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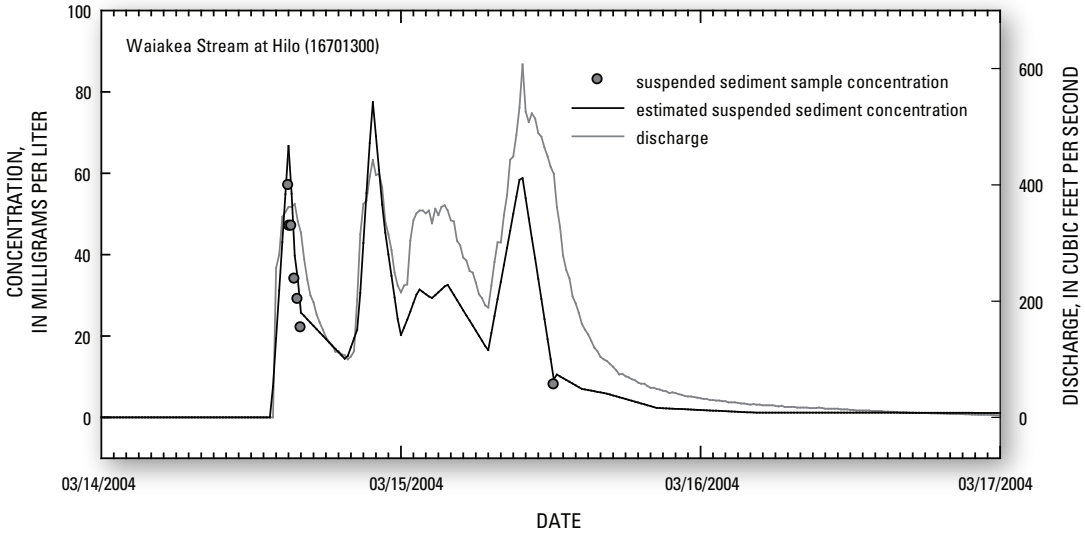
Suspended-Sediment and Nutrient Loads for Waiakea and Alenaio Streams, Hilo, Hawaii, 2003-2006



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By Todd K. Presley, Marcael T.J. Jamison, and Dale C. Nishimoto

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Conversion Factors

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Flow rate	
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)
	Volume	
cubic foot (ft^3)	28.3178	liter (L)
	Load	
pounds per day (lbs/day)	0.1825	tons per year (tons/yr)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

°F=(1.8×°C)+32

Vertical coordinate information is referenced relative to mean sea level.

Horizontal coordinate information is referenced to NAD 83 unless otherwise stated.

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (μg/L).

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (μS/cm at 25 °C).

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By Todd K. Presley, Marcael T.J. Jamison, and Dale C. Nishimoto

Abstract

Suspended sediment and nutrient samples were collected during wet-weather conditions at three sites on two ephemeral streams in the vicinity of Hilo, Hawaii during March 2004 to March 2006. Two sites were sampled on Waiakea Stream at 80- and 860-foot altitudes during March 2004 to August 2005. One site was sampled on Alenaio Stream at 10-foot altitude during November 2005 to March 2006. The sites were selected to represent different land uses and land covers in the area. Most of the drainage area above the upper Waiakea Stream site is conservation land. The drainage areas above the lower site on Waiakea Stream, and the site on Alenaio Stream, are a combination of conservation land, agriculture, rural, and urban land uses.

In addition to the sampling, continuous-record streamflow sites were established at the three sampling sites, as well as an additional site on Alenaio Stream at altitude of 75 feet and 0.47 miles upstream from the sampling site. Stage was measured continuously at 15-minute intervals at these sites. Discharge, for any particular instant, or for selected periods of time, were computed based on a stage-discharge relation determined from individual discharge measurements. Continuous records of discharge were computed at the two sites on Waiakea Stream and the upper site on Aleniao Stream. Due to non-ideal hydraulic conditions within the channel of Alenaio Stream, a continuous record of discharge was not computed at the lower site on Alenaio Stream where samples were taken.

Samples were analyzed for suspended sediment, and the nutrients total nitrogen, dissolved nitrite plus nitrate, and total phosphorus. Concentration data were converted to instantaneous load values: loads are the product of discharge and concentration, and are presented as tons per day for suspended sediment or pounds per day for nutrients. Daily-mean loads were computed by estimating concentrations relative to discharge using graphical constituent loading analysis techniques. Daily-mean loads were computed at the two Waiakea Stream sampling sites for the analyzed constituents, during the period October 1, 2003 to September 30, 2005. No record of daily-mean load was computed for the Alenaio Stream sampling site due to the problems with computing a discharge record.

The maximum daily-mean loads for the upper site on Waiakea Stream for suspended sediment was 79 tons per day, and the maximum daily-mean loads for total nitrogen, dissolved nitrite plus nitrate, and total phosphorus were 1,350, 13, and 300 pounds per day, respectively. The maximum daily-mean loads for the lower site on Waiakea Stream for suspended sediment was 468 tons per day, and the maximum daily-mean loads for total nitrogen, nitrite plus nitrate, and total phosphorus were 913, 8.5, and 176 pounds per day, respectively. From the estimated continuous daily-mean load record, all of the maximum daily-mean loads occurred during October 2003 and September 2004, except for suspended sediment load for the lower site, which occurred on September 15, 2005. Maximum values were not all caused by a single storm event. Overall, the record of daily-mean loads showed lower loads during storm events for suspended sediments and nutrients at the downstream site of Waiakea Stream during 2004 than at the upstream site. During 2005, however, the suspended sediment loads were higher at the downstream site than the upstream site. Construction of a flood control channel between the two sites in 2005 may have contributed to the change in relative suspended-sediment loads.

Introduction

The Hawaii Department of Health (HDOH) has the responsibility under the federal Clean Water Act to establish total maximum daily loads (TMDLs) for waterbodies on the Hawaii 303(d) list of impaired waterbodies (HDOH, 2004). Five streams that discharge into Hilo Bay on the island of Hawaii have been identified as impaired owing to high levels of sediment and nutrients: Wailoa, Waiakea, Alenaio, Wailuku, and Honolii streams (fig. 1). In order to assist with the preparation of a TMDL analysis for these streams, the HDOH and the U.S. Geological Survey (USGS) entered into a cooperative agreement to collect streamflow and water-quality data to determine suspended-sediment and nutrient loads at selected locations along two streams that discharge into Hilo Bay: Waiakea and Alenaio Streams (figs. 1 and 2).

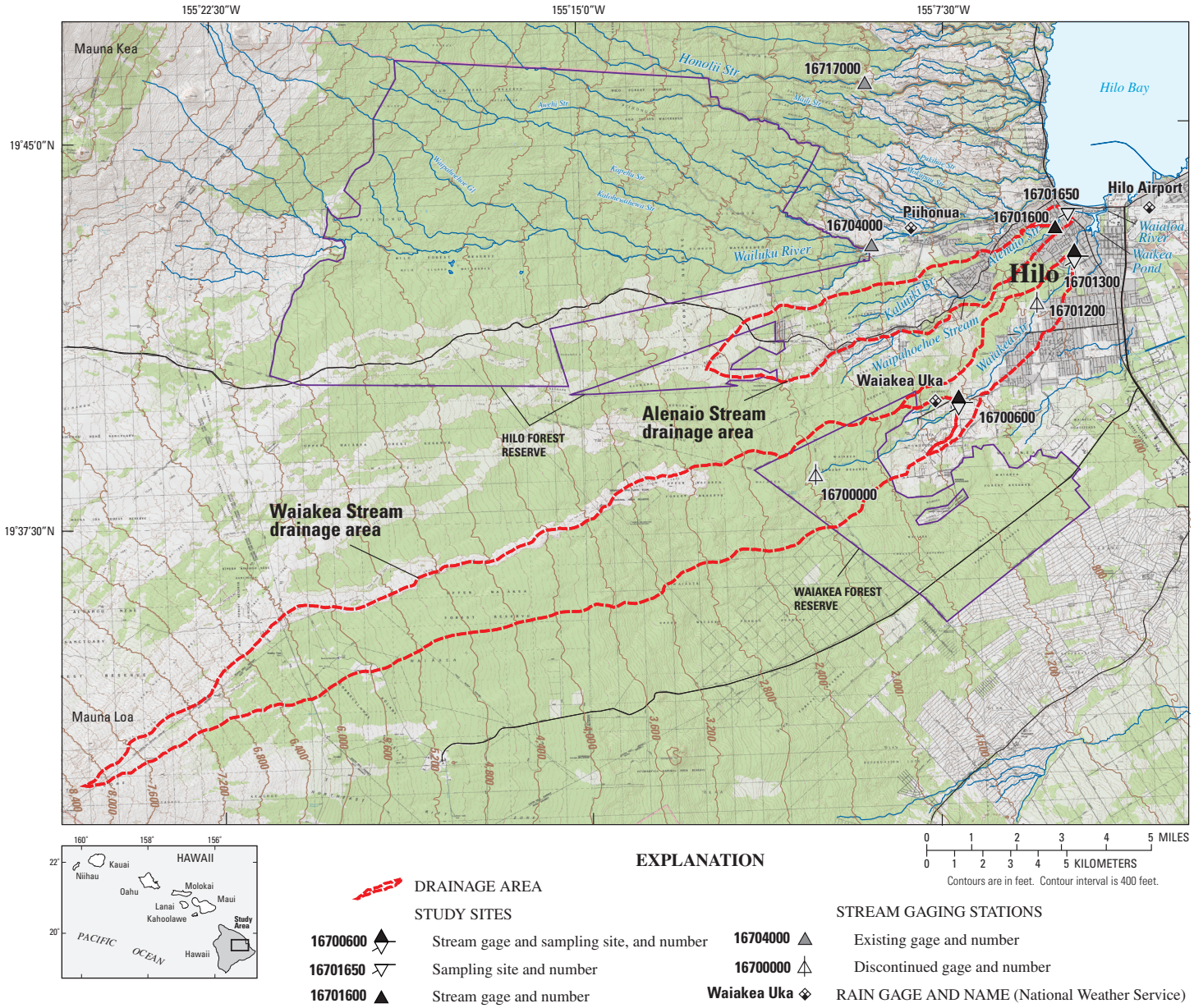

Figure 1. Map showing rain gages, stream-gaging sites, and stream-sampling sites used in this study, and the Waiakea and Alenaio drainage basins, Hilo area, Hawaii.

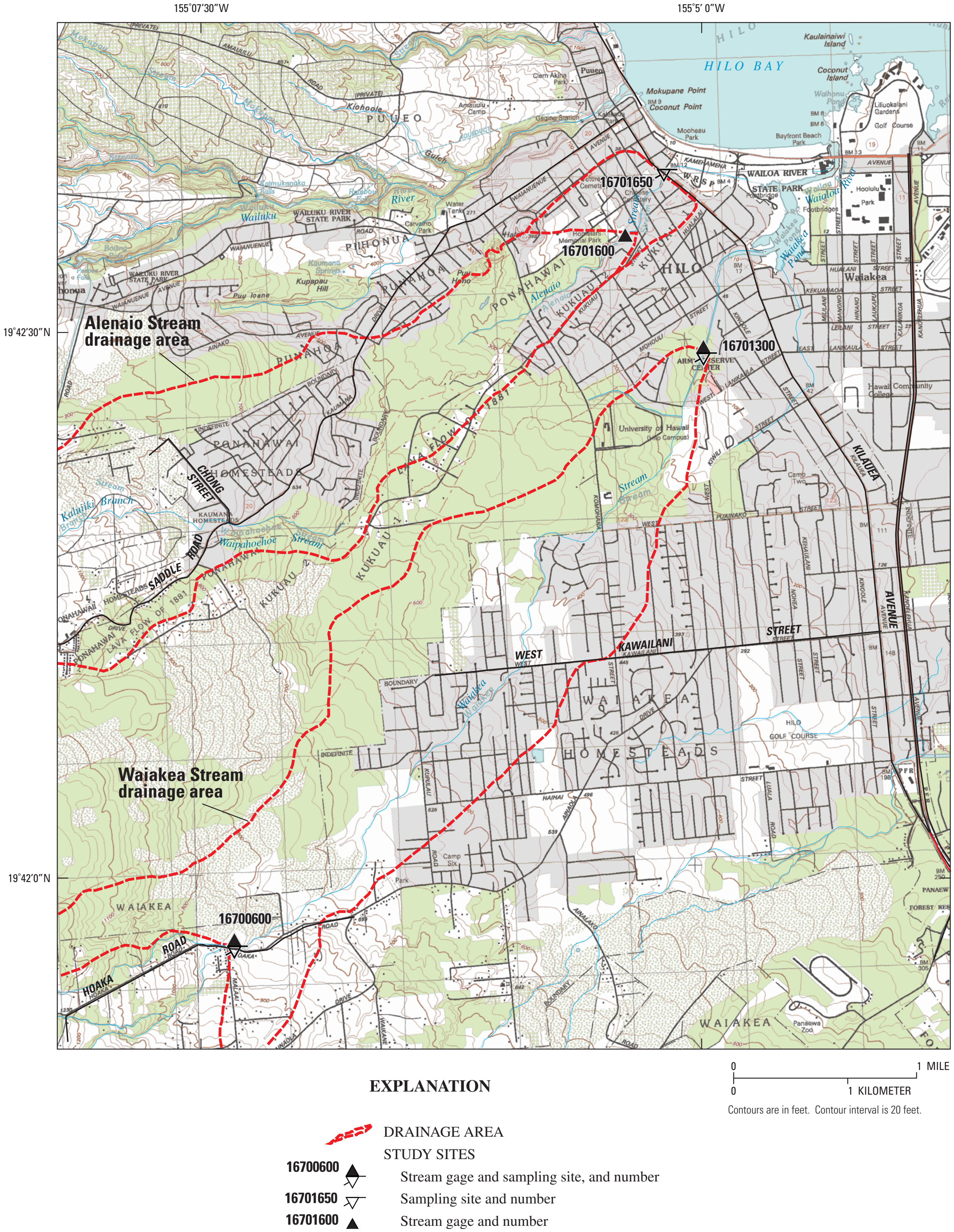

Figure 2. Map showing stream-gaging sites and water-quality sites used for this study, Hilo, Hawaii.

Stream load is a measure of the amount of constituent delivered by the stream, in pounds (lbs) or tons, divided over a period of time, in days. In order to calculate loads, the concentration of the constituent, in milligrams per liter (mg/L) or other concentration unit, is multiplied by discharge in cubic feet per second (cfs), and a conversion factor. Concentration data can be estimated to create a continuous record, and is based on the concentration of samples and a continuous record of discharge. Daily-mean loads are the mean of the unit-value loads for a given day, derived from the concentrations of samples and unit-value estimates of concentration multiplied by the corresponding unit-value discharge data.

This report presents streamflow, suspended sediment, and nutrient data collected on these two streams. Two sites were sampled on Waiakea Stream during March 2004 to August 2005 and one site on Alenaio Stream during November 2005 to March 2006. The site locations on each stream were selected in an effort to relate suspended-sediment and nutrient loads to different geographical areas, based on land use / land cover characteristics within the drainage areas. Percentages of land cover and soil type in the drainage areas of the sampling sites are presented. Continuous-record discharge data for the two Waiakea Stream sites are presented; however, due to difficulties developing a stage / discharge relation for the Alenaio Stream sampling site, no continuous-record discharge data for this site is presented. A second Alenaio Stream site, 0.47 miles (mi) upstream, was established to measure discharge only in lieu of the record at the lower site. Discharge data at this upstream site were collected concurrently with the sampling at the lower site.

Instantaneous loads were calculated for constituents analyzed in samples from all three sites, and daily-mean loads were calculated for the two sites on Waiakea Stream. Daily-mean loads could not be determined for the Alenaio Stream sampling site due to the difficulties of computing a record of discharge at that site.

The assistance and support of the State of Hawaii Department of Health is gratefully acknowledged. Special thanks to Dave Penn and Glen Fukunaga, for thorough review comments and supplementing the report with land cover and soil cover maps and data. David Bishaw, an intern with HDOH, assisted with site construction and sampling. The project was funded through a grant from the U.S. Environmental Protection Agency to the State of Hawaii Department of Health.

Description of Study Area

The study area includes the watersheds of Waiakea and Alenaio Streams on the island of Hawaii. These two watersheds drain a combined area of about 44.6 square miles (mi^2) on the windward (northeast) slope of the Mauna Loa Volcano (fig. 1). Both streams drain into the Wailoa River, which empties into Hilo Bay, the major harbor for the island. Drainage areas are from drainage area maps housed at the USGS Pacific Islands Water Science Center, and are based on field observations and the study of topography adjacent to the stream channel.

Terrain within the study area is mostly uniform slopes with poorly dissected stream channels. Altitudes within the study area range from sea level to about 8,680 feet (ft) above sea level for the Waiakea Stream drainage area, and about 2,530 ft above sea level for the Aleniao Stream drainage area.

Climate

The climate of the study area is warm and humid. At higher altitudes, especially at the summits of the high volcanoes, temperatures vary seasonally to a greater extent than at lower altitudes (Giambelluca and Schroeder, 1998). Rainfall is highly variable across space and time, and is greatly affected by the prevailing northeast trade winds, orographic effects of Mauna Loa and Mauna Kea, and inversion layer dynamics. Mean-annual rainfall ranges from 118 inches per year (in/yr) along the coast to over 236 in./yr at altitudes near 2,500 ft west-northwest of Hilo on the slopes of Mauna Kea (Giambelluca and others, 1986). Above 2,500 ft, mean annual rainfall decreases to about 39 in. at 8,600-ft altitude, and about 20 in. per year at the summits of Mauna Kea and Mauna Loa, which have altitudes over 13,000 ft. Rainfall occurs year-round, but major storms are more common between November and April than during the rest of the year (Giambelluca and others, 1986).

Geology and Soils

The exposed rocks in the study area include lava flows from Mauna Loa Volcano and ash deposits of unknown origin. Basaltic aa and pahoehoe lava flows of the Kau Basalt, and Pahala Ash are exposed in the study area. Underlying the Kau Basalt and Pahala Ash are basaltic flows of the Kahuku Basalt (Wolfe and Morris, 1996; Stearns and Macdonald, 1946).

Soils within the study area are generally thin or non existent due to the young age of Mauna Loa Volcano. Within the upper areas of the study area, the lava flows have little or no soil. Lava flows, stony land, and rock land account for 22.01 percent of the total surface throughout the study area. Soils, where present, are predominantly Histosols (organic soils with a high organic matter content in the surface horizon) with some Andisols (derived from volcanic ash, with high water-holding capacity and the ability to fix large quantities of phosphorus). Surface permeability values for these soils range from slow to rapid (2.0 to 20 inches per hour), runoff ranges from very slow to medium, and erosion hazard ranges from slight to moderate (Sato and others, 1973).

Land Use

Land use in the study area, in general sense, can be divided into four categories: conservation (forest reserves), agriculture, rural, and urban. Conservation areas above an altitude of roughly 1,500 ft in the Waiakea and Alenaio drainage areas include parts of the Hilo and Waiakea Forest Reserves. These reserves include both native and introduced forest trees, and include small areas used for planting and harvesting within the past 10 years. Most of the Waiakea Stream drainage area (fig. 1) below an altitude of 1,500 ft was used for cultivation of sugar cane from approximately 1880 to 1995. Since 1995, some of the former sugar fields have been used for pasture, diversified agriculture and low/medium density residences. Other agricultural areas have been left fallow and are overgrown with exotic grasses and shrubs. Light urban development is confined below an altitude of 800 ft, although in recent years, development has expanded into higher areas. Higher density residential and urban development predominates below 300 ft in the vicinity of Hilo.

Data Collection Sites

Four data collection sites were located and established within the study area based on: 1) upstream land use and land cover, and 2) suitability, in a hydraulic sense, for measuring discharge. Two sampling and discharge measurement sites were located on Waiakea Stream, and one site was located on Alenaio Stream (figs. 1and 2, table 1). The site Waiakea Stream at Hoaka Road (station number 16700600, fig. 3) was located near the forest reserve boundary (fig. 1). The site Waiakea Stream at Hilo (station number 16701300, fig. 4) was about 4.65 mi downstream of Waiakea Stream at Hoaka Road, about 1.60 mi upstream from the mouth of Wailoa River, and was near the campus of the University of Hawaii at Hilo (fig. 2).

The site Alenaio Stream at Kilauea Avenue Bridge (station number 16701650, fig. 5) was located in downtown Hilo (fig. 2). A fourth site, Alenaio Stream at Hilo (station number 16701600, fig. 6) was located about 0.47 mi upstream of Alenaio Stream at Kilauea Avenue Bridge, and was established to measure discharge only.

Stream Channels for Waiakea and Alenaio Streams

Both Waiakea and Alenaio Streams eventually flow into Wailoa River. Waiakea Stream flows first into an estuarine area and a water body called Waiakea Pond, which is directly connected to Wailoa River. Alenaio Stream flows into the Waialama Canal prior to flowing into Wailoa River. The flat area containing Waialama Canal, Waiakea Pond, Wailoa River, and a large park, serves as a flood control area and a buffer zone for tsunami waves (fig. 2).

Both Waiakea and Alenaio Streams have had substantial modification in the lower reaches within the Hilo area, and have channels that loose flow in the reaches above the Hilo area. Streams in the vicinity of Hilo have been modified primarily for flood control, and have fortified walls, straightened channels, or concrete linings. At higher altitudes, some of the streams may disappear and reappear due to interaction with lava tubes and other volcanic features found in the lavas of Mauna Loa, and some reaches of the streams loose substantial flow if their course is over permeable lavas. Distances and altitudes of features in the stream channels of Waiakea and Alenaio Streams are described in table 2.

Waiakea Stream.—Above Waiakea Pond, Waiakea Stream is a concrete-lined channel for about 0.22 mi upstream from the pond. Above the channelized reach of stream, the channel bottom is natural, with the walls of the channel either natural, or rock and concrete lined, to about 3.88 mi upstream of the Wailoa River mouth. The sampling and stream gage site Waiakea Stream at Hilo is within this section of stream

Table 1. Sampling sites, drainage area, types of data collected, and general land use above sites on Waiakea and Alenaio Streams, Hilo, Hawaii.

[mi^2, square miles]

Station number	Station name	Drainage area (mi2)	Data collected	General upstream land use
16700600	Waiakea Stream at Hoaka Road	31.82	Discharge, suspended sediment, nutrients	Conservation and agriculture
16701300	Waiakea Stream at Hilo	35.87	Discharge, suspended sediment, nutrients	Conservation, agriculture, rural, and urban
16701600	Alenaio Stream at Hilo	8.50	Discharge	Conservation, agriculture, and rural
16701650	Alenaio Stream at Kilauea Avenue Bridge	8.77	Suspended sediment, nutrients	Conservation, agriculture, rural, and urban

Figure 3. Photographs of sampling site and gage at Waiakea Stream at Hoaka Road (16700600), (*A*) looking downstream and (*B*) looking upstream, October 27, 2003, Hilo, Hawaii.

Figure 4. Photographs of sampling site and gage Waiakea Stream at Hilo (16701300), (*A*) looking upstream, and (*B*) looking downstream, on March 9, 2006, Hilo, Hawaii.

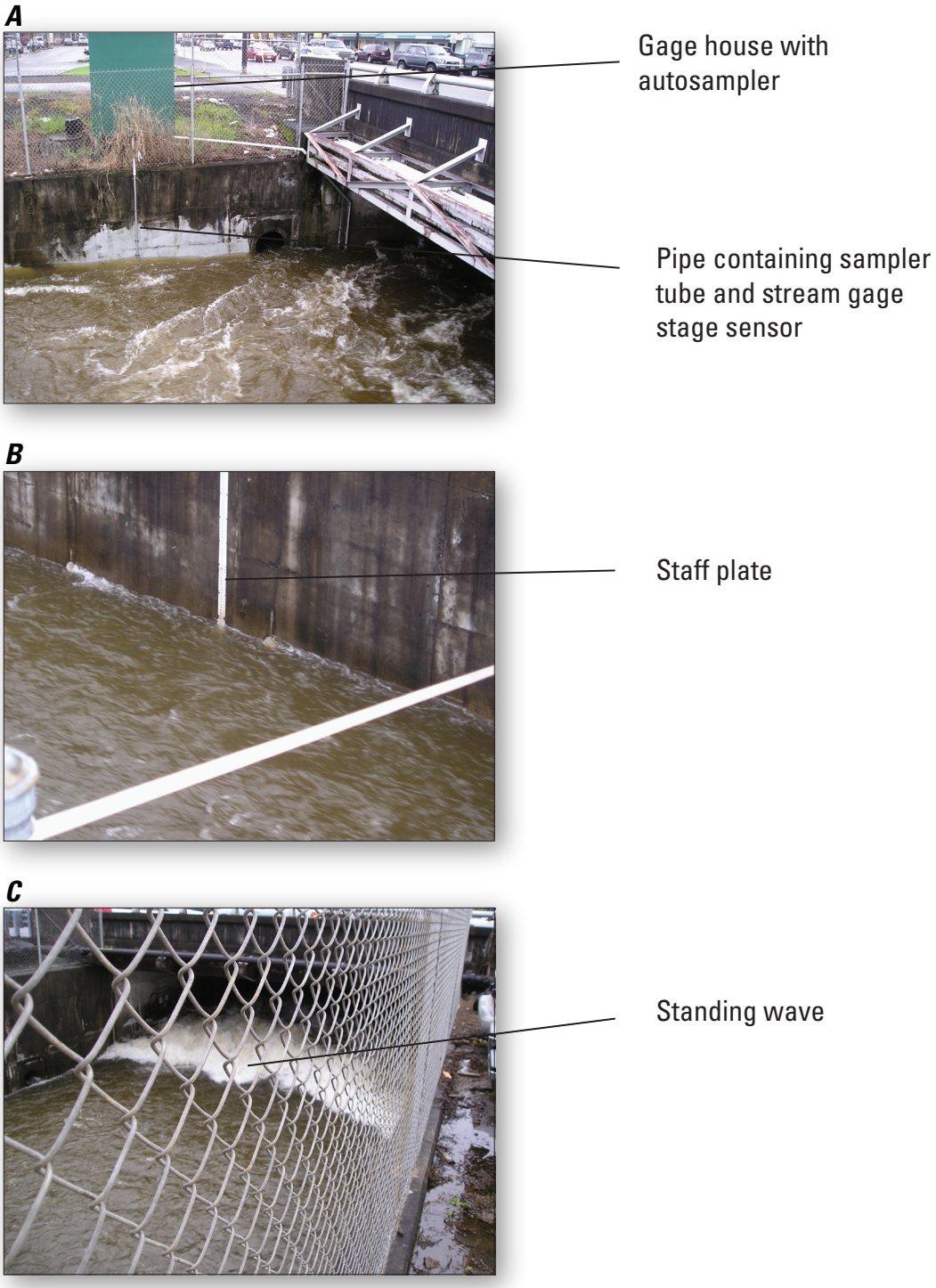

Figure 5. Photographs of sampling site and gage Alenaio Stream at Kilauea Avenue Bridge (16701650), (*A*) gage house and sampling line, (*B*) staff plate and (*C*) standing wave downstream of gage, on March 9, 2006, Hilo, Hawaii.

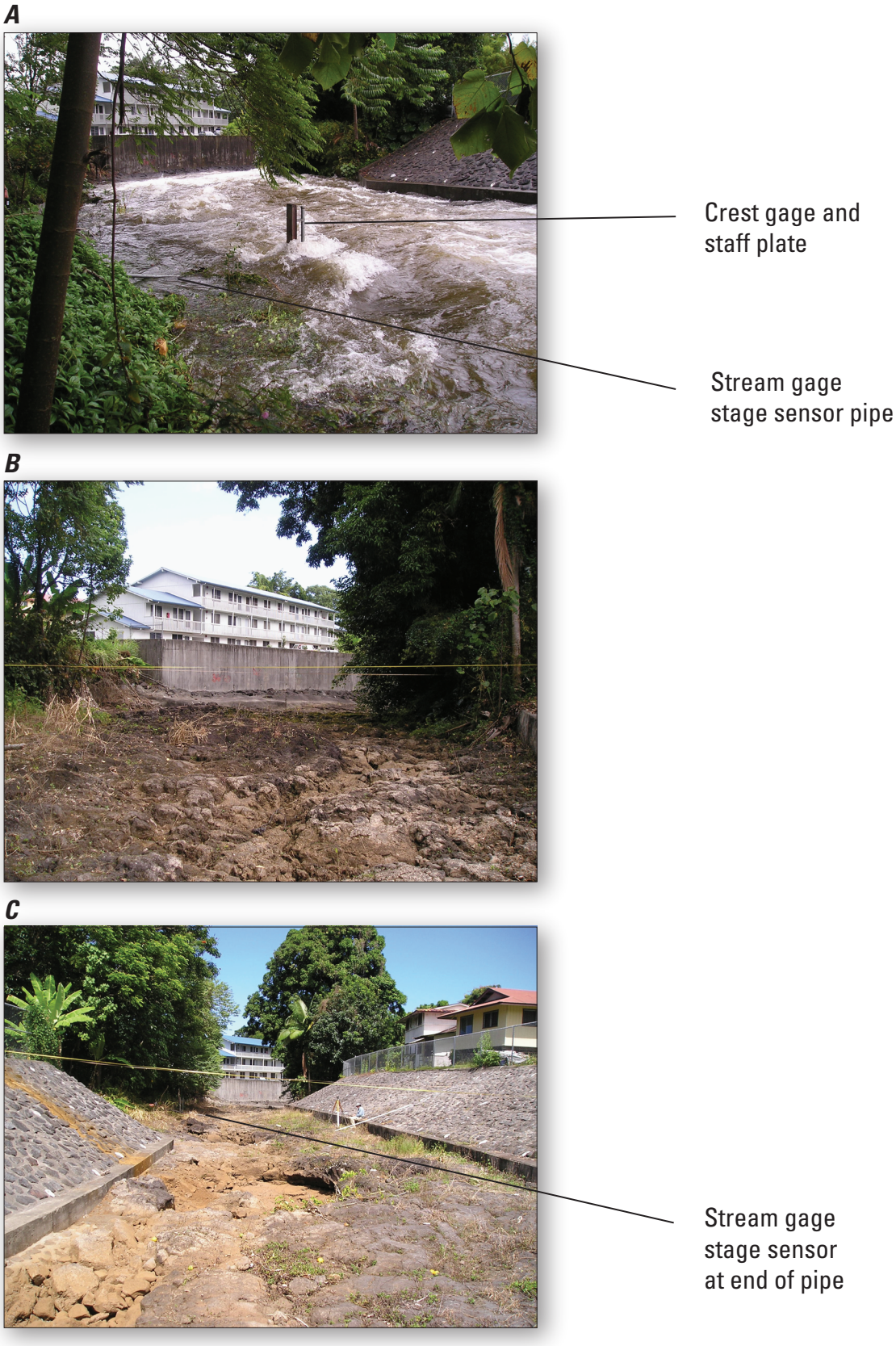

Figure 6. Photographs of sampling site and gage at Alenaio Stream at Hilo (16701600), (*A*) looking downstream during flow on March 9, 2006, (*B*) looking downstream from gage during dry conditions on October 13, 2006, and (*C*) looking downstream from upstream location, Hilo, Hawaii.

Table 2. Descriptions of stream channels for Waiakea and Alenaio Streams, based on distance and altitude, Hilo, Hawaii.
[Altitudes and Distances were estimated using a topographical map]

Distance from Mouth of Wailoa River (miles)	Altitude (feet)	Description of Channel or Feature
	Waiakea Stream	
0.00 to 1.10	approx. sea level	Wailoa River and Waiakea Pond
1.10 to 1.32	sea level to 40	concrete-lined streambed, walls, and levees
at 1.24	45	bridge at Kinoole Street
1.32 to 1.95	40 to 145	straightened channel, natural streambed, rock walls on banks
at 1.60	80	USGS Stream Gage: Waiakea Stream at Hilo (16701300)
at 1.90	130	bridge at West Lanikaula Street
1.95 to 3.88	145 to 445	natural streambed, with some rock walls on banks
3.88 to 4.06	445 to 461	construction site during 2004-2005, natural streambed with rock walls on banks
at 3.97	453	bridge at West Kawailani Street
4.06 to upper reaches	461 to upper reaches	natural stream channel with lava tubes
at 6.25	860	USGS Stream Gage: Waiakea Stream at Hoaka Road (16700600)
at 6.30	865	bridge at Hoaka Road
	Alenaio Stream	
0.00 to 0.59	approx. sea level	Wailoa River
0.59 to 0.84	< 10	grassy swale drainage within soccer field
0.84 to 1.07	<10	grassy areas, and concrete-lined streambed, walls, and levees
1.07 to 1.51	10 to 70	concrete-lined streambed, walls, and levees
at 1.10	~10	USGS Stream Gage: Alenaio Stream at Kilauea Avenue Bridge (16701650)
1.51 to 2.27	70 to 240	natural channel, with some sloping rock walls on banks
at 1.57	75	USGS Stream Gage: Alenaio Stream at Hilo (16701600)
at 2.27	240	concrete box culvert at Komohana Street
2.27 to 2.70	240 to 325	natural channel
at 2.70	325	channel disappears

(fig. 4), and is about 0.50 mi upstream from Waiakea Pond. Between 3.88 and 4.06 mi upstream of the mouth, at an altitude of about 445 to 461 ft, a flood-control channel (fig. 7) was constructed near the Kawailani Street Bridge beginning September 27, 2004, and ending June 1, 2005 (David Penn, HDOH, oral commun., 2006). This length of modified channel was a potential source of sediment load during the study.

Above the new flood control channel, the stream channel is natural with visible lava tubes. Waiakea Stream looses water along this reach between the new flood control channel and the Waiakea Stream at Hoaka Road sampling site.

Alenaio Stream.— Alenaio Stream flows into the upper part of the Waialama Canal, which is a grass-lined ditch. Above the grassy area for about 0.75 mi, the stream is a concrete channel (fig. 5). Above the concrete lined channel, the stream channel bottom is natural with some sloping rock walls and concrete (fig. 6). The channel is natural beyond a concrete box covert at about 2.27 mi upstream from the mouth. Alenaio Stream disappears in an upstream direction at about 2.7 mi from the mouth, at an altitude of about 325 ft. Above this altitude, a channel is not distinguishable.

The drainage area for Alenaio Stream includes the drainages of Waipahoehoe Stream and Kaluiiki Branch (fig. 1 and 2). At lower flow rates, Waipahoehoe Stream looses all of its water due to percolation into lava flows, tubes and other volcanic features starting at about 700 ft near Chong Street. Below Chong Street, the stream channel becomes undefined into a broader flood plain (U.S. Department of Agriculture,

Soil Conservation Service, 1976), which eventually connects with the upper reaches of Alenaio Stream. Part of the stream flow from Waipahoehoe Stream likely reemerges into Alenaio Stream. At higher flows, a part of the total streamflow flows overland from Waipahoehoe Stream into Alenaio Stream. Due to the subsurface flow, however, water falling in this drainage may not discharge into Alenaio Stream; there is some evidence that water may flow into adjacent drainages through lava tubes and other volcanic features (Richard Fontaine, USGS Surface Water Specialist, oral commun., 2007).

It is important to note that while the Alenaio Stream at Kilauea Avenue Bridge site collects water at a location right at the point prior to the stream reaching the Wailama Canal and Wailoa River, the lower site on Waiakea Stream is about 0.50 mi upstream from Waiakea Pond. On the basis of the sampled water being representative of the water that reaches the estuarine environment of the Wailama Canal, Waiakea Pond, and Wailoa River area, the site Waiakea Stream at Hilo may miss a small portion of runoff from the urban area between Waiakea Pond and the site. In addition, since there is substantial water loss within the natural channels, large volumes of water must reach the estuarine area via subsurface flow.

Soil Types Within the Drainage Areas of the Sites

The areas, percentages, and hydrologic characteristics of soil types, as delineated in the Soil Survey of Hawaii County, Hawaii (Soil Survey Staff, 2006), were determined for the drainage areas of each site of this study. Within the drainage areas, 24 soil types out of the 150 soil types mapped on the island of Hawaii are found. Table 3 lists the soils found within the drainage areas of the sites in this study, the area of each soil type and percentage within the drainage areas. The soils were grouped on the map (fig. 8) and in the table by their Soil Hydrologic Group (SHG) and Soil Erodibility Factor (K).

Figure 7. Photograph of Waiakea Stream flood control work near West Kawailani Street, January 11, 2005, Hilo, Hawaii.

Soils in each Soil Hydrologic Group have similar runoff potential under similar storm and cover conditions. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms. Although SHG A, B, C, and D are found within the drainage area for the site Waiakea Stream at Hilo, only SHG C and D (slow to very slow infiltration rates) are mapped within the drainage area for the site Alenaio Stream at Kilauea Avenue Bridge. SHG C and D (higher runoff potential) also make up 64 percent of the draingage area for Waiakea Stream at Hilo, while SHG A and B (high to moderate infiltration rates with lower runoff potential) make up the remaining 36 percent.

The Soil Erodibility Factor (K) indicates the susceptibility of a soil to sheet and rill erosion by water. It is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. Soil Erodibility Factors are further defined as Kf (rock free) and Kw (whole soil). Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters. Kw indicates the erodibility of the whole soil such that the estimates are modified by the presence of rock fragments. For Hilo soils, Kf and Kw are the same for each soil map unit, except for the Puukala extremely stony silt loam, Puukala very rocky silt loam, and the Rock land soil types. Kw was used for these soil types due to their rocky or stony characteristics.

Other factors being equal, the higher the K value, the more susceptible the soil is to sheet and rill erosion by water. Global values for K range from 0.02 to 0.69, while those for the 24 soil types within the drainage areas of this study range from 0.02 to 0.05 in all of the Alenaio drainage area and in 90.4 percent of the drainage area for Waiakea Stream at Hilo. Higher K value soils (0.10 to 0.20) are mapped in 9.6 percent of the drainage area for Waiakea Stream at Hilo; occurring at the upper elevations. Most of the area of soils of higher K value are associated with the high runoff potential SHG D.

Land Cover Within the Drainage Areas of the Sites

The National Oceanographic and Atmospheric Administration (NOAA) Coastal Change Analysis Program (C-CAP) map of land covers (National Oceanographic and Atmospheric Administration, 2001), was used to define the land-cover percentages in the drainage areas. Of the 22 land cover classes mapped nationwide by the NOAA Coastal Change Analysis Program, twelve classes are found on the island of Hawaii,

Table 3. Areas and percentages of soil map units within drainage areas of sites used in study, Hilo Hawaii.

[Hydrologic Group, groups defined by the National Resource Conservation Service based on the soil's runoff potential; Soil Map Unit Abbreviation, as defined by the National Resource Conservation Service; K, soil erodibility factor is a measure of the soil's susceptiblity to water erosion]

Soil Map Unit*	Soil Map Unit Percent Slopes	Soil Map Unit Abbreviation Symbol	Soil Type Symbol	Soil Erodibility Factor K Symbol	Waiakea Stream at Hoaka Road (16700600)		Waiakea Stream at Hilo (16701300)		Alenaio Stream at Hilo (16701600)		Alenaio Stream at Kilauea Avenue Bridge (16701650)	
					acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area
Hydrologic Group A												
Lava flows, aa	--	rLV	--	0.02	2,407.1	11.8	2,407.1	10.5	0.0	0.0	0.0	0.0
Mawae extremely stony muck	6 to 20	rMWD	Histosol	0.02	650.2	3.2	650.2	2.8	0.0	0.0	0.0	0.0
Kiloa extremely stony muck	6 to 20	rKXD	Histosol	0.05	3,644.6	17.9	3,644.6	15.9	0.0	0.0	0.0	0.0
Papai extremely stony muck	3 to 25	rPAE	Histosol	0.05	0.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0
Total Area of Hydrologic Group A					6,701.9	33.0	6,711.9	29.3	0.0	0.0	0.0	0.0
Hydrologic Group B												
Ohia silty clay loam	0 to 10	OHC	Andisol	0.05	329.1	1.6	450.8	2.0	0.0	0.0	0.0	0.0
Olaa silty clay loam	0 to 10	OaC	Andisol	0.05	3.6	0.0	227.5	1.0	0.0	0.0	0.0	0.0
Olaa extremely stony silty clay loam	0 to 20	OlD	Andisol	0.05	129.7	0.6	863.9	3.8	0.0	0.0	0.0	0.0
Ohia extremely stony silty clay loam	0 to 20	OSD	Andisol	0.05	118.2	0.6	124.5	0.5	0.0	0.0	0.0	0.0
Total Area in Hydrologic Group B					580.6	2.9	1,666.7	7.3	0.0	0.0	0.0	0.0

Table 3. Areas and percentages of soil map units within drainage areas of sites used in study, Hilo Hawaii.—*Continued.*

[Hydrologic Group, groups defined by the National Resource Conservation Service based on the soil's runoff potential; Soil Map Unit Abbreviation, as defined by the National Resource Conservation Service; K, soil erodibility factor is a measure of the soil's susceptiblity to water erosion]

Soil Map Unit*	Soil Map Unit Percent Slopes	Soil Map Unit Abbreviation Symbol	Soil Type Symbol	Soil Erodibility Factor K Symbol	Waiakea Stream at Hoaka Road (16700600)		Waiakea Stream at Hilo (16701300)		Alenaio Stream at Hilo (16701600)		Alenaio Stream at Kilauea Avenue Bridge (16701650)	
					acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area
Hydrologic Group C												
Lava flows, pahoehoe	--	rLW	--	0.02	79.4	0.4	852.4	3.7	1,491.7	27.5	1,491.7	26.7
Akaka silty clay loam	10 to 20	AkD	Andisol	0.05	2,241.3	11.0	2,241.3	9.8	0.0	0.0	0.0	0.0
Hilo silty clay loam	0 to 10	HoC	Andisol	0.05	0.0	0.0	0.0	0.0	127.9	2.4	251.9	4.5
Hilo silty clay loam	10 to 20	HoD	Andisol	0.05	0.0	0.0	0.0	0.0	14.4	0.3	14.4	0.3
Kaiwiki silty clay loam	0 to 10	KaC	Andisol	0.05	0.0	0.0	0.0	0.0	397.0	7.3	397.0	7.1
Kaiwiki silty clay loam	10 to 20	KaD	Andisol	0.05	0.0	0.0	0.0	0.0	183.2	3.4	183.2	3.3
Kaiwiki silty clay loam	20 to 35	KaE	Andisol	0.05	0.0	0.0	0.0	0.0	0.3	0.0	0.3	0.0
Very stony land	--	rVS	--	0.20	86.1	0.4	86.1	0.4	0.0	0.0	0.0	0.0
Total Area in Hydrologic Group C					2,406.8	11.8	3,179.8	13.9	2,214.6	40.8	2,338.5	41.8

Table 3. Areas and percentages of soil map units within drainage areas of sites used in study, Hilo Hawaii.—*Continued.*

[Hydrologic Group, groups defined by the National Resource Conservation Service based on the soil's runoff potential; Soil Map Unit Abbreviation, as defined by the National Resource Conservation Service; K, soil erodibility factor is a measure of the soil's susceptiblity to water erosion]

Soil Map Unit*	Soil Map Unit Percent Slopes	Soil Map Unit Abbreviation Symbol	Soil Type Symbol	Soil Erodibility Factor K Symbol	Waiakea Stream at Hoaka Road (16700600)		Waiakea Stream at Hilo (16701300)		Alenaio Stream at Hilo (16701600)		Alenaio Stream at Kilauea Avenue Bridge (16701650)	
					acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area
Hydrologic Group D												
Panaewa very rocky silty clay loam	0 to 10	PeC	Andisol	0.05	33.3	0.2	187.6	0.8	0.0	0.0	0.0	0.0
Kahaluu extremely rocky muck	6 to 20	rKAD	Histosol	0.05	4,971.8	24.5	4,971.8	21.7	0.0	0.0	0.0	0.0
Keaukaha extremely rocky muck	6 to 20	rKFD	Histosol	0.05	5.7	0.0	401.3	1.8	1,271.2	23.4	1,318.5	23.6
Keei extremely rocky muck	6 to 20	rKGD	Histosol	0.05	3,645.8	17.9	3,809.0	16.6	1,938.6	35.7	1,938.6	34.6
Hilea silty clay loam	6 to 12	HlC	Andisol	0.05	99.2	0.5	99.2	0.4	0.0	0.0	0.0	0.0
Puukala extremely stony silt loam**	6 to 12	PSC	Andisol	0.10	190.9	0.9	190.9	0.8	0.0	0.0	0.0	0.0
Puukala very rocky silt loam**	6 to 12	PTC	Andisol	0.10	246.9	1.2	246.9	1.1	0.0	0.0	0.0	0.0
Rock land**	--	rRO	--	0.20	1,434.7	7.1	1,434.7	6.3	0.0	0.0	0.0	0.0
Total Area in Hydrologic Group D					10,628.2	52.3	11,341.4	49.5	3,209.7	59.2	3,257.1	58.2

Table 3. Areas and percentages of soil map units within drainage areas of sites used in study, Hilo Hawaii.—*Continued.*

[Hydrologic Group, groups defined by the National Resource Conservation Service based on the soil's runoff potential; Soil Map Unit Abbreviation, as defined by the National Resource Conservation Service; K, soil erodibility factor is a measure of the soil's susceptiblity to water erosion]

Soil Map Unit*	Soil Map Unit Percent Slopes	Soil Map Unit Abbreviation Symbol	Soil Type Symbol	Soil Erodibility Factor K Symbol	Waiakea Stream at Hoaka Road (16700600)		Waiakea Stream at Hilo (16701300)		Alenaio Stream at Hilo (16701600)		Alenaio Stream at Kilauea Avenue Bridge (16701650)	
					acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area	acres	percent of drainage area
Totals by Soil Type or Erosivity Factor												
Andisols					3,392.2	16.7	4,632.6	20.2	722.8	13.3	846.8	15.1
Histosols					12,918.0	63.6	13,486.9	58.9	3,209.7	59.2	3,257.1	58.2
Lava flows, stony land, and rock land					4,007.4	19.7	4,780.4	20.9	1,491.7	27.5	1,491.7	26.7
Soil Erosivity Index K = 0.02					3,136.7	15.4	3,909.7	17.1	1,491.7	27.5	1,491.7	26.7
Soil Erosivity Index K = 0.05					15,222.2	74.9	17,031.5	74.4	3,932.6	72.5	4,103.9	73.3
Soil Erosivity Index K = 0.10					437.8	2.2	437.8	1.9	0.0	0.0	0.0	0.0
Soil Erosivity Index K = 0.20					1,520.8	7.5	1,520.8	6.6	0.0	0.0	0.0	0.0
Total Area in Drainage					20,317.5		22,899.8		5,424.3		5,595.6	

*Data from Hawaii; U.S. Department of Agriculture Natural Resources Conservation Service (Soil Survey Staff, 2006)

**Soil erosion factor K for these soil types is the soil erosion factor Kw (whole soil). All other soil types have equal Kf (rock free, material less than 2mm) and Kw.

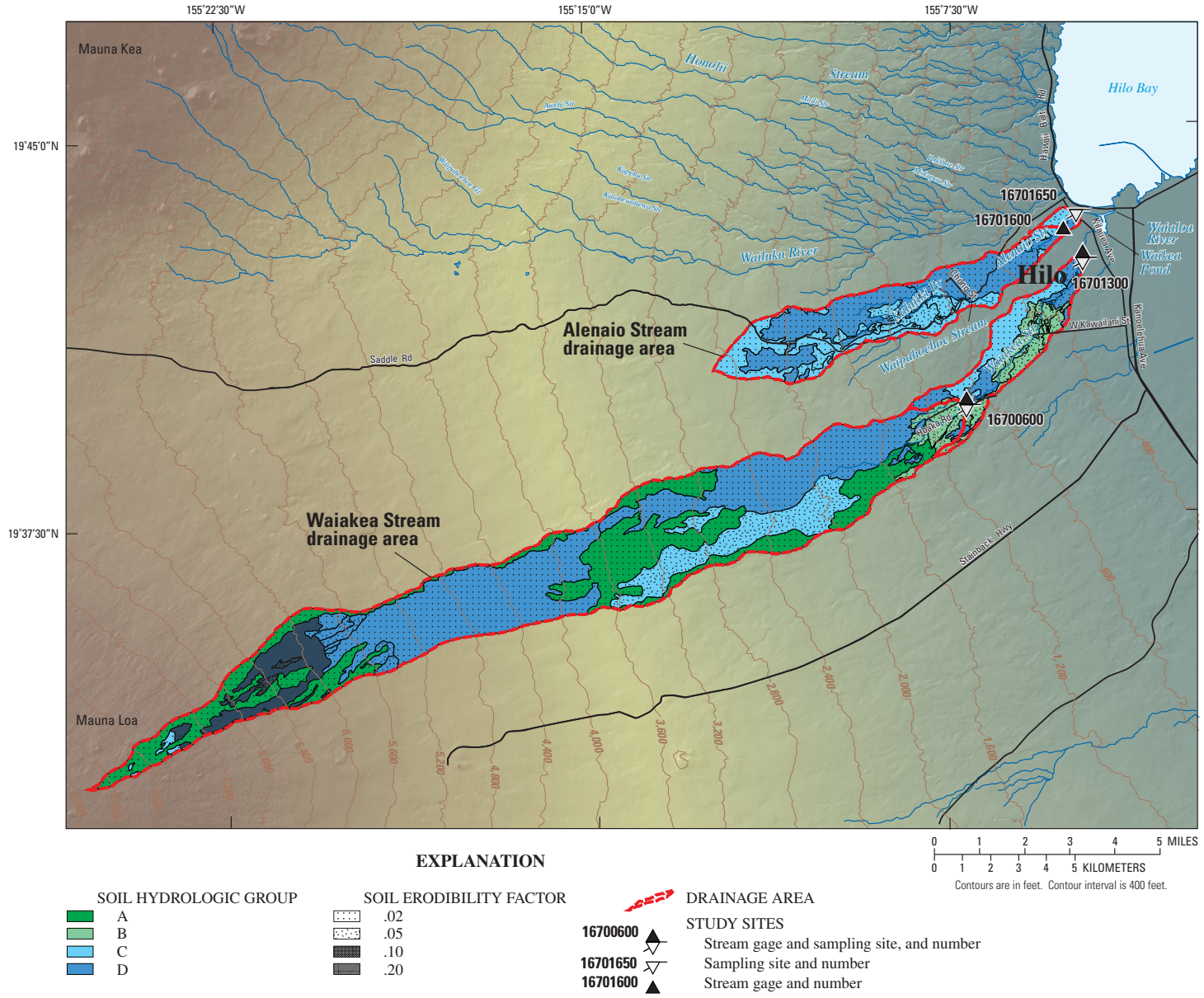

Figure 8. Map showing soil hydrologic groups and soil erodibility factors within drainage areas of stream-gaging and sampling sites for this study, Hilo, Hawaii.

nine of these twelve are common to the combined drainage areas of the three sampling sites of this study (table 4, fig. 9).

The land-cover classes with the highest coverages within the study area are 'evergreen forest' and 'scrub/shrub', covering 72.8 and 12.7 percent, respectively, of the drainage area above the site Waiakea Stream at Hilo, and 42.5 and 24.7 percent, respectively, of the drainage area above Alenaio Stream at Kilauea Avenue Bridge. Both of the lower sites of Waiakea and Alenaio streams have less than 2 percent 'hi-intensity developed', whereas only the lower site on Alenaio has appreciable 'low-intensity developed' land cover class at 11.3 percent. The remainder of the area of the drainages is comprised mostly of 'grassland', 'bare land', and 'cultivated land'. Definitions for these land-cover classes are available on-line (National Oceanographic and Atmospheric Administration, 2006).

Study Methods

Water quality samples for suspended sediment and nutrient analysis were collected at Waiakea Stream at Hoaka Road, Waiakea Stream at Hilo, and Alenaio Stream at Kilauea Avenue Bridge during wet weather storm events during March 2004 to March . Beginning and ending dates for data collection, the number of events, and the number of samples collected are listed in table 5. Sampling did not overlap between the two sites.

Methods used to collect the discharge and water quality data conformed to standard U.S. Geological Survey practices (Rantz and others, 1982; Wilde and others, 1998; Edwards and Glysson, 1999). The method used for developing daily-mean load for the constituents utilized U.S. Geological Survey software and techniques (McKallip and others, 2001).

Discharge Measurements and Continuous Record

Stream discharge was measured at the two sites on Waiakea Stream, and the two sites on Aleniao Stream. A continuous record of discharge was computed for the two sites on Waiakea Stream, and only the upper site of Alenaio Stream, Alenaio Stream at Hilo, using standard USGS methods (Rantz and others, 1982). These methods include a continuous record of stage measured every 15 minutes, individual measurements of discharge over a range of stages, development of a 'rating' to relate stage to discharge, and notations regarding factors that may affect the relations between stage and discharge.

During water years 2004 and 2005 (a 'water year' spans from October 1 to September 30, and takes the number of the calendar year in which it ends), instrument failure or malfunction caused short losses of record at both Waiakea Stream at Hoaka Road and Waiakea Stream at Hilo (table 5). The data gaps were estimated either visually or by regression methods using discharge records from long-term stations Honolii Stream near Papaikou (station number 16717000, figs. 1 and 2) and Wailuku River at Piihonua (station number 16704000, figs. 1 and 2).

Because of a hydraulic effect within the concrete channel, it was not possible to determine an accurate stage / discharge relation for the site Alenaio Stream at Kilauea Avenue Bridge. Photographs of discharge during January 26, 2006, show a hydraulic jump in the form of a standing wave near the measuring device of the gage (fig. 5). At higher flows, the standing wave moved away from the gage. Only instantaneous discharge measurements were made at Alenaio Stream at Kilauea Avenue Bridge using surface velocity measurements and a cross-section area (determined from stage height and predetermined channel geometry) during sampling; wading measurements using standard flow meters would be too dangerous to conduct in the slippery concrete channel. A continuous record of stream flow was not computed. Not all of the samples collected at Alenaio Stream at Kilauea Avenue Bridge have associated discharge measurements.

In addition to the measurements made at Alenaio Stream at Kilauea Avenue Bridge, and in lieu of a continuous discharge record at this site, stage and discharge were measured upstream at Alenaio Stream at Hilo. A stage/discharge relation and a continuous record of discharge were determined for this site using available measurements and computer modeling methods.

Daily-mean discharge (fig. 10) was computed using unit-value data (computed from the stage data measured every 15 minutes) for Waiakea Stream at Hoaka Road, Waiakea Stream at Hilo, and Alenaio Stream at Hilo. The duration of discharge record and the duration of data gaps for these sites are shown in table 5.

Sample Collection and Strategy

Flowing streamwater, in general, will have temporal and spatial heterogeneity. In order to adequately sample a stream, automated point samples are collected over time, either at specific intervals or based on discharge at irregular intervals. In order to represent the spatial heterogeneity, isokinetic, depth-integrating sampling methods are used to produce a discharge weighted sample for a discrete time (usually within 30 minutes or less); thus, each unit of stream discharge across the width and depth of the stream is equally represented in the sample (Wilde and others, 1998). By using the constituent concentration data from discharge weighted samples collected concurrently with automated point samples, a cross-section coefficient can be determined to adjust the automated point samples to better represent the constituent discharge for the stream spatially. In turn, the adjusted values from the automated point samples are used with discharge data to estimate the constituent concentrations and loads through time.

For this study, automated point samples were collected during storms, and whenever practical, discharge-weighted samples were collected concurrently with automated point

Table 4. Areas and percentages of NOAA C-CAP land cover classes within drainage areas of sites used in study, Hilo Hawaii.

[NOAA C-CAP Class Name, land cover classes defined by the NOAA Coastal Change Analysis program (National Oceanographic and Atmospheric Administration, 1995, 2001, and 2006); mi^2, square miles]

NOAA C-CAP Land Cover Class Name	Waiakea Stream					
	Waiakea Stream at Hoaka Road (16700600)			Waiakea Stream at Hilo (16701300)		
	Area (acres)	Area (mi^2)	percent of drainage area	Area (acres)	Area (mi^2)	percent of drainage area
High Intensity Developed	0.0	0.0	0.0	53.2	0.1	0.2
Low Intensity Developed	2.9	0.0	0.0	344.8	0.5	1.5
Cultivated Land	66.1	0.1	0.3	69.6	0.1	0.3
Grassland	548.3	0.9	2.7	1,267.8	2.0	5.5
Evergreen Forest	15,683.2	24.5	77.0	16,721.9	26.1	72.8
Scrub/Shrub	2,484.1	3.9	12.2	2,915.0	4.6	12.7
Bare Land	1,581.9	2.5	7.8	1,583.4	2.5	6.9
Water	0.0	0.0	0.0	0.4	0.0	0.0
Total Area	20,366.6	31.8	--	22,956.2	35.9	--

NOAA C-CAP Land Cover Class Name	Alenaio Stream					
	Alenaio Stream at Hilo (16701600)			Alenaio Stream at Kilauea Avenue Bridge (16701650)		
	Area (acres)	Area (mi^2)	percent of drainage area	Area (acres)	Area (mi^2)	percent of drainage area
High Intensity Developed	19.4	0.0	0.4	89.4	0.1	1.6
Low Intensity Developed	597.7	0.9	11.0	632.8	1.0	11.3
Cultivated Land	208.0	0.3	3.8	208.0	0.3	3.7
Grassland	832.0	1.3	15.3	886.7	1.4	15.8
Evergreen Forest	2,377.0	3.7	43.7	2,383.0	3.7	42.5
Scrub/Shrub	1,378.6	2.2	25.3	1,384.0	2.2	24.7
Bare Land	26.2	0.0	0.5	26.7	0.0	0.5
Water	0.0	0.0	0.0	0.0	0.0	0.0
Total Area	5,438.9	8.5	--	5,610.5	8.8	--

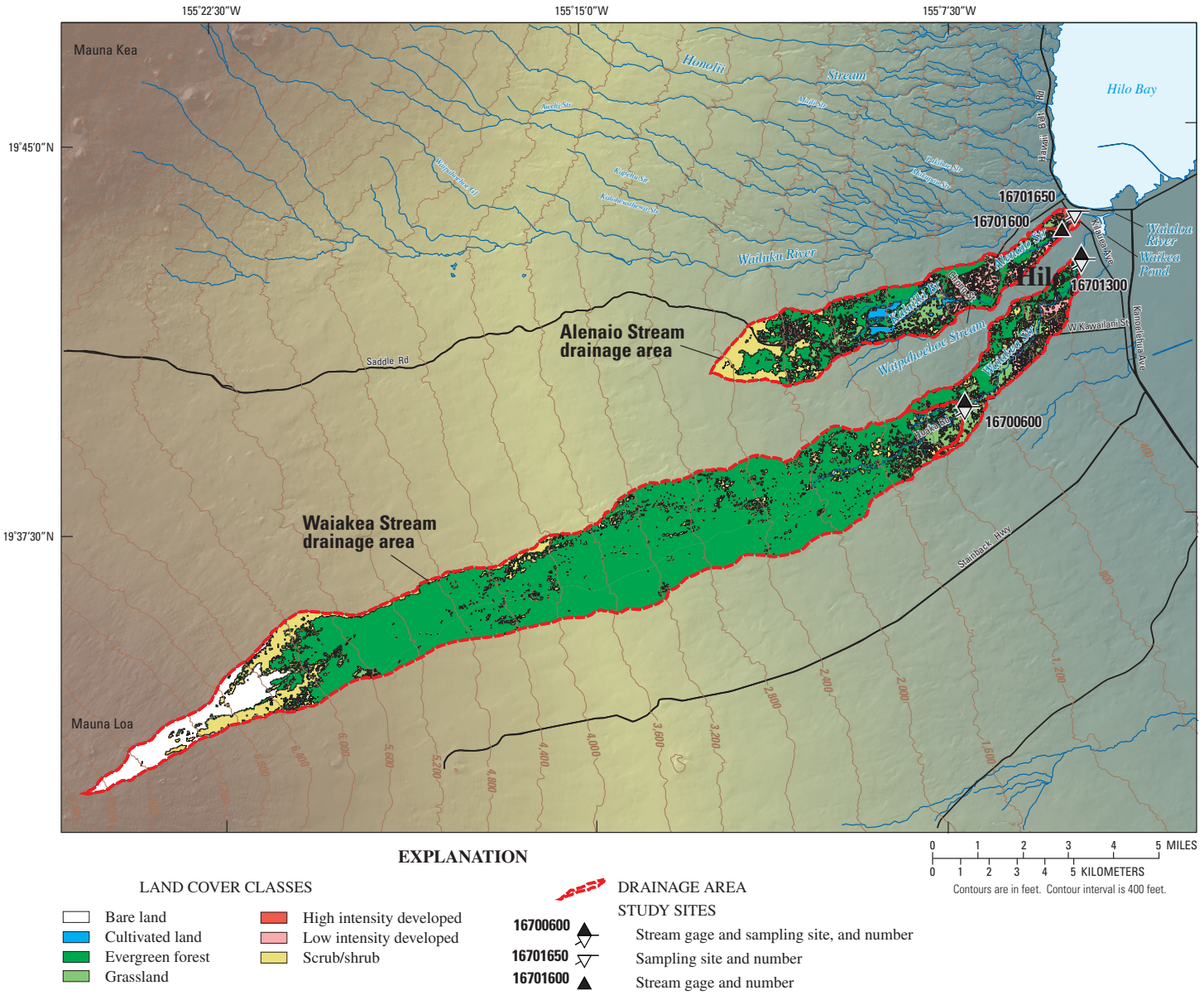

Figure 9. Map showing land cover classes within drainage areas of stream-gaging and sampling sites for this study, Hilo, Hawaii.

Table 5. Chronology of data collection, number of days samples were collected, number of samples collected, and number storm events at sites on Waiakea and Alenaio Streams, Hilo, Hawaii.

[cfs, cubic feet per second]

Description	Waiakea Stream at Hoaka Road (16700600)	Waiakea Stream at Hilo (16701300)	Alenaio Stream at Kilauea Avenue Bridge (16701650)	Alenaio Stream at Hilo (16701600)
Begin and end dates for types of data				
Daily-mean discharge	10/01/2003 to 10/11/2005	10/01/2003 to 10/14/2005	data not computed	10/01/2004 to 04/18/2006
Estimated daily-mean discharge	06/25/2004 to 07/02/2004 12/10/2004 to 01/06/2005	10/01/2003 to 10/03/2003 01/07/2005 to 02/04/2005	data not computed	none
Daily-mean loads for suspended sediment and nutrients	10/01/2003 to 09/30/2005	10/01/2003 to 09/30/2005	data not computed	no sampling at this site
Nutrient sampling	03/14/2004 to 03/30/2005	03/14/2004 to 03/30/2005	11/09/2005 to 03/09/2006	no sampling at this site
Suspended sediment sampling	03/14/2004 to 08/07/2005	03/14/2004 to 08/07/2005	11/09/2005 to 03/09/2006	no sampling at this site
Number of sampling days				
Suspended sediment	21	11	3	no sampling at this site
Nutrients	13	5	3	no sampling at this site
Number of samples				
Suspended sediment	156	78	33	no sampling at this site
Nutrients	71	31	34	no sampling at this site
Calibration for suspended sediment	5	1	3	no sampling at this site
Calibration for nutrients	3	1	3	no sampling at this site
Number of storm events*				
Number of events with daily mean discharge greater than 20 cfs during duration of discharge data	13	7	no discharge record at this site	7
Number of sampled events	11	6	3	no sampling at this site
Number of sampled events with daily mean discharge greater than 50 cfs	8	4	no discharge record at this site	no sampling at this site

* The "storm events" are loosely defined here; in some cases, a peak in discharge occurred immediately after the recession of a previous peak, and these were counted as an individual event.

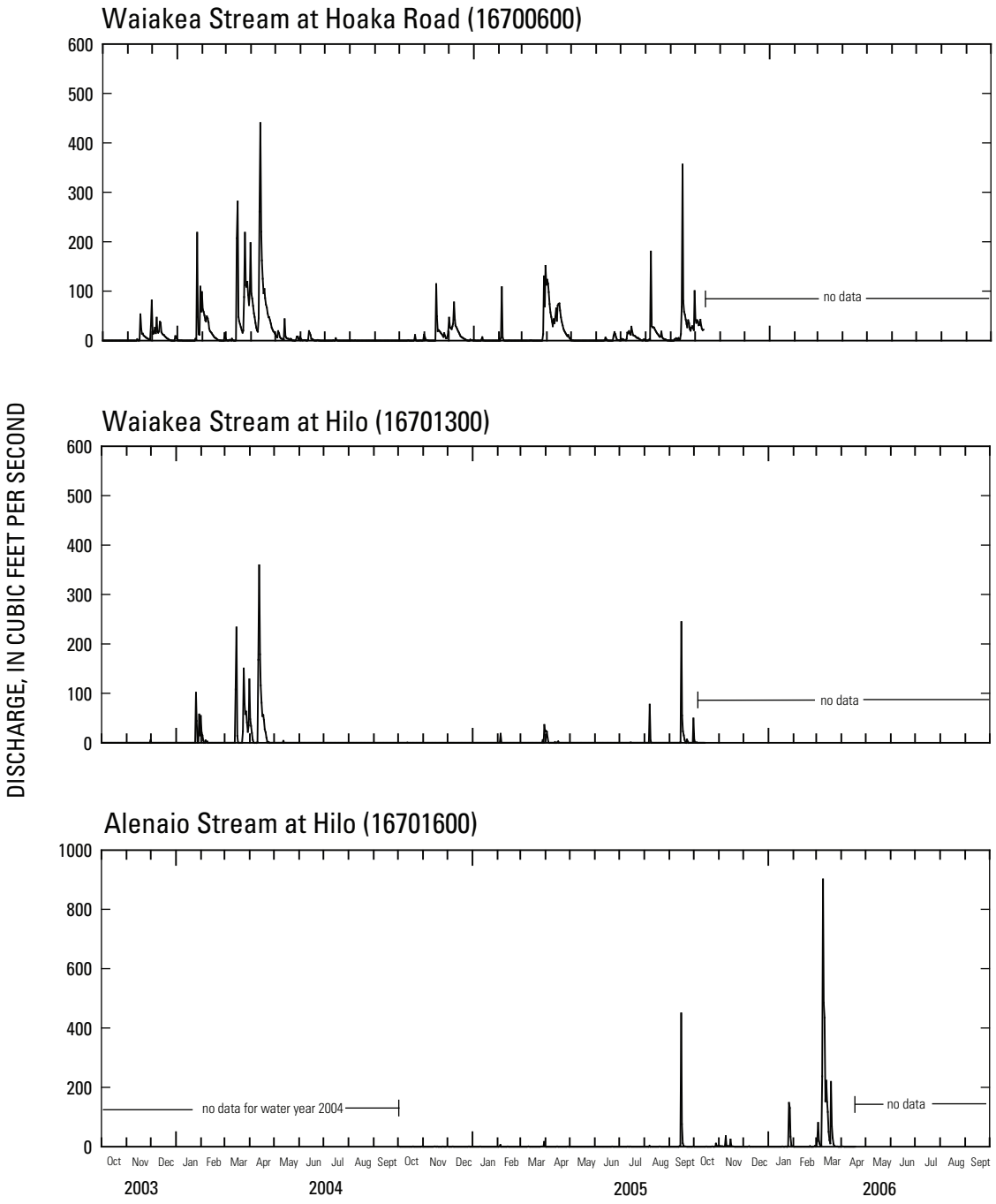

Figure 10. Daily-mean discharge for sites Waiakea Stream at Hoaka Road (16700600), Waiakea Stream at Hilo (16701300), and Alenaio Stream at Hilo (16701600), Hilo, Hawaii; October 1, 2003, to September 30, 2006.

samples. During the sampling period, two dip samples were collected at the Waiakea sites when streamflow was high; these samples were not used to create cross-section coefficients.

Automated point samplers were used to collect water samples for suspended-sediment and nutrient concentration analyses at each of the three water-quality sites according to methods described by Edwards and Glysson (1999). Samples were collected using an automated point sampler that pumps water from a permanently installed orifice at the stream gage. The automated point samplers have the capacity to collect 24 1-liter bottles. The automated samplers were programmed to collect multiple suspended-sediment and nutrient samples during storms at intervals ranging from 5 minutes to 24 hours. In most cases, the samplers were triggered to sample by the electronic loggers that measured stream stage. The threshold stages for the samplers were variable, and were based on experience and storm forecasting. For example, during drier periods, the sampler thresholds were set at stages that were low to sample small events at lower flows. If a storm was forecasted, stage thresholds were set higher in an effort to sample over a longer period of the discharge peak; if the threshold was left set at a lower stage, the sampler would have filled up with samples early in the event. During some events, the sampler was triggered manually while field personnel monitored the change in stage of the event. By manually triggering the sampler, field personnel could sample over a longer period of the discharge peak and over a range of discharge.

Discharge-weighted samples were collected concurrently with automated point samples at the two Waiakea Stream sites and at Alenaio Stream at Kilauea Avenue Bridge to determine cross-section coefficients. Unfortunately, discharge-weighted samples were only collected during relatively low flows, and ideally, these should be collected over a larger range of discharge. However, streams tend to be well mixed at higher flows, thus minimizing differences between automated point samples and discharge-weighted samples.

Samples were collected over a period of 24 months from March 14, 2004, through March 9, 2006 (table 5). Field personnel concentrated their efforts on Waiakea Stream during the early part of the project, from March 14, 2004, to August 7, 2005, and then changed focus to sampling at Alenaio Stream at Kilauea Avenue Bridge and determining the stage / discharge relation at Alenaio Stream at Hilo during November 9, 2005, to March 9, 2006.

Sample Processing, Physical Analysis, and Chemical Analysis

Suspended-sediment samples were shipped to the USGS Cascades Volcanoes Observatory Sediment Laboratory in Vancouver, Washington for analysis. Concentrations were determined according to ASTM Standard Test Method D 3977-97, which includes retaining, drying at 103˚C, and weighing all of the sediment in a known mass of a water-sediment mixture (Guy, 1969). Sediment concentrations were determined to the nearest mg/L. Concentrations of 100 mg/L and above are reported to 3 significant figures.

Nutrient samples were processed according to procedures in the USGS National Field Manual for the Collection of Water-Quality Data (Wilde and others, 1998). Processing and preservation chambers were used to reduce the potential for contamination from the surrounding environment during sample splitting, filtration, and preservation. Samples were chilled and shipped to the laboratory as quickly as possible. The temperature of the cooler and the date it was received were recorded at the laboratory. A record of all samples collected and shipped to a laboratory for analysis was maintained.

Nutrient samples were shipped to the USGS National Water Quality Laboratory (NWQL) in Arvada, Colorado for analysis. Concentrations were determined using semi-automated colorimetric methods (U.S. Environmental Protection Agency, 1983; Fishman, 1993; Patton and Truitt, 2000). Laboratory reporting limits were adequate for project requirements because the laboratory reporting limits are less than the minimum applicable state stream water-quality criteria.

Total nitrogen concentrations were computed as the sum of the concentrations of nitrogen, nitrite plus nitrate, dissolved, and total ammonia plus organic nitrogen (Kjeldahl). Although the analysis of nitrogen, nitrite plus nitrate, dissolved, is not directly comparable with the State of Hawaii's criteria for total nitrate plus nitrite nitrogen (defined as: the sum of total nitrate plus nitrite from an unfiltered sample, which may be filtered or centrifuged when extreme turbidity [threshold under development] indicates potential interference with analytical instruments), adding this sum to total ammonia plus organic nitrogen provides a satisfactory approximation of the State of Hawaii's criteria for total nitrogen, and meets the needs of HDOH for determining the degree of waterbody impairment. Furthermore, it also meets the needs of HDOH for developing TMDLs and pollutant load allocations for total nitrogen (David Penn, HDOH, written communication, 2004). Concentrations of nitrogen, nitrite plus nitrate, dissolved, are essentially equivalent to total nitrate plus nitrite because under normal conditions of pH and redox potential, nitrate and nitrite are completely dissolved in water (Hem, 1985).

Data Analysis and Computation

As mentioned before, stream load is a measure of the amount of constituent delivered by the stream, in tons or pounds (lbs), divided over a period of time, in days. In order to calculate loads, the concentration of the constituent, in milligram per liter (mg/L) or other concentration unit, is multiplied by discharge, in cubic feet per second (cfs), and a conversion factor. Daily-mean loads are the mean of the unit-value loads, derived from the concentrations of samples, estimates of concentration based on discharge, and the unit value (15 minute interval) discharge recordings over each day. The Appendix shows the methods used for these calculations.

Instantaneous loads were calculated for all samples from the three sampling sites, when discharge data was available. Daily-mean loads were computed for water years 2004 and 2005 for sites Waiakea Stream at Hoaka Road and Waiakea Stream at Hilo. Since a continuous record of discharge was not possible to compute at Alenaio Stream at Kilauea Avenue Bridge, no daily-mean load record was computed.

For the two Waiakea Stream sites, cross-section sample concentrations were compared to samples from the automatic sampler to determine cross-section coefficients (Edwards and Glysson, 1999). The cross-section coefficients are shown for each constituent, by site, in table 6. Different cross-section coeffiecients were used for suspended sediment for water year 2004 and 2005 at the upper Waiakea Stream site. For nutrient constituents at Waiakea Stream at Hoaka Road, and both suspended sediment and nutrient constituents at Waiakea Stream at Hilo, each constituent used the same cross-section coefficient for water years 2004 and 2005.

The data, after adjustment using the cross-section coefficients, showed weak correlations between discharge and concentration for suspended sediment and nutrients. At Waiakea Stream at Hoaka Road, a suitable regression or 'sediment transport curve' for suspended sediment (table 6) was developed and used to help create estimated points in GCLAS. However, no suitable regressions were developed for Waiakea Stream at Hilo due to the poor correlation. The regression equations for transport curves for total nitrogen, dissolved nitrate plus nitrite, and total phosphorus were not developed for the two sites, also due to poor correlation.

Sediment and nutrient (total nitrogen, total phosphorus, and dissolved nitrate plus nitrite) loads were computed following the methods described by Porterfield (1972), and by using the Graphical Constituent Loading Analysis System (GCLAS) software package (Koltun and others, 2006). GCLAS graphically displays samples and discharge, and allows the user to estimate constituent concentrations based on the peaks and troughs of discharge. GCLAS allows the user to interpolate the data through time between the estimated and/or actual points. Not all constituents behave the same way relative to discharge, in fact, for a given site, the concentration pattern for one storm or discharge event may differ from that of another, even if the discharge was similar (Porterfield, 1972). As shown in figure 11, this method creates a practical estimate of concentration.

Cross-section sample data, adjusted automated point sampler data, and suitable sediment transport curves were loaded into GCLAS. For the two sites on Waiakea Stream, the number of estimates for each water year are listed in table 6. GCLAS is capable of outputting unit values and daily mean values of concentration and load data. Daily-mean concentration data, unit value (15 minute) concentration data, and unit-value load data are not provided in this report, but are available by request.

Streamflow

Streamflow at Waiakea and Alenaio Streams is ephemeral and flashy. Streamflow data for two sites on Waiakea Stream and one site on Alenaio Stream show many long periods of zero flow (fig. 10).

For Waiakea Stream, discharge is generally greater and longer in duration at the higher altitude site, Waiakea Stream at Hoaka Road, than at the lower site, Waiakea Stream at Hilo. Also, streamflow resulted from more storms at the upper site than at the lower site. Contributing factors to the greater discharge at the upper site than the lower site include (1) higher rainfall at higher altitudes (Giambelluca and others, 1986) and (2) the reach between the two sites has exposed lava tubes within the channel and loses substantial flow. The reaches below the natural channel may lose water along the stream bed, but have been extensively modified; the walls of the channel are fortified, and the stream gains water from storm drains and other urban runoff during the early portion of runoff events. These stream characteristics also affect the duration of the discharge events at each site; the lower site returns to little or no flow more quickly than the upper site.

Along Alenaio Stream, discharge was about the same at both the lower site and the upper site during three of the sampling events (fig. 12). Discharge data from these two sites were derived by highly different methods, yet they agree within reason. However, it was found that during some localized storms, there was sufficient flow at the lower site to sample for nutrients and suspended sediment while there was little or no flow at the upper site. Similar to Waiakea Stream, Alenaio Stream has numerous storm drains that drain into the lower channelized part of the stream, which may add to runoff during the early part of storms.

Hydrologic Setting at the Time of Sampling

The collection of water-quality data requires additional information and data to put the sampled storms in perspective and context. Data from nearby raingages and long-term stream gages assist interpretation in this way, and are presented here as an example or starting point for further study.

Rainfall is measured by the National Weather Service at many locations within or adjacent to the study area. Presented here are data from three locations within or near the study area: Hilo Airport (altitude: 28 ft), Piihonua (altitude: 860 ft) and Waiakea Uka (altitude: 1,000 ft). Discharge and stage have been measured at over a dozen sites in the Hilo area; of interest to this report are two discontinued gages on Waiakea Stream; Waiakea Stream near Mountain View (station number 16700000) and Waiakea Stream near Hilo (station number 16701200), and two sites that are still in operation mentioned earlier; Honolii Stream near Papaikou and Wailuku River at Piihonua. Figure 1 and table 7 shows locations and periods of record for each of these stations. Figure 13 shows discharge at the sites in this study as well as discharge at Honolii Stream

Table 6. Number of samples used, number of estimates used, cross-section coefficient values, and transport curve equations used for estimating daily-mean load records at Waiakea Stream at Hoaka Road (16700600) and Waiakea Stream at Hilo (16701300), during water years 2004 and 2005.

[cfs, cubic feet per second; Q, discharge, in cfs; wy, water year]

Description	Waiakea Stream at Hoaka Road (16700600)	Waiakea Stream at Hilo (16701300)
Suspended Sediment Daily-Mean Load Compuations		
Number of samples used, wy 2004	51	50
Number of estimates used , wy 2004	285	126
Number of samples used, wy 2005	157	26
Number of estimates used , wy 2005	134	66
Cross-section coefficient for suspended sediment samples, wy 2004	0-20 cfs:2.4 20-150 cfs: prorated 2.4-3.0 >150 cfs:3.0	1.17
Cross-section coefficient for suspended sediment samples, wy 2005	2.25	1.17
Sediment transport curve equation, wy 2004	log (conc) = 0.67 x log (Q) - 0.53	poor correlation, not developed
Sediment transport curve equation, wy 2005	log (conc) = 0.67 x log (Q) - 0.18	equation underestimated concentrations at higher flows, not used
Total Nitrogen Daily-Mean Load Compuations		
Number of samples used, wy 2004	8	7
Number of estimates used , wy 2004	167	105
Number of samples used, wy 2005	56	22
Number of estimates used , wy 2005	128	49
Cross-section coefficient for total nitrogen samples, wy 2004 and 2005	0.95	0.90
Transport curve equation, wy 2004	negative and weak correlation, not developed	postive and weak correlation, not developed
Transport curve equation, wy 2005	negative and weak correlation, not developed	postive and weak correlation, not developed
Nitrogen, Nitrite + Nitrate, Dissolved Daily-Mean Load Compuations		
Number of samples used, wy 2004	8	7
Number of estimates used , wy 2004	173	97
Number of samples used, wy 2005	56	22
Number of estimates used , wy 2005	107	47
Cross-section coefficient for nitrogen, nitrite + nitrate, dissolved samples, wy 2004 and 2005	0.97	1.00
Transport curve equation, wy 2004	negative and weak correlation, not developed	negative and weak correlation, not developed
Transport curve equation, wy 2005	negative and weak correlation, not developed	negative and weak correlation, not developed
Total Phosphorus Daily-Mean Load Compuations		
Number of samples used, wy 2004	8	7
Number of estimates used , wy 2004	210	97
Number of samples used, wy 2005	56	22
Number of estimates used , wy 2005	131	52
Cross-section coefficient for total phosphorus samples, wy 2004 and 2005	1.06	0.84
Transport curve equation, wy 2004	negative and weak correlation, not developed	postive and weak correlation, not developed
Transport curve equation, wy 2005	negative and weak correlation, not developed	postive and weak correlation, not developed

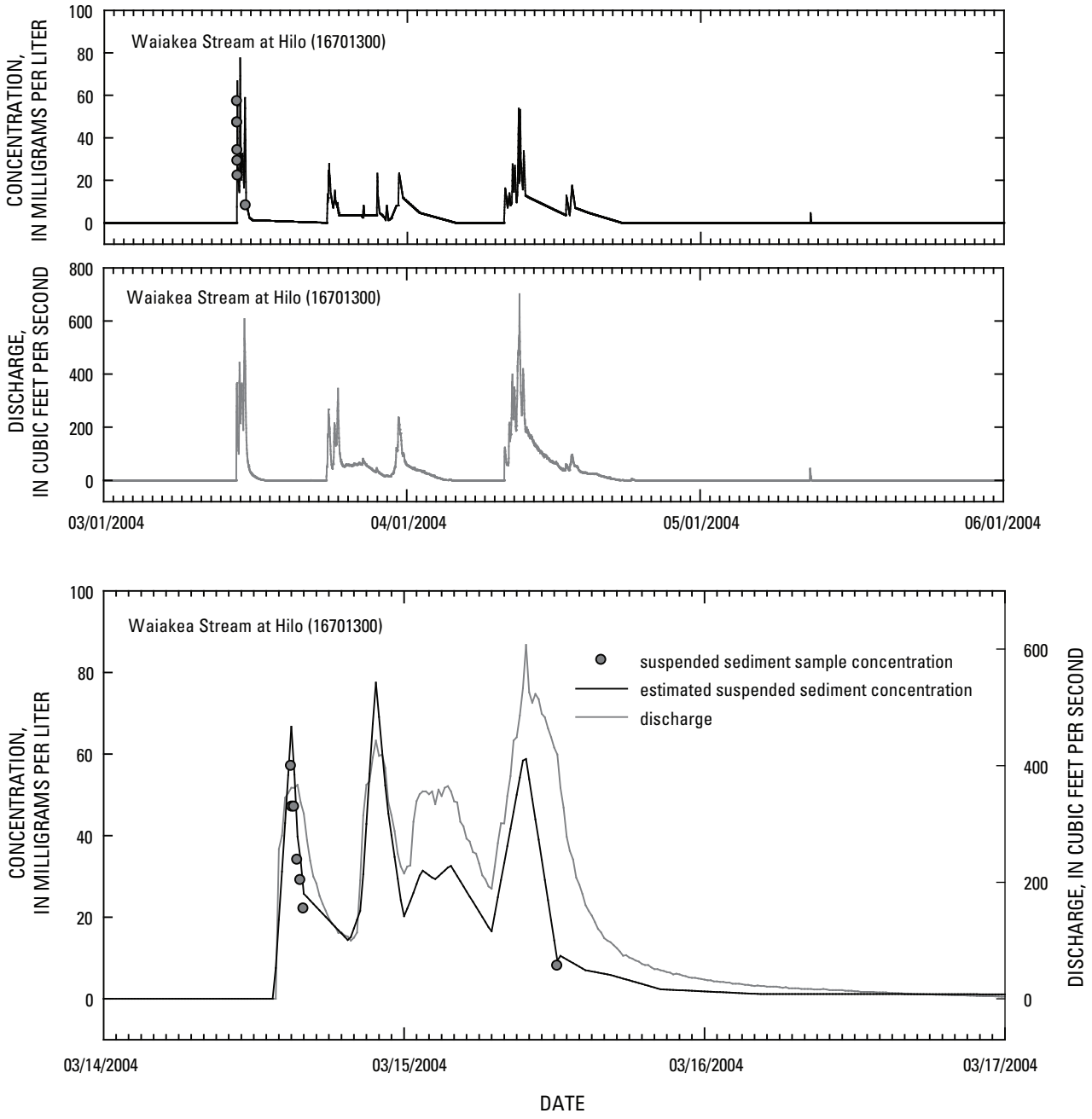

Figure 11. Discharge, suspended sediment sample concentration, estimated suspended sediment concentration, and discharge for Waiakea Stream at Hilo (16701300), Hilo, Hawaii, during March 1 to June 1, 2004, and detail of March 14 to March 17, 2004.

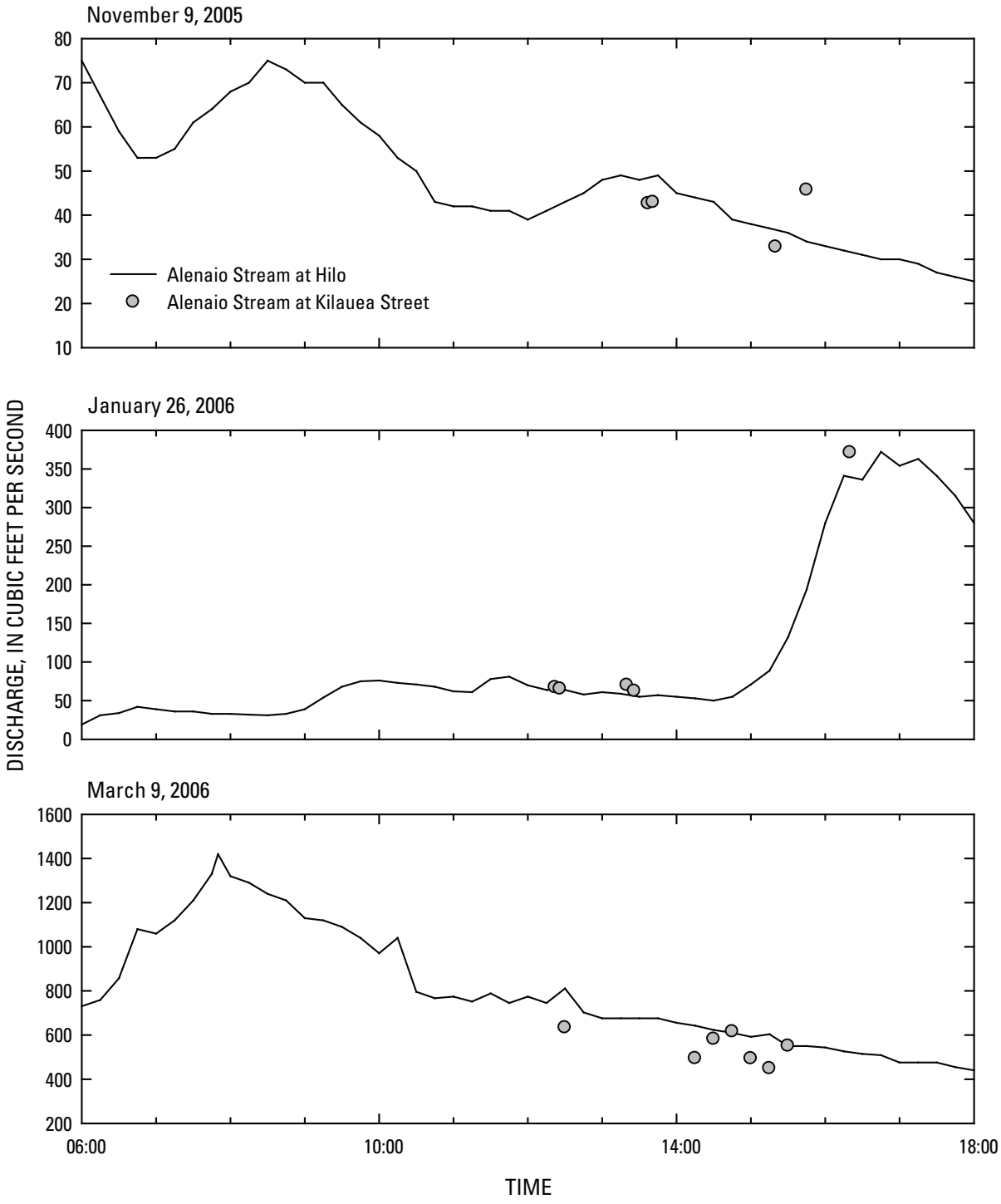

Figure 12. Discharge at Alenaio Stream at Hilo (16701600) and discharge measurements made at Alenaio Stream at Kilauea Avenue Bridge (16701650), during November 9, 2005, January 26, 2006, and March 9, 2006, Hilo, Hawaii.

near Papaikou and Wailuku River at Piihonua over seven water years.

Lower than normal rainfall and streamflow throughout the study period may have reduced the amount of sediment being washed into streams as well as constituents, such as phosphorus, that attach to sediment particles. Figure 14 shows monthly rainfall for four years, including the years of this study, as percent departure from the mean monthly rainfall for the period of record, as well as daily-mean discharge at Honolii Stream near Papaikou, with the 25th and 75th percentile daily discharge for the period of record (shown as a light blue band). For reference, figure 14 also shows the dates of the samples relative to the rainfall and Honolii Stream discharge hydrographs.

Data analyses, such as event rainfall intensities, flow-duration curves for the three sites of this report, as well as for other long-term stations in the general vicinity, and criteria to determine duration of a storm event, are required to define the conditions for each sampled event. Although the criteria for defining storm events was not developed for this study, the data suggests that about 13 storm events occurred at Waiakea Stream at Hoaka Road over the period of discharge record from October 1, 2003, to October 11, 2005, and about 7 events occurred at Alenaio Stream at Hilo from October 1, 2004, to April 18, 2006. Table 5 shows the number of 'storm events' sampled, based visual inspection of the hydrographs, at the three sampling sites. Further analyses and definition may increase the number of storm events if each peak is considered a storm.

Concentrations and Instantaneous Loads of Suspended Sediment and Nutrients

A total of 267 suspended sediment samples and 136 nutrient samples were collected at both sites on Waiakea Stream and the lower site on Alenaio Stream between March 14, 2004, and March 9, 2006. Table 5 shows the number of sampling dates, and the numbers of individual suspended-sediment and nutrient samples collected for each site.

Tables 8, 10, and 12 list suspended sediment concentrations and instantaneous loads for times when only suspended sediment samples were collected (no nutrient analyses). Tables 9, 11, and 13 list concentrations and instantaneous loads for times when both suspended sediment and nutrient samples were collected.

Concentrations of suspended sediment at Waiakea Stream at Hoaka Road range from 1 to 201 mg/L, and instantaneous loads range from 0.02 to 363 tons/day (table 8 and 9). Total nitrogen concentrations range from 0.14 to 29 mg/L, and instantaneous loads range from 5.3 to 7,400 lbs/day (table 9). Concentrations of nitrogen, as nitrite plus nitrate, dissolved, range from 0.011 to 0.200 mg/L, and instantaneous loads range from 1.2 to 238 lbs/day. Phosphorus concentrations range from 0.006 to 3.12 mg/L, and instantaneous loads range from 0.23 to 850 lbs/day.

At Waiakea Stream at Hilo, concentration of suspended sediment range from 1 to 1,430 mg/L, and instantaneous loads range from 0.03 to 1,010 tons/day (table 10 and 11). Total nitrogen concentration range from 0.21 to 1.0 mg/L, and instantaneous loads range from 5.7 to 2,000 lbs/day (table 11). Concentrations of nitrogen, as nitrite plus nitrate, dissolved, range from 0.014 to 0.121 mg/L, and instantaneous loads

Table 7. Altitude, drainage area, and period of record for additional stream gaging stations and National Weather Service rain gages presented in this report, Hilo, Hawaii.

[ft, feet; msl, mean sea level; mi², square miles]

Station Number	Station Name	Altitude (ft above msl)	Drainage Area (mi²)	Period of Record		Status
				Begin	End	
Stream Gaging Stations						
16700000	Waiakea Stream nr Mountain View, HI	1940	17.4	Oct-1930	Sep-1991	discontinued station
16701200	Waiakea Stream near Hilo, HI	370	33.6	Jun-1957	Jun-1967	discontinued station
16704000	Wailuku River at Piihonua, HI	1090	230	Jul-1928	present	current station
16717000	Honolii Stream nr Papaikou, HI	1540	11.6	Jun-1911	present	current station
National Weather Service Rain Gages						
NWS # 511492	Hilo Airport	28	--	Oct-1949	present	current station
NWS # 518053	Piihonua	860	--	Mar-1991	present	current station
NWS # 519084	Waiakea Uka	1000	--	Mar-1991	present	current station

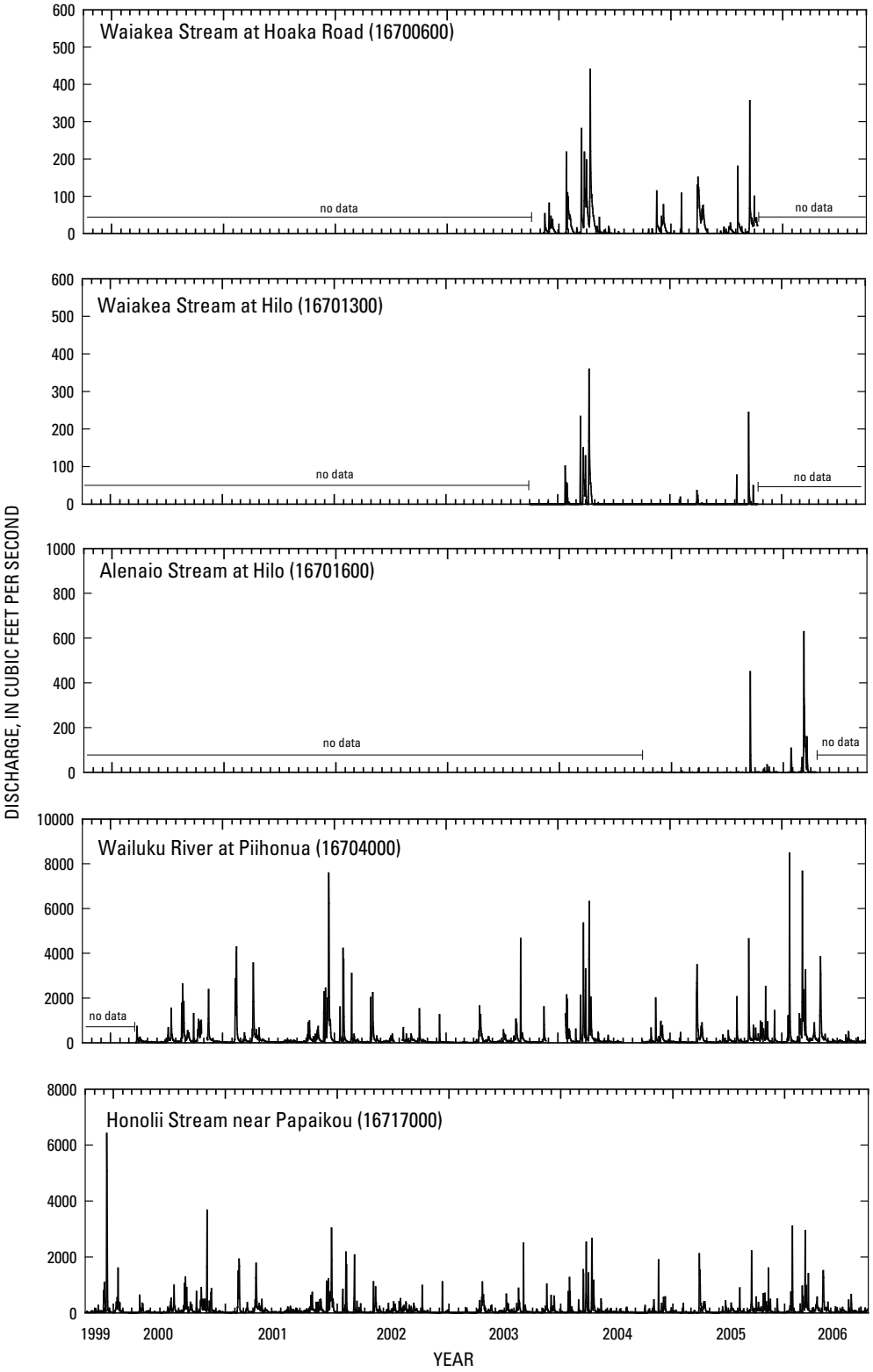

Figure 13. Daily-mean discharge for sites Waiakea Stream at Hoaka Road (16700600), Waiakea Stream at Hilo (16701300), Alenaio Stream at Hilo (16701600), Wailuku River at Piihonua (16704000), and Honolii Stream near Papaikou (16717000, Hilo, Hawaii; October 1, 2003, to September 30, 2005.

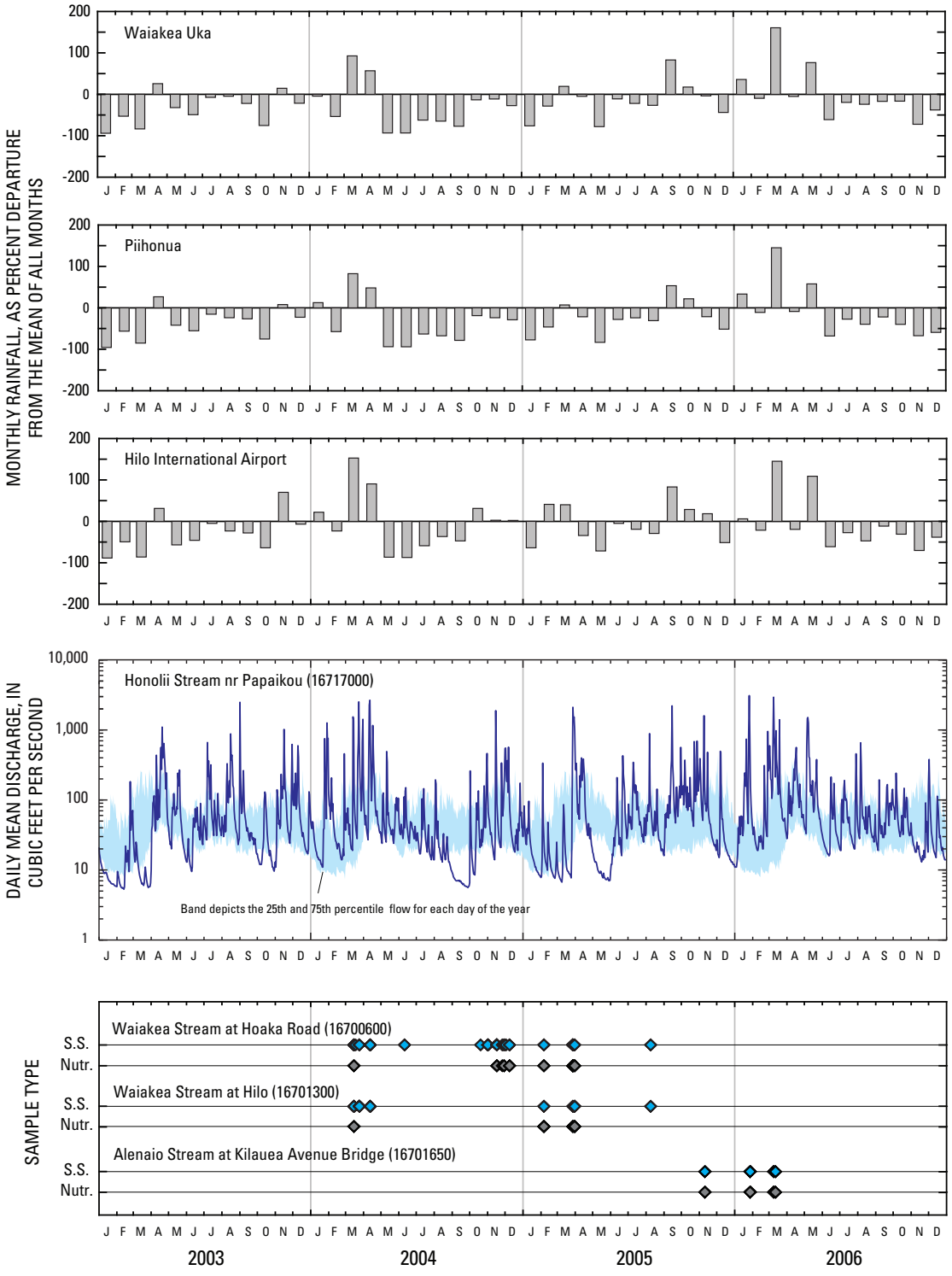

Figure 14. Monthly rainfall, as percent departure from mean-monthly rainfall, for three National Weather Service rain gages in or near study area; discharge at gaging station Honolii Stream near Papaikou (16717000), with band delineating 25th and 75th percentile flow, and sampling dates for suspended sediment and nutrients at study sites, during 2003 to 2006, Hilo, Hawaii.

Table 8. Discharge, concentration and instantaneous loads of suspended sediment, for samples collected without associated nutrient analyses, from March 15, 2004, to August 7, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Suspended sediment	
				Conc. (mg/L)	Load (tons/day)
March 15, 2004	10:01	automated point sample	670	8	10
March 15, 2004	11:15	automated point sample	452	6	7
March 15, 2004	13:15	automated point sample	214	5	3
March 15, 2004	15:15	automated point sample	131	3	1
March 15, 2004	17:15	automated point sample	97	2	0.5
March 15, 2004	23:15	automated point sample	63	2	0.3
March 17, 2004	07:15	automated point sample	39	<1	<0.1
March 23, 2004	20:15	automated point sample	184	20	9.9
March 23, 2004	20:30	automated point sample	210	27	15
March 23, 2004	20:45	automated point sample	239	26	17
March 23, 2004	21:00	automated point sample	247	21	14
March 23, 2004	21:15	automated point sample	239	19	12
March 23, 2004	21:30	automated point sample	231	16	10
March 23, 2004	21:45	automated point sample	227	14	8.6
March 23, 2004	22:00	automated point sample	247	14	9.3
March 23, 2004	22:15	automated point sample	303	15	12
March 23, 2004	22:30	automated point sample	382	22	23
March 23, 2004	22:45	automated point sample	406	24	26
March 23, 2004	23:00	automated point sample	396	19	20
April 12, 2004	10:15	automated point sample	538	14	20
April 12, 2004	10:30	automated point sample	584	11	17
April 12, 2004	10:45	automated point sample	680	19	35
April 12, 2004	11:00	automated point sample	749	39	79
April 12, 2004	11:15	automated point sample	843	43	98
April 12, 2004	11:30	automated point sample	1000	63	170
April 12, 2004	11:45	automated point sample	940	63	160
April 12, 2004	12:00	automated point sample	891	39	94
April 12, 2004	12:15	automated point sample	827	29	65
April 12, 2004	12:30	automated point sample	757	22	45
April 12, 2004	12:45	automated point sample	677	17	31
April 12, 2004	13:00	automated point sample	644	13	23
June 11, 2004	15:15	automated point sample	106	183	52.3
June 11, 2004	15:17	automated point sample	105	201	56.9
June 11, 2004	15:30	automated point sample	96	192	50
June 11, 2004	15:45	automated point sample	89	96	23
June 11, 2004	16:00	automated point sample	86	55	13
June 11, 2004	16:15	automated point sample	79	51	11
October 20, 2004	10:00	discharge-weighted sample	8	10	0.2
October 20, 2004	10:15	automated point sample	7	3	0.1
October 31, 2004	11:15	automated point sample	11	2	0.1
October 31, 2004	15:15	automated point sample	10	1	0.03
October 31, 2004	16:15	automated point sample	11	1	0.03
October 31, 2004	17:15	automated point sample	15	1	0.04
October 31, 2004	18:15	automated point sample	17	1	0.05
October 31, 2004	19:15	automated point sample	21	2	0.1
October 31, 2004	20:15	automated point sample	23	2	0.1
October 31, 2004	21:15	automated point sample	20	2	0.1

Table 8. Discharge, concentration and instantaneous loads of suspended sediment, for samples collected without associated nutrient analyses, from March 15, 2004, to August 7, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.—*Continued.*

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Suspended sediment	
				Conc. (mg/L)	Load (tons/day)
October 31, 2004	22:15	automated point sample	18	2	0.1
October 31, 2004	23:15	automated point sample	16	1	0.04
November 1, 2004	00:15	automated point sample	14	2	0.1
November 1, 2004	01:15	automated point sample	13	2	0.1
November 1, 2004	02:15	automated point sample	12	1	0.03
November 1, 2004	03:15	automated point sample	11	1	0.03
November 1, 2004	04:15	automated point sample	10	1	0.03
November 1, 2004	05:15	automated point sample	9	1	0.02
November 1, 2004	06:15	automated point sample	8	1	0.02
November 15, 2004	10:49	automated point sample	150	5	2
November 15, 2004	10:54	discharge-weighted sample	151	15	6.1
November 15, 2004	10:59	automated point sample	152	6	2
November 15, 2004	11:30	automated point sample	158	6	3
November 15, 2004	12:30	automated point sample	156	6	3
November 15, 2004	13:30	automated point sample	161	4	2
November 15, 2004	14:30	automated point sample	140	4	2
November 15, 2004	15:30	automated point sample	109	3	0.9
November 15, 2004	16:30	automated point sample	122	3	1
November 15, 2004	17:30	automated point sample	156	7	3
November 15, 2004	18:30	automated point sample	161	3	1
November 15, 2004	19:20	automated point sample	141	5	2
November 15, 2004	20:30	automated point sample	113	2	0.6
November 15, 2004	21:30	automated point sample	111	2	0.6
November 15, 2004	22:30	automated point sample	103	2	0.6
November 15, 2004	23:30	automated point sample	89	3	0.7
November 16, 2004	00:30	automated point sample	75	2	0.4
November 16, 2004	01:30	automated point sample	73	2	0.4
November 16, 2004	02:30	automated point sample	86	3	0.7
November 16, 2004	03:30	automated point sample	84	2	0.5
November 16, 2004	04:30	automated point sample	77	2	0.4
November 16, 2004	05:30	automated point sample	71	2	0.4
November 16, 2004	06:30	automated point sample	66	2	0.4
November 16, 2004	07:30	automated point sample	60	2	0.3
November 16, 2004	08:30	automated point sample	58	1	0.2
November 16, 2004	09:30	automated point sample	54	3	0.4
November 16, 2004	10:30	automated point sample	50	1	0.1
November 30, 2004	11:00	automated point sample	19	3	0.2
November 30, 2004	11:05	discharge-weighted sample	19	7	0.4
November 30, 2004	11:07	automated point sample	19	5	0.3
February 4, 2005	01:30	automated point sample	292	11	8.7
February 4, 2005	10:53	automated point sample	51	3	0.4
February 4, 2005	11:00	automated point sample	50	5	0.7
February 4, 2005	11:04	automated point sample	50	2	0.3
March 27, 2005	09:46	automated point sample	3	2	0.02
March 27, 2005	10:45	automated point sample	6	2	0.03
March 28, 2005	09:40	automated point sample	99	4	1

Table 8. Discharge, concentration and instantaneous loads of suspended sediment, for samples collected without associated nutrient analyses, from March 15, 2004, to August 7, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.—*Continued.*

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Suspended sediment	
				Conc. (mg/L)	Load (tons/day)
March 28, 2005	09:45	automated point sample	99	5	1
March 28, 2005	09:50	automated point sample	98	4	1
August 7, 2005	10:00	automated point sample	412	99	110
August 7, 2005	10:30	automated point sample	814	146	320
August 7, 2005	11:00	automated point sample	904	149	360
August 7, 2005	11:30	automated point sample	900	93	230
August 7, 2005	12:00	automated point sample	707	71	140
August 7, 2005	12:30	automated point sample	535	51	74

range from 1.5 to 86 lbs/day. Phosphorus concentrations range from 0.021 to 0.174 mg/L, and instantaneous loads range from 0.46 to 340 lbs/day.

At Alenaio Stream at Kilauea Avenue Bridge, concentration of suspended sediment range from 5 to 182 mg/L, and instantaneous loads range from 0.8 to 48 tons/day (table 12 and 13). Total nitrogen concentration range from 0.24 to 0.84 mg/L, and instantaneous loads range from 43 to 1,100 lbs/day (table 13). Concentrations of nitrogen, as nitrite plus nitrate, dissolved, range from 0.011 to 0.141 mg/L, and instantaneous loads range from 13 to 451 lbs/day. Phosphorus concentration range from 0.015 to 0.194 mg/L, and instantaneous loads range from 3.2 to 130 lbs/day.

It is important to note that the concentration and instantaneous load values, listed in these tables, were not adjusted based on the cross-section coefficients. Adjusted data were used for the computation of daily-mean loads.

Table 14 provides statistics for stream discharge, concentration and instantaneous loads. For Waiakea Stream, higher concentrations and loads of suspended sediment and nutrients were found at Waiakea Stream at Hoaka Road than at the downstream site Waiakea Stream at Hilo. At Alenaio Stream at Kilauea Avenue Bridge, only 12 of the nutrient samples had associated discharge measurements. The period of sampling for this site does not overlap the period of sampling at the two Waiakea sites.

Daily-Mean Loads of Suspended Sediment and Nutrients

This section presents the daily-mean load data for the two Waiakea sites. Within the hydrographs of the data (figs. 15a, 15b, 16a and 16b), the dates of the samples are also shown. Within the tables, the monthly total discharge data are also provided. Daily-mean load data are also available in electronic format.

Daily-mean loads, although estimated, can be used to calculate a total tonnage of the analyzed constituents that have passed by at the sampling / discharge site. The units for daily-mean load values are actually provided in tons, thus, by simply adding up the daily-mean loads, event, monthly, or annual totals can be calculated.

Unit-value data.—Unit-value discharge, concentration and load data were computed as part of the process to create daily-mean loads. Unit-value data, in this case, 15-minute interval data as shown in figure 11, can be used to estimate the tonnage of constituent delivered during a given storm event. In addition, the sampling methodology provides important information regarding the change in concentration relative to changes in discharge during storm events. As mentioned before, some constituents do not behave in a linear relation to discharge, and in some cases the peak concentration of a given constituent can occur before or after the peak in discharge (Porterfield, 1972). Unit-value discharge, concentration and load data are also available upon request.

Waiakea Stream at Hoaka Road (16700600)

Daily-mean loads of suspended-sediment and nutrient constituents for Waiakea Stream at Hoaka Road for water years 2004 and 2005 are shown in figures 15a and 15b, and tables 15a and b, 16a and b, 17a and b, and 18a and b. In addition, tables of daily-mean discharge are also provided (tables 19a, b, and c).

Suspended Sediment

Daily-mean loads of suspended-sediment varied from 0.00 to 79 tons/day over the period of record. Since discharge

Table 9. Discharge, concentration, and instantaneous loads of nutrients and suspended sediment samples collected from March 14, 2004, to March 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; e, value is estimated; --, not analyzed or measured; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Total nitrogen[a]		Nitrogen, nitrite + nitrate, dissolved		Total phosphorus		Suspended sediment	
				Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as P)	Load (lbs/day)	Conc. (mg/L)	Load (tons/day)
March 14, 2004	13:30	automated point sample	684	0.55	2,000	0.026	96	0.149	550	60	100
March 14, 2004	13:35	automated point sample	684	1.0	3,700	0.028	100	0.143	528	57	110
March 14, 2004	13:45	automated point sample	677	0.54	2,000	0.025	91	0.114	416	46	84
March 14, 2004	14:00	automated point sample	608	0.64	2,100	0.023	75	0.095	310	36	59
March 14, 2004	14:15	automated point sample	551	0.51	1,500	0.023	68	0.078	230	24	37
March 14, 2004	14:30	automated point sample	503	0.50	1,400	0.022	60	0.070	190	24	33
March 15, 2004	11:00	dip sample	503	0.22	600	0.036	98	0.029	79	5	7
March 15, 2004	11:01	automated point sample	504	0.19	520	0.034	92	0.031	84	--	--
October 20, 2004	09:30	automated point sample	6.5	0.16	5.6	0.037	1.3	0.012	0.42	--	--
October 20, 2004	09:35	discharge-weighted sample	6.5	0.15	5.3	0.034	1.2	0.013	0.46	--	--
October 20, 2004	09:45	automated point sample	8	0.20	8.6	0.036	2	0.011	0.5	--	--
November 15, 2004	03:00	automated point sample	47	29	7,400	0.086	22	3.12	790	10	1
November 15, 2004	03:05	automated point sample	47	0.46	120	0.088	22	0.034	8.6	9	1
November 15, 2004	03:15	automated point sample	66	0.64	130	0.108	38	0.048	17	18	3.2
November 15, 2004	03:30	automated point sample	47	0.76	190	0.105	27	0.065	16	28	3.5
November 15, 2004	03:45	automated point sample	99	0.68	360	0.095	51	0.081	43	34	9.1
November 15, 2004	04:00	automated point sample	103	0.60	330	0.088	49	0.071	39	20	6
November 15, 2004	10:33	automated point sample	149	0.28	220	0.038	31	0.021	17	--	--
November 15, 2004	10:35	discharge-weighted sample	149	0.25	200	0.043	35	0.022	18	--	--
November 15, 2004	10:44	discharge-weighted sample	149	0.25	200	0.038	31	0.020	16	--	--
November 25, 2004	09:45	automated point sample	23	0.26	32	0.077	9.6	0.042	5.2	1	0.1
November 25, 2004	10:30	automated point sample	25	e0.17	e23	0.097	13	0.006	0.8	2	0.1
November 29, 2004	22:15	automated point sample	24	2.2	280	0.113	15	0.170	22	16	1
November 29, 2004	22:20	automated point sample	24	0.33	43	0.067	8.7	0.017	2.2	3	0.2
November 29, 2004	22:30	automated point sample	26	0.21	29	0.073	10	0.008	1	3	0.2
November 29, 2004	22:45	automated point sample	28	0.18	27	0.073	11	0.009	1	4	0.3
November 29, 2004	23:00	automated point sample	29	0.30	47	0.073	11	0.015	2.3	5	0.4
November 29, 2004	23:15	automated point sample	30	0.18	29	0.069	11	0.009	1	3	0.2
November 30, 2004	10:48	automated point sample	19	0.17	17	0.036	3.7	0.012	1.2	--	--
November 30, 2004	10:50	discharge-weighted sample	19	0.15	15	0.037	3.8	0.009	0.9	--	--
November 30, 2004	10:51	automated point sample	19	0.14	14	0.038	3.9	0.008	0.8	--	--

Table 9. Discharge, concentration, and instantaneous loads of nutrients and suspended sediment samples collected from March 14, 2004, to March 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.—*Continued.*

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; e, value is estimated; --, not analyzed or measured; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Total nitrogen[a]		Nitrogen, nitrite + nitrate, dissolved		Total phosphorus		Suspended sediment	
				Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as P)	Load (lbs/day)	Conc. (mg/L)	Load (tons/day)
December 7, 2004	14:15	automated point sample	182	e0.45	e440	e0.011	e11	0.076	75	31	15
December 7, 2004	14:20	automated point sample	180	0.70	680	0.017	17	0.096	93	32	16
December 7, 2004	14:45	automated point sample	172	e0.28	e260	e0.014	e13	0.030	28	24	11
December 7, 2004	15:15	automated point sample	155	0.27	230	0.027	23	0.027	23	16	6.7
December 7, 2004	15:45	automated point sample	147	0.23	180	0.028	22	0.019	15	11	4.4
December 7, 2004	16:15	automated point sample	135	0.21	150	0.029	21	0.017	12	7	3
February 3, 2005	23:30	automated point sample	115	9.6	6,000	0.195	121	1.37	850	35	11
February 3, 2005	23:35	automated point sample	115	0.90	560	0.200	100	0.102	63.3	38	12
February 4, 2005	00:00	automated point sample	313	0.75	1,300	0.200	238	0.104	176	91	77
February 4, 2005	00:30	automated point sample	315	0.55	930	0.200	167	0.059	100	26	22
February 4, 2005	01:00	automated point sample	308	0.48	800	0.200	154	0.049	81	17	14
February 4, 2005	10:30	automated point sample	55	0.43	130	0.200	18	0.049	15	--	--
February 4, 2005	10:35	discharge-weighted sample	54	0.18	52	0.200	17	0.013	3.8	--	--
February 4, 2005	10:45	automated point sample	53	0.85	240	0.200	18	0.011	3.1	--	--
March 27, 2005	09:45	automated point sample	2.9	0.36	5.6	0.118	1.8	0.017	0.27	2	0.02
March 27, 2005	09:50	automated point sample	2.9	0.34	5.3	0.109	1.7	0.015	0.23	--	--
March 27, 2005	10:15	automated point sample	4.9	0.26	6.9	0.090	2.4	0.016	0.42	2	0.03
March 27, 2005	11:15	automated point sample	5.5	0.21	6.2	0.062	1.8	0.014	0.41	2	0.03
March 27, 2005	11:45	automated point sample	5.5	--	--	--	--	0.016	0.47	2	0.03
March 28, 2005	09:30	automated point sample	98	0.18	95	0.029	15	0.015	7.9	--	--
March 28, 2005	09:34	discharge-weighted sample	98	0.17	90	0.023	12	0.017	9.0	--	--
March 28, 2005	09:38	automated point sample	98	0.15	79	0.023	12	0.015	7.9	--	--
March 28, 2005	10:30	automated point sample	115	0.19	120	0.038	24	0.018	11	4	4
March 28, 2005	10:35	automated point sample	115	0.18	110	0.036	22	0.017	11	4	4
March 28, 2005	11:00	automated point sample	194	0.22	230	0.028	29	0.028	29	10	5.0
March 28, 2005	11:30	automated point sample	227	0.36	440	0.034	42	0.051	62	18	11
March 28, 2005	12:00	automated point sample	237	0.39	500	0.032	41	0.049	63	21	13
March 28, 2005	12:30	automated point sample	243	0.41	540	0.026	34	0.063	83	25	16
March 28, 2005	13:00	automated point sample	220	0.29	340	0.031	37	0.063	75	23	14
March 28, 2005	13:30	automated point sample	192	0.36	370	0.032	33	0.058	60	21	11
March 28, 2005	14:00	automated point sample	175	0.32	300	0.033	31	0.039	37	13	6.1
March 28, 2005	14:30	automated point sample	166	0.18	160	0.024	21	0.024	21	9	4
March 28, 2005	15:00	automated point sample	161	0.19	160	0.024	21	0.020	17	6	3
March 28, 2005	15:30	automated point sample	155	0.21	180	0.034	28	0.019	16	6	3

Table 9. Discharge, concentration, and instantaneous loads of nutrients and suspended sediment samples collected from March 14, 2004, to March 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.—*Continued.*

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; e, value is estimated; --, not analyzed or measured; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Total nitrogen[a]		Nitrogen, nitrite + nitrate, dissolved		Total phosphorus		Suspended sediment	
				Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as P)	Load (lbs/day)	Conc. (mg/L)	Load (tons/day)
March 30, 2005	00:30	automated point sample	130	0.18	130	0.059	41	0.016	11	4	1
March 30, 2005	00:35	automated point sample	138	0.23	170	0.060	45	0.018	13	5	2
March 30, 2005	01:00	automated point sample	235	0.28	350	0.054	68	0.030	38	10	6.0
March 30, 2005	01:30	automated point sample	277	0.31	460	0.050	75	0.046	69	15	11
March 30, 2005	02:00	automated point sample	268	0.25	360	0.043	62	0.030	43	11	8.0
March 30, 2005	02:30	automated point sample	257	0.22	304	0.037	51	0.029	40	10	7.0

[a] Total nitrogen is calculated by adding nitrogen, total organic + ammonia (Kjeldahl), to nitrogen, nitrite + nitrate, dissolved. If the concentration value of nitrogen, nitrite + nitrate, dissolved, is estimated and below the minimum reporting level, the concentration value of total nitrogen is reported as the sum of the values shown for nitrogen, total organic + ammonia (Kjeldahl) and nitrogen, nitrite + nitrate, dissolved, and noted as estimated.

Table 10. Discharge, concentration, and instantaneous loads of suspended sediment, for samples collected without associated nutrient analyses, from March 15, 2004, to August 7, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Suspended sediment	
				Conc. (mg/L)	Load (tons/day)
March 15, 2004	12:30	automated point sample	362	9	9
March 15, 2004	14:30	automated point sample	161	6	3
March 15, 2004	16:30	automated point sample	97	5	1
March 15, 2004	20:30	automated point sample	49	2	0.3
March 16, 2004	04:30	automated point sample	22	1	0.1
March 16, 2004	14:30	automated point sample	11	1	0.03
March 23, 2004	21:30	automated point sample	84	10	2.3
March 23, 2004	21:45	automated point sample	109	10	2.9
March 23, 2004	22:00	automated point sample	147	13	5.2
March 23, 2004	22:15	automated point sample	158	19	8.1
March 23, 2004	22:30	automated point sample	173	21	9.8
March 23, 2004	22:45	automated point sample	163	20	8.8
March 23, 2004	23:00	automated point sample	165	18	8.0
March 23, 2004	23:15	automated point sample	173	15	7.0
March 23, 2004	23:30	automated point sample	220	16	9.5
March 23, 2004	23:45	automated point sample	247	20	13
March 24, 2004	00:01	automated point sample	267	24	17
March 24, 2004	00:15	automated point sample	267	23	17
March 24, 2004	21:30	automated point sample	215	8	5
March 24, 2004	21:45	automated point sample	232	5	3
March 24, 2004	22:00	automated point sample	262	5	4
March 24, 2004	22:15	automated point sample	272	6	4
March 24, 2004	22:30	automated point sample	293	5	4
March 24, 2004	22:45	automated point sample	296	4	3
March 24, 2004	23:00	automated point sample	301	4	3
March 24, 2004	23:15	automated point sample	285	4	3
March 24, 2004	23:30	automated point sample	345	4	4
March 24, 2004	23:45	automated point sample	288	4	3
March 25, 2004	00:01	automated point sample	277	4	3
March 25, 2004	00:15	automated point sample	262	3	2
April 12, 2004	09:30	automated point sample	477	46	59
April 12, 2004	09:45	automated point sample	489	20	26
April 12, 2004	10:00	automated point sample	470	20	25
April 12, 2004	10:15	automated point sample	474	18	23
April 12, 2004	10:30	automated point sample	474	16	20
April 12, 2004	10:45	automated point sample	511	17	23
April 12, 2004	11:00	automated point sample	508	17	23
April 12, 2004	11:15	automated point sample	526	20	28
April 12, 2004	11:30	automated point sample	536	22	32
April 12, 2004	11:45	automated point sample	545	17	25
April 12, 2004	12:00	automated point sample	514	20	28
April 12, 2004	12:15	automated point sample	533	33	47
February 4, 2005	07:45	automated point sample	42	20	2.3
February 4, 2005	08:15	automated point sample	35	16	1.5
February 4, 2005	08:45	automated point sample	28	14	1.1
February 4, 2005	09:15	automated point sample	21	11	0.62
February 4, 2005	09:45	automated point sample	15	10	0.40

Table 10. Discharge, concentration, and instantaneous loads of suspended sediment, for samples collected without associated nutrient analyses, from March 15, 2004, to August 7, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.—*Continued.*

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Suspended sediment	
				Conc. (mg/L)	Load (tons/day)
February 4, 2005	10:15	automated point sample	9.3	8	0.2
February 4, 2005	10:45	automated point sample	5.6	6	0.1
March 30, 2005	12:02	automated point sample	62	12	2.0
March 30, 2005	12:05	discharge-weighted sample	62	14	2.3
March 30, 2005	12:09	automated point sample	61	12	2.0
August 7, 2005	11:15	automated point sample	143	463	179
August 7, 2005	11:30	automated point sample	262	1430	1010
August 7, 2005	12:00	automated point sample	334	780	703
August 7, 2005	12:15	automated point sample	359	654	633
August 7, 2005	12:30	automated point sample	452	624	761

was zero for a majority of the days during the period of record, the median value of mean-daily load for suspended sediment was zero. The annual load of suspended sediment during water year 2004 was 522 tons, and the annual load during water year 2005 was 298 tons.

Nutrients

Daily-mean loads of total nitrogen, dissolved nitrite plus nitrate, and total phosphorus varied from 0.00 to 1,350, 0.00 to 13, and 0.00 to 300 lbs/day, respectively, over the period of record. Since discharge was zero for a majority of the days during the period of record, the median value of mean-daily load for all of these constituents was zero. The annual loads for total nitrogen, dissolved nitrite plus nitrate, and total phosphorus during water year 2004 were 9,650, 328, and 1,430 lbs. The annual loads for total nitrogen, dissolved nitrite plus nitrate, and total phosphorus during water year 2005 were 5,820, 180, and 752 lbs, respectively.

Waiakea Stream at Hilo (16701300)

Daily-mean loads of suspended-sediment and nutrient constituents for Waiakea Stream at Hilo for water years 2004 and 2005 are shown in figures 16*A* and 16*B*, and tables 20*A* and *B*, 21*A* and B, 22*A* and *B*, and 23*A* and *B*. In addition, tables of daily-mean discharge are also provided (tables 24*A*, *B*, and *C*).

Suspended Sediment

Daily-mean loads of suspended-sediment varied from 0.00 to 468 tons/day over the period of record. Since discharge was zero for a majority of the days during the period of record, the median value of mean-daily load for suspended sediment was zero. The annual load of suspended sediment during water year 2004 was 114 tons, and the annual load during water year 2005 was 700 tons.

Nutrients

Daily-mean loads of total nitrogen, dissolved nitrite plus nitrate, and total phosphorus varied from 0.00 to 913, 0.00 to 8.5, and 0.00 to 176 lbs/day, respectively, over the period of record. Since discharge was zero for a majority of the days during the period of record, the median value of mean-daily load for all of these constituents was zero. The annual loads for total nitrogen, dissolved nitrite plus nitrate, and total phosphorus during water year 2004 were 4,420, 82.3, and 754 lbs, respectively. The annual loads for total nitrogen, dissolved nitrite plus nitrate, and total phosphorus during water year 2005 were 1,110, 19.8, and 153 lbs, respectively.

Daily-Mean Load Trends

For the two sites on Waiakea Stream, all of the maximum daily-mean loads for the different constituents occurred in the first year of data collection, except for an estimated suspended sediment load for the lower site, which was on September 15, 2005. As mentioned before, this increase in suspended sediment load in water year 2005 was likely due to construction activities in the stream channel at the West Kawailani Road bridge, which began on September 27, 2004, and ended June 1, 2005. Only events with low discharge occurred between September 27, 2004, when construction started, and August 7, 2005, when the suspended sediment sample was collected with higher concentration. No sampling was done for the storm of September 15-18, 2005, storm, thus the maximum is an esti-

Table 11. Discharge, concentration and instantaneous loads of nutrients and suspended sediment for samples collected from March 14, 2004, to March 30, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; e, value is estimated; --, not analyzed or measured; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Total nitrogen[a]		Nitrogen, nitrite + nitrate, dissolved		Total phosphorus		Suspended sediment	
				Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as P)	Load (lbs/day)	Conc. (mg/L)	Load (tons/day)
March 14, 2004	15:00	automated point sample	362	1.0	2,000	0.028	55	0.174	340	57	56
March 14, 2004	15:05	automated point sample	362	0.89	1,700	0.024	47	0.169	330	47	46
March 14, 2004	15:15	automated point sample	362	0.76	1,500	0.026	51	0.138	269	47	46
March 14, 2004	15:30	automated point sample	367	0.69	1,400	0.022	44	0.112	222	34	34
March 14, 2004	15:45	automated point sample	337	0.59	1,100	0.019	34	0.096	174	29	26
March 14, 2004	16:00	automated point sample	318	0.48	820	0.018	31	0.084	140	22	19
March 15, 2004	12:15	dip sample	419	0.22	500	0.038	86	0.035	79	8	9
March 15, 2004	12:16	automated point sample	419	0.26	590	0.031	70	0.055	120	8	9
February 4, 2005	07:30	automated point sample	44	0.35	83	0.084	20	0.043	10	--	--
February 4, 2005	08:00	automated point sample	38	0.30	61	0.087	18	0.032	6.6	--	--
February 4, 2005	08:30	automated point sample	32	0.28	48	0.079	14	0.030	5.2	--	--
February 4, 2005	09:00	automated point sample	23	0.23	29	0.061	7.6	0.033	4.1	--	--
February 4, 2005	09:30	automated point sample	18	0.27	26	0.094	9.1	0.027	2.6	--	--
February 4, 2005	10:00	automated point sample	12	0.29	19	0.102	6.6	0.023	1.5	--	--
February 4, 2005	10:30	automated point sample	7.5	0.26	11	0.113	4.6	0.021	0.85	--	--
February 4, 2005	11:00	automated point sample	3.9	0.27	5.7	0.121	2.5	0.022	0.46	--	--
March 28, 2005	13:45	automated point sample	20	0.31	33	0.021	2.3	0.079	8.5	58	3.1
March 28, 2005	13:50	automated point sample	20	e0.26	e28	e0.014	e1.5	0.089	9.6	63	3.4
March 28, 2005	14:00	automated point sample	26	0.33	46	0.017	2.4	0.120	17	85	6.0
March 28, 2005	14:15	automated point sample	28	0.43	65	0.017	2.6	0.140	21	76	5.7
March 28, 2005	14:30	automated point sample	28	e0.30	e45	e0.014	e2.1	0.097	15	55	4.2
March 28, 2005	14:45	automated point sample	26	0.36	50	0.017	2.4	0.102	14	46	3.2
March 30, 2005	02:30	automated point sample	38	0.23	47	0.049	10	0.028	5.7	16	1.6
March 30, 2005	02:35	automated point sample	41	0.24	53	0.049	11	0.040	8.8	20	2.2
March 30, 2005	02:45	automated point sample	49	0.24	63	0.049	13	0.035	9.3	21	2.8
March 30, 2005	03:00	automated point sample	52	0.32	90	0.051	14	0.049	14	25	3.5
March 30, 2005	03:15	automated point sample	54	0.32	93	0.049	14	0.061	18	32	4.7
March 30, 2005	03:30	automated point sample	58	0.33	100	0.048	15	0.075	23	41	6.4
March 30, 2005	11:54	automated point sample	62	0.25	84	0.038	13	0.040	13	--	--
March 30, 2005	11:57	discharge-weighted sample	62	0.21	70	0.038	13	0.030	10	--	--
March 30, 2005	12:00	automated point sample	62	0.22	74	0.039	13	0.032	11	--	--

[a] Total nitrogen is calculated by adding nitrogen, total organic + ammonia (Kjeldahl), to nitrogen, nitrite + nitrate, dissolved. If the concentration value of nitrogen, nitrite + nitrate, dissolved, is estimated and below the minimum reporting level, the concentration value of total nitrogen is reported as the sum of the values shown for nitrogen, total organic + ammonia (Kjeldahl) and nitrogen, nitrite + nitrate, dissolved, and noted as estimated.

Table 12. Discharge, concentration and instantaneous loads of suspended sediment, for samples collected without associated nutrient analyses, from November 9, 2005, to January 26, 2006, Alenaio Stream at Kilauea Avenue Bridge (16701650), Hilo, Hawaii.

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant. (ft^3/s)	Suspended sediment	
				Conc. (mg/L)	Load (tons/day)
November 9, 2005	15:18	automated point sample	--	6	--
November 9, 2005	15:28	automated point sample	--	6	--
November 9, 2005	16:02	automated point sample	--	6	--
November 9, 2005	16:15	automated point sample	--	6	--
January 26, 2006	10:45	automated point sample	--	62	--
January 26, 2006	13:11	automated point sample	--	12	--
January 26, 2006	14:28	automated point sample	--	5	--

mate based on the relation between sample concentration and discharge for the August 7 sample.

Maximum daily-mean load values were not all caused by a single storm event. In some cases, some samples had lower constituent concentrations than samples from other events, but flows were higher, resulting in higher daily-mean loads.

Along Waiakea Stream, concentrations and daily-mean loads were higher at the upstream site than the lower site for a given storm in 2004 (fig. 17). However, during the storm event beginning on March 27, 2005 (fig. 18), the maximum concentrations of suspended sediment and total nitrogen were nearly equal, yet the loads were much less at the lower site due to less discharge. During the latter part of water year 2005, possibly due to the construction in the stream channel mentioned above, the suspended sediment load was higher at the lower site (fig. 19), but since no nutrient samples were collected during both the August 7 and September 15, 2005, storms, it is uncertain what affect the construction had on nutrient loads. Nutrient concentrations and loads were estimated for the storms on August 7 and September 15, 2005 at the lower site.

In general, storms that were not sampled have estimated data. The estimated loads, for storms that were not sampled, are influenced by the concentrations and loads from samples collected from preceding and/or proceeding events. During any given year of sampling, the more storms with collected samples, the more validity and confidence in these estimations. A combination of sampling thoroughly over the length of an event, with a range of event sizes, durations, and patterns to characterize the manner in which concentration varies during a storm, and, at least, a few samples collected for every peak would allow more confidence in the continuous record.

Summary

Nutrient and suspended-sediment samples were collected during wet-weather streamflow conditions at three sites in the vicinity of Hilo, Hawaii, during October 2003 to March 2006. Two sites on Waiakea Stream, and one site on Alenaio Stream were selected to represent different land-use types in the area. Discharge was measured at the two sites on Waiakea Stream. For Alenaio Stream at Kilauea Avenue Bridge, a stage/discharge relation was not created due to hydraulic problems in the channel. Manual discharge measurements were made at the site, and a second site collected discharge data about 0.47 miles upstream of the sampling site to supplement discharge information at the lower site.

During 2003 to 2006, 267 suspended sediment samples and 136 nutrient samples were collected at the three sites. Using the analyses from the Waiakea Stream sites, continuous records of daily-mean loads were computed using a graphical technique that combines continuous discharge data with concentration data for samples collected at each sampling site. No daily-mean load record was computed for Alenaio Stream at Kilauea Avenue Bridge due to the problems with computing the discharge record at this site.

For the daily-mean load record at the two sites on Waiakea Stream, the maximum daily-mean loads occurred in 2004, except for suspended sediment load at the lower site, which reached its maximum value during the latter part of 2005. In a similar manner, the continuous record of daily-mean loads during 2004 showed higher daily-mean loads per storm event for suspended sediments and nutrients at the upstream site, Waiakea Stream at Hoaka Road, relative to the downstream site, Waiakea Stream at Hilo. During the latter part of 2005, however, the loads were higher at the downstream site than the upstream site for suspended sediment. A construction project within the stream channel during 2004-2005 may have been the source of increased suspended sediment at the lower site.

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Figures 15 through 19 and tables 13 through 24

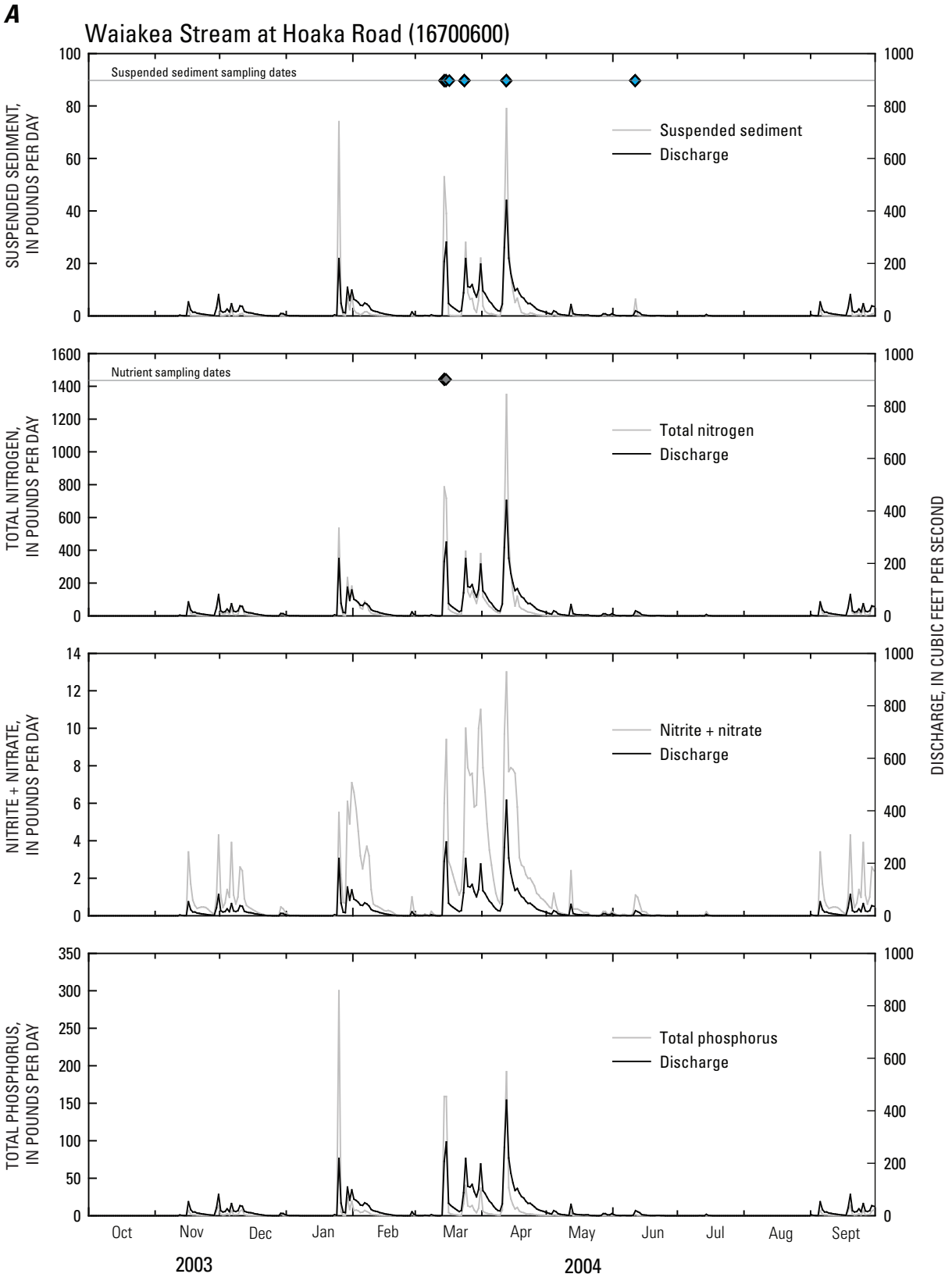

Figure 15. Daily-mean loads of suspended sediment and nutrients at Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii: (*A*) October 1, 2003, to September 30, 2004, (*B*) October 1, 2004, to September 30, 2005.

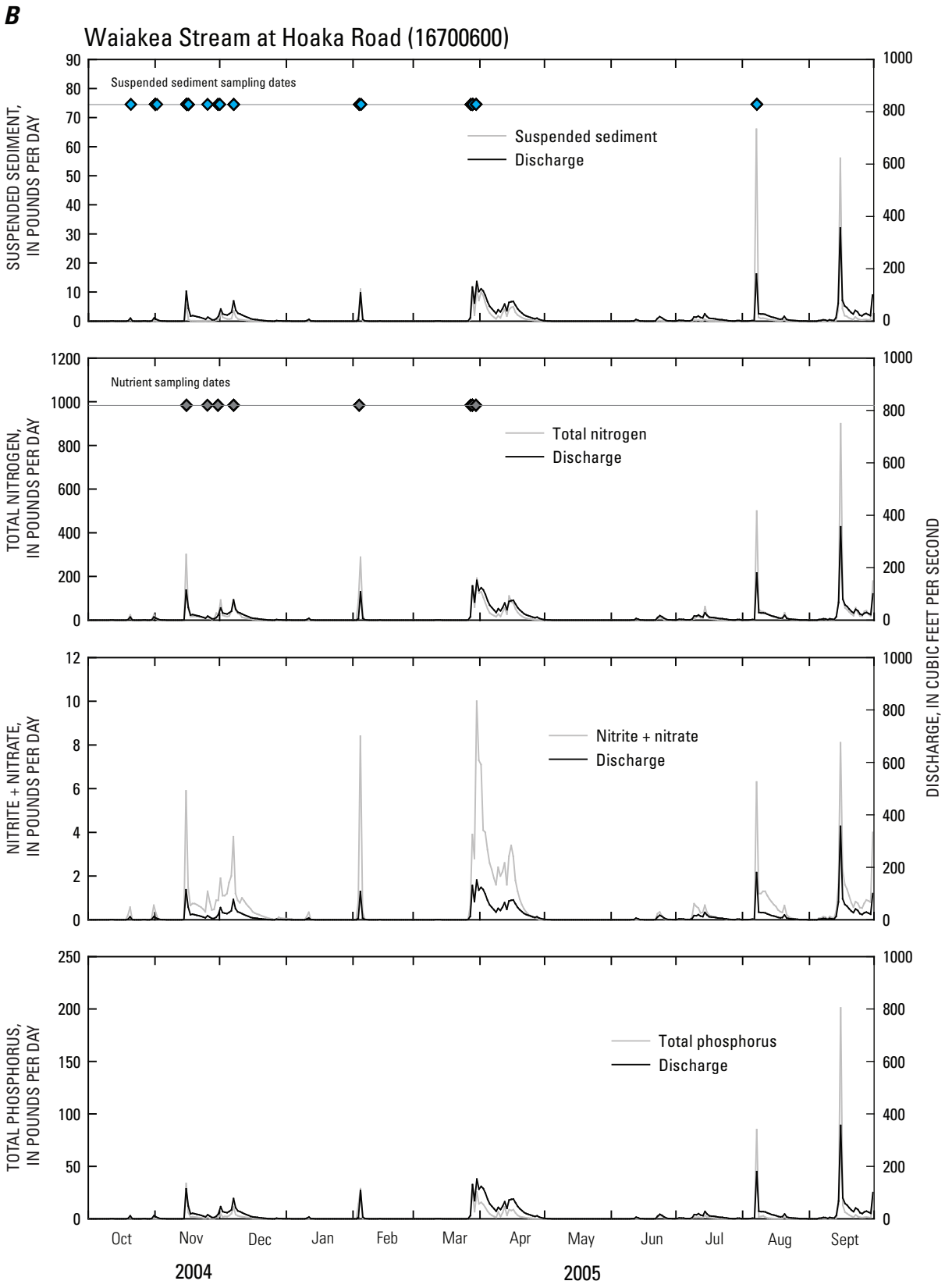

Figure 15. Daily-mean loads of suspended sediment and nutrients at Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii: (*A*) October 1, 2003, to September 30, 2004, (*B*) October 1, 2004, to September 30, 2005.—*Continued.*

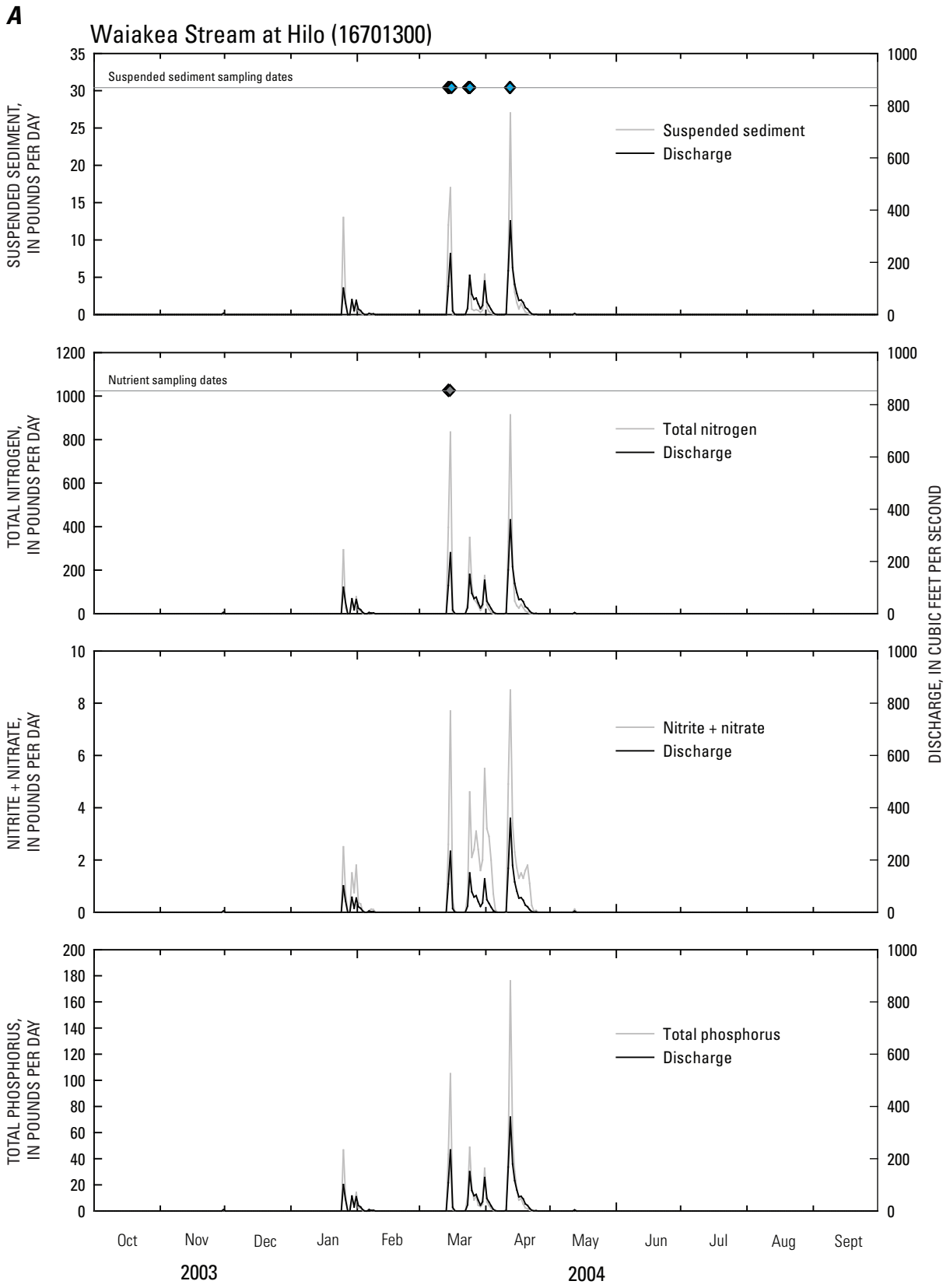

Figure 16. Daily-mean loads of suspended sediment and nutrients at Waiakea Stream at Hilo (16701300), Hilo, Hawaii: (*A*) October 1, 2003, to September 30, 2004, (*B*) October 1, 2004 to September 30, 2005.

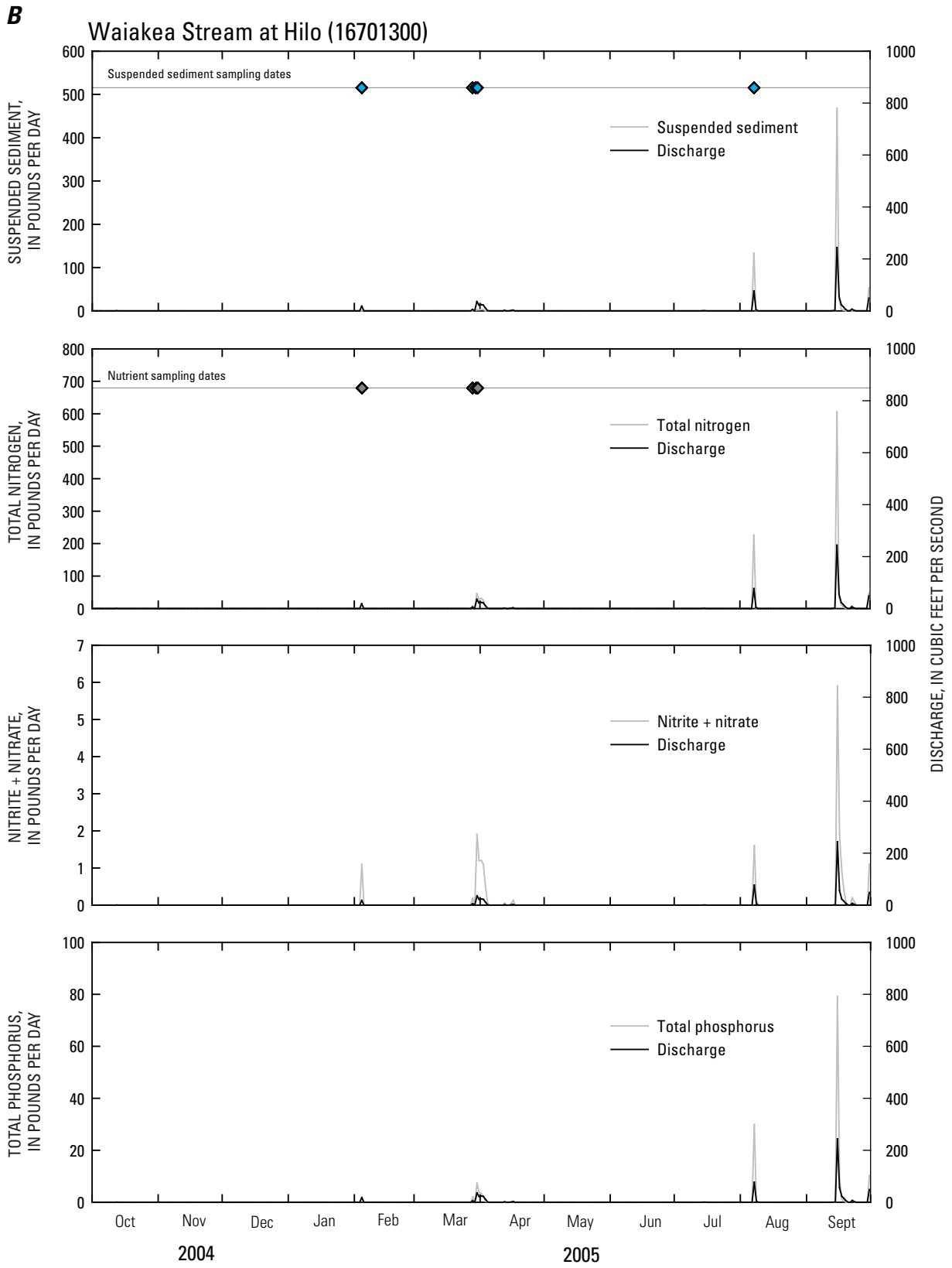

Figure 16. Daily-mean loads of suspended sediment and nutrients at Waiakea Stream at Hilo (16701300), Hilo, Hawaii: (*A*) October 1, 2003, to September 30, 2004, (*B*) October 1, 2004, to September 30, 2005.—*Continued.*

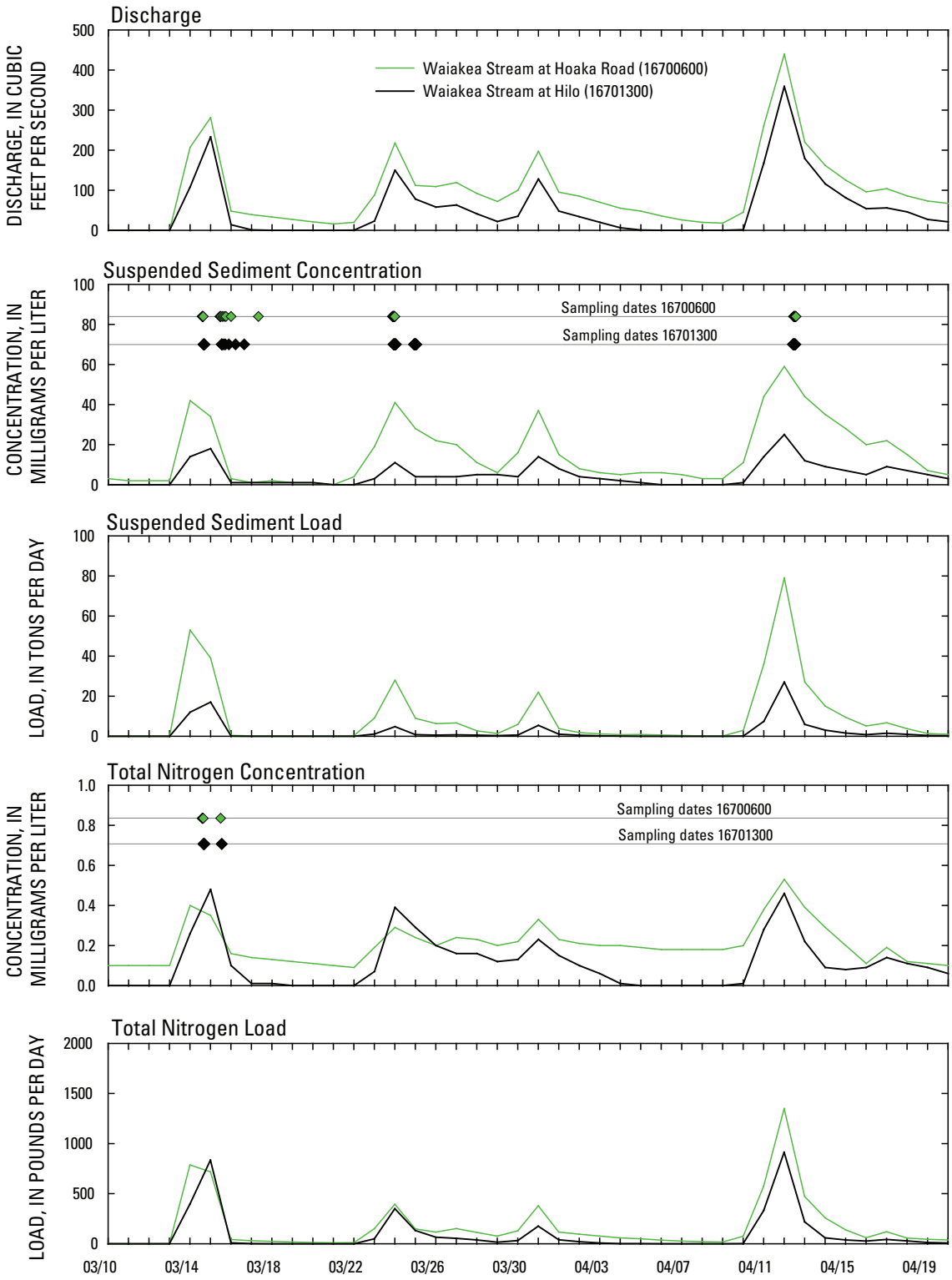

Figure 17. Daily-mean concentration and load for suspended sediment and total nitrogen, and daily-mean discharge, for sites Waiakea Stream at Hoaka Road (16700600) and Waiakea Stream at Hilo (16701300) during early March 2004, Hilo, Hawaii.

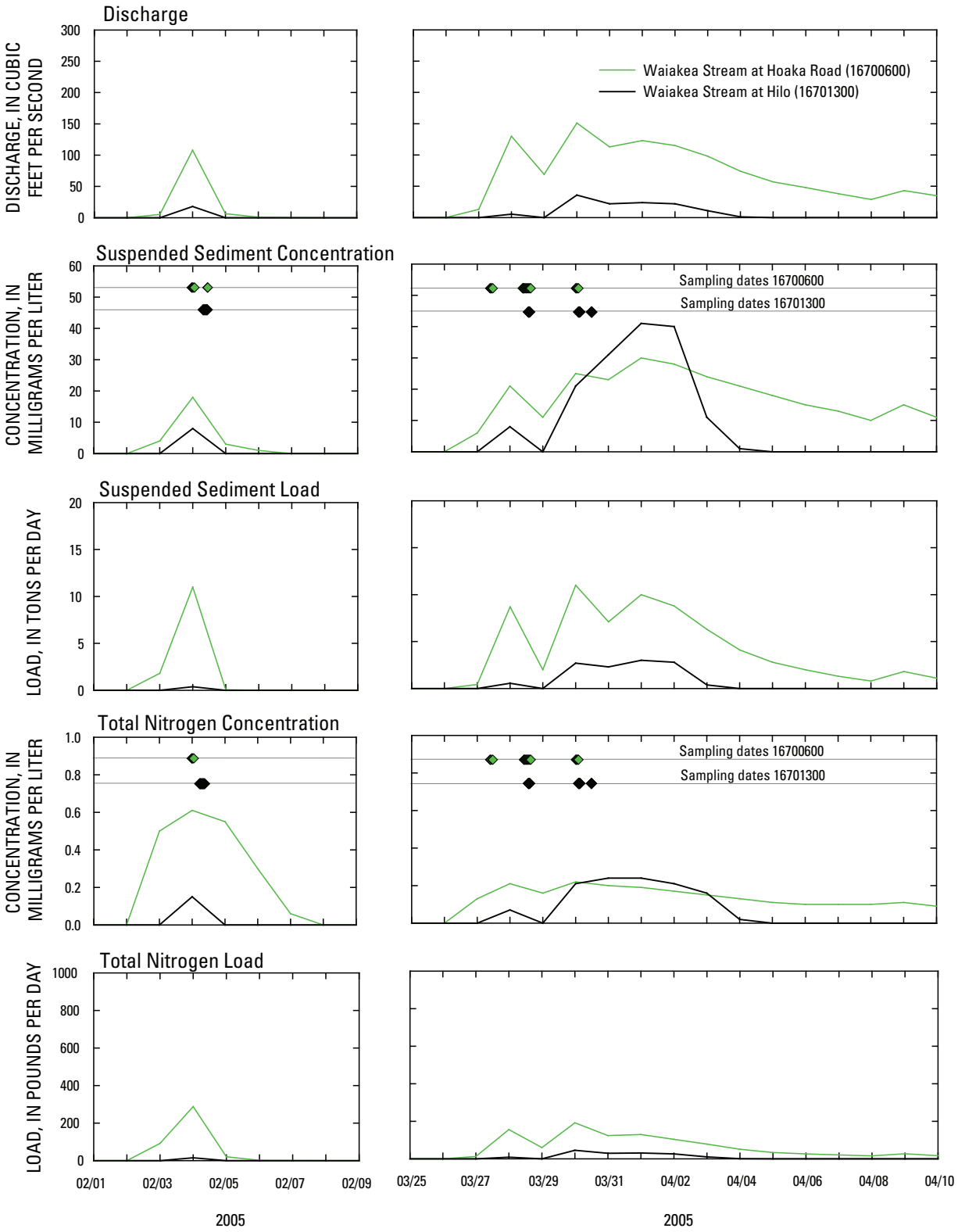

Figure 18. Daily-mean concentration and load for suspended sediment and total nitrogen, and daily-mean discharge, for sites Waiakea Stream at Hoaka Road (16700600) and Waiakea Stream at Hilo (16701300) during early February and late March 2005, Hilo, Hawaii.

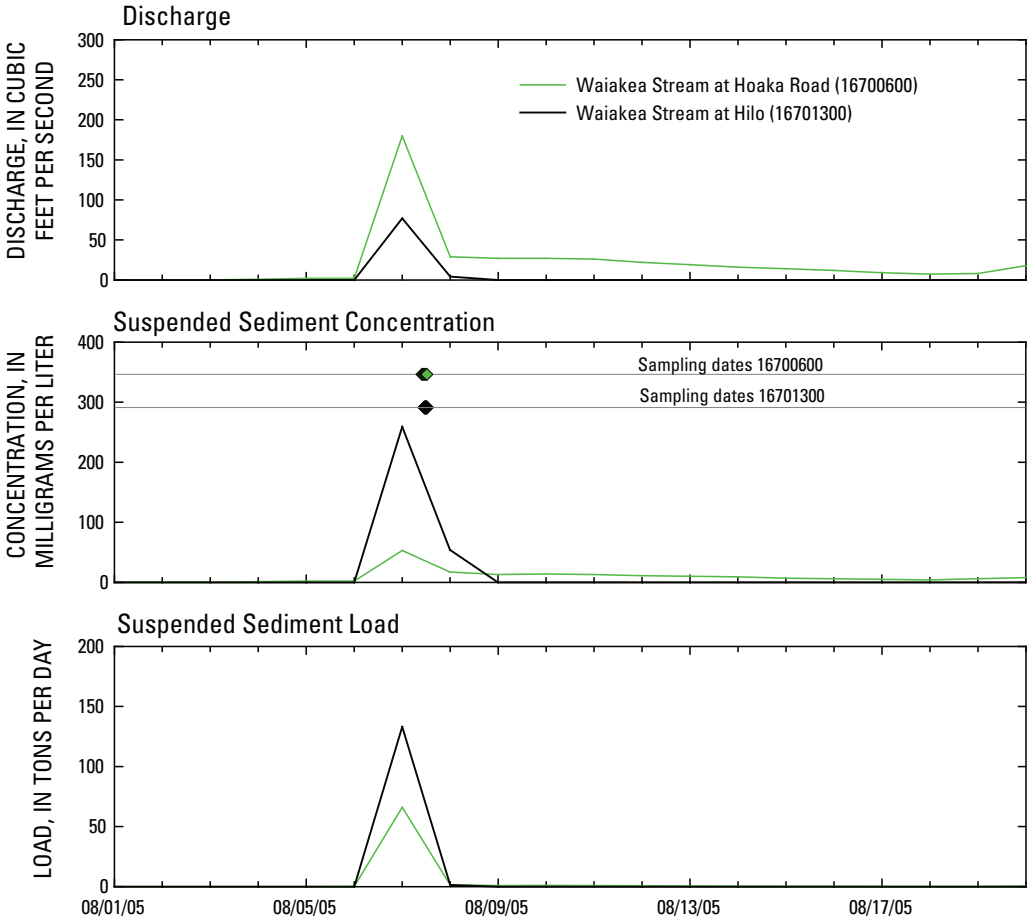

Figure 19. Daily-mean concentration and load for suspended sediment, and daily-mean discharge, for sites Waiakea Stream at Hoaka Road (16700600) and Waiakea Stream at Hilo (16701300) during early August, 2005 Hilo, Hawaii.

Table 13. Discharge, concentration and instantaneous loads of nutrients and suspended sediment for samples collected from November 9, 2005, to March 9, 2006, Alenaio Stream at Kilauea Avenue Bridge (16701650), Hilo, Hawaii.

[hh:mm, hours and minutes; Conc., concentration; Load, computed from concentration value and discharge value for each sample; e, value is estimated; --, not analyzed or measured; ft^3/s, cubic feet per second; mg/L,milligrams per liter; lbs/day, pounds per day]

Date	Mean time (hh:mm)	Sample type	Discharge, instant.[a] (ft^3/s)	Total nitrogen[b]		Nitrogen, nitrite + nitrate, dissolved		Total phosphorus		Suspended sediment	
				Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as N)	Load (lbs/day)	Conc. (mg/L as P)	Load (lbs/day)	Conc. (mg/L)	Load (tons/day)
November 9, 2005	13:32	automated point sample	42.6	0.66	150	0.075	17	0.063	14	9	1
November 9, 2005	13:46	automated point sample	42.9	0.28	65	0.075	17	0.022	5.1	7	0.8
November 9, 2005	15:17	automated point sample	32.8	0.27	48	0.074	13	0.019	3.4	--	--
November 9, 2005	15:27	automated point sample	32.8	0.24	42	0.073	13	0.018	3.2	--	--
November 9, 2005	16:00	automated point sample	--	0.26	--	0.071	--	0.019	--	--	--
November 9, 2005	16:10	discharge-weighted sample	--	0.25	--	0.088	--	0.018	--	9	--
November 9, 2005	16:14	automated point sample	--	0.25	--	0.070	--	0.018	--	--	--
January 26, 2006	09:45	automated point sample	--	e0.50	--	e0.011	--	0.096	--	182	--
January 26, 2006	10:00	automated point sample	--	0.62	--	0.025	--	0.100	--	113	--
January 26, 2006	10:15	automated point sample	--	0.54	--	0.020	--	0.188	--	67	--
January 26, 2006	10:30	automated point sample	--	0.50	--	0.024	--	0.145	--	58	--
January 26, 2006	11:00	automated point sample	--	0.35	--	0.023	--	0.103	--	56	--
January 26, 2006	13:08	automated point sample	--	0.36	--	0.069	--	0.064	--	--	--
January 26, 2006	13:09	discharge-weighted sample	--	0.47	--	0.073	--	0.043	--	--	--
January 26, 2006	14:26	automated point sample	--	0.31	--	0.097	--	0.097	--	--	--
January 26, 2006	14:27	discharge-weighted sample	--	0.28	--	0.097	--	0.020	--	--	--
January 26, 2006	16:00	automated point sample	--	0.36	--	0.099	--	0.015	--	12	--
January 26, 2006	16:15	automated point sample	371	0.43	860	0.097	190	0.043	86	23	23
January 26, 2006	16:30	automated point sample	371	0.56	1,100	0.100	200	0.066	130	48	48
January 26, 2006	16:45	automated point sample	--	0.66	--	0.099	--	0.036	--	53	--
January 26, 2006	17:00	automated point sample	--	0.59	--	0.092	--	0.064	--	50	--
January 26, 2006	17:15	automated point sample	--	0.60	--	0.077	--	0.078	--	45	--
March 9, 2006	07:15	automated point sample	--	0.70	--	0.085	--	0.184	--	95	--
March 9, 2006	07:30	automated point sample	--	0.76	--	0.085	--	0.174	--	96	--
March 9, 2006	07:45	automated point sample	--	0.83	--	0.086	--	0.194	--	101	--
March 9, 2006	08:00	automated point sample	--	0.84	--	0.086	--	0.192	--	90	--
March 9, 2006	08:15	automated point sample	--	0.75	--	0.084	--	0.154	--	108	--
March 9, 2006	08:30	automated point sample	--	0.70	--	0.084	--	0.160	--	88	--
March 9, 2006	14:15	automated point sample	494	0.32	850	0.132	352	0.028	75	15	20
March 9, 2006	14:30	automated point sample	581	0.32	1,000	0.135	423	0.025	78	14	22
March 9, 2006	14:45	automated point sample	615	0.32	1,100	0.136	451	0.028	93	14	23
March 9, 2006	15:00	automated point sample	493	0.31	820	0.138	367	0.023	61	14	19
March 9, 2006	15:15	automated point sample	448	0.29	700	0.141	341	0.027	65	13	16
March 9, 2006	15:30	automated point sample	550	0.28	830	0.141	418	0.021	62	14	21

[a] Discharge measurements at this site were made by using a previously determined cross-section geometry, depth measurements, and a radar gun to estimate surface velocity.

[b] Total nitrogen is calculated by adding nitrogen, total organic + ammonia (Kjeldahl), to nitrogen, nitrite + nitrate, dissolved. If the concentration value of nitrogen, nitrite + nitrate, dissolved, is estimated and below the minimum reporting level, the concentration value of total nitrogen is reported as the sum of the values shown for nitrogen, total organic + ammonia (Kjeldahl) and nitrogen, nitrite + nitrate, dissolved, and noted as estimated.

Table 14. Statistical summary of discharge, suspended sediment and nutrient concentrations, and instaneous loads, for Waiakea Stream at Hoaka Road, Waiakea Stream at Hilo, and Alenaio Stream at Kilauea Avenue Bridge, Hilo, Hawaii.

[ft^3/s, cubic feet per second; mg/L, milligrams per liter; lbs/day, pounds per day]

Parameter	Number of samples	Maximum	Associated discharge for maximum concentration or load	Minimum	Associated discharge for minimum concentration or load
Waiakea Stream at Hoaka Road (16700600)					
Discharge (ft^3/s) (for suspended sediment samples only)	155	1,000	--	2.9	--
Suspended sediment (mg/L)	155	201	105	<1	39
Inst. load, suspended sediment (tons/day)	155	170	1,000	<0.1	39
Discharge (ft3/s) (for nutrient samples only)	71	684	--	2.9	--
Total nitrogen (mg/L)	70	29	47	0.14	19
Inst. load, total nitrogen (lbs/day)	70	7,400	47	5.3	2.9
Nitrogen, nitrite + nitrate, dissolved (mg/L)	70	0.200	315	0.011	182
Inst. load, nitrogen, nitrite + nitrate, dissolved (lbs/day)	70	238	313	1.7	2.9
Total phosphorus (mg/L)	71	3.12	47	0.006	25
Inst. load, total phosphorus (lbs/day)	71	850	115	0.23	2.9
Waiakea Stream at Hilo (16701300)					
Discharge (ft^3/s) (for suspended sediment samples only)	77	545	--	5.6	--
Suspended sediment (mg/L)	77	1,430	262	1	11
Inst. load, suspended sediment (tons/day)	77	1,010	262	0.03	11
Discharge (ft^3/s) (for nutrient samples only)	31	419	--	3.9	--
Total nitrogen (mg/L)	31	1.0	362	0.21	62
Inst. load, total nitrogen (lbs/day)	31	2,000	362	5.7	3.9
Nitrogen, nitrite + nitrate, dissolved (mg/L)	31	0.121	3.9	0.014	20
Inst. load, nitrogen, nitrite + nitrate, dissolved (lbs/day)	31	86**	419	1.5	20
	31				
Total phosphorus (mg/L)	31	0.174	362	0.021	7.5
Inst. load, total phosphorus (lbs/day)	31	340	362	0.46	3.9
Alenaio Stream at Kilauea Avenue Bridge (16701650)					
Discharge (ft^3/s) (for suspended sediment samples only)*	10	615	--	32.8	--
Suspended sediment (mg/L)	33	182	no measurement	5	no measurement
Inst. load, suspended sediment (tons/day)	10	48	371	0.8	42.9
Discharge (ft^3/s) (for nutrient samples only)*	12	615	--	32.8	--
Total nitrogen (mg/L)	34	0.84	no measurement	0.24	32.8
Inst. load, total nitrogen (lbs/day)*	12	1,100	371	42	32.8
Nitrogen, nitrite + nitrate, dissolved (mg/L)	34	0.141	550	0.011	no measurement
Inst. load, nitrogen, nitrite + nitrate, dissolved (lbs/day)*	12	451	615	13	32.8
Total phosphorus (mg/L)	34	0.194	no measurement	0.015	no measurement
Inst. load, total phosphorus (lbs/day)*	12	130	371	3.2	32.8

* Some of the samples at this site had no associated discharge measurements, thus loads were not calculated.

** Grab sample.

Table 15*A*. Daily-mean loads of suspended sediment during October 1, 2003, to September 30, 2004, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Suspended sediment discharge, tons per day
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.17	e0.00	e2.3	e0.00	e3.8	e0.09	e0.02	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.14	e0.00	e1.2	e0.00	e1.8	e0.06	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.25	e0.00	e0.97	e0.00	e1.2	e0.04	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.56	e0.00	e0.40	e0.00	e0.75	e0.38	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.12	e0.00	e0.89	e0.01	e0.81	e0.24	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e2.5	e0.00	e1.5	e0.00	e0.57	e0.10	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.16	e0.00	e1.6	e0.00	e0.35	e0.06	e0.00	e0.00	e0.00	e0.00
8	e0.00	e0.00	e0.12	e0.00	e0.94	e0.04	e0.15	e0.04	e0.00	e0.00	e0.00	e0.00
9	e0.00	e0.00	e0.20	e0.00	e0.49	e0.00	e0.15	e0.02	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.72	e0.00	e0.36	e0.00	e2.9	e0.01	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.94	e0.00	e0.29	e0.00	e36	e0.00	e6.4	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.17	e0.00	e0.24	e0.00	e79	e2.4	e0.31	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.13	e0.00	e0.18	e0.00	e27	e0.13	e0.17	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.10	e0.00	e0.13	e53	e15	e0.07	e0.04	e0.24	e0.00	e0.00
15	e0.00	e0.00	e0.08	e0.00	e0.09	e39	e9.4	e0.05	e0.03	e0.00	e0.00	e0.00
16	e0.00	e2.5	e0.06	e0.00	e0.06	e0.41	e5.1	e0.04	e0.02	e0.00	e0.00	e0.00
17	e0.00	e0.22	e0.04	e0.00	e0.04	e0.12	e6.7	e0.03	e0.00	e0.00	e0.00	e0.00
18	e0.00	e0.08	e0.03	e0.00	e0.03	e0.15	e3.7	e0.02	e0.00	e0.00	e0.00	e0.00
19	e0.00	e0.10	e0.02	e0.00	e0.01	e0.09	e1.3	e0.02	e0.00	e0.00	e0.00	e0.00
20	e0.00	e0.02	e0.01	e0.00	e0.00	e0.04	e0.96	e0.01	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.01	e0.57	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.28	e0.53	e0.00	e0.00	e0.00	e0.00	e0.00
23	e0.00	e0.00	e0.00	e0.05	e0.00	e9.1	e1.1	e0.00	e0.00	e0.00	e0.00	e0.00
24	e0.00	e0.00	e0.00	e0.01	e0.00	e28	e0.97	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e74	e0.00	e8.9	e0.65	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e3.1	e0.00	e6.3	e0.33	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.34	e0.00	e6.6	e0.25	e0.06	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.15	e0.25	e2.7	e0.20	e0.07	e0.00	e0.00	e0.00	e0.00
29	e0.00	e2.7	e0.07	e6.8	e0.04	e1.3	e0.16	e0.02	e0.00	e0.00	e0.00	e0.00
30	e0.00	e6.0	e0.03	e2.4	---	e5.9	e0.12	e0.00	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e0.01	e7.7	---	e22	---	e0.08	---	e0.00	e0.00	---
TOTAL	0.00	11.62	6.63	94.55	12.01	183.95	201.52	4.04	6.99	0.24	0.00	0.00
MAX	0.00	6.0	2.5	74	2.3	53	79	2.4	6.4	0.24	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	265.77	371.41	564.37	526.08	1808.74	2454	192.44	67.04	6.33	0.04	0.00

WTR YR 2004 TOTAL 521.55 MEAN 1.4 MAX 79 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 15*B*. Daily-mean loads of suspended sediment during October 1, 2004, to September 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Suspended sediment discharge, tons per day
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	0.06	e2.7	e0.00	e0.00	e0.00	e10	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.02	e1.3	e0.00	e0.00	e0.00	e8.8	e0.00	e0.00	e0.02	e0.00	e0.00
3	e0.00	e0.00	e0.99	e0.00	1.8	e0.00	e6.3	e0.00	e0.00	e0.01	e0.00	e0.00
4	e0.00	e0.00	e0.75	e0.00	11	e0.00	e4.1	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.67	e0.00	e0.05	e0.00	e2.8	e0.00	e0.00	e0.00	e0.00	e0.02
6	e0.00	e0.00	e0.83	e0.00	e0.00	e0.00	e2.0	e0.00	e0.00	e0.00	e0.04	e0.02
7	e0.00	e0.00	e3.5	e0.00	e0.00	e0.00	e1.3	e0.00	e0.00	e0.00	66	e0.04
8	e0.00	e0.00	e1.5	e0.00	e0.00	e0.00	e0.79	e0.00	e0.00	e0.05	e1.3	e0.02
9	e0.00	e0.00	e0.74	e0.00	e0.00	e0.00	e1.8	e0.00	e0.00	e0.28	e0.93	e0.00
10	e0.00	e0.00	e0.48	e0.01	e0.00	e0.00	e1.1	e0.00	e0.00	e0.25	e1.0	e0.05
11	e0.00	e0.00	e0.45	e0.05	e0.00	e0.00	e2.8	e0.00	e0.00	e0.33	e0.88	e0.03
12	e0.00	e0.00	e0.33	e0.00	e0.00	e0.00	e4.0	e0.00	e0.07	e0.17	e0.67	e0.02
13	e0.00	e0.00	e0.24	e0.00	e0.00	e0.00	e1.7	e0.00	e0.02	e0.14	e0.51	e0.19
14	e0.00	e0.00	e0.17	e0.00	e0.00	e0.00	e3.9	e0.00	e0.00	e0.66	e0.38	e3.7
15	e0.00	5.6	e0.09	e0.00	e0.00	e0.00	e4.7	e0.00	e0.00	e0.23	e0.27	e56
16	e0.00	0.50	e0.06	e0.00	e0.00	e0.00	e4.9	e0.00	e0.00	e0.09	e0.20	e4.3
17	e0.00	e0.12	e0.05	e0.00	e0.00	e0.00	e3.0	e0.00	e0.00	e0.07	e0.11	e1.9
18	e0.00	e0.12	e0.04	e0.00	e0.00	e0.00	e2.1	e0.00	e0.00	e0.06	e0.08	e1.6
19	e0.06	e0.12	e0.02	e0.00	e0.00	e0.00	e1.6	e0.00	e0.00	e0.05	e0.16	e1.1
20	0.31	e0.10	e0.01	e0.00	e0.00	e0.00	e1.2	e0.00	e0.00	e0.03	e0.46	e0.78
21	e0.00	e0.09	e0.01	e0.00	e0.00	e0.00	e0.87	e0.00	e0.00	e0.02	e0.02	e0.53
22	e0.00	e0.08	e0.00	e0.00	e0.00	e0.00	e0.64	e0.00	e0.12	e0.02	e0.01	e1.4
23	e0.00	e0.06	e0.00	e0.00	e0.00	e0.00	e0.49	e0.00	e0.17	e0.01	e0.00	e0.79
24	e0.00	e0.04	e0.00	e0.00	e0.00	e0.00	e0.38	e0.00	e0.11	e0.00	e0.00	e0.48
25	e0.00	0.15	e0.00	e0.00	e0.00	e0.00	e0.27	e0.00	e0.03	e0.00	e0.00	e0.40
26	e0.00	e0.11	e0.00	e0.00	e0.00	e0.00	e0.19	e0.00	e0.00	e0.00	e0.00	e0.50
27	e0.00	e0.05	e0.01	e0.00	e0.00	0.43	e0.19	e0.00	e0.00	e0.00	e0.00	e0.53
28	e0.00	e0.11	e0.00	e0.00	e0.00	8.7	e0.10	e0.00	e0.00	e0.00	e0.00	e0.44
29	e0.00	0.30	e0.00	e0.00	---	e2.0	e0.04	e0.00	e0.00	e0.01	e0.00	e0.36
30	e0.00	0.40	e0.00	e0.00	---	11	e0.02	e0.00	e0.00	e0.00	e0.00	e8.8
31	0.12	---	e0.00	e0.00	---	e7.1	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.49	8.03	14.94	0.06	12.85	29.23	72.08	0.00	0.52	2.50	73.02	84.00
MAX	0.31	5.6	3.5	0.05	11	11	10	0.00	0.17	0.66	66	56
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
TOTAL Q	26.02	358.72	473.60	9.15	120.59	476.18	1328.6	1.21	62.44	207.37	441.08	1074.80

WTR YR 2005 TOTAL 297.72 MEAN 0.82 MAX 66 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 16*A*. Daily-mean loads of total nitrogen during October 1, 2003, to September 30, 2004, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Total nitrogen, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e18.6	e0.63	e104	e0.64	e116	e2.34	e3.70	e0.00	e0.00	e0.00
2	e0.00	e0.00	e11.8	e0.10	e93.3	e0.22	e95.8	e1.45	e1.50	e0.00	e0.00	e0.00
3	e0.00	e0.00	e14.2	e0.00	e79.4	e0.18	e76.5	e0.97	e0.52	e0.00	e0.00	e0.00
4	e0.00	e0.00	e21.3	e0.00	e49.1	e0.17	e58.1	e2.79	e0.23	e0.00	e0.00	e0.00
5	e0.00	e0.00	e9.37	e0.02	e41.3	e0.66	e49.6	e2.15	e0.50	e0.00	e0.00	e0.00
6	e0.00	e0.00	e39.2	e0.00	e89.4	e0.41	e36.0	e1.03	e0.51	e0.00	e0.00	e0.00
7	e0.00	e0.00	e8.06	e0.00	e72.8	e0.07	e25.7	e0.67	e0.21	e0.00	e0.00	e0.00
8	e0.00	e0.00	e6.23	e0.00	e32.2	e1.90	e19.4	e0.49	e0.06	e0.00	e0.00	e0.00
9	e0.00	e0.00	e9.80	e0.00	e16.6	e0.63	e17.5	e0.36	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e48.0	e0.00	e12.5	e0.11	e73.9	e0.24	e0.92	e0.00	e0.00	e0.00
11	e0.00	e0.00	e57.0	e0.00	e10.3	e0.00	e574	e0.16	e15.5	e0.27	e0.00	e0.00
12	e0.00	e1.07	e9.68	e0.00	e8.54	e0.00	e1350	e55.7	e11.7	e0.00	e0.00	e0.00
13	e0.00	e0.05	e6.38	e0.00	e6.78	e0.33	e472	e8.78	e7.01	e0.00	e0.00	e0.00
14	e0.00	e0.00	e4.93	e0.00	e5.08	786	e259	e5.25	e1.00	e3.86	e0.00	e0.00
15	e0.00	e0.01	e3.99	e0.00	e3.51	e717	e139	e3.81	e0.12	e0.74	e0.00	e0.00
16	e0.00	e71.2	e2.92	e0.00	e2.53	e42.0	e59.9	e3.22	e0.06	e0.06	e0.00	e0.00
17	e0.00	e16.6	e1.99	e0.00	e2.04	e30.1	e119	e2.63	e0.02	e0.00	e0.00	e0.00
18	e0.00	e7.80	e1.27	e0.00	e1.30	e22.8	e57.0	e1.92	e0.00	e0.00	e0.00	e0.00
19	e0.00	e6.66	e0.73	e0.00	e0.72	e16.9	e43.6	e3.67	e0.00	e0.00	e0.00	e0.00
20	e0.00	e3.89	e0.39	e0.00	e0.33	e12.1	e38.2	e3.46	e0.00	e0.00	e0.00	e0.00
21	e0.00	e2.78	e0.17	e0.00	e0.13	e8.60	e29.6	e0.51	e0.00	e0.00	e0.00	e0.00
22	e0.00	e2.14	e0.03	e0.00	e0.05	e9.91	e23.6	e0.10	e0.00	e0.00	e0.00	e0.00
23	e0.00	e1.58	e0.00	e2.40	e0.00	e149	e21.8	e0.00	e0.00	e0.00	e0.00	e0.00
24	e0.00	e1.13	e0.00	e0.87	e0.00	e394	e17.9	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.73	e0.00	e534	e0.00	e148	e13.8	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.44	e0.00	e48.4	e0.00	e116	e9.58	e0.50	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.26	e0.00	e4.25	e0.00	e152	e7.33	e6.05	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.11	e0.00	e1.57	e17.1	e113	e5.70	e7.10	e0.00	e0.00	e0.00	e0.00
29	e0.00	e53.8	e9.52	e233	e3.20	e76.6	e4.54	e2.15	e0.00	e0.00	e0.00	e0.00
30	e0.00	e119	e8.22	e106	---	e129	e3.39	e2.36	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e2.50	e181	---	e379	---	e8.56	---	e0.00	e0.00	---
TOTAL	0.00	289.25	296.28	1112.24	652.21	3307.33	3817.44	128.42	43.56	4.93	0.00	0.00
MAX	0.00	119	57.0	534	104	786	1350	55.7	15.5	3.86	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	3.39	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	265.77	371.41	564.37	526.08	1808.74	2454	192.44	67.04	6.33	0.04	0.00

WTR YR 2004 TOTAL 9651.66 MEAN 26.4 MAX 1350 MIN 0.00 MED 0.03

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 16*B*. Daily-mean loads of total nitrogen during October 1, 2004, to September 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Total nitrogen, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e6.50	e91.3	e0.10	e0.00	e0.00	e129	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e1.35	e21.6	e0.10	0.00	e0.00	e104	e0.00	e0.00	e0.36	e0.00	e0.00
3	e0.00	e0.02	e18.3	e0.00	91.7	e0.00	e77.8	e0.00	e0.00	e0.31	e0.00	e0.00
4	e0.00	e0.00	e16.4	e0.00	e288	e0.00	e50.9	e0.00	e0.00	e0.06	e0.00	e0.00
5	e0.00	e0.00	e18.3	e0.00	e20.1	e0.00	e32.9	e0.00	e0.00	e0.00	e0.00	e2.07
6	e0.00	e0.00	e40.2	e0.00	e1.40	e0.00	e25.8	e0.00	e0.00	e0.00	e0.68	e2.48
7	e0.00	e0.00	87.3	e0.00	e0.06	e0.00	e20.4	e0.00	e0.00	e0.00	e499	e4.68
8	e0.00	e0.00	e44.0	e0.00	e0.00	e0.00	e15.7	e0.00	e0.00	e3.30	e49.6	e3.61
9	e0.00	e0.00	e30.2	e0.00	e0.00	e0.00	e27.0	e0.00	e0.00	e4.99	e39.2	e1.13
10	e0.00	e0.00	e25.0	e2.00	e0.00	e0.00	e16.7	e0.00	e0.00	e14.9	e38.2	e4.11
11	e0.00	e0.00	e13.0	e1.68	e0.00	e0.00	e37.3	e0.00	e0.00	e17.0	e33.7	e2.55
12	e0.00	e0.00	e10.3	e0.02	e0.00	e0.00	e55.2	e0.00	e3.51	e10.4	e26.9	e1.62
13	e0.00	e0.00	e7.80	e0.00	e0.00	e0.00	e27.4	e0.00	e0.81	e9.98	e22.1	e18.2
14	e0.00	e0.00	e6.20	e0.00	e0.00	e0.00	e110	e0.00	e0.00	e61.3	e18.0	e77.1
15	e0.00	300	e4.70	e0.00	e0.00	e0.00	e82.8	e0.00	e0.00	e19.5	e14.2	e899
16	e0.00	e52.8	e2.90	e0.00	e0.00	e0.00	e77.5	e0.00	e0.00	e6.31	e11.6	e106
17	e0.00	e15.1	e2.30	e0.00	e0.00	e0.00	e50.2	e0.00	e0.00	e4.75	e7.89	e55.6
18	e0.00	e15.9	e1.90	e0.00	e0.00	e0.00	e34.5	e0.00	e0.00	e3.92	e5.85	e47.4
19	e2.75	e16.6	e1.60	e0.00	e0.00	e0.00	e24.5	e0.00	e0.00	e2.93	e7.66	e36.4
20	23.5	e16.0	e1.10	e0.00	e0.00	e0.00	e17.2	e0.00	e0.00	e1.90	e33.0	e27.0
21	e0.15	e15.0	e0.90	e0.00	e0.00	e0.00	e11.4	e0.00	e0.00	e1.25	e9.05	e20.2
22	e0.00	e13.9	e0.60	e0.00	e0.00	e0.00	e7.87	e0.00	e8.01	e0.97	e4.94	e56.9
23	e0.00	e12.0	e0.30	e0.00	e0.00	e0.00	e5.82	e0.00	e11.4	e0.47	e3.16	e32.2
24	e0.00	e9.21	e0.10	e0.00	e0.00	e0.00	e4.28	e0.00	e8.69	e0.19	e2.01	e18.7
25	e0.00	14.8	e0.10	e0.00	e0.00	e0.00	e2.89	e0.00	e1.94	e0.02	e1.21	e17.2
26	e0.01	e6.98	e0.00	e0.00	e0.00	e0.00	e1.83	e0.00	e0.08	e0.00	e0.49	e40.2
27	e0.00	e2.63	e0.00	e0.00	e0.00	12.5	e1.57	e0.00	e0.00	e0.00	e0.11	e43.3
28	e0.00	e7.24	e0.50	e0.00	e0.00	156	e0.67	e0.00	e0.00	e0.00	e0.01	e25.4
29	e0.00	31.9	e0.30	e0.00	---	e59.5	e0.19	e0.00	e0.00	e0.00	e0.00	e17.8
30	e0.23	16.6	e0.20	e0.00	---	192	e0.01	e0.00	e0.00	e0.00	e0.00	e179
31	e24.7	---	e0.10	e0.00	---	e124	---	e0.00	---	e0.00	e0.00	---
TOTAL	51.34	554.53	447.50	3.90	401.26	544.00	1053.33	0.00	34.44	164.81	828.56	1739.85
MAX	24.7	300	91.3	2.00	288	192	129	0.00	11.4	61.3	499	899
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
TOTAL Q	26.02	358.72	473.60	9.15	120.59	476.18	1328.6	1.21	62.44	207.37	441.08	1074.80

WTR YR 2005 TOTAL 5823.52 MEAN 16.0 MAX 899 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 17*A*. Daily-mean loads of nitrogen, nitrite plus nitrate, dissolved, during October 1, 2003, to September 30, 2004, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Nitrogen, nitrite + nitrate, dissolved, lbs/day as N
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e1.1	e0.09	e6.6	e0.08	e7.9	e0.61	e0.13	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.44	e0.02	e5.7	e0.04	e6.6	e0.46	e0.07	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.68	e0.00	e4.5	e0.03	e4.9	e0.39	e0.03	e0.00	e0.00	e0.00
4	e0.00	e0.00	e1.4	e0.00	e3.2	e0.03	e3.5	e1.2	e0.02	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.98	e0.01	e2.5	e0.09	e2.7	e0.57	e0.07	e0.00	e0.00	e0.00
6	e0.00	e0.00	e3.9	e0.00	e3.2	e0.05	e1.9	e0.23	e0.07	e0.00	e0.00	e0.00
7	e0.00	e0.00	e1.1	e0.00	e3.7	e0.00	e1.2	e0.15	e0.03	e0.00	e0.00	e0.00
8	e0.00	e0.00	e0.62	e0.00	e3.2	e0.23	e0.83	e0.12	e0.00	e0.00	e0.00	e0.00
9	e0.00	e0.00	e1.0	e0.00	e1.4	e0.10	e0.65	e0.09	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e2.6	e0.00	e0.63	e0.02	e1.5	e0.06	e0.19	e0.00	e0.00	e0.00
11	e0.00	e0.00	e2.4	e0.00	e0.53	e0.00	e9.7	e0.04	e1.1	e0.02	e0.00	e0.00
12	e0.00	e0.00	e0.90	e0.00	e0.49	e0.00	e13	e2.4	e0.98	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.55	e0.00	e0.43	e0.06	e7.7	e0.36	e0.61	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.45	e0.00	e0.36	6.0	e7.9	e0.36	e0.22	e0.21	e0.00	e0.00
15	e0.00	e0.00	e0.39	e0.00	e0.28	9.4	e7.8	e0.36	e0.22	e0.06	e0.00	e0.00
16	e0.00	e3.4	e0.32	e0.00	e0.25	e2.9	e7.6	e0.30	e0.19	e0.00	e0.00	e0.00
17	e0.00	e1.7	e0.25	e0.00	e0.28	e2.6	e5.8	e0.23	e0.07	e0.00	e0.00	e0.00
18	e0.00	e0.83	e0.18	e0.00	e0.24	e2.2	e3.1	e0.16	e0.03	e0.00	e0.00	e0.00
19	e0.00	e0.54	e0.13	e0.00	e0.18	e1.8	e2.7	e0.18	e0.00	e0.00	e0.00	e0.00
20	e0.00	e0.39	e0.09	e0.00	e0.10	e1.4	e2.6	e0.15	e0.02	e0.00	e0.00	e0.00
21	e0.00	e0.43	e0.06	e0.00	e0.04	e1.1	e2.2	e0.03	e0.05	e0.00	e0.00	e0.00
22	e0.00	e0.46	e0.03	e0.00	e0.02	e1.4	e2.0	e0.01	e0.05	e0.00	e0.00	e0.00
23	e0.00	e0.46	e0.00	e0.00	e0.00	e3.4	e2.0	e0.00	e0.02	e0.00	e0.00	e0.00
24	e0.00	e0.44	e0.00	e0.00	e0.00	e10	e1.8	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.36	e0.00	e5.5	e0.00	e7.9	e1.6	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.24	e0.00	e2.2	e0.00	e7.5	e1.2	e0.06	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.16	e0.00	e0.71	e0.00	e7.6	e1.1	e0.23	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.08	e0.00	e0.66	e1.0	e5.8	e0.94	e0.23	e0.00	e0.00	e0.00	e0.00
29	e0.00	e1.0	e0.47	e6.1	e0.22	e5.9	e0.86	e0.10	e0.00	e0.00	e0.00	e0.00
30	e0.00	e4.3	e0.37	e4.9	---	e10	e0.75	e0.09	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e0.20	e7.1	---	e11	---	e0.24	---	e0.00	e0.00	---
TOTAL	0.00	14.79	20.61	27.29	39.05	98.63	114.03	9.41	4.17	0.29	0.00	0.00
MAX	0.00	4.3	3.9	7.1	6.6	11	13	2.4	1.1	0.21	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.65	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	265.77	371.41	564.37	526.08	1808.74	2454	192.44	67.04	6.33	0.04	0.00

WTR YR 2004 TOTAL 328.27 MEAN 0.90 MAX 13 MIN 0.00 MED 0.01

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 17*B*. Daily-mean loads of nitrogen, nitrite plus nitrate, dissolved, during October 1, 2004, to September 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Nitrogen, nitrite + nitrate, dissolved, lbs/day as N
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.30	e1.9	e0.05	e0.00	e0.00	e7.1	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.05	e1.1	e0.04	e0.00	e0.00	e4.1	e0.00	e0.00	e0.03	e0.00	e0.00
3	e0.00	e0.00	e1.1	e0.04	0.85	e0.00	e4.0	e0.00	e0.00	e0.02	e0.00	e0.00
4	e0.00	e0.00	e1.2	e0.00	8.4	e0.00	e3.2	e0.00	e0.00	e0.02	e0.00	e0.00
5	e0.00	e0.00	e1.7	e0.00	e0.38	e0.00	e2.6	e0.00	e0.00	e0.00	e0.00	e0.07
6	e0.00	e0.00	e2.0	e0.00	e0.04	e0.00	e2.3	e0.00	e0.00	e0.00	e0.02	e0.08
7	e0.00	e0.00	3.8	e0.00	e0.00	e0.00	e1.9	e0.00	e0.00	e0.00	e6.3	e0.14
8	e0.00	e0.00	e1.2	e0.00	e0.00	e0.00	e1.6	e0.00	e0.00	e0.11	e1.2	e0.12
9	e0.00	e0.00	e0.89	e0.00	e0.00	e0.00	e2.4	e0.00	e0.00	e0.73	e1.2	e0.04
10	e0.00	e0.00	e0.77	e0.13	e0.00	e0.00	e2.0	e0.00	e0.00	e0.61	e1.3	e0.15
11	e0.00	e0.00	e1.0	e0.34	e0.00	e0.00	e2.2	e0.00	e0.00	e0.53	e1.3	e0.09
12	e0.00	e0.00	e0.86	e0.00	e0.00	e0.00	e2.6	e0.00	e0.00	e0.31	e1.1	e0.08
13	e0.00	e0.00	e0.72	e0.00	e0.00	e0.00	e1.6	e0.00	e0.00	e0.33	e0.94	e0.39
14	e0.00	e0.00	e0.61	e0.00	e0.00	e0.00	e2.9	e0.00	e0.00	e0.66	e0.82	e1.6
15	e0.00	5.9	e0.50	e0.00	e0.00	e0.00	e3.4	e0.00	e0.00	e0.34	e0.69	e8.1
16	e0.00	e1.5	e0.36	e0.00	e0.00	e0.00	e2.9	e0.00	e0.00	e0.20	e0.61	e2.3
17	e0.00	e0.65	e0.30	e0.00	e0.00	e0.00	e1.8	e0.00	e0.00	e0.17	e0.45	e1.6
18	e0.00	e0.74	e0.26	e0.00	e0.00	e0.00	e1.3	e0.00	e0.00	e0.15	e0.37	e1.4
19	e0.20	e0.74	e0.23	e0.00	e0.00	e0.00	e0.94	e0.00	e0.00	e0.12	e0.33	e1.1
20	0.57	e0.69	e0.18	e0.00	e0.00	e0.00	e0.69	e0.00	e0.00	e0.08	e0.65	e0.78
21	e0.00	e0.63	e0.15	e0.00	e0.00	e0.00	e0.49	e0.00	e0.00	e0.06	e0.23	e0.58
22	e0.00	e0.57	e0.11	e0.00	e0.00	e0.00	e0.35	e0.00	e0.28	e0.06	e0.13	e0.83
23	e0.00	e0.48	e0.08	e0.00	e0.00	e0.00	e0.25	e0.00	e0.35	e0.04	e0.08	e0.75
24	e0.00	e0.36	e0.05	e0.00	e0.00	e0.00	e0.18	e0.00	e0.17	e0.02	e0.05	e0.55
25	e0.00	e1.3	e0.04	e0.00	e0.00	e0.00	e0.12	e0.00	e0.06	e0.01	e0.03	e0.53
26	e0.00	e0.83	e0.00	e0.00	e0.00	e0.00	e0.08	e0.00	e0.00	e0.00	e0.01	e0.75
27	e0.00	e0.45	e0.00	e0.00	e0.00	0.60	e0.06	e0.00	e0.00	e0.00	e0.00	e0.90
28	e0.00	e0.47	e0.11	e0.00	e0.00	3.9	e0.02	e0.00	e0.00	e0.00	e0.00	e0.86
29	e0.00	e0.89	e0.07	e0.00	---	e2.8	e0.00	e0.00	e0.00	e0.00	e0.00	e0.80
30	e0.05	0.89	e0.06	e0.00	---	10	e0.00	e0.00	e0.00	e0.00	e0.00	e4.0
31	e0.66	---	e0.05	e0.00	---	e7.3	---	e0.00	---	e0.00	e0.00	---
TOTAL	1.48	17.44	21.40	0.60	9.67	24.60	53.08	0.00	0.86	4.60	17.81	28.59
MAX	0.66	5.9	3.8	0.34	8.4	10	7.1	0.00	0.35	0.73	6.3	8.1
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	26.02	358.72	473.60	9.15	120.59	476.18	1328.6	1.21	62.44	207.37	441.08	1074.80

WTR YR 2005 TOTAL 180.13 MEAN 0.49 MAX 10 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 18*A*. Daily-mean loads of total phosphorus during October 1, 2003, to September 30, 2004, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Phosphorus, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e1.60	e0.01	e6.74	e0.11	e5.62	e0.40	e0.16	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.88	e0.00	e7.57	e0.04	e4.07	e0.28	e0.06	e0.00	e0.00	e0.00
3	e0.00	e0.00	e1.06	e0.00	e6.57	e0.03	e3.12	e0.22	e0.02	e0.00	e0.00	e0.00
4	e0.00	e0.00	e2.56	e0.00	e4.39	e0.02	e2.37	e0.95	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.95	e0.00	e4.68	e0.11	e2.01	e0.62	e0.03	e0.00	e0.00	e0.00
6	e0.00	e0.00	e6.55	e0.00	e6.83	e0.06	e1.46	e0.22	e0.02	e0.00	e0.00	e0.00
7	e0.00	e0.00	e1.36	e0.00	e5.56	e0.00	e1.03	e0.12	e0.00	e0.00	e0.00	e0.00
8	e0.00	e0.00	e1.40	e0.00	e3.85	e0.46	e0.74	e0.08	e0.00	e0.00	e0.00	e0.00
9	e0.00	e0.00	e1.59	e0.00	e1.64	e0.12	e0.65	e0.06	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e6.18	e0.00	e1.25	e0.02	e7.56	e0.04	e0.06	e0.00	e0.00	e0.00
11	e0.00	e0.00	e7.93	e0.00	e1.05	e0.00	e97.3	e0.03	e1.21	e0.02	e0.00	e0.00
12	e0.00	e0.01	e1.21	e0.00	e0.89	e0.00	e192	e4.94	e0.52	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.75	e0.00	e0.73	e0.04	e37.4	e0.26	e0.21	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.59	e0.00	e0.56	e159	e22.6	e0.16	e0.03	e0.32	e0.00	e0.00
15	e0.00	e0.01	e0.49	e0.00	e0.40	e159	e14.5	e0.12	e0.02	e0.03	e0.00	e0.00
16	e0.00	e6.79	e0.37	e0.00	e0.30	e4.02	e8.84	e0.11	e0.01	e0.00	e0.00	e0.00
17	e0.00	e2.00	e0.26	e0.00	e0.25	e2.22	e11.0	e0.09	e0.00	e0.00	e0.00	e0.00
18	e0.00	e1.20	e0.18	e0.00	e0.17	e1.71	e6.18	e0.07	e0.00	e0.00	e0.00	e0.00
19	e0.00	e1.09	e0.11	e0.00	e0.10	e1.23	e4.67	e0.09	e0.00	e0.00	e0.00	e0.00
20	e0.00	e0.80	e0.07	e0.00	e0.05	e0.83	e3.86	e0.08	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.63	e0.04	e0.00	e0.02	e0.55	e2.78	e0.02	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.51	e0.01	e0.00	e0.00	e0.55	e2.04	e0.00	e0.00	e0.00	e0.00	e0.00
23	e0.00	e0.40	e0.00	e0.30	e0.00	e15.9	e2.23	e0.00	e0.00	e0.00	e0.00	e0.00
24	e0.00	e0.31	e0.00	e0.09	e0.00	e40.4	e1.87	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.22	e0.00	e300	e0.00	e13.1	e1.57	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.15	e0.00	e5.16	e0.00	e11.8	e1.08	e0.03	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.10	e0.00	e0.34	e0.00	e13.5	e0.87	e0.36	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.06	e0.00	e0.10	e2.26	e7.51	e0.73	e0.43	e0.00	e0.00	e0.00	e0.00
29	e0.00	e6.33	e2.87	e23.9	e0.57	e3.96	e0.63	e0.11	e0.00	e0.00	e0.00	e0.00
30	e0.00	e13.5	e0.69	e8.29	---	e10.0	e0.52	e0.09	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e0.11	e19.3	---	e36.8	---	e0.42	---	e0.00	e0.00	---
TOTAL	0.00	34.11	39.81	357.49	56.43	483.09	441.30	10.40	2.35	0.37	0.00	0.00
MAX	0.00	13.5	7.93	300	7.57	159	192	4.94	1.21	0.32	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	265.77	371.41	564.37	526.08	1808.74	2454	192.44	67.04	6.33	0.04	0.00

WTR YR 2004 TOTAL 1425.35 MEAN 3.89 MAX 300 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 18*B*. Daily-mean loads of total phosphorus during October 1, 2004, to September 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Phosphorus, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.22	e4.55	e0.01	e0.00	e0.00	e15.6	e0.00	e0.00	e0.05	e0.00	e0.00
2	e0.00	e0.05	e1.82	e0.00	e0.00	e0.00	e13.6	e0.00	e0.00	e0.29	e0.00	e0.00
3	e0.00	e0.00	e2.16	e0.00	13.9	e0.00	e10.7	e0.00	e0.00	e0.16	e0.00	e0.00
4	e0.00	e0.00	e2.03	e0.00	28.7	e0.00	e7.03	e0.00	e0.00	e0.17	e0.03	e0.00
5	e0.00	e0.00	e2.97	e0.00	e0.29	e0.00	e4.64	e0.00	e0.00	e0.07	e0.07	e0.10
6	e0.00	e0.00	e4.99	e0.00	e0.02	e0.00	e3.26	e0.00	e0.00	e0.04	e0.11	e0.11
7	e0.00	e0.00	e11.2	e0.00	e0.00	e0.00	e2.09	e0.00	e0.00	e0.04	e85.0	e0.18
8	e0.00	e0.00	e3.98	e0.00	e0.00	e0.00	e1.25	e0.00	e0.00	e0.29	e1.75	e0.09
9	e0.00	e0.00	e2.74	e0.00	e0.00	e0.00	e6.55	e0.00	e0.00	e1.30	e2.15	e0.02
10	e0.00	e0.00	e2.27	e0.21	e0.00	e0.00	e2.09	e0.00	e0.00	e1.21	e2.72	e0.19
11	e0.00	e0.00	e1.96	e0.38	e0.00	e0.00	e5.74	e0.00	e0.00	e1.57	e1.50	e0.09
12	e0.00	e0.00	e1.60	e0.00	e0.00	e0.00	e11.4	e0.00	e0.31	e1.04	e0.60	e0.06
13	e0.00	e0.00	e1.26	e0.00	e0.00	e0.00	e3.26	e0.00	e0.07	e0.94	e0.46	e0.71
14	e0.00	e0.00	e1.02	e0.00	e0.00	e0.00	e8.66	e0.00	e0.00	e3.26	e0.36	e13.6
15	e0.00	33.6	e0.78	e0.00	e0.00	e0.00	e7.94	e0.00	e0.00	e1.54	e0.28	e201
16	e0.00	e5.87	e0.50	e0.00	e0.00	e0.00	e8.71	e0.00	e0.00	e0.87	e0.22	e12.8
17	e0.00	e1.65	e0.38	e0.00	e0.00	e0.00	e5.56	e0.00	e0.00	e0.72	e0.14	e6.21
18	e0.00	e1.95	e0.31	e0.00	e0.00	e0.00	e3.16	e0.00	e0.00	e0.64	e0.10	e4.93
19	e0.19	e1.65	e0.26	e0.00	e0.00	e0.00	e2.14	e0.00	e0.00	e0.51	e0.32	e3.49
20	e1.10	e1.32	e0.18	e0.00	e0.00	e0.00	e1.62	e0.00	e0.00	e0.37	e1.25	e2.33
21	e0.00	e1.08	e0.14	e0.00	e0.00	e0.00	e1.17	e0.00	e0.00	e0.28	e0.13	e1.53
22	e0.00	e0.88	e0.08	e0.00	e0.00	e0.00	e0.86	e0.00	e1.88	e0.26	e0.08	e3.65
23	e0.00	e0.67	e0.04	e0.00	e0.00	e0.00	e0.66	e0.00	e3.25	e0.17	e0.05	e2.02
24	e0.00	e0.45	e0.01	e0.00	e0.00	e0.00	e0.51	e0.00	e2.43	e0.11	e0.03	e1.30
25	e0.00	e0.97	e0.00	e0.00	e0.00	e0.00	e0.37	e0.00	e0.96	e0.06	e0.02	e1.03
26	e0.00	e0.32	e0.00	e0.00	e0.00	e0.00	e0.25	e0.00	e0.13	e0.03	e0.01	e1.42
27	e0.00	e0.15	e0.00	e0.00	e0.00	e2.44	e0.25	e0.00	e0.06	e0.01	e0.00	e1.58
28	e0.00	e0.14	e0.08	e0.00	e0.00	e25.5	e0.13	e0.00	e0.04	e0.00	e0.00	e1.21
29	e0.00	e1.32	e0.03	e0.00	---	e6.80	e0.06	e0.00	e0.02	e0.11	e0.00	e0.99
30	e0.02	e1.04	e0.02	e0.00	---	e25.5	e0.02	e0.00	e0.03	e0.14	e0.00	e19.2
31	e0.57	---	e0.01	e0.00	---	e14.2	---	e0.00	---	e0.01	e0.00	---
TOTAL	1.88	53.33	47.37	0.60	42.91	74.44	129.28	0.00	9.18	16.26	97.38	279.84
MAX	1.10	33.6	11.2	0.38	28.7	25.5	15.6	0.00	3.25	3.26	85.0	201
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00
TOTAL Q	26.02	358.72	473.60	9.15	120.59	476.18	1328.6	1.21	62.44	207.37	441.08	1074.80

WTR YR 2005 TOTAL 752.47 MEAN 2.06 MAX 201 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 19*A*. Daily-mean discharge during October 1, 2003, to September 30, 2004, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Discharge, cubic feet per second
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	19	1.5	63	1.1	95	11	3.5	e0.00	0.00	0.00
2	0.00	0.00	14	0.30	58	0.39	85	8.3	1.6	e0.00	0.00	0.00
3	0.00	0.00	16	0.02	51	0.33	70	6.4	0.67	0.00	0.01	0.00
4	0.00	0.00	26	0.01	41	0.31	55	19	0.36	0.00	0.00	0.00
5	0.00	0.00	15	0.32	39	1.2	48	15	0.97	0.00	0.00	0.00
6	0.00	0.00	46	0.02	49	0.75	36	7.7	0.99	0.00	0.00	0.00
7	0.00	0.00	18	0.00	45	0.13	26	5.2	0.41	0.00	0.03	0.00
8	0.00	0.00	16	0.00	37	3.5	20	4.0	0.11	0.00	0.00	0.00
9	0.00	0.00	19	0.00	24	1.2	18	3.1	0.01	0.00	0.00	0.00
10	0.00	0.00	38	0.00	19	0.21	45	2.2	1.8	0.00	0.00	0.00
11	0.00	0.00	36	0.00	17	0.00	261	1.5	19	0.38	0.00	0.00
12	0.00	2.6	17	0.00	15	0.00	440	43	15	0.00	0.00	0.00
13	0.00	0.63	14	0.00	12	0.62	220	9.0	11	0.00	0.00	0.00
14	0.00	0.03	12	0.00	10	207	162	5.6	3.6	4.7	0.00	0.00
15	0.00	0.51	11	0.00	7.5	281	125	4.3	2.8	1.1	0.00	0.00
16	0.00	53	9.2	0.00	5.8	48	96	3.8	2.0	0.15	0.00	0.00
17	0.00	23	7.4	0.00	5.1	39	104	3.2	0.71	0.00	0.00	0.00
18	0.00	14	5.8	0.00	3.6	33	86	2.5	0.32	0.00	0.00	0.00
19	0.00	14	4.3	0.00	2.2	27	73	3.2	0.08	0.00	0.00	0.00
20	0.00	10	3.1	0.00	1.2	21	67	2.9	0.29	0.00	0.00	0.00
21	0.00	8.6	2.2	0.00	0.52	16	55	0.82	0.66	0.00	0.00	0.00
22	0.00	7.4	1.1	0.00	0.24	20	47	0.30	0.70	0.00	0.00	0.00
23	0.00	6.1	0.45	3.5	0.02	88	47	0.04	0.31	0.00	0.00	0.00
24	0.00	5.0	0.16	1.7	0.00	218	41	0.00	0.15	0.00	0.00	0.00
25	0.00	3.8	0.00	218	0.00	112	34	0.00	e0.00	0.00	0.00	0.00
26	0.00	2.8	0.00	48	0.00	109	26	0.78	e0.00	0.00	0.00	0.00
27	0.00	2.1	0.00	13	0.00	119	22	7.7	e0.00	0.00	0.00	0.00
28	0.00	1.2	0.00	12	15	92	19	7.9	e0.00	0.00	0.00	0.00
29	0.00	30	8.6	109	4.9	72	17	3.4	e0.00	0.00	0.00	0.00
30	0.00	81	8.3	59	---	100	14	3.0	e0.00	0.00	0.00	0.00
31	0.00	---	3.8	98	---	197	---	7.6	---	0.00	0.00	---
TOTAL	0.00	265.77	371.41	564.37	526.08	1808.74	2454	192.44	67.04	6.33	0.04	0.00
MEAN	0.00	8.86	12.0	18.2	18.1	58.3	81.8	6.21	2.23	0.20	0.00	0.00
MAX	0.00	81	46	218	63	281	440	43	19	4.7	0.03	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	14	0.00	0.00	0.00	0.00	0.00
MED	0.00	1.7	9.2	0.00	10	21	52	3.8	0.54	0.00	0.00	0.00

WTR YR 2004 TOTAL 6256.22 MEAN 17.1 MAX 440 MIN 0.00 MED 0.31

e Estimated

Table 19*B*. Daily-mean discharge during October 1, 2004, to September 30, 2005, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Discharge, cubic feet per second
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	7.2	46	e0.20	0.00	0.00	123	0.85	0.00	0.83	0.15	0.00
2	0.00	3.0	27	e0.10	0.00	0.00	115	0.30	0.00	3.3	0.18	0.00
3	0.00	0.73	25	e0.00	5.2	0.00	98	0.06	0.00	2.4	0.12	0.00
4	0.00	0.37	23	e0.00	108	0.00	74	0.00	0.00	2.3	0.96	0.00
5	0.00	0.21	28	e0.00	6.4	0.00	57	0.00	0.00	1.1	2.1	2.2
6	0.00	0.00	34	e0.00	0.76	0.00	48	0.00	0.00	0.72	2.0	2.8
7	0.00	0.00	77	0.00	0.10	0.00	38	0.00	0.00	0.68	180	4.6
8	0.00	0.00	42	0.00	0.00	0.00	29	0.00	0.00	3.6	29	4.1
9	0.00	0.00	30	0.00	0.00	0.00	43	0.00	0.00	16	27	1.5
10	0.00	0.00	e27	1.8	0.00	0.00	35	0.00	0.22	15	27	4.9
11	0.01	0.00	e23	6.7	0.00	0.01	48	0.00	0.40	19	26	3.2
12	0.01	0.00	e19	0.33	0.00	0.11	65	0.00	6.1	14	22	2.5
13	0.00	0.00	e16	0.02	0.13	0.02	40	0.00	3.0	12	19	13
14	0.00	0.01	e13	0.00	0.00	0.00	71	0.00	0.48	28	16	68
15	0.00	114	e9.0	0.00	0.00	0.00	74	0.00	0.08	18	14	356
16	0.00	49	e7.3	0.00	0.00	0.00	75	0.00	0.00	11	12	80
17	0.00	19	e6.2	0.00	0.00	0.00	61	0.00	0.00	10	9.0	58
18	0.00	21	e5.4	0.00	0.00	0.00	47	0.00	0.00	9.5	7.3	52
19	1.7	19	e4.0	0.00	0.00	0.00	38	0.00	0.00	8.3	8.1	42
20	11	17	e3.2	0.00	0.00	0.00	31	0.00	0.00	6.4	18	33
21	0.47	15	e2.1	0.00	0.00	0.00	24	0.00	0.21	5.3	6.6	27
22	0.00	13	e1.2	0.00	0.00	0.00	20	0.00	10	5.3	4.2	41
23	0.00	10	e0.50	0.00	0.00	0.00	17	0.00	17	3.8	3.3	35
24	0.00	7.3	e0.20	0.00	0.00	0.00	14	0.00	13	2.9	2.6	23
25	0.00	15	e0.00	0.00	0.00	0.00	11	0.00	6.9	1.7	2.1	20
26	0.14	9.9	e0.00	0.00	0.00	0.04	9.1	0.00	2.3	0.94	1.2	26
27	0.10	5.0	e2.0	0.00	0.00	13	11	0.00	1.1	0.46	0.52	29
28	0.00	4.8	e1.0	0.00	0.00	130	6.7	0.00	0.72	0.20	0.32	25
29	0.00	9.2	e0.70	0.00	---	69	3.8	0.00	0.41	2.0	0.29	21
30	0.59	19	e0.50	0.00	---	151	2.0	0.00	0.52	2.2	0.04	100
31	12	---	e0.30	0.00	---	113	---	0.00	---	0.44	0.00	---
TOTAL	26.02	358.72	473.60	9.15	120.59	476.18	1328.6	1.21	62.44	207.37	441.08	1074.80
MEAN	0.84	12.0	15.3	0.30	4.31	15.4	44.3	0.04	2.08	6.69	14.2	35.8
MAX	12	114	77	6.7	108	151	123	0.85	17	28	180	356
MIN	0.00	0.00	0.00	0.00	0.00	0.00	2.0	0.00	0.00	0.20	0.00	0.00
MED	0.00	6.1	7.3	0.00	0.00	0.00	39	0.00	0.15	3.6	4.2	22

WTR YR 2005 TOTAL 4579.76 MEAN 12.5 MAX 356 MIN 0.00 MED 0.46

e Estimated

Table 19*C*. Daily-mean discharge during October 1, 2005, to September 30, 2006, Waiakea Stream at Hoaka Road (16700600), Hilo, Hawaii.

STATION NUMBER 16700600 Waiakea Stream at Hoaka Road, Hawaii
LATITUDE 193940 LONGITUDE 1550720 NAD83
Discharge, cubic feet per second
WATER YEAR OCTOBER 2005 TO SEPTEMBER 2006
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	42	---	---	---	---	---	---	---	---	---	---	---
2	36	---	---	---	---	---	---	---	---	---	---	---
3	41	---	---	---	---	---	---	---	---	---	---	---
4	38	---	---	---	---	---	---	---	---	---	---	---
5	31	---	---	---	---	---	---	---	---	---	---	---
6	32	---	---	---	---	---	---	---	---	---	---	---
7	42	---	---	---	---	---	---	---	---	---	---	---
8	30	---	---	---	---	---	---	---	---	---	---	---
9	24	---	---	---	---	---	---	---	---	---	---	---
10	21	---	---	---	---	---	---	---	---	---	---	---
11	22	---	---	---	---	---	---	---	---	---	---	---
12	---	---	---	---	---	---	---	---	---	---	---	---
13	---	---	---	---	---	---	---	---	---	---	---	---
14	---	---	---	---	---	---	---	---	---	---	---	---
15	---	---	---	---	---	---	---	---	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---
18	---	---	---	---	---	---	---	---	---	---	---	---
19	---	---	---	---	---	---	---	---	---	---	---	---
20	---	---	---	---	---	---	---	---	---	---	---	---
21	---	---	---	---	---	---	---	---	---	---	---	---
22	---	---	---	---	---	---	---	---	---	---	---	---
23	---	---	---	---	---	---	---	---	---	---	---	---
24	---	---	---	---	---	---	---	---	---	---	---	---
25	---	---	---	---	---	---	---	---	---	---	---	---
26	---	---	---	---	---	---	---	---	---	---	---	---
27	---	---	---	---	---	---	---	---	---	---	---	---
28	---	---	---	---	---	---	---	---	---	---	---	---
29	---	---	---	---	---	---	---	---	---	---	---	---
30	---	---	---	---	---	---	---	---	---	---	---	---
31	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	---	---	---	---	---	---	---	---	---	---	---	---
MEAN	---	---	---	---	---	---	---	---	---	---	---	---
MAX	---	---	---	---	---	---	---	---	---	---	---	---
MIN	---	---	---	---	---	---	---	---	---	---	---	---
MED	---	---	---	---	---	---	---	---	---	---	---	---

e Estimated

Table 20*A*. Daily-mean loads of suspended sediment during October 1, 2003, to September 30, 2004, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Suspended sediment discharge, tons per day
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e0.47	e0.00	e1.0	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e0.15	e0.00	e0.42	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e0.03	e0.00	e0.17	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.03	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e0.06	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e0.03	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
8	e0.00	e0.00	e0.00	e0.00	e0.02	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.06	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e7.4	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	27	e0.02	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e5.9	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	12	e3.0	e0.00	e0.00	e0.00	e0.00	e0.00
15	e0.00	e0.00	e0.00	e0.00	e0.00	17	e1.6	e0.00	e0.00	e0.00	e0.00	e0.00
16	e0.00	e0.00	e0.00	e0.00	e0.00	e0.05	e0.76	e0.00	e0.00	e0.00	e0.00	e0.00
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.5	e0.00	e0.00	e0.00	e0.00	e0.00
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.89	e0.00	e0.00	e0.00	e0.00	e0.00
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.35	e0.00	e0.00	e0.00	e0.00	e0.00
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.19	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.06	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
23	e0.00	e0.00	e0.00	e0.00	e0.00	1.1	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
24	e0.00	e0.00	e0.00	e0.00	e0.00	4.8	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e13	e0.00	e0.74	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e2.2	e0.00	e0.55	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e0.66	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	e0.56	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e1.6	e0.00	e0.30	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e0.10	e0.00	e0.38	---	e0.58	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e0.00	e1.4	---	e5.4	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	0.10	0.00	18.58	0.76	43.74	50.33	0.02	0.00	0.00	0.00	0.00
MAX	0.00	0.10	0.00	13	0.47	17	27	0.02	0.00	0.00	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	5.10	0.00	271.00	49.60	953.99	1230.85	3.60	0.00	0.00	0.00	0.00

WTR YR 2004 TOTAL 113.53 MEAN 0.31 MAX 27 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 20*B*. Daily-mean loads of suspended sediment during October 1, 2004, to September 30, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Suspended sediment discharge, tons per day
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e3.0	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e2.8	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.38	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	e0.37	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	133	e0.00
8	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.3	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.03	e0.00	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.13
15	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.03	e0.00	e0.00	e0.00	e0.00	e468
16	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.18	e0.00	e0.00	e0.00	e0.00	e26
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e3.7
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.8
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.36
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.53
23	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.04
24	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	0.55	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e0.00	---	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e0.00	e0.00	e0.00	---	2.7	e0.00	e0.00	e0.00	e0.00	e0.00	e53
31	e0.00	---	e0.00	e0.00	---	e2.3	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	0.00	0.00	0.00	0.37	5.55	6.42	0.00	0.00	0.00	134.30	553.56
MAX	0.00	0.00	0.00	0.00	0.37	2.7	3.0	0.00	0.00	0.00	133	468
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.01	0.00	0.00	0.00	18.00	63.40	62.87	0.00	0.00	0.43	81.20	401.74

WTR YR 2005 TOTAL 700.20 MEAN 1.9 MAX 468 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 21*A*. Daily-mean loads of total nitrogen during October 1, 2003, to September 30, 2004, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Total nitrogen, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e16.8	e0.00	e39.3	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e13.5	e0.00	e19.6	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e1.82	e0.00	e6.44	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.64	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.02	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e3.15	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e2.38	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
8	e0.00	e0.00	e0.00	e0.00	e1.34	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.97	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e331	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e913	e2.61	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e219	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	396	e58.8	e0.00	e0.00	e0.00	e0.00	e0.00
15	e0.00	e0.00	e0.00	e0.00	e0.00	834	e36.9	e0.00	e0.00	e0.00	e0.00	e0.00
16	e0.00	e0.00	e0.00	e0.00	e0.00	e9.30	e25.9	e0.00	e0.00	e0.00	e0.00	e0.00
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.08	e42.6	e0.00	e0.00	e0.00	e0.00	e0.00
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e28.0	e0.00	e0.00	e0.00	e0.00	e0.00
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e12.6	e0.00	e0.00	e0.00	e0.00	e0.00
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e7.45	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e2.46	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.30	e0.00	e0.00	e0.00	e0.00	e0.00
23	e0.00	e0.00	e0.00	e0.00	e0.00	e48.4	e0.01	e0.00	e0.00	e0.00	e0.00	e0.00
24	e0.00	e0.00	e0.00	e0.00	e0.00	e350	e0.02	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e293	e0.00	e132	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e27.0	e0.00	e64.2	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e54.4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	e37.0	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e64.2	e0.00	e14.9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e4.38	e0.00	e16.8	---	e30.7	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e0.00	e77.8	---	e175	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	4.38	0.00	478.80	38.99	2145.98	1745.01	2.61	0.00	0.00	0.00	0.00
MAX	0.00	4.38	0.00	293	16.8	834	913	2.61	0.00	0.00	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	5.10	0.00	271.00	49.60	953.99	1230.85	3.60	0.00	0.00	0.00	0.00

WTR YR 2004 TOTAL 4415.77 MEAN 12.1 MAX 913 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 21*B*. Daily-mean loads of total nitrogen during October 1, 2004, to September 30, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Total nitrogen, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e31.2	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e25.7	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e9.98	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	14.9	e0.00	e0.39	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e226	e0.00
8	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e2.20	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.91	e0.00	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.10
15	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.86	e0.00	e0.00	e0.00	e0.00	e606
16	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e3.08	e0.00	e0.00	e0.00	e0.00	e35.3
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e11.7
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e4.99
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.92
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e7.48
23	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.38
24	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	8.07	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e0.00	---	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e0.00	e0.00	e0.00	---	45.6	e0.00	e0.00	e0.00	e0.00	e0.00	e48.1
31	e0.00	---	e0.00	e0.00	---	e28.9	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	0.00	0.00	0.00	14.90	82.57	72.12	0.00	0.00	0.00	228.20	715.97
MAX	0.00	0.00	0.00	0.00	14.9	45.6	31.2	0.00	0.00	0.00	226	606
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.01	0.00	0.00	0.00	18.00	63.40	62.87	0.00	0.00	0.43	81.20	401.74

WTR YR 2005 TOTAL 1113.76 MEAN 3.05 MAX 606 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 22*A*. Daily-mean loads of nitrogen, nitrite plus nitrate, dissolved, during October 1, 2003, to September 30, 2004, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Nitrogen, nitrite + nitrate, dissolved, lbs/day as N
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e0.37	e0.00	e3.2	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e0.32	e0.00	e2.9	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e0.05	e0.00	e2.0	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.70	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.09	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e0.06	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e0.12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
8	e0.00	e0.00	e0.00	e0.00	e0.10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e4.9	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e8.5	e0.12	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e3.4	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	2.6	e2.3	e0.00	e0.00	e0.00	e0.00	e0.00
15	e0.00	e0.00	e0.00	e0.00	e0.00	e7.7	e1.7	e0.00	e0.00	e0.00	e0.00	e0.00
16	e0.00	e0.00	e0.00	e0.00	e0.00	e0.46	e1.3	e0.00	e0.00	e0.00	e0.00	e0.00
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.04	e1.5	e0.00	e0.00	e0.00	e0.00	e0.00
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.3	e0.00	e0.00	e0.00	e0.00	e0.00
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.6	e0.00	e0.00	e0.00	e0.00	e0.00
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.8	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.1	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.26	e0.00	e0.00	e0.00	e0.00	e0.00
23	e0.00	e0.00	e0.00	e0.00	e0.00	e0.66	e0.04	e0.00	e0.00	e0.00	e0.00	e0.00
24	e0.00	e0.00	e0.00	e0.00	e0.00	e4.6	e0.07	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e2.5	e0.00	e2.1	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e0.79	e0.00	e2.4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e3.1	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	e2.4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e1.5	e0.00	e1.6	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e0.00	e0.00	e0.75	---	e2.0	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e0.00	e1.8	---	e5.5	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	0.00	0.00	7.34	1.02	35.16	38.66	0.12	0.00	0.00	0.00	0.00
MAX	0.00	0.00	0.00	2.5	0.37	7.7	8.5	0.12	0.00	0.00	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	5.10	0.00	271.00	49.60	953.99	1230.85	3.60	0.00	0.00	0.00	0.00

WTR YR 2004 TOTAL 82.30 MEAN 0.22 MAX 8.5 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 22*B*. Daily-mean loads of nitrogen, nitrite plus nitrate, dissolved, during October 1, 2004, to September 30, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Nitrogen, nitrite + nitrate, dissolved, lbs/day as N
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.2	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.1	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.49	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	e1.1	e0.00	e0.05	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.6	e0.00
8	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.14	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.05	e0.00	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.03
15	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.04	e0.00	e0.00	e0.00	e0.00	e5.9
16	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.13	e0.00	e0.00	e0.00	e0.00	e1.9
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.93
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.41
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.09
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.20
23	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.08
24	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	0.19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e0.00	---	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e0.00	e0.00	e0.00	---	1.9	e0.00	e0.00	e0.00	e0.00	e0.00	e1.1
31	e0.00	---	e0.00	e0.00	---	e1.2	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	0.00	0.00	0.00	1.10	3.29	3.06	0.00	0.00	0.00	1.74	10.64
MAX	0.00	0.00	0.00	0.00	1.1	1.9	1.2	0.00	0.00	0.00	1.6	5.9
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.01	0.00	0.00	0.00	18.00	63.40	62.87	0.00	0.00	0.43	81.20	401.74

WTR YR 2005 TOTAL 19.83 MEAN 0.05 MAX 5.9 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 23*A*. Daily-mean loads of total phosphorus during October 1, 2003, to September 30, 2004, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Phosphorus, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e2.41	e0.00	e6.85	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e2.15	e0.00	e4.15	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e0.28	e0.00	e1.96	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.45	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.01	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e1.31	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e0.24	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
8	e0.00	e0.00	e0.00	e0.00	e0.36	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.43	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e46.1	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e176	e0.60	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e56.2	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	e43.2	e30.3	e0.00	e0.00	e0.00	e0.00	e0.00
15	e0.00	e0.00	e0.00	e0.00	e0.00	105	e16.6	e0.00	e0.00	e0.00	e0.00	e0.00
16	e0.00	e0.00	e0.00	e0.00	e0.00	e1.01	e8.25	e0.00	e0.00	e0.00	e0.00	e0.00
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.02	e9.47	e0.00	e0.00	e0.00	e0.00	e0.00
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e5.36	e0.00	e0.00	e0.00	e0.00	e0.00
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e2.34	e0.00	e0.00	e0.00	e0.00	e0.00
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.53	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.60	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.10	e0.00	e0.00	e0.00	e0.00	e0.00
23	e0.00	e0.00	e0.00	e0.00	e0.00	e11.2	e0.01	e0.00	e0.00	e0.00	e0.00	e0.00
24	e0.00	e0.00	e0.00	e0.00	e0.00	e48.6	e0.01	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e46.6	e0.00	e17.8	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e12.5	e0.00	e8.43	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e11.4	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	e4.43	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e10.6	e0.00	e3.29	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e0.52	e0.00	e3.65	---	e5.04	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
31	e0.00	---	e0.00	e14.2	---	e32.6	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	0.52	0.00	87.55	6.75	292.02	366.72	0.60	0.00	0.00	0.00	0.00
MAX	0.00	0.52	0.00	46.6	2.41	105	176	0.60	0.00	0.00	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.00	5.10	0.00	271.00	49.60	953.99	1230.85	3.60	0.00	0.00	0.00	0.00

WTR YR 2004 TOTAL 754.16 MEAN 2.06 MAX 176 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 23*B*. Daily-mean loads of total phosphorus during October 1, 2004, to September 30, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Phosphorus, water, unfiltered, pounds per day
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e3.23	e0.00	e0.00	e0.00	e0.00	e0.00
2	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e2.36	e0.00	e0.00	e0.00	e0.00	e0.00
3	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.41	e0.00	e0.00	e0.00	e0.00	e0.00
4	e0.00	e0.00	e0.00	e0.00	1.41	e0.00	e0.01	e0.00	e0.00	e0.00	e0.00	e0.00
5	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
6	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
7	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e29.9	e0.00
8	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.48	e0.00
9	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
10	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
11	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
12	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.07	e0.00	e0.00	e0.00	e0.00	e0.00
13	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
14	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.02
15	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.07	e0.00	e0.00	e0.00	e0.00	e79.1
16	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.26	e0.00	e0.00	e0.00	e0.00	e9.17
17	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e1.21
18	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.53
19	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.11
20	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
21	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
22	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.66
23	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.15
24	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
25	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
26	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
27	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
28	e0.00	e0.00	e0.00	e0.00	e0.00	1.98	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
29	e0.00	e0.00	e0.00	e0.00	---	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00	e0.00
30	e0.00	e0.00	e0.00	e0.00	---	7.32	e0.00	e0.00	e0.00	e0.00	e0.00	e10.3
31	e0.00	---	e0.00	e0.00	---	e3.85	---	e0.00	---	e0.00	e0.00	---
TOTAL	0.00	0.00	0.00	0.00	1.41	13.15	6.41	0.00	0.00	0.00	30.38	101.25
MAX	0.00	0.00	0.00	0.00	1.41	7.32	3.23	0.00	0.00	0.00	29.9	79.1
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
TOTAL Q	0.01	0.00	0.00	0.00	18.00	63.40	62.87	0.00	0.00	0.43	81.20	401.74

WTR YR 2005 TOTAL 152.60 MEAN 0.42 MAX 79.1 MIN 0.00 MED 0.00

e Estimated
TOTAL Q Sum of daily mean discharge for the month

Table 24*A*. Daily-mean discharge during October 1, 2003, to September 30, 2004, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Discharge, cubic feet per second
WATER YEAR OCTOBER 2003 TO SEPTEMBER 2004
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	e0.00	0.00	0.00	0.00	21	0.00	48	0.00	0.00	0.00	0.00	0.00
2	e0.00	0.00	0.00	0.00	15	0.00	34	0.00	0.00	0.00	0.00	0.00
3	e0.00	0.00	0.00	0.00	4.8	0.00	20	0.00	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	0.00	0.00	6.1	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	4.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	0.00	2.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	2.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	1.5	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	168	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	359	3.6	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	179	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	108	116	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	233	81	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	14	54	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.92	56	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	46	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	27	0.00	0.00	0.00	0.00	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	21	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	0.00	0.00	10	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	0.00	0.00	0.07	2.3	0.00	0.00	0.00	0.00	0.00
23	0.00	0.00	0.00	0.00	0.00	23	0.42	0.00	0.00	0.00	0.00	0.00
24	0.00	0.00	0.00	0.00	0.00	150	0.79	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	101	0.00	78	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	44	0.00	58	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	63	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	41	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	57	0.00	22	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00	5.1	0.00	15	---	35	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00	---	0.00	54	---	128	---	0.00	---	0.00	0.00	---
TOTAL	0.00	5.10	0.00	271.00	49.60	953.99	1230.85	3.60	0.00	0.00	0.00	0.00
MEAN	0.00	0.17	0.00	8.74	1.71	30.8	41.0	0.12	0.00	0.00	0.00	0.00
MAX	0.00	5.1	0.00	101	21	233	359	3.6	0.00	0.00	0.00	0.00
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MED	0.00	0.00	0.00	0.00	0.00	0.00	4.2	0.00	0.00	0.00	0.00	0.00

WTR YR 2004 TOTAL 2514.14 MEAN 6.87 MAX 359 MIN 0.00 MED 0.00

e Estimated

Table 24*B*. Daily-mean discharge during October 1, 2004, to September 30, 2005, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Discharge, cubic feet per second
WATER YEAR OCTOBER 2004 TO SEPTEMBER 2005
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	0.00	0.00	0.00	0.00	e0.00	0.00	24	0.00	e0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	e0.00	0.00	22	0.00	e0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	e0.00	0.00	11	0.00	e0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	e18	0.00	0.97	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	77	0.00
8	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.2	0.00
9	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.01	0.00	0.00	e0.00	0.00	0.00	1.2	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02
14	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	1.0
15	0.00	0.00	0.00	e0.00	0.00	0.00	1.0	0.00	0.00	0.26	0.00	244
16	0.00	0.00	0.00	e0.00	0.00	0.00	2.7	0.00	0.00	0.00	0.00	55
17	0.00	0.00	0.00	e0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	23
18	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15
19	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.9
20	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42
21	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.3
23	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.1
24	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
25	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	e0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	e0.00	0.00	5.4	0.00	e0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	0.00	e0.00	---	0.00	0.00	e0.00	0.00	0.00	0.00	0.00
30	0.00	0.00	0.00	e0.00	---	36	0.00	e0.00	0.00	0.00	0.00	49
31	0.00	---	0.00	e0.00	---	22	---	e0.00	---	0.00	0.00	---
TOTAL	0.01	0.00	0.00	0.00	18.00	63.40	62.87	0.00	0.00	0.43	81.20	401.74
MEAN	0.00	0.00	0.00	0.00	0.64	2.05	2.10	0.00	0.00	0.01	2.62	13.4
MAX	0.01	0.00	0.00	0.00	18	36	24	0.00	0.00	0.26	77	244
MIN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MED	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

WTR YR 2005 TOTAL 627.65 MEAN 1.72 MAX 244 MIN 0.00 MED 0.00

e Estimated

Table 24*C*. Daily-mean discharge during October 1, 2005, to September 30, 2006, Waiakea Stream at Hilo (16701300), Hilo, Hawaii.

STATION NUMBER 16701300 Waiakea Stream at Hilo, Hawaii
LATITUDE 194238 LONGITUDE 1550502 OLDHI
Discharge, cubic feet per second
WATER YEAR OCTOBER 2005 TO SEPTEMBER 2006
DAILY MEAN VALUES

DAY	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1	6.1	---	---	---	---	---	---	---	---	---	---	---
2	0.52	---	---	---	---	---	---	---	---	---	---	---
3	0.23	---	---	---	---	---	---	---	---	---	---	---
4	0.38	---	---	---	---	---	---	---	---	---	---	---
5	0.00	---	---	---	---	---	---	---	---	---	---	---
6	0.00	---	---	---	---	---	---	---	---	---	---	---
7	0.00	---	---	---	---	---	---	---	---	---	---	---
8	0.00	---	---	---	---	---	---	---	---	---	---	---
9	0.00	---	---	---	---	---	---	---	---	---	---	---
10	0.00	---	---	---	---	---	---	---	---	---	---	---
11	0.00	---	---	---	---	---	---	---	---	---	---	---
12	0.00	---	---	---	---	---	---	---	---	---	---	---
13	0.00	---	---	---	---	---	---	---	---	---	---	---
14	0.00	---	---	---	---	---	---	---	---	---	---	---
15	---	---	---	---	---	---	---	---	---	---	---	---
16	---	---	---	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---	---	---	---
18	---	---	---	---	---	---	---	---	---	---	---	---
19	---	---	---	---	---	---	---	---	---	---	---	---
20	---	---	---	---	---	---	---	---	---	---	---	---
21	---	---	---	---	---	---	---	---	---	---	---	---
22	---	---	---	---	---	---	---	---	---	---	---	---
23	---	---	---	---	---	---	---	---	---	---	---	---
24	---	---	---	---	---	---	---	---	---	---	---	---
25	---	---	---	---	---	---	---	---	---	---	---	---
26	---	---	---	---	---	---	---	---	---	---	---	---
27	---	---	---	---	---	---	---	---	---	---	---	---
28	---	---	---	---	---	---	---	---	---	---	---	---
29	---	---	---	---	---	---	---	---	---	---	---	---
30	---	---	---	---	---	---	---	---	---	---	---	---
31	---	---	---	---	---	---	---	---	---	---	---	---
TOTAL	---	---	---	---	---	---	---	---	---	---	---	---
MEAN	---	---	---	---	---	---	---	---	---	---	---	---
MAX	---	---	---	---	---	---	---	---	---	---	---	---
MIN	---	---	---	---	---	---	---	---	---	---	---	---
MED	---	---	---	---	---	---	---	---	---	---	---	---

Appendix. Discharge-Reporting and Load-Calculation Methods

This appendix further defines the methods used for reporting discharge data and constituent-concentration data and the methods for calculating instantaneous constituent loads. Discharge and water-quality-data values are rounded off to the number of significant figures that best describe the precision of the measurement.

Discharge data.—Appendix Table 1 shows the number of significant figures and rounding limits for the range of discharges used in this study. Discharges measured by current meter or float-measurement techniques follow guidelines for measured discharges. Discharges determined by streamflow rating or by averaging follow guidelines for daily-mean discharges (Sauer, 2002). Measured discharges may have more significant figures because they are considered more precise than averaged discharges.

Table A1. Significant figures and rounding limits for measured, streamflow-rating, and averaged discharges.

[ft^3/s, cubic feet per second; <, actual value is less than shown; , actual value is greater than or equal to value shown]

	Measured discharge		Streamflow-rating and averaged discharges	
Range of discharge (ft^3/s)	Significant figures	Rounding limit	Significant figures	Rounding limit
<0.10	2	thousandths	1	hundredths
0.10 and <1.0	2	hundredths	2	hundredths
1.0 and < 10	3	hundredths	2	tenths
10 and < 100	3	tenths	2	units
100	3	variable	3	variable

Calculation of loads.—Appendix Table 2 shows the conversion factors used for determining constituent loads. Constituent loads for all analyses are reported as pounds per day (lbs/day) or tons per day (tons/day). All loads are the product of constituent concentration multiplied by associated discharge and the appropriate conversion factor (equation 1). Concentrations are reported in milligrams per liter (mg/L). Four significant figures are used for the conversion factors; however, the load value is reported with the lesser number of significant figures of the values of concentration and discharge.

$$Q(C)K = L \tag{1}$$

Where

Q = discharge (ft^3/s)
C = constituent concentration (mg/L)
K = conversion factor
L = constituent load (lbs/day, $tons/day$)

Table A2. Conversion factors for computing daily loads from constituent concentration and discharge

[mg/L, milligrams per liter; lbs/day, pounds per day]

Unit of concentration	Conversion factor[a]	Load unit
mg/L	5.394	lbs/day
mg/L	0.002697	tons/day

[a]All conversion factors are based on discharge in cubic feet per second.