

**FREDERIKSTED WATERFRONT
AREA OF PARTICULAR CONCERN
(APC)**

A COMPREHENSIVE ANALYTIC STUDY

V.I. DEPARTMENT OF PLANNING AND NATURAL RESOURCES
Coastal Zone Management Program

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TABLE OF CONTENTS**

1.	INTRODUCTION	1
1.1	General	2
1.2	Relationship to Other Plans and Regulations	2
1.3	Historical Perspective	2
1.4	Other Classifications	4
2.	DESCRIPTION OF THE SITE	5
2.1	APC Boundary	5
2.2	Ownership Summary	5
2.3	Physical Environment	5
2.3.1	Climate	6
2.3.2	Geological Setting	6
2.3.3	Hydrological Setting	7
2.3.4	Coastal Environment	8
2.4	Biological Environment	9
2.4.1	Terrestrial	9
2.4.2	Marine	10
2.4.3	Endangered Species	10
2.5	Cultural Resources	11
2.5.1	Prehistoric	11
2.5.2	Historic	11
2.6	Built Environment	12
2.6.1	Roads and Ports	12
2.6.2	Water Systems	12
2.6.3	Wastewater System	13
2.6.4	Energy Systems	14
2.6.5	Solid Waste Disposal Systems	14
3.	RESOURCE USE, USE CONFLICTS, AND ADVERSE IMPACTS	14
3.1	Resource Use	14
3.2	Use Conflicts	16
3.3	Adverse Impacts	17
3.3.1	Water Quality	17
3.3.2	Air Quality	18
3.3.3	Noise Pollution	18
3.3.4	Impacts to Biological Resources	18
3.3.5	Impacts to Cultural Resources	19
4.	MANAGEMENT RECOMMENDATIONS	19
4.1	Policy Framework	19
4.2	Planning and Permitting	24
4.3	Legislative Change	37
4.4	Institutional Development	38

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	CZMP
Division of Environmental Protection	DEP
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	MGPD
National Ambient Air Quality Standards	NAAQ
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	USACE
U.S. Environmental Protection Agency	USEPA
U.S. Fish and Wildlife Service	USFW
U.S. Geological Survey	USGS
University of the Virgin Islands	UVI

LIST OF FIGURES

1. Regional APC Map
2. APC Boundary Map
3. Historic District
4. Major Drainage Basins
5. 100-Year Floodplain
6. Proposed Stormwater Improvement

- 7. Biological Features
- 8. Physical Features
- 9. Location of Kingshill Aquifer
- 10. Major Groundwater Discharge Wells
- 11. Land Use
- 12. OTF's Proposed waterfront/pier improvements
- 13a. Zoning Map
- 13b. Zoning Map

1. INTRODUCTION

1.1 General

The Frederiksted Waterfront 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). Frederiksted town, comprised of approximately 1000 residents, is located on St. Croix's southwest coast, north of Sandy Point National Wildlife Refuge (also an APC), and about five miles west of the Alexander Hamilton International Airport. The APC comprises, additionally, a portion of Estate La Grange lying north of town, and some 3500 feet of shoreline and inshore submerged lands extending seaward to the submarine shelf edge (Figure 2).

On July 26, 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 and 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 ecosystem dynamics, energy linkages, historical development, and traditional uses, and an action-oriented plan for the area's future utilization. This Comprehensive Analytic Study is intended to serve as the overall planning and management framework within which the various regulatory entities carry out their respective decision-making duties under their authority.

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 permit request, not in advance of it. The goal of developing an APC management framework is to be able to make *a priori* decisions about the allowable extent of modification of an entire landscape unit or marine ecosystem. In other words, to raise the level of decision-making from the site-specific to that of functional ecosystems and the maintenance of a wide array of interactive resource uses.

1.2 Relationship to Other Plans and Regulations

The Frederiksted Waterfront APC was prepared under the authority of the Coastal Zone Management Commission. The Comprehensive Analytic Study 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 proposed herein will 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 Port Authority, the Department of Housing, Parks and Recreation (DHPR), the Water and Power Authority (WAPA), the Department of Public Works (DPW), the Historic Preservation Commission, and the Department of Property and Procurement. This Comprehensive Analytic Study will serve as a guide for future decisions concerning the area. Future development activity should be consistent with this Study and proposed management plan.

The intent of this Study 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 Study and 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 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 Study 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 Study.

1.3 Historical Perspective

Subsequent to Denmark's purchase of St. Croix in 1733, land was reserved from Estate La Grange for the construction of a town and a fort at the western end of St. Croix. The directors of the Danish West India and Guinea Company approved the establishment of a town in 1751. Frederiksted was named in honor of Danish King Frederik V.

The original plan was for the town to consist of two symmetrical parts separated by a lagoon and fort. The town was laid out in rectangular blocks formed by main streets which ran north-south, and secondary streets laid out in an east-west direction (Bresdorff, *et al.*, 1980).

Because of potential communication problems, the earlier decision to create dual towns was rescinded, and in 1767 the owner of Estate La Grange ceded an equal amount of land on the east and south sides of the southern half of Frederiksted. This, plus an addition of a small strip of land located to the east of New Street, added to Frederiksted in 1875, created what is today the town's limits. The same building code and ordinances for development were applied to Frederiksted as were established for Christiansted.

In 1752, construction was begun on Fort Frederik to protect the port from pirates and smugglers. The Fort was later the site of the abolition of slavery in 1848. It stands today as an important cultural and historical cornerstone for the town.

Frederiksted was the site of the "Great Fireburn" of 1878 when rioting laborers set fire to the town. The fire destroyed more than four square blocks which comprised the town's business district. Reconstruction occurred with the "Victorian" style of the time. Today, Frederiksted annually celebrates the emancipation-related event.

Historically, a major portion of the land on St. Croix was used for the cultivation of sugarcane and cotton as well as for grazing. Sugarcane farming was largely eliminated in the 1960's. Although commercial farming of other agricultural crops has declined since 1930, small-scale agriculture, especially on farm sizes of 3-9 acres, continues to provide a wide variety of fresh produce for local markets (McElroy and de Albuquerque, 1984).

Throughout the history of the Territory, Frederiksted has served as a major port for both the importation of foreign goods and the exportation of local agricultural products. Evidence of the long history and high level of maritime activity is found in the large amount of historic material and artifacts found by divers in the area.

The economy of St. Croix and the Territory as a whole is now primarily based on the tourism industry. In 1987, the tourism industry generated more than 70 percent of the Territory's employment and payrolls (PBSJ, 1989). The ocean pier which serves as port for larger visiting cruise ships to St. Croix is located in Frederiksted.

During the five year period from 1983 to 1987, the number of cruise ship calls at Frederiksted increased from 35 to 166. In 1987, Frederiksted served 132,217 cruise ship passengers, further increasing to 157,108 in 1988 (PBSJ, 1989). However, these figures have since declined, due in large part to extensive damage of the pier and town in the September 1989 Hurricane Hugo.

Frederiksted has experienced population and economic decline since Hurricane Hugo and has yet to fully recover (Our Town Frederiksted, n.d.). Prior to the hurricane, cruise ship activity was approximately two to three cruise ships per week. Presently, the eight large cruise ships which call weekly year-round at St. Thomas do not call at Frederiksted.

Military and commercial vessels have used the old pier which has berths to accommodate two large vessels. The north side of the pier has been under contract to the Navy, while commercial vessels have used the pier's south side. Currently, the V.I. Port Authority is constructing a new \$14.5 million pier 100-feet north of the old structure which will also accommodate two vessels.

Many aspects of Frederiksted make it an attractive cruise port, including (PBSJ, 1989):

Frederiksted is an open roadstead port without a harbor. The foot of the cruise pier is within walking distance of the town and its many historical sites. The water alongside the pier is deep enough to accommodate most cruise ships wishing to use Frederiksted as a homeport.

The town is in close proximity of the Alexander Hamilton International Airport. Many attractions of St. Croix are within an hour drive of Frederiksted.

Because the economic stability of Frederiksted is a reflection of the amount of cruise ship/tourist arrivals, it is hoped that the new pier will help to boost the local economy. A Governor's task force, consisting of community representatives, is working on the development of tourist facilities to augment the potential economic benefits of the new pier.

Most of the shoreline area in Frederiksted proper is occupied by park area and Fort Frederik, a National Historic Site. All of the town is an Historic District. The Frederiksted waterfront is currently used for many activities including fishing, swimming, snorkeling, diving, and boating. The old pier has received international attention as a conveniently accessible, premier "urban" dive site, due to the exceptionally clear waters in combination with a diverse biological community of sponges, crabs, brittle stars, tube worms, snails, and a variety of fish. The old pier is scheduled to be demolished upon completion of the new pier, although attempts will be made to assist colonization of the new pilings by an assemblage of organisms such as those mentioned.

The Frederiksted Waterfront APC can expect to see increased growth in the coming years, as the further development of both Christiansted and Frederiksted as St. Croix's major towns is the direction proposed in the new Comprehensive Land and Water Use Plan. The Plan calls for Frederiksted to be a "primary" center for St. Croix's West End, with intensified mixed-use development along the town's perimeter, maintaining the historic character of Frederiksted while allowing for controlled growth to support its economic development and housing needs. Thus, along with increased growth will come new demands on the natural resources of the area, and of course the popular waterfront and port.

1.4 Other Classifications

The Frederiksted Historic District was officially listed on the National Register of Historic Places on August 9, 1976. In 1990, the V.I. Government designated the entire town as an Historic District (Figure 3).

Both Fort Frederick and King Street in Frederiksted have been given special attention for their historical significance as highest priority sites for preservation. Fort Frederick is presently being considered by the National Park Service for National Historic Landmark status (pers. comm. E. Richter, DPNR/DAHP). In addition, a 1960 Park and Recreation Plan identifies the Frederiksted Public Beach, located just north of Fort Frederick, as the only public beach directly accessible from Frederiksted and vicinity (U.S. DOI, 1960). A 1981 DCCA document further identifies the entire area from Sprat Hall (north of Frederiksted) to Fort Frederick as a "high quality" beach area for recreational development. The Fort Frederick beach (immediately north of the Fort) is given similar designation as a "quality" beach area. In addition, the Frederiksted Pier is identified as an important dive and snorkeling site, and scenic marine area (USVI Govt/DCCA, 1981). In September 1992, the V.I. 19th Legislature approved acquisition costs for 0.65 acres of beachfront property at Estate Two Williams, to ensure access to the popular public beach near Sprat Hall.

A major portion of the APC boundary is within the 100-year (A-Zone) floodplain; coastal sections are within designated V-Zones (section 2.3.3). There are no Coastal Barrier Resources System sites within the APC.

The Frederiksted Community has been designated the Frederiksted Renewable Energy District (FRED) by the St. Croix Energy Office, and several solar powered projects have been implemented (section 2.6.4).

2. DESCRIPTION OF THE SITE

2.1 APC Boundary

The boundary for the Frederiksted Waterfront APC, established by the Coastal Zone Management Commission, is described as follows (Figure 2):

Beginning at the Frederiksted Fish Market at the west end of Fisher Street, the boundary extends easterly along Fisher Street to Strand Street; then north along Strand Street to Market Street; then easterly along Market Street to the end of Market Street; then continuing in an easterly direction, (this line being an extension of Market Street) to Route 63 (La Grange Road); then northerly and westerly along Route 63 to the intersection of Route 631; then due west to the outer shelf edge or three mile limit (whichever is closer), then south along the outer shelf edge or three mile limit to a point due west of the Frederiksted Fish Market; then due east to the Frederiksted Fish Market, the point of origin.

2.2 Ownership Summary

Most land within the APC boundary is publicly owned, with the exception of private holdings on the Estate La Grange portion, and a handful of private holdings elsewhere along the waterfront. The Department of Housing, Parks and Recreation is the responsible Government Department for a large portion of the waterfront recreation area south of the pier, along Strand Street. Fort Frederik is also publicly owned, and is undergoing renovation as a museum.

2.3 Physical Environment

Figure 8 depicts the principal physical features found within the APC.

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 the 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).

The wettest months are September to December, and the dry season is February to July. Most of St. Croix, including the Frederiksted Waterfront APC, receives 35-45, (average about 40) inches of

rainfall per year. The northeast hills receive slightly more, and Annaly, the wettest area, receives an average of 52 inches per year (Bowden, 1970). Rainfall usually occurs in brief, intense showers of less than a few tenths of an inch.

Temperatures average an annual 79° Fahrenheit, with winter averaging 76° F and summer averaging 84° F.

The Virgin Islands lie in the "easterlies" or "trade winds" which traverse the southern part of the "Bermuda" high pressure area; predominant winds are thus from the east-northeast and east (Island Resources Foundation, 1977). These trade winds vary seasonally, but most significantly during the late summer months when tropical depressions may form resulting in storms and/or hurricanes. 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). The rocks which underlie the mountain ranges are sedimentary, formed by debris from eroding volcanic rocks (Whetten, 1974). Two predominant mountain ranges exist (the Northside Range and East End Range), separated by a central sediment-filled valley. The two ranges at one time were distinct islands, separated by a submerged lagoonal environment, which during a later period of uplifting formed the present sediment-filled valley and island of St. Croix.

Estate La Grange and the area east of Frederiksted Town lie near the foothills of the mountainous northwest region of St. Croix. Upper slopes are moderate to steep (over 30 degrees in many areas), while the lower reaches of La Grange Gut and its surroundings flatten into a fan shaped valley. It is this valley which forms the inland portion of the APC boundary. Several tributaries feed into La Grange Gut.

There are four major natural soil/land types found within the APC (USDA, 1970):

Limestone Rock Land (Ls). This land type is found along the waterfront areas of Frederiksted. These areas along the coast include coral outcrops covered with as much as six inches of clayey sediments. Because of its rocky nature, this land type has severe limitations for most uses.

Aguirre clay, 0-2 percent slopes (AuA). This soil type is found in a small area north of the town of Frederiksted and east of the stadium. Its characteristics include slow permeability, waterlogging, high shrink-swell potential, high plasticity, and poor bearing strength. These characteristics severely limit all farm and nonfarm uses.

Coamo clay loam, 2-5 percent slopes (CaB). This soil type is found in a small area north of the town of Frederiksted. It has favorable soil characteristics for both farm and nonfarm uses.

San Anton clay loam, 0-3 percent slopes (SaA). This soil type is found in an area on the north eastern portion of the APC boundary. It has favorable soil characteristics for both farm and nonfarm uses.

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. 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, 1984].

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, 1984).

2.3.3 Hydrological Setting

The APC receives drainage from the La Grange Basin which is made up of three subwatersheds totalling approximately 3223 acres (Figure 4).

The major portion of the APC boundary is within the 100-year (A-Zone) floodplain (Figure 5). A-Zones are comprised of 100-year riverine floodplains. La Grange Basin and upslope watersheds are included in this zone. Coastal areas are designated as Zone V-5. Base flood elevations (BFE) of 5 feet and flood hazard factors have been determined for these areas (FEMA, 1987).

The Army Corps of Engineers has conducted a preliminary reconnaissance survey of a stormwater improvement project to reduce the flooding hazards from the La Grange Gut (Figure 6). La Grange Gut is approximately 4.8 miles long and runs between Estate La Grange and Frederiksted. It has a drainage of about 5.2 square miles. Mahogany Gut runs northeast of the city and joins La Grange Gut at the coastal plain north of Frederiksted. Runoff in La Grange Gut frequently bottlenecks at the bridge (confluence of the two guts), and again at a high spot at its lower reach. Water stagnates and the gut is often filled with trash (USACOE, 1990).

Severe flooding occurred in 1977, and again during Tropical Storm David in 1979. During periods of high rainfall, Mahogany Road serves as a channel for flood waters (Figure 5). Due to the intermittent nature of the stream and to the existence of several culvert road crossings, the channel has a relatively low discharge capacity. Property in the area subject to flooding includes 62 single housing structures, 20 business outlets, two multi-family buildings, a park, the baseball stadium, three groundwater well fields, and several roads and streets. Residential areas along Mahogany Road become isolated during floods (USACOE, 1990).

A draft report for the La Grange Gut project calls for channel improvements to the lower portion of La Grange Gut, construction of a levee and interior drainage canal to the town of Frederiksted, and replacement of the bridges at King Street, Highway 631, and Prince Street (USACOE, 1992).

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.

The coastline of the Frederiksted Waterfront APC is nevertheless greatly affected by wind and wave action. Storm surges associated with tropical disturbances are not uncommon. Wind and wave data for the period 1963-1973 are summarized in the following tables (USVI Govt/Port Authority, 1989):

**Table 1
Frederiksted, St. Croix
Wind Observation Data, 1963-1973**

<u>Direction</u>	<u>Frequency (%)</u>	<u>Mean Speed (mph)</u>	<u>Highest Observed Speed (mph)</u>
North	4.0	10.4	30
Northwest	1.1	8.9	30
West	0.6	7.6	30
Southwest	0.9	7.9	30

As the above table indicates, Frederiksted is confronted with wind blowing from the north, northwest, west, or southwest approximately 6.6% percent of the time. The remainder of the year, wind is predominantly from the east, southeast, or south, with little or no appreciable effect on the Frederiksted coast.

**Table 2
Frederiksted, St. Croix
Wave Observation Data, 1963-1973**

<u>Direction</u>	<u>Frequency (%)</u>	<u>Wave Height (feet)</u>
North	4.4	7
Northwest	1.3	7
West	0.6	6
Southwest	0.9	4

Of great significance for the Frederiksted Waterfront is potential damage from storm surge associated with hurricanes. Storm surge elevations for the 10, 50, 100, and 500 year hurricane events are calculated (estimated) to be 2.5, 4.0, 5.0, and 7.3 feet above still water respectively (USVI Govt/Port Authority, 1989). Wave heights of these dimensions could result in significant damage to coastal infrastructure. A near-vertical seawall exists along the entire waterfront. This was constructed to protect the town from high sea swells.

Coastal water quality on the west end of St. Croix is relatively high, with temperature, salinity, visibility, and dissolved oxygen parameters at the Frederiksted Pier similar to those which exist for more pristine sites (USVI Govt/Port Authority, 1989). This would be expected given that the coast is well flushed, and has limited sources of perennial freshwater runoff and nutrient input.

2.4 Biological Environment

2.4.1 Terrestrial

Terrestrial biological resources within the APC proper are limited. Most of the APC boundary parallels the shoreline, with the exception of the lower portion of the La Grange Gut watershed north-northeast of town. That area is largely undeveloped, and is comprised of mixed agricultural and some residential use, with emergent wetlands along the La Grange Gut water course. The following description of those wetlands is excerpted from USACOE, 1990:

The northern region of La Grange Gut is classified as a Palustrine system with unconsolidated bottoms present. Wetlands of this nature are classified as being intermittently exposed. The southern and western border (to coastline) of La Grange Gut is a riverine system which has an intermittent streambed. The streambeds are limited to tidal and intermittent subsystems. The area is seasonally flooded. The eastern and southern sides of La Grange are classified as a Palustrine system which is forested with broad-leafed evergreens. The area is only temporarily flooded.

The La Grange Gut is used by Great Egrets (*Casmerodius albus*), Great Blue Herons (*Ardèa herodias*), Snowy Egrets (*Egretta thula*), Little Blue Herons (*Florida caerulea*), Belted Kingfishers (*Megaceryle alcyon*), and Yellow-crowned Night Herons (*Nyctanassa violacea*) [pers. comm., W. Tobias, DPNR/DFW].

A significant coastal freshwater marsh exists north of the APC south of Sprat Hole. The marsh is known as Williams Marsh, and is comprised of White Mangrove (*Laguncularia racemosa*), and Buttonwood Mangrove (*Conocarpus erecta*). Freshwater stands in Williams Marsh during periods of heavy rain. The marsh has been impacted by agriculture, and today patches of wetland extend into the fields on either side (pers. comm., A. Dempsey, Bioimpact).

2.4.2 Marine

The marine community of the APC is a rich composite of both healthy and degraded benthic environments, and appears to exhibit a relatively high degree of species diversity. Seagrass beds interspersed with patch coral reefs are found scattered throughout the area. Soft corals and sponges are common within a few hundred feet of the coast. A large area of mixed seagrass, coral, and sandy

bottom is found to the north of the new pier, with relatively intact coral reefs to the north and seaward. At least a dozen species of corals were found to inhabit an exposed pavement zone north of the old pier (USVI Govt/Port Authority, 1989). Figure 7 presents a schematic drawing of the area's benthic communities.

Wave activity during Hurricane Hugo severely impacted the benthic environment of Frederiksted's inshore coastal waters. Previously vegetated areas have been scoured, and much of the *Thalassia* and *Syringodium* seagrass beds have been replaced by *Halodule wrightii* (pers. comm., L. Kaczmarzsky, St. Croix Aquarium and Marine Education Center). In addition, a notable change has recently occurred with the formation of wide bands of algae (*Cladophora* spp. and *Schizothrix*) south of the Fisher Street fishing dock (pers. comm., L. Kaczmarzsky, *ibid*). The algal growth is an indicator of excessive nutrient loading, and, although unconfirmed, is most likely the result of sewage discharge from a nearby housing project (pers. comm., T. Tobias, DPNR/DFW).

The old pier (scheduled to be demolished upon completion of the new pier) provides a unique habitat for a number of usually deep water marine organisms. The pilings provide substrate for several species of colorful sponges, and habitat for a wide variety of fishes and invertebrates. The pier is one of the most popular dive sites on the island, and receives international attention among diving enthusiasts.

Lobsters, octopus, squid, several species of crabs, conch, shrimp, brittle stars, sea urchins, several species of marine worms, anemones, are a few of the types of marine organisms found in the many cracks and crevices of the scattered coral rubble and hard rock pavement. (The EAR for the Frederiksted Cruise Ship Facility (USVI Govt/Port Authority, 1989) provides fairly extensive species lists of such organisms, and the corals, seagrasses, and fishes found in the vicinity of the pier.)

2.4.3 Endangered Species

The U.S. Endangered Species Act 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 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 listed rare or endangered species are found within the Frederiksted Waterfront APC. Brown pelicans (*Pelicanus occidentalis*) are frequently observed feeding in the waters directly in front of town; they also roost on the pier. Green sea turtles (*Chelonia mydas*), Hawksbill sea turtles (*Eretmochelys imbricata*), and Leatherback sea turtles (*Dermochelys coriacea*) are all federally listed endangered species found in these coastal waters. Sporadic nesting of Green sea turtles is reported at

the public beach north of Fort Frederik. Hatchlings have been seen trying to cross the road to the brightly lit ball park east of the beach (USVI Govt/Port Authority, 1989).

Four 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 physalus*), the Humpback whale (*Megaptera novaeangliae*), and the Sperm whale (*Physeter catadon*).

2.5 Cultural Resources

2.5.1 Prehistoric

One known prehistoric site exists within the APC. Prehistoric artifacts and several pottery shards have been found under and/or near Fort Frederik (pers. comm., B. Tilden, Fort Frederik Museum).

Four prehistoric sites were found during a 1992 USACOE funded archaeological survey of the La Grange project area outside of Frederiksted (pers. comm. E. Richter, DPNR/DAHP).

2.5.2 Historic

Fort Frederik, located on the waterfront just north of the pier, is the most historically valuable building in Frederiksted. The site is listed on the National Register of Historic Places, and has been rated as a "Class 1" site, the highest priority designation for preservation (OAS, n.d.).

Fort Frederik is a symmetrically planned military structure which dates back to the latter portion of the eighteenth century. In 1776, while still under Danish rule, it was the first foreign fort to salute the new American flag. It is probably located on top of the English Earthworks Fort St. James, which dates back to the 1640's (pers. comm., B. Tilden, *ibid*).

Adjacent to the Fort is Emancipation Garden, the site of the abolition of slavery in 1848 (Fort Frederik Commission, 1974).

A large quantity of cultural material has been found by divers in Frederiksted Port. Propellor wash from cruise ships has uncovered many artifacts including historic bottles and ceramics (Mistovich, 1989).

2.6 Built Environment

2.6.1 Roads and Ports

The road system in Frederiksted is comprised of streets in a neat grid which sits parallel and perpendicular to the shore. Strand Street parallels the waterfront and is one of the busiest streets in Frederiksted. Portions of Fisher Street and Market Street are included in the APC boundary and run perpendicular to Strand Street. Route 63 (La Grange road) borders the northwest portion of the APC to the intersection of Route 631.

2.6.2 Water Systems

Traditionally, water use on St. Croix has relied on rain catchment and storage in household cisterns. Since the late 1960's, several desalination plants have been commissioned, and a water supply distribution system is now operated by the Government. The public water supply is increasingly augmented by groundwater supplies. Hand-dug wells of the Danish colonial period have been replaced with a rapidly increasing number of modern drilled wells for both household and public supply use (Gill, 1990).

Groundwater provides approximately 43 percent of the potable water distributed through the public system on St. Croix (pers. comm., K. Thomas, WAPA). Presently, WAPA has the capacity to supply 1 MGD of well water and 2.3 MGD of desalinated water. Supplies are not enough to meet demand, and periodic rationing is necessary (pers. comm., K. Thomas, WAPA). A new 1.3 MGD desalination plant will become operational at Richmond in mid-1993 (pers. comm., K. Thomas, WAPA).

The principal groundwater aquifer on St. Croix underlies the southern, southwestern, and central part of the island (Figure 9). The aquifer is known as the Kingshill Aquifer. Groundwater withdrawals have increased from about 0.05 to 0.8 MGD since the early 1960's. Various modeling of the Kingshill aquifer has been carried out, indicating that withdrawal rates can be increased by 10-30 percent with the addition of new recharge sources (e.g., construction of surface retention basins). On the other hand, without such improvements to total recharge rates, an increase in water discharge (pumping) rates in excess of 1.20 MGD could substantially lower the potentiometric surface and, thus, induce saline water intrusion (Torres-Gonzalez, 1990).

St. Croix has the greatest potential in the Territory for groundwater use due to its larger land area, less steep topography, and landforms which enhance recharge rates (CH₂M Hill Southeast, 1983). Most groundwater suffers poor quality, however, due to chlorides, sodium salts, and total dissolved solids (TDS) concentrations in excess of USEPA drinking water standards. Several hundred wells are privately owned in addition to the 200 or so public and industrial wells in use.

There are currently four active wells that provide water to Frederiksted. These are located in the La Grange area (Figure 10). These wells each pump approximately 25 gallons of water per minute which is mixed with desalinated water from the Richmond plant. The water is chlorinated in-line (pers. comm., K. Thomas, WAPA).

WAPA has negotiated with VIALCO to purchase excess desalinated water (approximately 1 MGD) to augment public supplies. An agreement has been reached, but awaits signatures of both parties. USGS has determined that 400,000 GPD could be sustainably pumped at VIALCO, and that the water quality meets applicable standards (pers. comm., G. Cherry, USGS).

WAPA is currently (late 1992) discussing plans to construct a desalination plant in Frederiksted. A one million gallon tank is proposed for groundwater storage, to be mixed with desalinated water to provide an additional 200-250 thousand GPD of potable water. WAPA is currently seeking permission from the Department of Housing, Parks, and Recreation to utilize approximately 1 acre of land near the Lagoon Street pump station (pers. comm., K. Thomas, WAPA).

The western end of St. Croix presently receives publicly supplied water with higher mineral content (than that which Christiansted receives) due to its higher proportion of groundwater relative to desalinated water. The new plant would eliminate the in-line chlorination process which is currently used and would utilize more available groundwater to increase total potable water supplies for the island (pers. comm., K. Thomas, WAPA).

2.6.3 Wastewater Systems

St. Croix's sewage pumping and treatment facilities consist of a primary sewage treatment plant (STP), built in 1972 at Estate Anguilla, and 14 pump stations. The STP was designed to handle flows of 4.0 MGD and, as of May 1992, flows averaged approximately 2.8 MGD (Tetra Tech, 1992). The STP operates at 50 percent capacity on dry days, and at near full capacity during rainy periods, an indication of the amount of stormwater infiltration/inflow in sewer lines (Strategic Planning Group, 1991).

Under the Territorial Pollutant Discharge Elimination System (TPDES), the St. Croix STP is classified as a "major" facility because it receives more than 1.0 MGD of wastewater. The STP has a 1.9 mile ocean outfall located immediately south of Estate Anguilla on the island's central southshore.

The STP and four of the major pump stations, including the Lagoon Street pump station in Frederiksted, require rehabilitative improvements (USEPA, 1992). The use of salt water flushing systems and the high wastewater strength (a result of limited water availability) have contributed to advanced deterioration of the entire system. The result has been numerous breakdowns during the past several years, which have required that raw sewage be pumped directly into coastal waters while maintenance on the system is carried out. A previously used sewage outfall pipe located south of the Frederiksted pier is today the discharge point for bypass sewage at such times when the Lagoon Street pump station, or the Anguilla STP, is not working. A drainage ditch from the Lagoon Street pump station to La Grange Gut was dug by DPW to assist with emergency bypass needs.

2.6.4 Energy Systems

Power for St. Croix is generated at the Richmond power plant on the western outskirts of Christiansted. A new power plant is badly needed, as WAPA has projected an average of 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.

The Frederiksted Town area has been designated as a Renewable Energy District, and has been the recipient of several alternative energy projects co-sponsored by the St Croix Energy Office and WAPA. A solar powered fountain and "eternal flame" were dedicated in August 1992 at Veteran's Memorial Park on Strand Street. At least one housing project on the west end (Harrigan Court Housing Project) is utilizing solar energy to power groundwater pumps.

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. Frederiksted previously utilized an area northeast of Fort Frederik (within the APC) as a municipal landfill.

3. RESOURCE USE, USE CONFLICTS, AND ADVERSE IMPACTS

Figure 11 depicts the principal land use categories found within the APC.

3.1 Resource Use

Located at the ocean end of Fisher Street is a fish market, dock, and boat ramp. The area is presently run-down and has no fresh water facilities. The dock was built by the Division of Fish and Wildlife (DFW) to assist fishermen; it was re-decked and repaired after Hurricane Hugo by DPW. Traditionally, fish are sold at the market on Wednesday and Saturday mornings. The fish are usually sold quickly, as the demand is higher than the supply.

The office of Our Town Frederiksted (OTF) is located on the waterfront side of Strand Street between Fisher and Queen Streets. Founded in 1988, Our Town Frederiksted is a non-profit community development corporation that works to "improve the quality of life for those who live and work in Frederiksted and to create a healthy economic community that retains the rich traditions of the town" (OTF, n.d.).

Near OTF on Strand Street are the remains of the old Totten House, an historic structure that has suffered two devastating fires in recent years. The Totten House first burned to the ground as a result of arson following Hurricane Hugo in September 1989. Then, in September of 1992, following a lengthy refurbishing effort and just two days before its scheduled re-opening date, the House burned again, apparently the result of an electrical wiring fault. Several pieces of historic furniture were lost in the fire. It is as yet uncertain what the owners intend to do with this historic property.

Veteran's Memorial Park stretches along the waterfront in the central portion of town. It is protected by a near-vertical seawall along its entire length. The grassed area is shaded with Mahogany trees and other trees and shrubs; a few benches exist for park-goers to sit and watch the port activities.

Fort Frederik is located on the waterfront near the pier at the north end of Strand Street. The Fort is publicly owned and undergoing renovation as a museum by the DPNR.

North of Fort Frederik is a public beach and recreation area, with basketball, volleyball and tennis courts. The area is managed by the Department of Housing, Parks and Recreation.

Immediately adjacent to Fort Frederik is Emancipation Park and site of Vendor's Plaza, where local artists and retailers sell their wares to visiting tourists. A tour bus parking area is located east of the Fort. Of historical significance equalling that of the Fort, is the old Customs House, located at the end

of the pier. The Customs House was severely damaged during Hurricane Hugo; it is presently awaiting repair along with the old Library on Strand Street.

The Paul E. Joseph stadium is located on the waterfront north of the Fort. The stadium is the site for many recreational and cultural activities. Its facilities include a baseball field, softball field, parade ground, stadium, and concession area; the stadium has been vandalized numerous times (USVI Govt/DHPR, 1989).

Coastal waters are used for swimming, snorkeling, diving, and recreational as well as commercial fishing. Many different types and sizes of vessels regularly call at Frederiksted, utilizing the pier or anchoring offshore and disembarking passengers by launch.

Private vessels, including sailboats and motorboats, anchor both north and south of the pier. However, while the area provides good protection from the prevailing easterlies, it is exposed to westerly swells (pers. comm., J. Salafia, member of boating community).

Construction of the new pier started in September 1992, and is scheduled for completion in December of 1993. The new pier is 100 feet north of and parallels the old pier. It is intended to accommodate two ships up to 70,000 tons drawing up to 28 feet of water (USVI Govt/Port Authority, 1989) and two mini-cruise ships. The presently proposed mitigation plan for the new Frederiksted Pier involves the establishment of a vessel anchorage area to be designated by the VI Port Authority. The purpose of the designated anchorage area is to minimize damage to sea bottom communities by choosing an area where coral reefs and seagrass and algal beds are not abundant, and by confining anchor damage to a relatively small area. The designated anchorage will be marked with buoys and placed on nautical charts.

The old pier is scheduled to be demolished upon completion of the new pier and the debris used to form an artificial reef in Butler Bay. This is part of the mitigation required by the Army Corps of Engineers for the approximately one acre of submerged land that was filled to construct the new pier. CZM permit requirements were waived for construction of the new Frederiksted Pier, however, the Port Authority was required to obtain a Water Quality Certificate from DPNR/DEP which requires among other things that a serious attempt be made to transfer representative samples of the rich marine life on the old pier to the new pier. Plants and animals have already settled and are already visible on the partially completed new pier (pers comm., D. Brin, Port Authority, Sept., 1993).

The rich coral community offshore provides excellent snorkeling and diving. Inshore and offshore are large seagrass/algal beds which provides a good habitat for conch and many other marine species.

3.2 Use Conflicts

Recreational and subsistence uses of the ocean (for swimming, snorkeling, diving, fishing, and boating) are at times threatened by water quality degradation and habitat loss from poor anchoring practices. Land-based pollution sources, particularly sediments carried by La Grange Gut, add to the occasional turbidity evident in the area. The turbid conditions are exacerbated by propellor wash from larger vessels.

As previously mentioned, offshore areas support fine examples of diverse, healthy coral and seagrass communities of interest to divers. They are important also as productive fishery habitat. Fairly extensive anchor damage to the coral and seagrass communities is reported by long-time users of the area (pers. comm., L. Kaczmarsky; A. Dempsey; D. Coughlin). Anchor chains from large vessels drag along the bottom, destroying fragile coral heads and the entire benthic environment within range. Frequently, vessels anchor directly on coral to prevent dragging.

Project Anchors Away was developed by the St. Croix Association of Dive Operators (SCADO) to help minimize further destruction of St. Croix's coral reef system. Currently, there are 20 permanent moorings in place around the island, which are maintained by SCADO. Two of these moorings are located on the west coast in Butler Bay (USVI Govt/DPNR, 1992a). Although the moorings were installed for the intended use by divers, fishermen apparently utilize the moorings also, creating conflict between the desire to preserve a particular dive site and the use of that site for fishing (pers. comm., A. Link, Cruzan Divers).

All of the bottom habitats in the APC have been adversely affected by marine debris discarded from boats and washed into the marine environment from land.

Sewage bypass is discharged through a pipe which empties just south of the Pier, only a few feet from shore. A "drainage ditch" connecting the pump station to the La Grange Gut also receives sewage bypass discharge on occasion. These bypass discharges occur when the Lagoon Street pump station fails, or when the entire St. Croix sewage system is shut down (*Daily News*, 4 November 1992). Sewage bypass discharges have in the past forced the elimination of water contact activities in the area (USEPA, 1992).

Untreated sewage released into the water is both a hazard to marine life and public health. Various microbial and biotoxigenic diseases are possible, which are transmitted by swimming in, or ingesting fish caught from, areas contaminated with human and animal feces and other sewage. These diseases include acute gastroenteritis (AGI), which is the most commonly reported, as well as hepatitis, typhoid, skin diseases, cholera, and others (Tetra Tech, Inc., 1992).

Prior to Hurricane Hugo, a large amount of debris and sediment was built up offshore south of the pier. The sediment was "cleaned out" during the Hurricane and presently does not show the same build up of debris (pers. comm., A. Dempsey, Bioimpact). However, according to a regular diver in the area, the sediment is accumulating once again in the same area (pers. comm., L. Kaczmarsky, St. Croix Aquarium and Marine Education Center).

3.3 Adverse Impacts

3.3.1 Water Quality

Under normal weather conditions, coastal water quality in the Frederiksted area is good (Coulston and Tonnemacher, 1991). The DPNR/DEP monitors water quality at several sampling stations along the coast, including stations located at the Frederiksted pier. Turbidity is occasionally high as a result of propeller wash or anchor drag by the larger vessels (USVI Govt/Port Authority, 1989). A more visible problem is that of marine debris, the result of poor solid waste disposal practices on land, and

by at least some of the visiting vessels (section 2.6.5). In addition, as is typical of most urban areas, untreated stormwater runoff is reported to contain petroleum product residues (like automobile lubricants) and chemicals (USVI Govt/Port Authority, 1989).

3.3.2 Air Quality

Air quality in the Frederiksted area is relatively good, as winds and the openness of the west coast serve to disperse air pollutants quickly. Carbon dioxide and carbon monoxide from vehicle exhaust is the main source of air pollution; sulfur dioxide emissions from visiting large vessels can impact the area on days of westerly winds. Although the downtown and waterfront area will likely experience an increase in vehicular traffic once the new pier is complete, the additional impact is expected to be minimal.

3.3.3 Noise Pollution

As with air quality impacts, noise emanating from vehicular or vessel traffic is the greatest source for noise in the APC. It is not seen to be a major problem at present. An increasing frequency of the use of jet skis is reported along the coast north of the pier. The APC is situated beneath the normal approach path to the Airport. These noise sources should be studied or quantified.

3.3.4 Impacts to Biological Resources

As a result of poor anchoring practices by U.S. Naval vessels, merchant vessels, and private vessels, a significant portion of the offshore coral reef has been destroyed by anchor, and anchor chain, drag. Although as yet unstudied, additional adverse impacts are likely as a result of sediments stirred by propeller wash. Lethal and sub-lethal effects from sedimentation on coral reefs has been well documented (Rogers, 1990).

Additional impacts to the marine community result from marine debris, both land-based and vessel-based sources. The debris includes disposable diapers, paper and plastic garbage, old shoes, paint brushes, tin cans, ladders, cable, tires, rope, and other types of solid waste (USVI Govt/Port Authority, 1989). Household appliances, machine parts, and other large pieces of refuse have been found around the coral community north of the pier where boats frequently anchor. The amount of garbage found under the pier and in other areas off the coast has increased since surveyed in 1989 (pers. comm., A. Dempsey, Bioimpact). Marine debris is known to kill sea turtles and other aquatic and wildlife species through ingestion or strangulation.

Stormwater runoff contaminated with oils and other petroleum and chemical products is reported to flow into the ocean (USVI Govt/Port Authority, 1989). The lethal and sub-lethal effects on biological communities of this nonpoint pollution source should be studied.

Fish hooks, pots (traps), lines, and seines physically disturb benthic communities to some extent. Other disturbances to the benthic environment result from natural phenomena, including seismic disturbances and hurricanes through wave action and siltation.

3.3.5 Impacts to Cultural Resources

The several important cultural resources within the Frederiksted Waterfront APC suffered considerable damage during the 1989 Hurricane Hugo. The roof was destroyed on the Customs House; over three years later it has not been replaced and the structure is subject to continuing water damage.

The Totten House remains a charred ruin, with as yet no plans for rehabilitation. Efforts to renovate Fort Frederik as a museum is presently underway and historic structure renovation projects are underway within the adjacent Historic District, several of which are under the auspices of Our Town Frederiksted, through a federal Community Development Block Grant.

4. MANAGEMENT RECOMMENDATIONS

4.1 Policy Framework

Establishing a comprehensive policy framework to guide decision-making for improvements and future development of the Frederiksted Waterfront APC is a crucial process to be undertaken. 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 Frederiksted Waterfront and Port develop with vitality and sound planning.

One avenue for Frederiksted to pursue is the preparation of a comprehensive "Port and Waterfront Revitalization Plan". In such a plan, multiple goals must be addressed simultaneously, and specific implementation strategies (addressing the issues of funding and leadership) must be adopted. Our Town Frederiksted (OTF), has provided an accessible and effective forum for residents to voice concerns, aspirations, and visions of a rehabilitated and prosperous Frederiksted. As of early 1993, OTF has prepared a plan which strives to enhance the cruise ship visitor's experience, and to attract more visitors to the downtown area (Figure 12).

The Frederiksted Waterfront should continue to serve the local community, both residents and visitors alike, by providing the facilities and services for water dependent commerce, industry, and navigation, and by providing ample opportunities for recreation and enjoyment of the unique cultural, historical, and scenic qualities of this regional port, while sustaining clean waters and healthy fish and wildlife habitat, and ameliorating coastal hazards wherever they exist.

Specific goals in support of the foregoing include focus on the following list of objectives in the revitalization effort:

1. improve public access, both visual and physical, to the waterfront and all its amenities, and expand on the area inland which can enjoy waterfront benefits;
2. enhance economic activity in a sustainable manner which provides the appropriate level of services and facilities to residents and visitors alike, including services for the small boat industry;
3. achieve an appropriate use of land resources, which will allow for more intensive, mixed-use development within the Frederiksted periphery;

4. preserve the historic and cultural character of Frederiksted, to the maximum extent possible, without compromising the ability of this evolving town to accommodate the increasing number and diversity of users and user groups;
5. enhance public safety through rehabilitation of dilapidated portions and structures of the waterfront, and through improvements to transportation and pedestrian systems that will allow the more efficient (i.e., decreased costs and time) and safe movement of goods and people on both land and water;
6. further enhance public safety by reestablishing a Police substation within Frederiksted, and simultaneously promote the institutionalization of youth oriented activities;
7. reduce potential loss of life and property due to natural hazards through a combination of growth management policy and maintenance of existing shoreline protection structures;
8. improve water quality within Frederiksted Port through the use of Best Management Practices for nonpoint source pollution control in the contributory watersheds, and preserve and protect remaining aquatic and wildlife habitat;
9. inject new life and energy into the Frederiksted community, recognizing that it is the combination of waterfront activities and the unique character of Frederiksted that attract residents and visitors, and which represent great potential for simultaneous recreational enjoyment and achievement of governmental, business, trade, and commerce needs;
10. improve efficiencies in the various port operations, including the development of s to deal with the transportation, storage, and handling of hazardous and toxic cargo, and the development of spill s with trained personnel and proper equipment ready for response at all times; and
11. preserve and enhance park facilities, especially those at Veteran's Memorial Park along Strand Street, and the development of linkages to recreational areas along the coast north of town; integrate Fort Frederik into these shoreline parks; and minimize conflicts between user groups (e.g., between swimmers and jet ski operators) by separating such uses where possible.

Future developments should be oriented perpendicularly rather than parallel to the shoreline to enhance view corridors to the sea, and that stricter height and space limitations be placed on buildings closer to the waterfront. (Height limitations on buildings should be considered in relation with the architectural context of the area.) A successful urban waterfront area requires plenty of open space, or "green" space, to accomplish this goal. Both physical and visual access to the shoreline must always be considered.

The Frederiksted Waterfront has many opportunities for improvement in this regard. Arriving visitors are struck by both the natural beauty of the open stretch of coastline, and by the architectural and historic interests evident throughout the town and waterfront. Unfortunately, many of these structures were severely damaged during Hurricane Hugo. Although rehabilitation efforts are underway at Fort Frederik, the Customs House and Library are two extremely valuable structures in need of attention.

Short-term opportunities exist to improve the appearance of the waterfront by effecting a major clean-up of the area and establishing the necessary institutional arrangements and responsibilities for maintaining the waterfront litter-free.

Several recommendations to increase Frederiksted's competitive advantage in the cruise ship industry were offered in a previous study (PBSJ, 1989). A few of that study's recommendations, as they relate to APC management, are deserving of consideration:

Increase the visible security for residents and visitors wishing to stroll through town on their own.

Improve transportation access to hotels and beaches, as well as coastal recreational areas north of Frederiksted.

Provide larger and more efficient passenger loading zones for those wishing to board tour buses or taxis; locate these zones away from the base of the pier to enhance the arriving visitor's first impression of Frederiksted.

Offer organized tours of the historic sites of Frederiksted and natural features along the West End, and make high quality interpretive literature available.

Undertake additional restoration of historic structures along the waterfront and in town.

Provide a sufficient number of well-maintained public restrooms and other pedestrian amenities such as shaded rest areas, drinking fountains, interpreted "points of interest", etc.

Commence the immediate renovation of the old Customs House near the pier to house a Tourist Visitor Center and a Police Department substation.

A Tourist Visitor Center is an essential component of efforts to recapture the cruise ship industry.

The goal is to make Frederiksted Town and Waterfront a safe, and enjoyable learning experience for those who wish to take advantage of all that the area has to offer.

A Port and Waterfront Revitalization Plan for the Frederiksted Waterfront APC should include designated anchoring and mooring zones, with separation between short-term and long-term mooring needs. The use of permanent moorings, appropriately located, installed, and maintained with the right ground tackle, can greatly reduce anchor damage, and should be pursued as a long-term resource management goal to protect benthic communities.

This encourages the recognition that effective management of the Frederiksted Waterfront will necessitate the adoption of an overarching policy framework for future developments within the APC, and greater attention paid to nonpoint source pollution impacts from poorly planned or sited developments in the APC watersheds. Of special concern is the potential for increased sediment runoff via the three guts which comprise La Grange Gut.

4.2 Planning and Permitting

The area surrounding the town of Frederiksted is currently zoned R-3 (residential medium density), with the exception of the area north of Fort Frederik along the waterfront which is zoned P (public) [Figure 13a]. Within the town of Frederiksted, current zoning identifies at least six (6) different zones, including W-1 (waterfront/pleasure), P (public), B-1 (central business district), B-2 (business secondary), B-3 (business scattered), and R-4 (residential medium density). Permitted uses for these zones can be found in the V.I. Code, Title 29, Chapter 3, Section 228.

Since the late 1980s, DPNR/Comprehensive Planning staff have worked to prepare a Comprehensive Land and Water Use Plan that will re-designate all land and water in the Territory as one of ten (10) new designations, known as "Intensity Districts". The goal of the Comprehensive Plans is to ensure that the quality of life for island residents is maximized.

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 (Godschalk, *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 (10-15 cm), an increase in that much or more (10-20 cm) is projected by 2025, and of between 1.5 and 6.5 feet (50-200 cm) by the year 2100. Using an average of 1 meter of shoreline erosion per cm of SLR, the resulting average by 2025 would be 33 to 66 feet (10-20 meters) [Godschalk, *et al.*, 1989].

A strategy must be adopted to mitigate coastal storm hazards and SLR impacts. 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.

A coastal storm hazard mitigation policy and regulations should be developed for the Territory, and for the Frederiksted Waterfront 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. Appropriate attention should be given the design of 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 (section 2.3.3), 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

Although the waters of Frederiksted Port are of high quality, the likelihood exists for future increased turbidity due to increased large vessel traffic (propellor wash of bottom sediments) and stormwater runoff. Maintenance dredging near the pier may be required to ensure adequate water depth for the larger vessels. In such cases, small-scale, site-specific mitigation of sedimentation effects can be accomplished through the use of siltation curtains. Such devices should be routinely used on dredge and fill operations. Dredging can result in resuspension of fine sediments, and contaminant-laden sediments, with significant adverse impacts on coral reefs, seagrass, and other benthic communities.

Coastal water quality is adversely affected by oil spills. Although the potential for a major spill in Frederiksted Port is not as great as for other, busier ports, the situation could change if fueling services are supplied to the cruise ships as has been discussed with officials at Hess Oil of the Virgin Islands Corporation (HOVIC). A fueling barge would be brought to Frederiksted Port from the HOVIC southshore port, and cruise ships fueled via ship-to-ship pipeline.

Marina fueling and boat repair services must be designed, maintained, and operated to reduce the risk of accidental spill and to facilitate clean-up in the event of a spill. Design practices include as a minimum:

1. design boat hull maintenance areas to minimize contaminant-laden runoff;
2. locate and design fueling station and maintenance areas so that spills can be contained in a limited area;
3. implement source control practices such as vacuuming of impervious areas; use of tarpaulins to collect paint chips, sandings, and paint drippings; and use of sanders with vacuum attachments to collect hull paint sandings;
4. design spill contingency plans; and
5. design areas to include appropriate spill containment equipment.

Liquid materials (i.e. oil, solvents, coolants, paints, etc.) should be prevented from entering coastal waters. Also, appropriate storage, transfer, containment, and disposal facilities should be provided and maintained, and recycling of liquid materials (especially oil) should be encouraged. Possible practices to implement these goals include as a minimum:

1. build curbs, berms, or other spill containment barriers around areas used for liquid material storage. Store liquid materials in areas that are impervious to those materials;
2. separate containers for disposal of waste oil, waste gasoline, used antifreeze, and water, diesel, kerosene, and mineral spirits should be available and clearly labeled;

3. marina patrons and employees should be instructed on proper disposal methods for these materials through signs, mailings, training, etc.

The amount of fuel and oil from boat bilges and fuel tank overflow/air vents entering marina and coastal waters should be minimized. Practices to implement this goal include as a minimum:

1. use the best available technology (BAT) on air vents or tank stems of fuel tanks to prevent fuel from overflowing through tank air vents and spilling into coastal waters; and
2. place oil-absorbing materials in bilge areas of all boats with inboard engines; check these regularly and replace as necessary; recycle, if possible, or dispose of properly.

Nonpoint source pollution is a significant contributor to the overall degradation of nearshore environments in the U.S. 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.

In the Frederiksted Waterfront APC, the most significant nonpoint source pollution runoff enters coastal waters (episodically) through La Grange Gut. However, the town area is also deserving of stormwater management attention. The area near the First Pennsylvania Bank on Strand Street is reported to have an occasional strong sewage smell (pers. comm., L. Pierce, Architect). The following list of recommendations for nonpoint source discharge control is adapted from Tetra Tech, Inc. (1991):

1. separate storm and sanitary sewers;
2. collect and treat Combined Sewer Overflows (CSO's), using infiltration trenches/basins or chemical or filtration treatment systems;
3. regulate land use practices and behaviors that contaminate stormwater (e.g., waste oil disposal, establishment of green or infiltration areas on a portion of developed property, establishment of impervious surface limits);
4. impose routine inspection and management requirements for on-site (septic tank) wastewater systems;
5. develop treatment options for stormwater (e.g., detention basins, grassy swales, vegetation buffers, artificial wetlands);
6. implement source control practices such as street sweeping;
7. implement soil conservation measures on all construction projects (e.g., vegetation buffer zones, retention basins, silt-curtains, diversion ditches, etc.);
8. establish performance standards to reduce the total area of non-porous surface materials used on access roads, driveways, and parking areas; encourage the use of permeable materials such as "grassphalt", gravel, or appropriate vegetation.

A contributing factor to degraded water quality in Frederiksted Port is the occasional sewage bypass of raw sewage near the shoreline at Veteran's Memorial Park. The problem is systemic with the antiquated and poorly maintained sewage collection system on St. Croix, but must nevertheless be

considered as part of the APC . The municipal wastewater treatment facilities at Estate Anguilla, and the entire system of collection lines, must be given proper attention to Operation and Maintenance (O&M) procedures, not only to ensure that discharged effluent meets TPDES requirements, but that the collection system is leak-proof and of sufficient capacity to handle peak flows. To achieve this goal, the Department of Public Works:

1. has instituted proper O&M procedures at the existing WWTP. The daily operations, logging, sampling and analysis provides the department with data to evaluate its capabilities to meet the permit required;
2. is training and certifying operators, hiring new, certified operators, and contracting specialty maintenance services;
3. has a comprehensive sewer line rehabilitation program under development;
4. continues to apply user charges to purchases of equipment and materials for repairs and replacement; and
5. has earmarked over \$4.0 million for major rehabilitation of the St. Croix sewage treatment system, including purchase and installation of new pumps and valves at Lagoon Street pump station. Additional funding is being sought in the federal FY95 budget through the Department of the Interior. (Pers. comm., L.H. Francis, Commissioner, DPW)

Since the quality of the Territory's fresh and marine waters is reliant on a properly functioning waste treatment plant, well maintained lift stations with backup generators, and sewer lines that do not leak, DPW should ensure user fees reflect the cost of maintenance and construction of these facilities.

Specific short-term objectives shall include:

1. give high priority to upgrading the Lagoon Street Pump Station to minimize the recurrence of future break downs;
2. maintain a stock of spare parts to minimize "down time" due to needed repairs; and
3. repair leaks and/or upgrade with new pipes where needed.

DPNR/DEP and the Health Department should establish an inspection program for all on-site sewage treatment facilities (septic tanks and small household sewage treatment plants) found within the APC or located within the La Grange Gut watersheds.

A well-designed and targeted Water Quality Monitoring (WQM) program is essential if territorial Water Quality Standards are to be met, and if specific management actions are to be undertaken in response to degraded water quality.

Routine monitoring of the biological resources (e.g., submerged aquatic vegetation, benthic invertebrate communities, corals, mangroves, etc.) in the Territory's coastal waters should be performed (USVI Govt/DPNR, 1992b). *Biological monitoring can provide valuable information on the health of the environment, and should be incorporated into an improved WQM program with adequate funding and achievable goals for targeted areas.*

For several years, the Government has recognized the growing (and cumulative) problem of vessel waste discharges to the marine environment. In 1983, a Vessel Waste Control Plan (Wernicke and Towle, 1983) was prepared for the then Department of Conservation and Cultural Affairs. The Plan's three principal recommendations are excerpted here, as they remain valid and significant recommendations today, a decade later.

1. The first step, and the most important, is a clarification of goals. It is impossible to return the coastal embayments (now vessel anchorages and marina sites, etc.) to their original pristine environmental or ecological condition, and it is equally impossible to reduce environmental risks or even pollutant inputs to zero. Stating (or pursuing) unrealistic goals is counter productive. It encourages both a crisis orientation (short-term fixes to long-term problems) and, worse still, confrontations -- since environmentalists want the whole protective strategy now and Virgin Islands users (residential, commercial, industrial) see no point in taking costly steps toward an unreachable goal.

The public should be better informed about what would be gained by each initiative to protect coastal water quality and what it would cost -- in dollars and in life style adjustments.

2. A second step requires the improvement of the scientific basis of DPNR, the Port Authority, the Department of Public Works, and other V.I. agencies making decisions regarding uses of the natural resource base -- realizing that resources have limits of use (i.e., carrying capacities).

Agencies can, with scientific help, quantify risks. But the scientific basis of agency decisions can be improved without significant increases in costs or delays. Most important of all, the decision making process is rendered more realistic and defensible.

3. The third step involves improved implementation and enforcement of environmental protection strategies. There are limits, however, to DPNR's monitoring and enforcement responsibilities regarding existing standards for water quality and other environmental indicators. These responsibilities are hampered by personnel limitations, logistic costs, and jurisdictional constraints. Perhaps an alternative exists, even if partial, that would involve the corporate (and government agency) user conscience -- plus the threats of adverse publicity and lawsuits -- to promote and develop widespread compliance with suggested "voluntary" standards. Further, substituting economic incentives, such as a sewage waste discharge tax on vessel discharges or on unacceptable MSDs (Marine Sanitation Devices) -- in certain designated anchorages -- could improve targeted vessel waste enforcement, lower its costs, and generate revenue to pay for the "enforcement" activity.

Industrial Wastewater

Impacts from the operation of desalination plants result from the discharge of warm hypersaline brine and associated chemicals used to reduce biofouling in the cooling systems. The type of desalination process used, the volume of water undergoing treatment, and the location of discharge outfalls

determine the type and severity of environmental impact. *As with effluents from power plants, a reduction (through conservation measures) in the volume of water undergoing treatment may in the long-term pay dividends for the protection of distinctive or valuable marine habitat. At the very least, hypersaline effluents should be adequately diluted with fresh sea water and cooled prior to discharge.*

Solid Waste Management

The international MARPOL treaty requires that member governments provide at least the *potential* to receive vessel wastes, in accordance with applicable regulations. The Animal And Plant Health Inspection Service (APHIS) of the U.S. Department of Agriculture is the Federal agency responsible for regulating receipt of foreign-sourced solid wastes entering the Territory. Thus, certain food products purchased down island, for example, if brought back into the Territory aboard a yacht, are classified as foreign-sourced wastes, and are subject to USDA inspection and regulation. The USCG is responsible for implementing MARPOL regulations, and has required the V.I. Port Authority to provide refrigerated containers to receive foreign-sourced solid wastes (since proper processing facilities are not available in the Territory); these wastes must be shipped to Puerto Rico for processing. USDA handles processing and transfer of these wastes.

The above requirements will be difficult to meet on a recurrent budgetary basis, and the V.I. Government should explore the possibility of contracting with a private firm to provide such service in accordance with regulations when and if it is needed. The V.I. Government could then demonstrate to the USCG that it has secured the necessary arrangements to provide such service. All expenses should be passed on to the vessel operator who has imported foreign-sourced wastes. Fortunately, most new (large) vessels are now self-contained with respect to liquid and solid wastes, and so the cruise ship industry should generally not require such service in the USVI.

Air

There are no "non-attainment areas" in the Territory with respect to compliance with National Ambient Air Quality Standards (NAAQS). Air quality on St. Croix's west end, and in the Frederiksted Waterfront APC in particular, is of high quality. Nevertheless, future major developments should require an assessment of air quality impacts as part of the EAR process.

Title V of the federal Clean Air Act (CAA) requires all states and territories to submit a federally enforceable operating permits program to control air pollution to EPA by November 15, 1993. As a result, many small businesses will soon be required to monitor and control their emissions of pollutants and apply for operating permits. Realizing that many small business have neither the technical expertise or the financial resources to comply with the act, EPA requires that the Virgin Islands adopt a small business assistance program to assist business in complying with the act.

Noise

Similarly, preparers of EAR's should be required to assess cumulative noise impacts as they may affect particular target communities within an identifiable radius (or down wind corridor) of the proposed development. The APC is underneath the approach path for the Alexander Hamilton Airport.

In addition, an increasing use of jet skis in the waters north of the pier is a source of noise pollution that warrants monitoring and, if necessary, some type of control.

Biological Resources

The public beach north of Fort Frederik is a Green Sea Turtle nesting beach and, at least during the nesting season, should be closely monitored to avoid turtle disturbance.

The use of artificial lighting in the proximity of the beach should be "turtle sensitive": only low-pressure, long-wavelength, sodium-vapor lamps (of either high or low intensity) should be allowed, and they should always be shielded to direct illumination away from turtle nesting areas. This is particularly relevant to lighting arrangements for the new pier and terminal. Signs should be posted which instruct the public as to applicable regulations.

It is recommended that the new supplemental mooring system be sited to absolutely minimize further destruction of healthy habitat. A mooring and anchorage (with established zones) would help to control the piecemeal degradation of benthic communities that occurs through indiscriminate anchoring practices.

As see above (section 2.4.2), excessive nutrient loading is indicated south of the fishing dock at Fisher Street. The source is most likely sewage discharge from the nearby housing project. *Water quality monitoring in the area is warranted to determine the source and magnitude of the nutrient loading, and its degree of impact on water quality.*

Cultural Resources

The old Customs House is in need of immediate attention before additional damage to the structure results. It should be rehabilitated to serve as both a Police Substation for Frederiksted and the West End, and a Tourist Visitor Center.

The Library should receive similar, immediate remedial attention.

In the event that cultural sites are to be removed or damaged as a component of a proposed development, mitigation measures should be designed and fully enforced, and should include the requirement for a qualified archaeologist or historian (as appropriate) to direct such mitigation and/or data recovery efforts.

Further recommendations regarding cultural resources management are found below (section 4.3).

Transportation

A new traffic flow pattern has been suggested by a Governor's task force, comprised of representatives from various community groups and government agencies, to facilitate the expected increased traffic flow associated with the new pier and terminal facility. The suggested pattern is as follows (DuPre, pers. and written comm., 1992):

Designate Strand Street as one way going north from Queen Cross Street. Designate Customs House Street as a one way street going east. Lagoon Street would be made into a pedestrian walkway (at least when ships are in port), which would draw more people into Fort Frederik and the Vendors Plaza, and keep passengers out of traffic congestion at the pier/fort area by giving them only one street (Lagoon Street) to cross.

The above recommendations would improve the efficiency and safe movement of vehicular and pedestrian traffic. They should be adopted and implemented by the appropriate authorities as soon as possible.

Improvements to La Grange Gut

The U.S. Army Corps of Engineers plans to ameliorate flooding from La Grange Gut by channeling and straightening the drainage course to speed the flow of runoff to the ocean. This will eliminate aquatic habitat, increase sediment loading, and likely increase erosion rates at the terminal end of the Gut. *It is recommended that these plans not be approved.*

Flood control should consist of broadening the floodplain and slowing the runoff rate. This can best be accomplished by creating additional wetland in the lower reach of the Gut, which will both slow and cleanse runoff waters by trapping sediments and other pollutants before they can enter the sea.

It should be noted that WAPA has plans to construct a desalination plant somewhere in the vicinity of the Lagoon Street Pump Station, at the lower reaches of La Grange Gut. This would potentially be in conflict with the above recommendation to create wetlands for flood control purposes. It would also perhaps be in conflict with ongoing efforts to restore the historical character of the town. Moreover, and most importantly, the area in question is a known hazard area due to frequent flooding and possibly storm surge. Government should assess alternative sites further inland for the desalination plant.

4.3 Legislative Change

The Antiquities Legislation Bill, which is scheduled to be submitted to the Legislature during 1993 was conceived 4-5 years ago by two Senate members wanting to improve on the existing historic preservation institutional arrangements, and to include antiquities protection. Three versions of the Bill were subsequently produced and, as directed by the Legislature, these have finally been brought together in a compromise Bill now ready to submit. The (ALB) will 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.**

4.4 Institutional Development

Ways to reestablish a police substation in Frederiksted, and to work with the community to solve the street crime problem should be pursued.

Successful management of the Frederiksted Waterfront APC will come about quicker and with more lasting results if the local community is drawn into the process in a way that promotes self-responsibility and accountability by the various user groups. Government should call upon the non-governmental community (the various associations, churches, and other commercial and philanthropic organizations) to address certain specific components of the overall management framework, and even to finance certain elements that will have obvious payback benefits to the community.

5. CONCLUSION

Frederiksted is a town rich in historical culture and aesthetic beauty. One of its many attractions is its port and waterfront. Efforts to revitalize Frederiksted's economy revolve in large part around the construction of a new pier to accommodate cruise ships, restoration of important historic structures, and the development of appropriate visitor amenities and services. Frederiksted is projected to grow in importance as one of St. Croix's major towns, and will thus likely witness significant perimeter growth in the years and decades to come.

Such developments will place new pressures on the existing resource base, including nearshore water quality and the area's biological communities. They will also bring new challenges in managing competing uses for valuable shorefront property. The development of an effective port and waterfront plan is a fundamental step in managing that growth, and to ensure that future decision-making is not reactive, but made within a framework of vision, public consensus, and sound planning.

Several specific resource management objectives have been provided herein, some of which may be rejected in favor of more or less stringent codes or practices. What is most important, however, is that the Frederiksted community recognize that urban waterfront and port management is, like most of planning, a process which requires constant attention and nurturing. It will require the appropriate level of government oversight and funding, and a visionary, committed and accountable leadership to accomplish the goals and objectives of a long-term revitalization program.

Experience from other urban waterfront areas suggests that neglect leads, eventually, to expensive remedial action. New coastal developments, if not properly assessed for their vulnerability to coastal storm hazards, become an economic and safety liability and increase the degradation of natural and physical coastal features. Shore protection structures, if not maintained, quickly weaken or cause increased erosion along adjacent shorelines. Street litter problems, if not eliminated, become marine debris problems to the detriment of tourism development goals and the productivity of marine biological communities. Land use practices upslope and removed from the immediate planning area, if not conducted with nonpoint source control technologies in mind, add to the pollution loading burden of coastal waters and the degradation of water quality.

Maintenance and enhancement of the Frederiksted Waterfront and Port is central to the Town's efforts to achieve successful, sustainable revitalization.

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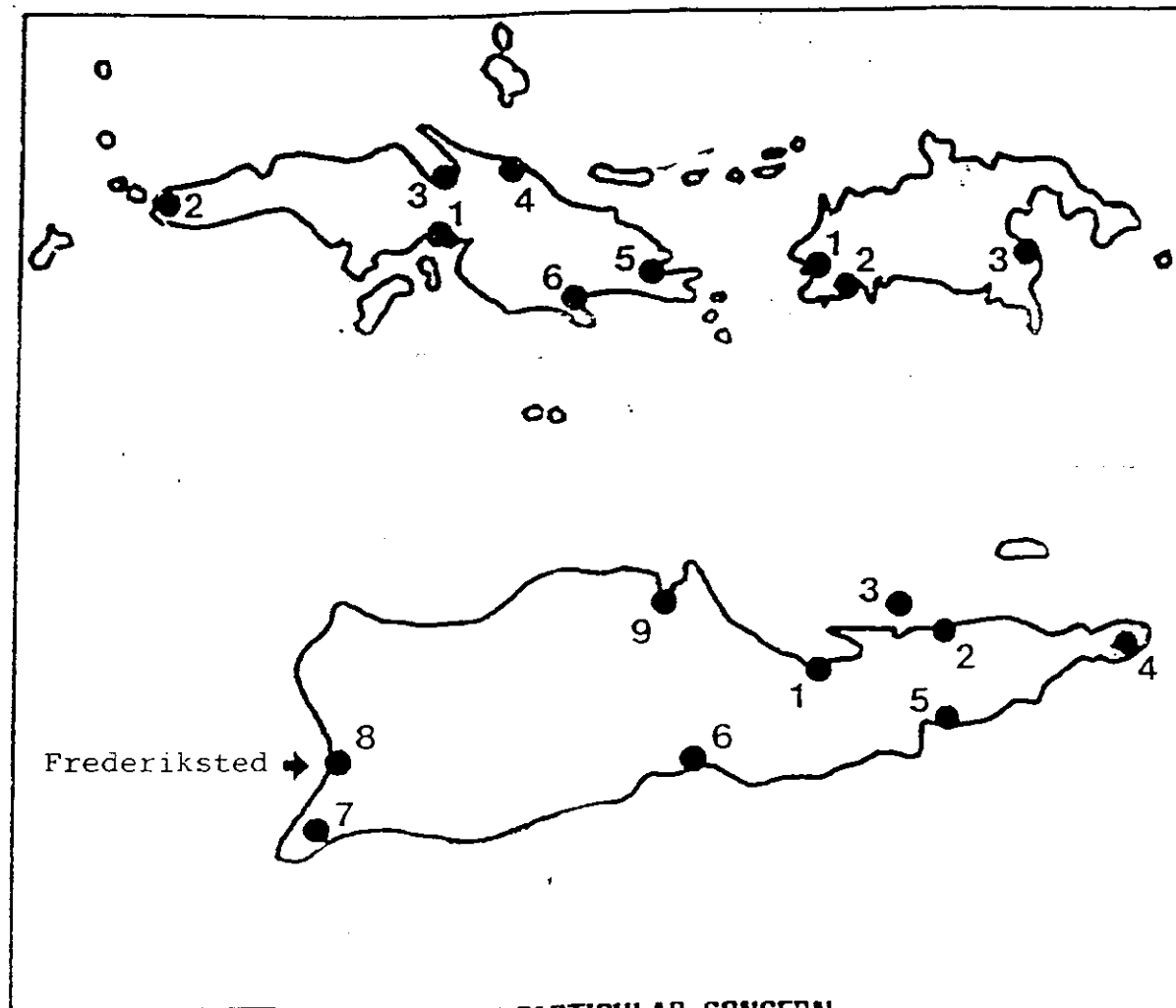
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AREAS OF PARTICULAR CONCERN



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) Coral Bay (APR)

St. Croix

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

Figure 1
Regional APC Map
 Adapted from: USDOC, 1979



FREDERIKSTED WATERFRONT

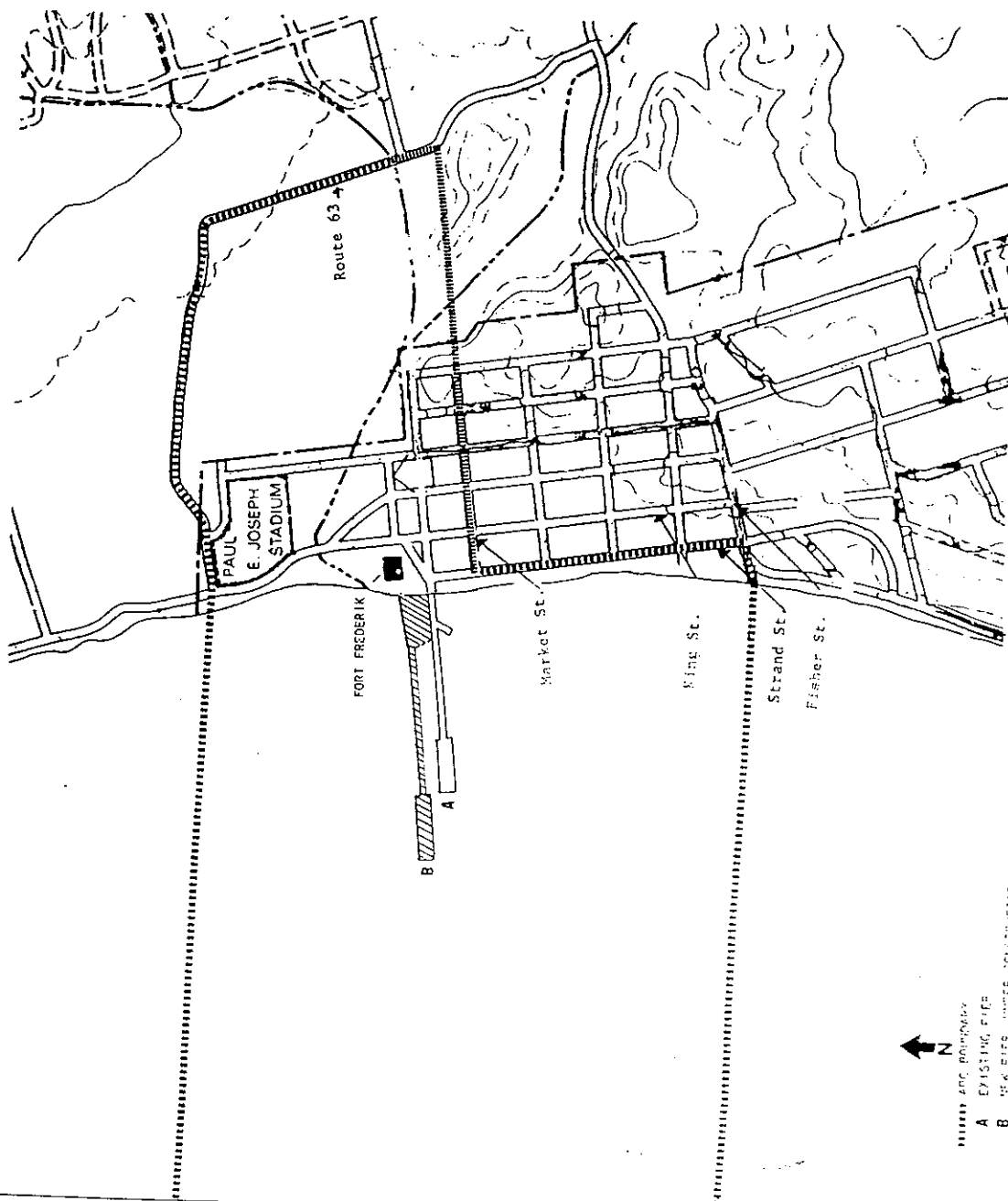
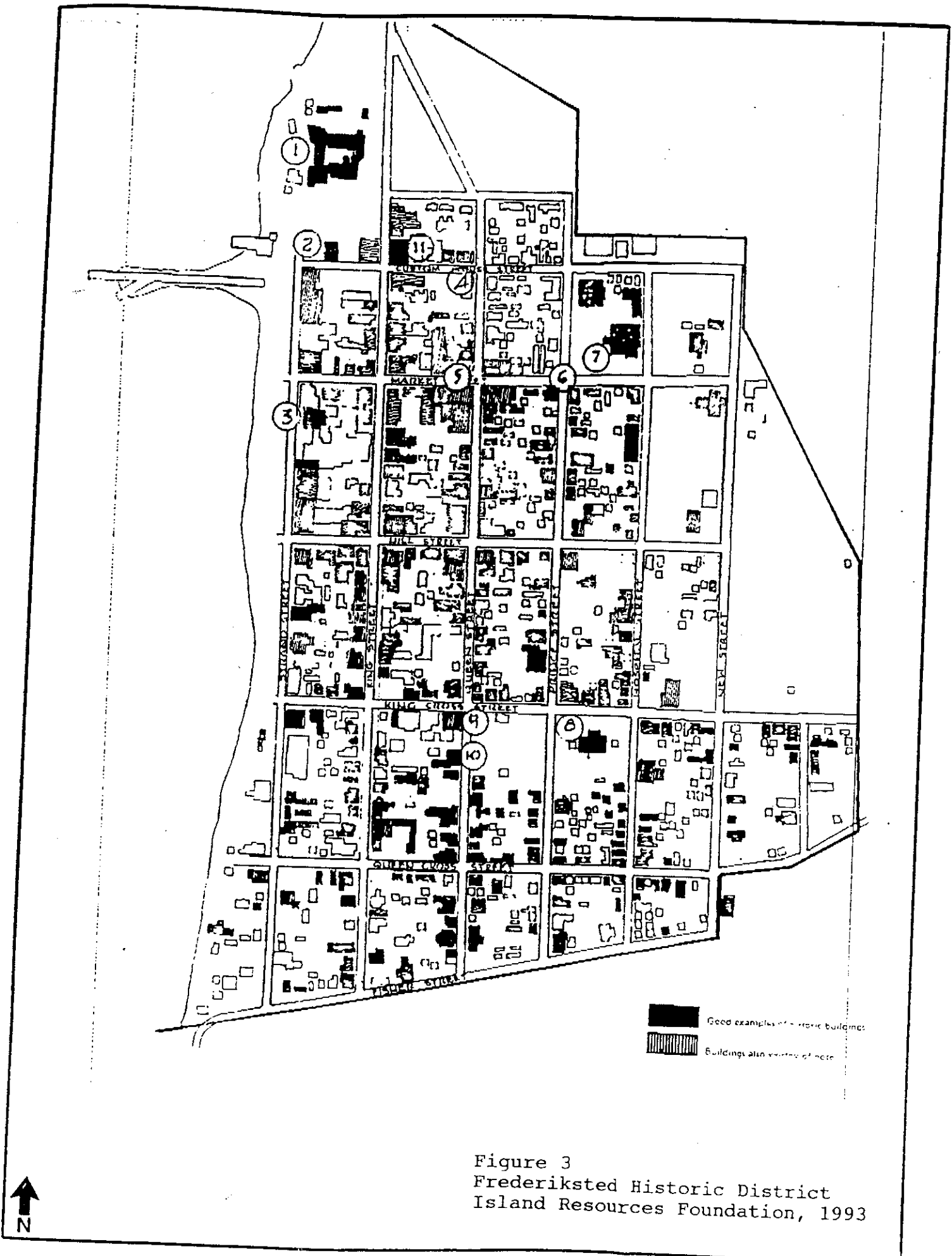


Figure 2
APC Boundary Map
Base map adapted from: USGS, 1982
Island Resources Foundation, 1993



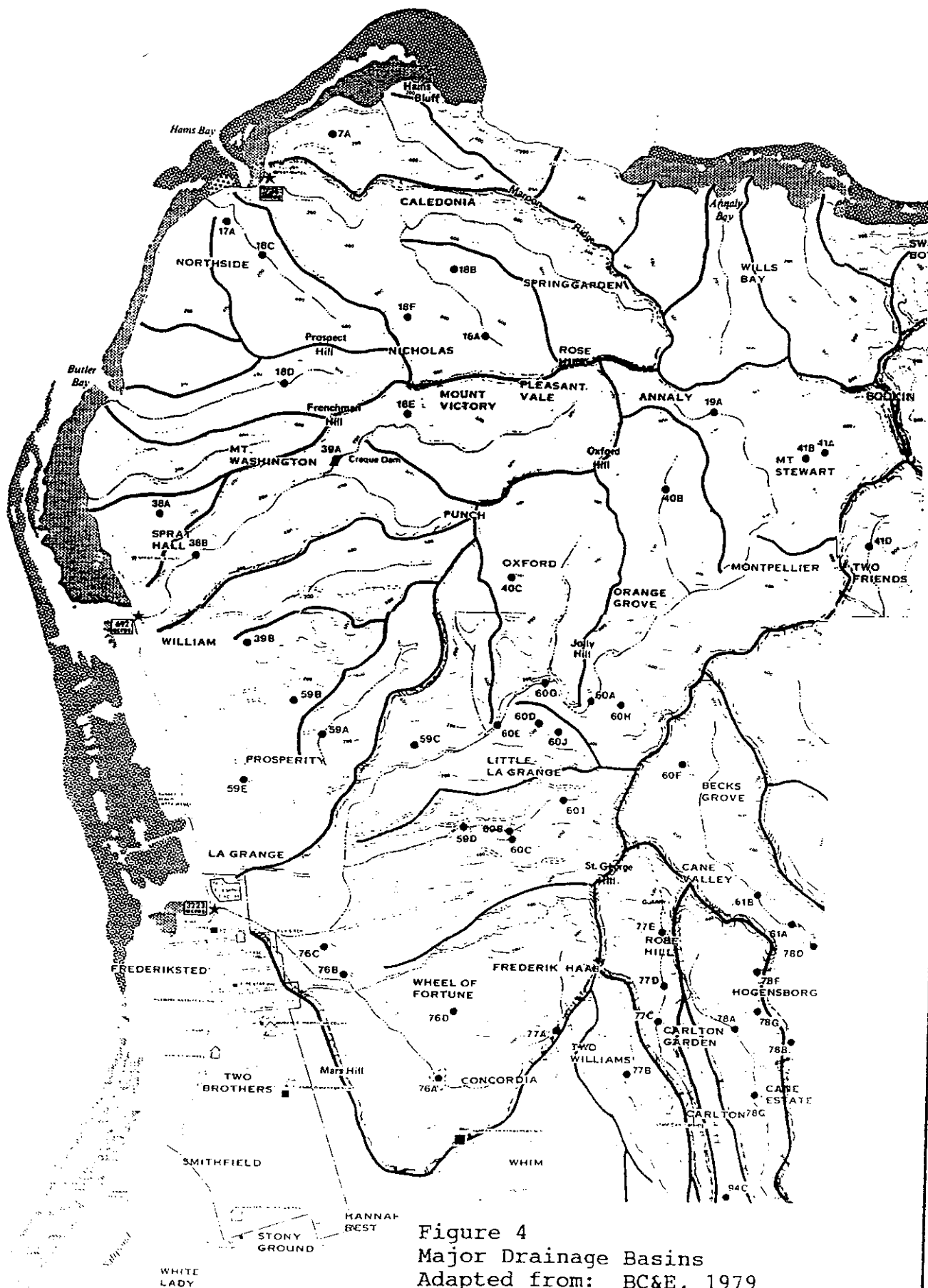
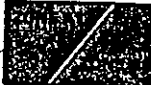
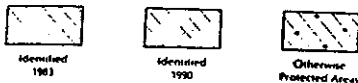


Figure 4
Major Drainage Basins
Adapted from: BC&E, 1979
Island Resources Foundation, 1993

KEY TO MAP

500-Year Flood Boundary	—
100-Year Flood Boundary	---
Zone Designations*	
100-Year Flood Boundary	---
500-Year Flood Boundary	---
Base Flood Elevation Line With Elevation in Feet**	—513—
Base Flood Elevation in feet Where Uniform Within Zone**	(EL 987)
Elevation Reference Mark	RM7X
Estate Boundary	---
River Mile	+M1.5

UNDEVELOPED COASTAL BARRIERS†



†Coastal barrier areas are normally located within or adjacent to special flood hazard areas.

**Referenced to Mean Sea Level

*EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

INITIAL IDENTIFICATION:
FEBRUARY 25, 1977

FLOOD HAZARD BOUNDARY MAP REVISION
NONE

FLOOD INSURANCE RATE MAP (EFFECTIVE)
OCTOBER 15, 1980

FLOOD INSURANCE RATE MAP REVISIONS:

March 18, 1987 - to add special flood hazard areas, and to change zone designations.

August 3, 1992 - to add undeveloped coastal barriers and otherwise protected areas.

THE ESTATE BOUNDARIES ON THIS MAP PANEL ARE FOR REFERENCE PURPOSES ONLY. THEY WERE PROVIDED BY THE DISASTER PREPAREDNESS OFFICE, CIVIL DEFENSE AND EMERGENCY SERVICES, OFFICE OF THE GOVERNOR. THE LOCATION OF THE BOUNDARIES ARE APPROXIMATE WITH RESPECT TO THE CULTURE SHOWN ON THIS MAP.

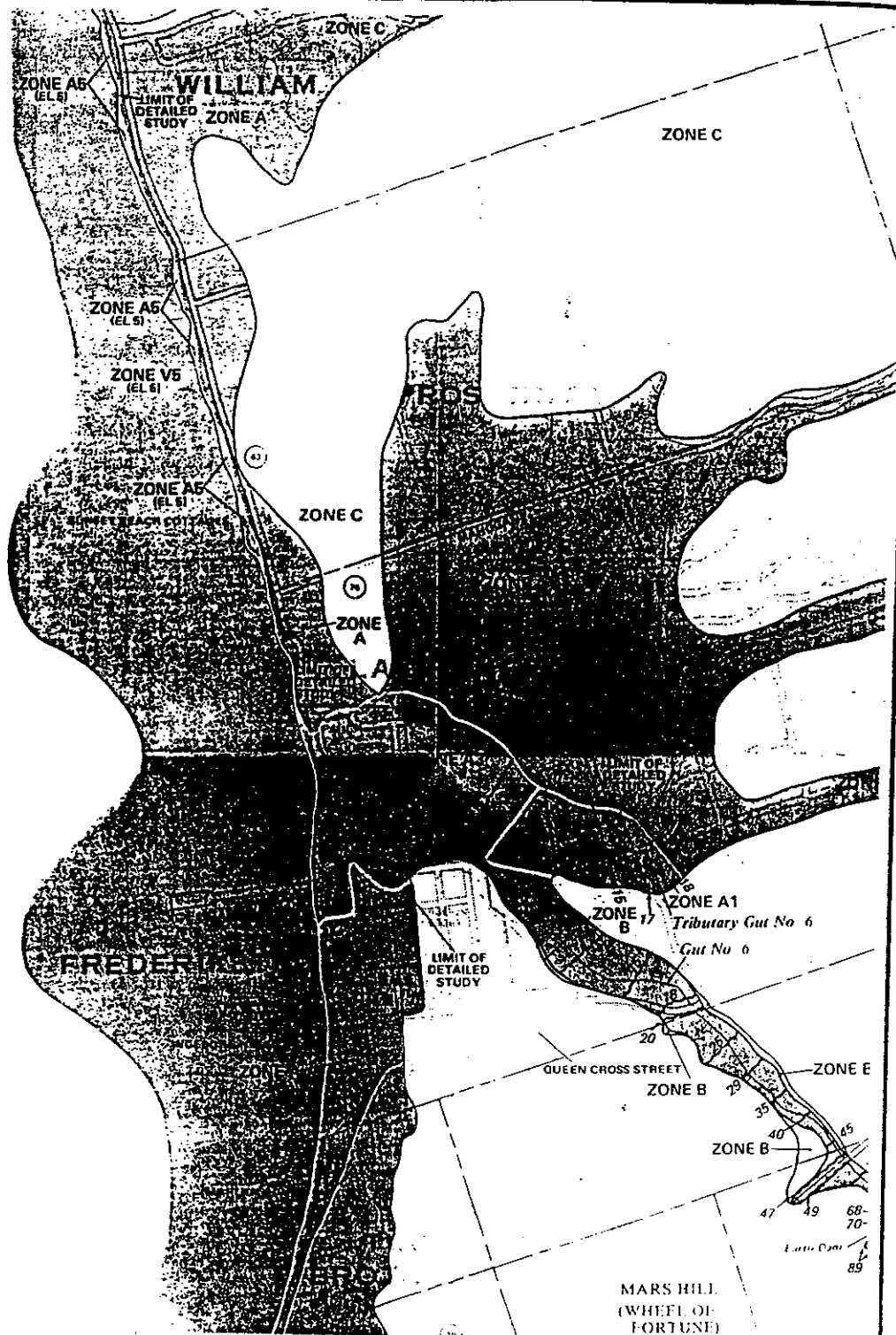


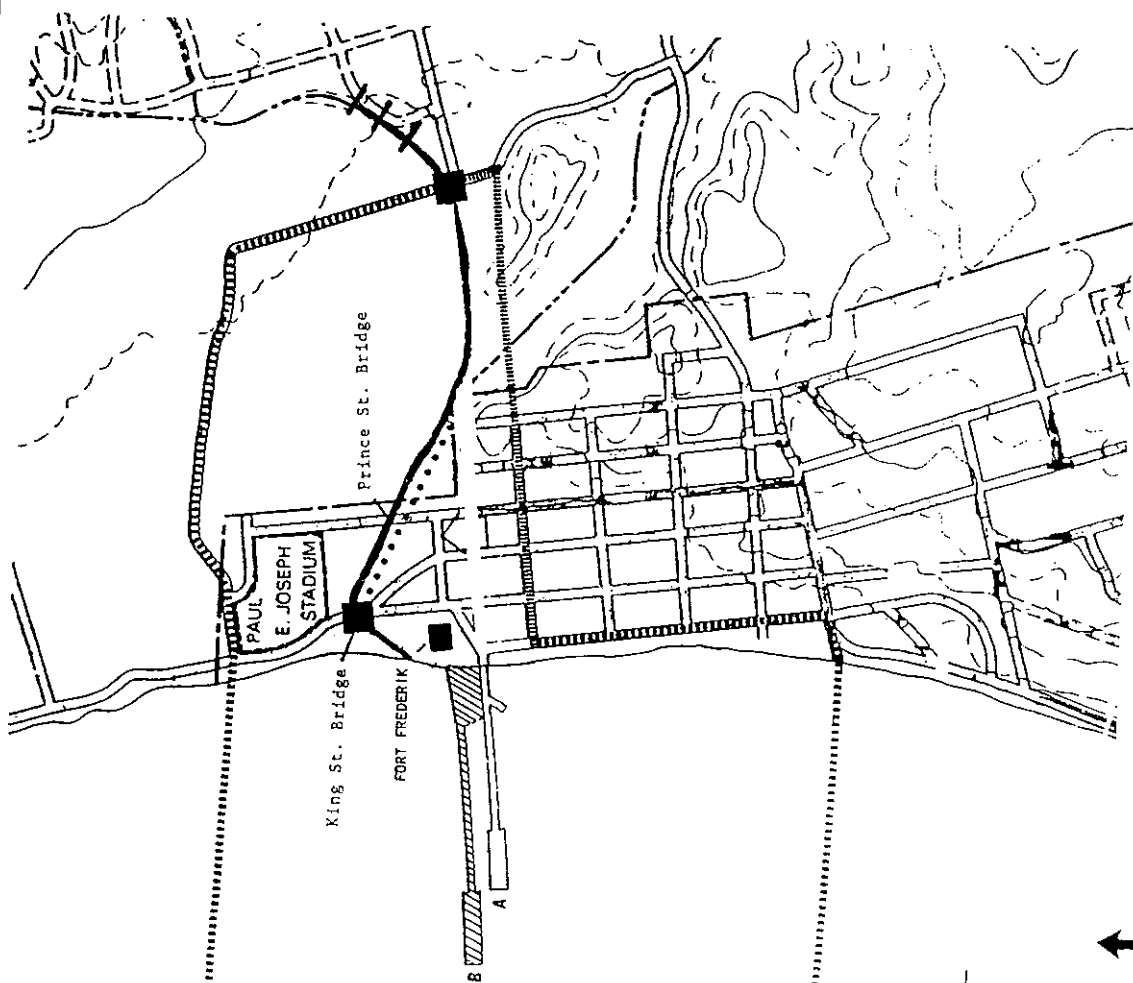
Figure 5
100-Year Floodplain
Adapted from: FEMA, 1992
Island Resources Foundation, 1993



APPROXIMATE SCALE

0 100 200 FEET

FREDERIKSTED WATERFRONT



LEGEND

BRIDGE REPLACEMENT

IMPROVED CHANNEL

EXISTING CHANNEL

BRIDGE REPLACEMENT

APC BOUNDARY










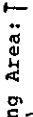
A EXISTING PIER

B NEW PIER (UNDER CONSTRUCTION)

Figure 6
Stormwater Improvement
Adapted from: USACE, 1992
Island Resources Foundation, 1993

0 500 1000 FEET

FREDERIKSTED WATERFRONT

- LEGEND:
- Deep Reef System: 
 - Seagrass: 
 - Coral Communities: 
 - Sand: 
 - Soft Corals: 
 - Coral Heads: 
 - Loggerhead Sponges: 
 - Rock Rubble: 
 - Riverine Habitat and Emergent Mangroves: 
 - Sea Turtle Nesting Area:  (on sand beaches)

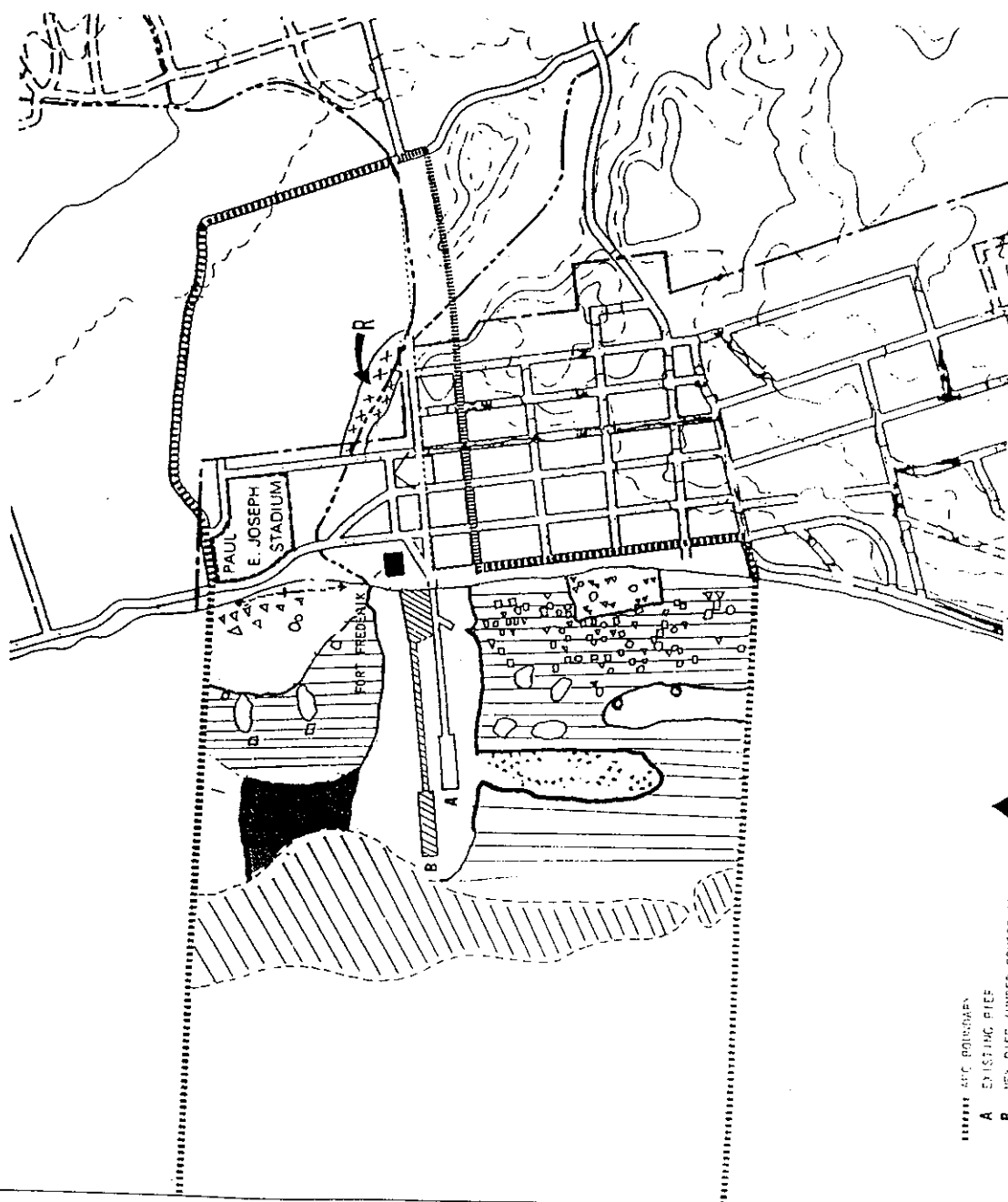


Figure 7
Biological Features
Adapted from: BioImpact, 1989
Base map adapted from: USGS, 1982
Island Resources Foundation, 1993

0 500 1000 FEET

----- AND BOUNDARIES
A EXISTING PIER
B NEW PIER (UNDER CONSTRUCTION)

FREDERIKSTED WATERFRONT

PHYSICAL FEATURES

Shoreline Types

- Low vertical seawall
- Exposed rocky/carbonate platform
- Fine-grained sand beaches

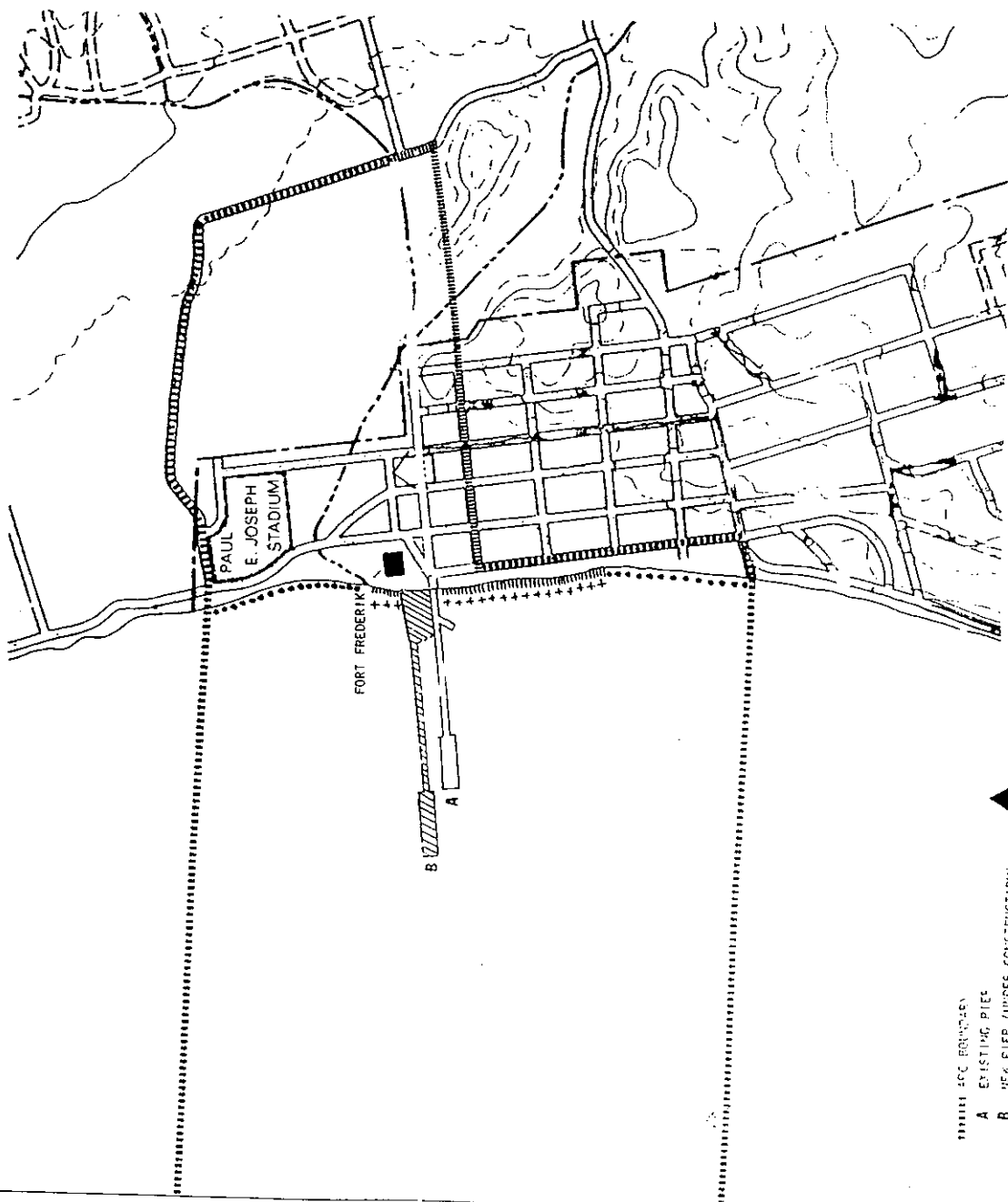
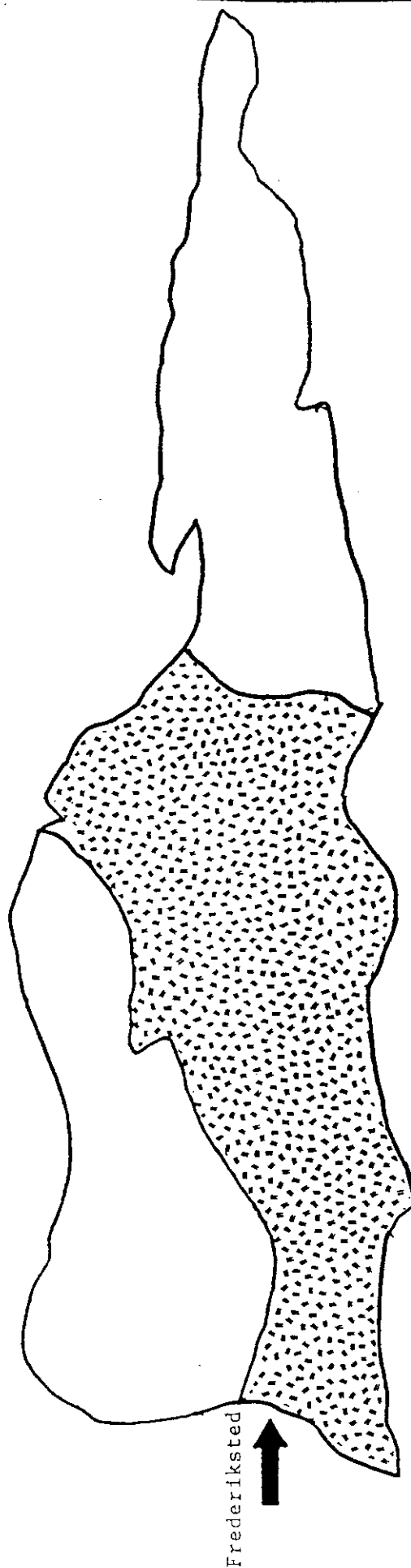


Figure 8
Physical Features
Base map adapted from: USGS, 1982
Island Resources Foundation, 1993

0 500 1000 FEET

PROPOSED PIER CONSTRUCTION
A EXISTING PIER
B NEW PIER (USGS CONSTRUCTION)



Frederiksted

N



Figure 9
Location of Kingshill Aquifer
Adapted from: USGS, 1987
Island Resources Foundation, 1993

Note: Flags indicate location of groundwater discharge wells.



Figure 10

Major Groundwater Discharge Wells
within the APC

Adapted from: U.S. Geological Survey, 1990
Island Resources Foundation, 1993



FREDERIKSTED WATERFRONT

LAND USE

Residential

- 111 Single unit (low density)
- 116 Multiple unit (low density)

Commercial and Services

- 121 Retail sales & services
- 123 Office & Professional services
- 127 Mixed commercial & services

Transportation

- 145 Port Facility

Institutional

- 161 Educational

Recreational

- 171 Beaches & Shores
- 173 Waterfront Park
- 175 Stadium
- 179 Other recreational

Agriculture

- 251 Inactive

Other

- Sewage outfall

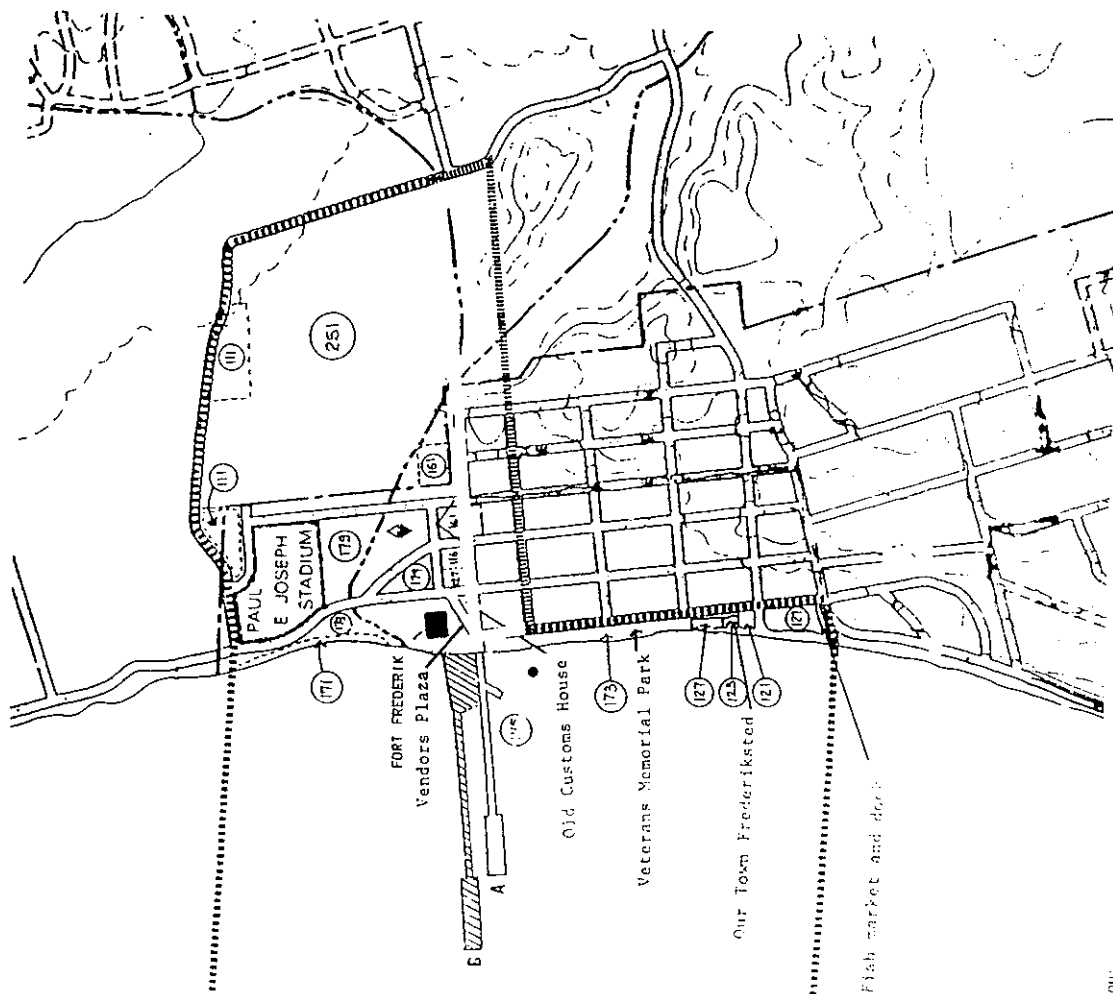
- ▲ Pump station (sewage)

Classification System: Tevstad, 1981

Figure 11

Land Use within APC

Base map adapted from: USGS, 1982
Island Resources Foundation, 1993



A DISTURBED
 B NEW OR RECONSTRUCTED



1. Remote taxi/bus parking at stadium.
2. Repaired and extended pedestrian path around Fort.
3. Craft workshop and sales area.
4. Entry plazas at Fort.
5. New pavers and planting at Buddhoe Park.
6. Bus Stop.
7. Renovated Customs House. Port Authority at upper level. Ground level uses: Tourist Office, Police sub-station, toilets, telephones.
8. New plaza with trees, new vendor area.
9. Expanded sidewalk, pavers at Lagoon, King streets.
10. New pavers set level with roadway at crossings. Stop signs, ramps as needed.
11. Renovated Clock Tower with canopied observation deck at upper level. Lower level to be canopied vendor areas.
12. Vendor plaza with decorative paving.
13. Reduce Strand St. to two lanes, 30' in width. Extend pedestrian areas.
14. New angled parking.
15. Forward transportation reserve.
16. Passenger loading area.

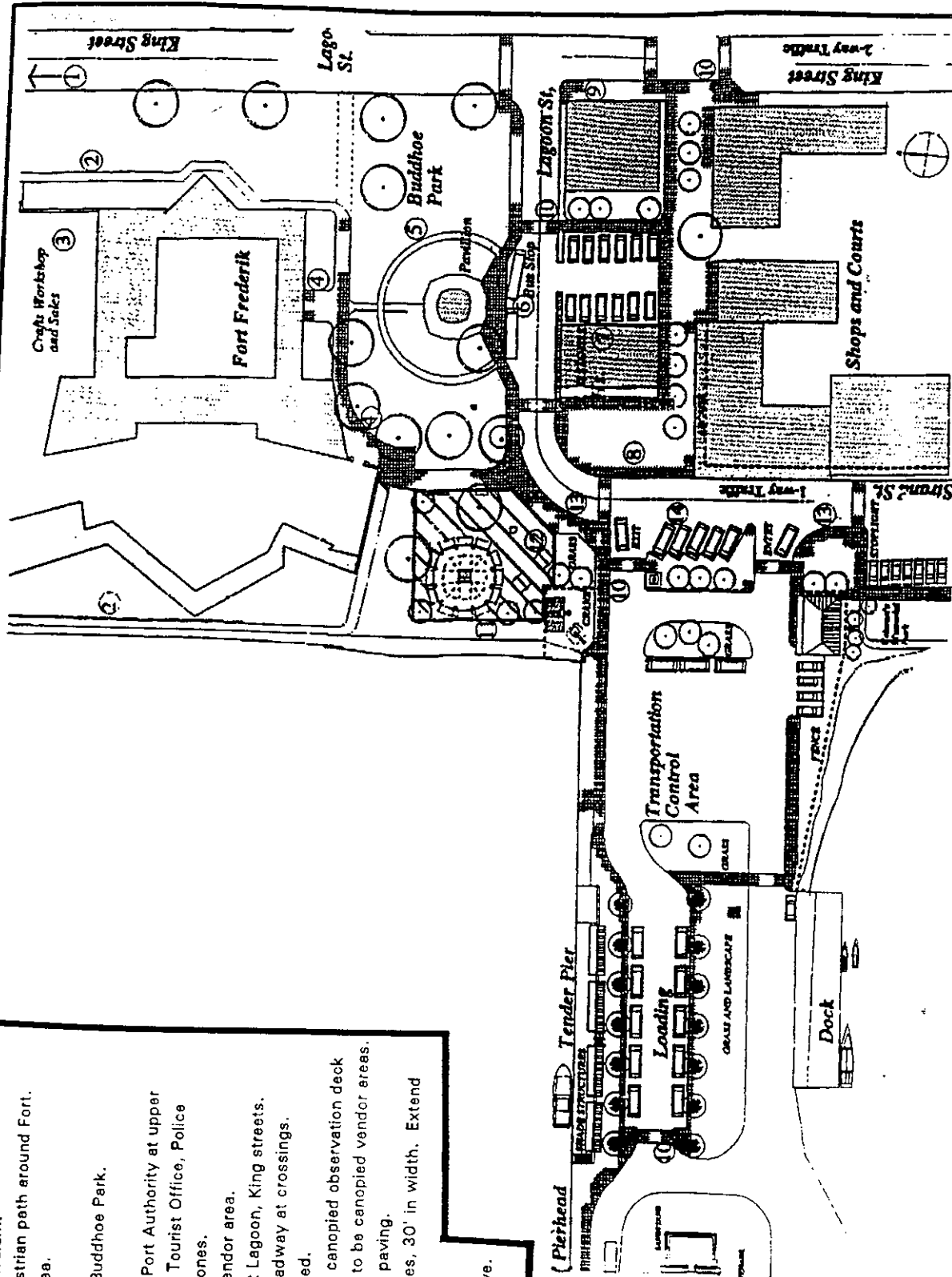
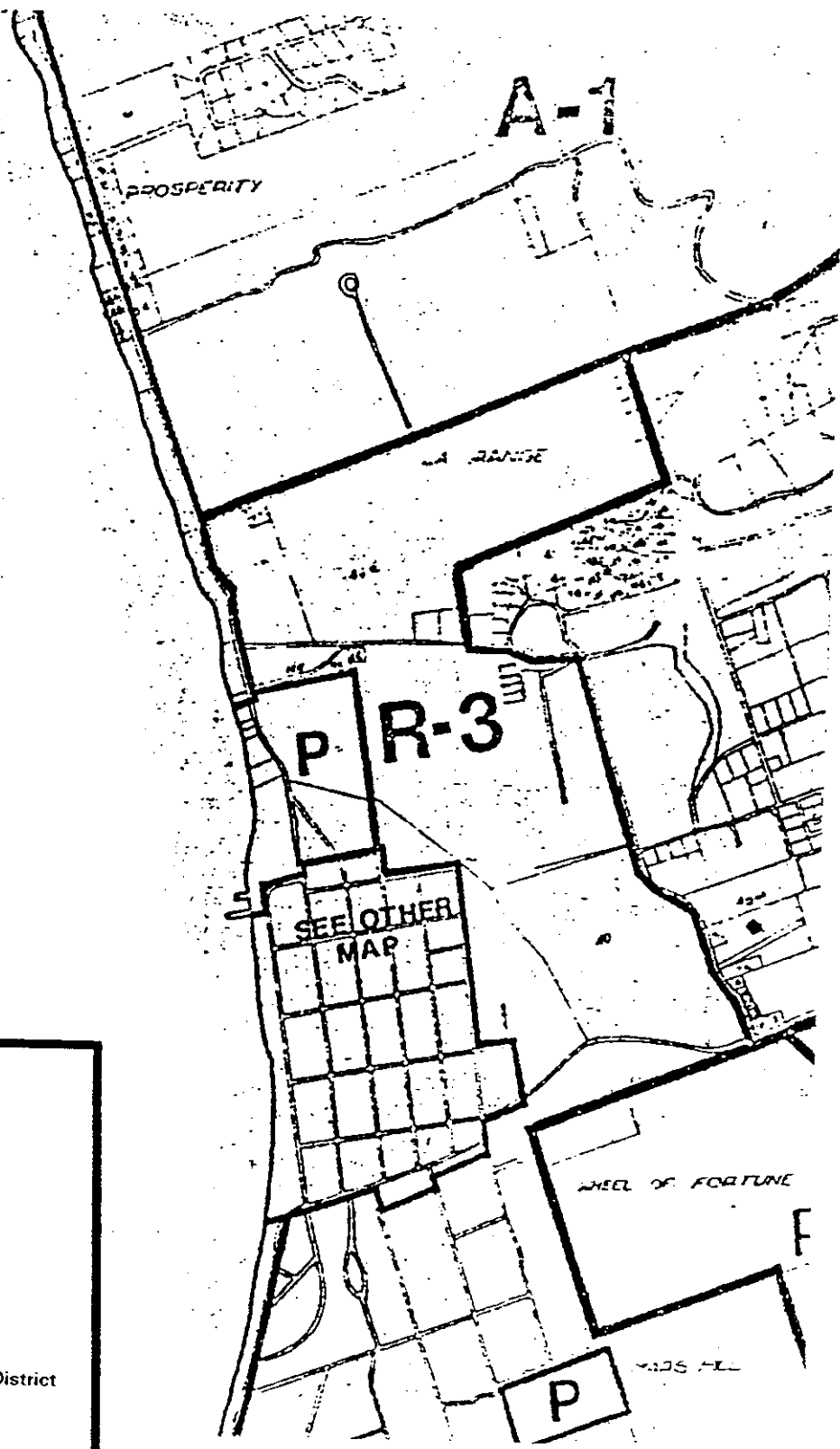


Figure 12

Our Town Frederiksted's proposed waterfront and pier improvements. Adapted from: OTF, December 15, 1992 Island Resources Foundation, 1993



U.S. Virgin Island
Zoning Codes

- A-1 Agricultural District
- A-2 Agricultural District
- R-1 Residence Low Density
- R-2 Residence Low Density
- R-3 Residence Medium Density
- R-4 Residence Medium Density
- R-5 Residence High Density
- B-1 Business Central Business District
- B-2 Business Secondary
- B-3 Business Scattered
- B-4 Business Residential
- C- Commercial
- I-1 Industry Heavy
- I-2 Industry Light
- W-1 Waterfront Pleasure
- W-2 Waterfront Commercial-Industrial
- P- Public

Figure 13a
Zoning Map
Adapted from: Real Estate
Data Inc., 1987
Island Resources Foundation, 1993

A-1	Agricultural District
A-2	Agricultural District
R-1	Residence Low Density
R-2	Residence Low Density
R-3	Residence Medium Density
R-4	Residence Medium Density
R-5	Residence High Density
B-1	Business Central Business District
B-2	Business Secondary
B-3	Business Scattered
B-4	Business Residential/Commercial
C-	Industry Heavy
I-1	Industry Light
I-2	Waterfront Pleasure
W-1	Waterfront Commercial-Industrial
W-2	Public

