

Hydrogeology of South-Central St. Croix, U.S. Virgin Islands

By Robert P. Graves

U.S. GEOLOGICAL SURVEY

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U.S. VIRGIN ISLANDS WATER AND POWER AUTHORITY

U.S. DEPARTMENT OF THE INTERIOR
BRUCE BABBITT, Secretary

U.S. GEOLOGICAL SURVEY
Gordon P. Eaton, Director



For additional information write to:

District Chief
U.S. Geological Survey
GSA Center
651 Federal Drive, Suite 400-15
Guaynabo, Puerto Rico 00965

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CONVERSION FACTORS, ABBREVIATED WATER-QUALITY UNITS, AND ACRONYMS

Multiply	By	To obtain
inch	25.4	millimeter
foot	0.3048	meter
foot squared per day ¹	0.09290	meter squared per day
gallon per minute	0.06308	liter per second
gallon per minute per foot	0.2070	liter per second

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows: °C = 5/9 (°F - 32)

Abbreviated water-quality units used in this report:

microgram per liter (µg/L)

milligram per liter (mg/L)

microsiemen per centimeter at 25 °C (µS/cm)

Acronyms used in this report:

National Oceanic and Atmospheric Administration (NOAA)

U.S. Geological Survey (USGS)

U.S. Virgin Islands (USVI)

U.S. Virgin Islands Water and Power Authority (VIWAPA)

¹ The standard unit for transmissivity is cubic foot per day per square foot times foot of an aquifer thickness [(ft³/d)/ft²ft]. In this report, the mathematically reduced form, foot squared per day (ft²/d), is used for convenience.

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Abstract

The subsurface geology of south-central St. Croix consists of alluvium and underlying carbonate rocks. Ground water occurs under water-table conditions in the alluvial deposits, the post-Kingshill Carbonates, and the Kingshill Limestone deposits. These deposits are hydraulically connected and are considered to be a single hydrologic unit. Depending on the location, depth to the top of the water-table aquifer can range from 5 to 68 feet below land surface. The top of the Jealousy Formation is considered to be the bottom of the water-table aquifer and lies from 85 to more than 120 feet below land surface. Well yields in south-central St. Croix ranged from less than 5 gallons per minute to 80 gallons per minute. Aquifer specific capacity at selected wells ranged from 1 to 14 gallons per minute per foot of drawdown. Aquifer transmissivity estimated from specific capacity ranged from 180 to 3,300 feet squared per day.

Ground water in south-central St. Croix is of the sodium-chloride type. Ground-water samples collected from selected wells had chloride concentrations ranging from 67 to 4,400 milligrams per liter, and dissolved solids concentrations ranging from 619 to 7,540 milligrams per liter. Depending on location, connate water or saltwater intrusion are suspected of being the source of sodium chloride in the ground water of the study area.

INTRODUCTION

Freshwater is a scarce and expensive commodity on St. Croix, U.S. Virgin Islands (USVI). To meet the demand for drinking water, all available sources of water are used including ground water, water collected in rooftop-rainfall catchments, and desalinated seawater.

Freshwater supply on St. Croix is provided to residents by the Virgin Islands Water and Power Authority (VIWAPA) from a combination of sources, primarily ground water and desalinated seawater. The high cost of desalination (\$16.00 per one thousand gallons of water produced, 1991) has prompted VIWAPA to consider increasing their water supplies through additional ground-water development, primarily in the south-central part of the island. The extent to which ground-water resources in this area can be further developed will depend, in large part, on the hydrogeology of the area, about which relatively little is known. Recognizing the need for a better understanding of the hydrogeology of the area, the U.S. Geological Survey, in cooperation with VIWAPA, initiated a study of the ground-water resources of south-central St. Croix in 1989. This study, which is described herein, focused on four areas where wells existed and some geologic, lithologic, and hydrologic data were available. These areas, the Adventure, Golden Grove, Fairplains, and Barren Spot well fields (fig. 1), were studied in detail but the knowledge of the hydrogeologic system in these areas was used to provide insight into the hydrogeology and ground-water resources throughout south-central St. Croix.

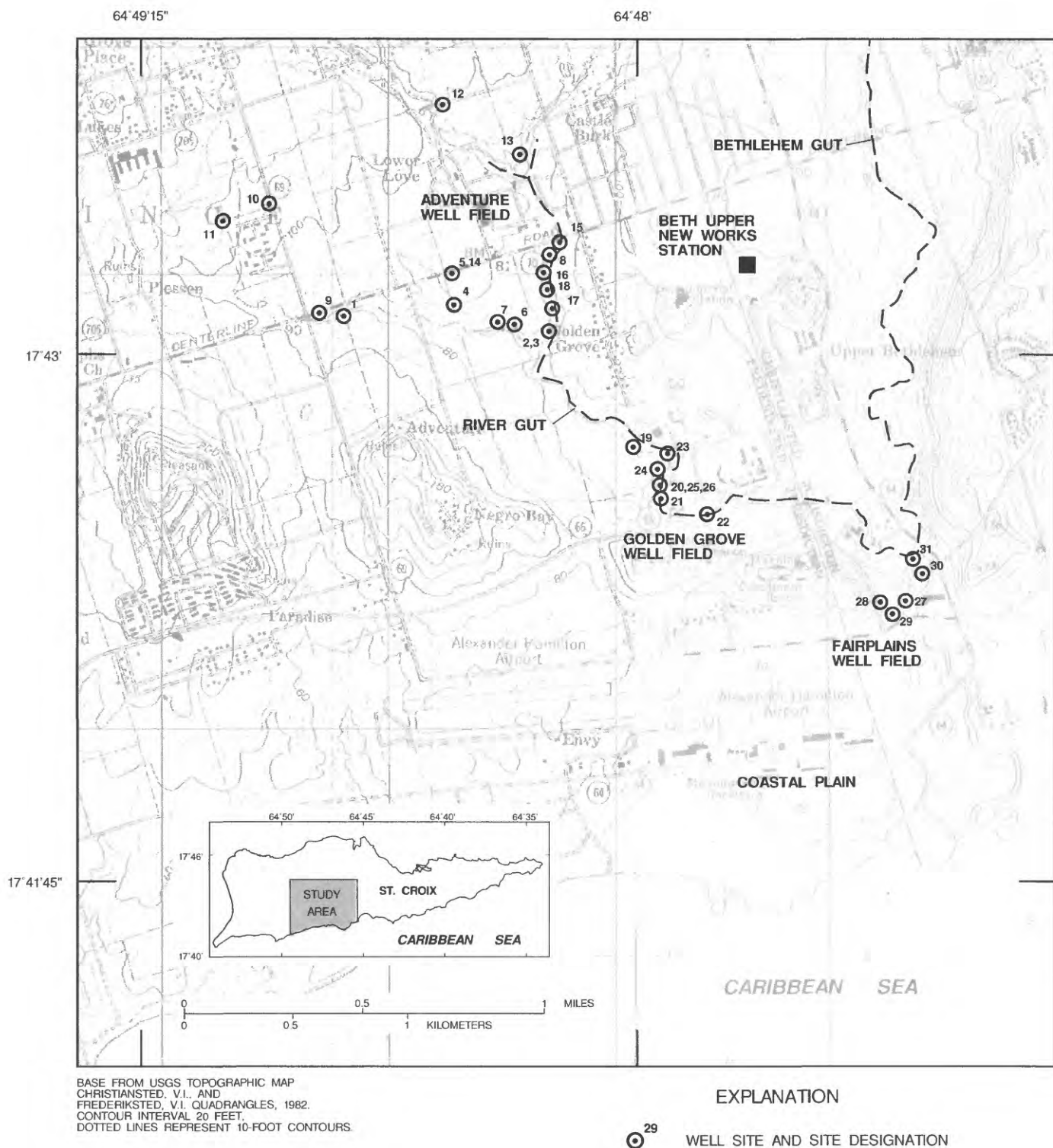


Figure 1. Location of study area, wells, and well fields in south-central St. Croix, U.S. Virgin Islands.

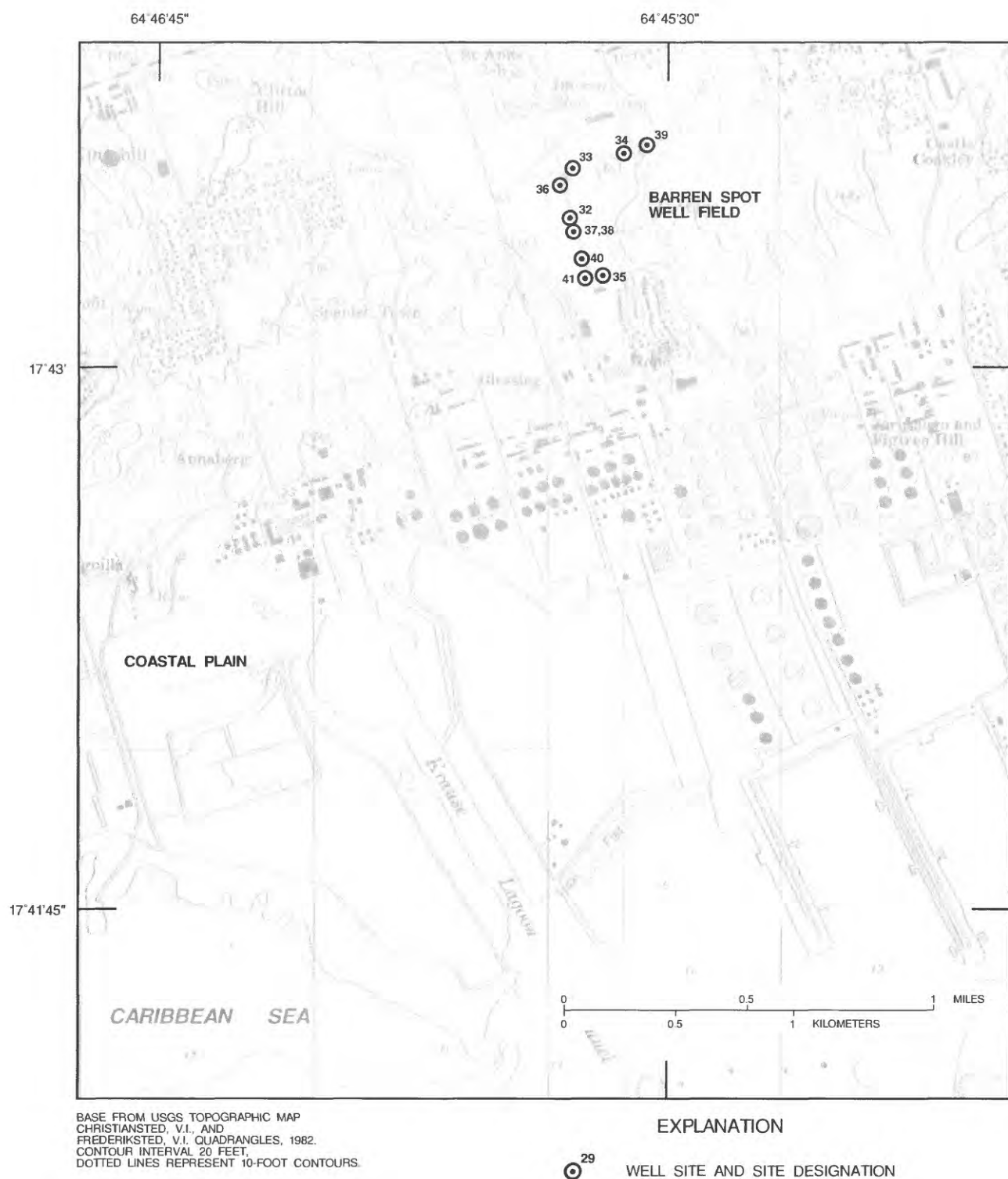


Figure 1. Location of study area, wells, and well fields in south-central St. Croix, U.S. Virgin Islands--(Continued)

This report summarizes the results of a study conducted between January 1989 and September 1992, to define the hydrogeology of selected lands in south-central St. Croix. The objectives of this study were to determine:

1. the occurrence and movement of ground water,
2. aquifer characteristics, and
3. ground-water quality in the area.

APPROACH

The objectives of this investigation were addressed primarily by analyses of data collected during test-hole drilling by VIWAPA. From April to August 1989, VIWAPA drilled 28 test holes (table 1). Of these test holes, 10 were completed as observation wells, 15 were completed as municipal water wells, and 3 were back-filled and abandoned. Of the 10 observation wells completed, 5 were instrumented by the USGS with continuous water-level recorders. These water-level monitoring sites were in operation from March 1990 until September 1992. Of the 15 municipal water wells completed, specific capacity tests to determine aquifer transmissivity were conducted on 4 wells and all wells were sampled for water-quality analysis. The test-hole drilling for this program was completed using the reverse-air circulation drilling method with an open-center reverse-air drill bit (Graves, 1992). Data used in this report include data from these test holes and wells and data from 13 VIWAPA wells completed prior to this investigation (table 2). Two of the existing VIWAPA wells were instrumented with continuous water-level recorders during January 1989, and 11 of the existing wells were sampled for water-quality analysis.

The locations of all wells used in this study are shown in figure 1. Well numbers, names, and site identification numbers for these wells are given in table 2. The well numbers in table 2 apply only to this report. However, the site-identification numbers conform with the established USGS Ground-Water Site Inventory numbering system (Mathey, 1990). The site-identification number does not change and can be used to reference a specific well in other USGS publications. Information regarding well-construction data and lithologic information for the 28 test-holes drilled by VIWAPA in 1989 is given in table 1.

DESCRIPTION OF THE AREA

South-central St. Croix has been characterized as undulating lowlands with rounded hills (Cederstrom, 1950). Surface drainage out of the area is by way of Bethlehem and River Guts, two ephemeral streams that flow only in response to heavy rainfall (fig. 1).

The mean annual air temperature recorded by the National Oceanic and Atmospheric Administration (NOAA) from 1982 to 1991 for St. Croix was 79.4 degrees Fahrenheit (U.S. Department of Commerce, 1982 to 1991). Mean-annual rainfall recorded by NOAA from 1982 to 1991 at the Beth Upper New Works Station (fig. 1) was 40.66 inches. Mean-monthly rainfall between 1982 and 1991 ranged from 1.48 inches in February to 6.48 inches in November (fig. 2). Monthly rainfall during this study (January 1989 to September 1992) ranged from less than 1 inch to more than 14 inches and differed substantially from the mean-monthly rainfall in some months (fig. 3).

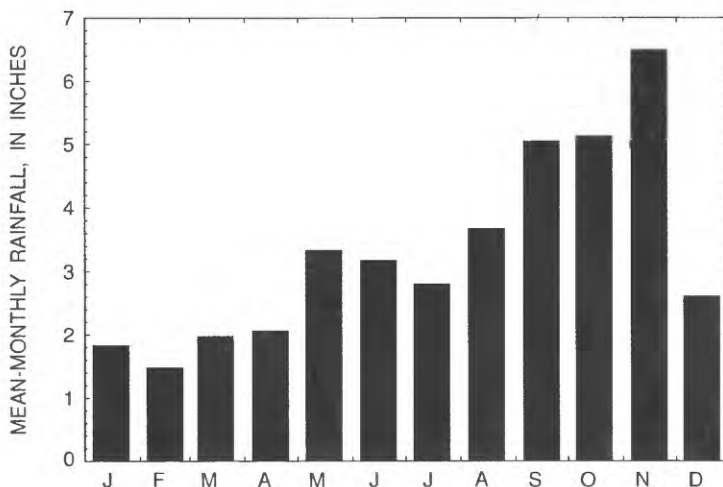


Figure 2. Mean-monthly rainfall for Beth Upper New Works Station, St. Croix, U.S. Virgin Islands, 1982-91. (Data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1982 to 1991)

Table 1. Description of test holes drilled during 1989 in south-central St. Croix, U.S. Virgin Islands

[fig, figure; mm-dd-yy, month-day-year; in, inches; ft-blstd, feet below land surface datum; gal/min, gallons per minute; VIWAPA, Virgin Islands Water and Power Authority; <, less than; ?, indicates that contact is uncertain; NA, data not available]

Well number (see fig 1)	Well name (see table 2)	Date drilled (mm-dd-yy)	Diameter of casing (in)	Depth of		Screen interval (ft-blstd)	Estimated yield (gal/min)	Subsurface material (ft-blstd)
				test hole (ft-blstd)	of casing (ft-blstd)			
1	VIWAPA 1, Adventure (Observation Well)	04-19-89	4	127	60	60 - 80	5	Topsoil 0 - 08 Kingshill Limestone 08 - 108 Jealousy Formation 108 - 127
2	VIWAPA 2, Adventure (Observation Well)	04-21-89	4	100	20	20 - 40	25	Topsoil 0 - 06 Alluvial deposits 06 - 43 Kingshill Limestone 43 - 100
3	VIWAPA 2A, Adventure (Municipal Water Well)	04-25-89	6	60	20	20 - 60	20	Topsoil 0 - 06 Alluvial deposits 06 - 43 Kingshill Limestone 43 - 60
4	VIWAPA 3, Adventure (Observation Well)	04-28-89	4	110	50	50 - 90	< 5	Topsoil 0 - 06 Alluvial deposits 06 - 24 Kingshill Limestone 24 - 107 Jealousy Formation 107 - 110
5	VIWAPA 4, Adventure (Observation Well)	05-01-89	4	100	40	40 - 80	< 5	Topsoil 0 - 08 Alluvial deposits 08 - 35 Kingshill Limestone 35 - 100
6	VIWAPA 5, Adventure (Municipal Water Well)	05-05-89	6	100	20	20 - 80	50	Topsoil 0 - 08 Alluvial deposits 08 - 43 Kingshill Limestone 43 - 100
7	VIWAPA 6, Adventure (Municipal Water Well)	05-06-89	6	100	20	20 - 80	25	Topsoil 0 - 07? Alluvial deposits 07 - 45 Kingshill Limestone 45 - 100
8	VIWAPA 7, Adventure (Municipal Water Well)	05-11-89	6	100	20	20 - 80	30	Topsoil 0 - 05? Alluvial deposits 05 - 13 Kingshill Limestone 13 - 100
9	VIWAPA 8, Adventure	05-12-89	NA	100	TEST HOLE BACK FILLED		NA	Topsoil 0 - 05? Alluvial deposits 05 - 10 Kingshill Limestone 10 - 100

Table 1. Description of test holes drilled during 1989 in south-central St. Croix, U.S. Virgin Islands--Continued

[fig, figure; mm-dd-yy, month-day-year; in, inches; ft-blstd, feet below land surface datum; gal/min, gallons per minute; VIWAPA, Virgin Islands Water and Power Authority; <, less than; ?, indicates that contact is uncertain; NA, data not available]

Well number (see fig 1)	Well name (see table 2)	Date drilled (mm-dd-yy)	Diameter of casing (in)	Depth of		Screen interval (ft-blstd)	Estimated yield (gal/min)	Subsurface material (ft-blstd)
				test hole (ft-blstd)	of casing (ft-blstd)			
10	VIWAPA 9, Adventure	05-15-89	NA	90	TEST HOLE BACK FILLED	NA	NA	Topsoil 0 - 05 Kingshill Limestone 05 - 90
11	VIWAPA 10, Adventure	05-16-89	NA	70	TEST HOLE BACK FILLED	NA	NA	Topsoil 0 - 10? Kingshill Limestone 10 - 70
12	VIWAPA 11, Adventure (Observation Well)	05-17-89	4	110	20	20 - 80	4	Topsoil 0 - 10? Kingshill Limestone 10 - 96 Jealousy Formation 96 - 100
13	VIWAPA 12, Adventure (Observation Well)	05-18-89	4	100	20	20 - 80	55	Topsoil 0 - 05 Kingshill Limestone 05 - 100
15	VIWAPA 17, Adventure (Observation Well)	06-09-89	4	95	10	10 - 40	< 5	Topsoil 0 - 05 Alluvial deposits 05 - 15 Kingshill Limestone 15 - 95
16	VIWAPA 18, Adventure (Municipal Water Well)	06-13-89	6	90	20	20 - 80	25	Topsoil 0 - 05? Alluvial deposits 05 - 17 Kingshill Limestone 17 - 85 Jealousy Formation 85 - 90
17	VIWAPA 19, Adventure (Municipal Water Well)	06-15-89	6	100	20	20 - 80	50	Topsoil 0 - 07? Alluvial deposits 07 - 25 Kingshill Limestone 25 - 98 Jealousy Formation 98 - 100
18	VIWAPA 20, Adventure (Municipal Water Well)	06-19-89	6	100	20	20 - 95	60	Topsoil 0 - 05? Alluvial deposits 05 - 17 Kingshill Limestone 17 - 98 Jealousy Formation 98 - 100
21	VIWAPA 13, Golden Grove (Municipal Water Well)	05-22-89	6	120	30	30 - 115	30	Topsoil 0 - 06? Alluvial deposits 06 - 57 Kingshill Limestone 57 - 120
22	VIWAPA 14, Golden Grove (Observation Well)	05-25-89	4	100	20 40 - 55	20 - 40 55 - 75	< 5	Topsoil 0 - 06? Alluvial deposits 06 - 50 Kingshill Limestone 50 - 100

Table 1. Description of test holes drilled during 1989 in south-central St. Croix, U.S. Virgin Islands--Continued

[fig, figure; mm-dd-yy, month-day-year; in, inches; ft-blsd, feet below land surface datum; gal/min, gallons per minute; VIWAPA, Virgin Islands Water and Power Authority; <, less than; ?, indicates that contact is uncertain; NA, data not available]

Well number (see fig 1)	Well name (see table 2)	Date drilled (mm-dd-yy)	Diameter of casing (in)	Depth of			Screen interval (ft-blsd)	Estimated yield (gal/min)	Subsurface material (ft-blsd)
				test hole (ft-blsd)	of casing (ft-blsd)	of hole (ft-blsd)			
23	VIWAPA 15, Golden Grove (Municipal Water Well)	05-30-89	6	100	31	31 - 92	20		Topsoil 0 - 05 Alluvial deposits 05 - 50 Kingshill Limestone 50 - 100
24	VIWAPA 16, Golden Grove (Municipal Water Well)	06-06-89	6	110	30	30 - 100	25		Topsoil 0 - 05 Alluvial deposits 05 - 55 Kingshill Limestone 55 - 110
25	VIWAPA 21, Golden Grove (Municipal Water Well)	06-21-89	6	100	30	30 - 90	80		Topsoil 0 - 05? Alluvial deposits 05 - 45 Kingshill Limestone 45 - 100
26	VIWAPA 21A, Golden Grove (Observation Well)	06-23-89	4	100	15	15 - 70	60		Topsoil 0 - 05 Alluvial deposits 05 - 55 Kingshill Limestone 55 - 100
36	VIWAPA 23, Barren Spot (Municipal Water Well)	08-12-89	6	120	80	80 - 120	50		Topsoil 0 - 02 Post-Kingshill Carbonates 02 - 120
37	VIWAPA 23A, Barren Spot (Observation Well)	08-08-89	4	110	70	70 - 110	80		Topsoil 0 - 01 Post-Kingshill Carbonates 01 - 110
38	VIWAPA 24, Barren Spot (Municipal Water Well)	06-30-89	6	110	70	70 - 110	80		Topsoil 0 - 01 Post-Kingshill Carbonates 01 - 110
39	VIWAPA 24A, Barren Spot (Municipal Water Well)	07-05-89	6	120	80	80 - 120	35		Topsoil 0 - 03 Post-Kingshill Carbonates 03 - 120
40	VIWAPA 25, Barren Spot (Municipal Water Well)	06-27-89	6	110	70	70 - 110	70		Topsoil 0 - 05 Alluvial deposits 05 - 20 Kingshill Limestone 20 - 110

Table 2. Well name and site identification number of wells drilled in south-central St. Croix, U.S. Virgin Islands

[*, indicates well drilled by the Virgin Islands Water and Power Authority (VIWAPA) during 1989, wells without this designation completed prior to 1989; DPW, Department of Public Works]

Well number (see figure 1)	Well name	Site identification number
1*	VIWAPA 1, Adventure	174304064484600
2*	VIWAPA 2, Adventure	174303064481100
3*	VIWAPA 2A, Adventure	174303064481101
4*	VIWAPA 3, Adventure	174308064482800
5*	VIWAPA 4, Adventure	174311064482601
6*	VIWAPA 5, Adventure	174304064481900
7*	VIWAPA 6, Adventure	174304064482000
8*	VIWAPA 7, Adventure	174311064481100
9*	VIWAPA 8, Adventure	174306064484701
10*	VIWAPA 9, Adventure	174321064485400
11*	VIWAPA 10, Adventure	174318064490300
12*	VIWAPA 11, Adventure	174329064483000
13*	VIWAPA 12, Adventure	174328064482000
14	VIWAPA 14, Adventure	174311064482900
15*	VIWAPA 17, Adventure	174316064480800
16*	VIWAPA 18, Adventure	174313064481100
17*	VIWAPA 19, Adventure	174307064481000
18*	VIWAPA 20, Adventure	174309064481100
19	VIWAPA 1/DPW 1, Golden Grove	174247064475800
20	VIWAPA 6/DPW 6, Golden Grove	174243064475100
21*	VIWAPA 13, Golden Grove	174240064475600
22*	VIWAPA 14, Golden Grove	174237064474900
23*	VIWAPA 15, Golden Grove	174247064475700
24*	VIWAPA 16, Golden Grove	174244064475500
25*	VIWAPA 21, Golden Grove	174247064475700
26*	VIWAPA 21A, Golden Grove	174247064475701
27	VIWAPA 1, Fairplains	174225064471700
28	VIWAPA 2, Fairplains	174225064472000
29	VIWAPA 6, Fairplains	174225064471900
30	VIWAPA 7, Fairplains	174229064471600
31	VIWAPA 9, Fairplains	174231064471900
32	VIWAPA 3A, Barren Spot	174323064454600
33	VIWAPA 5, Barren Spot	174329064454700
34	VIWAPA 6, Barren Spot	174331064453800
35	VIWAPA 7, Barren Spot	174316064453800
36*	VIWAPA 23, Barren Spot	174327064454600
37*	VIWAPA 23A, Barren Spot	174319064454401
38*	VIWAPA 24, Barren Spot	174319064454400
39*	VIWAPA 24A, Barren Spot	174332064453400
40*	VIWAPA 25, Barren Spot	174316064454300
41	VIWAPA 31, Barren Spot	174315064454000

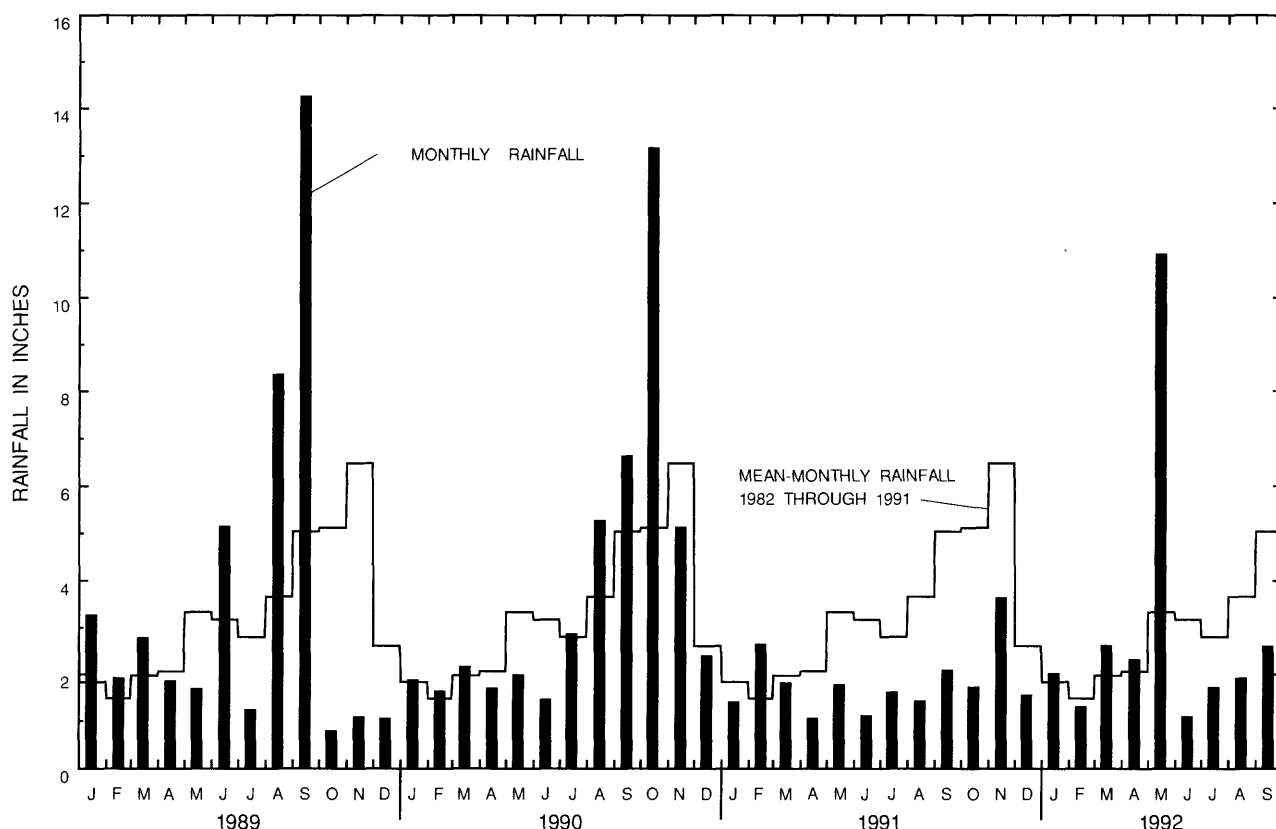


Figure 3. Monthly rainfall at Beth Upper New Works Station, St. Croix, U.S. Virgin Islands, 1989 through September 1992, and mean-monthly rainfall 1982-91. (Data from the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, 1982 through September 1992)

GEOLOGY

The subsurface geology of south-central St. Croix consists of alluvium and underlying carbonate rocks. The carbonate deposits consist of the Jealousy Formation of Eocene to middle Miocene age, the Kingshill Limestone of Miocene to Pliocene age (Gerhard, Frost, and Curth, 1978), and post-Kingshill Carbonates of Pliocene and younger age (Gill and Hubbard 1986). Using this stratigraphic nomenclature the results of the test-hole drilling in south-central St. Croix revealed the following:

ALLUVIAL DEPOSITS--sand and gravel with cobbles and boulders, locally with thin lenses of silt and clay. The alluvial deposits are localized and not laterally extensive. A 5- to 8-foot thick topsoil overlies the alluvial deposits. The alluvial deposits range in thickness from 8 to 51 feet. Depth to the top of the alluvial deposits ranges from 5 to 8 feet below land surface. Depth to the bottom of the

alluvial deposits ranges from 10 to 57 feet below land surface.

POST-KINGSHILL CARBONATES--a shallow-water carbonate deposit which is dominantly a benthic foraminiferal packstone, with significant quantities of reef and skeletal clasts (Gill and Hubbard, 1986). Locally, these deposits were interbedded with clay, crushed coarse-grained coral fragments, and conglomerates of washed out limestone boulders and volcanic gravel, cobbles, and boulders. The top of the post-Kingshill Carbonates was near land surface and this unit commonly was overlain by only a 1- to 3-foot thick topsoil. Deposits of the post-Kingshill Carbonates were localized and were penetrated only in test holes drilled in the Barren Spot well field (fig. 1, table 1). Test-hole drilling indicated that the depth to the bottom of these deposits exceeded 120 feet below land surface, at some sites.

KINGSHILL LIMESTONE--a deep-water carbonate deposit of relatively soft, white to buff marl, which is locally fractured (Gill and Hubbard, 1986) with iron and manganese oxide stains common in the fracture zones. The Kingshill Limestone generally was overlain by a 5- to 8-foot thick layer of topsoil or alluvium. Where the bottom of the Kingshill Limestone was penetrated by test holes, this unit had a thickness that ranged from 68 to 100 feet. Depth to the top of the Kingshill Limestone ranged from 5 to 57 feet below land surface. Depth to the bottom of the Kingshill Limestone ranged from 107 to more than 120 feet below land surface.

JEALOUSY FORMATION--a deep-water deposit of bluish-gray clay which contains a rich planktonic foraminiferal assemblage (Gill and Hubbard, 1986). The Jealousy Formation underlies the Kingshill Limestone. The top of the Jealousy Formation was from 85 to 108 feet below land surface in the test holes drilled during this study. However, data from other wells in the area indicate that the depth to the top of the Jealousy Formation exceeds 120 feet below land surface in places. The thickness of the Jealousy Formation has been estimated to exceed 1,400 feet (Gill and Hubbard, 1986).

GROUND-WATER HYDROLOGY

Fresh ground water is not plentiful in St. Croix, but it exists in sufficient quantities in some areas to be a source of water for public supply. Most of the fresh ground water exists at relatively shallow depths in unconsolidated surficial deposits or in relatively shallow limestone deposits.

Ground Water Occurrence and Movement

Ground water occurs under water-table conditions in the alluvial, post-Kingshill Carbonates, and Kingshill Limestone deposits. Where the alluvial deposits are saturated, they are considered to be hydraulically connected to the post-Kingshill Carbonates and Kingshill Limestone deposits and thus these thin units are considered a single hydrologic unit. The top of the

Jealousy Formation, which underlies all of south-central St. Croix, is considered to be the bottom of this hydrologic unit.

The water table fluctuates seasonally in response to rainfall variation and can fluctuate daily in wells located near pumping wells. Depth to the water table ranges from approximately 5 to 36 feet below land surface in the Adventure well field (fig. 4); 13 to 43 feet below land surface in the Golden Grove well field (fig. 5); 20 to 26 feet below land surface in the Fairplains well field (fig. 6); and 57 to 68 feet below land surface in the Barren Spot well field (fig. 6).

The general direction of ground-water flow in south-central St. Croix is south-southeast toward the coast (Torres-González and Rodríguez del Río, 1990) (fig. 7). The elevation of the water table can range from approximately 140 feet above mean sea level in the northern part of the study area to less than 5 feet above mean sea level near the coast.

The quantity of water recharging the water-table aquifer in south-central St. Croix has been estimated to be approximately 3 percent of annual rainfall (Robison, 1972). Jordan (1973) reported that aquifer recharge in the USVI is infrequent and probably occurs only after periods of heavy rainfall or a series of lesser rains. He believed that because of relatively low annual rainfall and high average annual temperatures, most recharge occurred after major rainstorms which produced more than 2 inches of rain. Evidence of the occurrence of recharge following a major rainstorm and the infrequency of aquifer recharge is evident when water-table fluctuations are compared to rainfall records (figs. 4, 5, and 6). During this study, substantial increases in ground-water levels were recorded only after three heavy rainfall events in September 1989 (14.24 inches), October 1990 (13.16 inches), and May 1992 (10.90 inches).

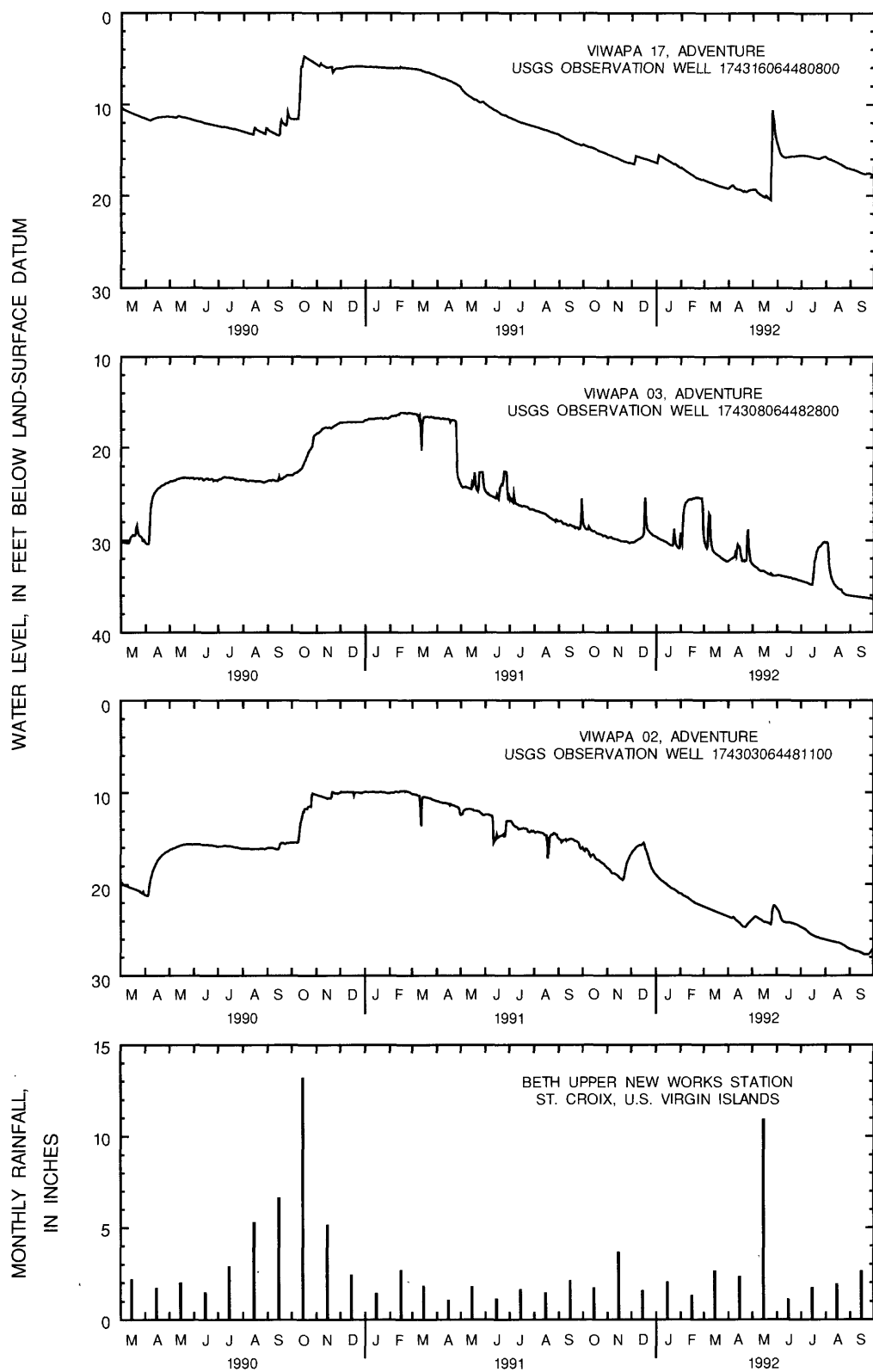


Figure 4. Daily mean ground-water levels in selected wells at the Adventure well field and monthly rainfall at Beth Upper New Works Station, St. Croix, U.S. Virgin Islands, March 1990 through September 1992.

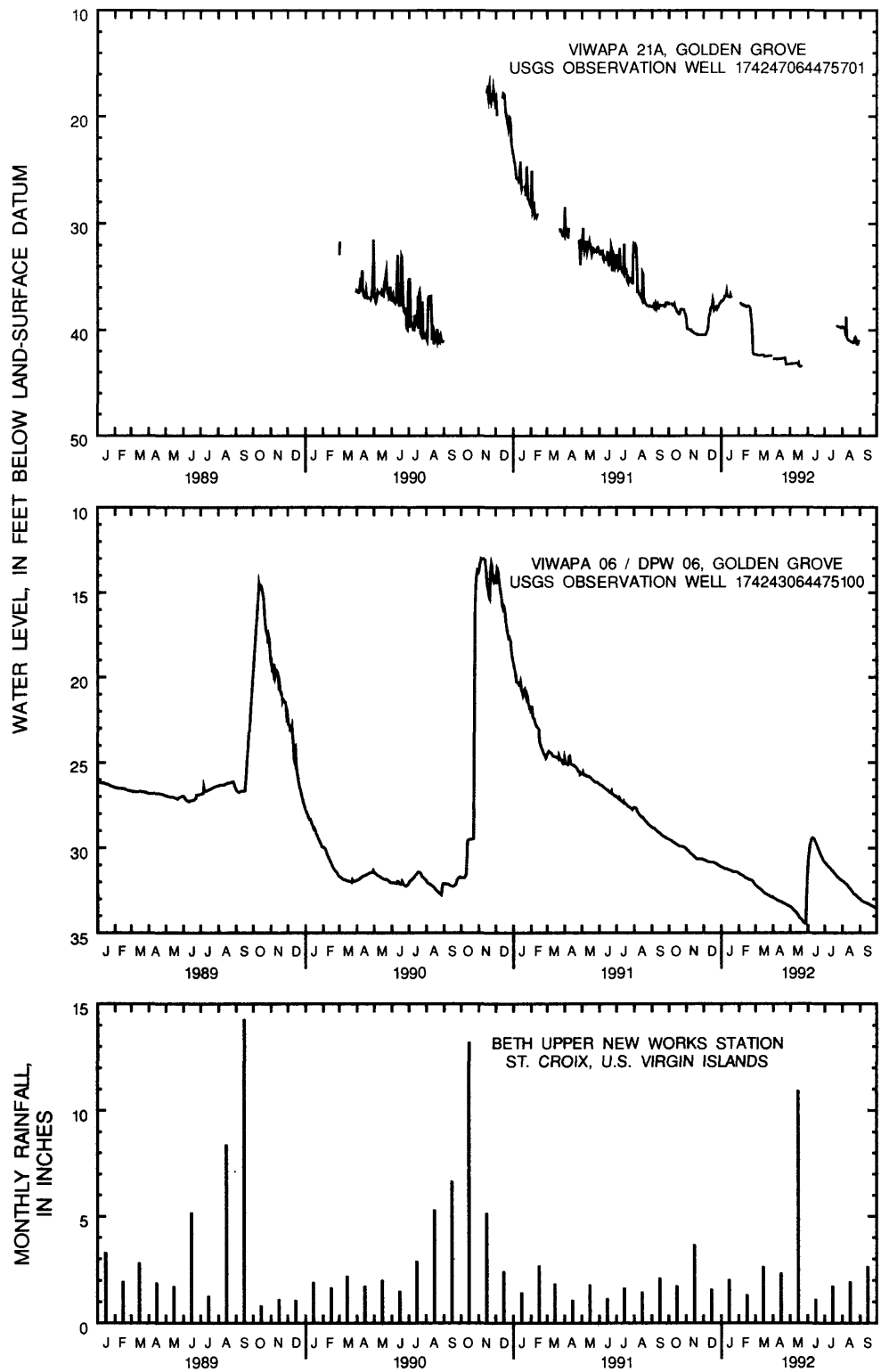


Figure 5. Daily mean ground-water levels in selected wells at the Golden Grove well field and monthly rainfall at Beth Upper New Works Station, St. Croix, U.S. Virgin Islands, 1989 through September 1992.

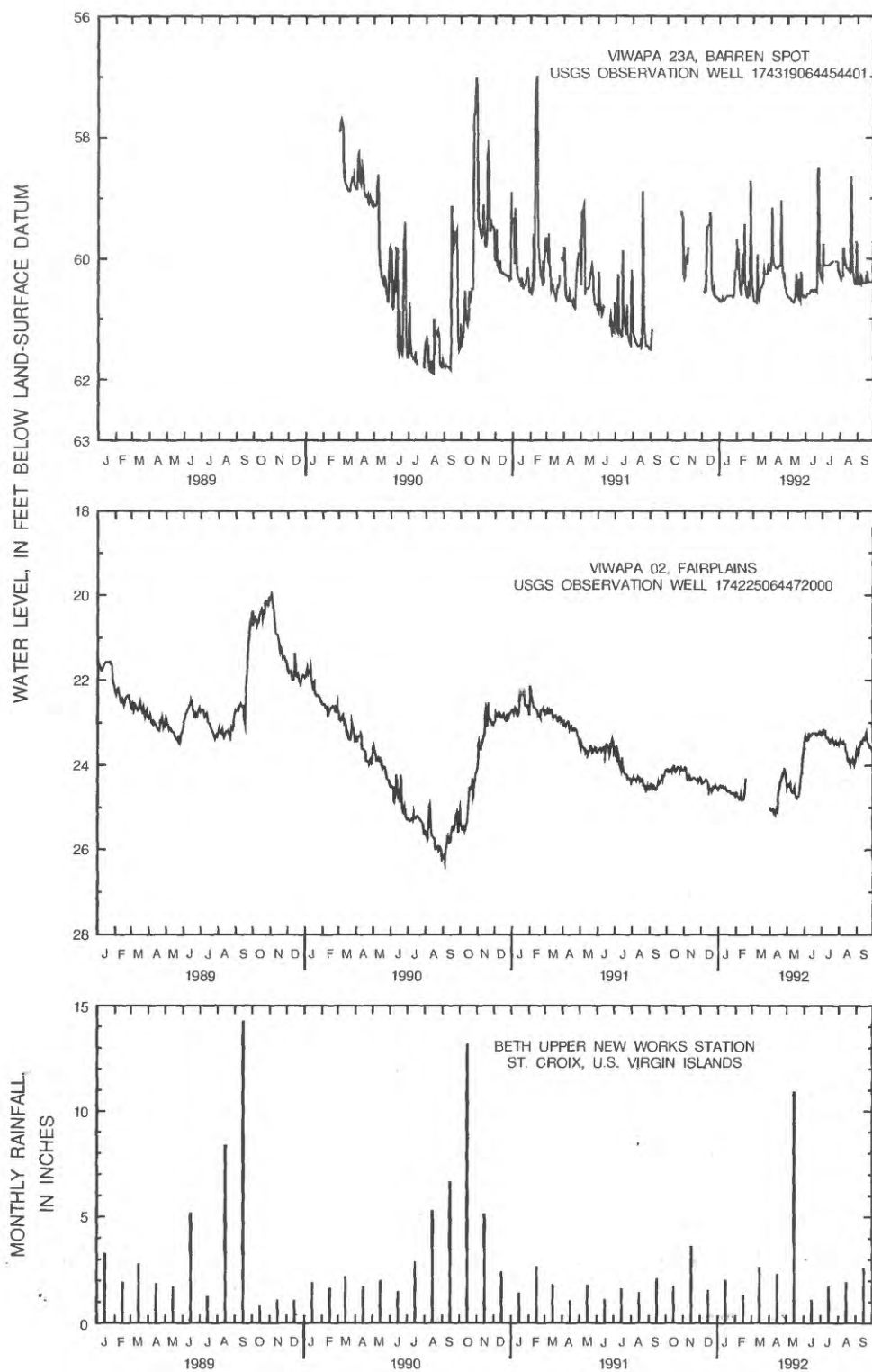
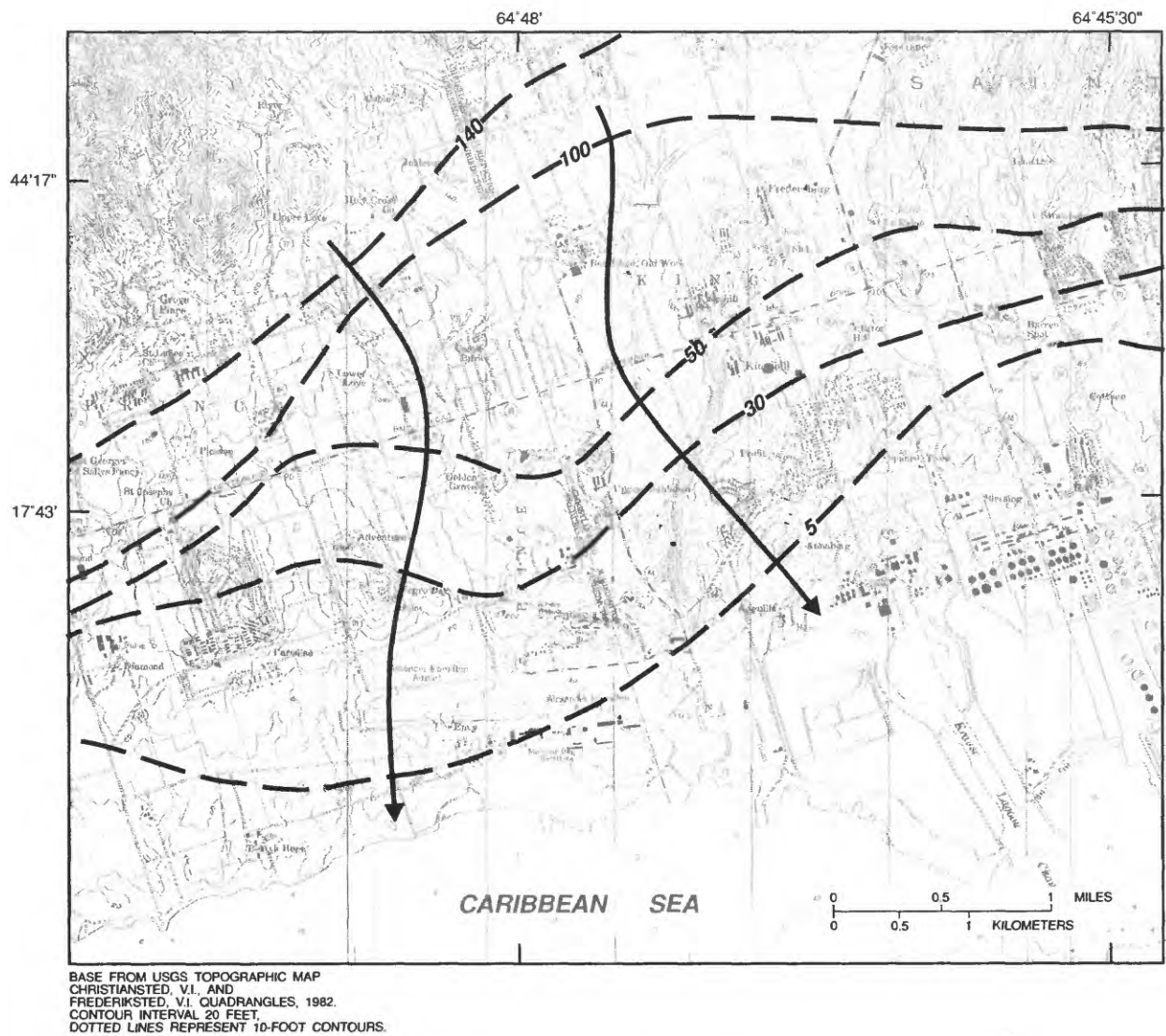


Figure 6. Daily mean ground-water levels in wells VIWAPA 02, Fairplains, and VIWAPA 23A, Barren Spot, and monthly rainfall at Beth Upper New Works Station, St. Croix, U.S. Virgin Islands, 1989 through September 1992.



EXPLANATION

- 5 — LINE OF EQUAL WATER-TABLE ALTITUDE, IN FEET ABOVE MEAN SEA-LEVEL
Interval is variable. All contours are approximately located.
- ← DIRECTION OF GROUND-WATER FLOW

Figure 7. Configuration of the water table in south-central St. Croix, U.S. Virgin Islands, July 1987.
(Adapted from Torres-González and Rodríguez del Río, 1990)

Hydraulic Characteristics of the Aquifer

The ground-water development potential of an aquifer is dependent upon hydraulic characteristics of transmissivity and storage coefficient. Transmissivity is a measure of the ability of the aquifer to transmit water and is defined as the product of the hydraulic conductivity and the aquifer thickness. The storage coefficient is the volume of water an aquifer releases from or takes into storage per unit surface area of the aquifer per unit change in head.

During this study, aquifer transmissivities in south-central St. Croix were estimated to range from 180 to 3,300 feet squared per day. Transmissivity values for wells located in the Adventure well field were determined from four specific capacity tests. The specific capacity values determined from these tests ranged from 1 to 14 gallons per minute per foot of drawdown (table 3). The specific capacity values were converted to transmissivity using a method described by Meyer (1963), that relates well diameter, specific capacity, and the aquifer storage coefficient to aquifer transmissivity. Aquifer storage coefficients were not determined from field tests for this report, but rather are assumed to be typical water-table storage coefficients, which range from 0.1 to 0.3 (Lohman, 1979). The specific capacity/aquifer transmissivity relation developed by Meyer (1963) assumes a water-table storage coefficient of 0.1.

The variation in aquifer transmissivity values in the Adventure well field can be explained by the presence or absence of intersecting fracture zones within the Kingshill Limestone. Where the density of fracture zones increase, the aquifer transmissivity will increase.

Field tests to determine specific capacity were conducted only in the Adventure well field. However, well yield was estimated for all 28 test holes drilled in 1989 (table 1). The test to estimate well yield was completed by forcing, at a constant rate, compressed air through the drill pipe and measuring continuous flow out of the test hole. Results of this testing indicated somewhat higher potential aquifer yields in the Barren Spot well field, where yields of 35 to 80 gallons per minute were measured, than in the other well fields. Yields of less than 5 to 60 gallons per minute and less than 5 to 80 gallons per minute were measured in the Adventure and Golden Grove well fields, respectively. No wells were drilled or specific capacity tests conducted in the Fairplains well field for this study. However, Torres-González (1991) indicated that aquifer transmissivity in the Fairplains area ranged from 3,000 to 4,000 feet squared per day.

The relatively wide range of yields in the study area probably is due to the nonhomogeneity of the aquifer material. High yields in the Post Kingshill are due to the primary depositional porosity of the shallow-water limestone deposits and interlayered conglomerates and

Table 3. Estimated transmissivity from specific capacity for selected wells at the Adventure well field, St. Croix, U.S. Virgin Islands (Estimates based on method described by Meyer, 1963)

[(gal/min)/ft, gallons per minute per foot of drawdown; ft²/d, feet squared per day]

Well name	Specific capacity [(gal/min)/ft]	Transmissivity (ft ² /d)	Length of test (hours)
VIWAPA 05, Adventure	2	420	19
VIWAPA 14, Adventure	1	180	19
VIWAPA 18, Adventure	1	180	20
VIWAPA 19, Adventure	14	3,300	20

volcanics, as well as to subsequent diagenetic changes within the limestone. Generally, where the Post Kingshill is tapped by wells, the yields will be consistently high. In the Kingshill Limestone high yields are common only in areas where there is a high density of intersecting fracture zones. The range of yields in the alluvial deposits are limited by the thin (10- to 30-foot), saturated thickness of the deposits. In areas where the thickness of the saturated alluvial deposits is greater, the yields probably are greater.

WATER QUALITY

In order to describe the quality of ground water in south-central St. Croix, 33 samples were collected from 25 wells and analyzed for common cations and anions and trace metals (table 4). Results of these analyses indicated that the ground water in the Golden Grove, Fairplains, and Barren Spot well fields was predominantly a sodium-chloride type water (Piper, 1953; figs. 8 and 9). In the Adventure well field, the ground-water type was mixed; no one cation or anion exceeded 50 percent of the total milliequivalents of cations or anions.

In an island setting, ground water that is a sodium chloride type water commonly is considered to contain a mixture of freshwater and seawater (Gómez-Gómez, 1984). The source of the seawater could be from the lateral migration of seawater from the ocean through the aquifer, from the upconing of saline water as a result of excessive pumping, or from the presence of connate seawater which has not been completely flushed out of the aquifer. To help identify the source of the sodium chloride in ground water in south-central St. Croix, ground-water samples were collected monthly from selected wells in each well field and analyzed for chloride concentration and specific conductance (tables 5, 6, 7, and 8). If the seasonal variations in the chloride concentrations are small, connate water is the most likely source of the sodium chloride; assuming that pumping at the well fields is relatively constant. If the variations are large, sodium chloride is most likely the source of upconing or lateral migration (intrusion) of seawater which changes with the seasonal water-level fluctuations in the aquifer, and the related movement of the saltwater-freshwater interface.

In the Adventure and Golden Grove well fields, it is suspected that connate water is the source of saltwater, whereas in the Fairplains and Barren Spot well fields it is suspected that intrusion is the source of saltwater. In the Adventure and Golden Grove well fields, relatively small seasonal variations in chloride concentration indicate that connate water might be the principle source of the chloride. In the Adventure well field, the ranges of seasonal variation in chloride concentrations in samples collected from June 1990 to September 1992, from wells 6, 7, 16, 18, and 19 were 66, 292, 14, 22, and 14 milligrams per liter (mg/L), respectively (table 5). In the Golden Grove well field, the variations in chloride concentrations in samples collected from August 1990 to September 1992, from wells 1, 13, 15, 16, and 21 was 70, 80, 84, 68, and 56 mg/L, respectively (table 6). With the exception of the significant change in chloride concentration in water from well 7 in the Adventure well field (292 mg/L), the relatively small seasonal variation in chloride concentrations and the relatively large water-level fluctuations of as much as 20 feet in the two well fields indicate that connate ground water probably is the predominant source of the sodium chloride. The seasonal variation in chloride concentration of 292 mg/L in well 7 of the Adventure well field might indicate possible upconing of saltwater into the Adventure well field at that site.

In the Fairplains and Barren Spot well fields the greater seasonal variations in chloride concentrations indicate that seawater intrusion into the aquifer might be the principal source of the chloride. In the Fairplains well field, the variation in chloride concentrations in samples collected from June 1991 to September 1992, from wells 7 and 8 were 290 and 710 mg/L, respectively (table 7). In the Barren Spot well field, the variations in chloride concentrations in samples collected from August 1990 to September 1992, from wells 3A, 5, 6, 7, 25, 24, 23, and 31 was 94, 220, 112, 94, 162, 250, 82, and 164 mg/L, respectively (table 8). The greater seasonal variations in chloride concentrations, and relatively small seasonal water-level fluctuations (approximately 6 feet) indicates that seawater intrusion could be the principal source of chloride in water from wells in these two well fields.

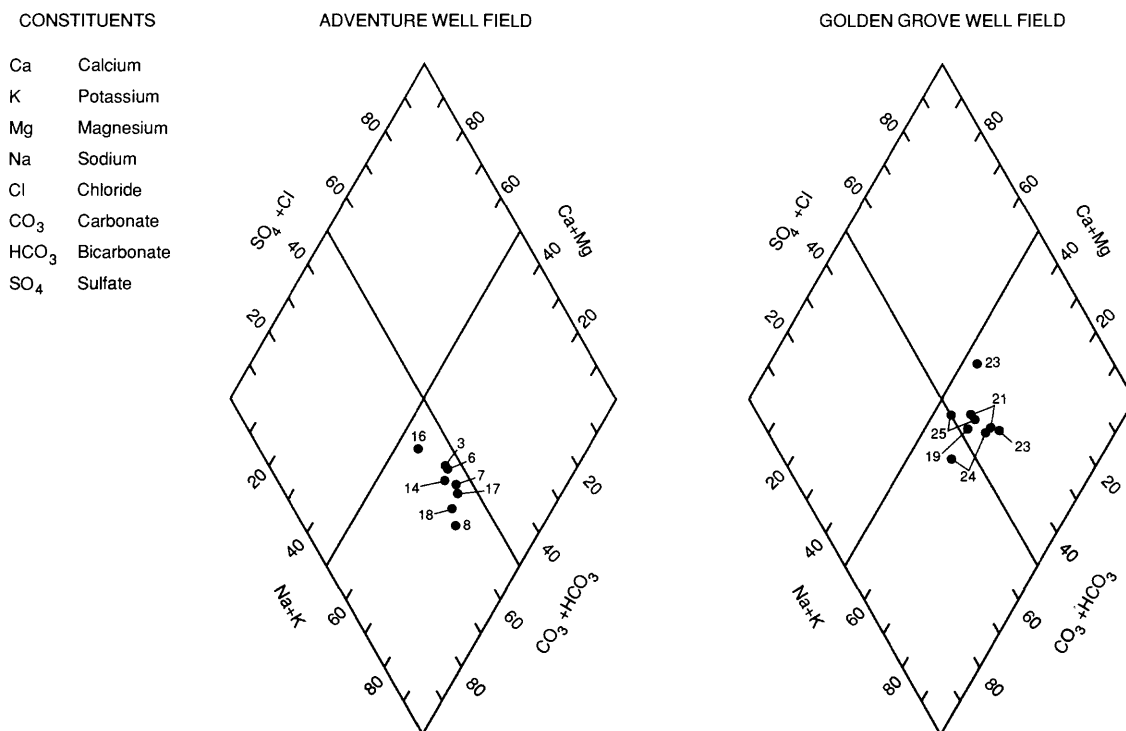


Figure 8. Diagrams showing major constituents in ground water from wells in the Adventure and Golden Grove well fields, St. Croix, U.S. Virgin Islands. Values shown are percent of total milliequivalents per liter. Numbers refer to wells in table 2.

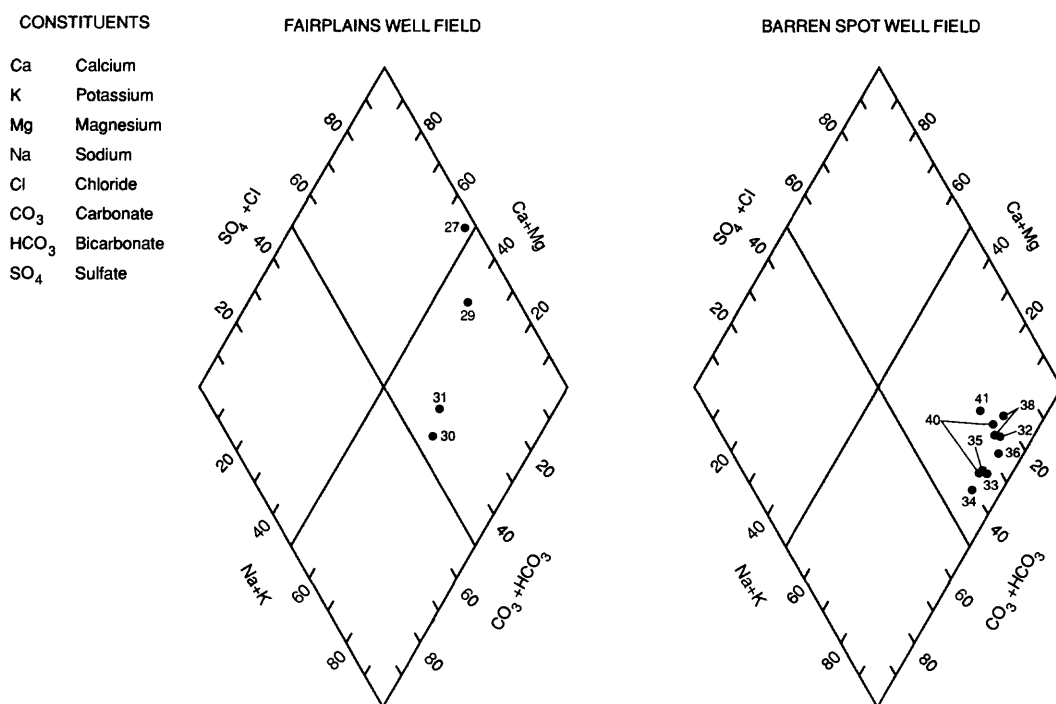


Figure 9. Diagrams showing major constituents in ground water from wells in the Fairplains and Barren Spot well fields, St. Croix, U.S. Virgin Islands. Values shown are percent of total milliequivalents per liter. Numbers refer to wells in table 2.

Table 4. Chemical analyses of ground-water samples from wells in south-central St. Croix, U.S. Virgin Islands

[fig, figure; mm-dd-yy, month-day-year; $\mu\text{S}/\text{cm}$, microsiemens per centimeter at 25 degrees Celsius; deg °C, degrees Celsius; mg/L, milligrams per liter; VIWAPA, Virgin Islands Water and Power Authority; DPW, Department of Public Works]

Well name	Well number (see fig 1 and table 1)	Date (mm-dd-yy)	Specific conductance		pH (field value)	Temperature (deg °C)	Hardness (mg/L as CaCO_3)		Alkalinity (laboratory value) (mg/L as CaCO_3)	Calcium, dissolved (mg/L as Ca)		Magnesium, dissolved (mg/L as Mg)		Sodium, dissolved (mg/L as Na)	
			($\mu\text{S}/\text{cm}$)	(laboratory value)			(mg/L)	(CaCO_3)		(mg/L)	(as Ca)	(mg/L)	(as Mg)	(mg/L)	(as Na)
VIWAPA 2A Adventure	3	03-11-91	1,870		7.3	26.5	330		597	56		45		290	
VIWAPA 05 Adventure	6	03-12-91	2,020		7.1	27.0	360		648	57		52		330	
VIWAPA 06 Adventure	7	03-12-91	2,030		7.3	26.5	310		634	45		47		350	
VIWAPA 07 Adventure	8	03-11-91	1,600		7.3	27.0	190		553	35		24		290	
VIWAPA 14 Adventure	14	04-17-91	1,700		7.3	25.5	270		528	42		40		260	
VIWAPA 18 Adventure	16	03-11-91	1,430		7.2	26.5	320		494	60		42		190	
VIWAPA 19 Adventure	17	07-31-91	1,810		7.3	29.0	230		577	39		32		290	
VIWAPA 20 Adventure	18	03-11-91	1,660		7.3	26.5	230		566	44		28		290	
VIWAPA Golden Grove DPW 1	19	02-12-91	1,930		8.3	28.0	390		537	75		50		280	
VIWAPA 13 Golden Grove	21	04-17-90	1,990		7.1	27.0	400		510	70		55		270	
VIWAPA 13 Golden Grove	21	01-22-91	1,630		7.1	27.0	280		449	48		38		250	
VIWAPA 15 Golden Grove	23	04-17-90	2,480		7.1	28.0	410		587	75		53		410	
VIWAPA 15 Golden Grove	23	01-22-91	1,360		7.1	27.5	340		488	66		42		180	
VIWAPA 16 Golden Grove	24	04-17-90	2,220		7.1	28.5	400		557	71		54		350	
VIWAPA 16 Golden Grove	24	01-22-91	1,440		7.1	27.5	290		480	52		40		200	
VIWAPA 21 Golden Grove	25	04-17-90	1,950		7.2	28.0	390		509	71		52		270	
VIWAPA 21 Golden Grove	25	01-22-91	1,820		7.1	27.0	420		527	77		55		230	
VIWAPA 01 Fairplains	27	01-10-91	12,600		7.0	27.5	3,400		278	660		420		1,400	
VIWAPA 06 Fairplains	29	01-10-91	5,970		7.2	27.5	1,200		504	220		150		800	
VIWAPA 07 Fairplains	30	01-10-91	3,830		7.2	27.5	550		560	110		67		620	
VIWAPA 09 Fairplains	31	01-10-91	2,320		7.4	28.0	380		539	68		50		370	
VIWAPA 3A Barren Spot	32	01-25-91	3,860		7.5	27.5	170		541	43		16		780	
VIWAPA 05 Barren Spot	33	01-28-91	3,010		7.7	27.0	110		596	25		11		620	
VIWAPA 06 Barren Spot	34	01-28-91	2,440		7.7	27.5	110		561	28		10		510	
VIWAPA 07 Barren Spot	35	01-25-91	2,760		7.7	26.5	130		559	34		12		570	
VIWAPA 23 Barren Spot	36	04-16-90	3,380		7.5	28.0	130		546	32		13		720	
VIWAPA 23 Barren Spot	36	01-28-91	3,670		7.6	26.0	150		566	37		15		750	
VIWAPA 24 Barren Spot	38	04-16-90	4,260		7.6	27.5	280		504	69		25		870	
VIWAPA 24 Barren Spot	38	01-25-91	3,690		7.6	27.0	210		549	54		19		740	
VIWAPA 25 Barren Spot	40	04-16-90	3,680		7.5	27.5	260		531	60		27		740	
VIWAPA 25 Barren Spot	40	01-25-91	2,760		7.5	25.5	140		559	35		12		550	
VIWAPA 31 Barren Spot	41	01-28-91	997		7.7	25.0	160		426	25		24		170	
VIWAPA 31 Barren Spot	41	07-24-91	3,400		7.3	27.5	320		508	79		31		610	

Table 4. Chemical analyses of ground-water samples from wells in south-central St. Croix, U.S. Virgin Islands--Continued
[fig, figure; mm-dd-yy, month-day-year; mg/L, milligrams per liter; VIWAPA, Virgin Islands Water and Power Authority; DPW, Department of Public Works]

Well name	Well number (see fig 1 and table 1)	Date (mm-dd-yy)	Potas- sium, dis- solved (mg/L as K)	Sulfate, dis- solved (mg/L as SO ₄)	Chlo- ride, dis- solved (mg/L as Cl)	Fluo- ride, dis- solved (mg/L as F)	Silica, dis- solved (mg/L as SiO ₂)	Dis- solved solids (mg/L)
VIWAPA 2A Adventure	3	03-11-91	0.4	94	230	0.80	43	1,120
VIWAPA 05 Adventure	6	03-12-91	.4	86	260	.80	44	1,220
VIWAPA 06 Adventure	7	03-12-91	.6	84	260	.80	41	1,210
VIWAPA 07 Adventure	8	03-11-91	.5	94	150	.90	44	970
VIWAPA 14 Adventure	14	04-17-91	.6	53	200	.60	41	954
VIWAPA 18 Adventure	16	03-11-91	1.2	71	150	.50	48	859
VIWAPA 19 Adventure	17	07-31-91	.4	84	220	1.00	41	1,050
VIWAPA 20 Adventure	18	03-11-91	.7	92	170	.70	45	1,010
VIWAPA Golden Grove DPW 1	19	02-12-91	.9	100	270	.60	44	1,140
VIWAPA 13 Golden Grove	21	04-17-90	1.1	86	300	.20	47	1,140
VIWAPA 13 Golden Grove	21	01-22-91	.7	75	210	.50	39	930
VIWAPA 15 Golden Grove	23	04-17-90	1.1	140	400	.30	58	1,490
VIWAPA 15 Golden Grove	23	01-22-91	1.9	51	140	.40	39	813
VIWAPA 16 Golden Grove	24	04-17-90	1.1	110	350	.20	54	1,320
VIWAPA 16 Golden Grove	24	01-22-91	.7	65	160	.50	39	845
VIWAPA 21 Golden Grove	25	04-17-90	1.2	91	290	.20	48	1,130
VIWAPA 21 Golden Grove	25	01-22-91	1.2	87	240	.30	40	1,050
VIWAPA 01 Fairplains	27	01-10-91	6.0	450	4400	.10	36	7,540
VIWAPA 06 Fairplains	29	01-10-91	3.5	290	1600	.30	38	3,400
VIWAPA 07 Fairplains	30	01-10-91	2.5	240	860	.90	38	2,270
VIWAPA 09 Fairplains	31	01-10-91	1.4	190	350	.10	38	1,390
VIWAPA 3A Barren Spot	32	01-25-91	9.0	250	780	.70	27	2,230
VIWAPA 05 Barren Spot	33	01-28-91	8.8	200	510	.80	26	1,760
VIWAPA 06 Barren Spot	34	01-28-91	5.5	130	380	1.00	23	1,420
VIWAPA 07 Barren Spot	35	01-25-91	6.8	130	480	1.00	26	1,590
VIWAPA 23 Barren Spot	36	04-16-90	8.6	200	670	.20	32	2,000
VIWAPA 23 Barren Spot	36	01-28-91	9.5	220	700	.70	27	2,100
VIWAPA 24 Barren Spot	38	04-16-90	8.0	290	880	.30	33	2,480
VIWAPA 24 Barren Spot	38	01-25-91	6.5	240	720	.80	27	2,140
VIWAPA 25 Barren Spot	40	04-16-90	12.0	230	760	.10	34	2,180
VIWAPA 25 Barren Spot	40	01-25-91	5.7	130	470	.90	26	1,560
VIWAPA 31 Barren Spot	41	01-28-91	12.0	39	67	.80	26	619
VIWAPA 31 Barren Spot	41	07-24-91	8.6	230	650	.90	27	1,940

Table 4. Chemical analyses of ground-water samples from wells in south-central St. Croix, U.S. Virgin Islands--Continued
[fig, figure; mm-dd-yy, month-day-year; mg/L, milligrams per liter; µg/L, micrograms per liter; VIWAPA, Virgin Islands Water and Power Authority; DPW, Department of Public Works; --, indicates data not available; <, less than]

Well name	Well number (see fig 1 and table 1)	Date (mm-dd-yy)	Nitro- gen, NO ₂ +NO ₃		Iron, dis- solved (µg/L as Fe)	Man- ganese dis- solved (µg/L as Mn)	Barium dis- solved (µg/L as Ba)	Alumi- nium dis- solved (µg/L as Al)	Arsenic dis- solved (µg/L as As)	Cadmium dis- solved (µg/L as Cd)	Chro- mium dis- solved (µg/L as Cr)
			dis- solved (mg/L as N)	solved (mg/L as N)							
VIWAPA 2A Adventure	3	03-11-91	--	--	3	2	27	<10	1	1	1
VIWAPA 05 Adventure	6	03-12-91	--	--	10	10	100	<10	1	1	1
VIWAPA 06 Adventure	7	03-12-91	--	--	10	10	100	15	1	1	1
VIWAPA 07 Adventure	8	03-11-91	--	--	3	1	31	1	1	2	1
VIWAPA 14 Adventure	14	04-17-91	--	--	6	2	21	12	1	1	1
VIWAPA 18 Adventure	16	03-11-91	--	--	5	6	40	--	1	1	1
VIWAPA 19 Adventure	17	07-31-91	1.2	--	9	1	24	10	1	1	1
VIWAPA 20 Adventure	18	03-11-91	--	--	5	1	39	--	1	1	1
VIWAPA Golden Grove DPW 1	19	02-12-91	--	--	12	1	48	<10	1	1	1
VIWAPA 13 Golden Grove	21	04-17-90	2.7	--	3	1	46	20	--	--	--
VIWAPA 13 Golden Grove	21	01-22-91	--	--	3	1	32	<10	1	1	1
VIWAPA 15 Golden Grove	23	04-17-90	2.8	--	10	10	100	10	--	--	--
VIWAPA 15 Golden Grove	23	01-22-91	--	--	3	1	20	<10	1	1	1
VIWAPA 16 Golden Grove	24	04-17-90	3.2	--	10	10	100	10	--	--	--
VIWAPA 16 Golden Grove	24	01-22-91	--	--	3	1	21	12	1	1	1
VIWAPA 21 Golden Grove	25	04-17-90	3.3	--	9	1	47	10	--	--	--
VIWAPA 21 Golden Grove	25	01-22-91	--	--	3	1	42	<10	1	1	1
VIWAPA 01 Fairplains	27	01-10-91	--	--	20	100	400	10	1	2	6
VIWAPA 06 Fairplains	29	01-10-91	--	--	10	10	100	14	1	1	1
VIWAPA 07 Fairplains	30	01-10-91	--	--	10	30	100	<10	1	1	1
VIWAPA 09 Fairplains	31	01-10-91	--	--	10	340	100	<10	1	1	1
VIWAPA 3A Barren Spot	32	01-25-91	--	--	10	10	100	<10	1	1	1
VIWAPA 05 Barren Spot	33	01-28-91	--	--	10	10	100	<10	2	1	1
VIWAPA 06 Barren Spot	34	01-28-91	--	--	10	10	100	11	3	1	2
VIWAPA 07 Barren Spot	35	01-25-91	--	--	10	10	100	<10	1	1	2
VIWAPA 23 Barren Spot	36	04-16-90	5.2	--	20	10	100	10	--	--	--
VIWAPA 23 Barren Spot	36	01-28-91	--	--	10	10	100	<10	1	1	2
VIWAPA 24 Barren Spot	38	04-16-90	6.1	--	200	10	100	10	--	--	--
VIWAPA 24 Barren Spot	38	01-25-91	--	--	10	10	100	<10	1	1	1
VIWAPA 25 Barren Spot	40	04-16-90	5.2	--	40	10	100	10	--	--	--
VIWAPA 25 Barren Spot	40	01-25-91	--	--	10	10	100	<10	1	1	1
VIWAPA 31 Barren Spot	41	01-28-91	--	--	14	23	110	<10	1	1	1
VIWAPA 31 Barren Spot	41	07-24-91	6.3	--	20	10	100	20	1	1	1

Table 4. Chemical analyses of ground-water samples from wells in south-central St. Croix, U.S. Virgin Islands--Continued
[fig. figure; mm-dd-yy, month-day-year; µg/L, micrograms per liter; VIWAPA, Virgin Islands Water and Power Authority; DPW,
Department of Public Works; --, indicates data not available]

Well name	Well number (see fig 1 and table 1)	Date (mm-dd-yy)	Mer- cury		Sel- nium		Silver		Lead	
			dis- solved (µg/L as Hg)	solved (µg/L as Se)	dis- solved (µg/L as Ag)	dis- solved (µg/L as Pb)				
VIWAPA 2A Adventure	3	03-11-91	0.2	1	1	1				
VIWAPA 05 Adventure	6	03-12-91	.9	1	1	1				
VIWAPA 06 Adventure	7	03-12-91	.3	2	1	1				
VIWAPA 07 Adventure	8	03-11-91	.1	2	1	1				
VIWAPA 14 Adventure	14	04-17-91	.1	2	1	1				
VIWAPA 18 Adventure	16	03-11-91	.2	2	1	1				
VIWAPA 19 Adventure	17	07-31-91	.1	1	1	1				
VIWAPA 20 Adventure	18	03-11-91	.2	3	1	1				
VIWAPA Golden Grove DPW 1	19	02-12-91	.1	3	1	1				
VIWAPA 13 Golden Grove	21	04-17-90	--	--	--	--				
VIWAPA 13 Golden Grove	21	01-22-91	.3	4	1	1				
VIWAPA 15 Golden Grove	23	04-17-90	--	--	--	--				
VIWAPA 15 Golden Grove	23	01-22-91	.1	4	1	1				
VIWAPA 16 Golden Grove	24	04-17-90	--	--	--	--				
VIWAPA 16 Golden Grove	24	01-22-91	.8	9	1	1				
VIWAPA 21 Golden Grove	25	04-17-90	--	--	--	--				
VIWAPA 21 Golden Grove	25	01-22-91	.1	6	1	1				
VIWAPA 01 Fairplains	27	01-10-91	1.6	4	2	2				
VIWAPA 06 Fairplains	29	01-10-91	.2	4	1	1				
VIWAPA 07 Fairplains	30	01-10-91	.1	3	1	1				
VIWAPA 09 Fairplains	31	01-10-91	.1	3	1	1				
VIWAPA 3A Barren Spot	32	01-25-91	.1	6	1	1				
VIWAPA 05 Barren Spot	33	01-28-91	.1	5	1	1				
VIWAPA 06 Barren Spot	34	01-28-91	.1	3	1	1				
VIWAPA 07 Barren Spot	35	01-25-91	.1	2	1	1				
VIWAPA 23 Barren Spot	36	04-16-90	--	--	--	--				
VIWAPA 23 Barren Spot	36	01-28-91	.2	5	1	1				
VIWAPA 24 Barren Spot	38	04-16-90	--	--	--	--				
VIWAPA 24 Barren Spot	38	01-25-91	.3	5	1	1				
VIWAPA 25 Barren Spot	40	04-16-90	--	--	--	--				
VIWAPA 25 Barren Spot	40	01-25-91	.1	3	1	1				
VIWAPA 31 Barren Spot	41	01-28-91	.2	1	1	1				
VIWAPA 31 Barren Spot	41	07-24-91	.1	4	1	1				

Table 5. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's (VIWAPA) municipal wells in the Adventure well field, St. Croix

[mm-dd-yy, month-day-year; mg/L, milligrams per liter; μ S/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; PWL, pumping water level; SWL, static water level; WP-WLNA, well pumping-water level not available]

WELL--VIWAPA 6, Adventure						WELL--VIWAPA 7, Adventure					
Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value μ S/cm)	Water level (in feet below land surface)	Comments		Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value μ S/cm)	Water level (in feet below land surface)	Comments	
12-13-89	NA	2,500	27.65	PWL		12-13-89	NA	1,210	11.53	PWL	
12-13-89	NA	2,500	27.65	PWL		01-11-90	NA	NA	12.45	PWL	
01-11-90	NA	NA	27.34	PWL		01-19-90	NA	NA	12.49	PWL	
01-19-90	NA	NA	26.45	PWL		01-31-90	NA	1,650	12.25	PWL	
01-31-90	NA	1,650	17.60	PWL		02-15-90	NA	1,600	13.27	SWL	
02-05-90	NA	NA	NA	SWL		02-23-90	NA	1,490	33.05	PWL	
02-23-90	NA	1,820	50.19	PWL		03-16-90	NA	1,010	29.23	PWL	
02-26-90	NA	1,900	39.57	PWL		03-26-90	NA	NA	29.22	PWL	
03-16-90	NA	NA	35.45	PWL		04-27-90	NA	2,050	12.28	SWL	
03-26-90	NA	1,790	40.65	PWL		06-01-90	NA	NA	12.30	SWL	
04-27-90	NA	1,840	19.33	SWL		06-27-90	NA	NA	12.42	SWL	
06-01-90	NA	NA	18.25	SWL		08-01-91	NA	NA	12.85	SWL	
06-27-90	NA	NA	18.69	SWL		08-29-91	176	1,810	NA	WP-WLNA	
06-26-90	292	2,040	NA	WP-WLNA		09-26-91	188	1,710	NA	WP-WLNA	
08-01-91	NA	NA	17.38	SWL		10-30-91	206	1,780	NA	WP-WLNA	
08-29-91	256	2,090	26.42	PWL		12-03-91	206	1,790	NA	WP-WLNA	
09-27-91	268	2,030	26.97	PWL		01-08-92	468	2,630	NA	WP-WLNA	
10-30-91	276	2,090	NA	WP-WLNA		02-04-92	450	2,560	NA	WP-WLNA	
12-03-91	280	2,080	NA	WP-WLNA		03-13-92	220	1,820	50.81	WP-WLNA	
02-08-92	300	2,060	NA	WP-WLNA		04-28-92	NA	NA	21.08	SWL	
02-05-92	276	2,010	NA	WP-WLNA		05-29-92	216	1,870	47.19	PWL	
03-13-92	280	2,030	NA	WP-WLNA		07-02-92	224	1,860	47.69	PWL	
04-28-92	272	2,030	51.23	PWL		07-28-92	214	1,700	NA	WP-WLNA	
05-29-92	280	2,100	50.74	PWL		09-15-92	NA	NA	21.06	SWL	
07-02-92	NA	2,070	50.46	PWL							
07-28-92	274	1,890	58.05	PWL							
09-15-92	234	2,060	58.61	PWL							

Table 5. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's (VIWAPA) municipal wells in the Adventure well field, St. Croix--Continued

[mm-dd-yy, month-day-year; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; PWL, pumping water level; SWL, static water level; WP-WLNA, well pumping-water level not available]

WELL--VIWAPA 16, Adventure						WELL--VIWAPA 18, Adventure					
Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value µS/cm)	Water level (in feet below land surface)	Comments		Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value µS/cm)	Water level (in feet below land surface)	Comments	
01-31-90	NA	NA	34.49	SWL		12-13-89	NA	1,200	12.35	PWL	
02-23-90	NA	NA	NA	WP-WLNA		01-11-90	NA	NA	12.18	PWL	
03-27-90	NA	NA	31.77	SWL		01-19-90	NA	NA	12.61	PWL	
08-01-91	220	1,730	63.88	PWL		01-31-90	NA	1,450	12.55	PWL	
08-29-91	212	1,750	67.17	PWL		02-15-90	NA	1,400	12.17	SWL	
09-27-91	214	1,700	64.90	PWL		02-23-90	NA	1,330	16.50	PWL	
10-30-91	224	1,750	NA	WP-WLNA		03-16-90	NA	NA	20.95	PWL	
12-03-91	226	1,740	NA	WP-WLNA		03-26-90	NA	1,280	38.25	PWL	
01-08-92	220	1,720	NA	WP-WLNA		04-27-90	NA	1,480	12.12	SWL	
02-05-92	NA	NA	34.52	SWL		06-26-91	146	1,400	NA	WP-WLNA	
03-13-92	216	1,720	64.14	PWL		08-01-91	140	1,400	NA	WP-WLNA	
04-28-92	214	1,690	65.71	PWL		08-29-91	140	1,410	NA	WP-WLNA	
05-29-92	216	1,740	63.51	PWL		09-26-91	140	1,390	NA	WP-WLNA	
07-02-92	224	1,660	65.59	PWL		10-30-91	148	1,390	NA	WP-WLNA	
07-28-92	NA	NA	38.00	PWL		12-03-91	154	1,380	NA	WP-WLNA	
09-15-92	218	1,730	65.81	PWL		01-08-92	144	1,390	NA	WP-WLNA	
						02-05-92	134	1,350	NA	WP-WLNA	
						03-13-92	140	1,360	NA	WP-WLNA	
						04-28-92	NA	NA	21.05	SWL	
						05-29-92	156	1,410	NA	WP-WLNA	
						07-02-92	148	1,390	47.68	PWL	
						07-28-92	NA	NA	NA	No access	
						09-15-92	140	1,410	43.76	PWL	
WELL--VIWAPA 19, Adventure											
12-13-89	NA	1,220	12.62	SWL							
01-11-90	NA	NA	13.16	PWL							
01-19-90	NA	NA	13.97	PWL							
01-31-90	NA	1,950	14.63	PWL							
02-26-90	NA	1,610	24.00	SWL							
03-16-90	NA	NA	17.37	SWL							
03-26-90	NA	1,650	17.31	SWL							
04-27-90	NA	1,670	13.22	SWL							
08-01-91	NA	NA	13.10	SWL							
08-29-91	NA	NA	14.35	SWL							
10-30-91	210	1,820	NA	PWL							
12-03-91	216	1,860	NA	PWL							
01-08-92	220	1,870	NA	WP-WLNA							
02-05-92	208	1,800	NA	WP-WLNA							
03-13-92	220	1,860	NA	WP-WLNA							
04-28-92	NA	NA	28.20	SWL							
05-29-92	216	1,900	49.49	PWL							
07-02-92	214	1,870	49.86	PWL							
07-28-92	206	1,660	50.45	PWL							
09-15-92	210	1,850	49.37	PWL							

Table 6. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's (VIWAPA) municipal wells in the Golden Grove well field, St. Croix

[DPW, Department of Public Works; mm-dd-yy, month-day-year; mg/L, milligrams per liter; μ S/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; SWL, static water level; PWL, pumping water level; WP-WLNA, well pumping-water level not available]

WELL--VIWAPA 1, Golden Grove, (DPW 1)					WELL--VIWAPA 13, Golden Grove				
Date (mm-dd-yy)	Chloride concen- tration (mg/L)	Specific con- ductance (field value μS/cm)	Water level (in feet below land surface)	Comments	Date (mm-dd-yy)	Chloride concen- tration (mg/L)	Specific con- ductance (field value μS/cm)	Water level (in feet below land surface)	Comments
03-16-90	NA	NA	30.40	SWL	12-13-89	NA	1,800	32.80	PWL
03-26-90	NA	NA	30.28	SWL	01-11-90	NA	NA	34.80	PWL
04-27-90	NA	1,500	47.86	PWL	01-19-90	NA	NA	34.98	PWL
05-29-90	NA	NA	31.83	SWL	02-01-90	NA	1,650	28.00	SWL
06-26-90	NA	NA	47.73	SWL	02-22-90	NA	1,850	42.80	PWL
08-07-90	NA	NA	40.35	PWL	03-16-90	NA	NA	42.99	PWL
08-27-90	NA	NA	43.38	PWL	03-26-90	NA	1,730	42.63	PWL
10-04-90	NA	NA	32.99	PWL	04-17-90	NA	1,740	40.01	PWL
11-01-90	NA	NA	20.54	SWL	05-29-90	NA	2,110	34.13	SWL
11-26-90	NA	NA	19.05	SWL	06-26-90	NA	NA	34.11	SWL
01-03-91	NA	NA	20.33	SWL	08-07-90	NA	NA	44.64	PWL
02-05-91	NA	NA	47.36	PWL	08-28-90	NA	NA	43.99	PWL
03-04-91	NA	1,840	47.86	PWL	11-01-90	250	1,340	NA	WP-WLNA
03-25-91	NA	1,900	47.62	PWL	11-26-90	NA	1,330	NA	PWL
05-01-91	330	1,870	47.84	PWL	01-03-91	NA	NA	25.75	PWL
06-17-91	270	1,850	NA	WP-WLNA	02-05-91	NA	1,570	26.10	PWL
08-01-91	266	2,000	48.03	PWL	03-04-91	NA	1,730	30.13	PWL
08-29-91	260	1,980	47.80	PWL	03-25-91	272	1,810	31.75	PWL
09-25-91	NA	NA	30.78	SWL	05-01-91	290	1,810	32.58	PWL
10-24-91	274	1,990	NA	WP-WLNA	06-17-91	280	1,800	34.20	PWL
12-03-91	280	2,000	NA	WP-WLNA	08-01-91	294	1,930	34.24	PWL
01-08-92	NA	NA	33.20	PWL	08-29-91	286	1,980	41.33	PWL
02-05-92	NA	NA	33.72	PWL	09-25-91	292	1,990	43.56	PWL
03-13-92	NA	NA	35.38	SWL	10-24-91	NA	NA	32.73	SWL
04-30-92	NA	NA	36.30	SWL	12-03-91	304	1,980	47.37	PWL
05-27-92	NA	NA	34.99	SWL	01-08-92	310	1,940	48.31	PWL
06-26-92	NA	NA	33.85	SWL	02-05-92	294	1,940	53.24	PWL
07-28-92	NA	NA	34.41	SWL	03-13-92	330	1,930	50.87	PWL
09-15-92	NA	NA	35.72	SWL	04-30-92	290	1,960	54.55	PWL
					05-27-92	NA	NA	35.71	SWL
					06-26-92	NA	NA	34.20	SWL
					07-28-92	NA	NA	34.85	SWL
					09-15-92	NA	NA	35.89	SWL

Table 6. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's (VIWAPA) municipal wells in the Golden Grove well field, St. Croix--Continued
[mm-dd-yy, month-day-year; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; SWL, static water level; PWL, pumping water level; WP-WLNA, well pumping-water level not available]

WELL--VIWAPA 15, Golden Grove										WELL--VIWAPA 16, Golden Grove									
Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific con- ductance (field value µS/cm)	Water		Comments	Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific con- ductance (field value µS/cm)	Water		Comments								
			level (in feet below land surface)	level (in feet below land surface)					level (in feet below land surface)	level (in feet below land surface)									
12-13-89	NA	2,400	52.06		PWL	12-13-89	NA	1,800	56.72		PWL								
01-11-90	NA	2,400	48.66		PWL	01-11-90	NA	NA	52.74		PWL								
01-19-90	NA	NA	50.80		PWL	01-19-90	NA	NA	44.12		PWL								
01-30-90	NA	2,450	49.53		PWL	01-30-90	NA	2,100	48.72		PWL								
02-22-90	NA	2,260	52.72		PWL	02-22-90	NA	1,900	55.05		PWL								
03-16-90	NA	NA	52.22		PWL	03-16-90	NA	NA	52.14		PWL								
03-26-90	NA	2,210	49.38		PWL	03-26-90	NA	1,970	45.76		PWL								
04-17-90	NA	2,300	50.45		PWL	04-17-90	NA	2,020	56.18		PWL								
05-29-90	NA	2,800	36.99		SWL	05-29-90	NA	2,090	37.47		SWL								
06-26-90	NA	NA	37.71		SWL	06-26-90	NA	NA	40.18		SWL								
08-07-90	NA	2,280	55.32		PWL	08-07-90	NA	2,000	62.23		PWL								
08-28-90	384	2,440	53.03		PWL	08-28-90	332	2,350	58.92		PWL								
10-04-90	NA	2,370	53.99		PWL	10-04-90	NA	1,830	60.24		PWL								
10-30-90	358	2,010	48.83		PWL	11-01-90	294	2,050	43.52		PWL								
11-26-90	NA	2,050	39.90		PWL	11-26-90	NA	1,720	39.62		PWL								
01-03-91	344	NA	38.20		PWL	01-03-91	308	NA	41.24		PWL								
02-05-91	NA	1,280	39.18		PWL	02-05-91	NA	1,380	42.26		PWL								
03-04-91	370	2,010	39.40		PWL	03-04-91	290	2,000	41.99		PWL								
03-25-91	347	2,200	41.20		PWL	03-25-91	NA	NA	31.55		SWL								
05-01-91	326	2,280	40.89		PWL	05-01-91	264	2,050	44.27		PWL								
06-17-91	342	2,290	42.02		PWL	06-17-91	314	1,860	45.34		PWL								
08-01-91	340	2,370	45.12		PWL	08-01-91	310	2,070	51.38		PWL								
08-29-91	330	2,440	49.81		PWL	08-29-91	306	2,240	55.52		PWL								
09-25-91	330	2,400	53.39		PWL	09-25-91	NA	NA	40.62		SWL								
10-24-91	350	2,370	NA		WP-WLNA	10-24-91	310	2,220	57.90		PWL								
12-03-91	346	2,390	NA		WP-WLNA	12-03-91	310	2,200	65.45		PWL								
01-08-92	360	2,410	NA		WP-WLNA	01-08-92	320	2,210	NA		WP-WLNA								
02-05-92	336	2,350	NA		WP-WLNA	02-05-92	280	2,160	NA		WP-WLNA								
03-13-92	340	2,410	NA		WP-WLNA	03-13-92	300	2,180	NA		WP-WLNA								
04-30-92	314	2,360	51.16		PWL	04-30-92	NA	NA	43.77		SWL								
05-27-92	300	2,150	40.43		PWL	05-27-92	310	2,150	61.48		PWL								
06-26-92	308	2,220	38.53		PWL	06-26-92	322	2,230	64.53		PWL								
07-28-92	300	2,120	39.15		PWL	07-28-92	296	2,160	60.28		PWL								
09-15-92	NA	NA	40.46		SWL	09-15-92	306	2,240	67.48		PWL								

Table 6. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water (VIWAPA) and Power Authority's municipal wells in the Golden Grove well field, St. Croix--Continued
[mm-dd-yy, month-day-year; mg/L, milligrams per liter; $\mu\text{S}/\text{cm}$, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; SWL, static water level; PWL, pumping water level]

WELL--VIWAPA 21, Golden Grove						
Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value $\mu\text{S}/\text{cm}$)		Water level (in feet below land surface)		Comments
02-22-90	NA	1,710	40.80	PWL		
03-16-90	NA	NA	39.80	PWL		
03-26-90	NA	1,730	37.47	PWL		
04-17-90	NA	1,790	38.24	PWL		
05-29-90	NA	1,750	34.24	SWL		
06-26-90	NA	NA	35.87	SWL		
08-07-90	NA	1,800	35.92	PWL		
08-28-90	284	2,140	42.13	PWL		
10-04-90	NA	1,630	39.87	PWL		
11-01-90	234	1,100	30.44	PWL		
11-26-90	NA	1,250	26.67	PWL		
01-03-91	250	NA	27.39	PWL		
02-05-91	NA	1,780	29.69	PWL		
03-04-91	245	1,780	30.84	PWL		
03-25-91	248	1,810	31.47	PWL		
05-01-91	254	1,720	32.61	PWL		
06-17-91	256	1,770	34.10	PWL		
08-01-91	290	1,910	32.90	PWL		
08-29-91	270	1,930	38.67	PWL		
09-25-91	270	1,940	37.91	PWL		
10-24-91	286	1,940	38.05	PWL		
12-03-91	276	1,880	35.67	PWL		
01-08-92	290	NA	36.31	PWL		
02-05-92	280	NA	37.07	PWL		
03-13-92	268	1,920	44.00	PWL		
04-30-92	260	1,890	44.27	PWL		
05-27-92	276	1,900	42.24	PWL		
06-26-92	268	1,970	40.44	PWL		
07-28-92	270	1,850	41.16	PWL		
09-15-92	280	1,990	42.07	PWL		

Table 7. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's (VIWAPA) municipal wells in the Fairplains well field, St. Croix

[mm-dd-yy, month-day-year; mg/L, milligrams per liter; μ S/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; WP-WLNA, well pumping-water level not available; PWL, pumping water level; SWL, static water level]

WELL--VIWAPA 7, Fairplains						WELL--VIWAPA 8, Fairplains					
Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value μ S/cm)	Water level (in feet below land surface)	Comments		Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value μ S/cm)	Water level (in feet below land surface)	Comments	
06-27-91	850	3,920	NA	WP-WLNA		06-18-91	1,390	5,640	55.51	PWL	
07-25-91	780	3,750	48.52	PWL		07-25-91	1,490	5,700	60.41	PWL	
08-29-91	800	3,850	48.59	PWL		08-28-91	1,550	6,080	62.97	PWL	
09-25-91	NA	NA	25.82	SWL		09-25-91	NA	NA	27.03	SWL	
10-23-91	NA	NA	28.89	SWL		10-23-91	1,530	5,830	61.44	PWL	
01-07-92	NA	NA	48.12	PWL		12-03-91	1,608	5,890	63.93	PWL	
02-04-92	NA	NA	48.13	PWL		01-07-92	1,670	6,110	63.23	PWL	
03-12-92	1,070	4,530	48.12	PWL		02-04-92	1,650	6,110	64.06	PWL	
04-30-92	848	4,050	48.11	PWL		03-12-92	1,700	6,430	57.48	PWL	
05-28-92	NA	NA	3.15	SWL		04-30-92	2,050	7,170	30.48	PWL	
07-01-92	870	4,080	48.13	PWL		05-28-92	1,372	5,240	24.90	PWL	
07-27-92	850	4,060	48.12	PWL		07-01-92	1,698	6,450	29.40	PWL	
09-14-92	NA	NA	4.63	SWL		07-27-92	NA	NA	NA	No Access	
						09-14-92	1,340	5,480	24.98	PWL	

Table 8. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's (VIWAPA) municipal wells in the Barren Spot well field, St. Croix

[mm-dd-yy, month-day-year; mg/L, milligrams per liter; μ S/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; WP-WLNA, well pumping-water level not available; PWL, pumping water level; SWL, static water level]

WELL--VIWAPA 3A, Barren Spot						WELL--VIWAPA 5, Barren Spot					
Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value μ S/cm)	Water level (in feet below land surface)	Comments		Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value μ S/cm)	Water level (in feet below land surface)	Comments	
02-26-90	NA	3,520	NA	NA	WP-WLNA	12-13-89	NA	NA	72.42	NA	PWL
03-26-90	NA	3,140	NA	NA	WP-WLNA	02-26-90	NA	2,620	70.14	NA	PWL
04-25-90	NA	3,370	NA	NA	WP-WLNA	02-26-90	NA	NA	70.16	NA	PWL
05-21-90	NA	3,540	63.37	PWL		03-26-90	NA	2,800	70.74	NA	PWL
06-25-90	NA	NA	60.26	SWL		04-25-90	NA	NA	77.12	NA	PWL
08-06-90	NA	3,460	66.32	PWL		05-21-90	NA	2,790	77.55	NA	PWL
08-29-90	780	3,830	66.02	PWL		06-25-90	NA	2,780	79.83	NA	PWL
10-04-90	NA	2,690	66.50	PWL		08-06-90	NA	2,790	79.29	NA	PWL
10-30-90	874	3,150	62.82	PWL		08-29-90	NA	2,880	79.10	NA	PWL
11-19-90	NA	3,830	58.92	PWL		10-04-90	NA	2,830	78.97	NA	PWL
12-27-90	796	NA	64.44	PWL		10-30-90	508	2,840	76.81	NA	PWL
02-06-91	NA	3,900	65.25	PWL		11-19-90	NA	2,860	77.04	NA	PWL
03-05-91	NA	NA	47.90	SWL		12-27-90	500	NA	79.23	NA	PWL
03-25-91	NA	NA	65.38	PWL		02-06-91	NA	2,880	77.15	NA	PWL
05-02-91	820	3,540	65.13	PWL		03-05-91	NA	NA	67.95	NA	SWL
06-20-91	800	3,800	65.86	PWL		03-25-91	704	2,890	76.68	NA	SWL
07-24-91	798	3,830	67.65	PWL		05-02-91	484	2,810	77.02	NA	PWL
08-27-91	810	3,940	66.15	PWL		06-20-91	510	2,970	77.74	NA	PWL
09-23-91	NA	NA	65.32	SWL		07-24-91	504	3,000	77.95	NA	PWL
10-22-91	780	3,930	65.30	PWL		08-27-91	520	3,060	78.22	NA	PWL
11-25-91	792	3,940	65.23	PWL		09-23-91	500	3,090	76.72	NA	PWL
01-09-92	850	3,940	66.05	PWL		10-22-91	510	3,050	77.43	NA	PWL
02-04-92	NA	NA	59.73	SWL		11-25-91	522	3,090	77.66	NA	PWL
03-12-92	NA	NA	62.61	SWL		01-09-92	522	3,080	78.08	NA	PWL
04-27-92	850	4,050	62.79	PWL		02-04-92	546	3,090	77.49	NA	PWL
05-28-92	840	4,090	62.94	PWL		03-12-92	516	3,070	78.33	NA	PWL
07-01-92	836	4,030	62.72	PWL		04-27-92	516	3,080	78.85	NA	PWL
07-27-92	860	4,110	62.12	PWL		05-28-92	506	3,100	79.05	NA	PWL
09-14-92	870	4,100	62.98	PWL		07-01-92	510	3,040	78.62	NA	PWL
						07-27-92	NA	NA	68.10	NA	SWL
						09-14-92	500	3,030	78.52	NA	PWL

Table 8. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's municipal wells in the Barren Spot well field, St. Croix--Continued
[mm-dd-yy, month-day-year; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; PWL, pumping water level; SWL, static water level]

WELL--VIWAPA 6, Barren Spot					WELL--VIWAPA 7, Barren Spot				
Date (mm-dd-yy)	Chloride concen- tration (mg/L)	Specific con- ductance (field value µS/cm)	Water level (in feet below land surface)	Comments	Date (mm-dd-yy)	Chloride concen- tration (mg/L)	Specific con- ductance (field value µS/cm)	Water level (in feet below land surface)	Comments
07-05-90	NA	2,019	76.63	PWL	05-21-90	NA	2,835	55.42	PWL
07-05-90	NA	2,019	76.63	PWL	06-25-90	NA	2,565	55.58	PWL
08-06-90	NA	2,019	78.81	PWL	08-06-90	NA	2,477	55.47	PWL
08-29-90	304	2,090	76.55	PWL	08-29-90	458	2,470	55.27	PWL
10-04-90	NA	2,115	76.39	PWL	10-04-90	NA	1,936	52.84	PWL
10-30-90	416	2,300	75.07	PWL	10-30-90	480	2,562	54.41	PWL
11-19-90	NA	2,325	75.24	PWL	11-19-90	NA	2,602	54.88	PWL
12-27-90	NA	NA	75.30	PWL	12-27-90	436	NA	54.52	PWL
02-06-91	NA	2,328	75.28	PWL	02-06-91	NA	NA	55.04	PWL
03-05-91	NA	NA	74.77	SWL	03-05-91	NA	NA	52.45	SWL
03-25-91	384	2,356	75.14	PWL	03-25-91	NA	NA	55.58	PWL
05-02-91	320	2,294	75.95	PWL	05-01-91	490	2,716	53.32	PWL
06-20-91	354	2,366	76.28	PWL	06-20-91	520	2,839	55.64	PWL
07-24-91	354	2,347	76.46	PWL	07-24-91	530	2,717	58.15	PWL
08-27-91	342	2,375	76.58	PWL	08-27-91	524	2,889	55.77	PWL
09-23-91	368	2,470	75.92	PWL	09-23-91	478	2,792	55.63	PWL
10-22-91	340	2,384	75.94	PWL	10-22-91	NA	NA	52.46	SWL
11-25-91	350	2,375	76.06	PWL	11-25-91	460	2,688	55.66	PWL
01-09-92	340	2,380	76.44	PWL	01-09-92	468	2,630	55.78	PWL
02-04-92	354	2,390	76.28	PWL	02-04-92	450	2,560	55.82	PWL
03-12-92	330	2,280	76.72	PWL	03-12-92	440	2,540	55.96	PWL
04-27-92	318	2,330	76.79	PWL	04-27-92	436	2,610	55.32	PWL
05-28-92	NA	NA	76.05	PWL	05-28-92	NA	NA	53.11	SWL
07-01-92	NA	NA	75.76	SWL	07-01-92	448	2,580	53.74	PWL
07-27-92	NA	NA	75.13	SWL	07-27-92	442	2,520	53.73	PWL
09-14-92	NA	NA	75.71	SWL	09-14-92	454	2,620	53.69	PWL

Table 8. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's municipal wells in the Barren Spot well field, St. Croix--Continued
[mm-dd-yy, month-day-year; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; WP-WLNA, well pumping-water level not available; PWL, pumping water level; SWL, static water level; USGS, U.S. Geological Survey]

WELL--VIWAPA 25, Barren Spot, (USGS-22)						WELL--VIWAPA 24, Barren Spot, (USGS-23)					
Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value µS/cm)	Water level (in feet below land surface)	Comments		Date (mm-dd-yy)	Chloride concentration (mg/L)	Specific conductance (field value µS/cm)	Water level (in feet below land surface)	Comments	
12-13-89	NA	1,130	52.06	PWL		12-13-89	NA	2,500	56.99	PWL	PWL
01-11-90	NA	NA	52.12	PWL		01-11-90	NA	NA	56.70	PWL	PWL
01-30-90	NA	NA	53.33	PWL		01-30-90	NA	3,800	56.83	PWL	PWL
02-26-90	NA	3,000	53.43	PWL		02-26-90	NA	NA	56.51	SWL	SWL
03-15-90	NA	NA	53.60	SWL		03-15-90	NA	NA	57.21	PWL	PWL
03-26-90	NA	NA	52.31	SWL		03-26-90	NA	NA	56.89	PWL	PWL
04-16-90	NA	3,350	53.75	PWL		04-16-90	NA	3,850	57.38	PWL	PWL
05-25-90	NA	3,140	57.62	PWL		05-21-90	NA	NA	64.00	PWL	PWL
06-25-90	NA	3,520	58.41	PWL		06-25-90	NA	NA	60.55	SWL	SWL
08-06-90	NA	3,410	67.01	PWL		08-06-90	NA	NA	58.79	PWL	PWL
08-29-90	672	1,920	59.70	PWL		08-29-90	NA	NA	67.20	PWL	PWL
10-04-90	NA	2,470	59.20	PWL		10-04-90	NA	NA	66.85	PWL	PWL
10-30-90	NA	NA	58.78	SWL		10-30-90	674	3,280	64.00	PWL	PWL
11-19-90	NA	2,640	56.20	PWL		11-19-90	NA	3,560	57.70	PWL	PWL
12-27-90	NA	NA	56.57	PWL		12-27-90	678	NA	69.75	PWL	PWL
02-06-91	NA	2,740	55.32	PWL		02-06-91	NA	1,250	67.46	PWL	PWL
03-05-91	NA	NA	54.94	SWL		03-05-91	NA	NA	58.40	SWL	SWL
03-25-91	NA	NA	55.16	SWL		03-25-91	726	3,500	66.65	PWL	PWL
05-02-91	534	2,940	57.59	PWL		05-02-91	NA	NA	NA	WP-WLNA	WP-WLNA
06-20-91	570	3,090	57.98	PWL		06-20-91	700	3,560	70.73	PWL	PWL
06-24-91	580	3,060	58.18	PWL		07-24-91	682	3,490	70.40	PWL	PWL
08-27-91	562	3,160	58.32	PWL		08-27-91	704	3,610	NA	WP-WLNA	WP-WLNA
09-23-91	572	3,380	57.45	PWL		09-23-91	NA	NA	57.95	SWL	SWL
10-22-91	580	3,250	57.51	PWL		10-22-91	900	4,320	58.70	PWL	PWL
11-25-91	590	3,250	57.72	PWL		11-25-91	900	4,430	58.93	PWL	PWL
01-09-92	576	3,170	58.17	PWL		01-09-92	738	3,690	63.05	PWL	PWL
02-04-92	580	3,160	57.98	PWL		02-04-92	740	3,680	62.67	PWL	PWL
03-12-92	568	3,070	58.16	PWL		03-12-92	700	3,630	63.04	PWL	PWL
04-27-92	514	3,060	57.93	PWL		04-27-92	676	3,530	62.81	PWL	PWL
05-28-92	514	3,060	58.27	PWL		05-28-92	650	3,530	63.08	PWL	PWL
07-01-92	534	3,020	57.96	PWL		07-01-92	674	NA	62.73	PWL	PWL
07-27-92	540	2,960	57.83	PWL		07-27-92	690	3,580	62.54	PWL	PWL
09-14-92	510	3,020	57.99	PWL		09-14-92	680	3,530	62.85	PWL	PWL

Table 8. Chloride concentration, specific conductance, and water levels for the U.S. Virgin Islands Water and Power Authority's municipal wells in the Barren Spot well field, St. Croix--Continued

[mm-dd-yy, month-day-year; mg/L, milligrams per liter; µS/cm, microsiemens per centimeter at 25 degrees Celsius; NA, data not available; PWL, pumping water level; SWL, static water level; USGS, U.S. Geological Survey]

WELL--VIWAPA 23, Barren Spot, (USGS-25)					WELL--VIWAPA 31, Barren Spot				
Date (mm-dd-yy)	Chloride concen- tration (mg/L)	Specific con- ductance (field value µS/cm)	Water level (in feet below land surface)	Comments	Date (mm-dd-yy)	Chloride concen- tration (mg/L)	Specific con- ductance (field value µS/cm)	Water level (in feet below land surface)	Comments
01-30-90	NA	3,200	65.37	PWL	05-21-90	NA	3,470	54.41	PWL
02-26-90	NA	3,100	66.92	PWL	06-25-90	NA	NA	51.99	SWL
02-26-90	NA	NA	NA	PWL	08-06-90	NA	3,550	55.79	PWL
03-15-90	NA	NA	65.72	PWL	08-29-90	630	3,010	55.73	PWL
03-26-90	NA	3,070	65.53	PWL	10-04-90	NA	3,530	51.81	PWL
04-16-90	NA	3,010	66.20	PWL	10-30-90	NA	NA	48.53	PWL
05-21-90	NA	3,200	69.77	PWL	11-19-90	NA	2,460	49.22	PWL
06-25-90	NA	3,350	72.17	PWL	12-27-90	NA	NA	48.73	PWL
08-06-90	NA	3,220	70.59	PWL	02-06-91	NA	NA	48.83	PWL
08-29-90	686	3,280	70.34	PWL	03-05-91	NA	NA	51.08	SWL
10-04-90	NA	2,760	70.38	PWL	03-25-91	NA	NA	51.33	SWL
10-30-90	668	2,230	68.03	PWL	05-01-91	674	3,200	54.03	PWL
11-19-90	NA	3,360	68.16	PWL	06-26-91	672	3,410	54.84	PWL
12-27-90	680	NA	69.55	PWL	07-24-91	672	3,430	54.91	PWL
02-06-91	NA	3,630	68.82	PWL	08-27-91	700	3,390	53.72	PWL
03-05-91	NA	NA	64.23	SWL	09-23-91	640	3,400	54.67	PWL
03-25-91	700	3,440	67.24	PWL	10-22-91	630	3,370	54.85	PWL
05-02-91	726	3,380	68.37	PWL	11-25-91	636	3,240	54.65	PWL
06-20-91	736	3,650	69.29	PWL	01-09-92	614	3,250	54.62	PWL
07-24-91	726	3,650	69.49	PWL	02-04-92	600	3,160	54.87	PWL
08-27-91	720	3,730	69.88	PWL	03-12-92	620	3,150	55.00	PWL
09-23-91	NA	NA	64.34	SWL	04-27-92	572	3,100	54.73	PWL
10-22-91	730	3,720	66.27	PWL	05-28-92	550	3,070	55.06	PWL
11-25-91	746	3,730	66.37	PWL	07-01-92	536	2,960	54.46	PWL
01-09-92	NA	NA	65.75	SWL	07-27-92	554	2,950	54.68	PWL
02-04-92	NA	NA	64.84	SWL	09-14-92	550	3,020	54.63	PWL
03-12-92	NA	NA	65.82	SWL					
04-27-92	750	3,750	70.60	PWL					
05-28-92	724	3,750	70.70	PWL					
07-01-92	740	3,670	70.37	PWL					
07-23-92	718	3,680	68.92	PWL					
09-14-92	NA	3,620	70.46	PWL					

Chloride concentrations in ground-water samples collected during this study ranged from 67 to 4,400 mg/L (tables 4, 5, 6, 7, and 8), and the dissolved solids concentrations ranged from 619 to 7,540 mg/L (table 4). The chloride and dissolved solids concentrations in ground-water samples collected during this study exceeded the U.S. Environmental Protection Agency's (EPA) Secondary Maximum Contaminant Levels in drinking water of 250 mg/L chloride and 500 mg/L dissolved solids (U.S. Environmental Protection Agency, 1992) in about 76 and 100 percent, respectively, of the wells sampled. In terms of water supply acceptance, the recommended maximum level for chloride is based largely on taste, with the EPA recognizing that ground water having a chloride concentration as high as 500 mg/L is potable. For dissolved solids the EPA Secondary Maximum Contaminant Level is based on an increase in the mineral taste in the water and possible economic consequences, due to deterioration of plumbing and pipes, because of the high mineral content.

SUMMARY

The freshwater supply on St. Croix, U.S. Virgin Islands, is obtained from ground-water sources and desalinated seawater. Because of the high cost of desalinization, however, the Virgin Islands Water and Power Authority is considering the development of additional ground-water sources. A study of the hydrogeology of several areas in south-central St. Croix - where some geologic and hydrologic data were available - was conducted to obtain information that would be useful in the planning for any future development of ground water.

The subsurface geology of south-central St. Croix is characterized by alluvium and underlying carbonate rocks. Ground water occurs under water-table conditions in the alluvial deposits, the post-Kingshill Carbonates and the Kingshill Limestone. Depth to the top of the water-table aquifer ranges from 5 to 68 feet below land surface. The top of the Jealousy Formation is considered to be the bottom of the water-table aquifers in south-central St. Croix. The top of the Jealousy Formation at the four well

fields ranged from 85 to more than 120 feet below land surface. Well yields in the study areas ranged from less than 5 gallons per minute to 80 gallons per minute. Aquifer specific capacity at four wells in the Adventure well field ranged from 1 to 14 gallons per minute per foot of drawdown. Using Meyers model that relates specific capacity to aquifer transmissivity, aquifer transmissivities were estimated to range from 180 to 3,300 feet squared per day. The wide range of transmissivity values in the Adventure well field probably is due to the presence or absence of intersecting fracture zones within the Kingshill Limestone. Where the density of fracture zones is high, the aquifer transmissivity is large.

The wide range of yields in the study area (less than 5 to 80 gallons per minute) is due to the nonhomogeneity of the aquifer material. The relatively high yields in the post-Kingshill Carbonates are due to the primary depositional porosity of the shallow-water limestone deposits and interlayered conglomerates and volcanics, as well as to subsequent diagenetic changes within the limestone. Generally, where the post-Kingshill Carbonates is tapped by wells, the yields are in the range of 35 to 80 gallons per minute. In the Kingshill Limestone, well yields range from 5 to 60 gallons per minute, the higher yields are primarily limited to those areas where there is a high density of intersecting fracture zones. The yields in the alluvial deposits are unknown, however, the yields will be limited by the thin, 10- to 30-foot, saturated thickness of the deposits.

Ground water in south-central St. Croix is of the sodium-chloride type. Ground-water samples collected from selected wells had chloride concentrations ranging from 67 to 4,400 milligrams per liter, and dissolved solids concentrations ranging from 619 to 7,540 milligrams per liter. Connate water probably is the source of sodium chloride in the Adventure and Golden Grove well fields. In the Fairplains and Barren Spot well fields, the greater seasonal variations in chloride concentration indicate that the sodium chloride in the ground water at these sites could be due to saltwater intrusion.

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