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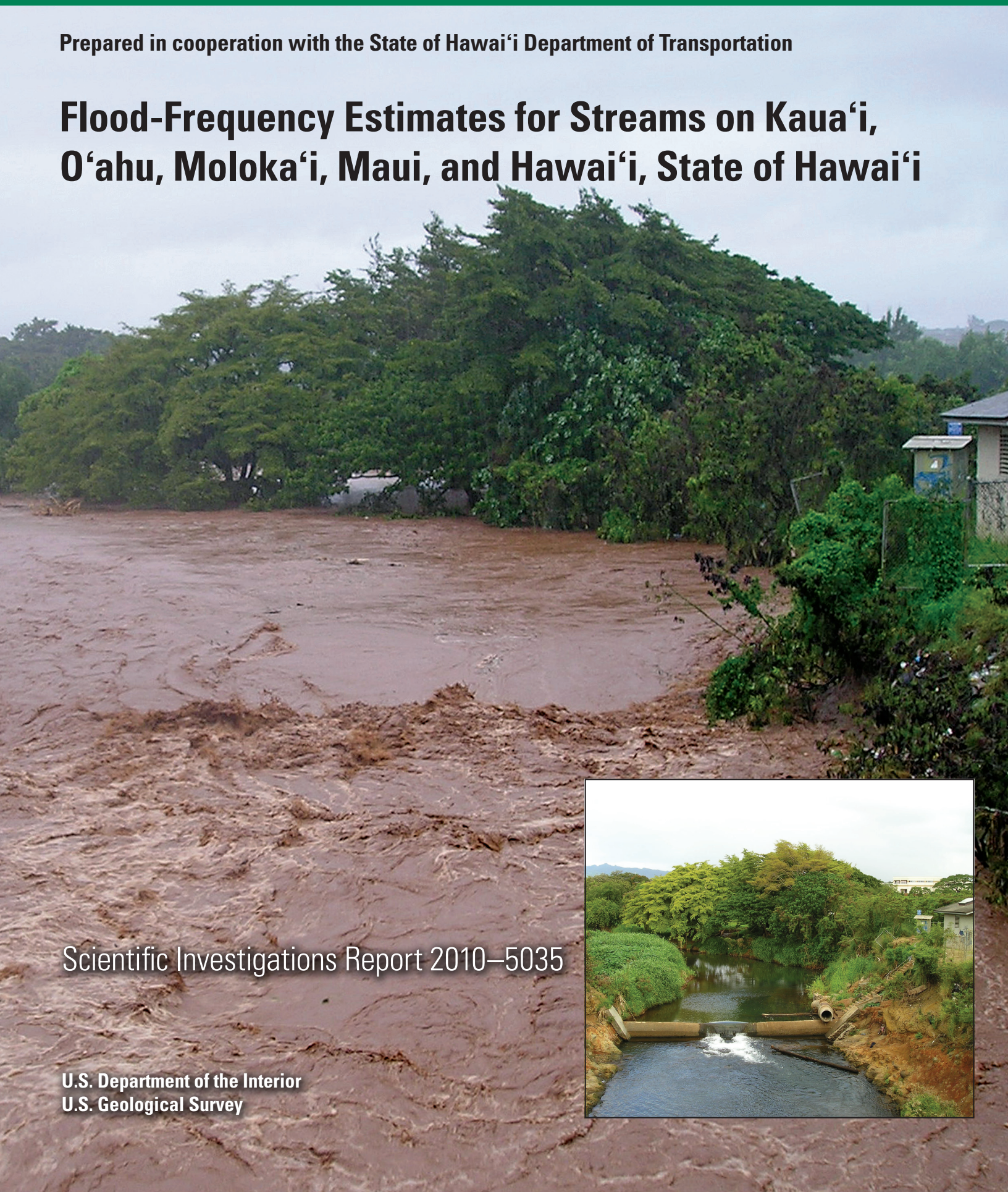
Flood-Frequency Estimates for Streams on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i, State of Hawai‘i



Scientific Investigations Report 2010–5035

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

Cover: Waikele Stream, O‘ahu, Hawai‘i, near U.S. Geological Survey gaging station 16213000 during flood of December 11, 2008 and on February 27, 2009 (inset). USGS photographs by Clarence Edwards (December 11, 2008) and Richard B. Castro (February 27, 2009).

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By Delwyn S. Oki, Sarah N. Rosa, and Chiu W. Yeung

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

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KEN SALAZAR, Secretary

U.S. Geological Survey
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Conversion Factors and Datum

[Inch/Pound to SI]

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	4,047	square meter (m^2)
square foot (ft^2)	0.09290	square meter (m^2)
square mile (mi^2)	2.590	square kilometer (km^2)
	Volume	
cubic foot (ft^3)	0.02832	cubic meter (m^3)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
gallon per day (gal/d)	0.003785	cubic meter per day (m^3/d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
inch per year (in/yr)	25.4	millimeter per year (mm/yr)

Vertical coordinate information is referenced to mean sea level.

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

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

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Flood-Frequency Estimates for Streams on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i, State of Hawai‘i

By Delwyn S. Oki, Sarah N. Rosa, and Chiu W. Yeung

Abstract

This study provides an updated analysis of the magnitude and frequency of peak stream discharges in Hawai‘i. Annual peak-discharge data collected by the U.S. Geological Survey during and before water year 2008 (ending September 30, 2008) at stream-gaging stations were analyzed. The existing generalized-skew value for the State of Hawai‘i was retained, although three methods were used to evaluate whether an update was needed.

Regional regression equations were developed for peak discharges with 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence intervals for unregulated streams (those for which peak discharges are not affected to a large extent by upstream reservoirs, dams, diversions, or other structures) in areas with less than 20 percent combined medium- and high-intensity development on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i. The generalized-least-squares (GLS) regression equations relate peak stream discharge to quantified basin characteristics (for example, drainage-basin area and mean annual rainfall) that were determined using geographic information system (GIS) methods.

Each of the islands of Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i was divided into two regions, generally corresponding to a wet region and a dry region. Unique peak-discharge regression equations were developed for each region. The regression equations developed for this study have standard errors of prediction ranging from 16 to 620 percent. Standard errors of prediction are greatest for regression equations developed for leeward Moloka‘i and southern Hawai‘i. In general, estimated 100-year peak discharges from this study are lower than those from previous studies, which may reflect the longer periods of record used in this study. Each regression equation is valid within the range of values of the explanatory variables used to develop the equation. The regression equations were developed using peak-discharge data from streams that are mainly unregulated, and they should not be used to estimate peak discharges in regulated streams. Use of a regression equation beyond its limits will produce peak-discharge estimates with unknown error and should therefore be avoided. Improved estimates of the magnitude and frequency of peak discharges in Hawai‘i will require continued operation of existing stream-gaging stations and operation of additional gaging stations for areas such as Moloka‘i and Hawai‘i, where limited stream-gaging data are available.

Introduction

Reliable estimates of the magnitude and frequency of floods are needed for the safe and efficient design of roads, bridges, water-conveyance structures, and flood-control projects and for the management of flood plains and flood-prone areas. Underestimation of peak flood discharges could lead to loss of human lives and property, whereas overestimation of peak flood discharges could potentially result in expensive, overdesigned projects. As the population of the State of Hawai‘i increases and development expands to new areas, the need for reliable flood-frequency estimates for streams will become increasingly important. Although recent flood-frequency estimates may be available for individual development projects or flood-insurance studies, the information generally is difficult to access from study reports and may not be applicable to other areas.

Federal agencies that use estimates of flood frequencies include, but are not limited to, (1) the Federal Emergency Management Agency (FEMA), which is responsible for flood-hazard mapping, (2) the National Weather Service, which provides flood warnings in the State, and (3) the U.S. Army Corps of Engineers, which has the mission of providing engineering services to the Nation that include the planning, design, and construction of flood-control projects. State agencies that use estimates of flood frequencies include, but are not limited to, (1) Hawai‘i Department of Transportation (DOT), which has the mission of providing a safe, efficient, and accessible transportation system that ensures the mobility of people and goods and enhances and preserves economic prosperity and the quality of life, (2) Hawai‘i Department of Land and Natural Resources, which is responsible for approving construction of dams and reservoirs and which contains the office of the State flood coordinator, and (3) Hawai‘i Civil Defense agency, which has the mission of minimizing loss of life and property, providing for the welfare and safety of citizens, restoring vital services, providing continuity of government, and coordinating resources for disaster response and recovery. County Civil Defense Administrators oversee the day-to-day emergency management activities, including those related to floods, in their respective counties. In addition, Departments of Planning, Departments of Design and Construction, and Departments of Public Works in the counties require reliable flood-frequency estimates for proper planning, design, and construction activities.

The most reliable estimates of peak-discharge magnitude and frequency are those made at sites where long-term

stream-gaging stations have been operated. At sites where streamflow data are unavailable, regionalization techniques can be used to estimate peak-discharge magnitude and frequency. Regionalization studies provide estimates of peak-discharge magnitude and frequency based on data collected from gaged streams in similar hydrologic settings. Regional flood-frequency studies also can be used to improve flood-frequency estimates at gaged sites with short-term data and assess the effectiveness of a crest-stage flood-gaging program. Although regional flood-frequency studies commonly are updated every 10 years, such studies for many islands in Hawai‘i were last updated more than 30 years ago and therefore do not take advantage of (1) the additional 30 plus years of data collected, (2) standardized Federal guidelines for computing flood frequencies (Interagency Advisory Committee on Water Data, 1982), (3) new statistical methods that have become available, and (4) geographic information system (GIS) technology.

Fontaine (1996) related the standard error of the 100-year peak-discharge estimate to record length using data from five long-term stream-gaging stations on O‘ahu. Results of his analysis indicate that (1) the decrease in standard error of the 100-year peak-discharge estimate is greatest as the length of record increases from 5 to 20 years and (2) the standard error continues to decrease, but at a slower rate, as the record length increases from 20 to 50 years (Fontaine, 1996). In 2008 a total of 169 gaging stations had 25 or more years of usable record, as compared to 68 in 1984 (table 1). The reliability of the existing flood-frequency estimation procedures can be improved by using the additional data and new analytical techniques.

Previous Studies

The U.S. Geological Survey (USGS) has operated stream-gaging stations in Hawai‘i since 1909. The number of active continuous-record stream-gaging stations peaked near 200 stations in the 1960s and has declined steadily since then. During 2008, only 60 continuous-record gaging stations were operated in Hawai‘i, close to the number of stations maintained during 1912. Starting in 1957, a network of 24 crest-stage gaging stations, which record peak stage, was established on O‘ahu for the purpose of improving the understanding of floods (State of Hawai‘i, 1970a). The crest-stage gaging-station network was later extended to Kaua‘i and Hawai‘i in 1962, and then to Moloka‘i and Maui in 1963 (State of Hawai‘i, 1970a). In 1971, a total of 93 crest-stage gaging stations were being maintained: 11 on Kaua‘i, 36 on O‘ahu, 10 on Moloka‘i, 21 on Maui, and 15 on Hawai‘i (Yamanaga, 1972). In 1994, the number of active crest-stage gaging stations had increased to 107: 13 on Kaua‘i, 41 on O‘ahu, 8 on Moloka‘i, 24 on Maui, and 21 on Hawai‘i (Fontaine, 1996). By 2008, however, only 65 crest-stage gaging stations were being maintained (9 on Kaua‘i, 24 on O‘ahu, 4 on Moloka‘i, 18 on Maui, and 10 on Hawai‘i), and by 2010 the number of crest-stage gaging stations was further reduced to 43 (2 on Kaua‘i, 27 on O‘ahu, 0 on Moloka‘i, 2 on Maui, and 12 on Hawai‘i). Peak-discharge data from both continuous-record and crest-stage gaging stations are used in this study.

Some of the published studies for estimating peak discharges at ungaged sites in Hawai‘i are described briefly below. (Peak-discharge estimates from the studies described below are compared to those generated by this study in a later section of this report.) Additional descriptions of these studies and others are provided in the appendix. Many of the existing published methods used to estimate peak discharges at ungaged sites in Hawai‘i have been based on limited records from a limited number of gaging stations. On the Island of Hawai‘i, for example, flood-frequency estimation methods were based on data from 30 gaging stations, with only 9 of the gaging stations having 10 or more years of record (State of Hawai‘i, 1970b). Through water year 2008, peak-discharge data were available from 47 gaging stations with 10 or more years of record on the Island of Hawai‘i

Table 1. Summary of available annual peak-discharge data through water year 2008 in comparison to available data used in previously published studies, State of Hawai‘i.

[—, no previous study]

Location	No. of sites with 10 or more years of annual peak-discharge data		No. of sites with 25 or more years of annual peak-discharge data	
	Previously published flood-frequency study	This study (through water year 2008)	Previously published skew study[f]	This study (through water year 2008)
Kaua‘i	20[a]	37	19	27
O‘ahu	79[b]	71	17	54
Moloka‘i	—	22	7	21
Maui	19[c]	58	25	46
Hawai‘i	9[d]	47	3	21
State total	75[e]	235	68	169

[a]State of Hawai‘i, 1973.
[b]Wong, 1994.
[c]State of Hawai‘i, 1971.
[d]State of Hawai‘i, 1970b.
[e]Yamanaga, 1972.
[f]Lee, 1984.

(table 1). (A water year covers the 12-month period from October 1 through September 30 and is designated by the calendar year in which it ends.) On the Island of Maui, flood-frequency estimation methods were based on data from 37 gaging stations, with only 19 of the gaging stations having 10 or more years of record (State of Hawai‘i, 1971). Through water year 2008, peak-discharge data were available from 58 gaging stations with 10 or more years of record on the Island of Maui (table 1). The present study incorporates data through water year 2008, thereby taking advantage of much additional data not available for earlier studies.

To estimate preliminary peak discharges for Kaua‘i, envelope curves relating peak discharge (recurrence interval exceeding 100 years) to drainage area were developed for each of five regions (State of Hawai‘i, 1973). For each region, curves of 10-, 50-, and 100-year peak discharges were drawn parallel to the envelope curves.

The most recent published regional flood-frequency study for the Island of O‘ahu (Wong, 1994) used available data through water year 1988 (79 gaging stations with 11 to 72 years of record) and followed guidelines documented in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). O‘ahu was divided into three regions, and regression equations were developed for the 2-, 5-, 10-, 25-, 50-, and 100-year peak discharges using either one explanatory variable (drainage area) or two explanatory variables (drainage area and median annual rainfall; or drainage area and 2-year, 24-hour rainfall) in the equations, depending on the region (Wong, 1994). The 100-year peak discharge for drainage areas greater than 100 acres on O‘ahu also can be estimated using the County storm-drainage standards. The County storm-drainage standards contain curves relating 100-year peak discharge to drainage area for drainage areas greater than 100 acres in each of three geographic regions of O‘ahu (City and County of Honolulu, 1988, 2000).

For the Island of Maui, relations between peak discharge and drainage area were developed for the 100-year peak discharge, as well as other selected peak discharges, for each of five regions (State of Hawai‘i, 1971). These regional relations, which are presented in the form of curves, were intended for use in preliminary planning studies.

For the Island of Hawai‘i, regional relations between peak discharge, for selected recurrence intervals, and drainage area were developed for each of eight regions (State of Hawai‘i, 1970b). In addition, storm-drainage standards for the County of Hawai‘i (1970) were developed using the City and County of Honolulu (1969) standards as a guide. For drainage areas greater than 100 acres, separate design curves relating peak discharge (approximate 100-year recurrence interval) to drainage area are provided for each of four regions (County of Hawai‘i, 1970).

Objectives

The primary objectives of this study were to (1) provide estimates of the magnitudes of the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak stream discharges at gaged sites on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i, using recorded annual peak discharges through water year 2008, and (2) develop regression equations that can be used to estimate the magnitude of the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak stream discharges at ungaged, unregulated sites on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i.

Purpose and Scope

This report addresses a need to provide a statewide analysis of the magnitude and frequency of peak discharges for streams in Hawai‘i. (For this study, floods and peak discharges related to streams are considered. Floods related to other factors, such as coastal storm surges, are beyond the scope of this study.) Annual peak-discharge data collected by the USGS during and before water year 2008 at continuous-record and crest-stage stream-gaging stations were considered for analysis. Generalized-skew coefficients and peak-discharge magnitude and frequency at gaged sites were determined using guidelines documented in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). Basin morphometric, soil, rainfall, and land-cover characteristics were determined using GIS methods. The estimated peak discharges at gaged sites for 2-, 5-, 10-, 25-, 50-, 100-, and 500-year recurrence intervals and the quantified basin characteristics were used as input for a regression analysis to develop peak-discharge frequency relations for ungaged sites on unregulated streams in Hawai‘i. (Unregulated streams are those for which peak discharges are not affected to a large extent by upstream reservoirs, dams, diversions, or other structures). Preliminary equations were developed using ordinary-least-squares multiple-regression techniques to identify significant explanatory variables and to determine whether Hawai‘i should be divided into separate hydrologic regions. Final regression equations were developed using generalized-least-squares (GLS) regression techniques (Stedinger and Tasker, 1985; Tasker and Stedinger, 1989) that adjust for differences in record lengths, differences in peak-discharge variances, and cross correlations of concurrent peak discharges among gaging stations used in the regression analysis. The estimated peak discharges for a 100-year recurrence interval at gaged sites were compared to previously published estimates from regional studies and existing design curves.

Acknowledgments

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additional GIS technical assistance. Adam G. Johnson and Steve P. Garcia helped check GIS basin delineations for accuracy, and Nathaniel Q. Adams identified inconsistencies in the peak-discharge records during the early phase of the study.

Setting

The eight main Hawaiian Islands are located between 154º and 161º west longitudes and between 18º and 22º north latitudes and are geologically youngest in the southeast and oldest in the northwest (fig. 1). The eight main islands of the State of Hawai‘i and their approximate sizes, in square miles, from northwest to southeast are Ni‘ihau, 70; Kaua‘i, 552; O‘ahu, 597; Moloka‘i, 260; Lana‘i, 141; Maui, 727; Kaho‘olawe, 45; and Hawai‘i, 4,028 (Juvik and Juvik, 1998). The highest altitude on Kaua‘i is about 5,200 feet above sea level in its central part, although large areas of the island shoreward of the interior mountains are less than 1,000 feet above sea level. O‘ahu has a mountainous ridge along its eastern side and another mountainous area along the western side, which rises to an altitude of about 4,000 feet above sea level; however, most of O‘ahu is less than 1,000 feet above sea level. Moloka‘i is mountainous in its eastern part, where it rises to an altitude of about 5,000 feet above sea level, although most of the island is less than 1,000 feet above sea level. The highest altitude on Maui is about 10,000 feet above sea level in its eastern part and about 5,800 feet above sea level in its western part; a broad lowland area separates the two parts. The Island of Hawai‘i has the highest altitude in the State at 13,796 feet above sea level. The main Hawaiian Islands can be divided into two primary physiographic zones, windward and leeward, which relate to the exposure of these areas to persistent northeasterly winds and orographic rainfall.

Climate

In general, mild temperatures, cool and persistent northeasterly winds, a rainy season from October through April, and a dry season from May through September characterize the climate of Hawai‘i (Blumenstock and Price, 1967; Sanderson, 1993). The location of the north Pacific anticyclone (an area of high atmospheric pressure located northeast of the main Hawaiian Islands) is one of the primary climate controls for the Hawaiian Islands. During the dry season, the stability of the north Pacific anticyclone produces persistent northeasterly trade winds that blow 80 to 95 percent of the time. During the rainy season, migratory low- and high-pressure systems and frontal systems often move past the Hawaiian Islands, resulting in less persistent trade winds that blow 50 to 80 percent of the time.

Rainfall

The topography of each Hawaiian island has a profound effect on rainfall. In general, the northeastern, windward sides of the islands are wettest. This pattern is controlled by the rise of moisture-laden northeasterly trade winds along the windward slopes of the islands (see, for example, Sanderson, 1993). When the moisture-laden air mass rises and cools, the moisture condenses and may precipitate on mountain slopes. Maximum rainfall occurs between altitudes of 2,000 and 6,000 feet above sea level, but amounts vary depending on the form, location, and topography of each island. Precipitation also may occur as fog drip, which is cloud vapor that is intercepted by vegetation and that subsequently drips to the ground. Above 6,000 feet, precipitation decreases, and the highest altitudes are semiarid. High mountain areas are dry because the upslope flow of moist air is prevented from penetrating above altitudes of about 6,000 to 8,000 feet by the temperature inversion in the atmosphere. Areas that are leeward (southwest) of mountain barriers generally are drier than windward areas because air loses moisture during its ascent over an upwind barrier. This is known as the rain-shadow effect (Giambelluca and others, 1986).

Mean annual rainfall exceeds 435 inches near the central summit area of Kaua‘i, 275 inches on the northeastern part of O‘ahu, 155 inches on the mountainous parts of eastern Moloka‘i, 355 inches near the central summit area of western Maui, and 235 inches on the northeastern part of the Island of Hawai‘i (Giambelluca and others, 1986) (fig. 1). Most of the southwestern coastal areas of all islands receive less than 40 inches of rain annually; the Island of Hawai‘i has areas at high altitudes, above the temperature inversion, and areas on the northwestern coast that receive less than 20 inches. Mean annual rainfall changes can be large over short horizontal distances; in some places, this change can exceed 100 in. over a horizontal distance of one mile.

Migratory low-pressure systems and frontal systems can bring heavy rains to the Hawaiian Islands. The dry coastal leeward areas can receive much of their annual rainfall from these systems. In Hawai‘i, 24-hour rainfall totals can exceed 10 in. over coastal areas and 20 in. over the mountainous interior areas during heavy storms (Perica and others, 2009; Giambelluca and others, 1984; U.S. Weather Bureau, 1962).

Streams

Most Hawaiian streams originate in the mountainous interiors of the islands and terminate at the coast. Streams are one of the main sculptors of the Hawaiian landscape because of the erosive power of the water they convey. In geologically young areas, such as much of the southern part of the Island of Hawai‘i, well-defined stream channels have not yet developed because the permeability of the surface rocks generally is so high that rainfall infiltrates before it runs off for long distances on the surface. In geologically older areas that have received large amounts of rainfall, streams and mass wasting have carved out large valleys.

Drainage-Basin Characteristics

Drainage basins in Hawai‘i generally are small and have steep sides. Drainage basins are small mainly because the distance between the headwaters and mouths of streams is short

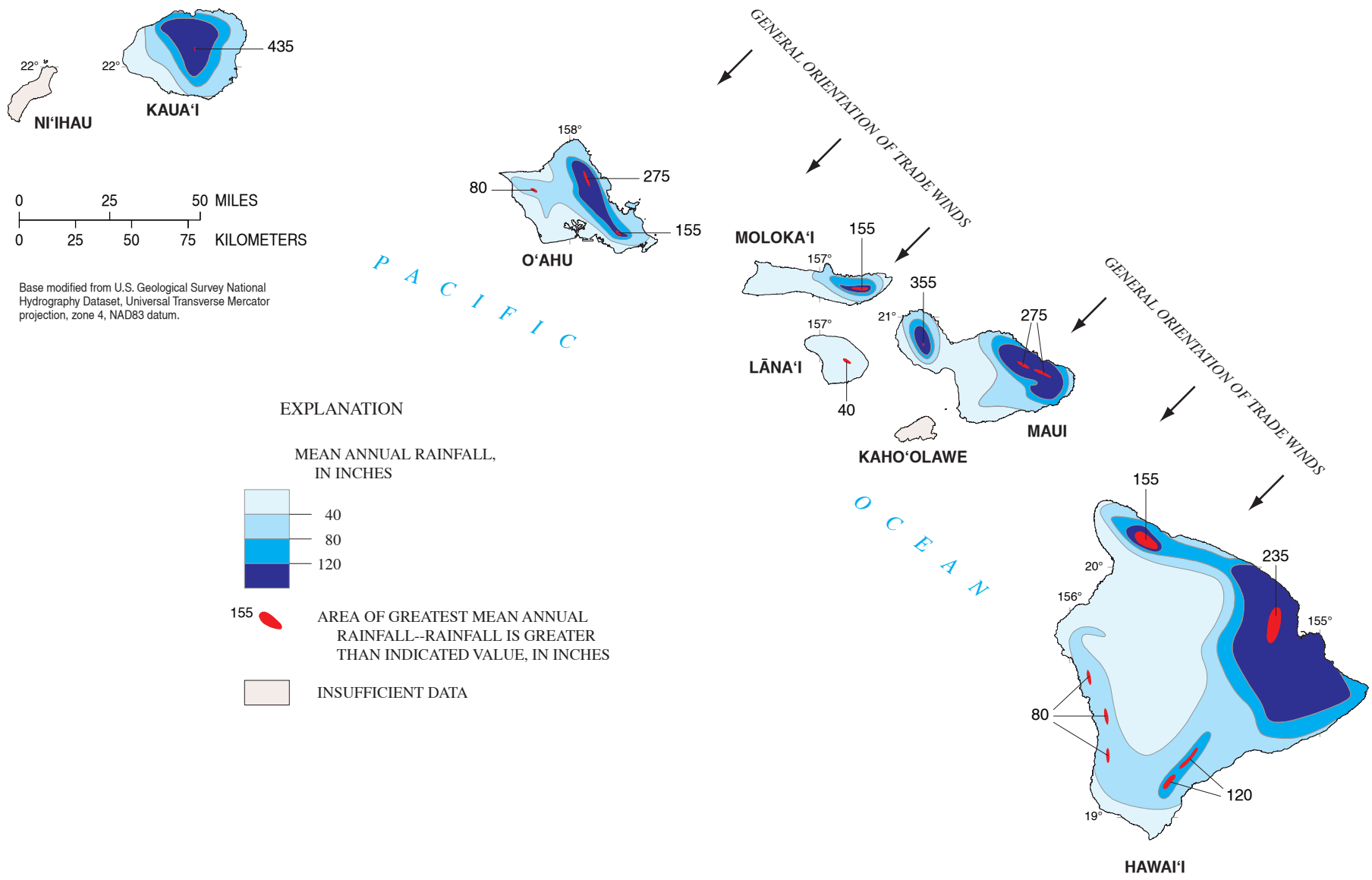

Figure 1. Geographic variation of mean annual rainfall, State of Hawai'i (modified from Giambelluca and others, 1986).

and adjacent streams are closely spaced. Furthermore, the topography associated with Hawaiian shield volcanoes leads to a radial drainage pattern in which streams flow away from each other, rather than into each other as in most continental settings. Drainage-basin divides may be clearly defined where formed by steep-sided ridges near mountainous interior areas and less well defined in flatter coastal areas. In some interior areas, the stream channel may be more than 1,000 feet below the adjacent ridgeline that forms the basin divide.

Streamflow Characteristics

Streamflow consists of (1) direct runoff of rainfall, in the form of overland flow and subsurface storm flow that rapidly returns infiltrated water to the stream, (2) groundwater discharge, in the form of base flow, where the stream intersects the water table, (3) water returned from bank storage, (4) rain that falls directly on streams, and (5) any additional water, including excess irrigation water, discharged to the stream by humans (see, for example, Oki, 2003). During periods of intense rainfall, streamflow generally is dominated by direct runoff. The amount of direct runoff and base flow that contributes to total streamflow is dependent on several factors, including rainfall amount and intensity, drainage-basin geology, morphology, and size, soils, and land cover. Humans can affect streamflow characteristics through diversions, channelization, dams, land-use changes, and other factors.

Streamflow in Hawai‘i is highly variable both in space and time. Streams that are dry most of the year are common in the leeward parts of the islands. Streams that flow continuously throughout the year are common in areas that receive large amounts of rainfall and groundwater discharge. Seasonal streamflow variations exist over both windward and leeward areas, but they commonly are less pronounced in windward areas where base flow (groundwater discharge to streams) and rainfall are persistent.

The percentage of rainfall that directly runs off varies both among basins and within a basin. Among basins, the percentage of mean annual rainfall that runs off typically ranges between 10 and 40 percent, although higher and lower values exist in places. Within a basin, the percentage of rainfall that runs off varies temporally among individual storms and may range from less than 5 to greater than 50 percent. The percentage of rainfall that runs off is expected to be high where the rainfall amount and intensity are high, permeability of the soils is low, slopes are steep, the water table is at or near the land surface, or antecedent soil moisture is high.

The timing and magnitude of peaks in the streamflow hydrographs for different sites reflect spatial differences in rainfall amount, intensity, and timing as well as differences in basin characteristics, including size, slopes, land cover, soil types, and geohydrologic conditions. Streams in Hawai‘i are flashy because of high-intensity rainfall, small drainage-basin size, steep basin and stream slopes, and little channel storage (Wong, 1994). Stream stage commonly rises and falls several feet over a few hours in response to rainfall. The flood hydrograph for a single storm typically has a sharp rise and a steep recession, and it can be characterized as having a steep triangular shape and short time to peak (Wu, 1969).

On the basis of 2,317 recorded annual peak discharges (with known dates) for O‘ahu streams, Wong (1994) estimated that 89 percent of the peaks occurred between October and May. This period generally corresponds to the rainy season during which heavy storms and flooding typically occur.

For a number of streams in Hawai‘i, discharge is affected by regulation by surface-water diversions or impoundment by reservoirs (Timbol and Maciolek, 1978). In general, annual peak discharges are not affected to a large extent by surface-water diversions designed to divert the low flows of streams. In some cases, however, reservoirs designed for flood control may substantially attenuate annual peak discharges. For example, annual peak discharges in Nuuanu Stream, in the southeastern part of O‘ahu, likely are affected by regulation by an upstream reservoir.

Soils

The Natural Resources Conservation Service (NRCS) has identified 12 soil orders or major soil types (U.S. Department of Agriculture, 1998). Of these 12 soil orders, 11 have been reported in Hawai‘i. The main factors that affect the character of a soil include climate, biological activity, parent material, topography, and time. Climatic gradients in Hawai‘i are steep, and this affects the spatial distribution of soils. In some cases, soil formation may be related more to past, rather than present, climatic conditions (Gavenda, 1992). Highly weathered soils generally are found in wetter areas, whereas other soils are found only in dry areas. Parent-rock materials in Hawai‘i are primarily volcanic in origin and may be associated with lava flows from which residual soils develop, or they may be from transported materials, including alluvium, colluvium, and volcanic ash. Topography also affects the character of the soil. For example, soils on steep slopes are commonly thin because of erosion. In geologically young areas, soils may not have developed yet because the soil-forming processes have not had sufficient time to be effective.

Soils that are used for agriculture in Hawai‘i generally can transmit water downward at rates of a few in/hr, although the rates can range from less than 0.06 to 20 in/hr (Foote and others, 1972). The infiltration capacity of agricultural soils can be reduced by urbanization. Murabayashi and Fok (1979) used double-ring infiltrometers to quantify the effects of urbanization on the constant infiltration rate and estimated that urbanization can reduce the constant infiltration rate by 83 percent. Wood (1971) indicated that hydrologic characteristics of soils on O‘ahu varied with land cover. In general, infiltration rates in forested areas were higher than in adjacent areas, with the same soil types, used for sugarcane, pineapples, or pasture (Wood, 1971).

Land Use

In general, land-use patterns during the 20th century in Hawai‘i reflected increases in population and decreases in large-scale agricultural operations over time. The resident population in Hawai‘i increased from 154,001 in 1900 to 1,211,537 in 2000 (State of Hawai‘i, 2000). In 2000, about 72 percent of the State’s resident population was on O‘ahu, 12 percent on Hawai‘i, 5 percent on Kaua‘i, and 11 percent on Maui, Moloka‘i, and Lana‘i combined. During the latter part of the 20th century, many large-scale plantation operations in the State were replaced by urban developments, diversified agriculture, or other land uses. For example, from 1984 to 2000 sugarcane acreage in Hawai‘i decreased from 188,396 to 43,821 acres (State of Hawai‘i, 2000).

During the late 1970s, the USGS used the Geographic Information Retrieval and Analysis System (GIRAS) protocol (Mitchell and others, 1977) for collecting land-use and land-cover data in Hawai‘i. Land use and land cover were classified using the system established by Anderson and others (1976). For nominal 2001 conditions, a national land-cover dataset was developed using 29 land-cover classes (Yang, 2008; Multi-Resolution Land Characteristics Consortium, 2009).

In general, increased urbanization in an area is expected to result in greater direct runoff from the area, because rain falling on paved surfaces commonly is efficiently routed to stream channels through storm-drainage systems. Even in unpaved areas, direct runoff can be enhanced by urbanization because of the potential reduction in the infiltration capacity of soils associated with urbanization (Murabayashi and Fok, 1979).

Data

Data necessary for evaluating the generalized skew for Hawai‘i and developing regional regression equations to estimate the magnitude of the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak discharges at ungaged, unregulated sites include annual peak-discharge data from USGS stream-gaging stations and associated drainage-basin characteristics. Basin morphometric, soil, rainfall, and land-cover characteristics are quantified using GIS methods.

Peak-Discharge Data

The annual maximum peak-discharge data collected at stream-gaging stations are used to determine the annual exceedance probability associated with a particular magnitude of peak discharge. The exceedance probability commonly is expressed in terms of a recurrence interval (in years). The recurrence interval is the expected (average) time between exceedances of a particular annual peak discharge. The recurrence interval in years is equal to the reciprocal of the exceedance probability (a dimensionless number ranging from 0 to 1) of the annual instantaneous peak discharge. Thus, a flood with a 100-year recurrence interval (100-year peak discharge) has an annual exceedance probability of 0.01 (1 percent). Because there is a 1 percent chance that a 100-year peak discharge will be exceeded in any given year, it is possible that the 100-year peak discharge will be exceeded more than once (or not at all) during a 100-year period. It also is possible that the 100-year peak discharge could be exceeded more than once in a single year.

Since 1911, the USGS has collected annual peak-discharge data from stream-gaging stations on the islands of Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i (figs. 2–6). For this study, only gaging stations with at least 10 years of usable record through water year 2008 were considered for estimating the magnitude and frequency of peak discharges, and only gaging stations with at least 25 years of usable record were considered for estimating the generalized skew (Interagency Advisory Committee on Water Data, 1982) (table 2).

Data in the USGS peak-flow file, which is part of the National Water Information System (NWIS) digital database containing annual peak-discharge data, were checked for accuracy using a systematic checking program (Ryberg, 2008), information in files maintained by the USGS Pacific Islands Water Science Center, as well as values published in USGS reports. This process identified a number of errors in the peak-flow file and resulted in revision of the NWIS database. In addition, data from a number of gaging stations with possibly inaccurate rating curves or other potential problems were identified (R.A. Fontaine, USGS, written commun., 2009), and these data were not used for this study (table 3). Data from gaging stations 16211200, 16212450, 16228600, 16311000, and 16318000 on O‘ahu were previously used by Wong (1994) to estimate the magnitude and frequency of floods for streams on O‘ahu, but these gaging stations were precluded from analysis in this study as a result of the data-review process. Eight additional gaging stations on O‘ahu (16212700, 16216500, 16247000, 16247100, 16265000, 16273900, 16273950, and 16274499) were precluded from analysis in this study because of potential effects of urbanization (see discussion below in section on “Basin Characteristics”), although data from only one of these gaging stations (16273900) indicated a statistically significant trend (downward) in annual peak discharge. Seven of these eight gaging stations (all except 16273950) were used previously by Wong (1994).

For this study, a total of 235 gaging stations contained at least 10 years of usable annual peak-discharge data, and 169 gaging stations contained at least 25 years of usable data (tables 1, 2). Only 14 gaging stations (6 percent) contained at least 70 years of usable data (fig. 7). The longest available record through water year 2008 is 96 years at gaging station 16587000 on Maui. About two-thirds of the annual peak discharges analyzed in this study occurred during the months of November through March (fig. 8). Less than 2 percent of the annual peak discharges occurred during the month of June, although June may not be the driest month of the year in terms of mean streamflow in Hawai‘i (see, for example, Oki, 2003). Peak discharges at all sites used in the analysis were not affected to a large extent by upstream dams or diversions.

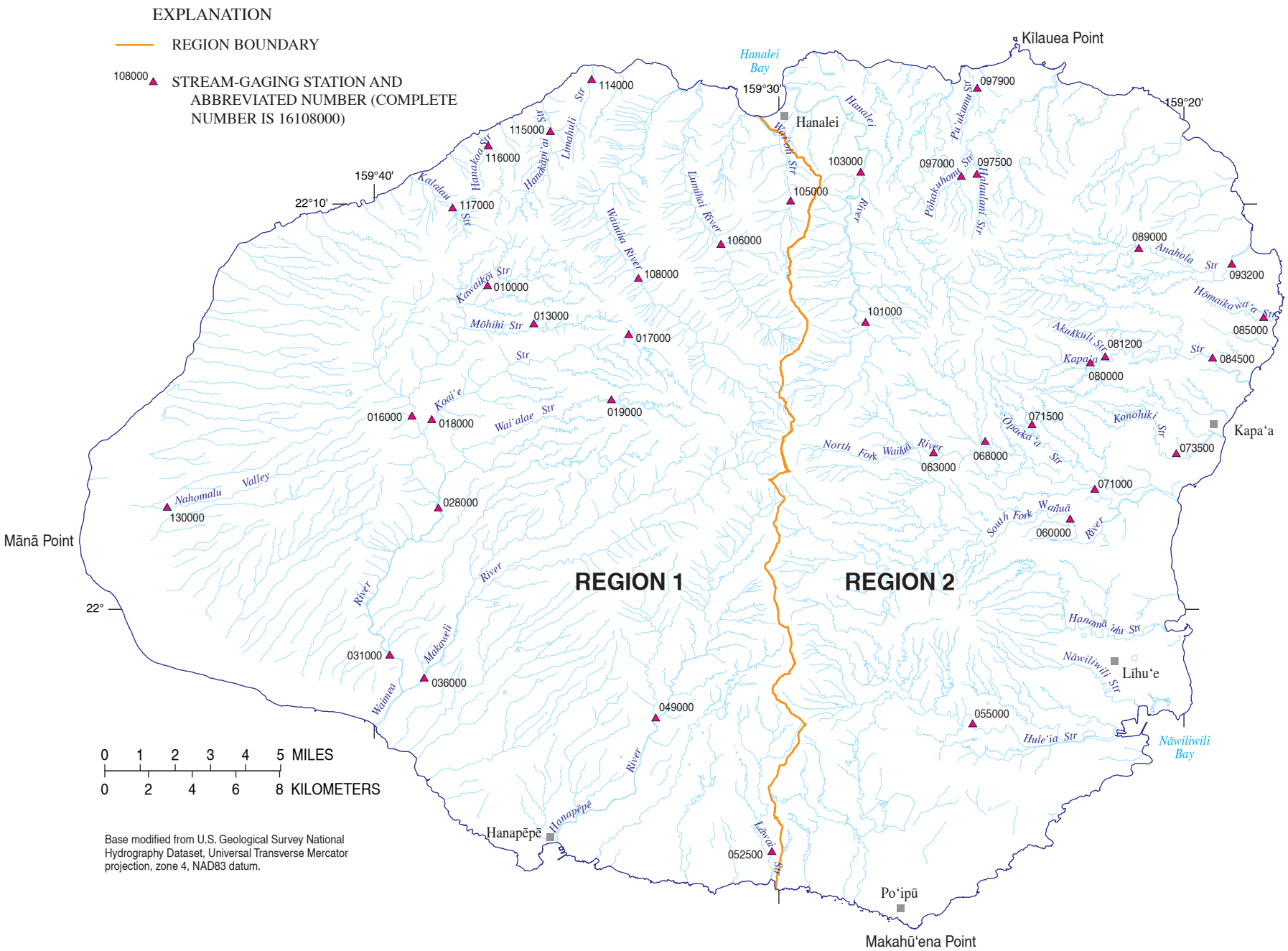

Figure 2. Stream-gaging stations with at least 10 years of usable peak-discharge data (through water year 2008), Kaua‘i, Hawai‘i.

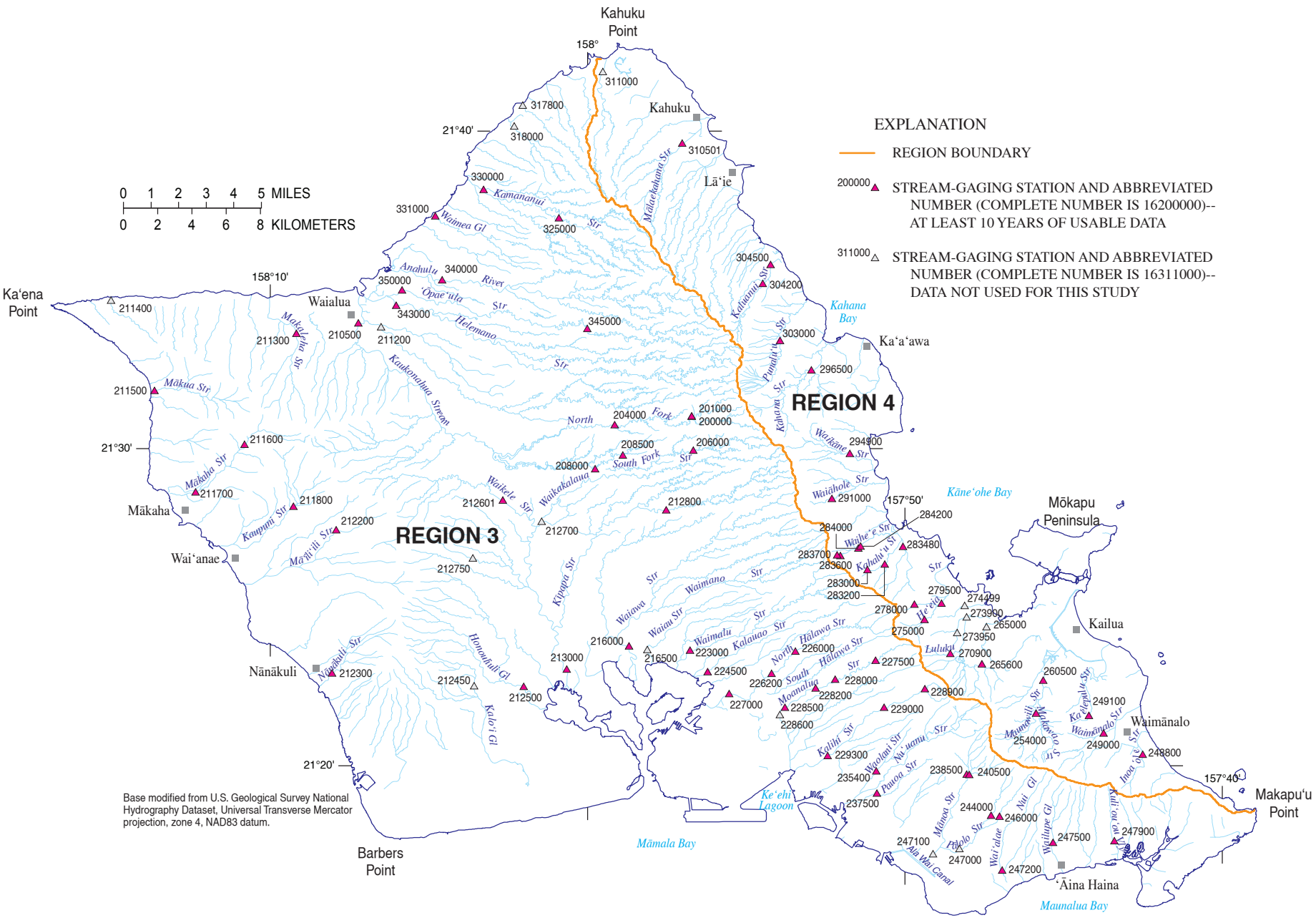

Figure 3. Stream-gaging stations with at least 10 years of usable peak-discharge data (through water year 2008), Oʻahu, Hawaiʻi.

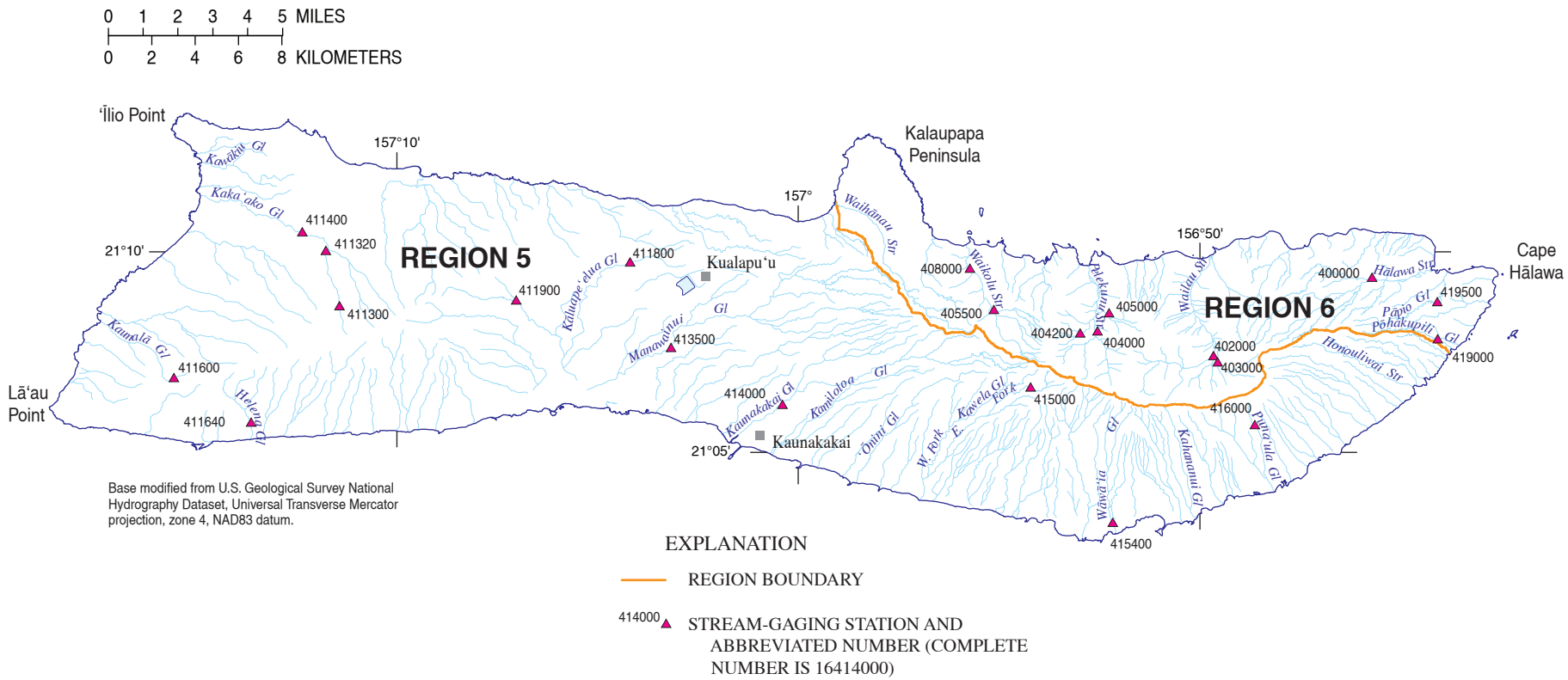

Figure 4. Stream-gaging stations with at least 10 years of usable peak-discharge data (through water year 2008), Moloka‘i, Hawai‘i.

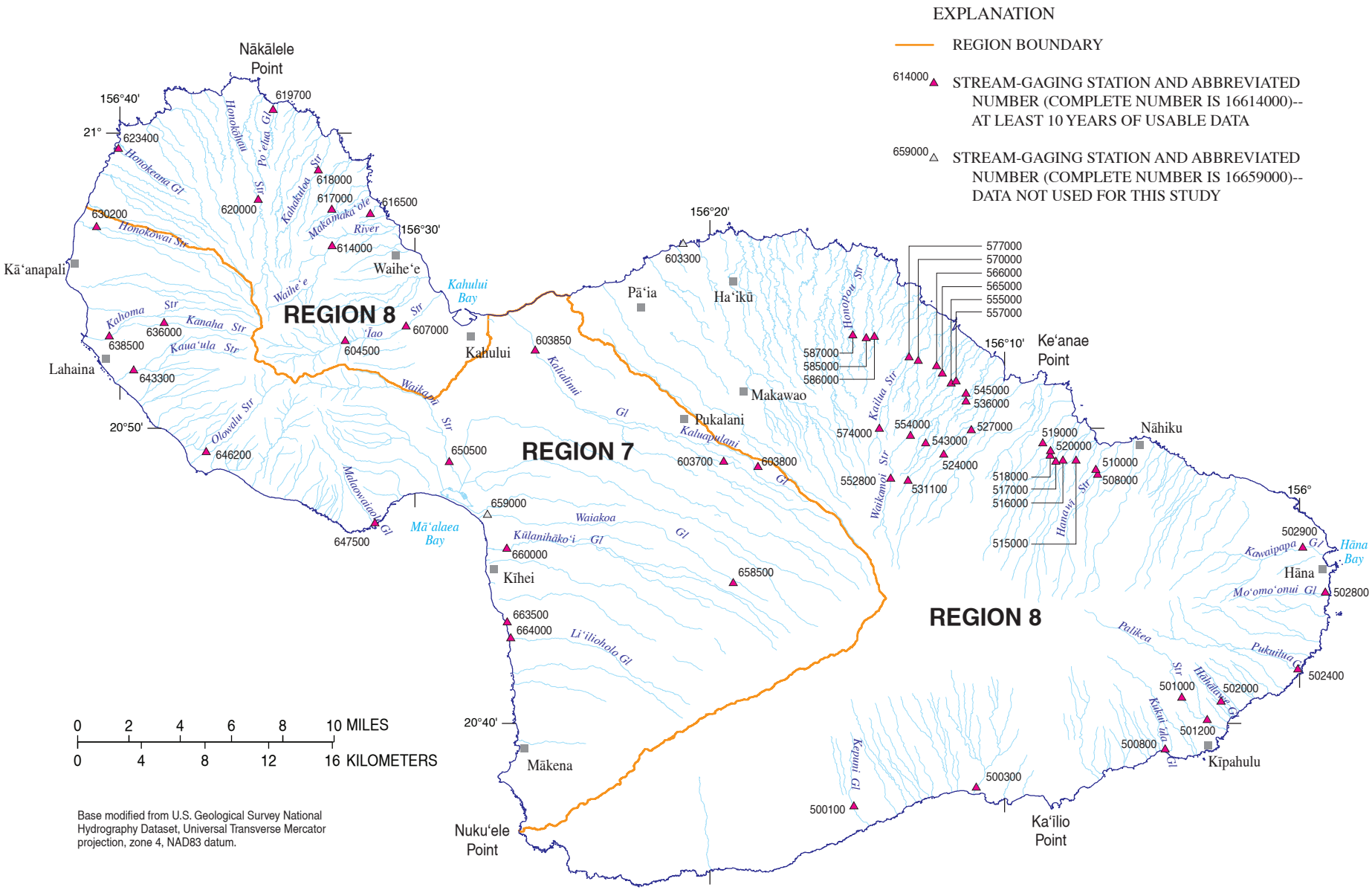

Figure 5. Stream-gaging stations with at least 10 years of usable peak-discharge data (through water year 2008), Maui, Hawai'i.

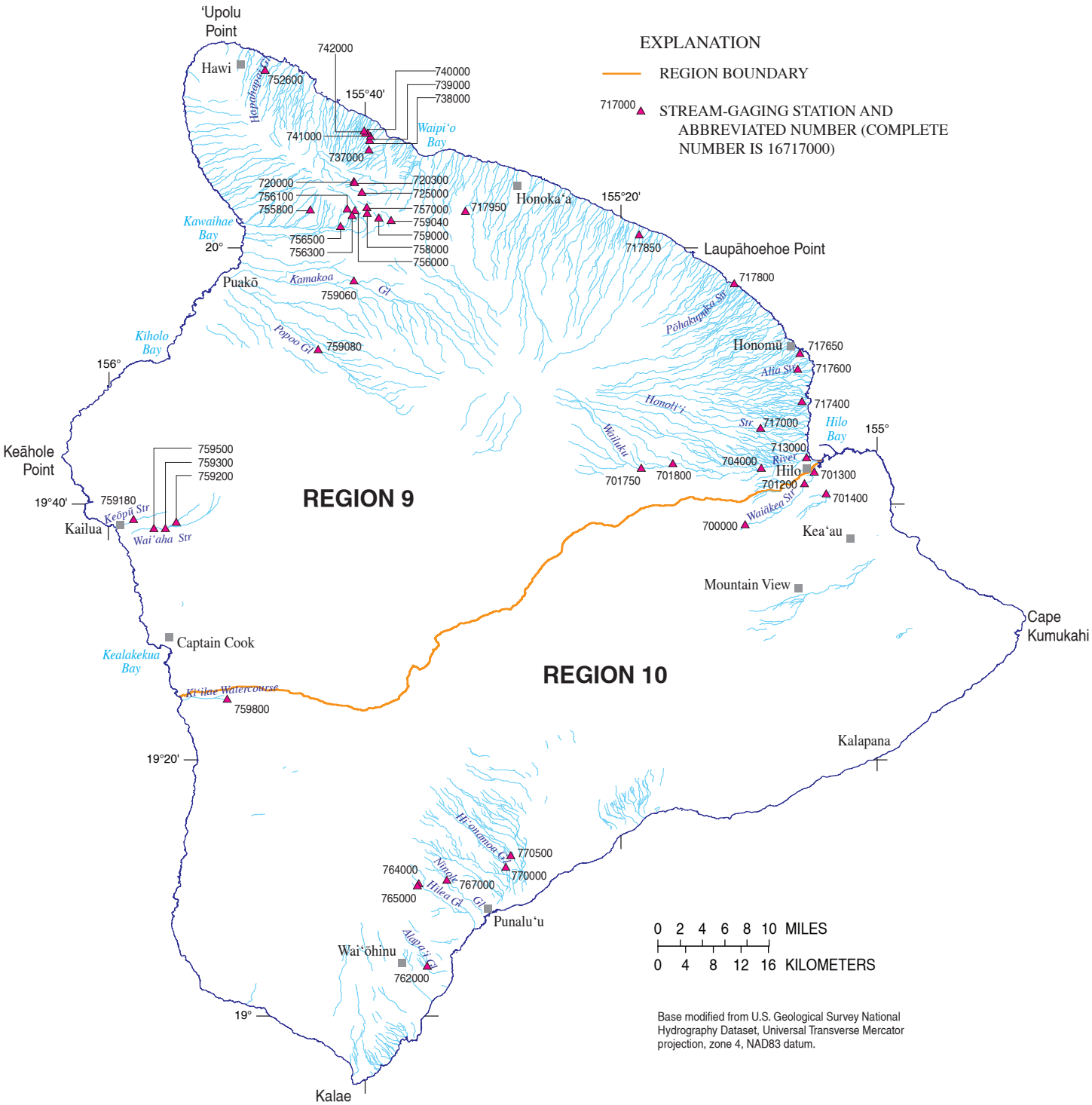

Figure 6. Stream-gaging stations with at least 10 years of usable peak-discharge data (through water year 2008), Island of Hawai‘i, Hawai‘i.

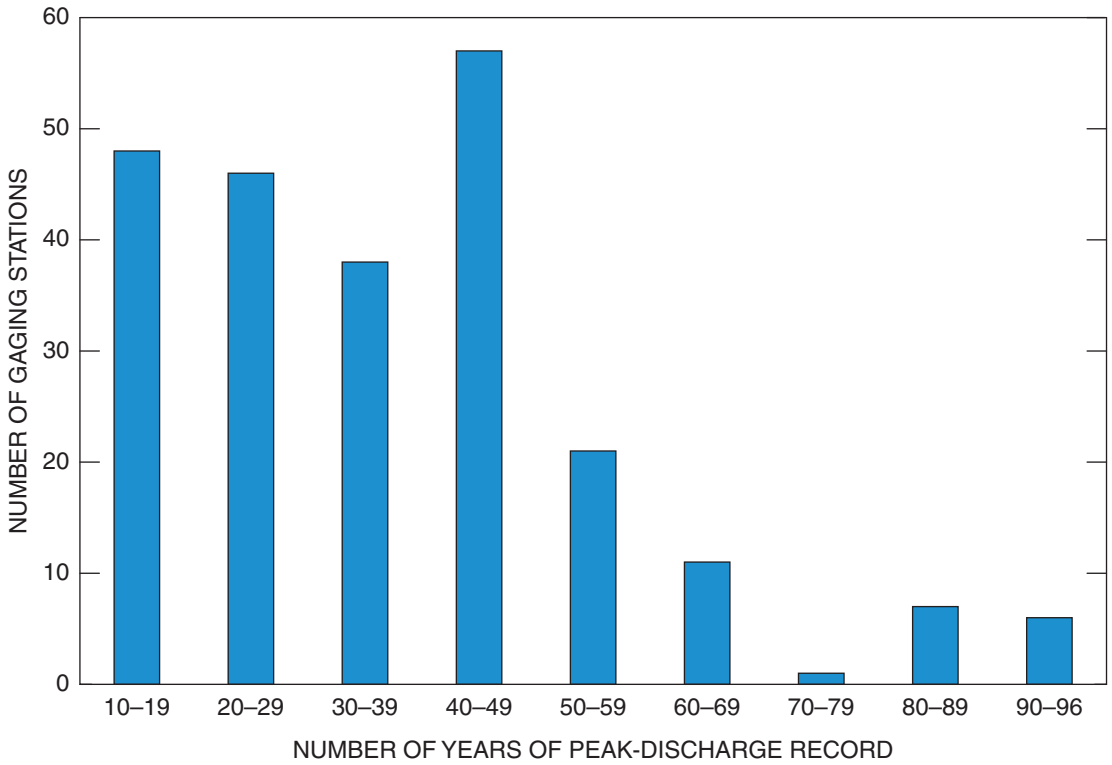

Figure 7. Distribution of record lengths of annual peak discharge for stream-gaging stations with at least 10 years of usable peak-discharge data (through water year 2008), State of Hawai‘i.

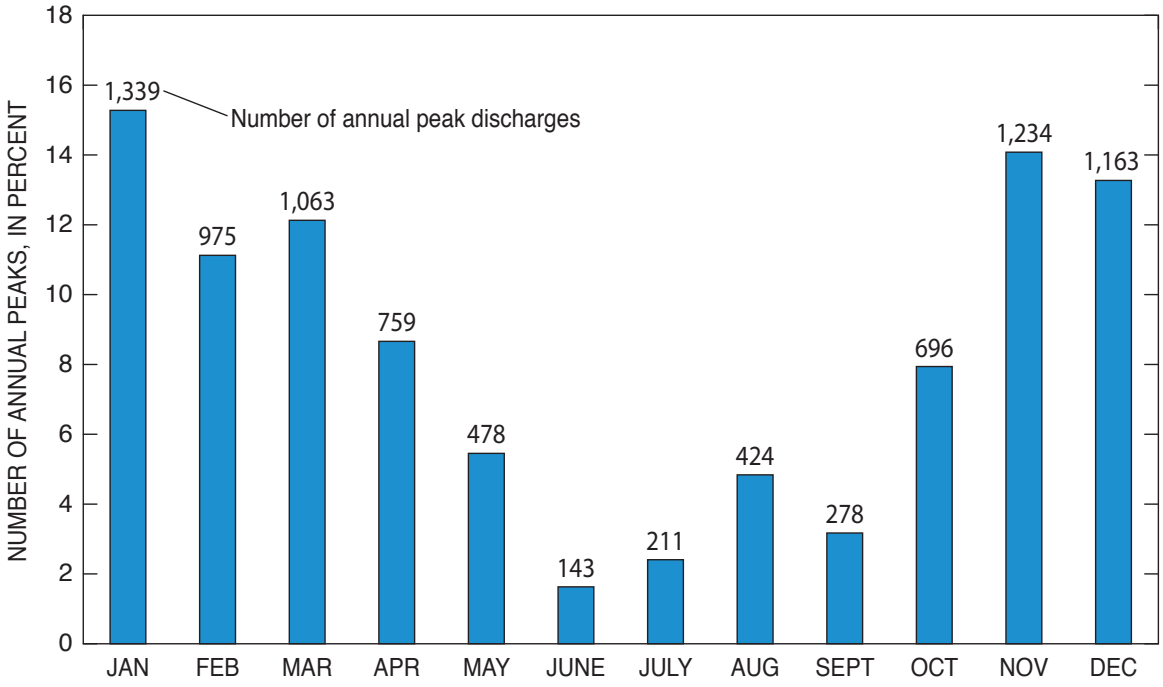

Figure 8. Distribution by month of 8,763 annual peak discharges included in this study (through water year 2008), State of Hawai‘i.

Table 2. Numbers and names of stream-gaging stations with peak-discharge data used in this study, State of Hawai‘i.

[NWIS; National Water Information System; —, data not used in this study]

Station no.	Station name (as it appears in NWIS database)	No. years of usable record	Period of record used in analysis
		Kaua‘i	
16010000	Kawaikoi Stream nr Waimea, Kauai, HI	92	1914, 1916–17, 1920–2008
16013000	MOHIHI STREAM AT ALT 3420 FT NR WAIMEA,KAUAI,HI	40	1921–26, 1937–43, 1945–71
16016000	WAIMEA RIVER AT ALT 840 FT NEAR WAIMEA,KAUAI,HI	43	1917–18, 1926–31, 1933–43, 1945–68
16017000	KOAIE STREAM AT ALT 3770 FT NEAR WAIMEA,KAUAI,HI	25	1920–22, 1924–25, 1927–32, 1955–68
16018000	KOAIE STREAM NEAR WAIMEA,KAUAI,HI	11	1917–18, 1963–71
16019000	Waialae Str at alt 3,820 ft nr Waimea, Kauai, HI	65	1921–22, 1924, 1926–30, 1932, 1953–2008
16028000	WAIMEA R BL KEKAHA DTCH INTK NR WAIMEA,KAUAI,HI	46	1922, 1924–56, 1958–69
16031000	WAIMEA RIVER NR WAIMEA, KAUAI, HI	57	1914, 1916–18, 1944–96
16036000	Makaweli River nr Waimea, Kauai, HI	64	1945–2008
16049000	Hanapepe Riv blw Manuahi Str nr Eleele, Kauai, HI	83	1918–21, 1927–31, 1934–2007
16052500	Lawai Str nr Koloa, Kauai, HI	47	1962–2008
16055000	Huleia Str nr Lihue, Kauai, HI	47	1962–2008
16060000	SF Wailua River nr Lihue, Kauai, HI	95	1914–2008
16063000	NF WAILUA RIVER AT ALT 650 FT NR LIHUE,KAUAI,HI	66	1914, 1916–18, 1920–22, 1924–25, 1927–35, 1937–41, 1943–85
16068000	EB of NF Wailua River nr Lihue, Kauai, HI	93	1916–2008
16071000	NF Wailua River nr Kapaa, Kauai, HI	51	1953–2003
16071500	Left Branch Opaekaa Str nr Kapaa, Kauai, HI	48	1961–2008
16073500	Konohiki Str nr Kapaa, Kauai, HI	43	1964–67, 1970–2008
16080000	KAPAA STR AT KAPAHI DITCH INTK NR KAPAA,KAUAI,HI	56	1937, 1939–40, 1942, 1944–75, 1977–96
16081200	Akulikuli Str nr Kapaa, Kauai, HI	43	1964–67, 1969, 1971–2008
16084500	Kapaa Str at Old Hwy Crsing nr Kealia, Kauai, HI	47	1962–2008
16085000	HOMAIKAWAA STREAM NR KEALIA,KAUAI,HI	23	1964–68, 1972–73, 1975, 1978–92
16089000	ANAHOLA STREAM NR KEALIA, KAUAI, HI	67	1914, 1916–30, 1932, 1934, 1936–40, 1942–85
16093200	ANAHOLA STREAM AT ANAHOLA, KAUAI, HI	22	1962–83
16097000	POHAKUHONU STREAM NR KILAUEA,KAUAI, HI	15	1958–72
16097500	Halaulani Str at alt 400 ft nr Kilauea, Kauai, HI	51	1958–2008
16097900	Puukumu Str nr Kilauea, Kauai, HI	36	1965–67, 1971–72, 1974–75, 1980–2008
16101000	HANALEI RIVER AT ALT 625 FT NR HANALEI,KAUAI,HI	37	1914, 1916–22, 1924–29, 1931–34, 1936–42, 1944–55
16103000	Hanalei River nr Hanalei, Kauai, HI	47	1962–2008
16105000	WAIOLI STREAM NEAR HANALEI, KAUAI, HI	15	1915–18, 1920–22, 1924–29, 1931–32
16106000	LUMAHAI RIVER NEAR HANALEI, KAUAI, HI	13	1914, 1916–17, 1922, 1924–25, 1927–33
16108000	Wainiha River nr Hanalei, Kauai, HI	55	1953–56, 1958–2008
16114000	Limahuli Str nr Wainiha, Kauai, HI	11	1995–2005
16115000	HANAKAPIAI STREAM NEAR HANALEI, KAUAI, HI	20	1933–52
16116000	HANAKOA STREAM NEAR HANALEI, KAUAI, HI	20	1933–52
16117000	KALALAU STREAM NEAR HANALEI, KAUAI, HI	23	1933–55
16130000	Nahomalu Valley nr Mana, Kauai, HI	45	1962–97, 2000–08
		O‘ahu	
16200000	NF Kaukonahua Str abv RB, nr Wahiawa, Oahu, HI	83	1916–25, 1927–43, 1945–53, 1961–2005, 2007–08
16201000	RB OF NF KAUKONAHUA STR NR WAHIAWA,OAHU,HI	33	1916–23, 1925–30, 1932–37, 1939–40, 1942, 1944–53
16204000	NF Kaukonahua Str nr Wahiawa, Oahu, HI	22	1947–68
16206000	S F KAUKONAHUA STREAM NEAR WAHIAWA, OAHU, HI	12	1945–48, 1950–57
16208000	SF Kaukonahua Str at E pump, nr Wahiawa, Oahu, HI	50	1958–2004, 2006–08
16208500	R BR OF S F KAUKONAHUA STR NR WAHIAWA,OAHU,HI	15	1958–72
16210500	Kaukonahua Str at Waialua, Oahu, HI	38	1963, 1968–2000, 2002, 2006–08
16211200	Poamoho Str at Waialua, Oahu, HI	—	—
16211300	Makaleha Str nr Waialua, Oahu, HI	39	1958–83, 1985–91, 1995, 2004–08
16211400	Manini Gulch at Kaena, Oahu, HI	—	—
16211500	Makua Str at Makua, Oahu, HI	18	1958–73, 1975–76
16211600	Makaha Str nr Makaha, Oahu, HI	49	1960–2008

Table 2. Numbers and names of stream-gaging stations with peak-discharge data used in this study, State of Hawai‘i—Continued.

Station no.	Station name (as it appears in NWIS database)	No. years of usable record	Period of record used in analysis
16211700	Makaha Str at Makaha, Oahu, HI	11	1966–76
16211800	Kaupuni Str at alt 374 ft nr Waianae, Oahu, HI	44	1961–2004
16212200	Mailiili Str nr Waianae, Oahu, HI	51	1958–2008
16212300	Nanakuli Str at Nanakuli, Oahu, HI	13	1968–69, 1971–76, 1982, 2001–04
16212450	Kaloi Gulch Trib nr Honouliuli, Oahu, HI	—	—
16212500	Honouliuli Str nr Waipahu, Oahu, HI	17	1956–58, 1962–63, 1965–72, 1974, 2006–08
16212601	Waikele Str at Wheeler Field, Oahu, HI	50	1958, 1960–2008
16212700[a]	Waikakalaua Str nr Wahiawa, Oahu, HI	—	—
16212750	Huliwai Gulch nr Kunia Camp, Oahu, HI	—	—
16212800	Kipapa Str nr Wahiawa, Oahu, HI	49	1957–2004, 2008
16213000	Waikele Str at Waipahu, Oahu, HI	56	1952–59, 1961–2008
16216000	Waiawa Str nr Pearl City, Oahu, HI	52	1953–2004
16216500[a]	WAIMANO FLOOD CHANNEL AT PEARL CITY, OAHU, HI	—	—
16223000	Waimalu Str nr Aiea, Oahu, HI	54	1952–70, 1974–2008
16224500	Kalauao Str at Moanalua Rd, at Aiea, Oahu, HI	43	1954–82, 1984–91, 2002–06, 2008
16226000	N. Halawa Str nr Aiea, Oahu, HI	57	1930–33, 1954–2006
16226200	N. Halawa Str nr Honolulu, Oahu, HI	25	1984–2008
16227000	HALAWA STREAM AT AIEA, OAHU, HI	20	1954–62, 1966–72, 1976–79
16227500	MOANALUA STREAM NR KANEOHE, OAHU, HI	10	1969–78
16228000	Moanalua Str nr Honolulu, Oahu, HI	71	1927–79, 1981–95, 1997–99
16228200	Moanalua Str nr Aiea, Oahu, HI	39	1969–99, 2001–08
16228500	MOANALUA STR AT ALT 100 FT NR HONOLULU,OAHU,HI	11	1958–68
16228600	Moanalua Str nr Tripler Army Med., Oahu, HI	—	—
16228900	Kalihi Str nr Kaneohe, Oahu, HI	33	1968–98, 2000–01
16229000	Kalihi Str nr Honolulu, Oahu, HI	92	1917–2008
16229300	Kalihi Str at Kalihi, Oahu, HI	44	1960, 1962–2004
16235400	Waolani Str at Honolulu, Oahu, HI	42	1959–2000
16237500	Pauoa Str at Honolulu, Oahu, HI	43	1958–2000
16238500	Waihi Stream at Honolulu, Oahu, HI	63	1915, 1917–21, 1927–83
16240500	Waiakeakua Str at Honolulu, Oahu, HI	89	1915–21, 1927–2008
16244000	Pukele Stream near Honolulu, Oahu, HI	59	1927–82, 2003–05
16246000	WAIOMAO STREAM NR HONOLULU, OAHU, HI	45	1927–71
16247000[a]	Palolo Stream near Honolulu, Oahu, HI	—	—
16247100[a]	Manoa-Palolo Drainage Canal at Moiliili, Oahu, HI	—	—
16247200	WAIALAINUI GULCH AT HONOLULU, OAHU, HI	11	1958–68
16247500	Wailupe Gulch at Aina Haina, Oahu, HI	43	1958–97, 2003–04, 2008
16247900	Kuliouou Valley at Kuliouou, Oahu, HI	35	1970–99, 2001–05
16248800	INOAOLE STREAM AT WAIMANALO, OAHU, HI	39	1958–96
16249000	Waimanalo Str at Waimanalo, Oahu, HI	11	1963, 1966–74, 2006
16249100	Kaelepulu Str Trib at Kailua, Oahu, HI	45	1963–2006, 2008
16254000	Makawao Str nr Kailua, Oahu, HI	49	1958–2006
16260500	MAUNAWILI STREAM AT HWY 61 NR KAILUA, OAHU, HI	39	1958–96
16265000[a]	Kawa Str at Kaneohe, Oahu, HI	—	—
16265600	RB of Kamooalii Str nr Kaneohe, Oahu, HI	13	1985–97
16270900	Luluku Str at alt 220 ft nr Kaneohe, Oahu, HI	30	1967–83, 1985–87, 1989–98
16273900[a]	KAMOOALII STREAM AT KANEOHE, OAHU, HI	—	—
16273950[a]	SF Kapunahala Str at Kaneohe, Oahu, HI	—	—
16274499[a]	Keaahala Str at Kamehameha Hwy, Kaneohe, Oahu, HI	—	—
16275000	Haiku Str nr Heeia, Oahu, HI	68	1915–19, 1940–77, 1983–96, 1998–2008
16278000	IOLEKAA STREAM MAUKA NEAR HEEIA, OAHU, HI	27	1940–41, 1943, 1945–51, 1953–56, 1958–70
16279500	Heeia Str at Kaneohe, Oahu, HI	25	1965–66, 1968–69, 1971–91
16283000	KAHALUU STREAM NR HEEIA, OAHU, HI	34	1937–41, 1943–71

Table 2. Numbers and names of stream-gaging stations with peak-discharge data used in this study, State of Hawai‘i—Continued.

Station no.	Station name (as it appears in NWIS database)	No. years of usable record	Period of record used in analysis
16283200	Kahaluu Str nr Ahuimanu, Oahu, HI	25	1984–2008
16283480	Ahuimanu Str nr Kahaluu, Oahu, HI	25	1963–68, 1990–2008
16283600	SF WAIHEE STR NR HEEIA, OAHU, HI	34	1963–96
16283700	NF WAIHEE STREAM NR HEEIA, OAHU, HI	34	1963–96
16284000	WAIHEE STREAM NR HEEIA, OAHU, HI	44	1938–51, 1953–82
16284200	Waihee Str nr Kahaluu, Oahu, HI	33	1975–95, 1997–2008
16291000	WAIAHOLE STR AT ALT 250 FT WAIAHOLE,OAHU,HI	13	1956–68
16294900	Waikane Str at alt 75 ft at Waikane, Oahu, HI	49	1960–2008
16296500	Kahana Str at alt 30 ft nr Kahana, Oahu, HI	49	1960–2008
16303000	Punaluu Str nr Punaluu, Oahu, HI	54	1954–2007
16304200	Kaluanui Stream nr Punaluu, Oahu, HI	42	1967–2008
16304500	Kaluanui Str at Hauula, Oahu, HI	16	1958–73
16310501	Malaekahana Str at alt 30 ft nr Kahuku, Oahu, HI	19	1959–68, 1982, 2001–08
16311000	Oio Stream near Kahuku, Oahu, HI	—	—
16317800	Kaunala Gulch nr Sunset Beach, Oahu, HI	—	—
16318000	Paumalu Gulch at Sunset Beach, Oahu, HI	—	—
16325000	Kamananui Str at Pupukea Mil Rd, Oahu, HI	38	1964–2001
16330000	Kamananui Str at Maunawai, Oahu, HI	50	1958–91, 1993–2008
16331000	Waimea Gulch nr Kawailoa Camp, Oahu, HI	40	1968–2006, 2008
16340000	Anahulu River nr Haleiwa, Oahu, HI	47	1958–2004
16343000	HELEMANO STREAM AT HALEIWA, OAHU, HI	15	1968–82
16345000	Opaeula Str nr Wahiawa, Oahu, HI	49	1960–2008
16350000	Opaeula Str nr Haleiwa, Oahu, HI	50	1956–2005
	Moloka‘i		
16400000	Halawa Stream near Halawa, Molokai, HI	83	1918–25, 1928–31, 1938–2008
16402000	PULENA STREAM NEAR WAILAU, MOLOKAI, HI	28	1921–26, 1928–29, 1938–57
16403000	WAIAKEAKUA STREAM NEAR WAILAU, MOLOKAI, HI	27	1921–23, 1925–29, 1938, 1940–57
16404000	PELEKUNU STREAM NR PELEKUNU, MOLOKAI, HI	28	1921–29, 1940–41, 1949–52, 1956–57, 1972–82
16404200	PILIPILILAU STREAM NR PELEKUNU, MOLOKAI, HI	28	1969–96
16405000	LANIPUNI STREAM NEAR PELEKUNU, MOLOKAI, HI	27	1921–29, 1938–44, 1947–57
16405500	Waikolu Str at alt 900 ft nr Kalaupapa, Molokai,HI	46	1957–96, 1998–2003
16408000	WAIKOLU STR BL PIPE CROSS NR KALAUPAPA,MOLOKAI	68	1920–32, 1938–69, 1973–78, 1980–96
16411300	Kakaako Gulch at HWY 46 nr Mauna Loa, Molokai, HI	26	1964–85, 2005–08
16411320	Kakaako Gl ab Kamakahi Gl nr Mauna Loa,Molokai,HI	33	1964–69, 1971–97
16411400	Kakaako Gulch near Mauna Loa, Molokai, HI	26	1964–89
16411600	Kaunala Gulch near Mauna Loa, Molokai, HI	34	1964–69, 1971–97, 1999
16411640	Halena Gulch near Mauna Loa, Molokai, HI	43	1965–69, 1971–2008
16411800	Kaluapeelua Gulch at Hoolehua, Molokai, HI	34	1964–81, 1983–91, 2000–06
16411900	KALUAPELUA GLCH TRIB NR MOLOKAI AIRPORT,MOLOKAI	17	1964–71, 1973–79, 1981–82
16413500	Manawainui Gulch near Kualapuu, Molokai, HI	30	1965–86, 1989, 2000, 2003–08
16414000	Kaunakakai Gulch at Kaunakakai, Molokai, HI	51	1950–99, 2001
16415000	EF KAWELA GULCH NR KAMALO, MOLOKAI, HI	25	1947–71
16415400	Wawaia Gulch at Kamalo, Molokai, HI	44	1964–68, 1970–2008
16416000	PUNAULA GULCH NR PUKOO, MOLOKAI, HI	25	1948–72
16419000	Pohakupili Gulch near Halawa, Molokai, HI	40	1964–2001, 2005–06
16419500	Papio Gulch at Halawa, Molokai, HI	43	1964–2006
	Maui		
16500100	Kepuni Gulch near Kahikinui House, Maui, HI	45	1963–94, 1996–2008
16500300	Hawelewele Gulch near Kaupo, Maui, HI	41	1967–2006, 2008
16500800	Kukuiula Gulch near Kipahulu, Maui, HI	46	1963–2008
16501000	PALIKEA STREAM BL DIV DAM NR KIPAHULU, MAUI, HI	53	1928–29, 1932–34, 1936–83
16501200	Oheo Gulch at dam near Kipahulu, Maui, HI	16	1989–97, 2002–08

Table 2. Numbers and names of stream-gaging stations with peak-discharge data used in this study, State of Hawai‘i—Continued.

Station no.	Station name (as it appears in NWIS database)	No. years of usable record	Period of record used in analysis
16502000	HAHALAWE GULCH NEAR KIPAHULU, MAUI, HI	49	1928–37, 1939–77
16502400	Pukuilua Gulch near Hana, Maui, HI	44	1963–2006
16502800	Moomoonui Gulch at Hana, Maui, HI	42	1963–2001, 2006–08
16502900	Kawaipapa Gulch at Hana, Maui, HI	36	1965–96, 1998–99, 2001, 2008
16508000	Hanawi Stream near Nahiku, Maui, HI	89	1915–16, 1922–2008
16510000	KAPAULA GULCH NEAR NAHIKU, MAUI, HI	40	1922–40, 1942–43, 1945–63
16515000	WAIOHUE GULCH NEAR NAHIKU, MAUI, HI	38	1922–25, 1927–40, 1942–43, 1945–48, 1950–63
16516000	KOPILIULA STREAM NEAR KEANAE, MAUI, HI	33	1915–17, 1923–31, 1933–34, 1937–40, 1942–43, 1945–48, 1950–58
16517000	EAST WAILUAIKI STREAM NEAR KEANAE, MAUI, HI	34	1916–17, 1923–25, 1927–40, 1943, 1945–58
16518000	West Wailuaiki Stream near Keanae, Maui, HI	88	1915–17, 1923–27, 1929–2008
16519000	WEST WAILUANUI STREAM NEAR KEANAE, MAUI, HI	32	1915–16, 1923–33, 1935–36, 1938–40, 1942–43, 1945–48, 1950–57
16520000	EAST WAILUANUI STREAM NEAR KEANAE, MAUI, HI	34	1915–17, 1923–25, 1927–40, 1942–43, 1945–48, 1950–57
16524000	HONOMANU STR AT HAIKU-UKA BDRY NR KAILIILI, MAUI	14	1921–25, 1933–34, 1963–69
16527000	HONOMANU STREAM NEAR KEANAE, MAUI, HI	45	1916–25, 1927–40, 1942–48, 1951–64
16531100	HAIPUAENA STR AT KULA PL INTK NR OLINDA,MAUI,HI	20	1947–48, 1950, 1952–68
16536000	HAIPUAENA STR AB SPRECKELS DITCH NR HUELO, MAUI	49	1914, 1916–25, 1927–38, 1940, 1942–43, 1945–67
16543000	M B PUOHOKAMOA STR AT HAIKU-UKA BDRY NR KAILIILI	15	1920–25, 1933–34, 1963–69
16545000	PUOHOKAMOA STR AB SPRECKELS DITCH NR HUELO,MAUI	56	1914, 1916–27, 1929–71
16552800	Waikamoi Str at Kula Pl intake nr Olinda, Maui, HI	15	1954–68
16554000	WAIKAMOI STR AT HAIKU-UKA BDRY NR KAILIILI, MAUI	11	1919–25, 1927–28, 1933–34
16555000	WAIKAMOI STR AB WAILOA DITCH NR HUELO, MAUI,HI	31	1923–25, 1927–40, 1942–43, 1945–48, 1950, 1952–58
16557000	ALO STREAM NEAR HUELO, MAUI, HI	37	1913–14, 1916–18, 1920–23, 1925, 1927, 1929–40, 1942–43, 1945–48, 1950–52, 1954–58
16565000	KAAIEA GULCH NEAR HUELO, MAUI, HI	35	1922–23, 1925, 1927–40, 1942–43, 1945–48, 1950–52, 1954–62
16566000	OOPUOLA STREAM NEAR HUELO, MAUI, HI	25	1932–40, 1942–43, 1945–58
16570000	NAILIIHAELE STREAM NR HUELO, MAUI, HI	61	1914–18, 1920–75
16574000	KAILUA STR AT HAIKU-UKA BDRY NR KAILIILI,MAUI,HI	11	1918, 1920–25, 1927–28, 1933–34
16577000	KAILUA STREAM NEAR HUELO, MAUI, HI	37	1914, 1916–17, 1920–25, 1927–34, 1936–39, 1941–43, 1945–48, 1950–58
16585000	HOOLAWANUI STREAM NR HUELO, MAUI, HI	57	1913–31, 1933–43, 1945–71
16586000	HOOLAWALIILII STREAM NEAR HUELO, MAUI, HI	42	1914–26, 1928–40, 1942–43, 1945–58
16587000	Honopou Stream near Huelo, Maui, HI	96	1911, 1913–14, 1916–2008
16603300	Unnamed Gulch at Maliko Bay, Maui, HI	—	—
16603700	Kalialinui Gulch Trib near Pukalani, Maui, HI	39	1964, 1967–86, 1988–2002, 2006–08
16603800	Kaluapulani Gulch Trib near Pukalani, Maui, HI	45	1963–98, 2000–08
16603850	Kalialinui Gulch near Kahului, Maui, HI	35	1967–94, 1996–2002
16604500	Iao Stream at Kepaniwai Park nr Wailuku, Maui, HI	25	1984–2008
16607000	Iao Stream at Wailuku, Maui, HI	58	1951–2008
16614000	Waihee Rv abv Waihee Dtch intk nr Waihee, Maui, HI	25	1984–2008
16616500	Unnamed Gulch at Maluhia Camp, Maui, HI	30	1965–68, 1971–72, 1974–75, 1979–91, 1994, 1996, 1999–2005
16617000	LEFT BR MAKAMAKAOLE STREAM NR WAIHEE, MAUI, HI	13	1940–52
16618000	Kahakuloa Stream near Honokohau, Maui, HI	62	1940–43, 1948–71, 1975–2008
16619700	Poelua Gulch near Kahakuloa, Maui, HI	44	1965–2008
16620000	Honokohau Stream near Honokohau, Maui, HI	91	1914–20, 1923–28, 1930–89, 1991–2008
16623400	HONOKEANA GULCH NEAR HONOKAHUA, MAUI, HI	22	1964–85
16630200	Honokowai Stream at Honokowai, Maui, HI	46	1962–63, 1965–2008
16636000	KANAHA STREAM AB PL INTAKE NR LAHAINA, MAUI, HI	13	1917–22, 1924–25, 1927–31
16638500	Kahoma Stream at Lahaina, Maui, HI	41	1960, 1962–89, 1991–97, 2004–08
16643300	Kauaula Stream nr mouth nr Lahaina, Maui, HI	47	1960, 1962, 1964–2008
16646200	Olowalu Stream at Olowalu, Maui, HI	45	1962–2002, 2005–08
16647500	Malalowaiaole Gulch near Maalaea, Maui, HI	41	1964–65, 1967–91, 1993–94, 1996–97, 1999–2008
16650500	WAIKAPU STREAM NEAR KIHEI, MAUI, HI	34	1963–88, 1990–97
16658500	Waiakoa Gulch Trib near Waiakoa, Maui, HI	42	1964–91, 1993–94, 1996–97, 1999–2008
16659000	Waiakoa Gulch at Kihei, Maui, HI	—	—

Table 2. Numbers and names of stream-gaging stations with peak-discharge data used in this study, State of Hawai‘i—Continued.

Station no.	Station name (as it appears in NWIS database)	No. years of usable record	Period of record used in analysis
16660000	Kulanihakoi Gulch near Kihei, Maui, HI	39	1963–91, 1996–97, 1999–2005, 2008
16663500	KAMAOLE GULCH AT KAMAOLE, MAUI, HI	13	1980–91, 1997
16664000	LIILIOHOLO GULCH AT KAMAOLE, MAUI, HI	13	1980–91, 1997
	Hawai‘i		
16700000	Waiakea Stream nr Mountain View, HI	61	1931–91
16701200	WAIAKEA STREAM NEAR HILO, HAWAII, HI	10	1957–66
16701300	Waiakea Stream at Hilo, HI	23	1969–75, 1979, 1994–2008
16701400	Palai Stream at Hilo, HI	17	1965–71, 1979–80, 1994, 2001, 2003–08
16701750	WAILUKU RIVER NR HUMUULA, HAWAII, HI	18	1965–82
16701800	WAILUKU RIVER NR KAUMANA, HAWAII, HI	16	1967–82
16704000	Wailuku River at Piihonua, HI	80	1929–2008
16713000	Wailuku River at Hilo, HI	20	1977–95, 2001
16717000	Honolii Stream nr Papaikou, HI	42	1967–2008
16717400	Kalaoa Mauka Stream nr Hilo, HI	20	1963–67, 1973–76, 1978–79, 1985, 2001–08
16717600	Alia Stream near Hilo, HI	25	1962–72, 1979, 1986, 1994–97, 1999–2006
16717650	Kapehu Stream near Pepeekeo, HI	25	1963–68, 1975, 1979, 1985–86, 1994–2008
16717800	POHAKUPUKA STREAM NEAR PAPAALOA, HAWAII, HI	26	1963–80, 1982–89
16717850	Keehia Gulch near Ookala, HI	14	1963–68, 1974, 1979, 1994–95, 2005–08
16717950	HONOKAIA GULCH TRIB NR HONOKAA, HAWAII, HI	17	1963–69, 1976–77, 1979–80, 1984, 1989, 1994–97
16720000	Kawainui Stream nr Kamuela, HI	45	1964–2008
16720300	KAWAIKI STREAM NEAR KAMUELA, HAWAII, HI	31	1969–99
16725000	Alakahi Stream near Kamuela, HI	45	1964–2008
16737000	WAIILIKAHI STREAM NEAR WAIMANU, HAWAII, HI	20	1939–43, 1945–54, 1956–60
16738000	KAIMU STREAM NEAR WAIMANU, HAWAII, HI	11	1939–43, 1945–47, 1950–52
16739000	PUNALULU STREAM NEAR WAIMANU, HAWAII, HI	13	1939–43, 1945–52
16740000	WAIAALALA STREAM NEAR WAIMANU, HAWAII, HI	12	1939–43, 1945–50, 1952
16741000	PAOPAO STREAM NEAR WAIMANU, HAWAII, HI	11	1940–41, 1943, 1945–52
16742000	KUKUI STREAM NEAR WAIMANU, HAWAII, HI	19	1940–43, 1945–52, 1960–66
16752600	Hapahapai Gulch at Kapaau, HI	27	1963–72, 1976–77, 1979–80, 1982–83, 1989, 1995–98, 2000–01, 2004, 2006–08
16755800	Luahine Gulch near Waimea, HI	34	1963–72, 1974–77, 1979–80, 1982–83, 1989, 1994–2008
16756000	KOHAKOHAU STREAM NEAR KAMUELA, HAWAII, HI	10	1957–66
16756100	Kohakohau Stream above DWS Intake, nr Kamuela, HI	11	1998–2008
16756300	KOHAKOHAU STREAM BELOW DWS INTAKE, NR KAMUELA, HI	25	1967–91
16756500	Keanuiomano Stream near Kamuela, HI	45	1964–2008
16757000	WAIKOLOA STREAM NR KAMUELA, HAWAII, HI	24	1948–71
16758000	Waikoloa Str at Marine Dam nr Kamuela, HI	61	1948–2008
16759000	Hauani Gulch near Kamuela, HI	48	1957–2004
16759040	Paiakuli Reservoir trib nr Waimea, HI	21	1963–70, 1994–2006
16759060	Kamakoa Gulch nr Waimea, HI	27	1963–68, 1972–74, 1979, 1982–83, 1994–2008
16759080	POPOO GULCH NEAR WAIKII, HAWAII, HI	12	1963–74
16759180	KEOPU STREAM NR KAILUA, HAWAII, HI	10	1962, 1965, 1967–68, 1970–72, 1982–83, 1995
16759200	R BR WAIAHA STREAM NEAR HOLUALOA, HAWAII, HI	23	1960–82
16759300	Waiaha Stream at Luawai nr Holualoa, HI	30	1961–89, 1995
16759500	WAIAHA STREAM NEAR HOLUALOA, HAWAII, HI	11	1959–69
16759800	KIILAE STREAM NEAR HONAUNAU, HAWAII, HI	25	1958–82
16762000	ALAPAI GULCH AT NAALEHU, HAWAII, HI	27	1963–89
16764000	HILEA GULCH TRIBUTARY NEAR HONUAPO, HAWAII, HI	25	1966–89, 1991
16765000	HILEA GULCH TRIB NO 2 NEAR HONUAPO, HAWAII, HI	17	1966–82
16767000	NINOLE GULCH NEAR PUNALUU, HAWAII, HI	24	1966–89
16770000	Hionamoa Gulch at Pahala, HI	20	1963–80, 1994, 2001
16770500	Paauau Gulch at Pahala, HI	29	1963–79, 1994–96, 1998, 2001–08

[a]Station not used because greater than 20 percent of basin is combined medium- and high-intensity developed.

Table 3. Values from the U.S. Geological Survey peak-flow file (July 2009) excluded from analysis, State of Hawai‘i.

Station no.	Water years excluded	Remarks
		O‘ahu
16211200[a]	1967–2004	existing peak-flow estimates for indicated period may be unreliable
16211300	1984; 1992–94; 1996	estimated values not used
16211400[a]	1980–97	existing peak-flow estimates for indicated period may be unreliable
16211500	1977–97	existing peak-flow estimates for indicated period may be unreliable
16211700	1977–97	existing peak-flow estimates for indicated period may be unreliable
16212300	1977–81; 1983–2000	existing peak-flow estimates for indicated period may be unreliable
16212450[a]	1968–2008	data in review (as of 07/2009)
16212500	1973; 1975–97	existing peak-flow estimates for indicated period may be unreliable
16212700[a]	1958–98, 2002	basin development (medium and high intensity) exceeds 20 percent; existing peak-flow estimates for 1975–98 may be unreliable
16212750[a]	1980–97	existing peak-flow estimates for indicated period may be unreliable
16216500[a]	1955–66	basin development (medium and high intensity) exceeds 20 percent
16228600[a]	1975–79; 1981–97	existing peak-flow estimates for indicated period may be unreliable
16247000[a]	1953–79; 2003–08	basin development (medium and high intensity) exceeds 20 percent
16247100[a]	1968–2008	basin development (medium and high intensity) exceeds 20 percent
16249000	1975–2005	existing peak-flow estimates for indicated period may be unreliable
16265000[a]	1965; 1968–74; 1977–97; 1999–2008	basin development (medium and high intensity) exceeds 20 percent
16273900[a]	1958–80	basin development (medium and high intensity) exceeds 20 percent
16273950[a]	1988–96; 1998	basin development (medium and high intensity) exceeds 20 percent
16274499[a]	1959–2008	basin development (medium and high intensity) exceeds 20 percent; existing peak-flow estimates for 1976–99 may be unreliable
16279500	1992–97	existing peak-flow estimates for indicated period may be unreliable
16283480	1969–89	existing peak-flow estimates for indicated period may be unreliable
16304500	1974–2001	existing peak-flow estimates for indicated period may be unreliable
16310501	1969–81, 1983–97	existing peak-flow estimates for indicated period may be unreliable
16311000[a]	1958–97	existing peak-flow estimates for indicated period may be unreliable
16317800[a]	1980–94; 2002	existing peak-flow estimates for indicated period may be unreliable
16318000[a]	1973–97	existing peak-flow estimates for indicated period may be unreliable
		Maui
16603300[a]	1963–2001	discharge affected by upstream storage
16659000[a]	1963–2008	data in review (as of 07/2009)

[a]Station has less than 10 years of usable data.

Trends in Peak-Discharge Data

The annual series of peak discharges may be affected by climate change or physical modifications of the watershed caused by factors such as land-use changes. A nonparametric, two-sided Mann-Kendall trend test (Helsel and Hirsch, 1992) was used to identify monotonic trends in annual peak-discharge values during the usable period of record for each gaging station. A 5-percent level of significance was selected to indicate a statistically significant trend.

Statistically significant trends in annual peak discharges were detected at 37 of the 235 gaging stations used in this study. Of the 37 statistically significant trends detected, 27 were downward and 10 were upward (table 4; tables 4, 6, 11, and 12 located near the end of document). Ries and Dillow (2006) identified upward trends in annual peak discharges for some nontidal streams in Delaware and detrended these data using a LOWESS (locally weighted scatterplot smoothing) curve. In other flood-frequency studies, annual peak discharges with identified trends were retained in the analysis because the trends could not be related to a particular cause and were assumed to reflect random conditions (see, for example, Miller, 2003; Olson, 2009). For this study, data from gaging stations with statistically significant trends in annual peak discharges were not precluded from analysis because (1) the trends were not associated with known changes to the watershed, including urbanization, (2) no consistent regional or temporal pattern of trends was identified, and (3) statistically significant trends detected at some gaging stations are for periods of only a few decades that may not reflect long-term conditions at the station. Most of the statistically significant trends identified in this study were downward and, thus, detrending the data is expected to reduce the peak-discharge estimates for these gaging stations. Detrending data with downward trends potentially could result in numerous annual peak discharges being adjusted to zero values, which may be an artifact of the detrending process and may not accurately reflect

future conditions. Because of uncertainty associated with future peak discharges and the possibility of underestimating peak discharges, detrending of the data was not considered appropriate at the time this study was conducted. If consistent and widespread trends are identified in the future, detrending of the data may be necessary.

Basin Characteristics

For each gaging station with at least 10 years of usable record, drainage basins were delineated by GIS methods using a USGS 10-meter digital elevation model (DEM). Drainage-basin characteristics are needed to develop regression equations for regionalizing flood estimates. Basin morphometric, rainfall, soil-permeability, and land-cover characteristics also were quantified by GIS methods.

Basin Delineation

An automated GIS method was used to delineate drainage basins from conditioned USGS 10-meter DEMs using bilinear resampling and ArcHydro Tools (Environmental Systems Research Institute, Inc., 2009). The resulting computer-generated drainage basins were compared with manually delineated basins. In general, differences in area between computer-generated and manually delineated basins were less than 5 percent. For cases with less than 5 percent difference in area, the computer-generated basins were selected for use in this study. For cases in which the computerized and manual methods produced equally plausible basin boundaries with areas that differed by more than 5 percent, the final basin boundary generally was based on the objective and reproducible computerized method, particularly in areas of low relief. In some cases, the final basin boundary was constrained to follow manually placed artificial features commonly referred to as walls.

Delineated drainage basins for gaging stations used in this study range in size from 0.048 to 245 square miles (tables 5, 6). The two smallest drainage basins are for gaging stations in windward O‘ahu (0.048 square miles for station 16283700; 0.054 square miles for station 16283600). The two largest drainage basins are for gaging stations on the Island of Hawai‘i (245 square miles for station 16713000; 220 square miles for station 16704000).

Characteristics

For each delineated drainage basin, 17 selected morphometric characteristics were quantified using GIS methods for implementation in StreamStats (U.S. Geological Survey, 2009) (tables 5, 6). Selected area-weighted rainfall statistics also were computed for each delineated drainage basin. Area-weighted mean annual rainfall (Giambelluca and others, 1986) for the delineated drainage basins ranges from 18.3 inches (gaging station 16411640 on Moloka‘i) to 254 inches (gaging station 16108000 on Kaua‘i). Rainfall frequency maps recently developed for the State (Perica and others, 2009) were used to estimate area-weighted rainfall for selected return periods (2, 5, 10, 25, 50, 100, and 500 years) and durations (1, 6, 24, and 48 hours) (tables 5, 6).

Digital information on soil permeability (U.S. Department of Agriculture, 2003) was used to compute area-weighted soil permeabilities for the top 12 and 24 inches of soil in each delineated drainage basin. Area-weighted soil permeability for the top 12 inches of soil ranges from 0.05 inches per hour (gaging stations 16720000, 16720300, 16725000) to 16 inches per hour (gaging station 16767000 on Hawai‘i). Area-weighted soil permeability for the top 24 inches of soil ranges from 0.09 inches per hour (gaging station 16283700 on O‘ahu) to 16 inches per hour (gaging station 16767000 on Hawai‘i) (tables 5, 6).

Digital land-cover information for the nominal 2001 time period (Yang, 2008; Multi-Resolution Land Characteristics Consortium, 2009) was used to determine the percentages of selected land-cover types in each delineated drainage basin (table 6, located near end of document). This land-cover information was used to identify basins with potentially significant urbanization that were not used in the subsequent regionalization analysis. Eight gaged basins (table 2) were determined to have more than 20 percent of their areas characterized as combined medium-intensity developed (50 to 79 percent impervious surfaces) and high-intensity developed (80 to 100 percent impervious surfaces) and were eliminated from the regionalization analysis mainly as a precautionary measure. All eight of these gaged basins are on O‘ahu, where storm runoff in developed areas commonly is diverted by storm drains. The storm-drainage system likely affects the size of the drainage area, which may not be delineated accurately using a DEM. Wong (1994) defined a basin with significant urbanization as any basin with greater than 36 percent urban cover, as indicated by USGS topographic maps. Wong (1994) found that (1) none of the gaged basins on O‘ahu contained more than 36 percent urban cover, (2) flood peaks for basins with urban cover did not have any significant trends, and (3) flood peaks from basins with urban cover did not differ from peaks in nearby nonurban basins. Thus, Wong (1994) did not preclude any gaging stations from analysis because of urbanization.

Frequency Analysis at Gaged Sites

Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) provides guidelines for estimating the magnitude and frequency of floods by fitting the log-Pearson Type III distribution to annual peak discharges. The method of moments is used to fit the log-Pearson Type III distribution to the base 10 logarithms of the peak-discharge data using the following equation:

$$\log\left(Q\right) = \bar{x} + KS \qquad (1)$$

where

$\log Q$ = base 10 logarithm of annual peak discharge for a selected recurrence interval,

Table 5. Selected drainage-basin characteristics evaluated in the regional-regression analysis, State of Hawai‘i.

[DEM, digital elevation model; in., inches]

Abbreviated name	Definition	Units	Minimum	Maximum	Median	Mean	Standard deviation
	Morphometric Characteristics						
BSLDEM10M	Mean basin slope computed from 10-meter DEM	percent	3.5	111	36.3	42.2	26.0
COMPRAT	A measure of basin shape related to basin perimeter and drainage area	dimensionless	1.36	4.32	2.06	2.20	0.57
CSL1085LFP	Change in elevation between points 10 and 85 percent of length along the longest flow path determined by a GIS divided by length between the points	feet per mile	50.5	4,460	506	616	586
DRNAREA	Area that drains to a point on a stream	square miles	0.048	245	2.41	7.46	22.8
ELEV	Mean basin elevation	feet	286	7,720	1,940	2,410	1,640
ELEV10FT	Elevation at 10 percent from outlet along longest flow path slope using DEM	feet	22	4,910	648	1,140	1,190
ELEV10FT3D	Elevation at 10 percent from outlet along longest flow path slope using 3D line	feet	21	4,910	647	1,140	1,190
ELEV85FT	Elevation at 85 percent from outlet along longest flow path slope using DEM	feet	355	11,700	2,520	3,240	2,280
ELEV85FT3D	Elevation at 85 percent from outlet along longest flow path slope using 3D line	feet	355	11,700	2,520	3,240	2,280
ELEVMAX	Maximum basin elevation	feet	401	13,800	3,510	4,350	2,610
LFPLENGTH	Length of longest flow path	miles	0.36	45.2	4.68	6.69	6.44
MINBELEV	Minimum basin elevation	feet	3.15	4,470	499	966	1,130
PERIMMI	Basin perimeter	miles	1.24	116	11.9	15.9	15.0
RELIEF	Maximum-minimum elevation	feet	187	13,800	2,710	3,390	2,350
RELRELF	Basin relief divided by basin perimeter	feet per mile	28	1,300	245	272	181
SLOP30_10M	Percentage area with slopes greater than 30 percent from 10-meter DEM	percent	0.0	99.4	48.4	47.6	31.2
SLPFM3D	Longest flow path slope using 3D line	feet per mile	78.4	4,450	598	713	587
	Rainfall Characteristics						
I60M2Y	Maximum 60-minute precipitation that occurs on average once in 2 years	inches	0.91	3.25	2.18	2.16	0.48
I60M5Y	Maximum 60-minute precipitation that occurs on average once in 5 years	inches	1.20	4.15	2.79	2.77	0.59
I60M10Y	Maximum 60-minute precipitation that occurs on average once in 10 years	inches	1.41	4.85	3.30	3.25	0.68
I60M25Y	Maximum 60-minute precipitation that occurs on average once in 25 years	inches	1.69	5.82	3.92	3.91	0.80
I60M50Y	Maximum 60-minute precipitation that occurs on average once in 50 years	inches	1.90	6.60	4.48	4.44	0.91
I60M100Y	Maximum 60-minute precipitation that occurs on average once in 100 years	inches	2.10	7.41	5.06	4.98	1.03
I60M500Y	Maximum 60-minute precipitation that occurs on average once in 500 years	inches	2.54	9.49	6.51	6.34	1.38
I06H2Y	Maximum 6-hour precipitation that occurs on average once in 2 years	inches	1.82	6.78	4.59	4.57	1.13
I06H5Y	Maximum 6-hour precipitation that occurs on average once in 5 years	inches	2.49	8.74	6.01	5.95	1.41
I06H10Y	Maximum 6-hour precipitation that occurs on average once in 10 years	inches	3.03	10.2	7.08	7.02	1.62
I06H25Y	Maximum 6-hour precipitation that occurs on average once in 25 years	inches	3.81	12.2	8.59	8.46	1.90
I06H50Y	Maximum 6-hour precipitation that occurs on average once in 50 years	inches	4.44	13.7	9.79	9.60	2.12
I06H100Y	Maximum 6-hour precipitation that occurs on average once in 100 years	inches	5.10	15.2	11.0	10.8	2.35
I06H500Y	Maximum 6-hour precipitation that occurs on average once in 500 years	inches	6.85	19.2	14.1	13.7	2.96

Table 5. Selected drainage-basin characteristics evaluated in the regional-regression analysis, State of Hawai‘i—Continued.

Abbreviated name	Definition	Units	Minimum	Maximum	Median	Mean	Standard deviation
I24H2Y	Maximum 24-hour precipitation that occurs on average once in 2 years	inches	2.91	11.8	7.13	7.29	2.09
I24H5Y	Maximum 24-hour precipitation that occurs on average once in 5 years	inches	4.14	15.3	9.50	9.66	2.63
I24H10Y	Maximum 24-hour precipitation that occurs on average once in 10 years	inches	5.15	17.9	11.3	11.5	3.06
I24H25Y	Maximum 24-hour precipitation that occurs on average once in 25 years	inches	6.27	21.4	13.9	14.1	3.62
I24H50Y	Maximum 24-hour precipitation that occurs on average once in 50 years	inches	7.16	24.2	15.9	16.1	4.07
I24H100Y	Maximum 24-hour precipitation that occurs on average once in 100 years	inches	8.07	27.2	18.0	18.3	4.54
I24H500Y	Maximum 24-hour precipitation that occurs on average once in 500 years	inches	10.4	35.5	23.3	23.7	5.74
I48H2Y	Maximum 48-hour precipitation that occurs on average once in 2 years	inches	3.76	16.3	9.20	9.36	2.83
I48H5Y	Maximum 48-hour precipitation that occurs on average once in 5 years	inches	4.94	21.3	12.2	12.4	3.61
I48H10Y	Maximum 48-hour precipitation that occurs on average once in 10 years	inches	5.84	25.3	14.7	14.9	4.24
I48H25Y	Maximum 48-hour precipitation that occurs on average once in 25 years	inches	7.07	30.8	17.8	18.3	5.14
I48H50Y	Maximum 48-hour precipitation that occurs on average once in 50 years	inches	8.05	35.3	20.6	21.1	5.89
I48H100Y	Maximum 48-hour precipitation that occurs on average once in 100 years	inches	9.06	40.0	23.5	24.0	6.70
I48H500Y	Maximum 48-hour precipitation that occurs on average once in 500 years	inches	11.6	52.2	30.5	31.6	9.01
PRECIP	Mean annual precipitation	inches	18.3	254	110	116	57.6
	Soil Characteristics						
PERM12IN	Area-weighted average soil permeability for top 12 inches of soil	inches per hour	0.05	16	3.8	4.8	3.0
PERM24IN	Area-weighted average soil permeability for top 24 inches of soil	inches per hour	0.09	16	3.7	4.5	2.9
	Land-Cover Characteristics						
NLCD012122	Percentage of area developed, open space and low intensity combined	percent	0.0	43.0	2.2	4.7	6.9
NLCD01_23	Percentage of area developed, medium intensity	percent	0.0	17.3	0.0	0.7	2.2
NLCD01_24	Percentage of area developed, high intensity	percent	0.0	5.4	0.0	0.2	0.8
NLCD01_2324	Percentage of area developed, medium and high intensity (derived from *NLCD01_23* and *NLCD01_24*)	percent	0.0	19.2	0.0	0.9	2.8
NLCD01_31	Percentage of area barren land	percent	0.0	62.4	0.0	1.9	7.4
NLCD01_42	Percentage of area evergreen forest	percent	0.0	100	67.7	60.9	29.3
NLCD01_82	Percentage of area cultivated crops	percent	0.0	38.5	0.0	1.7	5.9

$\bar{x}$ = mean of logarithms of annual peak-discharge values,
K = a factor that is dependent on the skew coefficient of the logarithms of annual peak-discharge values and the selected recurrence interval, and
S = standard deviation of logarithms of annual peak-discharge values.

The mean ($\bar{x}$), standard deviation (S), and skew coefficient (G) of the base 10 logarithms of the data are the first three moments of the sample data and are computed from the following equations:

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n} \tag{2}$$

$$S = \left(\frac{\sum_{i=1}^{n} \left(x_i - \bar{x} \right)^2}{\left(n-1 \right)} \right)^{1/2} \tag{3}$$

$$G = \frac{n \sum_{i=1}^{n} \left(x_i - \bar{x} \right)^3}{\left(n-1 \right)\left(n-2 \right) S^3} \tag{4}$$

where
G = skew coefficient of logarithms of annual peak-discharge values,
n = number of annual peak-discharge values,
i = index counter, and
x_i = logarithm of peak-discharge value i.

The skew coefficient is an indicator of the symmetry of the probability density function (Yevjevich, 1972). For a skew coefficient of zero, the probability density function is symmetrical (a bell-shaped curve); for a positive skew coefficient, the probability density function has a longer tail to the right, representing occasional years with extremely large magnitude peak discharge relative to the average peak discharge; for a negative skew coefficient, the probability density function has a longer tail to the left, representing occasional years with extremely small magnitude peak discharge relative to the average peak discharge (Haan, 1977) (fig. 9). The skew coefficient also is an indicator of the concavity of the cumulative distribution function, which integrates the area under the probability density function and conveys information at the extremes better than the probability density function. The cumulative distribution function relates values of the variable (in this case peak discharge) to exceedance probability. The cumulative distribution function of the log-Pearson Type III distribution commonly is plotted on a log-normal scale, with values of the variable (peak discharge) plotted on the logarithmic scale (vertical axis) and exceedance probability plotted on a normal probability scale (horizontal axis). For a skew coefficient of zero, the cumulative distribution function of the log-Pearson Type III distribution will plot as a straight line on a log-normal scale; for a positive skew coefficient, the distribution will plot as a concave upward curve; for a negative skew coefficient, the distribution will plot as a concave downward curve (Cudworth, 1989) (fig. 9).

Bulletin 17B includes a table of K values for various skew coefficients and exceedance probabilities. Because the skew coefficient is sensitive to extreme values, the skew coefficient calculated from the station record (station skew) may not be representative of the true population skew, particularly for gaging stations with short-term records. An improved estimate of population skew can be obtained by using a weighted sum of the station skew and a generalized skew estimated from long-term data at nearby gaging stations. The weighted skew coefficient is computed using the following equation:

$$G_W = \frac{MSE_{\bar{G}} \times G + MSE_G \times \bar{G}}{MSE_{\bar{G}} + MSE_G} \tag{5}$$

where
G_W = weighted skew coefficient,
$\bar{G}$ = generalized skew,
$MSE_{\bar{G}}$ = mean-square error of generalized skew, and
MSE_G = mean-square error of station skew.

Bulletin 17B provides a method to estimate the mean-square error of the station skew using the station skew value and the number of years of record.

Selection of Generalized Skew

Bulletin 17B provides guidelines for determining generalized skew and also provides a national map of generalized skew that can be used if more detailed generalized-skew information is not available or not applicable. The Bulletin 17B national map specifies a generalized skew of -0.05 and mean-square error of generalized skew of 0.302 for Hawai‘i. The Bulletin 17B guidelines were used to determine whether more detailed generalized-skew values for Hawai‘i would be an improvement over the national map value.

Lee (1984) used data from 68 gaging stations in Hawai‘i with 25 or more years of record and estimated a mean skew coefficient of -0.14. Lee (1984) indicated that the mean skew coefficient of -0.14 did not substantially improve upon the national map value of -0.05. For the present study, data from 169 gaging stations with 25 or more years of record were available and analyzed for determination of generalized skew. In accordance with Bulletin 17B guidelines, three methods for determination of generalized skew were considered: (1) mapping lines of equal skew coefficient, (2) developing a prediction equation relating skew coefficient to basin and climatologic variables, and (3) using the arithmetic mean of the station skew coefficients. Results from each of these methods are described briefly below and indicate that the Bulletin 17B values for generalized skew (-0.05) and mean-square error of generalized skew (0.302) do not warrant replacement at this time.

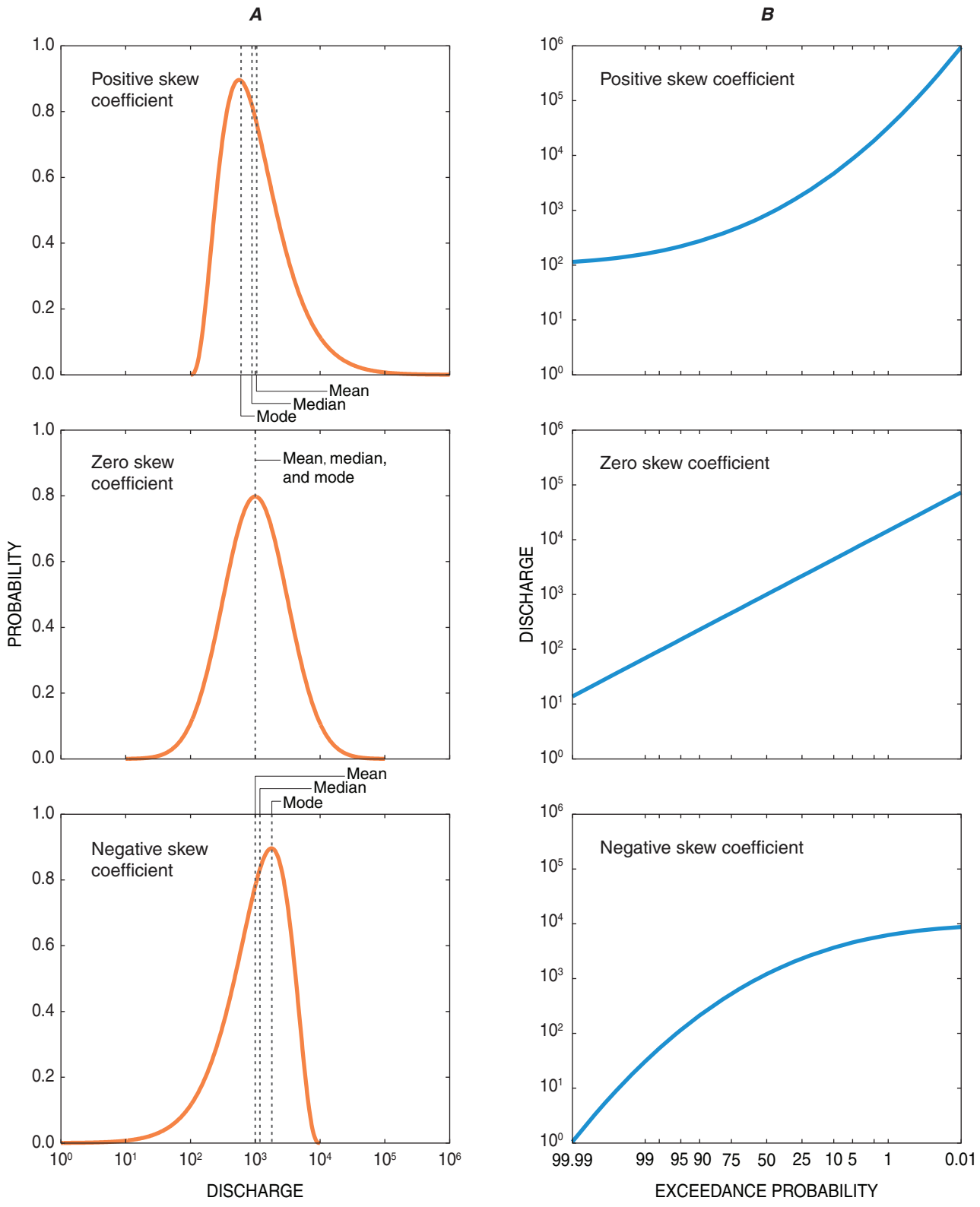

Figure 9. Generalized shapes of curves for positive, zero, and negative skew coefficients in the distribution of peak discharges. *A*, Probability density functions. *B*, Log-Pearson Type III frequency curves.

Skew Maps

Station skew values were plotted at the centroid of each basin, and isolines of equal skew coefficient (not shown) were drawn by hand, accounting for regional topographic and climatologic variations, for the islands of Kaua‘i, O‘ahu, Moloka‘i, and Maui. Insufficient data were available to map lines of equal skew coefficient for the Island of Hawai‘i. The isolines were drawn to generally represent the spatial distribution of skew. Although it is possible to reduce mean-square errors further by accurately contouring the station skew values using computerized contouring routines, such detailed contour maps may not provide reliable regional estimates of generalized skew. The skew maps produced lower mean-square errors than the other two methods used to estimate generalized skew (table 7), but the isolines of equal skew were not spatially consistent and often indicated steep gradients in skew that may not be representative of regional conditions. On that basis, the skew maps were considered to be potentially unreliable in Hawai‘i despite their generally small mean-square errors.

Table 7. Mean-square errors associated with selected generalized-skew estimates for annual peak discharges, State of Hawai‘i.

[—, skew map not developed; Bulletin 17B, Interagency Advisory Committee on Water Data (1982); skew values and errors based on peak-discharge data through water year 2008]

Area	Average skew value	Mean-square error associated with indicated skew estimate		
		Bulletin 17B value (–0.05)	Area average skew	Skew map
Kaua‘i	–0.07	0.18	0.18	0.11
O‘ahu	–0.02	0.19	0.19	0.11
Moloka‘i	–0.09	0.50	0.50	0.07
Maui	–0.17	0.36	0.35	0.21
Hawai‘i	0.16	0.35	0.30	—
State	–0.06	0.29	0.29	—

Prediction Equations

Multiple-linear-regression models, using both ordinary-least-squares (OLS) and weighted-least-squares (WLS) methods, were evaluated. Explanatory variables used in the analysis to predict skew included basin morphometric, rainfall, soil, and land-cover characteristics (table 5). Skew prediction equations were evaluated for the State, individual islands, and regions within an island, although none of the equations was found to be statistically significant (5-percent level of significance). Thus, prediction equations for generalized skew also were considered to be unreliable for Hawai‘i.

Arithmetic Mean

Arithmetic mean skew values were computed for the State as well as for individual islands (table 7). The mean-square-error values associated with using the arithmetic mean value as an estimator of skew range from 0.18 (Kaua‘i) to 0.50 (Moloka‘i). The national map in Bulletin 17B shows a generalized skew of -0.05 for all of Hawai‘i, with a mean-square error of 0.302. Because the mean-square-error values associated with using the arithmetic mean skew values (based on available data as of water year 2008) are not much different from the mean-square-error values associated with the Bulletin 17B generalized skew, the existing Bulletin 17B generalized skew of -0.05 is retained in subsequent analyses for this study.

Adjustments to the Fitted Log-Pearson Type III Distribution

The PeakFQ program for flood-frequency analysis (Flynn and others, 2006) was used to fit the log-Pearson Type III distribution to the recorded annual peak-discharge data. As described in Bulletin 17B, PeakFQ adjusts the fitted probability distribution to account for low outliers, high outliers, and historic floods. High outliers were detected by PeakFQ at 26 gaging stations. For this study, no adjustments were made to the frequency curve to reflect high outliers detected by PeakFQ because reliable historic information required for the adjustments was not available.

Low Outliers

As described in Bulletin 17B, PeakFQ detects low outliers using a statistical criterion rather than by considering the effect of these low values on the fit of the frequency curve. In some cases, the default criterion used to detect low outliers may fail to adequately detect all of the low outliers, which may adversely affect the fit of the log-Pearson Type III frequency curve to the data. Bulletin 17B and PeakFQ allow manually specified low-outlier thresholds to be used to improve the fit of the log-Pearson Type III frequency curve.

For this study, potential low outliers not detected by the default criterion were identified visually from the frequency curve, and the effect of increasing the low-outlier threshold to exclude these potential low outliers was assessed by comparing the 100-year peak discharge associated with the default and manually specified low-outlier thresholds. If the 100-year peak discharge using the default and manually specified low-outlier thresholds differed by less than 10 percent, then the default low-outlier threshold was retained. If the 100-year peak discharge using the default and manually specified low-outlier thresholds differed by more than 10 percent, then the manually specified low-outlier threshold was retained. The value of the manually specified low-outlier threshold was determined by incrementally excluding low outliers of greater value and evaluating the sensitivity of the estimated 100-year peak discharge to the number of low outliers excluded. Commonly, the estimated 100-year peak discharge remained nearly constant as additional data points were treated as low outliers.

The point at which the 100-year peak discharge first reached the nearly constant value was selected as the low-outlier threshold for cases in which manually specified low-outlier thresholds were used. For this study, low-outlier thresholds were manually specified for 27 gaging stations (table 8).

Table 8. Manually specified low-outlier thresholds for annual peak-discharge frequency analysis, State of Hawai‘i.

Station no.	Default low-outlier threshold, in cubic feet per second	Manually specified low-outlier threshold, in cubic feet per second
Kaua‘i		
16068000	421.8	964
16097500	156.4	465
O‘ahu		
16211600	13.3	29
16211800	0.9	11
16212601	69.7	178
16228900	38.0	39
16229000	98.2	316
16275000	28.4	74
16278000	2.7	4
16325000	224.5	345
16330000	367.4	1,120
16340000	326.5	737
Moloka‘i		
16400000	407.0	1,130
16411300	1.2	5
16411320	0.0	1
16411900	11.5	43
16414000	25.3	80
16419000	4.2	27
Maui		
16500100	20.6	74.7
16500800	12.9	80
16502400	2.3	28
16603850	1.0	12
16616500	0.4	3
16643300	12.1	30
16658500	0.6	2
Hawai‘i		
16764000	314.8	517
16767000	107.0	528

Values With Less-Than (<) Codes

The peak-flow file for Hawai‘i contains 49 gaging stations with at least one annual peak discharge that is reported as less than a specified value. The actual peak discharge for these cases is not known, and may be zero in some cases. The PeakFQ program will ignore all reported peak discharges that are less than the largest value with a less-than (<) code. For example, if the record for a gaging station contains the annual peak discharges (arranged in ascending order) 100; 200; 300; 400; 500; <600; 700; 800; 900; 1,000; and 1,100 ft^3/s, then the PeakFQ program will ignore the peak discharges 100; 200; 300; 400; 500; and <600 ft^3/s. This would reduce the number of usable peaks to five and would preclude use of data from this gaging station in the flood-frequency analysis. The peak-discharge values with less-than codes initially were set equal to the specified less-than values to identify low outliers. However, the final assigned values were determined as described below.

For this study, the sensitivity of the estimated 2-, 10-, and 100-year peak discharges (using the log-Pearson Type III frequency curve) to the values assigned to the reported peak discharges with less-than codes was evaluated. Two different values, representing the possible range of values, for the reported peak discharges with less-than codes were tested: (1) zero discharge and (2) a discharge set equal to the less-than value (representing the maximum possible value). The estimated 2-, 10-, and 100-year peak discharges associated with the two different replacement values were then compared. For many gaging stations, the 2-, 10-, and 100-year peak discharges associated with the replacement zero-discharge values differed from the corresponding 2-, 10-, and 100-year peak discharges associated with the replacement less-than discharge values by less than 5 percent. For these cases, the less-than discharge values were selected to replace the reported annual peak discharges with the less-than codes. For cases in which the 2-, 10-, and 100-year peak discharges associated with the replacement zero-discharge values differed from the corresponding 2-, 10-, and 100-year peak discharges associated with the replacement less-than values by more than 5 percent, existing records were checked for indications of nonzero flow during the year. If records indicated mainly nonzero flows for the affected years, the discharges equal to the less-than values were selected to replace the discharges with less-than codes. If records indicated mainly zero flows for the affected years, a value of zero was selected to replace the discharges with less-than codes (table 9).

Historic Floods

Information related to historic floods (Fontaine and Hill, 2002) was incorporated in this study (table 10). A historic flood is a major flood that occurs during a period that is not part of a systematic data-collection period. Information related to historic floods is useful for enhancing short-term records, improving frequency determinations, and ensuring that flood estimates fit community experience (Interagency Advisory Committee on Water Data, 1982). Adjustments to the frequency curve described in Bulletin 17B are implemented in the PeakFQ program for flood-frequency analysis (Flynn and others, 2006).

Computed Peak Stream Discharges

For all gaging stations with at least 10 years of usable peak-discharge data, a log-Pearson Type III frequency curve

Table 9. Stations with annual peak-discharge data less than a specified value and replacement values used for annual peak-discharge frequency analysis, State of Hawai‘i.

[maximum, annual peak discharges coded with “less than” replaced by the “less than” discharge value; zero, annual peak discharges coded with “less than” replaced by zero; <5 percent difference, estimated 2-, 10-, and 100-year peak discharges associated with the replacement zero-discharge values differed from the corresponding 2-, 10-, and 100-year peak discharges associated with the replacement maximum values by less than 5 percent]

Station no.	Water years with annual peak discharge less than a specified value	Method used to replace annual peak discharges less than a specified value
	Kaua‘i	
16052500	1984	maximum
16055000	1984	maximum; <5 percent difference
16073500	1999, 2001	maximum; <5 percent difference
16081200	2000–01, 2007–08	maximum
16097900	2000	maximum; <5 percent difference
16130000	2007	maximum; <5 percent difference
	O‘ahu	
16210500	1995, 1998–99	maximum
16211300	1973, 1995	maximum; <5 percent difference
16211500	1973	maximum
16211700	1973	maximum; <5 percent difference
16211800	1975, 1984, 1987, 1998–99, 2001, 2003	maximum
16212200	1973, 1977, 1981, 1984, 1987, 1995, 1998–2003, 2007	zero
16212300	1973, 2001	maximum
16235400	1998–99	maximum
16247500	1973, 1975–77	maximum; <5 percent difference
16247900	1973, 1998	maximum; <5 percent difference
16248800	1973, 1995	maximum; <5 percent difference
16249000	1973	maximum; <5 percent difference
16249100	1973, 1998–99, 2001–03	zero
16279500	1973	maximum
16331000	1973, 1995, 1998–99, 2001, 2003–04, 2008	zero
16350000	1999	maximum; <5 percent difference
	Moloka‘i	
16411300	2006–08	maximum
16411640	1999–2000	maximum; <5 percent difference
16411800	1989–90, 2004	maximum
16411900	1970, 1981	maximum
	Maui	
16500100	2005	maximum; <5 percent difference
16500300	1998–99, 2006	maximum; <5 percent difference
16500800	1998–99, 2002–03, 2008	maximum
16502400	1981, 1998	maximum
16502900	1981, 1998	maximum; <5 percent difference
16603700	1998, 2000	maximum
16603800	1998, 2000	maximum; <5 percent difference
16616500	2002–03	maximum
16630200	1973	maximum; <5 percent difference
16643300	1998, 2000–01	maximum
16647500	1988, 2000	maximum
16658500	1988	maximum
16663500	1984	maximum
16664000	1981	maximum

Table 9. Stations with annual peak-discharge data less than a specified value and replacement values used for annual peak-discharge frequency analysis, State of Hawai‘i—Continued.

Station no.	Water years with annual peak discharge less than a specified value	Method used to replace annual peak discharges less than a specified value
	Hawai‘i	
16717400	2003	maximum; <5 percent difference
16717850	1963, 1966	zero
16717950	1964, 1966, 1968, 1976–77, 1995–97	maximum
16752600	1964, 1976, 1983, 1996, 2000–01, 2007	zero
16759040	1995	maximum; <5 percent difference
16759060	1967, 1973, 1996–98, 2000, 2002, 2006, 2008	zero
16759080	1970, 1973	maximum
16759180	1970	maximum; <5 percent difference
16770500	1998	maximum; <5 percent difference

was fit to the annual peak-discharge data using the PeakFQ program for flood-frequency analysis (Flynn and others, 2006). The annual peak discharges from a gaging station are fit to the log-Pearson Type III distribution using the first three moments (mean, standard deviation, and skew) of the distribution (table 11, located near end of document), accounting for adjustments to reflect low outliers, historic floods, and a weighted skew coefficient that incorporates a statewide generalized skew of -0.05. Peak stream discharges for selected recurrence intervals (2, 5, 10, 25, 50, 100, and 500 years) from the frequency curve for each gaging station (table 12, located near end of document) were used as dependent variables in the regression analysis.

Table 10. Historic floods and periods for annual peak-discharge frequency analysis, State of Hawai‘i.

Station no.	Water year of historic flood	Historic period
16701300	2001	1957–2008
16701400	2001	1965–2008
16717400	1979	1963–2008
16717600	1979, 2001	1962–2008
16717650	1979	1963–2008
16770000	1979, 1980, 2001	1963–2008
16770500	2001	1963–2008

Regression Analysis

For this study, multiple-regression methods were used to develop regional regression equations relating peak stream discharges of selected recurrence intervals (2, 5, 10, 25, 50, 100, and 500 years) at gaged sites to various basin characteristics. Regression equations can be developed using ordinary-least-squares (OLS), weighted-least-squares (WLS), and generalized-least-squares (GLS) estimates of model parameters. Traditional OLS methods are based on the assumption that the residual errors associated with the individual observations are homoscedastic (variance of the residuals is constant and independent of all factors, including record length) and independently distributed (residuals are uncorrelated) (Stedinger and Tasker, 1985; Helsel and Hirsch, 1992). When OLS methods are used, equal weight is given to peak-discharge records at all gaging stations, regardless of record length and the possible correlation among concurrent flows at different stations. Weighted-least-squares (WLS) methods may be used to address uncertainty associated with short record lengths. In general, peak-discharge estimates based on gaging stations with longer records are more reliable and have lower variance than those based on gaging stations with shorter records. WLS methods can give greater weight to data from gaging stations with longer record lengths by assuming the variance of the observed flood characteristics is inversely related to record length (Tasker, 1980). Neither OLS nor WLS methods account for possible spatial correlation of peak discharges at different sites. Cross correlation of peak discharges may exist for sites on the same stream or for sites in nearby or similar basins. Generalized-least-squares (GLS) methods are used to correct for lack of homoscedasticity as well as lack of independence. Thus, GLS methods can account for unequal record lengths as well as cross correlation of concurrent flows at different sites (Stedinger and Tasker, 1985). The GLS method has been used extensively for developing regional relations for estimating peak discharges (see, for example, Wong, 1994; Ries, 2007; Griffs and Stedinger, 2007) and also is used for this study.

Selected basin characteristics (table 6) were used as explanatory (independent) variables in the regression analysis. Scatterplots of the logarithmically (base 10) transformed peak discharges and each explanatory variable were formed. The peak-discharge data for each recurrence interval were logarithmically transformed (log-transformed) to account for the large range of discharges covering several orders of magnitude and nonlinearity in the relation between untransformed values of peak discharge and explanatory variables. The number of explanatory variables was reduced by eliminating those that

were poorly correlated with peak stream discharge or that were correlated with less complex variables from which they were derived. Scatterplots of the log-transformed peak discharges and log-transformed explanatory variables also were created to evaluate whether log-transformation of the explanatory variables improved the correlation between peak discharge and each explanatory variable. Log-transformation of the explanatory variables was not used for explanatory variables that were poorly distributed or that could not be suitably transformed.

A stepwise regression analysis was used to further reduce the list of explanatory variables by adding and subtracting variables at each iteration to find the best combination of remaining basin attributes. Using the basin characteristics resulting from the stepwise regression analysis, a preliminary multiple-linear-regression model using OLS methods was formed. The OLS regression model was then trimmed down to no more than three explanatory variables using a 5-percent (0.05) level of significance as the criterion to identify statistically significant explanatory variables. Multicolinearity among explanatory variables was tested using the variance inflation factor (VIF) (Helsel and Hirsch, 1992). If several highly correlated explanatory variables remained in the OLS regression model they were tested one at a time, while keeping the other variables constant, to determine which of the correlated predictors produced the best model.

The explanatory variables and transformations in the best OLS regression models were then used to form GLS models with the program WREG (Eng and others, 2009). Sites with large leverage or influence (Tasker and Stedinger, 1989; Helsel and Hirsch, 1992) from the GLS models were identified by the WREG program, although no data were ultimately excluded on the basis of leverage or influence because (1) no known errors were associated with the data, (2) more complex models that fit the data better were not appropriate given the limited available data, and (3) a reasonable hydrologic justification for excluding the data could not be identified. Explanatory variables that were no longer significant or contained coefficients that did not make hydrologic sense were eliminated, and a final GLS model was generated with WREG. The GLS regression model with the highest pseudo R squared (an indicator of the variability in the dependent variable explained by the model when the time-sampling error is removed), lowest average standard error of prediction, and lowest standard model error was selected.

Regions

To improve peak-discharge estimates, basins were grouped into regions and separate regression equations were developed for each region. Regions can be defined using different methods, including (1) geography, (2) heuristic methods relying on an understanding of the hydrogeology of an area, (3) identifying groups of basins from the residuals of regression equations, and (4) statistical clustering (principal components or cluster analysis). For this study, regions were defined on the basis of the spatial pattern of residuals and hydrologic and geographic considerations.

Regression equations initially were developed for the State (based on data from Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i), as well as for the individual islands, for peak discharges with 10- and 100-year recurrence intervals. Residuals from these regression equations (in logarithm units) were plotted spatially on a map to identify regions of similar residual magnitudes and signs. (A residual is the difference between the peak discharge predicted from the regression equation and that obtained from the frequency curve for a gaging station.) Defining regions on the basis of residuals assumes that the spatial pattern of residuals reflects a spatial pattern of peak-discharge characteristics. In general, the patterns of residuals from the regression equations for the 10- and 100-year recurrence intervals were similar. Final determination of regions was based on the residuals as well as hydrologic (basins with similar climate were grouped together) and geographic (region boundaries conformed to topographic divides) considerations. For this study, each island was divided into two regions: Kaua‘i was divided into windward (eastern) and leeward (western) regions; O‘ahu was divided into windward (northeastern) and leeward regions; Moloka‘i was divided into windward (northeastern) and leeward regions; Maui was divided into eastern-northwestern and central-southwestern regions; and Hawai‘i was divided into northern and southern regions (figs 2–6). Other regions considered included those defined for Kaua‘i (Yamanaga, 1972; State of Hawai‘i, 1973); O‘ahu (Yamanaga, 1972; Nakahara, 1980; Wong, 1994; City and County of Honolulu, 2000); Moloka‘i (Yamanaga, 1972); Maui (State of Hawai‘i, 1971; Yamanaga, 1972); and Hawai‘i (State of Hawai‘i, 1970b; Yamanaga, 1972). The regions used for this study resulted in lower overall errors than regions defined in previous studies.

To test whether the regions defined by residuals are real or merely a result of chance, Tasker (1982) proposed using the nonparametric Wilcoxon signed-ranks test for testing the statistical significance of a cluster of regression residuals. The test was not meant to replace hydrologic judgment in defining regions, but does provide insight into whether region boundaries are supported by the regression data. The Wilcoxon signed-ranks test was used to test the regression residuals for region boundaries on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i, although none of the tests was significant at the 0.05 (5-percent) significance level. This result indicates that the residuals from the individual regions may not differ statistically from the residuals for the entire island (that is, the null hypothesis of no clustering cannot be rejected). Wong (1994) found a similar result using the Wilcoxon signed-ranks test for regions on O‘ahu. Standard errors of prediction using the islandwide regression equations were greater than those associated with regression equations from individual regions. Thus, the regions used for this study were retained to provide improved peak-discharge estimates and generally to account for hydrologic differences between regions.

Regression Equations

For this study, final regional regression equations related log-transformed peak discharge to at most two explanatory variables that also were log-transformed. Thus, final regional regression equations take the form:

$$Q_T = a\left(X_1^{b_1}\right)\left(X_2^{b_2}\right) \tag{6}$$

where

Q_T = peak discharge for a T-year recurrence interval, in ft^3/s,
a = regression constant,
X_i = explanatory variable (basin characteristic) i,
b_i = regression coefficient or exponent for explanatory variable i, and
i = index equal to 1 or 2.

Most of the final regional regression equations have drainage area as an explanatory variable, although the equations for southern Hawai‘i do not (table 13). Other explanatory variables that were significant in the final regression equations included mean annual rainfall and maximum 48-hour rainfall that occurs on average once in 5 years. For some equations, other explanatory variables, including rainfall of various return periods and durations and basin relief, may have been significant but were not included in the final regression equations to ensure consistent estimates among the peak stream discharges of selected recurrence intervals (2, 5, 10, 25, 50, 100, and 500 years).

The regression equations for southern Hawai‘i do not include drainage area as an explanatory variable. This may reflect the lack of well-defined stream channels in the area and the loss of streamflow to infiltration. Because the permeability of the surface rocks generally is high in southern Hawai‘i, loss of surface runoff to infiltration may cause downstream sites on a stream to have smaller peak discharges than upstream sites during a storm (State of Hawai‘i, 1970b). Thus, peak discharges may not be directly related to drainage area in this region.

Accuracy and Limitations

The regression equations developed for this study provide peak-discharge estimates based on statistical methods. Thus, these estimates may not accurately reflect conditions in some ungaged basins. Each equation has associated uncertainty that can be quantified by comparing predicted and observed (from station data) values of peak discharge. One useful measure of uncertainty in a regression equation is the average variance of prediction, AVP, which is the sum of the model-error variance and sampling-error variance (Gotvald and others, 2009):

$$AVP = \sigma^2 + \frac{\sum_{i=1}^{n} MSE_i}{n} \tag{7}$$

where

AVP = average variance of prediction,
σ^2 = model-error variance, and
MSE_i = sampling-error variance for site i, and
n = number of gaging stations.

The model-error variance is a measure of how well the explanatory variables in the regression equation predict the peak discharges determined from station records used to develop the equations. The sampling-error variance is a measure of how well the true peak discharges are characterized by a limited number of gaging stations, each with a limited number of annual peak discharges. The sampling-error variance decreases as the number of gaging stations increases or the record lengths increase (Gotvald and others, 2009).

The average standard error of prediction, S_p, in percentage error, is computed from the average variance of prediction, in base 10 logarithm units, using the following equation:

$$S_p = 100\left[10^{AVP \times \ln(10)} - 1\right]^{1/2} \tag{8}$$

For ungaged sites, about two-thirds of the peak-discharge estimates obtained from a regression equation will have errors less than the standard error of prediction (Gotvald and others, 2009). The regression equations developed for this study have standard errors of prediction ranging from 16 to 620 percent, and errors generally are greatest for leeward Moloka‘i and southern Hawai‘i (table 13). For each region, the largest standard error of prediction is associated with regression equations for either the 2- or 500-year peak discharges, which represent the extremes of the recurrence intervals considered. Standard errors of prediction associated with the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak discharges range from 100 to 620 percent for leeward Moloka‘i and from 140 to 190 percent for southern Hawai‘i (table 13). These relatively large errors underscore the need to better understand the processes controlling floods in these areas and the need to collect additional peak-discharge data there. Because the regression equations for leeward Moloka‘i and southern Hawai‘i contain much uncertainty, improved peak-discharge estimates for these regions may be required for proper design of engineering projects that could be affected by floods.

The regression equations developed for this study have a number of limitations:

1. Each regression equation was developed using one or two significant explanatory variables, and each equation is valid within the range of values of those explanatory variables (table 13). Use of a regression equation beyond its limits will produce peak-discharge estimates with unknown error and should therefore be avoided.

2. Basin boundaries were delineated and basin characteristics were quantified using GIS methods and processed 10-meter DEMs. The quantified basin characteristics (table 6) were used to develop the final regression equations. The same methods used in this study should be used to estimate the values of explanatory variables in the regression equations, and these methods are implemented in StreamStats (U.S. Geological Survey, 2009; Rosa and Oki, 2010).

Table 13. Regional regression equations for peak-discharge estimates, State of Hawai‘i.

[Q_T, peak discharge for T-year recurrence interval; $DRNAREA$, drainage area, in square miles; $PRECIP$, mean annual precipitation, in inches; $I48H2Y$, maximum 48-hour precipitation that occurs on average once in 2 years, in inches; $I48H5Y$, maximum 48-hour precipitation that occurs on average once in 5 years, in inches; R^2, coefficient of determination based on the variability in the dependent variable explained by the regression, after removing the effect of the time-sampling error (Eng and others, 2009) ; a ≤ *variable* ≤ b, the explanatory variable may be greater than or equal to a and less than or equal to b]

Regression equation by region[1]	Range of explanatory variables	Standard error of prediction, in percent	R^2	Standard model error, in percent
1. Kaua‘i, leeward				
$Q_2 = 620.9(DRNAREA^{0.748})$	$0.49 \le DRNAREA \le 57.6$	90	0.62	84
$Q_5 = 1{,}019(DRNAREA^{0.753})$	$0.49 \le DRNAREA \le 57.6$	72	0.71	67
$Q_{10} = 1{,}312(DRNAREA^{0.758})$	$0.49 \le DRNAREA \le 57.6$	64	0.75	60
$Q_{25} = 1{,}710(DRNAREA^{0.764})$	$0.49 \le DRNAREA \le 57.6$	58	0.79	54
$Q_{50} = 2{,}028(DRNAREA^{0.769})$	$0.49 \le DRNAREA \le 57.6$	55	0.81	51
$Q_{100} = 2{,}355(DRNAREA^{0.774})$	$0.49 \le DRNAREA \le 57.6$	53	0.82	49
$Q_{500} = 3{,}170(DRNAREA^{0.786})$	$0.49 \le DRNAREA \le 57.6$	51	0.84	47
2. Kaua‘i, windward				
$Q_2 = 391.7(DRNAREA^{1.087})$	$0.41 \le DRNAREA \le 23.7$	78	0.81	73
$Q_5 = 778.0(DRNAREA^{1.035})$	$0.41 \le DRNAREA \le 23.7$	53	0.88	49
$Q_{10} = 1{,}112(DRNAREA^{1.006})$	$0.41 \le DRNAREA \le 23.7$	43	0.91	40
$Q_{25} = 1{,}618(DRNAREA^{0.976})$	$0.41 \le DRNAREA \le 23.7$	36	0.93	32
$Q_{50} = 2{,}051(DRNAREA^{0.956})$	$0.41 \le DRNAREA \le 23.7$	33	0.94	29
$Q_{100} = 2{,}541(DRNAREA^{0.937})$	$0.41 \le DRNAREA \le 23.7$	32	0.94	28
$Q_{500} = 3{,}936(DRNAREA^{0.889})$	$0.41 \le DRNAREA \le 23.7$	35	0.93	31
3. O‘ahu, leeward				
$Q_2 = 2.339(DRNAREA^{0.679})(PRECIP^{1.113})$	$0.56 \le DRNAREA \le 45.1$; $31.9 \le PRECIP \le 252$	51	0.74	48
$Q_5 = 17.58(DRNAREA^{0.668})(PRECIP^{0.820})$	$0.56 \le DRNAREA \le 45.1$; $31.9 \le PRECIP \le 252$	42	0.76	40
$Q_{10} = 49.09(DRNAREA^{0.664})(PRECIP^{0.674})$	$0.56 \le DRNAREA \le 45.1$; $31.9 \le PRECIP \le 252$	40	0.77	38
$Q_{25} = 145.2(DRNAREA^{0.657})(PRECIP^{0.520})$	$0.56 \le DRNAREA \le 45.1$; $31.9 \le PRECIP \le 252$	40	0.76	37
$Q_{50} = 290.4(DRNAREA^{0.652})(PRECIP^{0.422})$	$0.56 \le DRNAREA \le 45.1$; $31.9 \le PRECIP \le 252$	40	0.76	37
$Q_{100} = 539.5(DRNAREA^{0.646})(PRECIP^{0.335})$	$0.56 \le DRNAREA \le 45.1$; $31.9 \le PRECIP \le 252$	41	0.75	38
$Q_{500} = 1{,}841(DRNAREA^{0.633})(PRECIP^{0.162})$[a]	$0.56 \le DRNAREA \le 45.1$; $31.9 \le PRECIP \le 252$	44	0.73	40
4. O‘ahu, windward				
$Q_2 = 570.2(DRNAREA^{0.770})$	$0.04 \le DRNAREA \le 5.44$	63	0.77	60
$Q_5 = 1{,}086(DRNAREA^{0.763})$	$0.04 \le DRNAREA \le 5.44$	51	0.83	48
$Q_{10} = 1{,}517(DRNAREA^{0.754})$	$0.04 \le DRNAREA \le 5.44$	47	0.85	44
$Q_{25} = 2{,}148\ (DRNAREA^{0.743})$	$0.04 \le DRNAREA \le 5.44$	46	0.85	42
$Q_{50} = 2{,}679(DRNAREA^{0.735})$	$0.04 \le DRNAREA \le 5.44$	46	0.85	43
$Q_{100} = 3{,}251(DRNAREA^{0.726})$	$0.04 \le DRNAREA \le 5.44$	48	0.84	44
$Q_{500} = 4{,}786(DRNAREA^{0.706})$	$0.04 \le DRNAREA \le 5.44$	54	0.79	49
5. Moloka‘i, leeward				
$Q_2 = 93.33(DRNAREA^{0.583})$[a]	$0.25 \le DRNAREA \le 10.3$	620	0.009	470
$Q_5 = 263.6(DRNAREA^{0.636})$	$0.25 \le DRNAREA \le 10.3$	180	0.24	150
$Q_{10} = 432.5(DRNAREA^{0.680})$	$0.25 \le DRNAREA \le 10.3$	120	0.40	110
$Q_{25} = 699.8(DRNAREA^{0.729})$	$0.25 \le DRNAREA \le 10.3$	100	0.51	88
$Q_{50} = 937.6(DRNAREA^{0.755})$	$0.25 \le DRNAREA \le 10.3$	110	0.52	90
$Q_{100} = 1{,}205(DRNAREA^{0.776})$	$0.25 \le DRNAREA \le 10.3$	110	0.51	96
$Q_{500} = 1{,}945(DRNAREA^{0.817})$	$0.25 \le DRNAREA \le 10.3$	150	0.45	120

Table 13. Regional regression equations for peak-discharge estimates, State of Hawai‘i—Continued.

Regression equation by region[1]	Range of explanatory variables	Standard error of prediction, in percent	R^2	Standard model error, in percent
6. Moloka‘i, windward				
$Q_2 = 410.2(DRNAREA^{1.158})$	$0.46 \le DRNAREA \le 4.68$	37	0.90	32
$Q_5 = 835.6(DRNAREA^{1.067})$	$0.46 \le DRNAREA \le 4.68$	25	0.95	21
$Q_{10} = 1{,}202(DRNAREA^{1.047})$	$0.46 \le DRNAREA \le 4.68$	20	0.97	15
$Q_{25} = 1{,}762(DRNAREA^{1.060})$	$0.46 \le DRNAREA \le 4.68$	17	0.99	10
$Q_{50} = 2{,}254(DRNAREA^{1.086})$	$0.46 \le DRNAREA \le 4.68$	16	0.99	8
$Q_{100} = 2{,}805(DRNAREA^{1.115})$	$0.46 \le DRNAREA \le 4.68$	17	0.99	6
$Q_{500} = 4{,}385(DRNAREA^{1.182})$	$0.46 \le DRNAREA \le 4.68$	18	1.00	5
7. Maui, central-southwestern				
$Q_2 = 55.46(DRNAREA^{0.506})$ [a]	$0.45 \le DRNAREA \le 18.6$	320	0.07	270
$Q_5 = 162.9(DRNAREA^{0.638})$	$0.45 \le DRNAREA \le 18.6$	99	0.50	87
$Q_{10} = 276.7(DRNAREA^{0.691})$	$0.45 \le DRNAREA \le 18.6$	62	0.73	52
$Q_{25} = 463.4(DRNAREA^{0.731})$	$0.45 \le DRNAREA \le 18.6$	55	0.80	44
$Q_{50} = 638.3(DRNAREA^{0.750})$	$0.45 \le DRNAREA \le 18.6$	59	0.79	48
$Q_{100} = 843.3(DRNAREA^{0.764})$	$0.45 \le DRNAREA \le 18.6$	67	0.76	54
$Q_{500} = 1{,}459(DRNAREA^{0.787})$	$0.45 \le DRNAREA \le 18.6$	89	0.71	73
8. Maui, eastern-northwestern				
$Q_2 = 602.6(DRNAREA^{0.885})$	$0.09 \le DRNAREA \le 17.2$	93	0.64	90
$Q_5 = 1{,}038(DRNAREA^{0.831})$	$0.09 \le DRNAREA \le 17.2$	70	0.71	68
$Q_{10} = 1{,}380(DRNAREA^{0.804})$	$0.09 \le DRNAREA \le 17.2$	66	0.72	64
$Q_{25} = 1{,}875\ (DRNAREA^{0.776})$	$0.09 \le DRNAREA \le 17.2$	65	0.72	63
$Q_{50} = 2{,}280(DRNAREA^{0.759})$	$0.09 \le DRNAREA \le 17.2$	67	0.71	65
$Q_{100} = 2{,}716(DRNAREA^{0.744})$	$0.09 \le DRNAREA \le 17.2$	70	0.69	67
$Q_{500} = 3{,}828(DRNAREA^{0.717})$	$0.09 \le DRNAREA \le 17.2$	79	0.64	76
9. Hawai‘i, northern				
$Q_2 = 0.148(DRNAREA^{0.763})(PRECIP^{1.664})$	$0.14 \le DRNAREA \le 245$; $18.3 \le PRECIP \le 190$	100	0.75	93
$Q_5 = 1.12\ (DRNAREA^{0.782})\ (PRECIP^{1.356})$	$0.14 \le DRNAREA \le 245$; $18.3 \le PRECIP \le 190$	72	0.83	67
$Q_{10} = 3.16(DRNAREA^{0.787})\ (PRECIP^{1.203})$	$0.14 \le DRNAREA \le 245$; $18.3 \le PRECIP \le 190$	61	0.87	56
$Q_{25} = 9.55(DRNAREA^{0.789})\ (PRECIP^{1.042})$	$0.14 \le DRNAREA \le 245$; $18.3 \le PRECIP \le 190$	53	0.90	48
$Q_{50} = 19.1(DRNAREA^{0.789})\ (PRECIP^{0.938})$	$0.14 \le DRNAREA \le 245$; $18.3 \le PRECIP \le 190$	51	0.91	45
$Q_{100} = 36.3(DRNAREA^{0.788})\ (PRECIP^{0.845})$	$0.14 \le DRNAREA \le 245$; $18.3 \le PRECIP \le 190$	51	0.91	44
$Q_{500} = 126(DRNAREA^{0.782})\ (PRECIP^{0.662})$	$0.14 \le DRNAREA \le 245$; $18.3 \le PRECIP \le 190$	54	0.91	46
10. Hawai‘i, southern				
$Q_2 = 15.31(I48H2Y^{1.541})$ [a]	$3.76 \le I48H2Y \le 13.9$	150	0.17	130
$Q_5 = 6.40(I48H5Y^{1.908})$	$4.95 \le I48H5Y \le 18.1$	140	0.29	120
$Q_{10} = 6.17(I48H5Y^{2.027})$	$4.95 \le I48H5Y \le 18.1$	150	0.32	130
$Q_{25} = 5.90(I48H5Y^{2.154})$	$4.95 \le I48H5Y \le 18.1$	150	0.35	130
$Q_{50} = 5.75(I48H5Y^{2.234})$	$4.95 \le I48H5Y \le 18.1$	160	0.36	140
$Q_{100} = 5.64(I48H5Y^{2.306})$	$4.95 \le I48H5Y \le 18.1$	170	0.37	140
$Q_{500} = 5.41(I48H5Y^{2.448})$	$4.95 \le 48H5Y \le 18.1$	190	0.38	160

[1]Equations were converted from original logarithmic form and regression constants rounded to the same number of significant figures as output by the WREG program (Eng and others, 2009).

[a]Explanatory variable not statistically significant.

3. The regional regression equations developed for this study may not be applicable for estimating peak discharges where stream discharge is substantially affected by regulation from dams, reservoirs, or other structures.

4. Streams in Hawai‘i commonly flow in natural, unmodified channels in their upper reaches, although some streams may flow through developed areas in their lower reaches. Where development has not modified the surface drainage characteristics of a basin, the effects of development likely are small. However, the equations developed for this study may not be reliable for streams with drainage basins containing more than 20 percent of the area affected by combined medium- and high-intensity developments. For streams in highly developed areas, peak discharges can be estimated using other methods (for example, Sauer and others, 1983)

5. Annual peak-discharge data from some gaging stations indicate statistically significant trends over the period of record for the station. For each statistically significant trend, the overall change in annual peak discharges over time was computed from the slope of the Kendall-Theil robust line (see, for example, Helsel and Hirsch, 1992) multiplied by the length of record. For each statistically significant trend, the overall change in annual peak discharges, expressed as a percentage of the 100-year peak discharge for the gaging station, was less than the standard error of prediction from the appropriate regression equation for the 100-year peak discharge. However, the overall change in annual peak discharges, expressed as a percentage of the 2-year peak discharge for the gaging station, in many cases exceeded the standard error of prediction from the appropriate regression equation for the 2-year peak discharge. If consistent and widespread trends are identified in the future, detrending of the data may be necessary to derive peak-discharge estimates that are representative of future conditions.

Confidence in peak-discharge estimates in Hawai‘i can be improved as more data are collected, expanding the database both temporally and spatially, to better characterize peak discharges. Longer periods of record at all gaging stations will tend to reduce time-sampling errors and improve peak-discharge estimates. Also, peak-discharge data are limited in some areas, including much of the Island of Hawai‘i. For regions with limited data, particularly those on the Island of Hawai‘i where regions cover large geographic areas that are hydrologically diverse, peak-discharge estimates from the regression equations may not accurately reflect local conditions and should be used with caution. Establishing additional stream-gaging stations would improve the understanding of the potential for flooding in these areas.

Application of Regression Equations

The regression equations developed for this study can be used to provide peak-discharge estimates for sites on ungaged or gaged streams. For gaged streams, peak-discharge estimates commonly are improved by computing a weighted-average value of two independent estimates. At gaged sites, estimates of peak discharge are available from the at-site station frequency curve, as well as from the appropriate regression equation developed for this study. By weighting each estimate with an appropriate weighting factor, the resulting weighted-average value will represent an improved estimate (Interagency Advisory Committee on Water Data, 1982). At ungaged sites on a stream with a gaging station, peak-discharge estimates from the regression equations for the ungaged site can be combined with peak-discharge estimates from the nearby gaging station to produce improved estimates. Each regression equation is valid within the range of values of the explanatory variables used to develop the equation (table 13). Use of a regression equation beyond its limits will produce peak-discharge estimates with unknown error and should therefore be avoided.

Ungaged Stream

At ungaged sites on a stream without a gaging station, peak-discharge estimates can be produced using the appropriate regional regression equation. For some regions, regression equations may have high standard errors of prediction. For regions where the prediction errors are not acceptable, other methods for estimating peak discharges may be needed.

Gaged Site

For a gaged site, two estimates of peak discharge are available: one from the at-site log-Pearson Type III frequency curve and the other from the appropriate regression equation developed in this study. A theoretically improved estimate can be calculated if the individual estimates are independent and the variances of the individual estimates can be determined. If the independent estimates are weighted inversely proportional to their respective variances, then the variance of the weighted-average estimate will be less than the variances associated with each individual estimate (Tasker, 1975; Interagency Advisory Committee on Water Data, 1982).

For a particular recurrence interval, the variance associated with the at-site frequency-curve estimate of peak discharge can be computed using an expression for the asymptotic variance developed by Cohn and others (2001) and implemented in the Weighted Independent Estimates (WIE) program (Berenbrock and Cohn, 2008) (table 12). The magnitude of the variance associated with the at-site frequency-curve estimate of peak discharge is dependent on the length of record; the mean, standard deviation, and skew of the fitted log-Pearson Type III frequency curve; and the accuracy of the method used to determine the generalized skew (Gotvald and others, 2009).

For a particular recurrence interval, the variance associated with the appropriate regression equation is the average variance of prediction, which can be computed from the standard error of prediction (table 13) using equation 8. An alternative variance associated with the regression equation can

be determined for each gaging station, although the average variance of prediction from all stations is used in this study.

Using the variances from the two independent estimates of peak discharge, the weighted-average estimate is computed from (Gotvald and others, 2009):

$$\log Q_{T_{gw}} = \frac{V_{T_{gr}} \times \log Q_{T_{gs}} + V_{T_{gs}} \times \log Q_{T_{gr}}}{V_{T_{gs}} + V_{T_{gr}}} \qquad (9)$$

where

$Q_{T_{gw}}$ = peak discharge for a T-year recurrence interval at a gaged site, weighted-average value, in ft^3/s,

$Q_{T_{gs}}$ = peak discharge for a T-year recurrence interval at a gaged site, value from the station log-Pearson Type III frequency curve, in ft^3/s,

$Q_{T_{gr}}$ = peak discharge for a T-year recurrence interval at a gaged site, value from the appropriate regression equation, in ft^3/s,

$V_{T_{gs}}$ = variance of prediction of peak discharge for a T-year recurrence interval at a gaged site, value from the station log-Pearson Type III frequency curve, in logarithm units, and

$V_{T_{gr}}$ = average variance of prediction of peak discharge for a T-year recurrence interval for a gaged site, value associated with the appropriate regression equation, in logarithm units.

For this study, weighted-average peak-discharge estimates for gaging stations were computed using the WIE program (Berenbrock and Cohn, 2008) (table 12).

Ungaged Site on a Gaged Stream

For an ungaged site on a stream with a gaging station that has 10 or more years of peak-discharge record, the peak-discharge estimate from the appropriate regression equation for the ungaged site can be combined with the weighted-average peak-discharge estimate and regression equation peak-discharge estimate from the nearby gaging station (see previous section on “Gaged Site”) to produce an improved estimate. Sauer (1974) presented the following equation to improve the peak-discharge estimate for an ungaged site on a stream with a gaging station:

$$Q_{T_{uw}} = \left[\left(\frac{2\left|A_g - A_u\right|}{A_g} \right) + \left(\left(1 - \frac{2\left|A_g - A_u\right|}{A_g} \right) \frac{Q_{T_{gw}}}{Q_{T_{gr}}} \right) \right] Q_{T_{ur}} \qquad (10)$$

where

$Q_{T_{uw}}$ = peak discharge for a T-year recurrence interval at an ungaged site, weighted value, in ft^3/s,

$Q_{T_{ur}}$ = peak discharge for a T-year recurrence interval at an ungaged site, value from the appropriate regression equation, in ft^3/s,

A_g = drainage-basin area associated with gaged site, in mi^2, and

A_u = drainage-basin area associated with the ungaged site, in mi^2.

Equation 10 is applicable if the drainage-basin area associated with the ungaged site is between 50 and 150 percent of the area associated with the gaged site. If the drainage-basin area associated with the ungaged site is less than 50 or greater than 150 percent of the area associated with the gaged site, then no weighting adjustment is applied to the regression estimate for the ungaged site.

Comparison with Previous Estimates

Weighted-average peak-discharge estimates at gaged sites from this study were compared to previously published estimates from Kaua‘i, O‘ahu, Maui, and Hawai‘i (fig. 10). The 100-year peak discharge was used as a basis for comparison. In general, estimated 100-year peak discharges from this study are lower than those from previous studies, which may reflect the longer periods of record used in this study. The previously published estimates for Kaua‘i, Maui, and Hawai‘i are from the 1970s. No comparable published regional estimates for the 100-year peak discharge on Moloka‘i were available.

For Kaua‘i, the 100-year peak discharges from this study were lower than those estimated from existing generalized curves (State of Hawai‘i, 1973) for 33 of 37 gaging stations (fig. 10). The previously published generalized curves for Kaua‘i relate peak discharge to drainage area and were considered useful for general approximations and adequate for preliminary planning (State of Hawai‘i, 1973).

Comparisons between 100-year peak discharges on O‘ahu from this study and those from previous studies (Wong, 1994; City and County of Honolulu, 2000) indicate less scatter than those from other islands, which may reflect the use of more recent data associated with the existing O‘ahu estimates. Wong (1994) used similar methods as this study to develop regional regression equations for O‘ahu, which also may partly account for the reduced scatter (fig. 10). The 100-year peak discharges from this study were lower than those estimated by Wong (1994) for 56 of 67 gaging stations (fig. 10).

For Maui, the 100-year peak discharges from this study were lower than those estimated from existing generalized curves (State of Hawai‘i, 1971) for 36 of 58 gaging stations (fig. 10). The previously published generalized curves for Maui relate peak discharge to drainage area and were considered useful for preliminary planning (State of Hawai‘i, 1971).

For the Island of Hawai‘i, the 100-year peak discharges from this study were lower than those estimated from existing generalized curves for 44 of 47 gaging stations (County of Hawai‘i, 1970) and 35 of 47 stations (State of Hawai‘i, 1970b) (fig. 10). The previously published generalized curves for Hawai‘i relate peak discharge to drainage area and were considered useful for preliminary planning (State of Hawai‘i, 1970b).

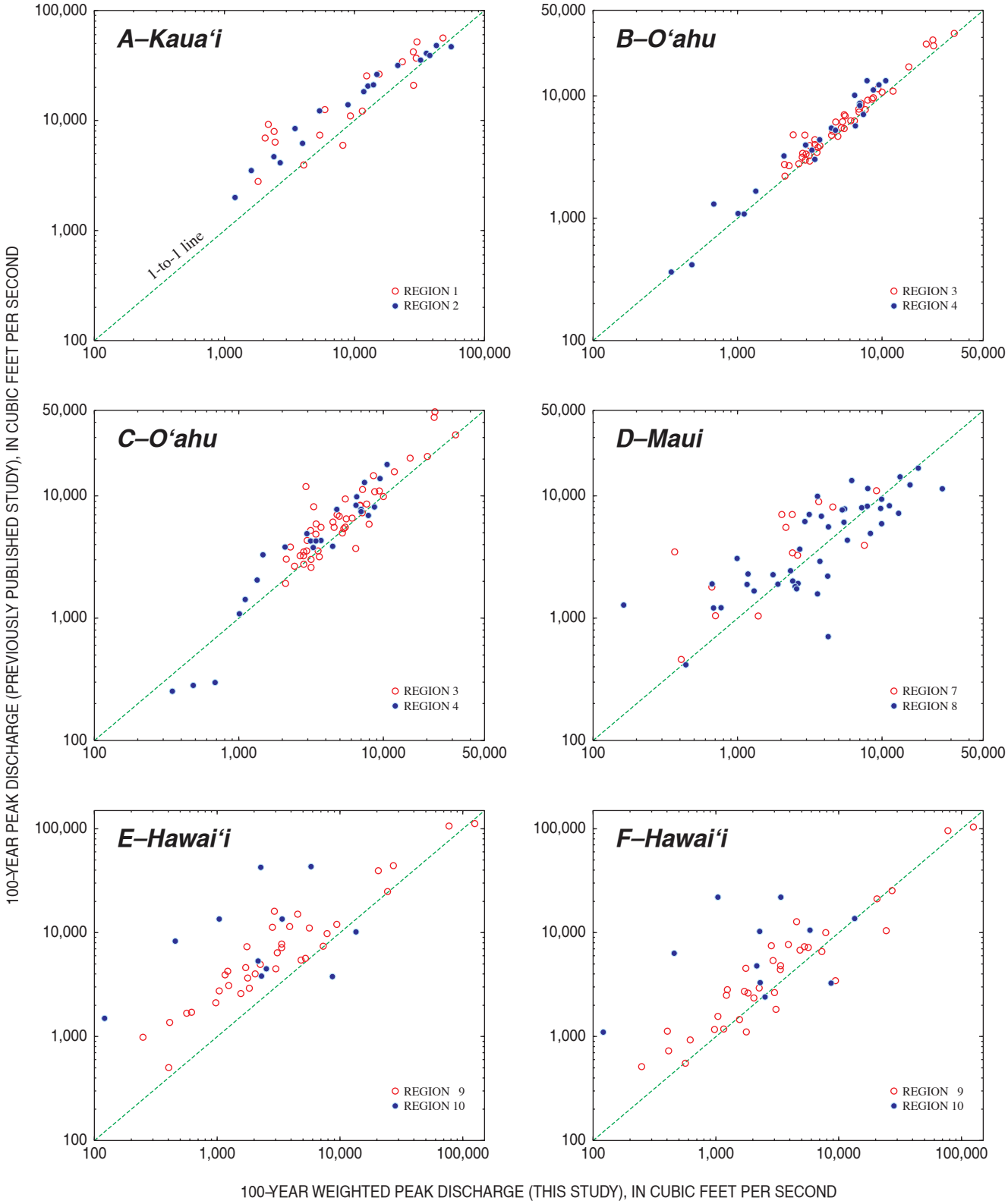

Figure 10. Comparisons between 100-year weighted peak-discharge estimates from this study with previously published 100-year peak-discharge estimates for gaging stations in Hawai‘i. *A*, Kaua‘i (State of Hawai‘i, 1973). *B*, O‘ahu (Wong, 1994). *C*, O‘ahu (City and County of Honolulu, 2000). *D*, Maui (State of Hawai‘i, 1971). *E*, Island of Hawai‘i (County of Hawai‘i, 1970). *F*, Island of Hawai‘i (State of Hawai‘i, 1970b).

Summary

Reliable estimates of the magnitude and frequency of floods for streams in Hawai‘i are necessary for the safe and efficient design of roads, bridges, water-conveyance structures, and flood-control projects, and management of flood plains and flood-prone areas. At sites where streamflow data are unavailable, regionalization techniques can be used to estimate peak-discharge magnitude and frequency. Regional flood-frequency studies commonly are updated every 10 years. However, existing regional flood-frequency studies for many islands in Hawai‘i were done more than 30 years ago and therefore do not take advantage of (1) the additional 30 plus years of data collected, (2) standardized Federal guidelines for computing flood frequencies (Interagency Advisory Committee on Water Data, 1982), (3) new statistical techniques that have become available, and (4) geographic information system (GIS) technology. Considerable uncertainty is associated with existing flood-frequency estimates that were based on limited data, and this uncertainty affects public-safety and engineering decisions.

This study addresses a need to provide a statewide analysis of the magnitude and frequency of peak discharges of streams in Hawai‘i. Annual peak-discharge data collected by the U.S. Geological Survey during and before water year 2008 at continuous-record and crest-stage stream-gaging stations were analyzed. The primary objectives of this study were to (1) provide estimates of the magnitudes of the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak stream discharges at gaged sites on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i using recorded annual peak discharges through water year 2008 and (2) develop regression equations that can be used to estimate the magnitude of the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak stream discharges at ungaged, unregulated sites on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i.

The Interagency Advisory Committee on Water Data estimated a generalized skew of -0.05 for the State of Hawai‘i by averaging the skew coefficients from 30 gaging stations with at least 25 years of record through water year 1973 (Interagency Advisory Committee on Water Data, 1982). For this study, the generalized skew of -0.05 for the State of Hawai‘i was retained, although three methods (skew maps, prediction equations, and arithmetic mean) were used to evaluate whether updated generalized-skew estimates could be developed.

Data from gaging stations with at least 10 years of usable record were used to develop regional regression equations to estimate peak discharges in Hawai‘i for selected recurrence intervals (2, 5, 10, 25, 50, 100, and 500 years). For this study, the generalized-least-squares regression method was used to develop the regional regression equations. Explanatory variables in the regression equations include drainage area, mean annual rainfall, and 48-hour rainfall intensities for 2- or 5-year recurrence intervals. To improve peak-discharge estimates, basins were grouped into two regions on each island (Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i) and separate regression equations were developed for each region. The designated regions on each island generally correspond to wet and dry regions.

The regression equations developed for this study provide peak-discharge estimates based on statistical methods. Thus, these estimates may not accurately reflect conditions in some ungaged basins. The regression equations developed for this study have standard errors of prediction ranging from 16 to 620 percent, and these standard errors generally are greatest for leeward Moloka‘i and southern Hawai‘i. For each region, the largest standard error of prediction is associated with regression equations for either the 2- or 500-year peak discharges, which represent the extremes of the recurrence intervals considered. Standard errors of prediction associated with the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year peak discharges range from 100 to 620 percent for leeward Moloka‘i and from 140 to 190 percent for southern Hawai‘i. These relatively large errors underscore the need to better understand the processes controlling floods in these areas and the need to collect additional peak-discharge data in these areas. Confidence in peak-discharge estimates in Hawai‘i can be improved as more data are collected and the database is expanded, both temporally and spatially. Longer periods of record at all gaging stations will tend to reduce time-sampling errors and improve peak-discharge estimates. Also, peak-discharge data are limited in some areas, including much of the Island of Hawai‘i. Establishing additional stream-gaging stations would improve the understanding of the potential for flooding in these areas.

In general, estimated 100-year peak discharges from this study are lower than those from previous studies, which may reflect the longer periods of record used in this study. The previously published estimates for Kaua‘i, Maui, and Hawai‘i are from the 1970s and were therefore based on limited data.

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Table 4. Periods of record and trends of annual peak-discharge data used in this study, State of Hawai‘i.

[the nonparametric Mann-Kendall test with a 5-percent level of significance was used to determine statistically significant trends; n, number of years of record; blue bold **x** indicates annual peak discharge available and statistically significant upward trend detected for period of record; red italic ***x*** indicates annual peak discharge available and statistically significant downward trend detected for period of record; black x indicates annual peak discharge available; station numbers and years of record also colored (**blue** for upward trend and **red** for downward trend) for records with statistically significant trends]

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Kaua‘i																																																			
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16068000	93							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
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x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
							x	x	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
							x	x	x	x	x				x	x		x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x															
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																								
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																									
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																																				
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
								x	x	x			x	x		x	x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
																																					x	x	x	x	x	x	x	x	x	x	x				
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
O‘ahu																																																			
				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
x	x	x	x	x	x	x	x	x	x	x	x																																								
x																																																			
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																																			
						x					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x				x	x	x
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x				x									x	x	x	x	x
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x																																
			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
									x	x	x	x	x	x	x	x	x	x	x																															
				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
											x	x		x	x	x	x	x	x					x																										
x	x				x	x		x	x	x	x	x	x	x	x		x																															x	x	x
	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					x
x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x					

Table 4. Periods of record and trends of annual peak-discharge data used in this study, State of Hawai‘i—Continued.

[the nonparametric Mann-Kendall test with a 5-percent level of significance was used to determine statistically significant trends; n, number of years of record; blue bold **x** indicates annual peak discharge available and statistically significant upward trend detected for period of record; red italic ***x*** indicates annual peak discharge available and statistically significant downward trend detected for period of record; black x indicates annual peak discharge available; station numbers and years of record also colored (**blue** for upward trend and **red** for downward trend) for records with statistically significant trends]

		Water year																																															
Station no.	n	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
16223000	54																																												x	x	x	x	x
16224500	43																																														x	x	x
16226000	57																					x	x	x	x																						x	x	x
16226200	25																																																
16227000	20																																														x	x	x
16227500	10																																																
16228000	71																		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16228200	39																																																
16228500	11																																																
16228900	33																																																
16229000	92								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16229300	44																																																
16235400	42																																																
16237500	43																																																
16238500	63						x		x	x	x	x	x						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16240500	89						x	x	x	x	x	x	x						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16244000	59																		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16246000	45																		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16247200	11																																																
16247500	43																																																
16247900	35																																																
16248800	39																																																
16249000	11																																																
16249100	45																																																
16254000	49																																																
16260500	39																																																
16265600	13																																																
16270900	30																																																
16275000	68						x	x	x	x	x																					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16278000	27																															x	x		x		x	x	x	x	x	x	x		x	x	x	x
16279500	25																																																
16283000	34																												x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x
16283200	25																																																
16283480	25																																																
16283600	34																																																
16283700	34																																																
16284000	44																													x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x
16284200	33																																																
16291000	13																																																x
16294900	49																																																
16296500	49																																																
16303000	54																																														x	x	x
16304200	42																																																
16304500	16																																																
16310501	19																																																
16325000	38																																																
16330000	50																																																
16331000	40																																																
16340000	47																																																
16343000	15																																																
16345000	49																																																
16350000	50																																																x
Moloka‘i																																																	
16400000	83									x	x	x	x	x	x	x	x			x	x	x	x							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16402000	28												x	x	x	x	x	x		x	x									x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

| Water year | | |

Table 4. Periods of record and trends of annual peak-discharge data used in this study, State of Hawai‘i—Continued.

[the nonparametric Mann-Kendall test with a 5-percent level of significance was used to determine statistically significant trends; n, number of years of record; blue bold **x** indicates annual peak discharge available and statistically significant upward trend detected for period of record; red italic ***x*** indicates annual peak discharge available and statistically significant downward trend detected for period of record; black x indicates annual peak discharge available; station numbers and years of record also colored (**blue** for upward trend and **red** for downward trend) for records with statistically significant trends]

		Water year																																													
Station no.	n	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
16403000	27												x	x	x		x	x	x	x	x									x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16404000	28												x	x	x	x	x	x	x	x	x											x	x								x	x	x	x				x
16404200	28																																															
16405000	27												x	x	x	x	x	x	x	x	x									x	x	x	x	x	x	x			x	x	x	x	x	x	x	x	x	x
16405500	46																																															
16408000	68											x	x	x	x	x	x	x	x	x	x	x	x	x						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16411300	26																																															
16411320	33																																															
16411400	26																																															
16411600	34																																															
16411640	43																																															
16411800	34																																															
16411900	17																																															
16413500	30																																															
16414000	51																																									x	x	x	x	x	x	x
16415000	25																																						x	x	x	x	x	x	x	x	x	x
16415400	44																																															
16416000	25																																							x	x	x	x	x	x	x	x	x
16419000	40																																															
16419500	43																																															
Maui																																																
16500100	45																																															
16500300	41																																															
16500800	46																																															
16501000	53																			x	x			x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16501200	16																																															
16502000	49																			x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16502400	44																																															
16502800	42																																															
16502900	36																																															
16508000	89						x	x						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16510000	40													x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x
16515000	38													x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x		x	x	x	x	x	x
16516000	33						x	x	x						x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x		x	x		x	x	x	x		x	x	x	x	x	x
16517000	34							x	x						x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x			x		x	x	x	x	x	x	x	x	x	x	x
16518000	88						x	x	x						x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16519000	32						x	x							x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x		x	x		x	x	x	x		x	x	x	x	x	x
16520000	34						x	x	x						x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x		x	x	x	x	x	x
16524000	14												x	x	x	x	x								x	x																						
16527000	45							x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x			x	x	x	x	x
16531100	20																																						x	x		x		x	x	x	x	x
16536000	49					x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x		x		x	x		x	x	x	x	x	x	x	x	x	x	x
16543000	15											x	x	x	x	x	x								x	x																						
16545000	56					x		x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16552800	15																																													x	x	x
16554000	11										x	x	x	x	x	x	x		x	x					x	x																						
16555000	31														x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x		x		x	x	x	x	x
16557000	37				x	x		x	x	x		x	x	x	x		x		x		x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x		x	x	x		x	x	x
16565000	35													x	x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x		x	x	x		x	x	x
16566000	25																							x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x
16570000	61					x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16574000	11									x		x	x	x	x	x	x		x	x					x	x																						
16577000	37					x		x	x			x	x	x	x	x	x		x	x	x	x	x	x	x	x		x	x	x	x		x	x	x		x	x	x	x		x	x	x	x	x	x	x
16585000	57				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
16586000	42					x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	x	x	x	x	x	x	x	x
16587000	96		x		x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Water year

1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
x																																																			
x															x	x	x	x	x	x	x	x	x	x	x																										
												x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
x																																																			
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x					
x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x												
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																				x	x	x	x
							x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x											
							x	x	x	x	x	x	x	x		x	x	x	x	x	x	x		x	x																										
								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x										x			x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x								
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																																					
							x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																																				
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x	x		
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x
						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
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x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																															
						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x
								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x		x						x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
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x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Maui

Table 4. Periods of record and trends of annual peak-discharge data used in this study, State of Hawai‘i—Continued.

[the nonparametric Mann-Kendall test with a 5-percent level of significance was used to determine statistically significant trends; n, number of years of record; blue bold **x** indicates annual peak discharge available and statistically significant upward trend detected for period of record; red italic ***x*** indicates annual peak discharge available and statistically significant downward trend detected for period of record; black x indicates annual peak discharge available; station numbers and years of record also colored (**blue** for upward trend and **red** for downward trend) for records with statistically significant trends]

		Water year																																																
Station no.	n	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928	1929	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956
16603700	39																																																
16603800	45																																																
16603850	35																																																
16604500	25																																																
16607000	58																																										x	x	x	x	x	x
16614000	25																																																
16616500	30																																																
16617000	13																															x	x	x	x	x	x	x	x	x	x	x	x					
16618000	62																															x	x	x	x					x	x	x	x	x	x	x	x	x
16619700	44																																																
16620000	91					x	x	x	x	x	x	x			x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16623400	22																																																
16630200	46																																																
16636000	13								x	x	x	x	x	x		x	x		x	x	x	x	x																									
16638500	41																																																
16643300	47																																																
16646200	45																																																
16647500	41																																																
16650500	34																																																
16658500	42																																																
16660000	39																																																
16663500	13																																																
16664000	13																																																
Hawai‘i																																																	
16700000	61																						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16701200	10																																																
16701300	23																																																
16701400	17																																																
16701750	18																																																
16701800	16																																																
16704000	80																				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
16713000	20																																																
16717000	42																																																
16717400	20																																																
16717600	25																																																
16717650	25																																																
16717800	26																																																
16717850	14																																																
16717950	17																																																
16720000	45																																																
16720300	31																																																
16725000	45																																																
16737000	20																														x	x	x	x	x		x	x	x	x	x	x	x	x	x	x		x
16738000	11																														x	x	x	x	x		x	x	x			x	x	x				
16739000	13																														x	x	x	x	x		x	x	x	x	x	x	x	x				
16740000	12																														***x***	***x***	***x***	***x***	***x***		***x***	***x***	***x***	***x***	***x***	***x***		***x***				
16741000	11																															x	x		x		x	x	x	x	x	x	x	x				
16742000	19																															x	x	x	x		x	x	x	x	x	x	x	x				
16752600	27																																																
16755800	34																																																
16756000	10																																																
16756100	11																																																
16756300	25																																																
16756500	45																																																
16757000	24																																							x	x	x	x	x	x	x	x	x
16758000	61																																							x	x	x	x	x	x	x	x	x

Water year

1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
							x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x
						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x
										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x						
																											x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
																											x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
								x	x	x	x			x	x		x	x				x	x	x	x	x	x	x	x	x	x	x	x	x			x		x			x	x	x	x	x	x	x			
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
								x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																								
					x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
			x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x							x	x	x	x	x
			x		x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						x	x	x	x	x
							x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x		x	x		x	x	x	x	x	x	x

Table 4. Periods of record and trends of annual peak-discharge data used in this study, State of Hawai‘i—Continued.

[the nonparametric Mann-Kendall test with a 5-percent level of significance was used to determine statistically significant trends; n, number of years of record; blue bold **x** indicates annual peak discharge available and statistically significant upward trend detected for period of record; red italic ***x*** indicates annual peak discharge available and statistically significant downward trend detected for period of record; black x indicates annual peak discharge available; station numbers and years of record also colored (**blue** for upward trend and **red** for downward trend) for records with statistically significant trends]

| | | Water year | | |

	Water year																																																										
	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
							x	x	x	x	x	x	x	x																								x	x	x	x	x	x	x	x	x	x	x	x	x		
							x	x	x	x	x	x				x	x	x					x			x	x											x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
							x	x	x	x	x	x	x	x	x	x	x	x																																					
						x			x		x	x		x	x	x										x	x												x															
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					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							x															
			x	x	x	x	x	x	x	x	x	x	x																																									
		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																												
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										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x																				
										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																												
										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																						
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x														x							x								
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x	x	x	x	x						x	x	x		x				x	x	x	x	x	x	x	x

	1957	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
							x	x	x	x	x	x	x	x																								x	x	x	x	x	x	x	x	x	x	x	x	x		
							x	x	x	x	x	x				x	x	x					x			x	x											x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
							x	x	x	x	x	x	x	x	x	x	x	x																																			
						x			x		x	x		x	x	x										x	x												x														
				x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																											
					x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x							x														
			x	x	x	x	x	x	x	x	x	x	x																																								
		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																											
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																				
										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x																			
										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																												
										x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x																					
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x														x							x								
							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				x	x	x		x							x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i.

[This large table covers 16 pages and consists of four 4-page spreads—that is, the data for each station appears on a similarly positioned line on 4 separate pages of this table; definitions and units for basin characteristics in table 5])

Station no.	BSLDEM10M	COMPRAT	CSL1085LFP	DRNAREA	ELEV	ELEV10FT	ELEV10FT3D	ELEV85FT	ELEV85FT3D	ELEVMAX	LFPLENGTH	MIN-BELEV
16010000	32.2	2.04	118	3.82	3,867	3,441	3,440	4,076	4,076	4,259	7.20	3414
16013000	39.4	1.91	136	1.75	3,900	3,452	3,452	3,961	3,960	4,263	4.97	3437
16016000	51.9	1.82	292	19.88	3,336	1,116	1,116	3,954	3,954	4,263	12.95	844
16017000	25.9	2.17	101	1.62	4,228	3,903	3,902	4,361	4,360	4,521	6.05	3784
16018000	60.4	2.08	291	11.24	3,285	1,235	1,230	4,262	4,262	4,521	13.89	871
16019000	27.7	1.87	175	2.09	4,337	3,878	3,878	4,509	4,509	4,650	4.81	3828
16028000	56.6	1.71	282	43.68	3,165	633	633	4,243	4,242	4,650	17.07	499
16031000	54.9	1.95	228	57.63	2,759	186	186	4,156	4,152	4,650	23.14	7
16036000	70.6	2.15	348	26.16	2,422	140	126	3,998	3,997	5,243	14.85	20
16049000	67.0	1.70	261	18.46	1,965	298	293	2,275	2,268	4,636	10.10	231
16052500	30.3	1.93	248	6.80	965	110	110	1,571	1,570	2,372	7.85	34
16055000	28.4	1.80	136	18.08	871	269	269	1,450	1,418	3,292	11.24	235
16060000	33.8	1.87	55	23.74	1,146	314	311	959	956	5,225	15.73	251
16063000	60.9	1.84	339	5.34	1,821	680	680	1,969	1,971	5,242	5.08	639
16068000	44.2	1.68	249	6.24	1,242	523	521	1,556	1,556	3,255	5.54	503
16071000	39.8	2.33	146	16.70	1,210	107	107	1,403	1,401	5,242	11.85	30
16071500	32.5	1.68	195	0.75	780	514	514	903	905	1,179	2.68	470
16073500	16.7	1.81	70	3.23	286	40	40	355	355	1,231	6.04	25
16080000	56.8	1.73	275	3.78	1,494	435	435	1,423	1,428	3,257	4.81	385
16081200	53.6	2.11	802	0.41	950	370	370	1,597	1,579	2,116	2.01	346
16084500	39.2	1.65	128	14.14	990	81	82	1,000	1,000	3,257	9.56	18
16085000	9.4	2.29	122	0.91	293	79	78	434	434	566	3.90	78
16089000	39.6	2.09	258	5.45	1,146	357	352	1,831	1,831	2,826	7.65	293
16093200	35.2	2.22	194	9.26	897	70	68	1,717	1,716	2,826	11.35	10
16097000	28.5	1.45	508	1.72	818	400	400	1,304	1,306	2,819	2.38	399
16097500	35.9	1.81	494	1.20	1,041	405	402	1,308	1,301	2,688	2.43	389
16097900	3.5	1.98	58	0.88	321	264	264	365	365	401	2.33	214
16101000	68.2	1.71	509	7.15	2,136	704	702	2,888	2,892	5,125	5.73	621
16103000	62.6	1.84	161	18.50	1,626	108	107	1,501	1,502	5,125	11.51	73
16105000	75.8	2.04	1488	1.90	2,237	712	708	4,279	4,278	4,409	3.20	553
16106000	73.7	1.57	401	6.84	2,287	777	776	2,107	2,105	4,611	4.42	716
16108000	71.4	1.90	610	10.45	3,237	1,112	1,112	4,646	4,643	5,126	7.71	984
16114000	72.6	1.90	995	1.37	1,742	351	349	2,706	2,706	3,312	3.16	178
16115000	79.6	1.83	1033	2.75	2,884	550	549	3,742	3,743	4,252	4.12	446
16116000	97.5	1.67	2242	0.49	2,572	656	657	3,549	3,549	4,044	1.72	447
16117000	82.2	1.63	1987	1.60	2,788	1,140	1,140	4,109	4,109	4,271	1.99	955
16130000	37.5	2.62	451	3.79	2,219	507	504	2,948	2,948	3,668	7.22	230
16200000	57.0	1.94	141	1.38	1,725	1,267	1,240	1,813	1,814	2,567	5.42	1187
16201000	55.8	1.72	216	1.15	1,753	1,238	1,231	1,825	1,824	2,683	3.67	1184
16204000	54.2	2.12	69	4.90	1,523	986	955	1,571	1,561	2,683	11.74	933
16206000	58.1	1.81	131	1.99	1,666	1,162	1,158	1,811	1,788	2,529	6.42	1108
16208000	51.6	2.58	67	4.10	1,423	884	883	1,558	1,558	2,529	13.36	873
16208500	37.8	1.86	132	0.86	1,312	1,057	1,057	1,393	1,389	1,745	3.34	1000
16210500	36.3	2.69	51	39.26	1,247	166	166	1,263	1,265	4,046	29.02	7
16211300	67.3	1.71	513	4.18	1,550	263	263	1,873	1,860	3,976	4.16	179
16211500	62.4	1.89	375	4.20	1,170	55	50	1,257	1,254	3,006	4.28	3
16211600	66.3	1.85	1120	2.28	2,054	1,077	1,077	3,840	3,840	4,024	3.29	957
16211700	64.0	1.97	549	5.21	1,627	243	243	2,742	2,745	4,024	6.07	125
16211800	53.6	1.51	755	3.61	1,594	464	464	2,191	2,191	3,940	3.05	366
16212200	50.5	1.59	601	1.53	1,002	250	250	1,379	1,378	2,884	2.50	207
16212300	48.6	1.55	573	4.05	1,166	58	60	1,662	1,665	3,052	3.73	17
16212500	25.6	1.78	157	11.09	1,011	135	135	1,114	1,114	3,093	8.31	66
16212601	26.6	2.20	83	6.72	1,269	741	741	1,301	1,301	2,897	8.99	689
16212800	61.6	2.02	110	4.28	1,549	800	791	1,649	1,644	2,780	10.35	702
16213000	25.9	2.42	68	45.14	984	99	92	1,335	1,335	3,113	24.32	10
16216000	44.2	1.91	119	25.19	916	46	46	1,241	1,242	2,800	13.41	3
16223000	62.4	2.37	125	6.00	1,018	79	81	1,054	1,054	2,571	10.40	10
16224500	57.3	3.34	213	2.58	1,048	96	96	1,448	1,448	2,806	8.45	13
16226000	67.0	1.88	246	3.43	1,340	402	397	1,399	1,391	2,828	5.38	324
16226200	64.5	2.19	176	4.02	1,220	234	234	1,136	1,129	2,828	6.77	161
16227000	50.9	1.96	138	8.83	919	45	44	970	965	2,828	8.93	18

PERIMMI	RELIEF	RELRELF	SLOP30_10M	SLPFM3D	PERM12IN	PERM24IN	NLCD012122	NLCD01_23	NLCD01_24	NLCD01_31	NLCD01_42	NLCD01_82
14.12	846	60	46.9	116	7.03	7.02	0.0	0.0	0.0	0.0	70.0	0.0
8.94	826	92	58.3	165	6.33	6.33	0.2	0.0	0.0	0.0	75.6	0.0
28.81	3,419	119	64.7	263	3.99	3.94	1.9	0.0	0.0	12.4	59.8	0.0
9.79	737	75	34.7	122	9.43	9.43	0.0	0.0	0.0	0.0	42.2	0.0
24.67	3,650	148	73.7	263	4.54	4.53	0.0	0.0	0.0	9.4	46.4	0.0
9.61	821	85	38.7	161	6.70	6.70	0.0	0.0	0.0	0.0	67.5	0.0
40.17	4,151	103	69.0	236	3.92	3.90	0.9	0.0	0.0	12.1	50.7	0.0
52.41	4,642	89	68.7	195	3.40	3.37	0.9	0.0	0.0	11.6	43.5	0.1
39.04	5,223	134	79.5	306	2.16	2.16	0.6	0.0	0.0	9.4	37.7	0.3
25.92	4,404	170	88.1	422	3.21	3.19	0.0	0.0	0.0	0.2	67.1	0.0
17.85	2,338	131	44.8	287	3.12	3.09	21.8	1.1	0.3	0.2	50.6	1.0
27.13	3,057	113	36.5	257	3.06	3.05	9.9	0.0	0.0	0.6	38.0	16.7
32.38	4,974	154	41.0	185	2.94	2.93	3.5	0.0	0.0	0.3	69.8	4.2
15.08	4,603	305	68.8	901	2.66	2.64	0.0	0.0	0.0	0.0	67.7	0.0
14.89	2,752	185	68.1	420	3.36	3.35	1.0	0.0	0.0	0.0	74.9	0.0
33.82	5,212	154	51.3	438	3.00	3.00	4.1	0.3	0.0	0.0	65.3	7.2
5.15	709	138	48.8	264	1.71	1.71	0.3	0.0	0.0	0.0	68.6	0.0
11.52	1,206	105	18.2	94	3.15	3.13	24.7	1.5	0.0	0.2	32.2	0.6
11.93	2,872	241	70.1	491	3.25	3.25	3.1	0.0	0.0	0.1	60.3	0.0
4.81	1,770	368	79.1	878	3.99	3.99	0.5	0.0	0.0	0.0	74.4	0.4
22.05	3,239	147	52.7	286	3.08	3.08	5.7	0.2	0.0	0.1	52.3	2.3
7.74	489	63	6.1	125	2.29	2.15	19.0	0.0	0.0	1.1	15.4	16.0
17.29	2,533	147	58.7	330	2.39	2.39	0.0	0.0	0.0	0.0	79.3	0.0
23.91	2,816	118	50.7	247	2.46	2.46	0.5	0.0	0.0	0.1	72.2	0.0
6.76	2,419	358	36.0	779	3.92	3.78	3.4	0.0	0.0	0.1	67.8	0.0
7.05	2,299	326	46.5	890	3.60	3.54	0.0	0.0	0.0	0.0	72.3	0.0
6.59	187	28	0.0	78	3.87	3.87	26.1	0.6	0.0	0.0	27.8	32.8
16.19	4,505	278	82.3	754	3.06	3.02	0.2	0.0	0.0	0.1	74.1	0.0
28.00	5,053	180	75.0	423	3.33	3.27	0.7	0.0	0.0	0.1	72.6	0.0
9.99	3,856	386	82.7	1205	3.41	3.41	0.0	0.0	0.0	0.0	59.7	0.0
14.59	3,896	267	84.4	871	3.01	3.01	0.0	0.0	0.0	0.1	77.7	0.0
21.71	4,142	191	77.6	537	5.32	5.32	0.0	0.0	0.0	0.1	61.1	0.0
7.89	3,134	397	92.4	992	2.77	2.77	0.2	0.0	0.0	0.0	72.0	0.0
10.78	3,806	353	89.2	900	3.62	3.62	0.0	0.0	0.0	0.0	75.1	0.0
4.15	3,597	867	96.4	1988	4.00	4.00	0.0	0.0	0.0	0.0	56.6	0.0
7.30	3,317	455	84.3	1612	3.14	3.14	2.4	0.0	0.0	0.2	60.9	0.0
18.07	3,438	190	51.7	468	2.43	2.38	2.4	0.0	0.0	6.9	48.8	0.0
8.07	1,380	171	84.3	232	3.96	3.96	1.5	0.0	0.0	0.0	95.8	0.0
6.55	1,499	229	84.3	398	4.00	4.00	0.4	0.0	0.0	0.0	84.1	0.0
16.60	1,750	105	81.7	129	3.99	3.99	1.5	0.1	0.0	0.0	93.5	0.0
9.07	1,422	157	85.0	215	3.99	3.99	0.4	0.0	0.0	0.0	97.1	0.0
18.52	1,657	89	77.2	121	3.95	3.83	3.4	0.0	0.0	0.0	92.3	0.0
6.10	744	122	56.1	217	3.99	3.97	6.9	0.0	0.0	0.0	80.2	0.0
59.78	4,039	68	49.5	85	3.49	3.34	11.2	3.4	1.7	0.3	58.6	7.8
12.37	3,797	307	87.9	861	3.35	3.35	5.3	0.0	0.0	0.0	86.5	0.1
13.75	3,003	218	71.1	661	1.97	1.72	4.0	0.0	0.0	0.8	60.4	0.0
9.88	3,067	310	82.1	932	3.06	2.89	3.0	0.0	0.0	0.0	91.3	0.0
15.93	3,899	245	71.9	642	2.23	2.05	6.7	0.2	0.0	0.0	80.7	0.0
10.18	3,574	351	60.0	1148	1.99	1.92	5.3	0.0	0.0	0.0	78.4	0.0
7.00	2,677	383	56.6	1018	1.04	0.89	10.7	0.0	0.0	0.0	57.8	0.0
11.05	3,035	275	62.0	798	1.35	1.22	2.7	0.9	0.0	0.0	63.8	0.0
20.97	3,028	144	31.3	306	2.68	2.57	10.1	0.5	0.1	0.0	31.4	28.9
20.18	2,208	109	32.7	198	2.99	2.67	14.6	3.6	4.3	0.0	55.4	14.8
14.81	2,078	140	86.3	195	3.93	3.77	3.2	0.0	0.0	0.0	86.0	0.0
57.69	3,103	54	33.5	106	3.25	3.01	16.2	8.6	3.6	0.0	42.1	16.8
34.07	2,797	82	60.1	203	3.41	3.12	8.3	4.1	1.8	0.1	69.8	0.5
20.59	2,561	124	81.7	240	3.27	3.08	5.1	3.6	1.2	0.0	83.6	0.0
19.03	2,793	147	76.7	330	3.01	2.90	8.4	5.6	1.7	0.0	77.7	0.0
12.37	2,504	202	89.3	435	3.65	3.63	5.2	1.7	0.5	0.0	87.4	0.0
15.57	2,667	171	86.4	372	3.26	3.20	6.1	1.7	0.9	0.0	84.6	0.0
20.64	2,810	136	67.0	298	2.62	2.49	13.9	6.8	5.4	0.9	66.0	0.0

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i—Continued.

[Definitions and units for basin characteristics in table 5]

Station no.	I60M2Y	I60M5Y	I60M10Y	I60M25Y	I60M50Y	I60M100Y	I60M500Y	I06H2Y	I06H5Y	I06H10Y	I06H25Y	I06H50Y	I06H100Y	I06H500Y
16010000	2.537	3.194	3.702	4.374	4.893	5.417	6.682	5.562	7.056	8.153	9.570	10.625	11.668	14.061
16013000	2.376	3.006	3.491	4.133	4.628	5.125	6.318	5.187	6.609	7.656	9.014	10.025	11.025	13.322
16016000	2.031	2.568	2.973	3.505	3.911	4.312	5.263	4.457	5.663	6.529	7.626	8.426	9.204	10.932
16017000	2.560	3.240	3.760	4.452	4.987	5.525	6.816	5.484	6.984	8.087	9.514	10.578	11.629	14.038
16018000	2.105	2.667	3.091	3.648	4.073	4.493	5.489	4.554	5.799	6.697	7.839	8.675	9.489	11.305
16019000	2.702	3.406	3.942	4.649	5.194	5.739	7.044	5.682	7.204	8.306	9.709	10.739	11.743	13.999
16028000	2.022	2.560	2.964	3.493	3.896	4.293	5.231	4.376	5.568	6.423	7.504	8.290	9.052	10.740
16031000	1.901	2.411	2.793	3.289	3.665	4.034	4.900	4.073	5.193	5.994	7.001	7.730	8.434	9.983
16036000	2.166	2.744	3.175	3.735	4.161	4.579	5.563	4.479	5.706	6.581	7.675	8.464	9.219	10.880
16049000	2.248	2.846	3.293	3.877	4.325	4.770	5.832	4.641	5.911	6.822	7.964	8.794	9.589	11.377
16052500	1.629	2.134	2.531	3.072	3.500	3.940	5.044	3.344	4.425	5.245	6.336	7.172	8.011	10.050
16055000	1.825	2.355	2.741	3.254	3.644	4.032	4.964	3.789	4.928	5.736	6.785	7.551	8.297	10.026
16060000	2.245	2.845	3.298	3.899	4.365	4.833	5.960	4.687	5.969	6.901	8.098	8.983	9.852	11.831
16063000	2.824	3.559	4.117	4.863	5.445	6.033	7.454	5.853	7.427	8.574	10.054	11.152	12.242	14.725
16068000	2.294	2.923	3.397	4.027	4.514	5.008	6.209	4.790	6.163	7.174	8.492	9.477	10.464	12.775
16071000	2.358	2.997	3.482	4.127	4.628	5.134	6.361	4.896	6.278	7.294	8.615	9.599	10.581	12.859
16071500	2.031	2.613	3.037	3.585	3.995	4.406	5.378	4.249	5.539	6.472	7.668	8.544	9.417	11.425
16073500	1.811	2.425	2.923	3.625	4.190	4.789	6.327	3.768	5.147	6.271	7.865	9.152	10.513	14.067
16080000	2.179	2.822	3.315	3.985	4.511	5.054	6.420	4.577	6.023	7.128	8.627	9.787	10.986	13.972
16081200	2.013	2.645	3.141	3.837	4.392	4.974	6.465	4.220	5.649	6.782	8.375	9.642	10.976	14.416
16084500	2.065	2.708	3.212	3.916	4.477	5.063	6.564	4.334	5.792	6.941	8.548	9.823	11.162	14.602
16085000	1.921	2.596	3.145	3.926	4.567	5.241	7.005	3.994	5.539	6.809	8.645	10.153	11.766	16.056
16089000	2.199	2.881	3.420	4.177	4.786	5.421	7.068	4.666	6.245	7.497	9.268	10.687	12.187	16.086
16093200	2.109	2.785	3.323	4.082	4.696	5.338	7.007	4.455	6.014	7.263	9.039	10.472	11.991	15.964
16097000	2.474	3.225	3.821	4.648	5.315	6.006	7.794	5.364	7.155	8.574	10.570	12.172	13.856	18.226
16097500	2.393	3.140	3.737	4.569	5.244	5.946	7.775	5.155	6.926	8.341	10.344	11.960	13.669	18.136
16097900	2.065	2.760	3.321	4.105	4.743	5.401	7.113	4.496	6.195	7.581	9.579	11.216	12.963	17.595
16101000	3.027	3.811	4.407	5.201	5.820	6.446	7.974	6.277	7.970	9.205	10.800	11.985	13.160	15.871
16103000	2.859	3.624	4.209	4.999	5.620	6.251	7.817	6.016	7.727	9.008	10.709	12.010	13.324	16.496
16105000	2.818	3.589	4.185	4.995	5.637	6.292	7.931	6.046	7.832	9.193	11.035	12.471	13.939	17.571
16106000	2.825	3.576	4.155	4.932	5.539	6.154	7.663	6.028	7.720	8.981	10.642	11.904	13.170	16.174
16108000	2.914	3.676	4.262	5.037	5.638	6.242	7.696	6.174	7.847	9.070	10.647	11.817	12.970	15.602
16114000	2.644	3.341	3.879	4.592	5.138	5.690	7.010	6.056	7.707	8.916	10.463	11.614	12.742	15.311
16115000	2.710	3.411	3.952	4.670	5.224	5.784	7.142	6.000	7.613	8.797	10.322	11.459	12.580	15.157
16116000	2.129	2.698	3.131	3.702	4.139	4.573	5.609	4.716	6.013	6.957	8.164	9.055	9.928	11.902
16117000	1.981	2.505	2.903	3.424	3.823	4.216	5.149	4.359	5.540	6.393	7.472	8.259	9.025	10.725
16130000	1.464	1.873	2.167	2.541	2.820	3.083	3.686	3.079	3.959	4.571	5.323	5.853	6.354	7.414
16200000	2.987	3.780	4.408	5.274	5.959	6.675	8.496	6.250	8.053	9.448	11.339	12.817	14.336	18.135
16201000	2.995	3.795	4.427	5.297	5.984	6.704	8.535	6.268	8.090	9.496	11.399	12.884	14.412	18.229
16204000	2.691	3.415	3.987	4.776	5.398	6.050	7.699	5.592	7.229	8.494	10.209	11.548	12.927	16.356
16206000	2.969	3.755	4.379	5.239	5.921	6.632	8.438	6.232	8.021	9.406	11.286	12.755	14.264	18.035
16208000	2.600	3.300	3.855	4.623	5.228	5.861	7.461	5.402	6.983	8.208	9.873	11.174	12.511	15.838
16208500	2.124	2.709	3.172	3.815	4.319	4.848	6.172	4.338	5.637	6.647	8.026	9.104	10.215	12.969
16210500	1.980	2.550	2.994	3.597	4.063	4.542	5.705	4.111	5.401	6.386	7.708	8.725	9.748	12.224
16211300	1.811	2.324	2.716	3.234	3.628	4.025	4.966	4.098	5.331	6.249	7.444	8.341	9.229	11.311
16211500	1.733	2.224	2.602	3.106	3.495	3.891	4.853	3.833	4.998	5.882	7.054	7.947	8.852	11.027
16211600	1.887	2.417	2.815	3.341	3.736	4.132	5.060	4.383	5.686	6.653	7.905	8.842	9.767	11.928
16211700	1.808	2.318	2.698	3.202	3.582	3.961	4.850	4.014	5.230	6.145	7.345	8.249	9.156	11.299
16211800	1.779	2.290	2.676	3.184	3.565	3.945	4.822	3.985	5.200	6.103	7.268	8.139	8.989	10.951
16212200	1.659	2.159	2.551	3.075	3.480	3.891	4.879	3.445	4.572	5.433	6.578	7.452	8.321	10.388
16212300	1.531	1.995	2.354	2.833	3.207	3.583	4.497	3.082	4.081	4.839	5.835	6.590	7.342	9.112
16212500	1.611	2.102	2.484	2.996	3.388	3.787	4.741	3.258	4.325	5.128	6.181	6.974	7.751	9.561
16212601	1.714	2.240	2.654	3.209	3.637	4.075	5.126	3.508	4.692	5.598	6.812	7.746	8.680	10.915
16212800	2.886	3.664	4.286	5.136	5.809	6.507	8.262	6.098	7.869	9.244	11.099	12.545	14.020	17.666
16213000	1.897	2.461	2.910	3.519	3.991	4.478	5.672	3.880	5.139	6.109	7.414	8.422	9.439	11.901
16216000	2.204	2.834	3.343	4.040	4.593	5.169	6.604	4.573	5.978	7.074	8.560	9.718	10.899	13.801
16223000	2.277	2.921	3.450	4.184	4.780	5.411	7.012	4.780	6.224	7.366	8.933	10.174	11.457	14.669
16224500	2.116	2.724	3.223	3.919	4.484	5.082	6.597	4.396	5.743	6.813	8.284	9.453	10.664	13.696
16226000	2.363	3.033	3.578	4.336	4.947	5.594	7.239	4.969	6.459	7.635	9.250	10.535	11.867	15.219
16226200	2.303	2.959	3.492	4.232	4.829	5.459	7.058	4.821	6.274	7.418	8.986	10.231	11.519	14.746
16227000	2.134	2.749	3.249	3.943	4.504	5.095	6.587	4.416	5.765	6.825	8.274	9.420	10.603	13.540

I24H2Y	I24H5Y	I24H10Y	I24H25Y	I24H50Y	I24H100Y	I24H500Y	I48H2Y	I48H5Y	I48H10Y	I48H25Y	I48H50Y	I48H100Y	I48H500Y	PRECIP
8.444	10.939	12.871	15.474	17.497	19.556	24.569	12.282	15.829	18.547	22.191	24.994	27.815	34.603	154.214
7.888	10.250	12.086	14.575	16.518	18.500	23.345	11.428	14.749	17.300	20.727	23.370	26.033	32.454	147.751
6.841	8.912	10.479	12.544	14.111	15.676	19.368	9.466	12.345	14.557	17.534	19.833	22.156	27.769	105.428
8.252	10.693	12.605	15.213	17.262	19.361	24.538	11.810	15.229	17.862	21.402	24.138	26.904	33.593	186.040
6.945	9.029	10.622	12.746	14.378	16.020	19.952	9.718	12.604	14.829	17.829	20.151	22.503	28.207	117.129
8.465	10.924	12.837	15.428	17.450	19.510	24.552	12.066	15.514	18.164	21.710	24.446	27.204	33.850	165.535
6.690	8.706	10.235	12.253	13.790	15.326	18.960	9.254	12.039	14.186	17.080	19.321	21.590	27.094	103.809
6.225	8.112	9.536	11.407	12.826	14.239	17.559	8.457	11.025	13.010	15.695	17.779	19.895	25.044	90.150
6.718	8.703	10.214	12.210	13.737	15.262	18.890	9.293	12.024	14.133	16.971	19.170	21.398	26.802	117.019
7.045	9.090	10.630	12.647	14.178	15.695	19.281	9.608	12.458	14.663	17.638	19.954	22.316	28.114	157.449
5.128	6.888	8.261	10.134	11.606	13.120	16.895	6.580	8.802	10.553	12.976	14.900	16.900	21.962	85.813
5.846	7.661	9.032	10.853	12.242	13.627	16.934	7.947	10.367	12.225	14.716	16.648	18.606	23.382	104.626
7.198	9.287	10.901	13.074	14.761	16.471	20.628	9.864	12.744	14.965	17.950	20.264	22.609	28.282	163.013
8.650	11.134	13.085	15.746	17.835	19.980	25.276	12.406	15.983	18.743	22.442	25.305	28.203	35.202	223.594
7.314	9.497	11.181	13.444	15.199	16.978	21.304	10.058	13.256	15.785	19.281	22.064	24.954	32.266	133.531
7.395	9.596	11.302	13.603	15.393	17.212	21.653	10.184	13.330	15.792	19.153	21.800	24.518	31.267	149.781
6.550	8.558	10.066	12.051	13.553	15.044	18.541	8.913	11.889	14.248	17.527	20.147	22.872	29.806	92.149
5.578	7.710	9.444	11.903	13.907	16.025	21.561	7.184	9.778	11.844	14.713	17.006	19.389	25.427	60.518
7.045	9.316	11.094	13.526	15.447	17.425	22.377	10.025	13.377	16.057	19.806	22.825	25.994	34.172	102.748
6.369	8.571	10.340	12.824	14.829	16.936	22.356	8.885	11.976	14.453	17.926	20.728	23.669	31.250	84.951
6.565	8.818	10.618	13.137	15.163	17.285	22.730	9.061	12.197	14.715	18.251	21.106	24.111	31.879	88.045
6.032	8.389	10.308	13.047	15.284	17.663	23.889	7.141	9.772	11.882	14.839	17.218	19.713	26.094	55.479
7.095	9.518	11.470	14.222	16.451	18.799	24.885	9.704	13.080	15.832	19.756	22.974	26.402	35.486	96.918
6.747	9.135	11.065	13.796	16.014	18.358	24.450	9.002	12.173	14.746	18.402	21.388	24.557	32.894	84.861
8.234	11.001	13.229	16.373	18.923	21.602	28.570	10.120	13.611	16.464	20.550	23.911	27.503	37.070	120.807
7.929	10.671	12.886	16.024	18.576	21.269	28.305	10.202	13.732	16.625	20.773	24.192	27.851	37.625	113.853
7.088	9.733	11.893	14.986	17.521	20.214	27.321	8.394	11.465	14.001	17.695	20.767	24.083	33.030	76.765
9.234	11.881	13.954	16.775	18.991	21.262	26.875	12.991	16.808	19.781	23.810	26.964	30.188	38.132	225.865
9.009	11.681	13.788	16.683	18.978	21.344	27.281	12.045	15.751	18.684	22.738	25.968	29.326	37.852	186.778
9.164	11.964	14.189	17.275	19.742	22.304	28.826	12.239	16.028	19.038	23.224	26.571	30.062	38.990	167.460
9.020	11.696	13.812	16.724	19.032	21.414	27.379	12.608	16.357	19.285	23.276	26.410	29.621	37.585	211.671
9.168	11.847	13.955	16.838	19.111	21.446	27.231	13.043	16.785	19.668	23.534	26.521	29.536	36.808	254.155
9.091	11.783	13.911	16.833	19.148	21.534	27.486	12.521	16.122	18.908	22.667	25.577	28.512	35.614	102.727
9.053	11.713	13.788	16.606	18.813	21.072	26.633	13.041	16.787	19.672	23.554	26.552	29.576	36.901	143.116
7.154	9.327	10.997	13.235	14.961	16.705	20.917	9.834	12.799	15.091	18.190	20.593	23.026	28.949	115.092
6.671	8.715	10.260	12.297	13.844	15.389	19.030	9.019	11.806	13.952	16.844	19.081	21.344	26.820	129.206
4.733	6.197	7.275	8.656	9.679	10.670	12.910	6.178	8.123	9.648	11.740	13.387	15.079	19.288	38.690
9.800	12.855	15.260	18.573	21.197	23.914	30.769	12.681	16.452	19.373	23.330	26.432	29.597	37.432	244.838
9.836	12.928	15.355	18.695	21.334	24.070	30.957	12.669	16.480	19.437	23.446	26.590	29.803	37.764	251.996
8.658	11.420	13.597	16.602	18.980	21.446	27.674	11.081	14.430	17.039	20.597	23.400	26.270	33.403	194.488
9.768	12.803	15.196	18.498	21.114	23.819	30.669	12.590	16.304	19.184	23.086	26.148	29.272	37.009	230.520
8.338	10.999	13.105	16.015	18.323	20.716	26.772	10.636	13.833	16.329	19.740	22.431	25.187	32.046	178.662
6.506	8.660	10.374	12.754	14.647	16.621	21.619	8.225	10.768	12.777	15.558	17.775	20.058	25.774	108.567
6.291	8.508	10.240	12.616	14.484	16.403	21.185	7.463	9.994	11.972	14.689	16.828	19.024	24.473	85.495
6.552	8.779	10.495	12.815	14.619	16.456	20.965	6.784	9.252	11.248	14.035	16.259	18.584	24.533	61.977
6.036	8.123	9.758	12.008	13.789	15.631	20.279	6.322	8.711	10.626	13.308	15.459	17.717	23.512	49.779
7.173	9.546	11.361	13.790	15.664	17.556	22.154	7.242	9.670	11.710	14.597	16.903	19.316	25.500	67.663
6.456	8.651	10.353	12.664	14.471	16.315	20.889	6.618	8.977	10.913	13.642	15.822	18.106	23.956	51.795
6.398	8.561	10.207	12.392	14.063	15.736	19.729	6.567	8.898	10.805	13.489	15.635	17.874	23.600	50.866
5.266	7.197	8.694	10.729	12.322	13.945	17.931	5.957	8.227	10.029	12.539	14.544	16.631	21.945	40.508
4.668	6.343	7.646	9.412	10.791	12.194	15.630	5.333	7.453	9.158	11.552	13.488	15.512	20.729	31.921
4.906	6.664	8.001	9.775	11.132	12.486	15.702	5.376	7.450	9.100	11.395	13.230	15.138	19.975	34.529
5.329	7.353	8.925	11.069	12.748	14.465	18.700	6.174	8.449	10.222	12.657	14.569	16.529	21.375	46.407
9.618	12.638	15.020	18.302	20.904	23.594	30.380	11.933	15.491	18.258	22.022	24.983	28.016	35.571	189.716
5.900	8.015	9.669	11.935	13.715	15.542	20.079	6.959	9.346	11.214	13.771	15.784	17.850	22.960	71.701
7.034	9.396	11.254	13.817	15.846	17.946	23.234	8.321	11.073	13.251	16.273	18.685	21.194	27.570	105.397
7.277	9.672	11.558	14.163	16.233	18.382	23.826	8.591	11.488	13.800	17.037	19.645	22.375	29.430	125.989
6.576	8.784	10.528	12.944	14.869	16.869	21.936	7.804	10.494	12.646	15.666	18.102	20.655	27.251	109.915
7.466	9.874	11.772	14.386	16.459	18.605	24.002	9.196	12.190	14.557	17.829	20.436	23.142	30.014	136.125
7.200	9.539	11.381	13.913	15.917	17.990	23.192	8.757	11.653	13.950	17.137	19.684	22.335	29.097	127.866
6.483	8.646	10.348	12.691	14.544	16.461	21.273	7.682	10.309	12.404	15.334	17.686	20.145	26.456	102.736

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i—Continued.

[Definitions and units for basin characteristics in table 5]

Station no.	BSLDEM10M	COMPRAT	CSL1085LFP	DRNAREA	ELEV	ELEV10FT	ELEV10FT3D	ELEV85FT	ELEV85FT3D	ELEVMAX	LFPLENGTH	MIN-BELEV
16227500	70.4	1.72	810	0.92	1,402	716	709	2,052	2,056	2,805	2.22	663
16228000	68.7	1.74	228	2.71	1,202	412	412	1,222	1,222	2,805	4.75	352
16228200	67.1	1.90	195	3.26	1,135	313	312	1,135	1,136	2,805	5.62	234
16228500	60.3	2.16	158	4.15	990	157	157	998	998	2,805	7.09	83
16228900	63.6	1.62	1115	0.57	1,434	861	860	1,883	1,889	2,722	1.23	837
16229000	57.0	1.60	263	2.56	1,190	506	500	1,078	1,082	2,724	2.95	460
16229300	50.4	1.94	171	5.21	918	113	110	881	879	2,724	5.98	50
16235400	37.3	1.86	236	1.30	659	255	255	760	760	1,864	2.85	223
16237500	44.6	2.11	445	1.43	832	132	128	1,386	1,386	2,007	3.76	79
16238500	65.7	1.83	1136	1.12	1,350	338	338	2,192	2,192	3,089	2.18	279
16240500	70.8	1.62	993	1.05	1,225	320	320	1,611	1,617	2,584	1.74	279
16244000	61.1	1.89	578	1.15	1,198	421	422	1,561	1,560	2,487	2.63	353
16246000	63.8	2.09	612	1.05	1,271	441	443	1,611	1,614	2,494	2.55	380
16247200	56.0	2.59	359	1.70	1,019	97	97	1,348	1,348	2,598	4.64	30
16247500	63.3	1.55	685	2.36	1,125	173	173	1,615	1,615	2,602	2.81	113
16247900	61.5	1.66	705	1.27	796	45	47	1,324	1,318	2,370	2.41	19
16248800	38.1	1.73	431	1.28	460	23	23	703	697	2,220	2.09	10
16249000	42.5	1.71	337	2.13	529	36	36	725	721	2,603	2.71	20
16249100	31.3	1.61	804	0.24	465	193	193	769	766	1,430	0.95	148
16254000	44.7	1.73	306	2.03	681	126	127	806	808	2,604	2.97	79
16260500	45.6	1.53	175	5.44	699	28	24	615	618	3,141	4.51	17
16265600	24.6	1.76	743	1.10	443	227	226	1,258	1,256	2,333	1.85	207
16270900	83.8	1.64	1854	0.49	1,200	238	238	1,896	1,908	2,805	1.20	206
16275000	81.3	1.53	1938	0.99	1,087	296	296	2,197	2,211	2,792	1.32	272
16278000	105.8	1.36	3291	0.32	1,331	356	346	2,157	2,177	2,795	0.74	311
16279500	69.7	1.70	800	1.87	910	150	150	1,551	1,557	2,795	2.35	131
16283000	95.6	1.92	2987	0.06	1,110	387	386	1,750	1,749	2,206	0.61	345
16283200	78.5	1.51	1224	0.83	1,005	173	173	1,465	1,473	2,558	1.42	139
16283480	43.4	1.62	524	2.32	507	22	21	1,063	1,071	2,815	2.67	20
16283600	101.6	1.59	3728	0.05	1,512	693	691	1,912	1,921	2,291	0.44	606
16283700	109.9	1.60	4464	0.05	1,607	771	787	2,001	1,998	2,310	0.36	689
16284000	81.5	1.51	1485	0.96	1,101	222	222	1,696	1,693	2,654	1.32	192
16284200	80.9	1.54	1359	0.97	1,092	210	209	1,608	1,629	2,654	1.39	174
16291000	86.2	1.45	1321	1.11	1,228	281	280	1,886	1,875	2,750	1.61	238
16294900	65.5	1.62	528	2.24	876	96	96	1,228	1,222	2,747	2.84	67
16296500	63.2	1.72	231	3.73	859	46	46	857	855	2,671	4.68	23
16303000	63.6	1.62	448	2.78	1,183	267	267	1,372	1,377	2,839	3.30	207
16304200	82.4	2.17	888	1.10	1,884	190	190	2,545	2,545	2,841	3.54	115
16304500	73.2	2.05	737	2.13	1,363	61	62	2,467	2,465	2,841	4.35	17
16310501	45.3	2.07	344	4.06	840	68	68	1,621	1,620	2,117	6.01	24
16325000	51.2	2.25	137	3.15	1,349	670	670	1,666	1,664	2,323	9.67	596
16330000	48.7	2.11	126	9.81	1,126	231	231	1,508	1,505	2,323	13.46	20
16331000	22.9	2.59	162	2.19	768	182	182	951	949	1,221	6.32	32
16340000	47.2	2.33	119	13.87	1,328	246	246	1,792	1,779	2,826	17.16	67
16343000	34.3	2.82	87	14.44	1,234	243	243	1,790	1,788	2,803	23.66	13
16345000	48.1	2.85	90	3.01	1,917	1,180	1,179	2,120	2,119	2,843	14.01	1126
16350000	41.3	4.32	78	5.89	1,367	363	363	1,831	1,831	2,843	25.08	17
16400000	43.1	1.76	487	4.68	2,218	1,109	1,113	2,963	2,968	3,612	5.08	184
16402000	77.7	1.52	676	4.39	2,259	843	830	2,617	2,619	4,946	3.53	702
16403000	73.2	1.51	1908	1.41	2,011	846	841	3,191	3,191	3,614	1.64	774
16404000	95.4	1.53	1600	2.64	2,400	772	771	3,317	3,329	4,931	2.13	641
16404200	98.4	1.48	2289	0.46	2,331	1,112	1,112	3,192	3,179	4,213	1.20	987
16405000	102.7	1.43	2352	1.10	2,290	648	647	3,530	3,535	4,558	1.64	559
16405500	65.7	1.57	1324	2.03	3,329	1,160	1,156	3,990	3,990	4,301	2.85	921
16408000	76.6	1.74	1057	3.78	2,676	447	443	3,928	3,925	4,301	4.39	294
16411300	10.7	1.52	252	0.52	1,197	1,018	1,018	1,257	1,258	1,352	1.27	984
16411320	10.5	2.02	257	1.53	1,031	591	591	1,180	1,179	1,368	3.05	531
16411400	10.6	1.69	236	5.04	894	443	443	1,207	1,207	1,421	4.31	390
16411600	4.2	2.17	187	0.25	505	400	398	620	619	666	1.58	374
16411640	12.6	1.67	281	1.96	588	153	153	877	878	1,059	3.43	63
16411800	13.1	2.78	159	1.54	945	626	625	1,146	1,143	1,518	4.34	591

PERIMMI	RELIEF	RELRELF	SLOP30_10M	SLPFM3D	PERM12IN	PERM24IN	NLCD012122	NLCD01_23	NLCD01_24	NLCD01_31	NLCD01_42	NLCD01_82
5.84	2,142	367	90.3	965	1.14	0.88	0.0	0.0	0.0	0.0	94.2	0.0
10.17	2,453	241	88.4	517	1.78	1.60	2.2	0.0	0.0	0.0	91.3	0.0
12.15	2,571	212	87.6	457	1.69	1.51	2.4	0.1	0.1	0.0	90.5	0.0
15.63	2,722	174	79.6	384	1.70	1.47	4.2	2.5	2.9	0.0	83.0	0.0
4.32	1,884	436	77.3	1438	2.21	2.07	1.5	2.1	0.0	0.0	77.8	0.0
9.06	2,264	250	72.0	752	2.98	2.90	3.5	1.0	0.2	0.0	88.7	0.0
15.71	2,674	170	64.6	440	2.57	2.46	8.0	10.9	4.3	0.0	72.0	0.0
7.51	1,640	219	41.9	499	1.97	1.89	31.2	17.3	1.9	0.0	46.3	0.0
8.96	1,928	215	63.7	511	5.18	5.09	22.3	12.8	1.6	0.0	58.2	0.0
6.89	2,810	408	78.7	1291	3.86	3.86	9.3	0.0	0.0	0.0	80.9	0.0
5.88	2,305	392	86.3	1171	3.87	3.87	3.7	0.1	0.0	0.0	84.1	0.0
7.20	2,134	297	82.4	785	3.72	3.72	10.5	2.2	0.8	0.0	74.7	0.0
7.57	2,114	279	85.3	829	4.47	4.46	4.4	1.7	0.9	0.0	72.6	0.0
11.94	2,569	215	78.6	553	2.34	2.25	6.7	10.0	3.9	0.0	52.3	0.0
8.43	2,490	295	85.1	868	2.74	2.56	3.6	3.0	0.8	0.0	76.4	0.0
6.62	2,351	355	81.6	977	1.89	1.75	3.0	3.6	2.9	0.0	44.9	0.0
6.96	2,210	318	36.1	1058	1.18	1.19	10.1	1.1	0.6	0.0	31.8	20.9
8.85	2,583	292	47.0	952	2.92	2.82	19.8	2.9	0.7	0.0	63.3	1.7
2.80	1,282	459	42.0	1179	3.76	3.52	0.9	0.0	0.0	0.0	99.0	0.0
8.75	2,525	289	56.4	812	3.42	3.41	11.1	0.5	0.0	0.0	72.3	0.6
12.61	3,123	248	52.4	547	3.28	3.27	12.7	1.1	0.2	0.0	68.8	0.3
6.55	2,127	325	27.5	1151	3.51	3.43	43.0	2.5	1.8	0.0	45.7	0.0
4.06	2,599	640	66.3	2128	1.66	1.66	8.5	3.2	1.0	0.0	28.2	0.0
5.39	2,519	467	77.9	1910	1.81	1.81	8.5	1.4	0.3	0.0	32.7	0.0
2.75	2,484	905	91.7	3334	1.14	1.14	0.0	0.0	0.0	0.0	44.6	0.0
8.25	2,664	323	66.1	1133	2.14	2.14	14.2	4.5	0.7	0.0	38.5	0.0
1.63	1,861	1,143	88.8	3045	1.57	1.57	0.0	0.0	0.0	0.0	33.4	0.0
4.87	2,419	497	79.8	1639	1.96	1.96	9.5	1.8	0.0	0.0	30.0	0.0
8.72	2,796	320	47.0	1018	3.02	3.02	25.0	13.4	2.5	0.0	40.3	0.0
1.30	1,685	1,291	99.1	3808	0.46	0.46	0.0	0.0	0.0	0.0	1.5	0.0
1.24	1,621	1,305	99.4	4454	0.09	0.09	0.0	0.0	0.0	0.0	0.2	0.0
5.23	2,462	471	79.4	1865	1.98	1.98	0.0	0.0	0.0	0.0	28.0	0.0
5.37	2,481	462	78.8	1781	1.99	1.99	0.2	0.0	0.0	0.0	28.5	0.0
5.43	2,512	462	88.1	1542	1.88	1.88	3.9	0.0	0.0	0.0	49.8	0.0
8.59	2,680	312	85.8	918	3.40	3.35	6.4	0.0	0.0	0.0	79.5	0.0
11.79	2,647	224	77.7	546	3.48	3.45	4.9	0.0	0.0	0.0	78.7	0.0
9.57	2,631	275	79.1	762	3.54	3.50	2.6	0.0	0.0	0.0	76.0	0.0
8.08	2,727	338	83.0	750	3.70	3.67	5.8	0.0	0.0	0.0	69.6	0.0
10.61	2,824	266	80.7	632	3.46	3.43	4.3	0.0	0.0	0.0	75.1	0.3
14.76	2,093	142	71.8	344	3.45	3.45	5.7	0.0	0.0	0.0	84.8	0.6
14.12	1,727	122	78.7	178	3.99	3.95	2.1	0.0	0.0	0.0	92.1	0.0
23.39	2,303	98	74.9	170	3.82	3.53	3.2	0.0	0.0	0.0	89.5	0.0
13.60	1,189	87	31.6	188	3.81	3.38	9.9	0.0	0.0	0.0	62.2	1.3
30.78	2,759	90	68.1	156	3.80	3.71	3.7	0.0	0.0	0.0	82.3	0.3
37.94	2,790	74	48.1	116	3.53	3.42	5.5	0.1	0.1	0.0	61.2	11.3
17.54	1,716	98	72.0	116	4.00	4.00	3.9	0.0	0.0	0.0	85.3	0.0
37.21	2,825	76	59.7	109	3.58	3.37	7.6	0.0	0.0	0.0	69.8	6.2
13.48	3,428	254	60.2	675	4.89	4.25	0.0	0.0	0.0	0.0	78.1	0.0
11.30	4,245	376	88.8	1198	3.67	3.67	0.0	0.0	0.0	0.0	90.9	0.0
6.35	2,839	447	83.2	1724	3.77	3.66	0.0	0.0	0.0	0.0	95.7	0.0
8.81	4,290	487	97.2	1793	4.05	4.01	0.0	0.0	0.0	0.0	79.6	0.0
3.57	3,226	904	93.4	2625	4.02	4.01	0.0	0.0	0.0	0.0	50.2	0.0
5.31	3,999	754	97.6	2440	4.02	4.01	0.0	0.0	0.0	0.0	88.4	0.0
7.92	3,381	427	70.3	1184	5.15	4.33	0.3	0.0	0.0	0.0	78.7	0.0
12.02	4,007	333	77.9	910	4.49	4.03	0.2	0.0	0.0	0.0	61.4	0.0
3.87	367	95	0.1	282	1.48	1.48	6.3	0.0	0.0	0.0	8.3	0.0
8.82	838	95	1.9	266	1.44	1.44	9.4	0.0	0.0	0.0	4.5	0.0
13.43	1,031	77	2.1	238	1.50	1.49	6.1	0.0	0.0	0.1	3.3	0.0
3.85	292	76	0.0	184	1.30	1.30	9.2	0.0	0.0	0.0	0.0	0.0
8.28	997	120	6.8	269	1.14	1.04	4.8	0.0	0.0	0.4	0.0	0.0
12.23	927	76	11.6	211	2.05	2.06	15.1	0.7	0.0	0.0	16.4	6.5

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i—Continued.

[Definitions and units for basin characteristics in table 5]

Station no.	I60M2Y	I60M5Y	I60M10Y	I60M25Y	I60M50Y	I60M100Y	I60M500Y	I06H2Y	I06H5Y	I06H10Y	I06H25Y	I06H50Y	I06H100Y	I06H500Y
16227500	2.408	3.099	3.650	4.409	5.022	5.662	7.282	5.079	6.589	7.766	9.365	10.633	11.936	15.193
16228000	2.387	3.068	3.615	4.368	4.979	5.618	7.234	5.011	6.495	7.653	9.228	10.476	11.763	14.969
16228200	2.355	3.027	3.567	4.313	4.918	5.552	7.155	4.925	6.386	7.527	9.082	10.315	11.586	14.755
16228500	2.274	2.925	3.451	4.178	4.768	5.387	6.951	4.730	6.146	7.253	8.762	9.957	11.190	14.259
16228900	2.376	3.071	3.625	4.391	5.022	5.671	7.327	4.995	6.469	7.631	9.220	10.486	11.783	15.016
16229000	2.414	3.119	3.682	4.455	5.091	5.747	7.418	5.054	6.554	7.733	9.339	10.620	11.932	15.204
16229300	2.235	2.892	3.420	4.146	4.742	5.359	6.931	4.652	6.053	7.154	8.653	9.848	11.075	14.134
16235400	2.091	2.704	3.192	3.853	4.386	4.932	6.297	4.324	5.628	6.632	7.977	9.035	10.108	12.728
16237500	1.880	2.434	2.878	3.492	3.991	4.506	5.814	3.855	5.040	5.962	7.220	8.215	9.238	11.778
16238500	2.498	3.159	3.683	4.414	5.006	5.623	7.199	5.122	6.556	7.662	9.190	10.396	11.648	14.780
16240500	2.496	3.147	3.671	4.407	5.005	5.629	7.230	5.085	6.506	7.614	9.151	10.373	11.642	14.843
16244000	2.275	2.888	3.388	4.096	4.676	5.285	6.855	4.624	5.957	7.010	8.484	9.665	10.899	14.048
16246000	2.225	2.833	3.331	4.038	4.615	5.224	6.790	4.533	5.858	6.907	8.379	9.561	10.795	13.960
16247200	1.793	2.326	2.771	3.406	3.929	4.482	5.928	3.647	4.801	5.727	7.040	8.105	9.220	12.110
16247500	1.959	2.527	2.985	3.623	4.134	4.666	6.018	3.991	5.226	6.182	7.495	8.528	9.589	12.240
16247900	1.776	2.315	2.755	3.374	3.872	4.396	5.746	3.582	4.746	5.667	6.949	7.974	9.042	11.765
16248800	1.841	2.403	2.849	3.466	3.957	4.460	5.732	3.632	4.821	5.761	7.072	8.124	9.214	11.992
16249000	2.103	2.711	3.195	3.859	4.381	4.915	6.249	4.362	5.704	6.757	8.188	9.309	10.458	13.331
16249100	1.952	2.528	2.983	3.602	4.084	4.570	5.767	3.972	5.220	6.200	7.520	8.549	9.593	12.180
16254000	2.279	2.944	3.477	4.214	4.802	5.407	6.946	4.779	6.267	7.448	9.088	10.396	11.762	15.229
16260500	2.313	2.987	3.530	4.286	4.895	5.525	7.140	4.788	6.270	7.453	9.100	10.420	11.800	15.320
16265600	2.144	2.793	3.325	4.077	4.693	5.341	7.021	4.459	5.848	6.980	8.564	9.847	11.189	14.639
16270900	2.251	2.888	3.384	4.064	4.605	5.158	6.537	4.789	6.170	7.221	8.620	9.705	10.798	13.438
16275000	2.276	2.937	3.465	4.199	4.791	5.411	6.986	4.789	6.243	7.383	8.944	10.188	11.471	14.700
16278000	2.211	2.865	3.387	4.118	4.703	5.321	6.887	4.647	6.098	7.248	8.842	10.120	11.449	14.830
16279500	2.198	2.844	3.362	4.085	4.669	5.283	6.846	4.611	6.033	7.154	8.700	9.940	11.223	14.471
16283000	2.457	3.167	3.743	4.546	5.192	5.877	7.629	5.246	6.860	8.146	9.927	11.356	12.842	16.655
16283200	2.365	3.057	3.616	4.395	5.019	5.680	7.364	5.033	6.599	7.849	9.586	10.978	12.429	16.150
16283480	2.019	2.633	3.120	3.798	4.332	4.893	6.294	4.218	5.582	6.671	8.188	9.397	10.658	13.867
16283600	2.702	3.458	4.072	4.923	5.611	6.338	8.201	5.811	7.539	8.906	10.788	12.291	13.846	17.807
16283700	2.739	3.500	4.119	4.975	5.667	6.398	8.270	5.893	7.637	9.013	10.907	12.416	13.978	17.947
16284000	2.651	3.397	4.003	4.843	5.521	6.237	8.070	5.679	7.380	8.726	10.583	12.066	13.601	17.515
16284200	2.647	3.393	3.998	4.837	5.515	6.231	8.063	5.670	7.369	8.715	10.570	12.051	13.586	17.498
16291000	3.026	3.817	4.431	5.251	5.888	6.526	8.055	6.426	8.203	9.561	11.374	12.760	14.144	17.449
16294900	2.684	3.390	3.941	4.701	5.303	5.916	7.448	5.540	7.111	8.316	9.959	11.244	12.558	15.817
16296500	2.765	3.512	4.099	4.908	5.548	6.210	7.874	5.735	7.405	8.700	10.466	11.852	13.275	16.831
16303000	2.819	3.613	4.239	5.099	5.778	6.486	8.270	5.893	7.679	9.076	10.979	12.474	14.011	17.870
16304200	2.917	3.775	4.453	5.382	6.115	6.881	8.801	6.131	8.062	9.586	11.658	13.293	14.973	19.188
16304500	2.698	3.512	4.155	5.035	5.729	6.452	8.251	5.649	7.466	8.906	10.866	12.414	14.002	17.981
16310501	2.193	2.831	3.334	4.020	4.559	5.115	6.507	4.651	6.116	7.250	8.779	9.961	11.172	14.160
16325000	2.419	3.106	3.643	4.369	4.939	5.527	6.992	5.143	6.732	7.942	9.560	10.805	12.069	15.159
16330000	2.173	2.798	3.286	3.944	4.458	4.985	6.280	4.566	5.994	7.079	8.524	9.630	10.744	13.437
16331000	1.821	2.368	2.793	3.361	3.802	4.249	5.316	3.733	4.956	5.883	7.115	8.053	8.989	11.207
16340000	2.330	2.992	3.509	4.209	4.757	5.320	6.715	4.799	6.303	7.454	9.002	10.202	11.420	14.415
16343000	2.246	2.883	3.379	4.049	4.571	5.107	6.432	4.593	6.027	7.121	8.589	9.723	10.872	13.686
16345000	2.776	3.532	4.129	4.946	5.591	6.264	7.973	5.770	7.489	8.820	10.624	12.032	13.477	17.095
16350000	2.347	3.007	3.525	4.227	4.778	5.345	6.756	4.822	6.315	7.463	9.013	10.217	11.441	14.465
16400000	1.817	2.413	2.896	3.589	4.159	4.760	6.338	3.441	4.523	5.371	6.523	7.425	8.349	10.637
16402000	1.711	2.262	2.712	3.352	3.876	4.429	5.878	3.365	4.428	5.258	6.389	7.272	8.176	10.424
16403000	1.683	2.226	2.670	3.300	3.817	4.362	5.787	3.279	4.316	5.126	6.232	7.095	7.977	10.173
16404000	1.807	2.387	2.860	3.535	4.086	4.673	6.216	3.617	4.751	5.634	6.840	7.782	8.749	11.159
16404200	1.856	2.448	2.934	3.625	4.188	4.790	6.374	3.731	4.894	5.799	7.038	8.002	8.995	11.470
16405000	1.747	2.310	2.771	3.427	3.962	4.530	6.019	3.434	4.522	5.371	6.528	7.431	8.359	10.664
16405500	1.988	2.613	3.126	3.858	4.455	5.095	6.787	4.048	5.292	6.258	7.580	8.609	9.671	12.327
16408000	1.978	2.602	3.114	3.844	4.440	5.079	6.766	4.014	5.249	6.211	7.527	8.552	9.609	12.256
16411300	1.384	1.885	2.317	2.947	3.484	4.064	5.669	2.671	3.660	4.472	5.647	6.617	7.651	10.404
16411320	1.362	1.857	2.283	2.905	3.434	4.004	5.581	2.618	3.591	4.390	5.546	6.499	7.514	10.214
16411400	1.338	1.826	2.244	2.852	3.366	3.919	5.440	2.558	3.508	4.286	5.406	6.324	7.300	9.878
16411600	1.240	1.702	2.097	2.672	3.157	3.676	5.098	2.325	3.215	3.947	5.002	5.868	6.787	9.209
16411640	1.280	1.754	2.162	2.756	3.260	3.801	5.294	2.424	3.347	4.106	5.206	6.112	7.078	9.637
16411800	1.633	2.173	2.619	3.258	3.782	4.338	5.807	3.216	4.240	5.042	6.147	7.010	7.899	10.104

I24H2Y	I24H5Y	I24H10Y	I24H25Y	I24H50Y	I24H100Y	I24H500Y	I48H2Y	I48H5Y	I48H10Y	I48H25Y	I48H50Y	I48H100Y	I48H500Y	PRECIP
7.640	10.057	11.948	14.528	16.558	18.640	23.818	9.317	12.287	14.609	17.783	20.284	22.856	29.256	125.016
7.484	9.867	11.739	14.305	16.333	18.421	23.644	9.142	12.068	14.364	17.514	20.003	22.570	28.990	122.940
7.327	9.674	11.521	14.058	16.067	18.139	23.334	8.909	11.783	14.044	17.155	19.619	22.167	28.565	118.921
6.989	9.258	11.047	13.507	15.457	17.471	22.531	8.348	11.092	13.259	16.254	18.635	21.105	27.341	107.776
7.442	9.841	11.727	14.305	16.343	18.437	23.675	8.841	11.738	14.004	17.126	19.582	22.120	28.414	111.644
7.555	9.980	11.892	14.520	16.603	18.749	24.139	9.068	11.970	14.235	17.338	19.777	22.287	28.494	119.199
6.923	9.183	10.972	13.445	15.412	17.448	22.592	8.340	11.034	13.146	16.051	18.343	20.710	26.606	105.752
6.482	8.569	10.206	12.458	14.229	16.052	20.601	7.879	10.337	12.254	14.875	16.933	19.042	24.259	105.077
5.774	7.672	9.174	11.259	12.914	14.628	18.947	7.088	9.341	11.117	13.564	15.501	17.495	22.479	99.247
7.640	9.915	11.707	14.176	16.126	18.132	23.129	9.928	12.736	14.886	17.754	19.954	22.170	27.451	143.065
7.585	9.846	11.630	14.092	16.039	18.051	23.064	9.916	12.717	14.861	17.725	19.924	22.138	27.417	134.667
6.900	9.026	10.711	13.056	14.920	16.856	21.731	8.874	11.481	13.488	16.197	18.298	20.430	25.590	115.016
6.773	8.882	10.552	12.875	14.721	16.635	21.455	8.470	11.000	12.953	15.597	17.650	19.742	24.830	104.860
5.445	7.294	8.773	10.850	12.518	14.265	18.737	6.636	8.831	10.553	12.929	14.808	16.750	21.596	69.698
5.978	7.938	9.447	11.480	13.052	14.653	18.550	7.113	9.409	11.190	13.614	15.512	17.456	22.246	63.459
5.396	7.226	8.645	10.567	12.066	13.600	17.380	6.466	8.629	10.292	12.534	14.278	16.053	20.399	48.240
5.609	7.428	8.798	10.597	11.949	13.288	16.420	6.839	9.014	10.601	12.617	14.102	15.534	18.761	48.907
6.579	8.687	10.293	12.427	14.060	15.697	19.598	7.572	9.952	11.741	14.085	15.858	17.622	21.745	66.081
5.992	7.952	9.435	11.390	12.875	14.352	17.821	6.822	9.035	10.690	12.849	14.476	16.084	19.796	56.243
7.287	9.626	11.436	13.894	15.802	17.737	22.445	8.357	10.916	12.873	15.487	17.497	19.527	24.392	80.613
7.271	9.616	11.445	13.948	15.907	17.909	22.842	8.474	11.094	13.113	15.841	17.957	20.108	25.336	82.460
6.681	8.931	10.718	13.206	15.191	17.251	22.473	7.670	10.269	12.342	15.244	17.563	19.988	26.169	76.046
7.178	9.371	11.044	13.263	14.969	16.679	20.788	8.415	11.150	13.289	16.212	18.510	20.870	26.700	98.315
7.231	9.551	11.366	13.844	15.792	17.789	22.756	8.728	11.549	13.758	16.769	19.143	21.580	27.633	102.361
7.105	9.417	11.234	13.726	15.688	17.704	22.727	8.594	11.387	13.578	16.562	18.916	21.333	27.342	95.822
6.972	9.245	11.029	13.479	15.411	17.397	22.362	8.404	11.144	13.294	16.226	18.540	20.917	26.822	95.087
8.249	10.906	13.001	15.899	18.204	20.598	26.654	10.129	13.330	15.837	19.262	21.969	24.754	31.743	135.247
7.895	10.450	12.463	15.243	17.448	19.729	25.476	9.698	12.783	15.199	18.496	21.099	23.775	30.473	124.306
6.543	8.707	10.404	12.727	14.548	16.413	21.019	7.845	10.429	12.444	15.181	17.330	19.527	24.944	84.655
9.227	12.132	14.425	17.597	20.124	22.754	29.437	11.180	14.653	17.380	21.113	24.072	27.124	34.828	161.652
9.370	12.308	14.628	17.835	20.389	23.047	29.802	11.330	14.843	17.601	21.380	24.376	27.468	35.279	164.893
9.028	11.886	14.147	17.281	19.781	22.385	29.014	10.985	14.397	17.068	20.721	23.609	26.584	34.067	153.141
9.013	11.867	14.126	17.256	19.754	22.356	28.978	10.969	14.376	17.045	20.692	23.577	26.548	34.020	152.794
10.586	13.715	16.185	19.595	22.298	25.085	32.076	12.895	16.674	19.598	23.549	26.645	29.802	37.618	178.115
8.529	11.073	13.078	15.849	18.042	20.295	25.943	10.889	13.988	16.358	19.513	21.952	24.397	30.263	151.963
8.884	11.636	13.800	16.785	19.149	21.586	27.690	11.536	14.970	17.609	21.144	23.890	26.662	33.395	201.959
9.238	12.220	14.551	17.750	20.269	22.873	29.367	11.940	15.701	18.601	22.503	25.535	28.609	36.104	213.421
9.688	12.964	15.512	18.993	21.713	24.518	31.492	12.590	16.789	20.001	24.311	27.641	31.006	39.128	193.799
8.801	11.854	14.229	17.475	20.012	22.623	29.105	11.493	15.418	18.420	22.449	25.563	28.707	36.273	154.084
6.990	9.482	11.412	14.037	16.087	18.191	23.390	8.499	11.393	13.625	16.639	18.973	21.341	27.112	88.106
7.896	10.618	12.719	15.567	17.792	20.066	25.671	9.722	12.934	15.416	18.750	21.332	23.949	30.326	144.502
6.933	9.374	11.256	13.807	15.796	17.824	22.801	8.526	11.408	13.638	16.637	18.960	21.314	27.041	111.148
5.521	7.604	9.224	11.434	13.164	14.937	19.307	6.519	8.844	10.652	13.082	14.962	16.863	21.460	59.975
7.397	9.960	11.955	14.688	16.834	19.042	24.536	9.215	12.260	14.619	17.798	20.264	22.768	28.872	132.459
7.038	9.454	11.342	13.936	15.976	18.080	23.332	8.448	11.235	13.401	16.341	18.636	20.978	26.723	106.322
9.021	11.949	14.241	17.390	19.869	22.438	28.881	11.621	15.286	18.121	21.937	24.901	27.913	35.273	200.274
7.436	9.979	11.968	14.704	16.857	19.082	24.644	9.137	12.145	14.479	17.633	20.087	22.584	28.686	128.848
5.228	7.035	8.490	10.535	12.186	13.922	18.417	7.180	9.593	11.542	14.293	16.528	18.882	25.046	76.295
5.100	6.857	8.259	10.225	11.806	13.467	17.749	6.848	9.153	11.014	13.632	15.752	17.982	23.791	150.597
5.037	6.775	8.166	10.120	11.694	13.351	17.630	6.895	9.191	11.044	13.651	15.757	17.970	23.712	156.586
5.403	7.246	8.714	10.766	12.417	14.147	18.605	7.275	9.713	11.673	14.435	16.674	19.030	25.183	129.456
5.501	7.370	8.858	10.933	12.601	14.347	18.841	7.302	9.748	11.715	14.490	16.740	19.103	25.279	112.670
5.145	6.920	8.335	10.314	11.904	13.571	17.858	6.804	9.117	10.981	13.611	15.746	17.993	23.863	102.930
5.833	7.788	9.344	11.508	13.245	15.061	19.731	7.568	10.086	12.109	14.956	17.264	19.691	26.025	113.645
5.759	7.695	9.235	11.379	13.100	14.898	19.520	7.384	9.850	11.832	14.621	16.880	19.252	25.435	102.640
3.908	5.462	6.747	8.612	10.164	11.839	16.323	4.778	6.615	8.115	10.258	12.014	13.882	18.783	27.934
3.842	5.376	6.644	8.484	10.015	11.666	16.081	4.701	6.515	7.995	10.111	11.843	13.685	18.513	27.038
3.765	5.267	6.507	8.300	9.788	11.389	15.652	4.627	6.423	7.892	9.990	11.710	13.538	18.333	25.463
3.489	4.916	6.096	7.805	9.223	10.748	14.801	4.213	5.861	7.199	9.098	10.642	12.270	16.482	18.843
3.614	5.085	6.304	8.072	9.543	11.130	15.365	4.362	6.057	7.437	9.401	11.001	12.693	17.089	18.257
4.575	6.146	7.403	9.159	10.571	12.039	15.779	5.557	7.496	9.063	11.262	13.040	14.902	19.690	36.977

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i—Continued.

[Definitions and units for basin characteristics in table 5]

Station no.	BSLDEM10M	COMPRAT	CSL1085LFP	DRNAREA	ELEV	ELEV10FT	ELEV10FT3D	ELEV85FT	ELEV85FT3D	ELEVMAX	LFPLENGTH	MIN-BELEV
16411900	10.2	1.83	153	1.74	533	385	385	703	702	989	2.76	361
16413500	25.2	2.14	226	10.33	1,426	417	417	2,019	2,018	3,158	9.46	289
16414000	40.5	2.41	428	6.62	2,306	587	579	3,606	3,606	4,149	9.42	236
16415000	21.8	1.91	596	0.44	4,067	3,718	3,718	4,354	4,350	4,529	1.41	3647
16415400	73.4	1.88	1026	2.18	2,261	191	191	3,385	3,379	4,930	4.14	35
16416000	43.5	1.86	1363	0.28	2,423	1,622	1,624	2,876	2,876	3,176	1.22	1462
16419000	33.2	2.66	445	0.48	1,008	456	452	1,442	1,441	1,863	2.96	318
16419500	31.3	2.30	279	0.99	1,235	690	690	1,597	1,594	2,165	4.32	653
16500100	36.4	2.83	1414	1.93	4,714	1,271	1,266	7,653	7,651	8,871	6.02	759
16500300	53.0	1.85	702	17.18	5,083	597	597	7,528	7,529	9,762	13.17	74
16500800	44.6	2.39	1411	0.71	1,723	313	314	3,365	3,367	4,009	2.89	116
16501000	53.8	2.00	772	6.84	4,286	1,872	1,872	6,237	6,241	8,092	7.55	1545
16501200	51.9	2.15	712	8.53	3,812	1,099	1,100	5,977	5,975	8,092	9.13	424
16502000	39.5	2.82	1312	0.44	2,715	1,194	1,194	3,763	3,762	4,327	2.61	900
16502400	21.9	2.62	811	0.47	897	211	213	1,883	1,883	2,040	2.75	71
16502800	32.7	3.29	758	0.88	1,806	206	207	2,676	2,676	3,460	4.35	76
16502900	25.9	1.96	703	6.18	2,517	487	480	4,035	4,035	4,977	6.74	159
16508000	29.3	2.20	1012	3.59	4,796	1,795	1,796	6,592	6,586	8,091	6.31	1348
16510000	14.8	2.52	663	0.37	2,058	1,459	1,457	2,520	2,520	2,661	2.14	1349
16515000	16.5	1.86	603	0.39	1,828	1,437	1,437	2,202	2,205	2,354	1.70	1320
16516000	31.2	2.28	970	3.85	4,860	1,794	1,791	6,618	6,617	8,369	6.64	1301
16517000	28.6	2.40	959	3.50	4,380	1,783	1,783	6,476	6,477	8,520	6.53	1340
16518000	32.8	2.49	938	3.64	4,578	1,671	1,664	6,555	6,554	8,851	6.95	1348
16519000	31.7	3.20	685	5.06	6,138	1,831	1,830	7,139	7,140	8,887	10.34	1280
16520000	21.4	2.32	592	0.52	2,040	1,466	1,458	2,545	2,544	2,777	2.45	1302
16524000	29.9	2.55	938	2.54	5,230	3,294	3,293	7,304	7,298	8,333	5.69	2911
16527000	31.2	3.03	872	2.94	4,864	2,306	2,308	7,035	7,035	8,333	7.23	1734
16531100	22.1	2.44	918	0.27	5,159	4,512	4,513	5,745	5,741	6,047	1.78	4321
16536000	28.9	3.85	691	1.21	3,444	1,796	1,796	5,103	5,105	6,047	6.39	1512
16543000	29.0	3.29	760	0.48	4,177	3,111	3,111	5,129	5,126	5,619	3.54	2908
16545000	32.3	2.83	615	2.22	3,043	1,591	1,590	4,686	4,685	5,619	6.71	1334
16552800	26.5	2.24	791	2.50	7,094	4,913	4,910	8,067	8,064	9,329	5.31	4467
16554000	26.1	2.84	750	3.08	6,508	3,467	3,467	7,698	7,693	9,329	7.52	2993
16555000	27.9	3.53	667	3.91	5,747	1,885	1,885	7,175	7,175	9,329	10.58	1297
16557000	27.7	2.20	506	0.47	1,904	1,389	1,387	2,243	2,241	2,505	2.25	1239
16565000	23.0	2.84	483	0.68	2,184	1,506	1,505	2,793	2,794	3,239	3.56	1297
16566000	25.5	2.06	567	0.25	1,672	1,291	1,292	1,959	1,959	2,058	1.57	1239
16570000	21.5	2.77	640	3.69	3,267	1,629	1,628	5,488	5,488	6,762	8.04	1207
16574000	19.6	1.72	736	0.95	3,844	3,135	3,133	4,551	4,552	4,978	2.57	3076
16577000	21.6	2.54	553	2.41	3,143	1,589	1,589	4,121	4,123	4,978	6.11	1316
16585000	17.3	2.65	439	1.34	2,337	1,435	1,433	3,123	3,125	3,508	5.14	1226
16586000	17.1	2.41	468	0.62	1,808	1,343	1,343	2,352	2,351	2,604	2.87	1248
16587000	23.9	2.10	361	0.59	1,788	1,344	1,338	1,994	1,993	2,286	2.42	1199
16603700	18.8	2.64	558	1.10	3,034	2,069	2,068	3,811	3,808	4,324	4.16	1914
16603800	17.3	1.94	708	0.45	2,992	2,598	2,598	3,557	3,557	3,701	1.81	2545
16603850	15.1	3.17	415	18.60	2,577	246	246	6,115	6,117	9,332	18.86	82
16604500	105.9	1.54	643	6.13	2,560	918	913	2,921	2,923	5,785	4.17	782
16607000	100.3	1.85	405	8.11	2,248	358	358	2,396	2,395	5,785	6.71	253
16614000	111.0	1.69	556	4.27	2,654	715	715	2,523	2,527	5,696	4.35	601
16616500	33.0	2.01	1144	0.09	966	641	639	1,329	1,329	1,386	0.80	583
16617000	38.7	2.24	607	0.37	2,196	1,674	1,674	2,498	2,499	3,006	1.81	1595
16618000	68.7	2.08	622	3.40	2,233	535	535	3,106	3,083	4,500	5.46	334
16619700	44.8	2.44	360	1.16	1,099	391	392	1,616	1,618	2,179	4.55	177
16620000	91.5	2.14	754	4.18	3,099	1,033	1,033	4,591	4,593	5,781	6.29	866
16623400	15.8	2.62	406	0.75	497	79	78	992	993	1,318	3.01	24
16630200	54.8	2.48	636	5.74	2,111	303	290	4,363	4,360	5,699	8.54	82
16636000	100.3	2.12	1148	1.57	3,166	1,353	1,345	4,735	4,736	5,709	3.94	1113
16638500	80.2	2.05	777	5.01	2,712	321	316	4,340	4,333	5,784	6.90	128
16643300	83.7	1.91	556	4.14	2,475	446	437	2,759	2,762	5,227	5.57	215
16646200	97.5	2.07	430	4.14	1,971	225	220	1,930	1,928	5,214	5.29	128
16647500	34.2	3.02	775	0.63	1,209	217	218	2,136	2,133	2,533	3.29	30

PERIMMI	RELIEF	RELRELF	SLOP30_10M	SLPFM3D	PERM12IN	PERM24IN	NLCD012122	NLCD01_23	NLCD01_24	NLCD01_31	NLCD01_42	NLCD01_82
8.55	628	73	5.1	227	1.62	1.60	5.3	0.0	0.0	8.3	0.0	6.7
24.36	2,869	118	28.9	275	2.89	2.81	7.2	0.1	0.0	0.0	41.0	4.1
21.96	3,913	178	52.3	416	3.01	2.83	3.7	0.0	0.0	5.1	43.2	0.0
4.49	882	197	18.8	623	7.38	4.91	0.0	0.0	0.0	0.0	100.0	0.0
9.86	4,895	497	87.0	1143	2.11	2.09	0.4	0.0	0.0	5.0	42.7	0.0
3.45	1,714	496	62.8	1386	8.23	5.13	0.0	0.0	0.0	0.0	94.4	0.0
6.52	1,545	237	47.7	519	3.64	3.35	0.5	0.0	0.0	0.0	43.1	0.0
8.14	1,512	186	42.5	351	3.73	3.47	0.1	0.0	0.0	0.0	81.1	0.0
13.92	8,112	583	70.0	1352	6.76	7.56	3.3	0.0	0.0	6.2	19.2	0.0
27.20	9,688	356	71.2	736	6.84	7.74	0.5	0.0	0.0	31.1	2.5	0.0
7.12	3,893	547	77.0	1349	8.23	6.00	0.0	0.0	0.0	0.0	90.9	0.0
18.58	6,547	352	58.8	868	7.41	5.67	0.0	0.0	0.0	0.3	87.8	0.0
22.27	7,668	344	57.9	839	7.37	5.61	0.1	0.0	0.0	0.2	85.9	0.0
6.65	3,427	515	56.0	1313	7.31	5.57	0.0	0.0	0.0	0.0	83.3	0.0
6.36	1,969	309	19.5	717	2.49	2.28	2.9	0.0	0.0	0.0	92.7	0.0
10.90	3,384	310	44.0	773	7.84	6.27	0.8	0.0	0.0	0.0	65.3	0.0
17.26	4,817	279	27.9	710	10.53	7.92	0.4	0.0	0.0	0.0	90.8	0.0
14.76	6,743	457	40.3	1043	10.64	8.01	0.0	0.0	0.0	1.4	88.7	0.0
5.41	1,312	243	0.2	612	9.36	6.55	4.3	0.0	0.0	0.0	94.4	0.0
4.14	1,034	250	4.8	609	8.85	6.31	0.0	0.0	0.0	0.0	99.9	0.0
15.86	7,068	446	50.1	1025	8.72	6.31	0.0	0.0	0.0	3.2	84.8	0.0
15.92	7,181	451	40.4	1100	8.90	6.33	0.0	0.0	0.0	0.6	86.8	0.0
16.86	7,502	445	46.6	1079	8.30	6.05	0.0	0.0	0.0	0.6	83.8	0.0
25.48	7,608	299	40.1	650	9.84	9.67	0.0	0.0	0.0	47.4	41.1	0.0
5.89	1,475	250	17.9	599	8.35	6.06	0.2	0.0	0.0	0.0	96.7	0.0
14.43	5,421	376	36.4	950	6.93	5.46	0.0	0.0	0.0	0.0	93.9	0.0
18.42	6,598	358	37.7	912	6.84	5.34	0.0	0.0	0.0	0.0	91.8	0.0
4.50	1,726	384	10.2	968	7.12	4.83	0.0	0.0	0.0	0.0	100.0	0.0
15.00	4,535	302	33.8	710	7.11	4.82	0.0	0.0	0.0	0.0	98.4	0.0
8.04	2,711	337	34.2	768	8.45	5.18	0.0	0.0	0.0	0.0	100.0	0.0
14.94	4,285	287	42.6	639	7.77	5.00	0.0	0.0	0.0	0.0	97.2	0.0
12.59	4,862	386	31.9	894	9.36	10.69	6.9	0.0	0.1	3.6	36.9	0.0
17.65	6,336	359	30.5	828	9.05	9.63	6.1	0.0	0.1	3.0	48.2	0.0
24.76	8,032	324	32.7	749	8.63	8.61	5.4	0.0	0.1	2.3	58.1	0.0
5.36	1,266	236	37.8	531	5.01	4.27	0.0	0.0	0.0	0.0	94.2	0.0
8.26	1,941	235	24.1	547	6.06	4.55	1.3	0.0	0.0	0.0	98.0	0.0
3.64	819	225	30.6	519	4.98	4.26	0.0	0.0	0.0	0.0	98.8	0.0
18.88	5,555	294	16.0	691	6.45	4.64	1.9	0.0	0.0	0.0	97.2	0.0
5.94	1,903	320	11.2	740	6.26	4.60	2.4	0.0	0.0	0.0	97.6	0.0
14.02	3,662	261	15.9	599	6.48	4.66	1.6	0.0	0.0	0.0	98.0	0.0
10.90	2,281	209	12.1	444	5.87	4.50	0.7	0.0	0.0	0.0	99.3	0.0
6.75	1,356	201	12.0	472	5.87	4.50	0.0	0.0	0.0	0.0	100.0	0.0
5.72	1,088	190	28.5	442	6.62	5.41	0.0	0.0	0.0	0.0	99.5	0.0
9.82	2,410	245	12.5	576	3.58	3.58	17.2	0.3	0.0	0.0	14.8	7.7
4.59	1,156	252	4.7	639	3.27	3.27	1.0	0.0	0.0	0.0	4.1	0.0
48.48	9,250	191	8.1	490	3.14	3.46	16.7	1.3	0.5	0.4	4.9	27.2
13.47	5,003	371	91.5	1154	4.00	4.00	0.3	0.0	0.0	0.0	55.4	0.0
18.70	5,532	296	87.6	794	3.85	3.85	2.7	0.5	0.3	0.0	55.5	1.0
12.37	5,095	412	94.5	1164	4.11	4.05	0.7	0.0	0.0	0.0	23.4	0.0
2.09	802	384	50.4	1008	2.35	2.35	5.6	0.0	0.0	0.0	48.6	0.0
4.86	1,411	290	63.5	768	5.53	4.56	1.9	0.0	0.0	0.0	59.3	0.0
13.61	4,165	306	79.0	690	5.44	4.68	0.1	0.0	0.0	0.0	80.4	0.0
9.33	2,002	215	66.4	440	4.49	4.05	6.7	0.0	0.0	0.2	78.0	0.0
15.55	4,915	316	91.4	768	4.30	4.14	1.5	0.0	0.0	0.0	66.3	0.0
8.05	1,294	161	10.3	430	3.51	3.51	36.7	7.0	0.4	0.0	13.8	35.4
21.07	5,616	267	54.8	658	3.67	3.33	11.0	0.0	0.0	0.0	64.5	13.9
9.45	4,596	487	89.7	1166	3.57	3.57	0.0	0.0	0.0	0.0	54.0	0.0
16.24	5,656	348	78.0	821	2.92	2.91	4.9	0.4	0.2	0.0	63.0	0.5
13.76	5,013	364	81.9	899	3.13	3.12	3.8	0.1	0.0	0.0	39.0	0.2
14.89	5,085	342	92.4	959	1.97	1.96	1.3	0.0	0.0	0.1	48.7	0.0
8.53	2,503	294	46.3	778	1.22	0.97	11.1	0.5	0.0	0.0	1.1	0.0

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i—Continued.

[Definitions and units for basin characteristics in table 5]

Station no.	I60M2Y	I60M5Y	I60M10Y	I60M25Y	I60M50Y	I60M100Y	I60M500Y	I06H2Y	I06H5Y	I06H10Y	I06H25Y	I06H50Y	I06H100Y	I06H500Y
16411900	1.312	1.797	2.201	2.789	3.279	3.814	5.248	2.495	3.407	4.151	5.201	6.048	6.945	9.262
16413500	1.790	2.367	2.842	3.517	4.066	4.652	6.189	3.577	4.698	5.571	6.768	7.697	8.654	11.022
16414000	1.939	2.553	3.051	3.758	4.328	4.938	6.533	3.968	5.202	6.154	7.449	8.450	9.480	12.028
16415000	1.906	2.511	3.006	3.711	4.286	4.902	6.525	3.872	5.072	6.005	7.277	8.271	9.293	11.847
16415400	1.644	2.182	2.619	3.242	3.750	4.288	5.691	3.236	4.275	5.087	6.195	7.062	7.950	10.152
16416000	1.611	2.131	2.556	3.160	3.655	4.175	5.532	3.132	4.128	4.906	5.971	6.804	7.653	9.767
16419000	1.912	2.550	3.064	3.805	4.416	5.055	6.738	3.468	4.555	5.408	6.562	7.462	8.386	10.652
16419500	1.923	2.563	3.079	3.823	4.436	5.079	6.770	3.489	4.580	5.437	6.596	7.500	8.428	10.706
16500100	1.534	2.007	2.388	2.922	3.348	3.797	4.950	2.823	3.771	4.518	5.540	6.347	7.171	9.216
16500300	1.802	2.347	2.787	3.406	3.901	4.422	5.768	3.617	4.790	5.705	6.959	7.945	8.957	11.470
16500800	1.863	2.451	2.951	3.689	4.305	4.988	6.882	4.139	5.505	6.618	8.220	9.539	10.958	14.754
16501000	2.661	3.402	3.998	4.823	5.481	6.170	7.958	6.255	8.043	9.405	11.222	12.621	14.046	17.538
16501200	2.519	3.236	3.818	4.634	5.292	5.989	7.825	5.886	7.606	8.932	10.727	12.127	13.572	17.184
16502000	2.121	2.782	3.343	4.173	4.868	5.641	7.792	4.851	6.408	7.679	9.504	11.005	12.628	16.974
16502400	1.625	2.185	2.668	3.389	4.001	4.673	6.550	3.539	4.794	5.850	7.397	8.673	10.067	13.846
16502800	2.045	2.710	3.269	4.094	4.791	5.553	7.665	4.571	6.083	7.328	9.115	10.593	12.180	16.443
16502900	2.510	3.269	3.897	4.804	5.555	6.370	8.583	5.777	7.550	8.968	10.953	12.560	14.259	18.714
16508000	2.700	3.482	4.111	4.986	5.687	6.419	8.308	6.374	8.227	9.641	11.534	12.998	14.485	18.107
16510000	2.683	3.518	4.199	5.155	5.932	6.747	8.869	6.562	8.522	10.023	12.051	13.623	15.226	19.138
16515000	2.678	3.521	4.210	5.179	5.968	6.794	8.950	6.517	8.474	9.973	12.000	13.572	15.172	19.073
16516000	2.633	3.405	4.026	4.892	5.588	6.315	8.199	6.123	7.930	9.311	11.167	12.608	14.076	17.671
16517000	2.643	3.421	4.045	4.916	5.616	6.345	8.230	6.125	7.937	9.319	11.175	12.615	14.077	17.642
16518000	2.610	3.374	3.983	4.832	5.513	6.220	8.043	5.996	7.769	9.120	10.930	12.335	13.755	17.212
16519000	2.184	2.841	3.371	4.116	4.716	5.344	6.974	4.659	6.110	7.236	8.763	9.962	11.184	14.208
16520000	2.909	3.758	4.430	5.363	6.108	6.876	8.839	6.777	8.736	10.216	12.180	13.687	15.196	18.793
16524000	2.222	2.886	3.422	4.181	4.795	5.442	7.140	5.270	6.884	8.138	9.834	11.176	12.547	15.978
16527000	2.326	3.012	3.561	4.335	4.959	5.614	7.321	5.496	7.154	8.435	10.157	11.511	12.888	16.304
16531100	2.105	2.724	3.215	3.906	4.454	5.027	6.496	5.175	6.725	7.912	9.495	10.732	11.983	15.047
16536000	2.651	3.388	3.960	4.747	5.366	6.005	7.606	6.366	8.168	9.516	11.270	12.608	13.935	17.070
16543000	2.381	3.041	3.551	4.253	4.799	5.362	6.761	6.040	7.737	8.997	10.629	11.865	13.086	15.938
16545000	2.742	3.494	4.072	4.865	5.486	6.125	7.716	6.606	8.448	9.813	11.578	12.912	14.227	17.297
16552800	1.865	2.494	3.036	3.835	4.508	5.239	7.258	3.944	5.353	6.522	8.187	9.573	11.037	14.934
16554000	1.955	2.585	3.116	3.889	4.531	5.221	7.094	4.355	5.815	6.994	8.639	9.981	11.382	15.023
16555000	2.116	2.769	3.307	4.081	4.714	5.389	7.190	4.826	6.363	7.576	9.238	10.570	11.944	15.437
16557000	2.987	3.805	4.428	5.279	5.946	6.628	8.310	6.769	8.659	10.055	11.855	13.209	14.540	17.626
16565000	2.872	3.660	4.263	5.087	5.736	6.403	8.064	6.614	8.464	9.833	11.601	12.936	14.253	17.328
16566000	2.831	3.609	4.200	5.007	5.639	6.287	7.882	6.370	8.150	9.463	11.154	12.424	13.672	16.559
16570000	2.459	3.155	3.695	4.442	5.035	5.649	7.204	5.804	7.475	8.728	10.369	11.625	12.878	15.869
16574000	2.240	2.868	3.351	4.015	4.531	5.061	6.376	5.804	7.438	8.648	10.215	11.399	12.568	15.294
16577000	2.404	3.078	3.596	4.309	4.868	5.445	6.891	5.907	7.578	8.817	10.427	11.647	12.855	15.693
16585000	2.310	2.977	3.488	4.194	4.753	5.331	6.792	5.308	6.851	7.999	9.502	10.648	11.785	14.484
16586000	2.373	3.050	3.568	4.279	4.844	5.421	6.874	5.375	6.917	8.059	9.546	10.674	11.785	14.391
16587000	2.233	2.882	3.379	4.065	4.609	5.165	6.570	5.073	6.547	7.644	9.075	10.163	11.237	13.762
16603700	1.456	1.960	2.372	2.964	3.453	3.978	5.381	3.008	4.083	4.950	6.157	7.138	8.158	10.792
16603800	1.513	2.043	2.477	3.103	3.624	4.185	5.694	3.251	4.412	5.350	6.662	7.734	8.854	11.771
16603850	1.301	1.745	2.104	2.617	3.035	3.476	4.638	2.621	3.557	4.303	5.335	6.163	7.017	9.180
16604500	3.138	3.994	4.656	5.561	6.280	7.033	8.940	5.653	7.285	8.500	10.099	11.306	12.519	15.434
16607000	2.846	3.637	4.250	5.090	5.756	6.454	8.217	5.192	6.722	7.866	9.379	10.525	11.679	14.459
16614000	3.224	4.112	4.800	5.744	6.496	7.283	9.288	5.754	7.419	8.658	10.289	11.515	12.743	15.694
16616500	1.686	2.232	2.657	3.254	3.727	4.217	5.447	3.248	4.337	5.164	6.286	7.139	7.998	10.083
16617000	2.251	2.930	3.464	4.214	4.818	5.455	7.096	4.146	5.433	6.416	7.739	8.752	9.778	12.299
16618000	2.480	3.211	3.787	4.596	5.247	5.938	7.725	4.526	5.894	6.937	8.335	9.407	10.493	13.161
16619700	1.682	2.230	2.669	3.296	3.803	4.345	5.743	3.236	4.279	5.092	6.198	7.061	7.942	10.123
16620000	3.247	4.146	4.850	5.821	6.597	7.410	9.486	5.833	7.499	8.746	10.388	11.629	12.875	15.867
16623400	1.443	1.946	2.351	2.935	3.411	3.922	5.245	2.812	3.780	4.548	5.609	6.447	7.311	9.473
16630200	2.393	3.126	3.713	4.545	5.221	5.941	7.836	4.444	5.837	6.923	8.401	9.559	10.754	13.743
16636000	2.912	3.721	4.349	5.211	5.894	6.605	8.410	5.334	6.881	8.038	9.563	10.720	11.888	14.693
16638500	2.676	3.438	4.031	4.846	5.493	6.168	7.878	4.929	6.388	7.487	8.944	10.053	11.177	13.888
16643300	2.322	2.990	3.513	4.234	4.808	5.409	6.942	4.290	5.586	6.564	7.872	8.874	9.891	12.361
16646200	2.098	2.716	3.202	3.876	4.416	4.989	6.469	3.893	5.103	6.022	7.264	8.227	9.209	11.638
16647500	1.345	1.812	2.178	2.694	3.107	3.547	4.672	2.644	3.591	4.335	5.362	6.174	7.010	9.116

I24H2Y	I24H5Y	I24H10Y	I24H25Y	I24H50Y	I24H100Y	I24H500Y	I48H2Y	I48H5Y	I48H10Y	I48H25Y	I48H50Y	I48H100Y	I48H500Y	PRECIP
3.645	5.092	6.284	7.992	9.399	10.906	14.897	4.663	6.537	8.082	10.309	12.152	14.132	19.397	22.580
5.032	6.745	8.108	9.999	11.514	13.087	17.077	6.162	8.271	9.973	12.361	14.290	16.309	21.507	45.972
5.513	7.384	8.864	10.900	12.523	14.205	18.465	6.848	9.165	11.030	13.655	15.779	18.008	23.803	62.970
5.695	7.615	9.142	11.274	12.986	14.779	19.398	7.605	10.132	12.162	15.027	17.350	19.796	26.189	120.543
4.876	6.582	7.944	9.858	11.399	13.017	17.192	6.463	8.672	10.454	12.967	15.000	17.140	22.707	73.050
4.808	6.477	7.814	9.695	11.210	12.807	16.932	6.476	8.634	10.376	12.820	14.793	16.861	22.197	133.147
5.102	6.878	8.315	10.329	11.957	13.666	18.082	5.936	8.046	9.759	12.189	14.167	16.253	21.700	43.725
5.151	6.939	8.384	10.412	12.050	13.770	18.216	6.145	8.306	10.058	12.541	14.562	16.691	22.253	46.708
4.238	5.807	7.062	8.823	10.239	11.720	15.521	5.389	7.425	9.102	11.531	13.548	15.721	21.596	43.964
5.835	7.863	9.457	11.662	13.411	15.224	19.810	7.193	9.812	11.980	15.138	17.775	20.631	28.419	63.780
7.154	9.641	11.692	14.669	17.143	19.825	27.092	9.764	13.055	15.781	19.763	23.092	26.707	36.546	116.740
11.345	14.815	17.527	21.243	24.181	27.218	34.860	16.340	21.324	25.285	30.785	35.180	39.772	51.533	185.203
10.615	13.922	16.533	20.148	23.033	26.046	33.747	15.213	19.912	23.673	28.933	33.169	37.622	49.158	176.347
8.571	11.472	13.869	17.347	20.244	23.387	31.936	12.172	16.151	19.444	24.224	28.208	32.522	44.276	156.340
5.899	8.112	9.978	12.738	15.059	17.601	24.604	7.171	9.761	11.929	15.117	17.787	20.691	28.620	84.683
7.933	10.679	12.952	16.258	19.013	21.990	30.091	10.493	14.011	16.928	21.189	24.745	28.599	39.124	113.676
10.390	13.725	16.420	20.247	23.372	26.695	35.501	14.715	19.388	23.211	28.712	33.247	38.122	51.258	175.159
11.591	15.048	17.720	21.326	24.140	27.001	34.040	16.283	21.262	25.232	30.788	35.256	39.956	52.184	186.520
11.709	15.087	17.648	21.037	23.638	26.222	32.370	15.346	19.857	23.372	28.154	31.896	35.734	45.273	249.445
11.558	14.874	17.378	20.678	23.200	25.693	31.572	15.015	19.396	22.789	27.367	30.919	34.535	43.398	233.962
10.969	14.283	16.845	20.317	23.034	25.804	32.660	15.156	19.881	23.684	29.054	33.413	38.034	50.221	172.493
10.825	14.088	16.599	19.991	22.637	25.326	31.946	14.593	19.165	22.851	28.071	32.316	36.826	48.753	187.091
10.505	13.690	16.146	19.467	22.062	24.701	31.215	13.947	18.383	21.980	27.106	31.302	35.781	47.739	181.895
7.833	10.391	12.396	15.161	17.356	19.624	25.374	10.134	13.620	16.496	20.671	24.153	27.924	38.239	110.830
11.799	15.208	17.788	21.207	23.827	26.437	32.639	15.312	19.948	23.637	28.784	32.901	37.208	48.268	245.407
9.434	12.502	14.928	18.310	21.020	23.848	31.159	10.819	14.745	18.068	23.021	27.260	31.957	45.299	169.084
9.786	12.912	15.368	18.770	21.479	24.293	31.495	11.373	15.399	18.785	23.799	28.063	32.761	45.982	181.529
9.579	12.638	15.037	18.359	20.999	23.733	30.705	10.315	14.117	17.349	22.185	26.338	30.954	44.130	164.384
11.390	14.776	17.366	20.855	23.556	26.290	32.967	13.247	17.594	21.182	26.383	30.713	35.395	48.159	228.356
11.293	14.674	17.267	20.767	23.480	26.228	32.954	12.145	16.297	19.766	24.859	29.156	33.858	46.958	225.044
11.811	15.268	17.897	21.414	24.120	26.841	33.412	13.653	18.048	21.660	26.863	31.173	35.808	48.340	237.979
6.546	9.084	11.187	14.263	16.834	19.619	27.248	7.932	11.257	14.155	18.609	22.530	26.965	39.992	78.346
7.521	10.230	12.429	15.584	18.175	20.941	28.344	8.715	12.174	15.171	19.733	23.714	28.188	41.195	106.613
8.431	11.294	13.580	16.803	19.411	22.157	29.351	9.696	13.330	16.439	21.109	25.137	29.619	42.457	133.184
11.519	14.824	17.315	20.610	23.117	25.615	31.519	14.067	18.420	21.958	26.979	31.069	35.402	46.765	197.739
11.388	14.679	17.172	20.488	23.027	25.568	31.648	13.399	17.586	20.997	25.858	29.838	34.074	45.309	209.392
10.756	13.832	16.151	19.212	21.539	23.853	29.304	12.492	16.369	19.512	23.971	27.601	31.445	41.529	180.164
10.276	13.373	15.756	18.978	21.488	24.039	30.329	11.567	15.383	18.566	23.197	27.066	31.266	42.783	187.854
11.086	14.411	16.962	20.407	23.080	25.787	32.419	11.359	15.111	18.363	23.154	27.205	31.653	44.097	204.704
10.785	13.990	16.444	19.746	22.304	24.889	31.202	11.744	15.555	18.749	23.387	27.256	31.450	42.940	211.638
9.130	11.842	13.921	16.705	18.861	21.034	26.316	11.057	14.565	17.413	21.479	24.806	28.354	37.771	187.573
9.105	11.756	13.770	16.438	18.483	20.528	25.407	11.190	14.680	17.488	21.471	24.706	28.131	37.091	175.963
8.565	11.088	13.011	15.567	17.533	19.502	24.217	10.714	14.067	16.760	20.571	23.660	26.925	35.436	169.335
4.871	6.719	8.227	10.383	12.155	14.041	19.056	6.386	8.878	10.982	14.098	16.749	19.669	27.874	39.788
5.394	7.425	9.088	11.477	13.449	15.555	21.204	6.905	9.608	11.907	15.335	18.269	21.522	30.754	44.577
4.148	5.717	6.989	8.793	10.262	11.812	15.869	5.448	7.559	9.316	11.887	14.048	16.399	22.876	33.430
8.998	11.869	14.171	17.407	20.023	22.765	29.890	12.481	16.555	19.835	24.464	28.216	32.184	42.575	185.716
8.238	10.903	13.044	16.053	18.487	21.039	27.669	11.515	15.332	18.413	22.766	26.301	30.044	39.864	153.470
9.263	12.214	14.561	17.826	20.440	23.163	30.147	12.635	16.819	20.180	24.913	28.742	32.776	43.280	152.741
5.196	7.044	8.512	10.536	12.142	13.802	17.976	7.310	10.061	12.284	15.450	18.027	20.744	27.805	41.848
6.765	9.012	10.789	13.239	15.186	17.207	22.315	9.494	12.839	15.541	19.372	22.491	25.786	34.410	72.509
7.416	9.836	11.751	14.395	16.501	18.687	24.229	10.160	13.657	16.479	20.476	23.727	27.159	36.141	108.484
5.349	7.205	8.675	10.710	12.329	14.011	18.249	7.127	9.743	11.871	14.910	17.397	20.031	26.966	65.516
9.447	12.493	14.926	18.331	21.069	23.934	31.320	12.614	16.735	20.040	24.685	28.435	32.375	42.587	234.795
4.402	6.086	7.458	9.412	11.003	12.689	17.101	5.487	7.680	9.493	12.111	14.285	16.610	22.818	56.435
7.090	9.563	11.586	14.488	16.879	19.431	26.229	9.303	12.456	15.012	18.638	21.598	24.730	32.955	123.010
8.463	11.202	13.413	16.545	19.092	21.777	28.799	10.851	14.300	17.062	20.927	24.039	27.296	35.682	126.290
7.790	10.362	12.445	15.401	17.810	20.354	27.021	9.865	13.063	15.630	19.232	22.140	25.186	33.047	115.026
6.731	8.981	10.801	13.389	15.502	17.735	23.598	8.674	11.507	13.788	17.006	19.616	22.360	29.508	89.672
6.105	8.174	9.854	12.252	14.220	16.309	21.836	8.157	10.907	13.142	16.324	18.930	21.701	29.045	103.879
4.100	5.676	6.979	8.856	10.415	12.082	16.545	5.352	7.422	9.132	11.617	13.677	15.903	21.893	19.738

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i—Continued.

[Definitions and units for basin characteristics in table 5]

Station no.	BSLDEM10M	COMPRAT	CSL1085LFP	DRNAREA	ELEV	ELEV10FT	ELEV10FT3D	ELEV85FT	ELEV85FT3D	ELEVMAX	LFPLENGTH	MIN-BELEV
16650500	55.7	2.26	240	6.99	1,314	77	75	1,606	1,607	4,613	8.52	36
16658500	28.6	3.55	1324	1.11	6,726	3,653	3,659	8,493	8,496	9,699	4.87	3413
16660000	17.0	2.58	543	15.03	2,902	276	267	6,218	6,225	9,414	14.62	39
16663500	19.3	3.52	614	4.10	2,709	223	222	4,998	4,991	7,127	10.36	20
16664000	17.8	3.16	603	3.90	2,071	181	181	4,274	4,277	6,468	9.05	17
16700000	8.0	3.22	319	19.09	4,919	2,469	2,470	7,299	7,300	8,687	20.20	1940
16701200	7.5	3.22	292	35.15	3,691	717	717	6,827	6,828	8,687	27.89	356
16701300	7.5	3.33	279	36.33	3,582	537	537	6,719	6,719	8,687	29.52	79
16701400	5.9	3.49	204	5.72	1,235	338	338	2,220	2,221	2,722	12.29	169
16701750	17.4	2.02	610	30.33	7,722	4,620	4,620	11,713	11,713	13,758	15.51	4263
16701800	15.8	2.06	528	38.43	7,123	3,993	3,991	11,461	11,462	13,758	18.86	3521
16704000	10.8	2.02	217	220.36	6,433	2,294	2,294	8,901	8,898	13,781	40.63	1081
16713000	11.0	2.09	222	245.48	6,096	1,069	1,069	8,605	8,606	13,781	45.21	15
16717000	11.2	2.55	327	12.04	3,752	1,935	1,935	5,263	5,264	6,241	13.58	1555
16717400	9.9	2.36	322	0.25	528	339	339	775	774	901	1.80	295
16717600	12.4	3.34	269	0.64	1,104	597	597	1,416	1,415	1,831	4.05	499
16717650	10.2	2.85	274	1.22	770	358	357	1,283	1,285	1,732	4.52	205
16717800	17.8	4.03	455	2.82	2,352	754	755	4,192	4,192	4,831	10.07	238
16717850	14.8	3.14	587	0.69	1,941	1,109	1,108	2,873	2,872	3,257	4.01	865
16717950	9.7	3.65	257	5.06	3,840	2,966	2,967	5,224	5,222	6,645	11.71	2699
16720000	17.8	1.75	158	1.54	4,619	4,183	4,183	4,511	4,511	5,336	2.76	4082
16720300	14.3	1.98	500	0.42	4,397	4,142	4,143	4,776	4,776	5,168	1.69	4095
16725000	12.5	1.82	390	0.83	4,292	3,955	3,956	4,614	4,617	4,876	2.26	3890
16737000	17.7	2.80	519	0.76	3,762	2,956	2,957	4,316	4,316	4,595	3.49	2704
16738000	26.3	3.09	539	0.81	3,194	2,446	2,444	4,098	4,096	4,421	4.09	1979
16739000	25.7	3.00	577	0.71	3,204	2,273	2,272	3,922	3,921	4,171	3.81	1955
16740000	22.8	1.94	775	0.14	2,365	2,075	2,076	2,662	2,662	2,738	1.01	2004
16741000	22.8	2.51	718	0.33	2,801	2,178	2,178	3,243	3,243	3,448	1.98	2018
16742000	25.5	2.61	689	0.20	2,531	2,132	2,132	3,014	3,014	3,180	1.71	2009
16752600	13.3	2.92	413	1.44	1,511	557	554	2,157	2,157	2,405	5.18	463
16755800	19.8	3.19	828	0.32	4,094	3,380	3,385	4,935	4,939	5,296	2.50	3187
16756000	18.5	2.31	319	2.39	4,521	3,747	3,747	4,958	4,958	5,493	5.06	3511
16756100	18.5	2.39	335	2.48	4,487	3,624	3,624	4,954	4,954	5,493	5.29	3422
16756300	18.6	2.47	340	2.56	4,453	3,511	3,512	4,944	4,942	5,493	5.62	3270
16756500	19.2	2.35	403	4.42	3,935	2,533	2,533	4,861	4,859	5,493	7.70	2417
16757000	10.3	1.82	327	0.90	3,879	3,594	3,594	4,150	4,151	4,362	2.27	3578
16758000	11.2	1.98	262	1.40	3,783	3,500	3,500	4,101	4,101	4,362	3.07	3471
16759000	15.7	1.86	317	0.46	3,491	3,218	3,215	3,586	3,586	4,081	1.56	3150
16759040	26.7	2.44	601	0.26	3,386	2,957	2,956	3,705	3,685	4,088	1.62	2910
16759060	18.1	2.04	578	49.50	6,440	2,714	2,714	11,165	11,159	13,337	19.47	2503
16759080	15.1	2.19	352	30.53	5,737	3,035	3,036	7,781	7,782	11,314	17.96	2517
16759180	19.4	3.29	913	3.08	3,595	1,319	1,318	6,798	6,799	8,200	8.01	755
16759200	21.3	2.18	891	2.82	5,082	3,517	3,520	7,134	7,133	8,212	5.41	3276
16759300	19.9	1.98	610	8.34	5,387	3,071	3,072	7,226	7,226	8,259	9.09	2582
16759500	19.5	2.16	589	9.02	5,175	2,436	2,433	7,039	7,040	8,259	10.42	1907
16759800	13.7	3.24	601	1.06	4,443	3,303	3,304	5,662	5,662	6,087	5.23	2896
16762000	10.3	2.57	394	2.57	2,231	1,181	1,177	2,906	2,906	3,242	5.86	716
16764000	27.5	2.16	787	1.68	4,273	3,083	3,075	5,431	5,431	5,672	3.99	2954
16765000	9.6	2.90	394	14.86	7,151	4,213	4,214	8,866	8,867	9,597	15.76	2879
16767000	10.9	3.64	464	14.87	7,594	3,147	3,148	10,188	10,189	11,750	20.23	2080
16770000	14.9	3.13	601	8.56	4,881	1,330	1,330	7,114	7,114	8,084	12.83	710
16770500	14.2	3.49	636	1.66	2,556	1,199	1,199	4,137	4,136	4,601	6.16	979

PERIMMI	RELIEF	RELRELF	SLOP30_10M	SLPFM3D	PERM12IN	PERM24IN	NLCD012122	NLCD01_23	NLCD01_24	NLCD01_31	NLCD01_42	NLCD01_82
21.21	4,577	216	48.4	518	4.31	4.23	8.3	0.4	0.1	0.1	31.2	30.3
13.25	6,286	474	40.8	1294	6.94	7.65	7.9	0.1	0.0	32.5	35.7	0.0
35.46	9,375	264	15.9	641	3.20	3.88	9.5	0.0	0.0	2.9	14.7	0.1
25.28	7,107	281	17.3	685	7.84	9.64	8.4	1.2	0.1	0.1	13.4	0.0
22.12	6,451	292	15.5	713	6.91	9.01	8.3	1.7	0.1	0.1	7.0	0.0
49.84	6,747	135	0.1	334	10.70	10.58	1.0	0.0	0.0	11.9	60.9	0.0
67.77	8,331	123	0.1	299	10.10	9.80	3.0	0.3	0.0	6.5	69.2	1.2
71.23	8,608	121	0.1	291	10.01	9.69	4.1	0.7	0.1	6.3	68.4	1.3
29.58	2,552	86	0.0	207	12.05	12.23	26.5	2.6	0.1	0.1	48.0	5.3
39.42	9,494	241	9.3	612	10.83	11.43	1.3	0.0	0.0	13.5	7.2	0.0
45.30	10,237	226	7.4	543	10.84	11.30	1.0	0.0	0.0	10.6	20.0	0.0
106.30	12,700	119	3.6	266	9.97	10.08	1.2	0.0	0.0	24.8	28.1	0.0
116.00	13,766	119	3.9	262	10.10	10.18	1.7	0.1	0.0	22.3	31.5	0.5
31.43	4,686	149	3.9	345	12.99	12.99	0.0	0.0	0.0	0.0	92.9	0.0
4.21	605	144	0.8	335	6.35	6.35	27.1	0.0	0.0	0.0	1.0	2.9
9.45	1,332	141	3.4	329	11.98	11.98	17.6	0.0	0.0	0.6	12.6	2.8
11.16	1,527	137	2.5	338	12.04	12.04	21.8	0.0	0.0	0.5	8.8	38.5
24.01	4,593	191	12.3	455	12.25	12.25	6.5	0.0	0.0	0.0	82.6	2.5
9.23	2,392	259	2.3	597	12.69	12.69	9.9	0.0	0.0	0.0	49.5	0.0
29.13	3,947	135	2.6	337	6.90	6.90	0.8	0.0	0.0	0.0	1.3	0.0
7.69	1,253	163	8.2	269	0.05	0.92	0.0	0.0	0.0	0.0	76.0	0.0
4.56	1,073	235	6.9	582	0.05	0.92	0.0	0.0	0.0	0.0	85.0	0.0
5.88	986	168	3.6	434	0.05	0.92	0.0	0.0	0.0	0.0	95.4	0.0
8.63	1,891	219	11.1	542	3.06	3.70	0.0	0.0	0.0	0.0	85.2	0.0
9.84	2,442	248	25.7	597	4.97	5.45	0.0	0.0	0.0	0.0	86.6	0.0
8.95	2,216	248	23.9	583	5.19	5.65	0.0	0.0	0.0	0.0	86.1	0.0
2.54	733	289	24.0	727	5.53	5.96	0.0	0.0	0.0	0.0	79.5	0.0
5.13	1,431	279	19.3	723	5.53	5.96	0.0	0.0	0.0	0.0	87.9	0.0
4.14	1,171	283	29.6	685	5.53	5.96	0.0	0.0	0.0	0.0	95.2	0.0
12.42	1,942	156	5.7	374	5.78	5.78	6.1	0.0	0.0	0.0	43.7	2.5
6.38	2,108	331	7.4	843	3.81	3.84	0.2	0.0	0.0	0.0	10.6	0.0
12.65	1,982	157	17.0	342	2.04	2.40	0.6	0.0	0.0	0.0	91.1	0.0
13.31	2,071	156	17.1	344	2.10	2.45	0.5	0.0	0.0	0.0	90.0	0.0
14.03	2,223	158	17.6	351	2.19	2.53	0.5	0.0	0.0	0.0	88.2	0.0
17.54	3,076	175	17.0	367	3.02	3.24	2.3	0.1	0.1	0.1	61.5	0.0
6.13	784	128	4.0	345	0.27	1.08	7.4	0.0	0.0	0.0	87.8	0.0
8.31	891	107	6.3	290	0.47	1.23	6.6	0.0	0.0	0.0	88.9	0.0
4.45	931	209	12.4	300	1.90	2.28	1.3	0.0	0.0	0.0	90.2	0.0
4.40	1,178	268	36.2	727	3.33	3.41	19.4	0.0	0.0	0.8	45.1	0.0
50.81	10,834	213	15.3	556	9.52	10.09	1.4	0.0	0.0	16.3	0.0	0.0
42.85	8,798	205	6.8	425	10.58	11.72	4.1	0.0	0.0	1.4	0.2	0.0
20.46	7,445	364	9.6	929	10.04	10.54	4.3	0.1	0.0	0.1	61.6	1.5
13.00	4,936	380	16.5	910	7.65	7.62	0.0	0.0	0.0	0.0	5.3	0.0
20.32	5,677	279	13.6	611	8.62	8.76	0.7	0.0	0.0	2.3	3.9	0.0
22.98	6,351	276	12.7	598	8.73	8.84	0.7	0.0	0.0	2.1	8.3	0.0
11.84	3,191	269	1.5	610	11.84	12.93	3.1	0.0	0.0	0.0	72.6	0.0
14.63	2,525	173	3.0	431	8.21	8.04	12.1	0.0	0.0	0.0	41.0	0.0
9.92	2,718	274	22.7	686	11.24	9.56	0.0	0.0	0.0	0.0	99.9	0.0
39.61	6,718	170	0.9	427	12.37	12.16	0.2	0.0	0.0	52.0	19.4	0.0
49.72	9,670	194	2.2	478	15.77	15.50	0.1	0.0	0.0	62.4	18.1	0.0
32.46	7,374	227	5.0	575	9.07	8.18	1.8	0.0	0.0	0.0	58.3	8.2
15.92	3,622	228	2.0	590	6.74	5.95	6.4	0.0	0.0	0.0	46.6	14.2

Table 6. Basin characteristics associated with the drainage basins of stream-gaging stations, State of Hawai‘i—Continued.

[Definitions and units for basin characteristics in table 5]

Station no.	I60M2Y	I60M5Y	I60M10Y	I60M25Y	I60M50Y	I60M100Y	I60M500Y	I06H2Y	I06H5Y	I06H10Y	I06H25Y	I06H50Y	I06H100Y	I06H500Y
16650500	1.799	2.371	2.811	3.421	3.906	4.420	5.720	3.441	4.583	5.457	6.645	7.566	8.510	10.848
16658500	1.467	1.910	2.268	2.773	3.180	3.606	4.708	2.785	3.698	4.419	5.406	6.186	6.979	8.947
16660000	1.207	1.586	1.884	2.301	2.629	2.967	3.817	2.290	3.062	3.667	4.486	5.126	5.772	7.338
16663500	1.306	1.706	2.019	2.444	2.775	3.117	3.952	2.467	3.277	3.908	4.748	5.397	6.048	7.611
16664000	1.289	1.688	2.000	2.424	2.754	3.094	3.923	2.398	3.194	3.815	4.645	5.287	5.931	7.481
16700000	2.181	2.712	3.089	3.551	3.886	4.200	4.889	5.036	6.480	7.560	8.949	9.994	11.031	13.445
16701200	2.349	2.906	3.306	3.801	4.161	4.501	5.255	5.475	7.010	8.159	9.652	10.780	11.904	14.534
16701300	2.344	2.901	3.301	3.796	4.157	4.497	5.252	5.470	7.002	8.152	9.644	10.774	11.899	14.534
16701400	2.466	3.041	3.459	3.986	4.374	4.746	5.580	5.892	7.504	8.721	10.328	11.558	12.793	15.718
16701750	1.768	2.207	2.507	2.872	3.126	3.363	3.857	3.863	5.023	5.897	7.026	7.884	8.748	10.802
16701800	1.866	2.323	2.636	3.017	3.284	3.533	4.054	4.120	5.337	6.253	7.434	8.330	9.231	11.366
16704000	1.855	2.306	2.629	3.030	3.322	3.602	4.232	4.129	5.340	6.265	7.483	8.425	9.387	11.736
16713000	1.911	2.374	2.705	3.117	3.417	3.705	4.351	4.280	5.525	6.475	7.726	8.692	9.677	12.075
16717000	2.601	3.198	3.626	4.159	4.551	4.926	5.769	6.101	7.758	9.008	10.652	11.912	13.179	16.186
16717400	2.352	2.912	3.316	3.830	4.209	4.568	5.385	5.595	7.144	8.321	9.893	11.106	12.323	15.242
16717600	2.391	2.957	3.366	3.876	4.255	4.622	5.448	5.835	7.435	8.649	10.259	11.495	12.744	15.715
16717650	2.244	2.781	3.169	3.651	4.011	4.359	5.138	5.434	6.937	8.079	9.596	10.765	11.950	14.772
16717800	2.432	2.981	3.369	3.848	4.200	4.531	5.266	5.730	7.261	8.430	9.985	11.186	12.405	15.331
16717850	2.201	2.729	3.117	3.611	3.983	4.338	5.166	5.020	6.446	7.581	9.149	10.409	11.730	15.097
16717950	1.391	1.793	2.084	2.476	2.771	3.061	3.754	2.925	3.866	4.629	5.720	6.624	7.592	10.164
16720000	2.283	2.860	3.292	3.863	4.292	4.728	5.753	4.773	6.118	7.222	8.804	10.127	11.539	15.321
16720300	2.224	2.786	3.206	3.758	4.170	4.586	5.551	4.665	5.979	7.053	8.593	9.880	11.247	14.892
16725000	2.167	2.719	3.131	3.673	4.077	4.486	5.430	4.575	5.870	6.928	8.448	9.717	11.067	14.670
16737000	2.753	3.419	3.920	4.585	5.093	5.611	6.864	5.704	7.261	8.544	10.385	11.926	13.584	18.063
16738000	2.807	3.481	3.991	4.667	5.189	5.720	7.016	5.792	7.368	8.670	10.539	12.105	13.794	18.366
16739000	2.816	3.493	4.005	4.685	5.210	5.744	7.048	5.798	7.377	8.682	10.553	12.119	13.809	18.380
16740000	2.739	3.393	3.891	4.554	5.069	5.593	6.881	5.625	7.151	8.419	10.234	11.757	13.402	17.865
16741000	2.826	3.501	4.014	4.697	5.225	5.763	7.082	5.802	7.377	8.681	10.548	12.113	13.802	18.376
16742000	2.791	3.458	3.965	4.641	5.165	5.697	7.006	5.729	7.280	8.568	10.409	11.951	13.617	18.129
16752600	1.302	1.638	1.901	2.269	2.564	2.863	3.632	2.654	3.417	4.065	5.003	5.802	6.682	9.112
16755800	1.745	2.217	2.575	3.048	3.411	3.778	4.656	3.681	4.783	5.693	6.997	8.090	9.264	12.430
16756000	1.946	2.457	2.840	3.347	3.729	4.116	5.020	4.128	5.330	6.318	7.740	8.927	10.197	13.607
16756100	1.937	2.447	2.829	3.334	3.715	4.102	5.004	4.111	5.310	6.295	7.713	8.898	10.165	13.568
16756300	1.926	2.434	2.814	3.317	3.697	4.082	4.981	4.089	5.282	6.264	7.676	8.856	10.119	13.511
16756500	1.725	2.192	2.543	3.007	3.359	3.717	4.552	3.666	4.762	5.666	6.971	8.063	9.233	12.386
16757000	2.080	2.616	3.015	3.543	3.940	4.342	5.271	4.437	5.707	6.747	8.244	9.493	10.828	14.417
16758000	2.010	2.535	2.926	3.443	3.834	4.232	5.159	4.296	5.538	6.559	8.028	9.257	10.574	14.124
16759000	1.824	2.322	2.694	3.189	3.570	3.960	4.893	3.929	5.112	6.093	7.508	8.697	9.982	13.475
16759040	1.666	2.148	2.508	2.989	3.357	3.733	4.631	3.631	4.775	5.734	7.110	8.267	9.521	12.920
16759060	0.908	1.199	1.413	1.694	1.901	2.102	2.542	1.824	2.488	3.034	3.815	4.454	5.134	6.896
16759080	0.956	1.234	1.442	1.712	1.915	2.115	2.574	1.884	2.528	3.060	3.815	4.435	5.102	6.855
16759180	1.496	1.812	2.045	2.342	2.560	2.770	3.250	2.746	3.402	3.939	4.695	5.306	5.949	7.621
16759200	1.325	1.623	1.842	2.122	2.327	2.523	2.959	2.402	3.012	3.511	4.218	4.790	5.387	6.931
16759300	1.304	1.605	1.827	2.112	2.322	2.523	2.970	2.358	2.971	3.474	4.189	4.767	5.374	6.944
16759500	1.319	1.620	1.842	2.126	2.335	2.535	2.981	2.387	3.001	3.504	4.218	4.796	5.402	6.969
16759800	1.282	1.615	1.867	2.199	2.445	2.683	3.234	2.246	2.914	3.458	4.239	4.876	5.548	7.303
16762000	2.031	2.619	3.054	3.589	3.985	4.361	5.211	4.471	5.922	7.037	8.530	9.694	10.880	13.793
16764000	2.289	2.935	3.413	4.024	4.480	4.926	5.976	5.336	7.020	8.314	10.046	11.404	12.795	16.243
16765000	1.573	2.051	2.405	2.865	3.208	3.541	4.310	3.356	4.489	5.372	6.578	7.531	8.514	10.955
16767000	1.478	1.934	2.273	2.715	3.043	3.362	4.096	3.151	4.230	5.071	6.220	7.125	8.057	10.361
16770000	2.037	2.631	3.070	3.652	4.087	4.521	5.552	4.901	6.471	7.671	9.278	10.524	11.799	14.889
16770500	2.148	2.772	3.232	3.848	4.311	4.778	5.893	5.355	7.050	8.336	10.049	11.374	12.725	15.949

I24H2Y	I24H5Y	I24H10Y	I24H25Y	I24H50Y	I24H100Y	I24H500Y	I48H2Y	I48H5Y	I48H10Y	I48H25Y	I48H50Y	I48H100Y	I48H500Y	PRECIP
5.369	7.267	8.815	11.030	12.843	14.777	19.883	7.355	10.038	12.248	15.425	18.050	20.875	28.447	46.624
4.284	5.831	7.071	8.804	10.199	11.657	15.400	5.566	7.599	9.259	11.641	13.606	15.709	21.345	41.686
3.491	4.780	5.812	7.246	8.396	9.588	12.611	4.264	5.872	7.173	9.016	10.513	12.091	16.191	25.988
3.766	5.112	6.185	7.667	8.850	10.071	13.146	4.741	6.450	7.813	9.719	11.248	12.846	16.906	27.342
3.626	4.941	5.992	7.449	8.615	9.822	12.871	4.476	6.122	7.439	9.289	10.775	12.333	16.307	24.187
8.964	11.763	13.919	16.809	19.041	21.288	26.718	11.852	15.551	18.460	22.469	25.644	28.926	37.185	133.439
9.723	12.660	14.937	18.014	20.406	22.830	28.730	12.939	16.806	19.845	24.017	27.308	30.694	39.149	155.062
9.712	12.643	14.918	17.995	20.387	22.813	28.725	12.926	16.786	19.819	23.983	27.269	30.648	39.085	154.910
10.394	13.405	15.777	19.036	21.606	24.246	30.785	13.884	17.801	20.884	25.104	28.424	31.826	40.250	173.948
6.615	8.918	10.719	13.179	15.121	17.116	22.138	8.056	11.029	13.575	17.401	20.708	24.396	35.030	72.983
7.096	9.507	11.388	13.955	15.977	18.050	23.247	8.771	11.876	14.503	18.407	21.745	25.436	35.930	84.919
7.179	9.561	11.448	14.062	16.153	18.329	23.911	9.165	12.274	14.870	18.669	21.877	25.387	35.192	92.956
7.458	9.896	11.827	14.498	16.633	18.851	24.525	9.590	12.778	15.425	19.273	22.502	26.016	35.743	101.753
10.808	13.958	16.436	19.842	22.532	25.299	32.181	14.752	18.967	22.300	26.899	30.543	34.318	43.816	187.857
9.829	12.740	15.048	18.244	20.783	23.400	29.957	12.948	16.733	19.726	23.818	27.038	30.353	38.546	153.488
10.265	13.256	15.621	18.891	21.484	24.163	30.854	13.724	17.685	20.801	25.078	28.446	31.913	40.513	189.968
9.574	12.397	14.630	17.726	20.186	22.733	29.103	12.830	16.570	19.511	23.550	26.729	29.996	38.091	166.459
10.111	13.095	15.468	18.766	21.399	24.133	31.054	13.442	17.416	20.585	25.000	28.535	32.223	41.640	162.653
9.099	12.017	14.426	17.929	20.828	23.952	32.328	11.000	14.753	17.926	22.621	26.605	30.969	43.070	131.003
4.950	6.728	8.210	10.361	12.148	14.073	19.266	6.818	9.397	11.552	14.696	17.323	20.171	27.908	46.194
7.508	9.924	11.915	14.787	17.163	19.709	26.512	10.403	13.894	16.825	21.130	24.761	28.714	39.557	165.637
7.289	9.639	11.572	14.359	16.661	19.123	25.674	9.966	13.347	16.199	20.401	23.960	27.844	38.534	160.177
7.134	9.444	11.345	14.088	16.353	18.775	25.229	9.922	13.295	16.127	20.275	23.772	27.568	37.947	145.214
9.110	11.957	14.304	17.695	20.504	23.526	31.647	12.591	16.696	20.121	25.124	29.322	33.876	46.320	158.221
9.348	12.262	14.666	18.144	21.029	24.139	32.518	12.959	17.142	20.626	25.708	29.964	34.577	47.170	134.836
9.377	12.300	14.711	18.200	21.094	24.212	32.613	12.916	17.075	20.536	25.586	29.812	34.391	46.888	137.380
9.224	12.086	14.455	17.887	20.740	23.821	32.152	12.702	16.766	20.145	25.075	29.198	33.666	45.864	101.597
9.468	12.408	14.836	18.351	21.270	24.417	32.912	12.975	17.130	20.583	25.617	29.826	34.385	46.814	118.153
9.385	12.289	14.692	18.170	21.062	24.180	32.607	12.788	16.876	20.273	25.223	29.360	33.839	46.044	109.615
4.204	5.546	6.690	8.390	9.842	11.444	15.934	5.826	7.618	9.119	11.312	13.143	15.127	20.549	78.549
5.770	7.721	9.332	11.669	13.608	15.696	21.329	8.595	11.489	13.892	17.389	20.309	23.464	32.045	56.938
6.428	8.561	10.320	12.865	14.971	17.231	23.283	9.208	12.359	14.991	18.830	22.049	25.532	34.995	103.521
6.400	8.526	10.279	12.816	14.915	17.169	23.205	9.172	12.314	14.937	18.763	21.970	25.440	34.864	102.166
6.361	8.477	10.222	12.747	14.838	17.082	23.094	9.119	12.247	14.857	18.665	21.855	25.306	34.679	100.813
5.643	7.566	9.154	11.458	13.367	15.421	20.940	8.127	10.973	13.345	16.799	19.688	22.807	31.250	81.416
6.907	9.164	11.023	13.711	15.932	18.312	24.679	10.031	13.446	16.275	20.369	23.776	27.437	37.262	102.819
6.690	8.897	10.717	13.352	15.533	17.873	24.153	9.749	13.083	15.846	19.842	23.167	26.739	36.331	91.803
6.179	8.294	10.042	12.583	14.690	16.968	23.118	9.255	12.453	15.104	18.939	22.130	25.563	34.811	70.815
5.763	7.819	9.523	11.996	14.045	16.264	22.232	9.217	12.410	15.059	18.900	22.097	25.540	34.838	73.268
2.914	4.144	5.172	6.677	7.931	9.282	12.917	3.807	5.451	6.846	8.909	10.657	12.564	17.817	18.296
2.931	4.140	5.153	6.642	7.894	9.255	12.979	3.910	5.533	6.922	8.989	10.764	12.723	18.250	20.878
3.874	4.955	5.808	6.981	7.910	8.866	11.266	4.362	5.561	6.502	7.790	8.813	9.859	12.465	43.118
3.406	4.415	5.216	6.321	7.200	8.104	10.376	3.885	5.011	5.901	7.123	8.099	9.095	11.573	31.613
3.337	4.348	5.152	6.268	7.157	8.075	10.391	3.815	4.943	5.836	7.066	8.050	9.058	11.574	30.803
3.378	4.392	5.197	6.312	7.200	8.115	10.423	3.860	4.990	5.884	7.114	8.098	9.104	11.615	32.960
3.244	4.307	5.160	6.356	7.316	8.316	10.861	3.761	4.949	5.904	7.242	8.326	9.453	12.357	43.734
7.318	9.936	11.936	14.601	16.670	18.749	23.741	9.248	12.692	15.406	19.161	22.135	25.221	33.001	85.283
9.183	12.348	14.766	17.995	20.504	23.039	29.166	12.098	16.549	20.076	24.996	28.922	33.020	43.496	69.057
5.384	7.376	8.922	11.025	12.677	14.364	18.501	6.800	9.400	11.479	14.402	16.753	19.215	25.545	40.001
5.088	6.996	8.479	10.494	12.076	13.689	17.634	6.427	8.933	10.942	13.773	16.053	18.445	24.603	39.032
8.591	11.584	13.864	16.906	19.250	21.608	27.245	11.425	15.743	19.186	24.006	27.872	31.913	42.287	67.117
9.551	12.831	15.313	18.612	21.129	23.648	29.591	13.094	18.063	22.017	27.543	31.966	36.575	48.345	89.038

Table 11. Mean, standard deviation, and skew values associated with logarithms of annual peak-discharge data from stream-gaging stations, State of Hawai‘i.

[Bulletin 17B, Interagency Advisory Committee on Water Data (1982); PeakFQ, program for flood-frequency analysis from Flynn and others (2006)]

		Systematic gaged record				Bulletin 17B weighted values		
Station no.	Number of years of record	Mean	Standard deviation	Skew		Mean	Standard deviation	Skew
16010000	92	3.5157	0.2532	-0.150		3.5157	0.2532	-0.133
16013000	40	2.8757	0.2275	-0.289		2.8757	0.2275	-0.210
16016000	43	3.7316	0.3115	0.412		3.7316	0.3115	0.259
16017000[l]	25	3.5112	0.2173	-0.466		3.5112	0.2173	-0.281
16018000[h]	11	3.6471	0.2104	2.157		3.6471	0.2104	0.374
16019000	65	3.2876	0.2193	-0.461		3.2876	0.2193	-0.352
16028000	46	4.0062	0.1868	0.236		4.0062	0.1868	0.151
16031000[l]	57	4.1029	0.2643	-0.279		4.1029	0.2643	-0.218
16036000	64	3.8646	0.2683	-0.227		3.8646	0.2683	-0.185
16049000	83	3.8703	0.2596	-0.041		3.8703	0.2596	-0.043
16052500[l]	47	3.0717	0.4340	-0.578		3.0717	0.4340	-0.400
16055000	47	3.6773	0.4485	-0.904		3.6773	0.4485	-0.575
16060000[l]	95	4.1282	0.2928	-0.283		4.1282	0.2928	-0.239
16063000	66	3.6262	0.1824	0.190		3.6262	0.1824	0.135
16068000[u]	93	3.4839	0.2302	0.543		3.4839	0.2302	0.410
16071000[h,l]	51	3.8391	0.2919	0.675		3.8391	0.2919	0.432
16071500	48	2.2099	0.4421	-0.464		2.2099	0.4421	-0.333
16073500	43	2.4174	0.4625	0.017		2.4174	0.4625	-0.002
16080000[l]	56	3.5004	0.2091	-0.301		3.5004	0.2091	-0.233
16081200[h,l]	43	2.4623	0.2664	0.182		2.4623	0.2664	0.112
16084500	47	3.7568	0.3752	-0.530		3.7568	0.3752	-0.372
16085000	23	2.3641	0.5752	0.024		2.3641	0.5752	-0.007
16089000[h]	67	3.4723	0.2840	0.256		3.4723	0.2840	0.184
16093200	22	3.6352	0.3176	-0.085		3.6352	0.3176	-0.070
16097000	15	3.1271	0.1672	-0.132		3.1271	0.1672	-0.089
16097500[u]	51	3.0775	0.2247	0.653		3.0775	0.2247	0.420
16097900	36	2.1521	0.5427	0.221		2.1521	0.5427	0.128
16101000	37	3.6403	0.2241	0.010		3.6403	0.2241	-0.009
16103000	47	4.1432	0.2577	-0.821		4.1432	0.2577	-0.536
16105000[l]	15	3.0305	0.1289	-0.320		3.0305	0.1289	-0.175
16106000[h,l]	13	3.7302	0.1543	0.612		3.7302	0.1543	0.225
16108000	55	3.7310	0.2684	0.525		3.7310	0.2684	0.351
16114000	11	2.5984	0.2735	-0.204		2.5984	0.2735	-0.112
16115000	20	3.1485	0.2880	-0.131		3.1485	0.2880	-0.094
16116000	20	2.7690	0.2167	0.410		2.7690	0.2167	0.188
16117000	23	2.4982	0.3584	-0.175		2.4982	0.3584	-0.121
16130000	45	2.3947	0.4657	0.029		2.3947	0.4657	0.007
16200000	83	3.2572	0.2602	-0.162		3.2572	0.2602	-0.141
16201000	33	3.0153	0.1796	-0.079		3.0153	0.1796	-0.069
16204000	22	3.4012	0.1198	0.541		3.4012	0.1198	0.260
16206000[h,l]	12	3.0165	0.1640	0.856		3.0165	0.1640	0.300

Table 11. Mean, standard deviation, and skew values associated with logarithms of annual peak-discharge data from stream-gaging stations, State of Hawai‘i—Continued.

[Bulletin 17B, Interagency Advisory Committee on Water Data (1982); PeakFQ, program for flood-frequency analysis from Flynn and others (2006)]

		Systematic gaged record			Bulletin 17B weighted values		
Station no.	Number of years of record	Mean	Standard deviation	Skew	Mean	Standard deviation	Skew
16208000	50	3.2175	0.2723	-0.142	3.2175	0.2723	-0.117
16208500[l]	15	2.7437	0.4832	-1.027	2.7437	0.4832	-0.434
16210500	38	3.3614	0.4275	-0.226	3.3614	0.4275	-0.167
16211300	39	2.6691	0.3711	0.353	2.6691	0.3711	0.215
16211500	18	2.3957	0.6697	-0.330	2.3957	0.6697	-0.191
16211600[u]	49	2.4158	0.4031	0.178	2.4158	0.4031	0.114
16211700[l]	11	2.9450	0.2898	1.346	2.9450	0.2898	0.362
16211800[u]	44	2.2271	0.8138	-0.775	2.2271	0.8138	-0.504
16212200[l]	51	2.5765	0.3420	0.071	2.5765	0.3420	0.040
16212300[l]	13	2.7133	0.6920	-1.126	2.7133	0.6920	-0.430
16212500	17	2.7834	0.4412	-0.340	2.7834	0.4412	-0.192
16212601[u]	50	2.7096	0.2395	0.563	2.7096	0.2395	0.365
16212800	49	3.2972	0.2289	0.442	3.2972	0.2289	0.289
16213000	56	3.5086	0.3714	-0.207	3.5086	0.3714	-0.166
16216000	52	3.9066	0.3161	-0.580	3.9066	0.3161	-0.411
16223000	54	3.2098	0.3297	0.066	3.2098	0.3297	0.037
16224500[l]	43	2.9548	0.2579	-0.389	2.9548	0.2579	-0.277
16226000	57	3.0177	0.3563	0.229	3.0177	0.3563	0.157
16226200	25	2.9375	0.2216	-0.276	2.9375	0.2216	-0.180
16227000	20	3.2960	0.2635	-0.195	3.2960	0.2635	-0.128
16227500[l]	10	2.6868	0.4053	-1.151	2.6868	0.4053	-0.393
16228000	71	2.9677	0.3383	-0.628	2.9677	0.3383	-0.469
16228200	39	3.0000	0.2991	-0.290	3.0000	0.2991	-0.209
16228500[l]	11	3.3031	0.2768	-1.270	3.3031	0.2768	-0.424
16228900[u]	33	2.6290	0.3105	0.116	2.6290	0.3105	0.058
16229000[u]	92	3.1629	0.3146	0.482	3.1629	0.3146	0.366
16229300	44	3.3346	0.3568	-0.646	3.3346	0.3568	-0.433
16235400	42	2.7527	0.3898	-0.362	2.7527	0.3898	-0.259
16237500	43	2.5803	0.2993	0.106	2.5803	0.2993	0.060
16238500	63	2.8131	0.3377	-0.079	2.8131	0.3377	-0.072
16240500	89	2.7751	0.2887	0.393	2.7751	0.2887	0.300
16244000	59	2.6228	0.3419	-0.034	2.6228	0.3419	-0.037
16246000	45	2.5654	0.3558	-0.545	2.5654	0.3558	-0.377
16247200[l]	11	2.9530	0.2389	-0.662	2.9530	0.2389	-0.283
16247500[l]	43	2.7556	0.3217	0.406	2.7556	0.3217	0.255
16247900[h]	35	2.6213	0.3608	0.612	2.6213	0.3608	0.351
16248800	39	2.4977	0.4717	-0.853	2.4977	0.4717	-0.528
16249000[l]	11	3.2178	0.3120	0.226	3.2178	0.3120	0.061
16249100[l]	45	2.0181	0.4454	-0.326	2.0181	0.4454	-0.240
16254000[l]	49	2.9114	0.4338	-0.038	2.9114	0.4338	-0.041
16260500[l]	39	3.2257	0.3511	-0.114	3.2257	0.3511	-0.094

Table 11. Mean, standard deviation, and skew values associated with logarithms of annual peak-discharge data from stream-gaging stations, State of Hawai‘i—Continued.

[Bulletin 17B, Interagency Advisory Committee on Water Data (1982); PeakFQ, program for flood-frequency analysis from Flynn and others (2006)]

		Systematic gaged record				Bulletin 17B weighted values		
Station no.	Number of years of record	Mean	Standard deviation	Skew		Mean	Standard deviation	Skew
16265600[h]	13	2.9117	0.2110	1.351		2.9117	0.2110	0.391
16270900[l]	30	2.2993	0.3158	0.097		2.2993	0.3158	0.043
16275000[u]	68	2.7704	0.3783	0.309		2.7704	0.3783	0.223
16278000[h,u]	27	1.6655	0.4494	0.822		1.6655	0.4494	0.415
16279500	25	2.9632	0.5380	-0.295		2.9632	0.5380	-0.191
16283000[h]	34	2.1423	0.3332	1.087		2.1423	0.3332	0.534
16283200	25	2.6140	0.2427	-0.700		2.6140	0.2427	-0.396
16283480	25	2.9251	0.3620	0.589		2.9251	0.3620	0.298
16283600[l]	34	1.9966	0.3018	0.230		1.9966	0.3018	0.131
16283700[l]	34	1.9014	0.2607	0.251		1.9014	0.2607	0.144
16284000[h]	44	2.6324	0.3685	0.199		2.6324	0.3685	0.124
16284200[l]	33	2.7180	0.2620	-0.377		2.7180	0.2620	-0.254
16291000	13	2.7864	0.3331	0.411		2.7864	0.3331	0.147
16294900	49	3.3187	0.3286	-0.639		3.3187	0.3286	-0.440
16296500	49	3.5187	0.1687	-0.500		3.5187	0.1687	-0.356
16303000	54	3.2576	0.2515	-0.204		3.2576	0.2515	-0.163
16304200	42	2.9044	0.3026	-0.496		2.9044	0.3026	-0.342
16304500[l]	16	3.2426	0.1924	-0.396		3.2426	0.1924	-0.213
16310501	19	3.0920	0.4158	-0.331		3.0920	0.4158	-0.194
16325000[u]	38	3.0945	0.2244	0.461		3.0945	0.2244	0.277
16330000[h,u]	50	3.4343	0.2471	0.625		3.4343	0.2471	0.401
16331000	40	1.7184	0.7390	-0.144		1.7184	0.7390	-0.115
16340000[u]	47	3.4292	0.2894	0.634		3.4292	0.2894	0.399
16343000	15	3.5808	0.4654	-0.529		3.5808	0.4654	-0.265
16345000[l]	49	3.2829	0.2246	-0.210		3.2829	0.2246	-0.165
16350000	50	3.1702	0.3476	-0.183		3.1702	0.3476	-0.146
16400000[h,u]	83	3.4499	0.2452	1.302		3.4499	0.2452	0.751
16402000	28	3.3838	0.3480	0.493		3.3838	0.3480	0.263
16403000	27	2.8789	0.2706	0.504		2.8789	0.2706	0.265
16404000	28	3.1386	0.3792	0.011		3.1386	0.3792	-0.011
16404200	28	2.2134	0.3877	-0.164		2.2134	0.3877	-0.120
16405000	27	2.9509	0.2899	0.414		2.9509	0.2899	0.218
16405500	46	3.0667	0.3074	-0.146		3.0667	0.3074	-0.118
16408000[h]	68	3.1810	0.3115	0.688		3.1810	0.3115	0.474
16411300[u]	26	1.2588	0.4900	-0.693		1.2588	0.4900	-0.397
16411320[u]	33	0.9749	1.5425	-1.229		0.9749	1.5425	-0.608
16411400	26	2.4440	0.6337	-0.349		2.4440	0.6337	-0.223
16411600	34	1.3289	0.5367	-0.754		1.3289	0.5367	-0.460
16411640	43	2.6655	0.3737	0.422		2.6655	0.3737	0.265
16411800	34	0.2203	1.4958	-1.479		0.2203	1.4958	-0.644
16411900[u]	17	2.2587	0.4118	-1.145		2.2587	0.4118	-0.477

Table 11. Mean, standard deviation, and skew values associated with logarithms of annual peak-discharge data from stream-gaging stations, State of Hawai‘i—Continued.

[Bulletin 17B, Interagency Advisory Committee on Water Data (1982); PeakFQ, program for flood-frequency analysis from Flynn and others (2006)]

		Systematic gaged record			Bulletin 17B weighted values		
Station no.	Number of years of record	Mean	Standard deviation	Skew	Mean	Standard deviation	Skew
16413500	30	2.7085	0.3627	0.340	2.7085	0.3627	0.187
16414000[u]	51	2.8228	0.3557	-0.274	2.8228	0.3557	-0.211
16415000[h]	25	2.4316	0.3267	0.993	2.4316	0.3267	0.456
16415400[l]	44	2.6300	0.2254	-0.545	2.6300	0.2254	-0.375
16416000	25	2.5228	0.2025	-1.065	2.5228	0.2025	-0.525
16419000[u]	40	2.1432	0.4526	-0.162	2.1432	0.4526	-0.127
16419500	43	2.3408	0.4892	-0.194	2.3408	0.4892	-0.150
16500100[u]	45	2.3955	0.3626	0.585	2.3955	0.3626	0.366
16500300[l]	41	3.5231	0.3351	-0.391	3.5231	0.3351	-0.276
16500800[u]	46	2.7479	0.3802	0.866	2.7479	0.3802	0.519
16501000	53	3.7511	0.1891	0.108	3.7511	0.1891	0.068
16501200[h]	16	3.7035	0.1582	1.679	3.7035	0.1582	0.450
16502000[h]	49	2.7977	0.2499	0.448	2.7977	0.2499	0.292
16502400[u]	44	2.2183	0.3471	0.080	2.2183	0.3471	0.043
16502800	42	2.8974	0.3194	-0.244	2.8974	0.3194	-0.183
16502900[l]	36	3.7732	0.3204	-0.136	3.7732	0.3204	-0.108
16508000[l]	89	3.3756	0.1666	-0.233	3.3756	0.1666	-0.198
16510000[l]	40	3.1796	0.2048	-0.866	3.1796	0.2048	-0.538
16515000[l]	38	2.8342	0.1429	-0.784	2.8342	0.1429	-0.490
16516000	33	3.3920	0.2004	0.525	3.3920	0.2004	0.298
16517000	34	3.3322	0.1925	-0.700	3.3322	0.1925	-0.433
16518000	88	3.5797	0.2049	-0.531	3.5797	0.2049	-0.421
16519000	32	3.0327	0.2195	-0.250	3.0327	0.2195	-0.176
16520000	34	2.9585	0.2059	-0.435	2.9585	0.2059	-0.289
16524000	14	3.1112	0.1478	-0.234	3.1112	0.1478	-0.134
16527000[l]	45	3.1772	0.1921	-0.543	3.1772	0.1921	-0.376
16531100	20	1.9276	0.1098	-0.020	1.9276	0.1098	-0.034
16536000	49	2.9491	0.2069	-0.035	2.9491	0.2069	-0.039
16543000	15	2.4458	0.1462	0.095	2.4458	0.1462	0.020
16545000	56	3.2060	0.1659	0.394	3.2060	0.1659	0.269
16552800	15	2.8253	0.4078	-0.196	2.8253	0.4078	-0.119
16554000	11	2.9641	0.2038	-0.073	2.9641	0.2038	-0.060
16555000[l]	31	3.4732	0.2587	0.061	3.4732	0.2587	0.021
16557000[h,l]	37	2.7917	0.1860	0.886	2.7917	0.1860	0.494
16565000[h]	35	2.7969	0.2137	1.137	2.7969	0.2137	0.550
16566000[l]	25	2.6082	0.1163	-1.272	2.6082	0.1163	-0.564
16570000	61	3.3038	0.2368	0.056	3.3038	0.2368	0.032
16574000	11	2.6531	0.1219	0.482	2.6531	0.1219	0.157
16577000	37	3.5448	0.2268	-0.485	3.5448	0.2268	-0.325
16585000	57	3.0025	0.3987	0.207	3.0025	0.3987	0.141
16586000	42	2.6158	0.1833	0.196	2.6158	0.1833	0.120

Table 11. Mean, standard deviation, and skew values associated with logarithms of annual peak-discharge data from stream-gaging stations, State of Hawai‘i—Continued.

[Bulletin 17B, Interagency Advisory Committee on Water Data (1982); PeakFQ, program for flood-frequency analysis from Flynn and others (2006)]

		Systematic gaged record				Bulletin 17B weighted values		
Station no.	Number of years of record	Mean	Standard deviation	Skew		Mean	Standard deviation	Skew
16587000	96	2.7339	0.3902	0.186		2.7339	0.3902	0.145
16603700	39	1.4315	1.0376	-1.041		1.4315	1.0376	-0.593
16603800[l]	45	1.6259	0.4063	0.131		1.6259	0.4063	0.079
16603850[u]	35	1.7160	1.0036	-0.951		1.7160	1.0036	-0.548
16604500	25	3.3570	0.3198	-0.845		3.3570	0.3198	-0.461
16607000[l]	58	3.4488	0.2369	-0.950		3.4488	0.2369	-0.624
16614000	25	3.6635	0.2356	-0.765		3.6635	0.2356	-0.426
16616500[u]	30	1.0370	0.8584	-1.374		1.0370	0.8584	-0.611
16617000	13	2.3855	0.1957	0.073		2.3855	0.1957	0.005
16618000	62	3.0847	0.2793	0.131		3.0847	0.2793	0.089
16619700	44	2.3597	0.3465	0.148		2.3597	0.3465	0.090
16620000	91	3.3246	0.2267	0.563		3.3246	0.2267	0.423
16623400	22	1.5462	1.0477	-1.549		1.5462	1.0477	-0.569
16630200[h]	46	2.7544	0.3175	0.590		2.7544	0.3175	0.371
16636000[h]	13	2.2666	0.1008	0.864		2.2666	0.1008	0.315
16638500[h]	41	2.9160	0.3615	-0.285		2.9160	0.3615	-0.209
16643300[h,u]	47	2.5240	0.3318	0.492		2.5240	0.3318	0.316
16646200	45	2.6645	0.2962	-0.382		2.6645	0.2962	-0.276
16647500	41	1.2273	0.8110	-0.629		1.2273	0.8110	-0.416
16650500	34	2.7109	0.2913	-0.628		2.7109	0.2913	-0.396
16658500[u]	42	1.5496	0.5885	-0.417		1.5496	0.5885	-0.294
16660000	39	1.8372	1.1900	-0.667		1.8372	1.1900	-0.432
16663500	13	0.7805	1.1794	-0.559		0.7805	1.1794	-0.263
16664000	13	1.0841	1.1723	-0.400		1.0841	1.1723	-0.200
16700000	61	2.1954	0.2071	-0.232		2.1954	0.2071	-0.187
16701200	10	2.7955	0.2526	-0.599		2.7955	0.2526	-0.251
16701300	23	2.8269	0.3748	0.622		2.8269	0.3748	0.404
16701400[l]	17	2.7120	0.2851	0.010		2.7120	0.2851	-0.007
16701750	18	2.9808	0.6516	-0.670		2.9808	0.6516	-0.343
16701800	16	3.6836	0.3691	-0.870		3.6836	0.3691	-0.407
16704000[l]	80	4.2490	0.2431	0.358		4.2490	0.2431	0.268
16713000[l]	20	4.5515	0.2756	-1.339		4.5515	0.2756	-0.533
16717000	42	3.9602	0.1927	-0.128		3.9602	0.1927	-0.105
16717400	20	2.0083	0.2658	0.207		2.0083	0.2658	0.131
16717600	25	2.5159	0.2424	1.338		2.5159	0.2424	0.642
16717650	25	2.8337	0.2517	0.512		2.8337	0.2517	0.326
16717800	26	3.3174	0.3137	0.370		3.3174	0.3137	0.191
16717850	14	2.1373	0.3167	0.375		2.1373	0.3167	0.139
16717950	17	1.4877	0.6608	0.866		1.4877	0.6608	0.359
16720000	45	2.9164	0.2438	0.268		2.9164	0.2438	0.171
16720300	31	2.5409	0.2740	0.359		2.5409	0.2740	0.201

Table 11. Mean, standard deviation, and skew values associated with logarithms of annual peak-discharge data from stream-gaging stations, State of Hawai‘i—Continued.

[Bulletin 17B, Interagency Advisory Committee on Water Data (1982); PeakFQ, program for flood-frequency analysis from Flynn and others (2006)]

		Systematic gaged record			Bulletin 17B weighted values		
Station no.	Number of years of record	Mean	Standard deviation	Skew	Mean	Standard deviation	Skew
16725000	45	2.5436	0.2569	0.534	2.5436	0.2569	0.337
16737000	20	2.5854	0.1767	0.513	2.5854	0.1767	0.236
16738000[h]	11	3.0365	0.2367	2.257	3.0365	0.2367	0.369
16739000	13	2.5378	0.3423	0.708	2.5378	0.3423	0.260
16740000	12	1.6083	0.2450	1.118	1.6083	0.2450	0.350
16741000	11	2.4737	0.2289	0.311	2.4737	0.2289	0.094
16742000	19	2.0627	0.1953	0.841	2.0627	0.1953	0.367
16752600	27	1.7349	0.7255	-0.818	1.7349	0.7255	-0.460
16755800	34	1.9712	0.2531	0.290	1.9712	0.2531	0.167
16756000	10	3.2026	0.3518	-1.164	3.2026	0.3518	-0.395
16756100	11	2.9370	0.1905	0.409	2.9370	0.1905	0.131
16756300	25	2.9842	0.2662	-0.026	2.9842	0.2662	-0.036
16756500	45	2.9733	0.2828	0.136	2.9733	0.2828	0.082
16757000	24	2.7005	0.3325	-0.458	2.7005	0.3325	-0.274
16758000	61	2.6960	0.3551	0.512	2.6960	0.3551	0.353
16759000	48	2.2923	0.3181	0.310	2.2923	0.3181	0.202
16759040[h]	21	2.1114	0.2969	1.038	2.1114	0.2969	0.435
16759060	27	1.7925	0.8759	-0.311	1.7925	0.8759	-0.204
16759080	12	2.7053	0.4882	0.569	2.7053	0.4882	0.199
16759180[l]	10	2.6911	0.1607	-0.450	2.6911	0.1607	-0.199
16759200	23	2.3269	0.4326	0.119	2.3269	0.4326	0.047
16759300	30	2.4003	0.6860	-0.179	2.4003	0.6860	-0.131
16759500	11	2.9954	0.4276	-1.028	2.9954	0.4276	-0.387
16759800	25	1.5503	0.2111	0.353	1.5503	0.2111	0.179
16762000[l]	27	2.8737	0.2430	-1.213	2.8737	0.2430	-0.569
16764000[h,u]	25	3.0057	0.1316	1.069	3.0057	0.1316	0.473
16765000[l]	17	2.6407	0.1597	0.161	2.6407	0.1597	0.056
16767000[u]	24	3.0471	0.2530	-0.860	3.0471	0.2530	-0.462
16770000	20	3.4246	0.3785	-0.529	3.4246	0.3785	-0.369
16770500	29	2.7482	0.5474	-0.049	2.7482	0.5474	-0.049

[h]A single high outlier detected by PeakFQ program.

[l]One or two low outliers detected by PeakFQ program using default criterion.

[u]A user-specified low-outlier criterion used.

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16010000	2	3320	1690	3310	2910	3750	7.9329E-04	1.1191E-01	7.8770E-04
16010000	5	5370	2800	5340	4670	6100	8.8469E-04	7.8775E-02	8.7486E-04
16010000	10	6860	3620	6780	5830	7900	1.1612E-03	6.4752E-02	1.1407E-03
16010000	25	8860	4760	8680	7160	10500	1.8711E-03	5.4694E-02	1.8092E-03
16010000	50	10400	5680	10100	8030	12700	2.6992E-03	4.9847E-02	2.5606E-03
16010000	100	12000	6650	11500	8800	15000	3.7935E-03	4.6693E-02	3.5084E-03
16010000	500	16000	9090	14700	10300	21100	7.4008E-03	4.3605E-02	6.3269E-03
16013000	2	765	944	767	647	909	1.4387E-03	1.1191E-01	1.4204E-03
16013000	5	1170	1550	1180	988	1410	1.5676E-03	7.8775E-02	1.5370E-03
16013000	10	1450	2010	1470	1200	1790	2.0065E-03	6.4752E-02	1.9462E-03
16013000	25	1810	2620	1840	1440	2350	3.0928E-03	5.4694E-02	2.9272E-03
16013000	50	2080	3120	2140	1610	2850	4.3334E-03	4.9847E-02	3.9868E-03
16013000	100	2340	3630	2460	1770	3420	5.9526E-03	4.6693E-02	5.2796E-03
16013000	500	2970	4920	3290	2150	5040	1.1213E-02	4.3605E-02	8.9195E-03
16016000	2	5230	5810	5240	4190	6550	2.5161E-03	1.1191E-01	2.4607E-03
16016000	5	9750	9680	9750	7500	12700	3.5261E-03	7.8775E-02	3.3750E-03
16016000	10	13800	12700	13700	9990	18700	5.2401E-03	6.4752E-02	4.8478E-03
16016000	25	20100	16800	19600	13200	29200	9.0484E-03	5.4694E-02	7.7640E-03
16016000	50	25900	20200	24600	15500	39000	1.3216E-02	4.9847E-02	1.0446E-02
16016000	100	32700	23800	29900	17800	50300	1.8560E-02	4.6693E-02	1.3281E-02
16016000	500	53300	33200	43000	22900	81000	3.5747E-02	4.3605E-02	1.9644E-02
16017000	2	3320	893	3240	2650	3970	2.0603E-03	1.1191E-01	2.0230E-03
16017000	5	4970	1470	4810	3910	5920	2.1902E-03	7.8775E-02	2.1310E-03
16017000	10	6060	1900	5780	4580	7290	2.7490E-03	6.4752E-02	2.6371E-03
16017000	25	7410	2480	6870	5200	9070	4.0930E-03	5.4694E-02	3.8080E-03
16017000	50	8400	2950	7560	5490	10400	5.5984E-03	4.9847E-02	5.0331E-03
16017000	100	9360	3430	8140	5660	11700	7.5401E-03	4.6693E-02	6.4918E-03
16017000	500	11600	4640	9290	5860	14700	1.3756E-02	4.3605E-02	1.0457E-02
16018000	2	4310	3790	4290	3210	5710	4.2182E-03	1.1191E-01	4.0650E-03
16018000	5	6600	6300	6570	4610	9370	6.6850E-03	7.8775E-02	6.1621E-03
16018000	10	8390	8210	8370	5490	12700	1.0068E-02	6.4752E-02	8.7133E-03
16018000	25	11000	10900	11000	6590	18300	1.6586E-02	5.4694E-02	1.2727E-02
16018000	50	13200	13000	13100	7440	23100	2.3129E-02	4.9847E-02	1.5798E-02
16018000	100	15600	15300	15500	8360	28700	3.1105E-02	4.6693E-02	1.8669E-02
16018000	500	22300	21200	21700	10700	43900	5.5341E-02	4.3605E-02	2.4389E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16019000	2	2000	1080	1990	1750	2270	8.3842E-04	1.1191E-01	8.3219E-04
16019000	5	2990	1780	2970	2610	3380	8.2566E-04	7.8775E-02	8.1710E-04
16019000	10	3620	2290	3600	3120	4150	1.0089E-03	6.4752E-02	9.9345E-04
16019000	25	4400	3000	4360	3650	5190	1.5632E-03	5.4694E-02	1.5198E-03
16019000	50	4960	3570	4890	3970	6030	2.2437E-03	4.9847E-02	2.1470E-03
16019000	100	5500	4170	5410	4230	6910	3.1584E-03	4.6693E-02	2.9583E-03
16019000	500	6700	5660	6560	4710	9150	6.1927E-03	4.3605E-02	5.4226E-03
16028000	2	10000	10500	10000	8810	11400	8.4737E-04	1.1191E-01	8.4100E-04
16028000	5	14500	17500	14600	12500	16900	1.1214E-03	7.8775E-02	1.1056E-03
16028000	10	17700	23000	17800	14900	21300	1.6132E-03	6.4752E-02	1.5740E-03
16028000	25	22000	30600	22400	17800	28100	2.7169E-03	5.4694E-02	2.5884E-03
16028000	50	25400	37000	26100	19900	34300	3.9290E-03	4.9847E-02	3.6419E-03
16028000	100	28900	43800	30200	22000	41500	5.4855E-03	4.6693E-02	4.9088E-03
16028000	500	37900	61700	41600	27500	63000	1.0494E-02	4.3605E-02	8.4583E-03
16031000	2	13000	12900	13000	11000	15300	1.3792E-03	1.1191E-01	1.3624E-03
16031000	5	21300	21600	21300	17900	25300	1.4799E-03	7.8775E-02	1.4526E-03
16031000	10	27200	28300	27200	22500	33100	1.8881E-03	6.4752E-02	1.8346E-03
16031000	25	35100	37900	35200	27700	44700	2.9505E-03	5.4694E-02	2.7995E-03
16031000	50	41200	45800	41500	31300	54900	4.1919E-03	4.9847E-02	3.8668E-03
16031000	100	47300	54300	48100	34700	66500	5.8305E-03	4.6693E-02	5.1833E-03
16031000	500	62200	76700	65000	42400	99500	1.1211E-02	4.3605E-02	8.9179E-03
16036000	2	7460	7140	7460	6360	8750	1.2697E-03	1.1191E-01	1.2554E-03
16036000	5	12400	11900	12400	10500	14600	1.3849E-03	7.8775E-02	1.3610E-03
16036000	10	16000	15600	15900	13200	19200	1.7860E-03	6.4752E-02	1.7380E-03
16036000	25	20700	20700	20700	16400	26200	2.8180E-03	5.4694E-02	2.6799E-03
16036000	50	24500	25000	24500	18600	32300	4.0202E-03	4.9847E-02	3.7202E-03
16036000	100	28300	29500	28400	20700	39100	5.6059E-03	4.6693E-02	5.0050E-03
16036000	500	37800	41200	38400	25200	58500	1.0816E-02	4.3605E-02	8.6661E-03
16049000	2	7450	5500	7430	6480	8520	9.2147E-04	1.1191E-01	9.1394E-04
16049000	5	12300	9150	12200	10600	14200	1.0834E-03	7.8775E-02	1.0687E-03
16049000	10	15900	12000	15800	13300	18800	1.4676E-03	6.4752E-02	1.4351E-03
16049000	25	20900	15900	20700	16700	25700	2.4062E-03	5.4694E-02	2.3048E-03
16049000	50	25000	19100	24500	19000	31700	3.4789E-03	4.9847E-02	3.2520E-03
16049000	100	29200	22500	28500	21100	38500	4.8837E-03	4.6693E-02	4.4213E-03
16049000	500	40200	31400	38400	25800	57300	9.4832E-03	4.3605E-02	7.7892E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16052500	2	1260	2600	1300	964	1740	4.4888E-03	1.1191E-01	4.3157E-03
16052500	5	2770	4310	2840	2120	3790	4.3384E-03	7.8775E-02	4.1119E-03
16052500	10	4040	5610	4140	3020	5660	5.2376E-03	6.4752E-02	4.8457E-03
16052500	25	5870	7390	6040	4150	8810	7.9707E-03	5.4694E-02	6.9569E-03
16052500	50	7370	8850	7620	4940	11800	1.1314E-02	4.9847E-02	9.2208E-03
16052500	100	8960	10400	9310	5700	15200	1.5790E-02	4.6693E-02	1.1800E-02
16052500	500	13000	14300	13500	7380	24700	3.0535E-02	4.3605E-02	1.7959E-02
16055000	2	5250	9110	5400	3980	7320	4.8035E-03	8.9636E-02	4.5592E-03
16055000	5	11500	15600	11800	8940	15600	4.1537E-03	4.6693E-02	3.8144E-03
16055000	10	16500	20500	17000	12700	22700	4.7879E-03	3.2000E-02	4.1648E-03
16055000	25	23300	27300	24200	17300	33900	7.3373E-03	2.2985E-02	5.5619E-03
16055000	50	28500	32700	29900	20600	43500	1.0640E-02	1.9497E-02	6.8834E-03
16055000	100	33800	38300	35800	23700	53900	1.5118E-02	1.8388E-02	8.2967E-03
16055000	500	46000	51600	49200	29600	81600	2.9777E-02	2.1796E-02	1.2584E-02
16060000	2	13800	12200	13800	11900	15900	1.0307E-03	8.9636E-02	1.0189E-03
16060000	5	23800	20600	23800	20500	27500	1.0783E-03	4.6693E-02	1.0540E-03
16060000	10	31300	26900	31100	26400	36600	1.3648E-03	3.2000E-02	1.3089E-03
16060000	25	41300	35600	40800	33400	49800	2.1644E-03	2.2985E-02	1.9782E-03
16060000	50	49100	42400	48100	38100	60900	3.1260E-03	1.9497E-02	2.6941E-03
16060000	100	57200	49400	55600	42500	72800	4.4119E-03	1.8388E-02	3.5582E-03
16060000	500	77000	65700	73600	51600	105000	8.6833E-03	2.1796E-02	6.2095E-03
16063000	2	4190	2420	4170	3750	4650	5.6916E-04	8.9636E-02	5.6557E-04
16063000	5	6000	4410	5980	5290	6750	7.3909E-04	4.6693E-02	7.2758E-04
16063000	10	7290	6000	7240	6270	8370	1.0613E-03	3.2000E-02	1.0272E-03
16063000	25	8990	8300	8940	7430	10800	1.8056E-03	2.2985E-02	1.6741E-03
16063000	50	10300	10200	10300	8300	12800	2.6355E-03	1.9497E-02	2.3217E-03
16063000	100	11700	12200	11800	9180	15200	3.7099E-03	1.8388E-02	3.0871E-03
16063000	500	15200	17500	15700	11300	21900	7.1960E-03	2.1796E-02	5.4099E-03
16068000	2	2940	2870	2940	2620	3300	6.5482E-04	8.9636E-02	6.5007E-04
16068000	5	4700	5180	4700	4100	5400	9.5757E-04	4.6693E-02	9.3833E-04
16068000	10	6130	7020	6160	5200	7310	1.5016E-03	3.2000E-02	1.4343E-03
16068000	25	8270	9670	8410	6720	10500	2.7891E-03	2.2985E-02	2.4873E-03
16068000	50	10100	11800	10400	7970	13600	4.2491E-03	1.9497E-02	3.4888E-03
16068000	100	12200	14100	12700	9330	17200	6.1599E-03	1.8388E-02	4.6142E-03
16068000	500	18300	20000	18900	12600	28200	1.2446E-02	2.1796E-02	7.9222E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16071000	2	6580	8360	6610	5450	8020	1.8787E-03	8.9636E-02	1.8401E-03
16071000	5	11900	14300	12100	9540	15200	2.8414E-03	4.6693E-02	2.6784E-03
16071000	10	16800	18900	17000	12800	22500	4.4526E-03	3.2000E-02	3.9087E-03
16071000	25	24600	25300	24800	17500	35100	8.1120E-03	2.2985E-02	5.9959E-03
16071000	50	31900	30300	31300	21200	46200	1.2175E-02	1.9497E-02	7.4949E-03
16071000	100	40700	35500	38100	24800	58300	1.7435E-02	1.8388E-02	8.9492E-03
16071000	500	68100	48100	55000	32700	92700	3.4536E-02	2.1796E-02	1.3363E-02
16071500	2	172	286	176	131	237	4.5615E-03	8.9636E-02	4.3406E-03
16071500	5	387	577	401	299	537	4.5910E-03	4.6693E-02	4.1800E-03
16071500	10	573	832	606	443	829	5.6530E-03	3.2000E-02	4.8043E-03
16071500	25	853	1220	941	658	1350	8.6479E-03	2.2985E-02	6.2837E-03
16071500	50	1090	1560	1250	846	1850	1.2235E-02	1.9497E-02	7.5174E-03
16071500	100	1350	1940	1610	1050	2450	1.7007E-02	1.8388E-02	8.8351E-03
16071500	500	2020	3040	2580	1540	4330	3.2704E-02	2.1796E-02	1.3079E-02
16073500	2	262	1400	288	208	400	5.5439E-03	8.9636E-02	5.2210E-03
16073500	5	642	2610	766	541	1080	6.7792E-03	4.6693E-02	5.9197E-03
16073500	10	1030	3610	1360	926	1990	9.2885E-03	3.2000E-02	7.1989E-03
16073500	25	1690	5070	2610	1690	4010	1.5028E-02	2.2985E-02	9.0868E-03
16073500	50	2330	6280	3910	2480	6170	2.1378E-02	1.9497E-02	1.0197E-02
16073500	100	3110	7610	5400	3340	8730	2.9556E-02	1.8388E-02	1.1336E-02
16073500	500	5600	11100	9160	5200	16100	5.5902E-02	2.1796E-02	1.5682E-02
16080000	2	3230	1660	3200	2810	3660	8.7834E-04	8.9636E-02	8.6982E-04
16080000	5	4770	3080	4730	4120	5420	9.3456E-04	4.6693E-02	9.1622E-04
16080000	10	5790	4230	5730	4910	6670	1.1866E-03	3.2000E-02	1.1442E-03
16080000	25	7070	5920	6970	5790	8410	1.8489E-03	2.2985E-02	1.7112E-03
16080000	50	8000	7300	7920	6370	9840	2.6252E-03	1.9497E-02	2.3137E-03
16080000	100	8930	8820	8910	6950	11400	3.6512E-03	1.8388E-02	3.0463E-03
16080000	500	11100	12800	11500	8250	15900	7.0215E-03	2.1796E-02	5.3107E-03
16081200	2	287	150	283	234	343	1.8394E-03	8.9636E-02	1.8024E-03
16081200	5	484	311	474	382	588	2.3903E-03	4.6693E-02	2.2739E-03
16081200	10	641	457	620	483	797	3.3947E-03	3.2000E-02	3.0691E-03
16081200	25	869	682	828	611	1120	5.6436E-03	2.2985E-02	4.5311E-03
16081200	50	1060	880	1000	713	1410	8.1090E-03	1.9497E-02	5.7270E-03
16081200	100	1270	1110	1210	828	1760	1.1271E-02	1.8388E-02	6.9878E-03
16081200	500	1840	1790	1820	1140	2900	2.1428E-02	2.1796E-02	1.0805E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16084500	2	6030	6970	6060	4690	7830	3.3539E-03	8.9636E-02	3.2329E-03
16084500	5	12000	12100	12000	9310	15400	3.2982E-03	4.6693E-02	3.0806E-03
16084500	10	16600	16000	16500	12600	21700	4.0146E-03	3.2000E-02	3.5671E-03
16084500	25	23100	21500	22700	16600	31100	6.1176E-03	2.2985E-02	4.8316E-03
16084500	50	28200	25800	27500	19400	38900	8.6656E-03	1.9497E-02	5.9992E-03
16084500	100	33600	30400	32300	22000	47500	1.2068E-02	1.8388E-02	7.2859E-03
16084500	500	46700	41500	43900	27200	70900	2.3267E-02	2.1796E-02	1.1254E-02
16085000	2	232	352	247	146	415	1.5679E-02	8.9636E-02	1.3345E-02
16085000	5	706	703	705	415	1200	1.9520E-02	4.6693E-02	1.3766E-02
16085000	10	1260	1010	1140	662	1960	2.6603E-02	3.2000E-02	1.4526E-02
16085000	25	2340	1470	1730	1000	3010	4.1733E-02	2.2985E-02	1.4822E-02
16085000	50	3500	1870	2190	1270	3780	5.7840E-02	1.9497E-02	1.4581E-02
16085000	100	5010	2320	2690	1550	4660	7.8145E-02	1.8388E-02	1.4885E-02
16085000	500	10400	3610	4150	2230	7720	1.4208E-01	2.1796E-02	1.8897E-02
16089000	2	2910	2470	2900	2460	3420	1.3607E-03	8.9636E-02	1.3403E-03
16089000	5	5110	4500	5090	4210	6140	1.8102E-03	4.6693E-02	1.7426E-03
16089000	10	6940	6120	6870	5500	8590	2.6407E-03	3.2000E-02	2.4394E-03
16089000	25	9710	8470	9490	7180	12500	4.5544E-03	2.2985E-02	3.8012E-03
16089000	50	12100	10400	11600	8470	16000	6.6867E-03	1.9497E-02	4.9791E-03
16089000	100	14800	12400	14000	9770	19900	9.4473E-03	1.8388E-02	6.2408E-03
16089000	500	22600	17800	20200	12900	31800	1.8408E-02	2.1796E-02	9.9796E-03
16093200	2	4350	4400	4360	3200	5940	4.9888E-03	8.9636E-02	4.7258E-03
16093200	5	8010	7790	7980	5740	11100	6.0039E-03	4.6693E-02	5.3198E-03
16093200	10	11000	10400	10800	7560	15600	8.0195E-03	3.2000E-02	6.4124E-03
16093200	25	15300	14200	14900	9930	22300	1.2356E-02	2.2985E-02	8.0362E-03
16093200	50	18900	17200	18100	11800	27800	1.6984E-02	1.9497E-02	9.0768E-03
16093200	100	22800	20500	21500	13600	33900	2.2822E-02	1.8388E-02	1.0183E-02
16093200	500	33300	28500	30100	17500	51500	4.1201E-02	2.1796E-02	1.4255E-02
16097000	2	1350	706	1330	1090	1620	1.9978E-03	8.9636E-02	1.9542E-03
16097000	5	1860	1360	1830	1470	2270	2.4110E-03	4.6693E-02	2.2926E-03
16097000	10	2190	1920	2160	1690	2760	3.1988E-03	3.2000E-02	2.9081E-03
16097000	25	2600	2750	2620	1970	3490	4.8133E-03	2.2985E-02	3.9799E-03
16097000	50	2900	3450	3030	2210	4150	6.4838E-03	1.9497E-02	4.8657E-03
16097000	100	3200	4220	3490	2480	4930	8.5533E-03	1.8388E-02	5.8378E-03
16097000	500	3890	6380	4760	3110	7280	1.4938E-02	2.1796E-02	8.8633E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16097500	2	1150	479	1140	982	1330	1.1130E-03	8.9636E-02	1.0994E-03
16097500	5	1820	942	1780	1490	2140	1.6741E-03	4.6693E-02	1.6161E-03
16097500	10	2360	1340	2270	1810	2830	2.6144E-03	3.2000E-02	2.4169E-03
16097500	25	3170	1940	2920	2200	3870	4.7479E-03	2.2985E-02	3.9351E-03
16097500	50	3870	2450	3430	2470	4750	7.1154E-03	1.9497E-02	5.2129E-03
16097500	100	4660	3020	3990	2770	5750	1.0178E-02	1.8388E-02	6.5516E-03
16097500	500	6900	4640	5710	3600	9050	2.0131E-02	2.1796E-02	1.0465E-02
16097900	2	138	341	150	99.7	226	9.0628E-03	8.9636E-02	8.2306E-03
16097900	5	403	682	448	289	696	1.1947E-02	4.6693E-02	9.5133E-03
16097900	10	716	978	798	496	1280	1.7024E-02	3.2000E-02	1.1112E-02
16097900	25	1340	1430	1390	835	2300	2.8188E-02	2.2985E-02	1.2661E-02
16097900	50	2010	1820	1880	1120	3150	4.0307E-02	1.9497E-02	1.3140E-02
16097900	100	2920	2250	2400	1410	4080	5.5770E-02	1.8388E-02	1.3828E-02
16097900	500	6290	3510	3880	2120	7110	1.0517E-01	2.1796E-02	1.8054E-02
16101000	2	4370	3320	4350	3660	5180	1.5052E-03	8.9636E-02	1.4803E-03
16101000	5	6750	5960	6710	5550	8120	1.8420E-03	4.6693E-02	1.7721E-03
16101000	10	8460	8050	8430	6780	10500	2.5160E-03	3.2000E-02	2.3326E-03
16101000	25	10800	11000	10800	8290	14100	4.0369E-03	2.2985E-02	3.4338E-03
16101000	50	12600	13500	12800	9470	17200	5.7073E-03	1.9497E-02	4.4149E-03
16101000	100	14500	16100	14900	10700	20900	7.8500E-03	1.8388E-02	5.5014E-03
16101000	500	19200	22600	20500	13400	31300	1.4722E-02	2.1796E-02	8.7869E-03
16103000	2	14700	9340	14500	12200	17400	1.5851E-03	8.9636E-02	1.5575E-03
16103000	5	23100	15900	22900	19400	27000	1.4057E-03	4.6693E-02	1.3646E-03
16103000	10	28500	20900	28100	23500	33600	1.6357E-03	3.2000E-02	1.5561E-03
16103000	25	35000	27900	34200	27600	42400	2.4965E-03	2.2985E-02	2.2519E-03
16103000	50	39400	33400	38400	30000	49300	3.5986E-03	1.9497E-02	3.0379E-03
16103000	100	43600	39100	42600	32100	56700	5.0906E-03	1.8388E-02	3.9869E-03
16103000	500	52600	52700	52600	36200	76500	9.9901E-03	2.1796E-02	6.8503E-03
16105000	2	1080	1000	1080	926	1260	1.1856E-03	1.1191E-01	1.1731E-03
16105000	5	1380	1650	1380	1170	1630	1.3636E-03	7.8775E-02	1.3404E-03
16105000	10	1560	2140	1570	1310	1900	1.7664E-03	6.4752E-02	1.7195E-03
16105000	25	1770	2790	1810	1440	2270	2.6108E-03	5.4694E-02	2.4919E-03
16105000	50	1920	3320	1990	1540	2570	3.4930E-03	4.9847E-02	3.2643E-03
16105000	100	2060	3870	2180	1630	2920	4.5907E-03	4.6693E-02	4.1797E-03
16105000	500	2370	5250	2680	1850	3880	7.9876E-03	4.3605E-02	6.7509E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16106000	2	5300	2620	5240	4300	6380	1.9463E-03	1.1191E-01	1.9131E-03
16106000	5	7210	4330	7090	5600	8970	2.8155E-03	7.8775E-02	2.7184E-03
16106000	10	8540	5630	8330	6300	11000	4.0771E-03	6.4752E-02	3.8356E-03
16106000	25	10300	7430	9930	7030	14000	6.5447E-03	5.4694E-02	5.8453E-03
16106000	50	11600	8890	11200	7520	16600	9.0421E-03	4.9847E-02	7.6537E-03
16106000	100	13000	10400	12400	7990	19300	1.2102E-02	4.6693E-02	9.6108E-03
16106000	500	16500	14400	15800	9170	27100	2.1447E-02	4.3605E-02	1.4376E-02
16108000	2	5190	3590	5170	4350	6140	1.4753E-03	1.1191E-01	1.4561E-03
16108000	5	8940	5960	8840	7190	10900	2.1417E-03	7.8775E-02	2.0850E-03
16108000	10	12100	7770	11900	9220	15300	3.2813E-03	6.4752E-02	3.1230E-03
16108000	25	17100	10300	16200	11700	22600	5.8714E-03	5.4694E-02	5.3022E-03
16108000	50	21500	12300	19700	13400	29100	8.7447E-03	4.9847E-02	7.4396E-03
16108000	100	26500	14500	23400	14900	36500	1.2460E-02	4.6693E-02	9.8353E-03
16108000	500	41600	20000	31900	18100	56200	2.4520E-02	4.3605E-02	1.5694E-02
16114000	2	401	785	418	288	606	7.2018E-03	1.1191E-01	6.7664E-03
16114000	5	676	1290	721	484	1070	8.6714E-03	7.8775E-02	7.8115E-03
16114000	10	882	1660	970	622	1510	1.1426E-02	6.4752E-02	9.7123E-03
16114000	25	1170	2170	1350	808	2250	1.6849E-02	5.4694E-02	1.2881E-02
16114000	50	1390	2580	1680	962	2950	2.2305E-02	4.9847E-02	1.5410E-02
16114000	100	1630	3000	2060	1130	3760	2.8949E-02	4.6693E-02	1.7870E-02
16114000	500	2230	4050	3060	1540	6070	4.9038E-02	4.3605E-02	2.3081E-02
16115000	2	1420	1320	1420	1050	1910	4.4951E-03	1.1191E-01	4.3215E-03
16115000	5	2470	2180	2450	1780	3370	5.3554E-03	7.8775E-02	5.0145E-03
16115000	10	3270	2820	3220	2250	4620	7.1004E-03	6.4752E-02	6.3988E-03
16115000	25	4400	3700	4270	2780	6570	1.0830E-02	5.4694E-02	9.0398E-03
16115000	50	5310	4410	5090	3140	8250	1.4789E-02	4.9847E-02	1.1405E-02
16115000	100	6290	5150	5930	3480	10100	1.9769E-02	4.6693E-02	1.3889E-02
16115000	500	8800	7010	7950	4230	14900	3.5385E-02	4.3605E-02	1.9534E-02
16116000	2	578	365	572	457	717	2.5417E-03	1.1191E-01	2.4852E-03
16116000	5	889	597	874	672	1140	3.5387E-03	7.8775E-02	3.3866E-03
16116000	10	1120	766	1090	801	1490	5.0994E-03	6.4752E-02	4.7271E-03
16116000	25	1450	994	1380	941	2030	8.3117E-03	5.4694E-02	7.2152E-03
16116000	50	1720	1170	1600	1030	2480	1.1669E-02	4.9847E-02	9.4557E-03
16116000	100	2010	1360	1820	1110	2970	1.5863E-02	4.6693E-02	1.1840E-02
16116000	500	2770	1810	2340	1290	4240	2.8957E-02	4.3605E-02	1.7401E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16117000	2	320	884	337	239	475	6.0845E-03	1.1191E-01	5.7708E-03
16117000	5	634	1450	678	471	977	7.1056E-03	7.8775E-02	6.5177E-03
16117000	10	897	1880	984	655	1480	9.3484E-03	6.4752E-02	8.1690E-03
16117000	25	1290	2450	1470	911	2380	1.4276E-02	5.4694E-02	1.1321E-02
16117000	50	1630	2910	1920	1120	3270	1.9586E-02	4.9847E-02	1.4061E-02
16117000	100	2000	3390	2420	1350	4340	2.6319E-02	4.6693E-02	1.6832E-02
16117000	500	3000	4590	3750	1900	7400	4.7607E-02	4.3605E-02	2.2759E-02
16130000	2	248	1680	271	196	374	5.3789E-03	1.1191E-01	5.1322E-03
16130000	5	611	2780	687	483	978	6.6007E-03	7.8775E-02	6.0904E-03
16130000	10	981	3600	1150	770	1720	9.0728E-03	6.4752E-02	7.9578E-03
16130000	25	1630	4730	2040	1250	3320	1.4739E-02	5.4694E-02	1.1610E-02
16130000	50	2250	5650	2960	1710	5120	2.1017E-02	4.9847E-02	1.4784E-02
16130000	100	3020	6600	4080	2230	7470	2.9108E-02	4.6693E-02	1.7930E-02
16130000	500	5480	9030	7250	3580	14700	5.5198E-02	4.3605E-02	2.4361E-02
16200000	2	1830	1320	1820	1590	2090	9.2651E-04	4.3605E-02	9.0723E-04
16200000	5	3000	1980	2960	2570	3420	1.0307E-03	3.0642E-02	9.9712E-04
16200000	10	3860	2470	3780	3220	4450	1.3490E-03	2.7994E-02	1.2870E-03
16200000	25	5010	3130	4840	3960	5930	2.1639E-03	2.7994E-02	2.0086E-03
16200000	50	5910	3640	5630	4440	7150	3.1129E-03	2.7994E-02	2.8014E-03
16200000	100	6850	4190	6420	4860	8480	4.3657E-03	2.9306E-02	3.7997E-03
16200000	500	9160	5490	8250	5690	12000	8.4907E-03	3.3379E-02	6.7689E-03
16201000	2	1040	1210	1050	902	1210	1.0796E-03	4.3605E-02	1.0535E-03
16201000	5	1470	1790	1480	1260	1740	1.2824E-03	3.0642E-02	1.2309E-03
16201000	10	1750	2230	1780	1480	2130	1.7160E-03	2.7994E-02	1.6169E-03
16201000	25	2120	2820	2170	1730	2710	2.6973E-03	2.7994E-02	2.4602E-03
16201000	50	2390	3280	2480	1910	3210	3.7748E-03	2.7994E-02	3.3263E-03
16201000	100	2650	3760	2800	2070	3770	5.1561E-03	2.9306E-02	4.3847E-03
16201000	500	3290	4920	3600	2440	5310	9.5791E-03	3.3379E-02	7.4431E-03
16204000	2	2490	2430	2490	2210	2800	7.0801E-04	4.3605E-02	6.9670E-04
16204000	5	3160	3830	3180	2760	3670	1.0207E-03	3.0642E-02	9.8783E-04
16204000	10	3610	4920	3670	3090	4350	1.5039E-03	2.7994E-02	1.4272E-03
16204000	25	4180	6400	4330	3490	5380	2.5080E-03	2.7994E-02	2.3018E-03
16204000	50	4610	7570	4880	3780	6280	3.5650E-03	2.7994E-02	3.1623E-03
16204000	100	5040	8810	5460	4080	7310	4.8912E-03	2.9306E-02	4.1916E-03
16204000	500	6080	11800	7010	4790	10300	9.0548E-03	3.3379E-02	7.1226E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16206000	2	1020	1590	1040	842	1290	2.3672E-03	4.3605E-02	2.2453E-03
16206000	5	1420	2410	1500	1160	1940	3.5840E-03	3.0642E-02	3.2087E-03
16206000	10	1700	3030	1870	1380	2520	5.2941E-03	2.7994E-02	4.4522E-03
16206000	25	2090	3860	2410	1670	3480	8.6117E-03	2.7994E-02	6.5857E-03
16206000	50	2390	4520	2900	1920	4380	1.1954E-02	2.7994E-02	8.3770E-03
16206000	100	2720	5200	3420	2160	5410	1.6039E-02	2.9306E-02	1.0366E-02
16206000	500	3540	6870	4800	2740	8400	2.8482E-02	3.3379E-02	1.5368E-02
16208000	2	1670	1960	1680	1400	2010	1.6607E-03	4.3605E-02	1.5998E-03
16208000	5	2810	3170	2830	2340	3420	1.8964E-03	3.0642E-02	1.7859E-03
16208000	10	3660	4130	3690	2970	4580	2.5011E-03	2.7994E-02	2.2960E-03
16208000	25	4820	5440	4890	3750	6380	3.9604E-03	2.7994E-02	3.4696E-03
16208000	50	5750	6500	5870	4310	7990	5.6147E-03	2.7994E-02	4.6767E-03
16208000	100	6720	7630	6900	4850	9830	7.7695E-03	2.9306E-02	6.1414E-03
16208000	500	9180	10400	9540	6040	15100	1.4777E-02	3.3379E-02	1.0243E-02
16208500	2	601	388	533	325	873	1.6494E-02	4.3605E-02	1.1967E-02
16208500	5	1440	739	1140	714	1820	1.6430E-02	3.0642E-02	1.0695E-02
16208500	10	2170	1040	1600	982	2600	1.9892E-02	2.7994E-02	1.1629E-02
16208500	25	3260	1500	2210	1290	3770	2.8178E-02	2.7994E-02	1.4043E-02
16208500	50	4170	1900	2660	1510	4710	3.7288E-02	2.7994E-02	1.5990E-02
16208500	100	5150	2340	3150	1710	5800	4.8856E-02	2.9306E-02	1.8318E-02
16208500	500	7660	3560	4420	2200	8880	8.5015E-02	3.3379E-02	2.3969E-02
16210500	2	2360	4000	2500	1830	3420	5.3376E-03	4.3605E-02	4.7555E-03
16210500	5	5300	7830	5650	4110	7770	5.9719E-03	3.0642E-02	4.9979E-03
16210500	10	7960	11300	8590	6040	12200	7.7487E-03	2.7994E-02	6.0689E-03
16210500	25	12200	16400	13300	8790	20100	1.2008E-02	2.7994E-02	8.4035E-03
16210500	50	15900	20800	17600	11100	27900	1.6809E-02	2.7994E-02	1.0503E-02
16210500	100	20100	25600	22400	13400	37300	2.3040E-02	2.9306E-02	1.2899E-02
16210500	500	32000	38600	35600	19200	66100	4.3194E-02	3.3379E-02	1.8829E-02
16211300	2	453	610	464	354	608	3.9227E-03	4.3605E-02	3.5990E-03
16211300	5	948	1350	1000	736	1360	5.3958E-03	3.0642E-02	4.5879E-03
16211300	10	1420	2050	1540	1080	2200	7.9034E-03	2.7994E-02	6.1633E-03
16211300	25	2220	3180	2490	1620	3830	1.3430E-02	2.7994E-02	9.0760E-03
16211300	50	2980	4210	3430	2120	5560	1.9447E-02	2.7994E-02	1.1475E-02
16211300	100	3900	5410	4560	2670	7800	2.7139E-02	2.9306E-02	1.4090E-02
16211300	500	6830	8880	8010	4210	15200	5.1785E-02	3.3379E-02	2.0297E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16211500	2	261	480	329	184	589	2.6856E-02	4.3605E-02	1.6620E-02
16211500	5	922	1130	1020	584	1780	3.0414E-02	3.0642E-02	1.5264E-02
16211500	10	1730	1770	1760	986	3120	3.9212E-02	2.7994E-02	1.6333E-02
16211500	25	3340	2850	3000	1610	5580	5.8310E-02	2.7994E-02	1.8914E-02
16211500	50	5030	3850	4130	2160	7900	7.8670E-02	2.7994E-02	2.0647E-02
16211500	100	7230	5050	5460	2760	10800	1.0429E-01	2.9306E-02	2.2878E-02
16211500	500	14800	8600	9340	4370	19900	1.8453E-01	3.3379E-02	2.8266E-02
16211600	2	256	446	267	205	348	3.7112E-03	4.3605E-02	3.4202E-03
16211600	5	566	967	608	455	814	4.8082E-03	3.0642E-02	4.1560E-03
16211600	10	865	1450	957	685	1340	6.8407E-03	2.7994E-02	5.4974E-03
16211600	25	1370	2230	1580	1050	2370	1.1442E-02	2.7994E-02	8.1223E-03
16211600	50	1850	2940	2200	1390	3490	1.6517E-02	2.7994E-02	1.0388E-02
16211600	100	2440	3770	2950	1770	4930	2.3047E-02	2.9306E-02	1.2901E-02
16211600	500	4290	6140	5260	2820	9800	4.4094E-02	3.3379E-02	1.8998E-02
16211700	2	846	580	798	551	1160	8.0084E-03	4.3605E-02	6.7658E-03
16211700	5	1520	1350	1470	959	2250	1.2606E-02	3.0642E-02	8.9314E-03
16211700	10	2120	2100	2110	1310	3410	1.8922E-02	2.7994E-02	1.1290E-02
16211700	25	3070	3340	3210	1860	5550	3.1083E-02	2.7994E-02	1.4729E-02
16211700	50	3930	4500	4270	2370	7690	4.3282E-02	2.7994E-02	1.6999E-02
16211700	100	4960	5880	5550	2960	10400	5.8150E-02	2.9306E-02	1.9486E-02
16211700	500	8070	9920	9430	4610	19300	1.0330E-01	3.3379E-02	2.5228E-02
16211800	2	197	444	247	150	407	1.6824E-02	4.3605E-02	1.2140E-02
16211800	5	840	1040	902	572	1420	1.5276E-02	3.0642E-02	1.0194E-02
16211800	10	1650	1630	1640	1020	2630	1.7933E-02	2.7994E-02	1.0931E-02
16211800	25	3170	2610	2880	1700	4900	2.7189E-02	2.7994E-02	1.3793E-02
16211800	50	4700	3520	3970	2230	7060	3.8859E-02	2.7994E-02	1.6272E-02
16211800	100	6540	4610	5210	2790	9710	5.4594E-02	2.9306E-02	1.9070E-02
16211800	500	12100	7850	8700	4240	17900	1.0627E-01	3.3379E-02	2.5401E-02
16212200	2	375	192	361	289	451	2.5695E-03	4.3605E-02	2.4265E-03
16212200	5	731	486	703	551	896	3.1978E-03	3.0642E-02	2.8956E-03
16212200	10	1040	790	1000	756	1320	4.4453E-03	2.7994E-02	3.8361E-03
16212200	25	1510	1320	1470	1040	2070	7.3143E-03	2.7994E-02	5.7991E-03
16212200	50	1930	1830	1900	1280	2830	1.0501E-02	2.7994E-02	7.6363E-03
16212200	100	2410	2460	2430	1550	3790	1.4614E-02	2.9306E-02	9.7515E-03
16212200	500	3780	4390	4050	2320	7060	2.7907E-02	3.3379E-02	1.5200E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16212300	2	579	285	415	217	792	3.8772E-02	4.3605E-02	2.0524E-02
16212300	5	2020	765	1170	650	2120	3.8952E-02	3.0642E-02	1.7150E-02
16212300	10	3650	1280	1890	1040	3440	4.7297E-02	2.7994E-02	1.7585E-02
16212300	25	6560	2200	3040	1610	5730	6.6486E-02	2.7994E-02	1.9699E-02
16212300	50	9350	3120	4070	2110	7860	8.7152E-02	2.7994E-02	2.1188E-02
16212300	100	12700	4250	5320	2670	10600	1.1312E-01	2.9306E-02	2.3276E-02
16212300	500	22400	7810	9120	4260	19500	1.9342E-01	3.3379E-02	2.8467E-02
16212500	2	627	617	625	402	973	1.2313E-02	4.3605E-02	9.6016E-03
16212500	5	1440	1600	1490	956	2320	1.3965E-02	3.0642E-02	9.5930E-03
16212500	10	2180	2640	2350	1470	3770	1.8002E-02	2.7994E-02	1.0956E-02
16212500	25	3360	4450	3850	2270	6530	2.6687E-02	2.7994E-02	1.3662E-02
16212500	50	4400	6210	5340	3030	9410	3.5895E-02	2.7994E-02	1.5728E-02
16212500	100	5590	8360	7170	3900	13200	4.7450E-02	2.9306E-02	1.8117E-02
16212500	500	8930	15000	12900	6440	26000	8.3510E-02	3.3379E-02	2.3847E-02
16212601	2	496	611	499	425	585	1.2877E-03	4.3605E-02	1.2507E-03
16212601	5	805	1460	833	689	1010	1.8891E-03	3.0642E-02	1.7794E-03
16212601	10	1060	2310	1140	903	1440	2.9027E-03	2.7994E-02	2.6300E-03
16212601	25	1440	3730	1670	1240	2250	5.1906E-03	2.7994E-02	4.3787E-03
16212601	50	1770	5080	2220	1560	3150	7.7198E-03	2.7994E-02	6.0511E-03
16212601	100	2140	6680	2920	1950	4370	1.0984E-02	2.9306E-02	7.9895E-03
16212601	500	3200	11500	5290	3160	8870	2.1561E-02	3.3379E-02	1.3099E-02
16212800	2	1930	2160	1940	1660	2260	1.1982E-03	4.3605E-02	1.1662E-03
16212800	5	3060	3430	3080	2570	3690	1.6960E-03	3.0642E-02	1.6070E-03
16212800	10	3950	4420	3990	3210	4960	2.5473E-03	2.7994E-02	2.3348E-03
16212800	25	5250	5780	5320	4020	7030	4.4602E-03	2.7994E-02	3.8472E-03
16212800	50	6340	6860	6430	4630	8940	6.5673E-03	2.7994E-02	5.3194E-03
16212800	100	7550	8000	7650	5240	11200	9.2800E-03	2.9306E-02	7.0481E-03
16212800	500	10900	10800	10900	6660	17700	1.8042E-02	3.3379E-02	1.1712E-02
16213000	2	3300	3610	3320	2640	4180	2.7689E-03	4.3605E-02	2.6036E-03
16213000	5	6670	7440	6730	5310	8540	3.0647E-03	3.0642E-02	2.7861E-03
16213000	10	9490	11000	9670	7410	12600	3.9774E-03	2.7994E-02	3.4826E-03
16213000	25	13700	16400	14200	10300	19600	6.2656E-03	2.7994E-02	5.1197E-03
16213000	50	17300	21100	18100	12500	26300	8.9018E-03	2.7994E-02	6.7541E-03
16213000	100	21200	26500	22700	14900	34500	1.2361E-02	2.9306E-02	8.6941E-03
16213000	500	31800	41000	35400	20800	60200	2.3677E-02	3.3379E-02	1.3852E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16216000	2	8480	3730	8150	6640	10000	2.1617E-03	4.3605E-02	2.0596E-03
16216000	5	15000	6910	14300	11700	17500	2.0670E-03	3.0642E-02	1.9363E-03
16216000	10	19700	9660	18600	15000	23100	2.4854E-03	2.7994E-02	2.2828E-03
16216000	25	25900	13600	24000	18500	31100	3.8020E-03	2.7994E-02	3.3474E-03
16216000	50	30500	17000	27700	20500	37600	5.4297E-03	2.7994E-02	4.5476E-03
16216000	100	35100	20600	31500	22100	44700	7.6184E-03	2.9306E-02	6.0465E-03
16216000	500	45800	30200	40300	25500	63700	1.4849E-02	3.3379E-02	1.0277E-02
16223000	2	1610	1720	1620	1310	2000	2.2591E-03	4.3605E-02	2.1479E-03
16223000	5	3070	3070	3070	2440	3860	2.8026E-03	3.0642E-02	2.5678E-03
16223000	10	4300	4200	4290	3290	5580	3.8937E-03	2.7994E-02	3.4182E-03
16223000	25	6180	5830	6120	4410	8470	6.4166E-03	2.7994E-02	5.2201E-03
16223000	50	7830	7190	7660	5260	11200	9.2266E-03	2.7994E-02	6.9394E-03
16223000	100	9680	8680	9360	6110	14300	1.2860E-02	2.9306E-02	8.9377E-03
16223000	500	14900	12500	13800	8090	23700	2.4617E-02	3.3379E-02	1.4168E-02
16224500	2	926	833	922	768	1110	1.7248E-03	4.3605E-02	1.6592E-03
16224500	5	1500	1560	1500	1240	1810	1.8023E-03	3.0642E-02	1.7022E-03
16224500	10	1890	2190	1910	1560	2350	2.2589E-03	2.7994E-02	2.0902E-03
16224500	25	2400	3120	2470	1930	3180	3.4585E-03	2.7994E-02	3.0782E-03
16224500	50	2790	3920	2930	2190	3920	4.8602E-03	2.7994E-02	4.1412E-03
16224500	100	3170	4810	3430	2460	4790	6.7071E-03	2.9306E-02	5.4580E-03
16224500	500	4080	7190	4780	3100	7370	1.2745E-02	3.3379E-02	9.2234E-03
16226000	2	1020	1280	1030	829	1290	2.5048E-03	4.3605E-02	2.3687E-03
16226000	5	2060	2250	2080	1630	2660	3.3028E-03	3.0642E-02	2.9814E-03
16226000	10	3020	3050	3020	2270	4030	4.7701E-03	2.7994E-02	4.0756E-03
16226000	25	4570	4200	4490	3140	6420	8.1179E-03	2.7994E-02	6.2930E-03
16226000	50	6010	5160	5750	3810	8670	1.1828E-02	2.7994E-02	8.3147E-03
16226000	100	7720	6200	7130	4480	11300	1.6616E-02	2.9306E-02	1.0604E-02
16226000	500	12900	8900	10800	6040	19200	3.2101E-02	3.3379E-02	1.6364E-02
16226200	2	879	1330	897	731	1100	2.1457E-03	4.3605E-02	2.0450E-03
16226200	5	1340	2380	1390	1130	1730	2.4166E-03	3.0642E-02	2.2399E-03
16226200	10	1650	3250	1760	1390	2240	3.1240E-03	2.7994E-02	2.8104E-03
16226200	25	2050	4510	2300	1720	3060	4.7337E-03	2.7994E-02	4.0490E-03
16226200	50	2350	5570	2760	1990	3840	6.4975E-03	2.7994E-02	5.2735E-03
16226200	100	2650	6730	3290	2270	4760	8.7518E-03	2.9306E-02	6.7393E-03
16226200	500	3370	9740	4740	2970	7580	1.5929E-02	3.3379E-02	1.0783E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16227000	2	2000	1780	1980	1520	2590	3.7614E-03	4.3605E-02	3.4627E-03
16227000	5	3310	3360	3310	2500	4380	4.3968E-03	3.0642E-02	3.8451E-03
16227000	10	4270	4730	4340	3180	5930	5.7717E-03	2.7994E-02	4.7851E-03
16227000	25	5570	6750	5830	4030	8420	8.7392E-03	2.7994E-02	6.6600E-03
16227000	50	6590	8480	7110	4700	10700	1.1903E-02	2.7994E-02	8.3520E-03
16227000	100	7660	10400	8530	5390	13500	1.5891E-02	2.9306E-02	1.0304E-02
16227000	500	10300	15500	12400	7110	21800	2.8413E-02	3.3379E-02	1.5348E-02
16227500	2	517	477	505	306	833	1.7127E-02	4.3605E-02	1.2297E-02
16227500	5	1080	872	998	619	1610	1.7742E-02	3.0642E-02	1.1236E-02
16227500	10	1540	1200	1380	836	2270	2.1806E-02	2.7994E-02	1.2258E-02
16227500	25	2180	1690	1910	1110	3290	3.0402E-02	2.7994E-02	1.4574E-02
16227500	50	2700	2110	2340	1310	4160	3.9261E-02	2.7994E-02	1.6342E-02
16227500	100	3250	2580	2810	1520	5190	5.0134E-02	2.9306E-02	1.8495E-02
16227500	500	4600	3820	4030	2010	8080	8.3011E-02	3.3379E-02	2.3807E-02
16228000	2	987	974	986	816	1190	1.8395E-03	4.3605E-02	1.7650E-03
16228000	5	1810	1770	1810	1510	2160	1.6744E-03	3.0642E-02	1.5876E-03
16228000	10	2400	2440	2410	1980	2920	1.9754E-03	2.7994E-02	1.8452E-03
16228000	25	3180	3410	3200	2520	4060	3.0775E-03	2.7994E-02	2.7727E-03
16228000	50	3760	4240	3820	2890	5060	4.4943E-03	2.7994E-02	3.8726E-03
16228000	100	4330	5150	4470	3220	6200	6.4246E-03	2.9306E-02	5.2694E-03
16228000	500	5650	7540	6120	3970	9460	1.2841E-02	3.3379E-02	9.2737E-03
16228200	2	1020	1070	1030	823	1280	2.5482E-03	4.3605E-02	2.4075E-03
16228200	5	1800	1950	1810	1440	2270	2.7804E-03	3.0642E-02	2.5491E-03
16228200	10	2380	2700	2410	1870	3110	3.5602E-03	2.7994E-02	3.1585E-03
16228200	25	3170	3790	3270	2410	4440	5.4822E-03	2.7994E-02	4.5844E-03
16228200	50	3800	4720	3990	2810	5660	7.6730E-03	2.7994E-02	6.0223E-03
16228200	100	4460	5740	4770	3210	7100	1.0530E-02	2.9306E-02	7.7465E-03
16228200	500	6100	8440	6890	4160	11400	1.9803E-02	3.3379E-02	1.2429E-02
16228500	2	2100	1120	1920	1350	2740	7.2776E-03	4.3605E-02	6.2367E-03
16228500	5	3470	2110	3150	2220	4460	7.3872E-03	3.0642E-02	5.9522E-03
16228500	10	4400	2960	3990	2750	5790	9.0028E-03	2.7994E-02	6.8121E-03
16228500	25	5560	4220	5110	3350	7770	1.2553E-02	2.7994E-02	8.6666E-03
16228500	50	6410	5300	5980	3780	9450	1.6282E-02	2.7994E-02	1.0295E-02
16228500	100	7240	6490	6920	4200	11400	2.0905E-02	2.9306E-02	1.2201E-02
16228500	500	9110	9680	9400	5210	17000	3.5010E-02	3.3379E-02	1.7088E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16228900	2	423	303	413	323	529	3.2269E-03	4.3605E-02	3.0046E-03
16228900	5	775	575	748	570	982	4.1099E-03	3.0642E-02	3.6238E-03
16228900	10	1070	808	1020	747	1390	5.7261E-03	2.7994E-02	4.7537E-03
16228900	25	1510	1160	1410	970	2060	9.2806E-03	2.7994E-02	6.9699E-03
16228900	50	1890	1470	1740	1140	2670	1.3135E-02	2.7994E-02	8.9400E-03
16228900	100	2320	1810	2110	1310	3400	1.8046E-02	2.9306E-02	1.1169E-02
16228900	500	3510	2760	3110	1730	5580	3.3708E-02	3.3379E-02	1.6771E-02
16229000	2	1390	906	1380	1180	1610	1.2334E-03	4.3605E-02	1.1995E-03
16229000	5	2630	1660	2570	2140	3090	1.7702E-03	3.0642E-02	1.6736E-03
16229000	10	3770	2300	3610	2880	4520	2.7398E-03	2.7994E-02	2.4956E-03
16229000	25	5640	3240	5180	3860	6960	5.0246E-03	2.7994E-02	4.2600E-03
16229000	50	7400	4030	6500	4580	9210	7.6078E-03	2.7994E-02	5.9821E-03
16229000	100	9510	4910	7940	5310	11900	1.0982E-02	2.9306E-02	7.9886E-03
16229000	500	16200	7240	11700	6980	19800	2.2057E-02	3.3379E-02	1.3281E-02
16229300	2	2290	1280	2200	1720	2820	3.2323E-03	4.3605E-02	3.0093E-03
16229300	5	4360	2420	4140	3260	5250	3.0687E-03	3.0642E-02	2.7893E-03
16229300	10	5920	3400	5550	4290	7180	3.6722E-03	2.7994E-02	3.2464E-03
16229300	25	8000	4850	7360	5410	10000	5.5626E-03	2.7994E-02	4.6405E-03
16229300	50	9600	6090	8690	6100	12400	7.8896E-03	2.7994E-02	6.1549E-03
16229300	100	11200	7470	10000	6700	15000	1.1009E-02	2.9306E-02	8.0027E-03
16229300	500	15000	11100	13400	7990	22300	2.1268E-02	3.3379E-02	1.2991E-02
16235400	2	588	498	580	441	763	4.0302E-03	4.3605E-02	3.6893E-03
16235400	5	1220	953	1180	895	1560	4.2600E-03	3.0642E-02	3.7400E-03
16235400	10	1740	1350	1670	1230	2260	5.3694E-03	2.7994E-02	4.5052E-03
16235400	25	2510	1940	2370	1650	3390	8.2318E-03	2.7994E-02	6.3612E-03
16235400	50	3150	2460	2930	1950	4410	1.1554E-02	2.7994E-02	8.1785E-03
16235400	100	3840	3040	3540	2240	5600	1.5920E-02	2.9306E-02	1.0316E-02
16235400	500	5660	4630	5150	2920	9080	3.0167E-02	3.3379E-02	1.5846E-02
16237500	2	378	497	383	310	474	2.3217E-03	4.3605E-02	2.2043E-03
16237500	5	678	968	700	554	884	2.9350E-03	3.0642E-02	2.6784E-03
16237500	10	924	1380	973	743	1270	4.1000E-03	2.7994E-02	3.5763E-03
16237500	25	1290	2010	1410	1010	1960	6.7284E-03	2.7994E-02	5.4246E-03
16237500	50	1600	2550	1800	1230	2640	9.6187E-03	2.7994E-02	7.1589E-03
16237500	100	1950	3170	2270	1470	3500	1.3331E-02	2.9306E-02	9.1628E-03
16237500	500	2910	4860	3630	2110	6230	2.5264E-02	3.3379E-02	1.4380E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16238500	2	656	634	655	537	800	2.0404E-03	4.3605E-02	1.9492E-03
16238500	5	1250	1110	1240	1010	1540	2.3754E-03	3.0642E-02	2.2045E-03
16238500	10	1750	1500	1720	1350	2190	3.1819E-03	2.7994E-02	2.8571E-03
16238500	25	2490	2070	2420	1800	3260	5.1317E-03	2.7994E-02	4.3367E-03
16238500	50	3120	2540	2990	2120	4210	7.3475E-03	2.7994E-02	5.8199E-03
16238500	100	3810	3060	3600	2430	5330	1.0239E-02	2.9306E-02	7.5882E-03
16238500	500	5700	4420	5190	3140	8570	1.9672E-02	3.3379E-02	1.2377E-02
16240500	2	576	565	576	498	667	1.0699E-03	4.3605E-02	1.0443E-03
16240500	5	1030	1010	1030	868	1220	1.4923E-03	3.0642E-02	1.4230E-03
16240500	10	1420	1380	1420	1160	1750	2.2633E-03	2.7994E-02	2.0940E-03
16240500	25	2040	1910	2020	1540	2640	4.0701E-03	2.7994E-02	3.5534E-03
16240500	50	2590	2370	2550	1850	3510	6.1047E-03	2.7994E-02	5.0117E-03
16240500	100	3230	2870	3150	2170	4560	8.7556E-03	2.9306E-02	6.7415E-03
16240500	500	5150	4190	4800	2960	7770	1.7427E-02	3.3379E-02	1.1449E-02
16244000	2	422	505	425	346	524	2.2291E-03	4.3605E-02	2.1207E-03
16244000	5	815	944	825	660	1030	2.6506E-03	3.0642E-02	2.4395E-03
16244000	10	1150	1320	1170	903	1500	3.5941E-03	2.7994E-02	3.1851E-03
16244000	25	1650	1870	1680	1230	2310	5.8359E-03	2.7994E-02	4.8292E-03
16244000	50	2080	2350	2140	1490	3070	8.3638E-03	2.7994E-02	6.4398E-03
16244000	100	2560	2890	2650	1760	4010	1.1651E-02	2.9306E-02	8.3368E-03
16244000	500	3900	4330	4070	2410	6860	2.2341E-02	3.3379E-02	1.3383E-02
16246000	2	387	428	390	305	498	3.1446E-03	4.3605E-02	2.9331E-03
16246000	5	740	823	748	589	949	3.0879E-03	3.0642E-02	2.8052E-03
16246000	10	1010	1170	1030	793	1330	3.7542E-03	2.7994E-02	3.3103E-03
16246000	25	1380	1680	1430	1050	1950	5.7062E-03	2.7994E-02	4.7400E-03
16246000	50	1670	2130	1760	1230	2520	8.0678E-03	2.7994E-02	6.2628E-03
16246000	100	1970	2640	2130	1420	3200	1.1218E-02	2.9306E-02	8.1127E-03
16246000	500	2680	4030	3150	1880	5280	2.1577E-02	3.3379E-02	1.3106E-02
16247200	2	921	377	834	609	1140	5.4646E-03	4.3605E-02	4.8561E-03
16247200	5	1440	812	1310	950	1800	5.9858E-03	3.0642E-02	5.0076E-03
16247200	10	1780	1220	1650	1160	2330	7.5477E-03	2.7994E-02	5.9449E-03
16247200	25	2220	1870	2120	1420	3160	1.0767E-02	2.7994E-02	7.7762E-03
16247200	50	2550	2460	2520	1630	3900	1.4067E-02	2.7994E-02	9.3625E-03
16247200	100	2880	3140	2970	1850	4790	1.8118E-02	2.9306E-02	1.1196E-02
16247200	500	3630	5110	4270	2420	7550	3.0429E-02	3.3379E-02	1.5918E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16247500	2	552	425	544	433	682	2.6835E-03	4.3605E-02	2.5279E-03
16247500	5	1050	939	1040	800	1350	3.7532E-03	3.0642E-02	3.3437E-03
16247500	10	1500	1430	1490	1090	2020	5.5709E-03	2.7994E-02	4.6462E-03
16247500	25	2220	2210	2220	1510	3250	9.6096E-03	2.7994E-02	7.1538E-03
16247500	50	2880	2930	2900	1870	4480	1.4029E-02	2.7994E-02	9.3453E-03
16247500	100	3660	3780	3710	2270	6050	1.9695E-02	2.9306E-02	1.1779E-02
16247500	500	6050	6220	6140	3360	11200	3.7919E-02	3.3379E-02	1.7752E-02
16247900	2	398	205	376	285	496	4.1130E-03	4.3605E-02	3.7585E-03
16247900	5	827	494	759	550	1050	6.0875E-03	3.0642E-02	5.0786E-03
16247900	10	1250	783	1110	761	1620	9.2708E-03	2.7994E-02	6.9644E-03
16247900	25	1970	1270	1680	1060	2650	1.6226E-02	2.7994E-02	1.0272E-02
16247900	50	2680	1740	2200	1320	3670	2.3775E-02	2.7994E-02	1.2856E-02
16247900	100	3570	2300	2820	1610	4960	3.3418E-02	2.9306E-02	1.5614E-02
16247900	500	6520	4010	4730	2430	9240	6.4322E-02	3.3379E-02	2.1975E-02
16248800	2	346	690	368	262	519	6.3378E-03	6.3044E-02	5.7589E-03
16248800	5	798	1310	845	613	1160	5.7020E-03	4.3605E-02	5.0426E-03
16248800	10	1170	1830	1250	893	1760	6.6616E-03	3.7645E-02	5.6600E-03
16248800	25	1710	2580	1870	1250	2780	1.0024E-02	3.6202E-02	7.8506E-03
16248800	50	2130	3220	2390	1520	3780	1.4256E-02	3.6202E-02	1.0228E-02
16248800	100	2570	3890	2960	1760	4970	1.9948E-02	3.9107E-02	1.3210E-02
16248800	500	3630	5700	4430	2290	8580	3.8553E-02	4.8262E-02	2.1432E-02
16249000	2	1640	1020	1540	1030	2320	9.3789E-03	6.3044E-02	8.1643E-03
16249000	5	3020	1930	2730	1750	4260	1.2447E-02	4.3605E-02	9.6828E-03
16249000	10	4170	2680	3630	2220	5920	1.7190E-02	3.7645E-02	1.1801E-02
16249000	25	5900	3770	4880	2800	8530	2.6332E-02	3.6202E-02	1.5244E-02
16249000	50	7390	4670	5890	3220	10800	3.5459E-02	3.6202E-02	1.7913E-02
16249000	100	9070	5630	7000	3630	13500	4.6537E-02	3.9107E-02	2.1250E-02
16249000	500	13800	8160	9940	4540	21700	7.9975E-02	4.8262E-02	3.0099E-02
16249100	2	109	190	113	83.4	153	4.9231E-03	6.3044E-02	4.5665E-03
16249100	5	250	366	260	191	354	5.2508E-03	4.3605E-02	4.6865E-03
16249100	10	377	518	395	282	555	6.6562E-03	3.7645E-02	5.6561E-03
16249100	25	575	745	609	407	912	1.0265E-02	3.6202E-02	7.9972E-03
16249100	50	749	940	799	505	1260	1.4450E-02	3.6202E-02	1.0328E-02
16249100	100	944	1160	1010	603	1700	1.9950E-02	3.9107E-02	1.3211E-02
16249100	500	1480	1750	1600	826	3080	3.7918E-02	4.8262E-02	2.1235E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16254000	2	821	985	831	624	1110	4.2976E-03	6.3044E-02	4.0233E-03
16254000	5	1890	1870	1890	1390	2570	5.1241E-03	4.3605E-02	4.5853E-03
16254000	10	2920	2590	2870	2030	4050	6.9333E-03	3.7645E-02	5.8550E-03
16254000	25	4620	3640	4370	2880	6630	1.1167E-02	3.6202E-02	8.5344E-03
16254000	50	6210	4510	5630	3500	9050	1.5903E-02	3.6202E-02	1.1049E-02
16254000	100	8080	5440	7010	4100	12000	2.2037E-02	3.9107E-02	1.4094E-02
16254000	500	13800	7900	10600	5410	20900	4.1895E-02	4.8262E-02	2.2427E-02
16260500	2	1700	2100	1720	1330	2230	3.5112E-03	6.3044E-02	3.3260E-03
16260500	5	3330	3960	3380	2570	4460	4.0915E-03	4.3605E-02	3.7405E-03
16260500	10	4700	5440	4790	3510	6530	5.4339E-03	3.7645E-02	4.7485E-03
16260500	25	6740	7560	6890	4740	10000	8.5578E-03	3.6202E-02	6.9216E-03
16260500	50	8490	9310	8690	5660	13300	1.2036E-02	3.6202E-02	9.0331E-03
16260500	100	10400	11100	10600	6530	17300	1.6528E-02	3.9107E-02	1.1618E-02
16260500	500	15700	15800	15700	8470	29300	3.1008E-02	4.8262E-02	1.8879E-02
16265600	2	791	614	780	599	1020	3.6129E-03	6.3044E-02	3.4171E-03
16265600	5	1210	1170	1210	876	1670	5.7344E-03	4.3605E-02	5.0679E-03
16265600	10	1550	1630	1560	1070	2280	8.7002E-03	3.7645E-02	7.0669E-03
16265600	25	2030	2310	2110	1330	3340	1.4529E-02	3.6202E-02	1.0368E-02
16265600	50	2440	2870	2590	1550	4340	2.0461E-02	3.6202E-02	1.3073E-02
16265600	100	2900	3480	3130	1760	5560	2.7755E-02	3.9107E-02	1.6234E-02
16265600	500	4160	5120	4630	2280	9390	5.0147E-02	4.8262E-02	2.4593E-02
16270900	2	198	328	204	156	266	3.6594E-03	6.3044E-02	3.4586E-03
16270900	5	367	629	386	288	517	4.6385E-03	4.3605E-02	4.1925E-03
16270900	10	508	884	550	394	769	6.4293E-03	3.7645E-02	5.4914E-03
16270900	25	719	1260	815	543	1220	1.0339E-02	3.6202E-02	8.0421E-03
16270900	50	902	1580	1060	669	1680	1.4559E-02	3.6202E-02	1.0383E-02
16270900	100	1110	1930	1340	795	2240	1.9923E-02	3.9107E-02	1.3199E-02
16270900	500	1680	2890	2120	1110	4080	3.6975E-02	4.8262E-02	2.0936E-02
16275000	2	571	564	570	459	708	2.3813E-03	6.3044E-02	2.2947E-03
16275000	5	1210	1080	1200	940	1540	3.2281E-03	4.3605E-02	3.0056E-03
16275000	10	1830	1500	1790	1340	2410	4.7681E-03	3.7645E-02	4.2321E-03
16275000	25	2890	2130	2730	1880	3960	8.3148E-03	3.6202E-02	6.7618E-03
16275000	50	3910	2650	3540	2300	5450	1.2268E-02	3.6202E-02	9.1632E-03
16275000	100	5150	3220	4460	2720	7310	1.7389E-02	3.9107E-02	1.2037E-02
16275000	500	9160	4740	6980	3690	13200	3.4025E-02	4.8262E-02	1.9956E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16278000	2	43.1	239	52.5	35.7	77	8.1664E-03	6.3044E-02	7.2299E-03
16278000	5	108	459	149	95.4	233	1.2642E-02	4.3605E-02	9.8007E-03
16278000	10	181	648	280	168	467	1.9535E-02	3.7645E-02	1.2861E-02
16278000	25	326	929	542	298	986	3.4254E-02	3.6202E-02	1.7601E-02
16278000	50	484	1170	808	420	1550	5.0035E-02	3.6202E-02	2.1005E-02
16278000	100	701	1430	1110	542	2260	7.0060E-02	3.9107E-02	2.5097E-02
16278000	500	1540	2160	1970	843	4620	1.3378E-01	4.8262E-02	3.5467E-02
16279500	2	956	924	950	598	1510	1.2645E-02	6.3044E-02	1.0533E-02
16279500	5	2630	1750	2380	1490	3800	1.4153E-02	4.3605E-02	1.0685E-02
16279500	10	4370	2430	3610	2190	5950	1.8237E-02	3.7645E-02	1.2285E-02
16279500	25	7390	3420	5300	3010	9320	2.7576E-02	3.6202E-02	1.5653E-02
16279500	50	10300	4250	6550	3540	12100	3.7830E-02	3.6202E-02	1.8499E-02
16279500	100	13800	5120	7870	4020	15400	5.0949E-02	3.9107E-02	2.2125E-02
16279500	500	24400	7450	11200	5010	25000	9.2738E-02	4.8262E-02	3.1743E-02
16283000	2	130	63.2	125	95.8	162	3.6005E-03	6.3044E-02	3.4060E-03
16283000	5	258	123	236	171	326	5.8347E-03	4.3605E-02	5.1461E-03
16283000	10	384	176	328	222	485	9.3559E-03	3.7645E-02	7.4935E-03
16283000	25	606	257	460	283	748	1.7129E-02	3.6202E-02	1.1627E-02
16283000	50	828	328	564	324	980	2.5637E-02	3.6202E-02	1.5009E-02
16283000	100	1110	409	685	368	1270	3.6569E-02	3.9107E-02	1.8898E-02
16283000	500	2080	637	1030	476	2210	7.1856E-02	4.8262E-02	2.8871E-02
16283200	2	427	492	429	343	537	2.5639E-03	6.3044E-02	2.4637E-03
16283200	5	663	939	676	542	843	2.5502E-03	4.3605E-02	2.4093E-03
16283200	10	818	1310	848	666	1080	3.0998E-03	3.7645E-02	2.8640E-03
16283200	25	1010	1860	1080	811	1440	4.5481E-03	3.6202E-02	4.0405E-03
16283200	50	1150	2330	1270	916	1770	6.2225E-03	3.6202E-02	5.3098E-03
16283200	100	1280	2830	1470	1010	2140	8.4071E-03	3.9107E-02	6.9195E-03
16283200	500	1580	4180	2000	1230	3250	1.5435E-02	4.8262E-02	1.1695E-02
16283480	2	808	1090	828	597	1150	5.7160E-03	6.3044E-02	5.2408E-03
16283480	5	1670	2060	1730	1190	2520	8.3607E-03	4.3605E-02	7.0156E-03
16283480	10	2510	2860	2590	1670	4010	1.2478E-02	3.7645E-02	9.3714E-03
16283480	25	3930	4010	3960	2350	6670	2.1156E-02	3.6202E-02	1.3353E-02
16283480	50	5310	4970	5150	2880	9200	3.0376E-02	3.6202E-02	1.6517E-02
16283480	100	7010	5980	6460	3400	12300	4.2006E-02	3.9107E-02	2.0252E-02
16283480	500	12500	8660	9970	4570	21800	7.8755E-02	4.8262E-02	2.9924E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16283600	2	97.7	60.2	95.6	75.2	122	2.9615E-03	6.3044E-02	2.8287E-03
16283600	5	177	117	171	131	224	3.9182E-03	4.3605E-02	3.5952E-03
16283600	10	244	168	232	170	319	5.5851E-03	3.7645E-02	4.8636E-03
16283600	25	345	245	322	219	474	9.2292E-03	3.6202E-02	7.3543E-03
16283600	50	434	313	398	255	620	1.3172E-02	3.6202E-02	9.6583E-03
16283600	100	534	390	483	292	799	1.8195E-02	3.9107E-02	1.2417E-02
16283600	500	819	609	724	382	1370	3.4210E-02	4.8262E-02	2.0019E-02
16283700	2	78.6	54.8	77.6	63	95.6	2.2098E-03	6.3044E-02	2.1349E-03
16283700	5	132	107	130	102	164	2.9438E-03	4.3605E-02	2.7576E-03
16283700	10	174	153	171	130	226	4.2130E-03	3.7645E-02	3.7889E-03
16283700	25	235	224	233	165	329	6.9845E-03	3.6202E-02	5.8549E-03
16283700	50	286	286	286	192	427	9.9825E-03	3.6202E-02	7.8249E-03
16283700	100	343	357	347	220	547	1.3800E-02	3.9107E-02	1.0201E-02
16283700	500	498	559	519	289	932	2.5974E-02	4.8262E-02	1.6886E-02
16284000	2	422	552	427	330	553	3.4422E-03	6.3044E-02	3.2640E-03
16284000	5	871	1050	887	665	1180	4.4980E-03	4.3605E-02	4.0774E-03
16284000	10	1290	1470	1310	939	1830	6.4137E-03	3.7645E-02	5.4800E-03
16284000	25	1960	2080	1990	1320	3000	1.0706E-02	3.6202E-02	8.2627E-03
16284000	50	2590	2600	2590	1620	4150	1.5415E-02	3.6202E-02	1.0811E-02
16284000	100	3330	3150	3270	1920	5560	2.1456E-02	3.9107E-02	1.3855E-02
16284000	500	5600	4640	5140	2630	10100	4.0873E-02	4.8262E-02	2.2131E-02
16284200	2	536	556	537	434	664	2.2959E-03	6.3044E-02	2.2152E-03
16284200	5	873	1060	882	710	1100	2.4540E-03	4.3605E-02	2.3233E-03
16284200	10	1110	1480	1140	892	1450	3.1007E-03	3.7645E-02	2.8647E-03
16284200	25	1420	2100	1490	1110	1990	4.7024E-03	3.6202E-02	4.1618E-03
16284200	50	1660	2620	1780	1270	2490	6.5269E-03	3.6202E-02	5.5299E-03
16284200	100	1900	3180	2090	1420	3070	8.9022E-03	3.9107E-02	7.2515E-03
16284200	500	2470	4680	2910	1760	4800	1.6587E-02	4.8262E-02	1.2344E-02
16291000	2	600	619	602	403	901	9.0897E-03	6.3044E-02	7.9443E-03
16291000	5	1160	1180	1160	745	1820	1.2585E-02	4.3605E-02	9.7665E-03
16291000	10	1650	1640	1650	1000	2710	1.7830E-02	3.7645E-02	1.2099E-02
16291000	25	2430	2320	2380	1350	4200	2.8103E-02	3.6202E-02	1.5821E-02
16291000	50	3140	2900	3010	1630	5580	3.8495E-02	3.6202E-02	1.8657E-02
16291000	100	3960	3510	3700	1890	7240	5.1216E-02	3.9107E-02	2.2175E-02
16291000	500	6380	5160	5560	2500	12400	9.0031E-02	4.8262E-02	3.1420E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16294900	2	2200	1060	2140	1720	2670	2.4739E-03	6.3044E-02	2.3805E-03
16294900	5	3980	2010	3850	3110	4750	2.3280E-03	4.3605E-02	2.2100E-03
16294900	10	5260	2790	5040	4010	6340	2.7777E-03	3.7645E-02	2.5868E-03
16294900	25	6940	3910	6540	4950	8630	4.2340E-03	3.6202E-02	3.7907E-03
16294900	50	8200	4850	7610	5500	10500	6.0452E-03	3.6202E-02	5.1802E-03
16294900	100	9460	5840	8680	5950	12600	8.4830E-03	3.9107E-02	6.9709E-03
16294900	500	12400	8460	11200	6800	18500	1.6524E-02	4.8262E-02	1.2310E-02
16296500	2	3380	1570	3350	2990	3760	6.5134E-04	6.3044E-02	6.4468E-04
16296500	5	4600	2970	4570	4080	5120	6.4590E-04	4.3605E-02	6.3647E-04
16296500	10	5340	4090	5310	4680	6020	7.8970E-04	3.7645E-02	7.7348E-04
16296500	25	6200	5710	6180	5300	7220	1.2072E-03	3.6202E-02	1.1682E-03
16296500	50	6800	7050	6810	5670	8170	1.7117E-03	3.6202E-02	1.6344E-03
16296500	100	7360	8460	7410	5990	9180	2.3850E-03	3.9107E-02	2.2479E-03
16296500	500	8560	12100	8820	6580	11800	4.6029E-03	4.8262E-02	4.2022E-03
16303000	2	1840	1250	1820	1550	2150	1.3152E-03	6.3044E-02	1.2884E-03
16303000	5	2960	2370	2940	2480	3480	1.4597E-03	4.3605E-02	1.4124E-03
16303000	10	3760	3280	3740	3080	4530	1.8963E-03	3.7645E-02	1.8054E-03
16303000	25	4820	4590	4810	3790	6090	2.9847E-03	3.6202E-02	2.7574E-03
16303000	50	5650	5670	5650	4280	7460	4.2355E-03	3.6202E-02	3.7919E-03
16303000	100	6490	6820	6530	4730	9020	5.8748E-03	3.9107E-02	5.1075E-03
16303000	500	8550	9840	8780	5710	13500	1.1231E-02	4.8262E-02	9.1111E-03
16304200	2	835	613	825	663	1030	2.4295E-03	6.3044E-02	2.3394E-03
16304200	5	1460	1170	1440	1160	1790	2.4435E-03	4.3605E-02	2.3138E-03
16304200	10	1900	1630	1880	1480	2390	3.0031E-03	3.7645E-02	2.7812E-03
16304200	25	2500	2300	2470	1860	3290	4.5600E-03	3.6202E-02	4.0499E-03
16304200	50	2950	2870	2930	2100	4090	6.4128E-03	3.6202E-02	5.4478E-03
16304200	100	3400	3480	3420	2330	5010	8.8695E-03	3.9107E-02	7.2298E-03
16304200	500	4480	5120	4640	2800	7680	1.6921E-02	4.8262E-02	1.2528E-02
16304500	2	1780	1020	1740	1400	2170	2.4805E-03	6.3044E-02	2.3866E-03
16304500	5	2550	1940	2510	1990	3160	2.7865E-03	4.3605E-02	2.6191E-03
16304500	10	3050	2690	3020	2330	3910	3.5718E-03	3.7645E-02	3.2622E-03
16304500	25	3670	3770	3680	2710	5000	5.2574E-03	3.6202E-02	4.5908E-03
16304500	50	4130	4680	4210	2980	5950	7.0400E-03	3.6202E-02	5.8938E-03
16304500	100	4570	5640	4760	3220	7030	9.2719E-03	3.9107E-02	7.4949E-03
16304500	500	5580	8170	6150	3740	10100	1.6219E-02	4.8262E-02	1.2139E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16310501	2	1280	1680	1320	873	2010	9.8286E-03	6.3044E-02	8.5030E-03
16310501	5	2790	3160	2860	1870	4370	1.1090E-02	4.3605E-02	8.8417E-03
16310501	10	4130	4360	4190	2650	6630	1.4285E-02	3.7645E-02	1.0355E-02
16310501	25	6190	6080	6150	3650	10400	2.1289E-02	3.6202E-02	1.3406E-02
16310501	50	7980	7500	7770	4380	13800	2.8798E-02	3.6202E-02	1.6039E-02
16310501	100	9990	8990	9480	5060	17800	3.8278E-02	3.9107E-02	1.9344E-02
16310501	500	15500	12900	13900	6530	29700	6.8059E-02	4.8262E-02	2.8238E-02
16325000	2	1210	1290	1220	1030	1440	1.4707E-03	4.3605E-02	1.4227E-03
16325000	5	1900	2230	1920	1580	2350	2.0899E-03	3.0642E-02	1.9565E-03
16325000	10	2440	3000	2490	1960	3170	3.1177E-03	2.7994E-02	2.8053E-03
16325000	25	3220	4090	3350	2470	4530	5.3764E-03	2.7994E-02	4.5102E-03
16325000	50	3870	5000	4100	2880	5830	7.8335E-03	2.7994E-02	6.1207E-03
16325000	100	4590	5990	4940	3300	7390	1.0975E-02	2.9306E-02	7.9846E-03
16325000	500	6550	8510	7250	4340	12100	2.1045E-02	3.3379E-02	1.2907E-02
16330000	2	2620	2090	2600	2210	3060	1.3714E-03	4.3605E-02	1.3296E-03
16330000	5	4330	3850	4290	3520	5230	2.0463E-03	3.0642E-02	1.9182E-03
16330000	10	5750	5350	5710	4490	7260	3.1774E-03	2.7994E-02	2.8535E-03
16330000	25	7930	7540	7860	5760	10700	5.7361E-03	2.7994E-02	4.7606E-03
16330000	50	9840	9400	9740	6760	14000	8.5698E-03	2.7994E-02	6.5612E-03
16330000	100	12000	11400	11900	7790	18000	1.2231E-02	2.9306E-02	8.6296E-03
16330000	500	18500	16800	17700	10400	30300	2.4114E-02	3.3379E-02	1.4000E-02
16331000	2	54	379	89.3	55.3	144	1.5179E-02	4.3605E-02	1.1260E-02
16331000	5	221	851	360	224	580	1.7467E-02	3.0642E-02	1.1125E-02
16331000	10	453	1300	729	439	1210	2.3043E-02	2.7994E-02	1.2639E-02
16331000	25	960	2040	1470	833	2590	3.6166E-02	2.7994E-02	1.5780E-02
16331000	50	1550	2720	2230	1220	4090	5.0854E-02	2.7994E-02	1.8055E-02
16331000	100	2370	3520	3130	1640	5990	6.9862E-02	2.9306E-02	2.0646E-02
16331000	500	5530	5860	5790	2770	12100	1.3127E-01	3.3379E-02	2.6612E-02
16340000	2	2570	3210	2600	2130	3160	1.9959E-03	4.3605E-02	1.9086E-03
16340000	5	4630	5600	4710	3720	5960	2.9836E-03	3.0642E-02	2.7189E-03
16340000	10	6460	7580	6610	4970	8780	4.6263E-03	2.7994E-02	3.9702E-03
16340000	25	9410	10400	9620	6700	13800	8.3224E-03	2.7994E-02	6.4152E-03
16340000	50	12100	12700	12300	8090	18700	1.2404E-02	2.7994E-02	8.5952E-03
16340000	100	15400	15200	15300	9520	24600	1.7669E-02	2.9306E-02	1.1023E-02
16340000	500	25300	21500	23300	12900	41900	3.4725E-02	3.3379E-02	1.7019E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16343000	2	3990	2580	3560	2200	5770	1.5416E-02	4.3605E-02	1.1389E-02
16343000	5	9490	4800	7450	4650	11900	1.6862E-02	3.0642E-02	1.0877E-02
16343000	10	14500	6710	10400	6330	17100	2.1319E-02	2.7994E-02	1.2102E-02
16343000	25	22500	9500	14300	8270	24700	3.0981E-02	2.7994E-02	1.4706E-02
16343000	50	29500	11900	17200	9590	30800	4.1219E-02	2.7994E-02	1.6671E-02
16343000	100	37400	14500	20200	10900	37700	5.4037E-02	2.9306E-02	1.9001E-02
16343000	500	59200	21300	27800	13700	56500	9.3857E-02	3.3379E-02	2.4623E-02
16345000	2	1950	1800	1940	1670	2260	1.1524E-03	4.3605E-02	1.1228E-03
16345000	5	2980	2830	2970	2540	3480	1.2810E-03	3.0642E-02	1.2296E-03
16345000	10	3690	3630	3680	3080	4400	1.6631E-03	2.7994E-02	1.5699E-03
16345000	25	4600	4710	4610	3700	5750	2.6066E-03	2.7994E-02	2.3846E-03
16345000	50	5300	5570	5330	4120	6890	3.6859E-03	2.7994E-02	3.2570E-03
16345000	100	6000	6480	6070	4510	8170	5.0970E-03	2.9306E-02	4.3418E-03
16345000	500	7670	8720	7890	5340	11700	9.6965E-03	3.3379E-02	7.5138E-03
16350000	2	1510	1740	1520	1210	1910	2.7066E-03	4.3605E-02	2.5484E-03
16350000	5	2920	3090	2930	2310	3720	3.0400E-03	3.0642E-02	2.7656E-03
16350000	10	4070	4210	4090	3130	5340	3.9713E-03	2.7994E-02	3.4779E-03
16350000	25	5770	5830	5780	4190	7980	6.2518E-03	2.7994E-02	5.1105E-03
16350000	50	7190	7170	7180	4960	10400	8.8522E-03	2.7994E-02	6.7255E-03
16350000	100	8730	8640	8710	5730	13200	1.2248E-02	2.9306E-02	8.6380E-03
16350000	500	12900	12400	12700	7470	21500	2.3311E-02	3.3379E-02	1.3725E-02
16400000	2	2630	2450	2620	2300	2980	8.4550E-04	2.4200E-02	8.1696E-04
16400000	5	4390	4340	4380	3730	5150	1.4206E-03	1.1435E-02	1.2636E-03
16400000	10	5990	6050	6000	4950	7280	2.4385E-03	7.3975E-03	1.8340E-03
16400000	25	8620	9050	8820	7020	11100	4.9469E-03	5.3736E-03	2.5757E-03
16400000	50	11100	12000	11700	9120	14900	7.8704E-03	4.7677E-03	2.9691E-03
16400000	100	14200	15700	15200	11600	20000	1.1763E-02	5.3736E-03	3.6885E-03
16400000	500	24000	27200	26500	19400	36300	2.4830E-02	6.0141E-03	4.8415E-03
16402000	2	2340	2280	2330	1750	3090	4.7417E-03	2.4200E-02	3.9648E-03
16402000	5	4690	4050	4440	3310	5960	6.7757E-03	1.1435E-02	4.2546E-03
16402000	10	6890	5660	6150	4580	8260	1.0025E-02	7.3975E-03	4.2566E-03
16402000	25	10600	8460	8920	6690	11900	1.6955E-02	5.3736E-03	4.0804E-03
16402000	50	14000	11200	11600	8740	15500	2.4364E-02	4.7677E-03	3.9874E-03
16402000	100	18200	14600	15000	11100	20500	3.3743E-02	5.3736E-03	4.6354E-03
16402000	500	31400	25200	25700	18400	35900	6.3485E-02	6.0141E-03	5.4937E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16403000	2	736	608	721	572	909	2.9686E-03	2.4200E-02	2.6443E-03
16403000	5	1270	1200	1250	971	1600	4.2531E-03	1.1435E-02	3.1000E-03
16403000	10	1710	1720	1710	1320	2230	6.2935E-03	7.3975E-03	3.4005E-03
16403000	25	2380	2530	2480	1890	3250	1.0628E-02	5.3736E-03	3.5691E-03
16403000	50	2970	3260	3190	2430	4180	1.5253E-02	4.7677E-03	3.6323E-03
16403000	100	3640	4100	4000	2980	5380	2.1099E-02	5.3736E-03	4.2828E-03
16403000	500	5560	6560	6420	4630	8890	3.9614E-02	6.0141E-03	5.2214E-03
16404000	2	1380	1260	1360	999	1840	5.6388E-03	2.4200E-02	4.5732E-03
16404000	5	2870	2350	2660	1980	3580	6.9568E-03	1.1435E-02	4.3253E-03
16404000	10	4210	3320	3680	2750	4930	9.4808E-03	7.3975E-03	4.1553E-03
16404000	25	6330	4930	5260	3960	6990	1.5006E-02	5.3736E-03	3.9567E-03
16404000	50	8230	6460	6760	5100	8950	2.0971E-02	4.7677E-03	3.8846E-03
16404000	100	10400	8270	8580	6330	11600	2.8552E-02	5.3736E-03	4.5224E-03
16404000	500	16800	13800	14100	10100	19600	5.2624E-02	6.0141E-03	5.3973E-03
16404200	2	166	169	167	122	228	5.8927E-03	2.4200E-02	4.7388E-03
16404200	5	348	369	356	265	478	6.8393E-03	1.1435E-02	4.2796E-03
16404200	10	507	539	524	393	699	9.0033E-03	7.3975E-03	4.0609E-03
16404200	25	751	782	773	584	1020	1.3886E-02	5.3736E-03	3.8743E-03
16404200	50	965	981	978	740	1290	1.9227E-02	4.7677E-03	3.8204E-03
16404200	100	1210	1190	1190	882	1610	2.6056E-02	5.3736E-03	4.4549E-03
16404200	500	1880	1770	1780	1280	2480	4.7836E-02	6.0141E-03	5.3424E-03
16405000	2	872	457	805	629	1030	3.4091E-03	2.4200E-02	2.9882E-03
16405000	5	1550	922	1330	1030	1730	4.7647E-03	1.1435E-02	3.3633E-03
16405000	10	2130	1320	1690	1290	2210	6.9536E-03	7.3975E-03	3.5844E-03
16405000	25	3020	1940	2230	1700	2930	1.1606E-02	5.3736E-03	3.6730E-03
16405000	50	3800	2490	2740	2080	3600	1.6567E-02	4.7677E-03	3.7023E-03
16405000	100	4690	3110	3360	2500	4530	2.2836E-02	5.3736E-03	4.3500E-03
16405000	500	7290	4890	5140	3700	7130	4.2672E-02	6.0141E-03	5.2712E-03
16405500	2	1180	933	1160	942	1420	2.2945E-03	2.4200E-02	2.0957E-03
16405500	5	2120	1780	2060	1670	2530	2.6248E-03	1.1435E-02	2.1348E-03
16405500	10	2860	2530	2750	2210	3430	3.4602E-03	7.3975E-03	2.3575E-03
16405500	25	3910	3740	3820	3020	4840	5.4596E-03	5.3736E-03	2.7081E-03
16405500	50	4770	4870	4830	3780	6170	7.7164E-03	4.7677E-03	2.9469E-03
16405500	100	5690	6190	6020	4600	7880	1.0650E-02	5.3736E-03	3.5715E-03
16405500	500	8080	10100	9600	7060	13000	2.0168E-02	6.0141E-03	4.6327E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16408000	2	1430	1910	1460	1220	1740	1.6258E-03	2.4200E-02	1.5235E-03
16408000	5	2710	3450	2830	2310	3470	2.4735E-03	1.1435E-02	2.0336E-03
16408000	10	3920	4840	4210	3350	5300	3.9369E-03	7.3975E-03	2.5695E-03
16408000	25	5940	7220	6650	5170	8550	7.3503E-03	5.3736E-03	3.1042E-03
16408000	50	7890	9550	9020	6950	11700	1.1197E-02	4.7677E-03	3.3439E-03
16408000	100	10300	12400	11800	8880	15800	1.6218E-02	5.3736E-03	4.0362E-03
16408000	500	18100	21100	20600	14900	28400	3.2693E-02	6.0141E-03	5.0797E-03
16411300	2	19.5	63.5	19.9	12.7	31.2	1.0068E-02	6.9311E-01	9.9235E-03
16411300	5	47.6	173	49.8	32	77.6	9.9911E-03	2.7246E-01	9.6376E-03
16411300	10	72.8	276	79.7	49.3	129	1.2136E-02	1.6824E-01	1.1320E-02
16411300	25	111	433	131	74.4	231	1.7847E-02	1.3074E-01	1.5703E-02
16411300	50	144	570	175	90.8	336	2.4478E-02	1.4957E-01	2.1035E-02
16411300	100	180	722	231	110	486	3.3147E-02	1.4957E-01	2.7134E-02
16411300	500	273	1130	371	138	996	6.1088E-02	2.2231E-01	4.7920E-02
16411320	2	13.5	119	16.9	5.1	56.3	7.9282E-02	6.9311E-01	7.1144E-02
16411320	5	198	345	222	77.1	637	6.8498E-02	2.7246E-01	5.4737E-02
16411320	10	667	576	637	224	1810	7.8681E-02	1.6824E-01	5.3609E-02
16411320	25	2130	952	1450	473	4470	1.1741E-01	1.3074E-01	6.1859E-02
16411320	50	4180	1290	2250	634	7990	1.6661E-01	1.4957E-01	7.8815E-02
16411320	100	7350	1670	2980	764	11600	2.3262E-01	1.4957E-01	9.1035E-02
16411320	500	20200	2750	5340	939	30400	4.4596E-01	2.2231E-01	1.4835E-01
16411400	2	293	240	292	164	521	1.6890E-02	6.9311E-01	1.6488E-02
16411400	5	962	737	946	522	1710	1.8536E-02	2.7246E-01	1.7355E-02
16411400	10	1740	1300	1680	874	3210	2.3657E-02	1.6824E-01	2.0741E-02
16411400	25	3190	2280	2970	1390	6310	3.5633E-02	1.3074E-01	2.8001E-02
16411400	50	4660	3180	4240	1780	10100	4.8915E-02	1.4957E-01	3.6860E-02
16411400	100	6510	4230	5710	2170	15000	6.5983E-02	1.4957E-01	4.5785E-02
16411400	500	12500	7290	10300	2930	36600	1.2055E-01	2.2231E-01	7.8165E-02
16411600	2	23.4	41.6	23.6	15.3	36.4	9.3488E-03	6.9311E-01	9.2244E-03
16411600	5	61.4	109	62.5	41.2	94.9	8.8291E-03	2.7246E-01	8.5520E-03
16411600	10	96.6	168	99.8	63.7	156	1.0515E-02	1.6824E-01	9.8961E-03
16411600	25	151	255	160	93.5	272	1.5663E-02	1.3074E-01	1.3987E-02
16411600	50	197	329	211	113	393	2.1923E-02	1.4957E-01	1.9121E-02
16411600	100	248	411	270	132	552	3.0256E-02	1.4957E-01	2.5166E-02
16411600	500	379	626	420	160	1100	5.7431E-02	2.2231E-01	4.5640E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16411640	2	446	138	443	338	581	3.6213E-03	6.9311E-01	3.6025E-03
16411640	5	943	404	928	674	1280	5.0903E-03	2.7246E-01	4.9969E-03
16411640	10	1430	683	1380	940	2030	7.5783E-03	1.6824E-01	7.2516E-03
16411640	25	2250	1140	2120	1290	3460	1.3106E-02	1.3074E-01	1.1912E-02
16411640	50	3060	1560	2830	1570	5100	1.9156E-02	1.4957E-01	1.6981E-02
16411640	100	4050	2030	3640	1840	7200	2.6915E-02	1.4957E-01	2.2810E-02
16411640	500	7280	3370	6290	2490	15900	5.1872E-02	2.2231E-01	4.2058E-02
16411800	2	2.4	120	3.5	1.1	11	7.2456E-02	6.9311E-01	6.5598E-02
16411800	5	31.8	347	49.3	18	135	6.1106E-02	2.7246E-01	4.9912E-02
16411800	10	101	579	169	61.9	459	6.9620E-02	1.6824E-01	4.9243E-02
16411800	25	302	957	504	170	1500	1.0457E-01	1.3074E-01	5.8099E-02
16411800	50	570	1300	861	251	2960	1.4951E-01	1.4957E-01	7.4770E-02
16411800	100	964	1680	1330	351	5060	2.0992E-01	1.4957E-01	8.7339E-02
16411800	500	2460	2760	2650	479	14600	4.0445E-01	2.2231E-01	1.4346E-01
16411900	2	196	129	194	123	308	1.0613E-02	6.9311E-01	1.0453E-02
16411900	5	409	375	407	260	638	1.0263E-02	2.7246E-01	9.8904E-03
16411900	10	577	631	580	358	940	1.2275E-02	1.6824E-01	1.1440E-02
16411900	25	809	1050	834	476	1460	1.7440E-02	1.3074E-01	1.5387E-02
16411900	50	991	1430	1040	549	1980	2.3280E-02	1.4957E-01	2.0145E-02
16411900	100	1180	1860	1270	619	2620	3.0789E-02	1.4957E-01	2.5533E-02
16411900	500	1620	3060	1840	715	4720	5.4469E-02	2.2231E-01	4.3749E-02
16413500	2	498	364	497	364	679	4.8239E-03	6.9311E-01	4.7906E-03
16413500	5	1020	1160	1030	714	1480	6.6048E-03	2.7246E-01	6.4485E-03
16413500	10	1510	2120	1540	1000	2370	9.5629E-03	1.6824E-01	9.0486E-03
16413500	25	2320	3840	2450	1430	4200	1.5926E-02	1.3074E-01	1.4197E-02
16413500	50	3080	5470	3330	1770	6270	2.2755E-02	1.4957E-01	1.9750E-02
16413500	100	4000	7380	4450	2150	9200	3.1414E-02	1.4957E-01	2.5961E-02
16413500	500	6840	13100	7840	2960	20800	5.8912E-02	2.2231E-01	4.6571E-02
16414000	2	684	281	682	538	865	2.7817E-03	6.9311E-01	2.7706E-03
16414000	5	1330	877	1330	1040	1700	3.0067E-03	2.7246E-01	2.9739E-03
16414000	10	1860	1560	1850	1410	2450	3.8457E-03	1.6824E-01	3.7597E-03
16414000	25	2630	2780	2630	1870	3700	5.9892E-03	1.3074E-01	5.7268E-03
16414000	50	3260	3910	3290	2190	4920	8.4743E-03	1.4957E-01	8.0199E-03
16414000	100	3940	5220	4020	2510	6430	1.1742E-02	1.4957E-01	1.0888E-02
16414000	500	5700	9110	5950	3130	11300	2.2437E-02	2.2231E-01	2.0380E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16415000	2	255	57.9	253	186	343	4.6384E-03	6.9311E-01	4.6076E-03
16415000	5	498	157	483	329	707	7.3621E-03	2.7246E-01	7.1684E-03
16415000	10	729	248	681	426	1090	1.1495E-02	1.6824E-01	1.0760E-02
16415000	25	1130	385	975	536	1770	2.0273E-02	1.3074E-01	1.7552E-02
16415000	50	1510	505	1260	620	2570	2.9659E-02	1.4957E-01	2.4751E-02
16415000	100	1990	638	1550	689	3510	4.1552E-02	1.4957E-01	3.2518E-02
16415000	500	3580	996	2560	858	7610	7.9346E-02	2.2231E-01	5.8475E-02
16415400	2	441	147	440	374	517	1.2894E-03	6.9311E-01	1.2871E-03
16415400	5	665	433	663	565	779	1.2688E-03	2.7246E-01	1.2629E-03
16415400	10	810	734	809	678	965	1.5438E-03	1.6824E-01	1.5298E-03
16415400	25	986	1230	990	797	1230	2.3440E-03	1.3074E-01	2.3027E-03
16415400	50	1110	1690	1120	869	1450	3.3098E-03	1.4957E-01	3.2382E-03
16415400	100	1240	2210	1260	930	1700	4.5971E-03	1.4957E-01	4.4600E-03
16415400	500	1510	3670	1560	1030	2360	8.8267E-03	2.2231E-01	8.4896E-03
16416000	2	347	44.1	345	285	418	1.7783E-03	6.9311E-01	1.7737E-03
16416000	5	497	116	493	411	591	1.6406E-03	2.7246E-01	1.6307E-03
16416000	10	587	180	579	475	705	1.9287E-03	1.6824E-01	1.9068E-03
16416000	25	689	274	676	533	856	2.8069E-03	1.3074E-01	2.7479E-03
16416000	50	758	355	744	564	981	3.8636E-03	1.4957E-01	3.7663E-03
16416000	100	822	444	805	584	1110	5.2585E-03	1.4957E-01	5.0799E-03
16416000	500	953	679	940	608	1450	9.7454E-03	2.2231E-01	9.3361E-03
16419000	2	142	174	148	109	201	5.6938E-03	2.4200E-02	4.6093E-03
16419000	5	336	380	351	263	470	6.5072E-03	1.1435E-02	4.1471E-03
16419000	10	521	554	538	405	715	8.5516E-03	7.3975E-03	3.9664E-03
16419000	25	823	805	810	613	1070	1.3388E-02	5.3736E-03	3.8345E-03
16419000	50	1100	1010	1030	778	1360	1.8814E-02	4.7677E-03	3.8038E-03
16419000	100	1420	1230	1260	934	1710	2.5842E-02	5.3736E-03	4.4486E-03
16419000	500	2380	1830	1880	1350	2620	4.8561E-02	6.0141E-03	5.3514E-03
16419500	2	225	407	254	185	349	6.2031E-03	2.4200E-02	4.9375E-03
16419500	5	570	830	657	488	884	6.9817E-03	1.1435E-02	4.3349E-03
16419500	10	911	1190	1060	791	1410	9.1082E-03	7.3975E-03	4.0821E-03
16419500	25	1480	1750	1670	1260	2220	1.4238E-02	5.3736E-03	3.9013E-03
16419500	50	2020	2240	2200	1660	2910	2.0044E-02	4.7677E-03	3.8516E-03
16419500	100	2660	2780	2760	2040	3740	2.7596E-02	5.3736E-03	4.4978E-03
16419500	500	4570	4350	4370	3140	6090	5.2098E-02	6.0141E-03	5.3917E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16500100	2	236	1080	246	191	318	3.2656E-03	1.1754E-01	3.1774E-03
16500100	5	493	1790	532	393	721	4.8147E-03	7.5214E-02	4.5250E-03
16500100	10	745	2340	833	576	1200	7.3900E-03	6.8199E-02	6.6675E-03
16500100	25	1180	3120	1390	866	2230	1.3152E-02	6.6470E-02	1.0979E-02
16500100	50	1620	3750	1940	1110	3390	1.9490E-02	6.9938E-02	1.5242E-02
16500100	100	2160	4430	2620	1380	4980	2.7649E-02	7.5214E-02	2.0217E-02
16500100	500	3990	6130	4680	2040	10700	5.4012E-02	9.1468E-02	3.3959E-02
16500300	2	3460	7460	3520	2760	4510	3.0485E-03	1.1754E-01	2.9715E-03
16500300	5	6440	11000	6580	5130	8450	3.1925E-03	7.5214E-02	3.0625E-03
16500300	10	8740	13600	8960	6790	11800	4.0033E-03	6.8199E-02	3.7814E-03
16500300	25	11900	17000	12300	8770	17200	6.1163E-03	6.6470E-02	5.6010E-03
16500300	50	14500	19700	15000	10100	22200	8.5766E-03	6.9938E-02	7.6397E-03
16500300	100	17100	22500	17800	11300	28100	1.1813E-02	7.5214E-02	1.0209E-02
16500300	500	23800	29400	24800	13500	45400	2.2376E-02	9.1468E-02	1.7978E-02
16500800	2	519	442	517	397	673	3.5207E-03	1.1754E-01	3.4183E-03
16500800	5	1130	777	1110	798	1530	5.5696E-03	7.5214E-02	5.1856E-03
16500800	10	1780	1040	1680	1120	2500	8.9322E-03	6.8199E-02	7.8978E-03
16500800	25	2990	1430	2580	1540	4350	1.6562E-02	6.6470E-02	1.3258E-02
16500800	50	4270	1750	3370	1830	6230	2.5041E-02	6.9938E-02	1.8439E-02
16500800	100	5940	2090	4240	2100	8570	3.6027E-02	7.5214E-02	2.4359E-02
16500800	500	12100	2980	6530	2640	16100	7.1808E-02	9.1468E-02	4.0227E-02
16501000	2	5610	3300	5590	4940	6330	7.5678E-04	1.1754E-01	7.5194E-04
16501000	5	8120	5130	8070	7030	9270	9.5484E-04	7.5214E-02	9.4287E-04
16501000	10	9880	6470	9800	8320	11500	1.3393E-03	6.8199E-02	1.3135E-03
16501000	25	12200	8330	12100	9780	14900	2.2210E-03	6.6470E-02	2.1492E-03
16501000	50	14000	9810	13800	10700	17700	3.1994E-03	6.9938E-02	3.0594E-03
16501000	100	15900	11400	15600	11600	20900	4.4621E-03	7.5214E-02	4.2122E-03
16501000	500	20500	15200	20000	13400	29700	8.5427E-03	9.1468E-02	7.8130E-03
16501200	2	4920	4020	4900	4080	5890	1.6614E-03	1.1754E-01	1.6382E-03
16501200	5	6790	6170	6770	5380	8520	2.6943E-03	7.5214E-02	2.6011E-03
16501200	10	8170	7740	8150	6140	10800	4.1700E-03	6.8199E-02	3.9297E-03
16501200	25	10100	9900	10100	7000	14500	7.1511E-03	6.6470E-02	6.4565E-03
16501200	50	11600	11600	11600	7580	17800	1.0241E-02	6.9938E-02	8.9329E-03
16501200	100	13300	13400	13300	8130	21700	1.4085E-02	7.5214E-02	1.1863E-02
16501200	500	17600	17800	17600	9280	33600	2.6044E-02	9.1468E-02	2.0272E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16502000	2	610	292	605	511	717	1.4282E-03	1.1754E-01	1.4111E-03
16502000	5	1010	526	991	811	1210	2.0245E-03	7.5214E-02	1.9714E-03
16502000	10	1330	716	1300	1020	1660	3.0434E-03	6.8199E-02	2.9134E-03
16502000	25	1820	995	1740	1270	2390	5.3331E-03	6.6470E-02	4.9370E-03
16502000	50	2240	1230	2100	1440	3070	7.8555E-03	6.9938E-02	7.0622E-03
16502000	100	2710	1480	2500	1610	3900	1.1103E-02	7.5214E-02	9.6747E-03
16502000	500	4040	2130	3570	1970	6490	2.1593E-02	9.1468E-02	1.7469E-02
16502400	2	164	310	167	131	214	3.0538E-03	1.1754E-01	2.9765E-03
16502400	5	323	555	332	253	436	3.8231E-03	7.5214E-02	3.6382E-03
16502400	10	462	753	479	349	657	5.3142E-03	6.8199E-02	4.9301E-03
16502400	25	678	1050	713	480	1060	8.6970E-03	6.6470E-02	7.6907E-03
16502400	50	869	1290	923	580	1470	1.2427E-02	6.9938E-02	1.0552E-02
16502400	100	1090	1550	1160	681	1980	1.7224E-02	7.5214E-02	1.4015E-02
16502400	500	1720	2230	1840	914	3710	3.2663E-02	9.1468E-02	2.4068E-02
16502800	2	808	536	800	634	1010	2.7053E-03	1.1754E-01	2.6444E-03
16502800	5	1480	929	1450	1140	1850	2.9896E-03	7.5214E-02	2.8754E-03
16502800	10	2000	1240	1950	1480	2560	3.8593E-03	6.8199E-02	3.6526E-03
16502800	25	2730	1690	2620	1880	3670	5.9896E-03	6.6470E-02	5.4945E-03
16502800	50	3320	2060	3160	2140	4670	8.4146E-03	6.9938E-02	7.5110E-03
16502800	100	3960	2460	3710	2360	5840	1.1576E-02	7.5214E-02	1.0032E-02
16502800	500	5580	3480	5090	2800	9270	2.1848E-02	9.1468E-02	1.7635E-02
16502900	2	6010	3020	5900	4600	7580	3.1589E-03	1.1754E-01	3.0763E-03
16502900	5	11100	4720	10600	8150	13900	3.6612E-03	7.5214E-02	3.4912E-03
16502900	10	15100	5970	14200	10500	19300	4.8399E-03	6.8199E-02	4.5192E-03
16502900	25	21000	7710	18900	13100	27500	7.5721E-03	6.6470E-02	6.7977E-03
16502900	50	25900	9080	22500	14600	34700	1.0607E-02	6.9938E-02	9.2101E-03
16502900	100	31100	10500	26100	15900	42900	1.4519E-02	7.5214E-02	1.2170E-02
16502900	500	45100	14100	34500	18000	66300	2.7108E-02	9.1468E-02	2.0911E-02
16508000	2	2410	1870	2400	2210	2620	3.5521E-04	1.1754E-01	3.5414E-04
16508000	5	3290	3000	3290	3010	3590	3.8152E-04	7.5214E-02	3.7959E-04
16508000	10	3850	3850	3850	3480	4250	4.8969E-04	6.8199E-02	4.8620E-04
16508000	25	4520	5050	4530	4000	5140	7.7948E-04	6.6470E-02	7.7045E-04
16508000	50	5010	6010	5020	4320	5840	1.1229E-03	6.9938E-02	1.1051E-03
16508000	100	5480	7020	5510	4610	6580	1.5795E-03	7.5214E-02	1.5470E-03
16508000	500	6540	9560	6620	5170	8470	3.0904E-03	9.1468E-02	2.9894E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16510000	2	1580	247	1550	1330	1810	1.1664E-03	1.1754E-01	1.1550E-03
16510000	5	2270	450	2220	1920	2560	1.0415E-03	7.5214E-02	1.0273E-03
16510000	10	2680	615	2610	2230	3050	1.2134E-03	6.8199E-02	1.1922E-03
16510000	25	3150	859	3040	2510	3670	1.8303E-03	6.6470E-02	1.7813E-03
16510000	50	3460	1060	3320	2640	4160	2.6108E-03	6.9938E-02	2.5168E-03
16510000	100	3750	1290	3570	2730	4660	3.6620E-03	7.5214E-02	3.4920E-03
16510000	500	4350	1860	4090	2840	5900	7.0991E-03	9.1468E-02	6.5878E-03
16515000	2	701	265	698	625	779	5.9621E-04	1.1754E-01	5.9320E-04
16515000	5	905	480	901	811	1000	5.4993E-04	7.5214E-02	5.4594E-04
16515000	10	1020	654	1020	905	1140	6.4896E-04	6.8199E-02	6.4284E-04
16515000	25	1150	912	1140	992	1310	9.7371E-04	6.6470E-02	9.5965E-04
16515000	50	1230	1130	1230	1040	1450	1.3764E-03	6.9938E-02	1.3499E-03
16515000	100	1300	1360	1300	1070	1580	1.9162E-03	7.5214E-02	1.8686E-03
16515000	500	1450	1970	1470	1120	1920	3.6820E-03	9.1468E-02	3.5395E-03
16516000	2	2410	1980	2410	2040	2840	1.3429E-03	1.1754E-01	1.3277E-03
16516000	5	3610	3180	3600	2960	4380	1.9401E-03	7.5214E-02	1.8914E-03
16516000	10	4510	4080	4490	3540	5700	2.9069E-03	6.8199E-02	2.7880E-03
16516000	25	5790	5330	5750	4230	7830	5.0036E-03	6.6470E-02	4.6533E-03
16516000	50	6840	6340	6790	4710	9790	7.2683E-03	6.9938E-02	6.5840E-03
16516000	100	7970	7400	7900	5160	12100	1.0152E-02	7.5214E-02	8.9451E-03
16516000	500	11000	10100	10800	6130	19200	1.9361E-02	9.1468E-02	1.5979E-02
16517000	2	2220	1820	2210	1900	2590	1.2030E-03	1.1754E-01	1.1908E-03
16517000	5	3140	2940	3140	2690	3650	1.1548E-03	7.5214E-02	1.1374E-03
16517000	10	3700	3770	3700	3140	4370	1.3854E-03	6.8199E-02	1.3578E-03
16517000	25	4350	4950	4370	3570	5350	2.0658E-03	6.6470E-02	2.0035E-03
16517000	50	4800	5890	4840	3820	6140	2.8858E-03	6.9938E-02	2.7714E-03
16517000	100	5230	6890	5300	4020	6990	3.9746E-03	7.5214E-02	3.7751E-03
16517000	500	6120	9390	6320	4340	9210	7.5252E-03	9.1468E-02	6.9532E-03
16518000	2	3930	1890	3910	3520	4350	5.4758E-04	1.1754E-01	5.4504E-04
16518000	5	5690	3030	5660	5120	6270	5.1091E-04	7.5214E-02	5.0746E-04
16518000	10	6780	3900	6750	6040	7540	6.1017E-04	6.8199E-02	6.0476E-04
16518000	25	8080	5110	8020	6980	9220	9.5762E-04	6.6470E-02	9.4402E-04
16518000	50	8980	6070	8910	7530	10500	1.4015E-03	6.9938E-02	1.3740E-03
16518000	100	9830	7100	9740	7980	11900	2.0065E-03	7.5214E-02	1.9543E-03
16518000	500	11700	9660	11600	8730	15300	4.0270E-03	9.1468E-02	3.8572E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16519000	2	1090	2530	1110	922	1330	1.6605E-03	1.1754E-01	1.6374E-03
16519000	5	1660	3990	1690	1400	2050	1.8586E-03	7.5214E-02	1.8138E-03
16519000	10	2040	5080	2100	1690	2620	2.4051E-03	6.8199E-02	2.3231E-03
16519000	25	2530	6590	2660	2040	3480	3.6913E-03	6.6470E-02	3.4971E-03
16519000	50	2900	7800	3100	2270	4240	5.1269E-03	6.9938E-02	4.7767E-03
16519000	100	3270	9070	3570	2490	5120	6.9798E-03	7.5214E-02	6.3871E-03
16519000	500	4150	12200	4740	2930	7670	1.2940E-02	9.1468E-02	1.1336E-02
16520000	2	930	335	919	778	1090	1.3777E-03	1.1754E-01	1.3617E-03
16520000	5	1360	598	1340	1130	1590	1.4411E-03	7.5214E-02	1.4140E-03
16520000	10	1640	810	1610	1330	1950	1.8016E-03	6.8199E-02	1.7553E-03
16520000	25	1990	1120	1940	1540	2440	2.7226E-03	6.6470E-02	2.6155E-03
16520000	50	2230	1380	2180	1660	2860	3.7840E-03	6.9938E-02	3.5898E-03
16520000	100	2470	1660	2410	1760	3300	5.1725E-03	7.5214E-02	4.8397E-03
16520000	500	3020	2380	2950	1930	4500	9.6785E-03	9.1468E-02	8.7524E-03
16524000	2	1300	1380	1300	1090	1560	1.6670E-03	1.1754E-01	1.6437E-03
16524000	5	1720	2250	1740	1420	2110	1.9665E-03	7.5214E-02	1.9164E-03
16524000	10	1990	2920	2020	1610	2520	2.5763E-03	6.8199E-02	2.4826E-03
16524000	25	2310	3870	2370	1810	3110	3.8265E-03	6.6470E-02	3.6182E-03
16524000	50	2540	4630	2640	1930	3610	5.1174E-03	6.9938E-02	4.7685E-03
16524000	100	2760	5440	2920	2050	4150	6.7136E-03	7.5214E-02	6.1635E-03
16524000	500	3260	7470	3580	2260	5650	1.1624E-02	9.1468E-02	1.0313E-02
16527000	2	1550	1570	1550	1350	1770	9.1665E-04	1.1754E-01	9.0955E-04
16527000	5	2200	2550	2200	1920	2520	9.0067E-04	7.5214E-02	8.9001E-04
16527000	10	2600	3290	2610	2250	3020	1.0953E-03	6.8199E-02	1.0780E-03
16527000	25	3070	4330	3100	2580	3720	1.6650E-03	6.6470E-02	1.6243E-03
16527000	50	3400	5180	3450	2780	4280	2.3539E-03	6.9938E-02	2.2772E-03
16527000	100	3720	6070	3800	2950	4890	3.2728E-03	7.5214E-02	3.1363E-03
16527000	500	4400	8300	4580	3240	6480	6.2944E-03	9.1468E-02	5.8891E-03
16531100	2	84.8	189	85.1	75.9	95.5	6.5353E-04	1.1754E-01	6.4992E-04
16531100	5	105	349	106	93.4	121	8.0541E-04	7.5214E-02	7.9688E-04
16531100	10	117	481	120	103	139	1.0877E-03	6.8199E-02	1.0706E-03
16531100	25	131	678	137	114	164	1.6829E-03	6.6470E-02	1.6414E-03
16531100	50	142	843	150	121	186	2.3113E-03	6.9938E-02	2.2373E-03
16531100	100	151	1020	163	128	209	3.0993E-03	7.5214E-02	2.9767E-03
16531100	500	173	1500	196	142	272	5.5661E-03	9.1468E-02	5.2468E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16536000	2	892	713	891	774	1030	9.7761E-04	1.1754E-01	9.6955E-04
16536000	5	1330	1210	1330	1140	1550	1.1669E-03	7.5214E-02	1.1491E-03
16536000	10	1630	1610	1630	1370	1950	1.5800E-03	6.8199E-02	1.5443E-03
16536000	25	2040	2170	2040	1630	2550	2.5462E-03	6.6470E-02	2.4523E-03
16536000	50	2340	2630	2360	1810	3070	3.6268E-03	6.9938E-02	3.4480E-03
16536000	100	2660	3130	2690	1970	3660	5.0260E-03	7.5214E-02	4.7112E-03
16536000	500	3430	4380	3510	2310	5340	9.5558E-03	9.1468E-02	8.6519E-03
16543000	2	279	312	279	234	333	1.5279E-03	1.1754E-01	1.5083E-03
16543000	5	370	560	374	307	456	1.9608E-03	7.5214E-02	1.9109E-03
16543000	10	430	760	439	349	553	2.6855E-03	6.8199E-02	2.5837E-03
16543000	25	504	1050	527	397	698	4.1453E-03	6.6470E-02	3.9019E-03
16543000	50	559	1300	596	430	825	5.6449E-03	6.9938E-02	5.2233E-03
16543000	100	614	1560	668	460	970	7.4966E-03	7.5214E-02	6.8171E-03
16543000	500	742	2250	853	525	1390	1.3197E-02	9.1468E-02	1.1533E-02
16545000	2	1580	1220	1580	1420	1750	5.5318E-04	1.1754E-01	5.5059E-04
16545000	5	2200	2010	2200	1940	2490	7.7164E-04	7.5214E-02	7.6381E-04
16545000	10	2650	2620	2650	2270	3080	1.1538E-03	6.8199E-02	1.1346E-03
16545000	25	3250	3480	3250	2660	3970	2.0213E-03	6.6470E-02	1.9617E-03
16545000	50	3720	4170	3730	2930	4750	2.9819E-03	6.9938E-02	2.8600E-03
16545000	100	4210	4910	4250	3190	5650	4.2220E-03	7.5214E-02	3.9976E-03
16545000	500	5470	6780	5570	3760	8240	8.2381E-03	9.1468E-02	7.5574E-03
16552800	2	681	1360	726	454	1160	1.1879E-02	1.1754E-01	1.0789E-02
16552800	5	1480	2230	1580	966	2580	1.4098E-02	7.5214E-02	1.1872E-02
16552800	10	2200	2890	2330	1350	4020	1.8548E-02	6.8199E-02	1.4582E-02
16552800	25	3330	3820	3470	1840	6520	2.7730E-02	6.6470E-02	1.9567E-02
16552800	50	4330	4580	4420	2190	8930	3.7259E-02	6.9938E-02	2.4309E-02
16552800	100	5470	5380	5440	2500	11800	4.9081E-02	7.5214E-02	2.9700E-02
16552800	500	8720	7390	8050	3120	20800	8.5586E-02	9.1468E-02	4.4215E-02
16554000	2	925	1630	942	712	1250	4.0018E-03	1.1754E-01	3.8700E-03
16554000	5	1370	2640	1430	1050	1940	4.9609E-03	7.5214E-02	4.6540E-03
16554000	10	1670	3410	1780	1260	2530	6.6291E-03	6.8199E-02	6.0418E-03
16554000	25	2070	4490	2290	1510	3480	9.8853E-03	6.6470E-02	8.6055E-03
16554000	50	2380	5360	2700	1680	4350	1.3151E-02	6.9938E-02	1.1069E-02
16554000	100	2690	6270	3140	1850	5360	1.7121E-02	7.5214E-02	1.3946E-02
16554000	500	3430	8580	4280	2190	8380	2.9115E-02	9.1468E-02	2.2085E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16555000	2	2970	2010	2940	2370	3660	2.3793E-03	1.1754E-01	2.3321E-03
16555000	5	4900	3220	4830	3790	6150	2.9770E-03	7.5214E-02	2.8637E-03
16555000	10	6390	4130	6230	4710	8250	4.1002E-03	6.8199E-02	3.8677E-03
16555000	25	8470	5400	8140	5740	11500	6.5714E-03	6.6470E-02	5.9802E-03
16555000	50	10200	6420	9640	6410	14500	9.2493E-03	6.9938E-02	8.1689E-03
16555000	100	12000	7490	11200	7010	17900	1.2660E-02	7.5214E-02	1.0836E-02
16555000	500	16800	10200	15100	8170	28100	2.3522E-02	9.1468E-02	1.8711E-02
16557000	2	598	310	594	514	687	1.0360E-03	1.1754E-01	1.0269E-03
16557000	5	875	556	867	723	1040	1.6393E-03	7.5214E-02	1.6043E-03
16557000	10	1090	755	1080	858	1350	2.6027E-03	6.8199E-02	2.5070E-03
16557000	25	1400	1050	1380	1020	1860	4.7391E-03	6.6470E-02	4.4237E-03
16557000	50	1660	1290	1630	1130	2330	7.0827E-03	6.9938E-02	6.4314E-03
16557000	100	1950	1550	1900	1240	2910	1.0097E-02	7.5214E-02	8.9017E-03
16557000	500	2750	2240	2650	1490	4710	1.9834E-02	9.1468E-02	1.6299E-02
16565000	2	599	426	596	503	707	1.4408E-03	1.1754E-01	1.4233E-03
16565000	5	931	750	924	745	1150	2.3485E-03	7.5214E-02	2.2774E-03
16565000	10	1200	1010	1190	910	1560	3.7841E-03	6.8199E-02	3.5852E-03
16565000	25	1620	1380	1590	1110	2280	6.9675E-03	6.6470E-02	6.3064E-03
16565000	50	1980	1690	1940	1260	2980	1.0462E-02	6.9938E-02	9.1006E-03
16565000	100	2390	2030	2330	1410	3850	1.4959E-02	7.5214E-02	1.2477E-02
16565000	500	3590	2890	3410	1740	6680	2.9502E-02	9.1468E-02	2.2307E-02
16566000	2	416	176	414	371	462	5.8578E-04	1.1754E-01	5.8288E-04
16566000	5	510	327	509	459	564	5.2820E-04	7.5214E-02	5.2452E-04
16566000	10	560	452	559	500	625	6.1518E-04	6.8199E-02	6.0968E-04
16566000	25	613	638	614	537	702	8.9486E-04	6.6470E-02	8.8298E-04
16566000	50	647	794	649	555	759	1.2355E-03	6.9938E-02	1.2141E-03
16566000	100	676	966	681	567	818	1.6864E-03	7.5214E-02	1.6494E-03
16566000	500	733	1410	749	584	960	3.1340E-03	9.1468E-02	3.0302E-03
16570000	2	2010	1910	2010	1740	2320	1.0352E-03	1.1754E-01	1.0262E-03
16570000	5	3180	3070	3180	2710	3730	1.2767E-03	7.5214E-02	1.2554E-03
16570000	10	4060	3940	4050	3360	4890	1.7721E-03	6.8199E-02	1.7273E-03
16570000	25	5260	5160	5260	4140	6670	2.9304E-03	6.6470E-02	2.8067E-03
16570000	50	6230	6140	6220	4680	8270	4.2276E-03	6.9938E-02	3.9866E-03
16570000	100	7250	7170	7240	5190	10100	5.9095E-03	7.5214E-02	5.4790E-03
16570000	500	9880	9760	9860	6270	15500	1.1369E-02	9.1468E-02	1.0112E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16574000	2	447	574	448	378	531	1.4292E-03	1.1754E-01	1.4121E-03
16574000	5	568	991	577	472	704	2.0027E-03	7.5214E-02	1.9508E-03
16574000	10	648	1320	666	526	843	2.8397E-03	6.8199E-02	2.7262E-03
16574000	25	746	1800	789	589	1060	4.4460E-03	6.6470E-02	4.1672E-03
16574000	50	820	2190	886	633	1240	6.0485E-03	6.9938E-02	5.5671E-03
16574000	100	893	2610	990	674	1450	7.9937E-03	7.5214E-02	7.2258E-03
16574000	500	1070	3680	1250	764	2060	1.3869E-02	9.1468E-02	1.2043E-02
16577000	2	3610	1310	3560	2990	4240	1.5412E-03	1.1754E-01	1.5212E-03
16577000	5	5480	2160	5370	4500	6410	1.5733E-03	7.5214E-02	1.5410E-03
16577000	10	6710	2800	6550	5380	7960	1.9449E-03	6.8199E-02	1.8910E-03
16577000	25	8230	3720	7960	6260	10100	2.9390E-03	6.6470E-02	2.8145E-03
16577000	50	9340	4450	8960	6770	11900	4.1044E-03	6.9938E-02	3.8769E-03
16577000	100	10400	5230	9930	7160	13800	5.6399E-03	7.5214E-02	5.2465E-03
16577000	500	12900	7200	12100	7790	18800	1.0647E-02	9.1468E-02	9.5371E-03
16585000	2	984	783	978	762	1260	3.1359E-03	1.1754E-01	3.0544E-03
16585000	5	2160	1330	2110	1590	2800	4.1015E-03	7.5214E-02	3.8894E-03
16585000	10	3310	1750	3140	2250	4380	5.8935E-03	6.8199E-02	5.4247E-03
16585000	25	5240	2360	4720	3100	7190	9.9876E-03	6.6470E-02	8.6829E-03
16585000	50	7100	2850	6070	3700	9950	1.4527E-02	6.9938E-02	1.2028E-02
16585000	100	9360	3380	7530	4250	13300	2.0385E-02	7.5214E-02	1.6038E-02
16585000	500	16500	4730	11300	5370	24000	3.9335E-02	9.1468E-02	2.7506E-02
16586000	2	409	396	409	358	468	8.9087E-04	1.1754E-01	8.8417E-04
16586000	5	587	700	589	505	686	1.1635E-03	7.5214E-02	1.1457E-03
16586000	10	713	943	717	598	860	1.6562E-03	6.8199E-02	1.6169E-03
16586000	25	879	1300	893	708	1130	2.7561E-03	6.6470E-02	2.6464E-03
16586000	50	1010	1590	1030	784	1360	3.9601E-03	6.9938E-02	3.7478E-03
16586000	100	1140	1910	1180	857	1640	5.5031E-03	7.5214E-02	5.1279E-03
16586000	500	1480	2730	1580	1020	2440	1.0456E-02	9.1468E-02	9.3834E-03
16587000	2	530	376	527	436	638	1.8076E-03	1.1754E-01	1.7802E-03
16587000	5	1150	667	1130	910	1400	2.3377E-03	7.5214E-02	2.2673E-03
16587000	10	1740	900	1680	1300	2170	3.3769E-03	6.8199E-02	3.2175E-03
16587000	25	2730	1240	2560	1840	3560	5.8307E-03	6.6470E-02	5.3604E-03
16587000	50	3670	1520	3340	2250	4950	8.5979E-03	6.9938E-02	7.6566E-03
16587000	100	4820	1830	4210	2650	6690	1.2202E-02	7.5214E-02	1.0499E-02
16587000	500	8430	2610	6610	3550	12300	2.3971E-02	9.1468E-02	1.8993E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16603700	2	34.2	58.3	35.3	16.4	75.9	3.0663E-02	4.5634E-01	2.8732E-02
16603700	5	209	174	203	104	396	2.6481E-02	1.2885E-01	2.1966E-02
16603700	10	477	296	407	214	775	3.0460E-02	6.1349E-02	2.0354E-02
16603700	25	1050	498	733	365	1470	4.6060E-02	4.9847E-02	2.3939E-02
16603700	50	1660	687	1030	470	2270	6.6081E-02	5.6338E-02	3.0411E-02
16603700	100	2440	909	1390	564	3420	9.3092E-02	6.9938E-02	3.9935E-02
16603700	500	4890	1580	2420	744	7890	1.8094E-01	1.1003E-01	6.8423E-02
16603800	2	41.7	36.8	41.7	31.3	55.6	4.0943E-03	4.5634E-01	4.0579E-03
16603800	5	92.5	97.2	92.7	67.3	128	5.2210E-03	1.2885E-01	5.0177E-03
16603800	10	141	158	143	99.2	206	7.3403E-03	6.1349E-02	6.5559E-03
16603800	25	223	257	229	147	358	1.2125E-02	4.9847E-02	9.7530E-03
16603800	50	300	348	311	185	523	1.7392E-02	5.6338E-02	1.3289E-02
16603800	100	393	455	408	223	747	2.4160E-02	6.9938E-02	1.7957E-02
16603800	500	683	772	708	314	1600	4.5936E-02	1.1003E-01	3.2407E-02
16603850	2	64.2	243	70	32.1	152	3.1777E-02	4.5634E-01	2.9708E-02
16603850	5	377	1050	453	228	902	2.8396E-02	1.2885E-01	2.3268E-02
16603850	10	849	2090	1160	601	2260	3.3053E-02	6.1349E-02	2.1480E-02
16603850	25	1860	3930	2700	1330	5500	4.9375E-02	4.9847E-02	2.4805E-02
16603850	50	2970	5720	4270	1920	9470	6.9850E-02	5.6338E-02	3.1185E-02
16603850	100	4380	7870	6160	2480	15300	9.7314E-02	6.9938E-02	4.0693E-02
16603850	500	8940	14600	12200	3720	39900	1.8669E-01	1.1003E-01	6.9230E-02
16604500	2	2410	3000	2430	1810	3260	4.4439E-03	1.1754E-01	4.2820E-03
16604500	5	4270	4680	4290	3230	5720	4.2560E-03	7.5214E-02	4.0281E-03
16604500	10	5600	5930	5620	4120	7660	5.0849E-03	6.8199E-02	4.7321E-03
16604500	25	7300	7650	7330	5070	10600	7.4211E-03	6.6470E-02	6.6758E-03
16604500	50	8560	9030	8620	5630	13200	1.0176E-02	6.9938E-02	8.8838E-03
16604500	100	9810	10500	9910	6090	16100	1.3794E-02	7.5214E-02	1.1656E-02
16604500	500	12600	14000	12900	6840	24400	2.5442E-02	9.1468E-02	1.9906E-02
16607000	2	2970	3840	2980	2570	3460	1.0997E-03	1.1754E-01	1.0895E-03
16607000	5	4490	5910	4500	3930	5150	9.1011E-04	7.5214E-02	8.9923E-04
16607000	10	5400	7420	5420	4700	6260	1.0356E-03	6.8199E-02	1.0201E-03
16607000	25	6440	9510	6500	5430	7780	1.6280E-03	6.6470E-02	1.5891E-03
16607000	50	7130	11200	7240	5820	9000	2.4163E-03	6.9938E-02	2.3356E-03
16607000	100	7760	12900	7940	6120	10300	3.4914E-03	7.5214E-02	3.3365E-03
16607000	500	9040	17200	9460	6580	13600	7.0039E-03	9.1468E-02	6.5057E-03

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16614000	2	4790	2180	4710	3780	5870	2.4142E-03	1.1754E-01	2.3656E-03
16614000	5	7330	3470	7160	5770	8890	2.3598E-03	7.5214E-02	2.2880E-03
16614000	10	8970	4430	8720	6890	11000	2.8454E-03	6.8199E-02	2.7314E-03
16614000	25	11000	5780	10500	7950	14000	4.1634E-03	6.6470E-02	3.9180E-03
16614000	50	12400	6860	11800	8520	16400	5.7010E-03	6.9938E-02	5.2713E-03
16614000	100	13700	8000	13000	8940	19000	7.7132E-03	7.5214E-02	6.9958E-03
16614000	500	16700	10800	15700	9530	25900	1.4190E-02	9.1468E-02	1.2285E-02
16616500	2	13.3	68.5	18	9.3	35.2	2.6849E-02	1.1754E-01	2.1857E-02
16616500	5	59.3	135	72	39.4	131	2.3289E-02	7.5214E-02	1.7783E-02
16616500	10	116	191	134	71.6	250	2.6766E-02	6.8199E-02	1.9222E-02
16616500	25	221	279	241	119	491	3.9610E-02	6.6470E-02	2.4820E-02
16616500	50	322	353	336	152	743	5.5788E-02	6.9938E-02	3.1033E-02
16616500	100	441	437	439	182	1060	7.7418E-02	7.5214E-02	3.8150E-02
16616500	500	773	657	699	239	2040	1.4709E-01	9.1468E-02	5.6397E-02
16617000	2	243	252	243	189	312	3.1417E-03	1.1754E-01	3.0599E-03
16617000	5	355	457	359	272	475	4.0188E-03	7.5214E-02	3.8150E-03
16617000	10	433	624	445	323	613	5.4759E-03	6.8199E-02	5.0689E-03
16617000	25	535	872	565	383	834	8.3618E-03	6.6470E-02	7.4274E-03
16617000	50	614	1080	664	425	1040	1.1292E-02	6.9938E-02	9.7223E-03
16617000	100	694	1300	770	466	1270	1.4884E-02	7.5214E-02	1.2425E-02
16617000	500	891	1890	1050	554	2000	2.5850E-02	9.1468E-02	2.0154E-02
16618000	2	1200	1780	1210	1020	1430	1.4177E-03	1.1754E-01	1.4008E-03
16618000	5	2080	2870	2100	1740	2540	1.8008E-03	7.5214E-02	1.7587E-03
16618000	10	2790	3690	2820	2250	3520	2.5462E-03	6.8199E-02	2.4545E-03
16618000	25	3820	4850	3880	2910	5160	4.2704E-03	6.6470E-02	4.0126E-03
16618000	50	4690	5780	4770	3400	6710	6.1930E-03	6.9938E-02	5.6892E-03
16618000	100	5660	6760	5760	3870	8580	8.6812E-03	7.5214E-02	7.7829E-03
16618000	500	8290	9210	8430	4930	14400	1.6747E-02	9.1468E-02	1.4156E-02
16619700	2	226	687	233	182	297	3.0433E-03	1.1754E-01	2.9665E-03
16619700	5	446	1170	468	356	616	3.9062E-03	7.5214E-02	3.7134E-03
16619700	10	641	1560	685	496	946	5.5101E-03	6.8199E-02	5.0982E-03
16619700	25	948	2100	1040	697	1560	9.1187E-03	6.6470E-02	8.0187E-03
16619700	50	1220	2550	1370	856	2210	1.3083E-02	6.9938E-02	1.1022E-02
16619700	100	1540	3030	1760	1020	3040	1.8174E-02	7.5214E-02	1.4637E-02
16619700	500	2480	4260	2880	1410	5880	3.4541E-02	9.1468E-02	2.5073E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16620000	2	2040	2140	2040	1820	2280	6.4898E-04	1.1754E-01	6.4541E-04
16620000	5	3230	3410	3230	2810	3710	9.5501E-04	7.5214E-02	9.4303E-04
16620000	10	4200	4360	4210	3540	5000	1.5029E-03	6.8199E-02	1.4705E-03
16620000	25	5660	5690	5660	4480	7150	2.7995E-03	6.6470E-02	2.6864E-03
16620000	50	6920	6750	6910	5190	9200	4.2702E-03	6.9938E-02	4.0245E-03
16620000	100	8340	7870	8300	5900	11700	6.1954E-03	7.5214E-02	5.7239E-03
16620000	500	12400	10700	12200	7590	19600	1.2531E-02	9.1468E-02	1.1021E-02
16623400	2	44.2	468	92.5	38.9	220	5.3606E-02	1.1754E-01	3.6816E-02
16623400	5	278	819	425	196	922	4.8550E-02	7.5214E-02	2.9505E-02
16623400	10	644	1100	821	371	1820	5.6585E-02	6.8199E-02	3.0926E-02
16623400	25	1450	1500	1480	622	3500	8.1461E-02	6.6470E-02	3.6603E-02
16623400	50	2330	1840	2020	791	5140	1.1135E-01	6.9938E-02	4.2957E-02
16623400	100	3470	2200	2560	932	7040	1.5066E-01	7.5214E-02	5.0169E-02
16623400	500	7160	3120	3840	1180	12500	2.7613E-01	9.1468E-02	6.8709E-02
16630200	2	543	134	539	431	674	2.4517E-03	4.5634E-01	2.4386E-03
16630200	5	1030	497	1010	775	1320	3.6199E-03	1.2885E-01	3.5210E-03
16630200	10	1490	925	1430	1030	1970	5.5658E-03	6.1349E-02	5.1029E-03
16630200	25	2230	1660	2130	1410	3200	9.9288E-03	4.9847E-02	8.2796E-03
16630200	50	2940	2370	2810	1720	4570	1.4735E-02	5.6338E-02	1.1680E-02
16630200	100	3790	3200	3640	2050	6460	2.0926E-02	6.9938E-02	1.6107E-02
16630200	500	6490	5770	6280	2880	13700	4.0946E-02	1.1003E-01	2.9841E-02
16636000	2	183	69.7	182	160	207	8.2772E-04	4.5634E-01	8.2622E-04
16636000	5	224	217	224	191	262	1.2593E-03	1.2885E-01	1.2471E-03
16636000	10	251	378	254	209	307	1.8702E-03	6.1349E-02	1.8149E-03
16636000	25	284	645	298	234	380	3.0669E-03	4.9847E-02	2.8891E-03
16636000	50	309	896	333	251	443	4.2808E-03	5.6338E-02	3.9785E-03
16636000	100	334	1190	368	265	512	5.7705E-03	6.9938E-02	5.3307E-03
16636000	500	394	2080	454	293	705	1.0331E-02	1.1003E-01	9.4447E-03
16638500	2	848	125	836	640	1090	3.5472E-03	4.5634E-01	3.5198E-03
16638500	5	1670	455	1610	1220	2120	3.8642E-03	1.2885E-01	3.7517E-03
16638500	10	2350	842	2170	1600	2950	4.9475E-03	6.1349E-02	4.5783E-03
16638500	25	3330	1500	2990	2070	4320	7.6357E-03	4.9847E-02	6.6214E-03
16638500	50	4140	2140	3730	2430	5720	1.0710E-02	5.6338E-02	8.9992E-03
16638500	100	5030	2890	4560	2770	7510	1.4725E-02	6.9938E-02	1.2164E-02
16638500	500	7330	5180	6840	3490	13400	2.7781E-02	1.1003E-01	2.2181E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16643300	2	321	114	319	253	402	2.6215E-03	4.5634E-01	2.6065E-03
16643300	5	627	403	619	471	813	3.7657E-03	1.2885E-01	3.6588E-03
16643300	10	910	739	894	645	1240	5.6988E-03	6.1349E-02	5.2144E-03
16643300	25	1380	1310	1370	905	2060	1.0030E-02	4.9847E-02	8.3501E-03
16643300	50	1820	1850	1830	1120	2980	1.4796E-02	5.6338E-02	1.1719E-02
16643300	100	2360	2500	2390	1350	4230	2.0929E-02	6.9938E-02	1.6109E-02
16643300	500	4040	4460	4150	1910	9040	4.0734E-02	1.1003E-01	2.9728E-02
16646200	2	477	114	473	384	584	2.1777E-03	4.5634E-01	2.1674E-03
16646200	5	826	403	816	659	1010	2.2735E-03	1.2885E-01	2.2341E-03
16646200	10	1080	738	1060	841	1350	2.8498E-03	6.1349E-02	2.7233E-03
16646200	25	1430	1310	1420	1060	1890	4.3730E-03	4.9847E-02	4.0203E-03
16646200	50	1690	1850	1710	1220	2390	6.1576E-03	5.6338E-02	5.5509E-03
16646200	100	1960	2490	2020	1360	2990	8.5122E-03	6.9938E-02	7.5886E-03
16646200	500	2620	4460	2810	1640	4800	1.6221E-02	1.1003E-01	1.4137E-02
16647500	2	19.2	44.1	19.8	11	35.8	1.7863E-02	4.5634E-01	1.7190E-02
16647500	5	83.4	122	87.2	50	152	1.7188E-02	1.2885E-01	1.5165E-02
16647500	10	168	202	176	100	308	2.0680E-02	6.1349E-02	1.5467E-02
16647500	25	335	332	334	179	623	3.1211E-02	4.9847E-02	1.9193E-02
16647500	50	509	454	484	238	985	4.4030E-02	5.6338E-02	2.4715E-02
16647500	100	730	596	664	294	1500	6.1144E-02	6.9938E-02	3.2623E-02
16647500	500	1440	1020	1210	411	3530	1.1730E-01	1.1003E-01	5.6776E-02
16650500	2	537	148	533	421	675	2.7556E-03	4.5634E-01	2.7390E-03
16650500	5	912	563	903	716	1140	2.7049E-03	1.2885E-01	2.6493E-03
16650500	10	1170	1060	1170	908	1500	3.2783E-03	6.1349E-02	3.1120E-03
16650500	25	1510	1920	1540	1140	2090	4.8991E-03	4.9847E-02	4.4607E-03
16650500	50	1760	2740	1850	1300	2630	6.8289E-03	5.6338E-02	6.0906E-03
16650500	100	2010	3730	2160	1430	3260	9.3821E-03	6.9938E-02	8.2724E-03
16650500	500	2580	6740	2950	1690	5140	1.7703E-02	1.1003E-01	1.5250E-02
16658500	2	37.9	58.4	38.2	24.9	58.6	9.1875E-03	4.5634E-01	9.0062E-03
16658500	5	113	174	116	75.8	177	9.5110E-03	1.2885E-01	8.8572E-03
16658500	10	192	297	206	131	323	1.1860E-02	6.1349E-02	9.9384E-03
16658500	25	330	499	368	219	619	1.8099E-02	4.9847E-02	1.3278E-02
16658500	50	461	689	522	287	949	2.5415E-02	5.6338E-02	1.7514E-02
16658500	100	617	912	703	353	1400	3.5064E-02	6.9938E-02	2.3355E-02
16658500	500	1090	1580	1250	498	3130	6.6616E-02	1.1003E-01	4.1495E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16660000	2	83.7	219	90.5	38	216	4.0340E-02	4.5634E-01	3.7064E-02
16660000	5	717	918	759	349	1650	3.8518E-02	1.2885E-01	2.9653E-02
16660000	10	1980	1800	1900	914	3950	4.6157E-02	6.1349E-02	2.6340E-02
16660000	25	5420	3360	4100	1900	8850	6.9416E-02	4.9847E-02	2.9013E-02
16660000	50	9950	4870	6320	2690	14800	9.7766E-02	5.6338E-02	3.5742E-02
16660000	100	16800	6690	9140	3470	24100	1.3561E-01	6.9938E-02	4.6141E-02
16660000	500	44500	12300	18000	5140	63200	2.5959E-01	1.1003E-01	7.7278E-02
16663500	2	6.8	113	11.9	3	46.4	1.1356E-01	4.5634E-01	9.0931E-02
16663500	5	61	401	154	49.5	480	1.2501E-01	1.2885E-01	6.3450E-02
16663500	10	180	734	496	192	1280	1.5826E-01	6.1349E-02	4.4211E-02
16663500	25	543	1300	1110	446	2770	2.2842E-01	4.9847E-02	4.0918E-02
16663500	50	1080	1840	1690	633	4520	3.0155E-01	5.6338E-02	4.7469E-02
16663500	100	1970	2480	2400	798	7190	3.9224E-01	6.9938E-02	5.9355E-02
16663500	500	6330	4430	4660	1160	18700	6.7115E-01	1.1003E-01	9.4535E-02
16664000	2	13.3	110	20.2	5.2	78.2	1.1243E-01	4.5634E-01	9.0208E-02
16664000	5	120	388	216	68.7	677	1.2817E-01	1.2885E-01	6.4255E-02
16664000	10	363	709	591	228	1540	1.6497E-01	6.1349E-02	4.4719E-02
16664000	25	1130	1250	1230	491	3080	2.4092E-01	4.9847E-02	4.1302E-02
16664000	50	2310	1770	1840	686	4950	3.1936E-01	5.6338E-02	4.7889E-02
16664000	100	4350	2390	2600	863	7860	4.1626E-01	6.9938E-02	5.9878E-02
16664000	500	15000	4260	5040	1250	20300	7.1355E-01	1.1003E-01	9.5333E-02
16700000	2	159	691	160	141	182	7.9261E-04	2.2231E-01	7.8979E-04
16700000	5	235	1200	237	207	270	8.6461E-04	2.0468E-01	8.6098E-04
16700000	10	286	1610	288	248	335	1.1143E-03	2.2231E-01	1.1087E-03
16700000	25	350	2180	355	294	429	1.7545E-03	2.2231E-01	1.7408E-03
16700000	50	398	2640	406	324	508	2.4990E-03	2.3949E-01	2.4732E-03
16700000	100	445	3160	457	351	595	3.4801E-03	2.5621E-01	3.4335E-03
16700000	500	556	4470	582	404	839	6.7003E-03	2.8824E-01	6.5481E-03
16701200	2	640	791	644	447	927	6.7047E-03	2.2231E-01	6.5084E-03
16701200	5	1030	1390	1040	706	1520	7.4987E-03	2.0468E-01	7.2336E-03
16701200	10	1290	1880	1310	853	2020	9.5365E-03	2.2231E-01	9.1442E-03
16701200	25	1640	2570	1680	1010	2810	1.3623E-02	2.2231E-01	1.2836E-02
16701200	50	1900	3140	1970	1100	3520	1.7747E-02	2.3949E-01	1.6523E-02
16701200	100	2170	3780	2270	1180	4360	2.2766E-02	2.5621E-01	2.0908E-02
16701200	500	2790	5410	3020	1320	6890	3.7885E-02	2.8824E-01	3.3484E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16701300	2	634	790	638	441	923	6.9037E-03	2.2231E-01	6.6958E-03
16701300	5	1360	1390	1360	862	2140	1.0741E-02	2.0468E-01	1.0206E-02
16701300	10	2090	1880	2080	1190	3630	1.6493E-02	2.2231E-01	1.5354E-02
16701300	25	3410	2570	3300	1610	6760	2.8500E-02	2.2231E-01	2.5262E-02
16701300	50	4740	3130	4460	1910	10400	4.1198E-02	2.3949E-01	3.5151E-02
16701300	100	6430	3770	5830	2200	15500	5.7181E-02	2.5621E-01	4.6748E-02
16701300	500	12300	5390	9830	2780	34800	1.0759E-01	2.8824E-01	7.8344E-02
16701400	2	516	882	523	372	734	5.8102E-03	2.2231E-01	5.6622E-03
16701400	5	896	1560	913	624	1340	7.3451E-03	2.0468E-01	7.0906E-03
16701400	10	1200	2110	1220	787	1900	9.9834E-03	2.2231E-01	9.5543E-03
16701400	25	1620	2910	1690	982	2890	1.5317E-02	2.2231E-01	1.4330E-02
16701400	50	1980	3570	2070	1110	3870	2.0804E-02	2.3949E-01	1.9141E-02
16701400	100	2370	4310	2510	1230	5110	2.7584E-02	2.5621E-01	2.4903E-02
16701400	500	3390	6230	3700	1480	9280	4.8463E-02	2.8824E-01	4.1487E-02
16701750	2	1040	2520	1200	623	2320	2.5315E-02	1.3074E-01	2.1208E-02
16701750	5	3450	5430	3860	2050	7280	2.6319E-02	7.8775E-02	1.9728E-02
16701750	10	6140	8080	6770	3520	13000	3.2550E-02	5.9666E-02	2.1061E-02
16701750	25	11000	12300	11600	5830	23200	4.7165E-02	4.6693E-02	2.3464E-02
16701750	50	15700	15800	15800	7640	32600	6.3232E-02	4.3605E-02	2.5808E-02
16701750	100	21400	20000	20500	9540	44000	8.3712E-02	4.3605E-02	2.8671E-02
16701750	500	38700	31100	32800	13900	77700	1.4830E-01	4.8262E-02	3.6413E-02
16701800	2	5110	3880	5020	3310	7610	9.0634E-03	1.3074E-01	8.4758E-03
16701800	5	9980	8020	9760	6490	14700	9.1374E-03	7.8775E-02	8.1877E-03
16701800	10	13700	11700	13400	8650	20700	1.1129E-02	5.9666E-02	9.3793E-03
16701800	25	18900	17400	18500	11300	30200	1.5878E-02	4.6693E-02	1.1849E-02
16701800	50	22900	21900	22500	13200	38600	2.1108E-02	4.3605E-02	1.4223E-02
16701800	100	27000	27500	27200	15100	48900	2.7763E-02	4.3605E-02	1.6963E-02
16701800	500	36800	41400	39100	19300	78800	4.8641E-02	4.8262E-02	2.4225E-02
16704000	2	17300	17100	17300	15200	19700	8.4061E-04	1.3074E-01	8.3524E-04
16704000	5	28200	35500	28300	24300	32900	1.1588E-03	7.8775E-02	1.1420E-03
16704000	10	36900	51500	37200	30900	44800	1.7385E-03	5.9666E-02	1.6893E-03
16704000	25	49700	75800	51000	40000	65000	3.0873E-03	4.6693E-02	2.8958E-03
16704000	50	60600	94600	63200	47300	84600	4.5999E-03	4.3605E-02	4.1609E-03
16704000	100	72800	117000	77400	55100	109000	6.5658E-03	4.3605E-02	5.7066E-03
16704000	500	107000	172000	118000	74800	186000	1.2979E-02	4.8262E-02	1.0228E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16713000	2	37700	21600	37000	27900	49200	4.0647E-03	1.3074E-01	3.9421E-03
16713000	5	61300	43700	60400	46100	79200	3.7777E-03	7.8775E-02	3.6048E-03
16713000	10	76800	62500	75700	56600	101000	4.4468E-03	5.9666E-02	4.1384E-03
16713000	25	95500	90700	94900	67700	133000	6.3626E-03	4.6693E-02	5.5996E-03
16713000	50	109000	112000	109000	74500	160000	8.6125E-03	4.3605E-02	7.1920E-03
16713000	100	121000	138000	125000	80900	192000	1.1548E-02	4.3605E-02	9.1302E-03
16713000	500	148000	199000	162000	93900	279000	2.0887E-02	4.8262E-02	1.4578E-02
16717000	2	9200	6000	9170	7960	10600	9.8457E-04	1.3074E-01	9.7721E-04
16717000	5	13300	9500	13200	11400	15400	1.1377E-03	7.8775E-02	1.1215E-03
16717000	10	16000	12200	15900	13400	18900	1.5058E-03	5.9666E-02	1.4688E-03
16717000	25	19500	15900	19300	15600	24000	2.3734E-03	4.6693E-02	2.2586E-03
16717000	50	22100	18500	21900	17000	28100	3.3456E-03	4.3605E-02	3.1072E-03
16717000	100	24800	21500	24400	18200	32700	4.6045E-03	4.3605E-02	4.1647E-03
16717000	500	30900	28200	30500	20700	44900	8.6754E-03	4.8262E-02	7.3536E-03
16717400	2	101	226	103	77.7	137	4.0205E-03	1.3074E-01	3.9006E-03
16717400	5	170	354	178	129	246	5.4367E-03	7.8775E-02	5.0857E-03
16717400	10	225	459	244	168	355	7.7008E-03	5.9666E-02	6.8205E-03
16717400	25	306	615	354	227	553	1.2346E-02	4.6693E-02	9.7641E-03
16717400	50	374	729	452	274	745	1.7186E-02	4.3605E-02	1.2327E-02
16717400	100	449	869	565	324	984	2.3219E-02	4.3605E-02	1.5151E-02
16717400	500	654	1210	871	443	1710	4.2004E-02	4.8262E-02	2.2458E-02
16717600	2	309	648	314	248	397	2.7431E-03	1.3074E-01	2.6868E-03
16717600	5	511	966	530	392	719	4.8036E-03	7.8775E-02	4.5275E-03
16717600	10	689	1220	737	506	1070	7.8897E-03	5.9666E-02	6.9682E-03
16717600	25	974	1580	1090	680	1760	1.4498E-02	4.6693E-02	1.1063E-02
16717600	50	1240	1830	1410	819	2420	2.1613E-02	4.3605E-02	1.4450E-02
16717600	100	1550	2140	1770	967	3250	3.0669E-02	4.3605E-02	1.8005E-02
16717600	500	2530	2850	2700	1290	5650	5.9616E-02	4.8262E-02	2.6671E-02
16717650	2	661	858	664	523	844	2.8717E-03	1.3074E-01	2.8100E-03
16717650	5	1100	1350	1110	833	1480	4.2707E-03	7.8775E-02	4.0511E-03
16717650	10	1460	1740	1480	1050	2090	6.4215E-03	5.9666E-02	5.7976E-03
16717650	25	2000	2310	2060	1350	3150	1.0939E-02	4.6693E-02	8.8626E-03
16717650	50	2470	2710	2540	1560	4120	1.5729E-02	4.3605E-02	1.1559E-02
16717650	100	3010	3210	3080	1790	5300	2.1766E-02	4.3605E-02	1.4519E-02
16717650	500	4550	4360	4460	2280	8730	4.0824E-02	4.8262E-02	2.2116E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16717800	2	2030	1560	2010	1510	2680	4.1404E-03	1.3074E-01	4.0133E-03
16717800	5	3790	2510	3680	2650	5120	5.7130E-03	7.8775E-02	5.3267E-03
16717800	10	5310	3270	5010	3410	7360	8.2671E-03	5.9666E-02	7.2611E-03
16717800	25	7700	4360	6770	4260	10800	1.3679E-02	4.6693E-02	1.0580E-02
16717800	50	9850	5130	8050	4770	13600	1.9436E-02	4.3605E-02	1.3444E-02
16717800	100	12300	6070	9420	5270	16800	2.6700E-02	4.3605E-02	1.6560E-02
16717800	500	19700	8250	12700	6250	25600	4.9642E-02	4.8262E-02	2.4471E-02
16717850	2	135	372	143	97.2	209	7.6530E-03	1.3074E-01	7.2298E-03
16717850	5	252	622	280	182	433	1.0519E-02	7.8775E-02	9.2795E-03
16717850	10	353	831	419	256	685	1.4881E-02	5.9666E-02	1.1911E-02
16717850	25	509	1140	667	379	1170	2.3506E-02	4.6693E-02	1.5635E-02
16717850	50	647	1380	893	483	1650	3.2284E-02	4.3605E-02	1.8550E-02
16717850	100	806	1670	1160	596	2250	4.3069E-02	4.3605E-02	2.1668E-02
16717850	500	1270	2370	1860	856	4040	7.6116E-02	4.8262E-02	2.9535E-02
16717950	2	28.1	300	42.4	21.5	83.6	2.7477E-02	1.3074E-01	2.2705E-02
16717950	5	107	719	208	98.4	440	4.2289E-02	7.8775E-02	2.7517E-02
16717950	10	227	1140	523	237	1160	6.3850E-02	5.9666E-02	3.0844E-02
16717950	25	527	1860	1270	562	2870	1.0748E-01	4.6693E-02	3.2552E-02
16717950	50	930	2500	2010	874	4610	1.5271E-01	4.3605E-02	3.3920E-02
16717950	100	1570	3320	2920	1240	6880	2.0897E-01	4.3605E-02	3.6077E-02
16717950	500	4770	5660	5550	2180	14100	3.8395E-01	4.8262E-02	4.2873E-02
16720000	2	812	1010	814	685	967	1.4745E-03	1.3074E-01	1.4581E-03
16720000	5	1320	1600	1320	1090	1610	1.9730E-03	7.8775E-02	1.9247E-03
16720000	10	1710	2070	1730	1360	2180	2.8555E-03	5.9666E-02	2.7251E-03
16720000	25	2280	2750	2320	1720	3120	4.8294E-03	4.6693E-02	4.3767E-03
16720000	50	2750	3230	2810	1980	3990	6.9939E-03	4.3605E-02	6.0272E-03
16720000	100	3270	3820	3360	2250	5030	9.7717E-03	4.3605E-02	7.9828E-03
16720000	500	4670	5190	4810	2850	8120	1.8705E-02	4.8262E-02	1.3480E-02
16720300	2	340	358	341	270	429	2.6673E-03	1.3074E-01	2.6140E-03
16720300	5	587	558	585	448	765	3.6744E-03	7.8775E-02	3.5106E-03
16720300	10	790	721	784	571	1080	5.3446E-03	5.9666E-02	4.9052E-03
16720300	25	1090	961	1070	725	1580	8.9472E-03	4.6693E-02	7.5084E-03
16720300	50	1360	1130	1300	831	2040	1.2820E-02	4.3605E-02	9.9075E-03
16720300	100	1650	1340	1560	938	2580	1.7738E-02	4.3605E-02	1.2609E-02
16720300	500	2490	1850	2210	1170	4160	3.3373E-02	4.8262E-02	1.9730E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16725000	2	338	510	340	283	408	1.6389E-03	1.3074E-01	1.6186E-03
16725000	5	568	829	575	462	714	2.3826E-03	7.8775E-02	2.3127E-03
16725000	10	760	1090	776	596	1010	3.6261E-03	5.9666E-02	3.4184E-03
16725000	25	1050	1480	1100	781	1540	6.4043E-03	4.6693E-02	5.6319E-03
16725000	50	1310	1760	1380	926	2050	9.4572E-03	4.3605E-02	7.7717E-03
16725000	100	1600	2110	1710	1080	2700	1.3384E-02	4.3605E-02	1.0240E-02
16725000	500	2450	2950	2610	1450	4700	2.6056E-02	4.8262E-02	1.6921E-02
16737000	2	379	547	381	317	458	1.6884E-03	1.3074E-01	1.6668E-03
16737000	5	539	865	547	440	680	2.4128E-03	7.8775E-02	2.3411E-03
16737000	10	654	1120	674	520	875	3.5256E-03	5.9666E-02	3.3289E-03
16737000	25	810	1500	867	627	1200	5.8140E-03	4.6693E-02	5.1702E-03
16737000	50	934	1770	1030	710	1500	8.2063E-03	4.3605E-02	6.9065E-03
16737000	100	1060	2100	1220	798	1870	1.1195E-02	4.3605E-02	8.9082E-03
16737000	500	1400	2900	1740	1010	2980	2.0535E-02	4.8262E-02	1.4406E-02
16738000	2	1050	441	1020	736	1410	5.3403E-03	1.3074E-01	5.1307E-03
16738000	5	1700	733	1570	1060	2320	8.4394E-03	7.8775E-02	7.6227E-03
16738000	10	2230	976	1930	1210	3060	1.2693E-02	5.9666E-02	1.0466E-02
16738000	25	3020	1340	2350	1370	4040	2.0885E-02	4.6693E-02	1.4431E-02
16738000	50	3700	1610	2650	1460	4810	2.9106E-02	4.3605E-02	1.7455E-02
16738000	100	4470	1940	3010	1580	5760	3.9127E-02	4.3605E-02	2.0622E-02
16738000	500	6670	2740	3950	1840	8450	6.9570E-02	4.8262E-02	2.8495E-02
16739000	2	333	411	338	221	518	9.5667E-03	1.3074E-01	8.9144E-03
16739000	5	662	678	664	405	1090	1.4113E-02	7.8775E-02	1.1969E-02
16739000	10	966	899	948	542	1660	2.0639E-02	5.9666E-02	1.5335E-02
16739000	25	1470	1230	1360	726	2560	3.3406E-02	4.6693E-02	1.9474E-02
16739000	50	1940	1470	1680	855	3310	4.6336E-02	4.3605E-02	2.2465E-02
16739000	100	2510	1770	2040	992	4210	6.2185E-02	4.3605E-02	2.5632E-02
16739000	500	4280	2500	2940	1290	6730	1.1064E-01	4.8262E-02	3.3603E-02
16740000	2	39.3	70.7	40.2	29.1	55.4	5.2700E-03	1.3074E-01	5.0658E-03
16740000	5	64.5	124	68.6	46.5	101	8.2064E-03	7.8775E-02	7.4322E-03
16740000	10	85.1	171	95.9	60.8	151	1.2293E-02	5.9666E-02	1.0193E-02
16740000	25	116	244	145	85.1	249	2.0236E-02	4.6693E-02	1.4117E-02
16740000	50	143	302	192	106	347	2.8253E-02	4.3605E-02	1.7145E-02
16740000	100	174	375	249	131	473	3.8063E-02	4.3605E-02	2.0323E-02
16740000	500	262	565	411	192	876	6.7995E-02	4.8262E-02	2.8227E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16741000	2	295	180	290	212	397	5.0461E-03	1.3074E-01	4.8586E-03
16741000	5	463	306	448	313	640	6.8226E-03	7.8775E-02	6.2788E-03
16741000	10	588	414	560	372	843	9.5077E-03	5.9666E-02	8.2009E-03
16741000	25	762	579	713	443	1150	1.4673E-02	4.6693E-02	1.1164E-02
16741000	50	902	705	835	493	1420	1.9826E-02	4.3605E-02	1.3629E-02
16741000	100	1050	861	976	548	1740	2.6081E-02	4.3605E-02	1.6320E-02
16741000	500	1440	1260	1350	678	2690	4.4961E-02	4.8262E-02	2.3276E-02
16742000	2	112	107	112	91.2	138	2.1580E-03	1.3074E-01	2.1230E-03
16742000	5	167	185	168	130	216	3.3173E-03	7.8775E-02	3.1832E-03
16742000	10	209	253	212	156	288	5.0288E-03	5.9666E-02	4.6379E-03
16742000	25	268	357	280	191	411	8.5372E-03	4.6693E-02	7.2176E-03
16742000	50	317	438	340	219	529	1.2204E-02	4.3605E-02	9.5356E-03
16742000	100	371	539	411	250	676	1.6788E-02	4.3605E-02	1.2122E-02
16742000	500	516	800	612	329	1140	3.1128E-02	4.8262E-02	1.8923E-02
16752600	2	61.7	279	76.2	41.4	140	2.1262E-02	1.3074E-01	1.8288E-02
16752600	5	227	554	272	154	483	2.0300E-02	7.8775E-02	1.6140E-02
16752600	10	419	803	505	279	914	2.4237E-02	5.9666E-02	1.7236E-02
16752600	25	764	1200	929	489	1760	3.5557E-02	4.6693E-02	2.0186E-02
16752600	50	1100	1530	1310	659	2600	4.9014E-02	4.3605E-02	2.3076E-02
16752600	100	1500	1930	1750	838	3630	6.6747E-02	4.3605E-02	2.6375E-02
16752600	500	2660	3010	2910	1250	6740	1.2405E-01	4.8262E-02	3.4744E-02
16755800	2	92.1	51.6	91.2	74.4	112	2.0827E-03	1.3074E-01	2.0500E-03
16755800	5	152	110	150	119	190	2.8084E-03	7.8775E-02	2.7117E-03
16755800	10	199	166	197	149	260	4.0475E-03	5.9666E-02	3.7904E-03
16755800	25	268	261	267	189	378	6.7492E-03	4.6693E-02	5.8968E-03
16755800	50	326	343	329	220	492	9.6700E-03	4.3605E-02	7.9148E-03
16755800	100	390	449	403	255	636	1.3389E-02	4.3605E-02	1.0244E-02
16755800	500	564	748	621	347	1110	2.5249E-02	4.8262E-02	1.6577E-02
16756000	2	1680	648	1540	946	2520	1.2902E-02	1.3074E-01	1.1743E-02
16756000	5	3190	1190	2760	1710	4480	1.3351E-02	7.8775E-02	1.1416E-02
16756000	10	4330	1660	3520	2110	5870	1.6402E-02	5.9666E-02	1.2865E-02
16756000	25	5870	2390	4370	2500	7640	2.2861E-02	4.6693E-02	1.5347E-02
16756000	50	7060	2950	4960	2730	9030	2.9519E-02	4.3605E-02	1.7603E-02
16756000	100	8280	3630	5650	2970	10700	3.7692E-02	4.3605E-02	2.0217E-02
16756000	500	11200	5370	7400	3510	15600	6.2407E-02	4.8262E-02	2.7215E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16756100	2	857	652	851	654	1110	3.4926E-03	1.3074E-01	3.4017E-03
16756100	5	1250	1210	1250	919	1690	4.8224E-03	7.8775E-02	4.5442E-03
16756100	10	1530	1690	1540	1080	2190	6.7890E-03	5.9666E-02	6.0955E-03
16756100	25	1900	2420	1990	1310	3020	1.0566E-02	4.6693E-02	8.6161E-03
16756100	50	2200	3000	2370	1480	3790	1.4334E-02	4.3605E-02	1.0788E-02
16756100	100	2500	3700	2820	1680	4730	1.8907E-02	4.3605E-02	1.3188E-02
16756100	500	3280	5480	4040	2150	7580	3.2714E-02	4.8262E-02	1.9498E-02
16756300	2	968	655	959	748	1230	3.0993E-03	1.3074E-01	3.0275E-03
16756300	5	1620	1220	1600	1220	2090	3.7855E-03	7.8775E-02	3.6119E-03
16756300	10	2110	1700	2070	1520	2830	5.1147E-03	5.9666E-02	4.7109E-03
16756300	25	2800	2460	2750	1890	3990	8.0001E-03	4.6693E-02	6.8299E-03
16756300	50	3360	3040	3290	2150	5030	1.1098E-02	4.3605E-02	8.8467E-03
16756300	100	3950	3760	3900	2420	6280	1.5022E-02	4.3605E-02	1.1173E-02
16756300	500	5480	5580	5520	3040	10000	2.7434E-02	4.8262E-02	1.7491E-02
16756500	2	932	695	928	760	1130	1.9835E-03	1.3074E-01	1.9539E-03
16756500	5	1620	1400	1620	1290	2020	2.5335E-03	7.8775E-02	2.4545E-03
16756500	10	2180	2020	2170	1670	2820	3.5652E-03	5.9666E-02	3.3642E-03
16756500	25	3000	3020	3000	2160	4150	5.8939E-03	4.6693E-02	5.2333E-03
16756500	50	3690	3820	3710	2540	5420	8.4563E-03	4.3605E-02	7.0828E-03
16756500	100	4450	4820	4530	2930	6990	1.1749E-02	4.3605E-02	9.2553E-03
16756500	500	6540	7410	6800	3890	11900	2.2343E-02	4.8262E-02	1.5273E-02
16757000	2	520	305	509	372	697	5.0166E-03	1.3074E-01	4.8312E-03
16757000	5	964	554	930	676	1280	5.3628E-03	7.8775E-02	5.0210E-03
16757000	10	1310	769	1240	870	1760	6.7461E-03	5.9666E-02	6.0608E-03
16757000	25	1780	1100	1630	1080	2460	1.0033E-02	4.6693E-02	8.2588E-03
16757000	50	2160	1360	1930	1220	3060	1.3696E-02	4.3605E-02	1.0422E-02
16757000	100	2550	1680	2250	1350	3760	1.8406E-02	4.3605E-02	1.2943E-02
16757000	500	3530	2500	3070	1630	5780	3.3452E-02	4.8262E-02	1.9758E-02
16758000	2	473	354	471	379	585	2.3373E-03	1.3074E-01	2.2962E-03
16758000	5	971	670	956	739	1240	3.3827E-03	7.8775E-02	3.2434E-03
16758000	10	1450	948	1410	1030	1920	5.1921E-03	5.9666E-02	4.7765E-03
16758000	25	2280	1380	2100	1410	3130	9.3378E-03	4.6693E-02	7.7816E-03
16758000	50	3090	1730	2690	1690	4280	1.3957E-02	4.3605E-02	1.0573E-02
16758000	100	4100	2160	3350	1980	5690	1.9943E-02	4.3605E-02	1.3684E-02
16758000	500	7430	3270	5140	2640	9990	3.9422E-02	4.8262E-02	2.1698E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16759000	2	191	97.4	189	152	235	2.3588E-03	1.3074E-01	2.3170E-03
16759000	5	360	196	352	274	452	3.1995E-03	7.8775E-02	3.0747E-03
16759000	10	508	286	488	362	656	4.6787E-03	5.9666E-02	4.3385E-03
16759000	25	742	435	687	473	997	7.9996E-03	4.6693E-02	6.8296E-03
16759000	50	954	559	852	553	1310	1.1651E-02	4.3605E-02	9.1942E-03
16759000	100	1200	715	1040	637	1700	1.6344E-02	4.3605E-02	1.1888E-02
16759000	500	1930	1140	1570	842	2930	3.1467E-02	4.8262E-02	1.9048E-02
16759040	2	123	67.1	121	89.4	162	4.5232E-03	1.3074E-01	4.3719E-03
16759040	5	225	132	216	150	311	7.1701E-03	7.8775E-02	6.5719E-03
16759040	10	318	192	294	190	455	1.1099E-02	5.9666E-02	9.3580E-03
16759040	25	471	289	408	241	692	1.9273E-02	4.6693E-02	1.3642E-02
16759040	50	614	370	504	280	908	2.7903E-02	4.3605E-02	1.7015E-02
16759040	100	786	473	619	324	1180	3.8757E-02	4.3605E-02	2.0519E-02
16759040	500	1330	754	945	438	2040	7.2958E-02	4.8262E-02	2.9047E-02
16759060	2	66.4	366	92.2	45.1	189	3.1126E-02	1.3074E-01	2.5140E-02
16759060	5	344	1220	506	252	1020	3.4487E-02	7.8775E-02	2.3986E-02
16759060	10	784	2250	1230	598	2520	4.4259E-02	5.9666E-02	2.5410E-02
16759060	25	1830	4290	3020	1430	6390	6.7019E-02	4.6693E-02	2.7520E-02
16759060	50	3120	6340	5050	2320	11000	9.2238E-02	4.3605E-02	2.9608E-02
16759060	100	4990	9160	7830	3480	17600	1.2464E-01	4.3605E-02	3.2304E-02
16759060	500	12500	18200	17100	6930	42000	2.2832E-01	4.8262E-02	3.9841E-02
16759080	2	489	316	460	251	845	2.1058E-02	1.3074E-01	1.8137E-02
16759080	5	1290	999	1200	618	2340	3.0117E-02	7.8775E-02	2.1788E-02
16759080	10	2190	1800	2020	987	4120	4.3251E-02	5.9666E-02	2.5075E-02
16759080	25	3910	3360	3570	1680	7580	6.8700E-02	4.6693E-02	2.7799E-02
16759080	50	5740	4900	5150	2360	11200	9.4283E-02	4.3605E-02	2.9816E-02
16759080	100	8160	7000	7280	3230	16400	1.2549E-01	4.3605E-02	3.2361E-02
16759080	500	16900	13600	14100	5760	34700	2.2032E-01	4.8262E-02	3.9590E-02
16759180	2	497	183	487	386	615	2.7191E-03	1.3074E-01	2.6637E-03
16759180	5	672	445	662	517	848	3.1292E-03	7.8775E-02	3.0097E-03
16759180	10	782	709	777	589	1030	4.0318E-03	5.9666E-02	3.7766E-03
16759180	25	914	1170	940	679	1300	5.8163E-03	4.6693E-02	5.1720E-03
16759180	50	1010	1580	1080	750	1550	7.6072E-03	4.3605E-02	6.4772E-03
16759180	100	1100	2120	1240	829	1860	9.7816E-03	4.3605E-02	7.9894E-03
16759180	500	1300	3670	1690	1030	2790	1.6322E-02	4.8262E-02	1.2197E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16759200	2	211	102	201	133	303	8.8687E-03	1.3074E-01	8.3053E-03
16759200	5	490	273	455	290	713	1.1372E-02	7.8775E-02	9.9374E-03
16759200	10	765	456	686	415	1140	1.5747E-02	5.9666E-02	1.2459E-02
16759200	25	1230	792	1060	594	1880	2.5007E-02	4.6693E-02	1.6285E-02
16759200	50	1680	1110	1400	747	2620	3.4824E-02	4.3605E-02	1.9361E-02
16759200	100	2230	1520	1830	926	3600	4.7177E-02	4.3605E-02	2.2660E-02
16759200	500	3950	2790	3160	1430	6990	8.6019E-02	4.8262E-02	3.0916E-02
16759300	2	260	224	256	146	446	1.7262E-02	1.3074E-01	1.5249E-02
16759300	5	958	614	876	496	1550	1.9865E-02	7.8775E-02	1.5865E-02
16759300	10	1860	1040	1560	848	2860	2.6065E-02	5.9666E-02	1.8140E-02
16759300	25	3710	1810	2660	1370	5170	4.0240E-02	4.6693E-02	2.1614E-02
16759300	50	5760	2540	3640	1800	7370	5.5855E-02	4.3605E-02	2.4488E-02
16759300	100	8510	3500	4840	2280	10300	7.5886E-02	4.3605E-02	2.7693E-02
16759300	500	18500	6400	8400	3570	19700	1.3999E-01	4.8262E-02	3.5889E-02
16759500	2	1050	266	897	513	1570	1.7409E-02	1.3074E-01	1.5363E-02
16759500	5	2300	716	1850	1070	3190	1.8024E-02	7.8775E-02	1.4668E-02
16759500	10	3330	1200	2530	1420	4480	2.2159E-02	5.9666E-02	1.6158E-02
16759500	25	4830	2070	3440	1860	6380	3.1068E-02	4.6693E-02	1.8655E-02
16759500	50	6060	2880	4240	2210	8150	4.0361E-02	4.3605E-02	2.0960E-02
16759500	100	7370	3940	5240	2620	10500	5.1848E-02	4.3605E-02	2.3685E-02
16759500	500	10700	7120	8230	3720	18200	8.6867E-02	4.8262E-02	3.1025E-02
16759800	2	35	118	35.4	29	43.1	1.9472E-03	2.2231E-01	1.9303E-03
16759800	5	53.2	135	53.8	42.7	67.9	2.6737E-03	2.0468E-01	2.6392E-03
16759800	10	66.8	158	67.8	51.3	89.4	3.8535E-03	2.2231E-01	3.7878E-03
16759800	25	85.6	185	87.5	61.4	125	6.3438E-03	2.2231E-01	6.1678E-03
16759800	50	101	205	104	68	158	8.9865E-03	2.3949E-01	8.6615E-03
16759800	100	117	225	121	74	197	1.2316E-02	2.5621E-01	1.1751E-02
16759800	500	160	271	166	86.2	320	2.2815E-02	2.8824E-01	2.1142E-02
16762000	2	788	472	784	630	976	2.3783E-03	2.2231E-01	2.3531E-03
16762000	5	1210	816	1200	978	1480	2.1288E-03	2.0468E-01	2.1069E-03
16762000	10	1470	1060	1460	1170	1830	2.4738E-03	2.2231E-01	2.4465E-03
16762000	25	1770	1410	1760	1350	2310	3.6213E-03	2.2231E-01	3.5632E-03
16762000	50	1980	1680	1970	1440	2710	5.0332E-03	2.3949E-01	4.9296E-03
16762000	100	2170	1980	2160	1490	3130	6.9090E-03	2.5621E-01	6.7276E-03
16762000	500	2570	2720	2570	1560	4250	1.2950E-02	2.8824E-01	1.2393E-02

Table 12. Estimated peak discharges for selected recurrence intervals at stream-gaging stations, State of Hawai‘i—Continued.

[ft^3/s, cubic feet per second; WIE, Weighted Independent Estimates program from Berenbrock and Cohn (2008); PeakFQ, program for flood-frequency analysis from Flynn and others (2006); The WIE program was used to compute the weighted peak discharge values and all variances. The WIE program also computes the station discharge value from the mean, standard deviation, and skew values, and the computed station discharge value may differ slightly (by less than 0.5 percent or, if greater than 0.5 percent, by less than 1 cubic foot per second) from the Bulletin 17B (Interagency Advisory Committee on Water Data, 1982) value shown in the table as computed from the PeakFQ program.]

Station no.	Recurrence interval, in years	Peak discharge values, in ft^3/s			95-percent confidence interval, in ft^3/s		Variance (logarithmic units)		
		Station value (Bulletin 17B)	Regression equation	Weighted value	Lower	Upper	Station value	Regression equation	Weighted value
16764000	2	989	714	988	873	1120	7.5226E-04	2.2231E-01	7.4972E-04
16764000	5	1300	1350	1300	1110	1520	1.2043E-03	2.0468E-01	1.1973E-03
16764000	10	1510	1820	1520	1250	1840	1.8895E-03	2.2231E-01	1.8736E-03
16764000	25	1800	2490	1810	1400	2350	3.3465E-03	2.2231E-01	3.2969E-03
16764000	50	2030	3040	2050	1500	2800	4.9059E-03	2.3949E-01	4.8074E-03
16764000	100	2270	3650	2300	1590	3330	6.8831E-03	2.5621E-01	6.7030E-03
16764000	500	2890	5210	2960	1790	4920	1.3171E-02	2.8824E-01	1.2595E-02
16765000	2	436	294	434	363	521	1.6163E-03	2.2231E-01	1.6047E-03
16765000	5	595	460	594	483	729	2.1058E-03	2.0468E-01	2.0844E-03
16765000	10	702	579	700	550	892	2.9156E-03	2.2231E-01	2.8779E-03
16765000	25	838	736	836	618	1130	4.5655E-03	2.2231E-01	4.4736E-03
16765000	50	941	858	938	659	1340	6.2745E-03	2.3949E-01	6.1143E-03
16765000	100	1050	989	1040	694	1570	8.3959E-03	2.5621E-01	8.1295E-03
16765000	500	1290	1300	1290	754	2210	1.4967E-02	2.8824E-01	1.4229E-02
16767000	2	1170	269	1140	899	1460	2.8910E-03	2.2231E-01	2.8539E-03
16767000	5	1840	418	1800	1420	2280	2.7726E-03	2.0468E-01	2.7355E-03
16767000	10	2270	522	2220	1720	2880	3.3134E-03	2.2231E-01	3.2647E-03
16767000	25	2800	660	2720	1990	3700	4.8222E-03	2.2231E-01	4.7198E-03
16767000	50	3180	766	3060	2130	4390	6.5942E-03	2.3949E-01	6.4175E-03
16767000	100	3540	880	3380	2220	5130	8.9160E-03	2.5621E-01	8.6162E-03
16767000	500	4330	1150	4030	2300	7060	1.6378E-02	2.8824E-01	1.5498E-02
16770000	2	2810	653	2650	1740	4030	9.0114E-03	2.2231E-01	8.6603E-03
16770000	5	5600	1230	5240	3430	8020	9.2551E-03	2.0468E-01	8.8548E-03
16770000	10	7800	1650	7240	4520	11600	1.1375E-02	2.2231E-01	1.0821E-02
16770000	25	10900	2240	9770	5590	17100	1.6368E-02	2.2231E-01	1.5246E-02
16770000	50	13300	2720	11700	6170	22100	2.1857E-02	2.3949E-01	2.0029E-02
16770000	100	15900	3250	13500	6550	28000	2.8844E-02	2.5621E-01	2.5925E-02
16770000	500	22200	4610	17500	6870	44800	5.0825E-02	2.8824E-01	4.3206E-02
16770500	2	566	806	576	358	928	1.1751E-02	2.2231E-01	1.1161E-02
16770500	5	1620	1600	1620	964	2730	1.4193E-02	2.0468E-01	1.3272E-02
16770500	10	2800	2180	2740	1510	4990	1.9105E-02	2.2231E-01	1.7593E-02
16770500	25	4980	3010	4690	2250	9770	2.9950E-02	2.2231E-01	2.6394E-02
16770500	50	7210	3690	6530	2790	15300	4.1703E-02	2.3949E-01	3.5518E-02
16770500	100	10000	4460	8670	3280	22900	5.6663E-02	2.5621E-01	4.6401E-02
16770500	500	19500	6450	14600	4180	50800	1.0423E-01	2.8824E-01	7.6549E-02

Appendix A

Floods and flood-control studies for specific sites are documented in numerous government and private reports, although these studies are not reviewed here. Lau and Mink (2006) provide a review of methods used to estimate peak discharges in Hawai‘i. These methods include the rational formula (County of Hawai‘i, 1970; County of Maui, 1995; City and County of Honolulu, 2000), envelope curves (County of Hawai‘i, 1970; County of Maui, 1995; City and County of Honolulu, 2000), station and regional frequency curves (State of Hawai‘i, 1970a; State of Hawai‘i, 1971; Cheng and Lau, 1975), regional regression equations (Wu, 1967, 1969; Nakahara, 1980; Wong, 1994), unit hydrographs, and physically based models (Fok and others, 1977; Shade, 1984). A description of these methods, including unit hydrographs and the rational formula, can be found in most textbooks on surface-water hydrology (see, for example, Viessman and others, 1977; Dunne and Leopold, 1978). Some of the published methods for estimating peak discharges at ungaged sites in Hawai‘i are described below.

County Storm-Drainage Standards

Each county (Kaua‘i, O‘ahu, Maui, and Hawai‘i) in the State of Hawai‘i has developed separate storm-drainage standards. As part of these standards, estimates of selected peak discharges are required. Methods used to estimate peak discharges in the County storm-drainage standards are briefly described below.

Kaua‘i

Storm-drainage standards for the County of Kaua‘i (2001) specify use of USGS stream gaging-station data to determine peak discharges. If stream gaging-station data are unavailable, the standards specify use of the rational formula for drainage areas up to 100 acres and Natural Resources Conservation Service (NRCS) hydrograph-analysis methods for drainage areas greater than 100 acres.

O‘ahu

Storm-drainage design criteria for O‘ahu first were developed in 1957 (City and County of Honolulu, 1957). For drainage areas up to one square mile, the rational formula was recommended. For drainage areas greater than one square mile, use of the rational formula in conjunction with runoff values from frequency curves was recommended. Frequency curves for 12 gaging stations on O‘ahu were developed using the Gumbel extreme-value distribution. Dodo and Ling (1958) described similar storm-drainage design criteria as the 1957 criteria (City and County of Honolulu, 1957) and incorporated intensity-duration-frequency curves as a function of maximum 24-hour rainfall. Storm-drainage standards for the City and County of Honolulu were formulated in 1959 on the basis of these studies (Wu, 1967).

Chow (1966) reviewed existing storm-drainage standards for the City and County of Honolulu and recommended use of the rational formula for drainage areas up to 100 acres and envelope curves for drainage areas greater than 100 acres. For drainage areas up to 100 acres, Chow (1966) recommended incorporation of rainfall frequency maps (U.S. Weather Bureau, 1962) that became available after the storm-drainage standards were formulated in 1959. For drainage areas greater than 100 acres, Chow (1966) developed separate envelope curves for windward O‘ahu and for the rest of the island. The envelope curves relate peak discharge to drainage area. The 1969 storm-drainage standards (City and County of Honolulu, 1969) incorporated the envelope curves from Chow (1966). Wu (1967) estimated the recurrence intervals for the estimated peak discharges from the envelope curves to be between 50 and 100 years. The storm-drainage standards for the City and County of Honolulu were modified later (City and County of Honolulu, 1986) to incorporate updated rainfall-frequency maps (Giambelluca and others, 1984) and flood-frequency estimates (Nakahara, 1980). For drainage areas greater than 100 acres, updated curves relating 100-year peak discharge to drainage area were developed, and the two regions from the 1969 storm-drainage standards also were slightly modified (City and County of Honolulu, 1986). These curves were subsequently modified again to allow estimation of the 100-year peak discharge from drainage areas in each of three geographic regions of O‘ahu (City and County of Honolulu, 1988, 2000).

Maui

Storm-drainage standards for the County of Maui (1995) specify use of the rational formula for drainage areas up to 100 acres and NRCS hydrograph-analysis methods for drainage areas greater than 100 acres.

Hawai‘i

Storm-drainage standards for the County of Hawai‘i (1970) were developed using the City and County of Honolulu (1969) standards as a guide. The County of Hawai‘i standards specify use of the rational formula for drainage areas up to 100 acres. For drainage areas greater than 100 acres, separate design curves relating peak discharge (approximate 100-year recurrence interval) to drainage area are provided for each of four regions.

Frequency Curves

Frequency curves can be developed to estimate peak discharges at a gaged site as well as at ungaged sites using regional curves. Frequency curves commonly are fit to data on the basis of a particular distribution (for example the log-Pearson Type III distribution), although they also may be visually fit to data.

Carson (1939) developed flood-frequency curves, apparently based on a visual fit to the data, for 17 streams on the islands of Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i using available data from 1910–35. Flood-frequency curves for

streams on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i were later updated using the log-Pearson Type III distribution (State of Hawai‘i, 1970a).

Using annual peak-discharge data from 51 gaging stations on O‘ahu during the 1958–69 base period, Cheng and Lau (1975) developed regional frequency curves for each of 5 hydrologic regions. For each region, a normalized regional frequency curve was developed by using the median normalized peak discharge, at each selected recurrence interval, from all gaging stations in the region. Peak discharges were normalized using an index flood, the mean annual flood (recurrence interval of 2.33 years) (see, for example, Dalrymple, 1960).

Regional Regression Equations

Regional regression equations relate annual peak discharges (the dependent variable) of specified recurrence interval to measureable basin characteristics (the independent or explanatory variables) at a site. Regional regression equations can be used to estimate peak discharges at an ungaged site using the basin characteristics associated with that site. The most common basin characteristic used in published regional regression studies in Hawai‘i is drainage-basin area.

Kaua‘i

For the Island of Kaua‘i, a regional regression equation relating peak discharge (for a recurrence interval of 2 years) to drainage area, channel length, mean annual precipitation, and a mapped peak runoff coefficient was developed using data from 28 gaging stations, although only 20 of these stations had at least 10 years of record (State of Hawai‘i, 1973). A method was described to estimate peak discharges for other recurrence intervals using a map of standard deviations of the logarithms of annual peak discharges, an assumed skew coefficient of 0.0, and the log-Pearson Type III distribution.

As an alternative means to estimate preliminary peak discharges, envelope curves relating peak discharge (recurrence interval exceeding 100 years) to drainage area also were developed for each of five regions on Kaua‘i (State of Hawai‘i, 1973). For each region, curves of 10-, 50-, and 100-year peak discharges were drawn parallel to the envelope curve. Peak-discharge data from gaging stations on Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i were used to develop the curves.

O‘ahu

Wu (1967) developed regional regression equations for O‘ahu using data from 20 gaging stations with 12 or more years of record. Frequency curves were developed using the Gumbel extreme-value distribution. O‘ahu was divided into four regions, although data were insufficient to develop an equation for one of the four regions. Wu (1967) developed an equation to estimate the 100-year peak discharge for windward O‘ahu using drainage area, basin length, basin height, and the 100-year, 24-hour precipitation as explanatory variables. Because the equation for windward O‘ahu indicated an inverse relation between peak discharge and basin slope and was based on data from only six gaging stations, Wu (1967) indicated that the equation should not be used as an estimator of peak discharge in the region. Wu (1967) combined two regions (Honolulu and central O‘ahu) and developed an equation to estimate the 100-year peak discharge using data from 14 gaging stations and the same explanatory variables associated with the windward O‘ahu equation. The standard errors of the estimates from the regression equations were not reported.

Wu (1969) developed an equation to estimate peak discharge (unspecified recurrence interval) based on data from 29 gaging stations on O‘ahu. The equation related peak discharge to drainage area, surface runoff volume, and a coefficient determined using the hydrograph time parameters, time to peak and recession constant.

Nakahara (1980) developed regional regression equations for O‘ahu using data from 74 gaging stations with 10 to 60 years of record. Following guidelines documented in Bulletin 17A, (U.S. Water Resources Council, 1977), frequency curves were developed using the log-Pearson Type III distribution. O‘ahu was divided into three regions, and regression equations were developed for the 2-, 5-, 10-, 25-, 50-, and 100-year peak discharges using one explanatory variable (drainage area) or two explanatory variables (drainage area and 2-year, 24-hour rainfall; or drainage area and ratio of vegetated to total area) in the equations, depending on the region. Reported standard errors of the estimates from the regression equations ranged from 33 to 67 percent.

The most recent published regional flood-frequency study for the Island of O‘ahu (Wong, 1994) used available data through 1988 (79 gaging stations with 11 to 72 years of record) and followed guidelines documented in Bulletin 17B (Interagency Advisory Committee on Water Data, 1982). O‘ahu was divided into three regions, and regression equations were developed for the 2-, 5-, 10-, 25-, 50-, and 100-year peak discharges using either one explanatory variable (drainage area) or two explanatory variables (drainage area and median annual rainfall; or drainage area and 2-year, 24-hour rainfall) in the equations, depending on the region. Reported standard errors of the estimates from the regression equations ranged from 27 to 58 percent. Wong (1994) used GIS methods to define basin characteristics and generalized-least-squares (GLS) regression techniques (Stedinger and Tasker, 1985; Tasker and Stedinger, 1989).

Maui

For the Island of Maui, regional relations between peak discharge, for selected recurrence intervals, and drainage area were developed for each of five regions using data from 37 gaging stations, although only 19 of these gaging stations had at least 10 years of record (State of Hawai‘i, 1971). For each region, relations between peak discharge and drainage area were developed for the mean-annual and 100-year peak discharges. Regression methods were used to develop the

relations in region 4, where data were considered sufficient (State of Hawai‘i, 1971). Regional relations for the remaining four regions were developed either graphically (region 2), or on the basis of available regional data and information from regions 2 and 4 (regions 1, 3, and 5). Selected additional regional relations (10-, 20-, or 50-year peak discharges) also were developed for four of the regions (regions 1, 2, 3, and 4), although the method used to develop these relations between peak discharges and drainage area was not fully described. The regional relations for Maui, which are presented in the form of curves, were intended for use in preliminary planning studies.

Hawai‘i

For the Island of Hawai‘i, regional relations between peak discharge, for selected recurrence intervals, and drainage area were developed for each of eight regions using data from 30 gaging stations, although only 9 of these gaging stations had at least 10 years of record (State of Hawai‘i, 1970b). For each region, relations between the mean-annual, as well as the 10-, 50-, and 100-year peak discharges, and drainage area were developed. For regions with at least three gaging stations, “best-fit lines were drawn through the scatter of points” for the mean-annual and 10-, 50-, and 100-year peak discharges (State of Hawai‘i, 1970b). For regions with fewer than three gaging stations, it was necessary to rely on data from similar regions to develop the regional relations, which are presented in the form of curves.

Statewide

Yamanaga (1972) developed regression equations for two regions: (1) the windward sides of the islands of Kaua‘i, O‘ahu, Moloka‘i, Maui, and Hawai‘i, and (2) the leeward sides of these islands. Data from 75 gaging stations with at least 10 years of record through water year 1971 were included in the analysis. Frequency curves were developed using the log-Pearson Type III distribution. Regional regression equations for the 2-, 5-, 10-, 25-, and 50-year peak discharges included from one to four explanatory variables. Explanatory variables used in the regression equations included drainage area, main channel length, mean basin elevation, range in elevation, mean annual precipitation, and percentage of area with less than 30-percent slope (Yamanaga, 1972). Reported standard errors of the estimates from the regression equations ranged from 42 to 63 percent.

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