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EAST END
AREA OF PARTICULAR CONCERN
(APC)

MANAGEMENT PLAN

V.I. DEPARTMENT OF PLANNING AND NATURAL RESOURCES
COASTAL ZONE MANAGEMENT PROGRAM

September 1993

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Island Resources Foundation
Under Contract PC PNR-330-92

With assistance from:
The University of the
Virgin Islands

This publication is financed in part through a federal grant from the Office of Coastal Zone Management, NOAA under the provision of Section 305 of the Coastal Zone Management Act of 1972 (Public Law 92-583).

Copies of this document may be obtained from the Department of Planning and Natural Resources, (Coastal Zone Management Program), Nisky Center, Charlotte Amalie, St. Thomas, United States Virgin Islands.

EAST END
APC MANAGEMENT PLAN
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LIST OF KEY ACRONYMS

Area of Particular Concern	APC
Base Flood Elevation	BFE
Biological Oxygen Demand	BOD
Coastal Barriers Resource System	CBRS
Coastal Zone Management Act	CZMA
Department of Housing, Parks, and Recreation	DHPR
Department of Planning and Natural Resources	DPNR
Department of Public Works	DPW
Division of Archaeology and Historic Preservation	DAHP
Division of Coastal Zone Management	DCZM
Division of Environmental Protection	DEPD
Division of Fish and Wildlife	DFW
Environmental Assessment Report	EAR
Federal Emergency Management Agency	FEMA
Gallons Per Day	GPD
Mean High Water	MHW
Mean Low Water	MLW
Million Gallons Per Day	MGD
National Ambient Air Quality Standards	NAAQS
National Flood Insurance Program	NFIP
National Park Service	NPS
National Register of Historic Places	NRHP
Our Town Frederiksted	OTF
Sea Level Rise	SLR
Sewage Treatment Plant	STP
Significant Natural Area	SNA
Territorial Pollutant Discharge Elimination System	TPDES
Total Suspended Particulates	TSP
U.S. Army Corps of Engineers	USACOE
U.S. Environmental Protection Agency	USEPA
U.S. Fish and Wildlife Service	USFWS
U.S. Geological Survey	USGS
University of the Virgin Islands	UVI

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1. INTRODUCTION

1.1 General

East End, St. Croix is one of 18 Areas of Particular Concern (APC's) designated by the Planning Office in 1979 after public nominations and comment had been received (Figure 1). The East End St. Croix APC is located on the east end of St. Croix and includes East End, Jack, Isaac, and Cottongarden Bays; Kramer Park, Point Cudejarre, and Point Udall - the easternmost point in the United States of America.

The APC includes mountains, forests, beaches, and ocean cliffs, many areas which are of natural, cultural, geological, recreational, and scenic importance. Owing to the unusual combination of resources within the APC, the area has received other significant classifications as well. For example, sites within the APC have been nominated as Significant Natural Areas (SNA's).

On July 26th, 1991, the CZM Commission adopted the 18 APC's recommended in the Final Environmental Impact Statement (USDOC, 1979), which accompanies the Virgin Islands CZM Act. The Final Environmental Impact Statement notes "the importance of the entire coastal zone", but declares that "certain areas are of yet greater significance." It also establishes the criteria for the designation of Areas of Particular Concern which are as follows:

- Significant Natural Areas
- Culturally Important Areas
- Recreation Areas
- Prime Industrial or Commercial Areas
- Developed Areas
- Hazard Areas
- Mineral Resource Areas

In September of 1991, the Coastal Zone Management (CZM) Commission met and held public hearings on all three islands on the boundaries for all 18 APC's. The Commission met again on October 1, 1991 and, based upon public input and staff recommendations, approved the boundaries of the APC's.

APC management requires knowledge of an area's historical development and traditional uses, and an action-oriented plan for the area's future utilization. This management plan is intended to serve as an overall planning and management framework within which the various regulatory entities carry out their decision-making authorities.

The APC planning effort recognizes that permit decision-making is most often reactive; that is, the decision to approve or disapprove a proposed development is made in response to a specific permit request and its content, rather than in response to previously established guidelines of what is or is not acceptable for the area. The goal of developing an APC management framework is to be able to make *a priori* decisions about the allowable extent to which an entire landscape unit may be modified. In other words, the planning goal is to raise the level of decision-making from the site-specific to that of natural landscape units and the maintenance of a wide array of interactive resource uses.

1.2 Relationship to Other Plans and Regulations

The East End, St. Croix APC was prepared under the authority of the Coastal Zone Management Commission. The Management Plan is intended to serve as the overall planning and management framework within which the various planning and regulatory entities carry out their respective authorities. It is intended that the policy framework contained herein be incorporated into the policies and review criteria of those entities, including, but not limited to, the Department of Planning and Natural Resources (DPNR), the Department of Housing, Parks and Recreation (DHPR), the Port Authority, the Water and Power Authority (WAPA), the Department of Public Works (DPW), the National Park Service (NPS), the U.S. Fish and Wildlife Service (USFWS), the U.S. Army Corps of Engineers (USACOE), the U.S. Environmental Protection Agency (USEPA), and the Department of Property and Procurement. This Management Plan will serve as a guide for future decisions concerning the area. Future development activity should be consistent with and comply with the Management Plan.

The intent of this Management Plan is for all participating territorial and federal agencies to utilize the broad policy framework to guide planning and permit decisions with respect to their own authorities. For those agencies that issue permits or review and comment on permit applications, the Management Plan does not eliminate the authority of those agencies, but increases the predictability and timeliness of the permitting process since many of the issues that must be addressed in a specific permit application are already addressed and mandated in the Plan.

The issues surrounding any proposed use or activity within the coastal environment are complex. A proposed use immediately outside the boundary of the APC planning area may result in significant adverse impacts on the APC and impair the goals of the APC management framework described herein. This Plan contains several different forms of guidance, all of which should be considered in evaluating impact on an APC. Both the individual property owner who is considering a specific proposal and the decision-maker who is evaluating the proposal should follow the guidance of this Plan.

1.3 Historical Perspective and Overview

Historic occupation of the East End was greatly influenced by climatological and geological factors. Settlement in East End Bay occurred during the early 1740's, with the agri-business originally devoted to cotton production. Pre-Danish maps do not record any settlement east of Chenay Bay, to the north, and Great Pond, to the south.

East End Quarter, where it was too dry for effective sugar cane growth, most of the cotton plantations were used for other more marketable products. By the time of the original Beck map of 1754, plantations were established in all but the north-west and east parts of the island, with a predominance of sugar cane plantations. The 1794 Oxholm map, which shows the island at the height of historic development for that period, indicates that the easternmost sugar mills were located at Coakley Bay on the northern shore, and at Great Pond and Cotton Grove on the southern shore. The map depicts a number of cotton plantations within the East End Zone, including, Cotton Garden and Teague Bay.(Aug.1990:Baumgardt,Kenneth)

1.4 Other Classifications

As early as 1960, East End, St. Croix was identified as an area in need of special planning. The 1960 Department of the Interior (DOI) study for the Governor recommended East End to be a Nature Preserve. A decade later, East End was singled out as an Area for Preservation and Restoration (APR) and nominated as a Significant Natural Area (SNA) in the DCCA/Teytaud study of 1980. The following year it was identified as an important element in an early V.I. Territorial Park System plan (VITPS/Alexander, 1981).

The offshore waters surrounding the East End were proposed for candidacy as a National Marine Sanctuary site in 1982. The 1991 post Hurricane Hugo - Virgin Islands' Territorial Park System Planning Project (VITPSPP) (Island Resources Foundation (IRF), 1991), concurred with previous management recommendations that the East End be preserved as a multi-purpose park within a proposed Territorial Park System. Additionally, IRF suggested including the adjacent marine platform and Lang Bank, the proposed Marine Sanctuary Site, with the East End Park in a combined area management scheme.

2. DESCRIPTION OF THE SITE

2.1 APC Boundary

The boundary for the East End St. Croix APC, established by the Coastal Zone Management Commission, is described as follows (Figure 2):

> Beginning at Hughes Point on the shoreline, heading northwest for two thousand (2000) feet; then west for five hundred (500) ft; then northerly to the mid-point of Knight Bay (the boundary follows the western boundary of the East End Conservation, Recreation and Traditional Uses District as mapped on the Coastal Land and Water Use Plan); then due north to a point on the outer shelf edge or three mile limit (whichever is closer); then east along the outer shelf edge or three mile limit around Point Udall and south and west to a point south of Hughes Point; and then north to Hughes Point, the point of origin.

2.2 Ownership Summary

Although approximately 95% of the land of St. Croix is held by private owners, the Virgin Islands Government currently owns approximately 340 acres, almost 50% of the East End peninsula. This peninsula is an APC. The entire APC is zoned either P (Public) or R1 (Residential-Low Density) under current zoning laws. Zoning designations are specified in the V.I. Code, Title 29, Chapter 3.

2.3 Physical Environment

2.3.1 Climate

Rainfall in the Virgin Islands generally increases with increasing elevation and exhibits a trend on each island of a dry-to-wet cline from east to west. Average rainfall data compiled from several years of records at various stations can be misleading in that it probably poorly represents the available

precipitation at a particular area in any given year. The U.S. Virgin Islands receive an average of 41 inches of rain per year (Bowden, 1968).

February and March are normally the driest months, September and October the wettest, with most rainfall coming in brief showers. Most of St. Croix receives 35-45 (average about 40) inches of rainfall per year. The climate of this APC is decidedly arid. At East End, the average annual rainfall is less than 30". Persistent salt-laden (Trade) winds from the east and relatively warm overall temperatures promote evaporation of soil moisture. Most of the rainfall does not occur until the air mass encounters the steeper hills to the west. The Virgin Islands experiences the eastern flow of the trade winds. Rainfall usually occurs in brief, intense showers of less than a few tenths of an inch.

Temperatures average an annual 79 degrees Fahrenheit, with the winter low averaging 76 degrees F and the summer high reaching an average of 84 degrees F.

The Virgin Islands are located in the area of "easterlies" or "tradewinds" which circulate around the Bermuda high pressure area to the north. The wind and wave patterns of the islands are directly related to these patterns. Predominant winds are thus from the east-northeast and east (Island Resources Foundation, 1977). The intensification of the high results in severe winds occurring during the winter and hurricanes in the fall (Hubbard, *et al.* 1981). Hurricane season is from June to November, with peak activity occurring in September. The annual probability of a hurricane is once every 16 years (Bowden, 1974).

2.3.2 Geological Setting

St. Croix was formed from volcanic sediments deposited deep on the ocean floor in the late Cretaceous period (approximately 80 million years ago) (Justus, 1980). The rocks which underlie the mountain ranges are thus sedimentary, formed by debris from eroding volcanic rocks (Whetten, 1974). These rocks, of the Caledonian formation, are composed of alternating light gray layers of sandstones and conglomerates and blue-black layers of fossiliferous mudstone or chert. According to Whetten (1968, in Multer & Gerhard, 1980) the Caledonia formation is at least 9,000 feet thick.

Two predominant mountain ranges exist (the Northside Range and the East End Range), separated by a central sediment-filled valley. It was believed that the two ranges used to be distinct islands, separated by a submerged lagoon, which during a later period of uplifting formed the present valley and single island of St. Croix (see for example, Multer, *et al.*, 1977). More recent investigations (see for example, Gill, 1990), indicate that the island may have always been a single island.

Other significant geological features are wave-cut terraces at Cottongarden Point, Isaac Point and Cudejarre Point which show former relative sea levels, igneous intrusions at East and Cudejarre Points, and a fossil locality at Isaac Point. There are six major natural soil/land types found within the APC (USDA, 1970) (Figure 5):

Volcanic Rock Land(Vr). This land type is made up of areas where volcanic rock outcrops cover 50 to 70 percent of the surface and is found on all three islands. It is restricted to wildlife habitat and aesthetic purposes. The very steep slopes, exposed rock, and shallow soil material preclude its use for commercial production of crops, forage, or trees and severely limit all engineering and recreational uses.

Cramer stony clay loam, 12-40 percent slopes (CsE2). This soil type is found on the ridges and side slopes of dissected volcanic uplands in the eastern part of St. Croix. Most of the acreage is forest or brushy forest. Shallowness over rock, moderately steep slopes, stoniness, poor workability, and rapid runoff preclude cultivation. Limitations are severe for nonfarm purposes,as well as for industrial.

Cramer gravelly clay loam, 12-40 percent slopes (CrE). same as above statement.

Cramer stony clay loam, 40-60 percent slopes (CsF). This soil is on the side slopes of dissected volcanic uplands throughout the Virgin Islands. Steep slopes, shallowness over rock, rapid runoff, susceptibility to erosion and the large numbers of coarse fragments throughout the profile preclude cultivation and make it difficult to establish and maintain pasture. These limitations preclude nonfarm uses.

Isaac Series soils, 5-20 percent slopes (IvD). This soil occurs on side slopes and foot slopes of dissected volcanic uplands throughout the Virgin Islands. It has limitations for both farm and nonfarm uses.

Jaucus Sand, 0-5 percent slopes (JuB). This soil occurs as low, hummocky,, sandy coastal areas on all three islands and on some small islands offshore. Severe conditions limit both farm and nonfarm uses.

San Anton Clay loam, 0-5 percent slopes (SaA). This soil type is found in the eastern portion of the APC boundary. It has favorable soil characteristics for both farm and nonfarm uses.

San Anton Clay loam, 5-12 percent slopes (SaA). same as above statement.

Historical seismicity in the USVI

As a result of convergence between the Caribbean and North American tectonic plates, the Virgin Islands are located in one of the most earthquake prone regions of the world. During the past 450 years, damage has occurred from earthquakes and associated tsunamis. Strong seismic shocks were recorded for the Virgin Islands in 1777, 1843, 1867, and 1918. Destructive tsunamis occurred in the U.S. Virgin Islands in 1867 and in 1918; the latter resulted in 116 deaths and economic losses estimated at $4 million (in 1918 dollars) (USGS, 1984a). The 1867 tsunamis was reported to have a wave height of 27-feet above sea level (Geoscience Associates 1984b).

Potential human and economic losses for a similar event occurring today would be several orders of magnitude higher. Scientists report high seismic potential for a major fault rupture in the Puerto Rico Trench north of Puerto Rico and the Virgin Islands (USGS, 1984a). The Virgin Islands are classified as "Zone 4" for earthquake vulnerability, the highest damage zone and the same classification given to many parts of California (Bower and Beatley, 1988)

Studies prepared in 1984 estimated that an earthquake of MMVIII intensity (Modified Mercalli Scale) has a recurrence period of between 110 and 200 years for the St. Thomas/St. John area. The probability of such an earthquake occurring in the next twenty years is between 50 and 70 percent, and between 60 and 80 percent during the next 50 years (Geoscience Associates, 1984a and 1984b). It is not clear whether the same probabilities can be assigned to St. Croix, as St. Croix is situated on a

different platform than St. Thomas and St. John. Nevertheless, the waterfront areas of Charlotte Amalie and Christiansted are especially vulnerable to impacts from earthquakes due to substantial construction on recently filled (reclaimed) land. It is these areas where liquefaction and ground settling are likely to be the greatest. Buildings constructed on loose alluvial or man-made fill soils along the waterfront are at risk of destruction should an earthquake occur (Geosciences Associates, 1984b).

2.3.3 Hydrological Setting

The East End APC covers six complete watersheds ranging in size from about 30 acres to about 230 acres and the eastern halves of two watersheds which together, comprise about 85 acres of drainage area. Cottongarden Bay (the largest), Boiler Bay, and Lamb Bay watersheds are on the north side of the peninsula; East End Bay (the smallest), Isaac Bay and Jack Bay watersheds are on the south side. To the west, are the eastern slopes of the Grapetree Bay and Knight Bay watersheds.

Much of the land in the watersheds have slopes above 40 percent grade and much of the upper portions of the watersheds have slopes of nearly 60 percent grade. On these steep slopes, with the poor soil types (Cramer stoney clay loam), severe erosion would follow any disturbance of the ground cover.

There are no salt ponds to aid in sediment retention at the base of these slopes. On the lower, less sloped areas, mature vegetation, occasional littoral woodland, low rainfall, and relatively undisturbed beach berms have kept all but the occasional deluge from affecting the sensitive marine environment.

2.3.4 Coastal Environment

St. Croix does not experience significant tidal ranges or surface currents; maximum tidal ranges are on the order of one-foot. Tides are primarily diurnal, with only a slight secondary (semi-diurnal) tide cycle. Surface currents are driven by the North Equatorial Current, with its west-northwesterly flow; they tend to come more from the south during the summer months. Currents are generally less than 1.1 knots, but produce very complicated patterns of crossing sea and swell which can be observed on aerial photographs.

2.4 Biological Environment

2.4.1 Terrestrial

The East End APC is considered to be the largest open space area left on St. Croix and perhaps, excepting the Virgin Islands National Park on St. John, in the territory as a whole. In fact, one can drive to Point Udall overlook, get out of the vehicle and, except for the road to the east end, look around in a 360 panorama and not see a man-made object. Based on this fact alone, preservation of the area for low-impact recreation, educational promotion and scientific study should be sought for the benefit of all people on St. Croix, not for just the few landowners of a new housing development.

2.4.2 Marine

Several factors and characteristics concerning the marine resources of the East End APC have been identified by various researchers and are presented in the following extracts from Chelsea (1983) (Figure 6):

1. A rich diversity of tropical marine organisms depend upon maintaining the integrity of the site.
2. Lang Bank has been identified as a Critical Area of high biological productivity.
3. The area has been an important site for scientific investigation of tropical marine habitats, and offers great potential as an interpretive center.
4. This area supports a small artisanal fishery.

Further information is supplied in the following extracts from Adey, *et al.* (1981):

> The 4,000 year old eastern and southeastern bank barrier reef of St. Croix is one of the best developed reef systems in the tropical-Atlantic Caribbean area. With a length of 23 miles, it is the most extensive reef on the Puerto Rican-Virgin Islands shelf. Indeed, except for some American controlled Indo-Pacific islands, it is certainly the largest modern tropical reef structure on American territory. In spite of the explosive population growth on St. Croix in the last two decades, most of this reef system has remained largely unaffected by human activities. An industrial complex has been built at the southwestern end of the reef, and the northern section is heavily used for recreational purposes. However, the eleven mile section from Cotton-garden Point in the northeast around to Manchineel Bay in the southwest has remained essentially minimally impacted by the marine environment for the last 1,000 years.
>
> In terms of the quality of life for an island population as well as shore protection, beach building and general recreational usage, this reef system is one of the most valuable natural assets possessed by the people of St. Croix. It is certainly the most important coastal resources. It has similar value to the many thousands of tourists that visit St. Croix each year, and of course has a more tangible value to the island in terms of the income brought by the visitors [sic]. While perhaps more modest, this reef system also has a considerable, but as yet unassessed, value in terms of the local commercial fishery for lobster, conch and fish.
>
> The bank barrier reef of St. Croix is especially critical for three reasons: (1) much of it is still relatively untouched, and because many different sub-types of reef exist in this one complex, it can serve as a baseline reef for comparison with others throughout the Caribbean. Its maturity and diversity allow it to be major type for comparison with Indo-Pacific reefs; (2) it lies in American territory, where long-range protection and study are considerably more economically feasible than they might be for a similar reef on an independent island country; and (3) a marine laboratory, the West Indies Laboratory of Fairleigh Dickinson University with many of the facilities required for reef study, lies on the eastern end of St. Croix. (Marine Environments for the Virgin Islands technical supplement no.1)

[NB. The West Indies Laboratory was substantially damaged during Hurricane Hugo, September, 1989 and was closed. The insurance money received was used to help the financially troubled Fairleigh Dickinson University.]

The major transects from east to west are: off Isaac Bay, where a "young" reef breaking the surface in discontinuous fashion ranges from Cudejarre Point to Isaac Point; off Robin Bay where a strongly developed mature reef with a nearly continuous crest and a moderately deep reef flat blocks most of the shore from Rod Bay to Great Pond Bay; and off Halfpenny Bay where a continuous reef with a broad and shallow reef flat is developed.

As this study has further demonstrated, reef communities can be the most productive biological systems on the face of the earth. They are also among the most diverse and aesthetically interesting. The east and south bank barrier reef on St. Croix is one of the larger and better developed reefs in the Caribbean. In facing environmental and social problems, understanding how these biological/geological systems can be so productive and diverse must be among our top priorities.

The Virgin Islands Government should demonstrate to the Federal Government the importance of Federal fiscal support for land purchase and management to keep the south reef in a natural state for essential basic research as well as for controlled use by local and tourist populations.

The question of management of fully-developed reef systems is not one that has been properly addressed, nor can it be until the principal components of the system are sufficiently understood, a goal towards which this study is directed. Obviously, the surest approach to maintaining natural conditions is to prohibit all land and water use in the neighborhood of the reef. Since that approach is probably unattainable, we are led to the question that this study was designed to probe - what factors are most critical to reef function and how are human activities likely to affect those factors.

Of particular interest is the role of grazers, fish and invertebrates, in maintaining algal turfs and a high level of productivity. We have not directly contributed to knowledge of grazer biomass, and dynamics and studies of grazer populations should be carried out. However, it seems very likely that overfishing of parrot fish and tangs could be crucial to these reefs in allowing colonization of larger algae. It might be that micrograzing invertebrates would only replace removed grazing fish, but predators are probably more effective in controlling micrograzer populations. In spite of the extremely high productivity of these reefs, it would seem that they are not characterized by significant export. Therefore general heavy fishing may never be feasible.

Monitoring

Prevention is preferable to monitoring, but the latter would probably always be necessary. We suggest stressing the following procedures to be carried out by two field technicians/wardens assigned full time to patrol and monitoring functions

(a) continuous or monthly examination of community productivity at selected sites. Continuous monitoring by telemetry is probably possible and highly desirable, but the initial investment would be high.

(b) legislation and patrol to maintain fishing, diving and boating at or near current levels on the reef itself. Public education on "how to behave" on or near a reef could probably be very effective.

(c) develop a procedure for monitoring coral cover and spatial heterogeneity that is less time consuming and destructive than chain transects. Low level aerial photography carried out under calm conditions would seem to offer many possibilities.

(d) nutrient analyses (winter and summer) to determine that nutrients are remaining at a generally low level.

Intensive building or clearing of land along the watershed from Halfpenny Bay to East Point, especially of multi-unit dwellings or hotels would have great potential for damage to the reef system. While careful timing and control of run-off could probably greatly minimize damage during building, adequate control of a large population on this coast, relative to the reefs would likely be difficult.

2.4.3 Endangered Species

The U.S. Endangered Species Act of 1973 (16 USC Sec 1531) defines "endangered species" to mean a species or subspecies that is in imminent danger of extinction throughout all or a significant portion of its range. "Threatened species" are those likely to become endangered in the foreseeable future unless current trends are reversed. Such species are protected by Federal Law; neither the whole animal or any products from it may be taken, sold, or possessed. Alteration of the habitat in which any of these species occurs may be, in certain cases, prohibited or constrained.

The V.I. Legislature has also passed endangered species legislation. Known as the Indigenous and Endangered Species Act of 1990, the bill (Act 5665), signed into law in December 1990, authorizes the Commissioner of the DPNR to promulgate a list of endangered and threatened species in the Virgin Islands. The V.I. Government, Department of Planning and Natural Resources, Division of Fish and Wildlife maintains a list of locally endangered or threatened species.

Several federally and locally listed rare or endangered species are found within the East End St. Croix APC. Those found are:

Federally listed:

Brown Pelican (*Pelecanus occidentalis*)
Green Turtle (*Chelonia mydas*)
Hawksbill Turtle (*Eretmochelys imbricata*)
Leatherback Turtle (*Derochelys coriacea*)
Peregrine Falcon (*Falco peregrinus*)

Several endangered species of whales have been reported off the coast of St.Croix (USACOE, 1990). These include the Sei whale (*Balaenoptera borealis*), the Finback whale (*Balaenoptera phyalus*), the Humpback whale (*Megaptera novaeangliae*), and the Sperm whale (*Physeter catadon*).

Locally listed:

Least Tern (*Sterna antillarum*)

2.5 Cultural Resources

2.5.1 Prehistoric

A prehistoric site is known near Cramer's park. There was little or no access to the eastern portion of the area when early archaeological work was done. There are several likely locations for prehistoric sites, primarily in East End and Jack and Isaac Bays but no recent studies have been done (Ehle and Gore, 1989).

2.5.2 Historic

A survey done on behalf of a proposed development in Estate Longpoint-Cottongarden (Figueredo, 1988), which is just outside the APC, found records for a portion of Estate Longpoint-Cottongarden that indicate that it was a cotton plantation in the late 1700's, becoming pasture after 1800.

2.6 Built Environment

This area is mostly undeveloped. There are a few residential buildings and the National Radio Astronomy Observatory (NRAO).

2.6.1 Roads and Ports

East of Kramer Park the roads are unimproved. These roads are on Government land and there are no plans to develop this area. Access to Jack and Issaac Bay is from Estates Cotton garden and Longpoint via a dirt road. There is presently no direct access from Grapetree Bay to Jack Bay.

2.6.2 Water Systems

Individual rainwater catchment systems are utilized throughout the APC; there is no municipal potable drinking water distribution system. Since this area is usually very dry, the water source is supplemented by private water haulers.

2.6.3 Wastewater Systems

Because of the mixture of soils found in this area, volcanic rock land, Cramer stoney clay loam, Cramer gravelly clay loam, Isaac series soils, Jaucus sand, and San Anton clay loam, farm or nonfarm use of individual septic tanks and drainfields is not recommended.

2.6.4 Energy Systems

Power for St. Croix is generated at the Richmond power plant on the western outskirts of Christiansted. Power outages are common. A new 22 megawatt power plant will be constructed in the future at the Southshore Industrial Area. The new power plant is badly needed, as WAPA has

projected an average 50 days/year of insufficient power supply given current supply/demand rates. In 1991, St. Croix experienced 304 hours, or 12.5 days, of insufficient supply (Daily News, 12 July 1992). The two large industries, HOVIC and VIALCO, operate independent power systems for their operations.

2.6.5 Solid Waste Disposal Systems

St. Croix's only municipal solid waste landfill is located on the central southshore, at Estate Anguilla within the Southshore Industrial APC. Residents are responsible for disposing of solid waste in large roadside dumpsters, which are transported to the landfill by a private contractor. Businesses are required to provide for their own solid waste removal.

3. RESOURCE USE, USE CONFLICTS, AND ADVERSE IMPACTS

3.1 Resource Use

The following list identifies the known and interpreted land and water uses of the East End Area of Particular Concern as indicated on the Land Use Map (Figure 8). Land use was interpreted from aerial photography and groundtruthed for accuracy. The classification system, based on the Teytaud/U.S. Geological Survey (TUSGS) land use/land cover classification system (DDCA-DCZM, 1981), is hierarchical, with three levels of categories, increasing in specificity from level I (e.g., 100 series [the most general] -Urban or Built-up Land) to level I (e.g., 110 series - Residential) to level III (e.g., 111 - Single unit, low density [less than 2 DUPA], the most detailed.

3.2 Use Conflicts

Clearly, the history of public opposition to the proposed development of Jack and Issac Bays must represent one of the most significant "use conflicts" for the East End APC. Oral and written testimony from numerous agencies, groups and individuals has advised against development of the Jack and Issac Bay watershed. The concern of the opponents of development in the area ranges from preservation of open space to protection of the rich coastal marine habitats from sedimentation and nutrient enrichment resulting from development of the watershed.

3.3 Adverse Impacts

3.3.1 Water Quality

Adverse impacts to water quality are generally restricted to near shore waters within the APC, and arise largely from land-based sources of pollution. Sediment runoff is perhaps the largest single and widespread contributed to degraded marine water quality in the APC. In the absence of a more comprehensive water quality monitoring program, it is probably fair to say that turbidity, fecal coliform, and nutrients are of most concern for overall water quality within the APC.

Water quality within the APC is determined in large part by the amount and quality of nonpoint sources of pollution which enter coastal waters. Terrestrial surface runoff and groundwater leachate, from poorly designed or functioning septic tank systems, are of principal concern. Although difficult to quantify or assess, the cumulative impacts from these sources can be significant. Groundwater

leachate is a source of fecal coliform and nutrients (e.g., nitrogen, phosphorus, ammonia, nitrate, nitrite, etc.). Surface runoff can carry a variety of toxic compounds, nutrients, and significant amounts of sediment. For example, sediment discharge from a single, three acre construction site located in the Rio Piedras watershed above San Juan, Puerto Rico, was calculated to be approximately one ton during a 0.5 inch (12.7 mm) rainfall which fell in a 30 minute period (Gellis, 1991). The study documented that annual sediment yields ranging from 21,600 to 33,200 tons per square mile were exhibited by the same developing, suburban watershed.

3.3.2 Air Quality

Air quality within the APC is generally considered to be excellent. There are no known adverse impacts on the East End from poor air quality.

3.3.3 Noise

There is no noise pollution within the APC.

3.3.4 Impacts to Biological Resources

There is presently no known negative biological impact to the APC, however, there has been persistent efforts to subdivide and develop this area. Development in this APC must be continuously scrutinized to avoid detrimental impact on the biological resources of the APC.

3.3.5 Impacts to Cultural Resources

The construction of the new National Radio Astronomy Observatory (NRAO) dish during the winter and spring of 1990-91, on a 4 - acre parcel of government land at Estate Longpoint and Cotton Garden was contested by CaribBank Financial Group on the grounds that the dish created visual pollution of the area and that it is inappropriate for coastline development (VI Daily News, 04/28/90). CaribBank is planning a 300 - acre, 157-home subdivision near the antenna site and felt that the dish was not amenable with a housing development. It seems as though the two groups reached an out-of-court settlement.

The 100 foot tall dish, the easternmost part of an interconnected ten-station Very Long Baseline Array (VLBA) antenna dish chain which spans the US from St. Croix to Hawaii, is designed to receive real-time radio signals from space. Scientists hope to relate the signals to hypotheses about the origins of the universe.

Existing recreational facilities in the EEN APC are limited to the beach and campground area at Kramer Park, several rough access roads to the east end beaches and a few primitive trails leading from the overlook at Point Udall. The Kramer Park site has a good beach, picnic tables and a large open field often used as a campground on holiday weekends. Rest rooms and changing houses are at the park sites but the food and beverage concession area that existed at the site was damaged during Hurricane Hugo in September, 1989, and has not been rebuilt.

The East End area overall has been subject to numerous scientific surveys done by students at the former West Indies Lab. Although the reef systems are excellent in quality and condition, not much

takes place in the area, mostly due to the difficult access to many of the sites. Several dive shop operators take guided dive tours to locations at Lang Bank, and the tour operators are careful to use moorings rather than anchors to limit reef damage.

4. MANAGEMENT RECOMMENDATIONS

4.1 Policy Framework

Establishing a comprehensive policy framework to guide decision-making for improvements and future development of East End, St. Croix APC is a crucial and fundamental process to be undertaken if the blight of similar APC's elsewhere is to be avoided. Private citizens, elected leaders, citizen action groups, other community groups, and the business community must all participate in the planning and goal-setting process, and reach consensus on the best strategy to pursue to ensure that the East End APC develops with vitality and sound planning.

4.2 Planning and Permitting

The East End APC is currently zoned as Public (P) and Residential-Low Density (R-1).

Since the late 1980's, DPNR/Comprehensive Planning staff have worked to prepare a Comprehensive Land and Water Use Plan (CLWUP) that will re-designate all land and water in the Territory as one of ten(10) classifications, known as "Intensity Districts". The purpose of the proposed Comprehensive Plan is to allow the territorial Government to begin providing public services and facilities concurrent with the demand for those services and facilities; that is, to ensure that the provision of public services and facilities occurs at the proper level and at the proper timing during the course of development. The overarching goal of the proposed Comprehensive Plan is to ensure that the quality-of-life for island residents is maximized by guiding the location and type of future growth through the provision of public facilities. DPNR/Comprehensive Planning is currently working to finalize the proposed Comprehensive Plan, including preparation of maps.

Due to potential for adverse impacts to marine resources in the event of sediment runoff, all permitted development should be required to strictly follow Best Management Practices (BMP's) for nonpoint source pollution control. Nonpoint source pollution is a significant contributor to the overall degradation of nearshore environments in the Virgin Islands (Tetra Tech, 1991). Although the islands have no perennial streams or rivers, episodic events of intense rainfall deliver pulses of fresh water laden with sediments, nutrients, organic matter, and potentially toxic chemicals to nearshore receiving waters. Control of nonpoint source pollution may have significant positive effects on pristine and otherwise valuable marine habitat. DPNR/CZM is currently working to assess the enforceability of existing regulations with respect to control of nonpoint source pollution.

Permitted development should be required to maintain an adequate distance from critical landscape features (such as guts, salt ponds, beaches, etc.). The setback distance (or buffer zone) should be determined through consideration of slope, aspect, vegetative cover, and other relevant factors. DPNR/CZM has drafted specific regulations as it pertains to steep slope development and is awaiting passage by the legislature.

Natural Hazards Mitigation

There is a need in the Territory for an effective coastal storm hazard mitigation policy and plan. The siting of facilities along the coast increases a cumulative threat potential with respect to three types of coastal storm impacts: (1) threats to public health, safety, and welfare; (2) costs to tax payers for disaster relief and protection; and (3)losses of irreplaceable natural resources (Godschallk, et al., 1989). Compounding the potential for catastrophic losses due to coastal storms is the possibility of significant sea level rise (SLR) in the decades ahead.

While average SLR over the last century has been less than one-foot (10-15cm), an increase in that much or more (10-20cm) is projected by 2025, and of between 1.5 and 6.5 feet (50-200cm) by the year 2100. Using an average of 1 meter of shoreline erosions per cm of SLR, the resulting average by 2025 would be 33 to 66 feet (10-20 meters) [Godschalk,et al., 1989].

There are generally three strategies that may be adopted to mitigate coastal storm hazards and SLR impacts. First,the natural coastline can be "hardened" by using designed protective structures, such as bulkheads, revetments, gabions, etc.. Second, facilities and structures built in high hazard areas can also be hardened through the use of stricter building standards to achieve increased wind and/or flooding resistance. These strategies often require resorting to and preparing for evacuation of people during a storm event, with its incumbent risk to human life.

Third, and a better approach, coastal development can be directed or redirected away from high hazard areas through the use of shoreline setback standards and/or re-zoning of high hazard areas to achieve simultaneous risk reduction and other objectives such as open space preservation or wildlife management.

This so-called "development management" strategy, is generally the most cost-effective option. As with the use of stricter building codes, increased costs associated with the alteration of land use patterns to reduce the exposure of people and property to storm damage are offset by long-term savings (from less damage) and reduced insurance rates. It is always (politically) easier to add a hazard mitigation section to an existing plan, regulation, or program than it is to adopt a totally new set of tools. In fact, there is no better time than today to prepare for the next storm, by introducing legislation that will require the use of new guidelines for decision-making during the next re-building effort.

> **A coastal storm hazard mitigation policy and regulations should be developed for the Territory on a site-specific basis. A "development management" alternative to hazard mitigation is recommended, and will require that implementing legislation be enacted soon in preparation for the next disaster. Future public and private developments should be directed away from high hazard areas. Redevelopment policies should be considered for existing shoreline development to minimize potential losses, and to establish a reconstruction plan prior to its need.**

As seen above, earthquake potential in the Territory is relatively high. While most of the APC is on lands with negligible slope, other lands immediately east and north of Frederiksted have considerable slopes. Where landfilled areas are to be used for construction, logic suggests that certain compaction standards be adhered to and a certified engineer report required for all major facilities.

Appropriate attention should be given the design for major facilities, especially those which will house large assemblies of people, so that threats from seismic activity are absolutely minimized.

Flooding mitigation will be an ongoing concern for new developments in many locations in the APC and its watersheds. As mentioned above, FEMA/NFIP A-Zone and V-Zone floodplains exist throughout the area.

Strict adherence to National Flood Insurance Program policies and regulations is recommended, and new developments restricted where the hydrology and flooding potential of an area may adversely affect important wildlife habitat or other natural features. Channelization for flood control should be avoided wherever possible, and new developments directed away from floodplain hazard areas. Cumulative impacts from the increased use of non-porous surface materials should be assessed, and guidelines established for the use of "grassphalt" and other porous surface materials on access roads, parking lots, and other suitable areas. These measures will be of increasing relevance for the contributory watersheds of La Grange Gut, in order to minimize flood potential at the Gut's lower reaches. Regular maintenance of all drainage systems, and an assessment of proper sizing of culverts, should be integral to a program of stormwater management for the APC.

Water

Due to the fairly undeveloped status of the East End, the water quality remains more or less unpolluted. However, actions to develop the area could lead to widespread water pollution as is found elsewhere on St. Croix.

4.3 Legislative Change

There is no V.I. law regarding the use of jet skis which are generally incompatible with other watersports activities. Although they are considered to be motor vessels, there are no standards (noise, speed, etc.) by which they operate, and no provisions in the law to consider the needs and safety of other water users, including swimmers and various aquatic or wildlife species.

The Division of Archaeology and Historic preservation is currently working on an Antiquities Legislation Bill that will be submitted to the Legislature for approval. This Bill will address the requirements for archaeological work any where in the Territory.

The Antiquities Legislation Bill will ostensibly bring greater clarification to the question of overlapping jurisdictions on historic protection matters, and will generally strengthen the overall authority and mandate of the Historic Preservation Commission (HPC). While such development is good, lawmakers should not lose sight of the long-term institutional and legal framework needed to bring about a comprehensive, coordinated, streamlined permitting system.

5. CONCLUSION

The East End is one of the few natural area on St. Croix that remains virtually undeveloped. The St. Croix Community and the V.I. Government should continue to work together in order to maintain the integrity of the site and its adjacent land and waters. The APC boundary should be seen as a *necessary* "buffer zone" within which development should be strictly controlled.

The V.I. Government should begin now to identify sources of funds to either acquire land or obtain conservation easements in this critically sensitive area. Such a fund-raising effort should be multi-faceted and creative, employing a variety of mechanisms that will encourage landowners in the area and the general public at large to participate.

The ecological integrity of the East End will rest on the ability of the Government to insure effective control over watershed development. Sound land use planning and site-specific mitigation practices must be utilized through the watershed if downstream effects are to minimized. Technical expertise in planning and resource management is needed, including, but not limited to watershed/nonpoint source pollution control, wildlife habitat management, water use planning and the management of aquatic habitat.

A long-term vision of the importance of bio-diversity conservation is needed. DPNR is mandated, by law, to effectively carry out this function.

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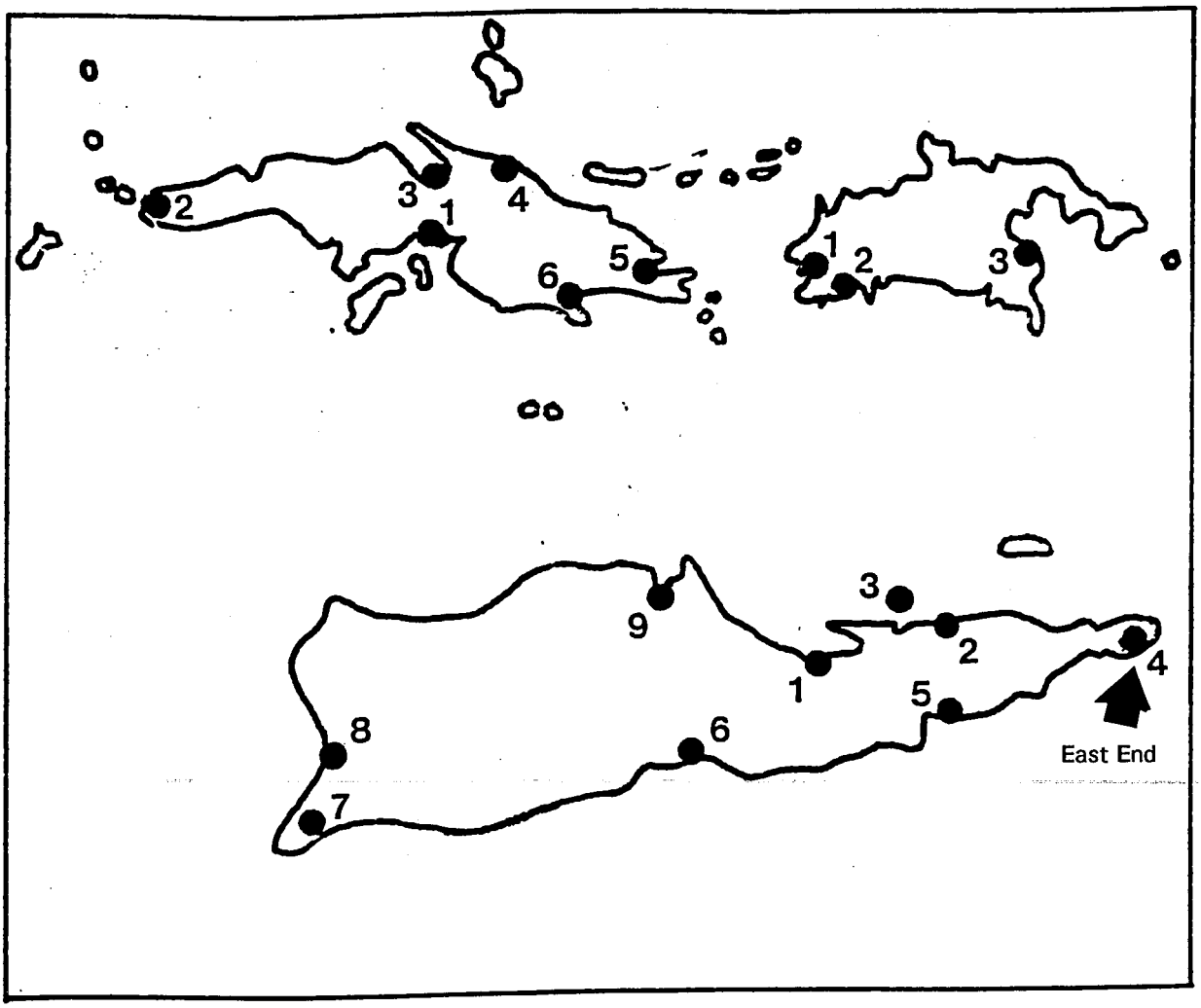
AREAS OF PARTICULAR CONCERN



ST. THOMAS

1. St. Thomas Harbor and Waterfront
2. Botany Bay (APR)
3. Magens Bay and Watershed
4. Mandahl Bay (APR)
5. Vessup Bay - East End
6. Mangrove Lagoon - Benner Bay (APR)

ST. JOHN

1. Enighed Pond - Cruz Bay
2. Chocolate Hole - Great Cruz Bay (APR)
3. Lagoon Point - Coral Harbor (APR)

ST. CROIX

1. Christiansted Waterfront
2. Southgate Pond - Cheney Bay (APR)
3. St. Croix Coral Reef System (APR)
4. East End (APR)
5. Great Salt Pond Bay (APR)
6. Southshore Industrial Area
7. Sandy Point
8. Frederiksted Waterfront
9. Salt River - Sugar Bay (APR)

Figure 1
Regional APC Boundary Map
Adapted from: U.S. DOC, 1979
Island Resources Foundation, 1993

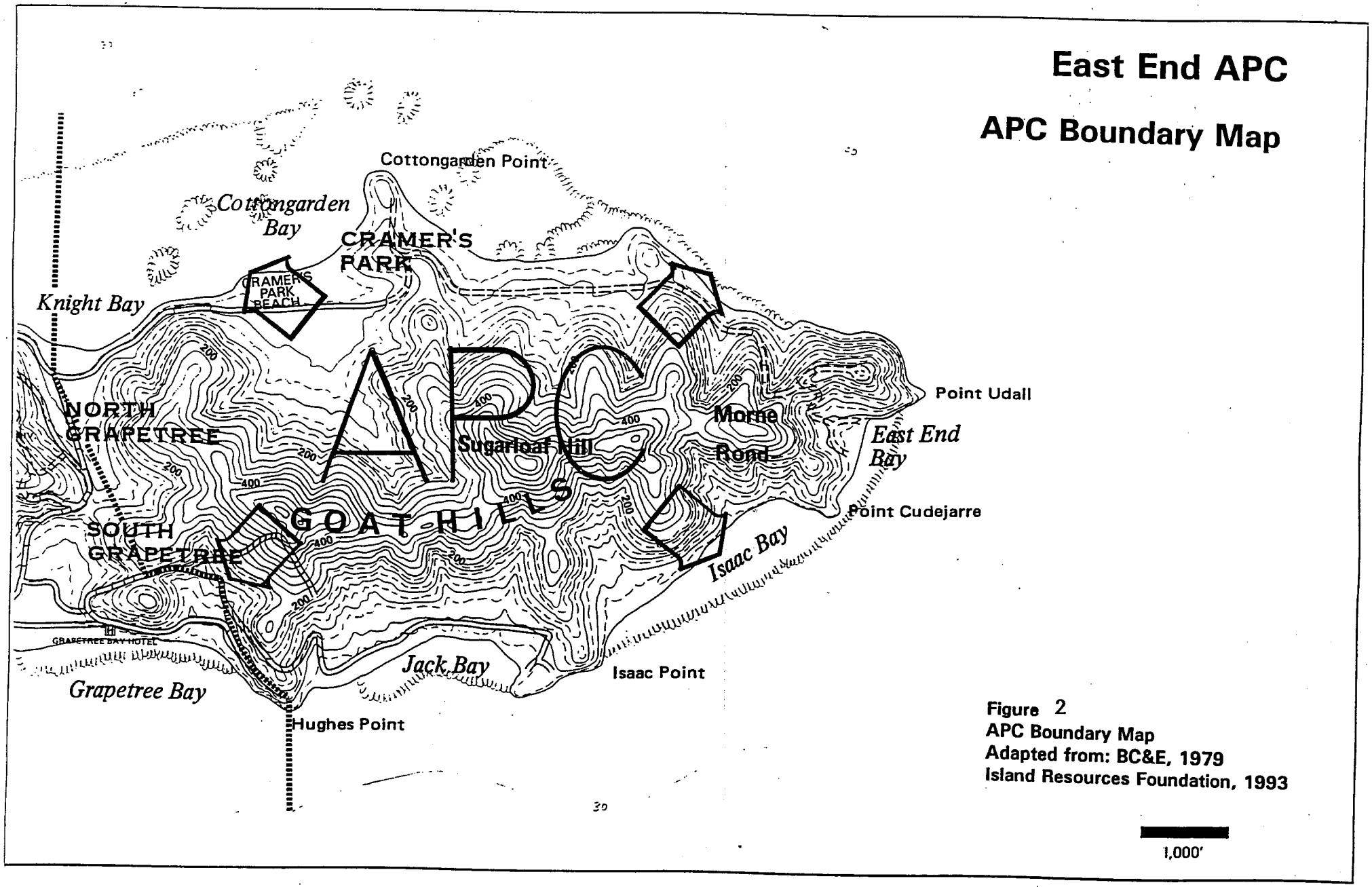


Figure 2
APC Boundary Map
Adapted from: BC&E, 1979
Island Resources Foundation, 1993

East End APC
Land Ownership Summary Map

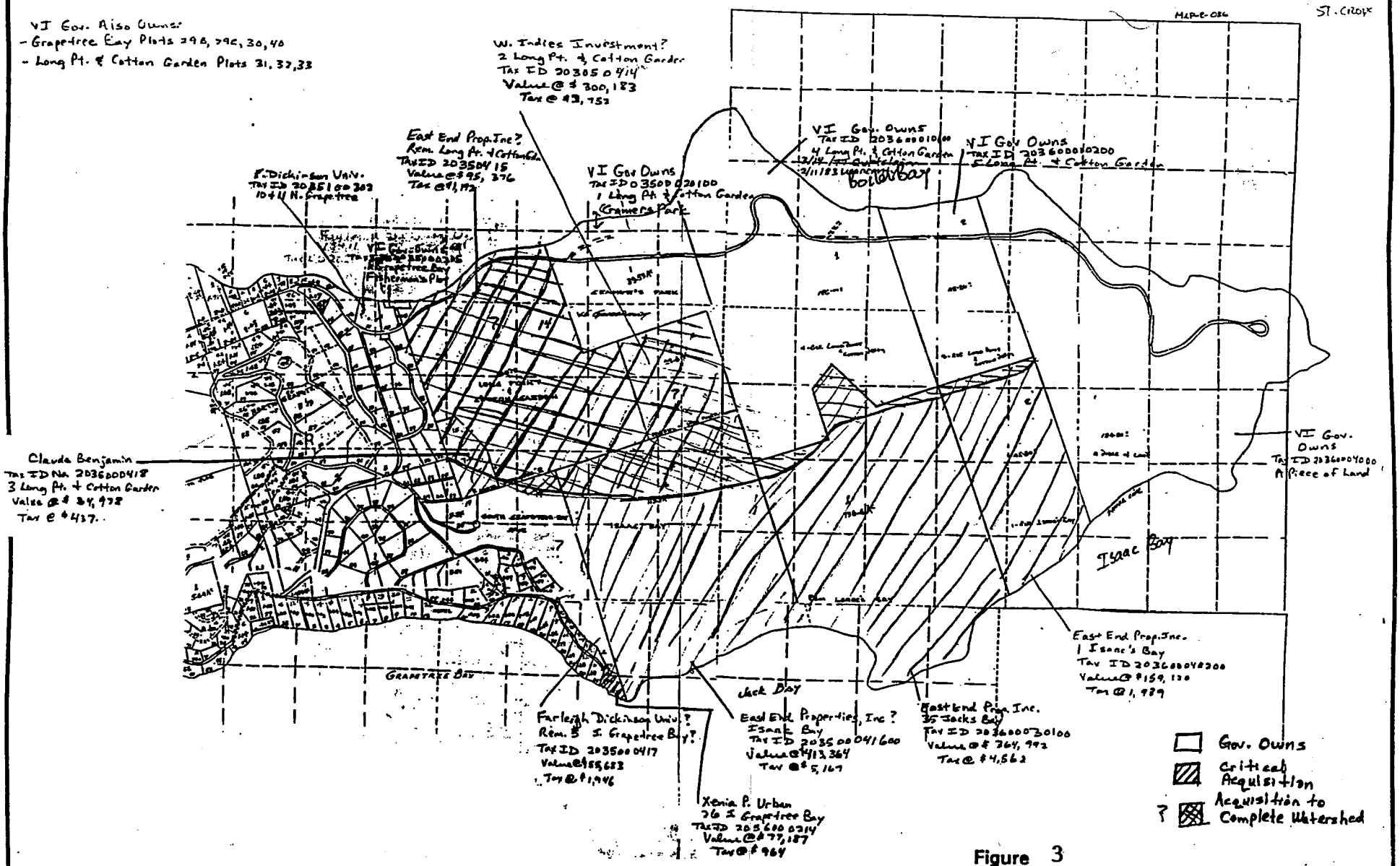
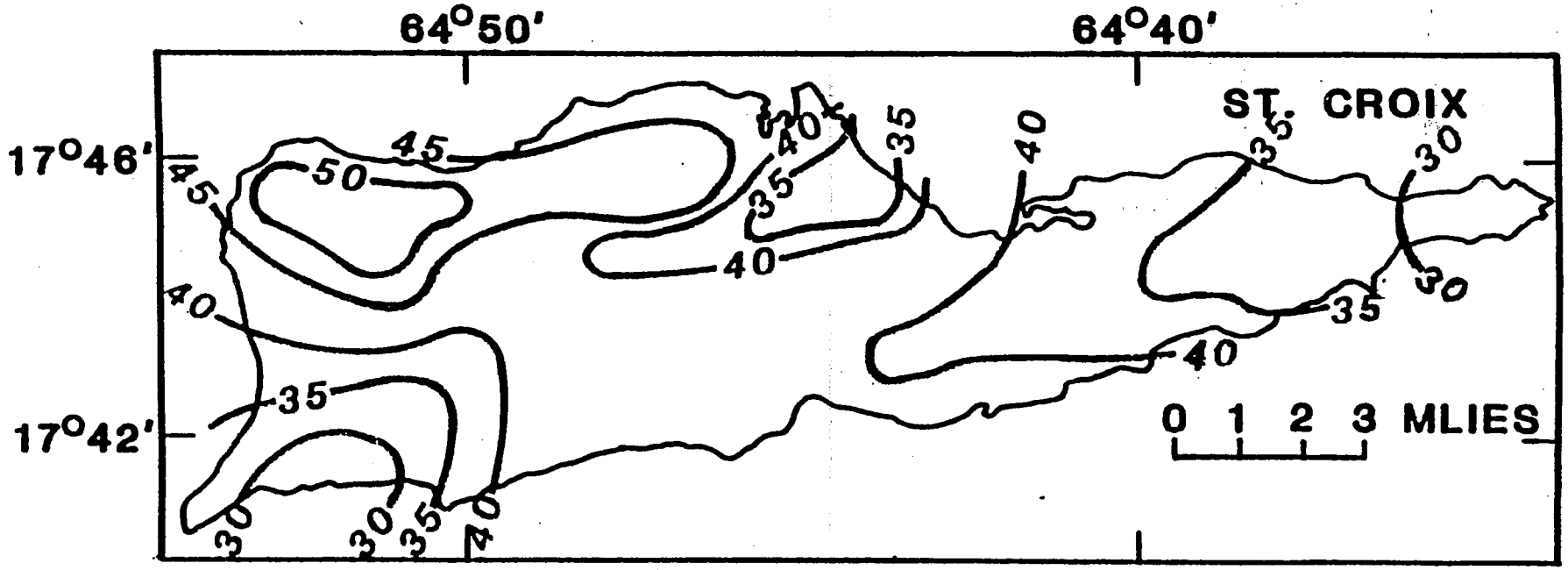


Figure 3
Land Ownership Summary Map
Island Resources Foundation, 1993

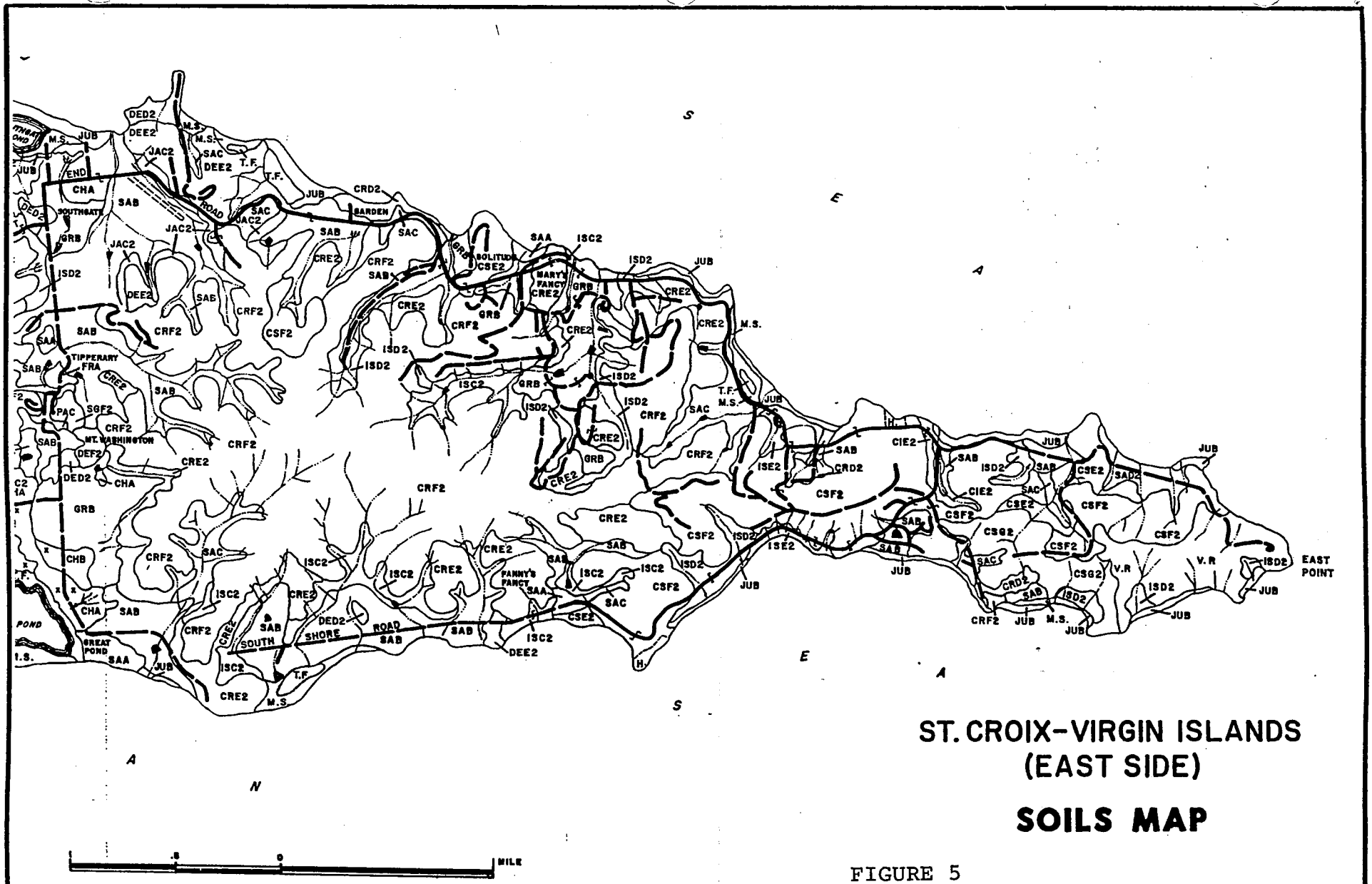


EXPLANATION

—35— LINE OF EQUAL RAINFALL IN INCHES

AVERAGE ANNUAL RAINFALL IN ST. CROIX
(Adapted from: R.J. Calvesbert, NOAA, NWS)

FIGURE 4 RAINFALL MAP
ISLAND RESOURCES FOUNDATION, 1992



ST. CROIX-VIRGIN ISLANDS (EAST SIDE)

SOILS MAP

FIGURE 5

US DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE, 1965

ISLAND RESOURCES FOUNDATION, 1992

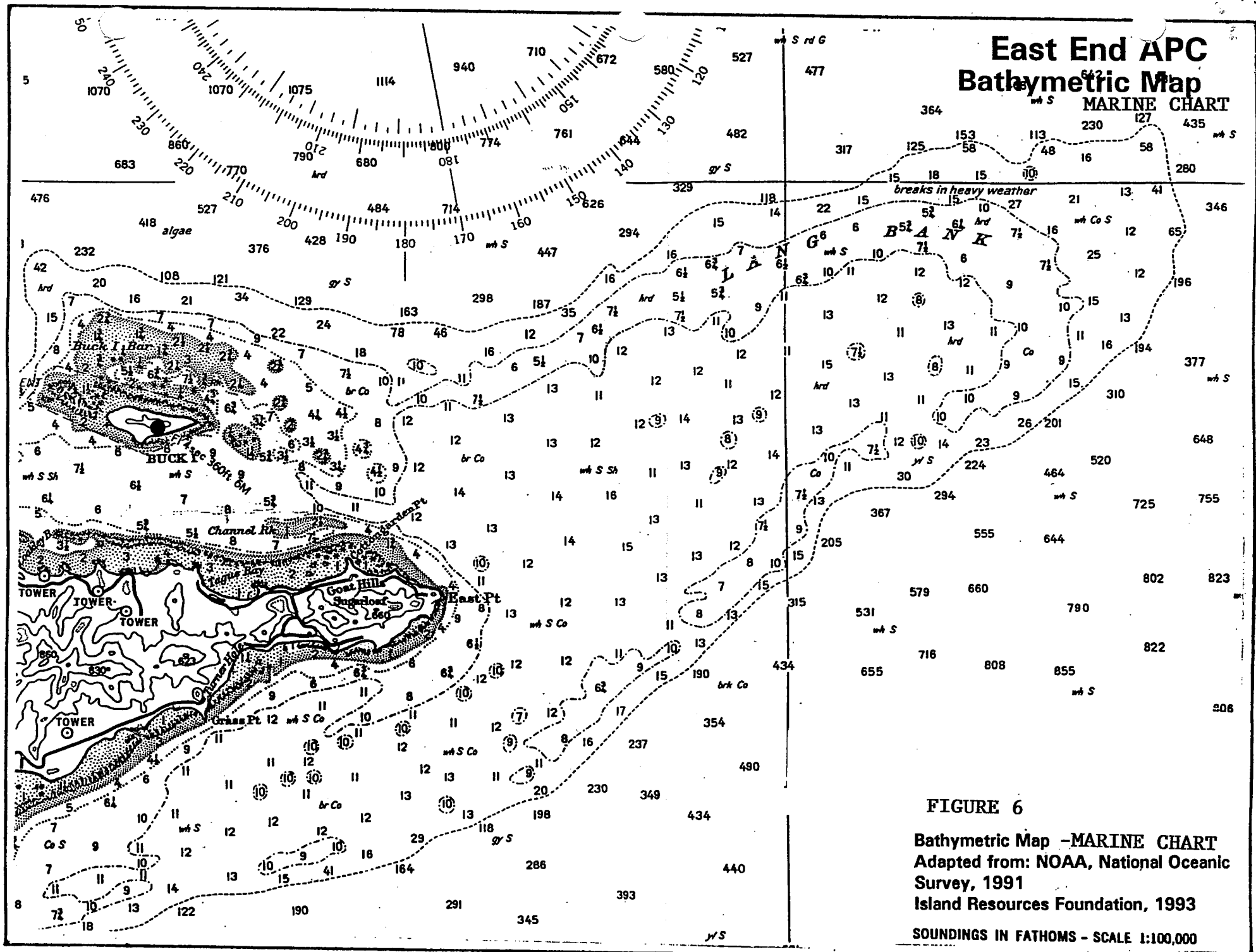
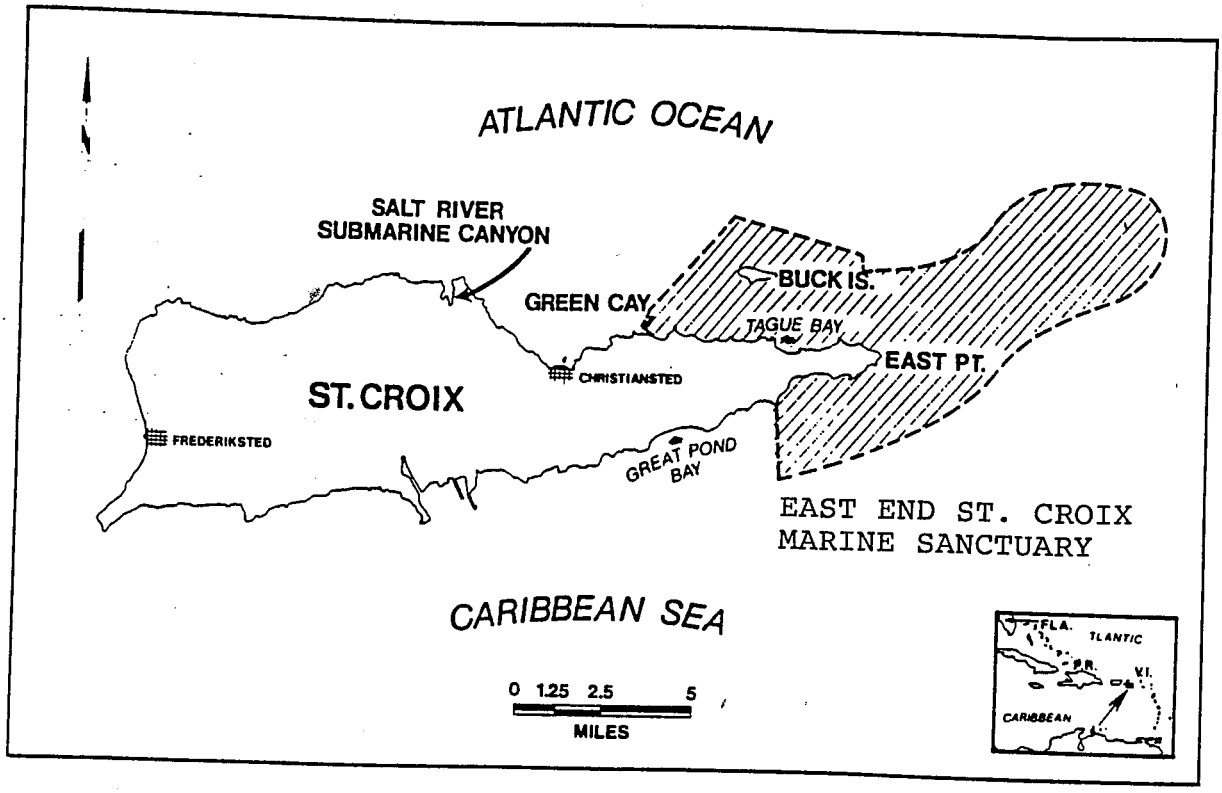


FIGURE 6

Bathymetric Map –MARINE CHART
Adapted from: NOAA, National Oceanic Survey, 1991
Island Resources Foundation, 1993

SOUNDINGS IN FATHOMS - SCALE 1:100,000



PRELIMINARY CANDIDATE
MARINE SANCTUARY SITE EVALUATION (C-3)

June 7, 1983

prepared by
CHELSEA INTERNATIONAL CORPORATION
1718 P St., NW
Washington, DC 20036

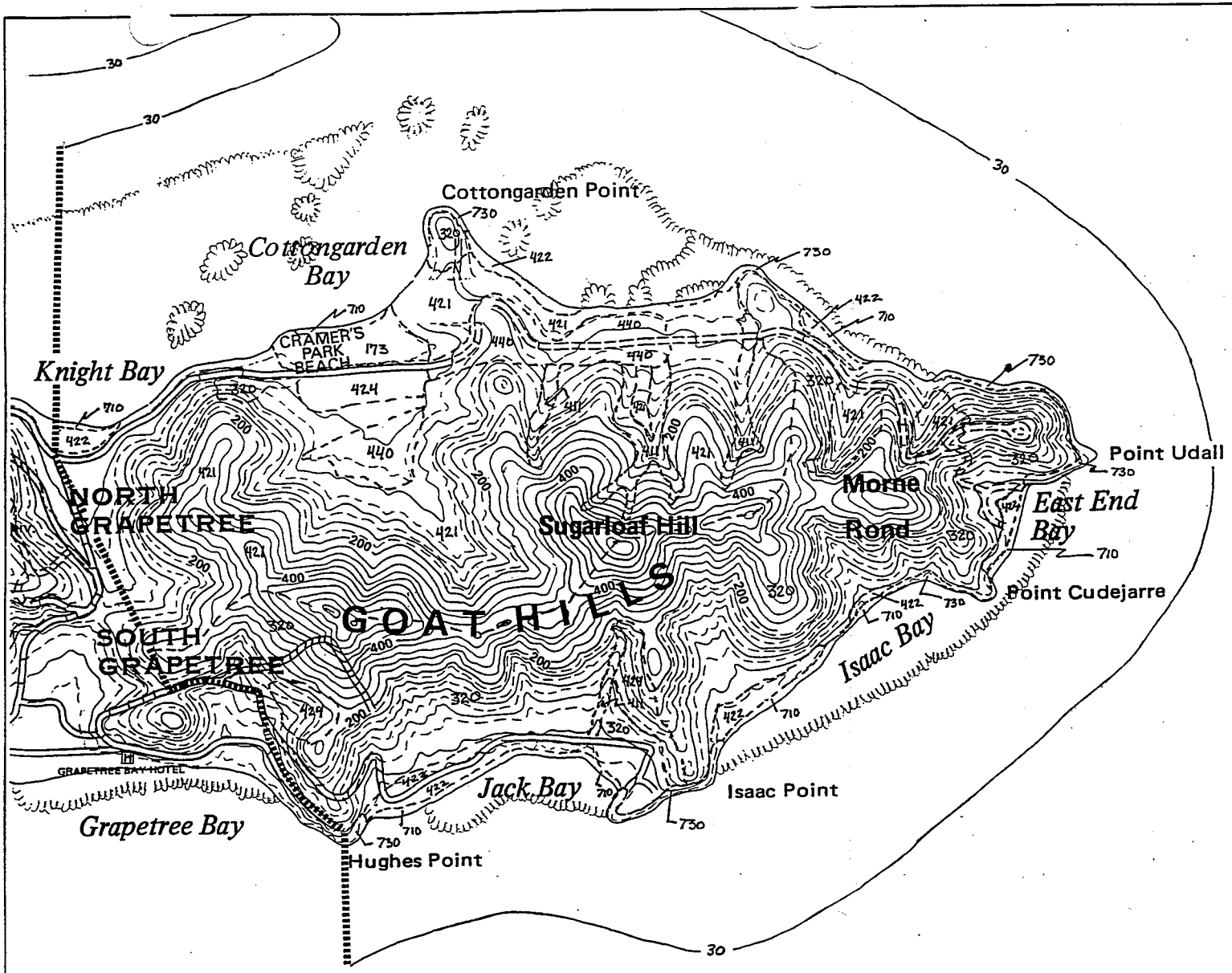
for

National Oceanic & Atmospheric Administration
Office of Ocean and Coastal Resource Management
Sanctuary Programs Division

Contract # NA-82-SAC-00647

FIGURE 7

ISLAND RESOURCES FOUNDATION, 1992



East End APC
Land Use Map

LAND USE / LAND COVER

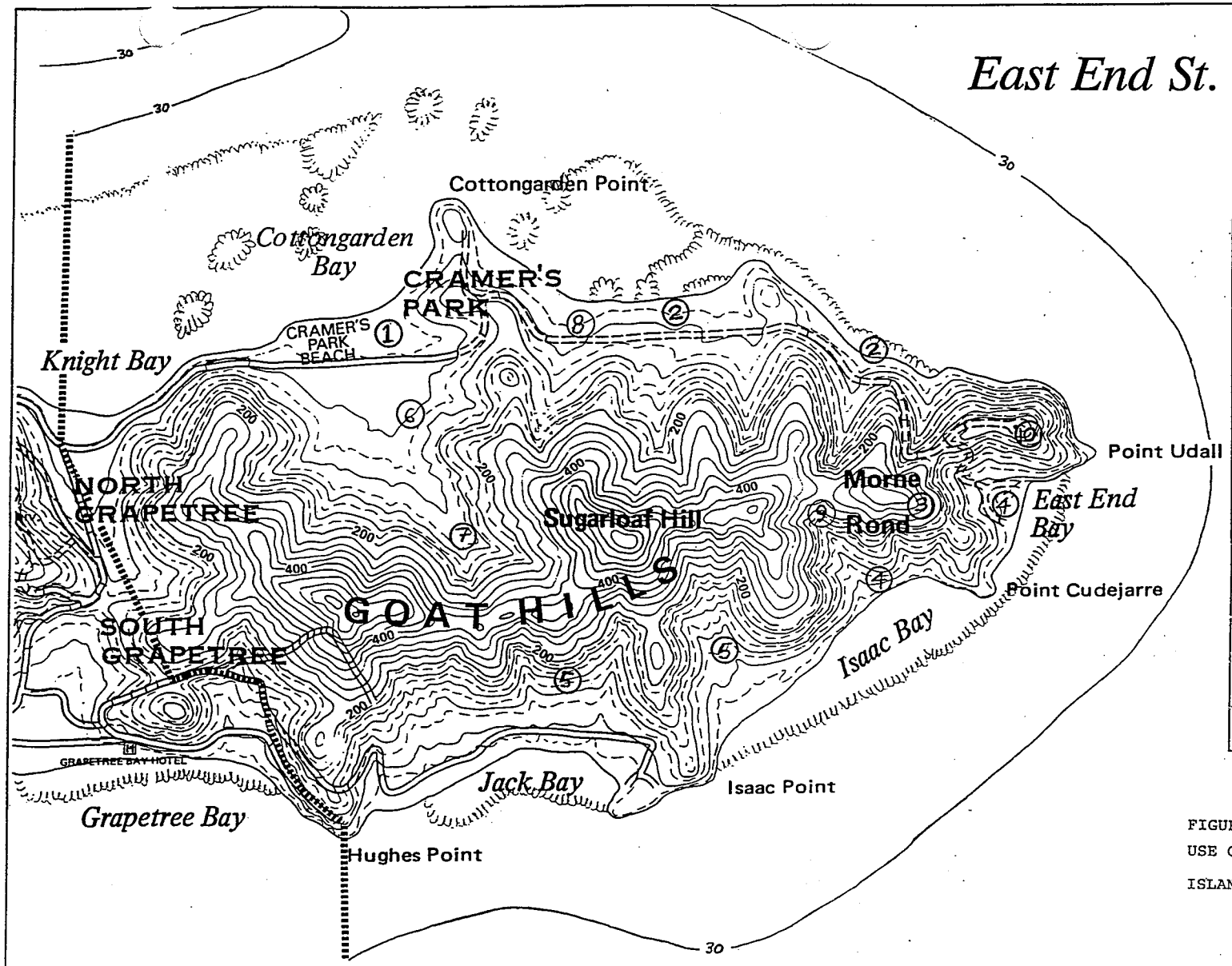
RECREATIONAL	173	Park
RANGELAND	320	Scrub/Brushland (mostly thorn scrub and cactus scrub)
WOODED AREAS	411	Stream (gallery) forest
	421	Woodland with cactus (thorn woodland)
	422	Beach woodland
	424	Mixed woodland and brush
BARREN LAND	710	Beaches
	730	Exposed rocky shoreline

Classification system: Teytaud, 1981.

Figure 8
Land Use Map
Adapted from: BC&E, 1979
Island Resources Foundation, 1993

1,000'

East End St. Croix APC/APR



EAST END ST. CROIX APC/APR
USE CONFLICT MAP (IRF AUG/91)

1. Cramer's Park Beach and campground is a popular holiday site. Problems with litter control in the picnic and campground area at times - possibly inadequate trash receptacles.
2. Several beach access roads, from the main (dirt) road (Route 82) should be regraded and barricaded. Vehicular traffic onto the beaches should be stopped. Regrading to redirect runoff into the area behind the beach rather than onto the beach itself would lessen silt-laden runoff entering the sea directly.
3. Poaching has been reported at East End (deer hunting and turtle egg poaching).
4. Recommended that vehicular access be restricted to the beaches at Jack, Isaac and East End Bays - some frequented by poachers (turtle eggs and deer hunters).
5. National Radio Astronomy Observatory VLBA telescope station site location - in conflict with (7).
6. Caribank Financial Group development proposal for a 300 acre, 1 home subdivision.
7. Suggested paving of Route 82 (East End Road) to reduce road erosion during rain storms.
8. Fire control and prevention a problem at times at East End.
9. Begin regular police patrols of East End Road to Point Udall and begin regular trash cleanup and pickup at Point Udall overlook.

FIGURE 9

USE CONFLICT/RESOURCE AVAILABILITY MAP

ISLAND RESOURCES FOUNDATION, 1992

1,000'