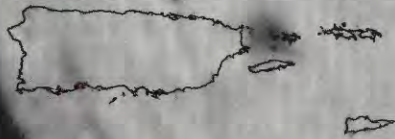


**STORM-TIDE ELEVATIONS CAUSED
BY HURRICANE HUGO ON THE
U.S. VIRGIN ISLANDS AND
PUERTO RICO, SEPTEMBER 18, 1989**



U.S. GEOLOGICAL SURVEY

Open-File Report 92-87

Storm-Tide Elevations Caused by Hurricane Hugo on the U.S. Virgin Islands and Puerto Rico, September 18, 1989

By Heriberto Torres-Sierra

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CONVERSION FACTORS AND ACRONYMS

	Multiply	By	To obtain
	inch	25.4	meter
	foot	0.3048	meter
	mile	1.609	kilometer
	mile per hour	1.609	kilometer per hour
	acre	0.4047	hectare

Acronyms used in this report:

NOS	National Ocean Service
USCGS	United States Coastal and Geodetic Survey
USGS	United States Geological Survey

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ABSTRACT

In September 1989, Hurricane Hugo, a very powerful and destructive hurricane that had winds in excess of 130 miles per hour, hit the U.S. Virgin Islands and Puerto Rico. This hurricane was one of the most destructive storms to hit the Caribbean in the 20th century. Although rainfall totals associated with this storm were relatively low (4 to 10 inches in most affected areas), high winds and storm-surge flooding along the coastal areas caused severe damage. St. Croix in the U.S. Virgin Islands was particularly hard hit; 65 percent of the buildings were destroyed and another 30 percent damaged. The maximum storm-tide elevations measured were 13.0 feet above mean sea level on St. Croix, and 13.5 feet above mean sea level near Mameyal, Puerto Rico. Although estimates of the loss of life and damage that can be attributed directly to the hurricane vary, at least five people lost their lives and damage was estimated at \$2 billion (National Oceanic and Atmospheric Administration, 1990).

INTRODUCTION

On September 18, 1989, Hurricane Hugo, a very powerful and destructive hurricane, hit the U.S. Virgin Islands and Puerto Rico. This hurricane was one of the most destructive storms of the 12 major hurricanes that have hit the area since the late 1800's (table 1). In the weeks that followed the passage of Hurricane Hugo through the Caribbean Sea, the U.S. Geological Survey (USGS) collected data on the storm-tide elevations

caused by this storm. This report presents storm-tide elevation data collected at sites on the islands of St. Croix, St. Thomas, and St. John, U.S. Virgin Islands; on the islands of Culebra and Vieques, Puerto Rico; and along the northeastern coast of Puerto Rico. The data presented here can be useful in guiding future development in these areas and in comparing the storm-tide elevations of past and future hurricanes. The location and elevation of high-water marks caused by storm tides produced by Hurricane Hugo are shown on a series of topographic quadrangle maps along with locations and elevations of reference marks and bench marks used in surveying the elevations of high-water marks (plates 1–16). The storm-tide elevations produced by Hurricane Hugo on the South Carolina coast of the eastern United States have been reported by Schuck-Kolben (1990).

PATH OF HURRICANE HUGO

On September 13, tropical storm Hugo, located in the middle of the Atlantic Ocean at about 13°N. latitude and 38°W. longitude (fig. 1), was upgraded to hurricane status having wind speed of 75 miles per hour (mi/hr). Over the next 4 days, the hurricane continued its westward movement and gained strength over the open water of the Atlantic Ocean. Hurricane Hugo, now a powerful category 4 hurricane (wind speeds 131–155 mi/hr), continued along a 750-mile stretch of the Lesser Antilles on Sunday, September 17, and passed over St. Croix between 4 a.m. and 5 a.m., Atlantic standard time, on Monday, September 18 (fig. 2). Traveling in a west-northwest direction and passing over the island of Vieques, Hurricane Hugo brushed the eastern coast of Puerto Rico at 8 a.m., Atlantic standard time, and had maximum sustained winds of 104 mi/hr, gusts of

Table 1. Chronology of major hurricanes in U.S. Virgin Islands, 1867–1989, and in Puerto Rico, 1899–1989

Date	Area affected	Remarks
U.S. Virgin Islands		
October 29, 1867	St. Thomas	Hurricane. Maximum wind speed, 170 miles per hour; lowest barometric pressure, 27.95 inches. Deaths, 600.
October 9, 1916	St. Thomas	Hurricane. Wind gusts, 160 miles per hour; lowest barometric pressure, 28.10 inches. Charlotte Amalie, Frenchtown, and Harry S. Truman Airport severely flooded.
August 28–29, 1924	St. Thomas, St. Croix	Hurricane. Maximum wind speed, 143 miles per hour; maximum 24-hour rainfall, 5.7 inches on St. Croix; and lowest barometric pressure, 28.56 inches. Numerous lives lost.
September 12–14, 1928	St. Croix	Hurricane. Maximum wind speed, 130 miles per hour on St. Thomas; maximum 3-day rainfall, 16.6 inches in Christiansted; and lowest barometric pressure, 29.80 inches. Substantial loss of life and substantial damage.
August 6–7, 1955	St. Thomas	Hurricane Connie. Maximum wind speed, 71 miles per hour; maximum 24-hour rainfall, 7.0 inches in Charlotte Amalie. Deaths, 3.
August 11–12, 1956	St. Croix	Hurricane Betsy, 30 miles south of St. Croix. Maximum wind speed, 86 miles per hour; maximum 24-hour rainfall, 4.7 inches in St. Croix. Damage, \$30,000.
August 29–31, 1979	St. Thomas, St. John, St. Croix	Hurricane David. Maximum wind speed, 54 miles per hour on St. Croix; rainfall 15 inches in 3 days.
September 18, 1989	St. Thomas, St. John, St. Croix	Hurricane Hugo. Maximum wind speed, 140 miles per hour; 20,000 people homeless; deaths, 3; damage, \$1.3 billion.
Puerto Rico		
August 8, 1899	Islandwide	Hurricane San Ciriaco. Wind speed, 104 miles per hour; 24-hour rainfall, 23 inches. Deaths, 3,000; damage, \$35 million.
September 13, 1928	Islandwide	Hurricane San Felipe II. Wind speed 160 miles per hour, barometric pressure 27.5 inches. Deaths, 300; damage, \$50–\$85 million.
September 26, 1932	Islandwide	Hurricane San Ciprian. Wind speed, 115 miles per hour; 40,000 homes destroyed; 70,000 families homeless. Deaths, 300; damage, \$30 million.
September 6, 1960	Eastern Puerto Rico	Hurricane Donna. Maximum 24-hour rainfall, about 19 inches; 484 homes destroyed. Deaths, 107; damage, \$7.5 million.
September 16, 1975	Southwestern Puerto Rico	Hurricane Eloise. Maximum 24-hour rainfall at Maricao, 23 inches; 15 bridges destroyed. Deaths, 34; damage, \$125 million.
August 29–31, 1979	Eastern, southern, and northern Puerto Rico	Hurricane David. Wind speed, 75 miles per hour; rainfall of 20 inches in 3 days; 800 homes destroyed and 8,000 damaged. Damage, \$125 million.
September 18, 1989	Eastern Puerto Rico	Hurricane Hugo. Maximum wind speed, 125 miles per hour; barometric pressure, 27.9; 13,000 people homeless. Deaths, 2; damage, \$1 billion.

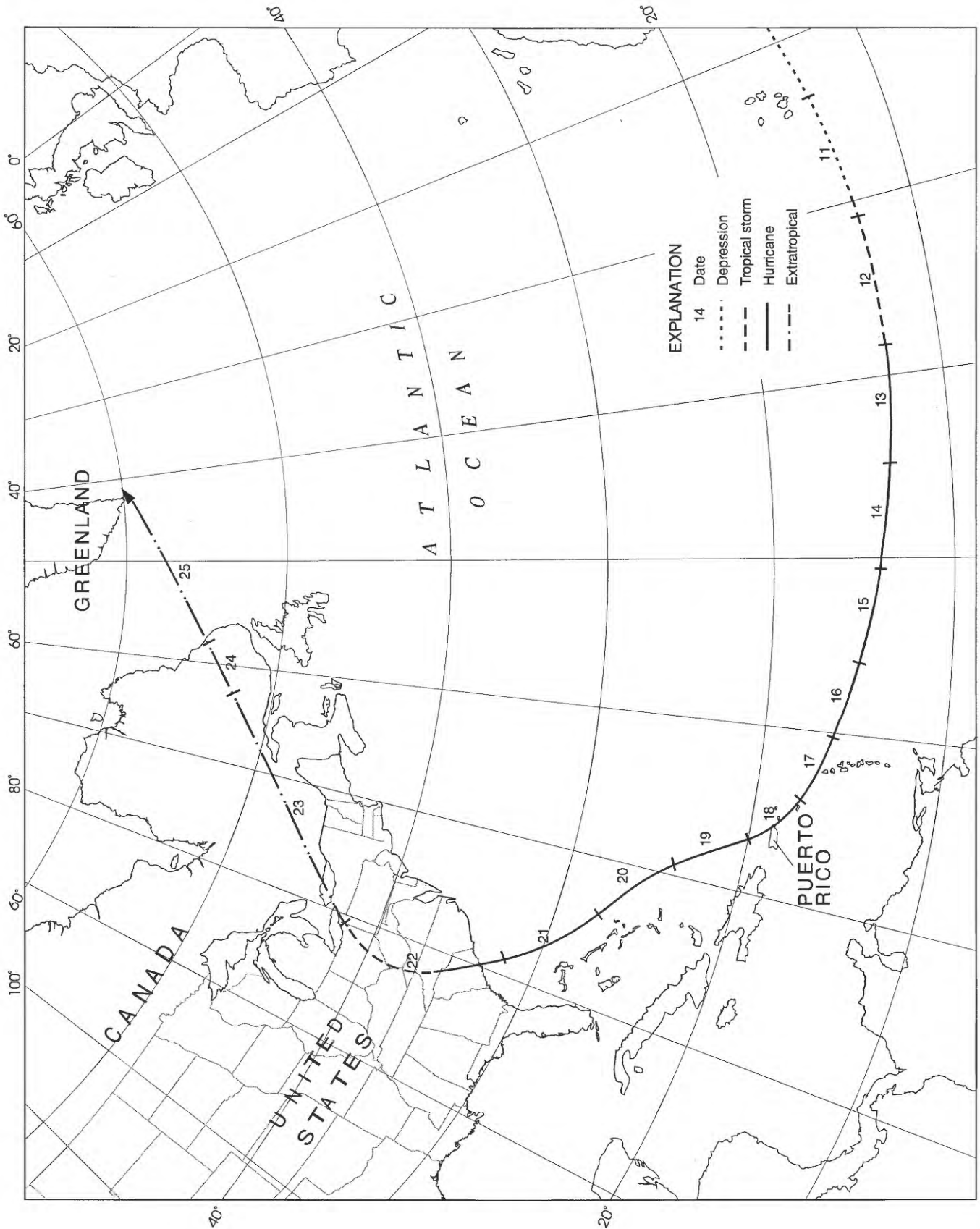


Figure 1. Track of Hurricane Hugo across the Atlantic Ocean and North America, September 1989. (Source: Modified from National Oceanic and Atmospheric Administration, 1989.)

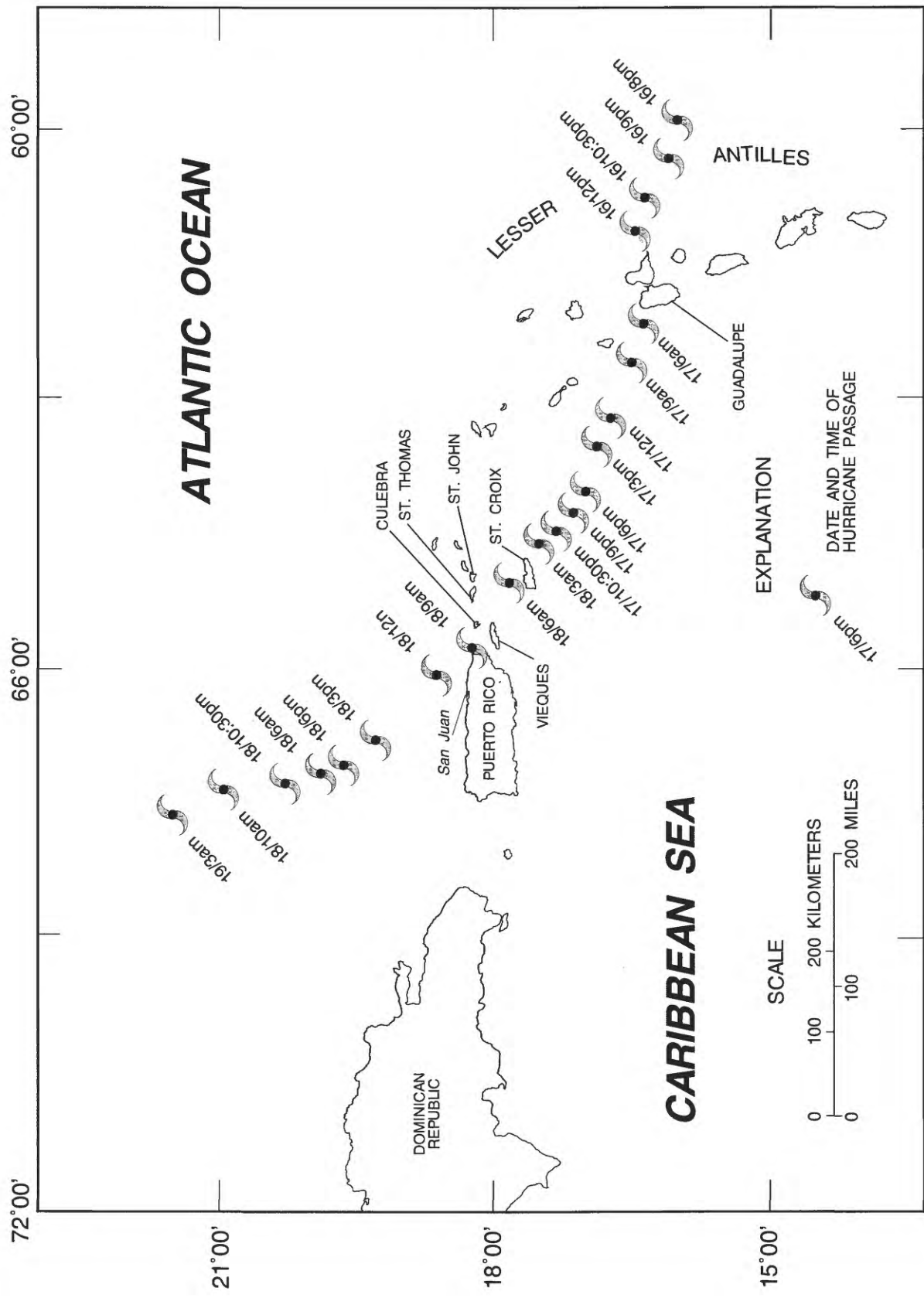


Figure 2. Track of Hurricane Hugo across the islands of the Caribbean Sea, September 1989.

120 mi/hr, and an atmospheric pressure in the eye of the storm of 946 millibars (27.94 inches of mercury). By noon, Hurricane Hugo, with maximum sustained winds of 125 mi/hr and minimum sea level pressure of 957 millibars (28.26 inches of mercury), was north of San Juan, Puerto Rico. San Juan experienced maximum sustained winds of 77 mi/hr with gusts to 92 mi/hr and a barometric pressure of 972 millibars (28.72 inches of mercury) at about 10 a.m.

Some of Hurricane Hugo's energy was dissipated as it passed over the eastern coast of Puerto Rico, and the storm was downgraded to a category 2 hurricane (wind speeds 96–110 mi/hr). By late Tuesday, September 19, Hurricane Hugo had weakened from land friction in the islands; but, as it moved over water, in a northwesterly direction toward the mainland of the United States, it regained strength.

By late Thursday, September 21, Hurricane Hugo had regained enough strength to be upgraded again to a category 4 hurricane. It was about 180 miles in diameter and had winds in excess of 135 mi/hr (Jarvinen, 1989). Early on Friday morning, September 22, at 1:05 a.m., eastern daylight time, Hurricane Hugo made landfall on the South Carolina coast. The estimated maximum sustained wind speed at the time of landfall was 138 mi/hr, and the estimated minimum central pressure was 934 millibars (27.58 inches of mercury) (Purvis, 1989).

Hurricane Hugo passed through South Carolina and into North Carolina, where it was downgraded to a tropical storm. The storm then moved through the eastern United States, where it was reclassified as an extratropical storm. It then passed through Canada and moved back over the North Atlantic Ocean and finally dissipated near Greenland on September 26 (fig. 1).

EFFECTS OF HURRICANE HUGO

Damage to the U.S. Virgin Islands and Puerto Rico from Hurricane Hugo was extensive, and has been estimated at \$2 billion (National Oceanic and Atmospheric Administration, 1990). A summary of the effects of Hurricane Hugo on the U.S. Virgin Islands and Puerto Rico is presented in the following sections.

U.S. Virgin Islands

Rainfall data for the U.S. Virgin Islands are scarce because no data were recovered from recording raingages on St. Thomas or St. Croix, and only one raingage was operational on St. John. At St. John's gage, a maximum of 10.3 inches of rain fell during the 2-day period ending at 8 a.m. on September 19. Although rain caused local flooding in the islands, rainfall totals associated with Hurricane Hugo generally were small in comparison with rainfall total commonly associated with hurricanes. Most of the flood damage in the U.S. Virgin Islands occurred in coastal areas and was the result of tidal flooding. High water levels resulting from a combination of normal (predicted) tide, storm surge, and wave action ranged from about 13.0 feet above mean sea level on St. Croix to 3.6 feet above mean sea level on St. Thomas.

Damage from Hurricane Hugo was severe throughout the U.S. Virgin Islands, particularly on St. Croix, where about 65 percent of the buildings were destroyed and about 20,000 people were left homeless. All marina and dock facilities and hundreds of boats were damaged or destroyed, hospitals were destroyed, roads were made impassable, the airport was heavily damaged, and all public utility services were disrupted. About 90 percent of all powerlines on the island were downed by the storm, two of the three desalination units were disabled, one 10 million-gallon water storage tank was destroyed and another severely damaged, and the sewage treatment system was disabled. High winds stripped leaves from trees and bushes and toppled trees, and saltwater burned grass and killed bushes. Restoration of public services on St. Croix was slow. In some areas, water-supply systems disrupted by the storm were not returned to normal service for several months.

St. Thomas and St. John also received substantial storm damage, particularly along their southern coasts. Waterfront areas and harbors on St. Thomas were damaged heavily by extensive flooding and high winds.

Puerto Rico

In eastern Puerto Rico, rainfall associated with the passage of Hurricane Hugo exceeded 10 inches near Naguabo; more than 9 inches of that total fell during a 24-hour period. Rainfall amounts and intensities were

substantially less than those associated with other large hurricanes, such as San Felipe in 1928, which produced rainfall totals of about 25 inches. Based on historical records of rainfall (U.S. Weather Bureau, 1961), Hurricane Hugo's recorded maximum rainfall intensities of 1-, 2-, and 3-hour durations had recurrence intervals of less than 5 years, although inland flooding occurred along some small streams.

High water levels along the eastern and northern coasts of Puerto Rico and the coasts of Puerto Rico's offshore islands, Vieques and Culebra, generally ranged between 4 and 10 feet above mean sea level but exceeded 13 feet at Mameyal (plate 1). At San Juan, the maximum storm surge occurred at 10:30 a.m., Atlantic standard time, about 30 minutes before the predicted high tide (Richard Webb, U.S. Geological Survey, oral commun., 1991). Coastal flooding occurred in some beaches and low-lying areas where land-surface elevations are less than 10 feet above mean sea level. In some of these areas, sand was removed from the beach and redeposited in overwash fans. The overwash in the area of Laguna de Piñones, east of San Juan, penetrated the mangrove lagoon more than 700 feet inland, and about 650,000 cubic yards of sand were deposited behind the dune line (Rodríguez and Webb, 1990). Along much of the coast, however, the effects of coastal flooding were limited by the geologic and physiographic setting of the Island. According to coastal geologist David Bush (1989) of Duke University, the narrow continental shelf accounted for the relatively small storm surge, and the rocky coastline provided protection against waves. The relatively high and steep shoreline also provided higher sites where many structures remained above the storm surge.

The tropical rain forest of Puerto Rico also was severely damaged. The Caribbean National Forest, which is located in the Sierra de Luquillo range in the north-eastern part of the Island (plate 6), has been managed by the U.S. Forest Service since 1917 and was designated a United Nations Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve in 1976. The forest, which ranges from about 330 to 3,500 feet above mean sea level and covers an area of 28,000 acres, includes subtropical wet forests, subtropical rain forests, lower montane wet forests, and lower montane rain forests (Brown and others, 1983). About 97 percent of

the trees in the Bisley Watersheds, a subtropical wet forest, were damaged or destroyed by wind (Fred Scatena, U.S. Forest Service, oral commun., February 1991). Not since Hurricane San Ciprian in 1932 has a hurricane caused such severe damage to Puerto Rico's tropical rain forest.

The area in and around the Caribbean National Forest, where rainfall amounts and intensities were high, was also the site of more than 400 shallow landslides on the steep and highly dissected mountain slopes (Larsen, 1990). Half of the landslides occurred where highways were constructed and along road cuts; the other half occurred on slopes that were without human modification. About 50 percent of all the landslides were shallow soil slips, 25 percent were debris flows, and the remainder were slumps and rockfalls. The largest observed landslide was 430 feet long and 70 feet wide. This landslide moved about 30,000 cubic yards of soil and rock 2,000 feet downslope into a river. According to an eyewitness, it occurred 3 days after the hurricane.

Drastic changes in water quality were associated with the storm, and many fish and shellfish perished. Although it is not known which factors most affected these marine animals, the physical disruption of the shoreline by the storm and freshwater flowing into the lagoons as a result of the heavy rains disturbed aquatic habitats and changed concentrations of dissolved oxygen, dissolved solids, dissolved sulfide, and other constituents in the water.

Homes and buildings in eastern and northeastern Puerto Rico and on Vieques and Culebra were severely damaged as a result of high winds. More than 13,000 people were left homeless, and electric power and public water-supply distribution systems were heavily damaged. Two deaths were directly attributed to the hurricane, and six employees of the power authority were killed during repair of downed powerlines.

VERTICAL DATUM

The vertical datum used for this study is local mean sea level derived by the U.S. Coast and Geodetic Survey (USCGS), which is now named the National Ocean Service (NOS). The local mean sea level, which varies with time and distance along the coastline, is the average,

over selected time periods, of the midpoints in elevation between mean higher-high water (MHHW) and mean lower-low water (MLLW). The mean tide level (MTL) established by the U.S. Department of Commerce, NOS, is physically the same as the local mean sea level of the USCGS, but is referenced to MLLW datum. That is, the MTL is the elevation of the local mean sea level above the MLLW. The MLLW datum, also called the chart datum, is used by the NOS to minimize the reporting of negative values in predicting tide elevations (U.S. Department of Commerce, 1988).

All of the study area has bench marks established by both the NOS and the USGS based on local mean sea level datum except for the Island of Culebra. For this study, local mean sea level was established for Culebra using techniques described in the section “Storm-Tide Elevations.”

STORM-TIDE ELEVATIONS

Immediately after the storm, the USGS sent crews to the coastal regions to investigate and survey the maximum water-surface elevations caused by the storm tide. High-water marks were located and marked. A description of each mark, which included a detailed description of its location, the type of mark (seedline, washline, driftline, stainline), and an assessment of the quality of the mark was prepared. The quality of each mark was assigned a category for interpretation of the storm-tide elevation as follows:

- Excellent—A level, extremely well-defined line of densely accumulated fine debris (or a distinct stain). Reliable to ± 0.05 foot.
- Good—A level, well-defined line of densely accumulated fine debris (or a distinct stain). Reliable to ± 0.10 foot.
- Fair—A level, but less distinct band of fine or coarse debris (or stain). Reliable to within ± 0.25 foot.
- Poor—A poorly defined band of sparsely accumulated coarse debris that may undulate due to surface wave action. Other examples include a discontinuous scatter of coarse debris on a structure, a coarse groundline of heavy-vegetative drift, or debris hung up in the branches of a tree.

Uncertainty in true elevation greater than about 0.25 foot.

The best high-water marks for indication of maximum stillwater storm-tide elevation generally were found inside buildings or other locations where wave action was dampened. Outside marks are sometimes of poorer quality because of wave action or, in the case of debris lines, distortion by high winds.

After each storm-tide high-water mark was located and assigned a quality rating, the elevation of the mark was determined. Most elevations were determined by using conventional direct leveling equipment and vertical control stations (bench marks) established by the NOS and the USGS.

On the Island of Culebra, bench marks referenced to mean sea level were not available. The high-water marks were referenced to local sea level at the time of the survey and the date and time of the survey were noted. The normal predicted tide data from the NOS tables (U.S. Department of Commerce, 1988) were used to estimate the departure from estimated “mean” tide level at the location and time of the survey for each high-water mark. Using this computed departure, each high-water mark elevation was then adjusted to “mean” sea level datum. The tidal variation during the time of the leveling (November 6–8, 1989) was 0.7 feet. The maximum adjustment to storm-tide elevation made using this procedure was 0.4 feet.

The high-water mark elevations are shown on the topographic quadrangle maps. The maps are identified on figure 3 and presented as plates 1–16. Descriptions of the high-water marks are given in table 2 (at end of report). Descriptions of the survey marks (reference marks and bench marks) used to determine the mean sea level elevations of the high-water marks are given in table 3 (at end of report). The survey-mark elevations are also shown on the topographic quadrangle maps (plates 1–16).

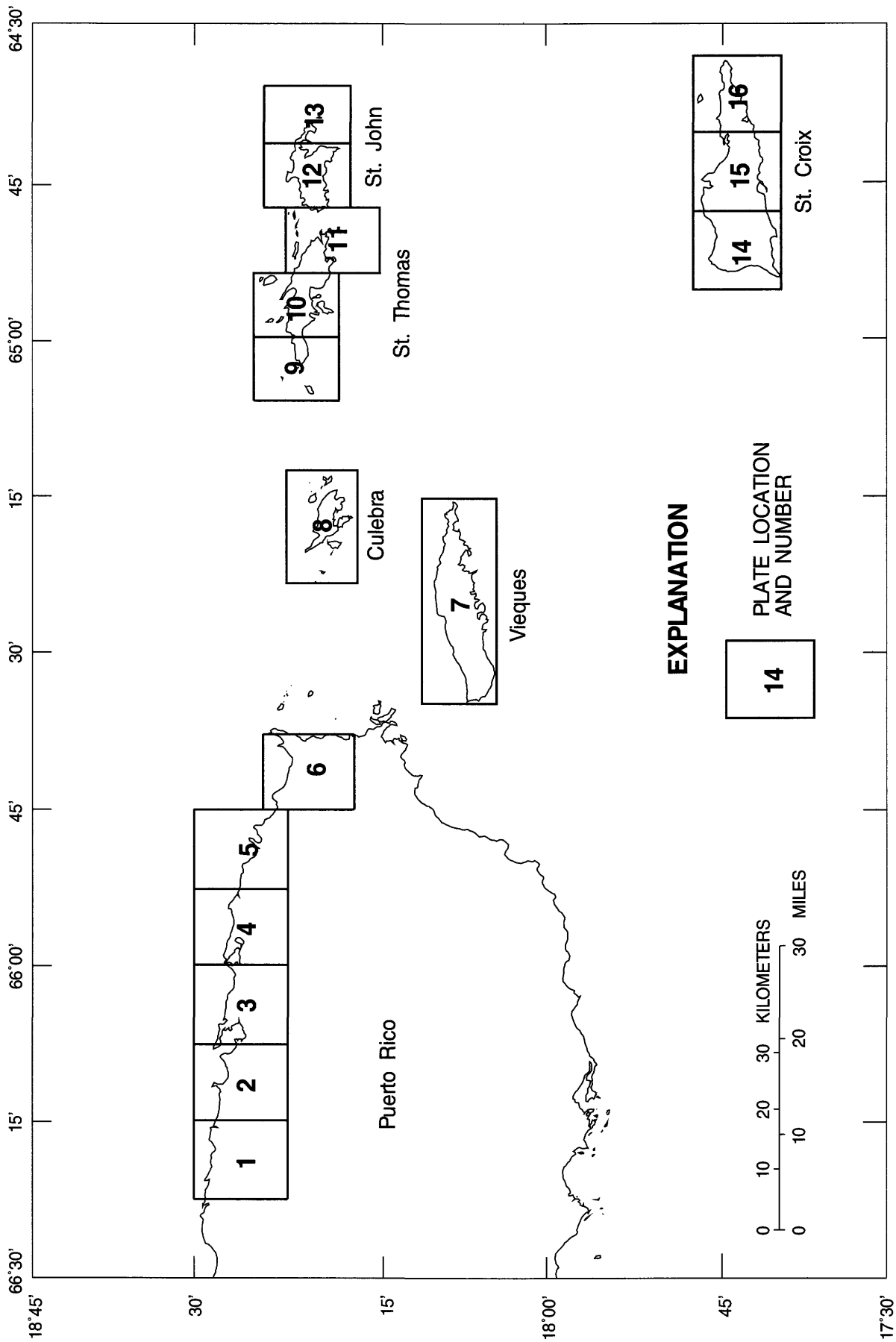


Figure 3. Study area and quadrangles for which high-water mark and survey-mark elevations are shown.

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Table 2. Descriptions of high-water marks

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
Northeast coast of Puerto Rico mainland								
1	Vega Alta	1	Cerro Gordo	18°29'06"	66°20'20"	Driftline	1	7.2
1	Vega Alta	2	Breñas	18°28'37"	66°18'54"	Driftline	1	4.7
1	Vega Alta	3	Punta Fraile	18°28'41"	66°16'44"	Stainline ¹	1	6.2
1	Vega Alta	4	Mameyal	18°28'48"	66°15'47"	Driftline	1	13.5
2	Bayamón	5	Mameyal	18°28'12"	66°14'10"	Driftline	1	10.0
2	Bayamón	6	Punta Corozo	18°28'12"	66°12'00"	Washline	1	9.1
2	Bayamón	7	Levittown	18°27'43"	66°11'02"	Driftline	1	8.7
2	Bayamón	8	Levittown	18°27'11"	66°09'54"	Driftline	1	9.4
2	Bayamón	9	Isla de Cabras	18°28'26"	66°08'10"	Driftline	1	8.5
2	Bayamón	10	Bay View	18°26'42"	66°07'41"	Driftline	1	5.9
3	San Juan	11	Cataño	18°26'46"	66°06'50"	Seedline	1	6.0
3	San Juan	12	Punta del Morro	18°28'19"	66°07'05"	Washline	1	8.8
3	San Juan	13	Punta Escambrón	18°28'05"	66°05'35"	Driftline	1	11.6
3	San Juan	14	Laguna del Condado	18°27'43"	66°04'55"	Driftline	1	5.5
3	San Juan	15	Condado	18°27'36"	66°04'26"	Driftline	1	10.8
3	San Juan	16	Ocean Park	18°27'25"	66°03'29"	Driftline	1	10.0
3	San Juan	17	Punta Las Marías	18°27'25"	66°02'24"	Driftline	1	8.2
3	San Juan	18	Isla Verde	18°26'46"	66°01'19"	Driftline	1	7.4
3	San Juan	19	Balneario Isla Verde	18°26'53"	66°00'04"	Driftline	1	8.0
3	San Juan	20	Los Angeles	18°25'44"	66°00'58"	Driftline	1	5.1

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
Northeast coast of Puerto Rico mainland								
4	Carolina	21	Balneario Isla Verde	18°27'32"	65°59'42"	Driftline	1	7.4
4	Carolina	22	Punta Cangrejos	18°27'58"	65°59'17"	Sandline	1	12.9
4	Carolina	23	Punta Maldonado	18°27'54"	65°58'41"	Driftline	1	12.3
4	Carolina	24	La Torre	18°27'40"	65°58'19"	Driftline	1	8.6
4	Carolina	25	Playa de las Tres Palmitas	18°27'18"	65°55'58"	Driftline	1	11.6
4	Carolina	26	Arenas	18°27'32"	65°53'53"	Driftline	1	10.2
4	Carolina	27	Arenas	18°27'11"	65°53'20"	Driftline	1	10.1
5	Río Grande	28	Punta Iglesia	18°26'10"	65°51'29"	Driftline	1	8.0
5	Río Grande	29	Las Carreras	18°25'52"	65°50'20"	Driftline	1	7.6
5	Río Grande	30	Boca Herrera	18°26'26"	65°49'44"	Driftline	1	6.3
5	Río Grande	31	Punta San Agustín	18°24'43"	65°49'01"	Driftline	1	9.8
5	Río Grande	32	Punta Miquillo	18°25'12"	65°47'42"	Driftline	1	6.4
5	Río Grande	33	Punta Picúa	18°24'36"	65°46'16"	Driftline	1	3.7
6	Fajardo	34	Fortuna	18°22'52"	65°44'24"	Driftline	1	8.2
6	Fajardo	35	Playa de Luquillo	18°23'02"	65°43'59"	Driftline	1	7.8
6	Fajardo	36	Luquillo	18°22'34"	65°42'47"	Driftline	1	9.0
6	Fajardo	37	San Miguel	18°22'05"	65°41'20"	Driftline	1	9.9
6	Fajardo	38	Bahía Las Cabezas	18°22'16"	65°38'10"	Driftline	1	7.2
6	Fajardo	39	Playa Sardinera	18°20'49"	65°38'13"	Driftline	1	9.9

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
Northeast coast of Puerto Rico mainland								
6	Fajardo	40	Playa de Fajardo	18°20'06"	65°37'59"	Driftline	1	4.4
6	Fajardo	41	Bahía Demajagua	18°17'35"	65°38'10"	Driftline	1	5.2
Vieques Island, Puerto Rico								
7	Isla de Vieques	1	Hacienda Arcadia	18°07'13"	65°32'58"	Driftline	1	8.0
7	Isla de Vieques	2	Hacienda Arcadia	18°07'35"	65°31'52"	Driftline	1	8.4
7	Isla de Vieques	3	Hacienda Arcadia	18°07'44"	65°31'28"	Driftline	1	9.2
7	Isla de Vieques	4	Hacienda Arcadia	18°07'46"	65°31'03"	Driftline	1	9.1
7	Isla de Vieques	5	Punta Caballo	18°08'02"	65°30'21"	Driftline	1	9.0
7	Isla de Vieques	6	Punta Caballo	18°08'06"	65°30'00"	Driftline	1	9.3
7	Isla de Vieques	7	Aeropuerto de Vieques	18°08'26"	65°29'02"	Driftline	1	9.5
7	Isla de Vieques	8	Punta Martineau	18°08'43"	65°28'05"	Driftline	1	12.4
7	Isla de Vieques	9	Isabel Segunda	18°08'48"	65°27'29"	Driftline	1	11.0
7	Isla de Vieques	10	Santa María	18°09'37"	65°25'31"	Driftline	1	9.0
7	Isla de Vieques	11	Playa Grande	18°09'32"	65°22'30"	Driftline	1	10.6
7	Isla de Vieques	12	Punta Brigadier	18°09'25"	65°21'52"	Driftline	1	8.2
7	Isla de Vieques	13	Punta Goleta	18°09'05"	65°20'33"	Driftlines	2	11.8
7	Isla de Vieques	14	Cerro Farallón	18°08'54"	65°19'48"	Driftline	1	7.4
7	Isla de Vieques	15	Punta Icacos	18°08'48"	65°18'33"	Driftlines	3	10.2

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
Vieques Island, Puerto Rico								
7	Isla de Vieques	16	Punta Gato	18°08'38"	65°17'47"	Driftline	1	7.3
7	Isla de Vieques	17	Punta Este	18°08'09"	65°16'31"	Driftline	1	8.4
7	Isla de Vieques	18	Cerro Indio	18°08'04"	65°16'47"	Driftline	1	7.1
7	Isla de Vieques	19	Laguna Anones	18°08'16"	65°18'01"	Driftline	1	7.9
7	Isla de Vieques	20	Mount Jalobre	18°07'56"	65°18'40"	Driftline	1	7.0
7	Isla de Vieques	21	Mount Jalobre	18°07'40"	65°18'56"	Driftline	1	11.0
7	Isla de Vieques	22	Mount Jalobre	18°07'45"	65°19'14"	Driftline	1	9.8
7	Isla de Vieques	23	Punta Matías	18°07'41"	65°19'30"	Driftline	1	11.5
7	Isla de Vieques	24	Punta Matías	18°07'38"	65°19'51"	Driftline	1	6.0
7	Isla de Vieques	25	Laguna Yanuel	18°07'38"	65°22'11"	Driftline	1	8.2
7	Isla de Vieques	26	Punta Conejo	18°06'52"	65°23'29"	Driftline	1	5.1
7	Isla de Vieques	27	Cerro Caracas	18°06'38"	65°24'47"	Driftline	1	7.4
7	Isla de Vieques	28	Esperanza	18°05'55"	65°27'55"	Driftline	1	9.7
7	Isla de Vieques	29	Esperanza	18°05'55"	65°28'56"	Driftline	1	6.6
7	Isla de Vieques	30	Laguna Playa Grande	18°05'42"	65°30'15"	Driftlines	2	11.2
7	Isla de Vieques	31	Laguna Playa Grande	18°05'27"	65°30'54"	Driftline	1	8.8
7	Isla de Vieques	32	Punta Boca Quebrada	18°06'03"	65°34'17"	Driftline	1	9.0
7	Isla de Vieques	33	Punta Boca Quebrada	18°06'09"	65°34'22"	Driftline	1	5.7
7	Isla de Vieques	34	Punta Boca Quebrada	18°06'12"	65°34'28"	Driftline	1	10.8

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
Culebra Island, Puerto Rico								
8	Culebra and adjacent islands	1	Península Flamenco	18°20'23"	65°19'50"	Not described	1	7.6
8	Culebra and adjacent islands	2	Península Flamenco	18°19'57"	65°19'23"	Not described	1	8.5
8	Culebra and adjacent islands	3	Playa Larga	18°19'20"	65°15'28"	Not described	1	7.6
8	Culebra and adjacent islands	4	Cabeza de Perro	18°18'31"	65°14'45"	Not described	1	6.9
8	Culebra and adjacent islands	5	Cabeza de Perro	18°18'30"	65°15'07"	Not described	1	7.1
8	Culebra and adjacent islands	6	Playa Manzanilla	18°18'07"	65°15'44"	Not described	1	9.1
8	Culebra and adjacent islands	7	Punta Cabras	18°18'35"	65°16'53"	Not described	1	5.4
8	Culebra and adjacent islands	8	Cayo Verde	18°18'47"	65°17'59"	Not described	1	4.5
8	Culebra and adjacent islands	9	Playa Sardinias II	18°18'10"	65°17'31"	Not described	1	6.5
8	Culebra and adjacent islands	10	Playa Sardinias II	18°17'38"	65°17'24"	Not described	1	4.9
8	Culebra and adjacent islands	11	Playa Sardinias II	18°17'05"	65°17'12"	Not described	1	7.9
8	Culebra and adjacent islands	12	Playa Sardinias II	18°17'50"	65°18'01"	Not described	1	9.8

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
Culebra Island, Puerto Rico								
8	Culebra and adjacent islands	13	Playa de Sardinas	18° 18'16"	65° 18'29"	Not described	1	7.4
8	Culebra and adjacent islands	14	Punta Tamarindo	18° 19'16"	65° 19'07"	Not described	2	11.3
St. Thomas, U.S. Virgin Islands								
9	Western St. Thomas	10	Krabbepan Pt.	18° 20'50"	65° 00'58"	Driftlines	4	6.6
10	Central St. Thomas	1	Pearson Gardens	18° 20'13"	64° 55'10"	Seedline excellent	1	5.7
10	Central St. Thomas	2	Fredericksberg Pt.	18° 20'23"	64° 55'32"	Seedline	1	6.0
10	Central St. Thomas	3	Kings Wharf	18° 20'29"	64° 55'49"	Seedlines ² good to excellent	4	6.1
10	Central St. Thomas	4	Frenchtown	18° 20'28"	64° 15'58"	Seedline excellent	1	4.4
10	Central St. Thomas	5	Altona	18° 20'17"	64° 53'56"	Seedlines	2	3.7
10	Central St. Thomas	6	Haypiece Hill	18° 19'55"	64° 19'55"	Driftlines poor to good	4	4.6
10	Central St. Thomas	7	Sara Hill	18° 20'12"	64° 57'50"	Seedline excellent	1	5.8
10	Central St. Thomas	8	Harry S. Truman Airport	18° 20'17"	64° 58'05"	Seedline excellent	1	5.9

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
St. Thomas, U.S. Virgin Islands								
10	Central St. Thomas	9	Adelphi	18°20'48"	64°58'43"	Seedlines and driftlines poor to good	5	9.7
10	Central St. Thomas	11	Ensomned	18°22'15"	64°57'08"	Driftline	1	6.2
10	Central St. Thomas	12	Enighed	18°22'15"	64°55'19"	Driftlines	2	5.5
11	Eastern St. Thomas	13	Coki Pt.	18°21'04"	64°51'57"	Driftlines	2	4.2
11	Eastern St. Thomas	14	Prettyklip Pt.	18°20'14"	64°51'06"	Sandlines and driftlines; poor	3	6.3
11	Eastern St. Thomas	15	Virgin Islands National Park	18°19'33"	64°50'59"	Seedline and driftline; good	2	3.6
11	Eastern St. Thomas	16	Benner	18°19'14"	64°52'01"	Stainlines ¹	2	3.6
11	Eastern St. Thomas	17	Coculus Pt.	18°18'51"	64°53'52"	Seedlines and driftlines poor to good	4	8.6
St. John, U.S. Virgin Islands								
12	Western St. John	1	Cruz Bay	18°20'02"	64°47'38"	Driftlines fair to poor	4	4.3
12	Western St. John	2	Caneel Bay	18°21'00"	64°47'13"	Driftlines good	3	5.6

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
St. John, U.S. Virgin Islands								
12	Western St. John	3	Maho Bay	18°21'32"	64°44'42"	Driftlines fair to poor	4	3.7
12	Western St. John	5	Coral Harbor	18°20'56"	64°42'43"	Driftlines good	3	4.8
12	Western St. John	6	Coral Harbor	18°20'35"	64°42'50"	Driftline good	1	5.4
12	Western St. John	7	Johns Folly Bay	18°19'16"	64°42'07"	Driftlines fair	4	7.6
12	Western St. John	8	Great Lameshur Bay	18°19'12"	64°43'30"	Driftlines good to poor	6	5.6
12	Western St. John	9	Fish Bay	18°19'19"	64°46'01"	Driftlines good	3	7.5
12	Western St. John	10	Chocolate Hole	18°19'12"	64°47'06"	Driftlines and washline good to poor	7	6.9
12	Western St. John	11	Great Cruz Bay	18°19'23"	64°47'13"	Driftline good	1	2.9
13	Eastern St. John	4	Haulover	18°21'18"	64°41'02"	Driftlines good to poor	6	5.0
St. Croix, U.S. Virgin Islands								
14	Frederiksted	22	Cooper	17°41'40"	64°48'20"	Driftlines fair	2	5.7
14	Frederiksted	23	Long Point	17°40'56"	64°50'14"	Stainlines excellent	1	2.4
14	Frederiksted	24	Long Point	17°41'00"	64°50'22"	Driftlines good	2	2.5

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
St. Croix, U.S. Virgin Islands								
14	Frederiksted	25	Carlton	17°41'16"	64°51'26"	Driftlines good	2	8.6
14	Frederiksted	26	Whites Bay	17°41'16"	64°52'24"	Driftlines good	2	6.8
14	Frederiksted	27	Smithfield	17°42'10"	64°53'11"	Stainlines excellent	2	6.7
14	Frederiksted	28	Frederiksted	17°42'57"	64°53'03"	Seedline excellent	1	7.1
14	Frederiksted	29	William	17°44'01"	64°53'21"	Driftline	1	6.8
14	Frederiksted	30	Hams Bay	17°45'55"	64°53'04"	Driftline poor	1	6.6
14	Frederiksted	31	Davis Beach	17°45'50"	64°50'01"	Sandlines fair to good	2	10.1
14	Frederiksted	32	La Vallee	17°46'51"	64°48'18"	Driftlines fair	2	12.1
15	Christiansted	1	Christiansted	17°44'52"	64°42'30"	Stain and seedlines excellent	2	5.4
15	Christiansted	2	Fort Christian	17°44'56"	64°42'06"	Drift, seed, and stainlines fair to excellent	4	5.2
15	Christiansted	3	Mt. Welcome	17°44'58"	64°41'56"	Stainlines ¹ excellent	2	4.5
15	Christiansted	4	Shoys	17°45'30"	64°41'02"	Driftlines poor to good	3	8.0
15	Christiansted	16	Halfpenny Bay	17°42'19"	64°42'05"	Seedlines excellent	2	11.6
15	Christiansted	17	Manchenil Bay	17°42'27"	64°42'22"	Driftline fair	1	9.6

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
St. Croix, U.S. Virgin Islands								
15	Christiansted	18	Krause Lagoon	17°41'53"	64°45'43"	Driftlines fair	2	7.3
15	Christiansted	19	Krause Lagoon	17°41'58"	64°45'55"	Driftlines fair	2	4.2
15	Christiansted	20	Anguilla	17°41'54"	64°46'46"	Driftlines fair	3	4.7
15	Christiansted	21	Manning Bay Racetrack	17°41'52"	64°47'11"	Driftlines	2	7.5
15	Christiansted	33	Rust Up Twist	17°46'49"	64°47'38"	Driftlines fair	2	5.7
15	Christiansted	34	Greig Hill	17°46'57"	64°45'55"	Seedline excellent	1	9.8
15	Christiansted	35	Kirkegaard Hill	17°46'38"	64°45'43"	Driftlines poor to fair	2	4.4
15	Christiansted	36	Judith Fancy	17°46'35"	64°44'32"	Driftline good	1	8.9
15	Christiansted	37	St. Johns	17°46'14"	64°44'13"	Stainline ¹	1	5.0
15	Christiansted	38	Golden Rock	17°45'22"	64°43'14"	Stainlines excellent	2	7.9
16	East Point	5	Pull Point	17°46'01"	64°39'22"	Stainline excellent	1	3.2
16	East Point	6	Yellowcliff Bay	17°45'40"	64°37'10"	Stainline and seedline excellent	1	4.1
16	East Point	7	Teagues Bay	17°45'20"	64°36'09"	Driftlines poor to fair	3	4.3
16	East Point	8	Cramer Park	17°45'37"	64°35'11"	Stainlines ¹ good	2	6.1

Table 2. Descriptions of high-water marks—Continued

Plate number	Quadrangle	High-water mark number	Location	Latitude	Longitude	Type and/or quality of mark	Number of high-water marks	Elevation (feet above mean sea level)
St. Croix, U.S. Virgin Islands								
16	East Point	9	Grapetree Bay	17°44'56"	64°35'35"	Stainline ¹ excellent	1	8.2
16	East Point	10	Turner Hole	17°44'33"	64°36'22"	Stainlines ¹ excellent	2	9.1
16	East Point	11	Grass Point	17°44'10"	64°36'40"	Driftlines fair	2	9.0
16	East Point	12	Rod Bay	17°44'11"	64°37'07"	Driftlines fair	2	9.7
16	East Point	13	Mt. Fancy	17°43'44"	64°38'00"	Driftlines fair	2	5.4
16	East Point	14	Great Pond	17°43'32"	64°38'57"	Driftlines good	2	13.0
16	East Point	15	Milord Point	17°43'10"	64°39'53"	Driftlines good	2	8.4

¹ Inside high-water mark

² Inside and outside high-water marks

Table 3. Descriptions of reference marks and bench marks

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
1	Vega Alta	RM 1	5.61	18°29'02"	66°20'24"	Chiseled square, painted orange, set on east side of concrete floor of the refreshment store at Balneario de Cerro Gordo, 0.15 mile east of intersection of road 690 and main entrance to Balneario de Cerro Gordo at Vega Alta.
1	Vega Alta	RM 2	63.81	18°28'08"	66°20'02"	One-half inch re-bar, set on culvert, at north side of road 693 in Breñas Community, 0.7 mile east of intersection of roads 690 and 693 at Vega Alta.
1	Vega Alta	RM 3	25.93	18°28'23"	66°19'16"	Chiseled square, painted orange, set on south side of median strip in front of security guard house at Cerromar Hotel main entrance on road 693, 1.6 miles east of intersection of roads 693 and 690 at Vega Alta.
1	Vega Alta	RM 4	9.59	18°28'37"	66°18'58"	Chiseled square, painted orange, set on 13th step down from top, at Playa de los Tocones, on road 693, 0.3 mile east of Cerromar Hotel main entrance, 0.25 mile north on unmarked road toward Playa de los Tocones at Vega Alta.
1	Vega Alta	RM 5	65.08	18°28'12"	66°18'00"	Chiseled square, set on manhole, south of road 693, 950 feet east of Dorado Beach Hotel main entrance, 0.5 mile west of airport at Dorado.
1	Vega Alta	RM 6	6.63	18°28'37"	66°16'44"	Chiseled square, set on north sidewalk of security guard house at entrance to Las Villas Apartments of Dorado del Mar, across from Villa Pesquera at Sardinera Beach Dorado on road 697, 0.65 mile northwest of intersection of roads 697 and 693 at Dorado.
1	Vega Alta	RM 7	17.93	18°28'44"	66°15'43"	Chiseled square, set on concrete slab at north side of Kennedy Street at Mameyal, 0.1 mile east of La Plata triangulation station, 0.5 mile west of Point Boca Juana at Dorado.
1	Vega Alta	RM 8	13.04	18°27'36"	66°15'32"	Chiseled square, set on west abutment of concrete bridge over Río de La Plata on road 693, 0.45 mile west of intersection of roads 693 and 165 at Dorado.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
2	Bayamón	RM 9	19.86	18°28'12"	66°14'10"	Chiseled square with 3/8 inch re-bar at center, set on front wall of abandoned building, 0.8 mile east of El Caracol Restaurant on road 165, 4.5 miles west of Balneario de Punta Salinas main entrance at Dorado.
2	Bayamón	BM 22 R	6.46	18°28'08"	66°11'56"	USGS <i>BM 22 R 1939</i> , standard brass tablet set flush in right downstream side of lock bridge over Río Cocal at Punta Corozo, 0.8 mile west of Balneario de Punta Salinas main entrance at Toa Baja.
2	Bayamón	RM 10	7.34	18°27'43"	66°11'06"	Chiseled square, set on concrete slab, west side of sewage outfall, 0.4 mile east of Balneario de Punta Salinas main entrance on road 165 at Toa Baja.
2	Bayamón	RM 11	12.18	18°27'11"	66°09'54"	Chiseled square, set on floor of telephone booth in front of ESSO service station, 0.5 mile west of intersection of roads 866 and 165 northeast of Levittown at Toa Baja.
2	Bayamón	RM 12	14.65	18°27'22"	66°09'11"	Chiseled square, set on concrete block at east side of Palo Seco entrance at intersection of roads 165 and 870, 0.15 mile west of main entrance to Palo Seco Thermolectric Power Plant at Toa Baja.
2	Bayamón	RM 13	13.56	18°27'22"	66°08'53"	Chiseled square, set on right downstream side of bridge over old channel of the Río de Bayamón, 0.2 mile east of main entrance to Palo Seco Thermolectric Power Plant at Toa Baja.
2	Bayamón	RM 14	6.41	18°28'23"	66°08'10"	Chiseled square, set at base of flag pole in front of police shooting club, 150 feet northeast of the four-way intersection in Isla de Cabras at Toa Baja.
2	Bayamón	RM 15	6.28	18°26'42"	66°07'42"	Chiseled square, set on concrete bench, north side of road 888, across from Francisco Oller Public School, 0.25 mile east of Cementerio Viejo at Cataño.
3	San Juan	RM 16	5.38	18°26'46"	66°06'50"	Chiseled square, set on southwest corner of boat ramp, 0.1 mile west of Vaello Public School, 0.1 mile east of public dock at Cataño.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
3	San Juan	RM 17	10.98	18°28'19"	66°07'05"	Chiseled square, set on retaining wall on the northeast side of the Malecon sidewalk at La Perla in Old San Juan.
3	San Juan	BM 29 Y	24.65	18°28'05"	66°06'22"	USGS BM 29 Y 1934, standard brass disk, set on center of south sidewalk entrance in front of Capitol Building in Old San Juan.
3	San Juan	RM 18	12.03	18°28'05"	66°05'35"	Chiseled square, set on sidewalk west side of street facing a concrete deck, east of NCO Club, near entrance to Escambrón Beach, 1.0 mile east of Capitol Building at San Juan.
3	San Juan	BM 28 Y	12.22	18°27'40"	66°05'13"	USGS BM 28 Y 1934, standard brass tablet, set on south end of sidewalk on bridge on Fernandez Juncos Avenue over Caño San Antonio at San Juan.
3	San Juan	RM 19	10.59	18°27'36"	66°04'30"	Chiseled square, set on top of east end security wall, between La Concha Hotel and the Convention Center at El Condado at San Juan.
3	San Juan	RM 20	11.84	18°27'25"	66°03'29"	Chiseled square, painted orange, set on sidewalk in front of fire hydrant at west side of dead end of Yardly Street, 0.1 mile north of intersection of McLeary and Yardly streets at Ocean Park at San Juan.
3	San Juan	RM 21	4.65	18°27'14"	66°02'56"	Chiseled square, set at entrance of the administration building of Barbosa Park on Cacique Street at Ocean Park at San Juan.
3	San Juan	RM 22	10.12	18°27'22"	66°02'24"	Chiseled square, painted orange, set on east side of dead end of Emajagua Street, next to school, Puntas Las Marias at San Juan.
3	San Juan	RM 23	10.08	18°26'53"	66°02'02"	Chiseled square, set at base of telephone junction panel, next to substation #21 of power company, between Baldorioty de Castro Avenue and Loíza Street in front of Puerto Rico Memorial Cemetery at Carolina.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
3	San Juan	RM 24	10.92	18°26'46"	66°01'37"	Chiseled square, set on west side of entrance gate of Marbella del Caribe Condos on road 187, 0.4 mile east of Puerto Rico Memorial Cemetery at Carolina.
3	San Juan	RM 25	7.36	18°26'46"	66°01'19"	Chiseled square, painted orange, set on base of east column of entrance gate of Mr. Pedro Tartak's residence at Boulevard Street in front of Playa del Alambique in Isla Verde at Carolina.
3	San Juan	RM 26	6.99	18°26'54"	66°00'04"	Chiseled square, painted orange, set on floor at bus stop on road 187 at kilometer post 2.5 in front of old Tropicana Club at Balneario de Isla Verde at Carolina.
3	San Juan	RM 27	5.14	18°25'48"	66°01'01"	Chiseled square, painted red, set on base of fire hydrant, 70 feet east of entrance to Laguna Gardens apartments, 0.2 mile east of Luis Muñoz Marín International Airport at Carolina.
4	Carolina	RM 28	8.48	18°27'29"	65°59'42"	Chiseled square, painted orange, set on top of concrete monument on south side of road 187 at kilometer 3.3, 60 feet east of Isla Verde driving examination office at Carolina.
4	Carolina	BM	19.27	18°27'54"	65°59'35"	USGS benchmark, standard table set on top of east abutment at northeast side of bridge on road 187 at Boca de Cangrejos at Carolina.
4	Carolina	RM 29	6.82	18°27'58"	65°59'17"	Chiseled square, painted orange, set on west corner of small concrete wall supporting guard rail in front of Los Migueles Bar and Restaurant in Piñones at Loíza.
4	Carolina	RM 30	17.72	18°27'58"	65°58'41"	Chiseled square, painted orange, set on first step of lateral stairs of Sinai Pentecostal Church at Punta Maldonado in Piñones at Loíza.
4	Carolina	RM 31	11.60	18°27'54"	65°58'41"	Chiseled square, set on the front step of main entrance of Restaurant La Cuestita on road 187 at La Torre in Piñones at Loíza.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
4	Carolina	RM 32	5.76	18°27'43"	65°58'19"	Chiseled square, painted orange, set on top of concrete monument behind an almond tree, northeast of "Y" intersection at main entrance to Sector Terraplen in Piñones at Loíza.
4	Carolina	RM 33	7.58	18°27'14"	65°57'29"	Chiseled square, set on casing of water meter at southwest corner of intersection of unnumbered roads in Finca Piñones, 0.1 mile south of intersection of unnumbered road and road 187 at Loíza.
4	Carolina	RM 34	16.45	18°27'18"	65°55'55"	Chiseled square, painted orange, set on water meter concrete base at south side of road 187 at kilometer 11.1 at entrance to private farm in Torrecilla Baja at Loíza.
4	Carolina	RM 35	11.17	18°27'29"	65°54'04"	Chiseled square, painted orange, set on top of concrete monument on north side of road 187 at kilometer 15.3, 4.3 feet east of electric pole in Vacía Talega at Loíza.
4	Carolina	RM 36	4.24	18°27'25"	65°53'49"	Chiseled square set on first concrete step of east entrance to destroyed rural school near kilometer 15.6 in Vacía Talega at Loíza.
4	Carolina	RM 37	12.92	18°27'11"	65°53'24"	Chiseled square, painted orange, set on top of manhole on north side of road 187 at kilometer 16.0, 150 feet north of entrance to an old dairy farm on south side of road 187, about 1.0 kilometer northwest of the Río Grande de Loíza mouth at Loíza.
5	Río Grande	RM 38	10.14	18°26'06"	65°51'25"	Top of fire hydrant in front of apartment number 59 on east side of main road at Santillana del Mar Apartments at Loíza.
5	Río Grande	BM 61 R	8.06	18°25'34"	65°50'35"	<i>USGS BM 61 R 1939</i> , standard disk, set on side wall of main entrance to Medtania Alta High School, 100 feet east of intersection of roads 964 and 187 at Loíza.
5	Río Grande	RM 39	10.99	18°25'48"	65°50'17"	Top of fire hydrant, painted orange, in front of rural mailbox shelter, next to house number 288 on road 965 at La Playa Sector, in Las Carreras, 0.3 mile north of intersection of roads 965 and 187 at Loíza.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
5	Río Grande	RM 40	7.43	18°25'30"	65°49'48"	Standard tablet labeled <i>Flood Mark</i> , set on west abutment, downstream side at bridge over Río Herrerías on road 187, 0.55 mile east of intersection of roads 965 and 189 at Loíza.
5	Río Grande	BM 60 R	4.00	18°25'05"	65°49'37"	USGS <i>BM 60 R 1939</i> , standard disk, set on east wall of road culvert on road 187, kilometer 14.7, 0.5 mile south of Boca Herrera at Río Grande.
5	Río Grande	RM 41	8.21	18°24'40"	65°48'54"	Northeast corner of concrete slab base of sprinkler timer controller box near hole 18 of golf course at Bahía Beach Resort on road 187, 0.8 mile west of Río Espíritu Santo mouth and 0.9 mile southeast of Punta San Agustín at Río Grande.
5	Río Grande	RM 42	3.88	18°25'16"	65°47'42"	A 3/4-inch re-bar embedded in a 6-inch diameter concrete column, 25 feet east of elevated abandoned water tank at Punta Miquillo, northwest of Ensenada Comezón at Río Grande.
6	Fajardo	RM 43	6.96	18°22'52"	65°44'24"	Chiseled square, painted orange, set on southeast corner of basketball field at Fortuna, 300 feet west of intersection of roads 193 and 3 at Luquillo.
6	Fajardo	BM 48 R	6.53	18°23'02"	65°44'24"	USGS <i>BM 48 R 1939</i> , standard disk, set on southwest corner of small bridge behind "Kioskos de Luquillo," 400 feet north from the "Kioskos de Luquillo" eastern entrance at Luquillo.
6	Fajardo	RM 44	4.98	18°23'24"	65°43'41"	Chiseled square, painted orange, set on southwestern corner of septic tank on east side of Balneario de Luquillo, 100 feet east of end of road, 600 feet southeast of Punta Embarcadero at Luquillo.
6	Fajardo	RM 45	8.55	18°23'02"	65°43'12"	Chiseled square, set on southwest corner of right drainage channel at north side of offshore road in front of Playa Azul Condominium at Luquillo.
6	Fajardo	RM 46	7.98	18°22'48"	65°43'01"	Chiseled square, set on top of curb at north side of the end of offshore road, 50 feet east of fire hydrant at Playa Azul at Luquillo.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
6	Fajardo	RM 47	18.43	18°22'34"	65°42'50"	Chiseled square, set on south side of ring on top of sewer manhole, at middle of intersection of PVT Angel G. Suárez Street and Rosendo Matienzo Cintrón Street at entrance to Sandy Hills Condominium at Luquillo.
6	Fajardo	RM 48	21.77	18°22'34"	65°42'50"	Top of fire hydrant in front of house number 155 at intersection of Rosendo Matienzo Cintrón Street and Florida (CPL Feliciano Rivera) Street at Luquillo.
6	Fajardo	BM	9.74	18°22'08"	65°42'04"	Standard brass disk, stamped <i>USGS</i> , set on concrete base on northeast end of abandoned gas tank at entrance to Finca San Miguel at Luquillo.
6	Fajardo	RM 49	9.91	18°22'05"	65°41'24"	Chiseled square, painted orange, set on west end, downstream side of culvert at the outlet of small lagoon, 0.8 mile west of Río Juan Martín mouth at Luquillo.
6	Fajardo	RM 50	6.84	18°22'16"	65°38'02"	Chiseled square, painted orange, set on southwest side of power distribution box on Balneario Seven Seas, 50 feet west of road 987, 0.25 mile southwest of entrance to Faro Cabezas de San Juan at Fajardo.
6	Fajardo	RM 51	7.94	18°22'23"	65°37'55"	Chiseled square, painted orange, set on north side of round base of public water faucet, south side of road 987, 100 feet west of entrance to Faro Cabezas de San Juan at Fajardo.
6	Fajardo	RM 52	18.88	18°22'01"	65°38'13"	Chiseled square, painted orange, set on north side of public water faucet base, south side of road 987, 200 feet west of baseball park and about 3000 feet southwest of entrance to Faro Cabezas de San Juan at Fajardo.
6	Fajardo	RM 53	66.63	18°21'36"	65°28'38"	Chiseled square, painted orange, set on culvert foundation on road 987, 1.0 mile north of Playa Sardinera next to intersection with an unmarked road at Fajardo.
6	Fajardo	RM 54	4.57	18°20'53"	65°38'13"	Chiseled square, painted orange, set on top of culvert foundation, south downstream side on road 987, 150 feet south of small church at Fajardo.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Northeast coast of Puerto Rico mainland						
6	Fajardo	RM 55	10.56	18°20'46"	65°38'17"	Top of copper spike, set on front of telephone pole, next to a public telephone booth at Villa Marina main entrance on road 987, 0.1 mile west of Playa Sardinera main entrance at Fajardo.
6	Fajardo	RM 56	3.61	18°20'06"	65°37'55"	Chiseled square, painted orange, on Union Street, set on front left side of step at the Fajardo District, Puerto Real Police Station at Fajardo.
6	Fajardo	RM 57	39.25	18°20'02"	65°20'49"	Chiseled square, painted orange, set on top of manhole, northeast corner of Shell gas station on road 987 near Pueblo Norte, 0.2 mile north of intersection of roads 987 and 195 at Fajardo.
6	Fajardo	RM 58	51.24	18°19'44"	65°39'04"	Chiseled square, painted orange, set on northwest corner of second column in front of flag pole at the R. Quiñones Pacheco Secondary School on downtown area of Fajardo.
6	Fajardo	RM 59	25.44	18°19'27"	65°39'04"	Chiseled square, painted orange, set on southeast corner of bridge parapet, downstream side, 0.6 mile north of intersection of roads 3 and 194 at Fajardo.
6	Fajardo	RM 60	30.89	18°18'54"	65°39'04"	A 5/8-inch steel bolt, set flush on median of road 194, 45 feet west of intersection of roads 194 and 3 at Fajardo.
6	Fajardo	RM 61	40.50	18°18'32"	65°39'00"	Chiseled square, painted orange, set on southeast corner of bridge parapet, downstream side on road 3, kilometer 48.4 at Fortuna at Fajardo.
6	Fajardo	RM 62	37.78	18°18'00"	65°38'46"	Chiseled square, painted orange, set on northeast corner of bridge parapet, downstream side on road 3, kilometer 49.5, 120 feet north of intersection of road 3 and 23rd Street, near Aldea Cintrón at Fajardo.
6	Fajardo	RM 63	32.68	18°17'42"	65°38'17"	Chiseled square, painted orange, set on northeast corner of culvert parapet, downstream side on road 3, kilometer 50.6 at Fajardo.
6	Fajardo	RM 64	37.33	18°17'35"	65°38'17"	Chiseled square, painted orange, set on south entrance to Maranatha Baptist Church on road 3, kilometer 50.5 at Fajardo.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Vieques Island, Puerto Rico						
7	Isla de Vieques	RM 1	18.55	18°07'11"	65°32'40"	Chiseled square, painted orange, set on southeast corner of upstream headwall of culvert on road 994 between kilometers 2.7 and 2.8 at Naval Ammunition Facilities at Vieques.
7	Isla de Vieques	RM 2	21.65	18°07'16"	65°32'28"	Chiseled square, painted orange, set on southeast corner of upstream headwall of culvert on road 994 between kilometers 2.4 and 2.5 at Naval Ammunition Facilities at Vieques.
7	Isla de Vieques	RM 3	25.17	18°07'27"	65°31'56"	Chiseled square, painted orange, set on southwest corner of upstream headwall of culvert on road 994, kilometer 1.4 at Naval Ammunition Facilities at Vieques.
7	Isla de Vieques	RM 4	18.36	18°07'42"	65°31'32"	Chiseled square, painted orange, set on northeast corner of downstream headwall of culvert on road 994 and intersection with main entrance to Naval Ammunition Facilities at Vieques.
7	Isla de Vieques	RM 5	8.56	18°07'46"	65°31'06"	Chiseled square, painted orange, set on southeast corner of downstream headwall of culvert on road 200, 0.5 mile west of Mosquito Pier entrance at Vieques.
7	Isla de Vieques	RM 6	13.53	18°07'58"	65°30'31"	Chiseled square, painted orange, set on southeast corner of upstream headwall of culvert at kilometer 7.0 on road 200, 0.2 mile east of Mosquito Pier entrance at Vieques.
7	Isla de Vieques	RM 7	6.93	18°08'13"	65°29'55"	Chiseled square, painted orange, set on southeast corner of upstream headwall of culvert at kilometer 7.0 on road 200, 0.3 mile east of Punta Caballo at Vieques.
7	Isla de Vieques	RM 8	14.39	18°08'25"	65°29'04"	Chiseled square, painted orange, set on northwest corner of downstream headwall of culvert at kilometer 4.5 on road 200, 0.5 mile east of airport at Vieques.
7	Isla de Vieques	BM 53 R	10.30	18°08'30"	65°28'51"	Standard USGS disk stamped <i>53 R 1941 3.1 meters</i> , set flush in upstream headwall of old railroad track pipe culvert, 115 feet north of road 200 at kilometer 4.5 and 2.8 miles west of Isabel Segunda at Vieques.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Vieques Island, Puerto Rico						
7	Isla de Vieques	BM Martineau	73.08	18°08'41"	65°28'11"	Standard USGS disk stamped <i>Martineau 1941 22.3 meters</i> , set flush in concrete post on top of low hill at Punta Martineau, 0.2 mile north of road 200 and about 2.0 miles west of Isabel Segunda at Vieques.
7	Isla de Vieques	RM 9	62.56	18°08'34"	65°27'28"	Chiseled square, painted orange, set on top of concrete base of destroyed iron tank, 60 feet northeast of intersection of roads 200 and 201 at Vieques.
7	Isla de Vieques	RM 10	12.83	18°09'36"	65°25'33"	Chiseled square, painted orange, set on downstream headwall of culvert on dirt road near municipal solid-waste disposal site, 0.5 mile northeast of intersection of road 200 and Santa Maria neighborhood at Vieques.
7	Isla de Vieques	BM 56 R	7.41	18°09'24"	65°22'22"	Standard USGS disk stamped <i>56 R 1941 2.3 METERS</i> , set flush in inner wall on south side of big well about 25 feet diameter, 130 feet north of dirt road and big jaguey tree, and about 260 feet southeast of the Laguna Algodones at Vieques.
7	Isla de Vieques	RM 11	4.93	18°09'27"	65°21'54"	Chiseled square, painted orange, set on southeast corner of cattle crossing on Playa Puerto Negro at the three-way dirt road intersection, 1.1 miles east of Playa Grande entrance at Vieques.
7	Isla de Vieques	BM 10	54.48	18°09'20"	65°21'16"	Brass disk, set by the U.S. Marines, labeled <i>Marines Survey Control PADS-Z Point 10</i> , set flush in 1-square-foot concrete block, 12 feet north of edge of road, 0.2 mile southeast of Punta Goleta at Vieques.
7	Isla de Vieques	RM 12	7.80	18°08'55"	65°19'46"	Chiseled square, painted orange, set on upstream headwall of culvert of dirt road, 0.18 mile east of Laguna Puerto Diablo drainage channel at Vieques.
7	Isla de Vieques	RM 13	9.39	18°08'47"	65°18'35"	Chiseled square, painted orange, set on southeast corner of boat ramp at Punta Icaos at Vieques.
7	Isla de Vieques	RM 14	7.73	18°08'47"	65°18'35"	Chiseled square, painted orange, set on 8-inch guard pipe, northeast of ramp at Punta Icaos at Vieques.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Vieques Island, Puerto Rico						
7	Isla de Vieques	RM 15	7.38	18°08'00"	65°18'41"	Chiseled square, set on west side of inner circular wall of concrete well, 75 feet northeast of dirt road intersection eastbound toward beach, 0.4 mile east of the observation post at Mount Jalobre, 1.0 mile south of Punta Icacos at Vieques.
7	Isla de Vieques	RM 16	39.35	18°07'42"	65°18'57"	Chiseled square, painted red, set on top of corrugated pipe, 5-foot diameter and 4 feet high with electric power pole at the center and 60 feet south of road, 0.4 mile southeast of the observation post at Mount Jalobre at Vieques.
7	Isla de Vieques	RM 17	10.44	18°07'45"	65°19'12"	Top of 6-inch diameter plastic pipe, in front of small concrete shelter, south of dirt road with sharp turn to the north heading to the observation post, 0.8 mile east of steel bridge (Guthrie) near Bahía Jalova at Vieques.
7	Isla de Vieques	RM 18	13.49	18°07'47"	65°19'55"	Chiseled square, painted orange, set on downstream headwall of culvert on dirt road, 75 feet west of dirt road to Bahía Jalova, 1.0 mile west of observation post at Mount Jalobre at Vieques.
7	Isla de Vieques	BM 60 R	11.76	18°08'13"	65°21'51"	Standard USGS disk stamped <i>60 R 1941 3.6 METERS</i> , set flush near west corner of north wall of a long narrow concrete cattle watering tank, south of concrete well known as La Loza, 0.7 mile northeast of Laguna Yanuel, north of Ensenada Honda at Vieques.
7	Isla de Vieques	RM 19	12.52	18°07'50"	65°22'22"	Chiseled square, painted orange, set on left downstream headwall of culvert on dirt road, 50 feet west of center of road curve, 100 feet north of Laguna Yanuel at Vieques.
7	Isla de Vieques	RM 20	5.81	18°06'52"	65°23'31"	Chiseled square, painted orange, set on left downstream side of bridge abutment on dirt road which run parallel to the Bahía de la Chiva shoreline at Vieques.
7	Isla de Vieques	RM 21	27.13	18°06'56"	65°24'03"	Chiseled square, painted red, set on downstream headwall of culvert on dirt road, 300 feet northwest of north corner swamp area at Bahía Tapón.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
Vieques Island, Puerto Rico						
7	Isla de Vieques	RM 22	19.62	18°07'07"	65°24'42"	Chiseled square, painted orange, set on upstream headwall of culvert on dirt road east of Camp García Airfield, 0.2 mile south of dirt roads intersection, at Camp García at Vieques.
7	Isla de Vieques	RM 23	57.74	18°07'20"	65°24'56"	Chiseled square, painted orange, set on upstream headwall of culvert on dirt road, located southwest of chainlink fence at Camp García quarters, north of airfield at Camp García at Vieques.
7	Isla de Vieques	RM 24	21.96	18°06'05"	65°28'02"	Chiseled square, painted orange, set on sidewalk near southeast corner of the ticket house at entrance to parking lot of Playa Sun Bay, 0.3 mile east of Esperanza at Vieques.
7	Isla de Vieques	RM 25	6.61	18°05'48"	65°18'18"	Chiseled square, painted orange, set on southeast corner of downstream headwall of culvert, 50 feet west of kilometer post 2.7 at road 997 in Esperanza at Vieques.
7	Isla de Vieques	RM 26	104.19	18°05'54"	65°29'59"	Chiseled square, painted orange, set on northeast corner of concrete floor of the back gate guardhouse at the Naval Ammunition Facilities on road 201, 1.5 miles west of Esperanza at Vieques.
7	Isla de Vieques	RM 27	94.35	18°05'54"	65°30'11"	Chiseled square, painted orange, set in center of upstream headwall of culvert on road 201 (known as the Back Gate Road) at Naval Ammunition Facilities at Vieques.
7	Isla de Vieques	RM 28	9.95	18°06'16"	65°34'38"	Top of 6-inch diameter concrete monument, raised 6 inches above ground, located at end of dirt road to Punta Boca Quebrada, 1.0 mile southwest of Laguna Kiani at Vieques.
7	Isla de Vieques	BM 4	8.56	18°06'59"	65°34'33"	<i>BENCH MARK #4 1922</i> , chiseled cross with letters <i>U.S.</i> 3.3 feet above ground on north side of crude oil tank, 0.35 mile southeast of Puntas Arenas, 0.1 mile west of Laguna Arenas at Vieques.
7	Isla de Vieques	BM 51 R	20.34	18°07'04"	65°33'00"	Standard USGS disk stamped <i>51 R 1941 6.2 METERS</i> , set flush on southwest corner of upstream headwall of culvert on road 994, between kilometers 3.4 and 3.5 at Naval Ammunition Facilities at Vieques.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Thomas, U.S. Virgin Islands						
9	Western St. Thomas	BM 5 Fortuna Bay	6.12	18°20'51"	65°00'56"	Standard National Ocean Service disk stamped <i>NO 5 1975</i> , set flush in a granite outcrop, 20 feet by 9 feet, rectangular in shape, 8 feet north of mean high water line at Fortuna Bay.
10	Central St. Thomas	RM 1	10.01	18°20'14"	64°55'07"	Chiseled square set on southeast corner of concrete grate, 15 feet north of intersection of roads 30 and 313 near Yacht Haven Marina at Charlotte Amalie.
10	Central St. Thomas	RM 2	5.35	18°20'25"	64°55'33"	Chiseled square, set on floor of an abandoned pump house, about 12 feet from corner near street and north of road 30 at Frederiksberg Point at Charlotte Amalie.
10	Central St. Thomas	BM 5 King's Wharf	5.03	18°20'29"	64°55'51"	Standard National Ocean Service disk stamped <i>NO 5 1975</i> , set flush in the southwest corner of a concrete step at the entrance to the administration building, U.S. Coast Guard Station, 27.3 feet east of the east curb of the road leading to the station and 3.5 feet west of the foundation at Charlotte Amalie.
10	Central St. Thomas	RM 3	3.57	18°20'28"	64°56'17"	Chiseled square, painted orange, set on south end of storm sewer grate, northeast corner of sidewalk on Veterans Drive (road 30), 12 feet from pedestrian light pole, in line with east side of First Federal Savings Bank at Charlotte Amalie.
10	Central St. Thomas	RM 4	5.31	18°20'17"	64°56'56"	Chiseled square, in north curb of west building line, in line with projection of access road to AAA Car Rental, 400 feet south of road 30 at Crown Bay.
10	Central St. Thomas	RM 5	14.47	18°20'07"	64°57'34"	Chiseled square set on southeast corner of headwall of culvert at north side of intersection of road 304 and main entrance to Krum Bay.
10	Central St. Thomas	RM 6	7.99	18°20'17"	64°57'52"	Chiseled square, set on north curb of road 302 to airport in the opposite side of entrance to Caribe Hotel near airport at Lindbergh Bay.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Thomas, U.S. Virgin Islands						
10	Central St. Thomas	RM 7	8.39	18°20'18"	64°58'04"	Chiseled square, set on north curb of road 302 to airport, 1 foot from west end of curb and 20 feet west of first light pole from airport entrance at Lindbergh Bay.
10	Central St. Thomas	RM 8	17.59	18°20'30"	64°57'52"	Chiseled square, set on southwest corner of sidewalk, north of intersection of roads 308 and 30, near airport at Lindbergh Bay.
10	Central St. Thomas	RM 9	17.24	18°20'41"	64°58'33"	Chiseled square, set on curb at median of road 30, 30 feet south of crossover, 800 feet southeast of main entrance to the Reichhold Center for the Arts, College of the Virgin Islands at Brewers Bay.
10	Central St. Thomas	RM 10	33.98	18°20'49"	64°58'42"	Chiseled square, set on southeast corner of upstream head wall of culvert on road 30, 400 feet northwest of main entrance to the Reichhold Center for the Arts, College of the Virgin Islands at Brewers Bay.
10	Central St. Thomas	RM 11	5.90	18°21'59"	64°55'19"	Top of 1-foot-high concrete monument near property limit fence, about 100 feet southwest of restroom building at Magens Bay Beach, Magens Bay.
10	Central St. Thomas	BM 2 Magens Bay	2.93	18°22'09"	64°55'23"	Standard disk, stamped <i>USC & GS BM 2</i> , set on top of boulder, 165 feet from sandy beach at head of the bay and on east side of bay at Magens Bay Beach, Magens Bay.
11	Eastern St. Thomas	RM 12	7.82	18°21'05"	64°51'54"	Chiseled square, set on concrete floor, 2.5 feet west of taxi station shack, 18 feet north of center line of main entrance to Coral World Aquarium at Coki Point.
11	Eastern St. Thomas	RM 13	12.61	18°20'17"	64°51'27"	Head of brass bolt, set flush in south corner of downstream headwall of culvert, 500 feet northwest of Pavilion and Pools Resort at Smith Bay.
11	Eastern St. Thomas	RM 14	51.91	18°20'12"	64°51'19"	Chiseled square, set on southwest corner of upstream headwall of culvert, 200 feet east of main entrance to Sapphire Resort at Smith Bay.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Thomas, U.S. Virgin Islands						
11	Eastern St. Thomas	RM 15	7.43	18°20'12"	64°51'06"	Chiseled square, painted orange, set on northeast corner of concrete slab, 10 feet east of big gas tank, 50 feet south of reception building of the Sapphire Beach Resort Marina at Smith Bay.
11	Eastern St. Thomas	RM 16	6.13	18°19'31"	64°51'20"	Chiseled square, painted orange, set on downstream headwall of culvert on road 32, 100 feet north of National Park Service entrance at Red Hook.
11	Eastern St. Thomas	BM 1	2.99	18°19'35"	64°50'59"	Standard National Ocean Service disk, stamped <i>NO 1 1973</i> , set flush in the center of the concrete foundation of the National Park Service visitor's building at Red Hook.
11	Eastern St. Thomas	BM 2	2.80	18°19'35"	64°50'56"	Standard National Ocean Service disk, stamped <i>NO 2 1973</i> , set flush in the concrete foundation on the south side of the National Park Service visitor's building, 37 feet east of the south entrance to the building at Red Hook.
11	Eastern St. Thomas	RM 17	120.13	18°19'24"	64°51'45"	Concrete monument with the letters <i>US</i> for Benner triangulation station, 200 feet south of intersection of roads 32 and 322 at Nazareth.
11	Eastern St. Thomas	RM 18	2.05	18°19'13"	64°52'00"	Chiseled square, painted orange, set on concrete base of public telephone booth at the MD Marina at Benner Bay.
11	Eastern St. Thomas	RM 19	15.63	18°19'25"	64°52'41"	Chiseled square, painted orange, set on downstream right abutment of bridge on road 30 over Turpentine Run at Nadir.
11	Eastern St. Thomas	RM 20	24.36	18°19'10"	64°53'12"	Chiseled square, painted orange, set on sidewalk in front of automatic pumps at entrance to Texaco Service Station at Bovoni.
11	Eastern St. Thomas	RM 21	14.73	18°18'52"	64°53'52"	Chiseled square, set on sidewalk north of driveway to Villas number 17 of Bolongo Apartments, 3 feet east of power pole number 49097002 at Bolongo Bay.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
				St. John, U.S. Virgin Islands		
12	Western St. John	BM 2	2.85	18°20'02"	64°47'38"	Standard brass disk stamped <i>NO 2 1972</i> , set in concrete seawall approximately 1 foot from northwest corner of the National Park Service dock at Cruz Bay.
12	Western St. John	RM 1	3.55	18°21'00"	64°47'13"	Chiseled square, set on manhole cover, 50 feet east of telephone booth in front of second building on the left, 0.4 mile north of Caneel Bay Ruins at Caneel Bay.
12	Western St. John	BM C	7.72	18°21'32"	64°44'42"	Standard brass disk stamped <i>C 1985</i> , set in drill hole cemented on top of large stone planter on east side of green recreational pavilion, approximately 1.5 feet above ground, 22 feet east of east corner of recreational pavilion on the northern most point of the planter, northwest side of road 20 at Maho Bay.
12	Western St. John	BM 1373 A	1.36	18°20'56"	64°42'43"	Standard brass disk stamped <i>1373 A 1983</i> cemented to drill hole at northwest corner of concrete wharf in Coral Harbor, 0.9 feet east of west edge of wharf, 0.9 feet south of north edge of wharf at Coral Bay.
12	Western St. John	RM 2	3.80	18°20'49"	64°43'01"	Top of nut in block about 1 foot above ground in <i>Bump</i> road sign north of road 107, 0.1 mile south of intersection of King Hill Road and road 107 at Carolina.
12	Western St. John	RM 3	8.40	18°20'35"	64°42'50"	Chiseled square, set on southeast corner of retaining wall on leeward side of road 107, 0.45 mile south of intersection of King Hill Road and road 107, Little Plantation.
12	Western St. John	RM 4	38.03	18°20'13"	64°42'43"	Chiseled square, painted orange, set on southeast corner of parapet, north side of small culvert at road 107 in Sanders Bay, 200 feet west of stairway on top of hill, 0.7 mile northwest of Johnson Bay Cemetery, 0.4 mile southeast of Pen Point Cemetery at Little Plantation.
12	Western St. John	RM 5	14.58	18°19'52"	64°42'11"	Chiseled square, set on center of downstream headwall of culvert on Hwy 107, 40 feet west of private concrete entrance to the beach, and about 150 feet east of intersection of road 107 and dirt road, near Johnson Bay Cemetery at Calabash Boom.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. John, U.S. Virgin Islands						
12	Western St. John	RM 6	56.77	18°19'37"	64°42'07"	Chiseled square, painted orange, set on mailbox concrete slab, 12 feet north of bus stop near Fish Bay, 900 feet north of main entrance to Calvary Baptist Church on road 107 at Calabash Boom.
12	Western St. John	RM 7	14.32	18°19'26"	64°42'00"	Chiseled square, painted orange, set at north side of headwall of culvert, located on east side of fence of Calvary Baptist Church on road 107, 200 feet from main entrance of church at Calabash Boom.
12	Western St. John	RM 8	25.10	18°19'16"	64°42'07"	Chiseled square, set on retaining wall seaward side of road 107 north of entrance dirt road to Johns Folly Bay at Johns Folly.
12	Western St. John	BM 4	2.71	18°19'12"	64°43'30"	Standard disk, stamped <i>NO 4 1972</i> , set flush at southeast corner of concrete pier, east of Viers Laboratory on Great Lameshure Bay at Lameshure.
12	Western St. John	RM 9	10.07	18°19'19"	64°46'01"	Chiseled square, painted orange, set on southeastern portion of concrete wall holding <i>Fish Bay</i> sign, on unmarked dirt road, 0.7 mile east of road 104 at Fish Bay.
12	Western St. John	RM 10	41.71	18°19'16"	64°46'55"	Chiseled square, painted orange, set on upstream side of circular culvert at south entrance road to Chocolate Hole.
12	Western St. John	RM 11	9.06	18°19'12"	64°47'06"	Chiseled square, set on stone wall, 150 feet due east of beach at Chocolate Hole.
12	Western St. John	RM 12	6.66	18°19'23"	64°47'13"	Chiseled square, set on west base of mountain at first driveway west of hotel, 3 feet from south end curve at Great Cruz Bay.
St. Croix, U.S. Virgin Islands						
14	Frederiksted	RM 23	7.70	17°40'58"	64°50'15"	Chiseled square, painted orange, set on floor at entrance to an uninhabited house, 0.7 mile south of road 66 at Long Point, Carlton.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
14	Frederiksted	BM 14	27.90	17°41'35"	64°50'25"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in downstream parapet of bridge on road 66, about 300 feet east of intersection of road 66 and road leading to Long Point at Carlton.
14	Frederiksted	RM 24	9.88	17°41'24"	64°42'02"	Chiseled square, painted orange, set on south side of outer concrete ring of manhole at center of 90-degree curve on road 701, about 25 feet north of road 66 at Camporico.
14	Frederiksted	BM 15	15.26	17°41'22"	64°52'03"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in east side of upstream parapet of bridge on road 66, 0.4 mile east of intersection of road 66 and road 661 at Camporico.
14	Frederiksted	RM 25	13.30	17°41'17"	64°52'26"	Chiseled square, painted orange, set on seaward door stoop of partially destroyed house, 0.2 mile south of intersection of roads 66 and 661 at Whites Bay.
14	Frederiksted	RM 26	6.97	17°42'09"	64°53'09"	Chiseled square, painted orange, set on top of wall by <i>Cottages by the Sea</i> sign in front of beach resort at Veterans Shore Drive, 0.5 mile south of Frederiksted at Hesselberg.
14	Frederiksted	RM 27	6.52	17°42'12"	64°53'09"	Chiseled square, painted orange, set on sidewalk leading to power plant at southeast corner of the King Frederik Hotel, about 650 feet north of the north shore of the Westend Saltpond, 0.5 mile south of Frederiksted at Hesselberg.
14	Frederiksted	BM 16	7.64	17°42'58"	64°53'03"	Standard U.S. Coast and Geodetic Survey disk stamped <i>I AZ 1957 8</i> , set flush in east side of concrete base of light tower at entrance to the Frederiksted pier at intersection of Strand and Custom House Streets at Frederiksted.
14	Frederiksted	RM 28	6.47	17°43'04"	64°52'55"	Chiseled square, painted orange, set on left upstream side of culvert headwall on second culvert in upstream order, over Jolly Hill Gut, about 800 feet southeast of Paul E. Joseph Stadium at Frederiksted.
14	Frederiksted	BM 17	8.27	17°43'54"	64°53'16"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in right upstream side of culvert headwall on road 63, 0.6 mile southeast of intersection of roads 63 and 78 at William.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
14	Frederiksted	BM 18	35.86	17°44'42"	64°53'36"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in left downstream side of culvert headwall on road 63, 0.2 mile north of U.S. Naval Station at Sprat Hall.
14	Frederiksted	RM 29	6.46	17°45'51"	64°53'07"	Chiseled square, painted orange, set on right upstream side of culvert headwall on road 63, 0.3 mile northeast of entrance to Northside Ruins, 0.4 mile southwest of Hams Bay Ruins at Northside.
14	Frederiksted	BM 19	5.84	17°45'53"	64°53'09"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in right downstream side of culvert headwall on road 63, 0.3 mile northeast of entrance to Northside Ruins at Northside.
14	Frederiksted	RM 30	12.07	17°45'48"	64°50'01"	Chiseled square, painted orange, set on southwest side of sidewalk at main entrance to apartments 251 and 257 of Carambola Beach Resort at Big Fountain.
14	Frederiksted	RM 31	29.77	17°45'51"	64°49'56"	Chiseled square, painted orange, set on southeast side of sidewalk at main entrance to apartments 11 and 17 of Carambola Beach Resort at Big Fountain.
14	Frederiksted	BM 20	19.69	17°46'02"	64°49'21"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in right upstream side of culvert headwall on road 80 (North Shore Road), 0.1 mile southeast of intersection of roads 80 and 69 at Prosperity.
14	Frederiksted	BM 21	6.19	17°46'19"	64°48'53"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in southwest corner of west concrete wall of Gabriel Williams boat ramp, about 25 feet north of road 80 at Cane Bay Beach, Cane Bay.
14	Frederiksted	RM 32	31.12	17°46'50"	64°48'16"	Steel rod embedded on north edge of road 80 in front of driveway gate of house number 120 at LaVallee.
15	Frederiksted	RM 1	8.85	17°44'48"	64°42'29"	Chiseled square, painted orange, set on corner of ditch in front of lot 27A near the corner of North and Market Streets at Christiansted.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
15	Christiansted	RM 2	4.30	17°44'51"	64°42'29"	Chiseled square, painted orange, set on sidewalk in front of entrance to Watertug Apartments administration office about 50 feet northwest of Watertug Street at Christiansted.
15	Christiansted	BM 1	4.38	17°44'56"	64°42'09"	Standard U.S. Coast and Geodetic Survey disk stamped <i>CL MAGNETIC 1905</i> , set flush in a concrete post, 54 feet southeast of southeast pillar at entrance to speaker's pavilion on grounds of Fort Christian Park at Christiansted.
15	Christiansted	BM 2	3.60	17°44'51"	64°42'02"	Standard USGS disk stamped <i>9 CES 1957 4</i> , set flush in southeast corner of step at south entrance to saltwater pumphouse, 12 feet south of southwest corner of pumphouse in Public Works Department yard at Christiansted.
15	Christiansted	RM 3	4.92	17°44'57"	64°41'55"	Chiseled square, painted orange, set on concrete planter box near the southwest corner of Virgin Islands Port Authority building on Gallows Bay Dock at Mount Welcome.
15	Christiansted	RM 4	4.01	17°44'52"	64°41'51"	Chiseled square, painted red, set on the north side of sidewalk corner of intersection of Port and Anchor Way Streets at Mount Welcome.
15	Christiansted	RM 5	17.88	17°44'46"	64°41'47"	Chiseled square, painted orange, set on southeast corner of south sidewalk of bridge on road 83, 100 feet west of entrance to Davis C. Canegata ball park at Mount Welcome.
15	Christiansted	BM 3	25.97	17°44'50"	64°41'11"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in left downstream side of bridge abutment on road 66, 200 feet northeast of St. Peters public school, south of Altona Lagoon at St. Peters.
15	Christiansted	RM 6	9.17	17°45'29"	64°41'00"	Chiseled square, painted orange, set on concrete wall around gas tank on beach behind Buccaneer Hotel at Shoys.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
15	Christiansted	RM 18	21.49	17°42'57"	64°40'32"	Chiseled square, painted orange, set near southwest end of west concrete wall of boat ramp, about 30 feet south of road 62, east of concrete cattle watering tank, about 500 feet southwest of main entrance to Castle Nugent Dairy Farm at Castle Nugent.
15	Christiansted	BM 10	31.22	17°42'52"	64°40'50"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in left downstream side of culvert headwall on road 62, 0.4 mile west of main entrance to Castle Nugent Dairy Farm at The Springs.
15	Christiansted	RM 19	10.44	17°42'21"	64°42'05"	Chiseled square, painted orange, set on step at south entrance to Halfpenny Bay Club, 0.7 mile southeast of intersection of road 62 and dirt road leading to Manchenil and Halfpenny Bays at Halfpenny Bay, Granard.
15	Christiansted	BM 11	45.39	17°42'53"	64°42'25"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in downstream side of culvert on road 62, 0.1 mile west of main entrance to Halfpenny Bay Club, 0.3 mile east of intersection of roads 62 and 83 at Granard.
15	Christiansted	BM 12	9.38	17°41'57"	64°45'17"	Standard National Ocean Service disk stamped 975 1401 L 1983, set flush in the northwest corner, 4.5 feet south of the concrete St. Croix Container Port pier, 3.5 feet west of the northwest corner of the northwest stop for an overhand crane, 1.5 feet east of west face of the pier at Krausses Lagune.
15	Christiansted	RM 20	12.36	17°41'54"	64°45'44"	Chiseled square, painted orange, set on floor at southeast side of concrete arched building in ruin, about 400 feet northwest of seashore, 0.2 mile northeast of mouth of Krause Lagoon Channel at Krausses Lagune.
15	Christiansted	RM 21	3.27	17°41'53"	64°46'45"	Chiseled square, painted orange, set at northeast side of boat ramp, 800 feet southeast of St. Croix Abattion office at Bethlehem Middle Works.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
15	Christiansted	BM 13	17.72	17°42'14"	64°47'10"	Standard USGS disk stamped <i>Flood Mark</i> , set flush on right downstream side of bridge abutment on road 64, 0.6 mile east of main entrance to Alexander Hamilton Airport, 0.3 mile south of intersection of road 64 and road 66 at Bethlehem Middle Works.
15	Christiansted	RM 22	16.16	17°42'03"	64°47'39"	Chiseled square painted orange, set on south side of concrete slab base that holds the entrance sign to the Alexander Hamilton Airport at Mannings Bay.
15	Christiansted	BM 22	6.06	17°46'51"	64°47'42"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in right upstream side of culvert headwall on road 80, 20 feet west of entrance to Mrs. April Williams' property at Rust Up Twist.
15	Christiansted	RM 33	5.75	17°46'51"	64°47'41"	Chiseled square, painted orange, set on right upstream side of culvert headwall on road 80 near entrance to Mrs. April Williams' property at Rust Up Twist.
15	Christiansted	RM 34	8.40	17°46'55"	64°45'55"	Chiseled square, painted orange, set at corner of concrete slab, about 40 feet west of swimming pool of Gentle Winds Apartments, 0.3 mile northwest of Greig Hill at Salt River.
15	Christiansted	BM 23	2.84	17°46'38"	64°45'45"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in south side of Salt River Marina Boat ramp at Salt River.
15	Christiansted	RM 35	1.87	17°46'38"	64°45'41"	Chiseled square, painted orange, set on top of seawall across from Salt River Marina office at Salt River.
15	Christiansted	RM 36	19.08	17°45'38"	64°45'55"	Chiseled square, painted orange, set on left upstream side of culvert headwall on road 80, about 300 feet north of intersection of roads 75 and 80 at Concordia.
15	Christiansted	RM 37	8.93	17°46'33"	64°44'31"	Chiseled square, painted orange, set on left downstream side of culvert headwall on Jefferson Road in front of house number 83 of Estate of Judith Fancy Homes at Judith Fancy.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
15	Christiansted	RM 38	43.27	17°46'12"	64°44'37"	Chiseled square, painted red, set on east side of median strip in front of security guard house at main entrance gate of Estate of Judith Fancy Homes at Judith Fancy.
15	Christiansted	RM 39	11.72	17°46'02"	64°44'11"	Chiseled square, painted red, set on top of concrete wall, 1.5 feet from storm sewer grate behind the Nicasio Niaud Apartments, about 0.6 mile east of St. Johns Ruins at St. Johns.
15	Christiansted	RM 40	29.66	17°45'19"	64°43'23"	Chiseled square, painted red, set on storm sewer drain gutter on road 752 across the main entrance to the Colony Cove Apartments at Golden Rock.
15	Christiansted	RM 41	6.82	17°45'24"	64°43'15"	Chiseled square, painted orange, set on sidewalk leading to apartment D-102 of the Colony Cove Apartments at Golden Rock.
15	Christiansted	RM 42	37.60	17°44'59"	64°42'54"	Chiseled square, set on floor at northwest side of first northwest column of entrance to fire truck garage at Herbert L. Canegata Fire Station on Richmond Street at Fangselet.
16	East Point	RM 7	43.38	17°45'16"	64°39'45"	Chiseled cross set on southwest corner of storm sewer grate, north of intersection of roads 60 and 66, about 0.4 mile southeast of Southgate Pond at Mt. Roepstorff and Southgate Farm.
16	East Point	BM 4	14.00	17°45'28"	64°39'44"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in left downstream side of culvert headwall on road 66, about 0.2 mile north of intersection of roads 66 and 60, south of Chenay Bay at Green Kay.
16	East Point	RM 8	18.42	17°45'35"	64°39'21"	Chiseled square, painted orange, set at west side of concrete base of the west sign for the Chenay Bay Beach Resort at main entrance on road 66 (East End Road) at Green Kay.
16	East Point	RM 9	2.05	17°46'01"	64°39'20"	Chiseled square, painted orange, set on sea wall near large gear set on concrete pad in Mr. Edward Dald's property at Pull Point.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
16	East Point	BM 5	22.94	17°45'35"	64°37'22"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in first step of entrance to East End Fire Station, 200 feet south of East End Road, south of Yellowcliff Bay at Mary's Fancy.
16	East Point	RM 10	4.57	17°45'21"	64°36'08"	Chiseled square, painted orange, set on flag pole concrete base in front of St. Croix Yacht Club main building at Tague Bay.
16	East Point	BM 6	3.88	17°45'23"	64°36'05"	Standard National Ocean Service disk stamped <i>NO 1 1975</i> , set flush in the southeast corner of a concrete slab on the eastern side of entrance to the Fairleigh Dickinson University pier, 13 feet east of a cement pipe enclosure that runs north and south from the Fairleigh Dickinson University lab grounds about 0.1 mile north of road 66 at Tague Bay.
16	East Point	RM 11	16.87	17°45'36"	64°35'06"	Chiseled square, painted orange, set on concrete floor at north entrance to house in ruin, about 200 feet south of restrooms and east of main entrance to Cramer Park Beach at Longpoint and Cotton Garden.
16	East Point	RM 12	6.91	17°44'56"	64°35'37"	Chiseled square, painted orange, set on south end of 2-foot high concrete wall in front of main entrance to room 1222 of the Grapetree Bay Hotel at Grapetree Bay.
16	East Point	BM 7	15.72	17°44'43"	64°36'19"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in northwest corner of concrete slab for underground electrical connection box in south side of road 60 (South Shore Road), 170 feet east of main entrance to DIVI St. Croix Beach Resort, 1 foot north of north property fence at Turners Hole.
16	East Point	RM 13	10.76	17°44'35"	64°36'24"	Chiseled square, painted orange, set on the seaward corner of the concrete base of the air conditioner condensation units of DIVI St. Croix Beach Resort at Turners Hole.
16	East Point	RM 14	25.33	17°44'13"	64°37'06"	Chiseled square, painted orange, set on right upstream side of culvert headwall on South Shore Road near Rod Bay, 0.5 mile northwest of Grass Point, 1.3 miles east of main entrance to Cotton Grove Ruins at Madame Carty.

Table 3. Descriptions of reference marks and bench marks—Continued

Plate number	Quadrangle	Reference mark or bench mark number	Elevation (feet above mean sea level)	Latitude	Longitude	Location and description
St. Croix, U.S. Virgin Islands						
16	East Point	RM 15	24.28	17°43'54"	64°37'52"	Chiseled square, painted red, set in the center of the upstream culvert headwall on road 60, 0.4 mile east of main entrance to Cotton Grove Ruins at Cotton Grove.
16	East Point	RM 16	45.88	17°44'00"	64°39'57"	Chiseled square, painted red, set on right downstream side of culvert headwall on road 624, about 650 feet east of intersection of roads 62 and 624 at Sally's Fancy.
16	East Point	RM 17	31.27	17°43'10"	64°39'57"	Chiseled square, painted orange, set on northeast corner of concrete slab of well behind Boys Scout camp main office at Fareham.
16	East Point	BM 9	56.00	17°43'29"	64°40'03"	Standard USGS disk stamped <i>Flood Mark</i> , set flush in right upstream side of culvert headwall on road 62, 0.4 mile south of dairy farm office, 0.4 mile north of main entrance to Boys Scout camp at Fareham.

Torres-Sierra —STORM-TIDE ELEVATIONS CAUSED BY HURRICANE HUGO ON THE U.S. VIRGIN ISLANDS AND PUERTO RICO,
SEPTEMBER 18, 1989—U.S. Geological Survey Open File Report 92-87