WATER QUALITY IN HILO BAY, HAWAII, U.S.A., UNDER BASEFLOW AND STORM CONDITIONS

FINAL PROJECT REPORT APRIL 2009

Dr. Tracy Wiegner[1] and Lucas Mead[2]

Marine Science Department[1]
Master's Program in Tropical Conservation Biology and Environmental Science[2]
University of Hawaii at Hilo
200 W. Kawili Street, Hilo, HI 96720

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICIES

EXECUTIVE SUMMARY

Hilo Bay waters have exceeded state water quality standards since the late 1970s for nutrients, turbidity, and fecal bacteria indicators and were formally included on the United States Environmental Protection Agency's (USEPA) 303(d) list of impaired water bodies in 1998. It has long been suspected that Hilo Bay's breakwater reduces water circulation and increases the residence time of pollutants inside the Bay. This public perception and the listing of Hilo Bay on the USEPA's 303(d) list contribute to the fact that only 10% of the people who use Hilo Bay's beach actually swim there.

These conditions in Hilo Bay led former Mayor Harry Kim to contact the U.S. Army Corps of Engineers (USACE) in January, 2005, and request assistance to "improve the water quality and circulation of Hilo Bay." USACE proposed and agreed to develop a computer circulation model to investigate whether modifications to the breakwater "or other alternatives will improve the water quality" of Hilo Bay. However, their original plans did not include measuring water quality parameters (nutrients, turbidity) within the Bay under different conditions [non-storm (baseflow) vs. storm]. University of Hawaii at Hilo (UHH) Marine Science Department agreed to collaborate with Hawaii County in conjunction with USACE to collect essential water quality data that would: 1) allow for a better understanding of the relationship between water quality and circulation within Hilo Bay, and 2) be used in the USACE computer model to accurately assess whether potential modifications to the breakwater would improve water quality.

To accomplish these goals, UHH Marine Science Department collected water samples from the Wailuku and Wailoa Rivers, as well as from Hilo Bay (both inside and outside the breakwater) under baseflow and storm conditions from January 2007 through

February 2008. Water samples were analyzed for total dissolved nitrogen (TDN), ammonium (NH_4^+), nitrate plus nitrite (NO_3^-+ NO_2^-), total dissolved phosphorus (TDP), phosphate (PO_4^{3-}), silicic acid (H_4SiO_4), dissolved organic carbon (DOC), total suspended solids (TSS), particulate carbon (PC), particulate nitrogen (PN), turbidity, pH, and chlorophyll *a* (Chl *a*). Additionally, at all stations within Hilo Bay, depth profiles of salinity, specific conductivity, temperature, dissolved oxygen concentration, and percent dissolved oxygen saturation, as well as light attenuation were measured. To assess and compare inputs from the Wailuku and Wailoa Rivers to Hilo Bay under these different conditions, instantaneous yields were calculated for nutrients and TSS.

Of the parameters measured in this study, NO_3^-+NO_2^-, turbidity, and Chl *a* were more closely examined for this report. We focused on these parameters because they have been either documented or suspected to exceed the Hawaii Department of Health's (HDOH) water quality standards and have contributed to Hilo Bay's listing on the USEPA's 303(d) list. Additionally, changes in either NO_3^-+NO_2^- and/or turbidity affect Chl *a* concentrations, a proxy for algal biomass and a parameter often used to assess whether a biological response to pollution inputs in estuaries is occurring.

The highest NO_3^-+NO_2^- concentrations measured in Hilo Bay were following storms, and under these conditions, NO_3^-+NO_2^- concentrations consistently exceeded HDOH's standards. Across all stations sampled, NO_3^-+NO_2^- concentrations were ~1.5 times higher following storms than during baseflow conditions. Under storm conditions, the largest surface water source of NO_3^-+NO_2^- to Hilo Bay was from the Wailoa River and the highest NO_3^-+NO_2^- concentrations in the Bay were measured within the Wailoa River plume. This pattern was also observed during baseflow conditions, where instantaneous NO_3^-+NO_2^- yields were 18 times greater from the Wailoa River than from the Wailuku River, and NO_3^-+NO_2^- concentrations within the Wailoa River plume were consistently higher than those measured within the Wailuku River plume and at stations outside of the breakwater.

The high NO_3^-+NO_2^- concentrations measured in the Wailoa River and its plume in Hilo Bay most likely stem from the land use within this watershed. Approximately 15% of the Wailoa River's drainage area is comprised of low- and high-intensity development and agriculture as compared to ~1% for the Wailuku River's watershed. Cesspools and septic tanks are likely the dominant sources of NO_3^-+NO_2^- to the Wailoa River, as only 30 to 40% of Hilo is connected to the sewer line, and the majority of homes are located within this watershed. Other possible anthropogenic sources of NO_3^-+NO_2^- include livestock waste and fertilizers from agricultural lands, although contributions from these sources are likely small as the extent and intensity of agricultural activities are relatively low in this watershed.

Similar to the NO_3^-+NO_2^- concentrations, turbidity levels were greatest in Hilo Bay following storms. Under these conditions, turbidity levels consistently exceeded HDOH's standards. The largest surface water source of turbidity to Hilo Bay during storms was the Wailuku River and the highest turbidity levels were measured within the Wailuku River plume. In contrast, during baseflow conditions, turbidity levels were comparable between the Wailuku and Wailoa River plumes in Hilo Bay and were lower than HDOH's embayment standard. Turbidity levels in Hilo Bay were also consistently higher inside the breakwater than outside during both storm and baseflow conditions, with the greatest differences observed during storms.

Our study shows that turbidity levels in Hilo Bay are significantly correlated to the Wailuku River's discharge and are affected by the presence of the breakwater. High turbidity levels in the Wailuku River most likely stem from the watershed's high relief and its greater percentage of barren land compared to the Wailoa River's watershed. Additionally, the higher turbidity inside the breakwater suggests that the breakwater acts as a partial barrier that prevents particles from being rapidly flushed outside of the Bay. However, within three days following peak storm discharge from the Wailuku River, turbidity levels inside Hilo Bay dropped below HDOH's embayment standards, suggesting that suspended sediments were rapidly exported out of the Bay and/or settled to the seafloor.

In contrast to NO_3^-+NO_2^- and turbidity, Chl *a* concentrations were highest in Hilo Bay during baseflow conditions, particularly during the dry, summer months. The highest Chl *a* concentrations were measured at stations inside the breakwater furthest from the mouths of the Wailuku and Wailoa Rivers. All of the stations sampled inside the breakwater had Chl *a* concentrations that exceeded the HDOH's embayment standard on two up to six of the eight baseflow sampling days in this study. Additionally, the two stations sampled outside the breakwater had concentrations two to three times lower than those measured inside the breakwater, but often higher than HDOH's standard for open coastal waters.

Nutrient availability, warmer water temperatures, and increased water clarity, as well as reduced grazing pressure can result in higher Chl *a* concentrations in coastal waters. Nutrient availability does not appear to be the primary factor limiting algal biomass in Hilo Bay over the annual scale, as nutrient concentrations are highest following storms when Chl *a* concentrations are lowest. However, nutrient availability does appear to enhance primary production in Hilo Bay, as the highest Chl *a* concentrations were measured within the Wailoa River plume, the region of the Bay with the highest NO_3^-+ NO_2^- concentrations. Probable factors affecting Chl *a* concentrations were water clarity, salinity, and residence time, as the water is less turbid, salinity fluctuations are minimal, and water residence time is longer during baseflow conditions. It is unlikely that grazer abundance limited Chl *a* concentrations during baseflow conditions as water residence time in Hilo Bay was greater and the likelihood that zooplankton would be flushed outside of the Bay was lower.

Following storms, Chl *a* concentrations inside Hilo Bay were 93% lower than those measured during baseflow conditions, often below detection limits and the HDOH's embayment standard. No phytoplankton blooms were detected in Hilo Bay five days after a storm event for the four storms sampled; however, it is possible we may have missed a bloom if it occurred after our sampling effort. Low Chl *a* concentrations in Hilo Bay following storms were most likely a function of the phytoplankton cells being washed out of the Bay, diluted by the increased terrestrial material discharged into the Bay from the Wailuku and Wailoa Rivers, light-limitation from the suspended particles in the water column, and stress from salinity fluctuations.

Our study suggests that of the pollutants we measured, NO_3^-+NO_2^- is having the greatest impact on Hilo Bay's water quality. The highest NO_3^-+NO_2^- concentrations were measured in the Wailoa River and its plume, where they consistently and often exceeded the HDOH standards, respectively. A biological response to these NO_3^-+NO_2^- inputs into Hilo Bay does appear to be occurring as the highest Chl *a* concentrations were measured within the Wailoa River plume. Unfortunately, the measurements made in our study do not tell us the source(s) of the NO_3^-+NO_2^-, they only provide information on the region in the watershed from where the NO_3^-+NO_2^- is coming. The most likely source of NO_3^- +NO_2^- is from cesspools and septic tanks, as this is the most heavily populated section of Hilo and 60 to 70% of the city is not connected to the sewer line. To determine if sewage is the primary the source of NO_3^-+NO_2^- entering Hilo Bay from the Wailoa River watershed, further studies are needed measuring chemical tracers of sewage within this watershed and Hilo Bay. With this information, Hawaii County will be better informed of the steps needed to improve the health and water quality of Hilo Bay.

PROJECT OVERVIEW

Hilo Bay waters have exceeded state water quality standards since the late 1970s and were formally included on the United States Environmental Protection Agency's (USEPA) 303(d) list of impaired water bodies in 1998 (Koch et al. 2004). Parameters exceeding standards include turbidity, nutrients, and fecal bacterial indicators. The listing of Hilo Bay for turbidity and nutrients has been determined solely by visual assessment and not by direct measurements of these parameters.

Since Hilo Bay has been designated as an impaired water body by the USEPA, Hawaii County has been committed to improving and restoring its ecosystem and water quality. Correspondence from former Mayor Harry Kim to the Army Corps of Engineers (USACE), dated January 20, 2005, requested assistance to "improve the water quality and circulation of Hilo Bay." It was proposed that USACE develop a computer circulation model to investigate whether modifications to the breakwater "or other alternatives will improve the water quality" of Hilo Bay. The USACE agreed to develop a computer model to assess alternatives to improving water circulation within the Bay (USACE 2009); however, their original plans did not include measuring water quality parameters (turbidity, nutrients) within the Bay under different conditions [non-storm (baseflow) vs. storm]. University of Hawaii at Hilo (UHH) Marine Science Department agreed to collaborate with Hawaii County in conjunction with USACE to collect essential water quality data that would 1) allow for a better understanding of the relationship between water quality and circulation within Hilo Bay, and 2) be used in the USACE computer model to accurately assess whether potential modifications to the breakwater would improve water quality (USACE 2009).

It is assumed that if circulation within Hilo Bay is enhanced, water quality will improve; to date, the relationship between circulation and water quality has not been established. More importantly, the source of turbidity, nutrients, and fecal bacterial indicators within the Hilo Bay watershed, as well as, the response of the Bay to these pollutants under base- and stormflow conditions are unknown. The potential effectiveness of remediation actions to improve the Hilo Bay's water quality, like modifying the breakwater, cannot be evaluated without knowledge about how the Bay functions. To understand how Hilo Bay functions as an ecosystem, water quality and circulation data are needed for the Bay, as well as water quality and discharge data for the rivers draining into the Bay. For this project, UHH collected baseline data on suspended sediment and nutrient inputs to Hilo Bay to assess its response to these inputs under baseflow and storm conditions. This information along with USACE circulation data will allow Hawaii County to identify the best and most cost-effective remediation actions to improve Hilo Bay's water quality.

BACKGROUND

In Hawaii, there is a tremendous economic reliance on the quality and health of coastlines. Hence, it is imperative that the fate and potential impacts of terrestrial inputs to coastal waters are quantified. Hilo Bay is an important wildlife and fishery area (HDOH 2000). It is also one of the longest, most accessible and least used sand beaches on the Island of Hawaii (Hawaii Island Journal 2004). However, only 10% of the people who actually use this beach swim there (USEPA 2002), which stems from the fact that Hilo Bay is thought to suffer from high turbidity and excessive nutrients. In fact, Hilo

Bay has been listed by Hawaii's Department of Health (HDOH) and USEPA as one of the seven most troubled watersheds in the state of Hawaii, having water quality below state and federal standards. Clearly, more information on the water quality of the rivers draining into Hilo Bay, as well as, the Bay itself, is needed for better management of this ecosystem.

Surprisingly, very little water quality data are available for Hilo Bay in contrast to other Hawaiian estuaries like Kaneohe Bay. Reports are scarce and only one peer-reviewed paper exists for Hilo Bay (Hallacher et al. 1985). Most water quality data for Hilo Bay are from consultant reports for Environmental Assessments (EA) and Environmental Impact Statements (EIS) from USACE evaluations, and monitoring by HDOH and the United States Geological Survey (USGS) (Silvius et al. 2005). However, these studies were not designed to evaluate how Hilo Bay functions under different conditions (i.e., baseflow vs. storms).

The Hilo Bay watershed has one of the highest precipitation rates on the Hawaiian Islands, ranging from 304.8 cm on the coast to 609.6 cm at the upper elevations annually (Juvik & Juvik 1998). Hence, it is no surprise that the amount of freshwater entering Hilo Bay is far greater than any other Hawaiian estuary. Surface waters are primarily discharged into Hilo Bay from the Wailuku and Wailoa Rivers. The Wailuku River is the largest perennial river in the state and the largest source of surface water to Hilo Bay. The average daily flow of water from the Wailuku River into Hilo Bay is 1 million cubic meters (range: 40 thousand - 7 billion m^3/d; M & E Pacific 1980). In contrast, the Wailoa River is a groundwater-fed, flood-control channel that discharges into Waiakea Pond prior to entering Hilo Bay. Waiakea Pond is the single largest source of groundwater into

Hilo Bay (M & E Pacific 1980). It is estimated that 1.8 million cubic meters of groundwater enters the Bay from this area daily (M & E Pacific 1980). Surprisingly, little is known about the inputs of sediments and nutrients from these rivers. Inputs of sediments and nutrients from the Wailuku River were measured by UHH from 2005 through 2006 (Wiegner et al. in press). From 2003 to 2006, the USGS quantified storm inputs of sediments and nutrients from Waiakea and Alenio Streams (both feed into Wailoa River) to Hilo Bay as a part of HDOH total daily maximum load (TMDL) program (Presley et al. 2007). Response of Hilo Bay to these inputs is presently unknown.

Much of the concern surrounding Hilo Bay's water quality stems from the fact that Hilo Bay's waters are not clear. High-relief drainage and intense rainfall in Hilo Bay's watershed may contribute to naturally high sediment loads observed in the rivers during storms. It is suspected that the Wailuku River delivers the majority of sediments to Hilo Bay during storms and is the reason behind the poor water clarity in the Bay (Silvius et al. 2005). Preliminary data from UHH has found that turbidity is 10 times higher in Wailuku River (average ±S.E., 10.29 ±3.33 NTU) than Wailoa River (1.33 ±0.33 NTU) during storms in October and

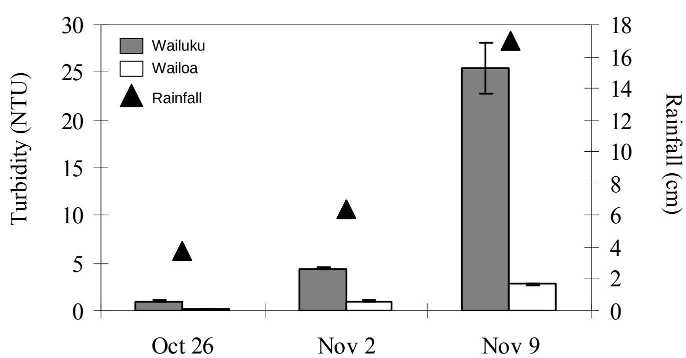

Figure 1. Comparison of average (±S.E.) turbidity values in the Wailuku and Wailoa Rivers in Hilo, HI, over different rainfall amounts. Rainfall data was obtained from http://www.prh.noaa.gov/hnl/pages /hiclimate.php. Rainfall amounts were calculated using data from two days prior to sampling. Turbidity data were collected during MARE 350 class during Fall 2005 semester.

November 2005 (Fig. 1). Currently, it is not known how long the Bay's waters stay turbid following a storm and whether these suspended sediment inputs impact the ecosystem.

Another possible factor contributing to the low water clarity in Hilo Bay are algal blooms. Algal blooms result when nutrients and sunlight are prevalent and their presence gives coastal waters a greenish tint. As previously mentioned, the USEPA 303(d) impaired listing for Hilo Bay for excessive nutrients was based solely on visual assessment. From these assessments, it was assumed that Hilo Bay had high nutrient concentrations because the water had "a greenish tint", resulting from suspected algal blooms (Silvius et al. 2005). Actual nutrient and chlorophyll *a* (Chl *a*) data for Hilo Bay are scarce. Preliminary data from UHH indicates that nitrate + nitrite concentrations are five times greater in the Wailoa (26.01 ±1.91 μM) than the Wailuku River (2.28 ±0.48 μM) (Fig. 2), suggesting that Wailoa may be the primary surface water source of nutrients to Hilo Bay (UHH MARE 350 unpublished data). The effect of these nutrient inputs to Hilo Bay has not been assessed yet.

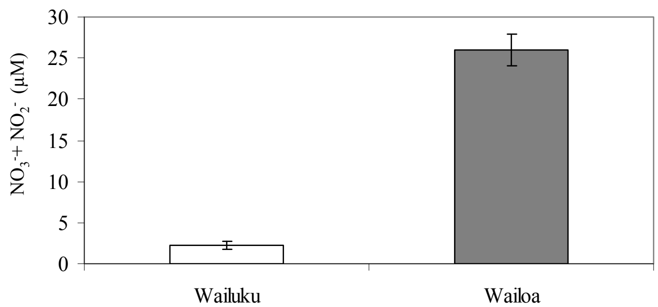

Figure 2. Comparison of average (±S.E.) nitrate + nitrite concentrations in the Wailuku and Wailoa Rivers, Hilo, HI, over October 19, October 26, November 2, and November 9. Data were collected by the MARE 350 class during Fall 2005 semester.

To date, the temporal scale over which the few turbidity and nutrient samples were collected is inadequate to characterize the range of conditions experienced in Hilo Bay. It is assumed that inputs of suspended sediments and nutrients to Hilo Bay are high during storms; however, these events have not been historically targeted. Current research efforts by UHH and USGS are beginning to quantify storm inputs of suspended sediments and nutrients into Hilo Bay from the Wailuku River, Alenio Stream, and Waiakea Stream (Presley et al. 2007; Wiegner et al. in press). Information on how Hilo Bay responds to storms over temporal and spatial scales is not known. Storm inputs of nutrients are thought to stimulate algal blooms; however, no direct measurements have verified this. Additionally, the importance of these algal blooms as a food source to higher trophic levels, like commercially and recreationally important fish, is unknown.

In 2005, a restoration plan for Hilo Bay summarized the state of knowledge on Hilo Bay and its watershed (Silvius et al. 2005). It also made recommendations for future studies that would collect critical data needed to identify 'troubled' areas, which would then allow for remediation and restoration plans to be developed. Some of the projects that the Hilo Bay Restoration Plan (Silvius et al. 2005) recommended were: 1) identification of suspended sediment and nutrient sources to Hilo Bay from surface waters under base- and stormflow conditions, 2) collection of baseline chemical and ecological data to substantiate visual assessment of nutrients (making direct measurements of nutrient and Chl *a* concentrations), 3) examination of the response of algae in Hilo Bay to base- and stormflow conditions, and 4) scientific coordination among research groups to ensure that samples are continuously and constantly gathered, without interruptions or changes in protocols, and with much better spatial coverage than provided by previous studies.

The following study conducted by UHH collected critical baseline data for Hilo Bay. These data are: 1) essential for understanding how the Bay functions under baseflow and storm conditions, 2) recommended by the Hilo Bay Restoration Plan (Silvius et al. 2005),

3) needed to develop a successful and cost effective restoration plan, and 4) required to evaluate whether potential modification of the breakwater by USACE will improve Hilo Bay's water quality (USACE 2009).

Deliverables from this project to Hawaii County and USACE are: 1) nutrient and suspended sediment data from Hilo Bay and its watershed in formats compatible with USACE inputs to water quality numerical models and 2) a draft and final report documenting nutrient and suspended sediment collection, meteorological data for sample collection periods, a description of nutrient and suspended sediment concentration trends for each collection period, and a summary/conclusion of sampling results.

METHODS

Experimental design: This study examined how storms affect water quality (nutrients, suspended sediments, Chl *a*) in Hilo Bay by comparing conditions in the Bay before and following a storm. A similar design was successfully used by Ringuet & Mackenzie (2005) to evaluate the effects of storms on water quality and phytoplankton in southern Kaneohe Bay, Oahu.

Site description: Hilo Bay is a salt-wedge estuary located on the northeast side of Hawaii Island, Hawaii, USA. Approximately 9 km of the estuary's perimeter is bordered by land, while the outer margin is defined by a 3-km long breakwater running east to west with a 1.5 km wide opening to the Pacific Ocean. The partially enclosed Bay has a nearly 6.4 km^2 surface area (Paquay et al. 2007), and ranges in depth from 0 to 15 m. Hilo Bay's watershed is the largest in the state of Hawaii (Juvik & Juvik 1998), and its surface water inputs are dominated by two rivers, the Wailuku River watershed to the north, and the Wailoa River watershed to the south. The Wailuku River watershed is the largest watershed in the state of Hawaii, encompassing 576 km^2 with headwaters starting near 3,500 m in elevation on the slopes of Mauna Kea, the largest mountain in the world (Juvik & Juvik 1998). The Wailoa River watershed encompasses 481 km^2 with headwaters starting near 762 m in elevation on the slopes of Mauna Loa, the most massive mountain in the world (Juvik & Juvik 1998). Average annual precipitation in the two watersheds ranges from 50 to 600 cm of rain per year (Juvik & Juvik 1998). Both the Wailuku and Wailoa Rivers' watersheds are dominated by grasslands, evergreen forest, and scrub/shrub lands; however, the Wailoa River flows through a more anthropogenically impacted landscape compared to the Wailuku River, where ~15% of its land use within the riparian zone is low- and high-intensity developed and cultivated lands (Table 1) (Mead & Wiegner submitted).

For this project, eight stations were sampled for nutrients, turbidity, and Chl *a* (Fig. 3). Two stations were located in the freshwater portion of the Wailuku and Wailoa Rivers (S1 and S4, respectively) to determine yields of dissolved and particulate nutrients, as well as suspended sediments, entering Hilo Bay from surface water runoff. Four stations were located inside the Bay, two along the Wailuku River plume (S2 and S3) and two along the Wailoa River plume (S5 and S6). The station locations within the Wailuku River plume are on a slight angle to the northwest of this river's mouth because previous studies have shown that the plume is deflected northwest in Hilo Bay (Dudley & Hallacher 1991). Two 'control' sites were chosen outside of the Hilo Bay breakwater in areas outside of the direct influence of the two rivers (C1 and C2). Latitude and longitude for all stations were recorded using a Garmin 2210C GPS receiver to ensure constancy of stations locations among sampling dates (Table 2).

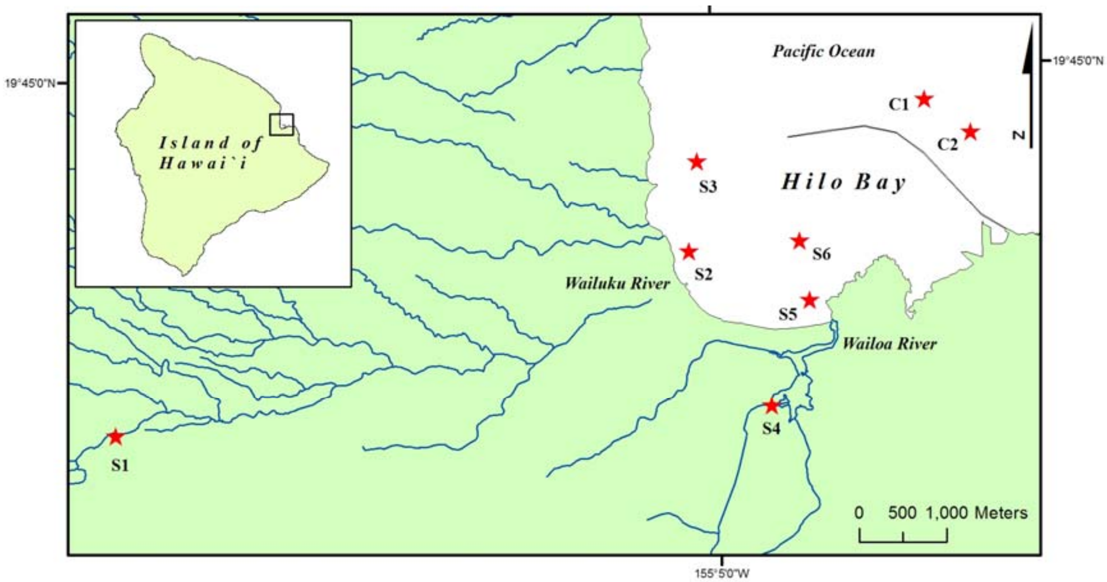

Figure 3. Locations of sampling stations in the Hilo Bay watershed, Hawaii, USA.

Sampling strategy: Water samples from the river and Bay stations were collected under baseflow and storm conditions from January 2007 through February 2008. Baseflow conditions for this study were defined as a dry period five days prior to sampling, where less than five cm of rain was recorded at Hilo International Airport (COOP ID # 511492); the same definition of baseflow conditions were used for a study in Kaneohe Bay, Oahu (Ringuet & Mackenzie 2005). During baseflow conditions, the Wailuku and Wailoa Rivers were sampled a day prior to sampling the stations in Hilo Bay. For this study, storm conditions were defined as a wet period, where greater than five cm of rain within 24 h were recorded at the Hilo International Airport and the ephemeral portion of the Wailoa River was hydrologically connected to the upper and lower portions of its watershed. Following a storm, the river stations were sampled one day prior to sampling the Bay stations. The stations in the Bay were then sampled for five consecutive days; this time frame was selected based on previous findings from Kaneohe Bay, Oahu, where phytoplankton bloomed three to five days following a storm (Ringuet & Mackenzie 2005). Data for winds and waves were taken from National Oceanic and Atmospheric Administration's (NOAA) National Weather Service for Marine Forecasts in Big Island Windward Waters (http://weather.noaa.gov/cgi-bin/fmtbltn.pl?file=forecasts/marine/coastal/ph/phz122.txt). Rainfall data were taken from NOAA's National Climatic Data Center for station #511492 at the Hilo International Airport (http://www4.ncdc.noaa.gov/cgiwin/wwcgi.dll?wwDI~Stn Srch~StnID~20023247) (Table 3). Tide data were taken from published tide tables for the Hilo area (http://www.freetidetables.com/sid/7760bcb8).

Sample collection: Surface water samples from all sample stations were collected in a plastic bucket, pre-rinsed with sample water, placed into triplicate 1-L acid-washed high density polyethylene (HDPE) bottles, and immediately placed on ice during transport to the laboratory. Because the focus of this study was to evaluate water quality in Hilo Bay before and after storms, surface water samples from the Bay were collected because that is where river sediments and phytoplankton are concentrated due to density stratification (Dudley & Hallacher 1991). Additionally, at the Bay and control stations, depth profiles of salinity, specific conductivity, temperature, dissolved oxygen concentration, and percent dissolved oxygen saturation, as well as light attenuation, were measured using a multi-parameter meter (YSI 85) and an underwater quantum sensor (Li-Cor LI-192), respectively.

Sample processing: At the laboratory, a known volume of water from the samples was filtered through pre-combusted (500° C, 6 h), pre-weighed, GF/F filters (Whatman) and frozen until analysis for dissolved nutrients. The filters used here were then dried to a constant weight at 70˚C for total suspended solids (TSS), particulate carbon (PC), and particulate nitrogen (PN) determination. Additionally, a known volume of water was filtered through another filter which was stored frozen in the dark for Chl *a* analysis. Aliquots of water from each sample were allowed to reach room temperature, and analyzed for pH (Hanna HI 991301) and turbidity (Hach 2100P Turbidimeter).

Analytical methods: Filtered nutrient samples were analyzed for total dissolved nitrogen (TDN), ammonium (NH_4^+), nitrate plus nitrite (NO_3^-+ NO_2^-), total dissolved phosphorus (TDP), phosphate (PO_4^{3-}), silicic acid (H_4SiO_4), and dissolved organic carbon (DOC). NH_4^+ [USGS I-2525, detection limit (d.l.) 1 μM], NO_3^-+ NO_2^- (USEPA 353.4, d.l. 0.1 μM), TDP (USGS I-4650-03, d.l. 0.1 μM), PO_4^{3-} (USEPA 365.5, d.l. 0.1 μM), and H_4SiO_4 (USEPA 366, d.l. 5 μM) were analyzed on a Technicon Pulse II Autoanalyzer. TDN was analyzed by high-temperature combustion, followed by chemiluminescent detection of nitric oxide (Shimadzu TOC-V, TNM-1). Dissolved organic nitrogen (DON) was determined from the difference between TDN and dissolved inorganic nitrogen (DIN = NH_4^+ + NO_3^- + NO_2^-). DOC was measured by high-temperature combustion (Shimadzu TOC-V, TNM-1) following the recommendations of Sharp et al. (2002). All nutrient samples were analyzed within two weeks of collection. Dried filters were reweighed for TSS determination (APHA et al. 1995) and subsequently analyzed for PC and PN on a CHN analyzer (Costech Analytical Technologies). Frozen filters were processed according to USEPA method 445.0 for Chl *a* and analyzed on a Turner 10-AU fluorometer.

River yield calculations: Daily yields from Wailuku and Wailoa Rivers to Hilo Bay for each sampling date were calculated from the product of nutrient or suspended sediment concentrations and river discharge divided by the drainage area for each river. Daily discharge for the Wailuku River was obtained from USGS website for gage station # 16704000 (http://waterdata.usgs.gov/hi/nwis/dv/?site_no=16704000&referred_module=sw) (Table 3). Discharge calculations for the Wailoa River were made by multiplying the measured cross-sectional area of the river by the calculated river velocity (Gore 1996; Table 3). River velocity was calculated using the time of travel for a neutrally buoyant marker placed in the flow of the river over a measured distance (Gore 1996).

RESULTS

From January 2007 through February of 2008, eight baseflow and four storms were sampled. In this report, we summarize concentrations of parameters monitored by HDOH (Table 4) and provide the remaining data requested by the USACE in both tables and appendices. To assess the state of water quality in Hilo Bay during base- and stormflow conditions, water quality parameters measured in this study were graphed with HDOH's standards (Figs. 4 - 26). Note, however, our study was not designed to evaluate water quality compliance.

River yields: TDN yields were almost six times higher in the Wailoa River (15.83 ±2.37 mol km^{-2} d^{-1}) as compared to the Wailuku River (2.69 ±1.33 mol km^{-2} d^{-1}) during baseflow conditions; yet, during storms, yields from the two rivers were comparable (Wailoa: 33.25 ±4.67 mol km^{-2} d^{-1} and Wailuku: 32.78 ±8.40 mol km^{-2} d^{-1}) (Table 5). NH_4^+ yields were 1.4 times higher from the Wailoa River (0.41 ±0.15 mol km^{-2} d^{-1}) than the Wailuku River (0.29 ±0.10 mol km^{-2} d^{-1}) during baseflow conditions; however, during storms, NH_4^+ yields from the Wailuku River increased by an order of magnitude (2.46 ±0.84 mol km^{-2} d^{-1}) and were almost four times greater than the storm yields from the Wailoa River (0.66 ±0.35 mol km^{-2} d^{-1}) (Table 5). NO_3^-+NO_2^- yields were approximately 18 times greater from the Wailoa River (14.02 ±3.20 mol km^{-2} d^{-1}) than from the Wailuku River (0.79 ±0.14 mol km^{-2} d^{-1}) during baseflow conditions. A similar pattern for NO_3^-+NO_2^- yields was also observed during storms, where yields from the Wailoa River (21.57 ±5.03 mol km^{-2} d^{-1}) were almost double of that from the Wailuku River (11.96 ±2.11 mol km^{-2} d^{-1}); however, increases in the NO_3^-+NO_2^- yields from base- to stormflow from the Wailoa River (increased 1.5 times) were an order of magnitude smaller than increases measured from the Wailuku River (increased 15 times) (Table 5). TDP yields from the Wailoa River (0.22 ±0.13 mol km^{-2} d^{-1}) were almost six times higher than those measured from the Wailuku River (0.04 ±0.02 mol km^{-2} d^{-1}) during baseflow conditions; however, during storms, TDP yields from the Wailuku River (0.08 ±0.05 mol km^{-2} d^{-1}) were almost three times higher than yields from the Wailoa River (0.03 ±0.03 mol km^{-2} d^{-1}) (Table 5). TSS yields were approximately three times higher in the Wailoa River (0.29 ±0.12 kg km^{-2} d^{-1}) compared to the Wailuku River (0.10 ±0.04 kg km^{-2} d^{-1}) during baseflow conditions; yet, during storms, TSS yields from the Wailuku increased by 230 times (23.61 ±13.43 kg km^{-2} d^{-1}) and were an order of magnitude greater than yields from the Wailoa River (2.03 ±1.81 kg km^{-2} d^{-1}) (Table 5).

Baseflow conditions: TDN concentrations in the Hilo Bay watershed and the Bay itself ranged from 2.99 to 61.13 µM, with the lowest and highest concentrations measured in the mouth of the Wailuku River (S2) (Table 6). TDN concentrations in the Wailuku River (S1) ranged from 5.28 to 52.93 µM and averaged 12.43 ±3.21 µM, which were two times lower than concentrations measured at the Wailoa River (S4) (range: 14.23 to 38.36 µM, average: 29.82 ±1.48 µM). TDN concentrations in the Wailoa River were consistently higher than HDOH's dry season standards for rivers during baseflow conditions, whereas concentrations measured in the Wailuku River were below the standard except on 5/03/2007 (Fig. 4). Inside Hilo Bay, TDN concentrations ranged from 2.99 to 61.13 µM and averaged 13.91 ±1.57 µM, with the lowest concentrations in front of the Wailuku River (S2 and S3) and highest in front of the Wailoa River (S5) (Table 6). Three of the four stations (S2, S3, and S6) within the Bay had TDN concentrations below HDOH's standards for embayments, except on 5/03/2007 (Fig. 7). In contrast, TDN concentrations in front of the Wailoa River mouth (S5) exceeded the HDOH's standards on five of the eight days sampled (Fig. 7). TDN concentrations at the control stations (C1 and C2) ranged from 3.67 to 54.65 µM and averaged 11.93 ±2.33 µM (Table 6). At both control stations on seven of the eight days sampled, TDN concentrations were below HDOH's standards for open coastal waters (Fig. 7). Like at the inner Bay stations, TDN concentrations at both control sites exceeded the HDOH's standards for open coastal waters on 5/03/2007 (Fig. 7).

NH_4^+ concentrations in the Hilo Bay watershed and the Bay itself ranged from non-detectable (n.d.) at several stations to 3.24 µM (Table 6). The average NH_4^+ concentration in the Wailuku River (S1) was 1.9 times higher than that measured in the

Wailoa River (S4). NH_4^+ concentrations in the Wailuku River (S1) ranged from 0.21 to 3.24 μM and averaged 1.30 ±0.24 μM. In the Wailoa River (S4), NH_4^+ concentrations ranged from n.d. to 1.55 μM and averaged 0.68 ±0.13 μM. In comparison, NH_4^+ concentrations inside Hilo Bay ranged from n.d. to 1.80 μM and averaged 0.21 ±0.05 μM. All four stations within the Bay had NH_4^+ concentrations exceeding HDOH's standards for embayments on one or two of the eight sampling days (Tables 4 and 6). However, for the majority of the sampling days, NH_4^+ concentrations at these stations inside the Bay (S2, S3, S5, and S6) were below detection limits (Table 6). NH_4^+ concentrations at the control stations (C1 and C2) were below detection limits for seven of the eight sampling days. On the eighth sampling date (11/08/2007), both control stations were between 2.8 and 3.3 times higher than the HDOH's standards for open coastal waters (Tables 4 and 6). However, like the stations within the Bay, NH_4^+ was below detection limits for most sampling dates and therefore below HDOH's standards.

NO_3^-+ NO_2^- concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. outside the breakwater to 37.86 μM in the Wailoa River mouth (S5) (Table 6). In comparison to the pattern observed for NH_4^+, average NO_3^-+ NO_2^- concentrations were 7.7 times higher in the Wailoa River (S4) than in the Wailuku River (S1) (Fig. 5). In the Wailuku River (S1), NO_3^-+ NO_2^- concentrations ranged from 1.81 to 5.48 μM and averaged 3.68 ±0.25 μM. In the Wailoa River (S4), NO_3^-+ NO_2^-concentrations ranged from 2.18 to 37.86 μM and averaged 28.51 ±2.20 μM. NO_3^-+ NO_2^-concentrations inside Hilo Bay (S2, S3, S5, and S6) ranged from 0.15 to 26.29 μM and averaged 5.17 ±0.68 μM. The highest NO_3^-+ NO_2^- concentrations inside Hilo Bay were observed at the two stations within the Wailoa River plume (S5 and S6) (Fig. 8). On all sampling dates, NO_3^-

+ NO_2^- concentrations at one or more stations inside Hilo Bay were above HDOH's standards for embayments, with the highest concentration measured being ~ 46 times higher than HDOH's standard (Fig. 8). Average NO_3^-+ NO_2^- concentrations at the control stations were 0.41 ±0.09 µM and 1.14 ±0.37 µM for C1 and C2, respectively. On four to five of the eight sampling days at one or both control stations, NO_3^-+ NO_2^- concentrations exceeded HDOH's standard for open coastal waters (Tables 4 and 6).

TDP and PO_4^{3-} concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. to 1.44 µM and n.d. to 0.27 µM, respectively (Table 6). In the Wailuku River (S1), TDP concentrations ranged from n.d. to 0.83 µM and averaged 0.19 ±0.06 µM. PO_4^{3-} concentrations were only above detection limits once, and averaged 0.00 ±0.00 µM. In the Wailoa River (S4), TDP concentrations ranged from n.d. to 1.28 µM and averaged 0.32 ±0.10 µM, while PO_4^{3-} concentrations ranged from n.d. to 0.27 µM and averaged 0.07 ±0.02 µM. TDP concentrations inside the Bay (S2, S3, S5, and S6) ranged from n.d. to 1.44 µM and averaged 0.17 ±0.05 µM (Table 6). On the first baseflow sampling date (3/14/2007), all stations inside Hilo Bay were above the HDOH's standard for embayments (Tables 4 and 6); however, this occurred only once during our study. PO_4^{3-} concentrations were only above detection limits twice, and averaged 0.01 ±0.00 µM at all stations inside Hilo Bay (Table 6). The average TDP concentrations at the control stations were similar to one another, with overall averages of 0.13 ±0.09 µM and 0.10 ±0.05 µM for C1 and C2, respectively. Similar to stations within Hilo Bay, both control stations had concentrations above the HDOH's standard for open coastal waters on the first baseflow sampling date, but never at any other time during the study (Tables 4 and 6). PO_4^{3-} concentrations were never above the detection limit or above the HDOH's standard for open coastal waters at any time during our study at the control stations (Tables 4 and 6).

Turbidity levels in the Hilo Bay watershed and the Bay itself ranged from 0.10 to 1.40 NTU (Table 6). In the Wailuku River (S1), turbidity levels ranged from 0.30 to 1.40 NTU and averaged 0.75 ±0.09 NTU (Fig. 6). In the Wailoa River (S4), turbidity levels ranged from 0.10 to 0.54 NTU, averaged 0.25 ±0.03 NTU, and were three times lower than those measured in the Wailuku River (Fig. 6, Table 6). Turbidity levels inside the Bay (S2, S3, S5, and S6) ranged from 0.21 to 1.38 NTU and averaged 0.72 ±0.03 NTU (Table 6). On all sampling dates, turbidity levels at the stations inside Hilo Bay were below the HDOH's standard for embayments (Fig. 9). Average turbidity levels at the control stations were nearly identical, with overall averages of 0.26 ±0.03 NTU and 0.26 ±0.02 NTU for C1 and C2, respectively. Turbidity levels at the control stations were 1.4 times lower than those measured inside the breakwater. Additionally, turbidity levels measured at the two control stations were lower than the HDOH's standard for open coastal waters during all of the baseflow sampling dates (Tables 4 and 6).

Chl *a* concentrations in Hilo Bay ranged from 0.18 µg/L outside of the breakwater to 23.19 µg/L at the Wailoa River mouth (S6) (Table 6). Chl *a* concentrations inside Hilo Bay (S2, S3, S5, and S6) ranged from 0.23 to 23.19 µg/L and averaged 3.86 ±0.57 µg/L. The highest Chl *a* concentrations inside Hilo Bay were observed at the two stations furthest from the mouths of Wailuku and Wailoa Rivers (S3 and S6) (Fig. 10). Chl *a* concentrations inside Hilo Bay (S2, S3, S5, and S6) were above the HDOH's standard for embayments at all of the stations on two up to six of the eight sampling dates, with the highest concentration measured being 15.5 times higher than HDOH's standard (Fig. 10).

Chl *a* concentrations at the two control stations (C1 and C2) ranged from 0.18 to 3.53 µg/L and averaged 1.44 ±0.16 µg/L (Table 6). On all but two sampling dates, these two stations had Chl *a* concentrations that were 1.6 to 11.8 times higher than the HDOH's standard for open coastal waters (Tables 4 and 6).

Storm 1: Storm 1 was sampled between 1/10/2007 and 1/15/2007. Both the Wailuku (S1) and Wailoa (S4) Rivers were sampled on the last day of the storm, 1/10/2007. The Bay (S2, S3, S5, and S6) and control (C1 and C2) stations were sampled for the five days following the end of Storm 1, starting on 1/11/2007 and ending on 1/15/2007. The entire data set for Storm 1 is summarized in Table 7 and Appendices 1 through 6.

TDN concentrations in the Hilo Bay watershed and the Bay itself ranged from 4.67 to 34.05 µM, with the lowest concentration measured in the Wailuku River plume (S3) and the highest in the Wailoa River (S4) (Table 7). TDN concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 9.14 ±1.29 µM and 34.05 ±1.15 µM, respectively, on 1/10/2007 - the last day of the storm (Fig. 4). Inside Hilo Bay, stations within the Wailoa River plume (S5 and S6) had the highest TDN concentrations within the Bay, ranging from 7.51 to 16.79 µM. TDN concentrations at these two stations peaked on day three and four following the storm, as river discharge decreased (Fig. 11). TDN concentrations within the Wailuku River plume (S2 and S3) ranged from 4.67 to 7.97 µM, were lower than concentrations within the Wailoa River plume (S5 and S6), and peaked on day three and four following the storm (Fig. 11). TDN concentrations at the control stations (C1 and C2) remained relatively constant for the five days following the storm, and ranged from 5.11 to 6.78 µM (Table 7). TDN concentrations at most Bay and control stations were below the HDOH's standards for embayments and open coastal waters (Tables 4 and 7), respectively, following the storm, except for one or two days at the two stations within the Wailoa River plume (S5 and S6) (Fig. 11).

NH_4^+ concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. at most stations to 1.96 µM (Table 7). NH_4^+ concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 0.21 ±0.03 µM and 0.35 ±0.12 µM, respectively, on 1/10/2007 - the last day of the storm. NH_4^+ concentrations inside the Bay (S2, S3, S5, and S6) were only above detection limits on the third day following the storm of (1/13/2007), and only at the two stations within the Wailoa River plume (S5 and S6) (Table 7). NH_4^+ concentrations were never higher than the HDOH's standard for embayments, except for the offshore station within the Wailoa River plume (S6) on third day following the storm (1/13/2007) (Tables 4 and 7). Concentrations of NH_4^+ at the control stations (C1 and C2) were never above detection limits on any of the days sampled or above the HDOH's standard for open coastal waters (Tables 4 and 7).

$NO_3^- + NO_2^-$ concentrations in the Hilo Bay watershed and the Bay itself ranged from 0.61 µM at the one of the control stations to 19.55 µM at the Wailoa River (S4) (Table 7). $NO_3^- + NO_2^-$ concentrations in the Wailuku and Wailoa Rivers were 5.05 ±0.05 µM and 19.55 ±3.00 µM, respectively, on 1/10/2007- the last day of the storm (Fig. 5). Stations in the Wailoa River plume (S5 and S6) had the highest concentrations within Hilo Bay, ranging from 3.99 to 10.32 µM. No consistent $NO_3^- + NO_2^-$ concentration pattern was observed for these two stations over the five sampling days following the storm (Fig. 12). In contrast, $NO_3^- + NO_2^-$ concentrations in the Wailuku River plume (S2 and S3) were generally lower than the stations within the Wailoa River plume (S5 and

S6), ranging from 0.92 to 5.48 µM. Concentrations at stations S2 and S3 peaked on the second day following the storm and declined through the fifth day (Fig. 12). $NO_3^- + NO_2^-$ concentrations at the control stations (C1 and C2) remained relatively constant for the five days following the storm, and ranged from 0.61 to 2.73 µM. $NO_3^- + NO_2^-$ concentrations at all the Bay (S2, S3, S5, and S6) and control (C1 and C2) stations were always above the HDOH's standards for embayments and open coastal waters, respectively, during the sampling period for Storm 1 (Fig. 12, Tables 4 and 7).

TDP and PO_4^{3-} concentrations in the Hilo Bay watershed and the Bay itself were only above detection limits at stations in the Wailoa River and within its plume (S4, S5, and S6), ranging from n.d. to 0.53 µM TDP and n.d. to 0.03 µM PO_4^{3-} (Table 7). TDP and PO_4^{3-} concentrations in the Wailoa (S4) River were 0.02 ±0.01 µM and 0.02 ±0.02 µM, respectively, on the last day of the storm (1/10/2007). TDP and PO_4^{3-} concentrations inside the Bay (S2, S3, S5, and S6) were only detectable at stations S5 and S6 and ranged from n.d. to 0.53 µM and n.d. to 0.03 µM, respectively, across all Bay stations (Table 7). TDP and PO_4^{3-} concentrations at these stations never exceeded HDOH's standards for embayments (Tables 4 and 7). At the control stations (C1 and C2), TDP and PO_4^{3-} concentrations were never above detection limits or exceeded the HDOH's standards for open coastal waters (Tables 4 and 7).

Turbidity levels in the Hilo Bay watershed and the Bay itself ranged from 0.33 to 3.58 NTU (Table 7). Turbidity levels in the Wailuku (S1) and Wailoa (S4) Rivers were 1.36 ±0.02 and 0.86 ±0.04 NTU, respectively, on 01/10/2007- the last day of the storm (Fig. 6). Turbidity levels inside the Bay ranged from 0.78 to 3.58 NTU, with the highest values being recorded at the stations closest to the mouths of the rivers (S2 and S5). With the exception of station S6, turbidity levels inside the Bay peaked on the second day following the storm (1/12/2007) and generally decreased through the fifth day (Fig. 13). The HDOH's standard for embayments was exceeded primarily at station S2, which is located at the mouth of the Wailuku River; however, by the fifth day of sampling following the storm, all stations inside the Bay (S2, S3, S5, and S6) were below the HDOH's standard (Fig. 13). Turbidity levels at the control stations (C1 and C2) ranged from 0.33 to 0.91 NTU and exceeded the HDOH's standards for open coastal waters on three to four of the five days sampled following the storm (Tables 4 and 7).

Chl *a* concentrations in Hilo Bay ranged from n.d. at two stations in Hilo Bay to 1.72 µg/L within the plume of the Wailoa River (S6) (Table 7). The Chl *a* concentrations at stations inside Hilo Bay (S2, S3, S5, and S6) ranged from n.d. to 1.72 µg/L, while concentrations at the control stations (C1 and C2) ranged from n.d. to 1.31 µg/L. With the exception of station S6, all stations inside Hilo Bay and the control stations showed the same pattern with respect to Chl *a* concentrations, where Chl *a* concentrations peaked on the second day following the storm, with concentrations decreasing on the third day and remaining relatively constant from the third through the fifth day (Fig. 14). Chl *a* concentrations at the two stations within the Wailuku River plume (S2 and S3) and the near-shore station within the Wailoa River plume (S5) never exceeded the HDOH's Chl *a* standard for embayment waters during the five day period following the storm (Fig. 14). In contrast, the station within the Wailoa River plume furthest from the river mouth (S6) and the two control stations (C1 and C2) had Chl *a* concentrations that exceed the HDOH's standards for embayments and open coastal waters, respectively (Fig. 14, Tables 4 and 7). In particular, Chl *a* concentrations at station C2 exceed the HDOH's standard for open coastal waters on all five sampling days following the storm (Tables 4 and 7).

Storm 2: Storm 2 was sampled between 3/01/2007 and 3/06/2007. Both the Wailuku (S1) and Wailoa (S4) Rivers were sampled on the last day of the storm on 3/01/2007. The stations inside Hilo Bay (S2, S3, S5, and S6) and the control stations (C1 and C2) were sampled for the five days following the end of Storm 2 from 3/02/2007 through 3/06/2007. All data for Storm 2 are summarized in Table 8 and Appendices 1 through 6.

TDN concentrations in the Hilo Bay watershed and the Bay itself ranged from 6.92 to 29.40 μM, with the lowest concentration measured at one of the control stations (C1) and the highest in the Wailoa River plume (S5) (Table 8). TDN concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 7.97 ±0.83 μM and 29.31 ±1.86 μM, respectively, on 3/01/2007 - the last day of the storm (Fig. 4). Inside Hilo Bay, stations within the Wailoa River plume (S5 and S6) had the highest TDN concentrations, ranging from 20.08 to 29.40 μM (Table 8). TDN concentrations at these two stations peaked on day three and four following the storm, as river discharge decreased (Fig. 15). TDN concentrations at stations within the Wailuku River plume (S2 and S3) were generally lower than the stations within the Wailoa River plume (S5 and S6), ranging from 7.85 to 17.22 μM (Table 8), and peaking on the fifth day following the storm (Fig. 15). TDN concentrations at the control stations (C1 and C2) ranged from 6.92 to 12.00 μM and were generally lower than concentrations measured within the two river plumes (Fig. 15). TDN concentrations at the two stations in the Wailoa River plume exceeded the HDOH's standards for embayments on all of the days following the storm; in contrast, none of the stations within the Wailuku River plume exceeded this HDOH's standard (Fig. 15). On only one day at both control stations (C1 and C2) did TDN concentrations exceed the HDOH's standard for open coastal waters (Tables 4 and 8).

NH_4^+ concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. at most stations to 0.90 µM (Table 8). NH_4^+ concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 0.36 ±0.05 µM and 0.41 ±0.08 µM, respectively, on the last day of the storm - 3/01/2007. Stations inside Hilo Bay (S2, S3, S5, and S6) had NH_4^+ concentrations ranging from n.d. to 0.90 µM, with the highest concentrations observed at stations S2 and S6 (Table 8). NH_4^+ concentrations that exceeded the HDOH's standard for embayments were only observed at stations S2 and S6 and their concentrations only exceeded the standard on one or two of the days sampled following the storm (Tables 4 and 8). NH_4^+ concentrations at the control stations (C1 and C2) were never above detection limits nor exceeded the HDOH's standard for open coastal waters (Tables 4 and 8).

NO_3^-+ NO_2^- concentrations in the Hilo Bay watershed and the Bay itself ranged from 0.44 µM at the one of the control stations to 24.38 µM in the Wailoa River (S4) (Table 8). NO_3^-+ NO_2^- concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 2.46 ±0.05 µM and 24.38 ±0.24 µM, respectively (Fig. 5). Stations within the Wailuku River plume (S2 and S3) had NO_3^-+ NO_2^- concentrations ranging from 1.53 to 8.73 µM. Concentrations at these stations remained relatively stable from the first through the fourth day following the storm and then peaked on the fifth day (Fig. 16). Stations within the Wailoa River plume (S5 and S6) had the highest NO_3^-+ NO_2^- concentrations within Hilo Bay, ranging from 7.20 to 15.27 µM (Fig. 16). The NO_3^-+ NO_2^- concentrations at these two stations were three times higher than those measured at stations within the Wailuku River plume (S2 and S3) (Table 8). $NO_3^- + NO_2^-$ concentrations at all stations inside Hilo Bay (S2, S3, S5, and S6) were always above the HDOH's standard for embayments following the storm, with the highest concentration being ~ 27 times higher than HDOH's standard (Fig. 16). Similarly, $NO_3^- + NO_2^-$ concentrations at the control (C1 and C2) stations remained relatively constant from the first through the fourth day following the storm, and peaked on the fifth day (Fig. 16). Concentrations at the control stations ranged from 0.44 to 2.73 μM and always exceed the HDOH's standard for open coastal waters following the storm (Tables 4 and 8).

TDP and PO_4^{3-} concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. to 0.08 μM and n.d. to 0.02 μM, respectively (Table 8). In the Wailuku River (S1), TDP and PO_4^{3-} concentrations averaged 0.02 ±0.02 μM and 0.01 ±0.01 μM, respectively. In the Wailoa River (S4), TDP and PO_4^{3-} concentrations were rarely above detection limits (Table 8). TDP and PO_4^{3-} concentrations ranged from n.d. to 0.08 μM and n.d. to 0.02 μM, respectively, inside the Bay (S2, S3, S5, and S6). Concentrations for these two parameters were only detectable within the Wailoa River plume at stations S5 and S6 and never exceeded HDOH's standards for embayments following Storm 2 at any of these stations (Tables 4 and 8). At the control stations (C1 and C2), TDP was never above detection, and PO_4^{3-} concentrations were detectable only once, on the first day after the storm (3/02/2007), at station C2 (Table 8). TDP and PO_4^{3-} concentrations at the control stations never exceeded the HDOH's standards for open coastal waters following Storm 2 (Tables 4 and 8).

Turbidity levels in the Hilo Bay watershed and the Bay itself ranged from 0.24 to 5.08 NTU (Table 8). Turbidity levels in the Wailuku (S1) and Wailoa (S4) Rivers were 5.08 ±0.18 NTU and 3.13 ±0.14 NTU, respectively, on the last day of the storm – 3/01/2007 (Fig. 6). Turbidity levels inside the Bay (S2, S3, S5, and S6) peaked on the first day following the storm and generally declined over the next four days (Fig. 17). Inside Hilo Bay, turbidity levels ranged from 0.54 to 4.52 NTU, with the highest values being recorded at the stations closest to the mouths of the rivers (S2 and S5) on the first day after the storm. At the two stations inside the Wailuku River plume (S2 and S3), turbidity levels exceeded the HDOH's standard for embayments on day one through day three following the storm (Fig. 17). At the stations within the Wailoa River plume (S5 and S6), turbidity levels exceed the HDOH's standards for embayments only for one to two days following the storm (Fig. 17). Turbidity levels at the control (C1 and C2) stations ranged from 0.24 to 1.20 NTU and exceeded the HDOH's standards for open coastal waters on the first day following the storm for both stations, as well as for two additional days at C1 (Tables 4 and 8).

Chl *a* concentrations ranged from n.d. at several station in Hilo Bay to 1.37 μg/L within the Wailoa River plume (S5) (Table 8). Chl *a* concentrations inside the Bay (S2, S3, S5, and S6) ranged from n.d. to 1.37 μg/L, with a general increase in concentration following the storm (Fig. 18). None of the stations inside Hilo Bay had Chl *a* concentrations that exceeded the HDOH's standard for embayment waters following the storm (Fig. 18). At the control stations (C1 and C2), Chl *a* concentrations ranged from n.d. to 0.46 μg/L. Like at the stations inside Hilo Bay, Chl *a* concentrations at the control stations generally increased following the storm (Fig. 18). Chl *a* concentrations at station

C2 never exceeded the HDOH's standard for open coastal waters; however, station C1 had concentrations that exceeded the standard on three of the five days sampled following the storm (Tables 4 and 8).

Storm 3: Storm 3 was sampled between 12/12/2007 and 12/17/2007. Both the Wailuku (S1) and Wailoa (S4) Rivers were sampled on the last day of the storm on 12/12/2007. The stations inside Hilo Bay (S2, S3, S5, and S6) were sampled for the five days following the end of the storm from 12/13/2007 through 12/17/2007. Due to a small craft advisory, control stations (C1 and C2) were not sampled during Storm 3. All data for Storm 3 are summarized in Table 9 and Appendices 1 through 6.

TDN concentrations in the Hilo Bay watershed and the Bay itself ranged from 6.11 to 35.94 µM, with the lowest concentrations measured at the mouth of the Wailuku River (S2) and the highest measured in the Wailoa River (S4) (Table 9). The average TDN concentrations in the Wailuku and Wailoa Rivers were 8.09 ±0.43 µM and 35.94 ±0.18 µM, respectively, on the last day of the storm on 12/12/2007 (Fig. 4). Stations inside Hilo Bay (S2, S3, S5, and S6) had TDN concentrations ranging from 6.11 to 25.94 µM, with the highest concentrations observed at the mouth of the Wailoa River (S5) (Fig. 19). TDN concentrations within both rivers' plumes decreased as river discharge increased (Fig. 19). TDN concentrations inside the Wailuku River plume (S2 and S3) and at one station in the Wailoa River plume (S6) did not exceed the HDOH's standard for embayments following the storm (Fig. 19). In contrast, the station in front of the Wailoa River mouth (S5) exceeded the HDOH's standard for embayments on all five days following the storm (Fig. 19).

NH_4^+ concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. to 0.78 μM (Table 9). NH_4^+ concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 0.78 ±0.11 μM and 0.20 ±0.20 μM, respectively, on the last day of the storm on 12/12/2007. Stations inside Hilo Bay (S2, S3, S5, and S6) had NH_4^+ concentrations ranging from n.d. to 0.47 μM, with the highest concentrations observed within the Wailuku River plume at station S3 (Table 9). Only once did NH_4^+ concentrations inside Hilo Bay exceed the HDOH's standard for embayments; this occurred on the second day after Storm 3 at station S3 (Tables 4 and 9).

$NO_3^- + NO_2^-$ concentrations in the Hilo Bay watershed and the Bay itself ranged from 1.80 μM within the Wailuku River plume (S2) to 24.88 μM within the Wailoa River plume (S5) (Table 9). $NO_3^- + NO_2^-$ concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 2.67 ±0.04 μM and 19.00 ±0.53 μM, respectively (Fig. 5). Stations within the Wailuku River plume (S2 and S3) had $NO_3^- + NO_2^-$ concentrations ranging from 1.80 to 4.05 μM (Table 9). As with baseflow conditions and other storms sampled, stations within the Wailoa River plume (S5 and S6) had the highest $NO_3^- + NO_2^-$ concentrations in Hilo Bay, ranging from 2.74 to 24.88 μM (Fig. 20, Table 9). $NO_3^- + NO_2^-$ concentrations at the inner Wailoa River plume station (S5) were on average four times higher than those of the outer Wailoa River plume station (S6), and seven times higher than those of the Wailuku River plume station (S2 and S3) (Fig. 20, Table 9). $NO_3^- + NO_2^-$ concentrations at all stations inside Hilo Bay (S2, S3, S5, and S6) were always above the HDOH's standard for embayments following the storm, with the highest concentration being ~44 times higher than HDOH's standard (Fig. 20).

TDP and PO_4^{3-} concentrations in the Hilo Bay watershed and the Bay itself were only detectable at the inner Wailoa River plume station (S5) following Storm 3 and ranged from n.d. to 0.37 µM and n.d. to 0.16 µM, respectively (Table 9). Both the Wailuku (S1) and Wailoa (S4) Rivers had no detectable TDP or PO_4^{3-} (Table 9). TDP and PO_4^{3-} concentrations measured at station S5 in the Wailoa River plume never exceeded HDOH's standards for embayments following Storm 3 (Tables 4 and 9).

Turbidity levels in the Hilo Bay watershed and the Bay itself ranged from 0.39 to 11.63 NTU (Table 9). Turbidity levels in the Wailuku (S1) and Wailoa (S4) Rivers were 11.63 ±0.73 and 0.39 ±0.02 NTU, respectively, on the last day of the storm on 12/12/2007 (Fig. 6). Turbidity levels inside the Bay (S2, S3, S5, and S6) peaked on the fourth day following the storm, coincident with a substantial increase in discharge from the Wailuku River (Fig. 21). Inside Hilo Bay, turbidity levels ranged from 0.75 to 10.28 NTU, with the highest values again being recorded at stations within the Wailuku River plume (S2 and S3) (Fig. 21, Table 9). The inner Wailoa River plume station (S5) was the only station that did not continually exceed the HDOH's standard for embayments following this storm (Fig. 21). In general, the Bay remained turbid and above HDOH's standards during the sampling period of this storm (Fig. 21).

Chl *a* concentrations in Hilo Bay ranged from n.d. to 2.21 µg/L (Table 9). Chl *a* concentrations exceeded the HDOH's standard for embayment waters within the Wailuku River plume at station S3 on the fifth day of sampling following the storm; however, with the exception of that single measurement, Chl *a* concentrations were low and often undetectable (Fig. 22, Table 9).

Storm 4: Storm 4 was sampled between 1/27/2008 and 2/01/2008. Both the Wailuku (S1) and Wailoa (S4) Rivers were sampled on the last day of the storm on 1/27/2008. The stations inside Hilo Bay (S2, S3, S5, and S6) were sampled for five days following the end of Storm 4 from 1/28/2008 through 2/01/2008. A small craft advisory prevented sampling at control stations (C1 and C2) for all days except 1/30/2008 and 1/31/2008. All data for Storm 4 are summarized in Table 10 and Appendices 1 through 6.

TDN concentrations in the Hilo Bay watershed and the Bay itself ranged from 5.66 µM at one of the control stations (C2) to 30.58 µM in the Wailoa River (Table 10). TDN concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 8.77 ±1.08 µM and 30.58 ±4.51 µM, respectively, on the last day of storm on 1/27/2008 (Fig. 4). Stations inside Hilo Bay (S2, S3, S5, and S6) had TDN concentrations ranging from 6.00 to 24.05 µM (Table 10), with the highest concentrations observed at station S5 within the Wailoa River Plume (Fig. 23). At all stations except S5, TDN concentrations peaked on day four following the storm when river discharge was its lowest (Fig. 23). TDN concentrations at stations within the Wailuku River plume (S2 and S3) and at one station within the Wailoa River plume (S6) were below the HDOH's standard for embayments (Fig. 23). In contrast, TDN concentrations at the station within the Wailoa River mouth (S5) always exceeded the HDOH's standard for embayments (Fig. 23). TDN concentrations at control stations (C1 and C2) ranged from 5.66 µM to 15.96 µM (Table 10). TDN concentrations at the control stations were below the HDOH's standard for open coastal waters on one of the two days sampled following the storm and above it on the other day (Tables 4 and 10).

NH_4^+ concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. at most stations to 1.56 µM (Table 10). NH_4^+ concentrations in the Wailuku (S1) and Wailoa (S4) Rivers were 1.11 ±0.05 µM and 1.26 ±0.29 µM, respectively, on the last day of the storm on 1/27/2008. Stations inside Hilo Bay (S2, S3, S5, and S6) had NH_4^+ concentrations ranging from n.d. to 0.86 µM, with the highest concentrations observed at station S2 within the Wailuku River plume (Table 10). NH_4^+ concentrations exceeded the HDOH's standard for embayments on at least one day following the storm at stations S2, S3, and S5 (Tables 4 and 10). NH_4^+ concentrations at the control stations (C1 and C2) ranged from below detection levels to 1.56 µM at station C1 (Table 10). NH_4^+ concentrations at control station C1 was four times higher than the HDOH's standard for open coastal waters on one of the two days sampled (Tables 4 and 10). NH_4^+ concentrations at control station C2 were above HDOH's standards for open coastal waters on both days sampled, and once exceeding the standard by three times (Tables 4 and 10).

NO_3^-+ NO_2^- concentrations in the Hilo Bay watershed and the Bay itself ranged from 2.14 µM at one of the control stations to 22.28 µM at the mouth of the Wailoa River (S5) (Table 10). NO_3^-+ NO_2^- concentrations at the Wailuku (S1) and Wailoa (S4) Rivers were 3.52 ±0.07 µM and 17.72 ±1.82 µM, respectively (Fig. 5). Stations within the Wailuku River plume (S2 and S3) had NO_3^-+ NO_2^- concentrations ranging from 2.16 to 4.13 µM (Table 10). Stations within the Wailoa River plume (S5 and S6) had the highest NO_3^-+ NO_2^- concentrations within Hilo Bay, ranging from 3.31 to 22.28 µM (Table 10). Concentrations at station S5 within the Wailoa River plume were always the highest measured following Storm 4 (Fig. 24). NO_3^-+ NO_2^- concentrations at all stations inside

Hilo Bay (S2, S3, S5, and S6) were always above the HDOH's standard for embayments following the storm, with the concentrations ranging between four and 40 times higher than HDOH's standard (Fig. 24). NO_3^-+ NO_2^- concentrations at the control stations(C1 and C2) ranged from 2.14 to 2.66 μM and had concentrations that were six times higher than the HDOH's standard for open coastal waters (Tables 4 and 10).

TDP and PO_4^{3-} concentrations in the Hilo Bay watershed and the Bay itself ranged from n.d. to 1.17 μM and n.d. to 0.57 μM, respectively (Table 10). In the Wailuku River (S1), TDP and PO_4^{3-} concentrations averaged 0.05 ±0.01 μM and 0.02 ±0.02 μM, respectively. In the Wailoa River (S4), TDP and PO_4^{3-} concentrations averaged 0.09 ±0.01 μM and 0.06 ±0.01 μM, respectively (Table 10). TDP and PO_4^{3-} concentrations ranged from n.d. to 0.72 μM and n.d. to 0.57 μM, respectively, inside the Bay (S2, S3, S5, and S6) (Table 10). Concentrations for these two parameters did not exceed HDOH's standards for embayments following the storm (Tables 4 and 10). At the control stations (C1 and C2), TDP and PO_4^{3-} concentrations were generally below detection limits, except for station C1 on the fourth day following the storm, where its concentration was two times higher than the HDOH's standard for open coastal waters (Tables 4 and 10).

Turbidity levels in the Hilo Bay watershed and the Bay itself ranged from 0.32 to 22.40 NTU (Table 10). Turbidity levels in the Wailuku (S1) and Wailoa (S4) Rivers were 3.60 ±0.04 NTU and 0.32 ±0.05 NTU, respectively, on the last day of the storm on 1/27/2008 (Fig. 6). Inside Hilo Bay, turbidity levels ranged from 1.77 to 22.40 NTU, with the highest values measured at station S2 within the Wailuku River plume (Fig. 25, Table 10). Turbidity levels exceeded the HDOH's standard for embayments at all stations within Hilo Bay on all sampling days following the storm (Fig. 25). Turbidity levels at the control (C1 and C2) stations ranged from 0.93 to 6.26 NTU and exceeded the HDOH's standards for open coastal waters on both days sampled (Tables 4 and 10).

Chl *a* concentrations in Hilo Bay ranged from n.d. to 1.72 µg/L (Table 10). Chl *a* concentrations exceeded the HDOH's standard for embayments only once at station S5 within the Wailoa River plume following the storm (Fig. 26). At the control stations (C1 and C2), Chl *a* concentrations were only above detection limits on one day of the two days sampled (Table 10).

DISCUSSION AND CONCLUSIONS

NO_3^-+NO_2^- in Hilo Bay: The highest NO_3^-+NO_2^- concentrations measured in Hilo Bay were following storms, and under these conditions, NO_3^-+NO_2^- concentrations consistently exceeded the HDOH's standards, with the highest concentration being ~44 times higher than the embayment standard. Across all stations sampled in Hilo Bay, NO_3^-+NO_2^- concentrations were ~1.5 times higher following storms than during baseflow conditions. An earlier study in Hilo Bay documented similar NO_3^-+NO_2^- concentrations during a storm; however, the concentration increase from baseflow to storm conditions that was observed was seven times greater than the one we measured (M & E Pacific 1980).

Under storm conditions, the largest surface water source of NO_3^-+NO_2^- to Hilo Bay measured in this study was from the Wailoa River, and the highest NO_3^-+NO_2^- concentrations in the Bay were measured within the Wailoa River plume. This pattern was also observed during baseflow conditions, where instantaneous NO_3^-+NO_2^- yields were 18 times greater from the Wailoa River than from the Wailuku River, and NO_3^-

$+NO_2^-$ concentrations within the Wailoa River plume were consistently higher than those measured in the Wailuku River plume (5 times higher) and outside of the breakwater (11 times higher).

Higher NO_3^-+NO_2^- concentrations in Hilo Bay following storms are likely a result of increased discharge from the Wailoa and Wailuku Rivers, as the concentration of NO_3^-+NO_2^- in the rivers generally decreased during storms. NO_3^-+NO_2^- yields from both the Wailoa and Wailuku Rivers increased 1.5 and 15 times, respectively, following storms. While the greatest change in NO_3^-+NO_2^- yields from baseflow to storm conditions were observed in the Wailuku River, the Wailoa River was still the largest surface water source of NO_3^-+NO_2^- to Hilo Bay, contributing two times more NO_3^-+NO_2^- than the Wailuku River to Hilo Bay during storms.

The high NO_3^-+NO_2^- concentrations measured in the Wailoa River and its plume in Hilo Bay most likely stem from the land use within this watershed. Approximately 15% of the Wailoa River's drainage area is comprised of low- and high-intensity development and agriculture as compared to ~1% for the Wailuku River's watershed (Table 1). Cesspools and septic tanks are likely the dominant sources of NO_3^-+NO_2^- to the Wailoa River, as only 30 to 40% of Hilo is connected to the sewer line, and the majority of homes are located within this watershed (Silvius et al. 2005). Other possible anthropogenic sources of NO_3^-+NO_2^- include livestock waste and fertilizers from agricultural lands, although contributions from these sources are likely small as the extent and intensity of agricultural activities are relatively low in this watershed (Wiegner pers. obs.). Decomposition of leaf litter in forests and grasslands may also contribute NO_3^-+NO_2^- to the Wailoa River too. To determine the contribution of these sources to the

NO_3^-+NO_2^- in the Wailoa River, measurements of stable nitrogen and oxygen isotopes for NO_3^- and those for boron are needed from both the potential sources of NO_3^- to the river, as well as NO_3^- from the river itself. These types of measurements will allow NO_3^- from natural sources like forests to be distinguished from NO_3^- human sources like sewage, as sewage has distinct stable isotope signatures for these elements (i.e., Vengosh et al. 1994; Kendall 1998). This type of approach has been successfully used in Maui County to trace sewage inputs from an injection well to the coastal waters of Kihei (Hunt 2006).

There is one additional ephemeral stream draining into Hilo Bay, Alenaio Stream, that we did not measure inputs from. A previous study estimates that instantaneous daily yields of NO_3^-+NO_2^- from Alenaio Stream during storms range from 18.48 to 641.44 mol of N km^{-2} d^{-1}, which at its lower end is comparable to inputs from the Wailoa River and at its upper end is 18 and 38 times greater than the highest yields from the Wailoa and Wailuku Rivers, respectively (Presley et al. 2007). This analysis suggests that our estimates of the amount of NO_3^-+NO_2^- entering Hilo Bay from the Wailoa River Harbor during storms is an underestimate, as we do not account for the large inputs of NO_3^-+NO_2^- from Aleniao Stream. Future studies need to measure inputs from the Wailoa River, Wailuku River, and Aleniao Stream simultaneously to quantify the total input of NO_3^-+NO_2^- into Hilo Bay during storms; no study has done this to date.

Turbidity in Hilo Bay: Similar to the NO_3^-+NO_2^- concentrations, turbidity levels were greatest in Hilo Bay following storms. Under these conditions, turbidity levels consistently exceeded HDOH's standards. The largest surface water source of turbidity to Hilo Bay during storms was from the Wailuku River and the highest turbidity levels were measured within the Wailuku River plume, which were 1.8 and 4.4 times higher than values measured within the Wailoa River plume and outside of the breakwater, respectively. In contrast, during baseflow conditions, turbidity levels were comparable between the Wailuku and Wailoa River plumes in Hilo Bay, even though the Wailuku River had turbidity levels three times higher than those measured in the Wailoa River. In contrast to storm conditions, all six stations sampled in Hilo Bay during baseflow conditions consistently had turbidity levels below the HDOH's standards.

Turbidity levels in Hilo Bay are significantly correlated to the Wailuku River's discharge (Mead & Wiegner submitted). The greatest amount of surface water and suspended sediments are delivered to Hilo Bay from the Wailuku River, especially during storms (M & E Pacific 1980). It is estimated that stormflow comprises approximately 84% of the annual discharge from the Wailuku River to Hilo Bay and 96% of the annual TSS yield (Wiegner et al. in press). High turbidity levels in the Wailuku River most likely stem from the watershed's high relief and its greater percentage of barren land compared to the Wailoa River's watershed (Table 1; M & E Pacific 1980). Erosion of young, easily weathered basalt and weakly developed soils with low organic matter content contribute to the high turbidity and suspended solids with low organic matter content in the Wailuku River during storms (Wiegner et al. in press).

Turbidity levels in Hilo Bay were also consistently higher inside the breakwater than outside of it during both storm and baseflow conditions, with the greatest differences observed during storms. Inside the Bay, turbidity levels were ~ 2.5 to 4.5 times higher than values measured outside the breakwater following storms. During baseflow conditions, turbidity levels were ~ 2.8 times higher than those outside the breakwater. The difference in turbidity between the stations inside Hilo Bay and outside the breakwater suggest that the breakwater acts as a barrier to flushing particles outside of the Bay; note, however, this barrier allows for some exchange because turbidity levels were four times higher outside the breakwater during storms compared to baseflow conditions. A similar pattern was observed for NO_3^-+NO_2^- suggesting that both particulates and dissolved constituents partially exchange through the breakwater. While the breakwater does appear to increase the turbidity levels inside Hilo Bay, results from Storm 1 and 2 suggest that turbidity levels inside Hilo Bay drop below HDOH's embayment standards three days following peak storm discharge from the Wailuku River. This observation suggests that suspended sediments are rapidly exported out of the Bay following a storm and/or settle to the seafloor allowing for the Bay waters to clear.

Chl *a* in Hilo Bay: In contrast to NO_3^-+NO_2^- and turbidity, Chl *a* concentrations are highest in Hilo Bay during baseflow condition, particularly during the dry, summer months; an earlier study also documented this pattern and reported similar concentrations (M & E Pacific 1980). In our study, the highest Chl *a* concentrations were measured at the stations inside the breakwater furthest from the mouths of the Wailuku and Wailoa Rivers. All of the stations sampled inside the breakwater had Chl *a* concentrations that exceeded the HDOH's embayment standard on two to six of the eight baseflow sampling days in this study, with the highest measurement being 15 times greater than the standard. Additionally, the two stations sampled outside the breakwater (C1 and C2) had concentrations two to three times lower than those measured inside the breakwater, but often higher than HDOH's standard for open coastal waters.

Nutrient availability, warmer water temperatures, and increased water clarity, as well as reduced grazing pressure can result in greater algal biomass, that is higher Chl *a* concentrations, in coastal waters (Valiela 1995). Nutrient availability does not appear to be the primary factor limiting algal biomass in Hilo Bay over the annual scale, as nutrient concentrations are highest following storms when Chl *a* concentrations and primary production rates are lowest (M & E Pacific 1980; Mead & Wiegner submitted). However, nutrient availability does appear to enhance primary production in Hilo Bay, as the highest Chl *a* concentrations were measured within the Wailoa River plume, the region of the Bay with the highest NO_3^-+ NO_2^- concentrations. The highest algal biomass, primary production, and algal growth rates in Hilo Bay have been observed during the dry, summer months when the water is warmer and clearer, the salinity fluctuations are minimal, and the water residence time is greater (M&E Pacific 1980; Mead & Wiegner submitted). Of these factors, the later three are thought to impose the greatest limitation on phytoplankton growth in Hilo Bay (M & E Pacific 1980). High Chl *a* concentrations during dry, summer months have also been observed in other tropical and temperate estuaries (Khan and Siddiqui 1971; Hashimoto et al. 2006). Low grazer abundance, and therefore, low grazing pressure can also lead to high Chl *a* concentrations in estuaries (Valiela 1995). However, it is unlikely that grazer abundance was lower during baseflow conditions than storms, as discharge from the Wailuku and Wailoa Rivers was lower and water residence time in Hilo Bay was greater (M & E Pacific 1980). Therefore, it is unlikely that the zooplankton were diluted or flushed outside of the Bay from the surface water inputs during baseflow conditions. Direct zooplankton abundance measurements are needed to confirm this assumption.

Following storms, Chl *a* concentrations inside Hilo Bay were 93% lower than those measured during baseflow conditions, and often below detection limits and the

HDOH's embayment standard. Unlike the phytoplankton blooms reported to occur in Kanehoe Bay, Oahu, two to five days following storms (Ringuet & Mackenzie 2005; Hoover et al. 2006; De Carlo et al. 2007), no blooms were detected in Hilo Bay five days after a storm event. Low Chl *a* concentrations in Hilo Bay following storms were most likely a function of the phytoplankton cells being washed out of the Bay, as large pulses of freshwater to estuaries has been shown to wash out phytoplankton communities (Alpine & Cloern 1992). At the highest discharge measured for the Wailuku River during our study, we estimate that the Wailuku River would be able to replace the entire water column of the Bay in less than 15 days, making it plausible that some portion of the phytoplankton community was washed out during these conditions (Mead & Wiegner submitted). Additionally, the amount of solids entering the Bay particularly from the Wailuku River increased by 230 times from its baseflow inputs and was an order of magnitude greater than the TSS inputs from the Wailoa River, and the overall turbidity in Hilo Bay was approximately five times higher following storms than during baseflow conditions. Therefore, it is also likely that any phytoplankton cells still remaining in Hilo Bay were diluted by the large amounts of debris discharging from the Wailuku River and light limited by the amount of particles suspended in the water column. An earlier study also suspected that salinity fluctuations in surface waters of Hilo Bay during and just following storms are too stressful for phytoplankton (M & E Pacific 1980; Muylaert et al. 2005). Additionally, high zooplankton grazer abundance can decrease Chl *a* concentrations in estuaries (Valiela 1995); however, it is unlikely that high grazing pressure was responsible for the low Chl *a* concentrations in Hilo Bay following storms, as the abundance of other types of plankton (bacteria and phytoplankton) in the Bay were low, most likely due to washout from high river discharge.

RECOMMENDATIONS

Our study suggests that of the pollutants we measured, NO_3^-+NO_2^- is having the greatest impact on Hilo Bay's water quality. The highest NO_3^-+NO_2^- concentrations were measured in the Wailoa River and its plume, where they consistently and often exceeded the HDOH's standards, respectively. A biological response to these NO_3^-+NO_2^- inputs into Hilo Bay does appear to be occurring as the highest Chl *a* concentrations were measured within the Wailoa River plume. Unfortunately, the measurements made in our study do not tell us the source(s) of the NO_3^-+NO_2^-, they only provide information on the region in the watershed from where the NO_3^-+NO_2^- is coming. The most likely source of NO_3^-+NO_2^- is from cesspools and septic tanks, as this is the most heavily populated section of Hilo and 60 to 70% of Hilo is not connected to the sewer line (Silvius et al. 2005). To determine if sewage is the primary the source of NO_3^-+NO_2^- entering Hilo Bay from the Wailoa River watershed, further studies are needed.

Specifically, we recommend that a study using chemical tracers to track sewage inputs from cesspools to Hilo Bay be conducted. The chemical tracers of sewage that should be measured are stable isotope signatures of oxygen ($\delta^{18}O$) and nitrogen ($\delta^{15}N$) in nitrate and stable isotope signatures of boron ($\delta^{11}B$). Sewage inputs can be tracked using this combination of stable isotopes because sewage has distinct stable isotope signatures for these elements allowing it to be distinguished from other anthropogenic and natural sources (i.e., Vengosh et al. 1994; Kendall 1998). Data from this proposed study will provide information on whether domestic sewage is entering Hilo Bay from the Wailoa River and whether it is the primary source of NO_3^-+NO_2^- to the Wailoa River. With this information, Hawaii County can decide whether they will require more residents to connect to the sewer lines in order to improve the health and water quality of Hilo Bay.

ACKNOWLEDGEMENTS

We are grateful to Lisa Shizuma, Kathy Seiber, Emily Hart, Randee Tubal, Stephanie Molloy, Randi Schneider, Jason Turner, Trisha Atwood, Melissa Netze, Trisann Bambico, Andrew Fredell, John Coney, Darren Roberts, Amy Dunn, and Chelsie Settlemier for their assistance in the field and the laboratory. In addition to funds provide by Hawaii County for this project, this project was also supported by funds from the National Science Foundation (NSF) under NSF Awards: 0237065 and UHH Research Experience for Undergraduates, a grant and cooperative agreement from the National Oceanic and Atmospheric Administration (NOAA), Project RIEL-38, which is sponsored by the University of Hawaii Sea Grant College Program, School of Ocean and Earth Science and Technology, under Institutional Grant NA050AR4171048 from NOAA Office of Sea Grant, Department of Commerce. The views expressed herein are those of the authors and do not necessarily reflect the view of NOAA or any of its sub-agencies. Cover photograph was taken by Trisha Atwood.

REFERENCES

Alpine, A.E., and J.E. Cloern. 1992. Trophic interactions and direct physical effects control phytoplankton biomass and production in an estuary. Limnology and Oceanography 37: 946-955.

APHA, AWWA, and WEF. 1995. Total solids dried at 103-105 °C. In: Eaton, A.D., L.S., Clesceri, and A.E. Greenberg (eds.), Standard Methods for the Examination of Water and Water Water, 19th edition. American Public Health Association, Washington, D.C.

DeCarlo, E.H., D.J. Hoover, C.W. Young, R.S. Hoover, and F.T. Mackenzie. 2007. Impact of storm runoff from tropical watersheds on coastal water quality and productivity. Applied Geochemistry 22: 1777-1797.

Dudley, W.C. Jr, and L. E. Hallacher. 1991. Distribution and dispersion of sewerage pollution in Hilo Bay and contiguous waters. Final report. County of Hawaii Department of Public Works.

Gore, J.A. 1996. Discharge measurements and streamflow analysis. In. Hauer, F.R. and G.A. Lamberti (eds.), Methods in Stream Ecology. Academic Press, San Diego.

Hallacher, L. E., E. B. Kho, N. D. Bernard, A. M. Orcutt, W. C. Dudley, Jr., and T. M. Hammond. 1985. Distribution of arsenic in the sediments and biota of Hilo Bay, Hawaii. Pacific Science 39: 266-273.

Hashimoto, S., N. Horimoto, T. Ishimaru, and T. Saino. 2006. Metabolic balance of gross primary production and community respiration in Sagami Bay, Japan. Marine Ecology Progress Series 321: 31-40.

HDOH. 2000. Hawaii’s implementation plan for polluted runoff control.

HDOH. 2004. Amendment and compilation of chapter 11-54. Hawaii administrative rules. http://www.Hawaii.gov/health/about/rules/11-54.pdf

Hawaii Island Journal. 2004. What's wrong with Hilo Bay?

Hoover, R.S., D. Hoover, M. Miller, M.R. Landry, E.H. DeCarlo, and F.T. Mackenzie. 2006. Zooplankton response to storm runoff in a tropical estuary: bottom-up and top-down controls. Marine Ecology Progress Series 318: 187-201.

Hunt, C.D. 2006. Ground-water nutrient flux to coastal waters and numerical simulation of wastewater injection at Kihei, Maui, Hawaii. USGS Scientific Investigations Report 2006-5283.

Juvik, J, and S. Juvik. 1998. Atlas of Hawaii. Department of Geography. University of Hawaii Press. Hilo, Hawaii.

Kendall, C. 1998. Tracing nitrogen sources and cycling in catchments. In: C. Kendall and J.J. McDonnell (eds.), Isotope Tracers in Catchment Hydrology. Elsevier Science, San Francisco.

Khan, A.A., and Q Siddiqui. 1971. Primary production in a tropical fish pond at Aligarh, India. Hydrobiologia 37: 447-456.

Koch, L., J. Harrigan-Lum, and K. Henderson. 2004. 2004 List of impaired waters in Hawaii prepared under Clean Water Act Section 303(d). HDOH Environmental Planning Office.

M & E Pacific. 1980 Hilo area comprehensive study—Geological, biological and water quality investigations of Hilo Bay. USACE, Honolulu District.

Mead, L.H., and T.N. Wiegner. Surface metabolism in a tropical estuary, Hilo Bay, Hawaii, USA, during storm and non-storm conditions. Submitted to Coasts and Estuaries.

Muylaert, K., M. Tackx, and W. Vyverman. 2005. Phytoplankton growth rates in the freshwater tidal reaches of the Schelde estuary (Belgium) estimated using a simple light-limited primary production model. Hydrobiologia 540: 127-140.

Paquay, F.S., F.T. Mackenzie, and A.V. Borges. 2007. Carbon dioxide dynamics in rivers and coastal waters of the 'big island' of Hawaii, USA, during baseline and heavy rain conditions. Aquatic Geochemistry 13: 1-18. doi: 10.1007/s10498-006-9005-5.

Presley, T.K., M.T.J. Jamison, and D.C. Nishimoto. 2007. Suspended-sediment and nutrient loads for Waiakea and Alenaio Streams, Hilo, Hawaii, 2003-2006. USGS open-file report 2007-1429.

Ringuet, S., and F. T. Mackenzie. 2005. Controls on nutrient and phytoplankton dynamics during normal flow and storm runoff conditions, southern Kaneohe Bay, Hawaii. Estuaries 28: 327-337.

Sharp, J.H., K. R. Rinker, K. B. Savidge, J. Abell, J. Y. Benaim, D. Bronk, D. J. Burdige, G. Cauwet, W. Chen, M. D. Doval, D. Hansell, C. Hopkinson, G. Kattner, N. Kaumeyer, K. J. McGlathery, J. Merriam, N. Morley, K. Nagel, H. Ogawa, C. Pollard, M. Pujo-Pay, P. Raimbault, R. Sambrotto, S. Seitzinger, G. Spyres, F. Tirendi, T. W. Walsh and C. S. Wong. 2002. A preliminary method comparison for measurement of dissolved organic nitrogen in seawater. Marine Chemistry 78: 171-184.

Silvius, K., P. Moravcik, and M. James. 2005. Hilo Bay watershed-based restoration plan. Submitted to HDOH, Polluted Runoff Control.

USACE. 2009. Hilo Bay water circulation and water quality study. Report prepared by the Department of the Army, U.S. Army Corps of Engineers, Honolulu District, for the County of Hawaii.

USEPA. 2002. National health protection survey of beaches-2001 swimming season. http://yosemite.epa.gov/water/beach2002.nsf

Valiela, I. 1995. Marine Ecological Processes 2nd ed. Springer-Verlag, New York.

Vengosh, A., K. G. Heumann, S. Juraske, and R. Kasher. 1994. Boron isotope application for tracing sources of contamination in groundwater. Environmental Science and Technology 28: 1966-1974.

Wiegner, T.N., T.L. Tubal, and R.A. MacKenzie. In press 2009. Bioavailability and export of dissolved organic matter from a tropical river during base- and stormflow conditions. Limnology and Oceanography.

Table 1. Characteristics of the Wailuku and Wailoa River watersheds, Hawaii, USA. Land cover data obtained from www.csc.noaa.gov/crs/lca/hawaii.html and are from 2001. N/A = no data available for that parameter. Riparian land cover was calculated in ArcGIS using land cover extractions from 100-m buffers surrounding each river. Watershed area and headwater elevation were calculated using ArcGIS.

Parameter	Wailuku River	Wailoa River
Watershed area (km^2)	576	481
Headwater elevation (m)	3,500	762
Riparian land cover (% of each river)		
High-intensity developed	0.1	3.3
Low-intensity developed	0.2	7.7
Cultivated land	0.8	3.9
Grassland	26.0	27.3
Evergreen forest	59.0	40.7
Scrub/shrub	10.7	14.6
Bare land	2.9	0.3
Emergent wetland	0.3	N/A
Water	N/A	2.3

Table 2. Station codes and corresponding locations with GPS coordinates in decimal degrees.

Station	Location	Latitude	Longitude
S1	Wailuku River	N 19.71348	W 155.14883
S2	Wailuku River mouth, inner Hilo Bay	N 19.72987	W 155.14883
S3	Wailuku River plume, mid Hilo Bay	N 19.73623	W 155.08460
S4	Wailoa River	N 19.71514	W 155.07750
S5	Wailoa River mouth, inner Hilo Bay	N 19.72568	W 155.07268
S6	Wailoa River plume, mid Hilo Bay	N 19.73225	W 155.07411
C1	Outside breakwater, near entrance to Hilo Bay	N 19.74514	W 155.06453
C2	Outside breakwater, near Puhi Bay	N 19.74545	W 155.06453

Table 3. Daily discharge from the Wailuku and Wailoa Rivers and rainfall in Hilo, Hawaii, USA, during the sampling events of this study. Discharge data for the Wailuku River was obtained online from the USGS's gage # 16704000. Discharge data for the Wailoa River was calculated as described in the methods section of this report. Rain on Day = daily rainfall as measured at the Hilo International Airport, Hilo, Hawaii, USA. Σ Rain 5 Days = sum of daily rainfall five days prior to sampling event including event date, as measured at the Hilo International Airport, Hilo, Hawaii, USA. Rain data were obtained online from NOAA National Climatic Data Center. (-) indicates where data were not collected.

Event	Date	Wailuku (L/s)	Wailoa (L/s)	Rain on Day (cm)	Σ Rain 5 Days (cm)
Storm 1	1/10/2007	10,562	4,088	0.79	17.73
Storm 1	1/11/2007	7,504	-	0.20	15.16
Storm 1	1/12/2007	10,902	-	0.48	9.55
Storm 1	1/13/2007	6,683	-	0.38	8.03
Storm 1	1/14/2007	5,154	-	0.08	1.93
Storm 1	1/15/2007	4,078	-	0.84	1.98
Storm 2	3/01/2007	45,590	8,004	1.93	18.49
Storm 2	3/02/2007	7,872	-	0.08	17.60
Storm 2	3/03/2007	3,936	-	1.04	17.09
Storm 2	3/04/2007	3,738	-	0.00	12.07
Storm 2	3/05/2007	2,379	-	0.00	3.05
Storm 2	3/06/2007	1,841	-	0.00	1.12
Base 1	3/14/2007	1,133	3,539	0.86	0.86
Base 2	5/03/2007	1,501	4,567	0.15	1.98
Base 2	5/04/2007	1,246	-	0.00	1.57
Base 3	6/18/2007	850	3,450	0.33	5.66
Base 3	6/19/2007	793	-	0.76	4.93
Base 4	7/08/2007	765	2,922	0.41	1.27
Base 4	7/09/2007	708	-	0.31	1.45
Base 5	7/30/2007	1,359	4,347	0.79	2.67
Base 5	7/31/2007	1,161	-	0.10	2.29
Base 6	9/05/2007	1,841	653	0.23	2.31
Base 6	9/06/2007	2,407	-	0.00	1.14
Base 7	10/10/2007	1,926	2,335	0.31	5.26
Base 7	10/11/2007	1,642	-	0.23	5.00
Base 8	11/07/2007	1,529	2,353	2.46	7.09
Base 8	11/08/2007	1,727	-	0.13	5.16
Storm 3	12/12/2007	22,229	3,926	3.18	8.51
Storm 3	12/13/2007	15,150	-	2.36	10.82
Storm 3	12/14/2007	15,319	-	1.14	9.17
Storm 3	12/15/2007	31,149	-	2.34	11.43
Storm 3	12/16/2007	50,121	-	0.91	9.93
Storm 3	12/17/2007	30,865	-	0.97	7.72
Storm 4	1/27/2008	26,731	7,374	1.35	7.70
Storm 4	1/28/2008	12,318	-	2.51	8.66
Storm 4	1/29/2008	7,617	-	4.45	13.11
Storm 4	1/30/2008	6,485	-	4.60	15.83
Storm 4	1/31/2008	4,984	-	6.58	19.49
Storm 4	2/01/2008	76,739	-	7.16	25.30

Table 4. Hawaii Department of Health's (HDOH) standards for nutrients, turbidity, total suspended solids (TSS), and chlorophyll *a* concentrations for rivers, embayments, and open coastal waters. River standards apply to the Wailuku (S1) and Wailoa (S4) River stations in this study. *Total Nitrogen values presented here are comparable to this study's Total Dissolved Nitrogen (TDN) values. (wet) values for river standards are to be applied between November 1 through April 30 (HDOH 2004). (dry) values for river standards are to be applied between May 1 through October 3 (HDOH 2004).

Parameter	Water Type	Geometric mean not to exceed the given value	Not to exceed the given value more than ten percent of the time	Not to exceed the given value more than two percent of the time
Total Nitrogen*	Rivers (wet)	17.85	37.13	57.12
(µM)	Rivers (dry)	12.85	27.13	42.84
	Embayments	14.28	25.00	35.70
	Open Coastal Waters	10.71	17.85	25.00
NH_4^+	Rivers (wet)	n/a	n/a	n/a
(µM)	Rivers (dry)	n/a	n/a	n/a
	Embayments	0.43	0.93	1.43
	Open Coastal Waters	0.25	0.61	1.07
$NO_3^- + NO_2^-$	Rivers (wet)	5.00	12.85	21.42
(µM)	Rivers (dry)	2.14	6.43	12.14
	Embayments	0.57	1.42	2.50
	Open Coastal Waters	0.36	1.00	1.78
Total Phosphorus	Rivers (wet)	1.61	3.23	4.84
(µM)	Rivers (dry)	1.00	1.94	2.58
	Embayments	0.81	1.61	2.42
	Open Coastal Waters	0.65	1.29	1.94
Turbidity	Rivers (wet)	5.0	15.0	25.0
(NTU)	Rivers (dry)	2.0	5.5	10.0
	Embayments	1.50	3.00	5.00
	Open Coastal Waters	0.50	1.25	2.00
TSS	Rivers (wet)	20.0	50.0	80.0
(mg/L)	Rivers (dry)	10.0	30.0	55.0
	Embayments	n/a	n/a	n/a
	Open Coastal Waters	n/a	n/a	n/a
Chlorophyll *a*	Rivers (wet)	n/a	n/a	n/a
(µg/L)	Rivers (dry)	n/a	n/a	n/a
	Embayments	1.50	4.50	8.50
	Open Coastal Waters	0.30	0.90	1.75

Table 5. Daily yields of total dissolved nitrogen (TDN), NO_3^- + NO_2^- (referred to as NO_3^- in the table), NH_4^+, total dissolved phosphorous (TDP), and total suspended solids (TSS) from the Wailuku and Wailoa Rivers, Hilo, Hawaii, USA, on sampling dates for this study. Yields are calculated as the product of river discharge (Table 3) and nutrient concentrations (Tables 6 through 10) divided by the watershed area (Table 1). Units for daily yields of N and P are mol km^{-2} d^{-1}, while TSS units are in kg km^{-2} d^{-1}.

		Wailuku River					Wailoa River				
Event	Date	TDN	NO_3^--N	NH_4^+-N	TDP	TSS	TDN	NO_3^--N	NH_4^+-N	TDP	TSS
Storm 1	1/10/2007	14.48	8.00	0.33	0.00	0.49	25.00	14.36	0.26	0.01	0.22
Storm 2	3/01/2007	54.50	16.82	2.46	0.14	41.17	42.14	35.05	0.59	0.00	7.45
Base 1	3/14/2007	0.90	0.74	0.16	0.14	0.03	21.42	1.39	0.00	0.81	0.00
Base 2	5/03/2007	11.92	0.54	0.40	0.09	0.13	11.67	26.72	1.27	0.83	0.52
Base 3	6/18/2007	0.70	0.35	0.10	0.01	0.03	18.62	16.84	0.46	0.00	0.17
Base 4	7/08/2007	0.68	0.21	0.10	0.00	0.01	20.13	19.87	0.24	0.02	0.00
Base 5	7/30/2007	1.86	0.93	0.15	0.03	0.06	23.99	21.39	0.57	0.09	1.04
Base 6	9/05/2007	2.28	1.14	0.06	0.03	0.33	2.99	2.87	0.03	0.01	0.11
Base 7	10/10/2007	1.69	1.15	0.94	0.00	0.19	13.72	8.37	0.64	0.01	0.21
Base 8	11/07/2007	1.50	1.26	0.43	0.00	0.04	14.10	14.76	0.08	0.02	0.30
Storm 3	12/12/2007	26.97	8.90	2.60	0.00	51.92	25.35	13.40	0.14	0.00	0.47
Storm 4	1/27/2008	35.16	14.11	4.45	0.20	0.88	40.51	23.47	1.67	0.12	0.00

Table 6. Average (±S.E.) nutrient, turbidity, and chlorophyll *a* concentrations, as well as pH in surface waters of Hilo Bay, Hawaii, USA, during baseflow conditions. (-) indicates where data were not collected. (*) indicates missing data. Stn. = station, DOC = dissolved organic carbon, PC = particulate carbon, TDN = total dissolved nitrogen, DON = dissolved organic nitrogen, PN = particulate nitrogen, TDP = total dissolved phosphorous, TSS = total suspended solids, Turbid. = turbidity, and Chl *a* = Chlorophyll *a*.

Stn.	Date	DOC (µM)	PC (µM)	TDN (µM)	DON (µM)	PN (µM)	NO_3^- + NO_2^- (µM)	NH_4^+ (µM)	TDP (µM)	PO_4^{3-} (µM)	H_4SiO_4 (µM)	TSS (mg/L)	Turbid. (NTU)	Chl *a* (µg/L)	pH
S1	3/14/2007	41.96(3.01)	9.39	5.28(0.21)	0.56(0.32)	0.59(0.05)	4.38(0.21)	0.95(0.53)	0.83(0.18)	0.00(0.00)	202.40(1.60)	0.17(0.17)	0.37(0.06)	-	7.33(0.04)
S1	5/03/2007	4.37(0.87)	9.93(0.70)	52.93(0.91)	48.73(1.76)	0.91(0.07)	2.42(0.37)	1.78(0.63)	0.40(0.12)	0.01(0.01)	113.88(8.47)	0.59(0.02)	0.30(0.00)	-	6.58(0.10)
S1	6/18/2007	92.40(1.82)	16.70(0.80)	5.50(0.31)	2.03(0.18)	1.48(0.13)	2.73(0.03)	0.75(0.23)	0.05(0.05)	0.00(0.00)	98.18(1.22)	0.21(0.21)	0.87(0.07)	-	6.49(0.13)
S1	7/08/2007	76.11(1.25)	13.83(1.53)	5.96(0.78)	3.29(0.72)	1.05(0.06)	1.81(0.04)	0.85(0.28)	0.00(0.00)	0.00(0.00)	290.20(6.62)	0.10(0.05)	0.47(0.03)	-	6.87(0.04)
S1	7/30/2007	52.85(1.28)	10.92(1.78)	9.10(0.29)	3.84(0.49)	0.82(0.07)	4.54(0.04)	0.72(0.23)	0.13(0.02)	0.00(0.00)	75.05(7.31)	0.31(0.04)	0.32(0.01)	-	6.68(0.01)
S1	9/05/2007	88.58(6.24)	22.50(0.58)	8.26(1.18)	3.92(1.20)	1.59(0.00)	4.13(0.01)	0.21(0.14)	0.11(0.09)	0.00(0.00)	126.29(12.55)	1.19(0.12)	1.40(0.03)	-	7.19(0.06)
S1	10/10/2007	71.60(0.85)	13.94(1.00)	5.84(0.38)	0.00(0.00)	1.06(0.10)	3.99(0.06)	3.24(0.27)	0.01(0.01)	0.00(0.00)	104.18(11.02)	0.67(0.02)	1.14(0.05)	-	6.48(0.12)
S1	11/07/2007	65.45(3.99)	18.42(4.14)	6.55(1.21)	0.20(0.20)	1.58(0.42)	5.48(0.42)	1.88(1.06)	0.00(0.00)	0.00(0.00)	164.19(33.04)	0.19(1.23)	1.13(0.05)	-	6.21(0.14)
S1	**Average**	**61.66(5.65)**	**14.91(1.07)**	**12.43(3.21)**	**7.82(3.25)**	**1.16(0.09)**	**3.68(0.25)**	**1.30(0.24)**	**0.19(0.06)**	**0.00(0.00)**	**146.80(14.35)**	**0.42(0.11)**	**0.75(0.09)**	**-**	**6.73(0.08)**
S4	3/14/2007	18.02(1.91)	*	33.69(0.34)	31.51(0.44)	*	2.18(0.36)	0.00(0.00)	1.28(0.16)	0.04(0.02)	74.11(1.86)	0.00(0.00)	0.11(0.00)	-	7.32(0.14)
S4	5/03/2007	34.20(1.41)	8.32(0.84)	14.23(1.64)	0.00(0.00)	0.93(0.10)	32.57(0.26)	1.55(0.20)	1.01(0.12)	0.27(0.02)	327.07(42.03)	0.63(0.06)	0.10(0.00)	-	6.55(0.04)
S4	6/18/2007	3.32(2.03)	6.42(0.94)	30.05(0.40)	2.38(1.45)	0.87(0.24)	27.18(1.55)	0.74(0.15)	0.00(0.00)	0.03(0.02)	78.29(28.94)	0.27(0.27)	0.13(0.03)	-	6.47(0.06)
S4	7/08/2007	25.10(0.78)	7.90(0.38)	38.36(0.30)	0.23(0.17)	0.79(0.02)	37.86(0.15)	0.46(0.20)	0.03(0.02)	0.07(0.01)	434.32(5.07)	0.00(0.00)	0.27(0.03)	-	6.38(0.03)
S4	7/30/2007	7.58(4.49)	14.08(0.85)	30.72(1.71)	2.60(0.19)	1.51(0.02)	27.39(1.82)	0.73(0.36)	0.12(0.02)	0.06(0.01)	88.78(13.47)	1.33(0.11)	0.20(0.01)	-	6.32(0.02)
S4	9/05/2007	0.92(0.92)	15.39(1.03)	25.47(2.74)	1.65(1.19)	1.75(0.09)	24.45(1.89)	0.26(0.24)	0.08(0.02)	0.00(0.00)	386.92(15.03)	0.91(0.04)	0.54(0.02)	-	6.56(0.03)
S4	10/10/2007	7.59(0.55)	6.73(0.51)	32.72(0.67)	11.24(0.33)	0.78(0.03)	19.95(0.54)	1.53(0.21)	0.02(0.02)	0.06(0.01)	98.51(9.25)	0.49(0.02)	0.25(0.00)	-	6.10(0.07)
S4	11/07/2007	7.91(2.20)	12.15(2.96)	33.35(0.74)	0.00(0.00)	1.27(0.30)	34.91(0.07)	0.20(0.20)	0.04(0.02)	0.04(0.01)	354.03(37.11)	0.72(0.59)	0.41(0.01)	-	6.38(0.07)
S4	**Average**	**13.08(2.35)**	**10.14(0.87)**	**29.82(1.48)**	**6.20(2.13)**	**1.13(0.09)**	**28.51(2.20)**	**0.68(0.13)**	**0.32(0.10)**	**0.07(0.02)**	**230.25(31.69)**	**0.55(0.11)**	**0.25(0.03)**	**-**	**6.51(0.07)**
S2	3/14/2007	73.95(1.26)	13.70(0.27)	7.07(1.14)	6.43(1.16)	1.37(0.05)	0.64(0.06)	0.00(0.00)	1.44(0.25)	0.01(0.01)	24.45(1.33)	11.88(0.54)	0.43(0.04)	0.96(0.15)	8.04(0.04)
S2	5/04/2007	6.58(0.32)	28.65(2.57)	61.13(2.79)	60.64(2.84)	3.43(0.29)	0.50(0.05)	0.00(0.00)	0.02(0.02)	0.00(0.00)	30.51(0.23)	22.76(2.49)	0.47(0.03)	1.23(0.19)	8.23(0.04)
S2	6/19/2007	49.29(2.59)	20.73(1.44)	2.99(0.18)	2.74(0.17)	2.72(0.21)	0.25(0.02)	0.00(0.00)	0.00(0.00)	0.00(0.00)	45.75(6.05)	10.82(2.76)	0.80(0.06)	1.54(0.05)	8.20(0.01)
S2	7/09/2007	105.79(0.65)	18.05(1.06)	7.14(0.76)	6.73(0.63)	2.46(0.19)	0.41(0.15)	0.00(0.00)	0.00(0.00)	0.00(0.00)	51.28(7.90)	4.64(1.30)	0.68(0.18)	1.81(0.50)	8.06(0.19)
S2	7/31/2007	57.45(8.18)	17.64(5.19)	7.53(0.31)	6.23(1.04)	1.59(0.11)	0.53(0.09)	0.77(0.64)	0.07(0.07)	0.00(0.00)	51.71(5.73)	6.17(0.32)	0.52(0.05)	0.42(0.06)	8.14(0.03)
S2	9/06/2007	54.95(4.90)	33.69(2.04)	6.29(0.86)	5.82(0.87)	3.49(0.26)	0.47(0.02)	0.00(0.00)	0.00(0.00)	0.00(0.00)	48.98(1.29)	18.96(3.06)	1.38(0.08)	1.39(0.44)	8.11(0.03)
S2	10/11/2007	72.70(0.72)	19.87(1.25)	5.52(0.35)	4.25(0.35)	1.82(0.08)	1.27(0.01)	0.00(0.00)	0.00(0.00)	0.00(0.00)	74.24(0.78)	14.09(2.17)	0.95(0.20)	0.58(0.27)	8.07(0.06)
S2	11/08/2007	75.32(1.10)	33.86(2.65)	5.97(0.31)	4.55(0.10)	3.33(0.34)	0.98(0.04)	0.43(0.22)	0.00(0.00)	0.00(0.00)	37.68(2.96)	14.25(2.24)	1.02(0.09)	0.67(0.35)	7.73(0.06)
S2	**Average**	**62.00(5.64)**	**23.27(1.68)**	**12.95(3.82)**	**12.17(3.85)**	**2.53(0.18)**	**0.63(0.07)**	**0.15(0.09)**	**0.19(0.10)**	**0.00(0.00)**	**45.57(3.24)**	**12.94(1.32)**	**0.78(0.07)**	**1.07(0.13)**	**8.07(0.04)**
S3	3/14/2007	71.89(3.54)	7.22(0.95)	5.65(0.20)	0.00(0.00)	0.84(0.08)	15.92(0.99)	0.00(0.00)	1.34(0.28)	0.00(0.00)	37.42(1.97)	8.16(0.87)	0.21(0.01)	1.36(0.09)	8.13(0.02)
S3	5/04/2007	5.03(0.45)	13.20(0.74)	52.96(2.43)	52.28(2.37)	1.70(0.11)	0.68(0.09)	0.00(0.00)	0.00(0.00)	0.00(0.00)	27.69(0.61)	12.40(1.47)	0.50(0.06)	1.01(0.03)	8.09(0.07)
S3	6/19/2007	43.17(5.09)	21.54(4.15)	3.10(0.24)	2.92(0.28)	3.11(0.25)	0.18(0.06)	0.00(0.00)	0.00(0.00)	0.00(0.00)	69.04(6.40)	11.42(3.10)	0.67(0.03)	5.08(0.21)	8.20(0.01)
S3	7/09/2007	100.21(2.48)	11.43(2.79)	5.87(0.23)	5.72(0.23)	1.69(0.33)	0.15(0.03)	0.00(0.00)	0.00(0.00)	0.00(0.00)	39.38(0.76)	4.78(0.52)	0.50(0.05)	4.71(0.25)	8.30(0.04)
S3	7/31/2007	38.69(4.60)	24.80(0.72)	7.10(0.69)	4.79(0.66)	4.02(0.11)	2.31(0.12)	0.00(0.00)	0.00(0.00)	0.00(0.00)	134.94(0.96)	7.14(0.97)	0.83(0.11)	8.24(0.64)	7.93(0.09)
S3	9/06/2007	53.58(9.38)	14.53(0.79)	5.77(0.86)	5.43(0.84)	1.85(0.07)	0.34(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	25.19(1.97)	16.17(1.96)	0.64(0.08)	1.95(0.25)	8.12(0.01)
S3	10/11/2007	71.02(1.66)	27.81(1.67)	4.47(0.39)	4.26(0.38)	3.45(0.19)	0.21(0.02)	0.00(0.00)	0.00(0.00)	0.00(0.00)	62.64(0.25)	15.22(1.77)	0.89(0.29)	13.77(2.37)	8.09(0.03)
S3	11/08/2007	76.38(4.39)	19.90(0.99)	5.11(0.46)	1.60(1.01)	1.74(0.10)	1.94(0.40)	1.58(0.29)	0.00(0.00)	0.00(0.00)	42.56(1.00)	19.25(3.66)	0.86(0.11)	0.23(0.10)	7.92(0.01)
S3	**Average**	**57.50(5.83)**	**17.55(1.50)**	**11.26(3.31)**	**9.63(3.40)**	**2.30(0.22)**	**2.72(1.06)**	**0.20(0.11)**	**0.17(0.10)**	**0.00(0.00)**	**54.86(7.03)**	**11.82(1.10)**	**0.64(0.06)**	**4.54(0.93)**	**8.11(0.03)**

Table 6 (continued).

Site	Date	DOC (μM)	PC (μM)	TDN (μM)	DON (μM)	PN (μM)	NO_3^- + NO_2^- (μM)	NH_4^+ (μM)	TDP (μM)	PO_4^{3-} (μM)	H_4SiO_4 (μM)	TSS (mg/L)	Turbid. (NTU)	Chl *a* (μg/L)	pH
S5	3/14/2007	24.13(3.46)	17.02(0.60)	6.83(1.05)	0.00(0.00)	1.92(0.11)	9.19(0.81)	0.34(0.28)	1.12(0.09)	0.00(0.00)	118.51(18.49)	8.47(2.16)	0.64(0.01)	2.68(0.16)	7.91(0.01)
S5	5/04/2007	13.93(0.77)	20.87(2.22)	45.28(9.37)	33.77(10.37)	2.65(0.30)	11.51(1.11)	0.00(0.00)	0.11(0.11)	0.00(0.00)	165.39(12.71)	11.86(1.52)	0.40(0.00)	1.07(0.11)	8.14(0.01)
S5	6/19/2007	37.43(3.17)	32.43(3.56)	6.52(0.79)	2.13(1.14)	4.34(0.43)	5.33(1.54)	0.00(0.00)	0.00(0.00)	0.00(0.00)	104.27(14.77)	18.24(2.41)	0.97(0.12)	3.66(0.15)	8.15(0.01)
S5	7/09/2007	84.45(6.14)	24.19(1.87)	11.87(0.88)	4.72(0.64)	4.69(0.27)	7.15(1.09)	0.00(0.00)	0.00(0.00)	0.00(0.00)	181.66(14.62)	11.90(0.34)	1.16(0.13)	5.64(0.09)	8.20(0.00)
S5	7/31/2007	20.08(4.69)	15.71(2.47)	17.34(2.88)	1.72(1.72)	2.33(0.39)	15.95(1.41)	0.21(0.21)	0.00(0.00)	0.00(0.00)	228.49(16.60)	6.13(0.45)	0.53(0.02)	1.28(0.74)	7.76(0.11)
S5	9/06/2007	34.46(3.42)	22.01(0.52)	16.28(0.67)	7.19(1.15)	3.10(0.04)	9.10(0.53)	0.00(0.00)	0.00(0.00)	0.00(0.00)	147.45(4.90)	7.35(0.10)	0.61(0.06)	2.85(0.07)	8.08(0.01)
S5	10/11/2007	41.90(1.19)	23.91(1.55)	18.48(0.19)	0.00(0.00)	3.04(0.19)	19.21(0.51)	1.14(0.25)	0.00(0.00)	0.00(0.00)	268.84(4.10)	9.40(1.29)	1.08(0.37)	5.43(0.40)	7.74(0.01)
S5	11/08/2007	23.85(1.52)	9.60(0.97)	22.66(0.57)	0.00(0.00)	0.97(0.05)	26.29(0.28)	0.00(0.00)	0.00(0.00)	0.24(0.02)	228.65(3.76)	2.48(0.51)	0.37(0.05)	0.23(0.06)	7.24(0.06)
S5	**Average**	**34.92(4.62)**	**20.72(1.45)**	**18.67(2.68)**	**6.37(2.59)**	**2.88(0.25)**	**12.97(1.41)**	**0.21(0.09)**	**0.15(0.08)**	**0.03(0.02)**	**180.41(11.87)**	**9.48(1.00)**	**0.72(0.07)**	**2.86(0.42)**	**7.90(0.06)**
S6	3/14/2007	58.39(5.36)	17.66(0.51)	13.51(0.62)	6.02(1.06)	2.00(0.06)	6.97(0.23)	0.53(0.40)	1.37(0.18)	0.00(0.00)	108.45(1.55)	10.07(0.72)	0.79(0.02)	2.38(0.11)	7.99(0.02)
S6	5/04/2007	11.44(0.93)	13.88(0.39)	43.46(8.24)	35.39(8.33)	1.65(0.11)	8.07(0.14)	0.00(0.00)	0.00(0.00)	0.00(0.00)	115.67(3.94)	7.38(1.91)	0.40(0.00)	0.59(0.19)	8.13(0.02)
S6	6/19/2007	31.89(1.01)	22.70(0.54)	4.61(0.26)	2.57(0.33)	4.52(0.22)	2.03(0.13)	0.00(0.00)	0.00(0.00)	0.00(0.00)	99.37(3.77)	14.91(0.54)	0.63(0.03)	4.38(2.09)	8.21(0.02)
S6	7/09/2007	85.46(0.81)	33.59(0.56)	6.73(0.18)	6.01(0.27)	6.21(0.20)	0.72(0.10)	0.00(0.00)	0.00(0.00)	0.00(0.00)	137.07(5.07)	6.81(0.97)	0.76(0.08)	10.71(2.29)	8.40(0.03)
S6	7/31/2007	49.87(3.52)	41.93(0.95)	8.30(1.00)	5.85(0.44)	6.72(0.39)	2.45(0.66)	0.00(0.00)	0.00(0.00)	0.00(0.00)	108.23(14.67)	16.28(0.36)	1.08(0.19)	11.59(1.84)	8.16(0.02)
S6	9/06/2007	52.38(1.74)	20.71(0.96)	8.02(0.37)	6.38(0.87)	2.47(0.08)	1.65(0.59)	0.00(0.00)	0.00(0.00)	0.00(0.00)	47.01(9.57)	9.84(1.39)	0.95(0.12)	2.04(0.28)	8.26(0.02)
S6	10/11/2007	70.25(0.06)	28.33(9.13)	5.80(0.65)	4.58(0.49)	4.55(1.50)	1.21(0.17)	0.00(0.00)	0.00(0.00)	0.00(0.00)	123.75(2.04)	10.24(2.54)	1.00(0.06)	23.19(2.12)	7.93(0.11)
S6	11/08/2007	66.58(5.00)	9.08(0.97)	13.30(0.26)	0.95(0.95)	1.10(0.07)	11.69(1.25)	1.80(0.36)	0.03(0.03)	0.00(0.00)	124.73(6.36)	6.26(1.61)	0.38(0.01)	0.41(0.14)	7.89(0.01)
S6	**Average**	**53.28(4.60)**	**23.49(2.31)**	**12.97(2.63)**	**8.47(2.33)**	**3.65(0.45)**	**4.35(0.80)**	**0.29(0.14)**	**0.18(0.10)**	**0.00(0.00)**	**108.04(5.73)**	**10.22(0.82)**	**0.75(0.06)**	**6.91(1.60)**	**8.13(0.04)**
C1	3/14/2007	70.44(4.53)	6.78(0.48)	6.38(0.20)	5.01(0.40)	7.56(0.84)	1.37(0.23)	0.00(0.00)	1.01(0.51)	0.00(0.00)	15.80(0.84)	5.51(0.44)	0.16(0.03)	0.58(0.08)	8.10(0.02)
C1	5/04/2007	6.57(0.75)	8.93(0.89)	52.91(3.92)	52.51(3.96)	0.92(0.08)	0.40(0.05)	0.00(0.00)	0.00(0.00)	0.00(0.00)	7.35(0.20)	6.71(0.48)	0.10(0.00)	0.29(0.03)	8.28(0.01)
C1	6/19/2007	39.15(0.32)	14.36(1.51)	4.18(0.73)	4.11(0.69)	1.85(0.22)	0.07(0.05)	0.00(0.00)	0.00(0.00)	0.00(0.00)	17.53(0.62)	10.99(0.48)	0.30(0.00)	2.31(0.30)	8.21(0.02)
C1	7/09/2007	98.34(1.47)	22.32(1.52)	8.22(0.76)	8.22(0.76)	2.22(0.13)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	14.05(1.33)	8.05(0.32)	0.35(0.06)	2.38(0.27)	8.37(0.01)
C1	7/31/2007	56.44(3.63)	10.42(0.56)	5.29(0.53)	5.13(0.54)	1.39(0.09)	0.16(0.01)	0.00(0.00)	0.00(0.00)	0.00(0.00)	13.72(1.04)	5.86(0.13)	0.22(0.01)	1.06(0.18)	8.17(0.04)
C1	9/06/2007	51.23(1.06)	9.22(1.13)	6.65(0.97)	6.22(0.89)	1.20(0.18)	0.43(0.08)	0.00(0.00)	0.00(0.00)	0.00(0.00)	16.94(1.53)	7.20(0.41)	0.34(0.08)	3.53(0.05)	8.24(0.02)
C1	10/11/2007	77.09(0.82)	13.66(1.93)	5.06(0.56)	4.52(0.55)	1.70(0.15)	0.54(0.03)	0.00(0.00)	0.00(0.00)	0.00(0.00)	18.87(0.81)	6.96(0.32)	0.46(0.11)	2.51(0.33)	8.07(0.04)
C1	11/08/2007	79.21(10.14)	7.05(0.88)	6.53(2.00)	5.51(1.48)	0.79(0.08)	0.31(0.11)	0.70(0.45)	0.00(0.00)	0.00(0.00)	0.00(0.00)	4.63(0.44)	0.15(0.02)	0.53(0.02)	8.13(0.02)
C1	**Average**	**59.81(5.66)**	**11.80(1.09)**	**11.90(3.28)**	**11.41(3.28)**	**2.20(0.44)**	**0.41(0.09)**	**0.09(0.07)**	**0.13(0.09)**	**0.00(0.00)**	**13.03(1.27)**	**6.99(0.39)**	**0.26(0.03)**	**1.65(0.24)**	**8.20(0.02)**
C2	3/14/2007	79.84(17.85)	7.42(0.86)	5.30(0.36)	4.54(0.59)	9.07(1.79)	0.76(0.32)	0.00(0.00)	0.70(0.16)	0.00(0.00)	9.78(5.00)	5.76(0.36)	0.29(0.04)	0.48(0.01)	8.15(0.01)
C2	5/04/2007	5.82(0.66)	5.26(0.33)	54.65(2.30)	54.46(2.30)	0.60(0.04)	0.19(0.02)	0.00(0.00)	0.00(0.00)	0.00(0.00)	3.75(0.26)	5.93(0.24)	0.10(0.00)	0.22(0.01)	8.28(0.01)
C2	6/19/2007	39.81(1.85)	14.78(0.83)	3.67(0.76)	3.40(0.85)	1.86(0.11)	0.27(0.18)	0.00(0.00)	0.00(0.00)	0.00(0.00)	14.83(3.24)	8.51(1.48)	0.30(0.00)	1.95(1.18)	8.20(0.01)
C2	7/09/2007	93.16(1.20)	14.90(1.11)	7.15(0.50)	7.15(0.50)	1.75(0.15)	0.00(0.00)	0.00(0.00)	0.06(0.06)	0.00(0.00)	13.62(2.17)	5.68(0.27)	0.37(0.03)	2.43(0.29)	8.31(0.04)
C2	7/31/2007	51.16(4.14)	7.04(0.19)	6.28(0.76)	5.15(0.69)	0.93(0.05)	1.14(0.10)	0.00(0.00)	0.00(0.00)	0.00(0.00)	19.07(1.05)	6.06(0.58)	0.22(0.03)	0.69(0.05)	8.09(0.31)
C2	9/06/2007	49.49(4.29)	11.95(1.95)	7.00(1.11)	6.63(1.11)	1.37(0.28)	0.37(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	7.11(0.52)	5.83(0.23)	0.20(0.02)	1.83(0.12)	8.23(0.03)
C2	10/11/2007	61.53(3.11)	12.75(1.64)	7.72(0.54)	2.00(0.44)	1.73(0.06)	5.71(0.18)	0.00(0.00)	0.00(0.00)	0.00(0.00)	94.16(2.37)	5.60(0.39)	0.27(0.01)	2.06(0.21)	8.01(0.08)
C2	11/08/2007	64.79(1.18)	5.04(0.29)	3.93(0.45)	2.37(0.37)	0.54(0.04)	0.72(0.03)	0.83(0.07)	0.00(0.00)	0.00(0.00)	0.00(0.00)	3.40(0.46)	0.31(0.10)	0.18(0.06)	8.06(0.01)
C2	**Average**	**55.70(5.54)**	**9.89(0.87)**	**11.96(3.39)**	**10.71(3.48)**	**2.23(0.58)**	**1.14(0.37)**	**0.10(0.06)**	**0.10(0.05)**	**0.00(0.00)**	**20.29(5.99)**	**5.85(0.32)**	**0.26(0.02)**	**1.23(0.22)**	**8.17(0.02)**

Table 7. Average (±S.E.) nutrient, turbidity, and chlorophyll *a* concentrations, as well as pH in surface waters of Hilo Bay, Hawaii, USA, following Storm 1 (1/10/2007 to 1/15/2007). (-) indicates where data were not collected. Stn. = station, DOC = dissolved organic carbon, PC = particulate carbon, TDN = total dissolved nitrogen, DON = dissolved organic nitrogen, PN = particulate nitrogen, TDP = total dissolved phosphorus, TSS = total suspended solids, Turbid. = turbidity, and Chl *a* = Chlorophyll *a*.

Stn.	Date	DOC (µM)	PC (µM)	TDN (µM)	DON (µM)	PN (µM)	NO_3^- + NO_2^- (µM)	NH_4^+ (µM)	TDP (µM)	PO_4^{3-} (µM)	H_4SiO_4 (µM)	TSS (mg/L)	Turbid. (NTU)	Chl *a* (µg/L)	pH
S1	1/10/2007	108.46(9.22)	20.50(0.51)	9.14(1.29)	3.88(1.27)	1.27(0.03)	5.05(0.05)	0.21(0.03)	0.00(0.00)	0.00(0.00)	13.04(0.64)	0.31(0.18)	1.36(0.02)	-	6.97(0.02)
S4	1/10/2007	54.15(4.26)	14.25(1.06)	34.05(1.15)	14.15(4.06)	1.08(0.11)	19.55(3.00)	0.35(0.12)	0.02(0.01)	0.02(0.02)	14.30(3.36)	0.30(0.15)	0.86(0.04)	-	6.41(0.05)
S2	1/11/2007	53.34(1.57)	27.34(1.58)	5.58(0.92)	4.15(0.87)	1.78(0.11)	1.44(0.07)	0.00(0.00)	0.00(0.00)	0.00(0.00)	29.89(0.52)	36.01(3.27)	1.65(0.25)	0.00(0.00)	8.43(0.04)
S2	1/12/2007	45.80(2.76)	46.94(0.81)	5.04(0.37)	2.10(0.42)	2.79(0.10)	2.94(0.05)	0.00(0.00)	0.00(0.00)	0.00(0.00)	39.06(2.69)	32.86(1.29)	3.58(0.18)	1.15(1.15)	8.29(0.01)
S2	1/13/2007	38.83(0.79)	26.24(0.67)	5.56(1.04)	3.95(1.06)	1.41(0.05)	1.61(0.13)	0.00(0.00)	0.00(0.00)	0.00(0.00)	33.33(3.75)	28.29(3.49)	1.84(0.22)	0.00(0.00)	8.36(0.01)
S2	1/14/2007	42.10(1.37)	29.16(0.50)	6.62(0.38)	5.13(0.13)	2.27(0.14)	1.49(0.25)	0.00(0.00)	0.00(0.00)	0.00(0.00)	23.54(2.07)	37.46(2.12)	1.70(0.08)	0.01(0.01)	8.25(0.01)
S2	1/15/2007	41.56(6.27)	15.48(0.12)	5.71(0.49)	4.78(0.47)	1.25(0.04)	0.92(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	27.52(1.49)	24.27(2.84)	1.32(0.08)	0.00(0.00)	8.30(0.02)
S3	1/11/2007	61.08(8.07)	22.44(2.14)	7.81(0.54)	6.01(0.37)	1.22(0.09)	1.80(0.21)	0.00(0.00)	0.00(0.00)	0.00(0.00)	31.35(4.38)	44.68(2.72)	1.54(0.17)	0.38(0.02)	8.32(0.02)
S3	1/12/2007	37.32(1.06)	24.34(1.20)	5.58(0.46)	1.98(1.26)	2.18(0.13)	5.48(2.74)	0.00(0.00)	0.00(0.00)	0.00(0.00)	59.66(23.54)	29.52(0.82)	1.76(0.11)	1.30(0.03)	8.28(0.01)
S3	1/13/2007	42.81(1.25)	26.08(1.71)	7.97(0.82)	5.40(0.69)	2.03(0.41)	2.58(0.19)	0.00(0.00)	0.00(0.00)	0.00(0.00)	43.83(3.35)	31.20(2.09)	1.37(0.08)	0.77(0.04)	8.36(0.01)
S3	1/14/2007	46.33(0.57)	20.54(2.13)	7.58(0.54)	6.12(0.51)	2.25(0.50)	1.46(0.06)	0.00(0.00)	0.00(0.00)	0.00(0.00)	26.76(1.89)	22.15(0.73)	1.13(0.03)	0.53(0.12)	8.28(0.01)
S3	1/15/2007	32.54(1.69)	12.89(0.96)	4.67(0.28)	3.41(0.22)	1.46(0.11)	1.26(0.06)	0.00(0.00)	0.00(0.00)	0.00(0.00)	30.20(2.64)	29.78(2.11)	0.90(0.09)	0.50(0.03)	8.33(0.03)
S5	1/11/2007	27.70(1.63)	32.80(2.16)	12.71(0.34)	5.31(0.71)	3.06(0.37)	7.40(0.42)	0.00(0.00)	0.00(0.00)	0.00(0.00)	77.77(4.98)	24.43(2.18)	1.18(0.11)	0.63(0.32)	8.17(0.01)
S5	1/12/2007	20.77(3.17)	26.98(2.36)	12.52(1.13)	6.36(2.66)	2.57(0.52)	6.16(2.13)	0.00(0.00)	0.00(0.00)	0.00(0.00)	68.52(21.00)	28.64(1.14)	2.52(0.23)	0.36(0.11)	8.11(0.02)
S5	1/13/2007	12.65(3.05)	14.14(0.94)	16.79(2.66)	6.13(1.87)	0.93(0.13)	10.32(0.46)	0.34(0.34)	0.16(0.01)	0.00(0.00)	85.52(3.63)	16.48(0.89)	1.10(0.08)	0.05(0.05)	8.03(0.02)
S5	1/14/2007	23.03(2.94)	22.93(3.85)	15.67(0.88)	8.50(0.88)	2.41(0.59)	7.17(0.42)	0.00(0.00)	0.00(0.00)	0.00(0.00)	78.70(1.22)	20.69(0.94)	1.43(0.12)	0.47(0.15)	8.08(0.03)
S5	1/15/2007	13.22(1.74)	13.65(1.61)	13.31(0.67)	3.93(0.19)	1.31(0.06)	9.38(0.53)	0.00(0.00)	0.53(0.28)	0.00(0.00)	91.46(2.56)	18.62(1.53)	0.81(0.03)	0.04(0.04)	8.06(0.01)
S6	1/11/2007	27.04(0.51)	13.63(0.86)	14.39(0.81)	6.26(1.30)	0.77(0.08)	8.12(0.49)	0.00(0.00)	0.00(0.00)	0.00(0.00)	80.23(12.84)	31.30(0.93)	0.78(0.06)	0.45(0.06)	8.12(0.01)
S6	1/12/2007	20.01(2.11)	17.03(1.71)	7.51(1.09)	2.48(1.33)	1.18(0.21)	5.31(1.56)	0.00(0.00)	0.00(0.00)	0.00(0.00)	72.42(23.16)	21.69(0.56)	1.27(0.09)	1.59(0.06)	8.23(0.01)
S6	1/13/2007	29.38(1.16)	16.79(0.92)	9.97(0.56)	2.31(1.31)	1.27(0.12)	6.34(0.43)	1.96(0.94)	0.12(0.08)	0.03(0.03)	69.58(6.58)	22.59(2.15)	1.40(0.06)	0.47(0.06)	8.24(0.04)
S6	1/14/2007	22.66(3.90)	13.31(0.19)	15.10(0.95)	7.33(1.14)	1.44(0.15)	7.77(0.51)	0.00(0.00)	0.00(0.00)	0.00(0.00)	76.40(6.25)	16.61(1.57)	0.91(0.10)	0.50(0.01)	8.11(0.02)
S6	1/15/2007	27.63(2.30)	17.94(0.21)	11.18(0.76)	7.19(1.12)	2.07(0.06)	3.99(0.43)	0.00(0.00)	0.00(0.00)	0.00(0.00)	65.13(6.92)	27.47(2.42)	1.01(0.08)	1.72(0.21)	8.27(0.02)
C1	1/11/2007	44.75(3.30)	24.32(0.82)	5.58(0.62)	4.35(0.64)	1.09(0.03)	1.23(0.03)	0.00(0.00)	0.00(0.00)	0.00(0.00)	9.55(0.15)	26.72(1.30)	0.70(0.02)	0.04(0.01)	8.29(0.02)
C1	1/12/2007	40.01(1.82)	17.96(2.29)	5.11(0.32)	4.31(0.17)	1.35(0.16)	0.80(0.20)	0.00(0.00)	0.00(0.00)	0.00(0.00)	5.71(0.65)	22.36(2.64)	0.83(0.12)	0.60(0.06)	8.28(0.01)
C1	1/13/2007	45.93(2.56)	16.90(3.05)	5.84(0.55)	4.77(0.56)	1.54(0.59)	1.07(0.01)	0.00(0.00)	0.00(0.00)	0.00(0.00)	12.68(0.64)	25.72(4.88)	0.64(0.03)	0.10(0.01)	8.38(0.02)
C1	1/14/2007	40.89(1.86)	11.00(0.55)	6.78(0.27)	4.05(1.05)	1.26(0.08)	2.73(1.06)	0.00(0.00)	0.00(0.00)	0.00(0.00)	23.46(3.15)	21.54(1.14)	0.91(0.04)	0.00(0.00)	8.27(0.02)
C1	1/15/2007	41.94(1.54)	8.52(0.67)	5.55(0.53)	4.64(0.57)	0.81(0.04)	0.90(0.05)	0.00(0.00)	0.00(0.00)	0.00(0.00)	13.46(1.18)	22.52(0.29)	0.47(0.03)	0.01(0.01)	8.32(0.03)
C2	1/11/2007	43.63(0.91)	15.93(2.21)	5.50(0.17)	4.50(0.21)	0.89(0.06)	1.00(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	5.47(0.19)	33.01(5.33)	0.70(0.13)	0.55(0.02)	8.34(0.00)
C2	1/12/2007	35.39(1.07)	17.59(1.66)	6.00(0.17)	4.53(0.32)	1.34(0.08)	1.46(0.17)	0.00(0.00)	0.00(0.00)	0.00(0.00)	13.35(2.34)	23.58(0.87)	0.65(0.04)	1.31(0.03)	8.21(0.02)
C2	1/13/2007	54.11(5.66)	16.81(0.82)	6.51(0.63)	5.17(0.71)	1.06(0.06)	1.34(0.09)	0.00(0.00)	0.00(0.00)	0.00(0.00)	10.62(0.88)	25.38(1.52)	0.80(0.05)	0.62(0.02)	8.38(0.00)
C2	1/14/2007	44.97(2.24)	8.86(0.51)	5.25(0.19)	4.47(0.11)	1.07(0.02)	0.78(0.13)	0.00(0.00)	0.00(0.00)	0.00(0.00)	11.62(2.88)	28.19(0.81)	0.48(0.14)	0.60(0.06)	8.33(0.02)
C2	1/15/2007	41.01(0.36)	10.63(0.39)	5.17(0.40)	4.56(0.56)	0.90(0.07)	0.61(0.16)	0.00(0.00)	0.00(0.00)	0.00(0.00)	8.35(1.01)	23.95(0.89)	0.33(0.03)	0.77(0.05)	8.34(0.01)

Table 8. Average (±S.E.) nutrient, turbidity, and chlorophyll *a* concentrations, as well as pH in surface waters of Hilo Bay, Hawaii, USA, following Storm 2 (3/01/2007 to 3/06/2007). (-) indicates where data were not collected. (*) indicates only one sample for data point. Stn. = station, DOC = dissolved organic carbon, PC = particulate carbon, TDN = total dissolved nitrogen, DON = dissolved organic nitrogen, PN = particulate nitrogen, TDP = total dissolved phosphorus, TSS = total suspended solids, Turbid. = turbidity, and Chl *a* = Chlorophyll *a*.

Stn.	Date	DOC (µM)	PC (µM)	TDN (µM)	DON (µM)	PN (µM)	NO_3^- + NO_2^- (µM)	NH_4^+ (µM)	TDP (µM)	PO_4^{3-} (µM)	H_4SiO_4 (µM)	TSS (mg/L)	Turbid. (NTU)	Chl *a* (µg/L)	pH
S1	3/01/2007	272.83(10.92)	130.37(5.40)	7.97(0.83)	5.15(0.77)	8.59(0.65)	2.46(0.05)	0.36(0.05)	0.02(0.02)	0.01(0.01)	7.25(0.51)	6.02(1.88)	5.08(0.18)	-	6.10(0.21)
S4	3/01/2007	107.61(4.54)	74.70(13.99)	29.31(1.86)	4.52(1.67)	6.04(1.06)	24.38(0.24)	0.41(0.08)	0.00(0.00)	0.02(0.01)	200.23(6.21)	5.18(0.57)	3.13(0.14)	-	6.23(0.07)
S2	3/02/2007	132.30(5.63)	55.67(1.28)	11.53(1.24)	9.77(1.19)	3.77(0.15)	1.75(0.17)	0.00(0.00)	0.00(0.00)	0.00(0.00)	76.70(6.88)	26.01(3.58)	4.52(0.25)	0.00(0.00)	8.02(0.05)
S2	3/03/2007	103.18(4.33)	32.88(1.19)	9.63(0.19)	6.31(0.81)	2.62(0.14)	2.66(0.11)	0.40(0.40)	0.00(0.00)	0.00(0.00)	77.66(6.55)	22.09(1.48)	2.10(0.10)	0.00(0.00)	8.08(0.03)
S2	3/04/2007	83.74(3.03)	33.44(7.24)	7.85(0.88)	6.18(0.83)	2.74(0.56)	1.53(0.36)	0.15(0.15)	0.00(0.00)	0.00(0.00)	29.48(11.04)	22.65(3.23)	2.32(0.08)	0.24(0.15)	7.99(0.04)
S2	3/05/2007	94.40(8.48)	31.08(4.48)	10.36(0.27)	8.38(0.28)	2.95(0.48)	1.98(0.37)	0.00(0.00)	0.00(0.00)	0.00(0.00)	42.29(7.09)	22.77(1.72)	1.18(0.06)	0.38(0.14)	8.15(0.02)
S2	3/06/2007	94.32(4.13)	23.70(1.08)	12.05(0.97)	6.51(1.89)	2.05(0.08)	4.64(0.17)	0.90(0.90)	0.00(0.00)	0.00(0.00)	93.79(5.03)	15.52(1.88)	1.19(0.09)	0.18(0.02)	8.01(0.04)
S3	3/02/2007	134.87(8.12)	34.71(1.52)	10.68(1.05)	8.95(0.91)	2.60(0.19)	1.61(0.16)	0.13(0.13)	0.00(0.00)	0.00(0.00)	79.12(0.71)	22.70(1.06)	2.89(0.10)	0.00(0.00)	8.09(0.01)
S3	3/03/2007	93.46(2.56)	21.14(0.39)	9.43(0.54)	7.22(0.38)	1.76(0.03)	2.06(0.04)	0.15(0.12)	0.00(0.00)	0.00(0.00)	38.97(1.67)	19.34(0.97)	1.56(0.01)	0.00(0.00)	8.09(0.03)
S3	3/04/2007	74.82(4.83)	26.71(0.87)	10.06(0.23)	7.77(0.36)	2.20(0.05)	2.14(0.28)	0.15(0.15)	0.00(0.00)	0.00(0.00)	27.65(6.24)	21.24(1.90)	1.84(0.07)	0.01(0.01)	8.05(0.03)
S3	3/05/2007	93.37(4.54)	20.03(2.81)	10.38(0.92)	7.92(0.42)	1.77(0.21)	2.46(0.53)	0.00(0.00)	0.00(0.00)	0.00(0.00)	45.08(5.56)	19.63(0.89)	1.17(0.11)	0.19(0.03)	8.17(0.02)
S3	3/06/2007	96.00(7.16)	16.30(0.88)	17.22(3.88)	8.50(1.32)	1.82(0.10)	8.73(2.62)	0.00(0.00)	0.00(0.00)	0.00(0.00)	121.08(22.38)	18.21(0.99)	0.95(0.09)	0.22(0.09)	8.05(0.03)
S5	3/02/2007	103.37(6.22)	43.58(4.47)	21.67(1.77)	14.38(1.02)	3.74(0.42)	7.20(0.76)	0.09(0.09)	0.03(0.01)	0.00(0.00)	179.43(13.96)	28.48(2.31)	3.60(0.45)	0.00(0.00)	7.93(0.01)
S5	3/03/2007	77.03(8.80)	24.81(2.12)	21.40(3.97)	11.71(1.57)	2.55(0.33)	9.58(2.43)	0.11(0.07)	0.08(0.08)	0.00(0.00)	141.62(55.08)	21.02(3.32)	1.67(0.25)	0.05(0.04)	7.96(0.06)
S5	3/04/2007	53.25(0.94)	19.35(0.84)	22.74(1.53)	9.83(1.35)	2.02(0.13)	12.88(2.70)	0.03(0.03)	0.06(0.06)	0.02(0.02)	232.20(10.40)	12.96(1.43)	1.18(0.14)	0.42(0.08)	7.79(0.03)
S5	3/05/2007	68.22(3.95)	15.85(1.18)	29.40(2.94)	14.13(1.90)	2.00(0.12)	15.27(1.57)	0.00(0.00)	0.02(0.02)	0.02(0.02)	204.37(20.91)	16.41(1.04)	0.95(0.06)	0.35(0.12)	7.98(0.02)
S5	3/06/2007	112.01(24.50)	25.14(1.14)	22.06(1.60)	10.04(0.81)	3.22(0.21)	12.02(1.18)	0.00(0.00)	0.00(0.00)	0.00(0.00)	159.89(14.77)	22.13(1.19)	1.17(0.03)	1.37(0.31)	8.04(0.01)
S6	3/02/2007	108.11(11.36)	30.54(0.69)	22.10(1.38)	11.95(1.26)	2.55(0.05)	9.72(0.12)	0.43(0.20)	0.05(0.01)	0.00(0.00)	188.15(0.64)	26.07(2.90)	3.05(0.12)	0.24(0.24)	7.88(0.03)
S6	3/03/2007	85.57(1.54)	14.75(1.54)	21.01(0.71)	12.23(0.53)	1.30(0.06)	8.27(0.27)	0.51(0.08)	0.00(0.00)	0.00(0.00)	154.87(2.19)	15.73(0.71)	1.26(0.04)	0.00(0.00)	8.02(0.00)
S6	3/04/2007	84.53(4.68)	12.22(0.86)	26.57(0.89)	15.50(2.00)	1.24(0.04)	11.07(2.10)	0.00(0.00)	0.00(0.00)	0.00(0.00)	166.08(0.87)	14.66(0.68)	0.92(0.12)	0.03(0.03)	7.92(0.00)
S6	3/05/2007	101.47(24.20)	22.13(7.24)	22.81(1.98)	13.49(1.77)	1.81(0.39)	9.31(0.41)	0.00(0.00)	0.00(0.00)	0.00(0.00)	132.44(3.31)	20.87(2.52)	0.84(0.10)	0.00(0.00)	8.04(0.02)
S6	3/06/2007	95.23(7.03)	9.19(0.92)	20.08(1.38)	9.78(1.39)	1.20(0.07)	10.30(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	130.86(0.91)	10.01(1.16)	0.54(0.02)	0.30(0.03)	7.90(0.02)
C1	3/02/2007	90.07(16.95)	16.77(1.81)	11.41(2.75)	9.90(2.71)	1.10(0.05)	1.51(0.09)	0.00(0.00)	0.00(0.00)	0.00(0.00)	29.05(3.78)	28.10(0.65)	1.20(0.07)	0.00(0.00)	8.07(0.07)
C1	3/03/2007	79.90(4.43)	9.17(0.30)	8.86(0.62)	7.78(0.67)	0.93(0.03)	1.09(0.05)	0.00(0.00)	0.00(0.00)	0.00(0.00)	6.37(0.63)	19.24(0.31)	0.60(0.03)	0.40(0.06)	8.18(0.01)
C1	3/04/2007	79.17(6.83)	7.55(0.28)	8.43(0.51)	7.99(0.54)	0.82(0.04)	0.44(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	10.19(1.94)	0.26(0.01)	0.24(0.01)	8.06(0.02)
C1	3/05/2007	93.84(2.11)	8.33(0.69)	8.65(0.14)	7.66(0.14)	1.10(0.06)	0.99(0.03)	0.00(0.00)	0.00(0.00)	0.00(0.00)	3.07(0.74)	15.74(1.43)	0.57(0.04)	0.46(0.08)	8.13(0.02)
C1	3/06/2007	104.21(8.01)	7.95(1.23)	6.92(0.42)	4.19(1.62)	0.78(0.03)	2.73(1.30)	0.00(0.00)	0.00(0.00)	0.00(0.00)	5.46(0.32)	11.11(0.58)	0.25(0.05)	0.43(0.05)	8.16(0.00)
C2	3/02/2007	105.47(11.21)	8.28(3.86)	9.44(0.56)	8.15(0.54)	1.01(0.05)	1.29(0.02)	0.00(0.00)	0.03(0.02)	0.00(0.00)	22.13(0.66)	24.20(2.42)	0.91(0.07)	0.01(0.02)	8.18(0.00)
C2	3/03/2007	72.90(8.02)	8.21(0.36)	7.54(1.19)	6.72(1.17)	0.76(0.01)	0.82(0.03)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.23(0.23)	16.80(0.49)	0.41(0.06)	0.03(0.02)	8.15(0.03)
C2	3/04/2007	76.33(8.96)	6.45(0.57)	8.89(1.16)	7.85(1.09)	0.67(0.07)	1.04(0.07)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.00(0.00)	12.83(1.76)	0.24(0.04)	0.01(0.01)	8.02*
C2	3/05/2007	99.87(9.60)	6.11(0.72)	7.47(0.32)	6.35(0.36)	0.75(0.08)	1.11(0.08)	0.00(0.00)	0.00(0.00)	0.00(0.00)	1.84(1.76)	12.07(0.58)	0.35(0.03)	0.19(0.02)	8.19(0.03)
C2	3/06/2007	109.10(2.53)	8.58(2.27)	12.00(1.01)	5.55(2.82)	0.72(0.05)	2.71(1.53)	0.00(0.00)	0.00(0.00)	0.00(0.00)	0.29(0.20)	11.08(0.41)	0.24(0.09)	0.15(0.01)	8.08(0.05)

Table 9. Average (±S.E.) nutrient, turbidity, and chlorophyll *a* concentrations, as well as pH in surface waters of Hilo Bay, Hawaii, USA, following Storm 3 (12/12/2007 to 12/17/2007). (-) indicates where data were not collected. Stn. = station, DOC = dissolved organic carbon, PC = particulate carbon, TDN = total dissolved nitrogen, DON = dissolved organic nitrogen, PN = particulate nitrogen, TDP = total dissolved phosphorus, TSS = total suspended solids, Turbid. = turbidity, and Chl *a* = Chlorophyll *a*.

Stn.	Date	DOC (µM)	PC (µM)	TDN (µM)	DON (µM)	PN (µM)	NO_3^- + NO_2^- (µM)	NH_4^+ (µM)	TDP (µM)	PO_4^{3-} (µM)	H_4SiO_4 (µM)	TSS (mg/L)	Turbid. (NTU)	Chl *a* (µg/L)	pH
S1	12/12/2007	300.23(1.94)	294.98(12.49)	8.09(0.43)	4.64(0.42)	20.41(0.82)	2.67(0.04)	0.78(0.11)	0.00(0.00)	0.00(0.00)	4.70(0.27)	15.57(0.56)	11.63(0.73)	-	6.80(0.10)
S4	12/12/2007	31.80(8.43)	11.05(0.42)	35.94(0.18)	16.73(0.62)	0.91(0.01)	19.00(0.53)	0.20(0.20)	0.00(0.00)	0.00(0.00)	76.78(2.79)	0.66(0.01)	0.39(0.02)	-	5.99(0.02)
S2	12/13/2007	150.02(4.43)	128.19(6.61)	8.79(0.52)	5.87(0.26)	7.83(0.14)	2.92(0.31)	0.00(0.00)	0.00(0.00)	0.00(0.00)	40.41(0.29)	35.35(5.70)	6.23(0.14)	0.00(0.00)	8.15(0.05)
S2	12/14/2007	129.48(11.99)	92.56(2.84)	8.88(0.74)	5.80(0.84)	5.93(0.16)	2.98(0.07)	0.10(0.10)	0.00(0.00)	0.00(0.00)	47.96(0.67))	25.88(3.32)	5.17(0.31)	0.34(0.22)	8.34(0.10)
S2	12/15/2007	145.38(2.65)	110.91(2.35)	6.77(0.33)	4.97(0.16)	6.93(0.13)	1.80(0.46)	0.00(0.00)	0.00(0.00)	0.00(0.00)	28.54(9.73)	26.67(1.08)	4.77(0.26)	0.02(0.04)	8.05(0.12)
S2	12/16/2007	187.06(5.54)	218.82(12.30)	6.11(0.14)	3.89(0.11)	13.13(0.96)	2.22(0.05)	0.00(0.00)	0.00(0.00)	0.00(0.00)	20.85(1.89)	35.27(1.28)	10.28(0.61)	0.45(0.45)	7.71(0.30)
S2	12/17/2007	143.71(5.15)	64.85(0.92)	6.51(0.48)	3.65(0.50)	4.85(0.36)	2.86(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	45.42(2.20)	17.27(0.36)	5.10(0.07)	0.00(0.00)	8.17(0.01)
S3	12/13/2007	142.52(5.55)	61.72(1.46)	7.83(0.16)	4.58(0.20)	4.08(0.05)	3.25(0.06)	0.00(0.00)	0.00(0.00)	0.00(0.00)	57.27(0.64)	29.43(0.19)	3.38(0.05)	0.00(0.00)	8.13(0.12)
S3	12/14/2007	136.83(4.00)	58.06(3.00)	8.20(0.38)	4.99(0.43)	3.71(0.11)	2.73(0.09)	0.47(0.24)	0.00(0.00)	0.00(0.00)	44.89(1.85)	25.37(4.49)	4.50(0.07)	0.00(0.00)	8.20(0.16)
S3	12/15/2007	105.07(2.32)	51.83(2.72)	8.28(0.55)	6.33(0.56)	3.62(0.09)	1.95(0.21)	0.00(0.00)	0.00(0.00)	0.00(0.00)	27.40(4.18)	23.95(4.00)	2.36(0.27)	0.17(0.29)	8.22(0.03)
S3	12/16/2007	163.25(6.93)	111.71(0.75)	7.29(0.29)	4.20(0.29)	7.50(0.58)	3.09(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	37.08(0.73)	24.63(2.29)	6.87(0.31)	0.00(0.00)	8.21(0.07)
S3	12/17/2007	130.74(0.78)	24.97(0.76)	7.66(0.17)	3.61(0.14)	2.28(0.04)	4.05(0.04)	0.00(0.00)	0.00(0.00)	0.00(0.00)	57.75(1.94)	8.43(1.30)	2.76(0.23)	2.21(2.21)	8.23(0.02)
S5	12/13/2007	49.85(1.93)	25.83(9.66)	25.94(0.44)	1.01(0.43)	1.67(0.19)	24.88(0.28)	0.05(0.05)	0.30(0.24)	0.16(0.02)	213.33(6.32)	6.31(0.38)	1.18(0.04)	0.27(0.13)	7.53(0.14)
S5	12/14/2007	62.94(2.81)	12.74(1.01)	24.64(0.43)	1.46(0.27)	1.16(0.06)	23.18(0.68)	0.00(0.00)	0.00(0.00)	0.07(0.01)	195.37(7.98)	8.14(1.98)	0.86(0.05)	0.00(0.00)	7.69(0.19)
S5	12/15/2007	40.89(1.25)	11.81(1.19)	24.66(0.38)	11.34(4.92)	1.03(0.06)	13.33(4.62)	0.00(0.00)	0.18(0.04)	0.01(0.01)	126.15(28.08)	4.95(0.14)	0.75(0.08)	0.16(0.07)	7.28(0.09)
S5	12/16/2007	84.65(6.01)	28.80(0.22)	21.81(2.76)	1.64(1.55)	2.50(0.19)	20.17(1.21)	0.00(0.00)	0.37(0.32)	0.00(0.00)	189.24(4.55)	8.00(1.56)	1.91(0.24)	0.01(0.01)	7.23(0.04)
S5	12/17/2007	75.85(3.46)	23.47(1.17)	19.89(0.47)	0.77(0.28)	1.86(0.03)	19.12(0.21)	0.00(0.00)	0.00(0.00)	0.00(0.00)	137.33(11.02)	11.14(0.11)	1.85(0.09)	0.00(0.00)	7.91(0.06)
S6	12/13/2007	111.12(2.60)	37.10(1.41)	14.65(0.23)	3.59(0.22)	2.64(0.14)	10.99(0.02)	0.06(0.06)	0.00(0.00)	0.00(0.00)	145.75(1.58)	13.78(2.80)	2.00(0.09)	0.00(0.00)	7.89(0.03)
S6	12/14/2007	124.54(4.21)	47.90(3.54)	10.99(0.25)	4.53(0.15)	3.51(0.15)	6.25(0.13)	0.21(0.21)	0.00(0.00)	0.00(0.00)	97.46(1.43)	13.63(1.89)	3.69(0.49)	0.00(0.00)	8.06(0.01)
S6	12/15/2007	126.80(2.87)	63.74(1.17)	6.74(0.14)	4.00(0.10)	4.12(0.06)	2.74(0.03)	0.00(0.00)	0.00(0.00)	0.00(0.00)	41.54(1.30)	20.44(1.30)	3.38(0.04)	0.00(0.00)	8.23(0.02)
S6	12/16/2007	155.67(1.86)	82.93(1.89)	8.11(0.52)	4.42(0.47)	6.04(0.22)	3.70(0.09)	0.00(0.00)	0.00(0.00)	0.00(0.00)	41.06(1.59)	28.20(0.92)	4.92(0.46)	0.00(0.00)	8.11(0.08)
S6	12/17/2007	131.19(0.97)	30.32(1.15)	7.00(0.50)	3.70(0.55)	2.95(0.03)	3.30(0.05)	0.00(0.00)	0.00(0.00)	0.00(0.00)	50.62(0.33)	22.59(1.14)	2.62(0.02)	0.00(0.00)	8.18(0.05)
C1	12/13/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1	12/14/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1	12/15/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1	12/16/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1	12/17/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	12/13/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	12/14/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	12/15/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	12/16/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	12/17/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 10. Average (±S.E.) nutrient, turbidity, and chlorophyll *a* concentrations, as well as pH in surface waters of Hilo Bay, Hawaii, USA, following Storm 4 (1/27/2008 to 2/01/2008). (-) indicates where data were not collected. Stn. = station, DOC = dissolved organic carbon, PC = particulate carbon, TDN = total dissolved nitrogen, DON = dissolved organic nitrogen, PN = particulate nitrogen, TDP = total dissolved phosphorus, TSS = total suspended solids, Turbid. = turbidity, and Chl *a* = Chlorophyll *a*.

Stn.	Date	DOC (µM)	PC (µM)	TDN (µM)	DON (µM)	PN (µM)	NO_3^- + NO_2^- (µM)	NH_4^+ (µM)	TDP (µM)	PO_4^{3-} (µM)	H_4SiO_4 (µM)	TSS (mg/L)	Turbid. (NTU)	Chl *a* (µg/L)	pH
S1	1/27/2008	258.65(6.28)	64.77(3.99)	8.77(1.08)	4.14(1.18)	4.56(0.25)	3.52(0.07)	1.11(0.05)	0.05(0.01)	0.02(0.02)	14.54(1.42)	0.22(0.22)	3.60(0.04)	-	7.28(0.06)
S4	1/27/2008	17.55(7.55)	7.98(0.66)	30.58(4.51)	11.60(6.29)	0.65(0.02)	17.72(1.82)	1.26(0.29)	0.09(0.01)	0.06(0.01)	17.17(7.99)	0.00(0.00)	0.32(0.05)	-	6.66(0.03)
S2	1/28/2008	81.85(2.19)	38.70(1.50)	7.39(0.19)	3.97(0.31)	2.34(0.06)	2.64(0.06)	0.78(0.40)	0.00(0.00)	0.00(0.00)	48.90(2.02)	23.42(4.24)	4.13(0.11)	0.03(0.01)	8.18(0.08)
S2	1/29/2008	60.90(3.58)	41.69(0.90)	6.00(0.37)	3.42(0.41)	2.57(0.06)	2.59(0.15)	0.00(0.00)	0.00(0.00)	0.00(0.00)	55.49(2.78)	18.13(1.12)	3.77(0.51)	0.03(0.03)	7.94(0.09)
S2	1/30/2008	78.64(2.65)	322.25(42.34)	7.22(0.16)	3.09(0.11)	20.43(2.44)	4.13(0.17)	0.00(0.00)	0.00(0.00)	0.00(0.00)	66.05(2.21)	43.23(4.97)	22.40(1.82)	0.00(0.00)	7.91(0.03)
S2	1/31/2008	94.92(2.63)	89.72(5.27)	10.10(0.43)	5.73(0.29)	6.22(0.37)	3.51(0.30)	0.86(0.08)	0.53(0.30)	0.00(0.00)	74.54(2.25)	21.44(1.31)	5.80(0.41)	0.02(0.01)	8.00(0.04)
S2	2/01/2008	178.62(4.82)	164.70(21.52)	9.56(0.55)	6.16(0.58)	10.93(1.63)	3.40(0.04)	0.00(0.00)	0.72(0.30)	0.00(0.00)	53.88(1.20)	44.83(10.17)	20.63(0.17)	0.00(0.00)	8.04(0.02)
S3	1/28/2008	71.42(2.42)	30.32(0.21)	7.35(0.67)	3.33(0.92)	1.79(0.04)	3.64(0.09)	0.38(0.21)	0.00(0.00)	0.00(0.00)	57.01(1.37)	16.10(2.11)	2.99(0.49)	0.00(0.00)	8.45(0.02)
S3	1/29/2008	49.86(8.23)	26.94(1.19)	6.07(0.87)	2.45(0.81)	1.67(0.03)	3.20(0.04)	0.42(0.21)	0.00(0.00)	0.00(0.00)	60.44(1.27)	15.14(0.73)	2.69(0.20)	0.02(0.02)	8.02(0.01)
S3	1/30/2008	87.96(3.89)	164.24(29.56)	6.81(0.42)	3.98(0.49)	10.03(2.66)	2.83(0.07)	0.00(0.00)	0.00(0.00)	0.00(0.00)	46.93(1.26)	57.25(8.22)	12.73(0.03)	0.00(0.00)	7.92(0.04)
S3	1/31/2008	111.69(9.30)	56.59(3.65)	12.05(0.29)	7.87(0.10)	5.23(0.51)	3.56(0.03)	0.62(0.36)	0.00(0.00)	0.00(0.00)	73.74(0.13)	13.83(1.62)	3.74(0.24)	0.00(0.00)	8.08(0.01)
S3	2/01/2008	136.20(2.19)	179.91(22.35)	7.62(0.03)	5.46(0.40)	11.88(1.46)	2.16(0.42)	0.00(0.00)	0.00(0.00)	0.00(0.00)	42.93(8.39)	47.96(6.29)	15.27(0.41)	0.00(0.00)	8.07(0.01)
S5	1/28/2008	16.17(1.42)	43.33(1.34)	20.18(1.57)	0.10(0.10)	3.09(0.16)	22.28(0.68)	0.02(0.02)	0.52(0.04)	0.06(0.03)	335.62(13.77)	10.71(2.50)	3.21(0.28)	1.26(0.19)	8.25(0.06)
S5	1/29/2008	22.90(3.98)	30.07(0.52)	17.93(0.32)	1.33(1.33)	1.92(0.05)	17.24(1.42)	0.00(0.00)	0.05(0.04)	0.00(0.00)	246.90(27.74)	11.04(0.70)	2.99(0.53)	0.73(0.20)	7.85(0.00)
S5	1/30/2008	40.70(2.96)	51.86(2.77)	24.05(0.59)	1.98(0.63)	3.55(0.27)	21.52(1.05)	0.55(0.27)	0.19(0.01)	0.08(0.03)	329.80(8.89)	10.83(0.52)	3.56(0.26)	0.16(0.09)	7.67(0.04)
S5	1/31/2008	61.28(3.80)	41.06(0.77)	19.74(0.09)	3.84(0.31)	3.94(0.12)	15.89(0.27)	0.00(0.00)	0.24(0.08)	0.00(0.00)	187.34(3.24)	9.31(1.27)	2.93(0.08)	1.72(0.13)	7.81(0.05)
S5	2/01/2008	74.42(13.83)	51.40(13.42)	19.94(0.85)	1.86(0.95)	3.62(0.85)	18.15(0.77)	0.00(0.00)	0.07(0.04)	0.00(0.00)	197.42(10.47)	12.61(2.85)	5.78(0.47)	0.00(0.00)	7.89(0.05)
S6	1/28/2008	73.62(5.35)	49.19(0.58)	7.28(0.59)	3.97(1.11)	2.95(0.06)	3.31(0.56)	0.00(0.00)	0.00(0.00)	0.00(0.00)	53.54(7.73)	21.72(1.74)	5.28(0.06)	0.03(0.03)	8.49(0.01)
S6	1/29/2008	60.05(2.01)	27.83(0.52)	7.35(0.38)	2.91(0.33)	2.03(0.12)	4.44(0.20)	0.00(0.00)	0.00(0.00)	0.00(0.00)	77.12(3.78)	14.00(0.50)	2.52(0.10)	0.32(0.05)	7.61(0.08)
S6	1/30/2008	95.75(1.07)	121.25(3.50)	9.47(0.63)	4.51(0.19)	8.43(0.14)	4.96(0.63)	0.00(0.00)	0.00(0.00)	0.00(0.00)	71.11(5.50)	36.58(4.63)	11.43(0.37)	0.00(0.00)	7.75(0.07)
S6	1/31/2008	57.52(3.49)	21.30(1.22)	17.87(1.97)	2.41(1.21)	1.79(0.05)	15.61(0.63)	0.00(0.00)	0.36(0.18)	0.57(0.52)	186.18(5.33)	9.46(0.40)	1.77(0.13)	0.00(0.00)	7.83(0.06)
S6	2/01/2008	129.70(6.06)	155.58(7.03)	7.96(0.09)	3.67(0.46)	9.88(0.45)	4.30(0.55)	0.00(0.00)	0.00(0.00)	0.00(0.00)	69.54(6.63)	31.80(3.99)	13.03(0.68)	0.00(0.00)	8.00(0.01)
C1	1/28/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1	1/29/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C1	1/30/2008	71.90(3.39)	59.56(1.33)	6.30(0.34)	3.95(0.36)	4.17(0.24)	2.36(0.03)	0.00(0.00)	0.00(0.00)	0.00(0.00)	32.28(0.26)	23.50(4.89)	6.26(0.18)	0.00(0.00)	7.97(0.04)
C1	1/31/2008	80.31(3.01)	18.42(0.87)	11.51(0.93)	7.28(0.81)	2.17(0.22)	2.66(0.07)	1.56(0.24)	1.17(0.65)	0.00(0.00)	23.28(0.83)	12.06(1.20)	0.93(0.11)	0.00(0.00)	8.04(0.04)
C1	2/01/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	1/28/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	1/29/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C2	1/30/2008	67.39(4.47)	51.66(1.80)	5.66(0.15)	3.01(0.49)	3.58(0.29)	2.14(0.06)	0.50(0.30)	0.00(0.00)	0.00(0.00)	31.03(1.01)	27.97(2.73)	5.20(0.08)	0.00(0.00)	8.07(0.02)
C2	1/31/2008	102.36(14.17)	15.89(2.81)	15.96(3.24)	12.17(2.41)	1.95(0.46)	2.57(0.17)	1.22(0.66)	0.00(0.00)	0.00(0.00)	25.82(1.56)	11.75(0.45)	0.97(0.04)	0.03(0.03)	8.11(0.01)
C2	2/01/2008	-	-	-	-	-	-	-	-	-	-	-	-	-	-

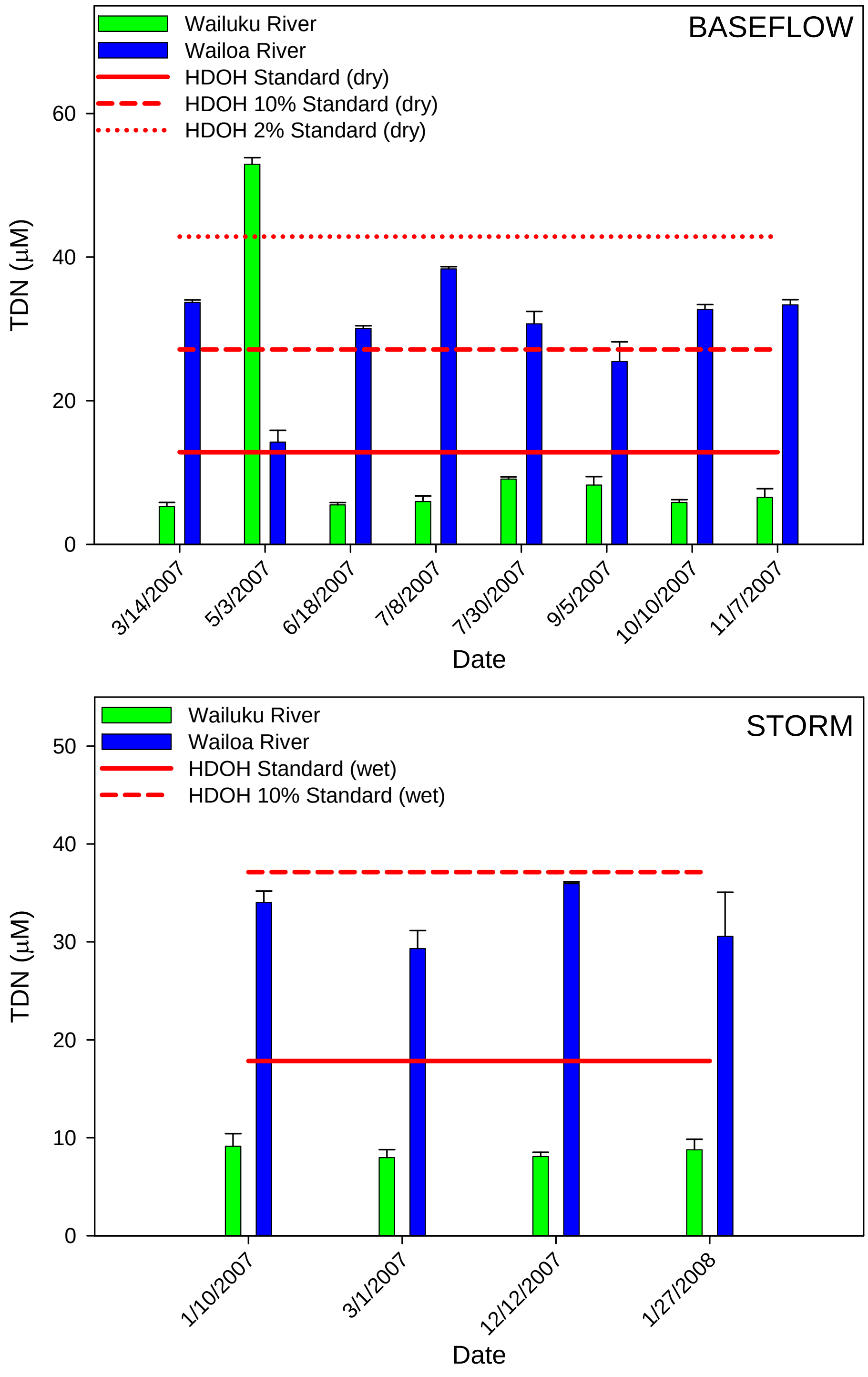

Figure 4. Average (±S.E.) TDN concentrations in the Wailuku (S1) and Wailoa (S4) Rivers, Hilo, Hawaii, USA, during baseflow (top) and stormflow (bottom) conditions.

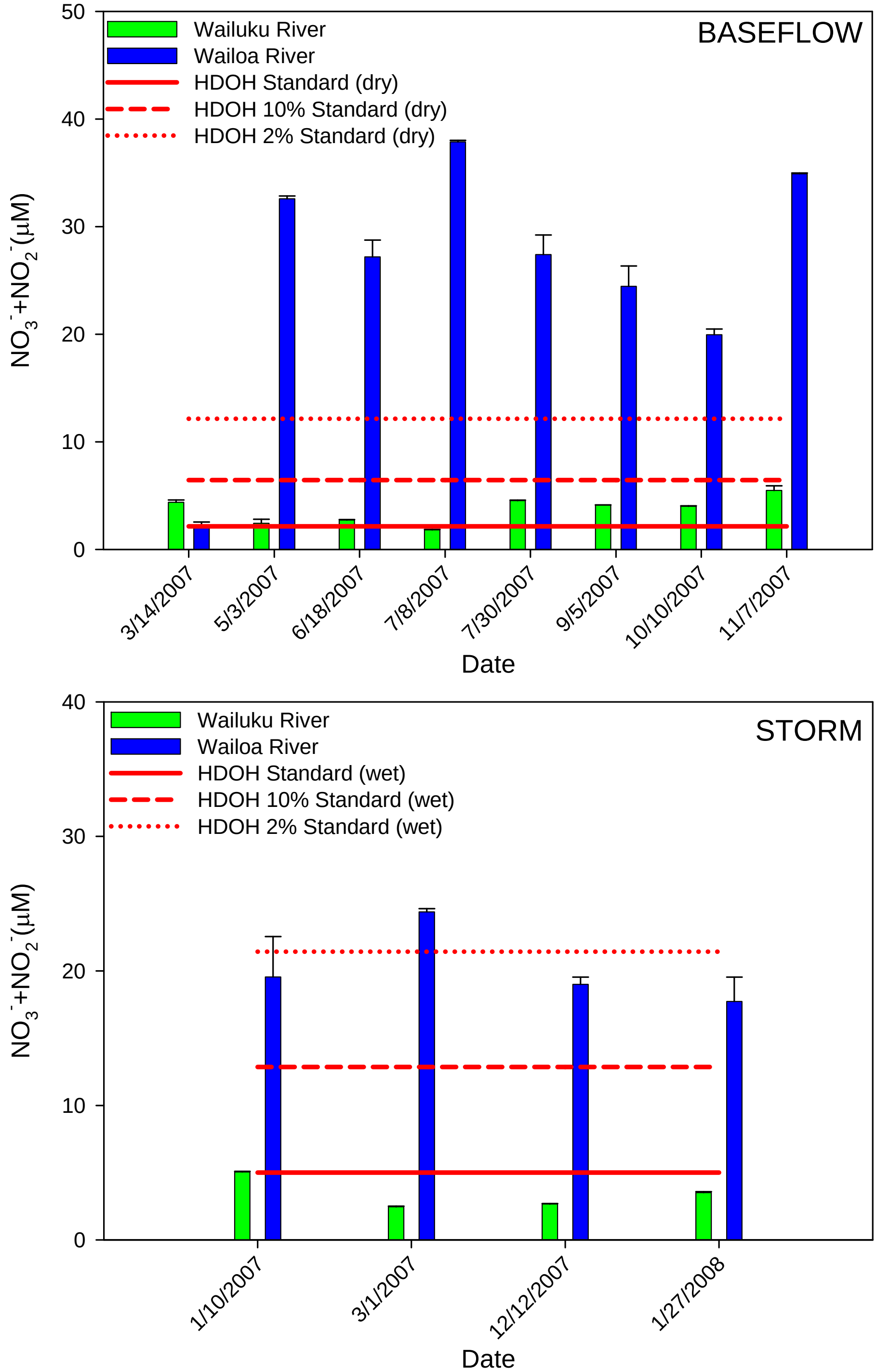

Figure 5. Average (±S.E.) NO_3^- + NO_2^- concentrations in the Wailuku (S1) and Wailoa (S4) Rivers, Hilo, Hawaii, USA, during baseflow (top) and stormflow (bottom) conditions.

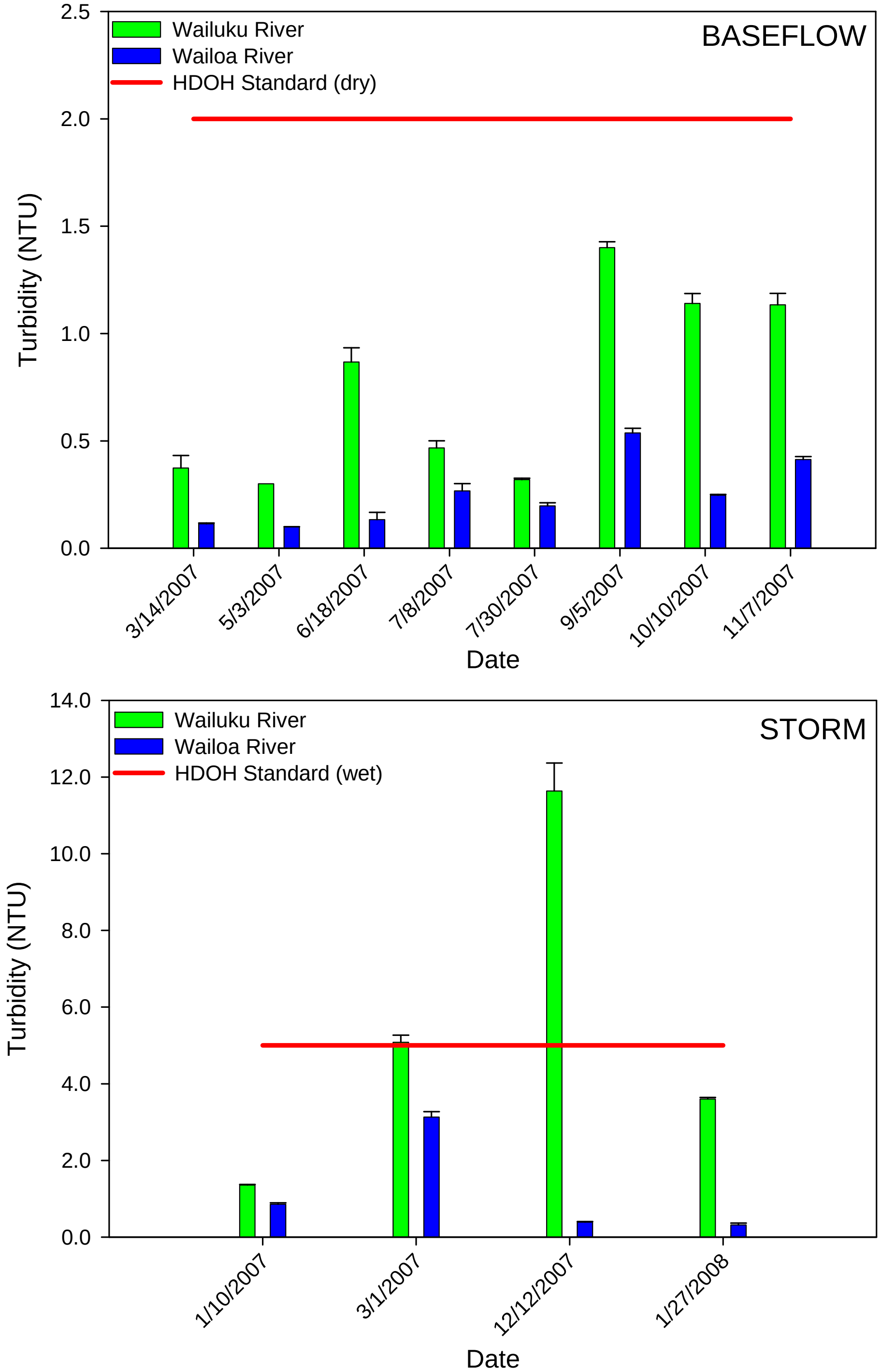

Figure 6. Average (±S.E.) turbidity levels in the Wailuku (S1) and Wailoa (S4) Rivers, Hilo, Hawaii, USA, during baseflow (top) and stormflow (bottom) conditions.

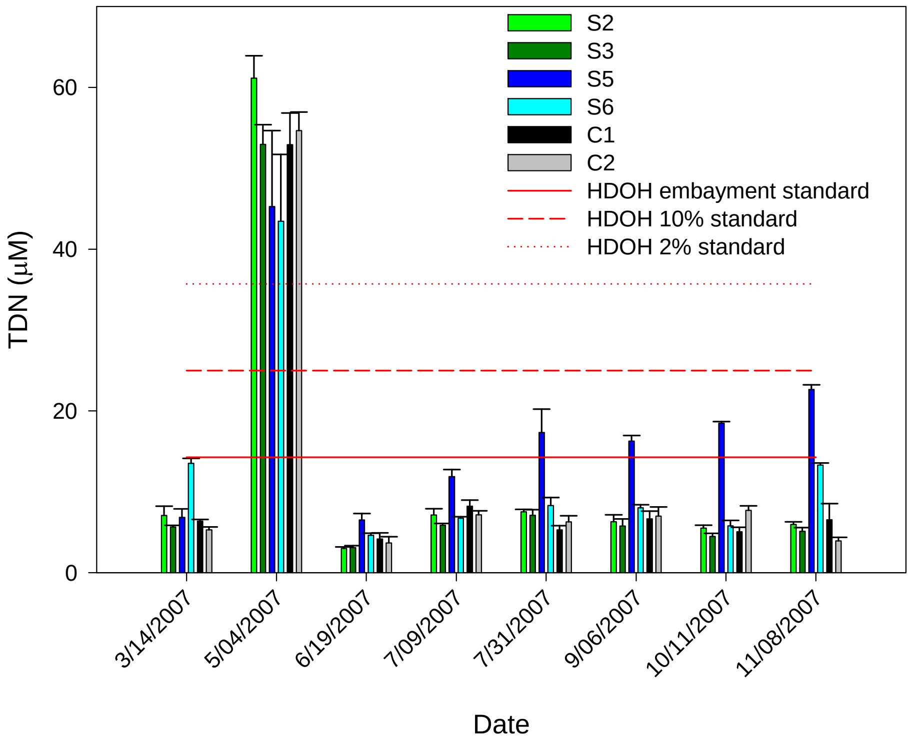

Figure 7. Average (±S.E.) TDN concentrations during baseflow conditions in Hilo Bay, Hawaii, USA.

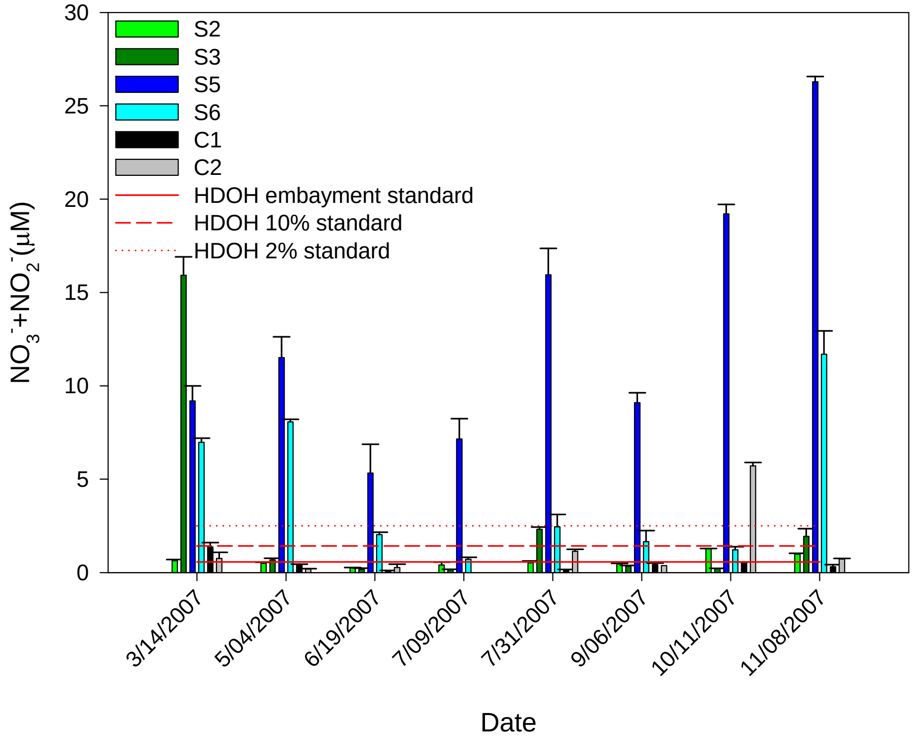

Figure 8. Average (±S.E.) NO_3^- + NO_2^- concentrations during baseflow conditions in Hilo Bay, Hawaii, USA.

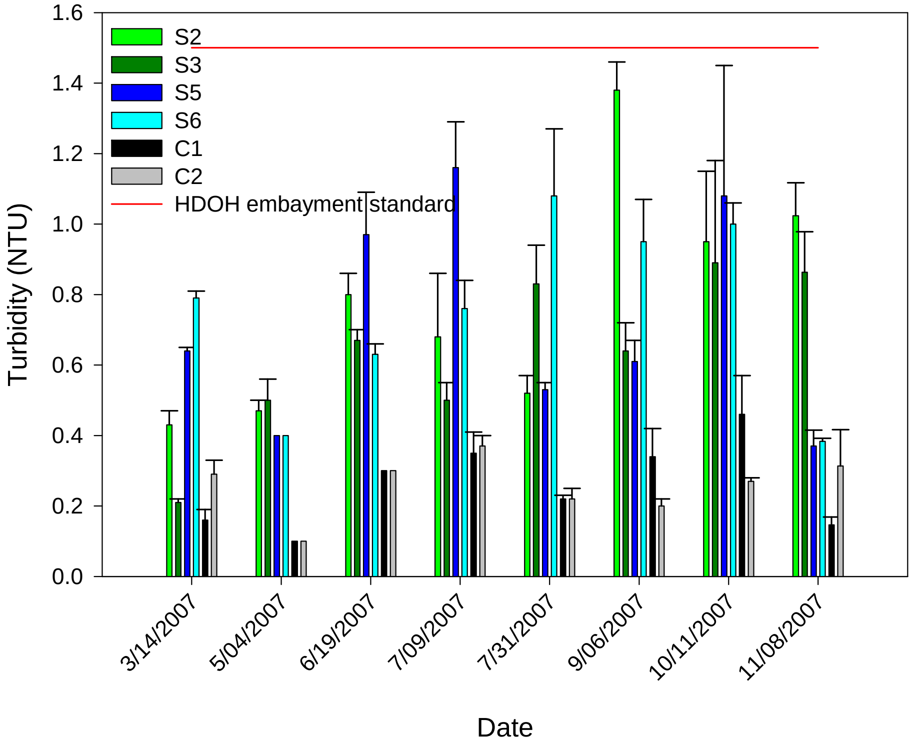

Figure 9. Average (±S.E.) turbidity levels during baseflow conditions in Hilo Bay, Hawaii, USA.

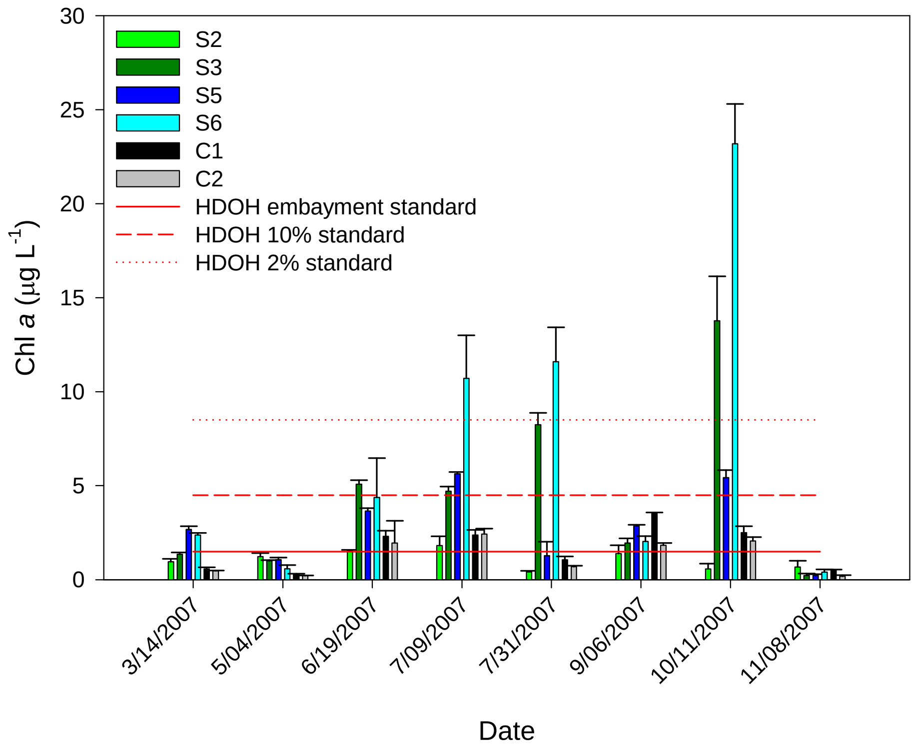

Figure 10. Average (±S.E.) Chl *a* concentrations during baseflow conditions in Hilo Bay, Hawaii, USA.

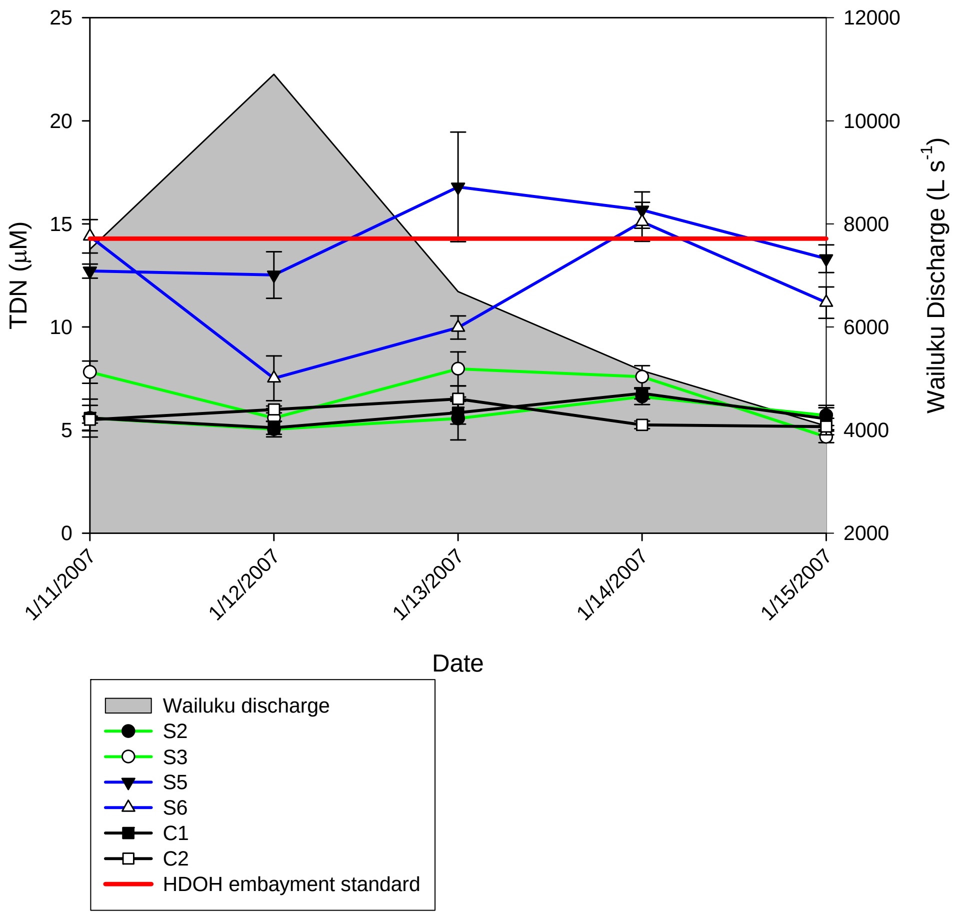

Figure 11. Average (±S.E.) TDN concentrations in Hilo Bay, Hawaii, USA, following <u>Storm 1</u> (1/10/2007 to 1/15/2007).

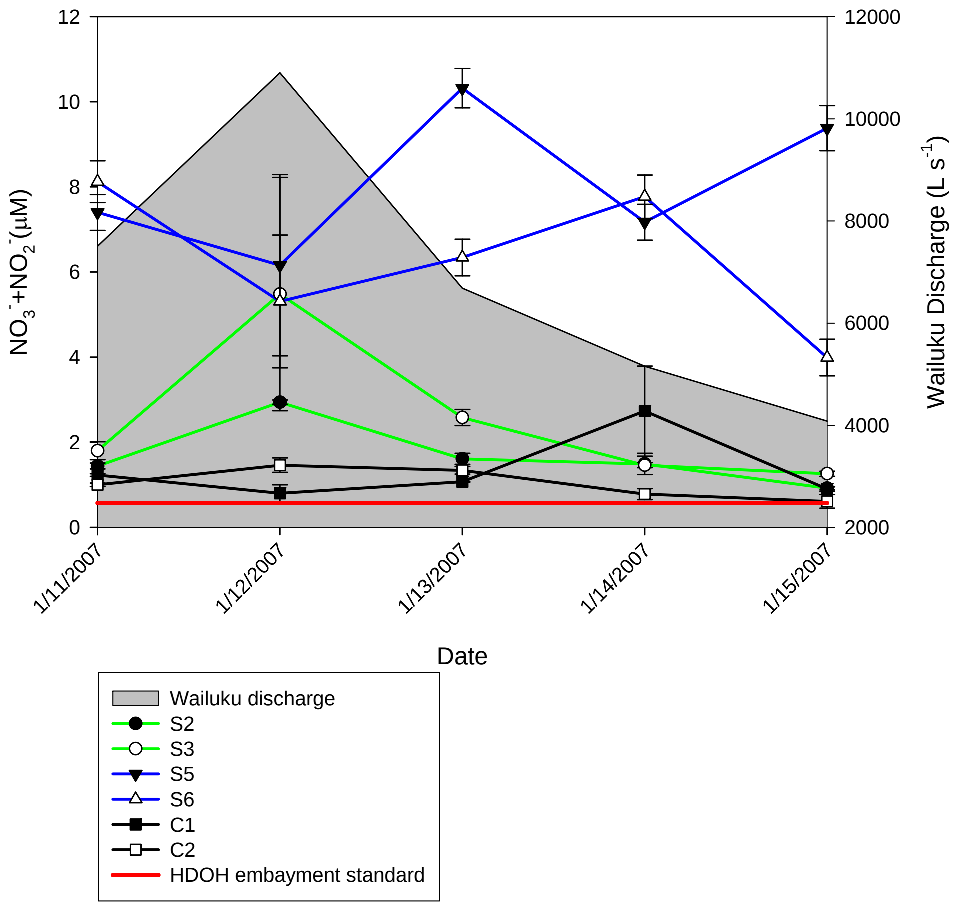

Figure 12. Average (±S.E.) NO_3^- + NO_2^- concentrations in Hilo Bay, Hawaii, USA, following Storm 1 (1/10/2007 to 1/15/2007).

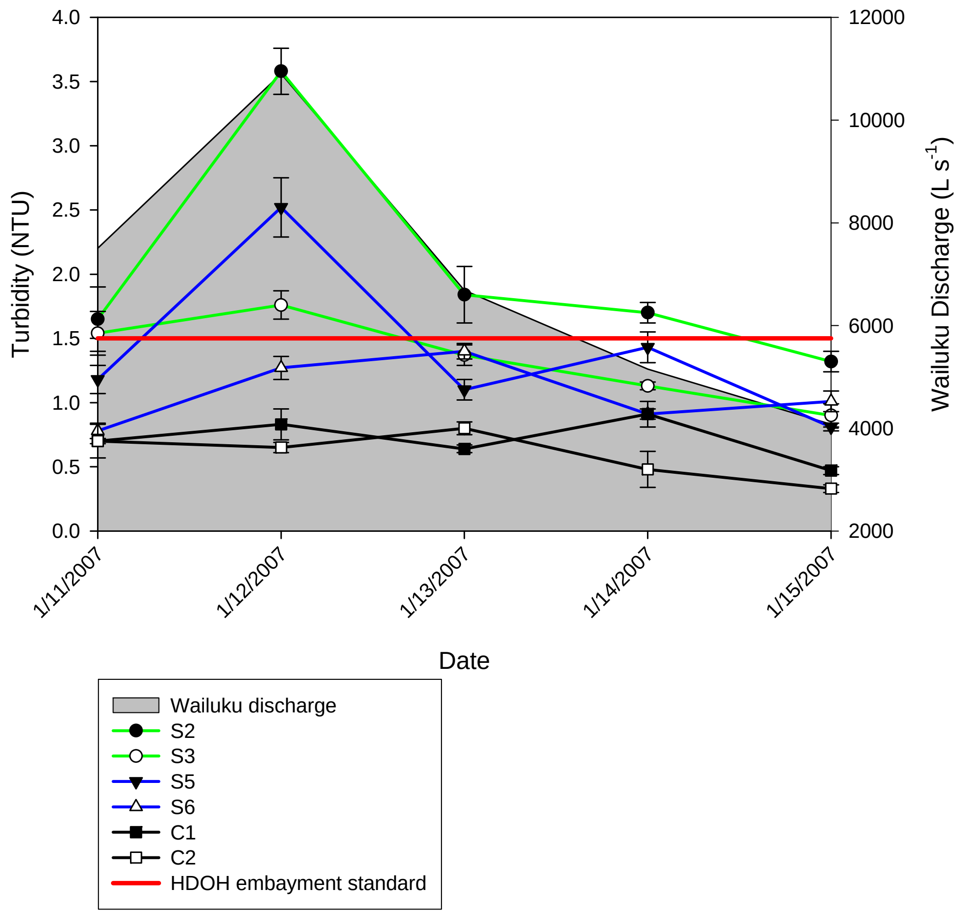

Figure 13. Average (±S.E.) turbidity levels in Hilo Bay, Hawaii, USA, following <u>Storm 1</u> (1/10/2007 to 1/15/2007).

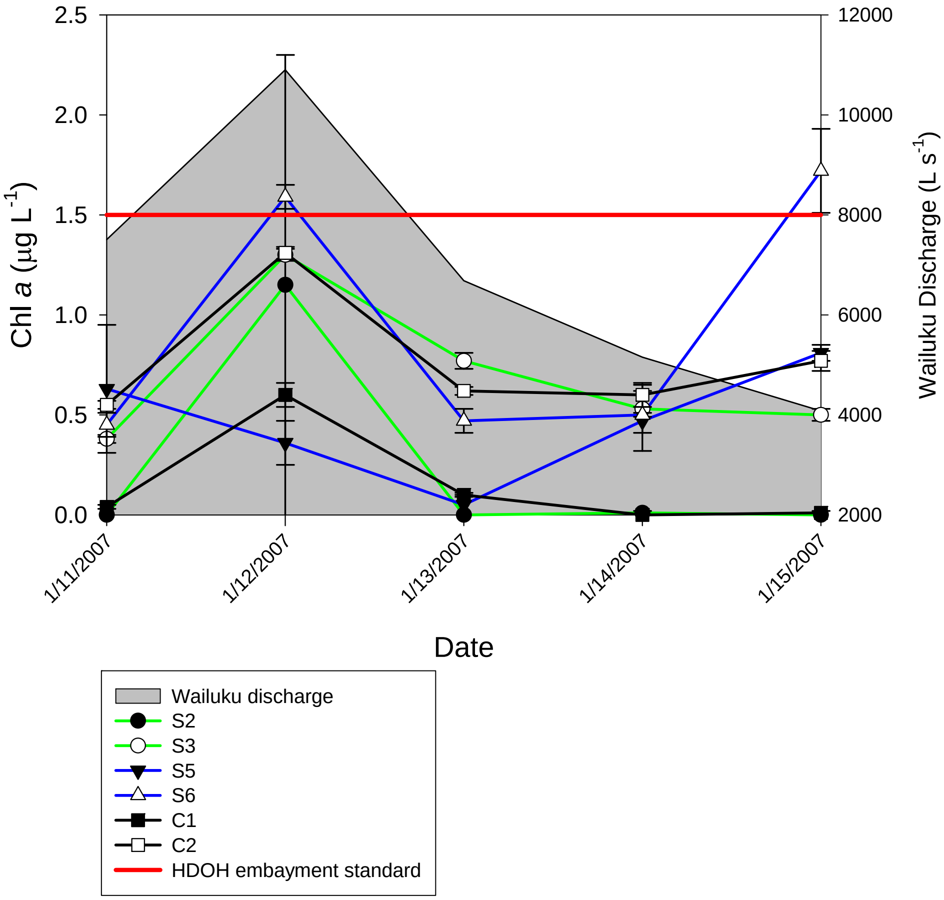

Figure 14. Average (±S.E.) Chl *a* concentrations in Hilo Bay, Hawaii, USA, following Storm 1 (1/10/2007 to 1/15/2007).

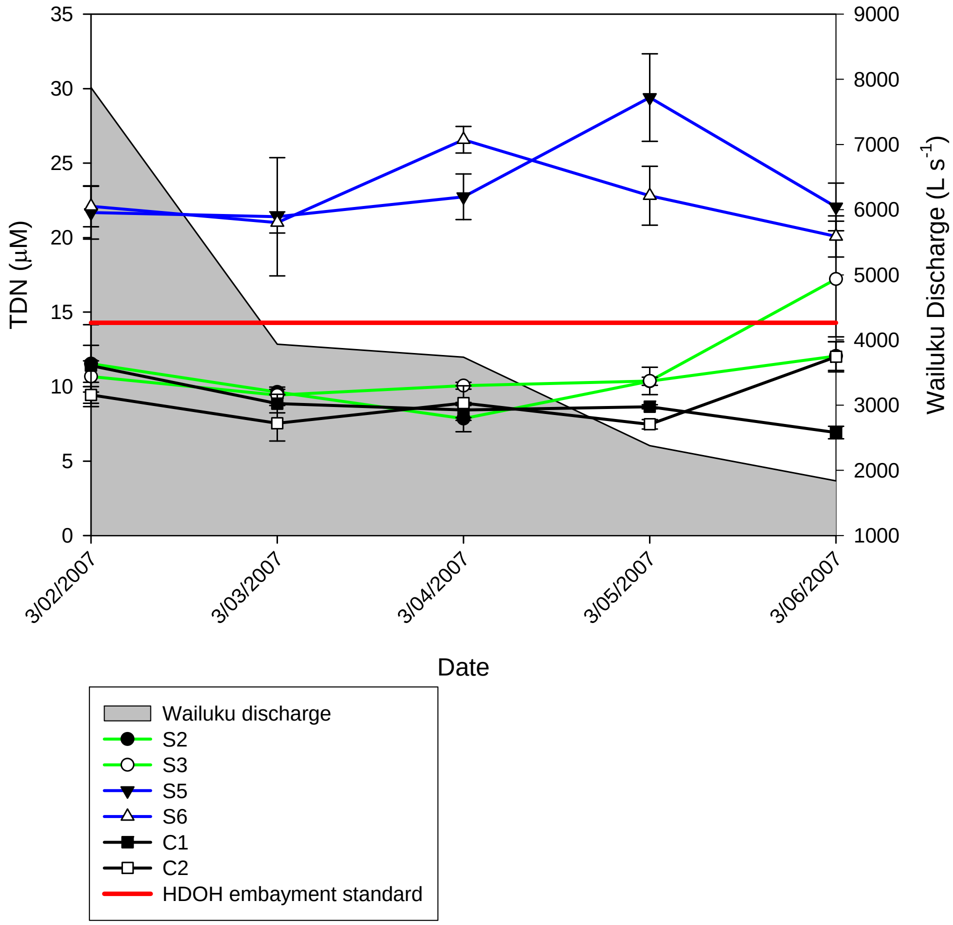

Figure 15. Average (±S.E.) TDN concentrations in Hilo Bay, Hawaii, USA, following Storm 2 (3/02/2007 to 3/06/2007).

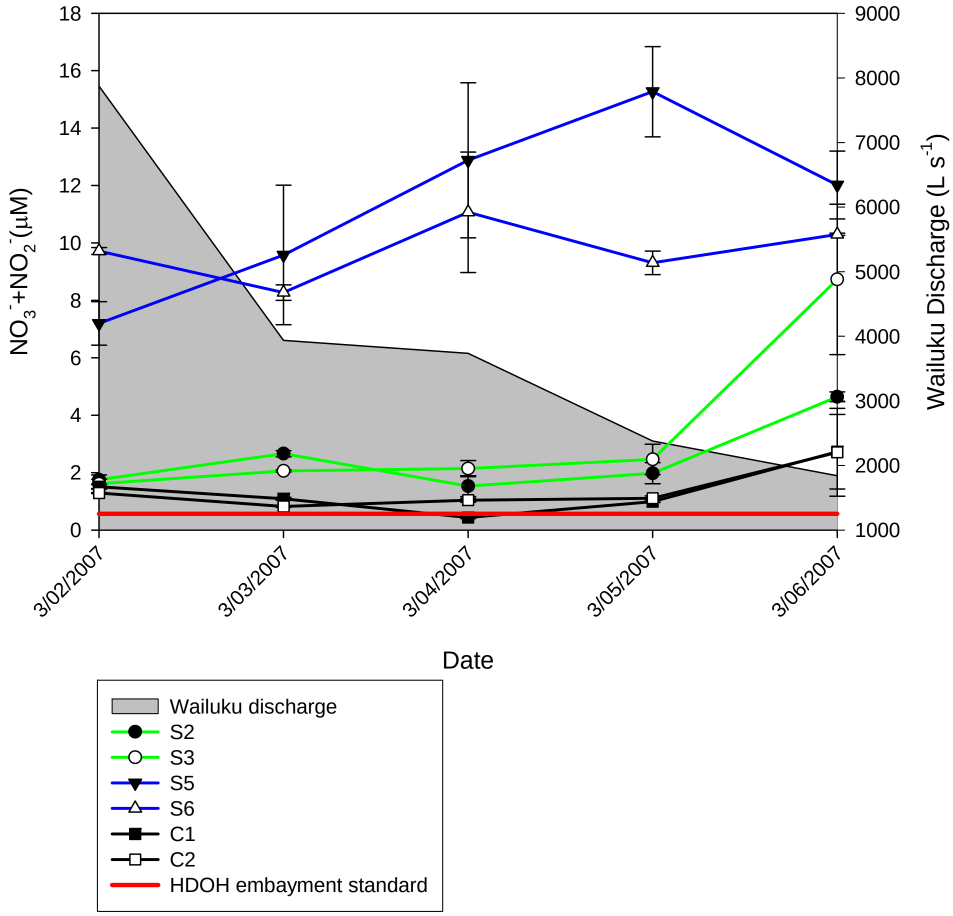

Figure 16. Average (±S.E.) NO_3^- + NO_2^- concentrations in Hilo Bay, Hawaii, USA, following Storm 2 (3/02/2007 to 3/06/2007).

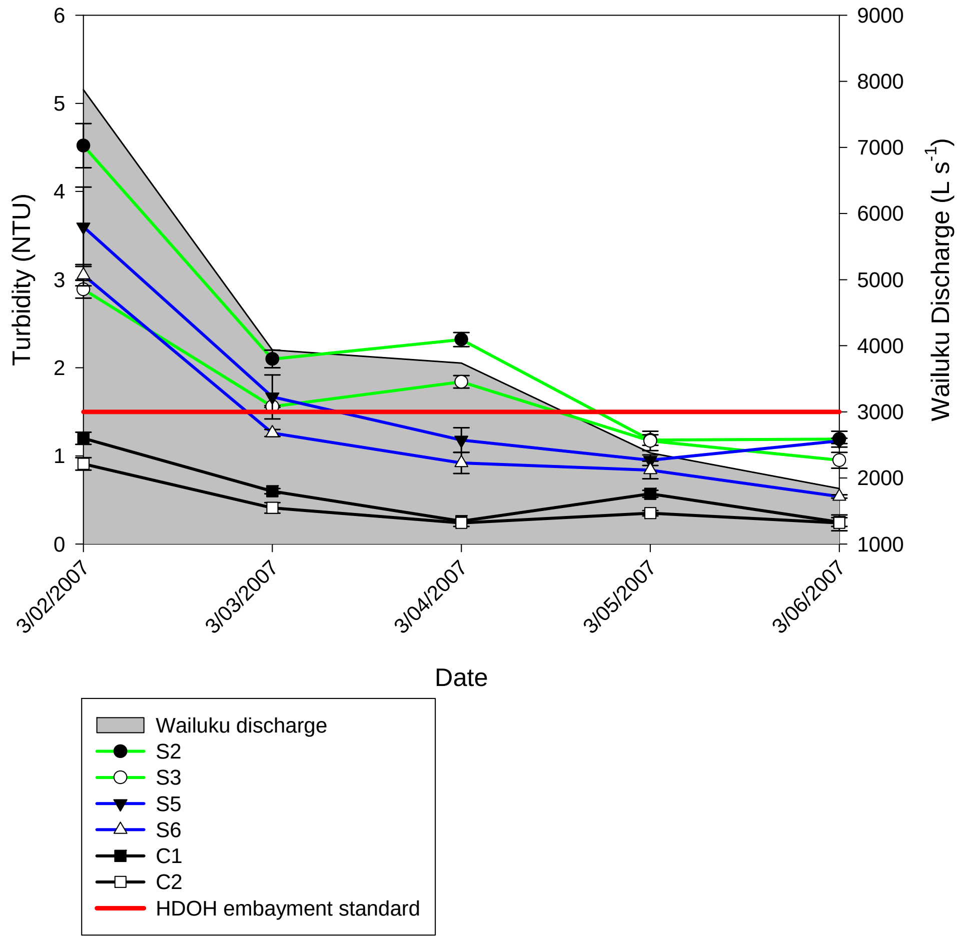

Figure 17. Average (±S.E.) turbidity levels in Hilo Bay, Hawaii, USA, following <u>Storm 2</u> (3/02/2007 to 3/06/2007).

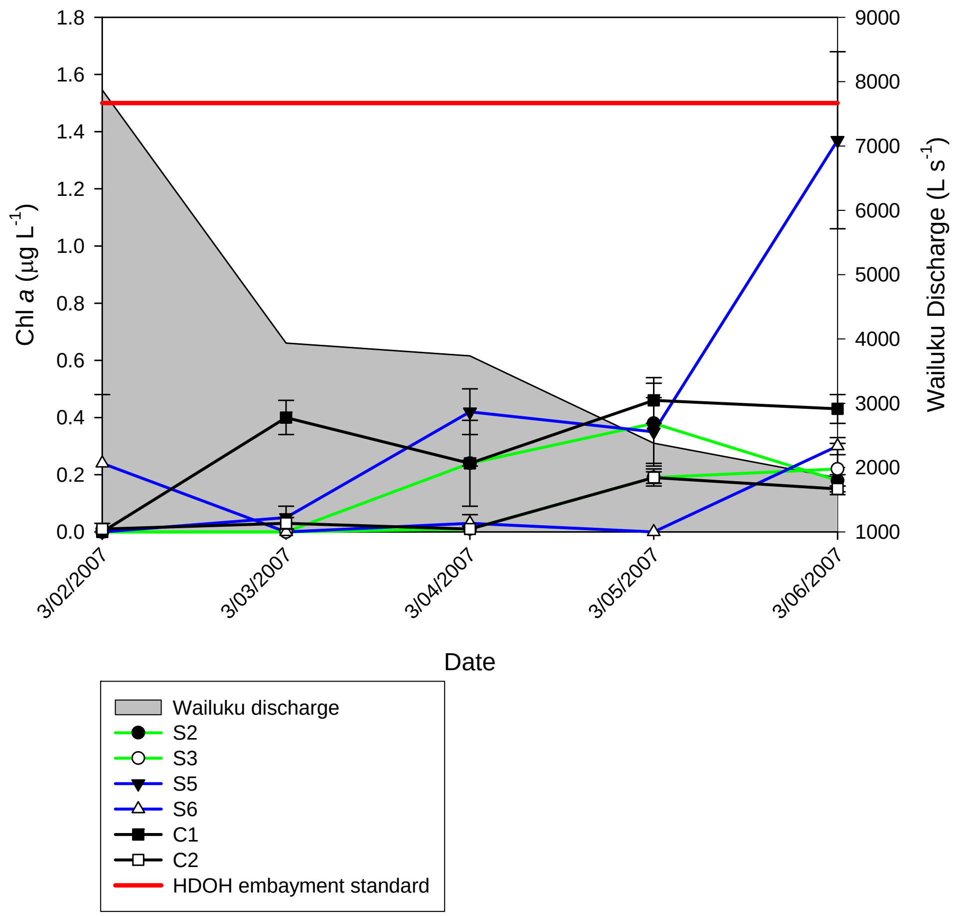

Figure 18. Average (±S.E.) Chl *a* concentrations in Hilo Bay, Hawaii, USA, following <u>Storm 2</u> (3/02/2007 to 3/06/2007).

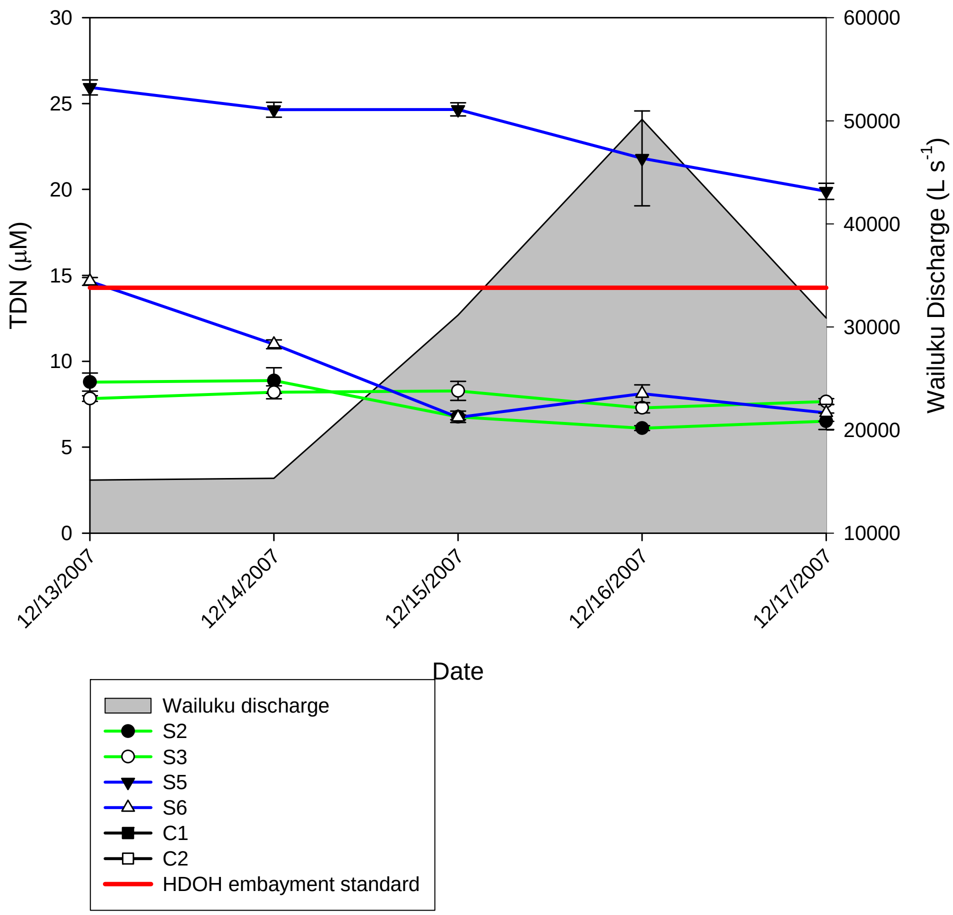

Figure 19. Average (±S.E.) TDN concentrations in Hilo Bay, Hawaii, USA, following Storm 3 (12/13/2008 to 12/17/2008).

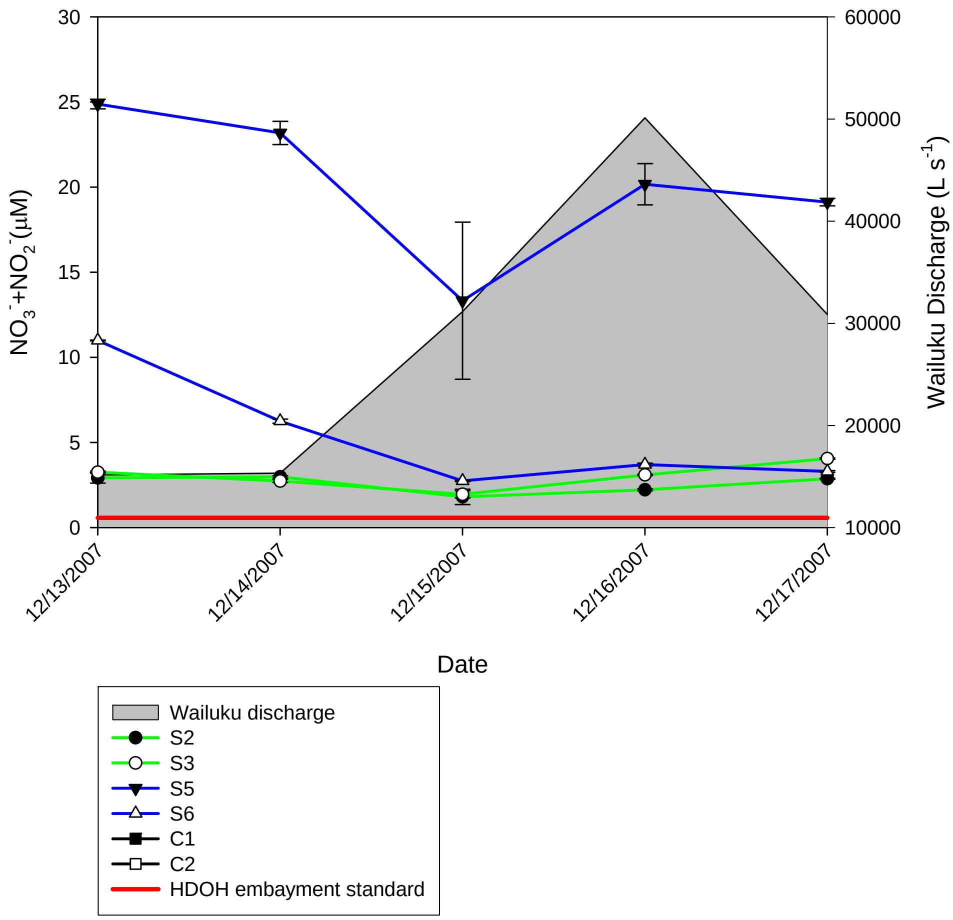

Figure 20. Average (±S.E.) NO_3^- + NO_2^- concentrations in Hilo Bay, Hawaii, USA, following Storm 3 (12/13/2008 to 12/17/2008).

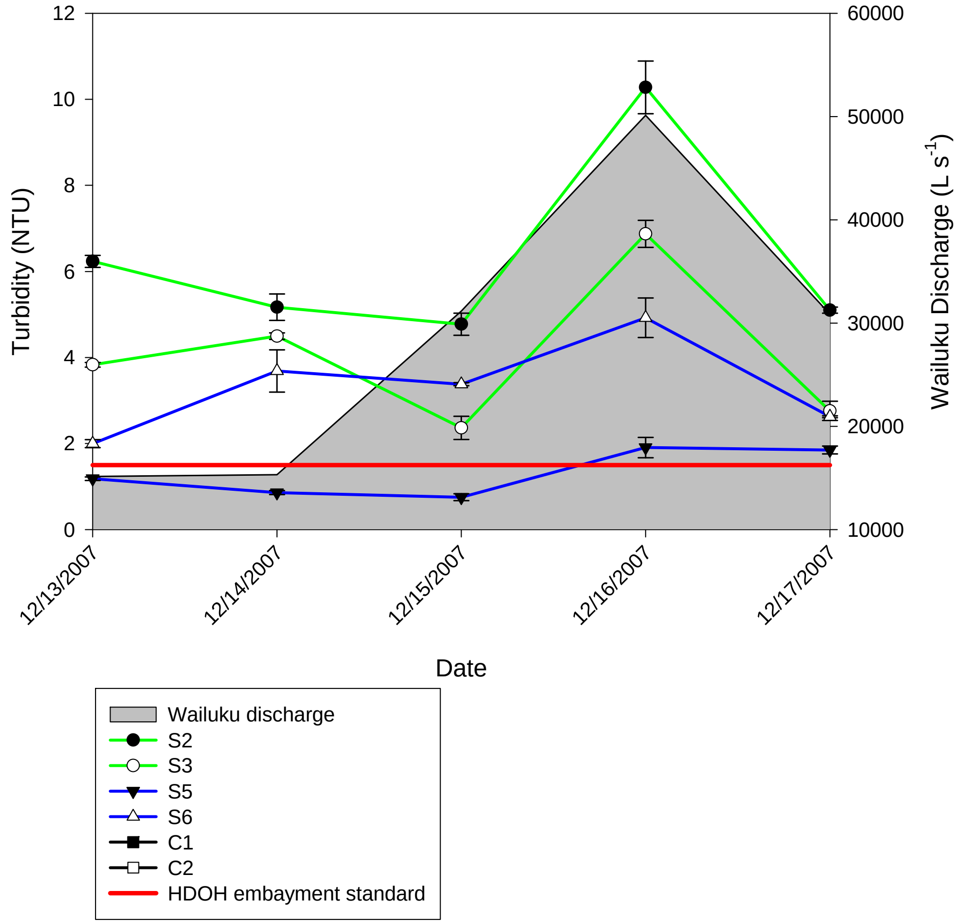

Figure 21. Average (±S.E.) turbidity levels in Hilo Bay, Hawaii, USA, following Storm 3 (12/13/2008 to 12/17/2008).

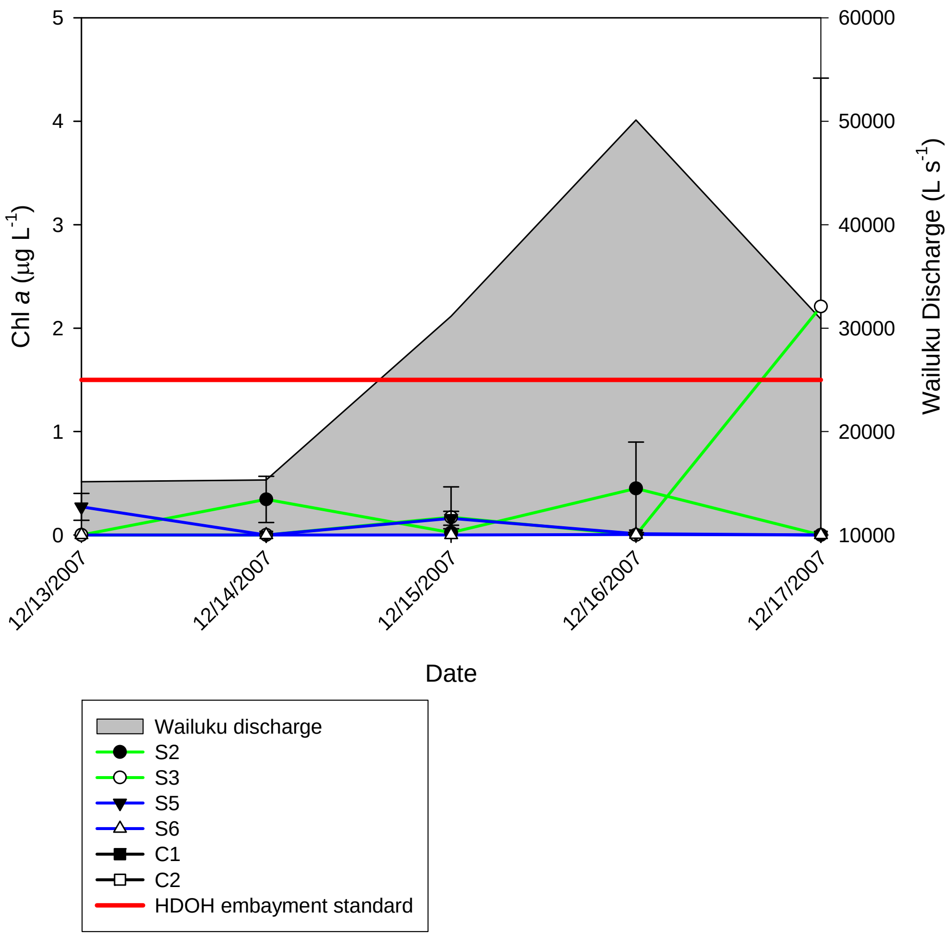

Figure 22. Average (±S.E.) Chl *a* concentrations in Hilo Bay, Hawaii, USA, following Storm 3 (12/13/2007 to 12/17/2007).

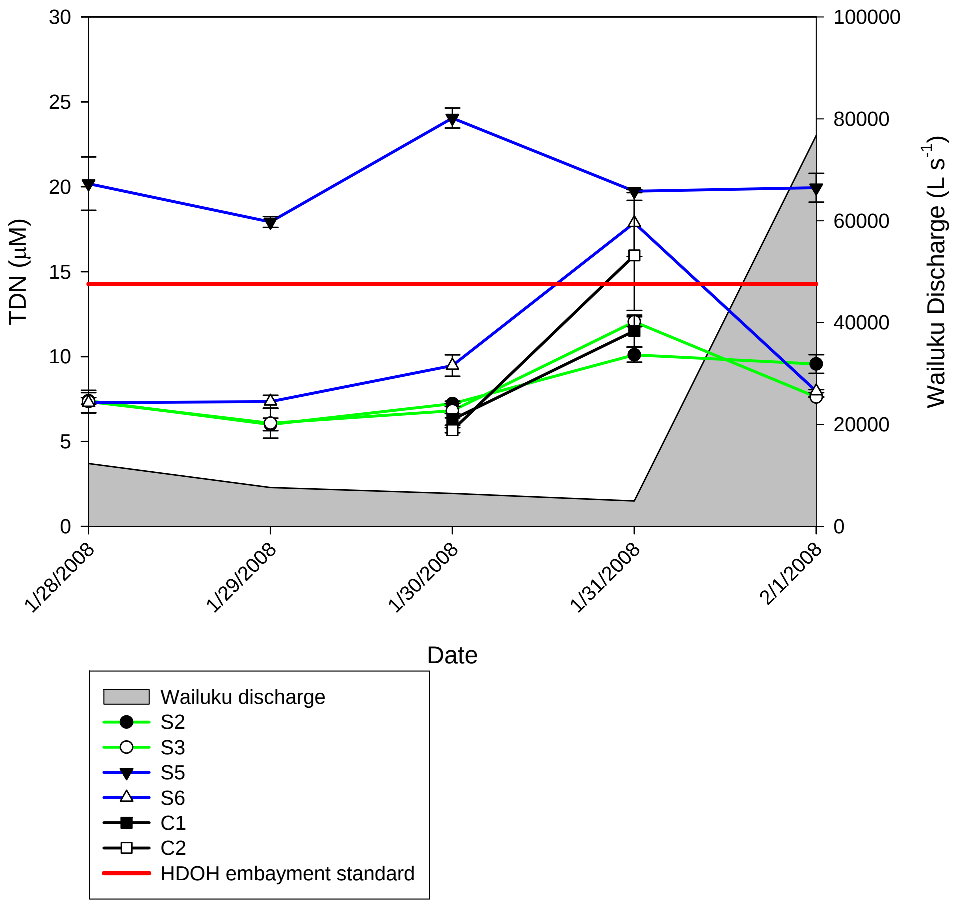

Figure 23. Average (±S.E.) TDN concentrations in Hilo Bay, Hawaii, USA, following Storm 4 (1/28/2008 to 2/01/2008).

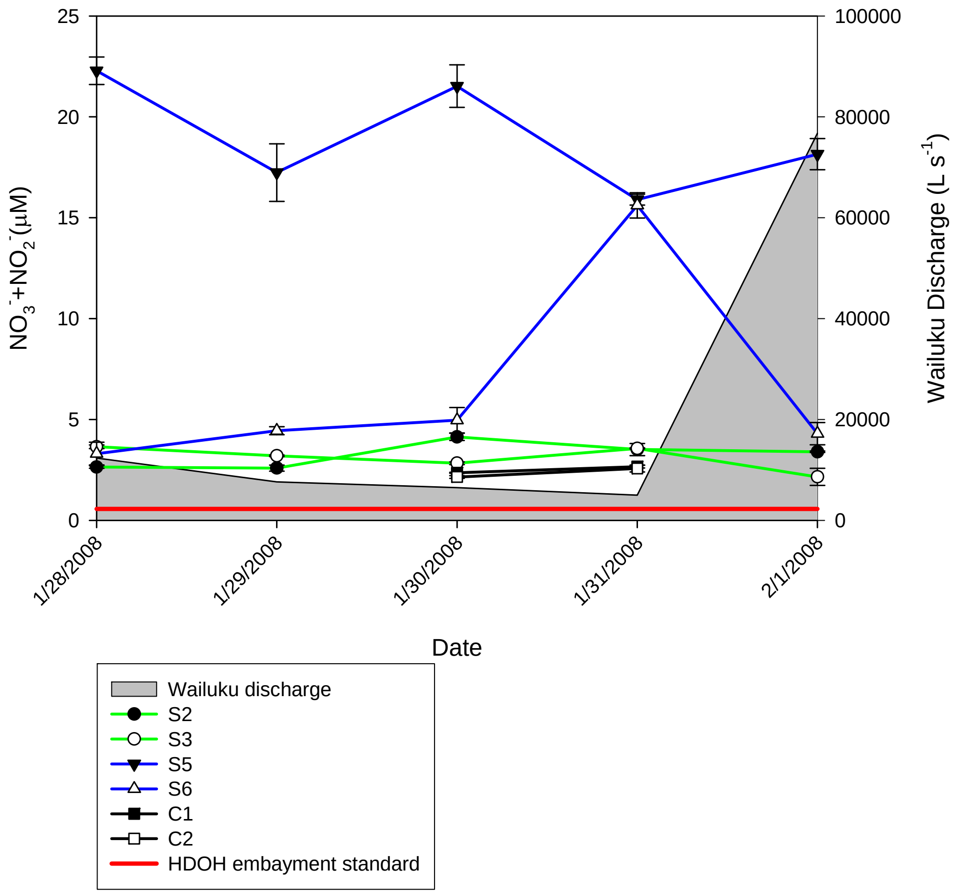

Figure 24. Average (±S.E.) NO_3^- + NO_2^- concentrations in Hilo Bay, Hawaii, USA, following Storm 4 (1/28/2008 to 2/01/2008).

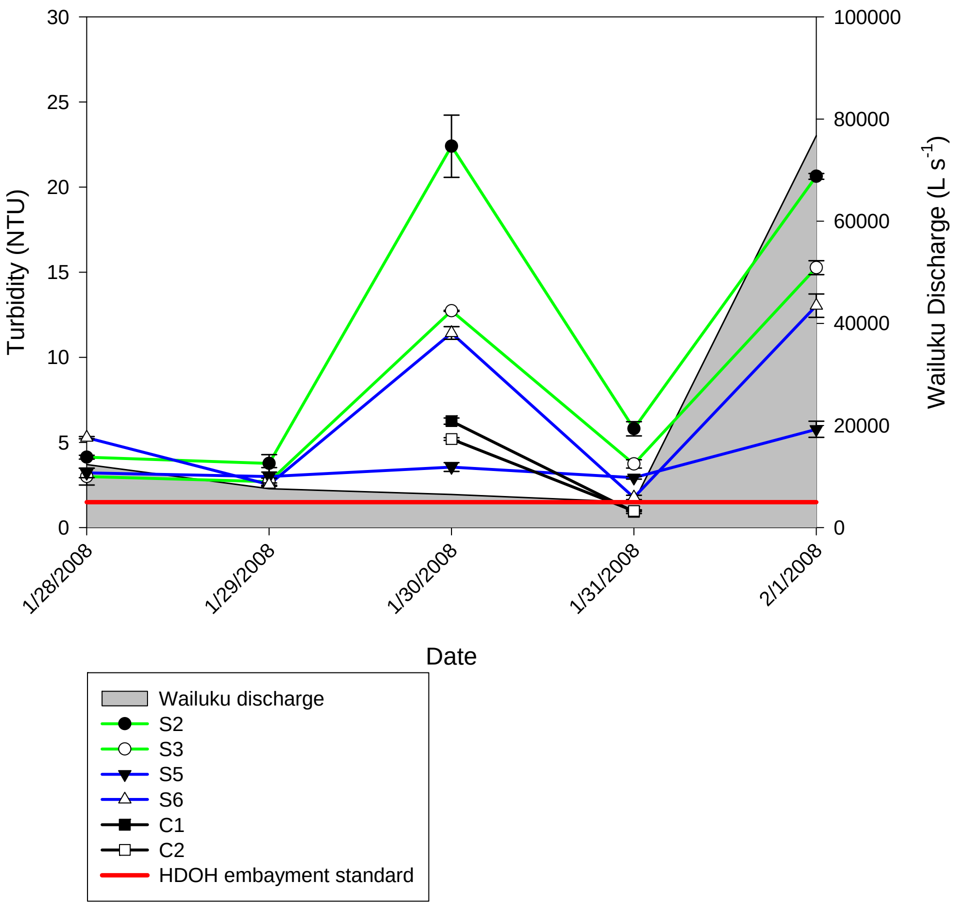

Figure 25. Average (±S.E.) turbidity levels in Hilo Bay, Hawaii, USA, following Storm 4 (1/28/2008 to 2/01/2008).

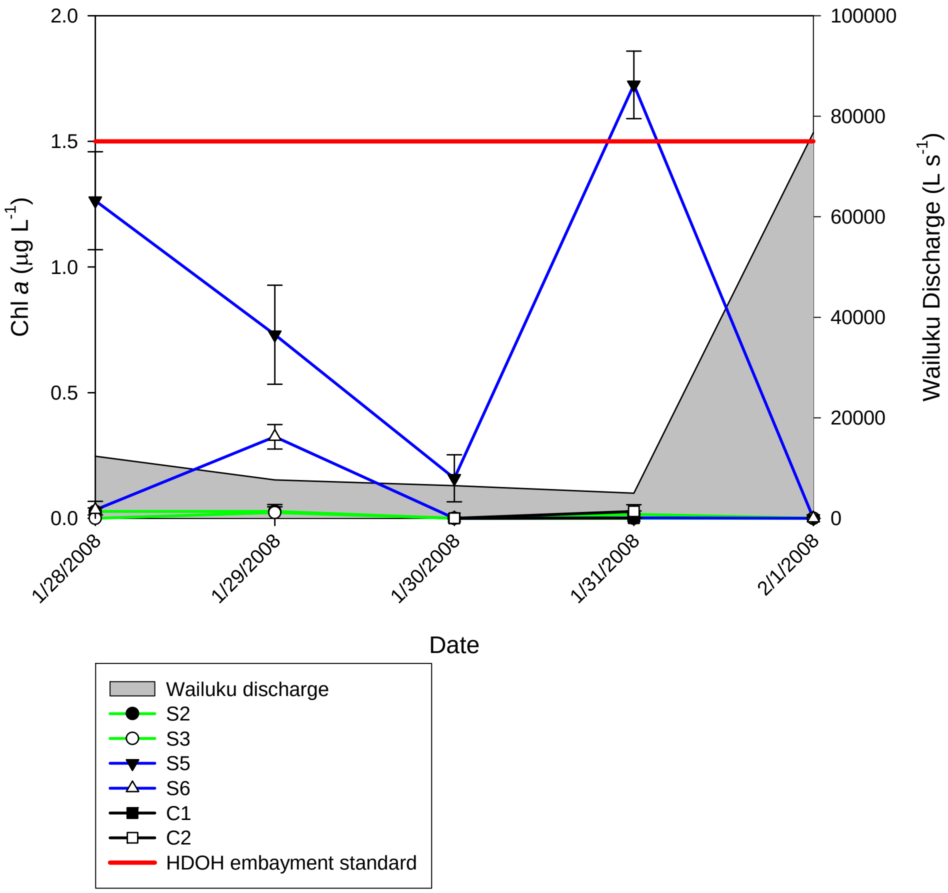

Figure 26. Average (±S.E.) Chl *a* concentrations in Hilo Bay, Hawaii, USA, following Storm 4 (1/28/2008 to 2/01/2008).

Appendix 1. Salinity profiles.

Table 11a. Salinity profiles for station S2 measured in ppt (‰) during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	26.5	28.4	27.6	26.3	32.3	28.6	24.0	31.4
0.5	28.7	33.9	28.8	29.6	32.8	31.5	24.7	34.5
1.0	31.2	34.6	32.8	32.0	33.0	34.0	31.5	35.0
1.5	31.6	34.6	33.0	33.6	33.7	34.3	33.7	35.1
2.0	32.1	34.5	32.8	34.0	34.7	34.4	34.5	35.1
3.0	33.2	34.8	35.1	34.7	34.9	34.5	34.7	35.2
4.0	33.9	35.1	35.1	35.0	34.9	34.6	34.7	35.2
5.0	34.2	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 11b. Salinity profiles for station S2 measured in ppt (‰) during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	25.5	25.2	20.7	26.7	27.0	15.9	24.7	28.7	28.0	23.0	23.9	21.1	18.3	10.2	14.9	-	24.2	23.1	26.7	18.1
0.5	29.7	27.3	29.1	30.5	31.3	22.1	30.9	31.1	33.3	25.9	26.2	23.3	19.7	13.7	14.9	-	25.7	24.7	28.3	21.3
1.0	32.3	29.8	29.9	31.6	33.1	29.1	31.2	33.2	33.4	33.5	29.7	29.0	29.6	22.8	25.1	-	26.2	25.1	29.0	25.1
1.5	33.0	31.4	31.3	32.4	33.1	29.8	33.0	34.3	34.3	34.4	29.9	29.4	30.0	26.9	30.3	-	29.8	26.9	30.6	25.2
2.0	33.1	32.4	33.0	33.2	33.4	30.8	33.8	34.6	34.6	34.5	30.6	30.7	30.1	29.4	28.0	-	30.3	29.1	33.3	28.1
3.0	34.8	34.2	33.8	33.8	33.7	33.7	34.4	34.7	34.6	34.6	32.9	32.4	30.4	30.2	30.8	-	45.4	31.5	34.8	28.7
4.0	35.0	34.4	33.9	34.1	33.8	34.6	34.6	34.7	34.7	34.7	35.1	33.0	32.7	30.7	32.1	-	31.3	34.7	35.0	33.8
5.0	35.1	34.6	33.9	34.5	33.8	34.7	34.6	-	-	34.7	35.2	34.3	34.1	34.6	33.5	-	32.3	34.7	-	34.6
6.0	35.1	34.6	34.0	-	-	34.7	-	-	-	-	-	34.3	-	35.1	-	-	32.9	-	-	34.9
7.0	-	34.8	34.0	-	-	34.7	-	-	-	-	-	34.6	-	-	-	-	33.1	-	-	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 12a. Salinity profiles for station S3 measured in ppt (‰) during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	31.8	32.8	27.9	31.8	26.9	33.1	27.7	28.7
0.5	31.7	32.9	30.9	32.4	30.6	33.2	28.6	34.5
1.0	31.8	33.3	33.2	33.8	32.8	34.1	31.6	34.7
1.5	32.5	34.2	33.5	34.5	34.3	34.3	33.7	35.0
2.0	32.8	34.9	34.4	34.4	34.8	34.3	34.1	35.1
3.0	33.6	34.9	34.8	34.7	34.9	34.5	34.7	35.1
4.0	33.8	35.1	35.0	34.8	35.0	34.6	34.8	35.2
5.0	33.9	35.2	35.2	35.0	35.1	34.7	34.9	35.3
6.0	34.0	35.2	35.2	35.1	35.1	34.8	34.9	35.3
7.0	-	35.2	35.2	35.1	35.2	34.8	35.0	35.3
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 12b. Salinity profiles for station S3 measured in ppt (‰) during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	25.6	20.4	25.0	28.2	30.1	22.9	24.6	25.3	31.6	31.7	22.9	23.3	22.1	16.3	19.4	26.0	26.1	20.8	28.0	18.0
0.5	27.8	22.6	25.7	31.7	31.1	28.8	28.2	33.1	32.8	37.9	23.5	22.9	29.2	16.7	22.0	26.3	26.2	23.1	31.2	20.9
1.0	32.7	29.0	29.7	32.4	32.4	29.4	32.3	33.6	33.6	33.7	29.7	28.6	29.5	23.1	28.3	29.1	27.2	26.9	31.0	24.7
1.5	33.7	29.2	31.3	32.9	32.9	29.4	32.6	33.8	34.1	34.5	30.0	29.7	29.5	26.0	27.8	29.4	28.5	29.2	32.8	27.0
2.0	33.9	29.8	32.1	33.1	33.5	32.0	33.5	34.4	34.3	34.6	30.3	30.6	29.6	27.4	29.6	29.4	30.5	29.9	33.5	26.7
3.0	34.8	34.6	33.6	33.6	33.6	34.2	34.5	34.5	34.5	34.5	34.9	32.1	31.4	31.2	32.8	30.4	30.6	34.2	34.0	29.8
4.0	34.9	34.8	33.9	33.9	33.7	34.5	34.6	34.6	34.7	34.7	35.1	33.4	31.8	33.4	35.9	32.6	32.3	34.6	34.6	32.2
5.0	35.1	-	34.2	34.2	33.8	34.7	34.6	34.7	34.7	34.7	35.4	34.6	34.3	34.6	35.5	34.1	33.6	34.6	34.8	34.7
6.0	35.1	-	34.2	34.4	33.8	34.7	34.7	34.7	34.8	34.8	35.4	34.8	34.6	35.3	36.4	34.3	34.1	34.7	34.9	34.8
7.0	35.2	-	34.2	34.6	33.9	34.8	34.7	34.7	34.8	34.8	35.5	34.7	34.7	35.8	36.8	34.5	34.3	34.7	35.0	34.9
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 13a. Salinity profiles for station S5 measured in ppt (‰) during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	28.6	26.8	27.8	23.0	24.9	22.1	16.3	27.5
0.5	31.6	33.7	26.4	30.1	28.2	29.5	24.3	31.5
1.0	31.7	34.1	33.7	32.1	34.2	33.0	31.9	34.0
1.5	31.7	34.7	34.3	34.3	34.4	34.1	33.5	34.6
2.0	31.8	34.9	34.5	34.7	34.8	34.5	34.2	35.0
3.0	33.7	35.0	35.1	35.1	34.8	34.8	34.6	35.2
4.0	34.4	35.1	-	35.1	-	-	-	-
5.0	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 13b. Salinity profiles for station S5 measured in ppt (‰) during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	17.3	19.0	18.8	19.3	26.2	22.8	23.4	20.4	27.5	22.8	16.0	19.7	16.3	10.4	15.5	17.3	21.3	18.0	24.9	13.4
0.5	28.5	21.9	22.2	27.3	27.8	24.4	28.5	30.1	32.1	31.6	21.6	21.7	21.2	12.9	17.7	21.5	24.6	23.0	25.4	16.2
1.0	30.7	27.6	28.0	28.2	30.6	29.7	29.8	33.6	32.5	34.0	28.0	25.9	22.3	13.7	24.2	21.5	26.5	24.4	28.0	26.0
1.5	32.7	28.8	32.6	32.4	32.4	31.8	32.6	33.8	34.5	34.1	29.7	27.9	28.5	16.4	29.0	27.7	29.1	25.8	29.2	28.1
2.0	34.4	32.1	33.0	33.4	32.8	32.8	33.1	34.5	34.6	34.5	32.3	30.9	32.0	26.2	29.6	27.8	29.8	31.1	32.4	31.8
3.0	35.0	34.4	33.6	34.5	33.2	34.4	34.2	34.6	34.6	34.6	34.6	32.8	33.3	28.6	31.4	28.3	32.8	32.2	33.9	32.8
4.0	35.1	34.7	33.7	34.4	33.5	34.7	34.7	34.7	34.7	34.6	34.9	33.7	34.2	31.4	33.4	-	33.5	33.1	-	33.5
5.0	-	-	-	-	-	-	-	-	-	-	-	34.7	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 14a. Salinity profiles for station S6 measured in ppt (‰) during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	24.1	26.7	26.4	25.9	27.8	29.6	24.6	26.3
0.5	31.0	30.9	27.4	29.3	30.7	30.8	28.6	30.6
1.0	31.0	31.4	31.0	33.5	33.4	31.1	34.8	34.0
1.5	31.6	34.7	34.4	34.3	33.9	31.8	33.6	34.8
2.0	32.5	35.1	34.7	34.8	34.0	34.5	34.0	35.0
3.0	34.4	35.1	35.1	35.1	34.0	34.8	34.5	35.2
4.0	34.4	35.2	35.1	35.1	34.7	34.8	34.6	35.4
5.0	34.5	35.2	35.1	35.2	34.8	34.9	34.8	35.4
6.0	34.5	35.2	35.1	35.2	34.9	34.9	34.8	35.4
7.0	-	35.2	35.2	35.2	35.0	34.9	34.9	35.4
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 14b. Salinity profiles for station S6 measured in ppt (‰) during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	22.6	23.6	28.0	25.0	24.7	21.2	23.1	25.7	26.2	26.2	19.3	19.8	18.6	15.0	17.8	24.8	24.1	17.4	23.6	12.8
0.5	26.5	23.7	28.1	27.7	26.9	22.1	26.9	31.3	27.2	26.9	21.9	20.5	19.7	15.3	18.1	25.2	24.5	23.0	25.1	16.1
1.0	30.2	24.0	28.9	30.2	30.2	27.9	31.7	31.4	33.1	31.5	25.7	21.7	23.3	15.7	24.2	27.5	24.4	23.9	26.5	20.3
1.5	32.7	32.3	32.0	32.3	31.8	29.9	33.5	34.2	34.1	31.9	30.7	28.9	30.7	16.8	28.3	28.6	24.8	26.1	29.3	23.4
2.0	34.7	33.3	32.6	33.9	33.1	33.8	33.8	34.4	34.4	34.6	31.6	30.7	31.3	22.6	29.3	29.3	28.4	31.4	32.0	26.1
3.0	35.0	33.9	33.7	34.3	33.6	34.5	34.6	34.4	34.7	34.7	34.2	32.9	33.1	24.5	31.9	31.1	32.0	33.4	34.3	33.2
4.0	35.1	34.2	33.8	34.5	33.8	34.7	34.7	34.6	34.7	34.7	35.2	34.3	33.3	25.0	33.6	32.6	32.9	33.9	34.9	34.2
5.0	35.1	34.5	33.9	34.5	33.9	34.7	34.8	34.7	34.7	34.7	35.5	34.6	33.8	28.4	34.9	33.7	33.0	34.6	34.9	34.8
6.0	35.2	34.6	34.0	34.5	34.0	34.7	34.8	34.7	34.8	34.7	35.5	34.6	34.4	29.3	36.2	34.1	33.7	34.7	35.0	32.9
7.0	35.2	34.8	34.1	34.5	34.0	34.7	34.9	34.8	34.8	34.7	35.5	34.7	34.5	30.3	37.0	34.2	34.1	34.7	35.0	34.9
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 15a. Salinity profiles for station C1 measured in ppt (‰) during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	33.7	34.9	33.9	33.5	33.9	33.4	34.4	34.9
0.5	33.6	34.9	34.0	33.5	34.1	33.5	34.4	34.9
1.0	34.2	34.9	34.2	34.5	34.8	34.2	34.8	35.0
1.5	33.7	35.0	34.5	34.8	34.8	34.4	34.9	35.0
2.0	34.3	35.0	34.6	34.9	34.9	34.7	35.0	35.0
3.0	34.4	35.0	35.0	35.1	35.0	34.9	35.1	35.1
4.0	34.4	35.2	35.1	35.1	35.1	34.9	35.0	35.2
5.0	34.4	35.2	35.1	35.2	35.1	34.9	35.1	35.2
6.0	34.4	35.2	35.2	35.2	35.1	34.9	35.1	35.2
7.0	-	35.2	35.2	35.3	35.2	34.9	35.1	35.3
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 15b. Salinity profiles for station C1 measured in ppt (‰) during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	33.4	-	32.5	29.6	32.2	32.6	33.6	34.9	34.5	34.1	-	-	-	-	-	-	-	-	33.4	-
0.5	33.9	-	33.2	31.3	32.4	32.6	34.1	34.8	34.5	34.1	-	-	-	-	-	-	-	-	33.7	-
1.0	34.7	-	33.4	34.4	32.5	33.8	34.6	34.8	34.5	34.2	-	-	-	-	-	-	-	-	33.9	-
1.5	35.0	-	33.4	34.3	33.0	33.9	34.6	34.8	34.5	34.4	-	-	-	-	-	-	-	-	33.9	-
2.0	35.1	-	33.8	34.3	33.3	34.2	34.7	34.8	34.7	34.5	-	-	-	-	-	-	-	-	34.1	-
3.0	35.1	-	34.3	34.4	33.9	34.5	34.8	34.7	34.8	34.6	-	-	-	-	-	-	-	-	34.1	-
4.0	35.1	-	34.3	34.5	34.0	34.7	34.9	34.8	34.9	34.7	-	-	-	-	-	-	-	-	34.5	-
5.0	35.1	-	34.3	34.5	34.1	34.7	34.9	34.8	34.9	34.7	-	-	-	-	-	-	-	-	34.6	-
6.0	35.2	-	34.3	34.5	34.3	34.8	34.9	34.8	34.8	34.8	-	-	-	-	-	-	-	-	34.8	-
7.0	35.2	-	34.3	34.5	32.3	34.8	34.9	34.8	34.8	34.8	-	-	-	-	-	-	-	-	34.9	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 16a. Salinity profiles for station C2 measured in ppt (‰) during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	34.3	35.1	34.0	33.9	33.7	34.6	34.5	35.3
0.5	34.3	35.1	33.8	34.2	34.2	34.5	34.7	35.2
1.0	34.4	35.1	34.2	34.7	34.6	34.5	34.8	35.1
1.5	34.4	35.1	34.4	34.8	34.6	34.6	34.8	35.1
2.0	34.4	35.1	34.6	34.9	35.0	34.7	34.9	35.2
3.0	34.4	35.1	35.0	34.9	35.0	34.7	35.0	35.3
4.0	34.4	35.1	35.0	34.9	35.0	34.8	35.0	35.3
5.0	34.4	35.1	35.1	35.0	35.1	34.9	35.0	35.4
6.0	34.4	35.2	35.2	35.1	35.2	34.9	35.0	35.4
7.0	-	35.2	35.2	35.1	35.2		35.0	35.3
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 16b. Salinity profiles for station C2 measured in ppt (‰) during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	34.4	-	32.8	31.1	32.7	32.2	34.4	34.9	34.6	34.6	-	-	-	-	-	-	-	-	33.1	-
0.5	34.0	-	32.9	33.4	32.9	33.9	34.4	34.8	34.6	34.8	-	-	-	-	-	-	-	-	33.1	-
1.0	34.8	-	33.2	34.0	33.2	33.9	34.5	34.8	34.6	34.8	-	-	-	-	-	-	-	-	33.2	-
1.5	34.9	-	33.2	34.3	33.5	34.3	34.7	34.7	34.6	34.8	-	-	-	-	-	-	-	-	33.5	-
2.0	35.0	-	33.6	34.3	33.7	34.3	34.8	34.8	34.5	34.8	-	-	-	-	-	-	-	-	34.0	-
3.0	35.2	-	33.8	34.3	34.0	34.3	34.8	34.8	34.8	34.8	-	-	-	-	-	-	-	-	34.4	-
4.0	35.1	-	33.8	34.3	34.4	34.5	34.9	34.8	34.8	34.8	-	-	-	-	-	-	-	-	34.8	-
5.0	35.2	-	33.8	34.4	34.4	34.7	34.9	34.8	34.9	34.8	-	-	-	-	-	-	-	-	34.9	-
6.0	35.2	-	33.8	34.4	34.5	34.7	34.9	34.8	34.8	34.8	-	-	-	-	-	-	-	-	34.9	-
7.0	35.2	-	33.9	34.4	34.5	34.7	34.9	34.8	34.9	34.8	-	-	-	-	-	-	-	-	34.9	-
8.0	-	-	-	-	-	-	-	-	-	34.8	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 2. Specific conductivity profiles.

Table 17a. Specific conductivity profiles for station S2 measured in mS cm^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	42.2	44.8	43.0	40.3	49.5	43.9	37.9	50.6
0.5	43.5	51.9	46.4	47.7	50.1	47.4	40.8	53.5
1.0	47.9	52.6	50.0	49.0	50.4	51.8	50.0	53.8
1.5	48.7	52.6	50.4	51.3	51.4	52.2	53.3	53.8
2.0	49.2	52.6	50.5	51.8	52.5	52.3	54.4	53.3
3.0	50.6	52.8	53.0	52.7	53.0	52.3	54.4	53.9
4.0	51.5	53.2	53.3	53.1	53.0	52.6	54.4	53.9
5.0	52.0	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 17b. Specific conductivity profiles for station S2 measured in mS cm^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	39.7	39.6	32.5	34.2	42.3	24.3	35.6	33.9	42.2	34.9	34.3	30.8	28.7	16.4	22.5	-	36.0	32.2	37.2	28.9
0.5	48.1	41.8	45.0	46.1	46.9	31.4	46.3	47.5	49.8	37.0	40.6	34.7	34.2	21.0	39.0	-	37.1	36.7	40.0	30.9
1.0	49.8	44.2	45.2	48.2	49.6	44.0	46.7	50.7	50.0	50.7	45.8	42.0	44.6	28.8	39.3	-	39.6	37.7	43.1	39.3
1.5	50.3	47.9	46.6	48.7	49.8	45.8	50.2	52.1	50.9	51.4	40.1	44.4	45.5	38.9	46.1	-	44.3	39.1	46.1	39.4
2.0	50.5	49.1	50.9	49.8	50.2	45.5	50.3	52.5	51.4	51.8	47.4	45.8	45.6	43.4	42.2	-	45.0	43.0	47.6	43.1
3.0	52.9	52.1	50.4	50.7	50.7	51.4	51.1	52.6	51.4	51.7	51.2	48.1	46.0	45.4	47.6	-	45.4	49.2	51.8	49.4
4.0	53.1	52.2	51.5	51.1	51.4	53.3	51.4	52.6	51.5	51.9	53.2	50.4	49.4	46.4	48.8	-	46.4	51.4	51.9	51.4
5.0	53.2	52.5	51.6	51.6	50.7	51.4	51.4	-	-	51.7	53.4	51.6	51.3	52.4	51.3	-	49.0	51.5	-	51.0
6.0	53.2	52.5	50.7	-	-	52.6	-	-	-	-	-	52.0	-	52.8	-	-	49.1	-	-	51.8
7.0	-	52.0	50.8	-	-	51.4	-	-	-	-	-	52.3	-	-	-	-	49.3	-	-	53.0
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 18a. Specific conductivity profiles for station S3 measured in mS cm^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	48.6	50.3	43.2	48.0	42.1	50.4	44.3	44.1
0.5	48.6	50.3	47.9	51.2	48.7	51.0	44.9	52.9
1.0	48.7	50.7	50.6	51.9	51.5	51.8	48.2	53.3
1.5	49.8	52.0	51.1	52.2	53.8	52.2	53.2	53.6
2.0	50.1	52.9	52.3	52.4	54.6	52.3	53.8	53.6
3.0	51.1	53.0	52.8	52.8	54.6	52.4	54.6	53.8
4.0	51.3	53.2	53.4	52.8	54.7	52.6	54.6	53.8
5.0	51.5	53.3	53.3	53.1	54.6	52.6	54.6	53.4
6.0	51.8	53.3	53.3	53.3	54.1	52.8	54.6	53.9
7.0	-	53.3	53.3	53.4	54.2	52.8	54.6	54.0
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 18b. Specific conductivity profiles for station S3 measured in mS cm^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	39.8	27.9	39.3	40.7	43.9	39.7	38.5	39.6	47.3	47.5	34.4	35.1	32.9	24.4	30.3	37.7	38.3	30.3	41.5	29.1
0.5	43.9	33.6	39.9	47.4	46.5	42.9	43.7	50.5	48.9	47.9	45.0	34.7	43.1	25.3	35.3	38.2	38.2	34.0	46.3	30.2
1.0	50.0	44.4	45.9	48.1	48.1	45.2	48.0	51.1	49.8	50.5	45.8	43.1	44.4	34.5	38.1	43.2	38.9	39.3	46.4	36.5
1.5	51.4	44.9	47.8	48.4	49.0	43.8	48.2	51.5	50.8	51.5	46.1	44.7	44.5	37.7	42.5	43.3	43.6	44.9	48.6	42.0
2.0	51.5	45.9	49.4	49.4	50.3	46.7	49.7	52.2	50.9	51.7	46.6	46.2	44.7	43.3	48.4	43.3	45.1	43.7	49.4	41.6
3.0	52.8	51.7	51.1	50.5	50.4	50.2	51.2	52.4	51.3	51.7	52.7	48.1	47.0	46.9	50.6	44.9	45.3	48.5	50.4	46.5
4.0	53.0	52.9	51.5	50.8	50.6	51.3	51.3	52.5	51.5	51.8	53.2	51.9	48.4	49.6	52.8	49.9	48.7	51.3	51.2	49.8
5.0	53.2	-	51.9	51.3	50.6	51.4	51.4	52.6	51.5	51.7	53.5	52.5	51.6	51.6	53.5	51.0	50.3	51.4	51.7	52.9
6.0	53.2	-	52.0	51.6	50.7	51.4	52.6	52.6	51.5	51.7	53.6	52.7	52.3	52.2	55.1	51.2	50.7	51.3	51.8	52.8
7.0	53.3	-	51.1	51.9	50.8	51.4	52.6	52.6	51.6	51.7	53.6	52.4	52.3	53.9	55.5	51.2	51.1	51.5	51.9	53.0
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 19a. Specific conductivity profiles for station S5 measured in mS cm^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	42.0	38.9	42.2	37.1	39.3	34.8	24.9	42.7
0.5	47.9	50.5	50.2	47.4	52.0	45.8	38.5	49.4
1.0	48.6	52.2	51.5	49.1	52.1	50.4	50.0	52.9
1.5	48.6	52.8	51.9	54.2	52.3	52.0	53.9	53.4
2.0	48.7	52.8	52.4	52.7	52.8	52.4	54.1	53.8
3.0	51.2	52.9	53.2	53.3	52.9	52.8	54.7	54.1
4.0	52.5	53.1	-	53.3	-	-	-	-
5.0	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 19b. Specific conductivity profiles for station S5 measured in mS cm^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	31.8	30.0	30.3	29.4	39.5	32.0	36.8	33.5	39.2	35.5	25.9	29.9	24.5	17.0	26.6	24.3	33.7	27.8	35.5	22.7
0.5	44.2	35.3	35.1	37.2	42.2	37.3	44.1	46.1	47.3	51.2	29.3	33.6	31.9	19.2	28.3	31.6	35.9	34.1	37.4	26.7
1.0	47.7	42.1	45.8	43.6	46.7	43.2	44.7	51.1	48.6	51.4	44.3	39.1	34.6	20.7	37.8	31.4	39.1	36.5	41.5	39.2
1.5	50.4	44.2	48.8	48.3	48.7	46.8	49.4	51.5	51.5	51.4	46.1	43.5	43.3	36.8	44.4	40.4	43.4	39.8	43.6	43.6
2.0	52.2	50.2	50.4	50.2	49.5	48.7	50.8	52.4	51.6	51.9	49.3	47.0	48.3	39.4	46.0	40.8	44.1	45.3	48.2	45.8
3.0	53.0	52.3	51.1	51.6	50.0	52.2	50.8	52.6	51.6	52.0	52.2	49.7	50.4	43.0	48.0	41.8	47.0	47.8	50.6	50.0
4.0	53.2	52.6	51.3	51.6	50.4	51.5	51.5	52.6	51.6	51.8	52.0	51.2	51.8	48.2	50.8	-	50.5	49.3	-	51.3
5.0	-	-	-	-	-	-	-	-	-	-	-	52.6	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 20a. Specific conductivity profiles for station S6 measured in mS cm^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	38.9	41.5	41.3	40.8	43.4	45.7	39.1	41.0
0.5	47.5	45.8	43.7	44.7	48.2	47.3	45.2	44.6
1.0	47.1	48.1	47.7	49.8	50.9	47.7	51.8	52.5
1.5	48.1	51.9	52.2	52.0	51.7	48.6	53.2	53.8
2.0	48.9	53.2	52.6	52.9	51.8	52.5	53.5	53.9
3.0	52.3	53.1	53.1	53.1	52.4	52.8	54.4	54.1
4.0	52.3	53.2	53.3	53.2	52.7	52.9	54.6	54.3
5.0	52.3	53.3	53.3	53.4	53.0	52.9	54.7	54.3
6.0	52.5	53.3	53.3	53.4	52.9	52.9	54.8	54.3
7.0	-	53.3	53.4	53.4	53.1	52.9	54.7	54.3
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 20b. Specific conductivity profiles for station S6 measured in mS cm^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	38.8	37.2	33.2	37.4	37.4	32.2	34.6	40.1	38.5	39.5	31.6	30.1	28.1	22.8	28.9	36.2	35.4	25.5	35.0	21.3
0.5	41.0	37.4	43.6	41.3	40.3	33.6	38.1	47.9	40.1	40.0	35.1	30.7	29.9	25.2	29.3	37.0	35.7	33.8	36.9	26.3
1.0	46.6	38.5	42.4	46.6	44.8	42.6	47.3	48.1	49.2	46.9	41.1	35.1	35.5	23.9	37.7	40.4	35.9	35.3	39.3	32.6
1.5	50.5	49.3	48.8	49.4	48.2	45.6	49.8	52.0	50.9	47.9	46.8	45.2	45.6	25.5	43.3	42.5	39.9	37.8	33.4	36.3
2.0	52.6	50.8	49.7	51.6	49.8	50.9	50.3	52.3	52.3	51.8	48.2	46.6	47.9	32.4	45.3	43.1	42.2	44.8	47.5	40.7
3.0	53.0	51.6	51.3	51.4	50.5	52.4	51.2	52.3	51.6	51.7	51.4	49.9	50.1	36.9	48.9	44.9	47.9	49.6	51.0	49.3
4.0	53.2	52.0	51.4	51.7	50.7	51.3	52.6	52.5	51.5	51.6	53.4	52.2	50.3	44.0	51.0	48.9	48.8	50.5	51.8	52.0
5.0	53.3	52.4	51.6	51.8	51.0	51.4	52.7	52.6	51.5	51.5	53.7	52.7	51.0	41.7	52.4	50.1	49.1	51.4	51.8	52.8
6.0	53.3	52.6	50.8	51.8	51.0	51.4	51.5	52.7	52.7	51.5	53.8	52.5	52.2	43.9	54.5	50.8	50.1	51.6	51.8	52.9
7.0	53.3	52.0	51.0	51.8	51.1	52.7	51.6	52.7	51.5	51.6	53.8	52.6	52.4	45.5	55.5	50.9	50.7	51.7	51.9	53.0
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 21a. Specific conductivity profiles for station C1 measured in mS cm^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	51.3	53.0	51.7	51.1	52.7	51.2	53.9	53.4
0.5	51.0	52.9	51.7	51.4	53.4	51.0	53.9	53.5
1.0	51.6	53.0	52.0	52.1	54.3	52.0	54.2	53.5
1.5	51.6	53.0	52.3	53.1	54.4	52.4	54.7	53.5
2.0	52.1	53.1	52.6	53.1	54.5	52.7	54.7	53.6
3.0	52.2	53.0	53.0	53.3	54.6	53.0	53.2	53.8
4.0	52.2	53.3	53.2	53.3	54.5	53.0	54.7	53.8
5.0	52.2	53.3	53.2	53.4	54.4	53.0	54.7	53.9
6.0	52.2	53.3	53.3	53.4	54.3	52.9	54.7	53.9
7.0	-	53.3	53.3	53.5	54.4	52.9	54.7	54.0
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 21b. Specific conductivity profiles for station C1 measured in mS cm^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	51.0	-	49.7	43.7	48.2	49.6	51.2	52.9	51.0	50.7	-	-	-	-	-	-	-	-	49.2	-
0.5	51.5	-	50.0	47.7	48.3	50.0	51.7	52.7	51.1	50.7	-	-	-	-	-	-	-	-	49.7	-
1.0	52.6	-	50.9	51.5	48.6	50.1	52.3	52.8	51.0	50.7	-	-	-	-	-	-	-	-	49.9	-
1.5	52.9	-	51.0	51.5	49.1	50.3	52.5	52.7	51.1	51.2	-	-	-	-	-	-	-	-	50.0	-
2.0	53.1	-	51.4	51.5	49.8	51.9	51.4	52.7	51.4	51.1	-	-	-	-	-	-	-	-	50.4	-
3.0	53.2	-	52.1	51.7	50.8	52.3	52.8	52.7	51.6	51.1	-	-	-	-	-	-	-	-	50.5	-
4.0	53.1	-	52.1	51.8	51.0	52.6	52.9	52.7	51.7	51.3	-	-	-	-	-	-	-	-	51.1	-
5.0	53.2	-	52.1	52.3	51.4	52.7	51.7	52.7	51.6	51.4	-	-	-	-	-	-	-	-	51.5	-
6.0	53.3	-	51.2	51.8	51.4	52.7	52.9	52.7	51.6	51.4	-	-	-	-	-	-	-	-	51.5	-
7.0	53.3	-	51.2	51.8	51.5	52.7	51.7	52.8	51.6	51.4	-	-	-	-	-	-	-	-	51.7	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 22a. Specific conductivity profiles for station C2 measured in mS cm^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	52.2	53.2	51.7	51.6	52.0	52.7	52.6	53.6
0.5	52.2	53.1	51.6	52.2	52.5	52.3	53.9	53.6
1.0	52.2	53.2	52.1	52.8	53.8	52.9	54.5	53.6
1.5	52.2	53.2	52.2	52.8	54.1	53.1	54.6	53.6
2.0	52.2	53.2	52.4	52.9	54.6	53.2	54.6	53.9
3.0	52.2	53.2	52.4	53.0	54.5	53.5	54.7	54.0
4.0	52.2	53.2	53.4	53.0	54.4	53.7	54.7	54.0
5.0	52.2	53.3	53.2	53.1	54.4	53.9	54.7	54.0
6.0	52.3	53.2	53.3	53.2	54.3	53.9	54.7	54.0
7.0	-	53.3	53.3	50.3	54.2	-	54.7	54.0
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 22b. Specific conductivity profiles for station C2 measured in mS cm^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	52.3	-	50.0	46.9	49.9	48.0	52.2	53.0	51.0	51.3	-	-	-	-	-	-	-	-	48.5	-
0.5	52.3	-	50.3	50.4	50.1	50.1	52.1	51.4	51.0	51.3	-	-	-	-	-	-	-	-	48.7	-
1.0	52.7	-	50.5	51.0	49.6	50.2	52.3	51.4	51.0	51.3	-	-	-	-	-	-	-	-	49.0	-
1.5	52.9	-	50.7	52.1	50.1	50.8	51.3	51.4	51.1	51.4	-	-	-	-	-	-	-	-	49.0	-
2.0	53.1	-	51.1	52.2	50.5	52.1	52.7	51.4	51.0	51.4	-	-	-	-	-	-	-	-	49.7	-
3.0	56.2	-	51.4	51.4	51.0	52.1	52.8	51.5	51.6	51.4	-	-	-	-	-	-	-	-	51.0	-
4.0	53.3	-	51.4	51.4	51.5	52.3	52.9	51.5	51.6	51.4	-	-	-	-	-	-	-	-	51.5	-
5.0	53.3	-	51.5	51.5	51.7	51.4	52.8	51.5	51.6	51.4	-	-	-	-	-	-	-	-	51.6	-
6.0	53.3	-	50.5	51.5	51.8	51.4	51.6	51.5	51.6	51.4	-	-	-	-	-	-	-	-	51.6	-
7.0	53.3	-	51.5	52.2	51.8	52.6	51.6	51.6	51.6	51.4	-	-	-	-	-	-	-	-	51.7	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 3. Temperature profiles.

Table 23a. Temperature profiles for station S2 measured in °C during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	23.5	24.6	24.7	26.1	26.5	25.8	25.4	25.9
0.5	24.4	25.3	25.5	26.2	26.8	25.9	25.2	25.7
1.0	24.3	25.2	25.9	26.2	26.8	26.2	26.5	25.8
1.5	24.4	25.0	25.7	26.6	26.8	26.1	26.9	25.7
2.0	24.5	24.7	25.6	26.7	26.8	26.1	27.0	25.7
3.0	24.6	24.7	25.6	26.4	26.6	26.1	26.6	25.6
4.0	24.6	24.7	25.4	26.4	26.6	26.2	26.6	25.6
5.0	24.6	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 23b. Temperature profiles for station S2 measured in °C during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	24.4	23.4	22.3	23.1	23.6	21.4	22.7	23.0	23.5	23.2	22.3	22.6	21.3	20.6	20.8	-	21.5	21.0	21.9	20.7
0.5	23.6	23.2	23.2	23.6	23.9	21.2	23.5	23.4	24.0	23.0	23.3	22.7	21.8	20.6	21.0	-	21.8	21.7	22.4	21.7
1.0	24.0	23.5	23.4	23.8	24.2	22.9	23.7	23.8	24.0	23.8	23.8	23.7	23.8	21.1	22.7	-	22.2	21.6	22.7	21.9
1.5	24.1	23.7	23.4	24.0	24.3	23.2	23.8	23.8	24.0	24.3	23.9	23.9	24.1	22.8	23.5	-	22.8	22.1	22.9	22.3
2.0	24.1	24.1	23.6	24.1	24.3	23.3	23.9	23.9	24.0	24.4	24.0	24.1	24.2	23.4	23.1	-	23.1	22.4	23.4	22.6
3.0	24.2	24.1	23.9	24.1	24.4	23.5	24.0	23.8	23.9	24.3	24.4	24.4	24.2	23.6	23.5	-	23.3	23.2	23.8	22.8
4.0	24.2	24.1	24.0	24.2	24.3	23.8	23.9	23.8	23.9	24.2	24.7	24.6	24.4	23.8	23.7	-	23.4	23.8	23.8	23.5
5.0	24.2	24.2	24.0	24.3	24.3	23.7	23.9	-	-	24.2	24.8	24.9	24.6	24.3	24.2	-	23.6	23.9	-	23.9
6.0	24.2	24.1	24.0	-	-	23.7	-	-	-	-	-	24.9	-	24.6	-	-	23.8	-	-	23.9
7.0	-	24.2	24.0	-	-	23.7	-	-	-	-	-	24.8	-	-	-	-	23.8	-	-	23.9
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 24a. Temperature profiles for station S3 measured in °C during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	23.4	24.4	25.0	25.3	25.3	25.7	25.1	24.9
0.5	24.3	24.4	25.3	25.8	26.2	25.8	25.5	25.4
1.0	24.3	24.5	25.6	26.3	26.4	25.9	26.4	25.6
1.5	24.4	24.6	25.8	26.4	26.6	25.9	26.9	25.6
2.0	24.5	24.5	25.7	26.4	26.7	26.0	26.9	25.5
3.0	24.6	24.5	25.4	26.4	26.6	26.0	26.8	25.5
4.0	24.6	24.5	25.3	26.4	26.5	26.0	26.7	25.5
5.0	24.5	24.5	25.3	26.2	26.5	26.0	26.6	25.4
6.0	24.6	24.5	25.3	26.0	26.1	26.0	26.5	25.4
7.0	-	24.5	25.3	25.9	26.0	26.0	26.5	25.4
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 24b. Temperature profiles for station S3 measured in °C during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	23.5	22.3	23.0	23.2	23.5	22.7	22.7	22.9	23.5	23.7	22.4	22.4	22.4	21.2	21.5	21.2	21.6	20.6	22.8	19.7
0.5	23.5	22.6	22.6	23.7	23.7	22.9	22.9	23.9	23.5	23.9	22.8	22.6	23.7	21.4	21.9	21.6	21.8	21.1	23.1	21.1
1.0	23.6	23.7	22.8	23.7	23.9	23.0	23.5	23.8	23.8	24.0	23.7	23.3	23.7	22.0	22.6	22.4	22.1	21.8	23.2	21.9
1.5	24.0	23.8	23.2	23.8	24.1	23.1	23.5	23.8	23.9	24.2	23.9	23.7	23.8	22.6	22.8	22.6	22.7	22.3	23.4	22.0
2.0	24.1	24.0	23.6	24.0	24.3	23.3	23.6	23.8	23.9	24.2	29.9	24.0	23.8	23.1	23.1	22.6	22.9	22.7	23.6	22.3
3.0	24.2	24.0	23.9	24.2	24.3	23.7	23.8	23.8	23.9	24.2	20.0	24.1	24.0	23.8	23.8	22.8	23.1	23.1	23.8	22.9
4.0	24.2	24.2	24.0	24.2	24.3	23.8	23.8	23.8	23.9	24.2	24.7	24.7	24.2	24.2	24.3	23.3	23.6	23.8	23.8	23.3
5.0	24.2	-	24.0	24.3	24.3	23.7	23.8	23.8	23.8	24.2	24.6	24.9	24.5	24.4	24.6	23.8	23.7	23.8	23.9	23.8
6.0	24.2	-	24.1	24.3	24.3	23.7	23.8	23.8	23.8	24.0	24.7	25.0	24.7	24.6	24.7	23.9	23.9	23.8	23.9	23.8
7.0	24.2	-	24.1	24.4	24.3	23.7	23.8	23.8	23.8	23.9	24.7	24.8	24.8	24.6	24.8	23.9	23.9	23.8	23.9	23.9
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 25a. Temperature profiles for station S5 measured in °C during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	23.8	24.9	26.9	26.0	25.9	25.1	24.1	24.6
0.5	24.2	24.7	26.2	26.5	26.7	25.6	25.2	24.9
1.0	24.3	24.7	26.1	26.6	27.1	25.7	27.0	25.8
1.5	24.3	25.7	26.1	26.9	27.1	26.6	27.2	25.8
2.0	24.3	25.4	26.0	26.7	26.9	26.7	27.2	25.8
3.0	24.5	25.0	26.1	26.5	26.9	26.5	27.0	25.7
4.0	24.6	24.9	-	26.4	-	-	-	-
5.0	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 25b. Temperature profiles for station S5 measured in °C during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	23.0	22.6	22.5	23.3	23.9	22.7	22.5	22.4	22.8	26.2	21.7	22.2	22.0	21.0	21.3	20.9	21.6	21.4	22.4	20.7
0.5	23.0	22.6	22.5	23.2	23.4	22.7	22.8	23.6	23.5	23.9	22.3	22.5	22.4	21.1	21.5	21.0	21.7	21.6	22.2	20.7
1.0	23.5	23.3	23.4	23.6	24.1	22.9	23.3	24.2	24.0	24.6	23.2	23.5	23.1.	21.2	22.6	21.0	22.1	21.9	22.4	21.9
1.5	23.9	23.6	23.9	23.6	24.2	23.4	23.7	24.2	24.1	24.6	23.9	23.9	23.9	22.2	23.5	21.6	22.7	22.3	22.7	22.3
2.0	24.2	24.1	23.9	24.3	24.3	23.7	23.8	24.1	24.1	24.5	24.3	24.3	24.4	22.9	23.7	22.1	22.9	22.8	23.3	23.2
3.0	24.2	24.2	24.0	24.3	24.3	23.8	23.8	23.9	24.0	24.4	24.5	24.8	24.6	23.2	23.8	22.3	23.3	23.5	23.7	23.6
4.0	24.4	24.2	24.1	24.3	24.4	23.8	23.7	23.9	24.0	24.4	24.8	25.0	24.8	23.9	24.3	-	23.7	23.7	-	23.7
5.0	-	-	-	-	-	-	-	-	-	-	-	25.2	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 26a. Temperature profiles for station S6 measured in °C during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	23.4	24.0	25.0	25.1	26.4	26.2	25.4	24.5
0.5	23.9	24.1	25.0	25.4	26.8	25.8	25.9	24.7
1.0	24.1	24.2	25.8	26.5	27.0	25.8	26.8	25.5
1.5	24.0	24.9	26.0	26.6	27.0	25.9	27.0	25.7
2.0	24.2	24.8	25.9	26.6	26.9	26.6	27.0	25.8
3.0	24.5	24.6	25.9	26.3	26.8	26.3	27.0	25.8
4.0	24.6	24.5	25.7	26.1	26.6	26.0	26.9	25.7
5.0	24.6	24.5	25.5	26.0	26.4	26.0	26.9	25.7
6.0	24.6	24.5	25.4	25.9	26.2	25.8	26.9	25.7
7.0	-	24.5	25.3	25.9	26.3	25.8	26.8	25.6
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 26b. Temperature profiles for station S6 measured in °C during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	23.6	23.0	22.4	22.9	23.2	22.6	22.1	22.8	21.8	23.9	21.9	22.1	21.9	21.2	21.4	21.2	21.4	20.9	21.6	20.6
0.5	23.2	23.0	22.3	22.7	23.1	22.5	22.2	23.4	22.1	23.1	22.2	22.2	21.9	21.3	21.4	21.4	21.4	21.3	21.8	20.7
1.0	23.2	23.1	23.2	23.5	23.7	22.5	23.5	23.5	23.7	23.4	22.6	22.7	22.6	21.3	22.3	21.9	21.6	21.5	22.2	21.1
1.5	23.4	23.6	23.5	23.9	24.0	23.1	23.7	23.9	24.1	24.3	23.7	24.0	23.4	21.7	23.3	22.4	22.1	21.9	22.9	21.5
2.0	24.1	24.1	23.8	24.1	24.2	23.5	23.8	24.0	24.2	24.1	24.1	24.4	24.6	22.3	23.5	22.7	22.4	22.8	23.3	21.9
3.0	24.2	24.2	24.1	24.3	24.3	23.8	23.8	24.0	24.1	24.1	24.4	24.6	24.6	22.9	23.9	22.9	23.4	23.5	23.7	23.4
4.0	24.2	24.2	24.0	24.3	24.3	23.8	23.8	23.9	23.9	24.1	24.9	25.0	24.6	23.3	24.2	23.5	23.6	23.8	23.9	23.8
5.0	24.2	24.2	24.0	24.4	24.3	23.8	23.8	23.8	23.9	23.9	25.2	25.2	24.6	23.4	24.4	23.8	23.7	23.9	23.9	23.9
6.0	24.2	24.2	24.1	24.4	24.6	23.7	23.7	23.8	23.8	23.9	25.2	24.9	24.9	23.8	24.6	23.9	23.8	23.9	23.9	23.9
7.0	24.2	24.2	24.1	24.3	24.4	23.7	23.7	23.8	23.8	23.9	25.2	24.8	25.0	23.9	24.8	24.1	23.9	24.0	23.9	23.9
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 27a. Temperature profiles for station C1 measured in °C during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	24.1	24.4	25.2	25.7	26.1	25.5	26.6	25.5
0.5	24.3	24.4	25.2	25.9	26.3	25.5	26.7	25.5
1.0	24.3	24.4	25.3	26.0	26.5	25.6	26.7	25.5
1.5	24.3	24.5	25.3	26.1	26.5	25.7	26.7	25.5
2.0	24.4	24.4	25.5	26.1	26.5	25.8	26.6	25.5
3.0	24.4	24.5	25.6	26.2	26.5	26.0	26.5	25.5
4.0	24.4	24.5	25.5	26.0	26.3	25.9	26.5	25.5
5.0	24.4	24.5	25.4	25.9	26.2	25.9	26.4	25.5
6.0	24.4	24.5	25.4	25.9	26.1	25.9	26.4	25.5
7.0	-	24.5	25.4	25.9	26.0	25.9	26.4	25.5
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 27b. Temperature profiles for station C1 measured in °C during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	24.0	-	23.6	23.1	23.7	23.7	23.6	23.6	23.6	26.3	-	-	-	-	-	-	-	-	23.3	-
0.5	24.0	-	23.7	23.5	23.8	23.6	23.7	23.7	23.7	23.9	-	-	-	-	-	-	-	-	23.4	-
1.0	24.1	-	23.8	24.2	23.8	23.7	23.8	23.7	23.7	23.8	-	-	-	-	-	-	-	-	23.4	-
1.5	24.1	-	23.9	24.4	23.9	23.8	23.9	23.7	23.7	23.9	-	-	-	-	-	-	-	-	23.5	-
2.0	24.2	-	23.9	24.4	23.9	23.8	23.8	23.7	23.8	23.9	-	-	-	-	-	-	-	-	23.5	-
3.0	24.2	-	24.1	24.4	24.2	23.8	23.8	23.7	23.9	23.7	-	-	-	-	-	-	-	-	23.7	-
4.0	24.2	-	24.2	24.4	24.2	23.7	23.8	23.7	23.8	23.7	-	-	-	-	-	-	-	-	23.7	-
5.0	24.2	-	24.2	24.4	24.4	23.7	23.8	23.7	23.8	23.7	-	-	-	-	-	-	-	-	23.8	-
6.0	24.2	-	24.2	24.4	24.4	23.7	23.8	23.8	23.8	23.8	-	-	-	-	-	-	-	-	23.8	-
7.0	24.2	-	24.2	24.4	24.4	23.7	23.8	23.8	23.8	23.8	-	-	-	-	-	-	-	-	23.8	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 28a. Temperature profiles for station C2 measured in °C during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	24.5	24.3	25.1	24.9	25.7	25.3	26.5	25.1
0.5	24.5	24.4	25.3	26.1	25.9	25.5	26.5	25.2
1.0	24.4	24.4	25.3	26.2	26.2	25.6	26.6	25.3
1.5	24.4	24.4	25.3	26.6	26.3	25.7	26.7	25.3
2.0	24.4	24.4	25.4	26.3	26.5	25.7	26.7	25.5
3.0	24.4	24.4	25.4	26.2	26.4	25.9	26.7	25.5
4.0	24.4	24.4	25.4	26.2	26.3	25.9	26.6	25.5
5.0	24.4	24.4	25.4	26.1	26.1	25.9	26.5	25.5
6.0	24.4	24.4	25.4	25.9	26.0	25.9	26.5	25.5
7.0	-	24.4	25.4	25.8	25.9	-	26.5	25.4
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 28b. Temperature profiles for station C2 measured in °C during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	22.2	-	23.6	23.2	23.2	23.1	23.4	23.6	23.5	20.2	-	-	-	-	-	-	-	-	22.9	-
0.5	24.0	-	23.6	23.7	23.8	23.6	23.6	23.7	23.5	23.6	-	-	-	-	-	-	-	-	23.0	-
1.0	24.1	-	23.6	24.0	24.0	23.7	23.6	23.7	23.6	23.6	-	-	-	-	-	-	-	-	23.2	-
1.5	24.1	-	23.7	24.2	24.1	23.8	23.7	23.7	23.6	23.7	-	-	-	-	-	-	-	-	23.4	-
2.0	24.1	-	23.7	24.3	24.3	23.8	23.7	23.7	23.6	23.7	-	-	-	-	-	-	-	-	23.4	-
3.0	24.1	-	23.8	24.2	24.3	23.8	23.8	23.7	23.8	23.7	-	-	-	-	-	-	-	-	23.7	-
4.0	24.2	-	23.9	24.2	24.4	23.8	23.8	23.8	23.8	23.7	-	-	-	-	-	-	-	-	23.8	-
5.0	24.2	-	23.9	24.2	24.5	23.8	23.8	23.8	23.8	23.7	-	-	-	-	-	-	-	-	23.8	-
6.0	24.2	-	24.0	24.3	24.5	23.8	23.8	23.8	23.8	23.7	-	-	-	-	-	-	-	-	23.8	-
7.0	24.2	-	24.0	24.3	24.5	23.8	23.8	23.8	23.8	23.7	-	-	-	-	-	-	-	-	23.8	-
8.0	-	-	-	-	-	-	-	-	-	23.7	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 4. Dissolved oxygen profiles.

Table 29a. Dissolved oxygen profiles for station S2 measured in mg O_2 l^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	7.25	6.66	6.05	6.61	5.66	5.58	6.63	5.92
0.5	7.18	6.23	6.08	6.16	5.49	5.43	7.26	5.71
1.0	6.92	6.50	6.37	6.07	5.52	5.17	5.99	5.78
1.5	6.77	6.43	6.08	6.10	5.68	5.20	5.88	5.85
2.0	6.74	6.53	5.84	6.19	5.50	5.05	5.83	5.75
3.0	6.79	6.39	5.62	5.92	5.60	5.09	5.66	5.81
4.0	6.70	6.33	5.56	5.49	5.60	5.01	5.72	5.88
5.0	6.41	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 29b. Dissolved oxygen profiles for station S2 measured in mg O_2 l^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	6.45	6.61	7.27	6.40	6.28	7.59	6.71	6.26	5.92	6.22	7.13	7.38	7.76	8.45	7.86	-	6.72	7.09	6.37	7.59
0.5	5.65	6.40	6.52	5.84	6.00	6.47	5.64	5.82	5.62	6.31	6.73	7.01	7.57	8.21	7.81	-	6.75	6.70	6.06	6.72
1.0	5.61	6.20	6.26	5.97	5.92	5.98	5.85	5.62	5.63	5.83	6.38	6.39	6.27	6.95	6.57	-	6.39	6.79	6.06	6.41
1.5	5.52	6.11	6.21	5.98	5.87	6.22	5.87	5.63	5.53	5.82	6.28	6.38	6.32	6.69	6.17	-	6.34	6.56	5.96	6.62
2.0	5.54	5.99	6.10	5.89	6.04	5.90	5.36	5.76	5.44	5.79	6.28	6.46	6.32	6.45	6.33	-	6.29	6.42	5.30	6.29
3.0	5.17	5.90	6.27	5.79	6.08	5.30	4.90	5.43	5.56	5.80	6.23	6.12	6.29	6.39	6.36	-	6.20	5.18	4.30	5.73
4.0	5.00	5.72	6.15	5.84	6.11	5.92	5.34	5.29	5.38	5.81	5.95	6.26	5.95	6.09	5.98	-	5.84	4.56	4.22	4.90
5.0	4.73	6.06	6.06	5.79	6.19	5.50	4.83	-	-	5.87	6.06	6.06	5.61	5.37	5.47	-	5.46	4.66	-	3.79
6.0	4.83	6.08	6.08	-	-	5.58	-	-	-	-	-	5.88	-	5.30	-	-	4.77	-	-	3.86
7.0	-	6.11	6.04	-	-	5.50	-	-	-	-	-	5.29	-	-	-	-	4.66	-	-	3.85
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 30a. Dissolved oxygen profiles for station S3 measured in mg O_2 l^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	6.95	6.61	6.69	6.58	6.53	5.15	6.54	5.98
0.5	7.03	6.57	6.99	6.42	5.90	4.97	6.59	5.77
1.0	6.85	6.56	6.60	6.32	5.57	5.00	6.23	5.66
1.5	6.96	6.66	6.18	6.25	5.73	4.97	6.05	5.93
2.0	6.92	6.68	6.07	6.08	5.64	4.93	6.02	5.88
3.0	6.90	6.67	5.83	6.12	5.33	4.93	5.82	5.91
4.0	6.70	6.78	5.79	6.07	5.43	4.76	5.71	5.86
5.0	6.00	6.72	5.83	6.34	5.47	5.09	5.77	5.99
6.0	6.64	6.70	5.91	6.16	5.78	5.31	5.84	5.94
7.0	-	6.56	5.96	6.12	5.95	5.36	5.89	5.87
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 30b. Dissolved oxygen profiles for station S3 measured in mg O_2 l^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	6.42	7.42	6.56	6.24	6.03	6.47	6.12	6.31	5.49	6.43	6.96	6.31	7.13	7.72	7.08	6.88	6.62	7.15	6.13	7.42
0.5	6.23	6.89	6.39	5.90	6.03	6.26	5.87	5.82	5.71	5.92	6.40	6.19	6.57	7.65	6.93	6.92	6.67	6.85	6.03	7.39
1.0	5.88	6.22	6.10	5.92	5.91	6.31	5.90	5.71	5.54	5.80	6.20	6.56	6.64	7.04	6.65	6.60	6.58	6.48	5.97	6.86
1.5	5.59	6.31	6.10	6.00	5.83	6.42	6.26	5.92	5.52	5.74	6.19	6.45	6.54	6.94	6.33	6.51	6.41	6.42	5.95	6.82
2.0	5.50	5.94	5.85	5.99	5.78	6.21	5.92	5.94	5.54	5.94	6.33	6.44	6.58	6.69	6.42	6.46	6.24	6.29	5.71	6.65
3.0	4.96	5.94	5.99	5.87	5.96	5.14	5.71	5.82	5.49	5.80	5.95	6.20	6.41	6.44	5.97	6.57	6.26	5.20	5.22	6.26
4.0	5.91	5.83	5.93	5.94	6.06	5.12	5.93	6.04	5.69	5.83	5.90	5.86	6.15	5.97	5.27	5.76	5.79	5.59	5.25	5.82
5.0	5.97	-	5.94	5.96	6.05	5.44	5.84	5.96	5.61	5.70	6.06	5.54	6.14	5.91	5.22	5.38	5.64	5.65	5.25	5.36
6.0	5.91	-	6.06	5.83	6.14	5.97	5.92	6.08	5.57	5.83	6.02	5.61	5.95	8.80	4.91	5.78	4.55	5.78	5.61	5.17
7.0	5.96	-	5.93	5.70	6.12	6.04	5.96	6.03	5.73	5.75	6.05	6.00	5.80	5.60	4.90	5.70	4.81	5.86	5.85	4.55
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 31a. Dissolved oxygen profiles for station S5 measured in mg O_2 l^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	7.08	6.50	6.46	6.88	6.06	5.38	6.76	5.67
0.5	7.02	6.82	6.77	6.74	5.66	5.76	7.88	5.66
1.0	6.73	6.90	6.23	6.59	5.67	4.66	6.52	5.99
1.5	6.98	6.42	6.42	6.57	5.71	4.83	6.26	6.00
2.0	6.66	6.58	6.41	6.38	5.59	3.72	6.06	5.93
3.0	6.66	6.61	5.72	4.67	5.17	3.48	5.79	5.84
4.0	7.02	5.73	-	5.02	-	-	-	-
5.0	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 31b. Dissolved oxygen profiles for station S5 measured in mg O_2 l^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	6.03	6.50	5.98	6.13	6.26	6.23	5.17	5.86	5.57	5.47	6.43	7.04	6.25	6.30	6.62	6.56	6.29	6.41	5.90	7.13
0.5	5.71	6.43	6.15	6.12	6.17	6.21	5.16	5.37	5.53	5.55	6.18	7.01	6.16	6.72	6.53	6.80	6.43	6.76	6.01	7.44
1.0	5.35	6.30	5.56	6.28	6.10	5.56	5.30	5.64	5.81	5.69	6.22	6.68	6.23	7.03	5.78	7.08	6.35	6.57	5.74	5.84
1.5	5.77	6.22	5.74	5.85	5.84	5.09	5.31	5.48	5.53	5.34	6.14	6.50	6.11	6.72	6.06	6.64	5.39	6.28	5.93	5.61
2.0	5.33	5.60	5.95	6.26	5.82	5.53	5.38	5.40	5.72	5.59	5.94	6.13	5.32	6.69	5.98	6.18	5.33	5.92	5.06	5.44
3.0	4.00	5.80	5.59	5.70	5.86	4.71	5.33	5.51	5.83	4.73	5.79	5.84	5.02	6.50	5.41	6.01	5.15	5.41	4.07	3.75
4.0	3.74	5.39	4.55	4.94	5.52	4.29	3.93	4.42	4.73	4.51	5.13	5.50	3.62	2.60	3.87	-	4.33	4.18	-	3.20
5.0	-	-	-	-	-	-	-	-	-	-	-	3.16	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 32a. Dissolved oxygen profiles for station S6 measured in mg O_2 l^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	7.05	6.57	6.72	7.31	6.35	5.42	6.85	5.73
0.5	6.97	6.83	6.97	7.01	6.27	5.30	6.34	5.83
1.0	6.77	6.62	6.11	6.35	6.01	5.26	6.24	5.97
1.5	6.98	5.93	6.29	6.04	6.06	5.44	6.13	5.83
2.0	6.84	6.41	5.99	5.78	5.72	5.05	6.09	5.82
3.0	6.73	6.45	5.66	5.64	5.81	5.12	5.85	5.76
4.0	6.80	6.40	5.72	5.95	5.64	5.18	5.76	5.71
5.0	6.83	6.54	5.91	6.16	5.65	5.23	5.76	5.68
6.0	6.67	6.37	5.76	6.12	5.60	5.44	5.45	5.70
7.0	-	6.50	5.70	5.90	5.70	5.31	4.90	5.70
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 32b. Dissolved oxygen profiles for station S6 measured in mg O_2 l^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	5.94	6.49	6.56	5.92	6.03	6.01	6.17	6.07	5.94	6.11	7.09	6.89	7.40	7.71	7.35	7.00	6.64	7.06	5.89	7.19
0.5	5.93	6.41	6.20	5.81	6.13	6.04	6.10	5.86	5.90	5.92	6.69	7.12	7.39	7.57	7.29	6.96	6.74	6.99	6.03	7.33
1.0	5.59	6.49	6.20	5.73	5.99	5.24	5.26	5.63	5.02	5.84	6.18	6.55	6.52	7.60	6.15	6.77	6.57	6.71	5.87	6.60
1.5	5.00	5.84	6.01	5.73	5.88	5.10	5.00	5.01	5.46	5.89	6.07	5.99	5.85	7.55	6.34	5.76	6.41	5.82	5.75	6.54
2.0	5.05	5.98	5.99	5.60	5.90	5.84	5.08	5.14	5.53	5.94	6.20	6.22	5.60	7.76	6.17	6.12	6.12	5.59	5.21	5.64
3.0	5.21	5.82	5.81	6.08	6.03	5.20	5.02	5.45	5.75	5.78	5.86	5.82	5.62	6.83	5.43	6.23	5.62	5.12	4.75	4.69
4.0	5.76	5.75	5.99	5.95	5.98	5.53	5.11	5.58	5.63	5.62	5.48	5.34	6.03	6.70	5.19	5.16	5.52	4.85	4.20	4.69
5.0	5.57	5.88	5.78	5.96	5.81	5.92	5.67	5.98	5.62	5.70	5.28	5.09	5.92	6.67	4.97	5.45	4.91	4.90	5.32	4.47
6.0	5.85	5.91	5.66	5.77	5.39	5.62	5.52	6.02	5.33	5.73	5.09	5.74	4.78	6.60	4.71	5.02	4.51	3.63	5.53	5.10
7.0	5.72	5.76	5.85	5.70	5.10	5.61	5.22	5.88	5.58	5.74	5.09	5.42	4.91	6.60	4.29	4.06	4.47	4.20	5.02	5.39
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 33a. Dissolved oxygen profiles for station C1 measured in mg O_2 l^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	6.84	6.60	6.38	6.34	6.18	5.44	5.84	5.86
0.5	6.98	6.57	6.35	6.41	5.87	5.51	5.83	5.79
1.0	6.67	6.58	6.30	6.45	5.83	5.63	5.75	5.75
1.5	6.79	6.49	6.03	6.23	5.86	5.70	5.60	5.91
2.0	6.56	6.55	6.26	6.12	5.91	5.74	5.67	5.97
3.0	6.53	6.65	6.26	6.35	5.90	5.76	5.64	5.94
4.0	6.22	6.77	6.18	6.22	5.75	5.74	5.54	5.92
5.0	6.51	6.63	6.10	6.06	5.74	5.73	5.54	5.90
6.0	6.50	6.42	6.11	5.98	5.48	5.69	5.43	5.90
7.0	-	6.45	6.12	5.46	5.48	5.76	5.45	5.70
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 33b. Dissolved oxygen profiles for station C1 measured in mg O_2 l^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	5.95	-	6.20	6.30	6.17	5.78	5.95	6.26	5.84	5.74	-	-	-	-	-	-	-	-	5.60	-
0.5	6.17	-	6.02	6.38	6.15	5.58	6.05	5.96	5.78	5.80	-	-	-	-	-	-	-	-	5.52	-
1.0	6.09	-	6.01	6.05	6.23	5.46	5.95	5.91	5.75	5.83	-	-	-	-	-	-	-	-	5.54	-
1.5	5.99	-	5.81	6.10	6.14	5.34	6.06	5.94	5.82	5.51	-	-	-	-	-	-	-	-	5.59	-
2.0	6.05	-	5.99	6.08	6.27	5.87	6.05	5.87	5.92	5.48	-	-	-	-	-	-	-	-	5.55	-
3.0	6.03	-	5.91	6.08	6.15	5.84	6.08	5.95	5.26	5.82	-	-	-	-	-	-	-	-	5.72	-
4.0	5.50	-	5.90	5.94	6.18	6.07	6.04	5.87	5.23	5.87	-	-	-	-	-	-	-	-	5.71	-
5.0	5.44	-	5.91	6.01	6.02	5.81	6.09	5.88	5.39	5.88	-	-	-	-	-	-	-	-	5.93	-
6.0	5.53	-	5.90	5.75	6.03	5.72	6.81	5.93	5.43	5.63	-	-	-	-	-	-	-	-	5.82	-
7.0	4.90	-	6.00	5.81	6.11	5.71	6.08	5.84	5.48	5.84	-	-	-	-	-	-	-	-	5.83	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 34a. Dissolved oxygen profiles for station C2 measured in mg O_2 l^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	6.37	6.31	6.32	6.41	5.94	5.46	5.38	5.73
0.5	6.41	6.57	6.26	6.41	5.92	5.47	5.79	5.69
1.0	6.39	6.50	6.09	6.28	5.90	5.55	5.34	5.67
1.5	6.44	6.36	5.99	6.26	5.90	5.51	8.29	5.70
2.0	6.47	6.28	5.96	6.28	5.93	5.68	5.19	5.47
3.0	6.43	6.01	6.15	6.35	5.93	5.68	5.36	5.01
4.0	6.43	5.95	6.09	6.25	5.86	5.71	5.06	4.91
5.0	6.32	5.99	5.86	5.82	5.89	5.81	4.87	4.81
6.0	6.32	5.90	5.49	4.97	5.37	5.80	4.85	4.86
7.0	-	5.78	5.13	4.79	4.94	-	4.92	4.85
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 34b. Dissolved oxygen profiles for station C1 measured in mg O_2 l^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	6.07	-	5.98	6.23	6.09	5.79	5.93	5.37	5.71	5.76	-	-	-	-	-	-	-	-	6.05	-
0.5	5.93	-	5.98	5.96	6.06	5.94	5.83	5.82	5.69	5.78	-	-	-	-	-	-	-	-	5.93	-
1.0	5.79	-	6.02	5.92	6.18	5.78	5.88	5.45	5.72	5.73	-	-	-	-	-	-	-	-	5.79	-
1.5	5.40	-	5.94	5.90	6.25	5.31	5.70	5.35	5.76	5.83	-	-	-	-	-	-	-	-	5.60	-
2.0	5.08	-	5.92	5.99	6.20	5.21	5.86	5.30	5.67	5.59	-	-	-	-	-	-	-	-	5.51	-
3.0	4.90	-	5.95	5.73	6.11	4.73	6.19	5.42	4.90	5.69	-	-	-	-	-	-	-	-	5.85	-
4.0	5.10	-	5.73	5.48	5.70	5.17	6.02	5.17	4.79	5.77	-	-	-	-	-	-	-	-	6.02	-
5.0	5.27	-	5.73	5.40	5.62	4.78	5.90	5.13	4.88	5.70	-	-	-	-	-	-	-	-	6.02	-
6.0	5.13	-	5.66	5.36	5.44	4.74	5.40	5.22	4.86	5.81	-	-	-	-	-	-	-	-	5.81	-
7.0	5.29	-	5.66	5.37	5.39	4.75	5.23	5.10	4.83	5.69	-	-	-	-	-	-	-	-	5.60	-
8.0	-	-	-	-	-	-	-	-	-	5.66	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 5. Percent oxygen saturation profiles.

Table 35a. Percent oxygen saturation profiles for station S2 during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	101.6	91.7	85.8	94.4	84.5	80.8	93.5	85.1
0.5	101.0	92.0	88.4	91.0	81.4	76.7	101.0	84.8
1.0	97.6	95.8	93.7	91.1	80.9	77.8	88.9	86.6
1.5	97.8	96.2	93.0	89.7	87.5	77.9	87.8	87.1
2.0	98.4	95.4	86.7	93.7	84.0	76.7	87.0	86.0
3.0	99.2	93.7	84.2	93.5	87.6	78.4	86.2	86.8
4.0	98.1	93.3	81.5	87.2	85.3	77.3	87.1	87.4
5.0	93.6	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 35b. Percent oxygen saturation profiles for station S2 during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	89.7	89.3	94.6	85.3	86.7	92.9	87.8	84.9	82.6	83.0	93.5	99.7	98.2	98.0	95.5	-	81.6	91.9	85.4	93.7
0.5	81.9	88.0	93.4	84.9	85.5	87.2	80.3	81.6	80.0	83.9	90.6	92.2	95.9	99.9	98.2	-	87.9	88.4	82.8	84.2
1.0	80.6	85.0	88.0	84.7	86.1	82.0	81.9	79.7	80.8	84.6	89.6	88.3	88.8	90.3	87.4	-	86.6	91.6	83.9	87.6
1.5	79.6	87.1	88.1	84.6	85.2	85.5	80.8	80.6	79.9	85.0	89.2	92.5	89.3	89.4	86.4	-	87.9	87.8	84.0	88.0
2.0	78.9	83.3	88.3	85.5	87.1	82.0	76.8	80.9	80.0	84.2	89.0	92.8	89.0	90.3	87.7	-	87.8	88.1	76.4	86.2
3.0	77.0	86.0	90.5	79.1	87.5	76.1	70.7	79.9	81.3	84.7	89.7	88.4	89.3	89.8	89.0	-	86.9	76.1	62.9	81.9
4.0	72.8	85.3	90.8	84.0	88.1	70.8	77.0	77.3	77.5	83.4	87.7	89.7	86.3	89.8	85.2	-	83.0	67.0	62.0	73.8
5.0	69.7	87.8	89.1	86.2	87.9	79.2	70.1	-	-	85.4	90.0	85.2	81.5	80.5	79.5	-	79.5	69.3	-	43.7
6.0	69.7	87.7	88.8	-	-	79.7	-	-	-	-	-	86.6	-	78.0	-	-	58.2	-	-	55.2
7.0	-	89.0	87.0	-	-	80.3	-	-	-	-	-	76.9	-	-	-	-	57.1	-	-	55.3
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 36a. Percent oxygen saturation profiles for station S3 during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	99.8	95.3	97.4	96.4	91.1	76.8	91.5	85.6
0.5	100.2	95.6	93.8	95.7	86.7	73.8	94.0	85.3
1.0	99.3	94.6	93.5	97.1	85.9	75.2	91.8	83.8
1.5	101.3	96.3	92.2	94.0	89.4	74.2	92.0	88.2
2.0	100.1	96.7	90.1	91.9	83.4	73.5	92.1	88.6
3.0	100.1	98.0	87.2	93.6	84.4	74.5	90.0	89.1
4.0	97.1	98.8	88.4.	91.0	83.0	72.1	89.0	88.2
5.0	98.9	97.2	89.1	90.3	83.3	74.7	87.5	89.0
6.0	96.9	98.5	89.9	92.6	86.2	80.3	89.4	87.6
7.0	-	95.9	89.1	93.2	88.7	80.5	89.5	88.6
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 36b. Percent oxygen saturation profiles for station S3 during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	87.7	97.8	89.0	93.4	84.5	89.2	84.1	86.4	77.6	86.6	91.8	92.2	92.5	96.0	89.5	91.1	89.5	90.1	85.9	92.8
0.5	86.1	91.7	87.1	84.3	85.4	85.3	80.8	85.5	81.3	83.9	89.0	93.8	91.5	95.5	89.6	91.6	87.9	88.0	85.5	92.7
1.0	84.1	87.0	87.0	86.2	85.1	86.2	83.5	82.3	80.1	84.7	86.2	92.1	90.6	93.2	89.8	93.9	88.1	88.4	83.2	91.0
1.5	79.9	87.7	86.9	86.1	85.0	88.2	89.5	84.0	79.4	84.3	87.2	90.6	91.1	92.9	86.7	90.1	88.0	88.4	84.8	91.6
2.0	82.7	83.8	85.1	85.1	84.5	86.7	84.6	84.8	79.5	86.0	89.8	90.6	92.3	93.5	88.6	89.0	87.5	86.8	83.1	88.1
3.0	72.3	87.0	83.5	83.1	87.1	73.9	83.0	84.5	80.1	85.0	88.4	92.3	89.1	90.9	85.1	91.5	87.4	81.9	75.3	87.7
4.0	86.4	85.5	87.0	85.2	87.4	80.3	85.7	86.8	81.7	85.1	86.9	86.0	86.1	87.2	76.7	84.1	82.2	79.2	76.5	84.5
5.0	87.4	-	86.5	86.5	87.9	77.1	84.5	86.5	81.2	84.2	89.4	82.9	88.2	86.1	77.1	80.1	82.5	81.6	75.3	77.9
6.0	85.4	-	86.5	87.3	88.7	86.7	87.1	86.0	79.8	84.5	88.7	85.2	84.6	84.4	72.3	82.2	68.3	82.8	81.8	74.3
7.0	88.1	-	86.7	86.4	88.2	87.0	85.6	87.3	82.6	84.6	89.7	86.3	84.0	84.4	73.2	83.0	73.7	84.6	83.8	74.7
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 37a. Percent oxygen saturation profiles for station S5 during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	98.8	91.3	93.5	95.2	86.2	73.2	87.8	80.2
0.5	99.2	99.8	98.1	98.0	87.4	83.3	107.1	83.4
1.0	96.9	102.7	94.2	102.0	86.5	76.5	99.0	88.8
1.5	100.7	95.7	95.8	105.0	86.6	73.4	94.5	89.8
2.0	96.7	96.7	96.2	99.7	88.2	56.7	93.2	89.7
3.0	97.0	97.2	97.3	71.2	78.6	52.1	88.4	87.7
4.0	101.7	84.6	-	75.8	-	-	-	-
5.0	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 37b. Percent oxygen saturation profiles for station S5 during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	77.3	82.8	78.0	77.6	86.5	82.9	70.6	78.6	76.2	81.1	80.3	88.6	78.0	83.9	81.7	81.6	82.4	81.3	78.2	87.3
0.5	80.2	83.9	80.0	83.4	86.9	82.1	70.8	76.8	78.8	78.6	79.6	88.5	81.2	83.9	82.9	85.3	84.0	85.8	80.3	91.2
1.0	75.6	86.8	83.0	87.1	89.7	78.4	74.7	80.8	84.7	82.8	85.6	86.4	84.4	85.2	77.4	90.2	86.4	89.2	79.2	77.5
1.5	83.4	86.4	83.5	85.2	81.2	70.4	75.4	79.3	79.3	79.8	84.6	92.1	86.6	90.2	84.2	92.8	83.5	86.2	81.2	77.9
2.0	80.0	81.9	86.5	88.0	84.9	77.7	77.2	79.3	83.0	79.3	85.7	90.6	78.7	90.8	84.3	84.4	74.6	83.4	75.6	74.8
3.0	54.2	83.3	83.2	85.7	84.5	68.0	75.1	69.6	84.0	71.7	85.6	85.2	74.4	92.2	77.2	81.5	72.6	79.1	60.7	54.1
4.0	54.8	79.9	69.5	71.7	79.1	63.2	58.5	64.6	69.5	68.7	75.9	74.3	56.2	50.3	55.8	-	65.2	63.2	-	52.8
5.0	-	-	-	-	-	-	-	-	-	-	-	48.7	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 38a. Percent oxygen saturation profiles for station S6 during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	97.4	91.4	94.6	101.3	91.5	79.7	95.4	81.3
0.5	98.6	96.6	97.4	99.7	95.0	79.1	91.1	83.9
1.0	96.1	96.3	91.9	95.3	91.9	77.4	94.7	88.4
1.5	98.9	90.0	94.8	91.8	85.8	78.9	92.9	87.2
2.0	98.8	93.9	90.1	88.0	90.9	76.4	90.5	86.9
3.0	97.6	95.2	84.6	85.2	87.5	77.4	89.4	85.8
4.0	98.4	94.4	85.2	90.3	84.3	78.4	88.1	86.0
5.0	99.5	96.4	89.4	89.4	85.1	79.1	86.9	85.4
6.0	97.8	93.9	89.3	85.4	83.3	80.6	83.9	85.4
7.0	-	95.2	83.5	85.9	87.3	81.3	74.9	85.2
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 38b. Percent oxygen saturation profiles for station S6 during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	79.7	86.4	90.0	82.5	82.8	79.5	81.2	82.2	77.9	85.5	91.2	88.6	94.2	94.9	91.5	90.5	86.3	88.1	77.8	87.3
0.5	81.9	86.1	87.0	81.6	83.6	79.9	81.7	82.3	79.2	81.2	87.9	92.3	94.6	94.1	91.2	93.4	88.0	90.7	79.0	90.2
1.0	76.7	87.9	87.3	81.1	83.9	74.1	75.6	78.5	71.3	82.9	86.0	88.8	89.5	95.8	82.2	92.1	86.2	88.7	78.0	91.2
1.5	72.3	82.5	86.6	82.4	82.5	70.8	71.1	74.4	78.7	84.5	85.0	84.0	83.0	94.7	87.0	77.7	87.6	81.5	79.6	85.8
2.0	73.8	85.6	86.3	83.1	81.7	68.9	74.2	73.8	79.8	86.5	88.4	87.6	80.2	94.1	86.0	83.7	84.2	79.5	75.4	79.8
3.0	76.2	81.2	82.5	84.3	81.5	74.4	72.9	78.4	84.2	83.6	85.9	89.8	81.6	93.1	78.3	86.9	80.5	76.8	70.4	68.2
4.0	84.6	83.6	85.5	83.5	81.0	80.8	73.6	77.4	80.9	83.5	81.9	81.0	86.7	92.5	75.6	77.6	79.4	69.1	63.2	69.5
5.0	82.1	85.1	82.8	82.0	77.4	84.8	80.5	83.9	82.0	82.7	78.7	75.7	85.0	92.7	72.3	77.7	70.6	71.5	76.4	65.5
6.0	85.7	88.0	82.6	81.2	73.5	80.9	79.0	86.9	78.2	82.3	75.0	85.7	71.5	91.9	70.0	73.1	66.9	79.5	80.7	72.4
7.0	85.4	83.7	85.3	81.7	75.8	81.6	75.8	84.6	80.7	83.0	75.6	80.0	71.7	92.7	64.4	64.6	65.2	58.2	76.2	78.5
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 39a. Percent oxygen saturation profiles for station C1 during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	100.5	99.9	93.9	98.4	92.5	81.2	87.4	87.3
0.5	98.8	95.4	91.0	95.0	88.2	82.2	87.6	87.5
1.0	97.0	96.2	90.5	96.0	88.9	84.2	87.2	85.8
1.5	99.2	94.8	88.4	95.8	90.6	85.0	85.3	88.3
2.0	95.6	96.5	92.7	95.6	89.4	87.0	87.7	88.8
3.0	94.8	96.7	92.8	94.8	88.7	86.7	85.8	88.6
4.0	96.8	98.5	90.7	94.5	87.2	87.6	83.7	88.5
5.0	95.3	98.2	92.1	91.5	88.1	86.6	83.0	89.0
6.0	94.6	95.4	90.2	90.0	83.0	85.4	81.9	87.2
7.0	-	95.7	91.0	84.0	82.3	86.1	83.1	84.5
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 39b. Percent oxygen saturation profiles for station C1 during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	86.5	-	86.1	86.4	88.0	81.9	84.7	85.2	82.2	83.00	-	-	-	-	-	-	-	-	80.2	-
0.5	87.9	-	86.5	87.9	88.1	80.2	86.3	84.9	83.4	84.10	-	-	-	-	-	-	-	-	79.0	-
1.0	88.8	-	86.3	87.5	88.9	78.0	86.4	85.6	82.4	83.10	-	-	-	-	-	-	-	-	79.3	-
1.5	87.8	-	85.5	88.7	88.7	75.2	85.6	85.4	84.6	79.90	-	-	-	-	-	-	-	-	80.1	-
2.0	89.7	-	86.6	88.2	90.3	83.5	87.2	86.3	85.2	80.00	-	-	-	-	-	-	-	-	80.4	-
3.0	88.2	-	85.8	86.4	89.5	84.7	86.8	85.0	77.0	83.50	-	-	-	-	-	-	-	-	82.2	-
4.0	80.9	-	86.1	86.9	90.1	87.3	88.2	84.0	74.8	84.90	-	-	-	-	-	-	-	-	81.9	-
5.0	79.9	-	86.4	86.6	87.5	85.5	87.2	85.5	78.4	84.90	-	-	-	-	-	-	-	-	84.6	-
6.0	80.3	-	86.3	87.0	88.1	83.6	88.6	83.8	78.4	82.50	-	-	-	-	-	-	-	-	84.7	-
7.0	71.5	-	86.1	85.5	87.7	82.4	88.2	84.8	79.0	84.40	-	-	-	-	-	-	-	-	84.2	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 40a. Percent oxygen saturation profiles for station C2 during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	93.2	93.8	92.4	97.1	87.1	82.6	80.3	85.1
0.5	94.5	94.9	90.8	96.6	90.6	81.3	83.6	85.1
1.0	94.5	94.7	89.9	96.4	88.9	82.8	82.0	85.4
1.5	93.7	92.5	89.2	96.2	90.6	82.4	80.1	84.7
2.0	94.5	89.4	88.8	95.9	88.8	83.5	76.6	81.5
3.0	93.6	91.6	92.3	95.8	90.0	84.6	81.1	73.6
4.0	93.3	88.6	92.0	93.5	90.2	85.8	76.4	74.2
5.0	90.9	87.7	87.0	86.3	88.3	87.4	74.0	72.1
6.0	92.3	89.6	78.8	75.5	86.1	86.6	74.2	71.7
7.0	-	84.9	76.8	76.4	74.6	-	73.4	71.9
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 40b. Percent oxygen saturation profiles for station C2 during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	86.7	-	86.1	85.6	88.6	87.5	85.1	77.3	81.6	83.8	-	-	-	-	-	-	-	-	85.0	-
0.5	86.1	-	87.3	86.6	87.6	82.7	83.8	77.0	82.6	83.4	-	-	-	-	-	-	-	-	84.1	-
1.0	84.3	-	86.2	87.9	89.9	83.0	84.1	79.4	81.7	83.1	-	-	-	-	-	-	-	-	82.9	-
1.5	77.5	-	85.7	85.2	91.2	75.8	81.6	78.2	82.1	83.7	-	-	-	-	-	-	-	-	80.3	-
2.0	71.4	-	85.3	85.7	89.9	73.9	84.4	75.9	82.4	82.8	-	-	-	-	-	-	-	-	80.1	-
3.0	72.5	-	85.9	82.5	89.3	69.1	88.8	74.7	71.5	82.7	-	-	-	-	-	-	-	-	83.0	-
4.0	75.5	-	84.0	80.3	85.5	74.9	87.2	75.4	70.0	84.0	-	-	-	-	-	-	-	-	87.2	-
5.0	76.4	-	82.2	78.3	82.5	68.7	87.3	73.6	70.5	83.6	-	-	-	-	-	-	-	-	87.9	-
6.0	74.9	-	83.0	77.1	81.0	68.5	77.3	75.3	69.6	84.7	-	-	-	-	-	-	-	-	84.4	-
7.0	77.0	-	82.0	77.7	80.0	68.7	76.3	72.3	69.5	84.3	-	-	-	-	-	-	-	-	82.5	-
8.0	-	-	-	-	-	-	-	-	-	82.2	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Appendix 6. Light attenuation profiles.

Table 41a. Light attenuation profiles for station S2 measured in µmol photons m^{-2} s^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	45.9	335.3	-	580.0	324.3	1282.0	1175.5	555.4
0.5	39.6	215.2	-	315.1	225.8	860.4	724.5	215.9
1.0	25.6	185.0	-	297.8	201.1	768.8	549.1	206.0
1.5	21.4	150.0	-	274.0	158.5	727.2	391.7	172.2
2.0	20.2	155.4	-	205.3	159.5	562.1	306.8	152.0
3.0	17.8	159.0	-	162.3	126.2	453.1	237.1	144.3
4.0	16.0	90.8	-	100.9	30.4	325.1	89.5	127.6
5.0	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 41b. Light attenuation profiles for station S2 measured in µmol photons m^{-2} s^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	549.4	148.5	447.5	202.2	494.7	883.1	1265.5	143.7	1166.0	183.6	122.2	117.9	106.5	23.7	20.5	-	52.6	116.9	57.0	-
0.5	205.3	121.5	257.2	166.0	358.8	608.6	796.1	75.7	513.6	88.7	36.6	88.4	29.4	11.7	2.8	-	26.2	51.5	30.1	-
1.0	130.3	87.0	202.4	141.9	314.5	362.6	469.9	71.7	399.5	58.7	22.3	63.9	22.4	7.4	1.6	-	19.2	30.0	19.6	-
1.5	87.6	61.5	168.1	118.6	287.4	234.5	400.7	105.0	307.8	37.7	14.5	43.9	15.2	4.1	1.2	-	15.3	13.6	12.2	-
2.0	67.7	59.7	121.3	109.0	263.8	165.8	347.8	92.2	264.7	43.1	11.3	31.7	14.3	2.3	1.2	-	14.8	8.4	9.3	-
3.0	38.9	51.9	105.3	76.0	217.9	76.9	223.7	57.8	201.1	58.1	8.2	19.8	12.4	1.6	0.3	-	9.6	1.8	4.2	-
4.0	24.5	53.3	90.6	59.2	271.7	20.6	142.3	6.8	134.1	57.2	6.3	13.7	8.2	0.8	0.0	-	5.2	0.2	0.5	-
5.0	11.6	51.6	55.4	24.3	107.6	8.2	102.2	-	-	54.2	5.0	10.8	5.5	0.2	0.0	-	1.9	0.0	-	-
6.0	1.1	47.6	22.4	-	-	1.7	-	-	-	36.1	-	7.4	-	-0.3	-	-	0.7	-	-	-
7.0	-	40.8	3.8	-	-	0.1	-	-	-	-	-	2.2	-	-	-	-	0.2	-	-	-
8.0	-	36.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.0	-	-	-

Table 42a. Light attenuation profiles for station S3 measured in µmol photons m^{-2} s^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	432.8	342.3	-	352.5	139.3	1034.5	345.4	1010.9
0.5	297.6	270.0	-	259.3	106.5	749.0	138.7	524.6
1.0	261.8	278.1	-	187.5	99.3	602.3	109.1	415.1
1.5	262.2	241.3	-	184.5	85.2	529.9	107.4	281.8
2.0	237.3	218.5	-	159.5	70.0	423.8	143.6	264.6
3.0	218.2	189.7	-	124.3	67.4	319.2	69.0	214.8
4.0	185.1	180.1	-	115.3	67.3	238.5	80.9	190.8
5.0	157.7	178.7	-	104.0	50.5	191.9	85.3	158.6
6.0	139.9	158.6	-	90.2	46.6	151.3	52.5	135.5
7.0	117.8	152.4	-	71.4	39.7	143.1	53.7	110.5
8.0	97.1	138.7	-	61.8	38.0	119.8	42.6	97.8
9.0	-	-	-	56.6	35.3	-	-	93.3

Table 42b. Light attenuation profiles for station S3 measured in µmol photons m^{-2} s^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	978.4	69.6	687.7	195.6	283.3	982.1	330.0	307.3	862.7	1801.5	56.2	48.1	18.7	41.1	3.0	50.2	14.6	254.5	49.2	-
0.5	799.2	39.5	383.1	126.2	220.4	572.8	180.6	194.0	572.3	737.9	14.0	15.1	9.7	5.4	2.1	29.5	8.8	85.4	18.1	-
1.0	689.2	30.0	322.1	105.6	165.8	273.7	132.2	150.2	383.8	611.1	13.0	9.6	7.5	3.1	0.6	19.5	6.5	41.4	14.8	-
1.5	438.0	25.3	209.9	107.7	130.3	173.3	102.2	107.9	283.8	506.2	11.1	10.4	4.9	2.0	0.0	14.8	4.8	23.0	9.7	-
2.0	303.0	21.4	125.3	90.7	111.3	125.8	86.2	93.7	222.2	466.4	9.0	10.3	2.8	1.0	0.0	11.1	4.7	7.8	7.9	-
3.0	270.1	15.2	93.4	82.0	100.0	62.3	67.5	82.8	152.2	323.1	7.1	4.1	2.0	0.5	0.0	5.7	3.3	4.3	5.9	-
4.0	203.5	9.4	74.9	69.5	92.8	36.1	57.6	78.5	107.2	240.7	4.9	2.3	1.2	0.1	0.0	2.5	2.5	2.0	3.9	-
5.0	146.6	1.7	57.9	64.1	84.5	21.0	47.0	57.6	74.2	194.2	3.9	1.7	0.9	0.0	0.0	1.3	1.7	1.2	2.4	-
6.0	119.7	-	57.3	60.1	77.7	17.2	38.1	47.0	50.5	153.8	3.4	1.2	0.4	0.0	0.0	0.7	1.5	0.8	1.9	-
7.0	92.4	-	55.2	51.2	70.1	12.6	31.8	36.0	34.8	120.3	2.6	0.9	0.2	0.0	0.0	0.6	0.9	0.6	1.5	-
8.0	73.7	-	-	48.1	62.6	7.8	26.7	35.5	25.5	96.2	2.1	0.5	0.0	0.0	0.0	0.5	0.6	0.4	0.9	-
9.0	63.5	-	-	-	52.3	2.9	22.5	-	18.0	87.7	-	0.2	0.0	-	0.0	0.3	0.3	0.2	0.7	-

Table 43a. Light attenuation profiles for station S5 measured in µmol photons m^{-2} s^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	81.7	-	-	426.3	748.5	1458.9	1823.5	905.4
0.5	59.7	-	-	371.4	502.1	1085.6	932.3	782.4
1.0	52.8	-	-	306.9	444.1	850.2	867.6	640.8
1.5	40.4	-	-	253.2	443.1	614.7	495.3	502.1
2.0	36.2	-	-	235.9	400.0	536.3	391.6	414.7
3.0	31.1	-	-	131.0	224.6	154.9	184.3	414.0
4.0	23.6	-	-	44.5	-	-	-	-
5.0	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-

Table 43b. Light attenuation profiles for station S5 measured in µmol photons m^{-2} s^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	601.3	220.0	432.9	1073.5	1089.7	228.4	875.1	245.9	2.2	1913.9	435.6	402.7	324.2	182.5	-	282.5	41.0	619.0	101.5	187.9
0.5	276.4	56.5	261.8	916.4	301.6	61.3	513.6	175.2	1.2	1056.6	302.2	171.2	146.4	60.3	-	69.2	29.2	175.9	26.4	51.3
1.0	187.9	38.1	175.5	634.5	201.6	43.8	414.7	95.8	1.1	622.5	205.0	99.8	98.9	26.4	-	19.7	20.8	82.7	13.4	32.7
1.5	135.7	26.1	158.7	539.5	153.6	27.3	319.1	80.4	0.6	502.2	152.6	99.9	86.1	18.0	-	10.4	13.1	36.0	11.4	31.0
2.0	111.8	22.1	144.1	281.0	110.8	18.5	213.4	77.6	0.5	374.7	134.0	99.7	63.6	12.5	-	6.4	6.9	25.0	9.8	21.1
3.0	70.6	13.3	43.3	208.0	80.8	12.4	153.4	28.9	0.3	217.9	87.8	76.0	28.6	6.6	-	1.6	2.2	9.4	5.7	12.1
4.0	13.4	4.2	3.6	13.8	39.7	4.2	79.6	9.4	0.1	110.9	31.2	47.0	0.6	0.0	-		1.0	2.8	-	4.2
5.0	-	-	-	-	-	-	-	-	-	-	-	4.8	-	-	-	-	-	-	-	-
6.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 44a. Light attenuation profiles for station S6 measured in µmol photons m^{-2} s^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	48.5	847.8	-	924.0	370.5	796.2	1591.0	330.9
0.5	35.1	692.1	-	627.6	221.4	795.6	1104.2	320.4
1.0	33.9	553.9	-	406.5	171.0	709.9	936.3	221.8
1.5	29.2	462.4	-	395.9	142.8	569.6	780.3	196.9
2.0	28.3	424.6	-	333.7	121.6	531.3	640.8	183.6
3.0	24.3	347.2	-	268.0	88.9	417.7	446.0	171.9
4.0	21.5	264.1	-	231.9	82.2	338.8	401.1	163.8
5.0	19.0	217.0	-	194.4	70.6	270.6	335.7	131.2
6.0	16.4	205.0	-	189.9	57.1	219.5	251.9	122.8
7.0	14.7	120.4	-	147.5	43.5	175.2	189.5	110.5
8.0	12.2	-	-	136.1	33.6	129.1	98.8	86.8
9.0	-	-	-	103.9	24.9	-	-	61.6

Table 44b. Light attenuation profiles for station S6 measured in µmol photons m^{-2} s^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	387.8	299.1	230.6	1170.0	676.7	1251.6	474.8	1236.6	171.0	1484.8	104.0	162.1	68.8	202.7	31.2	122.7	61.5	556.9	542.8	67.4
0.5	315.6	229.5	164.5	1004.9	454.4	698.6	322.9	848.3	108.4	1179.5	65.7	83.0	34.3	64.7	10.1	34.1	31.6	131.4	309.1	51.9
1.0	226.3	164.4	165.8	832.4	412.7	458.4	248.8	703.1	60.3	769.2	47.4	61.5	22.3	31.1	6.5	17.2	19.2	63.9	210.7	29.0
1.5	164.2	143.6	152.8	713.0	331.0	322.2	205.5	526.5	49.8	617.6	45.6	42.9	21.6	18.2	4.6	9.2	14.7	38.2	128.8	21.4
2.0	129.8	114.4	148.1	542.0	265.9	319.1	133.0	354.4	40.4	387.8	42.8	84.5	24.7	9.7	3.3	6.0	11.7	26.5	93.8	16.6
3.0	103.3	86.7	146.6	391.8	209.1	103.8	87.7	215.8	30.4	243.3	30.1	58.7	23.9	7.3	1.8	3.0	7.2	14.3	56.2	8.2
4.0	60.6	65.8	145.3	368.4	166.4	67.7	61.5	195.5	21.3	130.9	21.7	41.3	21.6	6.2	0.8	1.6	4.3	7.0	31.4	1.5
5.0	68.7	57.3	130.4	362.1	114.6	52.3	39.9	161.3	15.7	79.6	16.4	31.8	11.4	5.6	0.1	0.7	2.6	3.9	21.5	1.1
6.0	54.3	52.8	109.7	341.6	54.6	21.7	26.7	119.9	12.1	61.2	13.1	25.7	7.9	4.2	0.0	0.4	1.0	1.7	13.9	0.0
7.0	45.8	40.6	103.4	239.0	30.4	13.1	13.3	95.4	9.2	47.5	10.6	18.3	6.7	3.2	0.0	0.3	0.6	0.6	7.1	0.0
8.0	30.9	21.3	-	150.8	15.2	6.6	7.8	77.6	6.4	35.4	8.3	14.8	5.4	2.5	0.0	0.1	0.2	0.2	3.3	0.0
9.0	22.3	-	-	98.6	5.1	2.3	4.0	-	4.8	29.6	5.6	13.1	4.0	-	0.0	0.0	0.0	0.1	2.3	-

Table 45a. Light attenuation profiles for station C1 measured in μmol photons m^{-2} s^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	94.6	608.1	328.5	90.5	702.4	727.2	105.8	528.5
0.5	74.9	442.0	206.8	75.8	524.4	509.1	78.3	306.9
1.0	41.6	381.1	227.6	70.4	400.5	522.5	75.5	189.8
1.5	64.5	379.6	187.1	63.1	292.0	437.2	79.6	98.9
2.0	61.2	408.0	195.1	65.7	249.6	529.9	76.6	92.3
3.0	57.2	360.8	132.6	59.6	223.2	405.7	71.4	260.0
4.0	56.4	340.9	147.4	59.4	198.0	353.1	69.4	297.8
5.0	50.9	365.7	131.1	54.9	204.1	347.2	67.4	211.4
6.0	48.6	286.3	112.6	52.8	195.6	326.5	64.9	191.0
7.0	44.1	271.8	101.6	50.3	184.5	283.2	67.8	182.6
8.0	42.3	301.8	96.1	43.7	164.0	269.9	73.1	153.9
9.0	-	-	86.8	43.6	144.1	-	-	139.0

Table 45b. Light attenuation profiles for station C1 measured in μmol photons m^{-2} s^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	741.9	-	191.3	259.0	296.8	868.7	325.0	257.5	669.8	467.8	-	-	-	-	-	-	-	-	31.1	-
0.5	608.6	-	143.9	223.3	210.9	606.1	231.1	209.9	421.2	335.8	-	-	-	-	-	-	-	-	21.6	-
1.0	514.1	-	102.1	218.5	205.8	618.5	172.4	148.3	302.7	493.5	-	-	-	-	-	-	-	-	20.4	-
1.5	510.3	-	78.4	188.9	167.7	581.2	157.2	133.5	205.5	440.3	-	-	-	-	-	-	-	-	18.4	-
2.0	462.6	-	74.9	162.0	160.8	417.7	151.2	131.2	240.6	409.8	-	-	-	-	-	-	-	-	16.6	-
3.0	404.5	-	71.0	139.5	151.5	349.9	131.2	116.6	193.4	416.2	-	-	-	-	-	-	-	-	12.5	-
4.0	418.7	-	69.4	151.4	141.1	276.8	128.8	105.7	190.9	308.5	-	-	-	-	-	-	-	-	7.2	-
5.0	323.9	-	69.4	152.6	130.0	219.5	111.2	92.5	168.5	207.3	-	-	-	-	-	-	-	-	6.9	-
6.0	289.6	-	62.9	128.1	106.0	170.0	97.2	83.2	111.1	274.4	-	-	-	-	-	-	-	-	5.9	-
7.0	245.1	-	58.2	102.3	109.3	131.0	98.1	79.9	123.6	256.1	-	-	-	-	-	-	-	-	4.4	-
8.0	210.4	-	-	101.3	93.8	95.2	87.6	73.1	102.5	253.9	-	-	-	-	-	-	-	-	3.8	-
9.0	202.9	-	-	-	88.4	80.6	86.8	-	81.7	229.1	-	-	-	-	-	-	-	-	2.9	-

Table 46a. Light attenuation profiles for station C2 measured in µmol photons m^{-2} s^{-1} during baseflow conditions in Hilo Bay, Hawaii, USA.

Depth (m)	3/14/2007	5/04/2007	6/19/2007	7/09/2007	7/31/2007	9/06/2007	10/11/2007	11/08/2007
0.0	78.4	146.6	835.4	284.0	299.6	533.4	87.3	502.8
0.5	68.9	151.7	404.2	229.4	224.2	343.1	83.5	301.8
1.0	60.9	131.9	379.8	213.8	183.2	248.0	71.0	212.6
1.5	57.8	118.6	346.3	188.8	171.4	210.2	61.9	183.6
2.0	56.3	122.7	250.4	187.6	148.0	191.7	53.3	134.5
3.0	49.2	125.5	235.3	186.6	122.1	166.7	49.3	117.3
4.0	46.7	116.4	212.3	133.8	146.6	146.1	45.2	89.6
5.0	43.2	105.8	202.4	121.7	154.0	135.2	41.2	88.5
6.0	40.8	96.0	165.8	133.4	140.4	131.5	32.8	84.0
7.0	36.4	92.2	163.6	115.8	130.7	-	29.2	65.9
8.0	29.8	83.4	139.1	100.1	101.7	-	27.3	65.4
9.0	-	-	121.1	92.9	-	-	-	51.1

Table 46b. Light attenuation profiles for station C2 measured in µmol photons m^{-2} s^{-1} during storm conditions in Hilo Bay, Hawaii, USA.

Depth (m)	1/11/2007	1/12/2007	1/13/2007	1/14/2007	1/15/2007	3/02/2007	3/03/2007	3/04/2007	3/05/2007	3/06/2007	12/13/2007	12/14/2007	12/15/2007	12/16/2007	12/17/2007	1/28/2008	1/29/2008	1/30/2008	1/31/2008	2/01/2008
0.0	241.0	199.6	405.9	155.9	118.2	355.1	171.1	75.4	229.3	885.1	-	-	-	-	-	-	-	-	14.6	-
0.5	179.2	202.6	202.7	114.9	74.9	160.8	114.6	55.5	162.6	745.9	-	-	-	-	-	-	-	-	9.8	-
1.0	145.1	266.3	209.8	84.7	33.5	159.7	98.4	57.5	128.1	584.2	-	-	-	-	-	-	-	-	8.8	-
1.5	123.7	196.4	272.6	90.5	34.3	143.3	99.6	51.6	135.6	426.7	-	-	-	-	-	-	-	-	9.9	-
2.0	110.6	144.7	286.2	94.6	50.0	174.7	88.5	55.9	106.3	511.3	-	-	-	-	-	-	-	-	9.3	-
3.0	104.1	106.9	254.3	87.2	49.6	152.1	73.1	54.2	93.6	364.5	-	-	-	-	-	-	-	-	7.8	-
4.0	87.2	118.1	220.5	83.1	46.2	117.4	68.7	49.2	83.0	272.5	-	-	-	-	-	-	-	-	6.7	-
5.0	79.7	126.6	206.5	81.1	40.6	88.4	65.6	46.8	78.2	307.3	-	-	-	-	-	-	-	-	5.9	-
6.0	69.3	53.8	173.5	74.7	37.9	59.0	56.9	42.8	65.7	289.4	-	-	-	-	-	-	-	-	5.2	-
7.0	61.9	118.9	156.5	66.1	36.3	41.1	47.5	40.7	64.3	280.5	-	-	-	-	-	-	-	-	4.3	-
8.0	56.6	110.6	-	59.6	34.5	32.6	43.6	35.9	61.3	260.2	-	-	-	-	-	-	-	-	3.6	-
9.0	48.5	93.6	-	-	33.1	24.3	39.4	-	47.1	178.9	-	-	-	-	-	-	-	-	2.9	-