4,128	1,632.4	.228	.152
47	07346050	Little Cypress Creek near Ore City, Texas	32°40'21"	94°45'03"	NE	35	383	5.96	4.47	5,688	2,721.5	.331	.165
48	07346070	Little Cypress Creek near Jefferson, Texas	32°42'50"	94°20'44"	NE	52	675	10.84	3.14	6,439	3,075.3	.407	.250
49	07346140	Frazier Creek near Linden, Texas	33°03'14"	94°17'24"	NE	27	48	2.62	10.53	2,123	1,075.5	.321	.100
50	08017200	Cowleech Fork Sabine River at Greenville, Texas	33°07'58"	96°04'36"	NE	39	77.7	4.66	8.96	5,828	1,621.5	.203	.284
51	08017300	South Fork Sabine River near Quinlan, Texas	32°53'52"	96°15'11"	NE	39	78.7	4.34	8.88	10,379	3,532.5	.087	.044
52	08018500	Sabine River near Mineola, Texas	32°36'49"	95°29'08"	NE	22	1,357	7.82	3.47	27,824	11,535.7	.156	.074
53	08018730	Burke Creek near Yantis, Texas	32°59'26"	95°37'18"	NE	11	33.1	2.88	10.41	2,875	715.0	.101	.473
54	08019000	Lake Fork Creek near Quitman, Texas	32°45'47"	95°27'46"	NE	42	585	4.28	4.92	16,189	7,212.2	.351	.248
55	08019500	Big Sandy Creek near Big Sandy, Texas	32°36'14"	95°05'29"	NE	24	231	9.06	5.81	4,324	2,204.7	.490	.361
56	08020000	Sabine River near Gladewater, Texas	32°31'37"	94°57'36"	NE	29	2,791	9.39	2.57	28,418	14,492.2	.352	.125

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak streamflow	Contributing drainage area (mi^2)	Basin shape factor (dimensionless)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data			
										Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
57	08020500	Sabine River near Longview, Texas	32°28'00"	94°46'50"	NE	11	2,947	11.76	2.29	13,335	4,034.2	-0.031	-0.107
58	08020700	Rabbit Creek at Kilgore, Texas	32°23'17"	94°54'11"	NE	13	75.8	2.55	13.91	3,566	1,921.6	.427	.285
59	08022000	Sabine River near Tatum, Texas	32°22'11"	94°27'28"	NE	22	3,493	13.85	2.04	30,082	14,522.4	.376	.182
60	08022400	Socagee Creek near Carthage, Texas	32°13'54"	94°05'31"	NE	12	82.6	4.00	6.86	2,266	1,058.0	.422	.259
61	08022500	Sabine River at Logansport, Louisiana	31°58'20"	94°00'22"	NE	57	4,842	16.90	1.65	22,596	8,520.2	.281	.115
62	08023200	Tenaha Creek near Shelbyville, Texas	31°45'56"	94°05'02"	NE	30	97.8	3.96	9.00	4,443	2,293.2	.456	.288
63	08024400	Sabine River near Milam, Texas	31°28'01"	93°44'41"	NE	23	6,508	16.68	1.48	31,036	11,070.3	.336	.107
64	08024500	Palo Gaucho Bayou near Hemphill, Texas	31°23'10"	93°50'08"	NE	14	123	4.46	11.76	3,670	1,967.0	.527	.349
65	08028500	Sabine River near Bon Weir, Texas	30°44'49"	93°36'30"	SE	41	8,229	19.81	1.50	37,132	10,493.2	.312	.213
66	08029500	Big Cow Creek near Newton, Texas	30°49'08"	93°47'07"	SE	46	128	5.22	12.06	4,072	1,931.4	.469	.254
67	08030000	Cypress Creek near Buna, Texas	30°25'52"	93°54'28"	SE	32	69.2	4.81	4.50	2,544	836.6	.303	.256
68	08030500	Sabine River near Ruliff, Texas	30°18'13"	93°44'37"	SE	54	9,329	22.74	1.43	42,033	11,556.7	.232	.134
69	08031000	Cow Bayou near Mauriceville, Texas	30°11'10"	93°54'30"	SE	34	83.3	7.62	2.60	1,701	613.5	.337	.167
70	08031200	Kickapoo Creek near Brownsboro, Texas	32°18'34"	95°36'19"	NE	28	232	5.44	4.34	4,568	2,066.2	.328	.193
71	08032000	Neches River near Neches, Texas	31°53'32"	95°25'50"	NE	23	1,145	6.06	3.19	10,817	4,796.2	.342	.246
72	08032500	Neches River near Alto, Texas	31°34'45"	95°09'55"	NE	18	1,945	10.38	2.24	12,693	6,170.9	.365	.118
73	08033000	Neches River near Diboll, Texas	31°07'58"	94°48'35"	NE	23	2,724	17.07	1.87	14,510	6,501.0	.317	.178
74	08033300	Piney Creek near Groveton, Texas	31°08'25"	95°05'11"	SE	28	79	5.69	7.58	2,183	1,128.7	.289	.008
75	08033500	Neches River near Rockland, Texas	31°01'29"	94°23'55"	SE	27	3,636	18.83	1.71	17,880	6,950.8	.261	.080
76	08033900	East Fork Angelina River near Cushing, Texas	31°51'36"	94°49'23"	NE	26	158	4.69	7.47	5,463	2,738.9	.361	.206
77	08037000	Angelina River near Lufkin, Texas	31°27'26"	94°43'34"	NE	28	1,600	9.05	2.73	11,235	4,972.2	.343	.187
78	08037050	Bayou Lanana at Nacogdoches, Texas	31°36'58"	94°38'28"	NE	27	31.3	5.54	13.46	3,049	1,450.6	.397	.272
79	08038000	Attoyac Bayou near Chireno, Texas	31°30'15"	94°18'15"	NE	59	503	11.52	4.44	8,725	4,162.0	.285	.110
80	08038500	Angelina River near Zavalla, Texas	31°12'41"	94°17'40"	NE	14	2,892	8.77	2.06	12,439	5,885.0	.389	.186
81	08039100	Ayish Bayou near San Augustine, Texas	31°23'46"	94°09'03"	NE	40	89	5.53	10.06	5,093	2,228.6	.318	.206
82	08039500	Angelina River at Horger, Texas	31°02'08"	94°07'48"	SE	30	3,486	9.74	2.35	19,032	6,369.9	.303	.131
83	08041000	Neches River at Evadale, Texas	30°21'20"	94°05'35"	SE	32	7,951	16.17	1.45	37,964	12,739.7	.236	.066
84	08041500	Village Creek near Kountze, Texas	30°23'52"	94°15'48"	SE	61	860	7.18	4.47	14,340	6,991.2	.426	.223
85	08041700	Pine Island Bayou near Sour Lake, Texas	30°06'21"	94°20'04"	SE	30	336	8.95	2.27	7,223	3,761.9	.597	.459

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak streamflow	Contributing drainage area (mi^2)	Basin shape factor (dimensionless)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
86	08042000	Taylor Bayou near Labelle, Texas	29°52'30"	94°09'34"	SE	30	262	2.49	1.22	5,849	851.8	0.032	0.222
87	08042500	Hillebrandt Bayou near Lovell Lake, Texas	29°55'44"	94°06'35"	SE	30	128	2.25	1.55	6,060	1,523.2	.125	.191
88	08042700	North Creek near Jacksboro, Texas	33°16'57"	98°17'53"	NE	18	21.6	5.39	27.97	2,527	1,009.9	.265	.183
89	08042800	West Fork Trinity River near Jacksboro, Texas	33°17'36"	98°04'43"	NE	19	683	5.83	5.35	6,272	3,808.0	.609	.378
90	08043500	West Fork Trinity River at Bridgeport, Texas	33°12'05"	97°45'21"	NE	25	1147	9.70	4.54	8,300	2,578.6	.215	.151
91	08044000	Big Sandy Creek near Bridgeport, Texas	33°13'54"	97°41'40"	NE	19	333	7.42	8.18	7,253	4,758.2	.646	.543
92	08047500	Clear Fork Trinity River at Fort Worth, Texas	32°43'56"	97°21'31"	NE	29	518	6.96	11.20	13,513	6,676.2	.515	.442
93	08048000	West Fork Trinity River at Fort Worth, Texas	32°45'39"	97°19'56"	NE	11	2,615	11.36	4.11	16,352	8,733.6	.731	.718
94	08049550	Big Bear Creek near Grapevine, Texas	32°54'48"	97°07'44"	NE	13	29.6	7.48	16.76	1,386	485.3	.026	.083
95	08049580	Mountain Creek near Venus, Texas	32°39'07"	96°59'24"	NE	12	25.5	36.62	12.24	3,814	1,918.3	.287	.017
96	08049700	Walnut Creek near Mansfield, Texas	32°34'51"	97°06'06"	NE	37	62.8	5.71	15.07	4,372	1,976.4	.351	.246
97	08050200	Elm Fork Trinity Subwatershed No. 6–0 near Muenster, Texas	33°37'13"	97°24'15"	NE	17	.77	.18	53.20	334	118.7	.190	.182
98	08050400	Elm Fork Trinity River at Gainesville, Texas	33°27'27"	97°09'22"	NE	12	174	1.66	22.19	13,128	3,982.7	.141	-.070
99	08050800	Timber Creek near Collinsville, Texas	33°33'16"	96°56'49"	NE	12	38.8	5.23	13.13	4,172	2,254.3	.326	.021
100	08051000	Isle du Bois Creek near Pilot Point, Texas	33°24'23"	97°00'45"	NE	37	266	3.73	8.34	9,885	5,134.3	.404	.178
101	08051500	Clear Creek near Sanger, Texas	33°20'21"	97°10'51"	NE	32	295	7.99	10.13	7,408	3,103.9	.130	.048
102	08052630	Little Elm Creek Subwatershed No. 10 near Gunter, Texas	33°24'33"	96°48'41"	NE	11	2.10	3.12	39.74	1,332	485.6	.176	.261
103	08053500	Denton Creek near Justin, Texas	33°07'08"	97°17'25"	NE	14	400	9.72	8.41	7,712	4,534.3	.430	.134
104	08054000	Denton Creek near Roanoke, Texas	33°02'24"	97°12'17"	NE	21	621	9.63	7.72	13,293	5,974.3	.423	.278
105	08055500	Elm Fork Trinity River near Carrollton, Texas	32°57'57"	96°56'39"	NE	28	2,459	4.22	5.25	27,565	12,953.9	.426	.156
106	08057000	Trinity River at Dallas, Texas	32°46'29"	96°49'18"	NE	30	6,106	8.37	3.66	30,225	14,851.7	.447	.255
107	08061500	East Fork Trinity River near Rockwall, Texas	32°55'25"	96°30'20"	NE	29	840	3.34	7.56	23,782	9,231.4	.189	.080
108	08061540	Rowlett Creek near Sachse, Texas	32°57'35"	96°36'51"	NE	29	120	4.63	12.11	12,370	5,073.4	.214	.045
109	08062500	Trinity River near Rosser, Texas	32°25'35"	96°27'46"	NE	14	8,146	9.17	3.31	34,514	10,838.5	.066	-.042
110	08063000	Cedar Creek near Mabank, Texas	32°19'45"	96°10'05"	NE	27	733	3.82	4.90	17,443	5,914.9	.149	.058
111	08063500	Richland Creek near Richland, Texas	31°57'02"	96°25'16"	NE	24	734	4.87	8.12	25,374	10,079.0	.130	.031
112	08064500	Chambers Creek near Corsicana, Texas	32°06'29"	96°22'14"	NE	22	963	7.66	6.26	18,955	6,989.6	.154	.123
113	08064700	Tehuacana Creek near Streetman, Texas	31°50'54"	96°17'23"	NE	30	142	4.08	10.77	13,866	7,820.9	.616	.392
114	08064800	Catfish Creek near Tennessee Colony, Texas	31°52'51"	95°52'07"	NE	28	207	4.71	6.72	1,846	933.2	.473	.299

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak stream-flow	Contri-buting drainage area (mi^2)	Basin shape factor (dimen-sion-less)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
115	08065000	Trinity River near Oakwood, Texas	31°38'54"	95°47'21"	NE	29	12,833	13.00	2.55	48,348	18,871.9	0.336	0.164
116	08065200	Upper Keechi Creek near Oakwood, Texas	31°34'11"	95°53'17"	SE	36	150	5.39	8.31	6,881	4,010.8	.433	.225
117	08065500	Trinity River near Midway, Texas	31°04'28"	95°41'57"	SE	14	14,450	16.38	2.20	54,986	23,922.0	.405	.149
118	08065700	Caney Creek near Madisonville, Texas	30°56'12"	95°56'07"	SE	13	112	5.50	10.31	5,955	2,686.7	.297	.020
119	08065800	Bedias Creek near Madisonville, Texas	30°53'03"	95°46'39"	SE	30	321	4.46	7.80	12,567	5,696.8	.280	.032
120	08066000	Trinity River at Riverside, Texas	30°51'33"	95°23'55"	SE	51	15,589	18.22	2.01	43,371	14,327.1	.225	.162
121	08066100	White Rock Creek near Trinity, Texas	31°03'06"	95°22'40"	SE	18	222	4.16	9.18	7,672	3,357.8	.178	.049
122	08066170	Kickapoo Creek near Onalaska, Texas	30°54'25"	95°05'18"	SE	32	57	2.88	12.80	8,917	4,954.7	.662	.541
123	08066200	Long King Creek at Livingston, Texas	30°42'58"	94°57'31"	SE	35	141	3.46	10.70	9,615	4,788.3	.472	.287
124	08066300	Menard Creek near Rye, Texas	30°28'52"	94°46'46"	SE	32	152	10.10	7.54	3,615	1,816.0	.431	.250
125	08066400	Big Creek near Shepherd, Texas	30°30'59"	94°59'06"	SE	24	38.8	5.38	18.16	2,055	1,488.9	.746	.640
126	08066500	Trinity River at Romayor, Texas	30°25'30"	94°51'02"	SE	30	17,186	20.91	1.96	45,743	13,229.3	.213	.178
127	08067000	Trinity River at Liberty, Texas	30°03'27"	94°49'05"	SE	14	17,468	24.09	1.86	48,100	16,473.6	.302	.167
128	08067500	Cedar Bayou near Crosby, Texas	29°58'20"	94°59'10"	SE	26	64.9	4.11	2.81	2,620	784.6	.271	.197
129	08068000	West Fork San Jacinto River near Conroe, Texas	30°14'40"	95°27'25"	SE	37	828	3.89	5.09	17,914	9,850.7	.457	.314
130	08068500	Spring Creek near Spring, Texas	30°06'37"	95°26'10"	SE	59	409	6.40	6.15	9,110	4,856.2	.466	.354
131	08068520	Spring Creek at Spring, Texas	30°05'31"	95°24'21"	SE	58	419	7.15	5.93	9,927	5,484.6	.485	.355
132	08068720	Cypress Creek at Katy-Hockley Road near Hockley, Texas	29°57'00"	95°48'29"	SE	22	110	6.05	5.85	1,246	368.5	.044	.071
133	08068740	Cypress Creek at House-Hahl Road near Cypress, Texas	29°57'32"	95°43'03"	SE	23	131	7.68	4.96	1,610	475.7	.293	.256
134	08068780	Little Cypress Creek near Cypress, Texas	30°00'57"	95°41'50"	SE	15	41	4.07	5.84	1,535	652.7	.333	.130
135	08068800	Cypress Creek at Grant Road near Cypress, Texas	29°58'24"	95°35'54"	SE	15	214	8.20	5.01	3,083	1,004.4	.300	.471
136	08069500	West Fork San Jacinto River near Humble, Texas	30°01'37"	95°15'28"	SE	26	1,741	3.93	4.16	33,503	19,472.4	.613	.431
137	08070000	East Fork San Jacinto River near Cleveland, Texas	30°20'11"	95°06'14"	SE	58	325	6.29	5.51	9,459	5,464.9	.531	.354
138	08070200	East Fork San Jacinto River near New Caney, Texas	30°08'43"	95°07'27"	SE	12	338	11.76	4.74	10,913	7,454.2	.800	.708
139	08070500	Caney Creek near Splendora, Texas	30°15'34"	95°18'08"	SE	54	105	8.71	8.79	4,548	2,407.0	.586	.447
140	08071000	Peach Creek at Splendora, Texas	30°13'57"	95°10'05"	SE	34	117	7.93	9.91	3,720	2,468.4	.607	.428
141	08071280	Luce Bayou above Lake Houston near Huffman, Texas	30°06'34"	95°03'35"	SE	13	218	8.10	6.17	7,590	4,148.6	.468	.231
142	08071500	San Jacinto River near Huffman, Texas	29°59'40"	95°08'00"	SE	17	2,800	3.10	3.70	46,391	26,645.7	.574	.392
143	08072300	Buffalo Bayou near Katy, Texas	29°44'35"	95°48'24"	SE	20	63.3	2.14	4.08	1,943	493.8	-.001	.099

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak stream-flow	Contri-buting drainage area (mi^2)	Basin shape factor (dimen-sion-less)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
144	08072730	Bear Creek near Barker, Texas	29°49'50"	95°41'12"	SE	20	21.5	4.76	4.96	720	199.9	0.239	0.256
145	08072760	Langham Creek at West Little York Road near Addicks, Texas	29°52'01"	95°38'47"	SE	17	24.6	3.01	4.19	1,026	293.4	.041	.060
146	08072800	Langham Creek near Addicks, Texas	29°50'08"	95°37'30"	SE	11	48.9	1.86	4.81	1,432	494.1	.351	.123
147	08074020	Whiteoak Bayou at Alabonson Road at Houston, Texas	29°52'14"	95°28'49"	SE	13	34.5	4.49	4.22	4,340	1,341.7	.155	.043
148	08078000	Chocolate Bayou near Alvin, Texas	29°22'09"	95°19'14"	SE	51	87.7	3.44	2.74	2,970	1,063.5	.374	.407
149	08079500	North Fork Double Mountain Fork Brazos River at Lubbock, Texas	33°35'08"	101°49'40"	W	12	200	80.93	7.43	464	380.8	.694	.471
150	08079600	Double Mountain Fork Brazos River at Justiceburg, Texas	33°02'18"	101°11'50"	W	36	244	5.61	16.67	12,207	6,224.7	.372	.146
151	08080500	Double Mountain Fork Brazos River near Aspermont, Texas	33°00'29"	100°10'49"	W	69	1,864	57.11	7.41	19,723	8,574.1	.312	.202
152	08080540	McDonald Creek near Post, Texas	33°21'03"	101°13'36"	W	13	79.2	4.38	33.46	2,209	1,503.2	.728	.645
153	08080700	Running Water Draw at Plainview, Texas	34°10'44"	101°42'08"	W	37	382	47.17	9.07	1,064	828.9	.701	.526
154	08081200	Croton Creek near Jayton, Texas	33°17'18"	100°25'52"	W	27	290	13.49	18.99	3,686	1,543.8	.166	.077
155	08081500	Salt Croton Creek near Aspermont, Texas	33°24'03"	100°24'29"	W	21	64.3	3.40	23.31	5,430	3,306.2	.541	.336
156	08082000	Salt Fork Brazos River near Aspermont, Texas	33°20'02"	100°14'16"	W	27	2,496	47.49	8.62	19,570	5,858.3	.131	.105
157	08082100	Stinking Creek near Aspermont, Texas	33°14'00"	100°12'47"	W	18	88.8	6.96	10.69	894	447.6	.410	.187
158	08082180	North Croton Creek near Knox City, Texas	33°22'59"	100°04'51"	W	21	251	12.83	11.85	3,667	2,644.1	.693	.555
159	08082500	Brazos River at Seymour, Texas	33°34'51"	99°16'02"	W	50	5,972	33.74	7.40	30,968	11,917.5	.279	.124
160	08082700	Millers Creek near Munday, Texas	33°19'45"	99°27'53"	W	34	104	8.39	7.00	1,989	1,625.8	.779	.660
161	08083100	Clear Fork Brazos River near Roby, Texas	32°47'15"	100°23'18"	W	36	228	6.62	13.09	1,819	1,081.8	.434	.135
162	08083240	Clear Fork Brazos River at Hawley, Texas	32°35'53"	99°48'53"	W	22	1,416	8.13	7.37	2,819	1,272.7	.447	.162
163	08083245	Mulberry Creek near Hawley, Texas	32°34'04"	99°47'32"	W	21	205	12.06	17.69	1,178	422.7	.231	.066
164	08083400	Little Elm Creek near Abilene, Texas	32°23'29"	99°51'08"	W	16	39.1	4.72	32.85	744	349.9	.196	.031
165	08084000	Clear Fork Brazos River at Nugent, Texas	32°41'24"	99°40'09"	W	16	2,199	7.42	6.78	10,569	4,782.8	.509	.426
166	08084800	California Creek near Stamford, Texas	32°55'51"	99°38'32"	W	35	478	8.81	7.58	3,564	2,078.3	.602	.532
167	08085500	Clear Fork Brazos River at Fort Griffin, Texas	32°56'04"	99°13'27"	W	16	3988	12.39	5.28	11,462	4,540.7	.360	.190
168	08086050	Deep Creek at Moran, Texas	32°33'33"	99°10'11"	W	13	228	6.42	16.47	5,119	1,520.3	-.165	.188
169	08086100	Hubbard Creek near Albany, Texas	32°41'21"	99°09'52"	W	14	454	5.68	13.76	8,204	3,099.7	.045	-.051
170	08086150	North Fork Hubbard Creek near Albany, Texas	32°42'27"	99°16'29"	W	28	39.3	4.57	36.26	6,071	5,084.6	.825	.732
171	08086212	Hubbard Creek below Albany, Texas	32°43'58"	99°08'25"	W	31	613	5.18	12.75	20,784	15,490.6	.718	.620

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172	08086290	Big Sandy Creek above Breckenridge, Texas	32°38'54"	99°00'15"	W	22	280	28.10	8.10	7,686	5,043.5	0.744	0.683
173	08086300	Big Sandy Creek near Breckenridge, Texas	32°39'52"	99°00'01"	W	14	298	23.90	8.63	5,086	1,200.9	.084	-.017
174	08087300	Clear Fork Brazos River at Eliasville, Texas	32°57'36"	98°45'59"	W	31	5697	14.22	4.81	12,597	3,955.4	.192	.147
175	08088000	Brazos River near South Bend, Texas	33°01'27"	98°38'37"	W	23	13,107	22.41	6.47	30,575	10,669.8	.237	.178
176	08088100	Salt Creek at Olney, Texas	33°22'13"	98°44'40"	W	20	11.8	1.71	13.13	913	550.2	.645	.419
177	08088300	Briar Creek near Graham, Texas	33°12'43"	98°37'06"	W	31	24.2	6.09	15.41	1,114	573.7	.387	.137
178	08088450	Big Cedar Creek near Ivan, Texas	32°49'39"	98°43'25"	W	25	97	7.00	13.47	4,247	2,769.3	.525	.367
179	08089000	Brazos River near Palo Pinto, Texas	32°51'45"	98°18'08"	NE	17	14,245	27.66	5.93	41,201	11,145.9	.176	.262
180	08090500	Palo Pinto Creek near Santo, Texas	32°37'51"	98°10'50"	NE	13	573	4.92	10.20	15,132	6,750.4	.357	.220
181	08091000	Brazos River near Glen Rose, Texas	32°16'18"	97°39'48"	NE	17	16,252	37.82	5.04	41,961	11,231.5	.186	.341
182	08091500	Paluxy River at Glen Rose, Texas	32°13'53"	97°46'37"	NE	35	410	8.13	13.64	15,356	7,548.9	.353	.110
183	08092000	Nolan River at Blum, Texas	32°09'02"	97°24'09"	NE	16	282	3.81	13.11	12,354	3,365.8	.195	.267
184	08093250	Hackberry Creek at Hillsboro, Texas	32°00'20"	97°08'59"	NE	13	57.9	3.73	9.15	4,995	2,198.9	.248	-.036
185	08093500	Aquilla Creek near Aquilla, Texas	31°50'40"	97°12'04"	NE	44	308	4.90	8.19	12,840	5,215.6	.369	.250
186	08094000	Green Creek Subwatershed No. 1 near McKinney, Texas	32°09'57"	98°20'28"	NE	22	4.19	1.83	41.45	1,624	1,002.6	.610	.435
187	08095000	North Bosque River near Clifton, Texas	31°47'09"	97°34'04"	NE	44	968	9.28	9.69	22,369	7,996.3	.176	.137
188	08095300	Middle Bosque River near McGregor, Texas	31°30'33"	97°21'56"	NE	38	182	5.44	19.39	13,633	5,214.8	.189	.112
189	08095400	Hog Creek near Crawford, Texas	31°33'20"	97°21'22"	NE	20	78.2	15.25	17.20	7,451	2,330.4	.043	.128
190	08096500	Brazos River at Waco, Texas	31°32'06"	97°04'22"	NE	43	20,007	39.89	4.68	65,053	26,023.4	.335	.166
191	08096800	Cow Bayou Subwatershed No. 4 near Bruceville, Texas	31°19'59"	97°16'02"	NE	18	5.04	3.36	43.90	1,004	414.2	.050	-.020
192	08098203	Brushy Creek Watershed C near Riessel, Texas	31°31'11"	96°53'34"	NE	32	.90	1.60	32.83	320	128.1	.252	.114
193	08098206	Brushy Creek Watershed D near Riessel, Texas	31°30'38"	96°53'32"	NE	15	1.73	1.97	28.44	514	188.1	.080	-.017
194	08098227	Brushy Creek Watershed Y–2 near Riessel, Texas	31°28'30"	96°52'46"	NE	37	.21	.69	60.44	137	70.5	.307	.108
195	08098239	Brushy Creek Watershed Y near Riessel, Texas	31°28'36"	96°52'36"	NE	36	.48	.88	50.47	260	134.7	.280	.044
196	08098242	Brushy Creek Watershed G near Riessel, Texas	31°28'59"	96°52'06"	NE	24	6.84	4.10	17.97	1,189	539.7	.241	.116
197	08098263	Brushy Creek Watershed W–1 near Riessel, Texas	31°27'27"	96°52'48"	NE	38	.28	1.10	65.04	236	106.7	.188	.050
198	08098281	Brushy Creek Watershed W–2 near Riessel, Texas	31°27'19"	96°52'55"	NE	38	.20	3.44	56.63	149	77.2	.299	.103
199	08098300	Little Pond Creek near Burlington, Texas	31°01'35"	96°59'17"	SE	20	23	8.36	12.06	3,373	1,336.0	.141	.097
200	08099300	Sabana River near De Leon, Texas	32°06'50"	98°36'19"	W	19	264	11.63	12.37	5,332	1,858.3	.057	-.002

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201	08099500	Leon River near Hasse, Texas	31°57'28"	98°27'32"	W	15	1,261	6.79	9.33	10,781	5,295.6	0.256	0.086
202	08100500	Leon River at Gatesville, Texas	31°25'58"	97°45'42"	NE	13	2,342	19.69	5.81	14,398	8,130.1	.443	.160
203	08101000	Cowhouse Creek at Pidcoke, Texas	31°17'05"	97°53'05"	NE	46	455	11.36	13.24	17,507	8,539.3	.334	.178
204	08102500	Leon River near Belton, Texas	31°04'12"	97°26'28"	NE	31	3,542	24.76	5.09	19,754	6,704.5	.261	.158
205	08103800	Lampasas River near Kempner, Texas	31°04'54"	98°00'59"	W	11	818	5.22	13.46	19,529	8,634.9	.414	.496
206	08103900	South Fork Rocky Creek near Briggs, Texas	30°54'41"	98°02'12"	W	35	33.3	3.93	36.15	4,612	2,471.4	.419	.299
207	08104000	Lampasas River at Youngsport, Texas	30°57'26"	97°42'30"	NE	49	1,240	8.33	10.49	21,614	9,314.4	.370	.278
208	08104700	North Fork San Gabriel River near Georgetown, Texas	30°39'42"	97°42'40"	W	11	248	9.17	16.30	10,615	5,920.7	.442	.268
209	08104900	South Fork San Gabriel River at Georgetown, Texas	30°37'32"	97°41'27"	W	30	133	10.88	19.84	9,793	4,164.9	.277	.152
210	08105000	San Gabriel River at Georgetown, Texas	30°39'14"	97°39'18"	W	39	405	6.73	16.02	19,983	10,164.5	.452	.374
211	08105100	Berry Creek near Georgetown, Texas	30°41'28"	97°39'21"	W	30	83.1	9.44	16.04	5,177	2,234.2	.203	.120
212	08105400	San Gabriel River near Circleville, Texas	30°37'43"	97°28'23"	W	19	599	7.29	14.60	22,140	9,344.9	.223	.000
213	08105700	San Gabriel River at Laneport, Texas	30°41'39"	97°16'43"	W	15	738	9.59	12.68	15,342	5,369.5	.074	.062
214	08106500	Little River at Cameron, Texas	30°49'53"	96°57'01"	SE	36	7065	20.21	4.46	56,703	34,120.7	.603	.458
215	08108200	North Elm Creek near Cameron, Texas	30°55'52"	97°01'13"	SE	11	44.8	10.88	10.25	3,418	1,237.5	-.025	.112
216	08109000	Brazos River near Bryan, Texas	30°36'52"	96°29'10"	SE	20	29,949	34.50	4.30	77,530	18,775.3	.230	.104
217	08109700	Middle Yegua Creek near Dime Box, Texas	30°20'21"	96°54'16"	SE	35	236	7.15	6.79	2,736	1,555.0	.351	.160
218	08109800	East Yegua Creek near Dime Box, Texas	30°24'26"	96°49'02"	SE	35	244	4.97	7.25	3,065	1,634.1	.350	.196
219	08110000	Yegua Creek near Somerville, Texas	30°19'18"	96°30'26"	SE	42	1,009	3.79	4.14	11,064	5,842.9	.384	.226
220	08110100	Davidson Creek near Lyons, Texas	30°25'10"	96°32'24"	SE	35	195	8.01	8.30	5,842	3,009.4	.377	.211
221	08110430	Big Creek near Freestone, Texas	31°30'25"	96°19'31"	NE	19	57.1	6.32	7.25	3,051	1,642.1	.545	.429
222	08110500	Navasota River near Easterly, Texas	31°10'12"	96°17'51"	SE	37	968	7.58	3.83	17,774	8,421.2	.292	.131
223	08111000	Navasota River near Bryan, Texas	30°52'10"	96°11'32"	SE	11	1,454	10.12	3.30	14,655	7,355.6	.244	-.069
224	08111700	Mill Creek near Bellville, Texas	29°52'51"	96°12'18"	SE	30	376	5.30	8.01	15,413	6,257.8	.215	.137
225	08114000	Brazos River at Richmond, Texas	29°34'56"	95°45'27"	SE	21	35,441	41.16	3.73	62,867	13,301.0	.065	.122
226	08115000	Big Creek near Needville, Texas	29°28'35"	95°48'45"	SE	50	42.8	4.89	2.83	2,972	966.8	.295	.226
227	08116400	Dry Creek near Rosenberg, Texas	29°30'42"	95°44'48"	SE	21	8.65	3.93	3.38	816	222.7	.353	.364
228	08117500	San Bernard River near Boling, Texas	29°18'48"	95°53'37"	SE	43	727	9.58	4.01	8,629	3,091.1	.248	.071
229	08119000	Bluff Creek near Ira, Texas	32°35'29"	101°03'02"	W	18	42.6	8.56	18.72	1,204	480.2	.371	.441

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak stream-flow	Contri-buting drainage area (mi^2)	Basin shape factor (dimen-sion-less)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
230	08120500	Deep Creek near Dunn, Texas	32°34'25"	100°54'27"	W	34	188	10.85	14.02	3,651	1,919.1	0.504	0.408
231	08123500	Champion Creek near Colorado City, Texas	32°19'01"	100°49'28"	W	12	177	4.58	16.82	4,633	2,020.8	.124	-.150
232	08124000	Colorado River at Robert Lee, Texas	31°53'07"	100°28'49"	W	14	5047	4.04	4.64	20,764	4,666.0	-.081	.078
233	08126500	Colorado River at Ballinger, Texas	31°43'58"	99°57'13"	W	61	6160	6.23	4.30	19,320	6,507.0	.245	.200
234	08127000	Elm Creek at Ballinger, Texas	31°44'57"	99°56'51"	W	49	450	4.29	16.49	9,533	4,869.8	.471	.290
235	08128000	South Concho River at Christoval, Texas	31°11'15"	100°30'06"	W	67	354	3.24	13.37	9,654	7,261.9	.641	.434
236	08128400	Middle Concho River above Tankersley, Texas	31°25'38"	100°42'39"	W	37	1,611	6.47	7.61	3,885	2,264.4	.323	.065
237	08128500	Middle Concho River near Tankersley, Texas	31°22'35"	100°36'50"	W	31	1,685	7.39	7.56	11,286	4,795.0	.174	.019
238	08129300	Spring Creek above Tankersley, Texas	31°19'48"	100°38'24"	W	37	405	7.33	13.36	2,962	2,384.7	.673	.405
239	08130500	Dove Creek at Knickerbocker, Texas	31°16'24"	100°37'45"	W	37	198	5.74	15.66	3,883	2,586.7	.432	.111
240	08131000	Spring Creek near Tankersley, Texas	31°21'30"	100°32'05"	W	30	671	5.73	13.17	12,925	6,812.4	.398	.301
241	08131400	Pecan Creek near San Angelo, Texas	31°18'32"	100°26'44"	W	25	81.1	4.82	23.24	1,907	1,602.2	.774	.628
242	08133500	North Concho River at Sterling City, Texas	31°49'48"	100°59'36"	W	57	568	4.10	10.60	2,940	1,921.7	.497	.249
243	08134000	North Concho River near Carlsbad, Texas	31°35'33"	100°38'12"	W	73	1,191	5.90	9.44	11,962	8,271.4	.572	.315
244	08135000	North Concho River at San Angelo, Texas	31°27'57"	100°26'51"	W	17	1,450	7.74	8.30	14,104	8,245.9	.389	.077
245	08136000	Concho River at San Angelo, Texas	31°27'16"	100°24'37"	W	15	4,411	3.87	7.53	25,635	12,303.7	.349	.182
246	08136500	Concho River at Paint Rock, Texas	31°30'57"	99°55'09"	W	15	5,443	5.46	6.87	21,979	10,227.5	.361	.179
247	08138000	Colorado River at Winchell, Texas	31°28'04"	99°09'43"	W	24	13,788	6.41	3.97	30,194	7,388.4	.158	.259
248	08144500	San Saba River at Menard, Texas	30°55'08"	99°47'07"	W	78	1,128	3.06	9.55	16,187	11,078.6	.536	.276
249	08144600	San Saba River near Brady, Texas	31°00'14"	99°16'07"	W	15	1,626	6.18	8.87	15,010	10,080.3	.502	.245
250	08145000	Brady Creek at Brady, Texas	31°08'17"	99°20'05"	W	15	588	6.65	10.70	7,739	4,207.5	.568	.450
251	08146000	San Saba River at San Saba, Texas	31°12'47"	98°43'09"	W	47	3,039	8.03	8.02	22,236	13,288.1	.532	.324
252	08147000	Colorado River near San Saba, Texas	31°13'04"	98°33'51"	W	35	19,819	7.49	3.52	46,023	21,062.1	.562	.366
253	08148500	North Llano River near Junction, Texas	30°31'06"	99°48'39"	W	62	914	3.27	11.87	21,205	13,111.2	.401	.109
254	08150000	Llano River near Junction, Texas	30°29'51"	99°43'19"	W	80	1,851	2.98	9.98	33,902	22,555.8	.500	.237
255	08150700	Llano River near Mason, Texas	30°39'38"	99°06'32"	W	28	3,242	5.06	8.79	44,814	27,348.7	.460	.268
256	08150800	Beaver Creek near Mason, Texas	30°38'36"	99°05'44"	W	34	215	5.35	25.74	9,849	5,920.1	.470	.320
257	08151000	Llano River near Castell, Texas	30°43'00"	98°53'00"	W	15	3,742	5.62	8.12	76,621	43,300.6	.510	.361
258	08151500	Llano River at Llano, Texas	30°45'04"	98°40'10"	W	58	4,192	6.09	8.24	51,103	29,326.1	.417	.189

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak stream-flow	Contri-buting drainage area (mi^2)	Basin shape factor (dimen-sionless)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
259	08152000	Sandy Creek near Kingsland, Texas	30°33'30"	98°28'19"	W	29	346	6.75	24.84	14,333	8,022.8	0.519	0.407
260	08152900	Pedernales River near Fredericksburg, Texas	30°13'13"	98°52'10"	W	17	369	4.09	17.64	14,684	9,631.9	.495	.228
261	08153500	Pedernales River near Johnson City, Texas	30°17'30"	98°23'57"	W	58	901	7.05	14.57	42,773	24,821.7	.495	.321
262	08154000	Pedernales River near Spicewood, Texas	30°25'15"	98°04'50"	W	15	1,294	11.31	13.26	33,841	21,878.6	.544	.307
263	08154700	Bull Creek at Loop 360 near Austin, Texas	30°22'19"	97°47'04"	W	19	22.3	3.96	47.82	4,732	2,325.7	.308	.156
264	08155200	Barton Creek at SH 71 near Oak Hill, Texas	30°17'46"	97°55'31"	W	16	89.7	8.38	22.62	4,206	2,324.7	.266	.060
265	08155300	Barton Creek at Loop 360 at Austin, Texas	30°14'40"	97°48'07"	W	22	116	16.33	18.84	5,419	3,128.2	.305	.043
266	08158000	Colorado River at Austin, Texas	30°14'40"	97°41'39"	W	39	27,606	11.21	3.66	76,995	33,850.6	.499	.349
267	08158700	Onion Creek near Driftwood, Texas	30°04'59"	98°00'29"	W	16	124	8.25	15.59	4,640	2249.1	.058	-.143
268	08158810	Bear Creek below FM 1826 near Driftwood, Texas	30°09'19"	97°56'23"	W	19	12.20	2.47	55.55	1,944	1,356.4	.526	.275
269	08158840	Slaughter Creek at FM 1826 near Austin, Texas	30°12'32"	97°54'11"	W	20	8.24	2.14	52.32	1,497	905.5	.381	.114
270	08159150	Wilbarger Creek near Pflugerville, Texas	30°27'16"	97°36'02"	W	17	4.61	1.94	38.44	659	203.2	.258	.321
271	08160000	Dry Creek at Buescher Lake near Smithville, Texas	30°02'32"	97°09'34"	SE	26	1.48	2.15	69.96	489	282.9	.332	.063
272	08160800	Redgate Creek near Columbus, Texas	29°47'56"	96°31'55"	SE	36	17.3	3.35	18.11	2,084	711.4	.168	.060
273	08161000	Colorado River at Columbus, Texas	29°42'22"	96°32'12"	SE	21	30,237	16.90	3.22	59,303	21,371.0	.334	.279
274	08162600	Tres Palacios River near Midfield, Texas	28°55'40"	96°10'15"	SE	27	145	6.44	3.33	6085	1,820.7	.225	.202
275	08163500	Lavaca River at Hallettsville, Texas	29°26'35"	96°56'39"	SE	58	108	5.89	12.18	13,332	7,219.7	.495	.345
276	08164000	Lavaca River near Edna, Texas	28°57'35"	96°41'10"	SE	59	817	8.97	5.44	17,935	8,884.8	.484	.385
277	08164300	Navidad River near Hallettsville, Texas	29°28'00"	96°48'45"	SE	36	332	4.19	8.35	12,829	5,650.6	.276	.183
278	08164450	Sandy Creek near Louise, Texas	29°09'34"	96°32'47"	SE	20	289	10.65	5.97	6,934	2,756.2	.309	.214
279	08164500	Navidad River near Ganado, Texas	29°01'32"	96°33'08"	SE	42	826	10.40	4.78	18,854	8,430.8	.430	.303
280	08164503	West Mustang Creek near Ganado, Texas	29°04'17"	96°28'01"	SE	20	178	8.56	2.77	5,383	2,249.6	.408	.302
281	08164600	Garcitas Creek near Inez, Texas	28°53'28"	96°49'08"	SE	27	91.7	6.81	6.83	6,779	3,153.1	.312	.125
282	08164800	Placedo Creek near Placedo, Texas	28°43'30"	96°46'07"	SE	27	68.3	6.81	4.72	7,088	2,606.8	.187	.112
283	08165300	North Fork Guadalupe River near Hunt, Texas	30°03'36"	99°23'40"	W	30	168	4.53	20.35	13,842	8,687.9	.371	.079
284	08165500	Guadalupe River at Hunt, Texas	30°04'08"	99°19'23"	W	32	288	3.98	19.10	18,402	11,605.3	.441	.191
285	08166000	Johnson Creek near Ingram, Texas	30°06'00"	99°16'58"	W	50	114	3.44	25.03	8,663	6,880.0	.699	.475
286	08166200	Guadalupe River at Kerrville, Texas	30°03'09"	99°09'54"	W	12	510	3.85	16.73	27,540	19,533.4	.561	.291
287	08167000	Guadalupe River at Comfort, Texas	29°58'10"	98°53'33"	W	68	839	5.65	15.01	27,708	17,848.0	.534	.310

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak stream-flow	Contri-buting drainage area (mi^2)	Basin shape factor (dimen-sion-less)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data: Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
288	08167500	Guadalupe River near Spring Branch, Texas	29°51'38"	98°22'58"	W	75	1,315	13.10	10.85	23,625	13,781.0	0.515	0.289
289	08167600	Rebecca Creek near Spring Branch, Texas	29°55'06"	98°22'10"	W	14	10.9	2.84	77.79	2,920	1,737.3	.283	.025
290	08168500	Guadalupe River above Comal River at New Braunfels, Texas	29°42'53"	98°06'35"	W	35	1,518	20.81	9.86	19,564	11,732.4	.519	.288
291	08169500	Guadalupe River at New Braunfels, Texas	29°41'52"	98°06'23"	W	13	1,652	19.52	9.98	21,289	11,349.1	.277	-.040
292	08171000	Blanco River at Wimberley, Texas	29°59'39"	98°05'19"	W	70	355	10.27	19.02	16,124	9,737.7	.479	.295
293	08171300	Blanco River near Kyle, Texas	29°58'45"	97°54'35"	W	41	412	14.42	17.11	18,287	10,293.3	.373	.188
294	08172000	San Marcos River at Luling, Texas	29°39'54"	97°38'59"	SE	44	838	18.43	13.07	16,318	8,049.7	.343	.102
295	08173000	Plum Creek near Luling, Texas	29°41'58"	97°36'12"	SE	34	309	5.79	12.56	12,376	7,169.8	.480	.235
296	08173500	San Marcos River at Ottine, Texas	29°35'36"	97°35'22"	SE	28	1,249	15.05	12.11	32,006	20,904.5	.626	.423
297	08174600	Peach Creek below Dilworth, Texas	29°28'26"	97°18'59"	SE	19	460	5.50	7.83	13,357	7,146.0	.528	.468
298	08175000	Sandies Creek near Westhoff, Texas	29°12'54"	97°26'57"	SE	41	549	5.42	8.30	10,410	7,161.0	.610	.396
299	08176000	Guadalupe River below Cuero, Texas	29°03'05"	97°15'52"	SE	23	4,923	25.22	6.37	26,933	14,414.7	.436	.123
300	08176500	Guadalupe River at Victoria, Texas	28°47'34"	97°00'46"	SE	27	5,198	30.15	5.83	30,832	15,600.6	.422	.262
301	08176900	Coleto Creek at Arnold Road near Schroeder, Texas	28°51'41"	97°13'34"	SE	19	357	6.33	10.35	13,431	6,794.2	.232	.096
302	08177000	Coleto Creek near Schroeder, Texas	28°49'53"	97°11'10"	SE	31	369	7.04	8.30	18,880	10,767.6	.432	.266
303	08177300	Perdido Creek at FM 622 near Fannin, Texas	28°45'05"	97°19'01"	SE	19	28	2.63	17.21	6,896	4,131.0	.375	.113
304	08177500	Coleto Creek near Victoria, Texas	28°43'51"	97°08'18"	SE	18	514	7.32	7.65	17,896	10,665.2	.503	.309
305	08178500	San Pedro Creek at Furnish Street at San Antonio, Texas	29°24'22"	98°30'38"	W	14	2.64	84.89	29.81	738	273.0	.190	.240
306	08178640	West Elm Creek at San Antonio, Texas	29°37'23"	98°26'29"	W	13	2.45	2.58	82.13	387	136.1	.102	.160
307	08178880	Medina River at Bandera, Texas	29°43'26"	99°04'13"	W	15	427	6.28	19.83	12,918	9,259.9	.545	.213
308	08179000	Medina River near Pipe Creek, Texas	29°40'31"	98°58'33"	W	41	474	8.73	17.49	22,775	14,585.5	.613	.468
309	08179100	Red Bluff Creek near Pipe Creek, Texas	29°40'51"	98°57'19"	W	25	56.3	3.14	48.84	5506	3672.2	.551	.394
310	08181000	Leon Creek trib. at FM 1604 at San Antonio, Texas	29°35'14"	98°37'40"	W	12	5.57	1.85	71.50	467	318.7	.431	.073
311	08181400	Helotes Creek at Helotes, Texas	29°34'42"	98°41'29"	W	29	15	5.09	56.70	1,543	1,006.5	.444	.185
312	08182400	Calaveras Creek Subwatershed No. 6 near Elmendorf, Texas	29°22'49"	98°17'33"	W	21	7.01	2.24	32.31	1,734	869.0	.286	.011
313	08183900	Cibolo Creek near Boerne, Texas	29°46'26"	98°41'50"	W	15	68.4	4.59	35.38	8,214	4,788.4	.431	.245
314	08184000	Cibolo Creek near Bulverde, Texas	29°43'33"	98°25'37"	W	20	198	9.25	22.22	5,699	3,688.5	.372	.035
315	08185000	Cibolo Creek at Selma, Texas	29°35'38"	98°18'39"	W	35	274	16.45	18.32	10,380	7,568.6	.559	.279
316	08186000	Cibolo Creek near Falls City, Texas	29°00'50"	97°55'48"	SE	67	827	24.66	11.90	9,939	4,359.0	.303	.168

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										Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
317	08186500	Ecleto Creek near Runge, Texas	28°55'12"	97°46'19"	SE	28	239	13.17	7.66	7,075	5,326.4	0.779	0.656
318	08187900	Escondido Creek Subwatershed No. 11 near Kenedy, Texas	28°51'39"	97°50'39"	SE	20	8.43	2.10	30.39	1,760	1,374.0	.737	.597
319	08189200	Copano Creek near Refugio, Texas	28°18'12"	97°06'44"	SE	27	87.8	8.68	4.40	1,482	764.7	.341	.162
320	08189300	Medio Creek near Beeville, Texas	28°28'58"	97°39'23"	SE	16	204	7.16	8.59	8,310	7,036.2	.894	.894
321	08189500	Mission River at Refugio, Texas	28°17'30"	97°16'44"	SE	58	690	9.31	5.98	10,026	5,925.1	.551	.411
322	08189700	Aransas River near Skidmore, Texas	28°16'56"	97°37'14"	SE	31	247	4.10	9.59	9,206	6,564.7	.688	.545
323	08189800	Chiltipin Creek at Sinton, Texas	28°02'48"	97°30'13"	SE	21	128	1.67	5.83	4,948	2,899.2	.486	.368
324	08190000	Nueces River at Laguna, Texas	29°25'42"	99°59'49"	W	75	737	5.80	17.21	33,539	24,031.2	.595	.350
325	08190500	West Nueces River near Brackettville, Texas	29°28'21"	100°14'10"	W	51	694	6.04	15.15	24,488	18,540.0	.611	.373
326	08192000	Nueces River below Uvalde, Texas	29°07'25"	99°53'40"	W	70	1,861	5.12	15.62	40,501	30,428.9	.634	.415
327	08194000	Nueces River at Cotulla, Texas	28°25'34"	99°14'23"	W	25	5,171	8.34	9.15	14,497	8,166.8	.541	.337
328	08194200	San Casimiro Creek near Freer, Texas	27°57'53"	98°58'00"	W	36	469	3.86	9.03	7,206	5,243.2	.730	.548
329	08194600	Nueces River at Simmons, Texas	28°25'16"	98°17'03"	W	13	8,561	10.88	7.08	15,830	9,798.7	.561	.303
330	08195000	Frio River at Concan, Texas	29°29'18"	99°42'16"	W	72	389	6.34	22.73	20,293	13,248.8	.493	.266
331	08196000	Dry Frio River near Reagan Wells, Texas	29°30'16"	99°46'52"	W	45	126	10.00	26.70	10,723	7,373.9	.558	.376
332	08197500	Frio River below Dry Frio River near Uvalde, Texas	29°14'44"	99°40'27"	W	46	631	7.19	20.94	18,834	12,146.3	.455	.231
333	08198000	Sabinal River near Sabinal, Texas	29°29'35"	99°29'49"	W	55	206	6.00	28.28	9,774	5,569.0	.389	.214
334	08198500	Sabinal River at Sabinal, Texas	29°18'47"	99°28'46"	W	45	241	12.39	23.00	12,880	8,542.8	.480	.258
335	08200000	Hondo Creek near Tarpley, Texas	29°34'10"	99°14'47"	W	45	95.6	3.14	41.84	12,264	7,769.9	.531	.336
336	08200500	Hondo Creek near Hondo, Texas	29°27'05"	99°11'07"	W	12	132	6.75	30.44	12,331	8,678.2	.582	.464
337	08200700	Hondo Creek at King Waterhole near Hondo, Texas	29°23'26"	99°09'04"	W	37	149	8.67	27.47	11,618	7,507.3	.453	.233
338	08201500	Seco Creek at Miller Ranch near Utopia, Texas	29°34'23"	99°24'10"	W	35	45	4.88	40.29	7,848	5,367.0	.563	.369
339	08202500	Seco Creek near D'Hanis, Texas	29°29'20"	99°23'16"	W	12	87.4	5.49	34.59	9,175	7,504.0	.786	.665
340	08202700	Seco Creek at Rowe Ranch near D'Hanis, Texas	29°21'43"	99°17'05"	W	37	168	9.38	24.79	8,335	5,744.5	.486	.205
341	08205500	Frio River near Derby, Texas	28°44'11"	99°08'40"	W	82	3,429	5.74	13.22	12,324	8,399.9	.643	.504
342	08206600	Frio River at Tilden, Texas	28°28'02"	98°32'50"	W	19	4,493	9.36	10.11	6,297	3,535.6	.358	.081
343	08206700	San Miguel Creek near Tilden, Texas	28°35'14"	98°32'44"	W	34	783	9.27	8.05	5,766	2,786.5	.281	.095
344	08207000	Frio River at Calliham, Texas	28°29'31"	98°20'47"	W	52	5,491	8.92	9.64	11039	5626.1	.486	.348
345	08208000	Atascosa River at Whitsett, Texas	28°37'18"	98°17'02"	W	67	1,171	7.26	6.33	9289	5590.2	.563	.398

Table 1. Streamflow statistics and basin characteristics for 367 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as natural by 10-percent criterion)—Continued

Seq. no.	USGS station no. (pl. 1)	USGS station name	Latitude	Longitude	Region	Years of natural annual peak stream-flow	Contri-buting drainage area (mi^2)	Basin shape factor (dimen-sion-less)	Stream slope (ft/mi)	L-moment statistics of annual peak-streamflow data			
										Mean (ft^3/s)	L-scale (ft^3/s)	L-skew	L-kurtosis
346	08210000	Nueces River near Three Rivers, Texas	28°25'38"	98°10'40"	W	68	15,427	6.40	6.88	20,364	9,825.1	0.455	0.288
347	08210400	Lagarto Creek near George West, Texas	28°03'34"	98°05'48"	W	17	155	8.07	12.15	664	582.5	.795	.607
348	08211520	Oso Creek at Corpus Christi, Texas	27°42'40"	97°30'06"	W	22	90.3	1.53	4.74	3,339	1,254.0	.299	.287
349	08212400	Los Olmos Creek near Falfurrias, Texas	27°15'51"	98°08'08"	W	17	476	8.60	11.18	1,082	755.5	.543	.226
350	08365800	Government Ditch at El Paso, Texas	31°47'02"	106°26'41"	W	20	6.40	2.13	125.91	279	86.0	-.007	.084
351	08374000	Alamito Creek near Presidio, Texas	29°31'15"	104°17'40"	W	52	1,504	6.86	40.69	9,510	3,339.8	.374	.292
352	08374500	Terlingua Creek near Terlingua, Texas	29°12'00"	103°36'15"	W	52	1,070	9.07	29.97	14,322	4,497.2	.117	.084
353	08376300	Sanderson Canyon at Sanderson, Texas	30°07'46"	102°23'06"	W	12	195	8.87	46.53	10,048	5,864.8	.393	.197
354	08408500	Delaware River near Red Bluff, New Mexico	32°01'12"	104°03'00"	W	60	689	5.26	39.50	7,469	5,032.2	.602	.388
355	08411500	Salt Screwbean Draw near Orla, Texas	31°52'40"	103°56'50"	W	15	464	4.30	30.86	5,074	3,440.8	.701	.682
356	08424500	Madera Canyon near Toyahvale, Texas	30°52'04"	103°58'09"	W	18	53.8	14.81	104.71	1,619	802.6	.282	.164
357	08431700	Limpia Creek above Fort Davis, Texas	30°36'48"	104°00'04"	W	21	52.4	2.48	129.62	1,282	864.2	.525	.327
358	08431800	Limpia Creek below Fort Davis, Texas	30°40'52"	103°47'30"	W	16	227	4.24	70.63	2,102	767.9	.194	.207
359	08435800	Coyanosa Draw near Fort Stockton, Texas	31°02'27"	103°08'15"	W	14	1,182	6.73	26.90	2,052	1,459.3	.722	.567
360	08447020	Independence Creek near Sheffield, Texas	30°27'07"	101°43'58"	W	11	763	5.10	27.10	9,557	8,266.8	.843	.769
361	08447400	Pecos River near Shumla, Texas	29°50'00"	101°23'00"	W	55	35,162	6.81	4.09	50,081	34,579.8	.616	.450
362	08449000	Devils River near Juno, Texas	29°57'48"	101°08'42"	W	35	2,730	4.62	10.17	44,010	31,869.1	.590	.363
363	08449400	Devils River at Pafford Crossing near Comstock, Texas	29°40'35"	101°00'00"	W	16	3,961	5.38	9.95	62,838	41,090.0	.386	.049
364	08449500	Devils River near Del Rio, Texas	29°29'00"	101°00'00"	W	46	4,185	6.64	9.90	70,036	53,594.4	.663	.424
365	08450500	Devils River near Mouth at Del Rio, Texas	29°28'10"	101°03'25"	W	13	4,305	6.76	9.67	43,802	22,039.9	.198	.022
366	08453000	San Felipe Creek near Del Rio, Texas	29°19'55"	100°53'20"	W	29	46	5.44	20.32	9,372	4,729.9	.426	.338
367	08455000	Pinto Creek near Del Rio, Texas	29°08'45"	100°43'05"	W	54	249	7.85	17.43	12,031	8,917.1	.703	.557

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)

[Total period of station record analyzed was divided into number of static periods of regulation minus 1. Seq., sequence; mi^2, square miles; W, west; Max, representative maximum capacity (acre-feet) for corresponding static period of regulation; Norm, representative normal capacity (acre-feet) for corresponding static period of regulation; --, static period not applicable; NE, northeast; SE, southeast]

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
1	07228000	Canadian River near Canadian, Texas	35°56'06"	100°22'13"	W	18,178	1938–97	Period: 1938–64 Max: 15,000 Norm: 12,000	Period: 1965–97 Max: 2,463,000 Norm: 885,000	--	--
2	07235000	Wolf Creek at Lipscomb, Texas	36°14'19"	100°16'31"	W	475	1939–97	Period: 1939–69 Max: 2,792 Norm: 753	Period: 1970–97 Max: 3,877 Norm: 1,342	--	--
3	07297500	Prairie Dog Town Fork Red River near Canyon, Texas	35°00'38"	101°53'29"	W	711	1939–49	Period: 1939–49 Max: 74,360 Norm: 5,199	--	--	--
4	07298200	Tule Creek near Silverton, Texas	34°32'36"	101°25'46"	W	190	1965–85	Period: 1965–73 Max: 3,230 Norm: 1,580	Period: 1974–85 Max: 73,700 Norm: 48,270	--	--
5	07299540	Prairie Dog Town Fork Red River near Childress, Texas	34°34'09"	100°11'37"	W	2,956	1965–97	Period: 1965–73 Max: 129,000 Norm: 32,900	Period: 1974–97 Max: 231,000 Norm: 85,700	--	--
6	07300000	Salt Fork Red River near Wellington, Texas	34°57'27"	100°13'14"	W	1,013	1953–97	Period: 1953–67 Max: 900 Norm: 430	Period: 1968–97 Max: 102,000 Norm: 60,400	--	--
7	07301200	McClellan Creek near McLean, Texas	35°19'45"	100°36'32"	W	460	1968–97	Period: 1968–78 Max: 9,200 Norm: 3,350	Period: 1979–85 Max: 33,900 Norm: 4,760	Period: 1986–97 Max: 40,500 Norm: 7,550	--
8	07314900	Little Wichita River above Henrietta, Texas	33°49'36"	98°14'23"	NE	1,037	1953–97	Period: 1953–65 Max: 219,000 Norm: 114,400	Period: 1966–97 Max: 911,800 Norm: 379,400	--	--
9	07315500	Red River near Terral, Oklahoma	33°52'43"	97°56'03"	NE	28,723	1938–97	Period: 1938–65 Max: 1,693,800 Norm: 470,100	Period: 1966–97 Max: 2,586,500 Norm: 833,360	--	--
10	07316000	Red River near Gainesville, Texas	33°43'40"	97°09'35"	NE	30,782	1936–97	Period: 1936–65 Max: 1,696,700 Norm: 471,730	Period: 1966–97 Max: 2,725,500 Norm: 887,300	--	--

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
11	07343500	White Oak Creek near Talco, Texas	33°19'20"	95°05'33"	NE	494	1950–97	Period: 1950–72 Max: 5,365 Norm: 2,541	Period: 1973–97 Max: 47,500 Norm: 23,600	--	--
12	07344500	Big Cypress Creek near Pittsburg, Texas	33°01'15"	94°52'55"	NE	366	1943–97	Period: 1943–70 Max: 8,678 Norm: 4,831	Period: 1978–97 Max: 522,700 Norm: 324,000	--	--
13	07346000	Big Cypress Creek near Jefferson, Texas	32°44'58"	94°29'55"	NE	850	1913–97	Period: 1913–58 Max: 3,980 Norm: 1,830	Period: 1959–97 Max: 2,198,000 Norm: 436,500	--	--
14	08018500	Sabine River near Mineola, Texas	32°36'49"	95°29'08"	NE	1,357	1938–97	Period: 1938–59 Max: 23,000 Norm: 14,700	Period: 1960–97 Max: 1,719,900 Norm: 957,700	--	--
15	08019000	Lake Fork Creek near Quitman, Texas	32°45'47"	95°27'46"	NE	585	1925–97	Period: 1925–61 Max: 3,160 Norm: 1,520	Period: 1962–79 Max: 65,500 Norm: 12,500	Period: 1980–97 Max: 1,122,500 Norm: 689,400	--
16	08019500	Big Sandy Creek near Big Sandy, Texas	32°36'14"	95°05'29"	NE	231	1939–97	Period: 1939–61 Max: 4,096 Norm: 1,885	Period: 1962–97 Max: 87,140 Norm: 29,980	--	--
17	08020000	Sabine River near Gladewater, Texas	32°31'37"	94°57'36"	NE	2,791	1932–97	Period: 1932–59 Max: 61,000 Norm: 34,700	Period: 1960–79 Max: 1,899,500 Norm: 101,6000	Period: 1980–97 Max: 2,977,000 Norm: 1,702,000	--
18	08026000	Sabine River near Burkeville, Texas	31°03'50"	93°31'10"	SE	7,482	1956–97	Period: 1968–79 Max: 7,415,000 Norm: 5,698,000	Period: 1980–97 Max: 8,534,000 Norm: 6,412,000	--	--
19	08028500	Sabine River near Bon Weir, Texas	30°44'49"	93°36'30"	SE	8,229	1924–97	Period: 1924–59 Max: 148,000 Norm: 87,300	Period: 1968–79 Max: 7,415,000 Norm: 5,698,000	Period: 1980–97 Max: 8,534,000 Norm: 6,412,000	--
20	08030500	Sabine River near Ruliff, Texas	30°18'13"	93°44'37"	SE	9,329	1908–97	Period: 1908–59 Max: 148,000 Norm: 87,300	Period: 1968–79 Max: 7,416,000 Norm: 5,699,000	Period: 1980–97 Max: 8,535,000 Norm: 6,413,000	--
21	08032000	Neches River near Neches, Texas	31°53'32"	95°25'50"	NE	1,145	1939–97	Period: 1939–70 Max: 29,400 Norm: 12,400	Period: 1971–97 Max: 1,146,000 Norm: 468,700	--	--

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
22	08034500	Mud Creek near Jacksonville, Texas	31°58'35"	95°09'38"	NE	376	1939–79	Period: 1939–48 Max: 2,985 Norm: 972	Period: 1949–66 Max: 88,900 Norm: 43,500	Period: 1967–79 Max: 175,600 Norm: 87,200	--
23	08037000	Angelina River near Lufkin, Texas	31°27'26"	94°43'34"	NE	1,600	1924–76	Period: 1924–48 Max: 7,205 Norm: 3,293	Period: 1956–66 Max: 177,400 Norm: 75,400	Period: 1967–76 Max: 264,900 Norm: 119,000	--
24	08041000	Neches River at Evadale, Texas	30°21'20"	94°05'35"	SE	7,951	1905–97	Period: 1905–50 Max: 24,200 Norm: 8,669	Period: 1951–64 Max: 644,600 Norm: 252,700	Period: 1965–97 Max: 8,434,000 Norm: 3,682,000	--
25	08046000	Clear Fork Trinity River near Aledo, Texas	32°38'28"	97°33'51"	NE	251	1948–75	Period: 1948–56 Max: 1,094 Norm: 548	Period: 1957–75 Max: 81,260 Norm: 26,460	--	--
26	08047500	Clear Fork Trinity River at Fort Worth, Texas	32°43'56"	97°21'31"	NE	518	1924–97	Period: 1924–49 Max: 1,631 Norm: 973	Period: 1957–97 Max: 500,000 Norm: 119,000	--	--
27	08048000	West Fork Trinity River at Fort Worth, Texas	32°45'39"	97°19'56"	NE	2,615	1921–97	Period: 1921–49 Max: 1,631 Norm: 973	Period: 1957–97 Max: 505,000 Norm: 120,000	--	--
28	08050100	Mountain Creek at Grand Prairie, Texas	32°44'51"	96°55'32"	NE	298	1961–97	Period: 1961–85 Max: 82,010 Norm: 41,970	Period: 1986–97 Max: 724,200 Norm: 218,700	--	--
29	08050500	Elm Fork Trinity River near Sanger, Texas	33°23'11"	97°05'05"	NE	381	1963–83	Period: 1963–83 Max: 44,900 Norm: 4,374	--	--	--
30	08051500	Clear Creek near Sanger, Texas	33°20'21"	97°10'51"	NE	295	1949–97	Period: 1949–59 Max: 0 Norm: 0	Period: 1970–97 Max: 76,800 Norm: 7,600	--	--
31	08052700	Little Elm Creek near Aubrey, Texas	33°17'00"	96°53'33"	NE	75.5	1957–97	Period: 1957–65 Max: 0 Norm: 0	Period: 1970–97 Max: 20,600 Norm: 2,265	--	--
32	08053500	Denton Creek near Justin, Texas	33°07'08"	97°17'25"	NE	400	1950–97	Period: 1950–66 Max: 2,451 Norm: 847	Period: 1972–97 Max: 87,900 Norm: 8,396	--	--

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
33	08057000	Trinity River at Dallas, Texas	32°46'29"	96°49'18"	NE	6,106	1904–97	Period: 1904–30 Max: 99,810 Norm: 70,260	Period: 1931–53 Max: 1,778,000 Norm: 688,900	Period: 1954–85 Max: 5,666,000 Norm: 1,579,000	Period: 1986–97 Max: 8,308,000 Norm: 2,609,000
34	08059000	East Fork Trinity River near McKinney, Texas	33°12'13"	96°35'44"	NE	190	1955–74	Period: 1955–74 Max: 23,560 Norm: 3,644	--	--	--
35	08059500	Sister Grove Creek near Princeton, Texas	33°11'35"	96°28'32"	NE	113	1950–75	Period: 1960–75 Max: 31,970 Norm: 4,600	--	--	--
36	08062500	Trinity River near Rosser, Texas	32°25'35"	96°27'46"	NE	8,146	1939–97	Period: 1939–52 Max: 1,823,000 Norm: 701,300	Period: 1954–85 Max: 7,038,000 Norm: 230,800	Period: 1986–97 Max: 10,080,000 Norm: 3,600,000	--
37	08062800	Cedar Creek near Kemp, Texas	32°30'18"	96°06'57"	NE	189	1963–87	Period: 1971–87 Max: 56,080 Norm: 11,220	--	--	--
38	08063500	Richland Creek near Richland, Texas	31°57'02"	96°25'16"	NE	734	1939–89	Period: 1939–62 Max: 986 Norm: 613	Period: 1963–89 Max: 445,600 Norm: 74,860	--	--
39	08064500	Chambers Creek near Corsicana, Texas	32°06'29"	96°22'14"	NE	963	1939–84	Period: 1939–59 Max: 54,280 Norm: 25,280	Period: 1965–84 Max: 495,300 Norm: 101,800	--	--
40	08065000	Trinity River near Oakwood, Texas	31°38'54"	95°47'21"	NE	12,833	1924–97	Period: 1924–53 Max: 1,886,000 Norm: 723,000	Period: 1954–65 Max: 6,810,000 Norm: 2,111,000	Period: 1966–85 Max: 9,799,000 Norm: 3,530,000	Period: 1986–97 Max: 14,270,000 Norm: 5,715,000
41	08065500	Trinity River near Midway, Texas	31°04'28"	95°41'57"	SE	14,450	1940–70	Period: 1940–53 Max: 1,898,000 Norm: 728,400	Period: 1954–70 Max: 6,907,000 Norm: 2,127,000	--	--
42	08066500	Trinity River at Romayor, Texas	30°25'30"	94°51'02"	SE	17,186	1924–97	Period: 1924–53 Max: 1,893,000 Norm: 726,100	Period: 1954–68 Max: 7,310,000 Norm: 2,205,000	Period: 1969–85 Max: 12,040,000 Norm: 5,395,000	Period: 1986–97 Max: 16,440,000 Norm: 7,568,000
43	08067000	Trinity River at Liberty, Texas	30°03'27"	94°49'05"	SE	17,468	1940–97	Period: 1940–53 Max: 189,4000 Norm: 726,700	Period: 1954–68 Max: 7,312,000 Norm: 2,206,000	Period: 1969–86 Max: 12,040,000 Norm: 5,398,000	Period: 1987–97 Max: 16,440,000 Norm: 7,571,000

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
44	08068000	West Fork San Jacinto River near Conroe, Texas	30°14'40"	95°27'25"	SE	828	1924–97	Period: 1924–72 Max: 9,845 Norm: 2,583	Period: 1973–97 Max: 746,100 Norm: 454,800	--	--
45	08081000	Salt Fork Brazos River near Peacock, Texas	33°12'43"	100°25'53"	W	1,985	1950–86	Period: 1963–86 Max: 137,100 Norm: 52,790	--	--	--
46	08082000	Salt Fork Brazos River near Aspermont, Texas	33°20'02"	100°14'16"	W	2,496	1924–97	Period: 1924–62 Max: 1,421 Norm: 358	Period: 1963–97 Max: 149,600 Norm: 60,020	--	--
47	08082500	Brazos River at Seymour, Texas	33°34'51"	99°16'02"	W	5,972	1924–97	Period: 1924–62 Max: 10,600 Norm: 4,543	Period: 1963–93 Max: 247,000 Norm: 88,590	--	--
48	08087300	Clear Fork Brazos River at Eliasville, Texas	32°57'36"	98°45'59"	W	5,697	1916–82	Period: 1916–37 Max: 105,500 Norm: 109,800	Period: 1938–61 Max: 298,900 Norm: 207,100	Period: 1962–82 Max: 1,185,000 Norm: 589,200	--
49	08088000	Brazos River near South Bend, Texas	33°01'27"	98°38'37"	W	13,107	1939–93	Period: 1939–73 Max: 52,410 Norm: 21,330	Period: 1974–93 Max: 413,100 Norm: 142,500	--	--
50	08090500	Palo Pinto Creek near Santo, Texas	32°37'51"	98°10'50"	NE	573	1951–76	Period: 1951–63 Max: 7,242 Norm: 3,675	Period: 1964–76 Max: 182,700 Norm: 49,810	--	--
51	08091000	Brazos River near Glen Rose, Texas	32°16'18"	97°39'48"	NE	16,252	1924–97	Period: 1924–39 Max: 172,600 Norm: 137,300	Period: 1940–61 Max: 1,087,000 Norm: 856,300	Period: 1962–97 Max: 2,632,000 Norm: 1,531,000	--
52	08091500	Paluxy River at Glen Rose, Texas	32°13'53"	97°46'37"	NE	410	1948–97	Period: 1948–80 Max: 2,819 Norm: 1,653	Period: 1981–97 Max: 49,060 Norm: 6,854	--	--
53	08093500	Aquilla Creek near Aquilla, Texas	31°50'40"	97°12'04"	NE	308	1939–97	Period: 1939–82 Max: 0 Norm: 0	Period: 1983–97 Max: 374,100 Norm: 53,980	--	--
54	08093700	North Bosque River at Stephenville, Texas	32°12'56"	98°11'55"	NE	95.9	1959–79	Period: 1959–79 Max: 24,410 Norm: 1,686	--	--	--

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
55	08094800	North Bosque River at Hico, Texas	31°58'41"	98°02'04"	NE	359	1962–97	Period: 1972–97 Max: 112,100 Norm: 8,248	--	--	--
56	08095000	North Bosque River near Clifton, Texas	31°47'09"	97°34'04"	NE	968	1924–97	Period: 1924–66 Max: 14,410 Norm: 4,564	Period: 1967–97 Max: 134,100 Norm: 14,580	--	--
57	08095400	Hog Creek near Crawford, Texas	31°33'20"	97°21'22"	NE	78.2	1960–97	Period: 1960–76 Max: 0 Norm: 0	Period: 1977–97 Max: 17,280 Norm: 936	--	--
58	08096500	Brazos River at Waco, Texas	31°32'06"	97°04'22"	NE	20,007	1899–1997	Period: 1899–1949 Max: 172,600 Norm: 138,300	Period: 1950–70 Max: 3,700,000 Norm: 1,701,000	Period: 1971–97 Max: 5,501,000 Norm: 2,424,000	--
59	08099500	Leon River near Hasse, Texas	31°57'28"	98°27'32"	W	1,261	1939–91	Period: 1939–62 Max: 30,330 Norm: 4,021	Period: 1963–91 Max: 580,000 Norm: 102,400	--	--
60	08100000	Leon River near Hamilton, Texas	31°47'19"	98°07'16"	NE	1,891	1925–97	Period: 1963–97 Max: 657,600 Norm: 113,400	--	--	--
61	08102500	Leon River near Belton, Texas	31°04'12"	97°26'28"	NE	3,542	1924–97	Period: 1924–53 Max: 35,690 Norm: 6,597	Period: 1954–97 Max: 2,572,000 Norm: 577,100	--	--
62	08104700	North Fork San Gabriel River near Georgetown, Texas	30°39'42"	97°42'40"	W	248	1969–97	Period: 1969–79 Max: 72 Norm: 26	Period: 1980–97 Max: 220,200 Norm: 37,130	--	--
63	08105700	San Gabriel River at Laneport, Texas	30°41'39"	97°16'43"	W	738	1965–97	Period: 1965–78 Max: 8,053 Norm: 723	Period: 1979–97 Max: 789,600 Norm: 103,500	--	--
64	08106500	Little River at Cameron, Texas	30°49'53"	96°57'01"	SE	7,065	1918–97	Period: 1918–53 Max: 35,970 Norm: 6,687	Period: 1954–67 Max: 2,308,000 Norm: 535,800	Period: 1968–97 Max: 4,538,000 Norm: 930,500	--
65	08109000	Brazos River near Bryan, Texas	30°36'52"	96°29'10"	SE	29,949	1900–95	Period: 1900–50 Max: 218,100 Norm: 151,600	Period: 1951–64 Max: 5,390,000 Norm: 2,054,000	Period: 1965–95 Max: 9,970,000 Norm: 3,414,000	--

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
66	08110000	Yegua Creek near Somerville, Texas	30°19'18"	96°30'26"	SE	1,009	1925–91	Period: 1925–66 Max: 10,000 Norm: 5,000	Period: 1967–91 Max: 1,055,000 Norm: 179,100	--	--
67	08111000	Navasota River near Bryan, Texas	30°52'10"	96°11'32"	SE	1,454	1951–97	Period: 1951–77 Max: 50,550 Norm: 13,250	Period: 1978–97 Max: 513,300 Norm: 276,600	--	--
68	08111500	Brazos River near Hempstead, Texas	30°07'44"	96°11'15"	SE	34,314	1939–97	Period: 1939–50 Max: 956,000 Norm: 798,300	Period: 1951–66 Max: 6,370,000 Norm: 2,444,000	Period: 1967–97 Max: 12,100,000 Norm: 3,936,000	--
69	08114000	Brazos River at Richmond, Texas	29°34'56"	95°45'27"	SE	35,441	1903–97	Period: 1903–50 Max: 355,100 Norm: 229,600	Period: 1951–67 Max: 6,371,000 Norm: 2,445,000	Period: 1968–97 Max: 12,100,000 Norm: 3,938,000	--
70	08121000	Colorado River at Colorado City, Texas	32°23'33"	100°52'42"	W	1,585	1947–97	Period: 1952–97 Max: 363,210 Norm: 205,600	--	--	--
71	08124000	Colorado River at Robert Lee, Texas	31°53'07"	100°28'49"	W	5,047	1924–97	Period: 1924–51 Max: 10,380 Norm: 6,446	Period: 1951–68 Max: 535,200 Norm: 286,500	Period: 1969–88 Max: 1,349,000 Norm: 777,300	Period: 1989–97 Max: 1,627,000 Norm: 880,400
72	08135000	North Concho River at San Angelo, Texas	31°27'57"	100°26'51"	W	1,450	1916–90	Period: 1916–51 Max: 80 Norm: 80	Period: 1952–90 Max: 696,600 Norm: 119,300	--	--
73	08136000	Concho River at San Angelo, Texas	31°27'16"	100°24'37"	W	4,411	1916–97	Period: 1916–51 Max: 44,140 Norm: 15,530	Period: 1952–62 Max: 741,100 Norm: 135,100	Period: 1963–97 Max: 1,829,000 Norm: 321,300	--
74	08136500	Concho River at Paint Rock, Texas	31°30'57"	99°55'09"	W	5,443	1916–97	Period: 1916–51 Max: 45,050 Norm: 16,340	Period: 1952–62 Max: 742,700 Norm: 136,300	Period: 1963–97 Max: 1,831,000 Norm: 322,800	--
75	08137500	Mukewater Creek at Trickham, Texas	31°35'24"	99°13'36"	W	70.0	1951–73	Period: 1960–73 Max: 17,120 Norm: 1,052	--	--	--
76	08138000	Colorado River at Winchell, Texas	31°28'04"	99°09'43"	W	13,788	1924–97	Period: 1924–50 Max: 65,730 Norm: 24,760	Period: 1951–62 Max: 1,387,000 Norm: 468,200	Period: 1970–97 Max: 3,560,000 Norm: 1,182,000	--

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
77	08143500	Pecan Bayou at Brownwood, Texas	31°43'54"	98°58'25"	W	1,660	1924–83	Period: 1933–62 Max: 457,400 Norm: 123,300	Period: 1966–83 Max: 791,400 Norm: 185,200	--	--
78	08145000	Brady Creek at Brady, Texas	31°08'17"	99°20'05"	W	588	1940–85	Period: 1940–62 Max: 31,940 Norm: 1,288	Period: 1963–85 Max: 355,400 Norm: 35,210	--	--
79	08146000	San Saba River at San Saba, Texas	31°12'47"	98°43'09"	W	3,039	1916–94	Period: 1916–62 Max: 1,146 Norm: 733	Period: 1963–94 Max: 392,600 Norm: 38,470	--	--
80	08147000	Colorado River near San Saba, Texas	31°13'04"	98°33'51"	W	19,819	1916–97	Period: 1916–51 Max: 290,800 Norm: 84,080	Period: 1952–62 Max: 1,880,000 Norm: 563,400	Period: 1969–97 Max: 4,902,000 Norm: 1,421,000	--
81	08158000	Colorado River at Austin, Texas	30°14'40"	97°41'39"	W	27,606	1899–1997	Period: 1899–1941 Max: 69,000 Norm: 25,300	Period: 1942–62 Max: 5,866,000 Norm: 2,604,000	Period: 1963–97 Max: 9,428,000 Norm: 3,611,000	--
82	08159500	Colorado River at Smithville, Texas	30°00'43"	97°09'43"	SE	29,058	1931–97	Period: 1931–41 Max: 518,400 Norm: 144,900	Period: 1942–62 Max: 5,867,000 Norm: 2,605,000	Period: 1963–97 Max: 9,497,000 Norm: 3,664,000	--
83	08161000	Colorado River at Columbus, Texas	29°42'22"	96°32'12"	SE	30,237	1916–97	Period: 1916–41 Max: 69,330 Norm: 25,480	Period: 1942–62 Max: 5,868,000 Norm: 2,605,000	Period: 1963–97 Max: 9,643,000 Norm: 3,744,000	--
84	08168500	Guadalupe River above Comal River at New Braunfels, Texas	29°42'53"	98°06'35"	W	1,518	1928–97	Period: 1928–63 Max: 277 Norm: 184	Period: 1964–97 Max: 1,146,000 Norm: 392,200	--	--
85	08169500	Guadalupe River at New Braunfels, Texas	29°41'52"	98°06'23"	W	1,652	1915–97	Period: 1915–27 Max: 74 Norm: 74	Period: 1974–97 Max: 1,146,000 Norm: 392,300	--	--
86	08172000	San Marcos River at Luling, Texas	29°39'54"	97°38'59"	SE	838	1940–97	Period: 1940–82 Max: 24,260 Norm: 4,490	Period: 1983–97 Max: 74,830 Norm: 7,880	--	--
87	08173000	Plum Creek near Luling, Texas	29°41'58"	97°36'12"	SE	309	1930–93	Period: 1930–66 Max: 0 Norm: 0	Period: 1967–93 Max: 59,110 Norm: 3,921	--	--

Table 2. Static periods of regulation suitable for comparative analysis for 96 USGS streamflow-gaging stations with at least 10 years of annual peak-streamflow data through 1997 (designated as regulated by 10-percent criterion)—Continued

Seq. no.	USGS station number (pl. 1)	USGS station name	Latitude	Longitude	Region	Contri-buting drainage area (mi^2)	Total period of station record analyzed	Static or acceptably static period of regulation no. 1	Static or acceptably static period of regulation no. 2	Static or acceptably static period of regulation no. 3	Static or acceptably static period of regulation no. 4
88	08176500	Guadalupe River at Victoria, Texas	28°47'34"	97°00'46"	SE	5,198	1935–97	Period: 1935–63 Max: 49,710 Norm: 24,620	Period: 1964–97 Max: 1,353,000 Norm: 434,500	--	--
89	08177500	Coleto Creek near Victoria, Texas	28°43'51"	97°08'18"	SE	514	1939–97	Period: 1939–54 Max: 0 Norm: 0	Period: 1980–97 Max: 169,100 Norm: 35,160	--	--
90	08183500	San Antonio River near Falls City, Texas	28°57'05"	98°03'50"	SE	2,113	1926–97	Period: 1926–68 Max: 356,900 Norm: 261,500	Period: 1969–97 Max: 601,500 Norm: 361,000	--	--
91	08183900	Cibolo Creek near Boerne, Texas	29°46'26"	98°41'50"	W	68.4	1963–94	Period: 1963–77 Max: 575 Norm: 332	Period: 1978–94 Max: 23,330 Norm: 4,850	--	--
92	08185000	Cibolo Creek at Selma, Texas	29°35'38"	98°18'39"	W	274	1946–97	Period: 1946–77 Max: 575 Norm: 332	Period: 1978–97 Max: 23,330 Norm: 4,850	--	--
93	08188500	San Antonio River at Goliad, Texas	28°38'58"	97°23'04"	SE	3,921	1924–97	Period: 1924–68 Max: 375,500 Norm: 264,200	Period: 1969–97 Max: 673,500 Norm: 375,100	--	--
94	08193000	Nueces River near Asherton, Texas	28°30'00"	99°40'54"	W	4,082	1940–97	Period: 1940–62 Max: 22,020 Norm: 10,030	Period: 1963–97 Max: 43,070 Norm: 19,500	--	--
95	08194000	Nueces River at Cotulla, Texas	28°25'34"	99°14'23"	W	5,171	1924–97	Period: 1924–46 Max: 8,211 Norm: 5,343	Period: 1947–62 Max: 35,280 Norm: 15,210	Period: 1963–97 Max: 61,870 Norm: 27,730	--
96	08194500	Nueces River near Tilden, Texas	28°18'31"	98°33'25"	W	8,093	1942–97	Period: 1947–62 Max: 47,940 Norm: 20,890	Period: 1963–97 Max: 98,710 Norm: 43,390	--	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Type of spillway: C, controlled; U, uncontrolled
Purpose of dam: FC, flood control; O, other
Owner name: WID, Water Improvement District; WCID, Water Control and Improvement District; MUD, FWSD, Fresh Water Supply District; WSD, Water Supply District; MWSD, Municipal Water Supply
Updated Information: max. dis., maximum discharge; DA, drainage area; SA, surface area; ph. phone; dis. freq., discharge

[See text for specific definition of some columns. Seq., sequence; TNRCC, Texas Natural Resource Conservation recurrence interval; PMF, probable maximum flood; SCS, Soil Conservation Service]

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com-pleted	Drain-age area (mi^2)
1	TX00018	San Jacinto	South Mayde Creek	Harris	Addicks Reservoir	29°47'30	95°37'24"	1948	--
2	TX02376	Brazos	Sandy Creek	Milam	Alcoa Lake	30°34'30"	97°02'54"	1952	--
3	TX02296	Rio Grande	Rio Grande	Val Verde	Amistad Reservoir	29°27'00"	101°03'30"	1969	123,133
4	TX08004	Brazos	Aquilla Creek	Hill	Aquilla Lake	31°54'48"	97°12'30"	1983	--
5	TX00015	Neches	Neches River	Tyler	B.A. Steinhagen Lake	30°47'00"	94°10'00"	1951	--
6	TX05952	Colorado	Valley Creek	Runnels	Ballinger Municipal Lake	31°43'48"	100°02'36"	1985	--
7	TX00001	Trinity	Waxahachie Creek	Ellis	Bardwell Lake	32°16'00"	96°38'00"	1965	--
8	TX00019	San Jacinto	Buffalo Bayou	Harris	Barker Reservoir	29°46'12"	95°38'48"	1945	--
9	TX03622	Red	Baylor Creek	Childress	Baylor Lake	34°28'36"	100°22'18"	1950	34.2
10	TX00002	Brazos	Leon River	Bell	Belton Lake	31°06'00"	97°29'00"	1954	--
11	TX00003	Trinity	Clear Fork Trinity River	Tarrant	Benbrook Lake	32°39'00"	97°27'00"	1950	--
12	TX01659	Colorado	Brady Creek	McCulloch	Brady Reservoir	31°08'24"	99°23'30"	1963	--
13	TX04833	Sabine	Brandy Branch	Harrison	Brandy Branch Cooling Pond	32°25'48"	94°29'06"	1983	4.1
14	TX01432	San Antonio	Arroyo Seco	Bexar	Braunig Lake	29°14'24"	98°22'18"	1963	9.4
15	TX02789	Colorado	Pecan Bayou	Brown	Brownwood Reservoir	31°50'18"	99°00'06"	1933	2.4
16	TX01869	Brazos	Trib.—Thompsons and Peak Creeks	Brazos	Bryan Utilities Lake	30°42'30"	96°27'06"	1975	--
17	TX00026	Red	Tierra Blanca Creek	Randall	Buffalo Lake	34°55'18"	102°06'00"	1938	575
18	TX02317	Nueces	Trib.—Los Tablas Creek	Dimmit	Burro Lake	28°17'36"	99°34'30"	1947	10
19	TX01448	San Antonio	Calaveras Creek	Bexar	Calaveras Lake	29°16'42"	98°18'18"	1969	65
20	TX02137	Brazos	Camp Creek	Robertson	Camp Creek Lake	31°03'42"	96°17'12"	1949	40
21	TX00004	Guadalupe	Guadalupe River	Comal	Canyon Lake	29°52'00"	98°12'00"	1964	1,425
22	TX02267	Rio Grande	Chacon Creek	Webb	Casa Blanca Lake	27°32'00"	99°26'54"	1946	--
23	TX04847	Trinity-San Jacinto	Cedar Bayou	Chambers	Cedar Bayou Cooling Pond	29°45'18"	94°49'06"	1972	--

of 10,000 acre-feet

Municipal Utility District; MIWA, Municipal and Industrial Water Authority; MWA, Municipal Water Authority;
District; MWD, Municipal Water District; SWCD, Soil and Water Conservation District
frequency; norm. cap., normal capacity; max. cap., maximum capacity; max. outflow, maximum outflow
Commission; mi^2, square miles; acre-ft, acre-feet; ft^3/s, cubic feet per second; --, not applicable; T, peak discharge for T-year

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
1	204,500	--	--	9,150	C	FC	U.S. Army Corps of Engineers	P.O. Box 1229, Galveston, TX 77553	--	--	--
2	18,968	15,650	--	28,706	C	O	Aluminum Co. of America	Environmental Superintendent, Point Comfort, TX 77978	--	--	--
3	5,289,639	3,151,306	64,438	1,507,000	C	FC, O	International Boundary and Water Commission	U.S. Section, 4110 Rio Bravo, El Paso, TX 79902	X	All but max. dis.	Q_2 = 9,700 Q_5 = 13,000 Q_{10} = 21,000 Q_{25} = 52,000 Q_{50} = 73,000 Q_{100} = 99,000 Q_{250} = 120,000 Q_{500} = 144,000
4	359,900	524,00	--	126,800	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
5	306,400	124,700	--	218,300	C	O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
6	34,353	6,050	--	234,034	U	O	City of Ballinger	P.O. Box 497, Ballinger, TX 76821	--	--	--
7	268,400	54,900	--	74,300	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
8	207,000	--	--	10,980	C	FC	U.S. Army Corps of Engineers	P.O. Box 1229, Galveston, TX 77553	--	--	--
9	15,950	10,400	699	19,978	U	O	City of Childress	P.O. Box 1087, Childress, TX 79201	--	--	--
10	1,876,700	457,600	--	472,500	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
11	410,000	88,250	--	172,000	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
12	212,400	30,000	--	368,990	U	O	City of Brady	P.O. Box 351, Brady, TX 76825	--	--	--
13	38,672	29,513	1,242	1,550	U	O	Southwestern Electric Power Co.	P.O. Box 21106, Shreveport, LA 71156	--	--	--
14	32,324	26,500	1,350	16,944	C	O	City of San Antonio	512 Mission Rd., San Antonio, TX 78210	--	--	--
15	448,200	118,900	7,300	40,000	U	O	Brown County WID No. 1	P.O. Box 118, Brownwood, TX 76801	--	--	--
16	22,000	15,227	829	--	C	O	City of Bryan	P.O. Box 1000, Bryan, TX 77805	--	--	--
17	65,000	--	0	209,000	U	O	U.S. Fish and Wildlife Service	P.O. Box 1306, Albuquerque, NM 87103	--	--	--
18	10,000	3,500	25–50	4,000	U	O	R.W. Briggs, Jr.	P.O. Box 1417, Victoria, TX 77902	--	--	--
19	97,441	60,484	3,391	129,914	C	O	City of San Antonio	512 Mission Rd., San Antonio, TX 78210	--	--	--
20	25,000	8,400	750	14,300	U	O	Camp Creek Water Co.	--	--	--	--
21	1,129,300	386,200	--	502,800	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
22	58,600	20,000	--	88,373	U	O	Webb County	P.O. Box 29, Laredo, TX 78040	--	--	--
23	30,000	19,250	--	--	C	O	Houston Lighting and Power Co.	P.O. Box 1700, Houston, TX 77001	--	--	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com-pleted	Drain-age area (mi^2)
24	TX04380	Colorado	Cedar Creek	Fayette	Cedar Creek Reservoir	29°54'54"	96°44'12"	1977	6.3
25	TX00237	Trinity	Cedar Creek	Henderson	Cedar Creek Reservoir	32°10'48"	96°04'06"	1966	1,007
26	TX01691	Colorado	Champion Creek	Mitchell	Champion Creek Reservoir	32°16'54"	100°51'36"	1959	164
27	TX04425	Nueces	Frio River	Live Oak	Choke Canyon Reservoir	28°29'06"	98°14'36"	1982	--
28	TX00419	Red	Coffee Mill Creek	Fannin	Coffee Mill Lake	33°44'06"	95°58'00"	1938	--
29	TX04744	Guadalupe	Coleto Creek	Victoria	Coleto Creek Cooling Pond	28°43'24"	97°10'00"	1980	494
30	TX08012	Red	South Sulphur River	Hopkins	Cooper Lake	33°19'48"	95°37'30"	1991	476
31	TX03790	Nueces-Rio Grande	Off-channel	Hidalgo	Delta Lake 2	26°25'48"	97°56'12"	1939	3.01
32	TX00779	Trinity	West Fork Trinity River	Tarrant	Eagle Mountain Reservoir	32°52'12"	97°29'48"	1932	1,970
33	TX04010	Cypress	Ellison Creek	Morris	Ellison Creek Reservoir	32°55'06"	94°43'30"	1943	37
34	TX03517	Colorado	Colorado River	Coke	E.V. Spence Reservoir	31°53'42"	100°30'54"	1969	4,140
35	TX00692	Trinity	Big Brown Creek	Freestone	Fairfield Lake	31°49'06"	96°02'30"	1969	--
36	TX04395	Trinity	Caney Creek	Henderson	Forest Grove Reservoir	32°13'42"	95°57'54"	1980	--
37	TX01054	Brazos	Navasota River	Limestone	Fort Parker State Park Lake	31°35'18"	96°31'36"	1939	--
38	TX02483	Brazos	Big Elm Creek	Jones	Fort Phantom Hill Lake	32°37'00"	99°40'06"	1938	463
39	TX04634	Brazos	Gibbons Creek	Grimes	Gibbons Creek Reservoir	30°36'36"	96°03'42"	1981	85
40	TX08005	Brazos	San Gabriel River	Williamson	Granger Lake	30°42'12"	97°19'00"	1979	--
41	TX03698	Red	Salt Fork Red River	Donley	Greenbelt Reservoir	35°00'06"	100°53'36"	1968	266
42	TX01912	Guadalupe	Guadalupe River	Gonzales	H–4 Lake	29°29'42"	97°37'30"	1931	1,917
43	TX00006	Colorado	Hords Creek	Coleman	Hords Creek Reservoir	31°51'00"	99°34'00"	1948	--
44	TX03268	Trinity	Little Elkhart Creek	Houston	Houston County Lake	31°24'24"	95°36'18"	1966	44
45	TX03639	Brazos	Hubbard Creek	Stephens	Hubbard Creek Reservoir	32°49'42"	98°57'48"	1962	1,107
46	TX00579	Red	Fish Creek	Cooke	Hubert M. Moss Lake	33°46'24"	97°12'48"	1966	--
47	TX00988	Colorado	Colorado River	Burnet	Inks Lake	30°43'48"	98°23'06"	1938	--
48	TX00024	Rio Grande	Rio Grande	Starr	International Falcon Reservoir	26°33'30"	99°09'42"	1954	159,269
49	TX08007	Trinity	Mountain Creek	Dallas	Joe Pool Lake	32°38'42"	96°59'36"	1986	--
50	TX03887	Cypress	Johnson Creek	Marion	Johnson Creek Reservoir	32°50'24"	94°32'54"	1961	--
51	TX00204	Trinity	Coon Creek	Henderson	Coon Creek Lake	32°02'18"	95°51'30"	1934	--

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
24	88,628	71,400	2,400	1,152	U	O	Lower Colorado River Authority	P.O. Box 220, Austin, TX 78767	X	--	--
25	1,085,000	679,200	25,850	316,821	C	O	Tarrant County WCID No. 1	P.O. Box 4508, Fort Worth, TX 76102	--	--	--
26	90,200	42,500	--	85,290	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
27	1,083,000	714,000	--	250,584	C	O	Bureau of Reclamation	P.O. Box 1946, Austin, TX 78767	--	--	--
28	24,070	8,000	--	3,400	U	O	U.S. Forest Service	P.O. Box 969, Lufkin, TX 75901	--	--	--
29	169,000	35,084	3,100	415,300	U	O	Guadalupe-Blanco River Authority	P.O. Box 271, Seguin, TX 78155	X	DA; SA	--
30	797,300	310,000	19,280	135,600	U	O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
31	22,545	17,788	1,227	--	--	O	Delta Lake Irrigation District	Rt. 1, Box 225, Edcouch, TX 78538	--	--	--
32	680,335	190,460	6,160	125,100	C	O	Tarrant County WCID No. 1	P.O. Box 4508, Fort Worth, TX 76102	--	--	--
33	36,000	24,700	1,500	39,149	U	O	Lone Star Steel Co.	P.O. Box 1000, Lone Star, TX 75668	X	Address; ph.; DA; SA	--
34	810,000	488,760	18,000	796,007	U	O	Colorado River MUD	P.O. Box 869, Big Spring, TX 79721	--	--	--
35	70,840	50,600	--	32,260	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
36	54,300	20,038	--	104,900	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
37	21,274	3,100	--	59,929	U	O	Fort Parker State Recreation Area	Rt. 3, Box 95, Mexia, TX 76667	--	--	--
38	127,000	73,960	4,246	578,139	U	O	City of Abilene	P.O. Box 60, Abilene, TX 79604	X	Dis. freq.	Q_2 = 3,400 Q_5 = 7,500 Q_{10} = 11,800 Q_{25} = 10,000 Q_{50} = 21,600 Q_{500} = 578,139
39	81,874	32,084	2,770	26,000	U	O	Texas Municipal Power Agency	P.O. Box 7000 Bryan, TX 77805	--	--	--
40	561,100	65,500	--	342,330	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
41	100,500	59,800	2,020	313,545	U	O	Greenbelt MIWA	P.O. Box 665, Clarendon, TX 79226	--	--	--
42	23,520	4,620	495	--	C	O	Guadalupe-Blanco River Authority	P.O. Box 271, Seguin, TX 78155	X	DA; norm. cap.; SA	--
43	49,290	8,640	--	61,700	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
44	27,000	19,500	1,498	38,150	U	O	Houston County WCID No. 1	P.O. Box 1246, Crockett, TX 75835	X	DA; SA	--
45	720,000	317,750	15,250	480,387	U	O	West Central Texas MUD	P.O. Box 2362, Abilene, TX 79604	--	--	--
46	55,000	23,210	--	114858	U	O	City of Gainesville	200 S. Rusk, Gainesville, TX 76240	--	--	--
47	63,500	17,545	803	1,207,697	U	O	Lower Colorado River Authority	P.O. Box 220, Austin, TX 78767	X	--	--
48	3,964,541	2,653,793	87,181	490,000	C	FC, O	International Boundary and Water Commission	U.S. Section, 4110 Rio Bravo, El Paso, TX 79902	X	All but max. dis.	Q_2 = 13,700 Q_5 = 16,300 Q_{10} = 22,500 Q_{25} = 55,000 Q_{50} = 80,000 Q_{100} = 110,000 Q_{250} = 165,000 Q_{500} = 200,000
49	642,400	176,900	--	--	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
50	21,716	10,038	--	14,639	U	O	Southwestern Electric Power Co.	P.O. Box 21106, Shreveport, LA 71156	--	--	--
51	21,366	3,631	--	--	U	O	Coon Creek Club	P.O. Box 20297, Dallas, TX 75220	--	--	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com- pleted	Drain- age area (mi^2)
52	TX06464	Brazos	Double Mountain Fork Brazos River	Garza	Lake Alan Henry	33°03'41"	101°02'30"	1994	394
53	TX00699	Trinity	Big Sandy Creek	Montague	Lake Amon G. Carter	33°28'06"	97°51'54"	1956	--
54	TX09088	Trinity	Turtle Bayou	Chambers	Lake Anahuac	29°46'48"	94°41'38"	1954	199
55	TX00776	Trinity	Village Creek	Tarrant	Lake Arlington	32°43'18"	97°11'54"	1955	143
56	TX02883	Red	Little Wichita River	Clay	Lake Arrowhead	33°45'42"	98°22'00"	1966	1.28
57	TX00182	Neches	Flat Creek	Henderson	Lake Athens	32°12'18"	95°43'24"	1963	21.1
58	TX01086	Colorado	Colorado River	Travis	Lake Austin	30°17'42"	97°47'12"	1939	--
59	TX02718	Colorado	Spicer Creek	Bastrop	Lake Bastrop	30°09'18"	97°17'30"	1964	8.7
60	TX04785	Cypress	Big Cypress Creek	Titus	Lake Bob Sandlin	33°04'30"	95°00'06"	1978	239
61	TX00402	Red	Timber Creek	Fannin	Lake Bonham	33°39'06"	96°07'48"	1969	--
62	TX04101	Brazos	Brazos River	McLennan	Lake Brazos	31°33'06"	97°05'42"	1970	--
63	TX01496	Trinity	West Fork Trinity River	Wise	Lake Bridgeport	33°13'12"	97°49'48"	1931	1,111
64	TX00989	Colorado	Colorado River	Burnet	Lake Buchanan	30°45'06"	98°25'06"	1937	50.06
65	TX03453	Sabine	Cherokee Bayou	Gregg	Lake Cherokee	32°21'42"	94°36'18"	1948	167
66	TX01409	Brazos	Sandy Creek	Eastland	Lake Cisco	32°26'24"	98°59'00"	1923	--
67	TX02152	Colorado	Jim Ned Creek	Coleman	Lake Coleman	32°01'48"	99°27'54"	1966	299
68	TX01693	Colorado	Morgan Creek	Mitchell	Lake Colorado City	32°19'06"	100°55'00"	1949	322
69	TX03491	Brazos	Mercer Creek	Comanche	Lake Comanche	31°48'06"	98°34'42"	1948	37.8
70	TX00097	San Jacinto	West Fork San Jacinto River	Montgomery	Lake Conroe	30°21'24"	95°33'36"	1973	444
71	TX03895	Nueces	Nueces River	Jim Wells	Lake Corpus Christi	28°02'30"	97°51'54"	1958	--
72	TX04066	Brazos	Manos Creek	McLennan	Lake Creek Lake	31°27'24"	96°59'12"	1953	--
73	TX01841	Red	Pine Creek	Lamar	Lake Crook	33°43'42"	95°34'00"	1923	53.06
74	TX03288	Cypress	Big Cypress Creek	Franklin	Lake Cypress Springs	33°03'24"	95°08'24"	1971	75
75	TX03635	Brazos	Gonzales Creek	Stephens	Lake Daniel	32°38'54"	98°52'06"	1948	115
76	TX01424	Brazos	Dutchman Creek	Knox	Lake Davis	33°31'24"	99°44'30"	1959	--
77	TX01011	Red	Wichita River	Archer	Lake Diverson	33°49'12"	98°56'12"	1924	3.47
78	TX03946	Brazos	Flint Creek	Young	Lake Eddleman	33°07'48"	98°36'30"	1929	--
79	TX00966	Red	Camp Creek	Wilbarger	Lake Electra	33°58'30"	99°01'24"	1950	--
80	TX04388	Sabine	Lake Fork Creek	Wood	Lake Fork Reservoir	32°48'24"	95°32'24"	1980	493
81	TX08006	Brazos	North Fork San Gabriel River	Williamson	Lake Georgetown	30°40'30"	97°43'30"	1980	246
82	TX06485	Cypress	Kelsey Creek	Upshur	Lake Gilmer	32°45'48"	94°58'54"	1996	35.6
83	TX03725	Sabine	Glade Creek	Upshur	Lake Gladewater	32°33'18"	94°57'30"	1952	--

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
52	354,500	115,937	2,884	360,000	U	O	Brazos River Authority	P.O. Box 7555, Waco, TX 76714	X	Max. dis.	--
53	58,050	20,050	--	149,460	U	O	City of Bowie	304 Lindsey St., Bowie, TX 76230	--	--	--
54	60,000	35,300	5,300	17,200	U	O	Chambers-Liberty Counties Navigation District	P.O. Box 518, Anahuac, TX 77514	X	Gen. Man., Pudge Willcox; DA; yr. completed; SA; max dis.	--
55	103,500	45,710	2,275	44,120	C	O	City of Arlington	P.O. Box 231, Arlington, TX 76004	--	--	--
56	685,000	262,100	16,200	270,700	U	O	City of Wichita Falls	P.O. Box 1431, Wichita Falls, TX 76307	--	--	--
57	47,000	32,840	2,432	14,291	U	O	Athens MWA	501 N. Pinkerton, Athens, TX 75751	--	--	--
58	73,100	21,000	--	1,382,697	U	O	City of Austin	P.O. Box 1088, Austin, TX 78767	X	--	--
59	16,962	16,590	244	17,612	C	O	Lower Colorado River Authority	P.O. Box 220, Austin, TX 78767	X	--	--
60	297,490	204,678	9,004	249,300	C	O	Titus County FWSD No. 1	P.O. Box 650, Mount Pleasant, TX 75455	X	All but DA	--
61	28,000	13,000	--	14,600	U	O	Bonham MWA	2016 Arbor Bend, Bonham, TX 75418	--	--	--
62	10,000	3,537	--	100,000	C	O	City of Waco	P.O. Box 2570, Waco, TX 76702	--	--	--
63	923,814	386,539	12,940	99,600	C	FC, O	Tarrant County WCID No. 1	P.O. Box 4508, Fort Worth, TX 76102	--	--	--
64	982,000	846,303	23,060	1,339,388	U	O	Lower Colorado River Authority	P.O. Box 220, Austin, TX 78767	X	--	--
65	101,041	62,400	3,083	120,000	U	O	Cherokee Water Co.	NK–21 Lake Cherokee, Longview, TX 75603	X	DA; SA	--
66	45,000	45,000	--	25,600	U	O	City of Cisco	P.O. Box 110, Cisco, TX 76437	--	--	--
67	91,680	38,846	1,886	265,923	U	O	City of Coleman	P.O. Box 592, Coleman, TX 76834	--	--	--
68	70,700	31,800	1,610	150,000	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
69	10,634	4,800	382	100,019	U	O	Jimmy E. and Walter J. Gore	P.O. Box 274, Comanche, TX 76442	--	--	--
70	706,970	430,260	20,985	247,247	C	O	San Jacinto River Authority	P.O. Box 329, Conroe, TX 77305	--	--	--
71	531,000	300,000	--	1,853,758	C	O	City of Corpus Christi	P.O. Box 98, Sandia, TX 78383	--	--	--
72	10,580	8,500	--	42,000	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
73	27,600	11,011	890	30,794	U	O	City of Paris	P.O. Box 9037, Paris, TX 75461	X	DA; SA	--
74	164,000	72,800	4,750	69,257	--	O	Franklin County Water District	P.O. Box 559, Mount Vernon, TX 75457	--	--	--
75	38,242	11,400	954	222,020	U	O	City of Breckenridge	209 N. Breckenridge Ave., Breckenridge, TX 76424	--	--	--
76	19,000	5,395	--	--	U	O	Eagle Ranch Inc.	--	--	--	--
77	144,162	33,420	3,133	377,626	U	FC, O	Wichita County WCID No. 2 and City of Wichita Falls	402 E. Scott St., Wichita Falls, TX 76301	--	--	--
78	35,000	13,386	--	--	U	O	City of Graham	P.O. Box 1449, Graham, TX 76450	--	--	--
79	21,370	8,730	--	20,687	U	O	City of Electra	108 N. Main St., Electra, TX 76360	--	--	--
80	1,048,480	675,819	27,690	115,347	C	O	Sabine River Authority	P.O. Box 579, Orange, TX 77631	X	Op. Mgr., Donnie Henson; DA; SA	--
81	220,100	37,100	--	284,000	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
82	26,000	12,720	895	71,100	U	O	City of Gilmer	P.O. Box 760, Gilmer, TX 75644	X	Owner, Scott Thompson	--
83	14,391	6,950	--	49,656	U	O	City of Gladewater	P.O. Box 551, Gladewater, TX 75647	--	--	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com- pleted	Drain- age area (mi^2)
84	TX03945	Brazos	Salt Creek	Young	Lake Graham	33°08'00"	98°36'48"	1958	--
85	TX03956	Brazos	Brazos River	Hood	Lake Granbury	32°22'24"	97°41'18"	1969	16,113
86	TX00005	Trinity	Denton Creek	Tarrant	Lake Grapevine	32°58'00"	97°03'00"	1952	--
87	TX02568	Trinity	Elm Creek	Navarro	Lake Halbert	32°04'36"	96°24'12"	1921	--
88	TX00920	Sabine	Little Sandy Creek	Wood	Lake Hawkins	32°36'42"	95°15'06"	1962	--
89	TX00936	Sabine	Keyes Creek	Wood	Lake Holbrook	32°41'06"	95°33'06"	1962	--
90	TX03416	San Jacinto	San Jacinto River	Harris	Lake Houston	29°55'12"	95°07'54"	1954	2,828
91	TX04138	Colorado	Colorado River	Scurry	Lake J.B. Thomas	32°35'00"	101°08'06"	1952	--
92	TX00583	Neches	Gum Creek	Cherokee	Lake Jacksonville	31°54'30"	95°18'30"	1957	41
93	TX04358	Red	Big Wichita River	Baylor	Lake Kemp	33°45'18"	99°08'42"	1923	2,086
94	TX01010	Red	North Fork Little Wichita River	Archer	Lake Kickapoo	33°39'48"	98°46'42"	1945	.43
95	TX00536	Trinity	Indina Creek	Cooke	Lake Kiowa	33°33'12"	97°00'42"	1970	--
96	TX02703	Brazos	Cedar Creek	Taylor	Lake Kirby	32°23'06"	99°43'42"	1928	41.6
97	TX00976	Neches	Trib.—Angelina River	Angelina	Lake Kurth	31°27'06"	94°42'00"	1960	3.9
98	TX01417	Brazos	Leon River	Eastland	Lake Leon	32°21'36"	98°40'30"	1954	252
99	TX00008	Trinity	Elm Fork Trinity River	Denton	Lake Lewisville	33°04'00"	96°57'48"	1954	--
100	TX04455	Brazos	Navasota River	Robertson	Lake Limestone	31°19'30"	96°19'12"	1978	674
101	TX00986	Colorado	Colorado River	Burnet	Lake Lyndon B. Johnson	30°33'18"	98°20'18"	1951	37.82
102	TX00023	Canadian	Canadian River	Hutchinson	Lake Meredith	35°43'00"	101°33'12"	1965	--
103	TX01061	Brazos	Navasota River	Limestone	Lake Mexia	31°38'36"	96°34'42"	1961	198
104	TX01225	Brazos	Rock Creek	Parker	Lake Mineral Wells	32°49'00"	98°02'30"	1920	63
105	TX04585	Neches	Bayou Loco	Nacogdoches	Lake Nacogdoches	31°35'18"	94°49'36"	1977	--
106	TX03139	Colorado	South Concho River	Tom Green	Lake Nasworthy	31°23'18"	100°28'42"	1930	3,833
107	TX00775	Red	Farmers Creek	Montague	Lake Nocona	33°53'00"	97°39'06"	1960	94
108	TX00020	Cypress	Cypress Creek	Marion	Lake O' the Pines	32°45'54"	94°29'48"	1959	--
109	TX01407	Brazos	Leon River	Eastland	Lake Olden	32°22'18"	98°46'12"	1920	207
110	TX00170	Neches	Neches River	Anderson	Lake Palestine	32°03'18"	95°26'18"	1971	--
111	TX03845	Brazos	Palo Pinto Creek	Palo Pinto	Lake Palo Pinto	32°38'48"	98°16'06"	1964	471

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
84	105,000	39,000	--	--	U	O	City of Graham	P.O. Box 1449, Graham, TX 76450	--	--	--
85	136,823	136,823	8,700	635,000	C	O	Brazos River Authority	P.O. Box 7555, Waco, TX 76714	X	DA; norm. cap.; max. cap.; SA	--
86	758,800	181,100	--	182,500	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
87	14,400	7,357	--	--	U	O	City of Corsicana	200 N. 12th St., Corsicana, TX 75110	--	--	--
88	40,200	11,890	--	29,259	U	FC, O	Wood County	County Judge, Wood County Courthouse, Quitman, TX 75763	--	--	--
89	15,980	7,990	--	--	U	FC, O	Wood County	County Judge, Wood County Courthouse, Quitman, TX 75763	--	--	--
90	281,800	146,700	12,240	840,000	C	O	City of Houston	Public Works Dept., P.O. Box 1562, Houston, TX 77251	--	--	--
91	360,000	204,000	--	161,000	U	O	Colorado River MUD	P.O. Box 869, Big Spring, TX 79721	--	--	--
92	56,083	30,500	1,325	26,588	U	O	City of Jacksonville	P.O. Box 1390, Jacksonville, TX 75766	X	--	--
93	1,097,200	268,100	15,590	527,500	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 61, Tulsa, OK 74121	X	All statistics	Q_2 = 5,830 Q_5 = 5,830 Q_{10} = 5,830 Q_{25} = 5,830 Q_{50} = 5,830 Q_{100} = 7,100
94	202,000	106,000	6,200	82,500	U	O	City of Wichita Falls	P.O. Box 1431, Wichita Falls, TX 76307	--	--	--
95	23,520	7,000	--	12,400	U	O	Lake Kiowa Property Owners Association	905 Kiowa Dr. W., Lake Kiowa, TX 76240	--	--	--
96	17,811	7,620	780	104,000	U	O	City of Abilene	P.O. Box 60, Abilene, TX 79604	X	No info.	--
97	27,360	16,200	800	118	U	O	Champion Paper Co.	Power and Utilities, P.O. Box 149, Lufkin, TX 75901	X	SA	--
98	72,250	27,290	1,590	230,367	U	O	Eastland County WSD	Rt. 1, Box 157, Ranger, TX 76470	--	--	--
99	2,082,800	464,500	--	216,800	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
100	333,048	215,751	13,379	150,725	U	O	Brazos River Authority	P.O. Box 7555, Waco, TX 76714	X	Norm. cap.; max. cap.; SA; max. dis.	--
101	227,000	138,000	6,375	1,633,409	C	O	Lower Colorado River Authority	P.O. Box 220, Austin, TX 78767	X	--	--
102	2,434,215	864,400	--	61,100	U	FC, O	Canadian River MWA	P.O. Box 99, Sanford, TX 79078	--	--	--
103	45,000	10,000	--	161,456	U	O	Bistone MWSD	P.O. Box 145, Mexia, TX 76667	--	--	--
104	16,356	7,065	640	122,427	U	O	City of Mineral Wells	P.O. Box 339, Mineral Wells, TX 76068	X	DA; SA	--
105	122,000	42,318	--	50,160	U	O	City of Nacogdoches	P.O. Box 630648, Nacogdoches, TX 75963	--	--	--
106	42,500	13,990	1,210	659,064	C	O	City of San Angelo	P.O. Box 1751, San Angelo, TX 76902	X	DA; SA	--
107	59,688	25,389	1,470	115,597	U	O	North Montague County WSD	101 Cook St., Nocona, TX 76255	X	Phone; max. dis.; dis. freq.	Q_5 = 4,539 Q_{10} = 6,683 Q_{25} = 9,420 Q_{50} = 12,038 Q_{100} = 15,000
108	1,856,500	254,900	--	68,200	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
109	21,700	1,607	130	241,379	C	O	Eastland Industrial Foundation	104 N. Lamar, Eastland, TX 76448	--	--	--
110	1,045,000	411,840	25,500	187,056	U	O	Upper Neches River MWA	P.O. Drawer Y, Palestine, TX 75801	X	SA	--
111	170,735	44,100	2,661	313,757	U	O	Palo Pinto County MWD No. 1	P.O. Box 387, Mineral Wells, TX 76067	--	--	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com-pleted	Drain-age area (mi^2)
112	TX03594	Brazos	Nolan River	Johnson	Lake Pat Cleburne	32°17'18"	97°25'00"	1964	100.5
113	TX03814	Red	Wanderers Creek	Hardeman	Lake Pauline	34°15'00"	99°40'18"	1905	42.6
114	TX00950	Sabine	Dry Creek	Wood	Lake Quitman	32°51'30"	95°27'00"	1962	--
115	TX00837	Trinity	East Fork Trinity River	Kaufman	Lake Ray Hubbard	32°48'06"	96°30'24"	1969	--
116	TX00013	Brazos	Yegua Creek	Burleson	Lake Somerville	30°20'00"	96°32'00"	1967	1.57
117	TX03778	Brazos	Paint Creek	Haskell	Lake Stamford	33°04'18"	99°33'36"	1953	--
118	TX03549	Neches	Striker Creek	Rusk	Lake Striker	31°56'06"	94°58'30"	1956	--
119	TX04356	Sulphur	White Oak Creek	Hopkins	Lake Sulphur Springs	33°10'24"	95°36'36"	1973	--
120	TX02735	Brazos	Bitter Creek	Nolan	Lake Sweetwater	32°26'18"	100°18'06"	1930	104
121	TX03587	Red	Prairie Dog Town Fork Red River	Randall	Lake Tanglewood	35°02'24"	101°46'12"	1965	832.7
122	TX00491	Sabine	Sabine River	Rains	Lake Tawakoni	32°48'42"	95°55'00"	1960	752
123	TX04779	Lavaca	Navidad River	Jackson	Lake Texana	28°53'24"	96°34'42"	1981	1,392
124	OK10317	Red	Red River	Grayson	Lake Texoma	33°49'06"	96°34'12"	1944	39,719
125	TX00315	Neches	Blackwater Creek	Shelby	Lake Timpson	31°50'42"	94°25'48"	1956	--
126	TX01087	Colorado	Colorado River	Travis	Lake Travis	30°23'30"	97°54'24"	1942	--
127	TX00245	Neches	Prairie Creek	Smith	Lake Tyler	32°12'42"	95°10'18"	1949	42
128	TX00244	Neches	Mud Creek	Smith	Lake Tyler East	32°12'36"	95°08'42"	1967	65
129	TX00016	Brazos	Bosque River	McLennan	Lake Waco	31°36'00"	97°13'00"	1965	--
130	TX01089	Colorado	Decker Creek	Travis	Lake Walter E. Long	30°17'06"	97°35'48"	1967	9.2
131	TX01255	Trinity	South Prong Waxahachie Creek	Ellis	Lake Waxahachie	32°20'30"	96°48'18"	1956	31,000
132	TX01222	Trinity	Clear Fork Trinity River	Parker	Lake Weatherford	32°46'18"	97°40'30"	1957	109
133	TX00017	Brazos	Brazos River	Bosque	Lake Whitney	31°52'00"	97°22'12"	1951	27.59
134	TX01017	Red	Holliday Creek	Wichita	Lake Wichita	33°50'42"	98°32'18"	1901	143
135	TX00940	Sabine	Big Sandy Creek	Wood	Lake Winnsboro	32°53'12"	95°20'42"	1962	--
136	TX00785	Trinity	West Fork Trinity River	Tarrant	Lake Worth	32°47'30"	97°24'54"	1914	2,064
137	TX00007	Trinity	East Fork Trinity River	Collin	Lavon Reservoir	33°02'00"	96°29'00"	1953	--
138	TX00119	San Jacinto	Lewis Creek	Montgomery	Lewis Creek Reservoir	30°25'48"	95°32'36"	1969	--

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
112	667,00	25,560	1,550	99,580	U	O	City of Cleburne	P.O. Box 657, Cleburne, TX 76033	X	DA; norm. cap.; SA; dis. freq.	Q_2 = 4,000 Q_5 = 9,000 Q_{10} = 13,500 Q_{25} = 20,750 Q_{50} = 26,750
113	16,000	7,000	609	--	U	O	West Texas Utilities Co.	P.O. Box 841, Abilene, TX 79604	X	--	--
114	29,200	7,440	--	34,400	U	FC, O	Wood County	County Judge, Wood County Courthouse, Quitman, TX 75763	--	--	--
115	583,600	490,000	--	357,112	C	O	City of Dallas	City Hall, Dallas, TX 75201	--	--	--
116	1,028,800	160,100	11,460	286,000	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
117	150,000	57,927	--	134,500	U	O	City of Stamford	P.O. Drawer 191, Stamford, TX 79553	--	--	--
118	80,000	26,960	--	130,000	--	O	Angelina-Nacogdoches County WCID	Rt. 1, Box 75, Reklaw, TX 75784	--	--	--
119	34,700	17,838	--	49,800	U	O	City of Sulphur Springs	125 S. Davis St., Sulphur Springs, TX 75482	--	--	--
120	19,340	2,544	220.5	208,954	U	O	City of Sweetwater	P.O. Box 450, Sweetwater, TX 79556	--	--	--
121	13,275	4,897	258	194,426	U	FC, O	Lake Tanglewood Inc.	Rt. 8, Box 1000, Amarillo, TX 79118	X	--	--
122	1,660,000	927,440	36,700	131,500	U	O	Sabine River Authority	P.O. Box 579, Orange, TX 77631	X	Op. Mgr., Donnie Henson; DA; norm. cap.; SA	--
123	197,099	163,506	10,134	176,000	C	O	Lavaca-Navidad River Authority	P.O. Box 429, Edna, TX 77957	X	DA; norm cap.; max. cap.; SA; max. dis.	--
124	8,600,000	2,580,400	86,910	1,125,000	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 61, Tulsa, OK 74121	X	All but max. cap.	Q_2 = 40,000 Q_5 = 45,000 Q_{10} = 50,000 Q_{25} = 60,000 Q_{50} = 121,550 Q_{100} = 175,000
125	60,148	1,881	250	12,773	U	O	Shelby County FWSD No. 1	P.O. Box 106, Timpson, TX 75975	X	SA	--
126	3,223,000	1,172,600	18,929	572,000	U	FC, O	Lower Colorado River Authority	P.O. Box 220, Austin, TX 78767	X	--	--
127	85,810	42,500	2,365	32,666	U	O	City of Tyler	P.O. Box 2039, Tyler, TX 75710	X	DA; SA; ph.	--
128	85,010	43,000	2,507	31,000	U	O	City of Tyler	P.O. Box 2039, Tyler, TX 75710	X	DA; SA; ph.	--
129	828,300	152,500	--	563,300	C	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
130	45,200	33,940	1,280	34,467	C	O	City of Austin	P.O. Box 1088, Austin, TX 78767	X	DA; SA	--
131	23,663	13,500	690	56,521	U	O	Ellis County WCID No. 1	P.O. Box 757, Waxahachie, TX 75165	--	--	--
132	37,520	19,866	1,090	68,800	U	O	City of Weatherford	P.O. Box 255, Weatherford, TX 76086	X	--	--
133	2,100,400	627,100	23,560	684,000	C	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
134	57,280	5620	1,310	76,300	U	FC, O	Wichita County WCID No. 2 and City of Wichita Falls	402 E. Scott St., Wichita Falls, TX 76301	--	--	--
135	30,500	8100	--	--	U	FC, O	Wood County	County Judge, Wood County Courthouse, Quitman, TX 75763	--	--	--
136	96,225	38,130	3,560	101,760	U	O	City of Fort Worth	1000 Throckmorton St., Fort Worth, TX 76102	--	--	--
137	921,200	456,500	--	357,700	C	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
138	18,586	16,600	--	11,232	C	O	Gulf States Utilities Co.	P.O. Box 435, Willis, TX 77379	--	--	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com-pleted	Drain-age area (mi^2)
139	TX03823	Trinity	Trinity River	San Jacinto	Livingston Reservoir	30°38'00"	95°00'54"	1969	16,583
140	TX06399	Trinity	Lost Creek	Jack	Lost Creek Reservoir	33°14'36"	98°07'11"	1991	29.19
141	TX00784	Trinity	Marine Creek	Tarrant	Marine Creek Reservoir	32°49'30"	97°23'30"	1958	9.3
142	TX03547	Sabine	Martin Creek	Rusk	Martin Lake	32°16'18"	94°33'06"	1974	130
143	TX01787	San Antonio	Medina River	Medina	Medina Lake	29°32'24"	98°56'00"	1913	634
144	TX01029	Brazos	Millers Creek	Baylor	Millers Creek Reservoir	33°25'24"	99°22'06"	1974	241
145	TX06420	Colorado	Trib.—Beals Creek	Mitchell	Mitchell County Reservoir	32°14'24"	101°06'18"	1991	15.3
146	TX04013	Cypress	Blundell Creek	Titus	Monticello Reservoir	33°04'48"	95°02'36"	1973	--
147	TX00827	Trinity	Mountain Creek	Dallas	Mountain Creek Lake	32°43'54"	96°56'36"	1937	295
148	TX00330	Sabine	Murvaul Bayou	Panola	Murvaul Bayou Reservoir	32°02'00"	94°25'12"	1956	--
149	TX06028	Colorado	Sulphur Springs Draw	Howard	Natural Dam Lake	32°13'06"	101°37'30"	1989	556
150	TX00009	Trinity	Richland Creek	Navarro	Navarro Mills Lake	31°57'00"	96°42'00"	1963	--
151	TX01014	Red	North Fork Buffalo Creek	Wichita	North Fork Buffalo Creek Reservoir	33°59'12"	98°45'06"	1964	33.4
152	TX00832	Trinity	South Fork Grapevine Creek	Dallas	North Lake	32°56'48"	96°58'12"	1957	2.7
153	TX00012	Colorado	Concho River	Tom Green	O.C. Fisher Lake	31°28'00"	100°29'00"	1952	--
154	TX03516	Colorado	Oak Creek	Coke	Oak Creek Reservoir	32°02'24"	100°16'00"	1950	244
155	TX03245	Colorado	Elm Creek	Runnels	Old Lake Winters	31°57'06"	99°52'24"	1945	--
156	TX04313	San Antonio	Olmos Creek	Bexar	Olmos Reservoir	29°28'24"	98°28'24"	1926	32.4
157	TX06400	Canadian	Palo Duro Creek	Hansford	Palo Duro Reservoir	36°21'42"	101°09'48"	1991	614
158	TX04359	Red	Sanders Creek	Lamar	Pat Mayse Lake	33°51'18"	95°33'12"	1967	175
159	TX05871	Cypress	Trib.—Peacock Creek	Morris	Peacock Site 1A Tailings Reservoir	32°58'12"	94°40'42"	1983	1.7
160	TX04355	Neches	Sandy Creek	Shelby	Pinkston Reservoir	31°42'18"	94°21'48"	1977	--
161	TX03849	Brazos	Brazos River	Palo Pinto	Possum Kingdom Lake	32°52'12"	98°25'30"	1941	14,030

of 10,000 acre-feet—Continued

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
139	2,045,000	1,788,000	82,600	311,000	C	O	Trinity River Authority	P.O. Box 360, Livingston, TX 77351	X	Max. dis.; dis. freq.; Project Mgr., Bill Holder	Q_2 = 40,000 Q_5 = 70,000 Q_{10} = 85,000 Q_{25} = 107,000 Q_{50} = 122,000 Q_{100} = 137,000 Q_{250} = 152,000 Q_{500} = 167,000
140	21,831	11,900	413	84,062 (PMF)	U	O	City of Jacksboro	111 E. Archer, Jacksboro, TX 76458	X	DA; SA; max. dis; dis. freq.	Q_5 = 799 Q_{10} = 884 Q_{25} = 891 Q_{50} = 4,729 Q_{100} = 8,416 Q_{PMF} = 84,062
141	16,491	3,774	209	22,336	U	FC	Tarrant County WCID No. 1	P.O. Box 4508, Fort Worth, TX 76102	--	--	--
142	182,300	77,619	5,440	45,300	C	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
143	327,250	254,000	5,575	658,346	U	O	Bexar-Medina-Atascosa Counties WCID 1	P.O. Box 170, Natalia, TX 78059	--	--	--
144	131,000	38,800	2,882	313,211	U	O	North Central Texas MWD	P.O. Box 36, Munday, TX 76371	X	Owner, Dolan Moore; DA; max outflow	--
145	50,241	32,000	1,603	19,608	U	O	Colorado River MUD	P.O. Box 869, Big Spring, TX 79721	--	--	--
146	47,600	40,100	--	38,000	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
147	70,880	40,000	2,490	135,274	C	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
148	92,000	44,650	3,890	26,700	U	O	Panola County FWSD No. 1	P.O. Box 331, Carthage, TX 75633	X	Chairman, J.R. Jacks; SA; max dis.	--
149	207,265	54,560	--	--	U	FC, O	Colorado River MUD	P.O. Box 869, Big Spring, TX 79721	--	--	--
150	335,800	63,300	--	224,000	C	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
151	32,250	15,400	--	34,271	U	O	City of Iowa Park	P.O. Box 190, Iowa Park, TX 76367	--	--	--
152	24,000	16,000	806	--	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
153	696,300	119,200	--	356,200	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
154	79,336	39,360	2,375	112,300	U	O	City of Sweetwater	P.O. Box 450, Sweetwater, TX 79556	--	--	--
155	10,032	2,447	--	--	U	O	City of Winters	310 S. Main, Winters, TX 79567	X	--	--
156	14,240	--	0	--	--	FC	City of San Antonio	512 Mission Rd., San Antonio, TX 78210	--	--	--
157	278,500	60,897	2,413	237,500	U	O	Palo Duro River Authority	P.O. Box 99, Spearman, TX 79081	X	DA; norm. cap.; SA; dis. freq.	Q_{50} = 2,911.4 Q_{100} = 2,915.6
158	457,800	118,110	5,940	5,720	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 61, Tulsa, OK 74121	X	All statistics	Q_2 = 870 Q_5 = 915 Q_{10} = 940 Q_{25} = 950 Q_{50} = 960
159	13,336	6,853	176	2,537	U	O	Lone Star Steel Co.	P.O. Box 1000, Lone Star, TX 75668	X	Address; ph.; DA; norm. cap.; SA; max. cap.	--
160	13,500	7,380	--	5,620	U	O	City of Center	P.O. Box 311, Center, TX 75935	--	--	--
161	556,220	556,220	17,700	500,600	C	O	Brazos River Authority	P.O. Box 7555, Waco, TX 76714	X	DA; norm. cap.; max. cap.; max. dis.	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com- pleted	Drain- age area (mi^2)
162	TX00010	Brazos	Leon River	Comanche	Proctor Lake	31°58'18"	98°28'36"	1963	--
163	TX02250	Rio Grande	Becerra Creek	Webb	Rancho Blanco Lake	27°17'36"	99°28'54"	1943	--
164	TX08008	Trinity	Elm Fork	Denton	Ray Roberts Lake	33°21'24"	97°02'12"	1986	692
165	TX02312	Rio Grande	Pecos River	Reeves	Red Bluff Reservoir	31°54'06"	103°54'36"	1936	20,760
166	TX02465	Nueces-Rio Grande	Tranquitas Creek	Kleberg	Reservoir No. 6s	27°33'30"	97°56'00"	1938	--
167	TX03793	Nueces-Rio Grande	Off-channel	Hidalgo	Retama Reservoir	26°23'00"	98°09'42"	1935	--
168	TX06316	Trinity	Richland Creek	Freestone	Richland Creek Reservoir	31°58'00"	96°08'30"	1987	1,957
169	TX03746	Canadian	Rita Blanca Creek	Hartley	Rita Blanca Lake	36°01'30"	102°29'54"	1940	--
170	TX00011	Neches	Angelina River	Jasper	Sam Rayburn Reservoir	31°04'00"	94°05'00"	1965	3,449
171	TX00965	Red	Beaver Creek	Wilbarger	Santa Rosa Lake	33°56'24"	99°15'36"	1929	327.8
172	TX01384	Brazos	Duck Creek	Dickens	SCS Lake 1	33°38'42"	100°54'06"	1968	20.49
173	TX04602	Brazos	Hog Creek	Bosque	SCS Site 1	31°39'18"	97°38'12"	1977	--
174	TX70111	Brazos	Running Water Draw	Parmer	SCS Site 1	34°--'--"	103°--'--"	1974	128.24
175	TX05945	Guadalupe	Sink Creek	Hays	SCS Site 1	29°55'06"	97°58'24"	1983	33.6
176	TX02368	Rio Grande	Johnson Draw	Crockett	SCS Site 1	30°52'24"	101°12'42"	1958	17
177	TX06717	Rio Grande	Cornudas Draw	Hudspeth	SCS Site 1	31°58'44"	105°16'32"	1982	97.1
178	TX04481	San Antonio	Cibolo Creek	Kendall	SCS Site 1	29°49'18"	98°46'00"	1978	19.8
179	TX04716	San Antonio	Salado Creek	Bexar	SCS Site 1	29°39'48"	98°36'00"	1975	11.3
180	TX01677	Colorado	South Brady Creek	McCulloch	SCS Site 17	31°08'48"	99°35'48"	1962	28.8
181	TX04747	Trinity	Brushy Elm Creek	Cooke	SCS Site 19	33°39'24"	97°23'54"	--	--
182	TX00207	Trinity	Turkey Creek	Henderson	SCS Site 2	32°05'54"	95°59'48"	1955	19.8
183	TX00846	Brazos	Gilmore Creek	Erath	SCS Site 27	31°59'00"	98°06'42"	1973	20.7
184	TX01626	Colorado	Fitzgerald Creek	Concho	SCS Site 28	31°08'54"	99°52'48"	1957	21.88
185	TX02367	Rio Grande	Garrett Draw	Crockett	SCS Site 3	30°50'00"	101°16'06"	1958	16.7
186	TX02299	Rio Grande	Dry Devils River	Sutton	SCS Site 3	30°41'42"	100°41'00"	1961	23.93
187	TX04827	Brazos	Running Water Draw	Hale	SCS Site 3	34°15'00"	101°53'36"	1982	390.2
188	TX04715	Brazos	Running Water Draw	Parmer	SCS Site 3	34°24'12"	102°31'42"	1979	123.9
189	TX01625	Colorado	Brady Creek	Concho	SCS Site 31	31°10'06"	99°58'30"	1958	22.5
190	TX04530	Nueces-Rio Grande	Chiltipin Creek	Jim Wells	SCS Site 4	27°53'36"	98°10'00"	1974	37.6
191	TX01468	San Antonio	Panther Springs Creek	Bexar	SCS Site 4	29°37'24"	98°31'12"	1972	5.5
192	TX03612	Trinity	Turkey Creek	Johnson	SCS Site 42	32°22'18"	97°13'54"	1966	15.3
193	TX03350	Trinity	Big Cottonwood Creek	Kaufman	SCS Site 60	32°35'06"	96°15'36"	1962	8.32
194	TX02940	Colorado	North Prong Pecan Bayou	Callahan	SCS Site 7	32°18'48"	99°28'12"	1970	37.9
195	TX03341	Trinity	Muddy Cedar Creek	Kaufman	SCS Site 87A	32°43'42"	96°10'24"	1955	14.33

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
162	433,000	59,400	--	431,800	C	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
163	21,500	1,730	--	--	U	O	Rancho Blanco	P.O. Box 21130, San Antonio, TX 78221	--	--	--
164	1,931,900	799,600	29,350	21,600	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
165	518,950	308,180	7,507	389,749	U	O	Red Bluff Water Power District	111 W. Second St., Pecos, TX 79772	--	--	--
166	18,316	1,147	--	22,681	U	O	King Ranch, Inc.	P.O. Box 1090, Kingsville, TX 78364	--	--	--
167	13,500	8,864	--	--	--	O	Santa Cruz Irrigation District No. 15	P.O. Box 599, Edinburg, TX 78540	--	--	--
168	1,743,000	1,135,000	44,752	600,000	C	O	Tarrant County WCID No. 1	P.O. Box 4508, Fort Worth, TX 76102	--	--	--
169	13,600	11,507	--	--	U	O	Hartley-Dallam Counties	Hartley County Courthouse, Channing, TX 79018	--	--	--
170	6,520,245	2,898,200	--	125,300	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
171	28,792	9,561	1,582	165,541	U	O	W.T. Waggoner Estate	P.O. Box 2130, Vernon, TX 76384	X	SA	--
172	10,750	634	79.4	23,110	U	FC	Dickens County WCID No. 1	312 Willara Ave., Spur, TX 79370	--	--	--
173	12,119	740	74	19,893	U	FC, O	Bosque SWCD	Rt. 2, Box 82, Bluff Dale, TX 76433	--	--	--
174	25,150	2,170	235	40,173	U	FC	Central Curry SWCD	--	--	--	--
175	18,399	107	25	76,527	U	FC	Comal-Hays-Guadalupe SWCD	P.O. Box 992, Seguin, TX 78155	--	--	--
176	11,550	166	51	20,059	U	FC	Crockett SWCD	P.O. Box 39, Ozona, TX 76943	X	--	--
177	11,757	575	143	16,119	U	FC	El Paso-Hudspeth SWCD	11930 Vista del Sol, Ste. B, El Paso, TX 79936	--	--	--
178	15,668	4,043	189	43,756	U	FC, O	Kendall SWCD	Rt. 2, Box 2486C, Boerne, TX 78006	--	--	--
179	2,800,108	199	25	2,800,108	U	FC	San Antonio River Authority	P.O. Box 830027, San Antonio, TX 78282	--	--	--
180	13,511	277	76	13,850	U	FC	McCulloch SWCD	200A E. 11th St., Brady, TX 76825	--	--	--
181	11,700	4,700	--	12,353	U	FC, O	Upper Elm-Red SWCD	Rt. 2, Box 34-8, Gainsville, TX 75090	X	Address; ph.	--
182	10,500	433	121	--	U	FC	Trinity-Neches SWCD	209 Dallas Hwy., Athens, TX 75751	--	--	--
183	10,169	1,227	125	53,649	U	FC, O	Erath County Commissioners Court	Erath County Courthouse, Stephenville, TX 76401	--	--	--
184	13,042	200	67	--	U	FC	Concho SWCD	P.O. Box 392, Eden, TX 76837	--	--	--
185	10,723	174	50	19,277	U	FC	Crockett SWCD	P.O. Box 39, Ozona, TX 76943	X	--	--
186	10,643	200	50	84,775	U	FC	Edwards Plateau SWCD	301 S.E. Crockett, Sonora, TX 76950	X	No info.	--
187	14,312	8,213	54	8,875	U	FC	Hale County SWCD	P.O. Box 312, Plainview, TX 79072	--	--	--
188	18,499	4,427	233	8,920	U	FC, O	Parmer County SWCD	1306 W. Ninth St., Friona, TX 79035	X	--	--
189	11,155	189	--	8,250	U	FC	Concho SWCD	P.O. Box 392, Eden, TX 76837	--	--	--
190	17,023	200	65	41,186	U	FC	Nueces-Jim Wells-Kleberg-Kenedy SWCD	548 SH 77, Ste. B, Robstown, TX 78380	X	--	--
191	30,798	85	16	230,208	U	FC	San Antonio River Authority	P.O. Box 830027, San Antonio, TX 78282	--	--	--
192	14,107	4,757	503	48,244	U	FC, O	Johnson County SWCD	P.O. Box 293, Cleburne, TX 76033	X	--	--
193	16,800	1,834	330.3	--	U	FC, O	Kaufman-Van Zandt County SWCD	105 E. Sixth St., Kaufman, TX 75142	--	--	--
194	16,550	5,748	449	21,870	U	O	Callahan Divide SWCD	Rt. 1, Box 160-B, Cross Plains, TX 76443	X	--	--
195	20,147	8,712	840	22,468	U	FC, O	Kaufman-Van Zandt County SWCD	105 E. Sixth St., Kaufman, TX 75142	--	--	--

Table 3. Texas Natural Resource Conservation Commission permitted dams with maximum capacities in excess

Seq. no.	TNRCC no. (pl. 2)	River basin	Stream name	County	Reservoir name	Latitude	Longitude	Year com- pleted	Drain- age area (mi^2)
196	TX04788	Guadalupe	Dry Comal Creek	Comal	SCS Site 2	29°40'30"	98°15'06"	1981	30.1
197	TX03415	San Jacinto	Carpenters Bayou	Harris	Sheldon Reservoir	29°51'12"	95°10'00"	1944	6.6
198	TX01564	Brazos	Dry Creek	Fort Bend	Smithers Lake	29°28'48"	95°37'48"	1957	--
199	TX04627	Brazos	Squaw Creek	Somervell	Squaw Creek Reservoir	32°17'18"	97°45'36"	1977	64
200	TX00014	Brazos	Lampasas River	Bell	Stillhouse Hollow Reservoir	31°02'00"	97°32'00"	1968	--
201	TX06482	Colorado	Sulphur Springs Draw	Martin	Sulphur Springs Draw Storage Reservoir	32°19'18"	101°44'56"	1993	258
202	LA00030	Sabine	Sabine River	Newton	Toledo Bend Reservoir	31°10'42"	93°34'00"	1968	--
203	TX04110	Brazos	Tradinghouse Creek	McLennan	Tradinghouse Creek Reservoir	31°33'12"	96°58'48"	1968	--
204	TX05996	Red	Bluff Creek	Knox	Truscott Brine Lake	33°47'54"	99°50'12"	1982	26.2
205	TX04316	Red	Tule Creek	Briscoe	Tule Creek Lake	34°32'36"	101°26'12"	1974	188
206	TX00022	Colorado	Middle and South Concho Rivers	Tom Green	Twin Buttes Reservoir	31°22'36"	100°32'00"	1963	2,980
207	TX04453	Brazos	Duck Creek	Robertson	Twin Oak Reservoir	31°12'00"	96°27'48"	1982	--
208	TX06588	Brazos	Big Elm Creek	Bell	Unnamed trib.—Elm Creek Watershed SCS Site 1 Dam	31°14'30"	97°18'48"	1984	21.12
209	TX06458	Nueces	Leona River	Uvalde	Unnamed trib.—Leona River Watershed SCS Site 3	29°17'42"	99°45'54"	1983	37
210	TX06780	Rio Grande	Sanderson Canyon	Pecos	Unnamed trib.—Sanderson Canyon Watershed SCS Site 2	30°09'36"	102°40'48"	1986	53.23
211	TX01802	Nueces	Nueces River	Zavala	Upper Nueces Lake	28°46'42"	99°49'42"	1947	350
212	TX00418	Red	Brushy Creek	Fannin	Valley Lake	33°38'42"	96°21'30"	1961	--
213	TX04357	Cypress	Swauno Creek	Titus	Welsh Reservoir	33°02'36"	94°50'00"	1975	--
214	TX02143	Brazos	White River	Crosby	White River Lake	33°27'24"	101°05'00"	1963	--
215	TX00840	Trinity	White Rock Creek	Dallas	White Rock Lake	32°48'54"	96°43'30"	1911	--
216	TX05776	Colorado	Elm Creek	Runnels	Winters Elm Creek Reservoir	31°56'18"	99°52'06"	1983	65.5
217	TX00021	Sulphur	Sulphur River	Bowie	Wright Patman Lake	33°18'18"	94°09'36"	1957	5.38

Seq. no.	Maximum capacity (acre-ft)	Normal capacity (acre-ft)	Surface area (acres)	Maximum discharge (ft^3/s)	Type of spill-way	Pur-pose of dam	Owner name	Owner address	Ques-tion-aire returned	Updated infor-mation	Outflow peak-streamflow frequency (ft^3/s)
196	19,024	177	32	83,171	U	FC, O	Comal County Commissioners Court	150 N. Seguin, Ste. 301, New Braunfels, TX 78130	--	--	--
197	21,138	4,224	1,244	4,033	U	O	Texas Parks and Wildlife Department	4200 Smith School Rd., Austin, TX 78744	X	--	--
198	18,750	18,750	--	--	C	FC, O	Houston Lighting and Power Co.	P.O. Box 1700, Houston, TX 77001	--	--	--
199	199,427	151,047	3,228	87,128	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
200	1,013,300	235,700	--	673,500	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--
201	20,692	7,997	970	210,870	U	O	Colorado River MUD	P.O. Box 869, Big Spring, TX 79721	--	--	--
202	5,100,000	4,477,000	--	286,000	C	O	Sabine River Authorities of Texas and Louisiana	Toledo Bend Project Joint Operation, Rt. 1, Box 270, Burkeville, TX 75932	--	--	--
203	57,032	37,814	--	64,629	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
204	135,000	111,147	3,146	35,400	U	O	U.S. Army Corps of Engineers	P.O. Box 61, Tulsa, OK 74121	X	Yr. completed; norm. cap.; max. cap.; max. dis.; dis. freq.	--
205	69,249	46,077	896	77,900	U	O	Mackenzie MWA	Rt. 1, Box 14, Silverton, TX 79257	X	Owner, Roy F. Garris; DA	--
206	1,088,000	186,200	9,080	47,300	U	FC, O	Bureau of Reclamation	P.O. Box 1946, Austin, TX 78767	--	--	--
207	70,885	30,319	--	48,800	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
208	18,300	1,867	32	32,800	U	FC	Central Texas SWCD	202 S. Main, Temple, TX 76501	--	--	--
209	21,306	185	--	--	U	FC	Nueces-Frio-Sabinal SWCD	P.O. Box 146, Sabinal, TX 78802	--	--	--
210	11,789	1,874	51	35,102	U	FC	Rio Grande-Pecos River SWCD	P.O. Box 140, Sanderson, TX 79848	--	--	--
211	--	4,010	25	100	U	O	Zavala-Dimmit Counties WID No. 1	P.O. Box 729, Crystal City, TX 78839	X	DA; norm. cap.; max. cap.; SA; max. dis.	--
212	20,000	16,400	--	4,600	U	O	TU Electric	Skyway Tower, 400 N. Olive St., Dallas, TX 75201	--	--	--
213	50,300	23,587	--	21,840	U	O	Southwestern Electric Power Co.	P.O. Box 21106, Shreveport, LA 71156	--	--	--
214	80,000	44,897	--	91,120	U	O	White River MUD	Star Rt. 2, Spur, TX 79370	--	--	--
215	39,400	10,743	--	190,808	U	O	City of Dallas	City Hall, Dallas, TX 75201	--	--	--
216	33,500	8,374	643	102,236	U	O	City of Winters	310 S. Main, Winters, TX 79567	X	--	--
217	6,505,020	145,300	20,300	63,200	U	FC, O	U.S. Army Corps of Engineers	P.O. Box 17300, Fort Worth, TX 76102	--	--	--

Table 4. Regression equations for estimation of L-moments and L-moment ratios of annual peak streamflow for three regions in Texas

[CV, coefficient of variation; A, contributing drainage area in square miles (mi^2); SH, basin shape factor—ratio of length of longest mapped channel (stream length) squared to contributing drainage area (dimensionless); SL, stream slope in feet per mile (ft/mi)—ratio of change in elevation of (1) longest mapped channel from site (or station) to headwaters to (2) length of longest mapped channel; --, not applicable]

Region and L-moment statistic	Weighted least-squares regression equation for corresponding L-moment statistic	Regional mean (and standard deviation) of corresponding L-moment statistic (log_{10} or dimensionless)	Range of indicated independent variables in corresponding region (units as noted)	Adjusted R-squared[1]	Weighted standard error of estimate (percent)	Weighted standard error of estimate (log_{10} or dimensionless)	Percent change from regional standard deviation to standard error of estimate	No. of stations in analysis for equation
Northeast region								
Mean	$\mu = 135.8\ A^{0.631}\ SH^{-0.0911}\ SL^{0.370}$	3.87 (0.578) log_{10}	A: 0.20–38,600 mi^2	0.884	50	0.204 log_{10}	-64.7	99
L-CV	$\tau_2 = log_{10}(2.979\ A^{-0.0168})$	.434 (0.0949)	SH: 0.182–39.9	.034	21	.0885	-6.74	99
L-skew	$\tau_3 = 0.315$	.315 (0.153)	SL: 1.48–65.0 ft/mi	--	--	--	--	99
L-kurtosis	$\tau_4 = 0.203$	.203 (0.143)		--	--	--	--	99
Southeast region								
Mean	$\mu = 182.7\ A^{0.654}\ SH^{-0.299}\ SL^{0.339}$	3.90 (0.497) log_{10}	A: 1.48–35,400 mi^2	.845	44	.181 log_{10}	-63.6	92
L-CV	$\tau_2 = log_{10}(1.359\ A^{0.0685}\ SH^{-0.107}\ SL^{0.336})$	.462 (0.140)	SH: 1.67–41.2	.421	23	.100	-28.6	92
L-skew	$\tau_3 = log_{10}(1.229\ A^{0.0395}\ SL^{0.262})$	.374 (0.184)	SL: 1.22–70.0 ft/mi	.149	37	.154	-16.3	92
L-kurtosis	$\tau_4 = 0.249$	.249 (0.173)		--	--	--	--	92
West region								
Mean	$\mu = 104.7\ A^{0.582}\ SH^{-0.143}\ SL^{0.425}$	3.90 (0.522) log_{10}	A: 2.45–35,200 mi^2	.547	85	.321 log_{10}	-38.5	176
L-CV	$\tau_2 = log_{10}(5.488\ A^{-0.0218}\ SH^{-0.124})$	.551 (0.146)	SH: 1.53–84.9	.090	31	.131	-10.3	176
L-skew	$\tau_3 = log_{10}(3.530\ SH^{-0.109})$	.424 (0.192)	SL: 3.52–130 ft/mi	.031	40	.166	-13.5	176
L-kurtosis	$\tau_4 = 0.262$	.262 (0.175)		--	--	--	--	176

[1] Adjusted R-squared presented so equations based on different numbers of stations and using different independent variables—contributing drainage area, basin shape factor, and stream slope—can be compared.