An Environmental Profile of the Island of Anegada, British Virgin Islands

VOLUME 3 OF THE BRITISH VIRGIN ISLANDS ENVIRONMENTAL PROFILE SERIES

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A Report of Island Resources Foundation

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Cover Photo:

A SMALL FLOCK OF GREATER FLAMINGO FORAGING AT RED POND, ANEGADA

(Photo Credit: Jean-Pierre Bacle)

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ACRONYMNS

ACP	African, Caribbean and Pacific Group of States
ACRI	Anegada Conch Restoration Initiative
ARK	Association of Reef Keepers
BMP	Best Management Practice
BVI	British Virgin Islands
BVIEC	British Virgin Islands Electricity Corporation
CCCC	Caribbean Community Climate Change Centre
CCI	Caribbean Challenge Initiative
CDEMA	Caribbean Disaster Emergency Management Agency
CDERA	Caribbean Disaster Emergency Response Agency
CDM	Comprehensive Disaster Management
CEHI	Caribbean Environmental Health Institute
CERMES	Centre for Resource Management and Environmental Studies
CITIES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
DCF	Department of Conservation and Fisheries
DDM	Department of Disaster Management
DFID	Department for International Development (UK)
DOA	Department of Agriculture
DPU	Development Planning Unit
DTCP	Department of Town and Country Planning
DWM	Department of Waste Management
ECLAC	Economic Commission for Latin America and the Caribbean
EIA	Environmental Impact Assessment
EMT	Environmental Management Trust
ECACC	Enhancing Capacity for Adaptation to Climate Change in the Caribbean UK Overseas Territories
EPA	Environmental Protection Areas
EU	European Union
FATF	Financial Action Task Force
FEMA	Federal Emergency Management Agency (US)
GA	Greater Antilles
GoBVI	Government of the British Virgin Islands
HLSCC	H. Lavity Stoutt Community College
HMSO	Her Majesty's Stationery Office
HOA	House of Assembly
IPCC	Intergovernmental Panel on Climate Change
IRF	Island Resources Foundation
IUCN	International Union for the Conservation of Nature
JVD	Jost Van Dyke
LBS Protocol	Protocol Concerning Pollution from Land-based Sources and Activities
LYD	Lethal Yellowing Disease
MAB	Man and the Biosphere Programme
MNRL	Ministry of Natural Resources and Labour
MPA	Marine Protected Area
NASA	National Aeronautics and Space Administration (US)
NCCC	National Climate Change Committee
NDDP	National Disaster Development Plan
NEAP	National Environmental Action Plan
NGIS	National Geographical Information System
NGO	Nongovernmental Organisation
NIDP	National Integrated Development Plan
NIDS	National Integrated Development Strategy
NOAA	National Oceanic and Atmospheric Administration (US)
NPDP	National Physical Development Plan
NPO	Nonprofit Organisation
NPT	National Parks Trust
OECS	Organisation of Eastern Caribbean States
OTEP	Overseas Territories Environment Programme
R3I	Regional Risk Reduction Initiative
SA	South America
SPAW Protocol	Protocol Concerning Specially Protected Areas and Wildlife
STEP	Sustainable Tourism Environmental Programme
SRO	Statutory Rules and Orders
TNC	The Nature Conservancy
TNS	The Natural Step
UK	United Kingdom
UN	United Nations
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNFCC	United Nations Framework Convention on Climate Change
USEPA	U.S. Environmental Protection Agency
USVI	U.S. Virgin Islands
UVI	University of the Virgin Islands
VI	Virgin Islands
VIEC	Virgin Islands Environmental Council
VIRP	Virgin Islands Recycling Partnership
VISR	Virgin Islands Shipping Registry
WCMC	World Conservation Monitoring Centre
WI	West Indies

ABBREVIATIONS

In this document measurements are first stated as metric measures followed by U.S. equivalents in parenthesis.

ac	acre	**lb**	pound
cm	centimetre	**m**	metre
ft	foot	**m^2**	square metre
ha	hectare	**m^3**	cubic metre
in	inch	**mi**	mile
kg	kilogram	**mm**	milimetre
km	kilometre	**yd**	yard
km^2	square kilometre	**yd^3**	cubic yard

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Photo 110	Nancy Woodfield Pascoe, NPT

PREFACE AND ACKNOWLEDGEMENTS

In the 1990s, Island Resources Foundation (IRF) produced eight Environmental Profiles for six OECS Caribbean states and two UK Overseas Territories. These profiles were funded by the U.S. Agency for International Development and the United Nations Development Programme. At the time, no environmental profile was produced for the British Virgin Islands. A decade later, IRF was asked to join with the Jost Van Dykes Preservation Society to prepare an environment profile for the island of Jost Van Dyke (JVD). Funding for this joint effort was secured from the UK's Overseas Territories Environment Programme (OTEP), and the first environment profile for the BVI was published in 2009.

The Jost Van Dyke profile project was based on the premise that there is considerable value in taking a retrospective look at environmental change in order to assess priority environmental issues. Island Resources Foundation believes that the premise guiding the JVD profile holds equally true for other areas of the BVI. The lessons learned about Jost Van Dyke's environmental future through the profiling process could also provide a fresh approach to understanding environmental change in the territory as a whole.

In 2010, IRF began to plan for an expansion of the profile process, and by 2011 had successfully identified further funding to support two new environmental profiles for the British Virgin Islands. The first of these, an environmental profile for the island of Virgin Gorda and its nearby smaller islands and islets was completed in 2012. The third profile is this document, an environmental profile for the island of Anegada. Depending on the further availability of funding, IRF would like to extend and complete the process by preparing an environmental profile for Tortola and its adjacent islands.

Funding for the *Virgin Gorda and Anegada Profiles* was made possible in part through support provided by the Overseas Territories Environment Programme of the UK Foreign and Commonwealth Office. IRF's OTEP funding for the Virgin Gorda and Anegada profiles is administered in the BVI by the Office of the Governor, and we thank His Excellency Governor W. Boyd McCleary for his kind support during the execution of this project. Claire Hunter, Project/Consular Officer in the Governor's Office, was our project liaison, and we thank her for her helpful assistance during all phases of this project.

Additional funding was provided by the Government of the Virgin Islands through the office of the former Premier, the Honourable Ralph T. O'Neal, to whom we extend our appreciation for his early support of the project. We also extend our appreciation to Mrs. Rosalie Adams, Permanent Secretary in the Premier's Office, who was instrumental in securing the support of Government for continuation of the profile series. The endorsement and funding support of the BVI Government were critical in identifying additional funds for this initiative.

The enthusiastic encouragement and assistance of the Hokin family of the Bitter End Yacht Club have been instrumental in moving this project forward. The patriarch of the Hokin family, the late Myron Hokin, was an early supporter of Island Resources Foundation in the 1970s and 1980s. It was a joy for all of us at Island Resources Foundation to reunite with the Hokins three decades later in the execution of this project. The J.A. Woollam Foundation of Lincoln, Nebraska, has been exceedingly generous in its support of the Virgin Gorda and Anegada profiles. We thank its trustee, Dr. John A. Woollam, for joining with our Foundation in bringing these profiles to fruition, and also the Houwer family of Virgin Gorda and Sir Richard Branson of Necker and Mosquito Islands, whose kind donations have supported publication of this profile.

Island Resources Foundation extends its appreciation to the many persons who assisted the profile team in its research for the *Anegada Environmental Profile* or provided documentation and other information which assisted in making the profile as complete and comprehensive as possible. These persons are gratefully identified on pages **xv** and **xvi**. We are particularly grateful to Andrea Vanterpool-Fahie, the District Officer for the sister island of Anegada, who has often provided assistance to the IRF team well beyond our requests and expectations, thus making her, in effect, a valued member of the Anegada profile team.

It is our hope that the information contained within the *Anegada Environmental Profile* will assist the community of Anegada and the Government of the Virgin Islands to make more informed decisions about the island's future and to more fully assess the consequences of their actions (or inactions) on the long-term security of the richly diverse and equally splendid environmental resources of Anegada.

—Judith A. Towle (May 2013)
Vice President of Island Resources Foundation
Project Director for the Anegada Environmental Profile

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Island Resources Foundation extends its appreciation to each of the persons identified below for assisting us in the process of gathering data for the Anegada Environmental Profile.

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1. INTRODUCTION TO ANEGADA

1.1 The Physical and Natural Setting

1.1.1 Physical Geography

The island of Anegada, aptly christened by explorer Christopher Columbus, takes its name from the Spanish word meaning "drowned" or "flooded," describing the low-lying and flat—almost submerged—nature of the island that, when viewed from offshore, displays no unusual landmarks or features and appears dry and mostly devoid of vegetation.

Anegada is so dramatically different from its neighbouring islands that it has been referred to as the "Mysterious Virgin." Its extraordinarily flat terrain is an anomalous landscape that stands in stark contrast to all the other islands in the chain of islands we call the Virgin Islands, whether British or American. And yet, in this seemingly inhospitable environment can be found many exceptional features nowhere else seen in the Virgin Islands.

The Territory of the British Virgin Islands (BVI) is comprised of approximately 50-60 islands, islets, and cays. Anegada, the second largest at 38 km² (15 mi²), is the only land mass in the BVI archipelago that is flat and non-volcanic in origin. The island sits on the edge of the Caribbean tectonic plate at Latitude 18° 44' and Longitude 64° 20'.

Its closest, large-island neighbour is Virgin Gorda, 24 km (15 mi) to the south, while Tortola, the administrative and commercial capital of the BVI, lies 33 km (20.5 mi) to the southwest (**Figure 1**). Anegada is further from Tortola than any of the other British Virgins, and while it cannot usually be seen from Tortola, Anegadians can view Tortola and Virgin Gorda from its southern shore. North of the island is an unbroken view across the Atlantic Ocean to a distant horizon. Thus, Anegada is not only very flat and dry, it is also relatively isolated.

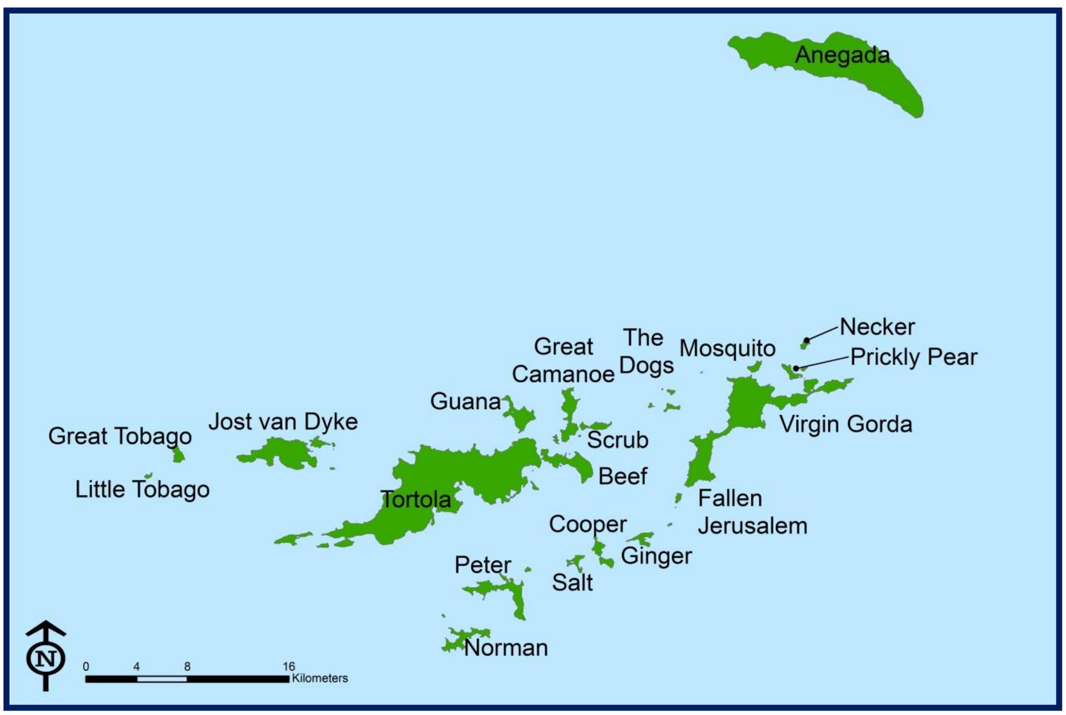


Figure 1.
Territorial map of the primary islands comprising the British Virgin Islands, with Anegada furthest to the north (source: adapted from the BVI National Geographical Information System).

From the air, the island of Anegada looks crescent shaped (**Figure 2**), stretching longitudinally from west to south-southeast for 17 km (10.5 mi). Its maximum width along the centre from Soldier Point to Pearl Point is approximately 4.75 km (3 mi). The island is so flat and infrastructure so low that first-time visitors arriving by boat would require some convincing that Anegada is out there—somewhere. If not for the tall Australian Pines and Coconut Palms, land is barely visible until the last few kilometres from shore (**Photo 1**).

Photo 1.
Looking at the Neptune's Treasure Hotel, located west of Setting Point. The inn is nestled within a coconut grove while tall Australian Pines mark the shoreline on the right.

According to conventional knowledge and the literature, the island rises to a maximum height of 8 m (26 ft). However the latest topographical map of 1976 indicates that the highest point of elevation is 36 ft (11 m) just northwest of the airport (British Government, 1977). It is estimated that a good 40 percent of the island lies under 3-4 m (10-13 ft) elevation, with large areas of land in the western half of the island being below sea level.

While being flat like a pancake, Anegada has two distinct landscapes that geographically split the island roughly in half. The western side is formed by a series of sand dunes and beach ridges that mark the coastline and cover extensive backshore areas. The dune system is very pronounced along the north side while a series of low sandy ridges mantle the south and western side of the island. Together, the dune and ridge system almost completely surrounds an interior wetland system comprised of seven interconnecting ponds.

In contrast, the eastern half of the island consists primarily of flat reef limestone. Most of this Limestone Plain is exposed or thinly covered with soils. The exposed bedrock surface is marked by thousands and thousands of sinkholes or solution holes (locally named "slobs"). Surrounding the Limestone Plain are sand dune ridges on the north side and a narrow band of wetland marshes along the east and southeast side, as well as fringing mangroves.

1.1.2 Geological History

Anegada lies at the northeastern edge of the Puerto Rico/Virgin Islands Platform. Except for Anegada, all other islands in the Virgin Islands archipelago are essentially volcanic and started forming about 80 million years ago. Geologically, Anegada is very young and started forming as a submerged barrier reef system between 119,000 and 130,000 years ago during the last interglacial within the late Pleistocene Epoch, when temperatures were warmer and seal levels about 3 to 15 m (10 ft to 49 ft) higher in the Caribbean region (Hearty, *et al.*, 2007).

Some 100,000 year ago, the last ice age of the Pleistocene Epoch initiated a "cooling off" period of the earth. As a consequence, sea levels lowered to approximately 120 m (393 ft) below today's level, thus exposing the entire Puerto Rico/Virgin Island Platform. At that time, it was theoretically possible to travel between geographical areas without crossing any body of water.

Since that period, the exposed coral reef that eventually became Anegada went through a lengthy process that gradually transformed it into a limestone platform. Afterwards, about 20,000 years ago, a warming phase initiated deglaciation and a gradual sea level rise that reached current levels approximately 4,000 to 6,000 years ago (Gore, 2012).

Figure 2.

General location map of the island of Anegada with key location points identified (adapted from the BVI Geographical Information System).

Rising sea levels stimulated an upward growth of coral throughout tropical waters. This caused the formation of a new barrier reef along the north side of Anegada, the Horseshoe Reef along the southeast side, and the multiple patch reefs south of the island. The coral reef history of Anegada can be seen in a multitude of evidence found in bedrock exposure and stone walls throughout the island (**Photo 2**).

Anegada continues to experience ongoing weathering and climatic processes. Shoreline erosion and accretion is a testament to the island's continuing adjustment to coastal dynamics, caused by normal climate fluctuations assisted by anthropogenic activity.

Photo 2.
Huge coral fragments located inland were used for stone walls. The specimens in the centre are likely brain coral species, broken away from the Limestone Plain as a result of erosion.

1.1.3 Landscape Features

Howard (1970) divides the island into five physiographic areas: Bedrock Ridge; Bedrock Flat; Dunes-Beach Ridge Complex; Salt Ponds; and Mangrove Areas. More recent studies, by Atwater, *et al*. (2011) and Gore, *et al*. (2012a), depict the island along features similar to those of Howard but with added details (**Figure 3**). Following is a summary of the four primary physiographic features of Anegada based on the above-cited references. The features are:

(1) Limestone Plain

(2) Dune and Sand Ridge Formation

(3) Salt Ponds

(4) Mangrove Forest

(1) The **Limestone Plain** covers the eastern two-thirds of the island and is primarily composed of exposed and hardened coral reef limestone bedrock that gently slopes southward and southeastward. The Limestone Plain is marked along the north side by a slightly curved ridge as described by Howard (1970), extending from Soldier Point to East End Point. He further notes that the highest elevations are generally found along this ridge. Other high spots are just north and west of the airport and along the pronounced dunes lining the northwest coastline.

Photo 3.
Most of the Limestone Plain is bedrock exposed and marked by sinkholes, such as this example (about 1 m in diameter), which serve as drinking holes for local livestock.

Much of the Limestone Plain is bare of soil formation. In many areas, the bedrock surface is riddled with sinkholes or solution pits (also called "slobs"), usually ranging from 10 cm (4 in) to 1 m (3 ft) in diameter (**Photo 3**) and, in certain areas, 8 to 10 ft (2.4 to 3 m) deep. Larger sinkhole formations are located between the airport and Bumber Well Pond, with the largest measuring at least 20 m (65 ft) in diameter (see **Figure 4** and **Photo 24** in Chapter 4).

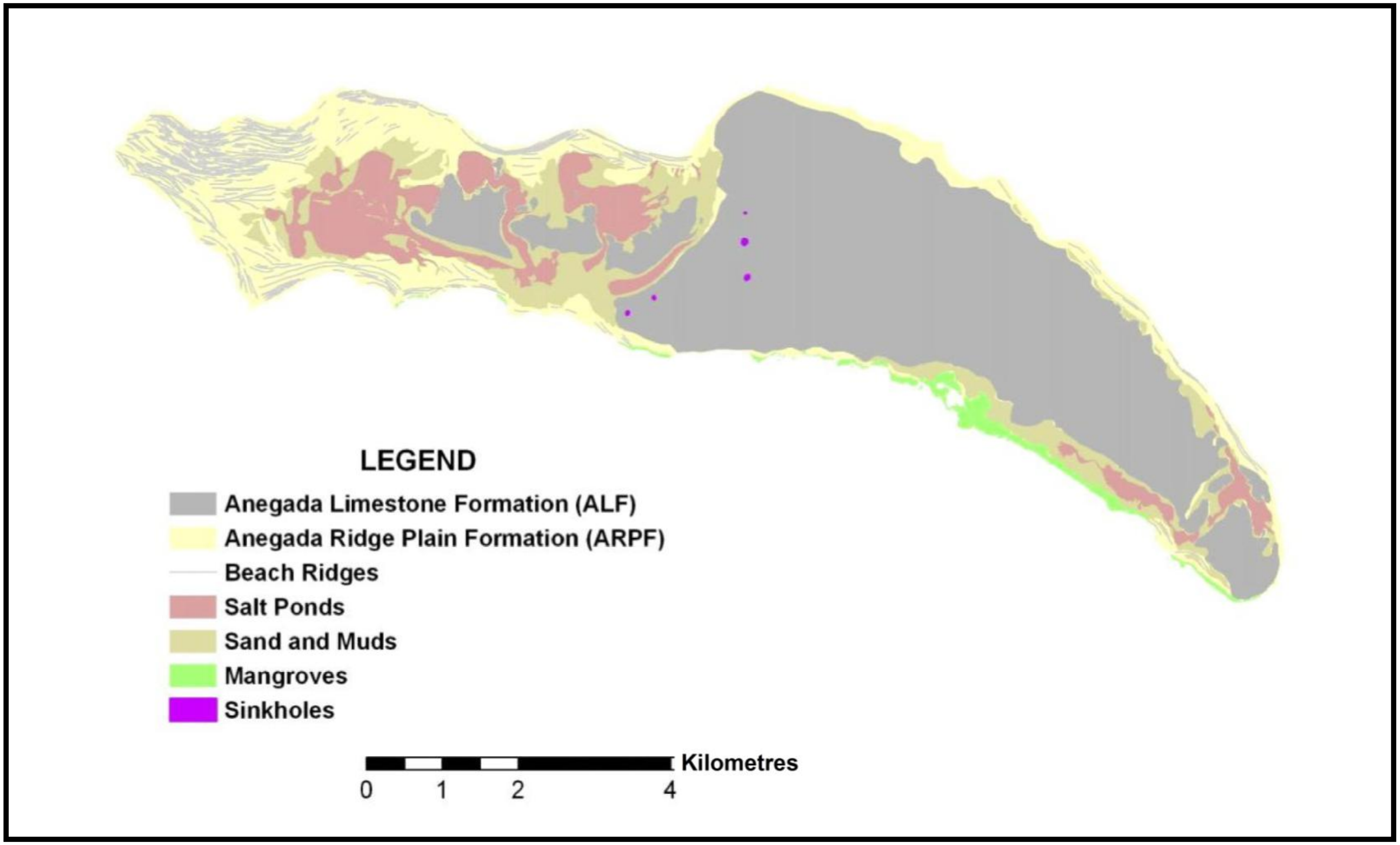


Figure 3.

Geological and physiographic features of Anegada (source: Atwater, *et al*., 2011)

(2) The **Dune and Sand Ridge Formation** covers a large portion of the western half of the island and mostly surrounds the western salt ponds and sand and mud flats. It is also found as a narrow strip along the northern edge of the Limestone Plain Formation.

According to Howard (1970), this Formation is essentially composed of unconsolidated bioclastic carbonate sands. The Sand Ridge Formation runs roughly parallel to the current shoreline and is characterised by a series of ridges and swales with an average height of 1.5 m (5 ft). The Dune Ridge System along the southern and western coastline is relatively low-lying, whilst the dunes along the north coast can exceed 5 to 6 m (16 to 20 ft) in height and can be found more than 100 m (330 ft) inland. These dune ridges are frequently targeted for sand mining as shown in **Photo 4**.

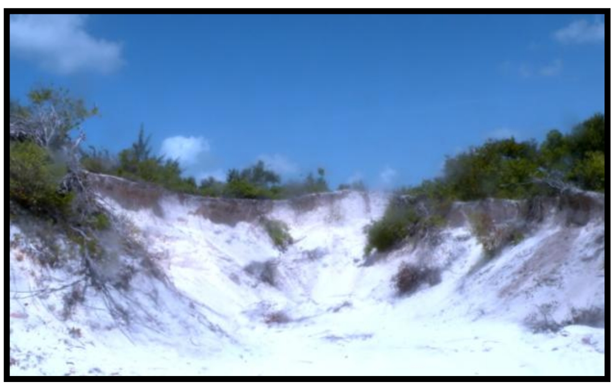


Photo 4.
Sand mining along a tall Dune Ridge Formation. Most sand mining activity takes place along the island's northwest road.

(3) The central western half of the island contains an extensive complex of **Salt Ponds** which occupy a topographical low in the bedrock (**Photo 5**). These ponds are mostly interconnected with one another and together form one of the largest wetlands in the Lesser Antilles (Scott and Carbonell, 1986; Jarecki, 2004). There are seven named ponds forming this vast wetland system:

1. **Flamingo Pond** (220 ha / 544 a)
2. **Red Pond** (110 ha / 272 a)
3. **Point Peter Pond** (72 ha / 178 a)
4. **Bones Bight Pond** (57 ha / 141 a)
5. **Bumber Well Pond** (size not available)
6. **Manhead Pond** (size not available)
7. **Vagabond Pond** (size not available)

Most ponds are bounded in part by limestone, and all except for Point Peter Pond adjoin beach ridges of the north shore (Atwater, *et al*., 2011).

The ponds are connected to the sea by one narrow channel along the south shore at Salt Heap Point. The connection to the sea is likely open year round but constricts inland to a few metres in width and a few tens of centimetre in depth (Jarecki and Walker, 2006: Atwater, *et al*., 2011). Pond levels vary little with tidal fluctuations. The normal tides rise and fall tens of centimetres daily.

At one point in the past, these ponds were a marine embayment environment that connected directly to the sea via inlets on the north shore but were later gradually transformed to hypersaline condition between 1650 and 1800, possibly caused by a major sedimentary event such as the tsunami caused by the Lisbon earthquake of 1755 (Atwater, *et al*., 2011).

A series of intermittent ponds and salt marshes are also found at the eastern end of the island, fringing inside the southern and northern shoreline. Aside from runoff over the limestone bedrock, these wetlands are likely fed periodically by storm tides which have access through tidal channels in the extensive mangrove forest along the southeastern side of the island.

Photo 5.
Flamingos at Red Pond, Anegada.

In the nineteenth century the Budrock Pond area once was a productive site for salt harvesting (Ausherman and Chapman, 1985). The most productive years were usually associated with times of little rainfall and high evaporation. These salt ponds produced salt, which was sold in its solid form and used to prepare salt fish. According to Schomburgk (1832), one salt pond of less than two acres (0.8 ha) yielded as much as 1,500 barrels annually. At the present time, there is no evidence that salt harvesting takes place.

(4) A fairly continuous band of **Mangrove Forest** covers the southeastern shoreline from Lower Bay to East Point. Here the mangroves form part of a rich wetland ecosystem that includes extensive salt marshes and sand and mudflats. Sand and mud flats are common features along the edges of most salt flats and salt marshes as well as along interconnecting channels. From Lower Bay westward, mangrove distribution becomes more fragmented until they disappear near Setting Point.

1.1.3.1 Shoreline

Anegada's shoreline is approximately 39 km (24 mi) in length, the majority of which is primeval sandy beach that stretches continuously from Setting Point westward, wrapping around West End Point and continuing along the entire northern coast to near East Point. The length covers approximately 25 km (15.5 mi) or 64 percent of Anegada's total shoreline length. A second dominant shoreline type is the coastal Red Mangrove forest that stretches from Pearl Point to East Point for a total of 8 km (5 mi) covering approximately 20 percent of the island's perimeter.

Anegada's shoreline can be further described in four segments as discussed in the following subsections.

(1) Southwestern Coast, from West End to Pearl Point. Most of this coastline is shaped into a series of broad lunate bays separated by points known as cuspate forelands such as Pomato Point, Setting Point, Saltheap Point, and Nutmeg Point. Although these lie on the south side (leeward side) of the island, some inner sections of these bays are eroding while others are showing signs of accretion (**Photo 6**). Beaches facing eastward (windward) along their points differ somewhat from those facing west (leeward). The eastward facing beaches have narrower foreshores and lower slopes than those facing west (Sterling Bank, *et al*., 1974).

Most of the coastline between Setting Point and Pearl Point benefits from protection provided by the offshore reef and shallow waters extending for a distance offshore; thus, it receives less wave impact. The coastline is lined by patches of fringing mangroves and narrow sandy beaches.

Photo 6.
From Pomato Point looking eastward toward Setting Point. The low-lying cuspate shoreline at Pomato Point is experiencing accretion, whilst beach erosion is evident heading eastward to Setting Point.

(2) Southeastern Coast, from Pearl Point to East Point. The southeastern coastline is mainly lined with Red Mangrove (*Rhizophora manglar*) forest in the lower seaward side (**Photo 7**) and by salt marsh grass in the upper tidal sections. The stretch from Lower Bay to East Point is interrupted by numerous small tidal channels that connect with the eastern ponds, thus allowing tidal flushing into and out of the salt marsh and inner ponds.

Salt marshes and ponds are floored with loose organic sediments underlain by sandy shells and, further down, by limestone bedrock. Inland, the pond shores are covered with salt marsh grass and stunted mangroves.

Photo 7.
Extensive coastal mangrove forest is characteristic of the southeastern shoreline of Anegada.

(3) Northwestern Coast, West End to Soldier Point. While the entire south coast is relatively low, flat and lacks dunes, the north coast, in contrast, is backed by dunes that reach 6 m (20 ft) in height. Most dune slopes are stabilised by vegetation. Sand deflation is uncommon except in areas where wave erosion along the fore-dune base is occurring, and further inland where there is dune mining along the north shore road (**Photo 4**).

Most of northwest coastline between West End and Windless Bight is exposed to prevailing winds and waves. Along this portion the shoreline is shaped into slightly accurate bays separated by broad sand bluff headlands. Bays are largely stable and often experiencing accretion whereas the headlands are locally eroding. At Keel Point, it is estimated that coastal erosion is occurring along a 150m (500 ft) stretch of coastline. Erosion has cut into the base of the 3 m (10 ft) high dune and exposed sand on the fore-dune slope, and is currently threatening coconut palms and the Keel Point cottages nearby (see also Chapter 3, Section 3.1.2.1).

Further to the west (at West End Point), considerable erosion has taken place as a result of recent storms, thereby necessitating beach nourishment measures in order to salvage a few coastal cottages (**Photo 8**). Since littoral drift is mainly westward, most erodible sands will mainly be transported in that direction (see also Chapter 3, Section 3.1.2).

Photo 8.
Many cottages along West End Point are at risk and have become vulnerable due to severe beach erosion.

(4) Northeastern Coast, Soldier Point to East End. The northeastern coastline from Soldier Point to East End Point borders the Anegada Limestone Formation and thereby is relatively straight with bays and headlands less pronounced than along the northwestern half of the island. The coast is backed by a narrow continuous ridge of sand dunes that ranges from 4 to 6 m (13 to 20 ft) in elevation (**Photo 9**). The dunes are largely stable except for few small areas in Table Bay.

The entire coastline is exposed to prevailing easterly winds and waves. Its shores are eroding at many points, due in part to a less continuous and more broken reef protecting the shoreline. This has resulted in crenulated bays at Loblolly and Table Bays. Beach rock formation is prominent at a few locations, mainly in the Soldier Point area and at East End. At the latter location, the submerged beach rock averages 60 m (195 ft) in width (Gore, *et al.*, 2012a).

Photo 9.
Looking towards Soldier Point and a wide beach backed by dunes reaching 6 m (20 ft) in elevation. The heavy surf is breaking on the offshore barrier reef.

1.1.4 Soils

Although there is no comprehensive soil survey for Anegada, one can assume the island's soil formation strongly reflects underlying geology, topography, weather and land use activity. As expected, soils from the eastern and western half of the island differ significantly in texture and thickness.

In the eastern half of the island, which is dominated by the Limestone Plain, soils tend to be thin or non-existent. However, some areas do have pockets of more significant soil accumulation. They can be found within limestone cavities, rock fissures, sinkholes and topographic lows. These depressions generally contain sandy organic soils and promote more dense vegetation cover due to the thickness of the sediment layer and increased moisture within these depressions (**Photo 10**).

Photo 10.
A palm tree occupying a small sinkhole, which allows loose sediments to accumulate and rainwater to be captured.

A factor contributing to Anegada's soil loss is overgrazing and trampling of the vegetation land cover by free-roaming and feral livestock. This is particularly true within a significant portion of the Limestone Plain, and increasingly so elsewhere. In the past, stone walls were used by Anegadians to delineate household gardens and keep livestock under control. Until the 1960s, households cultivated a variety of crops inside their walled enclosures, including guinea corn, garden fruits and vegetables (Koester, 1987). With changes in the island's economic base, as Anegadians moved away from cash crops and animal husbandry, maintenance of the walls was abandoned and most of the livestock let loose. Many Anegadians recall that soils on the island were much thicker and more productive than at present (*pers. comm.*, Anegada resident Kevin Faulkner, 4 November 2012).

Except for the wetlands and scattered limestone outcrops, most of the western half of the island is dominated by a sandy soil texture. In some places, the sand is only a thin veneer over bedrock; however in the western half of the island, sand thickness can reach a depth of more than 5 m (16 ft). In areas long covered by vegetation and protected from wind, top soil up to 30 cm (12 in) deep can be found, usually containing dark organic matter which promotes water retention and retains plant nutrients.

Salt pond surface sediments are predominantly composed of carbonate sand mixed with shell. Organic muck, calcareous mud and calcium carbonate crusts are also present. Similarly, low areas surrounding the ponds consist of carbonate sand mixed with muddy sand and organic debris (Sterling Bank, *et al*., 1974).

1.1.5 Watersheds, Drainage and Hydrology

Since Anegada's terrain is so flat and average elevation so low, the island lacks a well-developed drainage system. Unlike other insular areas that have tributaries draining into major ghuts, there are no such visible drainage features on Anegada. As a consequence, Anegada has no distinct watersheds.

The exposed Limestone Plain that covers close to 60 percent of the island is impervious and therefore exhibits low infiltration rates, except for isolated sinkholes (rock fissures where infiltration is high). The amount of precipitation however is so low and the topography so flat that concentrated runoff is limited. Along the Limestone Plain, water flows typically in a dispersed way towards the sea when slopes favour this option. Otherwise, surface water generally accumulates in ponds or shallow depressions, forming temporary pools that last for several weeks before eventually disappearing due to high evapotranspiration rates.

The sandy landscapes of the west and north coasts are comprised of dune ridges that have higher rates of infiltration. Shallow water-bearing aquifers may exist under higher parts of dune ridges, especially where the dunes rest on bedrock above sea level, such as along the north coast (**Figure 4**). Swales between sand dunes and ridges are frequently occupied by wetlands or intermittent ponds.

Many low-lying areas are susceptible to flash flooding. Occasional dry washes (**Figure 4**) observed on the eastern portion of the island provide evidence of limited surface drainage and occasional sheet flooding (Sterling Bank, *et al*., 1974). Most erosion is arrested by vegetation cover, low relief and rapid infiltration, especially in the sands of the western portion of the island.

Anegada's flooding and erosion conditions stand in contrast to that experienced on hilly islands. Runoff in mountainous islands is concentrated and delivers high-energy flows that can be very destructive. On the other hand, Anegada's flat and low-lying topography does not favour runoff intensity. Surface water tends to flow in a dispersed fashion with little energy and, as a consequence, is much less damaging. However, the lack of well-developed drainage systems can result in more stagnant pools resulting in mosquito infestation.

There are many freshwater wells on the island, and most have being built around existing sinkholes (**Photo 11**). Freshwater levels have been observed by the IRF team at depths of 2 to 4 m (6.5 to 13 ft) within the Limestone Plain area and at deeper levels where ground elevation is higher.

Photo 11.
Typical freshwater well on the Limestone Plain.
Concrete sides are to protect the sinkhole from filling up with rock debris and animal residues.

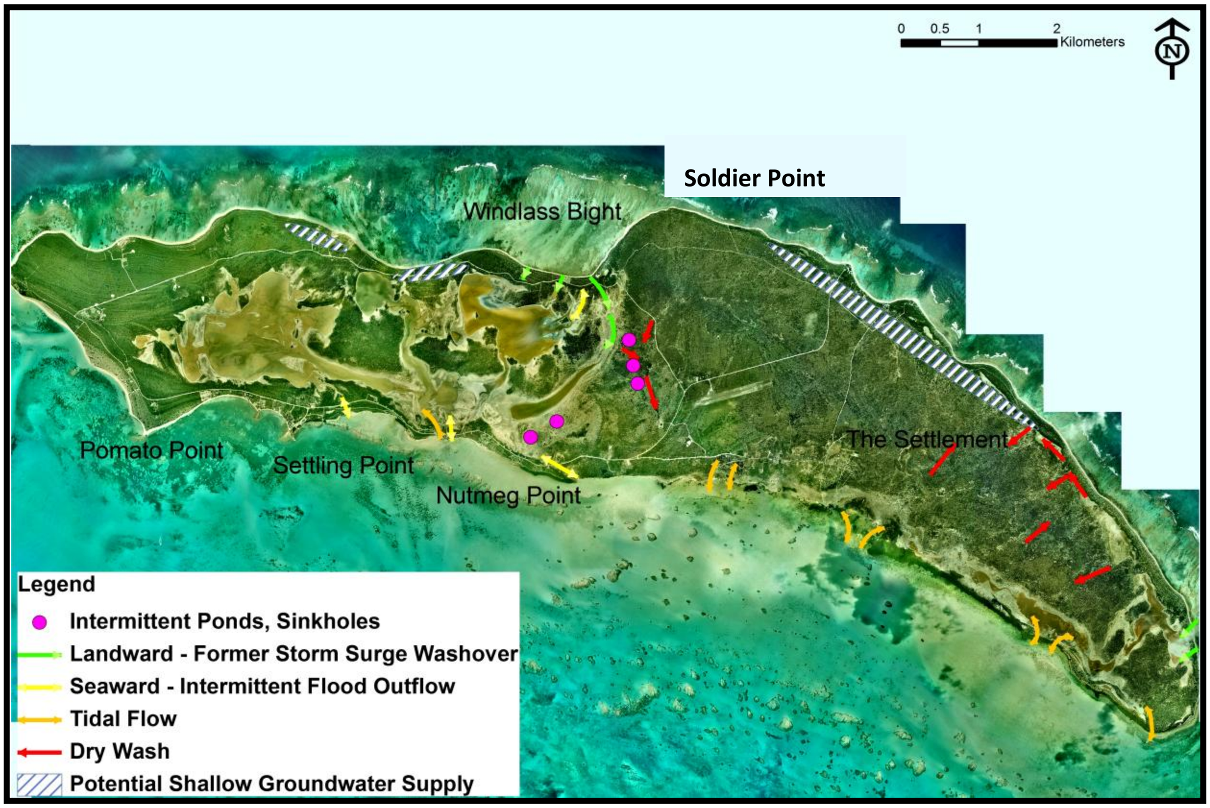


Figure 4.
Surface drainage and hydrology for the island of Anegada
(source: adapted from Sterling Bank, *et al*., 1974)

1.1.6 Climate

Similar to other islands in the Virgin Islands chain, Anegada enjoys a climate dominated by the Trade Winds Climate Zone. The climate is sub-tropical and characterised by fair weather, steady winds, and slight but regular annual, seasonal and diurnal temperature ranges.

The easterly trade winds are the dominant weather feature. The average wind direction varies throughout the year according to the following pattern:

- *December to February:*
  Winds blow from east-northeast
  (known locally as "Christmas winds").
- *March to May:*
  Winds blow from easterly directions.
- *June to August*:
  Winds blow from east to southeast.
- *September to November:*
  Winds blow mainly from east to southeast.

Except for tropical storms and hurricanes, the highest wind speeds normally occur from December to February and also from June and July. Average wind speeds for the months of June-July are around 12-30 km (7-12 mi) per hour, while in October; average wind speeds can drop to 7 km (4 mi) per hour. Because Anegada is flat, wind velocity is fairly consistent throughout the island, and there is little protection against the full force of the trade winds.

Anegada is significantly drier than its sister Virgin Islands because of its flat topography. Localised clouds tend to pass over the land mass without precipitation due to the absence of the cooling effect caused by elevated hills and mountains. As a result, vegetation is low in height and typically semi-arid, dominated by low shrub-like plants, thorny scrub, and cacti landscape.

There is no systematic weather collection data for Anegada; the only reliable records are from Tortola and, to a lesser extent, from Virgin Gorda. It is anticipated that under the Territory's Climate Change Initiative, the collection and archiving of weather and climate data for the BVI will be upgraded by the Department of Disaster Management.

Average rainfall for Anegada is estimated to be around 101 cm (40 in) per year (Earle, 1997), while averages elsewhere such as in Road Town (Tortola) are 115 cm (45.3 in) per year. Typically, the average amount of precipitation increases as elevation increases, but because of Anegada's lack of hilly or mountainous terrain, this factor is not present.

For the BVI, rainfall amounts vary monthly and annually. The wettest months on average are September to November, and the driest months on average are February and March. Due to year-round high temperatures and near constant winds, the evaporation rate is generally high in the BVI.

General records for the BVI show that temperature varies little throughout the year. The difference between the monthly mean temperatures of the coolest and warmest months is about five to seven degrees F with the highest temperatures in August or September and the lowest in January or February.

There are no official temperature records for Anegada. However, Road Town (Tortola), some 45 km (28 mi) away, has typical daily maxima at around 32°C (89.6°F) during the summer and 29°C (84.2°F) during the winter. Typically, daily minima are around 24°C (75.2°F) in the summer and 21°C (69.8°F) in the winter. **Table 1** shows a series of weather data for Virgin Gorda, some 24 km (15 mi) south of Anegada.

Table 1.
Weather records for Virgin Gorda (24 km south of Anegada), as historic averages.

Parameters/ Months	Jan Ave.	Feb Ave.	Mar Ave.	Apr Ave.	May Ave.	Jun Ave.	Jul Ave.	Aug Ave.	Sep Ave.	Oct Ave.	Nov. Ave.	Dec Ave.	Yearly Average
Record high °C	33	32	32	35	34	35	35	36	35	33	33	31	36
Record high °F	91	89	89	95	93	95	95	96	95	92	91	87	96
Average high °C	26	27	28	29	29	30	31	31	30	29	28	27	28.7
Average high °F	79	80	82	84	85	86	87	87	86	85	82	80	83.6
Average low °C	20	19	20	21	22	23	23	23	23	22	22	21	21.4
Average low °F	68	67	68	69	71	73	73	73	73	72	71	69	70.6
Record low °C	17	16	16	17	18	18	19	19	16	18	17	16	16
Record low °F	62	60	60	62	64	65	66	66	61	64	63	60	60
Precipitation mm	74.2	63.2	55.4	84.6	116.6	70.6	83.1	112	156	133.4	178.8	112	1239.3
Precipitation inch	2.92	2.49	2.18	3.33	4.59	2.78	3.27	4.4	6.14	5.25	7.04	4.4	48.79

Source: Intellicast, 2012. "*Virgin Gorda Historic Weather Averages in the British Virgin Islands*." http://en.wikipedia.org/wiki/British_Virgin_Islands#cite_note-9.

Anegada, like its neighboring islands, also lies within the Hurricane Belt. Most of these intense storms develop from August to October, with September being the most active month. Within the last 50-60 years, several hurricanes passed sufficiently close to Anegada to cause moderate to significant damage (see Chapter 3, Figure 6).

The most recent storm to cause damage was Hurricane Earl in August 2010. Earl was a Category 4 storm by the time it passed along Anegada's north coastline some 30 to 40 km (19 to 25 mi) offshore. According to Atwater, *et al.* (2012b), the waves and storm surge left wrack lines (organic debris and detritus line) on the island's perimeter and interior wetlands. The wrack lines were measured by level and determined to be no more than 2 m (6 feet) above mean sea level on the north shore at Windlass Bight and on the south shore in and near The Settlement. The storm caused significant coastal erosion particularly along the northwest coastline (**Photo 12**).

The largest storm to impact Anegada was Hurricane Donna in 1960. The storm's maximum sustained winds reached 110 knots (about 55 m/sec), and it was classified as a Category 3 event. The storm's eye passed close to 15 km (9.3 mi) south of the island (Dunn, 1961).

The surge from Donna was felt particularly along the low-lying areas south of The Settlement and extended further inland into The Settlement than did the surge during Earl. The Donna surge extended 0.5 km (0.3 mi) inland, reaching heights close to 2.5 m (8.2 ft) above mean sea level (Atwater, *et al*, 2012b). In fact, Donna is probably the largest hurricane to have passed so close to Anegada in the past century (NOAA, 2012).

Photo 12.
West End Point suffered severe beach erosion during the last storm event (Hurricane Earl, 2010). A beach nourishment and restoration project has since taken place to preserve the cottages (see Chapter 3, Section 3.1.2).

1.2 The Community Setting

1.2.1 Population Characteristics

In writing about the people of Anegada in 1975, BVI educators and scholars Dr. Pearl Varlack and Dr. Norwell Harrigan characterised the population of this comparatively isolated island as:

> *… a highly intelligent people of negro and mixed descent. As far back as 1886 the Anegada School … became eligible for grant-in-aid and in 1887 was awarded the highest average marks for reading and arithmetic. This native intelligence has served them in good stead, for wherever they have established their homes—in the United States Virgin Islands, the continental United States or elsewhere—they have been eminently successful and this success, through remittances they were able to send home, has kept Anegada alive for the better part of the twentieth century.* (Varlack and Harrigan, 1975).

This characterisation of the inhabitants of Anegada emphasises not only the authors' perception of their inherent intelligence but also points out another enduring attribute of Anegadians, namely, they have long been a community of migrants, and the important role played by migration and emigration in the development of the Anegada community cannot be denied.

Out-migration of Anegadians began with a seasonal relocation of males to the Dominican Republic to provide plantation labour for sugar cane harvesting. At the end of the January-to-June harvesting season, migrants would traditionally return home to resume agricultural and fishing pursuits in Anegada. J.R. O'Neal writes in his memoir, *Life Notes* (2004), that the peak of BVI labour migration to the Dominican Republic was reached in the 1920s, while Dr. Michael Downs (1997) reports that Anegadians continued to leave the island for employment in the cane fields or sugar factories of the Dominican Republic up until the early years of World War II.

St. Thomas in the neighbouring U.S. Virgin Islands was also a lure for Anegadians seeking employment opportunities—on its docks beginning in the late 1800s; for the building of its airport during World War II; and in construction work following the war for the USVI's emerging tourism industry. Often, migrants to St. Thomas did not return home but stayed in the U.S. Virgin Islands or embarked for the continental U.S., especially New York City (Faulkner, 1974).

Periodically, the immigration of Anegadians to the U.S. was slowed by changes in U.S. immigration policy, particularly the imposition of stricter immigration quotas in 1924 and again in 1952. However, beginning in 1965, with the establishment of more liberal immigration policies by the American Government, the migration of West Indians, including Anegadians, to the United States began to rise once more (Koester, 1987).

Not only were the migration patterns of Anegadians dictated by the immigration policies of the destination country, but local circumstances in Anegada often contributed to the outflow of population. For example, following the collapse of large-scale development plans for the island in 1971 and again in 1974, the renewed expectations of islanders for prosperity at home were thwarted, and one sees a concurrent decline in the resident population (over one-third) during the decade of the 1970s (see **Table 2**). As Paul Backshall wrote in November of 1974, the development schemes of Kenneth Bates and later of the Sterling Bank of the Cayman Islands (see Chapter 2, Section 2.2.6) had meant so many things to the people of Anegada, including:

> *… employment after years of existing on a scant income from fishing and handouts from more fortunate relatives living abroad. It meant that their sons and daughters could come home from St. Thomas or New York and re-establish themselves on their own island and even more than that, it meant proper roads and an efficient electricity supply and communication with the outside world* (Backshall, 1974).

With the failure of the development plans of the 1970s, and with the relative easing of immigration restrictions in the United States, a steady decline in the island's population is visible, with the lack of economic opportunity continuing to induce Anegadians to leave home. Immigration therefore has given a fluidity to Anegada's population that would not necessarily be present in a community with such small numbers. As Dr. Michael Downs wrote during his 1997 assessment of the Anegada community:

> *… it is common for individuals and families to have lived elsewhere for some greater or lesser portion of their lives, and if they were in family units at the time of their absence from the island, to have had children who were foreign born. Additionally, given the small size of the population in absolute terms, a number of spouses of Anegadians, who are now themselves Anegada resident, have come from different locales* (Downs, 1997).

The fact that many Anegadians have lived away from the island for sizeable portions of their lives, and then later returned home, has helped to stabilise a population on the decline throughout the twentieth century. Returning Anegadians have "also provided trained manpower in growth sectors of the local economy, most notably in the area of tourism-affiliated businesses" (Downs, 1997).

1.2.1.1 Population Trends

As noted in Section 1.3.2 of this Profile, an official British Government report recorded the population of the island in 1897 at 500 persons. **Table 2** shows that 14 years later, at the end of the first decade of the twentieth century, the population still stood at approximately the same number, just a little less than 500 persons. However, as the century unfolded, the population steadily declined so that by the beginning of the twenty-first century (*i.e.*, 2001, the last year for which official census figures are available), the population had been reduced by half. At the same time, the overall population of the territory had increased more than threefold, from approximately 5,500 in 1911 to just in excess of 23,000 persons in 2001.

Table 2.
Anegada and BVI population figures, 1911-2001.

Year	Anegada Population	Change in Population Figure	% of Change in Population (rounded)	BVI Population	Change in Population Figure	% of Change in Population (rounded)
1911	457	—	—	5,562	—	—
1921	358	-99	-22%	5,082	-480	-9%
1946	274	-84	-23%	6,505	+1,423	+28%
1960	274	0	0	7,291	+786	+12%
1970	271	-3	-1%	9,672	+2,381	+33%
1980	164	-107	-39%	10,985	+1,313	+13%
1991	161	-3	-1%	16,717	+5,732	+52%
2001	250	+89	+55%	23,161	+6,444	+39%
2010	*319*	+69	+28%	*29,537*	+6,376	+28%
2012 DPU Revision				*27,800*	*+4,639*	*+20%*

✳ DPU ***projections for 2010*** as the official census results have not yet been released.

Sources: Downs, 1997; DTCP, 1993; BVI Development Planning Unit.

Table 2 includes projected population figures from the Development Planning Unit (DPU) for 2010. The last completed census was in 2001. Data for the 2010 census are still being compiled and analysed, and only projected figures for the 2010 census are included in the table. The projection for 2010 estimated a total territorial population of nearly 30,000, but has since been revised and is currently projected at 27,800 (Raymond Phillips, DPU Director quoted in www.bviplatinum.com on 13 March 2012).

Anegada's population total in 2001 displayed a substantial increase after declining gradually during all of the twentieth century. The estimated figure for the island for 2010 shows a continued upward trend with a projected population of 319. However, given that the DPU has already lowered expectations for the territorial population, it is possible that the estimate for Anegada might also be less than originally anticipated

Anegada is the least densely populated of the four major British Virgin Islands. Its population is roughly that of Jost Van Dyke, but it is 30 square kilometres larger. As Anegada's population began to grow in the 1990s, its population density also rose. Michael Downs, writing in 1997 but using 1991 population figures, calculated the island's population density at four persons per square kilometre. Using the population figures from the 2001 census, the density of the island has increased to seven persons per square kilometre (19 persons/square mile), which is still the lowest density among the territory's major islands.

1.2.1.2 Other Demographic Features

The most recent demographic figures from 2001 indicate that there is an equal gender balance on the island, with approximately the same number of males and females residing on the island. See **Table 3**, which presents a breakdown of Anegada's population by age and sex, with data from the 1991 and 2001 censuses compared.

Of particular note is the number of persons in the prime working-age group (age 20-54) and therefore of an age to be potentially active in the labour force. The number and percentage of persons in this age group increased during the decade of the 1990s, an important increase since future development of the island will require a sufficient number of residents in the active work force.

The 20-to-54-age group is bracketed by the young and old. Thirty percent of the population was under the age of 20 and 27 percent above the age of 55 in 1991. Ten years later, the potential work force age group had increased, and there was a concurrent decrease in both the young and old populations, with a drop to 24 percent of the population classified as youths (below 20 years of age) and 23 percent as seniors (above 55 years of age).

Table 3.
Anegada population by age and sex for 1991 and 2001.

Age Group	1991	% of Total	Male	Female	2001	% of Total	Male	Female
0 – 9 years	27	17%	10	17	36	14%		
10 – 19 years	21	13%	10	11	24	10%		
20 – 54 years	71	44%	40	31	133	53%		
55 plus years	42	27%	27	16	57	23%		
TOTALS	**161**	**100%**	**87***	**75***	**250**	**100%**	**126**	**124**

* Male/female totals for 1991, taken from DTCP (1993), do not equal the island's total population figure for that year.

Source: BVI Government, Development Planning Unit.

As was noted in the Anegada Development Plan of 1993 (DTCP, 1993), Anegada has an aging population. By 2001, the population groups at either end of the population spectrum (*i.e.*, under 20 and over 55 years of age) each represented about one-fourth of the total population, with only slightly over half falling in the labour-force age group. Such demographics have implications for a variety of social and economic issues in Anegada, such as education and health care as well as development planning.

As per data from the 2001 census, the vast majority of Anegada's residents are of African ancestry (82 percent), followed by those of mixed ethnicity (7 percent) and of Caucasian descent (comprising 4 percent). The remaining population included two individuals who were classified as East Indian, three as Portuguese, and fourteen who did not identify ethnicity.

1.2.1.3 Geographic Distribution

At the time of a Commission of Inquiry regarding Anegada lands (Renwick, 1988), there was only one family known to be living on the north coast of the island (at Bones Bight), and two families occupying areas on the west end. All other residents were described as living in The Settlement, at Nutmeg Point, or Setting Point. The geographic distribution of the population as characterised in the 1993 Anegada Development Plan (DTCP, 1993) found the majority of the population (90 percent) resident in The Settlement, with the balance of the population located in the southwestern section of the island.

In the same 1993 Development Plan, the Town and Country Planning Department identified built development on the island as restricted to the following specific areas (see locations on **Figure 2**):

- Loblolly Bay
- Scattered development west of The Settlement
- Area known as the American Village west of Nutmeg Point
- Setting Point
- Pomato Point
- North of the Pond
- The Airport and adjacent areas
- The Walls
- The Settlement

1.2.1.4 Occupation Distribution

Tourism is expanding on the island but the underpinning of the local economy remains fishing, supplemented by tourism and government-related employment (Downs, 1997). While this 1997 overview is still accurate, it is not substantiated by data from the most recent census in 2001, where, in the 109-person labour force, the largest occupational categories were:

- 46 persons classified as "*service shop and market sale workers*;"
- 22 as "*managers, technicians, professionals and clerks*;"
- 16 as "*craft and related trade workers*;"
- 8 as "*clerks*;"
- **5 as "*skilled agriculture and fishery workers*;"**
- 5 as "*plant and machine operators*;" and
- 7 "*other*."

Given that fishing is often a seasonal or part-time vocation, it is possible that fishing as an occupation was undercounted in the census and thus the 2001 DPU figures downplay the significant role that small-scale, commercial fishing plays in Anegada's economy (see Chapter 5, Section 5.2).

It should also be noted that agriculture, as a major component of the island's economy, has not been practiced on a scale larger than home gardens since the 1960s (Downs, 1997), with fishing having emerged as a more profitable economic enterprise than farming. The island's dry climate and topography have always constrained commercial agricultural development as has the low return to labour that agriculture provided, particularly as Anegada began losing its markets in the U.S. Virgin Islands in the 1950s and 1960s to the importation of foodstuffs to the U.S. territory from the American mainland (Koester, 1987).

Additionally, according to Koester (1987), the shift away from agriculture changed the way Anegadians viewed and used their terrestrial resources, with marine resources increasing in economic importance while the use of the land decreased. Anegadians stopped maintaining their stone walls, which had been used for segmenting crop production and animal stock (see Chapter 6, Section 6.2), and began to allow their livestock to run free, an environmental, economic, and social issue that is discussed in more detail throughout Chapter 4 of this Profile.

1.2.1.5 General Observations

Given the island's small population, and even smaller labour force, the social, cultural, and demographic changes associated with future mid-to-large scale tourism projects could have a detrimental impact on the local community. For example, an influx of outsiders to fill labour requirements for development activities, even if only modest in scale, could easily result in an imbalance in the local/expatriate population ratio on an island whose resident population currently numbers only 250 to 300 persons. Most Anegadians would like to see more development, particularly tourism development focused on the island's beaches and coastal marine environment; but they also do not want to be overwhelmed by development. The lessons learned from the 1970s (see Chapter 2, Section 2.2.6) have not been forgotten.

It has long been accepted as a truism in Anegada that more Anegadians live outside of Anegada than on the island. As long ago as 1969, a report of a Commission of Enquiry into the Anegada and Wickham's Cay Agreements stated that:

> *Many more Anegadians (natives and first generation) live outside the British Virgin Islands, than on Anegada itself. We were told by witnesses from St. Thomas that about 300 live in the American Virgin Islands, and by a witness from New York that over 700 live there. Anegadians are of the same stock as other British Virgin Islanders but they identify themselves closely with their island, whether they live on it or elsewhere. The population may be constant in number, or dwindling, but individuals come and go frequently* (reported in Renwick, 1988:3).

This 44-year-old observation points out two long-enduring characteristics about the Anegada community: (1) Anegadians have long been emigrants, traveling from their home island in order to improve their economic circumstances, and (2) many migrating Anegadians, whether in population centres like St. Thomas or New York or elsewhere, will eventually return home—if only on a part-time basis—and even those who do not still closely identify with their island homeland.

1.2.2 Historical Development

Much of the human history of Anegada essentially revolves around its surrounding reef system that practically encloses the entire island, extending offshore to a maximum distance of about 16 kilometres (10 miles) southeast of East Point.

Shell middens on the southeastern point of Anegada provide a vivid reminder that Amerindians once harvested considerable amounts of Conch (*Strombus gigus*) from the reef, but no evidence has been excavated to suggest that there was a permanent settlement of any type. This lack of evidence implies instead that these pre-Columbian visitors operated seasonally, rather than inhabiting the island all year round (Schomburgk, 1832:153).

Shards of Elenoid series pottery, similar to examples found on Puerto Rico and other Virgin Islands, were uncovered on Anegada during an investigation in 1974 (Gross, 1975:15), whilst conch shells extracted from one of the middens provided a radio carbon date of AD 1245 ± 80. Samples from middens at Hull Bay in St. Thomas provided dates of AD 1310 ± 120 and AD 1220 ± 110, respectively, whilst carbon dating for a midden on St Croix produced a date of AD 1020 (Weiss and Gladfelter, 1978:29). These dates suggest that the middens were formed during the last stages of the Amerindian occupation of the Leeward Islands, which for the Virgin Islands ended in the mid-sixteenth century when a concerted effort was made to clear the region of its indigenous inhabitants (Dookhan, 1974:28).

The first European visitors to the island were shipwrecked sailors, and evidence suggests that as early as thirty years after the naming of the Virgin group by Columbus, vessels were already falling afoul of the reef. In 1523, two Spanish vessels became the first recorded victims, as recorded in the following account taken from Blytmann, 1998.

> *Two merchant* [vessels], *sailing from Spain for Santo Domingo, one under the command of Capt. Francisco Vara, and the other under Capt. Diego Sanchez Colchero, were lost in the Virgin Islands. The location of Vara's ship was given as on some "shallows", but Colchero's was reported wrecked on the island of Anegada. After several days, Colchero was able to refloat his ship by having its cargo and anchors thrown overboard. Then, going two leagues away, they located Vara's wrecked ship but could save the men only*.

This report confirms that Anegada was recognised by the Spanish very soon after the island's European discovery. Its location at the head of the Anegada Passage would have been a source of concern to incoming sailors from Spain. This was reflected in the name given to the island, the literal translation of which is "waterlogged" or "overflowed," in other words, difficult to observe and a potential obstacle.

A Porcaccio map from 1588 names the Virgin Islands as a group but individually identifies "Anegado," confirming that the island was recognised by this name in Europe less than one hundred years after its European discovery. Of all the islands in the British Virgin Islands group, Anegada appears to be the only one whose name has remained unchanged for nearly five centuries.

European settlement appears sporadic, but by the early eighteenth century evidence suggests that the island provided a hideout for buccaneers such as Kirke and Bone, the latter having had a bay named after him on the northwest coast (Schomburgk 1832:153). Piracy was certainly an issue in the Virgin Islands, and adjacent Virgin Gorda was a notorious rendezvous for some famous buccaneers. Eventually, some pirates accepted one of the King's Pardon—amnesties issued during the early eighteenth century—and began to settle on Virgin Gorda and prey on ships that wrecked on the Anegada Shoals. Governor of the Leeward Islands, William Matthews, complained in 1734 that:

> *Whilst I was in England they pirated upon a Spanish ship wrecked on the Anegadas (as they always do on such occasions) and did such things to men of distinction and their ladies on board as I cannot without blushing recollect to myself, much less repeat to your Lordships. As for being under government they are out of all notion of that.* (National Archives, Calendar of State Papers, 1734-35, No. 22).

In order to discourage Virgin Gorda inhabitants from pursuing their piratical tendencies, harsh penalties were given to those who preyed on wrecked vessels. Alternatively, efforts were made by the authorities to encourage more humane attitudes by the salvagers with the promise of reward for less tyrannical practices. In this regard, Sir George Thomas, Governor of the Leeward Islands, wrote to the Lords of Trade and Plantations in 1758 as follows:

> *I some time ago gave your Lordships an account of the execution of Captain White and three of his accomplices* [for piracies on Spanish vessels, Spain being at peace with England]. *O'Neal, late one of the Magistrates of Spanish Town, who has been sometime in custody for receiving goods piratically taken by White, will be brought to his trial on Friday next. The want of evidence has delayed his trail but I believe we have now sufficient to convict him. These wholesome severities have produced very good effect on the people of that island* [Virgin Gorda], *for after having being used to plundering all wrecks, and sometimes to murder or maltreat the unhappy sufferers, especially Spaniards, they are become contented with a reasonable salvage. A Spanish ship with $48,000 on board and a valuable cargo of indigo and cocoa having been wrecked on the Anegada Shoals*, [I] *immediately sent orders to treat the Spaniards with humanity and to assist them in saving their goods; which were so well observed that the people worked upon the wreck*

at the peril of their lives, whilst the Spaniards looked indolently and fearfully on, and they have been contented with a third of $6000 and of the goods saved for salvage and have honestly restored the other two thirds to the Spaniards who were permitted to send the same to Puerto Rico (National Archives, Colonial Office Series 152/29, p. 51).

The regularity with which vessels foundered on Anegada's reefs eventually encouraged permanent settlement on the island, which began during the early 1780s. Although most of the land was considered infertile, areas were cultivable, drawing small-scale cotton planters who emerged as the first consistent inhabitants (Dookhan, 1975:47). However, population fluctuations did occur.

The absence of information relating to the island is consistent with the lack of interest by the British authorities in what was then considered an inconvenient obstacle in the Anegada Passage. Subsequent to the introduction of a Legislature in 1774, both Jost Van Dyke and Virgin Gorda were allowed to return an elected official to the Assembly, but Anegada was not individually represented, a political situation which has endured to the present. However, the essential absence of provincial support also allowed the inhabitants of Anegada a freedom to evolve culturally in ways that were different from the rest of the colony.

Whilst the opening of the nineteenth century witnessed considerable decline for the planters of Tortola, Anegada appears to have been affected little by the European wars which plagued the region. These wars resulted in the subsequent, irreversible collapse of the sugar industry and placed the rest of the Virgin Islands colony in dire economic decline.

In Anegada, the 1815 population included 12 white people, 14 free people of colour, and 115 slaves. Ninety acres of cotton were cultivated, producing an annual amount of 15,600 pounds, whilst the salt ponds were producing 4,200 bushels per annum. Livestock was represented by sheep, horned cattle, goats, pigs, and poultry, whilst mules and horses were employed for transport. The staple Anegadian industry of fishing was responsible for supplying some 154,336 pounds of fish during the same year, much of which would have found its way to markets in Tortola and St. Thomas.

Surprisingly, eight years later, in 1823, and in complete contradiction to the depletion of Europeans from other islands in the group, the white population of Anegada rose to 22, whilst the free black population had more than doubled to 29. Curiously, the slave population had decreased, suggesting that the sharp rise in the number of free people of colour may be accounted for by some of the slave population obtaining their freedom.

Hurricanes, which occasionally tore through the Leeward Islands, imbibed fearful scenes of desolation for the financially strapped planter class but, for Anegadians, these storms presented an opportunity to salvage wrecked vessels and considerably supplement their income. Wrecked vessels could also work against Anegadians who had few resources available to support the community.

This was dramatically illustrated on 3 September 1819, when a Portuguese slaver, the *Donna Paula*, became a complete wreck on the Horseshoe Reef. The disaster presented the inhabitants of Anegada with a situation akin to the extinction of their community because they were in no way capable of feeding the 235 slaves who came ashore starving and in poor medical health. In this case, the slaves were extracted from Anegada and sold in St. Thomas before the British Government could study the legalities of the situation.

Robert Hermann Schomburgk, a member of the Horticultural Society of Berlin, visited the island in 1831 and reported in an article in 1832 that although there was some agriculture practiced on Anegada:

The great object, however, always was, and still is the wreck of vessels, and the indolence of the inhabitants is only thoroughly roused by the cry of 'a vessel on the reef.' Then all are roused to activity; scarcely is the news announced, than boats of every description, shallops and sailing vessels, are pushed off with all haste to the scene of action; arms which have been idle for weeks are bought into exercise; and both skill and intrepidity are tasked to the uppermost to get first onboard. The scene, indeed, baffles description; and it is to be feared that few are attracted by motives of *humanity, though some such do exist; for the name of Mr. Gildersleve, in particular, must ever be mentioned with respect and gratitude by all who have visited, or have been driven on, Anegada.*

In an effort to diversify the economic activities of Anegadians and make them less reliant on the shipwrecks that still fell afoul of the reef, President H. Drummond Hay, the British representative in the colony, established an industrial school on the island in 1847. The school was strictly secular and taught students how to make basket-ware, straw hats, fish pots and other items that could find a ready market in St. Thomas. Gardening and fishing were also taught on the assumption that academic knowledge was going to be of little use to Anegadian children for their future but that more practical skills—relevant to the environment in which they were growing up and in which they would live for the rest of their lives—would be.

This foresight proved useful after 1868 when a lighthouse was erected on Sombrero Island near Anguilla, almost immediately abrogating the loss of vessels on the Anegada Shoals and thus denying the inhabitants of Anegada access to revenues which, however tragically appropriated, had always been a mainstay of the island's economy.

Even after the erection of the Sombrero Lighthouse, which undoubtedly created an economic strain for Anegadians, the population still grew quite dramatically. By 1897, there were 500 people recorded living on the island which, although extracted from an official British Government report, may be suspiciously high.

Commissioner N.G. Cookman provided some interesting observations about Anegadians in his report for 1897:

The people, though bearing an undesirable reputation, through their wrecking propensities in the days before the erection of the Sombrero lighthouse, are in reality an extremely intelligent race, both men and women being of finer physique than in the other islands; hospitable, religious, and law abiding, so far as the non-committal of crime goes; possessed of an accurate ear for music, remarkable voices, and, withal, industrious, they constitute an example of how difficult it is to get rid of a bad name once acquired; they are separated from the people of the other islands by as broad, or broader a line of demarcation as the population of the Presidency, as a whole, is separated in its characteristics from the people of the other Presidencies comprising the Leeward Islands.

The fishermen of Anegada are very expert turtle catchers which art they carry on by means of a net and wooden floats, cut to resemble a turtle in shape; these nets are sunk in the sea, sometimes a considerable distance from the coast, and the turtles seeing the imitation turtle floats, come to join them, and, getting entangled in the nets, are taken. This form of fishing is extremely remunerative; the turtles, according to kind, are sold either for the table or the shell, as much as eleven dollars being got for the shell of one large turtle (HMSO, 1898).

The opening of the twentieth century saw few changes on Anegada, which was still very much a rural community growing vine crops, burning charcoal, stock farming, rearing poultry, fishing and turtling (Faulkner, 2005:13). Whilst women occupied themselves raising families, Anegadian men were travelling to Santo Domingo (Dominican Republic) to work in the cane fields or sugar factories. In 1904, the Methodist school reopened with Simon Samuel Harrigan as Headmaster, guaranteeing that young Anegadian children received at least a smattering of education.

However, the colonial authorities were essentially ignoring the British Caribbean, viewed as an economic burden to the empire which concentrated on the wealth created by Africa and India. Politically, all power rested with the Governor of the Leeward Islands, who answered directly to the Secretary of State for the Colonies. Virgin Islanders at this time had no say in how their islands were governed, creating tension in the small Virgin Islands colony which by the 1940s was becoming more polarised. It was an Anegadian who finally had the courage to speak out against the British authorities and to direct the political landscape towards a more internally autonomous democracy.

Sometime in 1949, Anegadian resident Theodolph Faulkner was roused to action when his wife fell seriously ill. A request to the Commissioner to send the Government launch in order to transport Mrs. Faulkner to the hospital on Tortola went unheeded, angering Faulkner. He consequently protested his concern about the lack of representation for Virgin Islanders and instigated a number of meetings which subsequently led to the “March of 1949” when 1,500 people peacefully protested and presented the Commissioner with a petition for more influence by Virgin Islanders in local matters. A year later, the Legislative Council was re-introduced for the first time in 97 years. It had taken an Anegadian from the most remote Virgin Island to facilitate this change.

Just eighteen years later, the inhabitants of Anegada, and their government in Tortola, were nearly hoodwinked into a development agreement that would have essentially deprived many Anegadians of their land and potential future incomes. In 1967, an English firm, the Bates-Hill Corporation, began negotiating with the BVI government to lease a large proportion of Anegada for development. Initially, Anegadians were favourable to the concept, seeing an opportunity to develop a fledgling tourist industry which would enrich the island and local community.

Eventually, an agreement was signed that would have permitted the Anegada Development Corporation to lease nine-tenths of the island for 199 years (for a further discussion, see also Chapter 2, Section 2.2.6.1). However, a closer examination of the agreement revealed that Anegadians would essentially become third-class citizens on their own island, and objections were raised. The Government, after constituents on both Anegada and Tortola raised heated objections to the plan, backed out of the agreement, and the project collapsed. Nevertheless, the episode had illustrated for Anegadians the development possibilities for their island within a modern Caribbean tourism framework.

The 1970s saw the opening of tourist accommodations like Neptune’s Treasure and the Anegada Reef Hotel, the latter built on the hotel property abandoned by the aborted Bates-Hill development scheme. During the 1980s and 1990s, other facilities like restaurant/bar establishments opened their doors to a growing number of charter boat guests who were visiting the BVI and sailing to Anegada. A small airport was constructed and overnight accommodations were available to attract land-based guests. Today plans are underway for the revitalisation of the former Sands Hotel at Cow Wreck Bay as a luxury property with refurbished accommodations. This site is scheduled to open in 2013 as the Anegada Beach Club.

While the tourism industry has not grown as fast or as expansively as some Anegadians wish, most of Anegada’s families to some degree are involved in the tourism business. What was once an island inhabited only because of the shipwrecks which regularly occurred on surrounding reefs has now become a community dedicated to accommodating visitors seeking a tranquil, off-the-beaten-path Caribbean island.

2. THE INSTITUTIONAL ENVIRONMENT

2.1 Land Ownership in Anegada

2.1.1 Background

Land tenure is the single governance issue that has for more than a century dominated how Anegadians feel about themselves and their island home and about their relationship with the central government in Tortola and, historically, with the British government in the UK.

Along with the island's relative isolation and underdevelopment, the issue of land ownership has also disconnected Anegada from the other Virgin Islands. According to Dookhan (1975), land ownership in the BVI—apart from Anegada—was largely settled almost 150 years ago through legislative action. Not so in Anegada, where a pattern of common ownership of land has prevailed, dating back to a popular assumption that Queen Victoria had given title to the island to the people of Anegada. This claim allowed Anegadians for generations to use the island in common, with plots of land held by families and handed down to future generations without disturbance, but with the greater part of the island regarded as common property.

The basis of the Anegadian claims can be found in a determination of the British Government in 1859 that if title to land in Anegada was in dispute, the right of the Crown to these lands should be waived in favor of those who claimed title (Dookhan, 1975). But it was not until 1885 that an Anegada Ordinance (No. 3 of 1885) was enacted giving title of land to persons who had occupied it for ten years or invested considerable sums in the improvement of the land. Unoccupied land continued to be used in common.

However, in the decades that followed, the process for obtaining land titles as outlined in the 1885 Ordinance was not utilised by Anegadians or any others (perhaps because the land had little value throughout the early-to-mid twentieth century), and thus land tenure issues were largely ignored for another 76 years. In 1961, a new Ordinance (Anegada Ordinance, Cap. 146 of the Revised Laws of the Virgin Islands) repealed the 1885 Ordinance and declared the island Crown Land. The 1961 Ordinance also designated a village area, known as The Settlement, where one-half to one acre plots of land could be granted to Anegadians as defined by the law, and permitted other lands to be reserved for cultivation and grazing. The unallocated lands (which encompassed most of the island) were to be held in trust for Anegadians but could be leased for development. According to Varlack and Harrigan (1971), the Ordinance meant little in practical terms.

Based on the authority granted in the 1961 Ordinance, the island was leased for the aborted "Bates project" in 1967 (see below, Section 2.2.6.1). The lease was eventually cancelled, and the 1961 Anegada Ordinance was repealed in 1973, although title to the island remained with the Crown.

In 1987, John Douglas Barrymore Renwick, Q.C., was appointed as a one-person Commission of Inquiry (Anegada Land Commission) by the British Governor of the Virgin Islands. Renwick was directed to hold an enquiry into the ownership and disposition of lands on Anegada. The Commission's subsequent report (1988) (known as the "Renwick Report") held that title to land in Anegada was governed solely by the Land Adjudication Ordinance, 1970 and the Registered Land Ordinance, 1970, and provided in an Appendix a list of those land titles then registered for Anegada.

The Report also recommended:

- that a land use plan for Anegada be prepared to indicate areas designated for development and those proposed to be set aside for conservation;
- that surviving "walls" (see Chapter 6, Section 6.2) be vested in their owners where it was possible to identify the owners and wall boundaries;

- that an Advisory Development Committee be appointed which might evolve into a form of local government; and
- that incentives be provided for developers who are Anegadians.

Left unresolved was the identification of a formal process for granting lands to Anegadians, a clarification of who was to be regarded as Anegadian with a legitimate land claim, and what was to be done about the claims of returning Anegadians or Anegadians living outside Anegada.

A decade after Renwick's Report, anthropologist Dr. Michael Downs, carrying out a community assessment in Anegada, pointed out that some crown lands had been leased and some land titles granted. But some development was also taking place in the absence of clear title or lease, based on an assumption that if a certain minimal level of consensus was reached locally, an individual could develop land without first obtaining title (Downs, 1997), which is exactly the long-held belief of Anegadians—namely, that the island is held in common for Anegadians.

2.1.2 Current Policy for Land Allocation in Anegada

The most recent effort to resolve the Anegada land issue has been spearheaded by the Ministry of Natural Resources and Labour in collaboration with the Department of Lands and Survey and the Department of Town and Country Planning. Since 2001, the Anegada Lands Committee has provided recommendations for the settlement of claims, with the Government initially (2003) concentrating land settlements in the area of the airport, taking into account proposed airport expansion. Claimants had the option of being compensated in money, lands, or both.

A development plan for the allocation of lands in Anegada was prepared in 2007 by the Ministry and the two collaborating departments (MNRL, 2007). The plan recognises that Anegadians have long lacked proper title to lands they occupy or claim and that the Government is committed to resolving the long-standing issues regarding these lands. The plan provides for the streamlining of land distribution on the island and also supports a planned development approach to the growth of the island.

Land use is designated in the plan for both commercial and residential purposes, as well as for hotel development, agriculture, community parks and recreational areas, a business district, protected areas, and government offices and related facilities (*e.g.*, educational, medical) (**Figure 5**). Three subdivisions have been designated: East End, West End, and North Airport.

For further discussion, please refer to Section 2.2.6.3 of this chapter.

2.1.3 The Impact of the Land Issue

One consequence of the still unresolved land tenure controversy has been to create a strained relationship between Anegadians and the rest of the Virgin Islands, including the territorial government in Tortola. This often difficult relationship has historically focused on the issue of land status, which, to the present, continues to influence and even overshadow how the people of Anegada feel about and interact with their government.

As noted in the Jost Van Dyke and the Virgin Gorda Environmental Profiles, the relationship of the central government and the sister islands has—perhaps inevitably—been characterised by:

- a belief by the sister islands that their interests have been neglected and
- an assumption by the sister islands of inequity in the distribution of public resources and services.

However, in Anegada, these stress lines have been intensified because of the land status issue.

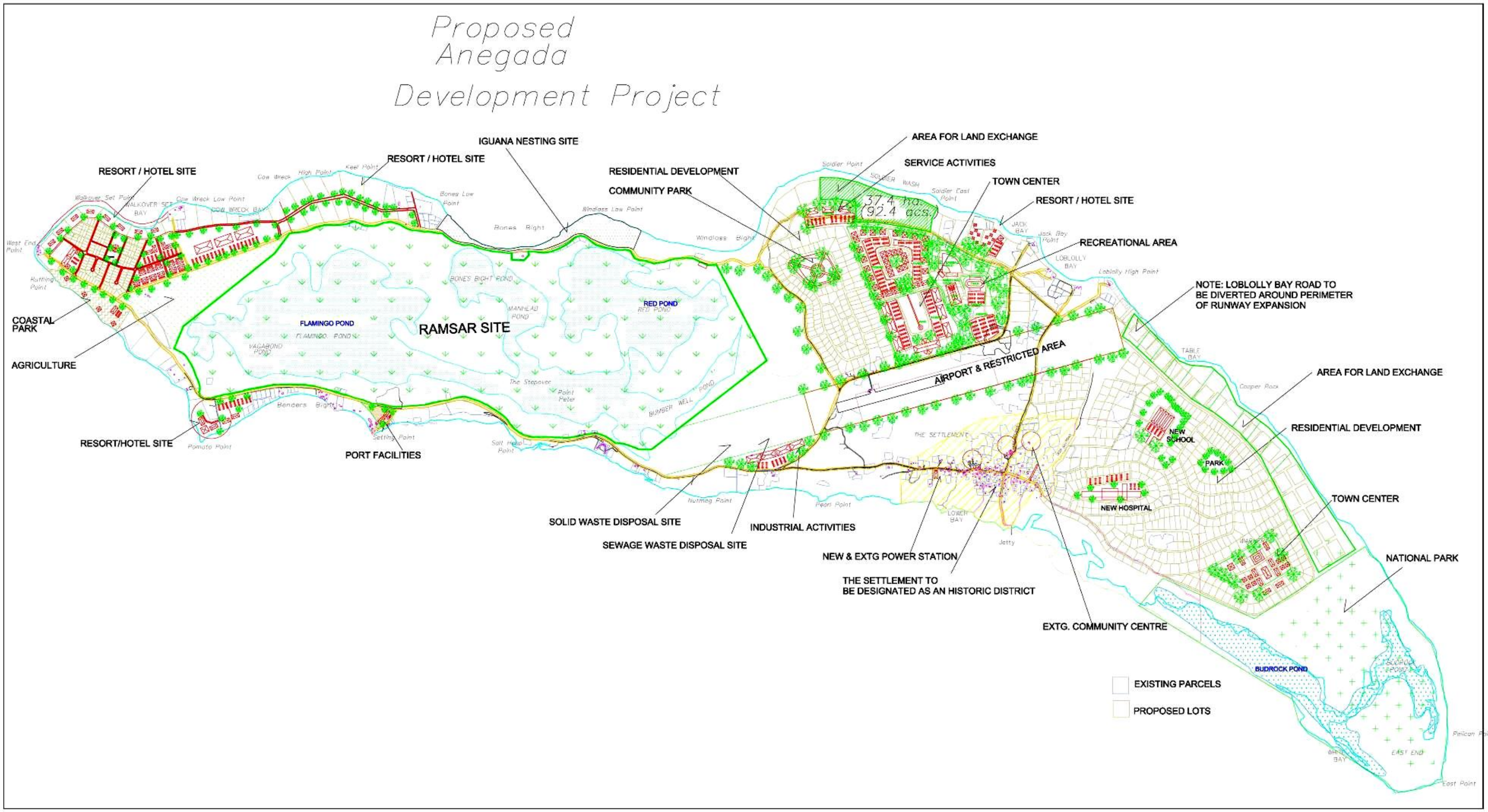


Figure 5.
Overall land use development plan for Anegada (MNR&L, 2007).

Two anthropologists writing about Anegada (Koester, 1987 and Downs, 1997) have noted an added dimension to the Anegada/central government dichotomy. Koester suggests that not only do Anegadians feel they are entitled to the land they and their ancestors have traditionally used, but Anegadians also recognise that by gaining title to land, they also gain a measure of control over development and the future of their island. In other words, Anegadians equate land status with control.

Downs points out that when he was writing in 1997 strong negative feelings toward the central government still persisted from the era of the aborted Bates development project (see Section 2.2.6.1), which at the time of Downs's writing was some 30 years in the past. The bitterness of the Bates fiasco continued to linger among residents, meaning that central government planning for the island already has sizeable obstacles to overcome before meeting favour with local Anegadians.

2.2 The Public Sector

2.2.1 Government Structure

The British have maintained sovereignty in the BVI since 1672, although initially the colony was not one of Great Britain's more profitable overseas enterprises. As a British colony, the BVI was administered as part of the Leeward Islands Colony from 1872 to 1956, at which time British colonial rule in the Caribbean began to break up and the Leeward Islands Colony was dissolved.

Constitutional reform in 1967 established the BVI as a British Dependent Territory (now named Overseas Territory), with a locally elected legislature and chief minister. The U.S. dollar was also established as the official national tender.

As a British Territory, the BVI Head of State is the British Monarch, represented locally by a Crown-appointed Governor who is responsible for external affairs, internal security, defence, and the public service. The BVI also enjoys a high level of self-government, based on a Westminster Parliamentary model of government. A new Constitution Order (2007) further defined the political relationship between the United Kingdom and the BVI.

The legislative functions of government reside in a 13-member, elected House of Assembly (replacing the Legislative Council in 2007). The Cabinet (replacing the Executive Council in 2007) is charged with the general management of Government and is collectively responsible to the House of Assembly. The Premier (replacing the office of Chief Minister in 2007) is appointed by the Governor from the elected members of the House, as are the other four ministers of government. There are at present six ministries, or portfolios, for the following: Premier, Finance, Natural Resources and Labour, Health and Social Development, Education and Culture, and Communications and Works.

2.2.2 Sister Islands Programme

The Sister Islands Programme was established in 2003 as part of the Deputy Governor's Office to monitor, promote and facilitate the delivery of Government services to the sister islands of Virgin Gorda, Anegada, and Jost Van Dyke. To achieve that objective, a Sister Islands Programme Coordinator works with and supervises District Officers on each of the three sister islands. The Coordinator serves, in effect, as a liaison from the central government to the sister islands through the District Officers on each island.

The primary function of Anegada's District Officer is to coordinate governmental activities on the island and serve as a focal point for official inquiries from residents to the central authorities in Tortola. The officer is the liaison between the community and the central government, and the community looks to that person to get things done, to know the right people in government, and to point residents in the right direction when they have matters before the central government. As such, it is also the responsibility of the District Officer to be up to date on island news and activities and to be able to appropriately report to the Government in Tortola (*pers. comm*., Andrea Vanterpool, District Officer, 19 September 2012).

The relationship between the administrative centre of government in Tortola and the sister islands can be intermittently strained. A recent news item on the subject (www.virginislandsnewsonline.com, 5 July 2012) quoted residents of the sister islands referring to themselves and their treatment by the central authorities as: "orphans of the VI," "the forgotten," "left for last in everything," and "always on the back burner." As an example, inconsistent access by Anegadians to telephone and internet communication is one factor that will continue to distance Anegada from the rest of the BVI, as the profile project team discovered in trying to maintain regular contact with the District Office.

Periodically, the residents of the two smallest sister islands, Jost Van Dyke and Anegada, have called for the formation of their own district and the right to vote for their own district representative. The argument put forward is that only an island-born and island-resident representative can truly understand and care for the needs of each of the two sister islands and that such a person would therefore be a better legislative representative.

One Anegadian, Jerry Vanterpool, pointed out in the online news article that the absence of an island-specific representative was particularly unfair for Anegada since it was an Anegadian, T.H. Faulkner, who, in 1949, was instrumental in introducing the ministerial form of government to the Virgin Islands, and now this very model was not serving the people of Anegada well.

A Constituency Boundaries Commission was established by the former Government in 2009 to study the issue of separate districts for Anegada and Jost Van Dyke; a report was subsequently issued, but no further action taken.

The stress lines in the relationship between Tortola and Anegada will likely continue to be a dynamic in the social and economic development of the latter, even as Anegadians assess their future options both for economic expansion and environmental protection.

2.2.3 Environmental Units of Government

The notion that the "environment," broadly speaking, is government's business is not disputed in the small islands of the Eastern Caribbean, including the British Virgin Islands. Government control of Crown Lands, public health, ports, harbours, and aspects of forestry and fishing, for example, is generally recognised.

While the idea of government as guardian of selected environmental resources is not new, what is new is the idea of government coordinating various units of government into a coherent resource management strategy *and* system designed to improve efficiencies, reduce risks, and minimise adverse impacts on the environment.

How these new directions and responsibilities are being executed in the British Virgin Islands is the subject of this chapter of the Environmental Profile.

While overall responsibility for the environment in the BVI resides within the **MINISTRY OF NATURAL RESOURCES AND LABOUR** (MNRL), there are other units of government that also have responsibilities related to the environment. These include:

- **DEPARTMENT OF TOWN AND COUNTRY PLANNING**, within the Premier's Office, responsible for physical development planning and development control functions.
- **DEPARTMENT OF DISASTER MANAGEMENT**, within the Deputy Governor's Office, the coordinating agency for the territory in preparing for, responding to, and recovering from natural and other disasters.
- **MINISTRY OF HEALTH AND SOCIAL DEVELOPMENT**, with responsibility for environmental health and waste management dis-

charged through the Division of Environmental Health and the Department of Waste Management.

- **TOURIST BOARD**, a part of the portfolio of the Premier with responsibility for development of the tourism, an economic sector which relies upon the attractiveness and healthy state of the territory's natural features and amenities.

- **MINISTRY OF COMMUNICATIONS AND WORKS** with responsibility for the BVI Electricity Corporation and for the enabling legislation that currently directs energy policy in the territory.

However, it is the Ministry of Natural Resources and Labour that carries primary responsibility for the Territory's environmental resources. Within the Ministry, three agencies execute specific responsibility for the management and protection of the environment:

1. **DEPARTMENT OF CONSERVATION AND FISHERIES**
2. **NATIONAL PARKS TRUST**
3. **DEPARTMENT OF AGRICULTURE**.

These agencies are discussed in the sub-sections that follow, and a summary of BVI public agencies currently charged with primary responsibilities for the management and protection of the environment is provided in **Table 4**.

2.2.3.1 Department of Conservation and Fisheries (DCF)

The Department of Conservation and Fisheries was created in 1991 from the merging of a recently created Conservation Office (1989) with the established Fisheries Division to create the new department within the Ministry of Natural Resources and Labour. The department's broadly based mandate is to manage the natural resources of the territory in a sustainable manner.

At present, the department carries out its responsibilities within five functional divisions (see www.bvidcf.org):

- administration and human resources;
- coastal zone management;
- policy and planning;
- environmental information; and
- fisheries management.

Current activities of the department focus on: environmental education; environmental information management (including resource mapping); and environmental monitoring (although much of the latter, such as monitoring BVI coastal waters, is in response to site-specific problems or incidences rather than as a part of a standardised, formal monitoring regime).

As structured, the department has a strong *resource* ***conservation*** *mandate* to protect the natural resources of the BVI. For example, at present, the DCF manages 14 protected areas, all fisheries reserves, only one of which is designated for Anegada—Horseshoe Reef (see also Chapter 8, Section 8.2.1).

The Department carries out an equally compelling *resource* ***development*** *mandate* in the area of fisheries development. A recent report (2011) from the BVI Fishing Complex stated that government's role in achieving a united fishing industry with the support and cooperation of local fishermen requires that more attention be placed on developing the industry's infrastructure and unifying local fishermen. The latter could best be achieved, according to the report, by reestablishing a Fisheries Advisory Committee.

Much of the DCF's focus has traditionally been on the coastal and marine environment. In 2008, the Department published the first edition of its *Marine Awareness Guide*, with a second edition released three years later. Through photos and documentation, this impressive publication brought to life a marine world with which many residents and visitors were not familiar. It focuses not only on the species and habitats of the marine environment, but also on safety and danger issues for resource users, plus conservation concerns and existing laws (Gore, S., 2008 and 2011).

With the exception of the Fisheries Act (1997), the department's legislative mandate is relatively weak as many extant laws supporting its regulatory and resource protection functions are outdated (*e.g.*, the Wild Birds Protection Ordinance of 1959/1980, the Turtles Ordinance of 1959, and the Beach Protection Act of 1985). Existing legislation on endangered flora and fauna mostly comprises species lists related to trade, possession, and removal, not biodiversity conservation and habitat protection. Additionally, environmental standards, such as those for water quality monitoring, have not been formalised in law and are therefore only informally administered.

2.2.3.2 National Parks Trust (NPT)

Unlike the DCF, the Trust is a statutory body, established by legislative authority in 1961 and governed by a minister-appointed board. The Trust's long-standing mission has been to preserve and manage designated natural and cultural areas in the BVI. It is currently responsible for the territory's Protected Areas System Plan (Gardner, L., *et al.*, 2008) and for management of the 21 sites falling under its jurisdiction (www.bvinationalparkstrust.org). In 2011, the NTP celebrated its Fiftieth Anniversary, an impressive record for a small island territory.

The protected areas of the BVI encompass a wide variety of sites, many of which were designated under legislation other than the National Parks Act, *e.g.*, the Wild Birds Protection Ordinance (1959), the Protection of Trees and Conservation of Soil and Water Ordinance (1954), and the Fisheries Act (1997). The overlapping jurisdictions are discussed in more detail in the BVI Protected Areas System Plan 2007-2017 (www.bvinationalparkstrust.org/downloads/NPT_Protected-Area-System-Plan-2008.pdf).

In the Government-approved Protected Areas System Plan, 2007-2017, the Trust has designated additional areas of national significance that are proposed for incorporation within the protected areas system (see Chapter 8, **Table 20** for identification of proposed sites in Anegada).

Given the geographical distance separating park sites, including large expanses of open sea, the NPT's responsibilities for existing protected areas are substantial, particularly when juxtaposed with the limited resources available to the park system to manage and protect sites; preserve biodiversity; provide recreational opportunities; enforce rules and regulations; maintain a publically accessible, territory-wide mooring system to protect marine resources; and self-fund its activities as the government's annual subvention to the Trust is likely to end in the near-term.

2.2.3.3 Department of Agriculture (DOA)

In addition to its primary mission to develop the agricultural sector, the department is also mandated to designate and manage areas for the protection of watersheds and water sources and prevention of deforestation. Seven such protected areas are currently under the authority of the Department, but none on the island of Anegada.

2.2.3.4 Department of Town and Country Planning (DTCP)

External to the Ministry of Natural Resources and Labour, the Department of Town and Country Planning (within the Office of the Premier) exercises considerable responsibility for the environment, including: physical development planning, land use planning, environmental impact assessment (EIA), protection of critical natural and historical resources through designation of environmental protection areas (EPAs), and coordination of the National Geographical Information System (NGIS).

In October of 2012, a new planning database was officially handed over from the Caribbean Disaster Emergency Management Agency and the BVI Department of Disaster Management to the Premier's Office and the Department of Town and Country Planning. The database provides for the collection and monitoring of all development applications by linking government departments involved in the review of development proposals, while also allowing developers and individual applicants to track their proposals in real time.

The DTCP and an *ad hoc* inter-agency planning review committee screen all applications for land development in the Territory (whether commercial or private) before forwarding them to the Planning

Authority for a final decision.* Part of the screening process is to determine whether a proposed development will require an environmental impact assessment. Applications requiring an EIA go through a more detailed approval process, including development of an environmental management plan to guide oversight and monitoring of approved projects. The implementation of both processes—EIAs and environmental monitoring—are the responsibility of the Town and Country Planning Department.

The Planning Authority (a statutory body within the Premier's Office established by the Physical Planning Act of 2004) comprises representatives from several government agencies (including the Chief Planner, Chief Conservation and Fisheries Officer, and the directors of Public Works and Disaster Management) and appointed stakeholders from the private sector with knowledge and experience relevant to physical planning. It is the final authority for approval of development applications, with the exception of tourism projects valued at over ten million dollars, in which case the Premier has the ultimate authority.

The BVI's development control process is now regulated under the Physical Planning Act (2004) (see section 2.2.4.2). This legislation also provides provisions related to protecting environmental, historic, and cultural values and resources. As such, the DTCP has worked collaboratively with other government sectors, for example, to produce a Wetlands Management Plan for the BVI. This was drafted in 2005, although it has not yet been finalised or formally approved.

Provisions of the Act also provide for the designation of environmental protection areas (EPAs) by the department, although "protected areas" are usually designated by the DCF and the NPT. DTCP does not currently have a process in place for designating EPAs and, if employed in the future, the department would do so as part of the review phase for individual development applications.

The department has drafted a number of area development plans for the Territory, although none has been formally approved. In Anegada, an "area action plan" was prepared for Setting Point (2009), which is only a draft, and no action has been taken on it to date (*pers. comm.*, Adrun Benjamin, Physical Planner, DTCP, 12 July 2012).

The Department of Town and Country Planning is also responsible for physical development planning for the Territory as a whole. The most recent national Physical Development Plan was drafted by TCPD in 2006, but, like its predecessors, it has not been adopted by Government (see Section 2.2.6 for a discussion of physical planning for Anegada).

2.2.3.5 Department of Disaster Management (DDM)

The Department of Disaster Management originated under the legal authority of the Deputy Governor's Office in 1983 and became an independent department in 1990. It serves as the coordinating agency to mobilise the Territory—including all sectors of government and civil society—in planning for and responding to hazards of all kind. The department seeks to ensure that adequate preparedness planning, mitigation measures, and response-and-recovery mechanisms are in place to counteract the impact of natural and technological hazards (www.bviddm.com).

The Governor of the BVI has overall responsibility for disaster management, serves as Chair of the National Disaster Management Council, and has primary responsibility for pre-disaster and disaster-response activities. The Premier serves as Deputy Chair of the Council and is primarily responsible for recovery activities.

A National Disaster Development Plan (NDDP) was initially approved by the Executive Council (renamed Cabinet) in 1997. It was updated and approved in 2009, and now includes hazard indices and a new disaster organisational structure. Additionally, assessing hazard potential has been in-

* Development of Crown Lands or the seabed falls under the jurisdiction of the Ministry of Natural Resources and Labour. Application is made to the Ministry, which will generally require inclusion of an "environmental assessment." Decisions are made by Cabinet on applications forwarded to it by the Minister. A Technical Review Committee assists the Ministry in reviewing applications.

corporated by the DDM in the development review process, but such assessments, coupled with the identification of vulnerability reduction strategies, are usually only carried out for private sector development projects.

The legislative authority for the department is the Disaster Management Act (2003), which is currently before the House of Assembly in a revised and updated version. Regulations in support of the Act are being drafted and will be sent to Cabinet upon passage of the Act. The new legislation provides for streamlining comprehensive disaster management in the territory, improved emergency response by government, and enhanced governance (*pers. comm*., Sharleen DaBreo, Director of Disaster Management, 11 October 2012).

Anegada was selected in 2010 as a pilot site for community interventions under a regional programme funded by the European Union and executed regionally by the Caribbean Disaster Emergency Management Agency (CDEMA) and locally by the DDM. The project for Anegada is focused on enhancing the safety of human populations by reducing the social, economic and environmental costs of natural disasters. (See Chapter 3, Sections 3.1.2 and 3.3.2 for details.)

2.2.3.6 Ministry of Health and Social Development

Two units of government within the Ministry of Health and Social Development have environment-related responsibilities: the Department of Waste Management (formally the Department of Solid Waste) with responsibility for solid waste (see also Chapter 7, Section 7.1) and the Division of Environmental Health with responsibility for environmental pollution control as related to public health.

Under the Public Health Ordinance (1967), regulations were authorised to prevent, abate, and control environmental pollution. However, the Division of Environmental Health is hindered in addressing these issues because this ordinance is so outdated, while the regulations authorised in the legislation were never enacted.

This means that major environmental health issues such as groundwater pollution, the disposal of hazardous materials, the discharge of untreated sewage into coastal waters, or harmful waste management practices cannot at the present time be fully regulated. Like the Department of Conservation and Fisheries, which is hampered in effectively monitoring coastal waters because of the lack of approved water quality standards, the Division of Environmental Health is also hampered by the lack of legislated environmental health standards. The Division's 2011 Annual Report indicates that it has long relied on the employment of contract officers and that this will continue without greater proficiency in recruiting and training BVI nationals in the field of environmental health.

2.2.3.7 Tourist Board

The mandate of the Tourist Board is laid out in the BVI Tourist Board Ordinance (1969), which divides the Board's role into two functional areas: (1) marketing and (2) product development and quality assurance. According to the most recent Tourism Development Strategy (Coopers & Lybrand, 1996), marketing has been the dominant activity of the Board, taking precedence over other functions.

A recent commitment by the Tourist Board to the environment is its "green tourism" programme, called STEP, to promote environmentally friendly initiatives in the industry. Among other strategies, the Sustainable Tourism Environmental Programme (STEP) promotes the international environmental certification of pilot properties in the BVI, none of which are in Anegada.

The BVI Protected Areas System Plan, 2007-2017 (see Section 2.2.5.6) calls for a more structured relationship and lines of coordination between the development of tourism (via the Tourist Board) and the promotion of parks and other protected areas (via the National Parks Trust). Since approval of the System Plan in 2008, a more formal approach to promoting protected areas in tourism planning has not yet officially been put in place.

In April of 2012, Government appointed a Tourism Liaison Officer within the Premier's Office, who is tasked with responsibility for the review and development of tourism policy, while the Tourist Board will continue to focus on tourism marketing. The new post within the Premier's office is a cross-ministry position and will allow the officer to work with other Government ministries in tourism-related areas.

2.2.3.8 Ministry of Communications and Works

The BVI Electricity Corporation (BVIEC) is a statutory body under the Ministry of Communications and Works charged with the exclusive right to generate electrical power in the Territory. The Electricity Ordinance dates from 1970 and has recently been the target of efforts to effect its revision and thereby to encourage the development of renewable energy in the Virgin Islands.

Elsewhere in the Caribbean, and certainly at a global level, the green energy movement has attracted growing support for renewable energy sources. In the British Virgin Islands, a number of private businesses and resorts have experimented with non-fossil-fuel sources of energy such as solar and wind, but only as a backup or secondary source to the electricity provided by the Electricity Corporation.

In the BVI, a virtual monopoly on the production of energy has been granted to the Electricity Corporation and prevents the provision of renewable energy as a primary power source in areas served by the BVIEC. As currently structured, the law supports the interests of the Corporation with regard to the generation and supply of electricity, while renewable sources of energy, such as solar or wind power, are not supported under the law. It is a case of legislative authority not keeping pace with technological advances.

The current Government of the BVI has recognised this inadequacy in the territory's energy policy and legislation and has pledged to encourage development of alternative energy approaches through a revision of the outdated legislation.

Early in 2012, the Minister of Natural Resources and Labour recommended a phased-in approach to the introduction of alternative energy in the Virgin Islands by first making renewal energy available to the island of Anegada as a case study for the rest of the territory (Pickering, 2012). According to the Minister, data collected from Anegada, with its closed energy system, could be studied, modified, and replicated on other islands in the BVI.

Table 4.
The primary environmental units of the BVI Government.

UNIT OF GOVERNMENT	ENVIRONMENTAL RESPONSIBILITIES
MINISTRY OF NATURAL RESOURCES AND LABOUR	• Environmental policy and international environment agreements. • Management of Crown Lands and the seabed. • Climate change and global warming. • Alternative energy.
DEPARTMENT OF CONSERVATION AND FISHERIES ***(Ministry of Natural Resources and Labour)***	• Wildlife protection. • Water quality monitoring of inshore waters. • Inventory and monitoring of beaches, coral reefs, mangroves, seagrass beds, including resource mapping. • Beach maintenance (especially heavily used beaches) and beach surveillance (to prevent sand removal). • Biodiversity conservation and research. • Management of designated Fisheries Protected Areas. • Promotion of fisheries development. • Promotion of environmental education and public awareness programmes.
NATIONAL PARKS TRUST ***(Ministry of Natural Resources and Labour)***	• Management of designated parks and protected areas. • Implementation of the BVI's Protected Areas System Plan. • Leadership for identifying and incorporating new sites within the BVI's Protected Areas System. • Biodiversity conservation and research within protected areas under its jurisdiction. • Management of a system of moorings for the protection of coral reefs. • Promotion of environmental education and public awareness programmes.
DEPARTMENT OF TOWN AND COUNTRY PLANNING ***(Office of the Premier)***	• Responsible for physical development planning and for preparation of national physical development plans. • Authority to designate Environmental Protection Areas in development plans. • Screening and review of environmental impact assessments for proposed development projects. • Compilation of a list of buildings or sites in the Territory that are of special interest, for the purpose of determining buildings that should be preserved or protected. • Issuance of plant preservation orders for the purpose of protecting plants or plant species designated for preservation. • Preparation of area development plans. • Coordination of the Territory's National Geographical Information System.
DEPARTMENT OF DISASTER MANAGEMENT ***(Office of the Deputy Governor)***	• Coordinating agency for the Territory to prepare for, respond to, and recover from natural and other disasters.
DEPARTMENT OF WASTE MANAGEMENT ***(Ministry of Health and Social Development)***	• Responsibility for the management of solid waste (see also Chapter 7, Section 7.1).
DIVISION OF ENVIRONMENTAL HEALTH ***(Ministry of Health and Social Development)***	• Responsibility for environmental pollution control under the Public Health Ordinance.
TOURIST BOARD ***(Office of the Premier)***	• Responsibility for development and marketing of tourism, including promotion of the BVI's landscape features, environmental amenities, and parks and protected areas.

2.2.4 Environmental Legislation

A number of BVI legal and regulatory instruments are related to the protection and management of the environment. These are outlined in **Table 5** along with certain global treaties and regional agreements that pertain to the BVI. Three fairly recently enacted laws are of particular relevance:

1. **FISHERIES ACT (1997), REGULATIONS (2003)**
2. **PHYSICAL PLANNING ACT (2004)**
3. **NATIONAL PARKS ACT (2006), REGULATIONS (2008)**.

2.2.4.1 Fisheries Act (1997) and Regulations (2003)

The purpose of this legislation is to make provision for the promotion, management and conservation of fisheries resources in the Territory. The Department of Conservation and Fisheries within the Ministry of Natural Resources and Labour (see Section 2.2.3.1) is the principal agency responsible for implementation of the Act.

The legislation authorises actions with respect to the conservation of fish and protection of the marine environment. Under the Act, the Minister may authorise marine protection zones, and, pursuant to the Act, 14 fisheries protected areas were declared under the 2003 Regulations, one of which is associated with the island of Anegada, the Horseshoe Reef Fisheries Protected Area.

In August 2011, a ruling by the Court of Appeal of the Eastern Caribbean Supreme Court effectively invalidated the fisheries protected areas system established under the Fisheries Act and the Regulations thereto. In the case of Quorum Island (BVI) Limited and the Virgin Islands Environmental Council and the Minister of Planning (HCVAP 2009/021), it was found that protected areas established under the Fisheries Regulations (2003) had not been correctly declared. Since the ruling, the Regulations have been under review to ensure that the process for declaring Fisheries Protected Areas is valid. The claimant in the court case, the Virgin Islands Environmental Council, has pointed out that "the ruling undermines confidence in legislation for environmental protection in the BVI" (*www.bviplatinum.com*, 17 August 2011). Environmentalists and others in the territory have called for revision of the Fisheries Regulations and the re-designation of the 14 fisheries protected areas, including the Horseshoe Reef Fisheries Protected Area in Anegada.

Under the Fisheries Act, the Minister also has broad authority to take measures to prevent, reduce and control pollution of fishery waters and the marine environment from any source, including measures to minimise the release of toxic, harmful or noxious substances from land-based sources.

The Act also authorises the Minister to declare by Order any type of fish as a "protected species," for a defined period of time or a specific protected area. Pursuant to this authority, the Fisheries Regulations prohibit disturbing or interfering with turtle eggs, turtle nests, and any turtle that is nesting.

2.2.4.2 Physical Planning Act (2004)

The Physical Planning Act, No. 15 of 2004 (enacted in March 2005), provides for the orderly development of land in the Territory. The responsible minister is the minister for physical planning, currently the Premier, under whose portfolio the Department of Town and Country Planning is assigned (see Section 2.2.3.4). The Act calls for the establishment of a statutory body, the Planning Authority. This body has the ultimate authority to approve development projects with the exception of tourism projects valued at over ten million dollars, in which case the minister's decision shall prevail.

The Physical Planning Act governs the environmental impact assessment (EIA) process for development activities in the Territory, including future development projects on the island of Anegada. Schedule 3 outlines the circumstances that will require an EIA, and, pursuant to the Act, the DTCP has designed an Environmental Screening Form to be submitted with development applications. The form requires sufficient information for the department to determine if an EIA will be required and, if so, what level of EIA is necessary. A Hazard Vulnerability Assessment is also required.

Additionally, the department has developed a matrix outlining the development application process with step-by-step procedures and a timeline.

At present, no Regulations to the Act have been issued, but a contract for the drafting of such Regulations was issued in 2012. Uniform controls and regulatory procedures to be provided in the forthcoming Regulations are necessary to guide all parties—public and private—when taking action under the Act. The Government has also recently pledged to strengthen the Act by introducing requisite regulations to replace the Land Development Control Guidelines (1972) and to address procedures for environmental impact assessments, the regulation of land sub-division, and the preservation of buildings and other important sites (Speech from the Throne delivered by His Excellency the Governor Mr. Boyd McCleary, 8 December 2011).

One area that needs to be reinforced in the Regulations is the applicability of the EIA requirement for government-sponsored projects as well as those in the private sector. The Act binds the Crown and therefore, intrinsically, all development activity—whether public or private—is subject to the same requirements. The environmental profile research team has not been able to determine whether EIAs were required for recent beach replenishment projects on Anegada (see Chapter 3, Section 3.1.2), although it seems likely that EIAs were not provided.

Like most small places, the BVI cannot afford the consequences and costs associated with inopportune planning decisions and the failure to assert sound development control. It can be argued that the importance of planning decisions is inversely related to a country's size—primarily because there is so little margin for error (Towle, 1991). This is why the promulgation and implementation of Regulations to the BVI's Physical Planning Act can no longer be delayed.

2.2.4.3 National Parks Act (2006) and Regulations (2008)

The BVI's new National Parks Act and Regulations provide a forward-looking framework for protected area management in the Territory. The new legislation updated the original National Parks Act of 1961, which established the National Parks Trust as a statutory body to manage parks and protected areas in the BVI (see Section 2.2.3.2).

The legislation incorporates modern concepts of protected area management, including an internationally recognised system of categories for designating protected areas (see Chapter 8, Section 8.1). The Act also incorporates provisions of international conventions to which the BVI is a party, such as the Convention on Biological Diversity (see Table 5).

The Act strengthens enforcement provisions and updates penalties. It also promotes environmental assessments of proposed development activities that occur outside designated parks but may impact the parks, especially in areas adjacent to a protected area, so-called "buffer zones."

The Act also includes provision for the management of historical sites by the NPT, provides guidance on management planning for protected areas, and specifically requires the preparation of a protected areas system plan, which was prepared by the Trust in 2007 and approved by Cabinet in 2008.

2.2.4.4 Other Environmental Legislation

Other BVI environmental laws are noted in Table 5. Although these laws remain in effect, for the most part they are outdated and therefore are no longer effective or adequate to protect and manage the natural resources of the territory.

This table and the discussion in preceding sections on the territory's three substantive and modern environmental laws illustrate that, although important legal and policy tools for environmental management have been established in the BVI, many challenges still lie ahead. For example:

- The Physical Planning Act requires regulations and until then, much of the law will operate as legislated guidelines rather than as enforceable policy.
- The area of pollution control needs to be strengthened, particularly critical given the BVI's high population density, rapid-paced development, and geographical and geological challenges for pollution control.
- There is limited legal authority for protecting wildlife, critical ecosystems or habitats outside of formally protected areas.
- No comprehensive policy, authority, or legal framework exists for the management of the coastal zone.

2.2.4.5 Proposed Environmental Management and Conservation of Biodiversity Bill

Since early in this century, Government has considered a more comprehensive approach to environmental protection and management. Most recently, the Law Reform Commission drafted a new framework for environmental management in the BVI. The Commission's report, Environmental Management and Conservation of Biodiversity Reform, was submitted to Cabinet in 2008 but has not yet been made available to the public and no further action has been taken. More recently, Government indicated its intent to bring an Environmental Management and Conservation of Biodiversity Bill before the House of Assembly (Speech from the Throne delivered by His Excellency the Governor Mr. Boyd McCleary, 8 December 2011).

This environmental legislation would bring together many public sector environmental responsibilities—particularly those identified with the DCF and the NPT—under a single new management authority, tentatively called the Environmental Management Trust (EMT). This agency would replace both the Department of Conservation and Fisheries and the National Parks Trust.

Moreover, the current Chief Conservation and Fisheries Officer would become the first director of Conservation and Fisheries within the Environmental Management Trust, and the current director of the National Parks Trust would become the first Director of National Parks within the EMT, while the current board of the NPT would become the first board of the EMT. The provisions of the Fisheries Act and Regulations and the National Parks Act and Regulations would be retained.

Additionally, the legislation would permit the Territory to deal more holistically and effectively with the conservation of biodiversity as well as the BVI's obligations under multilateral environmental agreements to which the territory is a party (see Table 5).

2.2.5 Environmental Policy

In addition to the units of Government tasked with primary environmental responsibilities and the legal framework comprising the territory's extant environmental legislation, a number of national policy agreements and planning documents are available to strengthen the objectives of environmental protection and resource sustainability.

Primary among these are the following, which are reviewed in more detail in the sections that follow:

1. **ST. GEORGE'S DECLARATION OF PRINCIPLES FOR ENVIRONMENTAL SUSTAINABILITY IN THE OECS**
2. **BRITISH VIRGIN ISLANDS ENVIRONMENT CHARTER**
3. **NATIONAL INTEGRATED DEVELOPMENT PLAN**
4. **NATIONAL ENVIRONMENTAL ACTION PLAN**
5. **NATIONAL PHYSICAL DEVELOPMENT PLAN**
6. **PROTECTED AREAS SYSTEM PLAN**
7. **NATIONAL TOURISM DEVELOPMENT STRATEGY**
8. **COMPREHENSIVE DISASTER MANAGEMENT POLICY**
9. **CLIMATE CHANGE ADAPTATION POLICY**
10. **BEACH MANAGEMENT FRAMEWORK**

2.2.5.1 St. George's Declaration

On 25 July, 2001, the BVI Chief Minister signed the St. George's Declaration of Principles for Environmental Sustainability in the OECS (OECS, revised 2006). This document contains 21 Principles which, among other things, recognise the need for an integrated approach to managing land and marine areas as a single unit.

The St. George's Declaration also recognises and supports:

(1) The Rio Declaration on Environment and Development, adopted at the UN Conference on Environment and Development in Rio de Janeiro in June of 1992.

(2) The decisions in the Barbados Declaration adopted at the UN Global Conference on the Sustainable Development of Small Island Developing States held in Barbados in 1994.

By virtue of the BVI Government having signed the Declaration, the territory is also bound by the principles stated therein.

2.2.5.2 British Virgin Islands Environment Charter

A second policy agreement—the BVI Environment Charter—was signed in 2001 by the BVI Government and the UK Government and provides guiding principles for the two governments in the area of the environment.

Ten principles are set out in the Environment Charter and have been agreed to by the UK and BVI Governments, including:

- To use the natural resources of the BVI wisely, being fair to present and future generations (#2).
- To identify environmental opportunities, costs and risks in all policies and strategies (#3).
- To aim for solutions that will benefit both the environment and development (#5).
- To safeguard and restore native species, habitats and landscape features, and control or eradicate invasive species (#7).
- To encourage activities and technologies that will benefit the environment (#8).
- To control pollution, with the polluter paying for prevention or remedies (#9).

Additionally, the BVI Government has committed to eleven specific actions under the Charter, including:

- To ensure the protection and restoration of key habitats, species and landscape features through legislation and appropriate management structures and mechanisms (#2).
- To ensure that environmental considerations are integrated within social and economic planning processes (#3).
- To ensure that environmental impact assessments are undertaken before approving major projects (#4).
- To commit to open and consultative decision-making on developments and plans which may affect the environment, and to ensure that environmental impact assessments include consultation with stakeholders (#5).
- To implement effectively obligations under the Multilateral Environmental Agreements already extended to the British Virgin Islands (#6).
- To review the range, quality and availability of baseline data for natural resources and biodiversity (#7).
- To ensure that legislation and policies reflect the principle that the polluter should pay for prevention or remedies and establish effective monitoring and enforcement mechanisms (#8).

Table 5.
BVI legal and regulatory instruments related to the environment. *

NATIONAL LEGISLATION		
PLANNING AND DEVELOPMENT CONTROL	***Physical Planning Act*** (2004) (Regulations currently being drafted)	See Section 2.2.4.2 for details.
COASTAL RESOURCES	***Fisheries Act*** (1997) ***Fisheries Regulations*** (2003)	See Section 2.2.4.1 for details. See Section 2.2.4.1 for details.
	Beach Protection Act (1985)	The Act requires a permit for dumping on and removal of material from the foreshore and removing any natural barriers against the sea. It is outdated and does not provide a beach management policy framework or regulations.
AGRICULTURE	***Protection of Trees and Conservation of Soil and Water Ordinance*** (1954/1965)	Authorises designation of protected forest areas, protected water areas and protected trees. Seven protected areas have been established under this Ordinance, none on Anegada.
PROTECTED AREAS	***National Parks Act*** (2006) ***National Parks Regulations*** (2008)	See Section 2.2.4.3 for details. See Section 2.2.4.3 for details.
WILDLIFE	***Wild Birds Protection Ordinance*** (1959/1980)	The law protects listed birds, their eggs, nests, and young throughout the territory. Bird Sanctuaries Orders in 1959 and 1977 designated 20 bird sanctuaries in the Territory, one of which is on Anegada, the Flamingo Pond (declared 1977).
	Turtles Ordinance (1959)	The Ordinance protects turtles from being disturbed or taken during nesting periods and prohibits the taking of turtle eggs, but does not address general protection of habitat for turtle nesting or feeding grounds.
	Protection of Endangered Animals, Plants, and Articles (Removal and Possession) Ordinance (1981)	This law was enacted to prohibit removal of listed corals without a license; it does not address protection of coral reefs *in-situ*. Needs updating to conform to species on IUCN's Red List and with CITES; need to add locally important species.
POLLUTION CONTROL	***Public Health Ordinance*** (1967)	Authorises regulations to prevent, abate, and control environmental pollution. Environmental pollution is not defined, and regulations providing environmental standards have not been enacted.
	Litter Abatement Act (Amended 2009)	Authorises appointment of litter wardens to issue warnings and tickets to violators of the litter law.
NATURAL HAZARDS	***Disaster Management Act*** (2003) *(updated bill pending in the HOA)*	Provides legislative authority for disaster management in the territory.

NATIONAL POLICY AGREEMENTS		
ENVIRONMENTAL SUSTAINABILITY	***St. George's Declaration of Principles for Environmental Sustainability in the OECS*** (July 25, 2001)	The Declaration was signed by the Chief Minister, on behalf of the Government, in 2001. The document contains 21 Principles and recognises, among other things, the need for an integrated approach to managing land and marine areas as a single unit. (See also Section 2.2.5.1.)
ENVIRONMENTAL SUSTAINABILITY	***British Virgin Islands Environment Charter*** Signed by UK and BVI Governments (September 26, 2001)	Guiding principles for the UK Government, the Government of the BVI, and the people of the British Virgin Islands (Section 2.2.5.2).
REGIONAL TREATIES		
MARINE ENVIRONMENT	***Cartagena Convention***, commonly known as the **Caribbean Regional Seas Agreement**, came into force in 1986 and was extended to the BVI in 1987	The Convention encourages Contracting Parties to undertake agreements and protocols for the protection of the marine environment in the region.
	Two protocols adopted under the Convention define further obligations of the Contracting Parties:	
	1) ***Protocol Concerning Specially Protected Areas and Wildlife*** (commonly known as ***SPAW***)	Creates a general obligation to protect, preserve and manage threatened or endangered species of flora and fauna in a sustainable way. Requires Parties to take actions to prevent species from becoming endangered or threatened.
	2) ***Protocol Concerning Pollution from Land-based Sources and Activities*** (commonly known as ***LBS Protocol***)	"Land-based sources and activities" are defined to include pollution from coastal disposal or discharges emanating from coastal establishments and outfall structures. Parties to the Convention have a general obligation to prevent, reduce and control pollution from land-based sources and activities using the best practical means and in accordance with capabilities.
GLOBAL TREATIES		
BIODIVERSITY	***Convention on Biological Diversity*** (1992), extended to the BVI in 1994	The Convention contains a series of far-reaching obligations related to the conservation of biological diversity and the sustainable use of its components.
WETLANDS	***Convention on Wetlands of International Importance especially for Waterfowl Habitat*** (1971), also known as **Ramsar**	This international Convention was extended to the BVI in 1999 with the acceptance by the Ramsar Secretariat of the BVI's application to list the Western Salt Ponds of Anegada as a "wetland of international importance especially for waterfowl." One of the obligations triggered by the Convention is that the BVI promote wise use of all wetlands within the Territory.

MIGRATORY SPECIES	***Convention on Migratory Species*** (1983), also known as the **Bonn Convention**, extended to the BVI in 1985	The Parties to the Convention acknowledge the importance of migratory species being conserved and the need to take action to avoid any migratory species becoming endangered.
LAW OF THE SEA	***United Nations Convention on the Law of the Sea*** (1982) Convention came into force in 1994, was ratified by the UK and extended to the BVI in 1997	Part XII of the Convention ("Protection and Preservation of the Marine Environment") sets out a fundamental obligation for the BVI to protect and preserve its marine environment, and to take all measures necessary to prevent, reduce, and control pollution of the marine environment from any source.
TRADE IN ENDANGERED SPECIES	***Convention on International Trade in Endangered Species of Wild Fauna and Flora* (CITES)** Convention entered into force in 1975, extended to the BVI in 1976	The Convention requires national legislation as the Convention is not self-executing. The BVI's *Protection of Endangered Animals, Plants, and Articles (Removal and Possession) Ordinance* is outdated and does not fully comply as CITES legislation. Additionally, the BVI does not have general wildlife conservation legislation to reinforce compliance.

* For a further discussion, see Lausche (2005).

We do not know the extent to which the guiding principles and commitments incurred by the BVI Government in the Environment Charter or the St. George's Declaration are actively consulted by Government in executing environmental policy, legislation, or management decisions. However, a number of national planning strategies and documents are available to Government for incorporating the principles and commitments of both the Environment Charter and the St. George's Declaration. These are discussed in the sub-sections that follow.

2.2.5.3 National Integrated Development Plan, 1999-2003 (NIDP)

The National Integrated Development Strategy (NIDS) was adopted by the Government of the British Virgin Islands to promote the sustainable development of the territory; it covered the five year period from 1999-2003. The draft National Integrated Development Plan (NIDP) was a major output of the NIDS and was prepared by the Development Planning Unit (DPU) of Government in 1999. Since the BVI does not have a national development plan, the NIDP provides many of the elements of such a planning instrument. It represents the first formal attempt at national integrated planning in the Virgin Islands.

Individual ministries and departments of Government are responsible for implementing the strategies incorporated in the NIDS. Although it prepared the document, the DPU had no coordinating role in implementation (*pers. comm.*, Raymond Phillips, Director of DPU, interview with Lloyd Gardner, 7 December 2011).

Whether the National Integrated Development Plan will be revised and updated is not known at the present time.

2.2.5.4 National Environmental Action Plan (NEAP)

The BVI developed a National Environmental Action Plan (NEAP) in 2004 as an attempt to provide a rational framework within which the environment of the territory could be managed in a responsible and sustainable manner (DCF, *et al.*, 2004). The Plan was the product of a collaboration of a number of government agencies and others external to the public sector, coordinated by the Department of Conservation and Fisheries with the technical support of the Department of Town and Country Planning and two consulting companies.

The process was funded by the UK Foreign and Commonwealth Office (Department for International Development) and was prepared—according to the Plan's authors—as "part and parcel" of the National Physical Development Plan and National Integrated Development Strategy, in order to ensure the integration of environmental concerns in the national development planning process.

The NEAP was not approved by Cabinet, but its objectives and recommendations exist as a guide and planning tool for environmental action.

2.2.5.5 National Physical Development Plan (NPDP)

Responsibility for national physical development planning has long been a responsibility of the Department of Town and Country Planning. Over time, the department has prepared several National Physical Development Plans (NPDPs) to guide land use planning and development control in the territory.

The most recent drafts were prepared by DTCP in 1996 and 2006. Although not formally adopted by Government, the NPDP is used as a framework for area development planning by the department and a guide for development control decision making in the territory.

In discussions with the profile project team at the end of 2011, officials in the Town and Country Planning Department noted that the Government elected in November 2011 intends to update the National Physical Development Plan, with the DTCP to function as the coordinating agency (*pers. comm*., Ronald Beard, Deputy Director and Dylan Penn, Physical Planner, DTCP, interview with Lloyd Gardner, 25 November 2011).

The reader is also referred to Section 2.2.6 for a discussion of development planning specific to the island of Anegada.

2.2.5.6 Protected Areas System Plan, 2007-2017

The Protected Areas System Plan 2007-2017 was approved by Cabinet in 2008 and integrates in one plan all protected areas in the BVI, regardless of whether such areas are a part of the national park system. As such, the Plan provides an overall policy framework for the development and management of protected areas and sites in the Virgin Islands.

The first System Plan for Protected Areas in the BVI was prepared in 1981 with the assistance of the Eastern Caribbean Natural Areas Management Programme (ECNAMP); it was subsequently revised in 1986. The current System Plan (Gardner, *et al*., 2008) was prepared in 2007 with the assistance of Island Resources Foundation under a grant from Laurance S. Rockefeller for the Sandy Cay Development Programme. It was approved by Cabinet in 2008.

The National Parks Trust is responsible for preparing and updating the System Plan as per the provisions of the National Parks Act (2006). The current System Plan includes, among other things, a statement of priorities for protected areas management during the ten-year period covered by the Plan and a process for evaluating progress in the development of the protected areas system.

2.2.5.7 National Tourism Development Strategy, 1996-2005

With an opening reference to the fact that "tourism has come of age in the BVI," the National Tourism Development Strategy (prepared by Coopers & Lybrand Consulting in 1996) identified five guiding principles upon which the BVI's vision for tourism development would be built. The first of these is "the environment," which, according to the strategy, is essential in order:

> *… to develop and manage the tourism sector in harmony with the physical environment and in accordance with the principles of the carrying capacity of the environment.*

The statement recognises the dependency of the BVI tourism sector on the well being and healthy state of the Territory's physical attributes and natural environment. The strategy states unequivocally that the environment is the single most important element of the BVI Tourism Development Plan.

Additionally, the tourism strategy identifies the need for comprehensive development planning in the territory to ensure sustainable tourism development. Whether tourism planning and national development planning are sufficiently coordinated and harmonised is not always evident in actual implementation. Additionally, a more formal and structured approach to promoting protected areas within tourism planning, as called for in the BVI Protected Areas System Plan, 2007-2017, has yet to be achieved.

The National Tourism Development Strategy identifies four "zones" for national tourism planning and ranks environmental carrying capacity for each zone. It suggests that this kind of assessment and ranking should be incorporated in national physical development planning, as carried out by Town and Country Planning, and should also be taken into consideration in development control decision making.

2.2.5.8 Comprehensive Disaster Management (CDM) Policy and Strategy, 2009-2013

The BVI Government, through its Department of Disaster Management (DDM), has adopted a Comprehensive Disaster Management (CDM) approach for the territory. As such, the department's strategy for the management of disasters has evolved from one principally concerned with guiding government responses to events, to one based on disaster risk reduction through greater attention to mitigation, preparedness and recovery.

The current CDM Policy (DDM, 2009/a) was developed in concert with the 2009-2013 Virgin Islands CDM Strategy and Programming Framework (DDM, 2009/b). The CDM Policy defines the vision, goal, purpose and priorities of Comprehensive Disaster Management in the BVI and provides the policy framework within which the DDM operates and implements its CDM strategy.

The CDM Strategy and Programming Framework for 2009-2013 is a strategic planning tool for the DDM that describes the activities to be implemented and the results to be achieved by the DDM in realising its overall goal of "reinforcing the development potential of the VI by reducing risks from all hazards" (DDM, 2009/b, page 9).

With the completion of the CDM Policy and the updating of the CDM Strategy and Programming Framework, the next step in territorial planning for disaster management is enactment of a new Act to revise and update the 2003 Disaster Management Act (a bill for new legislation is currently before the House of Assembly).

2.2.5.9 Climate Change Adaptation Policy

From 2007-2012, the BVI Government supported a climate change initiative under a programme entitled Enhancing Capacity for Adaptation to Climate Change in the Caribbean UK Overseas Territories (ECACC). The project was funded by the UK Department for International Development (DFID) and managed by the Caribbean Community Climate Change Centre (CCCC) in Belize.

ECACC funding was provided for the following activities (*pers. comm*., Angela Burnett Penn, Environment Officer for Climate Change, DCF, interview with Judith Towle, 7 February 2012):

- building institutional capacity in the BVI for climate change;
- implementing climate change educational activities;
- providing institutional structures to monitor the impacts of climate change in the BVI;
- carrying out vulnerability assessments; and
- preparation of a climate change policy paper for the British Virgin Islands.

A Virgin Islands Climate Change Green Paper was prepared in 2010 (Burnett Penn, 2010), and a Climate Change Adaptation Policy and Strategy was drafted for the Territory in 2011. Following extensive public consultations, the policy paper was approved by an inter-departmental Climate Change Committee, and approved by Cabinet in 2012 under title of The Virgin Islands Climate Change Adaptation Policy: Achieving Low-Carbon, Climate-Resilient Development (DCF, 2012).

While the Virgin Islands is not a large contributor to global warming (*e.g.*, on a global scale, the territory's greenhouse gas emissions are small), the adverse effects of climate change on the BVI and other small oceanic islands will likely be widespread and felt more acutely than in larger continental countries that are more responsible for human-induced global warming. The BVI's Climate Change Adaptation Policy is designed to ensure that the local impacts of climate change are minimised and that climate change adaptation is fully integrated into all levels and sectors of territorial planning and policies.

The Policy reviews existing and potential impacts of climate change, many of which are a significant risk for the BVI's tourism-dependent economy. The Policy also commits the Virgin Islands to specific adaptation actions (interventions) to minimise the impacts of climate change in the territory, with most of the actions to be undertaken with the next four years.

The Government has also committed to establishing a Climate Change Trust Fund to support implementation of the Climate Change Policy. The Fund is to be established by law and administered by a Board of Trustees charged with mobilising funds from a variety of possible sources, including a carbon levy on hotel and yacht tourists and a financial risk management levy on foreign-registered companies and ships in the BVI.

Implementation of the Climate Change Policy has been vested with a National Climate Change Committee (NCCC), chaired by the Permanent Secretary of the Ministry of Natural Resources and Labour, who is also the National Climate Change Focal Point. The Policy recommends that the NCCC function as a sub-group of the established Technical Review Committee (under the MNRL) and the Planning Authority (under the Premier's Office). The Technical Review Committee and the Planning Authority are already responsible for the review and approval of all development applications, for seabed development and land development, respectively. If the NCCC were to function under the umbrella of the two bodies, the opportunity for integrating climate change adaptation measures as a part of the planning process would be strengthened.

2.2.5.10 Beach Management Framework

Gore (2012a) points out that the period between the advent of tourism in the late 1950s and the present has witnessed a paradigm shift from preserving natural resources for local subsistence to exploiting natural resources for economic gain. Beaches are no exception to this shift; yet, the changes in how beaches are now used in the BVI have not produced balancing change in how beaches are managed and protected.

Under the leadership of the Department of Conservation and Fisheries, an initiative to review beach management policy and legislation in the Virgin Islands was initiated in late 2011. The emerging framework is intended to provide background and direction for a fresh look at beach management issues in the territory.

As part of the current initiative, Government will be considering a beach policy to provide a more comprehensive approach to beach management and protection; beach legislation to replace the outdated Beach Protection Ordinance of 1985 (Cap. 233); and a beach management framework to address issues such as beach carrying capacity, marine zoning, beachfront zoning, beach vendor licensing standards, and other related issues.

2.2.6 Development Planning for Anegada

Although the most remote, least populated, most underdeveloped of the four major British Virgin Islands, Anegada has surprisingly been the focus of a number of ambitious development plans and large-scale development projects dating back to the 1960s.

2.2.6.1 The Bates Development Plan

The first of these emerged in 1967 when the Administrator of the BVI entered into an agreement with a British firm, the Bates-Hill Corporation, and its BVI subsidiary, the Development Corporation of Anegada, headed by an English businessman Kenneth Bates. Under the agreement and development plan put forward by Bates, all but 1,500 acres of the island (8,092 acres of the island's 9,592 acres) was leased to the Corporation for 199 years for the purpose of carrying forward a variety of development activities.

The agreement obligated the Corporation to construct an international airstrip, resort hotel, jetty for a deep water harbour, public roads, certain public facilities, and to expend $1,500,000 in the first five years of the lease and at least $3,000,000 in the first ten years, plus a modest annual ground rent. An Outline Development Plan put forward by the Corporation showed areas allocated for residences, high-density housing, hotels and resorts, a light industrial estate, marina, neighbourhood units, parks, schools, and a village for the "natives" (Varlack and Harrigan, 1971).

As development proceeded, concerns began to arise among Anegadians and the BVI Government through its Legislature about the concessions granted to the Corporation and about the way the lease agreement had confined existing residents to a relatively small area around The Settlement. Eventually a Commission of Inquiry was appointed to examine the Anegada Agreement and its terms and to make recommendations as to whether a new development concept for Anegada should be adopted.

Ultimately, the lease was cancelled, and in 1971 the UK Government paid $5.8 million to buy out Mr. Bates's interest in Anegada and in a concurrent, half-finished reclamation development scheme in Road Harbour in Tortola.

The aborted Bates Anegada project illustrates the paradoxical quality of such development plans. On the one hand, the project benefited all Anegadians as it constructed and left behind most of the island's infrastructure. On the other hand, it heightened Anegadians' sense of powerlessness and exploitation in that the plan had evolved with no input from local people and with restrictions imposed by the developer that were perceived locally as racially motivated discrimination (Koester, 1987).

The Bates development, whatever else it represented for Anegadians and their government, also changed land use patterns on the island forever. Here is what researcher Peter Freeman wrote in 1975:

> *The land use management pattern in which stone walls were so important a feature were destroyed by the construction of the airport and a number of roads. The airport was located in approximately the center of an intensively cultivated (plantation) area, and its orientation was such that it cut across a number of important cattle paths. Many fields were (breached) along the roads and the edge of the runway, and the airfield itself was cleared from areas formerly cultivated. Not only was land lost, but the exclusion of cattle and goats from fields was more difficult. Many men worked for Bates to the neglect of the fields and the walls. The animals learned to climb over the walls during this period of neglect and destruction and are no longer deterred by low stone walls.*

As a final word about the Bates's plan, it is interesting to note that prior to the signing of the agreement with the Development Corporation of Anegada, alternative, smaller-scale development plans had been presented to the BVI Government for Anegada. For example, following his successful 1962 launching of a resort hotel in Virgin Gorda, Laurance Rockefeller had submitted a relatively modest plan for development of 1,400 acres on

Anegada, later reduced to 700 acres. Rockefeller did not receive a response from Government, and in January of 1967 an agreement was signed with the Bates Corporation which effectively nullified the Rockefeller proposal (Varlack and Harrigan, 1971).

2.2.6.2 Development Planning Following Bates

Following the collapse of the Bates project, other plans emerged for the development of Anegada. In June of 1973, following a year of negotiation, the Government turned down another development proposal, this one put forward by the Virgin Islands Refinery Corporation, based in the USVI, to establish an oil storage complex on Anegada. The reason for the decision, as stated by the Chief Minister to the Legislative Council, focused primarily on the sizeable amount of land required by the oil company at the island's west end, thereby excluding, the Government felt, the possibility of tourism development on the island (Institute of Caribbean Studies, 1973).

Next, the BVI Government was asked to consider a plan for another major resort-residential development for the island, this one put forth in 1973 by the Anegada Corporation, a subsidiary of Sterling Bank and Trust Company of the Cayman Islands.

Perhaps learning a lesson from the Bates project, this development plan was preceded by an extensive feasibility study carried out by the Anegada Corporation (Sterling Bank and Trust Company, Ltd. 1974). The study covered:

> *… every aspect of [the island's] nature and potential. ... Its geology, flora and fauna, marine life, subsoil, water supply and quality, reefs and beaches [were] studied by an impressive team of experts, whose reports … [assessed] the island's potential [for] resort, residential, commercial, agricultural, aviation, maricultural, transport and seasport development.*

Feasibility studies were also completed for sewage disposal, agriculture, roads, and electricity infrastructure (*B.V.Islander*, 1974a; Backshall, 1974).

Whether this scheme would have encountered obstacles similar to the Bates plan is not known for the parent company, Sterling Bank, collapsed in 1974, and its development plans for Anegada suffered a similar fate. The disappointment of Anegadians can be sensed in the remarks of Anegadian spokesperson and former legislator, Teodolph Faulkner, who accused the BVI administration of "fooling Anegadians for too long." He proposed sending a petition to the Queen suggesting that Anegada be annexed to the U.S. Virgin Islands (*The Island Sun*, 12 October 1974).

Although annexation might have been a bit extreme for most Anegadians, this period of disappointment upon disappointment, dating from the late 1960s to the mid-1970s, created the basis for ensuing decades of Anegadian mistrust of the central governing authority in Tortola. According to anthropologist Dr. Stephen Koester, following the aborted, large-scale development plans of this period, Anegadians have had more definite ideas about how future development should proceed. "Most Anegadians," Koester wrote, "seem to want development that is compatible with the scale of their community and island" (Koester, 1987).

Koester's assessment was confirmed to some extent in the more recent Anegada community questionnaire administered in 2012 by the Environmental Profile Programme. When asked to rank 17 development options for Anegada, almost 70 percent of respondents gave the lowest ranking to the need for "*more resorts and larger hotels*," while only 30 percent gave this option a high ranking (see also Chapter 9, Section 9.2.1). As observed by Varlack and Harrigan (1971) more than 40 years ago, smaller development schemes for Anegada in the late 1960s "would have provided an adequate start for the tiny population to participate in the development [process], as had happened in Virgin Gorda" with the establishment of the Little Dix Bay Resort in the early 1960s.

Instead Anegadians were presented with a number of large development schemes, principally conceived with little input from Anegadians, none of which were carried to completion or provided a better quality of life for Anegadians.

2.2.6.3 Recent Development Plans

Government planning for the island continued following abandonment of the large-scale development plans of the 1960s and 1970s. An Anegada Development Plan was prepared in 1993 by Town and Country Planning, in conjunction with a local advisory committee. A number of mapping products were prepared for the 1993 planning exercise, including maps to depict coastal and wildlife features, environmentally sensitive areas, proposed land use, and proposed projects. The primary developmental thrust of the plan was to promote Anegada as a special recreational and tourist destination (DTCP, 1993).

Despite local input, including a local lands advisory committee to work with Government on the still unresolved land allocation question, Downs (1997) found in his interviews with islanders that a significant number of Anegadians objected to specific provisions in the plan. One contentious issue was the amount of Anegada land to be considered for inclusion in the territory's Parks and Protected Areas System, which the community felt should not be determined until the issue of individual land ownership had been resolved (Downs, 1997).

More recently, the Ministry of Natural Resources and Labour, with the Survey Department and the Town and Country Planning Department, prepared a Lands Allocation Plan for Anegada (see Section 2.1.2) that includes mapping products for an overall development project for Anegada (**Figure 5**), for three Subdivisions (West End, North Airport, and East Settlement), for land options available for land exchanges, and for designation of stone walls.

According to a ministry representative (*pers. comm*., Michelle St. Edmonson, 23 August 2012), the 2007 plan has been approved by Government, including approval for land allocations to proceed in the West End, East End, and North Airport. The Ministry has begun transferring land to persons who had occupied their plots for long periods, as well as to persons who are Anegadians by birth but who own no land. Other specific claims have been received from Anegadians, although Government has been focused on transferring land to young Anegadians, thereby providing a new generation with an opportunity for land ownership. Many individuals have received title to land in the West End and a few in the North Airport area. No land has been transferred in the East End as this area is riddled with walls that have hindered the surveying process.

In the end, central government planning for Anegada continues to be a complicated and vexing task, predicated as it is upon layer upon layer of history and disappointment, misunderstandings and false starts. Planning is tied to land use and land use is tied to land ownership and all are tied to what the Anegadians perceive as issues of self-determination. In the end, development planning for Anegada going forward will need the support of the local community and the central government and a merging of mutual aspirations and like interests that has yet to be fully achieved.

2.3 The Private Sector

2.3.1 Environmental NGOs in the British Virgin Islands

In the area of the environment, the NGO sector in the BVI has not been especially vibrant, broadly based, or long-lasting—particularly when compared to the sector as seen elsewhere in the region.

The emergence of a private-sector conservation movement in the Commonwealth Caribbean can be dated to the mid-1960s and early 1970s when several national trusts, based on the British model, were established throughout the region. Although created by governments and with statutory authority, these early trusts often functioned very much like NGOs in that they had independent governing boards, were membership based, and were responsible for raising funds.

During their early years, many of the emerging trusts in the region focused on the preservation of historic buildings, monuments and related historical and cultural artifacts. However, by the decade of the 1980s, several of the trusts in the Caribbean had become important voices for a larger number of environmental concerns and were taking on more broadly-defined environmental agendas, for example, the National Trust in St. Lucia.

During the 1980s, the region also witnessed the launching of several national environmental NGOs, which operated entirely in the private sector with no statutory authority. These groups took on a full agenda of environmental issues, and, in the smaller islands of the Eastern Caribbean, often succeeded because there was not an established national trust, for example, in Antigua, St. Kitts, and Nevis (Towle, 1995).

In the BVI, this general pattern was not repeated. In the first place, the national trust established by legislation in the 1960s had a clear focus on parks and was put in place specifically as a vehicle to manage early land donations for the purpose of conservation. Indeed, the word "parks" is in its title (National *Parks* Trust), thus embodying its primary purpose in its very name, the only trust to do so in the Caribbean.

It is true that, like its sister institutions elsewhere in the region, the BVI National Parks Trust often takes on roles and functions more attuned to that of a NGO. Nevertheless, with 21 park sites under its direct management, the National Parks Trust's interests and agenda lie closer to its park management responsibilities than they do to environmental activism or the public oversight role more naturally assumed by NGOs with no government affiliation.

Thus, in the BVI, there has always been room for an environmental NGO (also referred to as nonprofit organisation or NPO) to take on leadership for a wide-ranging spectrum of environmental issues and concerns, to serve as an environmental advocate in the private sector, and to influence public policy and public action on behalf of the environment. Yet, this has not generally occurred.

In the BVI, a few conservation-focused NGOs emerged in the 1980s and into the1990s. However, none displayed—when active—a broad environmental agenda. Instead, the programmatic focus was generally a single "cause" (for example, support for the Botanical Gardens) or a single issue (for example, the preservation of historical and archaeological resources).

A new environmental NGO emerged in the new century—the **Virgin Islands Environmental Council** (VIEC)—although to date the organisation has been primarily focused on a single issue, *i.e.*, initiating legal action to seek judicial review of Government's approval for the Beef Island Development Project (see Section 2.2.4.1 of this chapter). It is not clear at this writing whether, or in what direction, the Environmental Council will extend its mission or agenda.

NGOs with more inclusive environmental agendas have been active in the BVI since the late 1990s:

(1) Association of Reef Keepers (ARK), dedicated to promoting the conservation and preservation of the marine environment. More recently, ARK has been less active in promoting a broader environmental agenda and has concentrated primarily on its original reef monitoring programme. At this writing, the NGO is reconsidering its priorities and direction and hopes to become more actively engaged.

(2) Green VI was founded in Tortola in 2009 to help create "a green, clean, healthy, and prosperous BVI in which a balance is maintained between development and conservation of the natural environment." The organisation has become an important voice for applying on-island technology to address solid waste concerns and recycling opportunities. In 2012, Green VI coordinated UNESCO-funded sustainability training for the BVI and was instrumental in developing a sustainability network (Purkis and Miller, 2012).

(3) Island Resources Foundation (IRF), a 40-year-old, Caribbean-focused environmental NGO, established a presence in the BVI in 1999 in cooperation with the H. Lavity Stoutt Community College. IRF is the sponsoring organisation of the current Environmental Profile Programme for the BVI.

The U.S. NGO, **The Nature Conservancy** (TNC), has a long history in the BVI dating to the 1970s when it facilitated the donation of the 30-acre island, Fallen Jerusalem, to the National Parks Trust. Currently, the Conservancy is supporting the involvement of the BVI in natural resource management collaborations with the USVI and Puerto Rico and in large-scale regional conservation with the greater Caribbean as a member of the Caribbean Challenge Initiative (CCI). The latter was launched in 2008 by the Conservancy and Caribbean government partners as an effort to chart a new course for protecting and sustainably managing marine and coastal environments across the Insular Caribbean. Additionally, in partnership with the Ministry of Natural Resources and Labour through its Conservation and Fisheries Department, TNC is developing a best management practices guide for reducing island erosion in the BVI.

There is one other environmental NGO in the BVI that has a broad programme agenda although one that is focused on Jost Van Dyke and nearby Little Jost Van Dyke. The **Jost Van Dykes Preservation Society** was launched in the early 1990s, was relatively inactive throughout most of the 1990s, and reemerged in 2004 with its establishment as a BVI not-for-profit organisation. It now boasts an office and director headquartered in Great Harbour and supports a number of community-based research and educational programmes including preparation of the *Jost Van Dyke Environmental Profile*, in partnership with IRF.

Virgin Gorda currently lays claim to two community groups with an environment-related agenda, although neither supports a wide range of environmental issues or programmes. They are the **Virgin Gorda Green Team**, whose mission focuses primarily on keeping Virgin Gorda and its marine environment clean, and **Voices of Interest for Economic and Social Stability** (Voices), a community group formed in 2010 with the goal of bettering the community of Virgin Gorda, including "greening" projects.

At present, no NGO/NPO or community group has been established on the island of Anegada in support of the environment. One Anegadian, Kevin Faulkner, is pursuing the legal establishment of a nonprofit organisation on Anegada which would have a research focus to support a proposed public/private cooperative venture for the sustainable development of Queen Conch. Faulkner's planning calls for the institutionalisation of his **Anegada Conch Restoration Initiative** (or ACRI), which, if successful, could form the basis for a more broadly based environmental NGO/NPO for Anegada.

2.3.2 BVI NGOs and the Legal Framework

Prior to 2012, the legal framework in the BVI supporting the nonprofit sector was very weak. It basically provided only for registration of nonprofit organisations under the territory's Companies Act or earlier Friendly Societies legislation. The Financial Services Commission, which oversees registration of companies in the BVI—including not-for-profit organisations—provided no further oversight or support for the sector once registration had been completed.

This *laissez-faire* approach to the sector changed dramatically in 2012 with enactment of the Non-Profit Organisations Act. The immediate incentive for the legislation came from the territory's powerful financial services sector, which confronted a 2012 deadline to comply with international standards related to money laundering and the financing of terrorist activities. Since the Financial Action Task Force (FATF) had determined that such activities often occur under the aegis of charitable institutions, FATF required that the BVI enact an updated and strengthened law which prevented non-profit organisations (NPOs) from being used for illegal activities.

Under the Non-profit Organisations Act, 2012, which was passed by the House of Assembly in October and assented to by the Governor in November, all NPOs operating in the territory must be registered or face substantial fines and/or imprisonment. Responsibility for the Act will fall within the portfolio of the Minister of Health and Social Development.

Registration requires that substantial documentation, including financial statements, be provided by NPOs. Leaders of the BVI nonprofit community have stated that these requirements will unnecessarily burden NPOs, especially smaller community-based, public service groups that are generally operated by volunteers.

Thus far, the law reform process for NGOs in the BVI has been driven by those primarily concerned about regulating the nonprofit sector. It remains to be seen whether the authorities implementing the law will demonstrate equal concern about a legal process that strengthens philanthropy and supports civil society organisations in the territory, including those focused on the environment.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE ONE Although three, more modern and comprehensive laws have been enacted to protect and manage the environment (Fisheries Act in 1997, Physical Planning Act in 2004, and National Parks Act in 2006), the totality of the legal framework for the environment in the BVI remains uneven and fragmented, and many laws: – are very outdated and therefore ineffective; – lack regulatory authority to fully implement legislated mandates; – lack standards for monitoring and enforcement; and – are difficult to implement or enforce because implementing units of government lack the technical capabilities and personnel to do so.	If Government does not move forward in updating and/or revising several environment-related laws, as well as enacting new laws where critical legislative gaps are evident, the territory's ability to do the following will be severely and continuously impeded: – ability to protect its resource base, – ability to enforce environmental standards and regulations, – ability to honour its treaty obligations, and – ability to provide for the sustainable development of one of the territory's two primary economic sectors—tourism.	**SHORT-TERM OPTIONS** **1.** Government should expedite the drafting and approval of **Regulations to the Physical Planning Act**. Regulations for environmental impact assessments need to conform to international standards for the preparation, review and enforcement of EIAs for development projects, including those initiated by Government. **2.** In light of the 2011 court ruling in the matter of the Hans Creek Fisheries Protected Area, Government needs to move ahead quickly to revise Regulations to the Fisheries Act in order to **re-designate specific fisheries protected areas** in the Territory. **3.** Government should give priority attention to initiating a comprehensive review of the Law Reform Commission's 2008 report entitled **Environmental Management and Conservation of Biodiversity Reform**. Its review should include an inter-agency assessment within government and public meetings external to government. Biodiversity protection legislation is needed in the Territory, which currently lacks a sufficient legal framework to protect endangered wildlife and critical ecosystems and habitats, particularly if such are outside of officially designated protected areas. **4.** Outdated legislation from the 1970s that currently restricts development of alternative energy sources in the BVI needs to be revised, and a **new energy policy that encourages and supports green energy** for the territory needs approval by Government. **LONG-TERM RECOMMENDATIONS** Beyond the four legislative recommendations listed above, all of which are in some form of readiness for near-term action, two areas of the legal code pertaining to the environment require more long-term attention. **1.** The first is **environmental pollution**. Environmental pollution is not defined in law and regulations providing environmental quality standards have not been enacted. Modernised public health legislation, with appropriately strengthened national standards for water quality, pollution control, and waste management, is needed to ensure that the quality of life for BVIslanders is not compromised. Standards *(continued)*

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
		LONG-TERM RECOMMENDATIONS (continued) developed should take into consideration institutional capacities and resources for monitoring and enforcement. To fully implement pollution control legislation, a centralised environmental testing laboratory would need to be established. **2.** The second area requiring longer-term attention is that of **coastal area (or coastal zone) management**. In 1987, a draft Coastal Conservation Act was prepared by an environmental consultant undertaking a legislative review for the OECS. Even 25 years ago, it was recognised that a comprehensive coastal area management policy, embedded within legislative authority, was necessary to protect and manage coastal and marine resources and to achieve sustainable development of coastal areas. The proposed act was eventually abandoned, but it is recommended herein that the BVI Government now take appropriate steps to: – re-examine the fragmented and limited legal authority and institutional capacity for managing the BVI's coastal environment; – assess the adequacy of existing policy and the supporting legal framework; and – consider options for new legislation to address integrated planning for and holistic management of coastal areas in the BVI. **3.** As new laws are enacted, such as those discussed above, the **capability and capacity of assigned units of government to fully implement the laws** must be considered, particularly as new mandates are added to units of government already tasked with substantial environmental responsibilities. Not only is the technical capacity of staff of importance, but access to necessary resources—including field equipment, electronic hardware, vehicles, boats, and the like—must be considered or the new and modern laws will remain relatively benign tools rather than powerful instruments of change.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE TWO Responsibility for the environment in the BVI is dispersed among a number of departments and statutory bodies within several ministries. For a small island state, it may surprise BVIslanders to learn how many public sector institutions have environment-related responsibilities (see Section 2.2.3). One result of this diffusion is that effective implementation of the resource management, resource protection, pollution control, and planning functions of Government is mostly dependent on the ability of Government to coherently coordinate these many agencies with varying degrees of responsibility for a diverse number of resource sectors.	When environmental policies and priorities are driven mostly by the institutional mandates of individual public sector agencies, then the ability of the central government to act will be more constrained and less effective in two critical areas: (1) The ability to execute coordinated environmental policy, and (2) The ability to influence national opinion on critical environmental issues. Concurrently, decisions about critical issues such as land use or development priorities will tend to be based on shorter-term considerations rather than longer-term planning.	**SHORT-TERM OPTIONS** **1.** Many within Government interviewed by the Environmental Profile team pointed to blurred lines of coordination between agencies with planning mandates, whether physical planning by the Department of Town and Country Planning or tourism infrastructure planning by the Tourist Board or national development planning by the Development Planning Unit. **Clearer and more formal lines of coordination** are required, with **improved mechanisms for integrated and comprehensive national planning** in the Territory. **2.** Most of the Territory's **national planning documents need updating and/or strengthening** as well as (in most cases) official approval by Cabinet, for example: the National Environmental Action Plan, the National Physical Development Plan, and the National Integrated Development Strategy (see Section 2.2.5). **3.** Reporting requirements for national planning strategies are weak and therefore information on implementation, progress, need for revision, and lessons learned is generally unavailable and so does not feed into a **coordinated and continuous review and evaluation process**. **4.** **In Anegada**, land distribution as per the framework provided in the **2007 Lands Allocation Plan** needs to proceed as expeditiously as possible. Land use on the island is tied to land ownership which in turn is tied to what the Anegadians perceive as issues of self-determination. Thus, Anegadians will be reluctant to commit to other land use planning options until land tenure issues are resolved. **LONG-TERM RECOMMENDATION** **1.** The territory has never had a National Development Plan, although a National Integrated Development Strategy was developed (1999-2003), but not updated. BVI Governments in the past have generally converted political manifestos into governing development plans, an option that confuses the purpose of development planning. What is required however is a legally mandated or formally approved **national development plan** to provide a comprehensive framework for growth management and environmental protection in the territory.

3. NATURAL HAZARDS AND ENVIRONMENTAL RISKS

3.1 Natural Hazards Affecting Anegada

Anegada is vulnerable to a number of natural and technological hazards, which have the potential to cause significant loss of life and property, seriously disrupt the economy and cause damage to the environment. The hazards that are likely to affect Anegada are:

- Hurricanes
- Coastal Erosion
- Flooding
- Earthquakes and Tsunamis
- Global Warming and Sea Level Rise
- Technological Hazards:
  Oil spills/Hazardous Materials.

Multiple studies and reports have been conducted to assess hazards and risks that are associated with the Virgin Islands, many of which are cited in the References section of this document. This chapter of the *Anegada Environmental Profile* will summarise the risks to which Anegada is exposed and will also identify the environmental issues resulting from the impacts of natural hazard events.

3.1.1 Hurricanes and Other Storms

The location of The Virgin Islands at the northeastern tip of the Caribbean places it directly in the Hurricane Belt. Traditionally, there is a 25-to-30-year intensity cycle of tropical cyclone activity, and during that period the Virgin Islands may expect a Category 4 storm and several Categories 2 or 3 storms (DDM, 2002). **Figure 6** shows the distribution of storm paths that surrounded the Virgin Islands from 1851-2010. **Table 6** summarises the damages incurred from selected hurricanes that impacted the British Virgin Islands from 1916 to 2011.

A recently completed project in the territory produced high-resolution storm surge inundation maps for Category 4 and 5 hurricane events from the directional headings of both 60 degrees and 290 degrees. The climate change scenario was defined for the hurricane event by adding one metre of sea level rise to the inundation data. The project, the Regional Risk Reduction Initiative (R3I), was funded by the European Union, executed by United Nations Development Programme and coordinated by the BVI Department of Disaster Management (DDM) (see also Table 8).

Figures 7 and **8** provide the inundation values for the island of Anegada for the western and eastern sections of the island for a Category 4 hurricane with a directional heading of 290 degrees plus one metre of sea level rise. The storm surge scenarios were developed based on historical records from the U.S. National Oceanic and Atmospheric Administration (*pers. comm*., DDM staff, January-February 2013).

3.1.2 Coastal Erosion

Coastal erosion refers to the wearing or washing away of coastal lands (FEMA, 2011). The entire island of Anegada is vulnerable to the effects of coastal erosion from a variety of natural or man-made actions, including:

- Storms and coastal flood events, usually rapid and dramatic (also called storm-induced erosion);
- Natural changes associated with tidal inlets and entrances to bays (*e.g.*, interruption of littoral transport by jetties and channels, migration or fluctuation of channels and shoals, or formation of new inlets);
- Construction of man-made structures and human activities (*e.g.*, certain shore protection structures);
- Dredging or mining of sand from beaches and dunes;

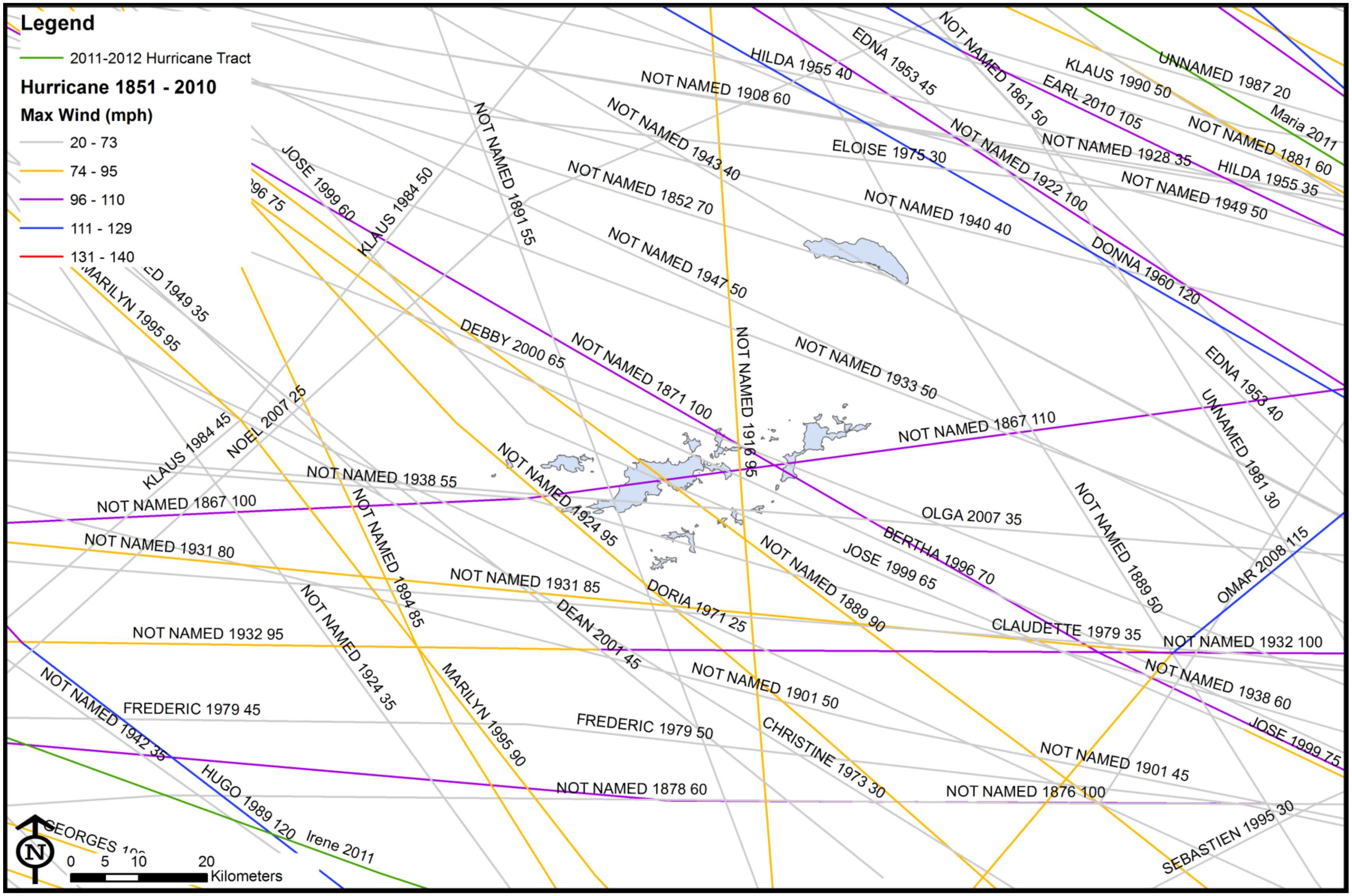


Figure 6.

Distribution of storms surrounding the British Virgin Islands.

Numbers following storm name are the maximum winds recorded as miles per hour (source: NOAA).

Table 6.
Selected hurricanes affecting the British Virgin Islands from 1916 to 2011 and estimated losses incurred.

Year	Hurricane	Category	Storm's Closest Position	Date	Estimated Loss
1916	Not Named	2	Lat. 18.0N, Long. 64.8W	9 October	Fatalities and Property: No Estimate Available
1924	Not Named	2	Lat. 18.3N, Long. 63.4W	29 August	Fatalities and Property: No Estimate Available
1960	Donna	4	Lat. 18.4N, Long. 63.4W	5 September	Property: No Cost Available
1989	Hugo	4	Lat. 18.2N, Long. 65.5W 40 miles SW of The Virgin Islands	18 September	US$40 million
1995	Luis	4	Lat. 18.4N, Long. 63.0W 37 miles NE of Anegada	6 September	No Estimates
1995	Marilyn	3	Lat. 18.5N, Long. 65.2W 40 miles SW of Tortola	15 September	US$10 million
1996	Bertha	1	Lat. 18.6N, Long. 64.9W	8 July	US$2 million
1998	Georges	2	Lat. 17.8N, Long. 65.0W 46 miles south of Tortola	21 September	US$12 million
1999	Lenny	4	Lat. 17.7N, Long. 64.0W 5 miles	17 November	US$29 million
2008	Omar	3	Lat. 18.2N, Long. 63.9W 40 miles east of Road Town	16 October	Minimal impacts
2010	Earl	4	Lat. 19.3N, Long. 64.7W 50 miles North of Anegada	29 August	To Be Determined
2010	Otto	TS	Lat. 24.8N, Long. 65.5W approximately 400 miles north of San Juan, Puerto Rico	8 October	To Be Determined
2011	Maria	TS	Lat. 19.0N, Long. 63.7W 66 miles east-northeast of Tortola	11 September	To Be Determined

Source: Department of Disaster Management (DDM), Government of the British Virgin Islands (GoBVI).

- alteration of vegetation, surface drainage, or groundwater at coastal bluffs.

Coastal erosion and accretion is a natural process and should not normally be regarded as a problem. Problematic issues only arise when erosion threatens human activities or assets, or when the erosion is a result of human interference with coastal processes along an adjacent frontage (FEMA, 2011).

Coastal erosion is capable of threatening natural resources and impacting human populations in Anegada in a number of ways, including the following:

- Destruction of dunes or other natural protective features;
- Destruction of erosion control devices;
- Lowering of ground elevations, undermining shallow foundations, and reducing penetration depth of pile foundations;
- Transporting of beach and dune sediments landward, where they can bury roads and buildings.

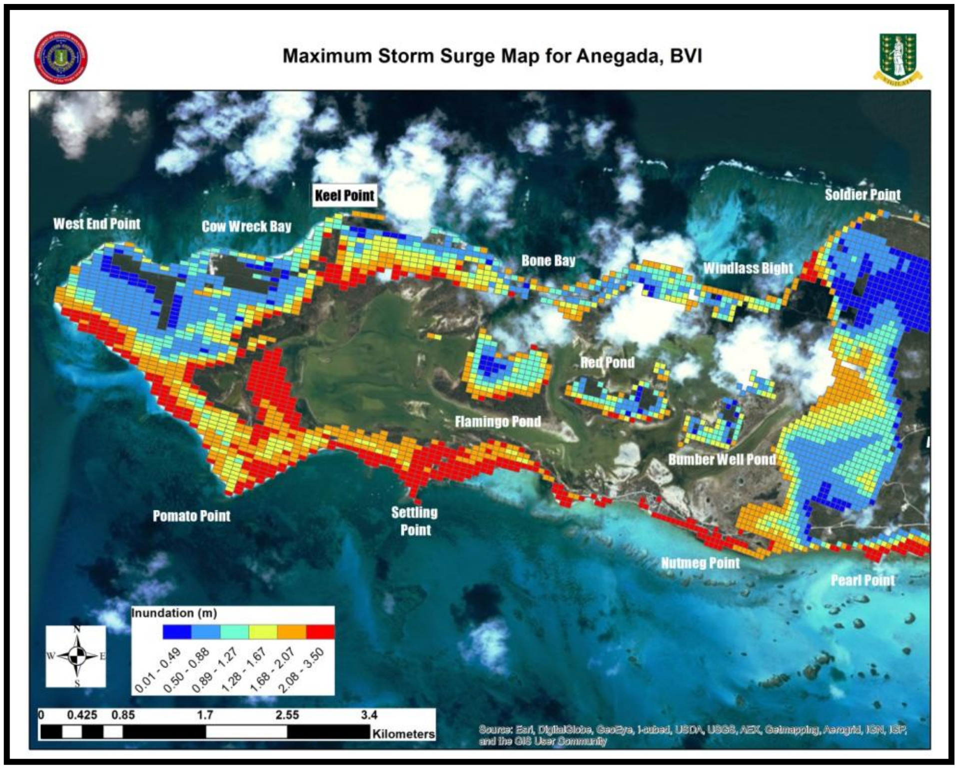


Figure 7.
Maximum storm surge map for the west end of Anegada (source: DDM).

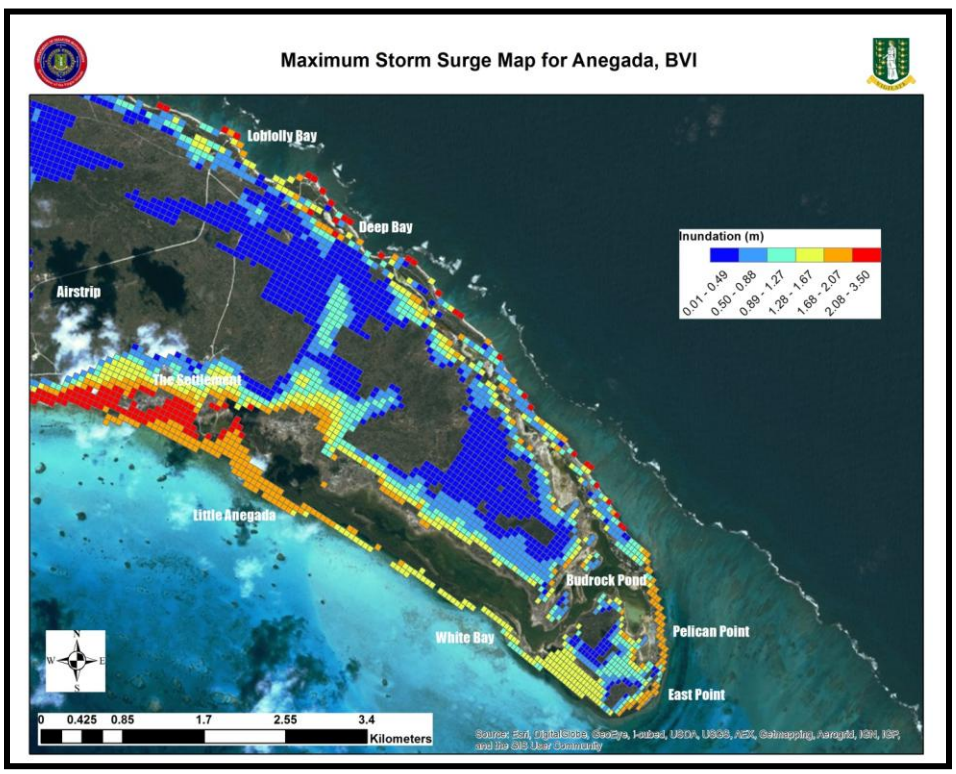


Figure 8.
Maximum storm surge map for the east end of Anegada (source: DDM).

3.1.2.1 Examples of Anegada Coastal Erosion

(1) Anegada Seaside Villas

Seven cottages comprising the Anegada Seaside Villas were constructed adjacent to the shoreline at West End Point and have been severely impacted by coastal erosion following the multiple passage of hurricanes, including Hurricane Omar in 2008 and Hurricane Earl in 2010. The series of pictures in **Photo 13** present a timeline of both the man-made and natural processes occurring in the area of the cottages over a ten-year timeframe.

In October of 2010, the owner of the cottages contracted with a commercial dive service based in Tortola to stabilise the immediate area around the cottages in order to remove one of the damaged cottages and to attempt to restore the remaining cottages.

The company used a diver pump system (**Photo 14**) that allowed divers to methodically backfill around the cottages and obtain a stable beach condition. GeoBags (sand bags) were then installed to build a revetment (**Photo 15**), which functions as a sea defence parallel to the coastline in front of the Anegada Seaside Villas (Commercial Dive Services, 2012).

In addition, the dive company built two groin structures perpendicular to the coastline consisting of GeoBag placement to protect the coastline from erosion incurred by long-shore currents.

An effort was made by the Environmental Profile team to secure copies of environmental studies carried out prior to approval of the restoration project at this site. In particular, Profile researchers wanted to understand how this particular method would impact natural coastal processes of the shoreline over time. DCF staff reported that no such studies were conducted prior to implementation of this project.

(2) Keel Point

As part of the Disaster Risk Management Sub-Regional Programme under the ACP-EU Natural Disaster Facility, the British Virgin Islands was selected as one of 12 pilot countries to benefit from interventions at the community/local level. The BVI's targeted pilot area for the project was Anegada. In 2011, a representative from the Caribbean Disaster Emergency Management Agency (CDEMA) conducted an assessment to determine Anegada's level of vulnerability.

The CDEMA representative identified as a priority the need to arrest non-replenishing coastal erosion in specific coastal areas of Anegada and recommended structural reinforcement along the coast where beach erosion was observed. The report also identified a specific area which residents agreed was in need of disaster management intervention, specifically, Keel Point, a section on the island's northern coast that was experiencing non-replenishing erosion at a rapid rate (Octave-Joseph, 2012).

The same methods used to attempt stabilisation of the shoreline at the west end of Angeda (Seaside Villas) will be applied at Keel Point. The method will involve the use of mechanical equipment to excavate sand from the sea. Sand removed from this area will be reused for back fill purposes. Bags filled with sand from the shore and adjacent water zone will be placed along the coastline on firm, natural and undisturbed subgrade.

Once the bags are in place, natural vegetation will be replanted to assist in stabilising the sand and to firm up the revetment. Currently, three rows of 100 GeoBags, each 4.6 m long x 1.5 m wide (15 ft long x 5 ft wide), are proposed for placement parallel to the shoreline in an attempt to protect the coastal properties developed at Keel Point (*pers. comm*., DDM staff, January-February 2013).

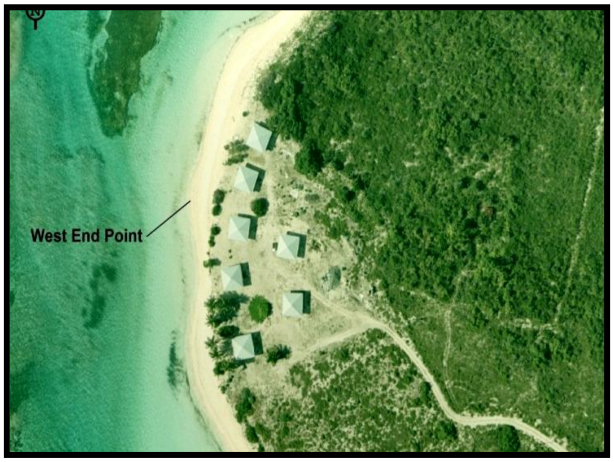


Photo 13a
Anegada Seaside Villas, 2002 (source: DDM).

Photo 13b.
Anegada Seaside Villas, May 2008 (source: DCF).

Photo 13c.
Anegada Seaside Villas, October 2008,
following passage of Hurricane Omar (source: DDM)

Photo 13d.
Anegada Seaside Villas, February 2012 (source: DCF).

Photo 13e.
Anegada Seaside Villas, February 2012 (source: DCF).

Photo 13f.
Anegada Seaside Villas, October 2012 (source: DCF).

Photo 14.

Sand is dredged (pumped) from the nearshore via a pipe and …

… poured within the confinement of a GeoBag enclave (Anegada Seaside Villas).

Photo 15.
A view of GeoBags forming beach groins and revetment at the Anegada Seaside Villas.

3.1.2.2 Challenges Associated with Coastal Erosion on Anegada

Any beach restoration project first requires an understanding of the natural processes which build, shape and affect the beach. In the case of the Keel Point project, the Environmental Profile team could not confirm what preliminary feasibility studies had been carried out to better understand the behaviour of Anegada's shoreline at the site of the proposed change. The section where the Keel Point Cottages are located has been naturally eroding since 1953 (-45 m/-148 ft). However, to the west in Bones Bight, the beach has accreted +30 m (+98 ft) and to the east in Cow Wreck Bay, the beach has accreted +50 m (+164 ft) (**Figure 9**) (Gore, *et al*., 2012a).

Removal of vegetation on the dunes and the construction of hard structures along the dune face (such as stairs) have accelerated erosion at the site as shown by the red dotted line displayed in **Photo 16**. Any hard engineering measures (*i.e*., geo-textile bags) may exacerbate the problem in the event of any storm or swell waves, similar to what occurred at West End Point. The proposed shoreline stabilisation methods at Keel Point, Anegada need to be carefully reviewed by project planners prior to implementing engineering works at the site. The project design team will want to mitigate negative impacts on natural coastal processes that could result in irrepairaple alterations, for example, to *adjacent* shorelines.

3.1.2.3 Lessons Learned from Anegada

Dr. Andrew Cooper, a specialist in coastal zone management and Professor of Coastal Studies at the University of Ulster, conducted several site visits to Anegada and witnessed the coastal erosion at the Anegada Seaside Villas and the subsequent mitigation efforts that were attempted to save the cottages and restore the coastline.

Dr. Cooper provided the following explanation of the cause and effect of coastal erosion impacts at this location (*pers. comm*., correspondence with Cynthia Rolli, *Environmental Profile* project team, 16 November 2012):

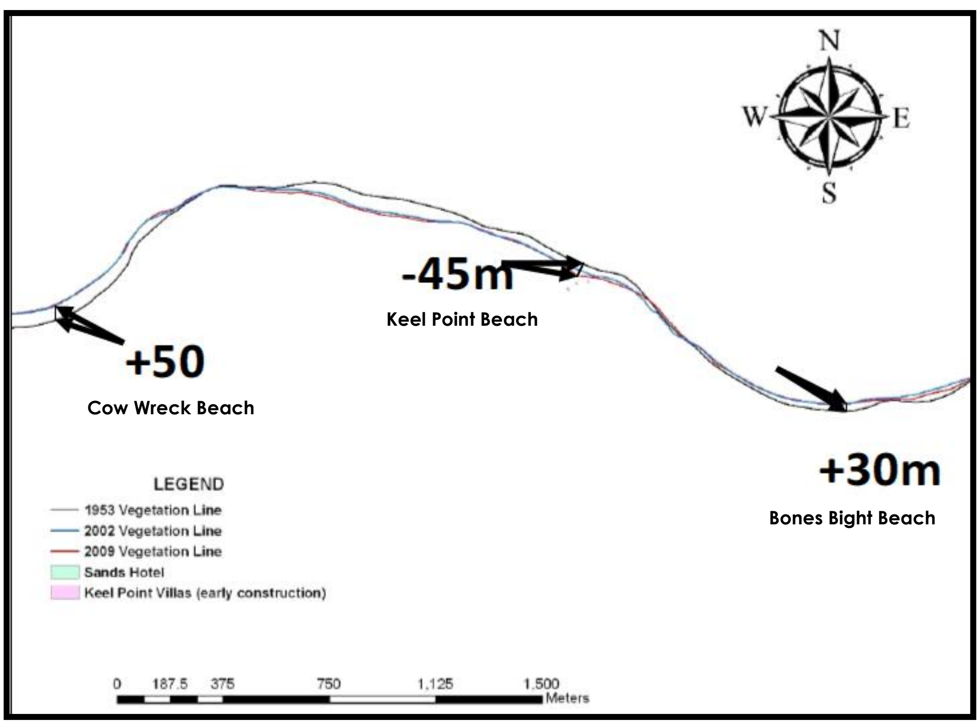


Figure 9.
Shoreline change since 1953 along three beaches on Anegada's northern coastline (source: Gore, *et al*., 2012a).

Photo 16.
Beach erosion at Keel Point, Anegada, with erosion shown by the red dotted line (source: Gore, *et al*., 2012a).

A sandy coast adjusts its shape (along shore and across shore) in response to variations to wave energy, sediment supply, and the surrounding geology. This ability to change shape is why beaches (which are simply loose piles of sand) can survive when other structures like walls and cliffs collapse. Allowing beaches space to fluctuate is essential to their continued presence. Put simply, the houses were constructed too close to the shore on a section of coast that has been experiencing long-term erosion as the shoreline adjusts to sea level and storms.

Dr. Cooper further explained that the mitigation methods implemented along the shoreline at West End Point had not been fully effective in achieving shoreline stability because the engineered works had compromised the ability of the beach to adjust naturally.

When asked to recommend prudent development guidelines for Anegada's coastline, Dr. Cooper provided the following response (*pers. comm*., 16 November 2012):

Don't attempt shoreline stabilization on the dynamic and fully functioning sandy shore of west, north and east coasts of Anegada. This can easily be avoided by careful siting of new development a suitable distance from the shore, by moving threatened structures back, or rebuilding them. In the long run the costs associated with this will be much less than efforts at shoreline stabilization which carry the additional costs of environmental degradation. It is always the case that when shoreline stabilisation projects begin, they are followed by subsequent ones that attempt to repair the damage caused by the first efforts. It is a domino effect that generates costs not only now, but for future generations—and those costs can be avoided by not letting defence of local infrastructure destroy perfectly healthy natural beaches. Anegada is a rare example of large stretches of Caribbean beach that have not been compromised by sea defences. Beaches are more valuable than buildings.

As evidenced by this example, identifying and understanding the risks and potential hazards that affect coastal areas is a key factor in successful mitigation. Failure to consider hazard risks—such as long-term erosion and the effects of multiple storms—can increase coastal flooding over time. Long-term erosion and the accumulation of short-term erosion impacts can cause the loss of protective beaches, dunes and bluffs, and soils supporting building foundations (FEMA, 2011).

Siting near erosion-control or flood-protection structures can contribute to building damage or destruction because these structures may not afford required protection during a natural hazard event. Seawalls, revetments, berms, and other structures may themselves be vulnerable as a result of erosion and scour or other prior storm impacts. Siting too close to protective structures may preclude or make diffcult any maintenance of the protective structure. Buildings sited on the downdrift shoreline of a groin or stabilised tidal inlet (an inlet whose location has been fixed by jetties) may be subject to increased erosion. **Figure 10** shows how increased erosion rates on the downdrift side of groins can threaten structures (FEMA, 2011).

3.1.2.4 Predicting and Mitigating Erosion

Although the concept of erosion is simple, erosion is one of the most complex hazards to understand and predict at a given site (FEMA, 2011).

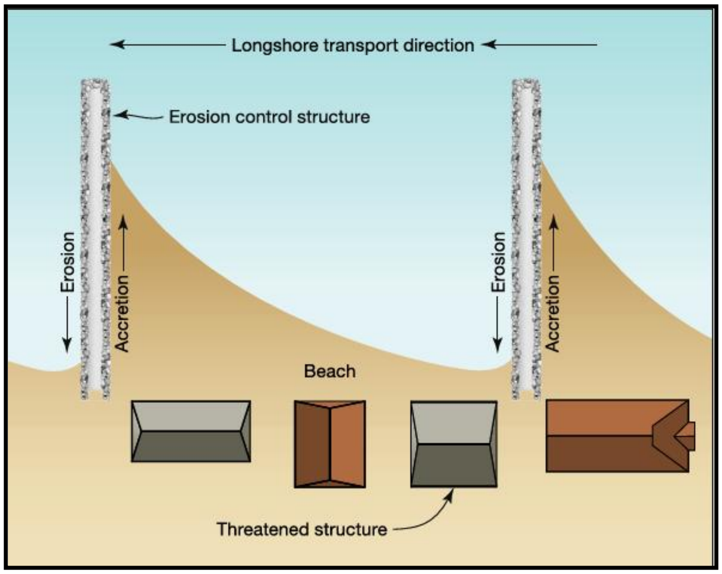


Figure 10.
This diagram shows the impact of groins.
Groins are established perpendicular to the shoreline and trap sand on the updrift side, causing erosion on the downdrift side (source: FEMA, 2011).

Figure 11 displays the potential impact of storm surge inundation on the island of Anegada with a 10 percent probability for occurrence within a 50-year timeframe (Young, 2006). This information can be used to form the basis on which to implement planning strategies for prevention and mitigation, preparedness and response, and recovery and rehabilitation. Examples of positive outputs resulting from storm surge risk identification include:

- Identification of critical facilities in storm surge high-risk areas;
- Identification of environmental attributes in high-risk areas;
- Identification of high-risk areas based on economic components;
- Development of mitigation strategies for vulnerable and high-risk areas; and
- Incorporation of development conditions associated with high-hazard areas in land use maps.

In a recent study, Dr. Shannon Gore of the BVI Department of Conservation and Fisheries documented change in the coastline of Anegada over the period 1861 to 2009 by comparing historical maps and air photographs (Gore, *et al.*, 2012a). As shown in **Figure 12**, the extreme western end of the island experienced severe erosion between 1861 and 2009, with up to 285 m (95 ft) loss from Walkover Set Point to Ruffling Point.

On the eastern end of the island, Dr. Gore documented that the beaches along the north-eastern coastline show a trend of long-term stability, and have not eroded/accreted more than ±30 m (± 98 ft) intermittently between 1953 and 2002 (**Figure 13**). In contrast, Dr. Gore noted the most significant erosion change was between Jack and Cooper Bays (Gore, *et al*., 2012a).

Dr. Gore has illustrated the resiliency of Anegada's coastal environments. As stated in her doctoral thesis (Gore, 2011a):

> *Although Anegada has shown extensive erosion at its western end, its adjustment to multi-decadal changes, the stability of the northern coast and the progradation on the southern coast indicates a level of resiliency.*
>
> *… Understanding these morphological adjustments is required to ensure continued resilience to future coastal development and climatic events that may threaten the island.*

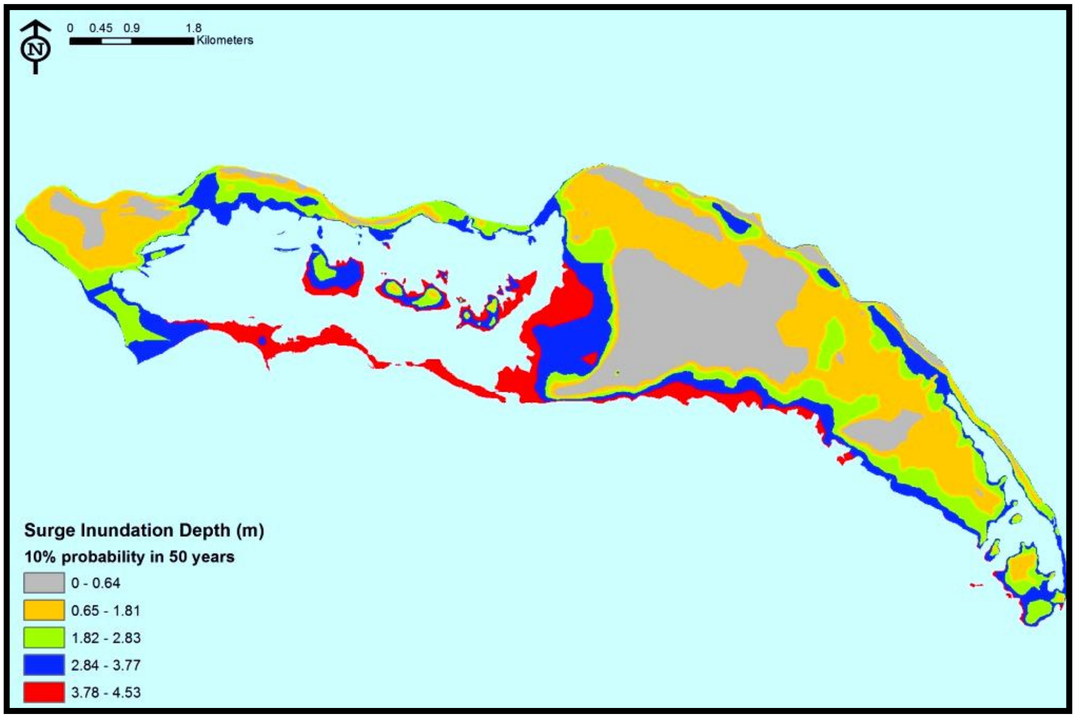


Figure 11.
Potential impact of storm surge inundation on the island of Anegada (source: DDM).

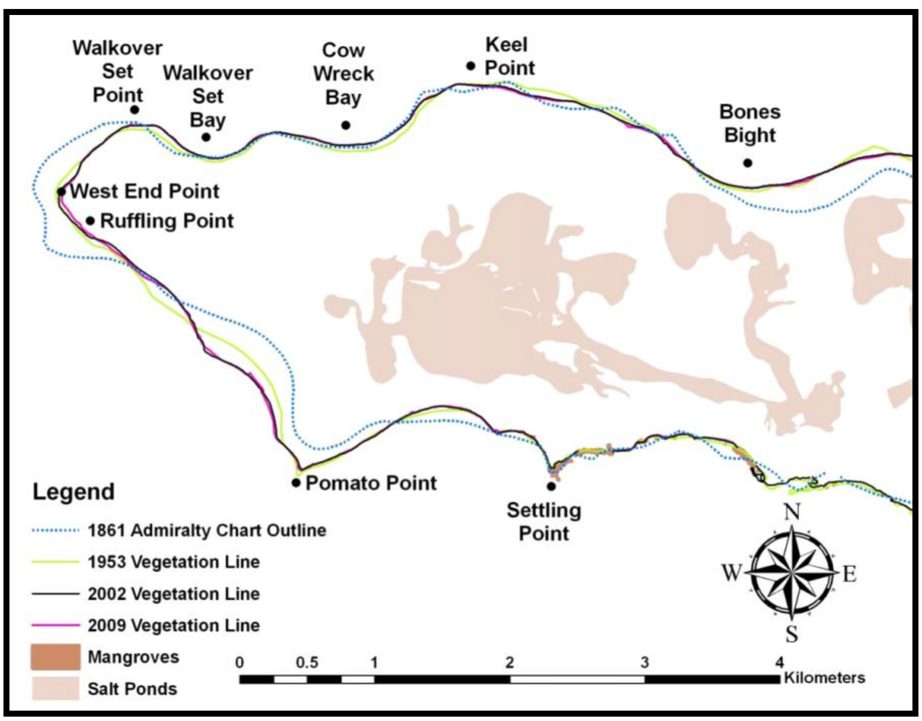


Figure 12.
This diagram illustrates severe coastal erosion on the western end of Anegada from 1861-2009 (source: Gore, *et al.*, 2012a).

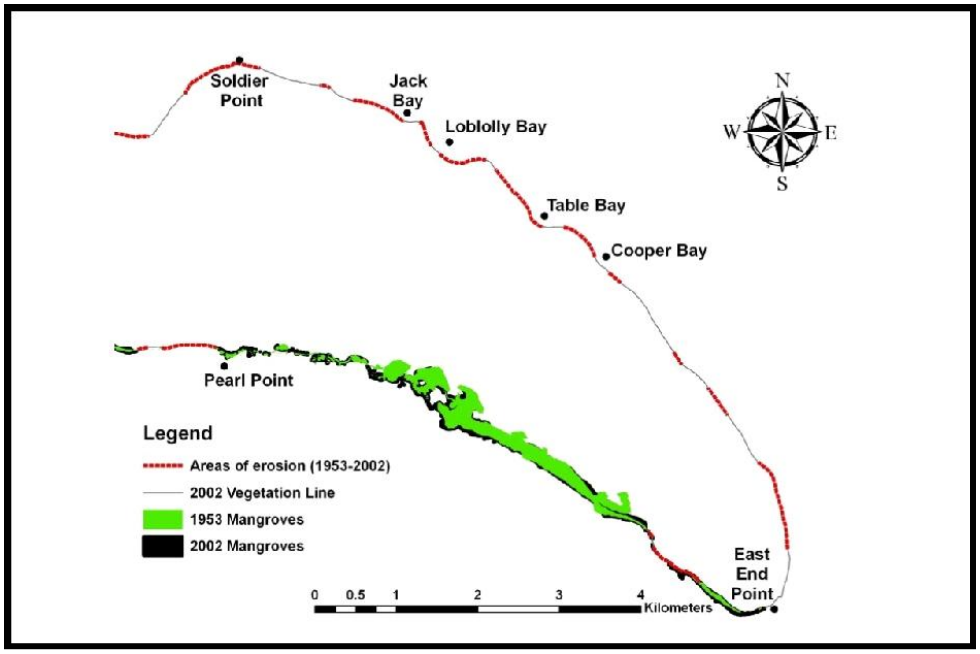


Figure 13.
This diagram illustrates the relative stability of the beaches located along Anegada's northeastern coastline (source: Gore, *et al*., 2012a).

3.1.3 Flood Events

Flooding has been a major challenge for the Virgin Islands in the past decade, specifically for events occurring in 2003, 2005, and 2010. The territory suffered flooded homes and businesses, landslides, severe sedimentation of coastal waters, and—subsequently—negative environmental and economic impacts on a substantial scale.

Photo 17.
The Settlement, Anegada, following the passing of Hurricane Omar in 2008 (source: DDM).

In 2010, a combination of three tropical cyclones, in addition to moisture from various troughs, produced some of the heaviest downpours experienced in the territory. Damage assessment reports revealed that the damages sustained in the BVI was in excess of 10 million dollars. On Anegada, however, flooding and consequent damage was minimal as floodwaters are distributed and absorbed through Anegada's extensive wetland ecosystems (**Photo 17**) (Gore, *et al*., 2012a).

3.1.4 Earthquakes and Tsunamis

The islands comprising the Virgin Islands are especially vulnerable to the impacts of earthquakes and tsunamis as they sit on the northeastern edge of the Caribbean Tectonic Plate where it meets the North American Plate at the Puerto Rico Trench (**Figure 14**).

The boundaries of the Caribbean Plate are characterised by intense earthquake activity caused by faulting induced by the differential movements of the plates. The edges of these plates, where they move against each other, are sites of geologic activity such as earthquakes, volcanoes, and mountain building. **Figure 15** represents the seismic activity that occurred over a 10-year period.

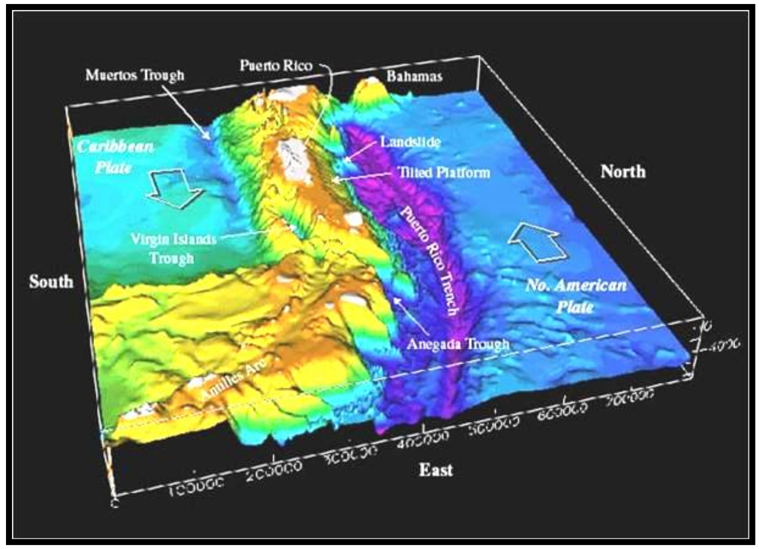


Figure 14.
Caribbean Tectonic Plate meets the North American Plate at the Puerto Rico Trench (source: US Geological Survey, Woods Hole Science Centre).

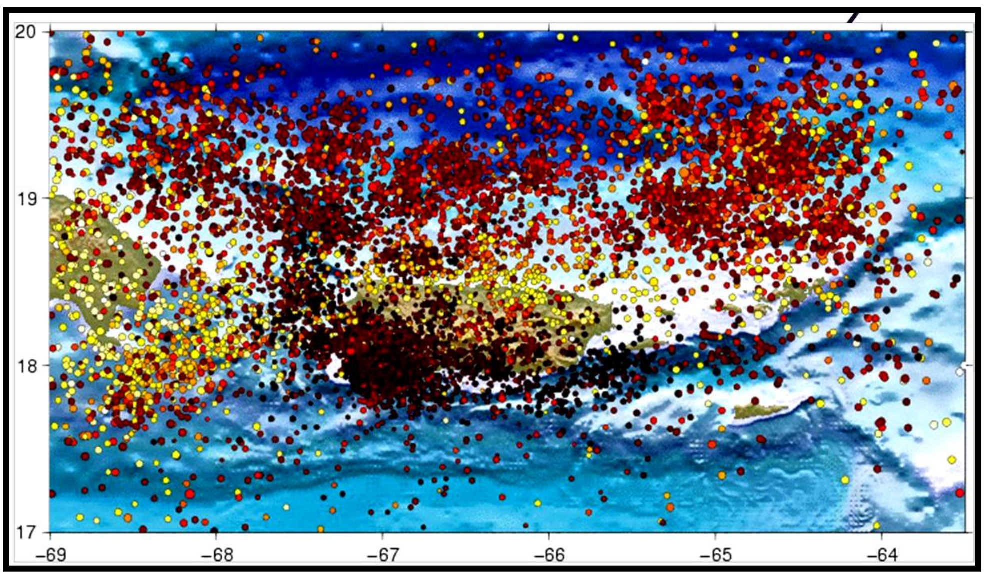


Figure 15.
Seismic activity on the northeastern boundary of the Caribbean Plate, 1995-2005 (source: Joyce, 2008).

Dr. Uri ten Brink, a geophysicist with the US Geological Survey's Woods Hole Science Centre who studies earthquakes, tsunamis and geology in Puerto Rico and the Caribbean region, writes that there are a number of possible sources for earthquakes and tsunamis in the Caribbean (*Science Daily*, 2005). He reports:

The threat of major earthquakes in the Caribbean, and the possibility of a resulting tsunami, are real even though the risks are small in the bigger picture. Local earthquakes, such as from the fault on Hispaniola or effects from distant earthquakes, can be severe. Landslides and volcanic eruptions can also cause major earthquakes and potential tsunamis in this region. It has happened before, and it will happen again.

There is recent evidence to support the hypothesis of severe earthquakes and tsunamis having previously affected the Virgin Islands. The evidence is the result of an ongoing paleoseismic investigation conducted by a team of scientists including Mr. Brian F. Atwater with the U.S. Geological Survey and Dr. Martitia P. Tuttle with M. Tuttle & Associates. The investigation was initiated in 2008 to determine the historical recurrence of earthquakes and tsunamis in the region and the earthquake and tsunami potential of the subduction zone marked by the Puerto Rico Trench.

Atwater and his scientists have discovered two tsunami-related events that impacted the island of Anegada between the time periods AD1200-1450 and AD1650-1800. The evidence is supported by carbon dating of coral boulder deposits and numerical modeling of hurricane and earthquake scenarios. In a comparison among numerical models of storms and tsunamis, only tsunami waves of nearby origin managed to wash over an area where coral heads of medieval age are scattered hundreds of metres inland from the north shore of Anegada (Wei, 2012).

The likely scenarios related to the two time periods identified for tsunami-related impacts are:

(1) Deposits dated to 1650-1800 at Anegada represent either the largest known far-field tsunami in the Caribbean (1755, Lisbon) or some other tsunami or unusual storm that surpassed the Lisbon tsunami in its local geologic effects (Atwater, *et al*., 2010, 2012a).

(2) The likely tsunami source responsible for the 1200-1450 overwash deposits found on the north shore of Anegada is faulting along the eastern Puerto Rico Trench 200 km (124 mi) to Anegada's north (Atwater, *et al*., 2010, 2012a).

The team of scientists is planning to return to Anegada in 2013 to continue their investigations.

The recent Anegada-focused project, the Regional Risk Reduction Initiative (see Section 3.1.2.1), also produced tsunami wave-inundation modeling of scenario events and created quantitative hazard maps. The tsunami inundation depths were based on scenarios defined for both earthquakes (1755, 1867, and a hypothetical one in the Puerto Rico Trench) and landslides (one slide from the south of St. John and one from east of the Amphitheatre Escarpment, which is north of Puerto Rico). The climate change scenario was defined for the tsunami hazard by adding one metre of sea level rise to the inundation data.

Figures 16 and **17** provide the inundation values for the island of Anegada from both the western and eastern ends of the island. The inundation values that are provided are the Maximum of the Maximum (MOM) which is an ensemble product of maximum tsunami inundation values for all tsunami scenarios listed. MOMs represent the worst case scenario for any given storm event. The tsunami scenarios were defined using historical records and data from the United States Geological Survey (*pers. comm*., DDM staff, January-February 2013).

3.1.5 Global Warming and Sea Level Rise

The vulnerability of the low-lying coastal communities of Anegada to global climate change is of particular concern since climate change's primary effects will most likely include rising sea levels and ever-stronger hurricanes. **Figure 18** portrays the projected changes of most concern in the Caribbean region.

The Virgin Islands, like all small-island developing states, will be among the first and worst affected by climate change, as identified by the United Nations Framework Convention on Climate Change (UNFCCC) and the Intergovernmental Panel on Climate Change (IPCC) (Burnett-Penn, 2010).

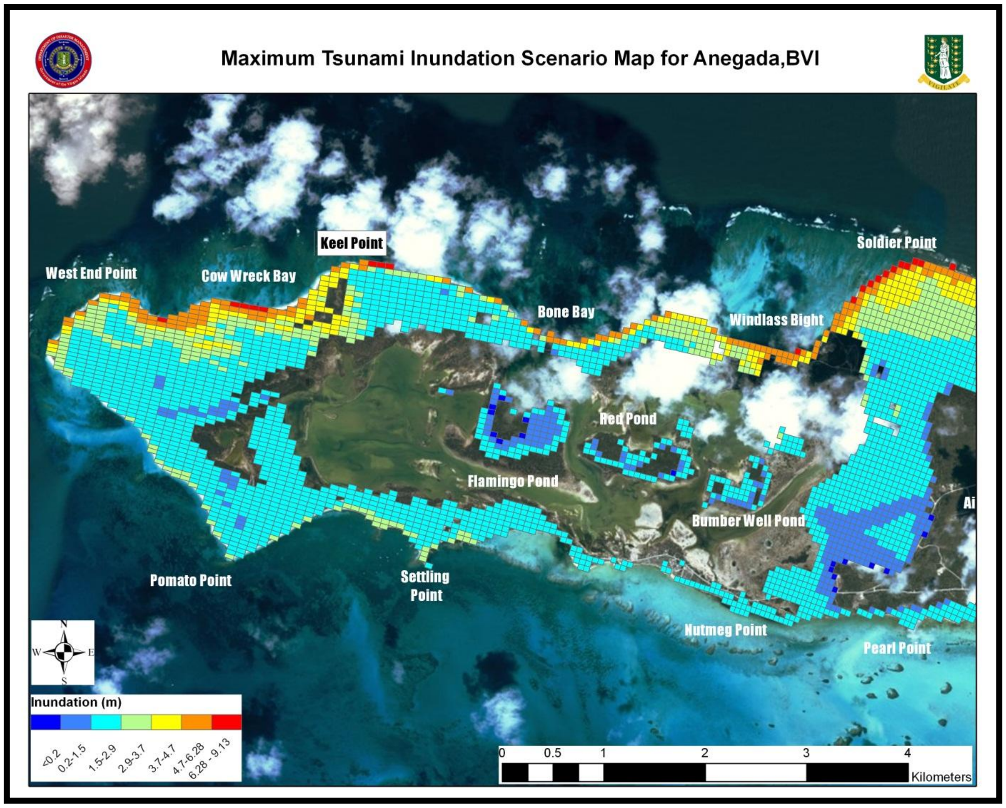


Figure 16.
Maximum tsunami inundation scenario map for the west end of Anegada (source: DDM)

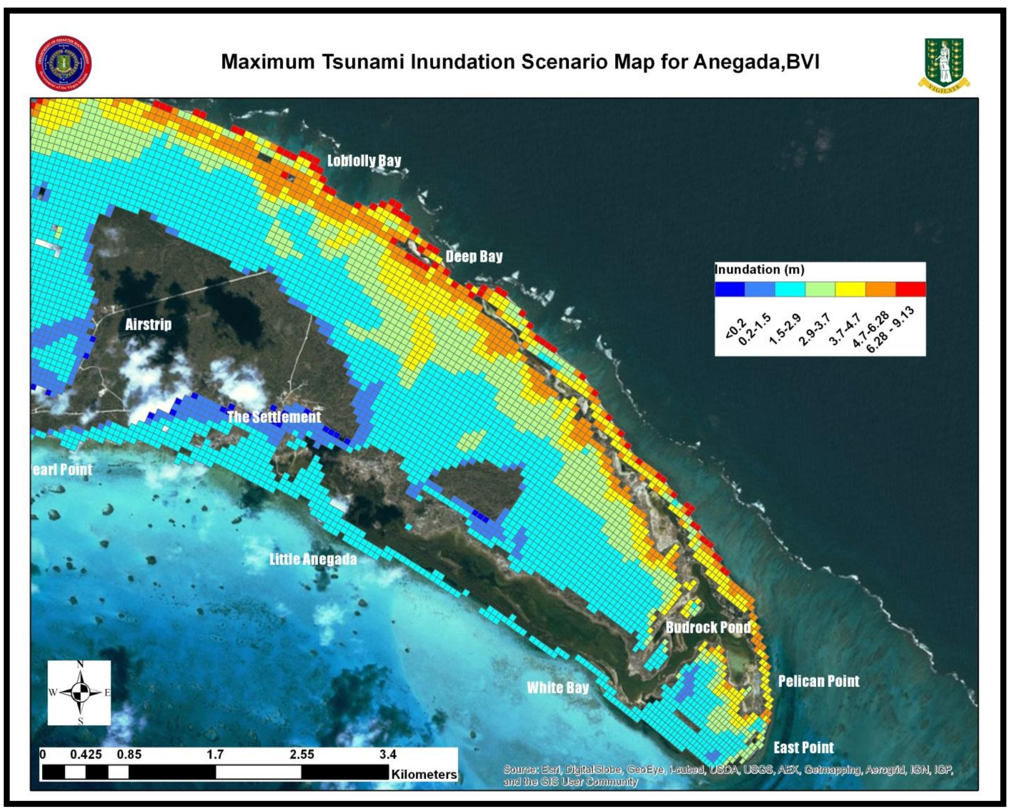
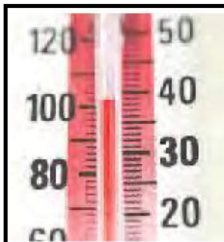


Figure 17.
Maximum tsunami inundation scenario map for the east end of Anegada (source: DDM)



Rising temperatures

1°C - 5°C (1.8°F – 9°F) warmer by the 2080s under the Medium-High Carbon Emissions Scenario (Taylor et al., 2007);

Changing rainfall patterns

Up to 25% drier by the 2080s under the Medium-High Carbon Emissions scenario, accompanied by a *change in rainfall patterns such that more, heavier rain events and thus floods are likely* (Taylor et al., 2007);

Stronger, more persistent and devastating hurricanes

A greater likelihood of category 4 and 5 hurricanes as is already being observed (Mimura et.al, 2007).

Rising sea level

0.19 – 0.58 metres (0.6 – 1.9 feet) higher sea level by 2100 as a result of warmer ocean temperatures and melting polar glaciers (Mimura et.al, 2007).

Figure 18.
Predicted climate changes of most concern for the Caribbean region
(source: Burnett Penn, 2010).

Recently, a comprehensive study was undertaken by the BVI Government under the leadership of the Department of Conservation and Fisheries to assess the potential impacts of Global Warming and Sea Level Rise on the Virgin Islands. The findings of this study can be found in the report titled *Virgin Islands Climate Change Green Paper*. The Green Paper identifies and discusses the potential local effects of climate change, climate-related vulnerabilities, adaptation options, and the territory's capacity to respond (Burnett Penn, 2010).

A Climate Change Adaptation Policy was developed as a result of the Green Paper and approved by the House of Assembly in June 2012. The objective of the Climate Change Adaptation Policy is to ensure that the local impacts of climate change are minimised through proactive planning and protective measures. To be successful, the Adaptation Policy must be fully integrated into territory-level planning and policy in all impacted sectors (DCF, 2012). See also Chapter 2, Section 2.2.5.9.

The portfolios of several territory-level, inter-agency committees or bodies allow them to have a direct influence on policies and decisions relevant to climate change adaptation. However, to fully accomplish these mandates, the Green Paper identifies major management gaps that need to be addressed by public sector managers and policy makers in tourism and finance; land and critical infrastructure planning; water and electricity; the environment, agriculture and fisheries; and the health sector to ensure that adaptation strategies will minimise climate change impacts. According to the Green Paper, management gaps that need to be addressed include (Burnett Penn, 2010):

- A comprehensive Coastal Management Plan;
- Specific management plans for beaches (work is currently ongoing in this area; see Chapter 2, Section 2.2.5.10);
- A sustainable management programme for fish stocks;
- Management plans for designated Fisheries Protected Areas;
- A comprehensive Land Use and Physical Development Plan inclusive of zoning (see also Chapter 2, Section 2.2.5.5).

A land allocation plan was developed for Anegada in 2007, spearheaded by the Ministry of Natural Resources and Labour in collaboration with the Department of Town and Country Planning and the Department of Lands and Survey (MNRL, 2007) (see also Chapter 2, Section 2.1.2). If this development plan for Anegada is widely implemented prior to achievement of the outputs identified in the management gaps enumerated above, then climate change adaption strategies defined in the Green Paper will not be fully or comprehensively effective for the island of Anegada.

It is also critical that future development planning for Anegada, as framed in the 2007 Land Allocation Plan, be subject to the requirements of Environmental Impact Assessments and Hazard Vulnerability and Risk Assessments. This will help to ensure that climate change strategies are incorporated into development planning for Anegada.

3.1.6 Technological Hazards: Oil Spills and Hazardous Materials

Marine traffic, especially oil tankers and large cruise liners and cargo vessels in transit through the coastal waters of the BVI, present a risk for major oil pollution from collisions, fires and explosions, and groundings.

Land-based operations—such as fuel stations, garages and auto body repair shops—pose the greatest risk as sources of land-based pollution from spills, fires and explosions, and from improper disposal of petroleum-based waste products. Many industries in the Virgin Islands use oil and other pollutants in large quantities on a daily bases. The presence of such large quantities poses a potential hazard should there be an accident or if the products are not properly stored.

Disposal of oil and other pollutants is regulated and costly in the BVI, which has, in turn, often resulted in the illegal dumping of such products. Many times the most likely place for such activity is in remote and environmentally sensitive areas.

The damage and pollution caused by a major oil spill or other harmful products would have a long-lasting and devastating effect on an environmentally sensitive area like the Virgin Islands. However, damage from an oil spill or other harmful products is not limited to major incidents; long-term leakage or dumping of small amounts, over time, can be just as harmful. Even small amounts in ecologically sensitive areas can lead to ecocide or other environmental issues (DDM, 2009).

Heavy metals, petroleum hydrocarbons (much of which comes from runoff of motor oil and other wastes from roads), and other toxic materials are a cause for concern because of their poisonous effects on aquatic life, and because accumulation in the tissues of fish and shellfish can be harmful to human health.

3.2 Natural Hazard Events and Associated Environmental Impacts

Table 7 illustrates the relationship between major ***Hazard Events*** encountered in Anegada, the ***Secondary Results*** of some of these Events, the ***Major Environmental Impacts*** that result from Hazard Events, and those ***Man-made Factors*** that exacerbate the negative consequences of each type of Hazard Event or its Secondary Result. To a large extent, the information presented in the table is derived from the long experience of the BVI's Department of Disaster Management and a consolidation of several disaster management studies undertaken in recent years.

Table 7.
Relationship of selected hazard events (and their secondary results), major environmental impacts, and man-made factors that increase those impacts.

	Important Secondary Results					Major Environmental Impacts								Man-Made Factors Increasing Hazard Event's Negative Impacts					
Hazard Events	High Winds	Coastal Flooding	Inland Flooding	Landslides	Tsunami	Loss of Species Diversity (Ecosystem Resilience)	Coastal Erosion	Sewage/Waste Contamination	Inland Sedimentation and Erosion	Reef Degradation	Loss of Land Productivity (Land Degradation)	Decreased Fisheries	Natural Habitat Destruction	Destruction of Functioning Coastal Ecosystems	Reefs Degraded from Run-off (sediment and sewage)	Accumulated Toxins (lack of proper sewage and waste treatment)	Weak Development Planning, Control, and Implementation Practices.	Loss of Natural Protective Buffers (e.g., wetlands, salt ponds)	Excessive Green House Gas (GHG) Production
Hurricane/Tropical Storm	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X
Rain Events		X	X	X		X	X	X	X	X		X		X	X	X	X	X	X
Earthquake		X		X	X	X	X	X	X	X		X	X	x	X	X	X	X	
Sea Level Rise (or coastal subsidence)		X				X	X	X	X	X		X	X		X	X	X		X
Spills of Oil or Hazardous Materials		X	X			X		X		X		X	X	x	X	X	X	x	
Increased Temperatures	X					X				X	X	X	X			x			X
Increased Climate Variability	X	X	X				X		X		X		x	x	X		x	X	X

3.3. Development Trends Affecting Natural Hazard Risk

3.3.1 Reduction of Natural Environmental Defences

Limited physical and economic development and a long-standing small population (approximately 300 at present, see Table 2, Chapter 2) have permitted a majority of Anegada's coastal ecosystems to remain intact and undisturbed (Gore, *at el*., 2012a).

Nevertheless, some human practices of recent years have negatively affected the island's environment and have increased risks to the local community from natural hazards. These practices have included:

- Inadequate setbacks from the shoreline for coastal structures;
- Degradation of natural ecosystems, thus limiting their eco-benefits for storm protection and flood mitigation;
- Problematic shoreline stabilisation techniques;
- Unpaved roads; and
- Waste pollution.

In the aftermath of the 2004 tsunami in Indonesia, compelling evidence has emerged from field studies in several affected countries indicating that mangrove forests played a crucial role in saving human lives and property. Similarly, vegetated coastal dunes, seagrass beds, and intact coral reefs all performed a similar protective function in some areas. Where mangroves and other coastal habitats had been destroyed, often illegally, the waves were able to penetrate far inland, destroying homes, inundating farmland and washing away people and livelihoods (EJF, 2006).

As development increases in Anegada and if effective land development control practices are *not* put in place, the risk of further loss of natural ecosystems will continue and the ability of these systems to protect the environment will be reduced.

Human interference with natural coastal process should be avoided. For example, the adverse effects of shoreline stabilisation methods can be significant, and erosion-control solutions can impact natural resources in many ways, such as those enumerated below (New York State Department of Environmental Conservation, 2011):

- Increased erosion of the adjacent natural shorelines and scouring in front of structures.
- Reduced or degraded habitat for a variety of fish and wildlife species;
- Impaired movement of organisms between aquatic and terrestrial habitat;
- Altered physical structure of the water's edge, with changes to hydrology;
- Local changes in water quality, including changes to temperature and increases in turbidity, nutrients and contaminants.

Impacts from coastal erosion can be avoided by careful siting of new developments a suitable distance from the shore, and by moving existing threatened structures back or rebuilding them.

3.3.2 Planning and Building Regulations

Several planning initiatives and projects, focusing on risk reduction and mitigation planning have recently been implemented in the territory and are identified in **Table 8**.

Currently, development applications submitted for review to the Department of Town and Country Planning must include a vulnerability assessment if the location or dimensions of the project appear to put the development at risk from hazard phenomena, whether natural or man-made. The Department of Disaster Management supports DTCP in this effort and conducts the hazard vulnerability assessment and prepares a report for each development that requires a hazard assessment.

Table 8.
BVI planning initiatives and projects focusing on risk reduction and mitigation planning for the territory.

Project	Funding Agency	BVI Co-ordinating Agency	Objectives	Outputs	Status
Regional Risk Reduction Initiative (R3I)	European Union, executed by the United Nations Development Programme	DDM	To develop the capacity, knowledge and tools to enable the mainstreaming of disaster risk management consistent with the Hyogo Framework for Action and CDERA-led Comprehensive Disaster Management.	1. Tsunami wave inundation modeling of scenario events, and creation of quantitative hazard maps. 2. High resolution storm surge inundation maps.	Completed December 2012
Community Disaster Risk Reduction Project for Anegada	Disaster Risk Management Sub-regional Programme being funded by the European Union and executed by Caribbean Disaster Emergency Management Agency (CDEMA)	DDM	To enhance human safety, to reduce social, economic and environmental costs of natural disasters, and to build more resilient communities.	1. Vulnerability analysis and risk profile (participatory approach). 2. Assessment of emergency communications. 3. Community Disaster Plan. 4. Community Preparedness Tool Kit. 5. Model Evacuation Policy. 6. Beach Restoration.	Pending Completion 2013
Planning Regulations to the Physical Planning Act, No. 15 of 2004	CDEMA	DDM	To reduce the vulnerabilities associated with climatic events on the Virgin Islands environment, through the development and subsequent application of Planning Regulations.	Regulations specified by the Physical Planning Act (2004) to include: 1. Procedures for environmental impact assessments (EIA) and the form of environmental impact statements (EIS) 2. Incorporation of hazard vulnerability assessments to provide guidance for making decisions on development applications.	Pending Completion 2013

Project	Funding Agency	BVI Co-ordinating Agency	Objectives	Outputs	Status
Planning Database	Comprehensive Disaster Management Harmonised Implementation Programme (CDM-HIP), through CDEMA	DDM	To collect and monitor all development applications by linking all Government agencies with an integral role in development, as well as external stakeholders such as developers and individual applicants, and giving them the ability to track their applications in real time.	An electronic system to allow for the monitoring of planning applications and mitigation measures being implemented during early stages of the planning and development control process	Pending Completion 2013
Enhancing Capacity for Adaptation to Climate Change in the Caribbean UK Overseas Territories (ECACC)	UK Department for International Development (DFID); managed by the Caribbean Community Climate Change Centre (CCCCC)	CFD	To identify and discusses the potential impacts of climate change in the BVI, the territory's vulnerabilities, adaptation options, and capacity to respond.	Virgin Islands Climate Change Green Paper	Completed August 2010
Climate Change Adaptation Policy	Climate Change Trust Fund (to be established)	National Climate Change Committee	To ensure that the local impacts of climate change are minimised through proactive planning and protective measures.	Ongoing implementation of the Climate Change Adaptation Policy	Policy approved by the House of Assembly in 2012

Hazard vulnerability assessment reports are based on geological mapping and scientific models. In addition (and as important as the hazard data), recommendations are required for mitigation measures specific to each development and each hazard identified within the assessment. Mitigation recommendations may include:

- Cut slope recommendations for the specific geologic formation associated with the project, based on the degree and direction of the slope;
- A drainage plan;
- Erosion control recommendations;
- Coastal mitigation recommendations related to climate change adaptation measures.

The hazard data that is currently available from the DDM to assist applicants include the following:

- Storm surge inundation/flood hazard maps utilising high-resolution coastal topography data;
- Tsunami inundation maps;
- Wind and wave hazard maps;
- Reclaimed land maps;
- Solid and surficial geology maps and engineering characterisations;
- Landslide susceptibility, liquefaction susceptibility and shaking amplification maps at high resolution;
- Comprehensive engineering vulnerability assessments of critical infrastructure and development of vulnerability data collection methodology;
- Development and implementation of quantitative risk assessment methodology, with model runs for critical infrastructure; and
- Compilation of multi-hazard risk map for "model housing" in the BVI.

The DDM is also working with the DTCP to identify development applications that require a geotechnical investigation and study to determine adequate design criteria for developments in areas of reclaimed land, unconsolidated materials and landslide vulnerability.

These efforts to incorporate hazard risk mitigation planning into development practices in the BVI are continually improving, particularly as coordination and collaboration are emphasised and implemented amongst key public-sector agencies overseeing land development in the territory.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE ONE Insufficient building setbacks on Anegada have led to property loss and loss of natural resources, as illustrated by development activities on Anegada's western coastline.	If adequate setback parameters and exacting beach management guidelines are not implemented and enforced, construction and other human activities have the potential to cause significant coastal erosion and could not only increase the impact from natural hazards (such as coastal flooding) but could also, over time, contribute to the depletion of Anegada's natural resources. Improperly sited buildings and buildings with inadequate foundation support are especially vulnerable to the effects of coastal erosion.	**SHORT-TERM OPTIONS** **1.** The damaged cottages at West End Point should be removed or set further inland in order to prevent interference with natural coastal dynamics. Native vegetation should be replanted where the vegetation line was removed. **2.** The Department of Conservation and Fisheries might consider development of a monitoring programme for the shoreline in the west end of Anegada for the purpose of identifying the impacts which development activities, such as the Seaside Villas project, may have caused along other areas of the coast. **LONG-TERM RECOMMENDATIONS** **1.** The Government of the Virgin Islands should establish adequate setback requirements from all coastal developments in the territory, including those of Anegada. Such requirements should consider the following: **(a)** A coastal vulnerability assessment should be carried out using historical aerial photography to identify coastal change over time near any beach in the territory. Access to such data will help to improve decision-making about appropriate setbacks for development activities in the coastal zone. **(b)** Changing the term "*high water mark*" to "*natural vegetation line*" in designating setback requirements would provide a static survey position that can be more easily identified by anyone at any time, as well as on aerial maps. Where the vegetation line has been removed, the use of aerial photos can assist in making the determination. If this change was implemented, then setbacks such as the one described in the Land Development Control Guidelines of 1972 would thereafter begin from the vegetation line. **(c)** A minimum requirement for a 60 m (200 ft) setback for Anegada should be established, with provisions for additional setback as determined by the conditions of each proposed development site. The setback area should also be considered a buffer zone in which vegetation cannot be removed.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
		2. Consideration should be given to the development of a Dune Restoration Programme for Anegada.
ISSUE TWO The construction of sea defences and the implementation of beach stabilisation projects are not always successful, whether in Anegada, other islands in the BVI, or elsewhere.	The possible adverse effects of shoreline stabilisation methods can be significant, including the following: • Increased erosion of the adjacent natural shoreline and scouring in front of stabilisation structures. • Reduced or degraded habitat for a variety of fish and wildlife species; • Impaired movement of organisms between aquatic and terrestrial habitat; • Altered physical structure of the water's edge, with changes to hydrology; • Local changes in water quality, including changes in temperature and increases in turbidity, nutrients and contaminants.	**SHORT-TERM OPTIONS** **1.** The BVI Government should establish adequate setback requirements for all coastal developments in Anegada that allow for the natural fluctuation of the shoreline. **2.** All proposed engineering works along the shoreline in Anegada should require expert coastal engineering and environmental consultation prior to project approval, as well as the submission of design plans from a qualified coastal scientist. **LONG-TERM RECOMMENDATION** **1.** Once put in place, Government will need to enforce setback requirements and building regulations.
ISSUE THREE The lack of a territorial beach management policy has resulted in the loss of natural resources along the coastlines of the BVI, including Anegada.	If a comprehensive beach management policy, with guidelines, is not implemented, construction and other human activities have the potential to cause significant coastal erosion.	**SHORT-TERM OPTIONS** **1.** Designated footpaths to Anegada's beaches should be created to ensure dune vegetation is not destroyed from trampling. In some cases, a raised boardwalk may be required to protect the dune system. The use of dune fencing is recommended for dune restoration to help capture wind-blown sand. (For more information see *Manual for Dune Management in the Wider Caribbean* found at: http://www.cep.unep.org/issues/sanddunes.PDF.) **2.** See also Short-Term Options in Chapter 4, Issue One (Sand Mining).

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
		LONG-TERM RECOMMENDATION **1.** The Department of Conservation and Fisheries should complete its review and assessment of beach management strategies for the BVI (see Chapter 2, Section 2.2.5.10) and should then move forward to develop a comprehensive beach management policy for the territory, as well as modern beach management legislation to replace the outdated Beach Protection Ordinance of 1985.
ISSUE FOUR The 2007 Anegada Lands Allocation Plan (MNRL, 2007) does not incorporate adequate risk-reduction parameters to ensure reduced environmental and societal impacts from development activities. New development projects on Anegada, including those in the coastal zone, do not at present require adequate building standards or drainage, elevation, and setback practices that deal effectively, over the long term, with: • regular floods, • strong hurricanes and storm surges, and • sea level rise.	The consequences of natural hazard events can be of disastrous dimensions in terms of impact on physical, economic and social infrastructure. Many impacts can be diminished if proper attention is paid to establishing and implementing building standards that mitigate the dimensions of natural disasters.	**SHORT-TERM OPTIONS** **1.** The Government of the BVI, through the Department of Disaster Management, should conduct a strategic environmental impact assessment and natural hazards vulnerability assessment of the 2007 Anegada Lands Allocation Plan. **2.** The BVI Government should take appropriate action to improve mitigation planning within the key departments and agencies charged with land use planning, development control, natural resource management, and disaster management. **3.** Setbacks need to be incorporated in development activities located in identified high-hazard areas. **4.** Proposed development projects need to consider and integrate topographic and natural features into the design and layout of such projects. **5.** Government needs to ensure that in the planning phase of proposed land use activities provisions are included for best management practices to control all types of potential erosion (e.g., long-term erosion, storm-induced erosion, erosion due to inlets) and for governing erosion-control practices when laying out lots and infrastructure near a shoreline. **6.** A multi-hazard approach to physical planning and design should be promoted throughout the BVI Government. **7.** A multi-disciplinary team approach to physical planning should be employed by the BVI Government, one that includes professionals with local knowledge and a broad base of technical expertise and backgrounds.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
		LONG-TERM RECOMMENDATION **1.** Over time, the Government of the BVI should implement the following: **(a)** In Anegada, require that all future coastal developments be constructed at appropriate elevations or on pilings (no concrete structures) so as not to disrupt the dune system and to allow an uninterrupted flow of potential floodwaters. **(b)** Require that all primary roads are paved and incorporate proper drainage measures. **(c)** Approve and implement Regulations under the Physical Planning Act of 2004 (see Chapter 2, Section 2.2.4.2). **(d)** Complete, approve and implement the draft Wetlands Management Plan (DTCP, 2005). **(e)** Establish adequate setback requirements for all coastal developments. **(f)** Integrate hazard data in territorial physical development planning.

4. BIODIVERSITY RESOURCES: THE TERRESTRIAL ENVIRONMENT

Anegada—the so-called "*drowned land*"—is no accident of nature. Many may dismiss this flat, dry and often waterlogged sliver of land as barren, hot and too far removed. Like nature's experimentation gone awry, the island seems to be an aberration. Yet, while it may be a contradiction, it is in such a bizarre and extreme environment that we often see the earth's natural beauty at its best. Nature here seems less concerned with human biases and feelings and more concerned with the creation of a truly unique and special place.

Nature experiments and this is how the natural world designs resilient and lasting landscape features. On a grand scale, we see the vastness of oceans and continents, the great migrations across immense areas—and we are in awe. However, on a small scale, there are also grand designs; they are merely smaller details in nature's grand plan. Anegada is one of these smaller gems, a sparkle in the spectacular of nature's designs.

When the current landmass of Anegada gradually emerged from below the seas some 100,000 years ago, it was part of a massive coral reef system formed along the edge of the Puerto Rico/Virgin Islands Platform. Subsequently, through thousands of years of exposure to climatic conditions, the coral reef system transformed into solid limestone that can be seen on the island today. This land, a hard brutal place forged on the divide between Gorda Sound and the pounding and raging Atlantic Ocean, earned its survival the hard way. For millennia, Anegada endured countless storms, tsunamis, earthquakes, floods, droughts, and animal and human invasions that continued to define and redefine its isolated beauty, its endemic plants and animals, its countless wetlands, its wild landscapes, and its hardy people and distinctive way of life.

The surviving flora and fauna of Anegada have undergone rapid evolution in order to adapt to the island's conditions. Species that persisted were joined with other survivors to create the unusual and distinctive environment that is Anegada, an island that is like no other in the Virgin Islands archipelago. This chapter of the *Anegada Environmental Profile* tells the story of what from the past has survived and suggests how humans may join with nature to help ensure the future survival of Anegada's natural riches.

4.1 An Overview of Biodiversity Research

Scientific research and environmental conservation in the Virgin Islands are for the most part a modern phenomenon of the twentieth century. However, the earliest studies of natural history began in the 1800s when European explorers and researchers first documented the diversity and richness of the area's fauna and flora and began to collect, describe, and explain the natural world they explored.

Robert Schomburgk was the first to publish an overview of the vegetation of Anegada in 1832. It was a somewhat different island than it is today. His descriptions are a bit vague and the livestock were carefully "penned" and pastured during his time. Yet it is still possible, based on evidence that survives and the experiences of other researchers, to imagine the island in Schomburgk's time and to define and describe vegetation communities and understand their distribution across the island.

Later, in 1916, some 85 years after Schomburgk's visit, Lord N.L. Britton—the first botanist to visit the island—described its plants, landscapes and vegetation, and was the first to compile a comprehensive species list (Britton, 1916 and 1918).

J.S. Beard followed in the 1940s, briefly describing the vegetation of the British Virgin Islands in his *The Natural Vegetation of the Windward and Leeward Islands* published in 1949. Unfortunately, Beard barely mentions Anegada is his monumental book.

It was not until W.G. D'Arcy's work in the 1970s that a recognised authority gave the island's vegetation and plants significant attention. His first report, entitled *The Island of Anegada and Its Flora*, was published in 1971 and summarises the vegetation communities; it also provides an updated list of plants, including a number of Britton's observations and many of the native, naturalised and cultivated species on the island. That same year, he also published an assessment of the two native palms of Anegada in the journal *Principes* in an article entitled "*The Mystery Sabal of Anegada*." D'Arcy later updated his *Flora* in 1975, re-titling it *Anegada Island: Vegetation and Flora*.

More recently, teams from the Royal Botanic Gardens at Kew, the Smithsonian Institution, the Royal Society for the Protection of Birds, the National Parks Trust of the Virgin Islands, and individual researchers have been conducting more detailed assessments of the island's native and naturalised plants, with a special focus on the island's endemics.

For Anegada's fauna, Schomburgk can be considered Anegada's first chronicler in his 1832 study. But the island seemed to fall back into general obscurity soon after he left its shores. People visited but no one seemed too bothered to sing the island's natural praises.

It was not until the second decade of the twentieth century that Thomas Barbour, eminent herpetologist, naturalist and geographer and Director of the Museum of Comparative Zoology at Harvard University in the United States, made Anegada a place to know. It was Barbour who named the island's endemic iguana *Cyclura pinguis* and who first recognised the distinctive and unique nature of the species. Barbour had not visited Anegada himself, but described the iguana from a live specimen procured on his behalf. He published the name and description of the species in *Notes on the Herpetology of the Virgin Islands* (Barbour, 1917).

It was in the late 1960s, amid fears that a proposed large-scale development scheme for the island could mean the loss of unique species, that several studies were undertaken. In particular, the Caribbean Research Institute at the then College of the Virgin Islands in St. Thomas, USVI, began to promote research studies on the iguana and explore ways to conserve the species. It created an extensive network of experts and officials and provided the earliest foundation for the conservation and protection of the species.

In 1971, Laverne Curry visited the Virgin Islands. Her research resulted in one of the first and one of the most extensive collections of insects for the subject islands and was published in *The Canadian Entomologist* as "*The* Chironomidae (Diptera*) Found in the U.S. Virgin Islands and Anegada, British Virgin Islands*."

As development plans for Anegada continued in the 1970s (see Chapter 2, Section 2.2.6), many called for efforts to save the island's natural and cultural heritage and pressed for critical surveys before proposed development projects began. Some of these studies focused on Anegada's fauna, including the most comprehensive work at the time on the island's herpetology, "*The Herpetology of Anegada, British Virgin Islands*," written by Michael Carey in 1972 and published in the *Caribbean Journal of Science*.

The following year, Anne LaBastille and Milo Richmond followed up Carey's work with a survey and detailed assessment of the island's birds and mammals in their "*Birds and Mammals of Anegada Island, British Virgin Islands*," also published in the *Caribbean Journal of Science*.

By the middle of the last century, the Anegada Rock Iguana numbers had plummeted due to hunting, predation, disease, and habitat loss. Carey followed up his work on the island's reptiles and amphibians with one of the most extensive early studies on the iguana in his 1975 *work "The Rock Iguana,* Cyclura pinguis*, on Anegada, British Virgin Islands …,"* published in the *Bulletin of the Florida State Museum*.

In the late 1970s scientists such as Skip Lazell continued to transform our understanding of Anegada's flora and fauna. Lazell and others restored the Greater Flamingo to Anegada in 1991, and today researchers like Lazell, Gad Perry, Kelly Bradley, Clive Petrovic, Colin Clubbe, and Rondell Smith continue to follow in the footsteps of the likes of Schomburgk. Big shoes to fill, but they are making a difference.

4.2 Vegetation and Flora

Anegada is the only limestone island in the British Virgin Islands, reaching a maximum height of about nine metres (29.5 ft) above sea level. Both of these characteristics have helped to define the island's vegetation. Additionally, as a result of the low elevation, dry hot winds, the dominance of salt spray, thin saline soils, low rainfall, limited moisture and high evaporation, vegetation is short-statured and composed of many drought-tolerant species, which are perfectly adapted to the desert-like and extreme conditions found throughout much of the island.

Anegada's plant species show strong affinity to other islands on the Puerto Rico Bank, and, in fact, many of the endemics that are found here are closely related to plants on Puerto Rico or are also found on that island. Furthermore, Anegada is a link to the Lesser Antilles situated across the deep Anegada Passage to the south. The Passage is a biogeographic barrier that makes it difficult for the movement of plant genetic materials in either direction. Nevertheless, one can begin to see similarities between some plants of the Northern Lesser Antilles and those of Anegada.

For example, Anegada's landscape features and plant adaptation are very similar to some conditions and characteristics found in Barbuda, a dry and flat limestone island reminiscent of Anegada (though larger at about 162 km²). Some of the aquatic marsh plants and environments of Anegada could easily be associated with those of Barbuda. Further, many of the columnar cactuses *Pilosocereus royenii* of Anegada are reminiscent of those in islands like Antigua and St. Kitts. They are more grey-glaucous, like those in Antigua or St. Kitts, rather than the vivid blue-glaucous colour more typical of the Virgin Islands and Puerto Rico.

4.2.1 Vegetation Communities

Today Anegada supports nearly 20 vegetation communities, according to Kennaway, *et al*. (2008), researchers from Kew, and IRF field studies.

Table 9 provides a summary of these vegetation communities. Of the 19 communities, aquatic-associated habitats and deciduous woodland and scrub cover much of the island. **Figure 19** shows the most recent vegetation habitat map prepared by the BVI's National Parks Trust and the Royal Botanic Gardens, Kew as part of the Anegada Biodiversity Darwin Initiative Project (2003-2006). It highlights 14 vegetation habitat types.

4.2.1.1 Primary Vegetation Habitats

Following are descriptions of the three primary vegetation communities, which also correspond to the three main physiographic characteristics of the island. These are:

- **(1)** Wetlands
- **(2)** Limestone Plain
- **(3)** Dunes

(1) Wetlands

About half of the island is covered by wetlands from a large area just east of The Settlement to an inland mangrove and salt pond system spanning much of the island to the west. Several interconnected seasonal ponds, pools, channels and salt flats dominate the landscape.

These communities are remnants of swales, marshes, mangrove systems and tide channels that would have covered most of the original island as it emerged from previous sea levels. As soil and other sedimentary material were deposited, drier land and terrestrial plants and ecosystems created more of the Anegada we see today. Old charts of the island show wide open channels linking these inland "ponds" to the sea. While early maps should be interpreted with caution, it is likely that prior to the twentieth century the ponds, flashes and channels were much deeper and more open than they are today.

Table 9.
Vegetation alliances and community types for Anegada.

NO.	VEGETATION ALLIANCES and COMMUNITY TYPES	SUMMARY of VEGETATION TYPES (FIGURE 19)
A	**Woodlands and shrublands**	
1	Drought Deciduous Woodland	Dense scrub Dense Thicket Dune Scrub Dune Thicket
2	Drought Deciduous Xeric Coastal Shrubland with Succulents	
3	Evergreen Coastal Shrubland	
B	**Forests**	
4	Deciduous, Evergreen and Mixed Forest, and Shrubland with Succulents	Limestone thicket Limestone woodland
5	Drought Deciduous Young Forest and Forest Shrub	
6	Seasonal Evergreen Forest and Forest Shrub	
7	Semi-Deciduous Gallery Forest	
C	**Herbaceous Communities**	
8	Coastal Grassland	Halophytic herbaceous Disturbed agriculture
9	Pasture, Hay, Abandoned Agriculture or Other Grassy Areas	
10	Native grasslands (*many areas not shown on map*)	
D	**Wetlands**	
11	Dry Salt Flats	Buttonwood Mangrove Seasonal Pond Mangrove Red/White
12	Emergent Wetland (including freshwater systems)	
13	Mangroves	
14	Salt Pond	
15	Surface Water	
E	**Sparse Vegetation**	
16	Coastal Rock	Foredune Clearance recolononised
17	Coastal Sand	
18	Quarries	
F	**Developed Areas**	
19	Low Density Urban	Disturbed other

Source: Kennaway, *et al*., 2008.

Western Anegada contains a series of wetlands that together form the largest wetland system in the Virgin Islands (**Figure 2**). According to Jarecki (2004), there are five major ponds, the largest of which is the **Flamingo Pond** (220 ha/544 ac), located at the southwestern portion of the system. The second largest is **Red Pond** (110 ha/272 ac), situated just northeast of Flamingo. The third in size is **Point Peter Pond** (72 ha/178 ac) located between Flamingo and Red Ponds. The fourth largest is **Bones Bight Pond** (57 ha/141 ac), which lies at the northern end of the system. **Bumber Well Pond** (size not available), which forms the easternmost part of the system, is the remnant of a tidal channel that is now largely silted up, although there is still a connection to the sea located near the area called Saltheap Point.

The vegetation surrounding the ponds includes low mangrove woodlands, largely composed of White Mangrove (*Laguncularia racemosa*), Buttonwood Mangrove (*Conocarpus erectus*) and a few patches of Black Mangrove (*Avicennia germinans*). Along creeks, channels and deeper waters, *Rhizophora mangle*, the Red Mangrove with its stilt roots, forms low narrow woodlands.

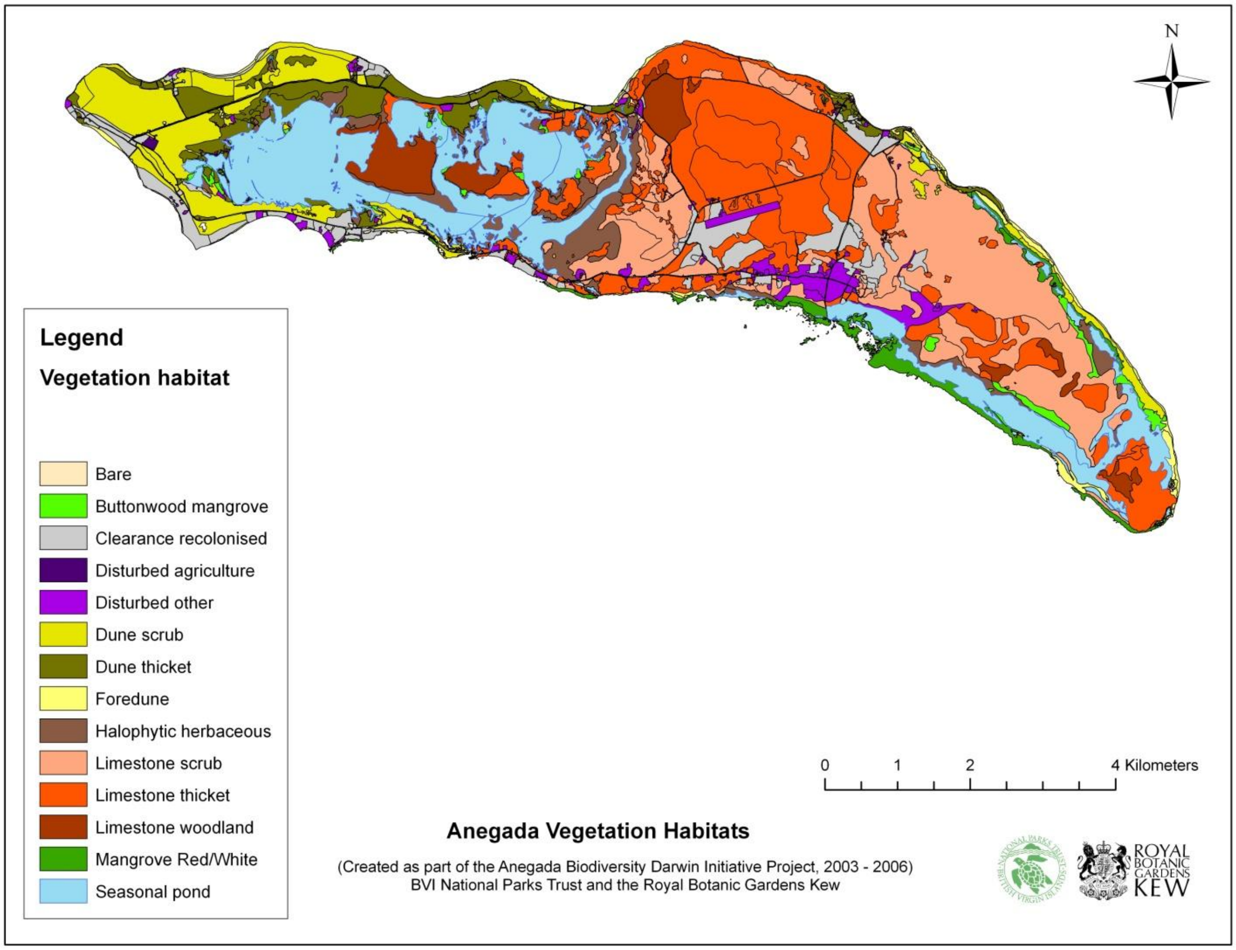


Figure 19.

Summary map of Anegada's vegetation communities (*source*: McGowan, *et al*. 2006).

On the immediate edges, vegetation may be non-existent, with a strip of bare mud, a mix of sand and soil, and rocks forming a narrow strip. Where there is plant growth, it may consist of scattered clumps of shrubs such as *C. erectus* and/or herbaceous growth such as *Batis maritima*. During the annual dry season, extensive areas of the ponds may become exposed, giving the impression that the bare ground dominates the landscape.

In the ponds, few plants can withstand the extreme temperatures, salt content, low oxygen levels and the relatively poor availability of nutrients. In such instances, algal species dominate—whether it is blue, green or brown algae. Little is known about this community, and further investigation is needed to shed light on its species, ecosystems, and functions.

On the southeastern section of the island, running from the eastern tip of the island to just east of The Settlement, a sliver of wetlands can be found (**Figures 2 and 19**). Here narrow bodies of water are bounded on the seaward side by mangroves, dunes and limestone outcrops, and on the landward side by limestone outcrops. Though these ponds may occasionally dry out completely, for most of the time the deeper areas maintain some level of water. Following heavy rains during the wet season, the salinity of the water drops, allowing the system to seem almost like a large freshwater ecosystem. This also coincides with the arrival of thousands of seasonal bird migrants to the island, including shorebirds, waterfowl and passerines. They relish the short time that they have on Anegada and the nourishment that these ponds provide.

Photo 18.
Salt marshes dominated by aquatic herbaceous growth.
The photo is looking west toward The Settlement.

These ponds are quite different from the large inland ponds such as Flamingo and Red Ponds in the northwest of the island. The southeastern coastal ponds represent some of the Virgin Islands' rare salt marshes. Here, herbaceous aquatic marsh species form extensive fringing microhabitats—some areas with swales of just one or two species. It is a system seldom found in most of the Eastern Caribbean except for Barbuda.

A view of a portion of the ponds near White Bay is provided in **Photo 18**, which shows *Salicornia* species and herbaceous marsh habitats during the dry season in 2012. The salt marshes include an occasional shrub, a few scattered herbaceous plants, and extensive herbaceous swales of *Batis maritima*, *Sueda linearis*, *Philoxerus vermicularis*, *Salicornia nerennis*, and *Salicornia bigelovii*. These plants are very rare species throughout the Virgin Islands and Lesser Antilles, and the unique ecosystems are worthy of protection from the degradation caused by free-roaming and feral livestock.

Less understood and known are the extensive green, brown and blue algal communities that dominate the submerged and waterlogged muddy soils at the base of the ponds. What is the role of the algae? What are the species that are found here? How are they connected to the overall functions and stability of the ecosystems? These are questions that can only be answered through careful study and assessment so that resource managers can better manage and protect these rare and fragile wetlands.

Just north and northwest of these coastal wetlands at White Bay, a raised limestone platform forms what is often called the **Limestone Plain** (see **Figure 2** in Chapter 1). On average, this area rises just a few metres above sea level. There are extensive clumps of woodland, intermixed with large patches of bare rocks and scattered small limestone boulders. Here, over time, eroded and weak fissures in the rock formed depressions or small solution holes (sinkholes) where water may collect.

These depressions may be mere flash pans where water collects for weeks or may form permanent cavities where scarce freshwater remains throughout the year. The depressions could also form small wetlands, dominated by *Conocarpus erectus* and with herbaceous plants and species of slimy mold on the wet soil. However, because of the adverse impacts of feral and free-roaming livestock, these systems have been severely altered and may scarcely resemble their original form.

Deeper depressions with permanent freshwater can be found to the east and northeast of the Limestone Plain. These are very rare, but have been used by local residents for the collection of scarce freshwater for many centuries.

On the northern, eastern and western dunes, small patches of marshes and mangrove wetlands have formed between sandy dunes. These areas may be broadly categorised as "emergent wetlands" under the vegetation classification system, but they are far more complicated, and some are more permanent than the name suggests.

These areas are usually dominated by grasses and species of sedges and, in larger systems, by the four mangrove species. In some years, water levels may be quite low or are quick to evaporate, leaving the wetlands dry, but in very rainy years, high water levels may persist for months. In some areas, the White Mangrove (*L. racemosa*) will exhibit extensive and prominent stilt roots, possibly due to the low oxygen levels, high salinity and temperatures, high evaporation rates, turbid water, and other factors. In these isolated and extreme wetland systems, the mangrove plants form low, stunted shrubs and low, fringing woodlands.

Photo 19.
Mangrove wetland formed between sand dunes on the northeastern end of Anegada. White-cheeked Pintails enjoy the pond during the dry season of 2012.

Open wet and damp areas are usually dominated by species of sedges, grasses and algae. **Photo19** shows one such system within the dunes on the northeastern end of Anegada, and **Photo 20** shows the waterlogged areas of this wetland with the mud and wet areas covered by partially desiccated mats of algae and slime.

Photo 20.
Algal and slime mats (bare foreground) dominating a mangrove area.

Photo 21.
Deciduous woodland east of Bumber Well Pond.

(2) Limestone Plain

The raised Limestone Platform is found primarily on the eastern half of the island, broken here and there by dunes and wetlands. The highest elevation is in the northeast at about 8 m (26 ft) above sea level. The Limestone Plain gently slopes to the south and for the most part is bare or has a thin veneer of soils.

Given the paucity of soil and nutrients, limited moisture and humidity, and the area's high exposure to solar radiation, salt spray, heavy winds and storm surges, vegetation consists of patches of woodland, low scrub, degraded native grasslands, small solution holes and swaths of cacti and other succulents—an indication of just how extreme the environment is.

The tallest vegetation on Anegada occurs as patches of deciduous woodland and a short-stature forest found on the northeastern section of the Limestone Plain and on areas east and northeast of Bumber Well Pond. Most of these patches are only a few square metres to about a couple of hectares in extent; prominent among the species are columnar cacti (*P. royenii*) and a few scattered *Agave missionum*. Most of the plants are deciduous, and may include *T. heterophylla* and *T. lepidota*, *Bursera simaruba*, *Plumeria alba*, *B. succulenta*, *E. xylocarpum* and *F. citrifolia*, and the endemic Acacia, *V. anegadensis*, among others. Many of the species are thorny or possess unpalatable and/or toxic sap, which make them unattractive to livestock. In some areas near sandy dunes, there are small but almost pure stands of the Button Mangrove (*C. erectus*). **Photo 21** shows a patch of deciduous woodland east of Bumber Well Pond.

In between these patches of woodland and forests are areas of scrub woodland, bare rock, thin soils covered by patchy and degraded herbaceous growth, and native grasslands. The scrub usually consists of stunted forms of widespread tree species, which under ideal conditions grow taller and often form forests and woodlands. The species may include Agave, *T. lepidota*, Frangipani (*P. alba*), an extremely spiny and rare Puerto Rico Bank endemic of *Randia portoricensis* (**Photo 22**), *C. krugii, C. rhacoma* and *P. aculeata*. **Photo 23** shows patches of scrub vegetation bordered by taller deciduous woodland found on the Limestone Plain northeast of Bumber Well Pond.

Photo 22.
Randia portoricensis, a densely thorny small shrub in dry harsh areas of northeastern Anegada.

Occasionally, there are small solution holes, some dry, others with damp soil and organic deposits, and a few with permanent pools of water. These natural watering holes are rare and found only in isolated areas on the coast northeast of Bumber Well Pond, the eastern tip of the island and the two small ponds east of Bumber Well Pond. The areas around these solution holes are usually bare, and plants found growing within may include Coconut (*C. nucifera*), the endemic Anegada Acacia, *P. subcordata*, grasses, sedges, a few herbaceous plants, and—where there is permanent water—both terrestrial and aquatic algae.

Photo 23.
Patches of scrub woodland bordered by taller deciduous woodland, on the northeast Limestone Plain.

Undoubtedly, the vegetation surrounding and within these solution holes, especially those with permanent water, would have been far more diverse and dynamic in times past. However, these areas were modified through human action to provide access to livestock, to collect potable water for local use, and for small-scale crop farming. **Photo 24** shows the largest solution hole (pond) on the island, located east of Bumber Well Pond. It is often used by livestock.

Photo 24.
A natural solution hole forming a freshwater pond habitat near Bumber Well Pond. Note the bare rock and patches of soil where overgrazing has degraded the landscape and the ecology of the pond.

(3) Dunes

The coastal dunes of Anegada are composed almost entirely of fine sandy marine deposits and small boulders. These are found on the southwestern, western, northwestern, northern, northeastern, and eastern coasts, and small patches on the southern coasts. The lowest dunes are found on the western end of the island, while the highest are to be found on the northeastern coast.

Dune vegetation varies considerably. On the low western and northwestern dunes, there are low shrubs and a few scattered trees, but the most dominant plant is a terrestrial orchid, *Tetramicra elegans*. Here, this species forms extensive colonies, some covering hectares. During the annual dry season, these areas erupt into a pink bloom that lasts for months. The species is found from Puerto Rico to Guadeloupe in the Lesser Antilles, but on Anegada, the plants can be very large. The leaves with serrated edges and the flower can be fairly large as well. Plants will often scramble up into the shrubs and small stunted trees. **Photo 25** shows one such colony on the western end of the island. During stakeholder consultations for the Anegada profile, some residents reported the loss of wild orchids due to the harvesting of Torchwood which is used as fuel wood for barbeque grills.

Photo 25.
Low dunes on the western end of Anegada, dominated by low shrubs and the orchid *T. elegans*. White flecks in the photo represent thousands of flowers of this species.

Photo 26.
Uniola virgata, a grass species endemic to the Greater Antilles, found in sheltered areas of dunes on the north coast of Anegada. This is a species that dominates small patches of native coastal grassland.

When dunes show a definite crest and corresponding swale pattern, they are usually covered by taller growth, with small shrubs and stunted trees on the crests and sides and taller but small patches on woodlands in the sheltered swales, where more moisture may be available or where the strong winds have far less impact.

Also found in these dunes are small patches of wetlands, including isolated mangroves, some dominated by *Rhizophora mangle* even when completely cut off from the sea. Near the coast, especially on the northern and northwestern dunes, small patches of native grasslands may persist, despite the presence for more than a century of feral and free-roaming livestock. The most prominent and dominant grass species is *Uniola virgata*, a species endemic to the Greater Antilles. **Photo 26** shows a small patch of this grassland on the north coast of the island.

4.2.2 Plant Species

Anegada has approximately 332 different species of plants. Of these, 228 (87 percent) are considered native to Anegada and 44 (13 percent) are non-native (McGowan, *et al*., 2006). Many of the non-natives (introduced) are now found reproducing in the wild. The plant list found in **Addendum 1** to the *Anegada Environmental Profile* provides a list of the currently known native and naturalised plants of Anegada. It has been compiled from surveys and assessments over the last 100 years, from contemporary reports, and from recent field surveys of the IRF team between 2008 and 2012.

Most of the plants are herbaceous, with the approximate breakdown as follows:

- 42 percent are herbaceous,
- 22 percent are shrubs,
- 12 percent are vines and climbers, and
- 24 percent are trees.

There are a few species endemic to Anegada. The island has a further 49 range-restricted species, *i.e.*, species that are endemic to the Puerto Rico Bank, the Greater Antilles and to the wider West Indies.

In addition, the island has at least one species of fungi officially recorded (there are other species, but so far not officially surveyed), at least one recorded species of algae, eight lichens and three mosses. Based on Island Resources Foundation's recent field surveys and local knowledge, these numbers do not wholly reflect the species diversity of these organisms on Anegada. This is also true for the rest of the BVI.

For native plants, Anegada's geology, evolution and isolation have all contributed to the creation of an exceptional natural laboratory. The result is that a number of plants are found only on Anegada or on Anegada and one or two other islands. These species include:

- **Blackbrush Wattle** (*Vachellia anegadensis*), endemic to Anegada, and listed as Critically Endangered.
- **Caribbean Swallow-wort** (*Metastelma anegadensis*), endemic to Anegada and possibly Virgin Gorda. Listed as Critically Endangered.
- **Puerto Rico Manjack** (*Varronia rupicola*), endemic to Anegada and Puerto Rico. Listed as Critically Endangered.
- **Pitahaya or Sebucan** (*Leptocereus quadricostatus*), endemic to Anegada and to Puerto Rico, and is Critically Endangered.

The species of *Vachellia* and *Varronia* are fairly common on Anegada, but this relatively small island is the entire global range of the *Vachellia*. In the case of the *Varronia*, it is found on Puerto Rico, but it is critically declining there and has disappeared from many areas, making Anegada a very important habitat.

The *Metastelma* may also be found on Virgin Gorda, as a recent specimen from Leverick Bay suggests that it is this or a similar species. It is listed as critically endangered by IUCN, but is not uncommon in parts of Anegada.

Leptocereus, a spiny, scrambling shrub cactus, is rare on both Puerto Rico and Anegada.

The island has several other regionally endemic species, meaning that they are restricted in range to the Virgin Islands, the Puerto Rico Bank, the Greater Antilles, the Virgin Islands and the Lesser Antilles and/or to the wider West Indies. **Table 10** provides a list of these *regional endemics* that are found on Anegada, some 62 in all; and **Table 11** (in Section 4.2.3) provides an overview of Species of Special Concern, which lists 50 plants.

Table 10.
Local and regional endemic plants of Anegada.

Key to Species Conservation Priority:
Green = High Priority **Yellow = Medium Priority** **No Color = Low Priority**.

FAMILY	SPECIES	GROWTH FORM	ORIGINS	STATUS
DICOTS				
Acanthaceae				
	Oplonia spinosa (Jacq.) Raf. subsp. *Spinosa*	S	N; RE	Common
Aizoaceae				
	Sesuvium sp. (perhaps *S. microphyllum* Willd.)	H	N; RE?	Common
Apocynaceae				
	Allotoonia agglutinata (Jacq.) J.F. Morales & J.K. Williams	V	N; RE	Rare
	Metastelma anegadensis Britton	**V**	**N; E**	**Uncommon; CE**
	Plumeria alba L.	T	N; RE	Common
Asteraceae				
	Gundlachia corymbosa (Urb.) Britton ex Bold.	S	N; RE	Common
Bignoniaceae				
	Tabebuia heterophylla (DC.) Britton	T	N; RE	Common
	Tabebuia lepidota (Kunth) Britton	T	N; RE	Common
Boraginaceae				
	Varronia rupicola (Urb.) Britton	**T**	**N; RE**	**Common; CE**
Cactaceae				
	Leptocereus quadricostatus (Bello) Britton & Rose	**S**	**N; RE**	**Rare; CE**
	Melocactus intortus (Mill.) Urb. subsp. intortus	**S**	**N; RE**	**Common**
	Pilosocereus royenii (L.) Byles & Rowley	T	N; RE	Common
Celastraceae				
	Elaeodendron xylocarpum (Vent.) DC.	T	N, RE	Common
Convolvulaceae				
	Evolvulus squamosus Britton	**H**	**N; RE**	**Rare**
	Jacquemontia cayensis Britton	V	N; RE	Uncommon
Euphorbiaceae				
	Argythamnia stahlii Urb.	S	N; RE	Uncommon
	Croton betulinus Vahl	S	N; RE	Common
	Croton discolor Willd.	S	N; RE	Common
	Croton fishlockii Britton	**S**	**N; RE**	**Common**
	Euphorbia articulata Aubl.	S	N; RE	Common
	Euphorbia torralbasii Urb.	H	N; RE	Rare?
	Euphorbia turpinii Boiss.	H	N; RE	Rare?
Fabaceae				
	Chamaecrista glandulosa (L.) Greene var. *glandulosa*	S	N; RE	Rare

FAMILY	SPECIES	GROWTH FORM	ORIGINS	STATUS
	Vachellia anegadensis (Britton) Seigler & Ebinger	**T**	**N; E**	**Common; CE**
Loranthaceae				
	Dendropemon caribaeus Krug & Urb.	S	N; RE	Common
Malpighiaceae				
	Malpighia infestissima Rich. ex Nied.	T	N; RE	Rare
	Malpighia linearis Jacq.	T	N; RE	Common
	Malpighia woodburyana Vivaldi	**T**	**N; RE**	**Uncommon**
	Stigmaphyllon emarginatum (Cav.) A. Juss.	V	N; RE	Uncommon
Nyctaginaceae				
	Phyllanthus pentaphyllus C. Wright ex Griseb. subsp. *polycladus* (Urb.) G.L. Webster	H	N; RE	Rare
Polygalaceae				
	Polygala hecatantha Urb.	H	N; RE	Common
Primulaceae				
	Jacquinia arborea Vahl	T	N; RE	Uncommon
	Jacquinia berteroi Spreng. var. *berteroi*	T	N; RE	Common
Rhamnaceae				
	Randia portoricensis (Urb.) Britton & Standl.	**S**	**N; E**	**Rare; CE**
Rutaceae				
	Amyris diatrypa Spreng.	T	N; RE	Rare
Sapindaceae				
	Serjania lucida Schumach.	V	N; RE	Common
Sapotaceae				
	Sideroxylon cf. ***horridum*** (Griseb.) T.D. Penn.	**T**	**N; RE**	**Rare**
	Sideroxylon obovatum Lam.	T	N; RE	Common
Schoepfiaceae				
	Schoepfia obovata C. Wright	T	N; RE	Common
Solanaceae				
	Pilea margarettae Britton	**H**	**N; RE**	**Rare**
Vitaceae				
	Cissus trifoliata (L.) L.	V	N; RE	Common
Arecaceae				
	Sabal causiarum (O.F. Cook) Becc.	T	N; RE	Rare
Primulaceae				
	Jacquinia arborea Vahl	T	N; RE	Uncommon
	Jacquinia berteroi Spreng. var. *berteroi*	T	N; RE	Common
	MONOCOTS			
Asparagaceae				
	Agave missionum Trel.	H	N; RE	Common
	Furcraea tuberosa W.T. Aiton	**H**	**N; RE**	**Rare**

FAMILY	SPECIES	GROWTH FORM	ORIGINS	STATUS
Cyperaceae				
	Cyperus unifolius Boeckeler	H	N; RE	Rare
	Fimbristylis inaguensis Britton	H	N; RE	Rare
Orchidaceae				
	Psychilis macconnelliae Sauleda	H	N; RE	Common
	Tetramicra canaliculata (Aubl.) Urb.	H	N; RE	Common
	Tolumnia prionochila (Kraenzl.) Braem	**H**	**N; RE**	**Rare**
Poaceae				
	Uniola virgata (Poir.) Griseb.	H	N; RE	Rare
Primulaceae				
	Jacquinia arborea Vahl	T	N; RE	Uncommon
	Jacquinia berteroi Spreng. var. *berteroi*	T	N; RE	Common
	MONOCOTS			
Asparagaceae				
	Agave missionum Trel.	H	N; RE	Common
	Furcraea tuberosa W.T. Aiton	**H**	**N; RE**	**Rare**
Cyperaceae				
	Cyperus unifolius Boeckeler	H	N; RE	Rare
	Fimbristylis inaguensis Britton	H	N; RE	Rare
Orchidaceae				
	Psychilis macconnelliae Sauleda	H	N; RE	Common
	Tetramicra canaliculata (Aubl.) Urb.	H	N; RE	Common
	Tolumnia prionochila (Kraenzl.) Braem	**H**	**N; RE**	**Rare**
Poaceae				
	Uniola virgata (Poir.) Griseb.	H	N; RE	Rare

TABLE KEY:
H = herb
S = shrub
T = tree
V = vine
N = native
E = endemic
RE = regionally endemic

The island has four species of orchids, including ***Tetramicra elegans***, ***Psychilis macconnelliae***, ***Tolumnia prionochila*** and ***Mesadenus lucayanus***. The first two species are widespread and fairly common on Anegada, white the latter two are quite rare. **Photo 27** shows *T. prionochila*, sometimes called the "yellow dancing lady."

Photo 27.
The Yellow Dancing Lady orchid (*T. prionochila*) on Anegada.

The terrestrial orchid, *M. lucayanus*, is rarely seen, and it may be threatened by feral and free-roaming livestock, which consume the plants quite readily.

The island also has several native cacti and other succulents, in addition to the very rare ***Leptocereus***. The most common cactus is the columnar ***P. royenii***, found throughout the island, but more so at the middle and eastern regions of Anegada.

The other species, ***O. dillenii*** and ***O. repens***, are relatively rare and are found scattered throughout the island. The barrel cactus, ***M. intortus***, is found in small colonies and as single plants throughout the island, but is more common on the Limestone Plain, and some specimens here can get quite large. Nevertheless, collection of this species for export seems to be on the rise. The IRF team noted large piles of specimens heaped up in compounds at The Settlement, suggestive of a local trade in the species. This practice could create future conservation problems for the species on Anegada.

The other native succulent, the century plant, ***Agave missionum***, is fairly common on Anegada, but the invasive Agave Weevil (*Scyphophorus acupunctatus*), a species native to Mexico but introduced to the Virgin Islands, has had an adverse impact on the numbers and distribution of the plant species. Many plants have died as a result of Weevil's habit of burrowing into the core of the plant. It eventually causes it to collapse and die. **Photo 28** shows dead and dying specimens on the eastern end of Anegada.

Though the population on Anegada seems relatively stable at the moment, for the longer-term the species may need to be carefully monitored so that any declines as a result of the impacts of the Weevil, or other factors, could be detected and conservation measures established. The species has been decimated in other parts of its range across the Virgin Islands and Puerto Rico as a result of this insect and loss of habitat.

Photo 28.
Dead and dying native Agave or century plants (*A. missionum*), the result of an infestation of the introduced and destructive Agave Weevil (*S. acupunctatus*).

There are two species of native palms, ***Leucothrinax morrisii*** and ***Sabal causiarum***. Both are rare and were first reported by Schomburgk in 1832. Since then, other authorities have commented on the rarity of the species, and it therefore appears that they were never common.

The mature *Sabal* Palms seem quite old, and D'Arcy in 1976 pointed out that steps cut into an old tree (*Sabal causiarum*) suggest that it was used as a lookout for ships because there were so few tall objects or trees that could be used as a tower. IRF's field investigation suggests that these same palms—first reported by Britton in 1916 and then by D'Arcy in 1976—still survive today. They are evidently quite old, beyond 110 years. Senior residents of Anegada report that these older Sabal Palms have been there for all of their lives, and even before.

At present, the Sabal Palms are readily reproducing, and a number of small trees can be found on the western end of the island. However, indiscriminate bulldozing for roads and for residential and commercial development is threatening this species. **Photo 29** shows one of the roads recently laid out in the habitat of this species.

Photo 29.
Recently cut road through *Sabal causiarum* habitat on the west end of Anegada.
Note the large old specimen in the distance.

Sabal causiarum, endemic to the Greater Antilles and perhaps to some of the northern Lesser Antilles, is rare in the Virgin Islands and is now found in the wild only at a few locations, including Anegada, Mosquito Island and St. Thomas. The population on Anegada may number about 200 plants, but most of these are seedlings and sub-adults. There are very few adult specimens of reproductive age.

The other palm, ***L. morrisii***, is considered a Dwarf Palm, because of its short stature, but in some places, it may grow to over 10 metres (30 ft). On Anegada, it rarely gets to over 4 metres (12 ft). It is found in small patches (colonies) or as individual plants on the western end of the island. **Photo 30** shows an isolated individual found on the west end of Anegada.

Photo 30.
An isolated Dwarf Palm specimen (*L. morrisii*) found on the west end of Anegada.

Some observers have commented on the fact that the plants on Anegada show unique qualities, including the green-to-light-green undersides of their leaves as compared to the silvery undersides of plants in places such as Barbuda, where the species is also found.

The species is found in the Florida Keys, some islands of the Greater Antilles, Anegada, Anguilla and Barbuda. It is not found anywhere else in the Virgin Islands. On Anegada, the population may be as many as 400 plants (the IRF team counted over 200), but most of these are seedlings and sub-adults. The Dwarf Palm on Anegada is threatened by indiscriminate bulldozing, sand mining and livestock destruction.

Some of Anegada's plants remain little understood. One such species is the Tillandsia bromeliad or wild pine, often thought to be a parasite. But in fact these plants do not "suck life" or "juices" from trees and shrubs in order to survive. They simply use the branches of plants as physical support and obtain sustenance from rainwater and nutrients from dead leaves and insects.

Photo 31.
Tillandsia sp. on Anegada, with single-spike inflorescence.

The species of *Tillandsia* previously reported for Anegada is ***T. utriculata***, which is widespread throughout the West Indies, Florida, and Central and South America. It is quite variable and many forms have been assigned to it. However, because of this wide variability, it can present a difficult taxonomic challenge for botanists (*i.e*., difficulty in applying a specific biological identity).

This same difficulty is apparent on Anegada where at least two or more species may be present, but all have always been assigned to *T. utriculata*. For example, *T. utriculata* when it "flowers," as we like to say locally, sends out a spike which is multi-branched, almost like the branches of the Christmas tree of temperate climates. However, some forms on Anegada have a single spike with no branching at all, and the plants are small with the leaves fluted upward. Other forms have very simple branching, but similarly fluted leaves as well. To make matters more confusing, these forms may be hybridising with each other. What exactly is going on needs careful study, but it is an intriguing plant mystery on Anegada.

A similar phenomenon is known from the north coast and east end of Virgin Gorda, so the two islands share some botanical peculiarities. **Photo 31** shows a single spike form of *Tillandsia* from the west end of Anegada.

The major threat to the native plants of Anegada comes from the impact of feral and free-roaming livestock which browse and trample plants, cause a loss of soil, change ecosystem function, and shift plant dynamics, including a potential increase in the number of non-native invasives.

Herbaceous plants are by far, the most common plants on any given island. These plants are usually pioneers, colonising and transforming the land over time until forests and woodlands take over. But when animals like sheep, goats and cattle are present, they seek out these succulent, juicy and nutritious plants. Initially, they may have little effect, but, over time, the green habitats are not able to keep up with the animals' voracious appetites and the plants begin to decline. As a result, most of the native grasses and sedges, herbs and other plants, as well as their ecosystems, will decline, and some will become extinct, while others will hang on to existence by a thin thread.

4.2.3 Species and Habitats of Special Concern

4.2.3.1 Plant Species of Special Concern

Anegada has approximately 50 Plant Species of Special Concern (**Table 11**). Many are local and regional endemics, as well as plants that have been severely reduced in numbers and distributions by feral and free-roaming livestock.

Many of the species listed are limited to only a few locations on the island and/or to specific habitats. An example would be the marsh plants found on the southeastern and eastern coastal wetlands of the island.

Island Resources Foundation determined the conservation status of listed species by using a number of sources and approaches, including:

- the team's extensive field knowledge and experience;
- previous studies and reports, including assessments by teams from the Royal Botanic Gardens, Kew;
- data from the International Union for the Conservation of Nature (IUCN);
- other expert opinions; and
- local knowledge.

The IUCN status assessments for some species are specifically listed by members of the Kew team. Such assessments however are not available for all local plants, and where the local and regional status of a species is considered critical, some of IRF's status determinations do not fully follow the IUCN approach—the most recognised international methodology for determining species status.

The IRF team used its best judgment in making such assessments along with materials and information from other sources. Very few BVI species have been completely evaluated utilising the IUCN guidelines, which means that further study is required. Nevertheless, the categories used by IUCN to denote conservation status were employed in **Table 11** to express tentative ranking for each species.

4.2.3.2 Habitats of Special Concern

(1) Beaches. Beaches are the target of coastal development, especially for hotel development and upscale homes. Given the vulnerability of Anegada to storm surge and sea-level rise, beaches are also critical natural barriers to help prevent flooding and sea intrusions. Indiscriminate coastal development encourages the spread of the invasive Australian Pine (*Casuarina equesitifolia*) and destruction of coastal mangroves.

(2) Dunes. Natural dunes are a rare ecosystem in the Virgin Islands, and nowhere are they more prominent than on Anegada. These natural features make up a significant portion of the island's landscape framework, and are most common in the western, northern and northeastern areas.

Nevertheless, over time, roads have been cut into many of them to provide vehicular access. Some roads were once small paths used by residents for generations, but have more recently been widened to accommodate vehicles. New roads are more indiscriminate, and environmentally sensitive sites and species have been carelessly bulldozed.

Dunes systems and dune habitats have also been altered by sand mining. This is particularly evident along the northwest road corridor. Mining sand not only physically changes the dune system and its dynamics, but it also alters hydrology, moisture availability, species composition, and coastal integrity. It renders the mined area more vulnerable to coastal erosion and to the invasion of non-native exotics. It is already evident that the Australian Pine has spread northeastward on the island, and the species could eventually take over dunes throughout much of Anegada.

Table 11.
Anegada plant species of special concern.

Green = High Conservation Priority/Endangered   Yellow = Medium Conservation Priority/Threatened

No Color = Lower Conservation Priority/Vulnerable.

FAMILY	SPECIES	GROWTH FORM	ORIGINS	STATUS
	DICOTS			
Amaranthaceae				
	Salicornia bigelovii Torr.	**H**	**N**	**Rare**
	Sarcocornia perennis (Mill.) A.J. Scott	**H**	**N**	**Rare**
	Suaeda tampicensis (Standl.) Standl.	**H**	**N**	**Rare**
Apocynaceae				
	Metastelma anegadensis Britton	**V**	**N; E**	**Uncommon CE**
Boraginaceae				
	Varronia rupicola (Urb.) Britton	**T**	**N; RE**	**Common; CE**
Cactaceae				
	Leptocereus quadricostatus (Bello) Britton & Rose	**S**	**N; RE**	**Rare; CE**
	Melocactus intortus (Mill.) Urb. subsp. intortus		**N; RE**	**Common**
	Opuntia dillenii (Ker Gawl.) Haw.	**S**	**N**	**Rare**
Convolvulaceae				
	Evolvulus squamosus Britton	**H**	**N; RE**	**Rare**
Euphorbiaceae				
	Croton fishlockii Britton	**S**	**N; RE**	**Common**
	Euphorbia torralbasii Urb.	H	N; RE	Rare?
	Euphorbia turpinii Boiss.	H	N; RE	Rare?
Fabaceae				
	Chamaecrista glandulosa (L.) Greene var. *glandulosa*	S	N; RE	Rare
	Vachellia anegadensis (Britton) Seigler & Ebinger	**T**	**N; E**	**Common; CE**
	Senna polyphylla (Jacq.) H.S. Irwin & Barneby var ***neglecta*** H.S. Irwin & Barneby	**T**	**N; RE**	**Rare**
	Senna polyphylla (Jacq.) H.S. Irwin & Barneby var ***polyphylla***	**T**	**N; RE**	**Rare**
Malpighiaceae				
	Malpighia infestissima Rich. ex Nied.	**T**	**N; RE**	**Rare**
	Malpighia woodburyana Vivaldi	**T**	**N; RE**	**Uncommon**
Nyctaginaceae				
	Phyllanthus pentaphyllus C. Wright ex Griseb. subsp. *polycladus* (Urb.) G.L. Webster	H	N; RE	Rare
Primulaceae				
	Jacquinia arborea Vahl	T	N; RE	Uncommon
	Jacquinia berteroi Spreng. var. *berteroi*	T	N; RE	Common
Rhamnaceae				

FAMILY	SPECIES	GROWTH FORM	ORIGINS	STATUS
	Randia portoricensis (Urb.) Britton & Standl.	**S**	**N; E**	**Rare; CE**
Rutaceae				
	Amyris diatrypa Spreng.	T	N; RE	Rare
Sapotaceae				
	Sideroxylon cf. **horridum** (Griseb.) T.D. Penn.	**T**	**N; RE**	**Rare**
Solanaceae				
	Pilea margarettae Britton	**H**	**N; RE**	**Rare**
Arecaceae				
	Sabal causiarum (O.F. Cook) Becc.	T	N; RE	Rare
	Thrinax morrisii H. Wendl.	**T**	**N**	**Rare**
MONOCOTS				
Asparagaceae				
	Agave missionum Trel.	H	N; RE	Common
	Furcraea tuberosa W.T. Aiton	**H**	**N; RE**	**Rare**
Bromeliaceae				
	Catopsis floribunda L.B. Sm.	**H**	**N**	**Rare**
Cyperaceae				
	Abildgaardia ovata (Burm. f.) Kral	**H**	**N**	**Rare**
	Bulbostylis curassavica (Britton) Kük. ex Ekman	**H**	**N**	**Rare**
	Cyperus brunneus Sw.	**H**	**N**	**Rare**
	Cyperus elegans L.	**H**	**N**	**Rare**
	Cyperus esculentus L.	**H**	**I**	**Rare**
	Cyperus fuligineus Chapm.	**H**	**N**	**Rare**
	Cyperus planifolius Rich.	**H**	**N**	**Rare**
	Cyperus squarrosus L.	**H**	**N**	**Rare**
	Cyperus unifolius Boeckeler	**H**	**N; RE**	**Rare**
	Fimbristylis inaguensis Britton	**H**	**N; RE**	**Rare**
Orchidaceae				
	Mesadenus lucayanus (Britton) Schltr.	**H**	**N**	**Rare**
	Tolumnia prionochila (Kraenzl.) Braem	**H**	**N; RE**	**Rare**
Poaceae				
	Anthephora hermaphrodita (L.) Kuntze	**H**	**N**	**Rare?**
	Chloris sagrana A. Rich. subsp. *cubensis* (Hitchc. & Ekman) Catasús	**H**	**N**	**Rare?**
	Cynodon dactylon (L.) Pers. var. *dactylon*	**H**	**I**	**Rare**
	Dactyloctenium aegyptium (L.) Willd.	**H**	**I**	**Rare**
	Eragrostis urbaniana Hitchc.	**H**	**N**	**Rare?**
	Eustachys petraea (Sw.) Desv.	**H**	**N**	**Rare?**
	Lasiacis divaricata (L.) Hitchc.	**H**	**N**	**Rare**
	Paspalidium geminatum (Forssk.) Stapf	**H**	**N**	**Rare**
	Paspalum laxum Lam.	**H**	**N**	**Rare**

FAMILY	SPECIES	GROWTH FORM	ORIGINS	STATUS
	Paspalum sp.	**H**	**N**	**Rare**
	Setaria utowanaea (Scribn.) Pilg. var. *utowanaea*	**H**	**N**	**Rare**
	Sporobolus pyramidatus (Lam.) Hitchc.	**H**	**N**	**Rare**
	Uniola virgata (Poir.) Griseb.	**H**	**N; RE**	**Rare**

TABLE KEY: H = herb; S = shrub; T = tree; V = vine; N = native; E = endemic; RE = regionally endemic

Conservation Status Definition and Approach for Table 11.

For the assessment of conservation status for Species of Special Concern, the IRF team incorporated IUCN methodology, and also sought local knowledge and other expertise to help develop a more comprehensive picture. The three categories used to characterise status are ***endangered, threatened,*** and ***vulnerable***, defined as follows:

ENDANGERED: A species is considered *endangered* when the best available evidence indicates the species is facing a very high risk of being totally destroyed, including the habitats it relies on for survival.

THREATENED: A species is considered *threatened* if it has been evaluated but does not yet qualify for the category of *Endangered*, but, it is close to qualifying for or is likely to qualify as being endangered in the near and medium-term.

VULNERABLE: A species is considered *vulnerable* when the best available evidence indicates that it is facing a high risk of threats that may elevate its risk to severe damage and disruption, and may elevate its status to *threatened* or *endangered* in the near and medium-term.

Note: A species is considered **STABLE** when it no longer falls under the categories of *Endangered*, *Threatened* or *Vulnerable* and when prevailing circumstances do not or will not immediately cause severe population declines and damage or loss to its habitats.

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(3) Wetlands and Solution Holes. Despite the dominance of the wetlands and solution holes across Anegada, many of these areas are under stress or in decline.

In 1832, Schomburgk described many of the solution holes that he found on the island. In his account of the "shelf holes" on the northern side of the island, located midway between Soldier's Wash and Loblolly Bay, Schomburgk writes:

> [F]*abulous accounts were formerly circulated respecting of the great depth of these shelf-holes; but I sounded most famed, and the result was—six fathoms, 5 1/2 fathoms, 2 1/2 fathoms, and 4 fathoms…**
>
> [T]*o the northwest of Mr. Gildersleve's is a similar shelf-hole, with 2 fathoms water, called 'Lilly Well,' the water of which has by far the most agreeable taste. The formation of these shelf-holes is curious—the mouth is usually from 10-25 feet wide; and they descend to form a funnel.*

* Note that a fathom is about 1.82 metres or about 6 feet in depth.

Figure 20 shows the map drawn by Schomburgk, in 1831 (published in 1832). The red arrow on the northern coast points to Schomburgk's "shelf holes filled with freshwater," and the arrow to the east of that indicates the solution hole he identified as that where "*…the bottom of which sinks, and has occasionally, caused the loss of both men and cattle. This owing to a great quantity of vegetable matter accumulated there, the upper stratum being by no means a quicksand…*"

Today, there are no reports from experts who have visited, studied or described these ponds and solution holes, nor has there been an attempt to develop critical conservation options for these unique Virgin Islands—and Caribbean—ecosystems.

The wetlands are also under threat from livestock, especially because they trample and compact the substrate of the ponds, browse the vegetation, remove plant cover, and affect ecosystem function and the ability to adapt to climate change. Additional stress factors include development activities along the coastline and road corridors, including areas west of The Settlement and east and west of the Ferry Dock.

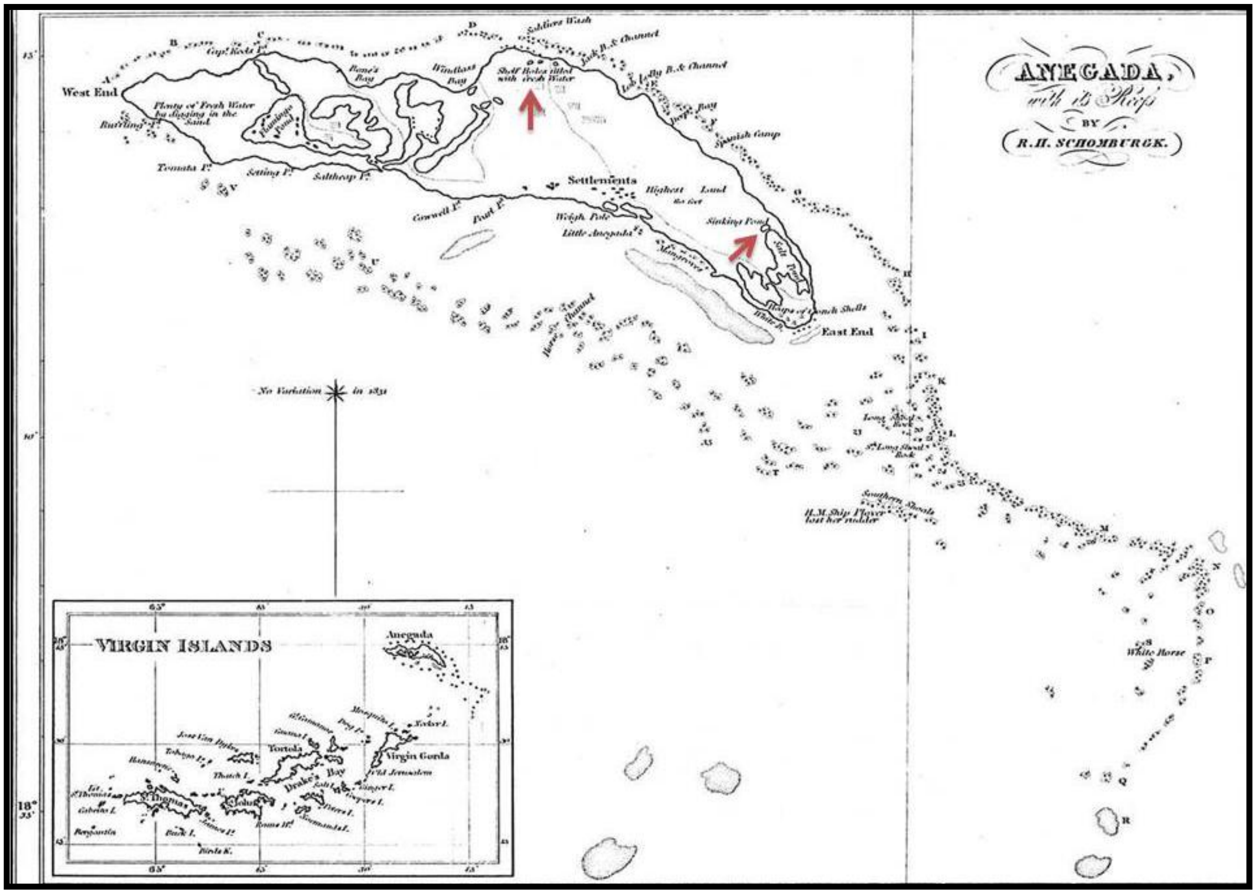


Figure 20.

Schomburgk in 1831 (published 1832) indicated the presence on Anegada of several natural solution holes with freshwater. Today, these areas remain virtually unknown and unexplored.

(4) Native Grasslands. Anegada's native grasslands have not been seriously studied by experts, many of whom have either dismissed them or merely mentioned them in passing. It was often believed that for the native grasslands to be viable ecosystems of natural origin, they had to cover dozens of hectares. The natural savannas of islands such as Trinidad or in South America seemed much more compelling and attractive for comprehensive studies. As a result, many of Anegada's small patches of herbaceous grasslands and cryptogamic plant communities (the latter being seedless plants including some mosses, fungi, algae and others) have been easily removed to make way for development activities.

The remaining native grasslands on Anegada are to be found amidst coastal dunes, on limestone pavement scattered throughout the island, along the edges of wetlands, and around solution holes. However, many are badly degraded or completely altered because of past land use, primarily the impacts of feral and free-roaming livestock.

4.2.4 Invasive Species

The two defining components of an invasive plant species are:

1. One that is introduced from somewhere else, and
2. One that causes or may cause adverse environmental, economic, social and/or health impacts on the local environment and on human development.

Most invasives have been introduced by humans, unintentionally or intentionally, as ornamentals for food or shade, as wind breakers, or for medicinal or religious purposes.

There are several species identified as "invasive" occurring in the BVI. Experts from the Royal Botanic Gardens, Kew and the BVI's National Parks Trust have been working to identify and catalogue invasive species and their distribution and impacts, but there is no formal register, no invasive species control policy, no responsible authority, and no response procedures for the territory. Many invasive plants (and animals) remain unstudied and undocumented, but a few have received much needed attention because of the serious threat they pose to local biodiversity, for example, the Australian Pine (see number (2) on page 101).

In addition to the known invasives, several other species have also been identified as potentially invasive. **Table 12** provides a list of both invasive and potentially invasive species for Anegada.

A species evolves as invasive due to many factors, but primary among these is the action of humans. For example, wildfires, land-clearing, and the presence of feral and free-roaming livestock may encourage certain non-native species to flourish because such actions often eliminate native species, render ecological conditions unsuitable for their growth, or prepare the ground for the invasion of new and potentially destructive plants. Some invasive species have an advantage under these conditions because they have adapted and thrive in the degraded and harsh conditions that eliminate competition and natural mechanisms that control alien plants.

Most of the ornamental/horticultural plants brought to the BVI originate in Florida. Such non-native plants often carry with them other pests, both plant and animal, including pathogens of various sorts, all of which compound and magnify the adverse environmental effects of invasive species.

An example of an alien invasion is Lethal Yellowing Disease (LYD), a plant disease that affects palms, primarily non-native species including Coconut Palms (*C. nucifera*) and date palms (*Phoenix* spp.). The disease is caused by a phytoplasma (a small microscopic organism that invades cells and tissues). This tiny organism is spread by an insect called a leafhopper (*Haplaxius crudus*), a species found in Florida and some parts of the Caribbean. The adult insect feeds on the sap of palm leaves and transmits the phytoplasma to the tree.

Lethal Yellowing was first reported in the 1890s in isolated parts of the Western Caribbean and later around the Florida Keys, but it was not until the 1950s that the disease was properly identified and classified. The small insect that transmits the tiny bacteria was transported throughout Florida, and its population quickly multiplied when exotic grasses used on lawns and golf courses were planted. The insect lays its eggs on the grass, and the young feed on the roots. When they become adults, they turn their appetites to palms. Usually, these palms were planted as ornamental adornments on lawns and golf courses, making this easier for the insects to multiply and readily spread the disease. LYD was then spread across the wider Caribbean region when infected palms and grasses were imported from Florida for golf courses and as ornaments for hotels and expensive homes.

Lethal Yellowing is not known from Anegada or the Virgin Islands, but this example of unregulated and little-understood trade in exotic species illustrates how the importation of something from the outside can have unintended consequences.

There are nine species listed as invasive or potentially invasive for Anegada (**Table 12**).

Table 12.

Invasive and potentially invasive plants of Anegada.

INVASIVE SPECIES	STATUS	GROWTH FORM	ORIGIN
Apocynaceae			
Cryptostegia grandiflora R. Br.	Naturalised; invasive	**S**	**I**
Casuarinaceae			
Catharanthus roseus (L.) G. Don	Naturalised; invasive	**H**	**I**
Casuarina equisetifolia L. ex J. R. & G. Forster	Naturalised; invasive	**T**	**I**
Crassulaceae			
Kalanchoe marmorata Baker	Naturalised; invasive	**H**	**I**
Kalanchoe pinnata (Lam.) Pers.	Naturalised; invasive	**H**	**I**
Fabaceae			
Leucaena leucocephala (Lam.) De Wit subsp. *leucocephala*	Naturalised; invasive	**T**	**I**
Vachellia macracantha (Humb. & Bonpl. ex Willd.) Seigler & Ebinger	Naturalised; invasive	**T**	**I**
Goodeniaceae			
Scaevola taccada (Gaertn.) Roxb.	Naturalised; invasive	**S**	**I**
Malpighiaceae			
Galphimia gracilis Bartl.	Naturalised; invasive	**S**	**I**

Table Key: H=herb; S=shrub; T=tree; I=introduced.

Of the nine species, eight are of immediate concern because of the conservation challenges they pose now, or may pose in the future. A summary of the eight species follows.

(1) *Cryptostegia grandiflora*

This vine and sometimes scandent shrub—known as Purple Allamanda by many—is a native of Madagascar but has been introduced to the Virgin Islands as an ornamental and is often planted. It is toxic and unpalatable to most animals—although goats on Anegada, out of desperation, sometimes eat the leaves and shoots. It is often one of the only plants that remains in an area after livestock overgraze. The shrub is somewhat salt tolerant and therefore can grow in mangroves, on beaches and along the coast. It readily smothers native vegetation and eliminates indigenous plants. In many other West Indian islands, it has become a major pest and should be eliminated from the wild when encountered. On Anegada, it is found naturalised in degraded lands east and southeast of The Settlement, including on former homesteads.

(2) *Casuarina equisetifolia*

This species, known as Australian Pine to some, is a recent invasive and is—as its name implies—native to Australia and South Pacific islands. This pine look-alike is not really a pine at all. It is actually a deciduous tree, an angiosperm (*i.e.*, a flowering plant), and member of the Casuarinaceae family. Specimens can grow up to 35 m (10.6 ft) tall.

The Australian Pine is very salt tolerant and can out-compete most native species contending for the same real estate. It can suppress other plants by its allelophathic characteristics, *i.e.*, the ability to produce chemicals toxic to other plants.

On Anegada, the species is most common on the southwest coast where large stands of mature trees and seedlings are now in the hundreds. It is also found on the south coast, the west, northwest and north coast and is slowly spreading eastward. It is especially suited to beach and dune habitats. The species readily invades road-cuts, newly bull-dozed sites and sand mined areas, as seen in a few areas on the north coast of the island (**Photo 32**).

Photo 32.
The largest concentration of Australian Pine is at Pomato Point. Notice abundance of seedlings.

In beach environments, native plants have deep roots that hold dunes and drifting sands. Australian Pines on the other hand have web-like, shallow roots that extend quite a distance. The thick impenetrable roots will not only prevent other species from establishing themselves, but will also prevent nesting opportunities for sea turtles and iguanas that nest in sandy areas.

The Australian Pine was introduced to Anegada in the late 1960s and soon after spread to many islands in the BVI, including Virgin Gorda and Tortola. Its aesthetic appeal and important function as a windbreaker will probably ensure its survival. However, efforts to control its distribution should be a priority. This species should be prevented from colonising coastal and dune areas, particularly areas of native vegetation and areas where sea turtles nest; existing seedlings should promptly be removed from infested areas and completely destroyed.

(3) *Kalanchoe marmorata* and (4) *K. pinnata*

Species of *Kalanchoe* and, in this case, the two species found on Anegada, are native especially to Asia and have become naturalised in many parts of tropical and subtropical America.

On Anegada, both species are found in and around The Settlement and adjacent areas, including on the shores of nearby salt ponds. They are easily spread through vegetative means and seeds. They can grow in fairly extensive colonies, although typically they may be found in small patches consisting of a few dozen or a few hundred plants.

The species were introduced as ornamentals in local gardens but have since spread and become naturalised, especially on lands degraded by feral and free-roaming livestock. Although they are not expected to rapidly invade across the island (and in fact they have remained in relatively limited areas around The Settlement and nearby coastal ponds), they could potentially be introduced to other areas of the island through various methods, including human transport.

These plants readily invade degraded ground and areas of dry thin soils and can easily over-crowd native plants, especially low herbaceous grasses and succulents.

(5) *Leucaena leucocephala*

This species is native to Central America but has been widely introduced throughout the tropics as a fodder crop, especially in drier islands, including much of the Virgin Islands. On Anegada, it is found mainly around the Agricultural Station. It is very aggressive and will easily invade native woodlands, especially after hurricanes and other land disturbance events. It will smother native species and rob them of nutrients and moisture. Seeds are readily dispersed through wind as well as through livestock. It should be carefully monitored for any spread outside of its current location and, if found, it should be removed.

(6) *Vachellia macracantha*

Although this species is believed to be native to parts of the Western Caribbean and Central America, it is now introduced to the Virgin Islands. It is fairly widespread on Anegada, including areas around The Settlement, around the Agricultural Station, on the south coast near the docks, on the southwest coast, and in some dune areas.

Like *L. leucocephala*, it is quite invasive and readily colonises native woodlands. The dried pods are very nutritious and attractive to livestock, and they consume large quantities of these, passing the seeds out in their droppings. Since these animals travel widely across the island, the plant can quickly spread and invade new ground. It should be carefully monitored for its spread outside of its current location and, if found, it should be removed.

(7) *Scaevola taccada*

This species is native to Asia and the Pacific, and has been widely introduced to the Americas by hotels and the horticultural trade as a landscape ornamental. It is often planted on beaches and around resorts. *S. taccada* readily hybridises with the native *S. plumieri*, a species which has now become rare due to coastal development. *S. sericea* needs to be eliminated from the wild, and the remaining native habitats of *S. plumieri* should be protected. It is also important that resorts and home owners be educated about the risks posed by this introduced invasive.

The plant has been the focus of Darwin Initiative partners—National Parks Trust and Royal Botanic Gardens, Kew—in order to raise awareness of its negative impact and for future removal.

(8) *Galphimia gracilis*

This very attractive plant with yellow flowers is often called Shower of Gold or Gold Shower and is a relative of the more familiar West Indian Cherry (*Malpighia emarginata*), a species that is often grown in BVI gardens and prized for its tart, red juicy fruits.

G. gracilis is native to Mexico and is widely planted in the tropics for its showy flowers. On Anegada, it has become naturalised in a small patch just southwest of The Settlement and is now spreading. In most places where it is grown around the world, it does not seed, but in Anegada it does and therefore it represents a potentially serious invasive.

4.2.4.1 Invasive Species Control

For Anegada and the rest of the British Virgin Islands, invasive species control is a challenge. The territory does not possess the technical and financial resources to aggressively pursue and completely eliminate major threats, and in fact no country or territory currently does. Nor is it able to anticipate and act offensively to prevent the potential harm that these aliens may cause.

Several departments of agriculture in the Eastern Caribbean have had some success in using a plant protection approach. However, for such a programme to be successful in the BVI, the following would need to be in place:

- An invasive plant control policy for the territory, sensitive to local communities.
- An institution designated for management and enforcement.
- An education programme on invasive species control for stakeholders and the general public.
- A technical training programme for persons whose professional or personal activities bring them into contact with invasive species.
- Access to information networks that target effective and successfully applied approaches and applications for invasive plant control.

4.3 Fauna

For the flora and fauna of the Virgin Islands, Anegada was figuratively the end of the line. Like wanderers everywhere, these animals and plants were looking for a receptive resting spot and stumbled on this land of extremes. Although many undoubtedly perished, many also stayed and thrived. Most were likely accidental arrivals brought to Anegada by hurricanes and other storms, violent seas, floods and winds. More immigrant species arrived over time and gradually adapted to local conditions and produced unique animals, ecosystems and landscapes. Among the more familiar species that are found across the Virgin Islands and the Caribbean, many are now also found on Anegada.

4.3.1 Birds

Birds are versatile species and can readily reach locations even as remote as Anegada. There are as many as 109 bird species recorded for the island; with time and more observations, that number will grow. **Table 13** provides a list of the birds of Anegada. This list represents a compilation from many sources, including the annotated checklists maintained by Clive Petrovic (BVI biologist), historical accounts, and other reports such as the annual Audubon Christmas Bird Count (coordinated by the NPT), as well as observations of the IRF field team.

Given the landscape, the many rare and endemic species and the ecological realities of the island, it is quite possible that what we see today is only a relic of a more diverse fauna that existed on the island over 500 years ago. For example, was the flightless Debooy's or Antillean Cave Rail (*Nesotrochis debooyi*), which once inhabited coastal swamps and marshes of many of the Virgin Islands, ever present on Anegada? This rail was endemic to Puerto Rico, the USVI and the BVI, and was hunted by Amerindians for food. Anecdotal reports from BVIslanders and from Puerto Rico suggest that it was still present in the US/BVI region up until the 1960s when tourism development changed the coastline and many wetlands, beaches, and coastal forests were destroyed.

Another unique species, one with a deeply affecting and enigmatic call, is the Virgin Islands Screech Owl (*Megascops nudipes newtoni*). Was Anegada fortunate enough to have heard its call; did it ever haunt the island's woods and forests? Sadly, this species may now be extinct in the Virgin Islands.

And yet, because of its many and diverse wetlands, Anegada still has a particular and often dramatic bird fauna. During the rainy season, especially during the fall season starting in late September, North American bird migrations begin to move south in response to the oncoming winter season. Many of the island's marshes, ponds and flashes are besieged by hundreds and even thousands of visiting birds. No other island in the Virgin Islands has such a fantastic avifauna display. Anegada is indeed "for the birds."

During the dry season, from December to April, seabirds find dry coastal flats to lay their eggs and raise their young. Mockingbirds nest during the spring months while, at the same time, flycatchers and doves nest throughout the island where isolation provides sanctuary.

Despite there being over a century of reporting on Anegada's birds, the island's avifauna is not fully understood or documented. Local residents, the most knowledgeable of all observers, may absorb and save information in forms that seem abstract to some researchers, presenting yet another challenge to long-term understanding.

Anegada harbours many avian secrets. One such example is the nesting **Antillean Nighthawk** population that occurs during the spring and early summer of each year. This species is primarily nocturnal in that it is active mostly during the night. It feeds on insects and small vertebrates, including small birds, and hides during the day in coastal and inland dry deciduous forests, scrub and woodlands and amongst bare rocky terrain. For most of the year, it lives in South America, but during the latter part of each year, it returns to these ancient islands for its breeding season.

During the spring of 2012, the IRF field research team photographically documented the nesting of this species, only the second documentation in the Virgin Islands (the first photographic evidence of Antillean Nighthawk nesting was recorded by the NPT in 2007). **Photos 33** to **35** display the egg, chick and adult on the south coast of Anegada.

The species is critically threatened by habitat loss, and from the adverse impacts of goats, sheep, donkeys and cattle, which may destroy its natural environment, trample eggs, and disrupt or destroy nesting.

The Nighthawk is most active from dusk until dawn. During the spring of each year, when they return from their wintering grounds in northern South America, the birds begin their courtship dance. At dusk, they lift to the skies their *que-re-be-bé* or their more common *pitta-pitta-pitta*, repeated over and over in quick succession, the male chasing the female, often ascending and then descending in bounds, twists and dashes. Males will also fight each other similarly, but far more aggressively.

During early evenings, they may fly quite low over vegetation, between trees and along paths, somewhat reminiscent of large fruit bats. Their dark outlines suddenly appear, ghostly and silent, and then just as suddenly fade into the shimmer of the moon- and star-lit night.

Photo 33.
Antillean Nighthawk egg laid on bare ground and rock on the edge of wetlands on the south coast of Anegada.

Photo 34.
A newborn chick of the Antillean Nighthawk, observed on Anegada in 2012.

Photo 35.
Adult Antillean Nighthawk nesting on Anegada.

One of Anegada's most prominent and famous citizens is the **Greater Flamingo** (*Phoenicopterus ruber*), a species which was hunted to extinction and then reintroduced to the island in 1992. The Greater Flamingo, commonly known as the American Flamingo, was mercilessly hunted throughout the region and soon disappeared from the Virgin Islands and from many islands in the Caribbean, including Anguilla, St. Martin/St. Maarten, Antigua, Barbuda and Guadeloupe. Today, the species is absent from the Lesser Antilles except for the occasional vagrant.

The population on Anegada has increased from 22 to about 250 birds, and a programme of monitoring by the National Parks Trust ensures that numbers are sustainable, that habitat conditions are safe and that this natural icon will endure for a very long time. **Box 1** provides a short history of the restoration of the Greater Flamingo to Anegada. **Photo 36** shows a flock of the Greater Flamingos on the eastern end of Anegada.

Efforts are now under way to study the reintroduction of the species to the island of Barbuda, a prospect that was inspired by the effort in Anegada. Indeed, the Greater Flamingo reintroduction to Anegada is one of the most successful biodiversity restoration projects in the Caribbean, and one that holds promise for other species.

Photo 36.
Flamingos on the eastern end of Anegada.

Box 1
The Restoration of the Greater Flamingo to the Island of Anegada

The Greater Flamingo (*Phoenicopterus ruber*), also called the American Flamingo, is one of a few species of flamingo found in the Americas. Historically, the Greater Flamingo was widely distributed in northern South America, the Yucatan Peninsula, southern Florida, the Bahamas, the Greater Antilles and as far south as Guadeloupe in the Lesser Antilles.

On Anegada, the species was reported to sometimes flock into the thousands, with many of the birds likely migrating from across the region and augmenting the resident population during certain times of the year.

By the turn of the twentieth century, population numbers began to plummet as the species was hunted for food and for its feathers. By the 1950s, the last flamingo on Anegada was gone, and all that remained of its former presence were place names like Flamingo Pond.

By the late 1980s, at a time when local residents were increasing nostalgic about their lost natural heritage and when the region had begun to see a surge in environmental activism, an expat biologist and a handful of local BVIslanders began to call for the restoration of the species.

Dr. Skip Lazell of the U.S.-based Conservation Agency, the Guana Island (BVI) Wildlife Sanctuary, the BVI National Parks Trust, and other local and international interests, including the Bermuda Aquarium, Museum and Zoo, imported an initial eight birds from Bermuda to Guana Island as a test case. Though challenging, this initial effort provided the foundation for later reintroduction efforts.

In 1992, Dr. Numi Mitchell, also of the Conservation Agency, with the aid of the Bermuda Aquarium, Museum and Zoo, the Guana Island Wildlife Sanctuary and local support, including the owners of the Anegada Reef Hotel, brought 22 birds to Anegada and released them at Flamingo Pond.

Here they were watched over by local residents and protected. Rondell Smith, an island resident and the Anegada representative for the National Parks Trust, has been with the effort from the beginning, monitoring the birds from day one.

Today, that initial flock of 22 birds has multiplied to approximately 250 flamingos.

A more detailed chronicle of the restoration of the Greater Flamingo can be found on the Conservation Agency's website:

http://www.theconservationagency.org/flamingos.htm

One such possibility is the reintroduction of the **West Indian Whistling Duck** (*Dendrocygna arborea*), a West Indian endemic species that disappeared from the Virgin Islands by the mid-twentieth century due to habitat destruction and hunting. There is widespread interest in the Virgin Islands to have the species restored, and Anegada is the most likely place given its many natural wetlands and the successful reintroduction of the flamingo.

The West Indian Whistling Duck is entirely absent from all of the Virgin Islands, but is present on nearby Puerto Rico and much of the Greater Antilles and the Bahamas. It is also present on Antigua and Barbuda. The species is classified as "*vulnerable*" on the IUCN Red List, and has severely declined from most of the region due to hunting and habitat destruction, circumstances similar to those in the BVI.

In recent years, the occasional vagrant, most likely from Puerto Rico, has been observed on nearby St. Croix in the USVI. However, these visits by this once common resident are few. With the significant reduction of wetlands across the BVI, this waterfowl species stands little chance of long-term survival. **Photo 37** shows a pair of Whistling Ducks at McKinnon's Pond on Antigua.

The West Indian Whistling Duck is not the only species to have disappeared from Anegada. Two other species may no longer be present: the **Puerto Rican Flycatcher** (*Myiarchus antillarum*) and the Puerto Rican Bank endemic hummingbird, the **Antillean Mango** (*Anthracothorax dominicus*).

The Puerto Rican Flycatcher was once a widespread species, tied to coastal forests, woodlands and open areas. Today, it is rarely seen and heard, and there are only occasional reports of the species being on Anegada in the last 10 to 20 years. Although occasional sightings have also been reported from St. John in the USVI and Beef Island, Tortola, it seems that a unique Virgin Islands bird is now on the verge of extinction.

Photo 37.
West Indian Whistling Ducks (*D. arborea*), a species now gone from Anegada. (Photo taken on Antigua by Kevel C. Lindsay.)

The absence of the Antillean Mango Hummingbird is more problematic because other members of this group have been very successful in the VI region. The two common and widespread species, the **Antillean Crested Hummingbird** (*Orthorhyncus cristatus*) and the **Green-throated Carib** (*Eulampis holosericeus*), are more common in the US/BVI and in the Lesser Antilles. They are habitat generalists, *i.e.*, able to adapt and master the varied and often complicated facets of human habits and landscapes.

The latter species, the Green-throated Carib, colonised the Virgin Islands and parts of Puerto Rico during the last 100 years, and its expansion was aided by the presence of local flower gardens and the ability of the species to adapt. The Antillean Mango was undoubtedly present in the Virgin Islands for millennia, but began to decline following the arrival of Europeans who altered the landscape and after the arrival of the Green-throated Carib. Today, there are no confirmed reports of the Mango from Anegada or the rest of the Virgin Islands.

Curiously absent is the **Scaly-naped Pigeon** (*Patagioenas squamosa*), a species that is otherwise common on the Puerto Rico Bank. It is possible that the species is a migrant here and arrives when the fruits of the Sea Grape (*C. uvifera*) ripen, attracting many species of birds to gorge on this sugary treat. This is a phenomenon seen elsewhere in the Caribbean as other members of Columbidae (pigeons and doves)—including the very rare White-crowned Pigeon (*P. leucocephala*)—move from island to island in search of the best and richest foods. Observers should remain alert for these species during this seasonal event.

During field investigations in April of 2012, the IRF biodiversity team discovered that the ponds and marshes on the southern and southeastern coast of Anegada also harbour rare species of shorebirds, even during the late spring and early summer months. One of the most remarkable sightings was of a number of **American Whimbrels** (*Numenius phaeopus hudsonicus*) still inhabiting Anegada in late April, long after they were expected to have joined other birds in the high Arctic for breeding. Whimbrels have long curved bills, which they use for probing deep mud and for catching fast-moving prey in the ponds. **Photo 38** shows two Whimbrels in the area of the White Bay Pond.

Photo 38.
Two Whimbrels (the birds are in the background), foraging at White Bay Pond, eastern Anegada.

These birds are long-distance fliers and are known to travel almost non-stop for thousands of miles, crossing the Atlantic on their way to wintering grounds in South America or the Caribbean and again on their return journey back to nesting grounds in North America during the early spring.

Photo 39.
White-winged Dove and nestlings at White Bay, Anegada.

A recent example was the flight of a bird nick-named Pingo, tagged with a satellite tracking device. Beginning on 20 August 2012, when an Atlantic tropical disturbance seemed to affect Pingo's journey, many bird enthusiasts kept close track of Pingo. By the time the storm became Tropical Storm Isaac, it was feared that Pingo would meet an unfortunate demise. However, the bird showed remarkable resilience and landed safely in northern Brazil on 22 August.

The IRF team also documented nesting **White-winged Doves** (*Zenaida asiatica*) (see **Photo 39**).

Anegada also has a population of **Ruddy Turnstones** (*Arenaria interpres*). These birds are found at the restaurant of the Anegada Reef Hotel at certain times of the year and will approach patrons for scraps of food, often sitting at a table or the bar and darting between the legs of patrons. **Photo 40** shows a small group of the birds waiting for handouts on the grounds of the hotel.

Photo 40.
Ruddy Turnstones lining up for food handouts on the beach area of the Anegada Reef Hotel.

Table 13.
The birds of Anegada.

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS
PHAETHONTIDAE	**Tropicbirds**		
Phaethon lepturus	White-tailed Tropicbird	P/M	Very Rare/Nesting
SULIDAE	**Boobies**		
Sula sula	Brown Booby	P/M	Transient
Sula dactylatra	Masked Booby	P/M	Vagrant
PELECANIDAE	**Pelicans**		
Pelicanus occidentalis	Brown Pelican	M	Locally Common/Transient
FREGATIDAE	**Frigatebirds**		
Fregata magnificens	Magnificent Frigatebird	M	Transient
LARIDAE	**Terns and Their Allies**		
Larus atricilla	Laughing Gull	P/M/Oa	Locally common
Larus delawarensis	Ringed-billed Gull	Oa/M/Co	Rare/Vagrant
Larus argentatus	Herring Gull	Co	Rare/Vagrant
Sterna maxima	Royal Tern	P/M	Uncommon transient
Sterna antillarum	Least Tern	P/M/Sp/Co	Common/Nesting
Sterna sandvicensis	Sandwich Tern	Co/M	Uncommon
Sterna nilotica	Gull-billed Tern	Co	Uncommon
Sterna hirundo	Common Tern	P/M	Transient
Sterna dougallii	Roseate Tern	P/M	Transient
Chlidonias niger	Black Tern	P/M/ Sp/Co	Very Rare/Vagrant
ARDEIDAE	**Egrets, Herons and Bitterns**		
Botaurus lentiginosus	American Bittern	Fr	Very Rare/Vagrant
Ixobrychus exilis	Least Bittern	Sp	Very Rare
Ardea herodias	Great Blue Heron	Fr/Co/O	Migrant
Egretta caerulea	Little Blue Heron	Co	Uncommon
Egretta tricolor	Tricolored Heron	Sp	Common
Bubulcus ibis	Cattle Egret	Fr/Sp/O	Common
Egretta thula	Snowy Egret	Sp	Common
Egretta rufescens	Reddish Egret	Sp	Very Rare
Ardea alba	Great Egret	Sp	Uncommon
Nycticorax nycticorax	Black-crowned Night Heron	Fr/Co/Sp	Rare/Vagrant?
Nyctanassa violacea	Yellow-Crowned Night Heron	Fr/Co/Sp	Uncommon
Butorides virescens	Green Heron	Fr/Co/Sp/Oa	uncommon
THRESKIORNITHIDAE	**Spoonbills**		
Ajaja ajaja	Roseate Spoonbill	Fr/Co	Accidental
PHOENICOPTERIDAE	**Flamingos**		
Phoenicopterus ruber	Greater Flamingo	Co	22 birds reintroduced in 1992; breeding; population around 200
PODICIPEDIDAE	**Grebes**		

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS
Podylymbus podiceps	Pied-billed Grebe	Fr	Rare/Vagrant
ANATIDAE	**Ducks, Geese and Swans**		
Anas acuta	Northern Pintail	Sp/Fr/Co	Rare/Vagrant
Anas bahamensis	White–Cheeked Pintail	Sp/Fr/Co	Rare; local resident
Anas carolinensis	Green-winged Teal	Sp/Fr/Co	Usually in small flocks with *A. discors*; rare migrant
Anas discors	Blue-winged Teal	Sp/Fr/Co	Rare/Migrant
Anas americana	American Widgeon	Sp/Fr/Co	Uncommon/Migrant
Anas clypeata	Northern Shoveler	Sp/Fr/Co	Uncommon/Migrant
Aythya collaris	Ringed-neck Duck	Sp/Fr/Co	Uncommon/Migrant
Aythya affinis	Lesser Scaup	Sp/Fr/Co	Rare/Vagrant
Oxyura jamaicensis	Ruddy Duck	Sp	Uncommon
ACCIPITRIDAE	**Hawks and Harriers**		
Buteo Jamaicensis	Red-tailed Hawk	Oa	Rare
Pandion haliaetus	Osprey	M	Uncommon to Rare
FALCONIDAE	**Falcons**		
Falco sparverius	American Kestrel	Wo/Oa	Uncommon/Nesting
Falco peregrinus	Peregrine Falcon	Co/Wo/Oa	Very rare
CHARADRIIDAE	**Plovers**		
Pluvialis dominica	American Golden Plover	Sp/Fr/Co/Oa	Rare/Migrant
Charadrius alexandrinus	Snowy Plover	Sp/Fr/Co	Uncommon to rare/Nesting
Charadrius semipalmatus	Semipalmated Plover	Co	Common/Migrant
Charadrius melodus	Piping Plover	Sp/Fr/Co	Uncommon to rare/Migrant
Charadrius wilsonia	Wilson's Plover	Sp/Co	Common/nesting
Charadrius vociferus	Killdeer	Sp/Fr/Co/Oa	Common/Nesting
Pluvialis squatarola	Black-bellied Plover	Co	Uncommon/Transient
SCOLOPACIDAE	**Turnstones, Snipes and Sandpipers**		
Tringa solitaria	Solitary Sandpiper	Sp/Co	Uncommon/Migrant
Catoptrophorus semipalmatus	Willet	Sp/Co	Common/Nesting
Numenius phaeopus	Whimbrel	Sp/Co	Uncommon/Migrant
Actitis macularia	Spotted Sandpiper	Sp/Co	Uncommon to Rare
Tringa flavipes	Lesser Yellowlegs	Sp/Co	Uncommon to Rare
Tringa melanoleuca	Greater Yellowlegs	Sp/Co	Uncommon to Rare
Himantopus mexicanus	Black-necked Stilt	Sp/Co	Common/Nesting
Arenaria interpres	Ruddy Turnstone	Sp/Fr/Co/Oa	Common/Migrant
Calidris canutus	Red Knot	Co	Rare
Calidris pusilla	Semipalmated Sandpiper	Co/Sp	Common
Calidris minutilla	Least Sandpiper	Co/Sp	Common
Calidris bairdii	Baird's Sandpiper	Co	Very Rare
Calidris melanotos	Pectoral Sandpiper	Co/Sp	Rare
Calidris fuscicollis	White-rumped Sandpiper	Co/Sp	Common

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS
Calidris mauri	Western Sandpiper	Sp/Fr/Co	Uncommon/Migrant
Philomachus pugnax	Ruff	Sp/Fr	Rare/Accidental
Haematopus palliatus	American Oystercatcher	Co/Sp	Common
Limnodromus griseus	Short-billed Dowitcher	Sp/Fr/Co	Common/Migrant
Limnodromus scolopaceus	Long-billed Dowitcher	Sp/Fr/Co	Common/Migrant
Gallinago gallinago	Common Snipe	Sp/Fr/Co	Uncommon/Migrant
PHASIANNINAE	**Pheasants**		
Gallus gallus	Domestic Chicken	Wo	Introduced escaped domestic chickens
NUMIDIDAE	**Guinea Fowl**		
Numida meleagris	Helmeted Guinea Fowl	Wo	Escaped domesticated birds imported from Africa. Sometimes kept as poultry by a few residents. Extirpated from the wild on Anegada.
RALLIDAE	**Rails, Crakes, Moorhens, Gallinules and Coots**		
Porzana carolina	Sora	Sp/Fr/Co	Common/Migrant
Fulica americana	American Coot	Sp/Fr/Co	Uncommon to rare/Vagrant
Fulica caribaea	Caribbean Coot	Sp	Rare
Gallinula chloropus	Common Moorhen	Sp	Common
Rallus longirostris	Clapper Rail	Sp	Common
COLUMBIDAE	**Pigeons and Doves**		
Patagioenas leucocephala	White-crowned Pigeon	Fa/Wo	Rare/Nesting?
Zenaida asiatica	White-Winged Dove	Wo/Oa	Common/Nesting
Zenaida aurita	Zenaida Dove	Fa/Wo/Oa	Common/Nesting
Columbina passerina	Common Ground Dove	Wo/Oa	Common/Nesting
Streptopelia decaocto	Eurasian Collared Dove	Oa	Introduced
PSITTACIDAE	**Parrots and Parakeets**		
Amazona sp.	Amazona parrot	Oa	Accidental/Introduced
Nimphicus hollandicus	Cockatiel	Oa/Urb	Escaped cage birds occasionally reported from Spanish Town and some villages.
CAMPRIMULGIDAE	**Goatsuckers**		
Chordeiles gundlachii	Antillean Nighthawk	Oa	Rare/Migrates/Nesting in spring to early summer
CUCULIDAE	**Cuckoos and Anis**		
Coccyzus minor	Mangrove Cuckoo	Wo	Uncommon/Nesting
Crotophaga ani	Smoothed-Billed Ani	Wo/Oa	Locally common but stable/Nesting
TROCHILIDAE	**Hummingbirds**		
Anthracothrax dominicus	Antillean Mango	Fa/Wo/Oa/Ca	Extirpated?
Eulampis holosericeus	Green-Throated Carib	Fa/Wo/Oa	Locally Common/Nesting
Orthorhyncus cristatus	Antillean-Crested Hummingbird	Fa/Wo/Oa	Locally Common/Nesting
ALCEDINIDAE	**Kingfishers**		
Ceryle alcyon	Belted Kingfisher	Co/Fr/Sp	Common/Migrant

SPECIES	COMMON NAME	HABITAT	CONSERVATION STATUS
TYRANNIDAE	**Tyrant Flycatchers**		
Myiarchus antillarum	Puerto Rican Flycatcher	Wo/Oa/Co	Very Rare/Occasional/Extirpated?
Tyrannus dominicensis	Gray Kingbird	Wo/Oa/Co	Common/Nesting
Elaenia martinica	Caribbean Elaenia	Fo/Wo/Oa/Co	Locally common/Nesting
HIRUNDINIDAE	**Swallows and Martins**		
Progne dominicensis	Caribbean Martin	Oa/Cl	Rare/Transient
Hirundo rustica	Barn Swallow	Oa/Cl	Rare/Migrant
MIMIDAE	**Mockingbirds and Thrashers**		
Mimus polyglottos	Northern Mockingbird	Fo/Wo/Co/Co	Common/Nesting
Margarops fuscus	Pearly-Eyed Thrasher	Fo/Wo/Oa	Very Rare or seasonal
VIREONIDAE	**Vireos**		
Vireo altiloquus	Black-Whiskered Vireo	Fo/Wo	Uncommon/Nesting
Vireo griseus	White-eyed Vireo	Fo/Wo/Oa	Rare/Vagrant
EMBERIZIDAE	**Wood Warblers, Blackbirds and their Allies**		
Dendroica striata	Blackpoll Warbler		
Dendroica petechia	Yellow Warbler	Fo/Wo/Oa/Co	Locally Common/Nesting
Dendroica magnolia	Magnolia Warbler	Fo/Wo/Oa/Co	Rare/Transient
Dendroica coronata	Yellow-rumped Warbler	Fo/Wo/Oa/Co	Rare/Transient
Dendroica discolor	Prairie Warbler	Fo/Wo/Oa/Co	Uncommon/Migrant
Coereba flaveola	Bananaquit	Fo/Wo/Oa/Co	Common/Nesting
Piranga olivacea	Scarlet Tanager	Wo/Fa	Rare migrant
Tiaris bicolor	Black-faced Grassquit	Wo/Oa/Co	Uncommon to rare
Passer domesticus	House Sparrow	Oa	Uncommon/Introduced
Passerina cyanea	Indigo Bunting	Wo/Oa/Co	Rare/Transient

Observers: Kevel Lindsay, Clive Petrovic, and Jean-Pierre Bacle

Table_Key: Cl = Cliffs; Co = Coastal; Fa = Forested Areas; Fr = Freshwater Habitat; M = Marine; O = Open Areas; P = Pelagic; Sp = Salt Pond; Wo = Woodland

4.3.2 Mammals

Bats are the only native mammals known to occur on Anegada as well as throughout the Virgin Islands. There are two known species.

(1) The Velvety Free-tailed Bat or Pallas's Mastiff Bat (*Molossus molossus*)

This bat is small, brown-to-blackish brown and sometimes reddish-brown. It feeds on insects caught during its long hours of flight from dusk until dawn (bats rest for periods of time before returning to feed).

It is probably the most common and widely known species on Anegada and is often seen around residences at The Settlement. They may spend the day below the metal sheet roofs of houses, and their movements and twitter calls may be heard during the day. Their small droppings are sometimes seen on the outside of structures.

Some residents on the island complain of having roof bats and want to learn how to rid themselves of these pests. There is general fear of bats, but the species is harmless and poses little threat. It feeds on pesky mosquitoes, beetles, flies and other insects and so provides an important natural service to residents. Aside from the roofs of houses, the species also roosts in rock fissures and between the bases of palm fronds.

(2) The Jamaican Fruit Bat (*Artibeus jamaicensis*)

The Jamaican Fruit Bat is the larger of the two species. It is usually a light-brown, dark-brown or reddish-brown colour and has a pointed nose-leaf. It feeds on fruits, foliage, nectar and pollen and, to a lesser extent, on insects. It is most active just after sunset when darkness begins to the first light of the sun the next day. It may roost in caves, old and abandoned structures, building and tree cavities, and the dense foliage of large palms.

The Jamaican Fruit Bat is little known by residents of Anegada. Most reported they had never seen a large bat on the island. This is not a surprise since there is little roosting habitat available for this species. It seems relatively rare on Anegada.

In addition to these two bats, it is probable that several other species may be present or are vagrant on Anegada (**Table 14**). Further research is needed to confirm the presence of these species.

The first researchers to record two bats from Anegada were Dr. Anne LaBastille and Milo Richmond. They completed an assessment of the birds and mammals of the island and published their results in the *Caribbean Journal of Science* in 1973. The IRF field team also confirmed the continued presence of these two species in its field assessment of spring 2012.

Table 14. Probable, but not confirmed, bat species on Anegada.

SPECIES	COMMON NAME	COMMENTS
Brachyphylla cavernarum	**Cave Bat**	This species may roost in abandoned buildings, but prefers hot and humid caves. There may be small solution holes on Anegada that could support a small population of this bat. It is similar in general appearance to the Jamaican Fruit Bat but does not have the prominent nose-leaf.
Noctilio leporinus	**Fishing Bat**	This is the largest bat species in the Caribbean, and it feeds primarily on fish and aquatic invertebrates, though it may also eat flying insects. It is often seen fishing along the coast and near docks throughout most of the Virgin Islands.
Tadarida brasiliensis	**Brazilian/Mexican Free-tailed Bat**	Similar to the Velvety Free-tailed Bat, it roosts in caves, buildings and roofs. It is possible that a small population may be present on Anegada.

4.3.2.1 Invasive Mammalian Species

In addition to the bats, LaBastille and Richmond (1973) reported on the presence of the invasive **Black Rat** (*Rattus rattus*) and the European **House Mouse** (*Mus musculus*). The island also has a small population of feral cats, the occasional wild or stray dog, and large herds of feral and free-roaming cattle, horses, donkeys, sheep and goats.

These introduced and often times invasive animals do untold damage to the island's landscapes, ecosystems, species and property and pose a safety and security risk.

Some animals, especially young and curious calves, donkeys, horses and goats, will often trample and maim the Anegada Iguana and other wildlife. Cats will catch, kill and sometimes eat

Iguanas and other animals. Livestock also pose a serious safety risk to drivers, especially to visitors.

As part of the Anegada environmental profile project, IRF distributed survey questionnaires to the community to seek opinions on environmental issues (see Chapter 9, Section 9.2). A section of the survey addressed the issue of free-roaming and feral livestock, especially, goats, sheep, cattle and donkeys.

Almost 70 percent of respondents considered free-roaming livestock a significant problem, 25 percent considered it a slight problem, and only 6 percent did not view it as a problem at all. Interestingly enough, only 25 percent of respondents owned some type of livestock. **Table 15** lists the primary issues associated with free-roaming livestock based on the community survey.

Table 15.
Issues associated with free-roaming livestock as perceived by community survey respondents.

Issue	% of Respondents Who Concur
A hazard to vehicular traffic	87%
Destroy crops and damage gardens	75%
Overgraze and trample natural habitats and wildlife	56%
Damage and pollute water catchments and ponds	56%
Contribute to unsightliness of roadways	12%

Source: Anegada Community Questionnaire administered by IRF for the Anegada Environmental Profile Project.

More detailed information on the island's invasive mammals is provided in the enumerated sub-sections that follow.

(1) Cattle (*Bos taurus*)

Cattle have been present on the island for many years, and many residents suggest they have always roamed the island. Others (Koester 1987 and Downs 1997) report they were at one time kept within walled enclosures, but in the 1970s these enclosures (stone walls) were broken up when the airstrip and road infrastructure were established. Cattle are now feral in all parts of the island and are especially numerous in the eastern two-thirds of the island. They trample wetland areas and overgraze plants and vegetation, driving some to extinction. Because they remove vegetation, they cause considerable erosion of already thin soils and help to exacerbate the dry conditions of the island.

During the dry season, and especially during droughts, many of these animals suffer greatly. Even when rains return and some vegetation may be available, their suffering often continues due to stomach compaction, a condition that develops when animals eat dry vegetational material and become dehydrated. They cannot pass the material and develop bloating and other ailments, which eventually can lead to a painful death. This condition seems common in the island's livestock.

Cattle also suffer from gut worms and other parasites, which may cause severe malnourishment and other ailments. This is also true for feral cats and dogs on the island. **Photo 41** shows cattle on Anegada during a relatively dry October.

(2) Donkeys (*Equus asinus*)

These animals are present in low numbers and are very mobile. They are found mostly in the eastern half of the island and share similar grazing environments with cattle. There is no apparent use of this livestock by local residents although some people consider them a potential tourist attraction. As with cattle, donkeys contribute to the deterioration of vegetation and wildlife habitat.

(3) Goats (*Capra hircus*)

These mammals are feral throughout the island but more abundant in the eastern half. When "owned," they are said to be identified by their ear marks. When agriculture was an important activity on the island, the goat population was kept under control, away from gardens and confined to stone wall enclosures. As agriculture was abandoned, the population of goats has increased significantly.

This species now has a detrimental impact on vegetation. With greater numbers, mobility, and

Photo 41.
Free-roaming cattle on Anegada seeking food during a relatively dry October day.

reproduction, they are likely to be foraging on a wider range of plants species than either cattle or donkeys.

For some residents, goats and other livestock are "endearing" and "tolerated" because they provide a reliable source of meat for Anegadian households (Koester 1987). Amongst the seven largest livestock owners, Koester (1987) estimated about 245 goats on the island. Many other households owned 10 or less goats. There are no updated numbers on the total goat population since his reporting.

(4) Sheep (*Ovis aries*)

Sheep are in low numbers and are usually encountered near The Settlement. The sheep population is estimated to be less than 20 percent of that of goats (Koester, 1987). They are far better controlled than goats. Sheep are harvested as a food item by a few households. Most are of the West African woolless breed, with others that are part Barbados Black-belly or Blackhead Persian or both, or all three mixed.

(5) Cats (*Felis catus*)

Feral cats are present throughout the island, although cat density appears to be low except at the dump site. It is believed that cats pose a threat to juvenile iguanas and have contributed to their decline. It is a reasonable probability that cats are eating young iguana (less than 3 years old). Cats will require fresh water during the dry season and are probably dependent on the rat population as their main food source, augmented by birds and lizards.

4.3.3 Amphibians and Reptiles

To date, only one amphibian species has been reported for Anegada, the **Puerto Rican Ditch Frog**, sometimes called the **White-lipped Frog** (*Leptodactylus albilabris*). It is surprising that no other amphibian species has been recorded given the presence of numerous freshwater and moist solution holes. Perhaps the dry and often extreme conditions that also exist make it difficult for other species to become established. Further research is needed to determine if there are other species.

The Ditch Frog requires standing freshwater to breed and is often found or heard calling from small pools or around gutters and even cisterns. During dry months, the frog may go silent as it aestivates (temporarily ceases activities) until the rains return.

One species that will undoubtedly colonise Anegada is the **Cuban Tree Frog** (*Osteopilus septentrionalis*). First introduced to Tortola around the late 1990s, it has spread to other larger islands, and even to smaller cays such as Mosquito. Its spread is linked to human activities, including the inter-island transport of lumber, potted plants, shipping containers, vehicles, boats, etc. If it is not yet present on Anegada, it is expected to arrive there in the near future (see Section 4.3.7 below).

There are at least 12 terrestrial reptiles and 3 marine turtles reported for Anegada (**Table 16**). Three species—an iguana, a small snake and a skink—are endemic. Most species are fairly common, although several are either critically endangered or believed to be quite rare and possibly threatened.

Table 16.
Amphibians and reptiles of Anegada.

SPECIES	COMMON NAME	DISTRIBUTION	STATUS
AMPHIBIANS			
Leptodactylus albilabris	Puerto Rican Ditch Frog; White-lipped Frog	Puerto Rico Virgin Islands	Very Rare
TERRESTRIAL REPTILES			
Ameiva exsul	Virgin Islands Ground Lizard	Throughout the Virgin Islands (UK and US)	Common and widespread
Anolis cristatellus wileyae	Virgin Islands Crested Anole	Culebra, Vieques, and Virgin Islands (UK and US)	Common and widespread
Anolis pulchellus	Puerto Rican Bush Anole	Puerto Rico and Virgin Islands (UK and US?)	Common and widespread
Anolis stratulus	Puerto Rican Spotted Anole	Puerto Rico and Virgin Islands (UK and US?)	Common and widespread
Cyclura pinguis	Anegada Rock Iguana	Necker, Anegada, Mosquito and Guana Islands, BVI	Listed as Critically Endangered under the IUCN criteria
Hemidactylus mabouia	House Gecko	Virgin Islands and the rest of the Neotropics	Reportedly common around residences and undoubtedly in the wild
Thecadactylus rapicauda	Forest Gecko Turnip-tailed Gecko	Parts of the Neotropics, Lesser Antilles, St. Croix (USVI), Necker and Mosquito (BVI) and reported for Anegada	Virtually nothing is known about this species on Anegada
Spondylurus anegadae	Anegada Skink	Endemic to Anegada	Considered rare Hedges, *et al.* (2012) consider this species, based on IUCN criteria, to be Critically Endangered
Sphaerodactylus macrolepis macrolepis	Puerto Rican Eye-spot Gecko/Sphaero	Throughout the Virgin Islands	In the past, reported to be fairly common, but recent observations suggest the species is relatively rare
Borikenophis portoricensis anegadae	Puerto Rican Racer	British Virgin Islands	Relatively common
Magliophis exiguous exiguus	Virgin Islands Racerlet	Virgin Gorda, rest of the Virgin Islands and Puerto Rico	Rare
Typhlops catapontus	Virgin Gorda Blindsnake	Virgin Gorda and Necker Island	Rarely seen or observed; Conservation status remains unknown
MARINE REPTILES			
Chelonia mydas	Green Turtle	Worldwide	Endangered
Dermochelys coriacea	Leatherback Turtle	Worldwide	Endangered
Eretmochelys *imbricata*	Hawksbill Turtle	Worldwide	Endangered

Reports by early observers also indicate that there may be at least two other species present, although this is speculative. The renowned naturalist, Robert Hermann Schomburgk, spent a number of months in the year 1831 surveying the wrecks, reefs and landscapes of Anegada. In 1832, the *Journal of the Royal Geographical Society* of London published his observations as "*Notes from the Island of Anegada*." In it, Schomburgk mentions two reptiles, an Amphisbaenid, and a small red snake. To this day, no specimens of such animals have been collected for the island, and so their identities remain a mystery.

For the Amphisbaenid, he may have been referring to the species *Amphisbaena fenestrata*, a species that is present on most of the larger islands and cays of the Puerto Rico Bank. It is possible that this species also exists on Anegada but is yet to be collected and studied.

For the small red snake, Schomburgk wrote:

> [I] *have met with a small red snake, very similar in appearance to the dangerous coral snake; but I was assured that this species was entirely inoffensive*.

The coral snake to which he refers may be one of several species of small snake (some may grow to about 1.5 m/5 ft, though many are just over 30 cm/12 in). These are found in Tropical America and parts of the Old World, and are often banded black, red/ruddy, white or yellow. They are all venomous.

The three species of endemic reptiles are: the **Anegada Rock Iguana** (*C. pinguis*) (**Photo 42**), the **Anegada Skink** or galliwasp (*S. anegadae*), and the **Anegada Blind Snake** (*T. catapontus*). **Photo 43** shows a juvenile Anegada Blind Snake.

Two accounts of the Rock Iguana are provided in **Box 2** and **Box 3** on the following pages.

The Skink was recently identified by Hedges and Conn (2012) as a species found only on Anegada. Previously, it was listed as *Mabouya sloani sloani*, a subspecies considered widespread across the VI region. Genetic, morphological and some ecological analyses by Hedges and Conn suggest this,

Photo 42.
Anegada Rock Iguana (photo courtesy of Kelly Bradley).

and many of the species in the West Indies represent unique populations and warrant immediate conservation intervention. The Anegada Skink is considered rare and only a handful of specimens are known. Residents occasionally report seeing them around the rock piles and walls of The Settlement. The species is suggested to be Critically Endangered under IUCN assessment criteria.

The Blind Snake is a fossorial species of snake, meaning that it lives underground. For this reason, it is rarely seen. Little is known about its habits and ecology on Anegada and even less about its conservation status. Given how dry the conditions of the island are and the impacts of human activities and of feral and free-roaming livestock and other invasives, it is prudent to list the species as "*endangered*" until further assessment can ascertain its true status.

Photo 43.
A juvenile Anegada Blind Snake
found near to The Settlement.

Box 2
Notes on the Rock Iguana (*Cyclura pinguis*)

The Rock Iguana was first reported by Schomburgk in 1832 when he wrote: "*The leguan, or guana (*Iguana sapidissima*), is frequently met with at the west end, and attains a considerable size: it is hunted with dogs*."

During this time, *Iguana sapidissima* was a widely applied name for many iguana species in the Caribbean and South America and continued in use until more careful analysis assigned the species to more specific nomenclature. The first specimen taken for biological research was around 1917 by Mr. James Lee Peters, who apparently worked for the Museum of Comparative Zoology at Harvard College and assisted Dr. Thomas Barbour, a herpetologist, in collecting specimens. Barbour (1884–1946) was an American herpetologist who became the director of the Museum of Comparative Zoology. He traveled widely, focusing on reptiles and amphibians and describing hundreds of species, many of which are named after him.

It was Thomas Barbour who named the species *Cyclura pinguis*, after recognising that it was distinct from all other species in the Americas. The genus name ***Cyclura*** is from the Ancient Greek word cyclos, which means "circular," and from ourá, which means "tail." The species name ***pinguis*** means "fat" and refers to the appearance of the animal, which is often called the "Stout Iguana."

Cyclura pinguis is of an ancient lineage and is thought to be the oldest and most divergent of all the *Cyclura* iguanas of the West Indies. There are fossil remains of the species from cave deposits in Puerto Rico and from nearby St. Thomas. These, however, are associated with human remains, suggesting that the animal may have been widely transported from island to island for food. Nevertheless, it is believed to have been more widespread across the Puerto Rico Bank, but was eventually driven to extinction everywhere except on Anegada, its last refuge.

Today, populations of this species have also been established on Norman, Guana, Mosquito and Necker Islands in the BVI. These are all private islands, but Iguana experts advise against the uncontrolled transport and restoration of the species to other areas. They fear that without careful assessment and monitoring, inbreeding and other threats could doom the species. Nevertheless, current populations on these private islands appear to be doing well.

On Anegada, to save the species from extinction, the National Parks Trust and the IUCN Iguana Specialist Group launched a "headstart programme" in 1997 to boost populations and help ensure the species' survival in the wild. In headstart programmes, animals are reared in captivity, sometimes brought in from wild populations as eggs, hatchlings, juveniles, young adults or breeding adults, or sometimes reared from animals born in captivity.

The Anegada Iguana headstart programme is carried out in partnership with the Fort Worth Zoo in Texas and the San Diego Zoo in California. These facilities have successfully bred the animals in captivity and house small populations of the species as a safety-net. A team of researchers, students and other specialists maintain a regular presence on Anegada and carry out long-term restoration, monitoring, and invasive species control. Kelly Bradley of the Fort Worth Zoo heads this team.

The Anegada Iguana Headstart Facility (**Photo 45**) is located near the headquarters of the BVI Royal Police and the island's firehouse. It houses some 60-80 animals, all of which are slated for release into the wild once they reach 400 grams (14 ounces) in mass. Since 2003, 162 headstart Iguanas have been released into the wild. Today, the population stands at approximately 400 individuals on Anegada.

The main threat to *C. pinguis* is habitat loss, especially in dune areas where they frequently nest. Another threat is the large population of feral cats on the island. Each year this introduced predator kills most hatchling Iguanas within months of emerging, drastically reducing recruitment. Other threats include direct competition for food from free-roaming and feral livestock and the killing of Iguanas by these same animals. Another threat is from vehicles which kill animals on the back roads of Anegada. It is feared that paving the roads on the north side of the island would increase this threat since drivers would have greater access and would likely travel at higher speeds.

For more information on the Anegada Rock Iguana conservation effort, contact the BVI National Parks Trust at planning@bvinpt.org and Kelley Bradley, Conservation Biologist, at kbradley@fortworthzoo.org.

Box 3

The Longstanding Struggle to Save the Anegada Rock Iguana

The story of the fight to save the Anegada Rock Iguana began in the late 1960s. As documents from the archives of Island Resources Foundation show, in 1968 Dr. Edward Towle, then director of the Caribbean Research Institute at the College of the Virgin Islands (USVI) and later the founding president of Island Resources Foundation, embarked on a programme to enlist the support of the World Wildlife Fund (WWF) and the International Union for the Conservation of Nature (IUCN) to prevent the extinction of the species.

Photo 44.
Anegada Iguana photo taken from the late 1960s or early 1970s.

Dr. Towle reached out to some of the experts of the day, including then IUCN president Harold Coolidge, biologist Richard Philibosian, author and ecologist Anne LaBastille, zoologist William Rainey of the Caribbean Research Institute, Michael Carey, then a doctoral student, Austin Maduro of the Department of Agriculture in Tortola, and Richard Fitte of the Fauna Preservation Society, UK (now Fauna and Flora International). The scientific community joined forces with leaders from the BVI, including the Governor of the BVI (1971-1974) Derek George Cumore and Chief Minister (1971-1979) Willard Wheatley.

The effort spanned the globe, from Europe to the Caribbean to Washington, DC and included international meetings where papers and presentations told the story of the plight of the unique iguana from a tiny island. From 1968 to 1976, Dr. Ed Towle and his colleagues and supporters carried forward the first major effort to save this most enigmatic species from extinction.

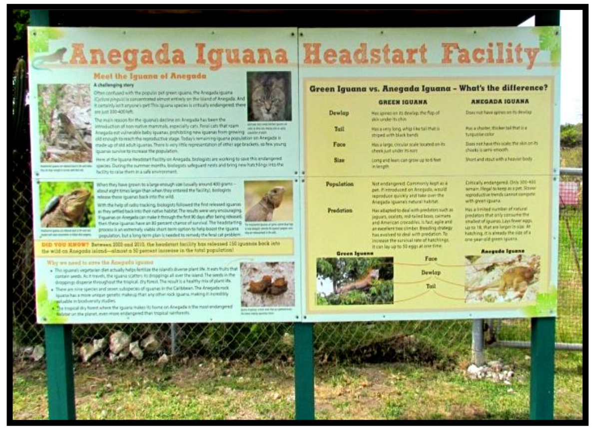


Photo 45.
The Anegada Rock Iguana Headstart Facility.

Anegada also has a number of reptile species considered rare, either because they are rarely seen, or because their populations are very low, or both. These include the **Puerto Rican Racerlet Snake** (*M. exiguus exiguus*), and the **Puerto Rican Eye-spot Gecko** (*Sphaerodactylus macrolepis macrolepis*). The Racerlet is a relative of the more commonly seen Puerto Rican Racer, which is larger in size. They have similar habits and live in similar habitats. It is not known why the Racerlet species is rare on Anegada. It is also relatively uncommon to rare on other islands in the Virgin Islands region.

The Eye-spot Gecko was reportedly common in parts of Anegada, according to Michael Carey when he published "*The Herpetology of Anegada, British Virgin Islands*" in the *Caribbean Journal of Science* in 1972. In the article, he reported:

> *Sphaerodactylus on Anegada are rather common lizards. … On Anegada, sphaerodactylus appear to reach their greatest abundance in the vicinity of The Settlement where piles of trash (boards, pieces of tin, coconut husks, etc.) and rocks have accumulated over the years. They seem to prefer retreats with soil rather than limestone as the substrate. Away from The Settlement, sphaerodactylus are most often encountered beneath logs, rocks and rock piles, moist leaf litter, and fallen palm fronds at the bases of trees. Often, several could be seen at once sitting (basking?) on a fallen palm frond during the day. They disappeared beneath the frond at the slightest disturbance.*"

The IRF biodiversity team's search for the species throughout many areas of the island found that it was uncommon to rare in most areas. This could be due to seasonal population variability since it is expected that the numbers would decline in dry periods because of low food availability and other factors. However, further study is warranted to determine the exact status of the species throughout Anegada.

Photo 46.
Eye-spot Gecko on Anegada. Note the size of the animal relative to the human hands.

Most specimens carry the distinctive white eye-spots on the nape, common to the species across the Puerto Rico Bank (although some populations may lack these spots), but most are overall lighter, greyer and with fewer dark spots and stripes. **Photo 46** shows a specimen captured near The Settlement.

The other species of reptiles on Anegada are relatively common and found in most habitats. The three species of Anoles (**Table 16**) are abundant, although the Puerto Rican Bush Anole (*A. pulchellus*) is rarely observed because of its relatively small size and habitat preferences; it is often found in low bushes and amongst grasses and herbaceous plants and is easily overlooked. **Photo 47** shows a male *A. cristatellus* on Anegada. Note the distinctive tail fan.

Photo 48.
Large male Ground Lizard in the Table Bay area, Anegada.

The *Ameiva* or Virgin Islands Ground Lizard is readily observed (**Photo 48**), and the Puerto Rican Racer is seen fairly often, especially around The Settlement. During the April 2012 field assessment for the profile project, several road kills of the Racer were noted. Animals will lie on a warm concrete tarmac to warm their bodies early in the morning or early evening, and cars will sometimes kill them. **Photo 49** shows a dark-coloured form of the Racer attempting to drink water in a solution hole well on Anegada.

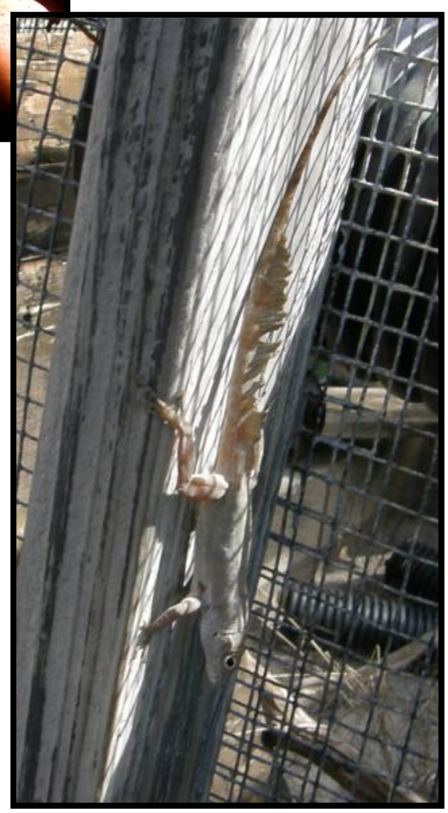


Photo 47.
Old male *A. cristatellus*, Anegada.

There are three marine reptiles on Anegada (**Table 16**). The island's extensive sandy beaches offer significant nesting sites for the Green (*Chelonia mydas*) and Hawksbill (*Eretmochelys imbricate*) turtle. Most nesting occurs on the northern shores, particularly on the beaches of the eastern end of the island. An occasional Leatherback Turtle (*Dermochelys coriacea*) nests at West End Point.

The once significant turtle fishery in Anegada is much reduced, and turtles are rarely taken from nesting beaches. Commercial fishing of turtles ceased because of a reduced demand in Tortola. However, a low level of harvest for local use does continue.

Photo 49.
Puerto Rican Racer getting ready to take a drink at a solution hole well.

4.3.4 Aquatic Fish

There are no known freshwater fish species native to Anegada, and none have been introduced. The island does possess freshwater habitats, but many of these are either too isolated or experience periodic seawater intrusion, which destroy the sensitive environments needed by animals.

Nevertheless, the salt ponds do support an aquatic fauna of fish and invertebrates, and small fish are often seen darting about in Flamingo Pond. Fishing for White Mullet (*Mugil curema*) (known locally as Curemal) is very popular within the western saline ponds. The occasional mullet is seen dead and desiccated on the shores suggesting that the ponds support fairly consistent populations of fish.

On the eastern and southeastern ends of the island, the ponds also support populations of fish. Field observations have allowed glimpses of fish jumping, flicking their tails or feeding near the surface. The species here are unknown, but could include Atlantic Tarpon (*Megalops atlanticus*), Snook (*Centropomus undecimalis*), and others.

4.3.5 Invertebrates

Invertebrates are animals without backbones, and include insects such as butterflies and spiders. Many live on land, some in the sea, some in streams and ponds, some below ground, and some even inside homes and on other creatures.

Outside of bacteria, viruses, fungi and lichens, invertebrates represent the largest group of living things on these islands. Their significance to the ecology of the Caribbean is often overlooked due—for the most part—to our lack of understanding, appreciation and to some extent our fear of many of these creatures. But when one looks closely at their diversity, ecological roles, beauty, complexity, and influence on larger vertebrates such as birds and reptiles, then it becomes obvious how important it is that we more fully identify the species, understand their roles, and protect them and their habitats.

But despite the significance of invertebrate species, very little is known about them in the BVI, including Anegada. Many of the records of species collected and observed are held in research institutions outside of the Caribbean region and are unpublished. It would take a great deal of time and resources to fully assess and compile the information, and present it in a comprehensive way.

Anegada is known to have at least two endemic Lepidoptera (butterflies and moths make up this group). The two endemic species are butterflies: the **Anegada Skipperling** (*Copaeodes eoa*) and the **Anegada Calisto** (*Calisto anegadensis*). Both are locally common (Smith, *et al*., 1991).

One of the most prominent and remarkable species is the **Frangipani Sphinx Moth** (*Pseudosphinx tetro*), whose caterpillar stage feeds on plants in the family Apocynaceae. One of their favorites is the Frangipani; **Photo 50** shows a small group on a native Frangipani (*Plumeria alba*).

We do not yet have the data to tell us the conservation status and the distributions of many of the island's invertebrate species. Only further fieldwork and study will allow us to properly understand the local species and to then develop effective conservation and management programmes.

Addendum II to the *Anegada Environmental Profile* provides a preliminary list of some of the invertebrates of the island.

Photo 50.
The Frangipani Caterpillar (*P. tetro*) on native wild Frangipani.

4.3.6 Species of Special Concern

There are 17 animals of Special Concern on Anegada today, and because we know so little about the island's faunal species, the number is likely to rise significantly. For example, little is known about the two endemic butterfly species listed for the island. Further field research needs to be done to address gaps in our knowledge of much of Anegada's biodiversity so that effective conservation measures can be put in place. **Table 17** provides a summary of the species of Special Concern.

4.3.7 Invasive Species

(1) Agave Snout Weevil (*Scyphophorus acupunctatus*)

This Weevil was introduced to the Virgin Islands sometime in the 1990s. It is native to Mexico, but was likely accidentally imported with potted plants, perhaps from Florida.

It attacks and destroys the native and endemic *Agave missionum*, populations of which have dramatically declined across much of the Virgin Islands and Puerto Rico. The insect attacks the heart of the unopened leaves by burrowing deep inside. The grubs eat the succulent tissue, while at the same time, toxins build up, which allows fungi and bacteria to attack the plant, cutting off vital circulation. The result is the collapse of the central rosette of the plant, followed by the plant's eventual death (**Photo 28**).

Agave missionum, a Puerto Rico and Virgin Islands endemic, is an important native species because its flowers provide support for birds and insects; additionally, reptiles and amphibians find refuge amongst its dead and dying leaves. See **Photo 51** of a flowering A. missionum on the eastern end of Anegada.

After the adult plants flower, the drying mass provides homes to snakes, lizards, frogs, and invertebrates, and helps to supply essential organic matter to the soil.

Over the last 10 to 15 years, *A. missionum* populations had been reduced to a few scattered individuals in the BVI. Although numbers once again seem to be on the increase, the process is slow, and any major disaster or habitat destruction could once again reduce population numbers.

Table 17.
Anegada fauna species of special concern.

Species	Conservation Status	Issues/Concerns
Invertebrates		
Catabenoides lazelli	Rare	Butterfly is listed as endemic to the BVI. Little is known about its population.
Anegada Skipperling *(Copaeodes eoa)*	Rare	Butterfly is listed as endemic to Anegada. Little is known about its population.
Anegada Calisto *(Calisto anegadensis)*	Rare	Butterfly is listed as endemic to Anegada. Little is known about its population.
Mammals		
Jamaican Fruit Bat *(Artibeus jamaicensis)*	Uncommon	Population seems limited by suitable roost sites.
Velvety Free-tailed Bat *(Molossus molossus)*	Rare	This species is limited by available roost sites and is on the decline. Currently, it seems to mainly roost in the roofs of homes.
Birds		
Greater Flamingo *(Phoenicopterus ruber)*	Rare and vulnerable	This species went extinct in the Virgin Islands but was restored to Anegada in the 1980s. The nesting population is about 200.
Antillean Mango *(Anthracothrax dominicus)*	Possibly extinct	Very rare if not extinct in the Virgin Islands.
Puerto Rican Flycatcher *(Myiarchus antillarum)*	Very rare and locally critically endangered	Very rare and on the decline, and has disappeared from many islands in the BVI.
Willet *(Catoptrophorus semipalmatus)*	Uncommon	Localised nesting. Dependent on healthy wetlands, and may be affected by feral livestock.
Killdeer *(Charadrius vociferous)*	Uncommon	Localised nesting. Dependent on healthy wetlands, and may be affected by feral livestock.
Wilson's Plover *(Charadrius wilsonia)*	Uncommon	Localised nesting. Dependent on healthy wetlands, and may be affected by feral livestock.
Antillean Nighthawk *(Chordeiles gundlachii)*	Uncommon	Localised nesting. Dependent on healthy shrub and woodland vegetation. One of the few nesting populations in the Virgin Islands. May be affected by feral livestock.
Black-necked Silt *(Himantopus mexicanus)*	Uncommon	Localised nesting. Dependent on healthy wetlands, and may be affected by feral livestock.
White-tailed Tropicbird *(Phaethon lepturus)*	Rare	Reportedly nesting, and affected by feral livestock, rats and cats.
Least Tern *(Sterna antillarum)*	Rare	Localised nesting. Dependent on healthy wetlands, and may be affected by feral livestock, rats and cats.
Terrestrial Reptiles		
Virgin Island Worm Lizard *(Amphisbaena fenestrata)*	Rare and vulnerable	This species of legless lizard is fossorial in habit, and, as a result, it often goes unseen and unobserved. Nevertheless, because we know so little about its populations, and because so little native habitat remains, it is relatively rare and vulnerable. It is suggested for Anegada based on Schomburgk, but not yet confirmed. It is possible that this species is now extinct on Anegada.

Species	Conservation Status	Issues/Concerns
Anegada Rock Iguana *(Cyclura pinguis)*	Rare and endangered	The ground–living Rock Iguana was once widespread across the Virgin islands, but by the early 1960s, only a relict population survived on Anegada. Today, some have been introduced to Necker, Guana and Mosquito Islands (private resort islands), and there is a concerted effort to restore the population on Anegada to sustainable levels.
Puerto Rican Eye-spot Gecko/Sphaero *(Sphaerodactylus macrolepis macrolepis)*	Uncommon and vulnerable	Reported to be fairly common in the past, but recent observations suggest that the species is uncommon. This small reptile requires native woodlands and forests with stable leaf litters and small rocks where it may hide during the day. Its numbers seem relatively low on Anegada, and further investigations are needed to determine its exact status.
Turnip-tail Gecko *(Thecadactylus rapicauda)*	Rare	Nothing is known about this species on Anegada. It is known only from two other islands in the BVI. Some consider its presence in the region to be via human introduction, but it has been reported for that island since at least the 1800s.
Anegada Skink *(Spondylurus anegadae)*	Very rare and critically endangered	Endemic to Anegada. Hedges, *et al.* (2012) consider this species, based on IUCN criteria, to be Critically Endangered. It is reportedly most commonly observed around The Settlement, but is rare elsewhere.
Virgin Islands Racerlet *(Magliophis exiguus exiguus)*	Locally rare and vulnerable	This species is quite rare in the BVI. The reasons for this remain unknown, but it is likely similar to the species listed above. It is especially vulnerable to predation by rats, especially as juveniles.
Anegada Blind Snake *(Typhlops catapontus)*	Rare	This snake is endemic to Anegada. It is fossorial in habits, so it is rarely observed. However, it is an easy prey for rats, and is vulnerable to habitat loss, especially deforestation.
Marine Reptiles		
Green Turtle *(Chelonia mydas)*	Endangered	This species has been traditionally netted. It primarily feeds on seagrass. Most nesting occurs on the northern beaches on the eastern half of Anegada.
Leatherback Turtle *(Dermochelys coriacea)*	Endangered	Largest of the three turtles, it primarily feeds on jellyfish and other soft-bodied prey. Recent records indicate that they occasionally nest along the West End Point area.
Hawksbill Turtle *(Eretmochelys imbricata)*	Endangered	This is the most common nesting turtle in the BVI. On Anegada, it frequently nests along the northern and western beaches.
Amphibians		
Puerto Rican Ditch Frog/White-lipped Frog *(Leptodactylus albilabris)*	Rare	Rarely observed or heard, and populations are limited in distribution.

(2) House Mouse (*M. musculus*)

This species arrived with the first Europeans as a stowaway on ships. It is now widespread on the island, but most common around humans, including The Settlement.

(3) Black Rat (*R. rattus*)

The Black Rat's history is similar to that of the House Mouse. It will attack native wildlife, including baby Rock Iguana and their eggs, and nesting birds, their eggs and chicks. It will also prey on reptiles and amphibians. Being omnivorous and tree climbing, it will also consume native plants, their flowers and seeds.

Photo 51.
On Anegada, the flowers of an *Agave missionum* provide local birds with food—pollen, nectar and insects.

(4) Cuban Tree Frog (*O. septentrionalis*)

This species is *not* yet present on Anegada, but because it is present on most large islands in the American and British Virgin Islands and is rapidly spreading, we choose to highlight this invasive species and its potential threats.

The Cuban Tree Frog presents an economic and ecological threat to Anegada and the rest of the Virgin Islands. It is difficult to manage given its rapid rate of colonisation and spread, the size of its populations and its widespread presence on most large islands of the US/BVI. Additional field study will help to determine its impacts, as well as ways to control and manage it. The species consumes small birds, including young at nests, other frogs, lizards and invertebrates. It will also out-compete other species.

On other islands, it has been spread through the movement of building materials, potted plants, vehicles, and shipping containers, all factors that are currently present on Anegada.

(5) Feral and Free-roaming Livestock and Feral Cats and Dogs

Several domestic livestock breeds are present throughout Anegada, including sheep, goats, horses, donkeys and cattle. In addition, feral cats and, occasionally, feral dogs may occur. These animals present several challenges for the island.

Livestock farming has been an integral part of the development, culture and identity of Anegada and Anegadians since the late 1700s. The landscape was carefully managed to accommodate herds of animals. Residents eked out a hard living from the land, and livestock provided them with sustenance and insurance against bad times.

By the mid-twentieth century, fishing had become a more profitable enterprise than farming, and marine resources had increased in economic importance while the importance of land resources had decreased (Koester, 1987). Anegadians stopped maintaining their garden walls and allowed an increasing number of livestock to run free.

During lean times, residents could rely on the meat and the sale of stock to survive. Even as the BVI progressed to today's service-oriented economy, aspects of this farming tradition persist, and the adverse impacts of these introduced non-native herbivores over the decades have resulted in habitat degradation and loss, deforestation, erosion, and ecosystem dysfunction.

Throughout much of Anegada, overgrazing of plants, trampling of ground, compaction of soil, pollution of water, and disruption of ecological frameworks have resulted in a degraded, "goat-climax" vegetation community. In many areas, the dominant plants are crotons and other species that are unpalatable to livestock because of their sap and foul taste—and so they persist. The result is a highly degraded landscape.

Even after feral and free-roaming livestock have been removed from a particular area, the damage they have caused may persist for years. For the landscape to heal, animals need to be controlled, and careful conservation measures will need to be applied over many years.

As for feral cats and dogs, the presence of these non-native predators may be a result of pet owners seeking a humane way to dispose of unwanted animals, *i.e.*, they are left in "the bush" far away from human-inhabited areas. However, historically, it has been suggested (beginning with Schomburgk) that some wild dogs were used to hunt the Anegada Rock Iguana and allowed to run wild when not needed. Although these packs do not now exist on Anegada, there are occasional reports of wild dogs, and these may be the result of unwanted pets.

Feral cats and dogs are predators and will attack Iguanas, snakes, birds and other animals. They also carry diseases and pests. Researchers (Veitch, 1998; Gerber, 2000; Bradley, *et al*., 2005) have reported that the stomachs of many cats were heavily populated with intestinal parasitic worms and showed signs of diseases and malnutrition. Thus, discarding unwanted pets in "the bush" may not be humane after all and should be discouraged.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE ONE **Sand Mining** Indiscriminate sand mining within dune areas is causing increased risks for dune ecology and wildlife.	Ongoing sand mining, particularly along the northwest road corridor, is contributing to the deterioration of sand dune ecosystems, including native vegetation and also the alteration of natural dune dynamics. This in turn poses a continuing threat to the Rock Iguana, especially in key nesting habitats. Furthermore, the scar left by sand mining activity encourages recolonisation of invasive species such as the Australian Pine (see Issue Three).	**SHORT-TERM OPTIONS** **1.** Sand mining should be halted within Rock Iguana dune habitat and in areas surrounding the Ramsar Site. **2.** The Department of Town and Country Planning and the Department of Conservation and Fisheries need to identify sites that—if disturbed— could have negative impacts on Rock Iguanas and native vegetation, and prevent further sand mining through legislative means. **LONG-TERM RECOMMENDATIONS** **1.** As part of a long-term strategy, each site that has suffered environmental damage from sand mining should be identified, mapped, restored, and then continuously monitored. **2.** A Vegetation and Dune Restoration Plan for Anegada could be developed by a collaboration of Town and Country Planning with Conservation and Fisheries. Provisions of the Physical Planning Act (2004) could be employed by DTCP to designate "environmental protection areas" for purposes of developing a plan for restoring vegetation and dunes.
ISSUE TWO **Invasive Species: Feral and Free-roaming Livestock** Feral and free-roaming livestock have in the past, and continue in the present, to contribute to land deterioration and degradation throughout Anegada. They have caused considerable reduction in the island's biodiversity, particularly its vegetative land cover.	If no action is taken, the continued presence of feral and free-roaming livestock will further stress the environment with increased loss of biodiversity, reduction and degradation of wildlife habitats, increased soil erosion, and deterioration of wetlands.	**SHORT-TERM OPTIONS** **1.** To manage feral and free-roaming livestock on Anegada will require more involvement by the community to achieve a common purpose. A first step might be the assemblage of information on livestock ownership and production, including the population that can be identified as property of a specific owner and the population that is free-ranging. **2.** With such information in hand, it will be easier to develop measures to better control the livestock population, including community-focused projects that demonstrate improved livestock management, improved animal husbandry, and establishment of demonstration plots to illustrate a livestock-degraded landscape and a natural landscape free of livestock. **3.** Data on livestock populations and ownership will also facilitate development of conservation management strategies that identify and map areas on Anegada where feral and free-roaming livestock are an issue.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
		LONG-TERM RECOMMENDATIONS **1.** The Department of Agriculture, in cooperation with the Department of Conservation and Fisheries, must increase public awareness about the short- and long-term impacts of livestock on Anegada's environment and the consequences of inaction. **2.** Government should establish a cooperative effort with the community to remove livestock from critical habitats or natural areas, particularly those that require restoration.
ISSUE THREE **Other Invasive Species Issues** The presence of rats and feral cats poses a threat to young Iguanas, and to the many species of nesting birds. The introduction of invasive plants such as the Australian Pine contributes to the deterioration of beach vegetation habitats and sea turtle nesting opportunities.	If kept unchecked, the rat and cat population will continue to rise thereby increasing the threat to the young iguanas and other wildlife. Many invasive plant species, such as the Australian Pine (*Casuarina equisetifolia*), pose a threat to native plants and wildlife.	**SHORT-TERM OPTIONS** **1.** Although discussed in the past (but with little follow-up action), there is still a need for a detailed threat assessment of feral cats and rats on Anegada, along with the identification of proposed remedial actions. The National Parks Trust seems to be the appropriate lead agency for this activity; the Trust might seek external expertise when local resources are not adequate to meet desired outcomes. **2.** Identify and map areas where distribution of the Australian Pine is most significant. This effort might be undertaken by community members and students with training and supervision by the DCF and/or NPT. **LONG-TERM RECOMMENDATIONS** **1.** Based on the information assembled from the above-recommended assessment, a plan for eradicating feral cats and controlling the rat population, especially in areas where they have the most impact on wildlife, needs to be prepared and implemented, probably under the leadership of the NPT in cooperation with the Department of Conservation and Fisheries. **2.** A plan for the control and removal of the Australian Pine and other invasive plants that pose a significant threat to natural habitats should be developed by the conservation agencies of Government, and should include management requirements and a monitoring regime.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE FOUR **Loss and Degradation of Wetlands** Wetland habitats are under increasing pressure and threat from land use activities around pond perimeters. Despite the presence of a Ramsar-protected site on the island, the perimeters of these ponds remain under threat of development.	Unless the public sector—through the planning and/or environmental units of Government—takes a more aggressive and focused approach to protecting, managing, and conserving the wetlands of Anegada, further deterioration and loss is certain to occur.	**SHORT-TERM OPTION** **1.** Wetlands and their buffer areas that have been used for the deposit of litter and waste need to be cleaned up and waste and refuse removed, perhaps as part of a targeted island-wide clean-up campaign. **LONG-TERM RECOMMENDATION** **1.** Because the BVI lacks comprehensive legislation to protect and manage wetland resources and coastal areas, it is important that Government put in place a wetlands policy, approved by Cabinet, that: – Integrates planning for wetlands across government departments and agencies; – Provides a workable definition for what constitutes a wetland system; – Identifies and determines the status of the territory's wetlands, including profiles of plant and animal species; – Creates a GIS database and updates maps of the territory's wetland resources; – Protects wetland habitats whose system integrity has been identified as critical; – Implements an educational component to help communities like the one on Anegada to better understand and appreciate the valuable environmental services performed by wetlands (some respondents to the Anegada Community Survey implemented by the profile project indicated that "there are *too many wetlands* on Anegada" [emphasis added]); – Ensures perpetual maintenance of high levels of biodiversity in wetland habitats consistent with traditional natural conditions. Given the importance of wetlands to the island of Anegada, the island could serve as a model for implementation of an approved wetlands policy. Note that the existing draft wetlands policy and management plan (DTCP, 2005) could be revived and used as a starting point for this recommended action.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE FIVE **Loss of Natural Freshwater Habitats, Including Solution Holes** Most freshwater ponds are under increasing threat of pollution due to livestock activity and sedimentation due to soil runoff. Compounding the problem is the deterioration and loss of vegetation cover surrounding these water bodies, due to overgrazing.	If these trends continue, it will contribute to other adverse impacts, including those from human development activities, and will further deteriorate the natural environment and the sustainability of insular biodiversity on Anegada.	**SHORT-TERM OPTIONS** **1.** The freshwater habitats on Anegada need to be better studied, beginning with research to identify, assess, and determine the status of major freshwater habitats. **2.** Such research should also include the mapping of major freshwater habitats and important solution holes. **LONG-TERM RECOMMENDATION** **1.** Preparation of a recovery plan to restore viable natural freshwater pond habitats, including important solution holes, should eventually be considered in the long-term planning schedule of the Department of Conservation and Fisheries.
ISSUE SIX **Road Construction** Increasing development activities on Anegada will likely increase the volume of the island's paved and unpaved road networks. If improperly planned, such construction is likely to have an adverse impact on the surrounding environment and biodiversity.	If responsible authorities do not establish a uniformly applied and consistently monitored policy for the design and construction of roads (for both public and private roads), a reduction in biodiversity is inevitable with each new project.	**SHORT-TERM OPTIONS** **1.** The Department of Town and Country Planning, working with the Department of Conservation and Fisheries, should identify critical Anegada habitats in need of a temporary stay of road construction to allow for a survey and assessment of habitats and species before construction proceeds. Such identified habitats should include areas where road construction might adversely impact the Anegada Rock Iguana and where vehicular traffic will increase wildlife mortality. **2.** An assessment and review of the potential impact of road cuts and construction across dunes, wetlands and limestone pavements should always be carried out prior to construction, as a part of the Environmental Impact Assessment process. The geology, landscape, climate and ecology of Anegada need to be considered as part of the assessment for all road construction activities.
ISSUE SEVEN **Off-road Vehicles** The recreational use of four- wheel drive vehicles, two-wheel motor bikes and other off-road vehicles is on the increase, especially along the dryer sand flats surrounding Anegada's wetlands.	Such vehicles allow users to access sensitive ecosystems which are slowly exhibiting negative environmental impacts. Noise impact is also a factor especially adjacent to nesting wetland birds.	**SHORT-TERM OPTIONS** **1.** Regulations should be drafted by Government to control the use of off-road vehicles on Anegada, including mapping of sensitive zones where off-road vehicular activity should be prohibited.

5. COASTAL AND MARINE RESOURCES

5.1 Introduction to the Marine Environment of Anegada

Anegada is very different from the other islands in the Virgin Islands archipelago. A quick look at the topography suggests an island that has been repeatedly submerged over geologic time spans. As noted in earlier chapters, the name Anegada means "drowned land" in Spanish. It is well named because the island's bedrock and sediments are marine in origin (see Chapter 1, Section 1.1.2).

The connection to the sea becomes immediately clear to any visitor arriving by boat or by air. The island is surrounded by reefs, expanses of seagrass, mangroves and magnificent beaches. These habitats are inter-connected with many species of plants and animals spending parts of their life cycles moving from one ecosystem to another.

Perhaps most significant is the extent of the island's coastal and marine environments. When compared to the other islands in the BVI chain, Anegada's habitats cover large areas. In fact, the Horseshoe Reef system extends about 15 km (9.3 mi) southeast of the island. Often identified as the second largest barrier reef in the Caribbean, it represents an environment of regional significance.

Such extensive habitats support a diverse and rich assemblage of flora and fauna. The marine resources have figured prominently in the human history of the island, and the entire Virgin Islands.

We know the first humans arrived in the area by dugout canoe from South America many centuries before Columbus and other European explorers. These first visitors found an abundance of marine life that sustained early settlements. The large mounds of Queen Conch shells off the southeastern coast of Anegada demonstrate the importance of this protein-rich mollusk (**Photo 52**). The enormous shell piles suggest the ocean was harvested for many centuries.

Whilst available evidence suggests there was not a permanent settlement of pre-Columbian peoples on Anegada—only seasonal habitation (see Chapter 1, Section 1.2.2)—there was an abundance of fish, lobster, sea turtles, and other marine life present to support these cyclic migrations.

Photo 52.
Mounds of Queen Conch shells in the background
(Photo: Nancy Woodfield Pascoe).

Very likely, the presence of Manatee and the now extinct Monk Seal provided additional food, while readily available fresh water and plenty of terrestrial resources, such as the Flamingo, provided ample reason for Amerindian visits to recur.

The marine life of Anegada has likely been harvested for centuries, but the surrounding reefs and marine habitats continue to support an active fishery. However, in recent years, fishing pressure has substantially increased, and resource extraction appears to exceed sustainable levels, at least for some species. This is partly due to improved technologies, such as wire fish traps and outboard motors for fishing vessels. In addition, the growth of tourism fueled demand for more and more local seafood. High-value species, such as lobster, grouper and snapper, have been targeted. The result is that today many reefs that should be teeming with grouper and lobster are virtually fished out.

While the local community on Anegada is small and is dependent on fishing, the reefs attract fishermen from other islands in the territory and even from the US Virgin Islands. Further, in recent years, large, commercial, foreign fishing vessels have illegally fished the territorial waters of the BVI. Very often such illegal harvest has occurred in the waters just north and east of Anegada. These waters are difficult to patrol, so it is not easy to assess the impact such foreign vessels may have had.

Over the years, many other factors, both natural and anthropogenic, have affected the marine environments of Anegada. Some, such as hurricanes, are easy to identify and document. Overturned coral heads, eroded beaches and degraded coastal mangroves can often be attributed to passing storms. Impacts of oil spills can also be readily identified.

The real difficulty in assessing the current health of the marine environments around Anegada is the complexity of impacts and the near impossibility of linking a specific cause to an observation. The reality is that marine ecosystems are incredibly diverse, and changes observed may be natural, man-made, or, as is often the case, a mix.

For example, when the beaches on the northwest section of the island begin to erode, the natural inclination is to attribute it to weather events (**Photo 53**). Elevated ground seas produce big waves that cause shoreline erosion. It may simply be part of a long-term natural cycle. After all, beaches are ephemeral, and they disappear in one place and grow somewhere else.

Perhaps the answer is not so simple. Perhaps years of overfishing, and other man-made changes, altered the community structure of the offshore barrier reefs. Removal of herbivorous fish may allow algae to overgrow corals and accelerate bio-erosion that weakens the reef structure. The weaken structure may then collapse during large wave events which then destroy this protection for the beach. The impacts of climate change will undoubtedly increase year by year.

Photo 53.
Beach erosion at the resort at Cow Wreck Bay.

There is no doubt that the island's marine environments have significantly changed over the years. Thus, any survey must be considered a snapshot of current conditions with an understanding that historical conditions were very different. There are no baseline records for what the Anegada marine environment looked like in pre-Columbian times when the reefs were teeming with lobster, large grouper and many species of reef fish. One wonders what impact the extinct Caribbean Monk Seal may have had on the nearshore habitats, or the impact of large flocks of Flamingos foraging in the salt ponds and coastal wetlands. Queen Conch must have been enormously abundant as suggested by the huge shells mounds along the southeast coast of the island.

5.1.1 Overview of Marine Research

Anegada has always been an attraction for naturalists and scientists. The remoteness and unusual biodiversity is a magnet for researchers. However, that same remoteness makes accessibility and logistics a significant challenge. Thus, the island has been visited infrequently and little has been recorded in the scientific literature. Most of the historical information and baseline data are contained in unpublished gray literature. Anecdotal reports are scarce and difficult to obtain. By far, the best source for historical information is the Edward L. Towle Island Systems Environmental Collection at the H. Lavity Stoutt Community College on Tortola.

The earliest reference to Anegada's natural history is contained in a paper for the Royal Geographic Society by R. H. Schomburgk in 1832 (Schomburgk, 1832). The paper briefly describes species of fish and invertebrates encountered during his visit. Also described are currents and physical conditions that contributed to the large number of shipwrecks on the Horseshoe Reef.

Very little marine-related work was published until the Report of the Cambridge Anegada Expedition of 1975 (Cambridge University, 1976). Conducted during August and September, a team of 11 divers and marine biologists from the Cambridge University Underwater Exploration Group surveyed the coastal and marine habitats around Anegada. The marine biological survey is a comprehensive document that provides a baseline for marine conditions around the island and remains an important starting point for further studies. A follow-up report on the ecology of the island's coral reefs was published in the *Atoll Research Bulletin* in 1979 (Dunn and Brown, 1979).

In more recent years, there have been few published papers related to the marine environments of Anegada. However, numerous unpublished technical reports have been produced by the Department of Conservation and Fisheries (DCF). In particular, sea turtle surveys have been conducted on a regular basis, and the results are recorded in departmental reports and several publications in peer-reviewed journals.

A Darwin Initiative Project on the Coastal Biodiversity of Anegada was carried out from 2003-2006 by a number of partner organisations in the BVI and overseas, principally in the UK. It culminated in an Action Plan (McGowan, *et al*., 2006) to protect both terrestrial and marine resources. A special emphasis was placed on sea turtle surveys and research to update previous information and assess both nesting locations and populations in nearby shallow water habitats.

Detailed studies of beach morphology on Anegada were conducted by Dr. Shannon Gore, a marine biologist with the DCF; her research initially formed the basis of her doctoral dissertation from the University of Ulster (Gore, 2011a). Dr. Gore's research has sparked interest in Anegada's beaches and potential threats resulting from climate change and human activities. In addition, the Department of Disaster Management is currently completing an EU-funded project focused on Anegada and its vulnerability to natural hazard risks (see Chapter 3, Section 3.1.2.1 and Table 8).

Visual observations, anecdotal reports and occasional specimens have been collected by visitors, including scientists, sailors, divers, and fishermen. Such data are rarely published and exist in files and personal records of the Department of Conservation and Fisheries, National Parks Trust, H. Lavity Stoutt Community College and private individuals. At the present time there is no single repository for such information.

5.1.2 Shipwrecks and Treasure

Anegada is world famous for its shipwrecks and stories of lost treasure. Historical accounts and documents are intertwined with legends of swashbucklers, pirates and plenty of nefarious individuals. Stories of Anegada's shipwrecks and treasure have circulated for centuries and have found their way into numerous published stories and books on the subject. In the process, tall tales are spun and reality drifts into dreams of adventure and riches.

In the world of treasure hunters, truth and fantasy blend into a surrealistic world where desires become obsessions and entire lives are devoted to the quest for fortune. Treasure hunters are the nemesis of marine archaeologists and those who view shipwrecks as time capsules of a bygone era that should be salvaged for historical value. Anegada certainly provides ample opportunity for all these pursuits.

Though the exact number remains uncertain, it is estimated that over 200 vessels have come to an unhappy ending at Anegada, mostly on the Horseshoe Reef (see Chapter 6, Section 6.4.1). Perhaps this is not surprising when one considers the extensive reef system, the prevailing winds and currents, and the lack of nearby landmarks. In fact, the reef continues to take a toll on boats today despite the availability of accurate navigation charts, radar, GPS and modern electronics.

Most of the ships wrecked on the reef have not been recovered or evidence of recovery is lacking. In 1832, Schomburgk listed 53 wrecked vessels. Historically, the residents of Anegada would salvage wrecked boats, and there are stories of individuals lighting fires at night to lure ships onto the reef.

Today only a handful of vessels can be identified. The rest have been dispersed by waves and hurricanes or decomposed and buried under sand and rock. A few recent vessels are occasionally visible. Two in particular became popular dive sites. The *Paramatta* was a steam-powered paddle wheeler that was wrecked on the reefs in June 1859. Parts of the ship are still visible, but the exposed location has resulted in considerable deterioration over the years. The *Rocus* was a freighter that sank in 1929. It carried a cargo of animal bones destined to be made into fertiliser. The entire cargo spilled onto the reef, and it is an eerie experience swimming over the large expanse of skulls and bones of livestock.

Most other wrecks have been reduced to ballast piles or scraps of iron and debris. Some, such as the *Astrea*, a British Frigate lost in May of 1808, were excavated and cannon and artifacts recovered.

Search and salvage of wrecks have been underway for centuries. The earliest residents of the island were opportunists and recovered as much as possible immediately after a disaster. However, storms, treacherous conditions and a lack of modern equipment and technologies limited their efforts. Consequently, much of what was lost could not be salvaged. In fact, most of the ships lost, including their treasure and artifacts, remain in the sea.

Over the years, there have been many colourful characters visiting the Virgin Islands in search for treasure and riches. One of the more interesting individuals searching the Anegada reefs was Bert Kilbride. Kilbride was a diver who arrived in the archipelago in the 1950s and quickly succumbed to the spell of shipwrecks and treasure. He operated a hotel and dive shop in the North Sound of Virgin Gorda for many years until his retirement in the 1990s. Throughout those decades, he explored the Horseshoe Reef and uncovered numerous wrecks. His businesses and residence became virtual museums of the artifacts he found. Most were personal items from sailors on the vessels, but cannons and anchors were also salvaged. A bronze cannon from the *Astrea* was an especially prized item.

Kilbride, like most treasure salvors, was reluctant to offer details of ships or treasure found. However, he proudly wore a large gold coin around his neck and was always willing to spin a few yarns to captivate his audience. His biggest dream and greatest challenge was to find the wreck of the *San Ignacio*, a Spanish galleon that supposedly sank in 1742. Apparently, the ship's manifest included four cases of diamonds, tons of gold, millions of silver coins and plenty more. Presumably, the ship is still out there waiting to be discovered.

During the 1970s and 1980s, while Kilbride was most active and successful, he attracted considerable attention. He was the subject of numerous stories and film documentaries. At one time he was the guide for an expedition of the Royal Ontario Museum, and on another occasion he took Hugh Downs, a US newscaster, diving for a TV film. In the early 1980s he joined forces with the legendary "treasure diver" Mel Fisher of *Atocha* fame.

Their company, Melbert, continued the exploration of the Horseshoe Reef and successfully found additional wrecks. Unfortunately, further details are scarce. During this period, the Government of the BVI became concerned about its oversight of salvage operations in Anegada. It engaged the services of Island Resources Foundation to review the contract proposed by Melbert and to provide professional advice about objectives and administrative procedures for the specific contract and also for marine archaeology development, conservation, and management generally in the territory (Tyson and Towle, 1987).

Upon his retirement, Bert Kilbride donated several boxes of artifacts to the H. Lavity Stoutt Community College for its Maritime Museum. In addition, he granted several lengthy interviews that produced many hours of taped recollections and stories. Of course, separating fact from fiction will be a challenge for future researchers.

While there are plenty of legends and stories, verifiable facts are hard to find. However, it is well documented that many ships were lost in the waters around Anegada (see Chapter 6, Section 6.4.1). Only a few sites were properly recorded. It is probable that the majority of the older wrecks, complete with artifacts and treasure, remain historic time capsules hidden beneath the reefs.

5.2 Fishing and Fisheries Resources

Fishing has been, and remains, an important activity of Anegada's islanders. The coastal and marine habitats contain many species of economic importance. Invertebrates, inshore fish and pelagics comprise the fishery.

The fishing methods are varied and adapted to the species targeted. Certainly, the most common is the fish trap or fish pot. Traps target demersal species, primarily reef fish and lobster. Originally made of local wood and materials, traps had a short life and would deteriorate quickly if lost. Today the fishermen can afford wire mesh and often attach sacrificial zincs to improve trap longevity. Unfortunately, when such traps are lost, they remain intact for a long time. These "ghost" traps continue fishing with substantial mortality of local fish populations.

Many reef species are taken in traps. Among the most common are grouper, snapper, grunt, parrotfish, surgeonfish, and angelfish. In fact, the catch is primarily size limited to fish that can enter the trap and are unable to escape. Lobsters are also common in traps.

Trap fishing takes place in a wide variety of locations, including the Horseshoe Reef fisheries protected area (see Chapter 8, Section 8.2.1). Traps may be placed in shallow reefs, seagrass beds or near mangroves. Some are placed in deeper water off the north shore of the island.

Hand lining is common from small boats and targets species such as yellowtail, jacks, grouper, snapper and grunt. Nets, or seines, are used in shallow nearshore areas. They are effective in catching schooling fish. Depending on the fish targeted, seines may be used off a sandy beach or shallow-water mangrove and seagrass habitat. The White Mullet, known locally as Currimole or Curemal, is a highly prized fish that may be seen under the bridge in the channel to the Western Salt Ponds. This fishery resource is unique to Anegada.

Hand collecting and small nets are effectively used to harvest conch, lobster and slow-moving, shallow-water species. Individuals are occasionally seen towing a small boat in shallow, calm water. They collect anything of value including algae, (locally called sea moss), ornamental shells and starfish, and lobster.

Photo 54.
A fisher's catch of Nurse Sharks and fillets being dried.

Historically, harvested fish were sold and consumed quickly while fresh, or salted and dried (**Photo 54**). The distance to markets and lack of refrigeration limited the worthwhile catch for local fishermen. Thus, for centuries there was little risk of overfishing. With the advent of tourism, improved technology, and expanding local markets, the demand for fresh seafood grew rapidly. Consequently, fishermen can now sell virtually anything they harvest. It is thus not surprising that overfishing is becoming a major concern for the BVI public agencies responsible for managing the environment (see **Box 4** at the end of this chapter).

Offshore commercial fishing tends to be limited, with few fishermen venturing out to sea for days at a time. The Soares family of Anegada has been long-lining the offshore waters north of the island for many years. Vernon Soares, the patriarch of the family, emigrated to Anegada from Bermuda approximately a half century ago.

Long-line fishermen prefer high-value species, but will harvest any economically worthwhile pelagics. The Soares family usually targets Swordfish, but they also catch Dolphin, Tuna, Wahoo, Billfish and others. Their catch is sold or used in the family restaurant at Neptune's Treasure. The primary difficulty for long-liners is that the fish are migratory and are only in territorial waters for a short period of time. Thus, they are actively fished throughout their range. Once in international waters the fish are pursued by large commercial vessels from many countries. There is ample evidence that these pelagic stocks are overfished and in serious decline. The long-term prospect for local long-line fishermen does not appear to be promising.

5.2.1 Sport Fishing and Tourism

In recent decades, tourism has expanded in the BVI. Though remote, Anegada has attracted visitors looking for tranquility, undeveloped beaches and watersports. The tourists who visit the island appreciate the lack of big hotels, shopping malls and all the trappings of the developed world. Many seek opportunities to enjoy the marine environment. Sport fishing is an enjoyable pastime that is growing in popularity.

Big game fishing for deep water pelagics has always been exciting. While there are a few luxury sport fishing yachts based in Anegada and Virgin

Gorda, most sport fishers visit the island to fish off the north coast. The fishing vessels will go offshore all along the north drop from Anegada to Jost Van Dyke and beyond. Chasing large, fast-swimming pelagics requires sound boats with extended range and speed.

A few Anegadians have recently started to promote fly-fishing and inshore fishing. This type of fishing attracts enthusiasts who travel to remote locations for a chance to hook Bonefish and other nearshore species, such as the Blacktip Shark. Local guides will develop a loyal following of fly-fishermen who return annually to cast their lines.

Most of the inshore fishing takes place from small outboard-powered boats along the southeastern portion of the island. Since much of the fishing occurs in the lee of the island and its barrier reef, there is less risk of lost opportunity due to weather.

5.2.2 Marine Turtles

Sea turtles have been harvested since pre-Columbian times. Turtle bones have been found in Amerindian middens throughout the Caribbean. Turtle meat and eggs have figured prominently in the diets of Anegadians for generations.

All sea turtles are long-lived and require undisturbed beaches where they can lay their eggs. The beaches of Anegada and the surrounding waters are ideal habitat for turtles. Historical populations of all species were undoubtedly significantly greater than today or in recent times. Data presented in published and unpublished reports in the last few decades confirms the decline of turtle populations locally and regionally.

The Leatherback or Trunk Turtle is the largest species and rarely visits the BVI to nest. They appear to be uncommon on Anegada. There was only one nesting record on the western tip of the island during the Darwin Initiative surveys. Their rarity suggests they need complete protection at all times with no harvest allowed.

Marine turtles are considered endangered and given international protection through a variety of treaties and laws. Turtles and turtle products cannot legally be taken across boundaries and into most countries. Recovery projects are widespread in the Caribbean, including the BVI. An Anegada sea turtle recovery community assessment was

The Darwin Initiative Project summarised nesting locations during its 2003-2006 study of Anegada's coastal biodiversity. It was estimated that less than ten females per year nested on the beaches and they may have traveled hundreds of thousands of kilometres to Anegada. Studies of genetics indicate local turtles may originate from populations as far away as the USA, South America, or the South Atlantic.

The most common species are the Hawksbill (**Photo 55**) and Green Turtle. Both are common in shallow waters around the island. Nesting is restricted to suitable beaches on the north coast and west and southwest beaches (see Figure 29 in Chapter 9). Anegada has been identified as a nesting stronghold for these species, and protection is important if the population is to be maintained.

Photo 55.
The Hawksbill Turtle is the most common species around Anegada.

prepared by Island Resources Foundation in 1997 (Downs, 1997) and examined the issues impacting successful implementation of effective sea turtle preservation and restoration activities on the island. The Darwin Initiative project (2003-2006) updated this earlier assessment with specific recommendations in an Action Plan for the Coastal Biodiversity of Anegada (McGowan, *et al*., 2006).

A significant hurdle to the protection and recovery of turtle populations is the resistance of individuals who claim traditional rights to the resource. This is a complex issue that requires sensitivity to the local culture, public education, and a management plan that engages the community. The killing of turtles for their meat and the harvesting of turtle eggs have long been a tradition in the Caribbean. For people who still depend on local natural resources, it is difficult to change old ways. Fortunately, there appears to be diminishing interest in turtles among the younger generation.

Although a substantial turtle fishery previously existed, it is much reduced and nesting females are no longer taken. With decreasing commercial demand, the only harvest is for limited local consumption, and this will likely decrease further. Perhaps a realisation that turtles have greater value as a tourist attraction may change opinions and help turtles recover.

5.3 The Marine Resource Base

5.3.1 Physical Features

The topography of Anegada is generally flat. The highest elevation is only 8 m (26 ft) above sea level. Underwater topography is similar. The island is located at the extreme northeast edge of the Puerto Rico Bank. If the sea level was 100 m (330 ft) lower, as in the last ice age, Anegada would be a slight rise on a plain extending to Virgin Gorda and Tortola. However, just a short distance north, the plateau slopes steeply into the trench more than seven thousand metres in depth.

The ocean currents are affected by this topography and, in turn, have a significant impact on the marine ecosystems on the bank. As the westward moving ocean current is deflected by the bank, a portion passes along the northern boundary. This is the famous north drop and is the migratory pathway for the pelagic fish that are prized by long-liners and sport fishermen seeking a world record.

Part of this ocean current passes over the bank. While this water is clean and clear, it is also lacking in the nutrients essential for plant growth. However, the currents swirling over the shallow bank cause a mixing of marine sediments. This helps produce the rich, diverse habitats of Anegada and the Horseshoe Reef. Clean, clear, warm water is essential for coral growth.

The shoreline of Anegada consists almost exclusively of sand or mangrove. Sand beaches extend from the eastern end, along the north coast, around the west end and then the south shore to Setting Point and a few areas beyond. In places, particularly on the exposed north coast, there are patches of beach rock. This is cemented sedimentary rock that forms under a layer of sand and may contain fragments of coral, shells and other items of calcium carbonate. Shelves of beach rock are often exposed when wave action erodes the shore. The area near Loblolly Beach is a good place to find beach rock deposits.

Composition of the beach sand is calcium carbonate sediments. These are primarily fragments of coral, shells and other marine organisms. Depending on the currents and wave patterns, the sand may be deposited as very fine, almost powdery material, or a coarse mix of gravel and pebbles. The sand is produced by erosion of rubble caused by the constant movement of the substrate.

The remaining shoreline is a Red Mangrove forest with numerous small bays and inlets. Typically the mangrove habitat exists in areas sheltered from large waves and open sea conditions.

The offshore habitats are a mix of coral reef, seagrasses, sand and algal flats. While there are distinct zones—as shown on the BVI Coastal Atlas (**Figure 21**)—exposure to sea conditions influences habitat distribution. The underlying substrate of all marine habitats is sand or a calcium carbonate platform. Cores through the sediment would eventually reach igneous or metamorphic bedrock similar to that of the other islands.

The accumulation of marine sediments and the cementing of the material through biological or chemical processes produced the substrate on which the coral reefs have developed.

Coral reefs protect most of the north coast beaches. They are called barrier reefs. Barrier reefs are comprised of many species of corals, sponges and sessile invertebrates. These complex reef ecosystems may be dominated by specific species, such as *Acropora, Montastrea,* or soft corals. This barrier reef extends approximately 15 km (9.3 mi) to the southeast to form the Horseshoe Reef ecosystem. Healthy reefs flourish in the high-energy zone of crashing waves. This reef line is readily visible and identified by breaking waves, especially during storms or winter ground seas.

There are zonation patterns in reef types as well as species. Along the exposed seaward edge, the reef crest contains large boulder coral, Acropora species and considerable rubble. Rubble concentrations in places like the White Horse clearly show the impacts of waves and currents.

The White Horse is an accumulation of coral rubble that has formed several small "islands" or exposed bars. Located near the southern end of the Horseshoe Reef, these bars are formed by waves and currents. They are unstable and vary considerably depending on the sea state. The material is a mix of coral rock and sand that is assorted by the waves and changes often. Sand deposits and mini beaches occasionally form. The White Horse is often used for navigation by passing vessels, though the area is surrounded by shallow reefs and poses a threat to unwary seafarers.

Behind the barrier reef there are areas of rubble and miles of back reef habitats. The zonation patterns of coral reefs are well understood and easy to see. Moving away from the reef crest, there is usually a wide rubble zone where coral fragments are deposited by storms. Small corals, invertebrates and algae are common here. In sheltered spots, there may be patches of Finger Coral and other species.

Small patch reefs are common in sand and algal flats. A patch reef is a small isolated coral reef ecosystem. It is generally found on a sand flat shallower than ten metres. The patch grows as a column or mound, often with vertical sides. They may be anywhere from a few metres in diameter to many hundreds of metres across. These patch reefs are separated by extensive sand and algal flats. Seagrasses are also common but usually in sparse and isolated patches.

Since the Horseshoe Reef extends in a north to southeast direction, the sheltered habitats lie to the west. Beyond the rubble and patch reefs, the shelf deepens slightly and seagrasses become more common. The mix of sand, algal flats and seagrasses extend many miles at average depths of less than 15 m (49 ft).

This mix of habitats is most easily seen off the south coast beyond the mangrove fringe. Algae and seagrasses are dominant in much of the shallow water near the shore. With increasing depth and distance from land, patch reefs become numerous. The zone of patch reefs varies in size and density. Some reefs are circular with vertical sides that reach within a metre of the surface. These small reefs pose significant risk to small boats, particularly in poor light or at night.

Patch reefs are diverse and contain many species of sponges, hard and soft corals, calcareous algae, and attached invertebrates. Reef fish and mobile invertebrates are usually abundant. Sadly, the scarcity of lobster, grouper and large snapper is a result of overfishing. Most patch reefs contain ledges, crevices, and small caves on the sandy bottom. These are frequently used as resting or sleeping sites for Nurse Sharks, rays, and turtles. During calm periods when underwater visibility is good, the patch reefs become popular snorkeling sites for visitors.

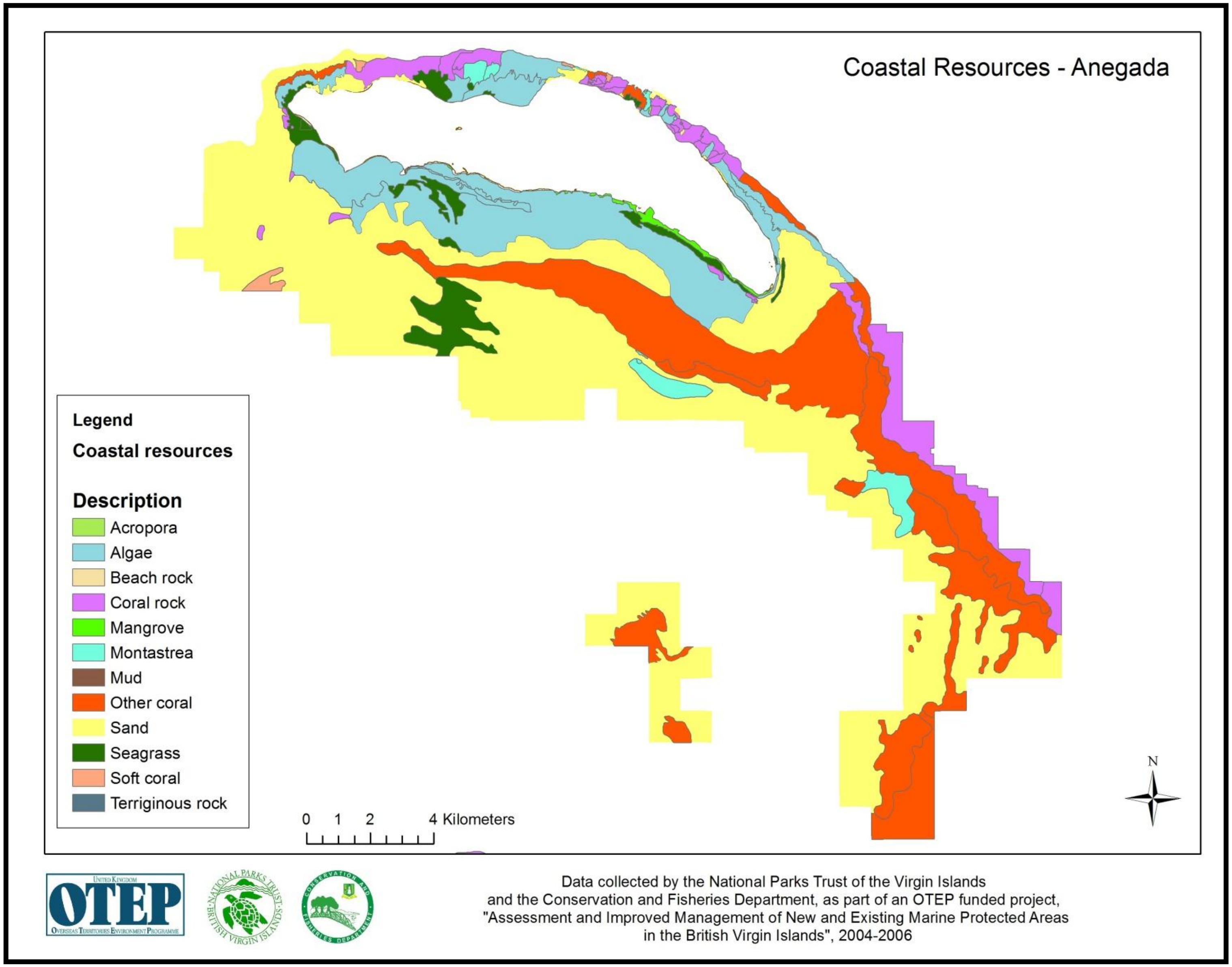


Figure 21.
The coastal and nearshore marine environment of Anegada.

5.3.2 Habitat Descriptions

The marine habitats around Anegada are diverse and contain substantial variation within each type. For example, coral reefs, even the barrier reefs, may be dominated by several different species of coral, thus giving each a different appearance. Similarly, seagrasses can vary in density and species composition. Seagrass habitats often blend with algal flats, and associated flora and fauna can vary as a gradient or as patches.

Therefore, only a general description of each major habitat type is presented here. In addition, only common names are used. A comprehensive species list, with scientific names, is included in **Addendum III** to this Profile.

The basic coastal and marine habitat types present for Anegada are:

1. Sand Beaches
2. Red Mangrove Coastal Forest
3. Coral Reefs
4. Seagrasses
5. Algal Flats and Bare Sand

5.3.2.1 Sand Beaches

Sand beaches are the most common coastal habitat on the island. Most tend to be wide and uniform in composition and consistency. North shore beaches are steep, suggesting considerable variation in sea conditions and deposition characteristics.

Beach studies conducted by Dr. Shannon Gore (DCF) have helped to focus attention on this important habitat. Recent erosion and collapse of structures on the western end of the island demonstrated the instability of beaches (see Chapter 3, Section 3.1.2). Beaches have come and gone for centuries, and therefore erosion in one area may not necessarily be cause for concern. Changes may result from natural or anthropogenic events, or a combination. The future impact of climate change will likely produce significant changes on the island's beaches.

Flora and fauna on beaches tend to be sparse and ephemeral. This is a response to the high-energy conditions associated with this habitat. Most animals are small and live in interstitial spaces, or are highly mobile and use the habitat sparingly. Additionally, the smaller species, such as the worms and crustaceans, must be adapted to the alternating wet/dry cycles associated with waves and tides.

Finding the smaller species usually involves digging in the sand at the water's edge. Among the animals common on these beaches are the Mole Crab, Coquina Clam, sand dollars, and a variety of worms. Higher on the beach, Ghost Crabs can be found scurrying from their burrows searching for food items. Nearly all these animals are important prey for migrating shorebirds that depend on the beaches and mudflats of Anegada as refueling stops on their long annual flights south in the fall and north in the spring. Gulls, terns, egrets and other birds also will take advantage of these prey animals.

Perhaps the best known visitors to the Anegada beaches are sea turtles (see above Section 5.2.2). These marine reptiles remain tied to their ancestral characteristics and must come ashore to lay their eggs. Anegada is recognised as an important island for turtle nesting. While turtles are still harvested and there is some collecting of eggs, a combination of better enforcement of regulations and changing public attitudes are slowly reducing pressure on the populations. As development and tourism are projected to expand in the future, consideration should be given to the needs of these turtles. In particular, identified nesting beaches should be protected from disturbance, especially when adults come ashore to lay eggs.

As Anegada continues to develop in the future, its pristine beaches will be a major attraction. Recognition of the value of this natural resource should lead to careful planning and the implementation of sound management decisions.

5.3.2.2 Red Mangrove Coastal Forest

Anegada's coastal mangroves are restricted to the sheltered portions of the southeastern shore. This stretch of coastline is protected from annual winter ground seas. It is also sheltered from the east and south by Horseshoe Reef and the zone of patch reefs.

The ecological importance of the mangrove ecosystem is well known and documented. Thus, the emphasis here is to provide a brief description of the mangrove shoreline and associated flora and fauna of Anegada.

Along much of the mangrove shoreline, depths are sufficient to allow small boats easy access (**Photo 56**). In fact, the area is ideal for kayaks and similar water craft. If approaching this area from The Settlement and other points west, the most obvious sight is the presence of large mounds of conch shells. These date to pre-Columbian times and are sufficiently large to support vegetation and nesting seabirds. The water in this area rarely exceeds two metres, and the bottom consists of seagrasses, sand and algal flats, with isolated patch reefs.

Photo 56.
A BVI sloop anchored in the quiet waters of the southeastern shore of Anegada, surrounded by Red Mangroves (*Rhizophora mangle*) (Photo: Nancy Woodfield Pascoe).

This shoreline is dominated by the Red Mangrove (*Rhizophora mangle*), with few terrestrial plants until well inland. Mangrove Tree crabs and snails are visible at the water's edge and on higher branches. Few terrestrial animals are present. However, both land and water birds are conspicuous. Gray Kingbirds, Yellow Warbler, Mangrove Cuckoo, and a variety of other land birds can be identified. During the winter, the Spotted Sandpiper is very commonly seen foraging among the prop roots. Several species of herons and egrets also forage and roost in this habitat. Perhaps most conspicuous are the coastal species. The Brown Pelican often perches on the trees and feeds on schools of baitfish near the mangrove roots. Gulls, terns, and a variety of other species use this habitat for feeding, roosting, and nesting.

Turtles are common in the shallow calm waters, especially in the small coves and inlets. It is quite possible that manatee and the extinct Monk Seal once foraged in these same habitats.

Of course, the real biodiversity and productivity are underwater in and around the mangrove root system. The Red Mangrove is known for its dense prop root structure. The roots extend underwater and form a maze of hiding places for small fish and invertebrates. The roots themselves become substrate for the attachment of worms, sponges, corals, tunicates and a variety of marine life. The many species of plants and invertebrates provide food for the juvenile stages of reef animals. Lobster, crabs, and many reef fish begin their life cycles in the mangroves and migrate to the coral reefs as they mature.

The prop roots along this coastline are teeming with juvenile snapper, grunts, parrotfish, angelfish and jacks. Many hide in the roots during the day and then venture out onto the seagrasses at night to feed. The shallow waters near the mangroves contain, rays, Nurse Sharks, Blacktip Sharks and the much prized Bonefish. This is the area favoured by fly-fishermen. It is common to see local guides with their clients searching the shallows for telltale signs of feeding Bonefish.

5.3.2.3 Coral Reefs

The coral reef is certainly the most visible marine habitat and the one that attracts the most attention. It is recognised for its biodiversity and is often called the rain forest of the sea. However, it is not only the diversity that is important; it is the physical structure and the role reefs play in shoreline protection. The entire north coast of Anegada is protected by the offshore barrier reef (**Photo 57**). Were it not for this protective reef, shoreline erosion would be considerably worse. In fact, without the reef, Anegada might not exist at all. Thus, the health and structure of the reef is of vital importance to the future of the island.

World-wide, coral reefs are in rapid decline. While the reefs around Anegada appear to be intact, they are showing signs of stress from overfishing, disease and climate change.

While the barrier reef along the north coast is of vital importance, it is the Horseshoe Reef that is the heart of this ecosystem. This reef extends for about 15 km (9.3 mi) and covers a very large area. The eastern boundary faces the prevailing wind and waves. Therefore, this part contains some of the species associated with the fore reef and reef crest. Different species of coral will dominate different sections. *Montastrea* and *Acropora* coral are common as are many hard and soft corals (**Photo 58**). In places, behind the reef crest, there are extensive rubble zones characterised by shifting substrates. These will contain small corals, other invertebrates and algae.

Photo 57.
A view of Anegada's northwest coastline (east of Cow Wreck Bay) with offshore reef system (Photo: Shannon Gore).

In recent years, the role of biodiversity in reef health has been studied and is much better understood. The role that different species play in the ecological balance can determine the function and survival of a reef. While corals appear to be well adapted to the forces of open ocean waves, they seem much more vulnerable to overgrowth of algae when herbivores disappear. They are susceptible to disease from land-based sediments, and they can succumb to elevated sea surface temperatures that are becoming more frequent.

The Horseshoe Reef contains many patch reefs of variable size. Proceeding west from the main reef, the bank deepens to a broad sand flat with patch reefs becoming less common (**Figure 21**).

The barrier reef along the north shore is smaller than the Horseshoe Reef. Thus, zonation patterns are more apparent because they cover less area.

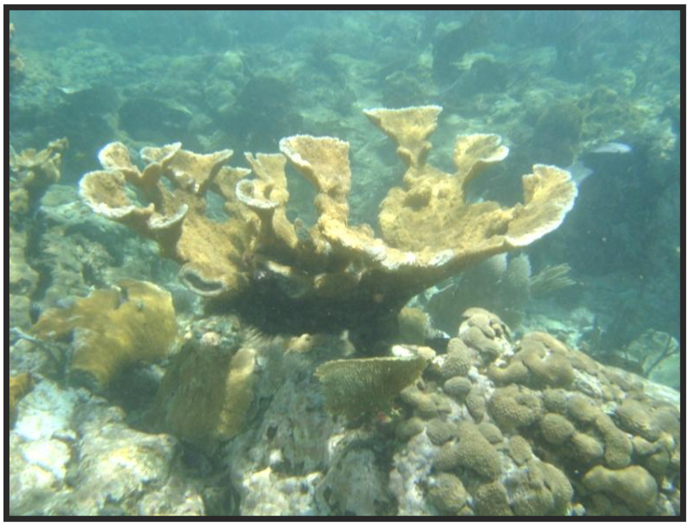


Photo 58.
A healthy Elkhorn Coral colony (*Acropora palmata*) along the north shore reef system of Anegada.

The reef crest and fore reef slope may contain distinct spur and groove structures. There are often haystack structures, caves and depressions. This rugosity is typical and provides essential habitat for mobile invertebrates and fish. Between the reef crest and the shore, there are usually areas of patch reefs, sand and algal flats, and occasional seagrass beds. These habitats are generally compressed in area but no less diverse.

The species composition of the reefs is variable. There are differences in the density of the dominant hard and soft corals. However, species lists of other sessile invertebrates, crustaceans, molluscs, echinoderms, and fish are similar regardless of reef type or location.

The most striking feature of all reefs is the scarcity of lobster, grouper, large snapper, parrotfish and other large reef fish. It is clear evidence of overfishing. Older fishermen and divers report that the Anegada reefs once teemed with all these species. Some, such as the Nassau Grouper and other large grouper species, are virtually extirpated from the reef ecosystem. These fish are easily trapped, or caught during spawning aggregations, and are the most targeted reef animals.

The growth of tourism fuels the demand for local seafood and increases pressure on fishermen to catch all they can. Lobster are so heavily fished that divers rarely see lobster on reefs where they should be abundant.

Large parrotfish are essential herbivores on reefs. They graze on plants and help prevent certain algal species from overgrowing corals. Without the grazers, algae can outcompete coral for space and kill parts of the reef. This can then lead to the bio-erosion of the coral structure. Once weakened, the coral is more vulnerable to collapse during storms. The result can be less protection from waves and accelerated loss of the beach.

While the Horseshoe Reef is a Fisheries Protected Area, enforcement of it status remains a challenge. Perhaps a combination of enforcement with public education may produce better long-term benefits.

5.3.2.4 Seagrasses

Seagrasses are widespread around the island, but are more common on the sheltered south side. Dense Turtle Grass beds grow just off the sandy beach from Pomato Point to Setting Point. They are also common from The Settlement east along the mangrove shore. In most areas of dense Turtle Grass, the habitat will merge with other seagrass species and algal flats. Seagrass habitats vary considerably depending on physical conditions, particularly wave action. Usually, seagrasses grow in proximity to algal habitats and in patches near reefs.

In addition to Turtle Grass, both Manatee Grass and Shoal Grass are common. However, these species tend to grow interspersed with Turtle Grass or algae. They rarely form the dense beds associated with Turtle Grass.

While dense seagrass habitats are common on the south side of Anegada, they are also widespread on the bank. South of the island and west of the Horseshoe Reef, the bottom gradually slopes to approximately ten metres depth. This relatively flat bottom extends to Virgin Gorda, Tortola and Jost Van Dyke. While the bottom is mostly bare sand with occasional patch reefs, seagrasses are common. However, the deeper grass beds are usually sparse with all three grasses represented.

Seagrasses are important habitats because they represent the beginning of the food chain. Many reef species spend a portion of their life cycle in seagrass habitats. Reef fish and some invertebrates will hide in crevices during the day, but then venture into grass beds at night to feed. The characteristic halo around coral reefs results from fish consuming the grasses near the reef.

Queen Conch metamorphose from planktonic drifters to tiny snails in seagrasses. They spend at least the first two years buried in the sand in grass beds. Once they emerge from the sand as "rollers," they remain in seagrass beds.

The Green Turtle also depends on seagrasses for its sole food source. As the name implies, Turtle Grass beds are the primary feeding habitats for this turtle. Green Turtle are commonly seen in the grass beds along the south coast near the mangroves.

While they may appear to be uniform habitats, seagrasses exhibit great biodiversity. A close look at Turtle Grass blades will reveal many small encrusting organisms. They include worms, sponges, anemone, and an abundance of crustaceans. These represent an important food source for fish and other animals foraging in the grasses.

The many small animals attract larger predators. Stingrays and Spotted Eagle Rays forage in grass beds for crustaceans and worms buried in the sand. They are often seen creating depressions as they dig for their prey. Nurse Sharks and large predatory fish also feed in these habitats. Both sharks and rays will feed on Queen Conch. Schools of Bar Jack and pelagics frequently forage over grass beds.

Grass beds are vulnerable to a variety of anthropogenic impacts, such as sediment runoff from land, chemical pollution and mechanical damage from boat anchors. In the vicinity of Setting Point, boat traffic and yacht anchoring is common. Consequently, there is much evidence of damage from propeller scars in the shallows and anchor scouring in deeper areas. In particular, as boats swing on their anchors, their chains will destroy a substantial amount of seagrass habitat. The installation and use of moorings will lessen anchor damage. Buoys and markers can also be used to identify shallow or sensitive areas.

5.3.2.5 Algal Flats and Bare Sand

Bare sand and algal flats cover more area than all the other habitats combined. They are associated with reefs and seagrasses and are found in all habitats around the island. Throughout the entire bank, wherever the depth exceeds eight m (26 ft), the sand and algal flats are most common. This habitat extends from Anegada to all of the nearest islands in the BVI archipelago.

In shallow water, especially near reefs, bare sand is an unstable habitat. Waves and currents can move large quantities of sand in a short time. Very often, these unstable areas can be identified by the lack of algae or seagrasses.

In sheltered areas, or where the depth is greater, the sand may shift less and algae are more common. These algal flats may contain diverse flora and fauna. Often the most conspicuous plants are the calcareous green algae. Species such as *Halimeda*, *Penicillus*, *Udotea*, and *Caulerpa* tend to grow in patches or interspersed with clumps of red and brown algae. Seagrasses are also found, although nearly always sparse and in patches.

The fauna tends to be similar, though not as diverse, as the seagrass habitat. Mobile invertebrates and reef fish frequently forage in the algal flats, but usually do not remain long.

These flats are generally not uniform, but contain areas of gravel, rubble or larger boulders. Occasionally there will be a substantial patch reef complete with corals and many reef species.

In the shallow waters near the island, algal flats are small and fragmented. On the north shore, sand patches occur behind the reef and frequently shift with sea conditions.

5.3.3 Invasives

The introduction of non-native plants and animals can have serious consequences in tropical ecosystems. Fortunately, there have been few problems with invasives in the marine environments around Anegada.

A notable exception is the recent arrival of the Indo-Pacific Lionfish (*Pterois* spp.). This alien invader was originally introduced off the east coast of Florida. Within two decades, it spread throughout the Bahamas and Caribbean. Lionfish are now found in all parts of the territory. The general lack of reports from Anegada is probably a result of few individuals searching for it. There is no doubt Lionfish will spread to every reef and marine habitat in the BVI. Unfortunately, this species is here to stay.

While Lionfish are firmly established and are not likely to be eradicated, some control efforts are under way. Reef Guardians, a local NGO, uses volunteer divers to patrol dive sites and remove as many Lionfish as possible. The hope is that the removal efforts may give native fish additional time to adapt to this new voracious predator. The data collected during the process will be helpful in understanding how marine invasions can impact native environments and the potential consequences for fisheries and tourism.

5.3.4 Water Quality

Anegada has a small population and relatively few visitors. There are no steep hillsides where uncontrolled development can result in massive erosion of sediment onto nearshore reefs. There are no enclosed bays that trap sediments and pollutants. The use of fuel, oil, and chemicals appears to be limited. Any pollutants entering the sea will be quickly swept away by the ever-present currents. Thus, there appear to be few water quality issues of serious concern. However, without proper sewage treatment and waste disposal, localised water quality problems may develop. This is especially true near Setting Point and The Settlement.

Improved sewage treatment, holding tanks on yachts, and the proper collection and disposal of waste oil and chemicals should be part of development planning for the island. It will be much easier to prevent future water quality problems than to remedy them at a later date. (See also Chapter 7, Sections 7.2.1 and 7.2.2.)

Marine debris presents a challenge for Anegada. Much of the debris washing up on the north shore comes from outside the BVI and is beyond the control of the local population (see also Chapter 7, Section 7.1.3.4). The best option for the local community is to conduct periodic clean-up projects and help to prevent local contributions to the debris problem. Anegada must become part of a global effort to reduce marine pollution.

Box 4
A Sampling of Fishermen's Comments from the Anegada Community Questionnaire
As Administered by the Environmental Profile Project in 2012 (See Chapter 9, Section 9.2)

- Almost 40 percent of respondents to the questionnaire completed the "*fishing*" section of the survey form.
- All but one identified the market for fish exclusively as the local community or local hotels and restaurants.
- Most saw a decline in the catch for grouper. Fewer saw declines in snapper. Overfishing and infringement on fishing regulations (for example, catching ineligible lobsters or fishing out of season) were generally seen as the major causes for declines.
- Many felt that overfishing by "outsiders," either foreign fishermen or recreational fishers, and lack of enforcement had led to overfishing. Most called for Anegada-based fisheries officers or an increase in enforcement patrols of Anegada waters. Some called for limiting the number of fishing licenses to outsiders.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE ONE **Habitat Loss: Coastal Development Along Sand Beaches** Habitat loss is one risk of careless coastal development and sand mining along the beaches of Anegada. Important turtle nesting sites may also be damaged. .	Development near beaches, especially for tourism, can alter ecological processes and negatively impact native species. Sand mining near beaches may accelerate erosion. Sea turtle nesting beaches may be lost. Coastal erosion could occur and beach morphology may change.	**SHORT-TERM OPTIONS** **1.** The BVI Government needs to reconsider its policy on sand mining near beaches and dune environments and should give consideration to halting all sand mining on Anegada (see also Chapter 3, Issue Three, Short-Term Options and Chapter 4, Issue One, Short Term Options). **2.** The Government of the Virgin Islands should establish adequate setback requirements for all coastal developments in the territory. In Anegada, developments should be sited inland from the beach and dunes (see specific recommendations in Chapter 3, Issue One, Long-Term Options). **3.** Natural beach vegetation should always be preserved. Exotic plant species should be restricted to areas behind the beach ecosystem. **4.** All activities on a beach, especially tourism-related, should consider the potential impact on sea turtle nesting. Livestock and invasive plants should be removed from beaches. **LONG-TERM RECOMMENDATIONS** **1.** Under the provisions of the Physical Planning Act (2004), the Department of Town and Country Planning has the authority to protect resources of environmental, historic, and cultural value. As such, the department could develop a management plan for the territory's beaches (as a resource of value), in much the same way that the department collaborated with other government agencies to create a draft Wetlands Management Plan. **2.** Beaches of special importance for turtle nesting should be identified by the Department of Conservation and Fisheries and designated as "environmental protection areas" (EPAs) under the Physical Planning Act. During the processing of development applications, activities in such designated areas should be limited or prohibited. **3.** The vulnerability of a specific beach to coastal erosion should be considered before approval is given to making alterations. This is of particular importance for Anegada with its abundance of undeveloped beach areas.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
		4. The Department of Conservation and Fisheries should complete its review and assessment of beach management strategies for the BVI (see Chapter 2, Section 2.2.5.10) and should move forward to develop a comprehensive beach management policy for the territory, as well as modern beach management legislation to replace the outdated Beach Protection Ordinance of 1985.
ISSUE TWO **Habitat Loss: Coastal Development and Pollution in Mangrove Areas** Mangrove degradation is taking place in the area of Setting Point, which, if allowed to continue, will severely impair the ecosystem function of this mangrove habitat.	Development and pollution in and near mangroves will result in reduced marine productivity, particularly for economically important fish species, and the loss of essential habitat for marine species and birds.	**SHORT-TERM OPTION** **1.** All dumping of wastes in mangroves—especially oil, fuel, sewage and chemicals—needs to be prohibited, and this is best accomplished as part of a broader coastal management initiative by Government. As a first step, the BVI's draft wetlands policy and management plan (DTCP, 2005) needs to be completed, approved by Government, and implemented without delay. **LONG-TERM RECOMMENDATIONS** **1.** Within the framework of a territorial wetlands policy, the territory's most productive mangrove wetlands need to be identified for protection and preservation. **2.** The designation of fisheries protected areas should be expanded to include mangroves that function as a related ecological unit.
ISSUE THREE **Overfishing** Overharvesting of important marine species has occurred in Anegada, while further damage to fish populations has resulted from lost "ghost" traps. Disruption of reef ecosystem balance by the selective removal of essential species has occurred, while coral reef structures damaged by fishers may result in increased beach erosion.	If current fishing patterns continue: – Targeted fish and invertebrates will be reduced in numbers and some may be extirpated. – Ecological balances in reef systems and other marine habitats may be disrupted by the population reduction of keystone species. – The economic livelihood of Anegada's fishers will be negatively affected.	**SHORT-TERM OPTIONS** **1.** Limits on species, sizes and seasons should be clearly communicated and strictly enforced by the Department of Conservation and Fisheries. **2.** All traps should have escape gaps for non-target species and biodegradable panels to reduce the life of those that are lost. **3.** Restaurants, resorts, stores and purchasers of seafood should be educated and accountable for following fishery regulations. **4.** Fishing on reefs that function as beach protection should be limited and regulated. **LONG-TERM RECOMMENDATIONS** **1.** Educational outreach programmes for fishermen should focus on improving understanding of fisheries regulations and the need for Anegada's fisheries protected area.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
	– Lost fishing gear will continue to kill fish and will further impair natural populations, without economic benefit to fishers.	**2.** Fisheries protected areas, including the one for Anegada, should be assessed and adjusted as necessary to assure sustainable harvest of all species. **3.** Effort should be made to promote alternate livelihoods for fishermen who are unable to continue fishing. **4.** Landing data should be collected and assessed to help design and implement regulations that support the sustainable harvest of all commercially valuable species.
ISSUE FOUR **Water Quality** At Setting Point small-scale coastal projects—mostly by individuals—are having a visible impact on nearshore water quality. The growing number of yachts in the calm waters of Setting Point is likely to increase levels of pollution from vessel discharges. Generally, however, coastal water quality is good in the waters around Anegada, including the entire north coast and most of the western and southeastern coastline.	At Setting Point, runoff into marine waters has caused significant turbidity and signals what could be a more significant decline of water quality in the area. As Anegada develops—and lacking the implementation of erosion and sediment control best management practices (as has been the case at Setting Point)—what is taking place at this one area of Anegada will occur elsewhere on the island.	**SHORT-TERM OPTIONS** **1.** Erosion and sediment control guidelines need to be developed and approved for the British Virgin Islands. An erosion-control handbook is currently being developed by the DCF in cooperation with The Nature Conservancy. The manual will provide BMPs for reducing erosion. As it becomes available, the DCF should create an extensive public awareness and educational programme for all stakeholders. **2.** Yachts using the waters of Anegada and elsewhere in the BVI should be required to have and use holding tanks. Discharge should not be permitted in sheltered bays, critical marine habitats, and other sensitive nearshore environments. This might best be accomplished if Government designated "no discharge" areas. **3.** Guidance needs to be provided for individual home owners and small business establishments for the proper installation and maintenance of septic systems for sewage disposal. **LONG-TERM RECOMMENDATIONS** **1.** DTCP should require that erosion mitigation and sediment control practices are addressed in all EIAs for major development projects, including those in Anegada. Additionally, BMPs for the control of erosion and sediment runoff for all major development projects need to be applied and monitored. **2.** Enforceable standards for water quality, pollution control, and waste management are needed for the BVI, but to accomplish this, the BVI's environmental pollution legislation requires major revision and modernisation.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE FIVE **Vessel Impact on the Marine Environment** As yachting in the BVI continues to increase and more vessels visit Anegada, damage to coral reefs and seagrass beds by vessel anchors and chains is increasing. Power boats and small vessels damage seagrasses with prop scars when they run aground, especially near the shore. Damage to reefs and seagrass beds from boat groundings, fish traps, seines and other fishing gear continues to occur.	Continued anchoring by boats in sensitive environments will degrade habitats and make them less productive while also reducing the important ecosystem services they provide. The problem is likely to worsen as larger yachts, particularly mega-yachts, become more common. Lost fishing traps and other gear will further damage reefs and degrade habitats.	**SHORT-TERM OPTIONS** 1. Additional moorings should be placed in popular anchorages and destinations to reduce the need for anchoring. 2. More effort should be expended by the marine industry and the BVI Government (e.g., Tourist Board, DCF, and NPT) in educating boaters about proper anchoring techniques and how to avoid anchoring in coral. 3. Fishermen should be encouraged to avoid placing their traps and nets directly onto coral reefs. 4. Improved navigational aids should be installed in areas frequented by visiting boaters. **LONG-TERM RECOMMENDATIONS** 1. An anchoring plan should be prepared for Anegada that designates both safe anchorages and no-anchor zones. 2. Moorings for larger vessels and mega-yachts should be placed at popular recreational destinations. 3. Improved regulations are needed to enforce controlled anchoring around Anegada and other popular recreational boating areas in the British Virgins. 4. Sensitive reef areas should be identified and declared as "no fishing zones" to reduce coral damage from traps.
ISSUE SIX **Tourism Impacts on the Marine Environment** Fewer marine recreational visitors to Anegada has reduced the impacts on coral reefs by swimmers, snorkelers and divers and is not yet major a concern. Nevertheless, there are indications of increasing impacts, which will continue as visitation to the island is encouraged. Direct and indirect damage to turtle nesting beaches could also emerge as a problem.	Without further measures to educate inexperienced marine users, popular snorkeling and diving sites around Anegada are at risk through inexperience, lack of awareness and carelessness by resource users. Beaches too can be damaged by carelessness and lack of knowledge. Visitors can interfere with natural beach ecology, resulting, for example, in diminished success for turtle nesting.	**SHORT-TERM OPTIONS** 1. Divers, snorkelers and swimmers should be encouraged to wear appropriate buoyancy aids to reduce the need to grab and stand on corals in shallow water. Additionally, divers and snorkelers should be directed to less sensitive reef areas for recreational activities. The BVI Marine Awareness Guides (Gore, 2008, 2011) are a positive step in the direction of providing marine education for users of the marine environment. 2. Turtle nesting beaches should be identified and marked so Anegadians and visitors to the island can appreciate and protect the habitats. 3. Solid waste in marine recreational areas needs to be collected and disposed of in a manner that reduces risk to the natural environment.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
		LONG-TERM RECOMMENDATIONS **1.** As part of national physical planning efforts in the BVI, reefs and other sensitive habitats around Anegada should be identified and prioritised for recreational use. Especially sensitive areas should have use restrictions. **2.** Educational outreach activities by the DCF, NPT and others should continue to target turtle nesting, specifically aimed at improving awareness within the Anegada community and by visitors about turtle nesting on the island.

6. HISTORICAL HERITAGE RESOURCES

Anegada has been occupied by Europeans and people of African descent for over 300 years (see also Chapter 1, Section 1.2.2). Nevertheless, because of the nature of the environment and patterns of settlement, few historic ruins dating earlier than the nineteenth century have survived. Living on Anegada can be a harsh experience, especially during the storm season. Hurricanes have regularly destroyed what mankind has erected.

Because sugar was never cultivated on the island, the ruins of sugar mills found so prolifically on Tortola are absent. Historically, time taught the inhabitants that wooden buildings were preferable to stone structures, and so there is an absence of the andesite foundations found on other islands where planters erected their great houses. An occasional pile of large rocks will indicate where a wooden structure had once stood, but as Anegadians build more and more block and concrete houses and abandon their traditional vernacular homes, an inevitable deterioration of the historical built environment is taking place, which in many cases is irreversible.

Undoubtedly, the survey of Anegada's surviving historic sites carried out as a part of the Anegada environmental profile project omitted some sites because they were either too difficult to reach or have quite simply been forgotten about or not yet discovered. None of the shipwrecks which litter the Horseshoe Reef have been investigated as a part of this survey (see Section 6.4) because they are in extremely dangerous locations, which of course is why they wrecked in the first place.

Likewise, some land sites were mentioned to the team's historian, but many were unreachable or their locations hazy in the minds of local residents. One such site, as described by Anegadian Michelle Moore (*née* Soares), was a series of low foundations next to which was located what appeared to be burial mounds. As a child she remembers visiting the site, but relocating it today is problematic.

There are many historic sites yet to be discovered and identified on Anegada, especially in the waters of the reefs surrounding the landmass. As methodological and technological techniques improve, more appropriate research designs, specifically addressing the historical resources of the island, will eventually be formulated. It is hoped that this chapter of the *Anegada Environmental Profile* will assist in that effort.

6.1 Vernacular Housing Resources

Of the surviving historical sites and buildings on Anegada, the vernacular (traditional) residences that have provided homes and shelter for the island's inhabitants for centuries are by far the most prolific resource. The largest concentration of traditional vernacular housing remaining in the BVI can be found on Anegada in The Settlement.

Fifty vernacular structures were identified during the current survey, 37 of which were recorded. This is a decrease of 35 residences since a cultural resource study was undertaken in 1985 on behalf of the Eastern Caribbean Natural Area Management Programme (Ausherman and Chapman, 1985).

Shirley Faulkner records that many original residences were constructed from the wrecks of vessels. Her grandmother's house had been salvaged from the remnants of a vessel that was sunk in 1899 and had the ship's name, *Margarita*, inscribed on a timber above the kitchen window (Faulkner, 2005:85). No evidence of shipwreck timber was observed during the current study, although some may still be present.

Section 6.1.1 provides an inventory of the structures recorded during field surveys on Anegada in 2012. Other surviving structures (not recorded) are identified in Section 6.1.2. Individual names associated with buildings included in the survey are the names of current owners or, in the case of abandoned structures, the last known owner(s) of the site. The names reflect "traditional" owner(s) even if no longer resident in the building. IRF acknowledges Anegada resident Mr. Vernon Vanterpool, whose kind assistance was invaluable in helping to identify property "owners."

6.1.1 Survey of Vernacular Architecture

1. Residence of Ada Vanterpool (Photo 59)

Description: This inhabited structure is a traditional hipped-roof building which sits upon an old field stone foundation. The siding has been replaced, from what was probably originally lapboarding to modern grooved siding, but still retains the interior and exterior shutters, the interior of which are screened. The modern shed roof addition has jalousie full shutters and an entry door which is half jalousie full shuttered and half solid. The steps leading to the entrance door are rendered block with a modern wooden handrail. There is a large exterior plastic cistern for fresh water storage at the rear of the building. However, there is an absence of roof drainage pipes except on the main facing wall of the shed roofed structure.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.301 W: 064° 19.222	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Main: field stone/Portland Addition: rendered Portland	Modern grooved siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main structure	Absent	Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors and modern single	Rendered block
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent round plastic cistern
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

2. Residence of Alice Procter (Photo 60)

Description:

This occasionally occupied structure is a traditional hipped-roof building which sits upon a rendered block foundation. The sides are dressed with modern grooved siding whilst the roof is galvanized. The majority of window apertures are filled with jalousie full shutters with one jalousie louvered glass window present.

The shed roofed addition has a screen door covering a jalousie full shuttered door and is approached at a right angle to the main structure entrance. The two steps leading to both entrance doors are rendered block in common with the foundation.

There is a large exterior plastic cistern for fresh water storage at the rear of the building. There is, however, an absence of roof drainage pipes except on the main facing wall of the shed roofed structure.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.317 W: 064° 19.325	Puerto Rico	3.35m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Rendered block and fieldstone	Modern grooved siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main structure	Absent	Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occasionally occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters and Jalousie glass louver	Jalousie full shutters	Rendered block and fieldstone
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent round plastic cistern
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Stable	Low

3. Residence of Alicia Levons (Photo 61)

Description:

This large residence consists of three main structures, two of which are hipped roofed and joined together with an additional shed roof structure joined to the side. The siding of the building is modern horizontal lapboard whilst the blue painted roofs are covered with galvanize sheets. The window apertures are filled with modern half and half sash type paned windows whilst the main entrance door is paned the full length.

Both the main structure and shed addition are reached by climbing four steps which lead to a covered balcony. The shed addition entrance door is full with an observation pane whilst the single window aperture is filled with modern half and half sash type paned window.

There is a rendered bloke cistern at the front of the house fed by drains surrounding the roof edge, which is covered with a gabled galvanize sheet.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.328 W: 064° 19.170	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Rendered block	Lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Two hipped structures joined	Absent	Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Modern half and half sash type windows	Modern paned and solid	Rendered block
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Surface rendered block galvanized covered
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

4. Anegada School House (Photo 162)

Description:		
The original Anegada schoolhouse is a simple rectangular building sitting on poured rubble concrete columns with traditional lapboard sidings, punctuated by window apertures which are filled with jalousie full shuttered windows. The steeply pitched roof is covered with galvanize. The exterior poured rubble cistern is rendered with concrete and capped; however, there are no roof drains present to feed the cistern. The door has been detached from the front entrance aperture, and the building may be described as dilapidated and not maintained. Much of the interior remains unchanged, and there is still an organ and the original school pews present in the structure which has been subdivided into different work spaces. Some features and fittings should be recovered prior to inevitable collapse.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.333 W: 064° 18.983	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Poured rubble concrete columns	Traditional lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main	Absent	Absent
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	Fair	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		Not maintained
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters	Jalousie full shutters	Concrete
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

5. Residence of Augustus George (Photo 63)

Description:

The main structure for this house sits on a fieldstone foundation and is one of the few shingle-dressed buildings remaining on the island; it has a steeply pitched, galvanize roof lying on top of wooden board. The window apertures are filled with traditionally constructed interior and exterior shutters, which are either now nailed shut or absent.

There is a shed roofed addition adjoining the main structure which has been painted the same colour yellow; to the rear is an independent, exterior-poured rubble cistern which has been rendered with concrete and capped.

The condition of this residence dictates that it will collapse in the near future; however, it is one of the few remaining houses constructed almost entirely from traditional materials and deserves further recording for posterity.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.279 W: 064° 19.057	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Field stone/Portland	Main: shingle siding Addition: lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		Not maintained
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Hand-blown glass		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Collapse	Medium

6. Residence of Brianca Jackson (Photo 64)

Description:

The entire residence stands on a poured rubble, concrete-rendered platform with two steps surrounding each side. Steps now below a window indicate significant change to the original structure which, with the adjacent Tamarind tree and ceramic evidence, suggests a period of occupation for this particular site stretching back two centuries.

Significant changes to the siding material and window type hide what was a traditional Anegadian residence with the surface poured rubble concrete cistern next to a modern plastic type illustrating some of the evolutionary architectural phases which have taken place in the area.

The hipped roof main residence has been added to over the years with both a gabled roofed and shed roofed addition, both of which provide a more modern perspective for the original Anegadian vernacular architecture.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.377 W: 064° 19.124	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Poured rubble concrete rendered	Rendered plaster siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Two hipped structures joined	Additional structure	Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie glass louver Double wooden doors	Jalousie full Louvers	Poured rubble
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Creamware and Pearlware ceramics Hand-blown glass		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

7. Residence of Carl Varlack (Photo 65)

Description:		
The steeply pitched hipped roof main structure has its sides dressed with a double layer of lapboard and shingles and has retained many traditional features, such as the window and door aperture shutters, whilst incorporating modern construction materials such as the jalousie glass louver windows and metal front door. There are two additional structures both shed roofed, dressed with modern grooved siding on one and modern lapboard on the other. Both have full shuttered jalousie windows; the lapboard addition has traditional double wooden exterior shutters. The large independent exterior poured rubble rendered concrete cistern is capped and fed by a sporadic drainage system which is in need of repair.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.371 W: 064° 19.029	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Poured rubble concrete rendered	Main: Lapboard and shingle Additions: Modern siding and block	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional x2
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Florida full and glass louver Double wooden shutters	Jalousie full shutters	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

8. Residence of Altheia Young (*née* Wheatley) (Photo 66)

Description:

This house, built in the 1930s, is one of the older remaining intact residences on the island which is still lived in. The steeply pitched hipped roof adjoins a porch roof which is only partially hipped being flat on the side which joins the main house. The sidings for the walls are traditional board interior, shingle exterior punctuated by window apertures which house modern full jalousie shutters. The doors are modern metal half Jalousie full shutters with one still showing traditional double wooden doors on the exterior. The four steps leading to the exterior balcony area are rendered in common with the foundation, which is rendered poured rubble concrete. The value of this particular property relies on the wall siding construction using the traditional board-and-shingle method.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.286 W: 064° 19.175	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Poured rubble concrete rendered	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main Porch: partially hipped		
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters	Double wooden doors	Poured rubble
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

9. Church of God of Prophecy (Photo 67)

Description:

This building is the original Church of God of Prophecy which, as the congregation grew, was moved to one side for the construction of a new and larger modern church which is in use today. The steeply pitched roof covers four walls which are sided with traditional board and shingle, painted in yellow and slowly peeling away from the board interior siding. The original shutter windows have been replaced with full jalousie shutters and the entire structure sits on a series of cinder blocks.

As both a religious monument and an example of traditional Anegadian architecture, this building could be preserved and displayed. Like many similar buildings, however, the lack of any upkeep means that the next serious storm could easily claim this shingle-sided structure.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.315 W: 064° 19.146	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Block	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
X		
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters and double wooden shutters	Double wooden doors	Steps absent
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		absent
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

10. Residence of Elbert Vanterpool (Photo 68)

Description:

From the exterior, this large residence has only two modern features: full jalousie windows and modern drain pipes. Otherwise, the traditional board-and-shingle siding, wooden shutters and hipped roofs present a residence which is still occupied and has not changed considerably from its original form.

The two main structures sit upon a shaky foundation of loose fieldstone which in places has been rendered with modern Portland cement. A shed addition is attached to the side of the main structure in an overgrown garden which is crowded with wild bush. This residence is one of just a few large traditional houses remaining on Anegada and deserves closer study.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.331 W: 064° 19.066	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose and rendered fieldstone	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Two hipped structures joined		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters Double wooden shutters	Double wooden doors and modern single	Poured rubble rendered x 3 sets
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**MODERN FEATURES PRESENT**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

11. Residence of Oliva Rhymer (Photo 69)

Description:

The four steps leading up to this residence are like the foundation, poured rubble with concrete rendering on top of which sits a small house with board-and-shingle siding and double wooden doors. There are two shed-roofed additions, one constructed of modern rendered block the other sided with the traditional board-and-shingle cover.

Some old hand-blown glass was observed in the vicinity of the house suggesting occupancy of the plot stretching back at least 150 years. Apart from the modern block addition and windows, the remainder of the building is original.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.050 W: 064° 19.212	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Poured rubble concrete rendered	Main: board and shingle Addition: rendered block x 1	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
	X	
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters	Double wooden doors	Rendered block
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Hand-blown glass		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

12. Residence of Elsato Buckley (Photo 70)

Description:

This dilapidated structure is in a state of collapse and has been abandoned by the owner. Apart from the galvanize roof, the residence is completely original with board-and-shingle sidings, double interior wooden jalousie shutters and double exterior full jalousie shutters. The hipped roof is steeply pitched, whilst the addition to the rear has the typical shed roof covering it.

There were a number of surface artefacts observed during the recording of the building including eighteenth century ceramics and case gin bottle remains. More importantly, a number of the house's hand-forged fittings, including door and shutter hinges, are lying on the ground and should be collected for any future museum or display. It would be advantageous to salvage as many features from this building as possible before it collapses completely and is re-claimed by its surroundings.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.273 W: 064° 19.075	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Absent	Absent
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Creamware, hand-blown glass, iron hardware		Absent
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Collapse	Medium

13. Residence of Emily Faulkner (Photo 71)

Description:

The abundance of surface artefacts surrounding this building indicate that this plot has been occupied for some time. Eighteenth-century Creamware and Pearlware are present as well as hand-blown glass and other unrecognisable items.

The residence has all of the traditional features to be expected from classic Anegadian vernacular architecture including double wooden doors, double wooden shutters on the exterior and interior of the windows, board-and-shingle sidings all standing on a loose field stone foundation.

The structure is derelict and would be a prime candidate for further recording on the basis that little modernisation has taken place.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.360 W: 064° 19.057	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Fertile surface artifact distribution		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

14. Residence of Eric Wheatley (Photo 72)

Description:

Although from the exterior this house looks modern, the steeply pitched roof, surrounded by shed-roofed modern block extensions, reveals that this is an old structure which has been surrounded by additions hiding the original layout of the traditional building.

The abundance of artefacts in the area suggests a long period of occupation for the site which is well maintained and permanently occupied. There are the remains of a beautiful West Indian four-poster bed outside which should be salvaged for future display in a museum. The owner seemed willing to sell the bed, but its survival is threatened should it remain exposed to the elements.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.245 W: 064° 19.119	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone and poured rubble	Main: plyboard facing Addition: modern siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure x 2
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie glass louver	Jalousie half Louvers	Poured rubble
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Creamware and Pearlware ceramics, hand-blown glass		Independent round plastic cistern
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

15. Residence of Eslin Smith (Photo 73)

Description:

This is another example of a traditional building with all of the features associated with a typical Anegadian residence in a state of collapse. The building sits atop a loose fieldstone foundation with poured rubble steps at each of the doorways. The double wooden doors and double wooden shutters on the interior and exterior have escaped modern fittings, which would suggest that this particular building has been abandoned for some time.

In common with other structures in similar shape, the cost of rehabilitation would not justify the end result, making it more realistic to salvage whatever original fittings are worth displaying and keeping them.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.221 W: 064° 19.005	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Traditional lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
X		
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors x 2 Stable door x 1	Poured rubble x 4
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Hand-blown glass		Independent exterior poured rubble
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Collapse	Medium

16. Residence of Irvin and Evadney George (Photo 74)

Description:

This beautiful residence is in exceptional condition and clearly maintained to a high traditional standard. The original fieldstone foundation is bound with Portland cement, whilst a later balcony addition sits upon loose fieldstone. The gabled roof of the main building is not in keeping with the traditional hipped-roof main building, suggesting a more recent date of construction. A separate shed roofed structure is joined to the main building by a covered walkway.

The majority of windows are full louver with just one glass louver example, whilst the front door is full glass louver. There are two independent exterior-poured, rubble-rendered concrete cisterns, which are fed by the rear half of the main building roof and the shed roof. Eighteenth and early-nineteenth century ceramics can be found around the house suggesting a long period of occupation for the site.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.202 W: 064° 19.138	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Field stone/Portland	Lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
	Main	Additional structure x 2
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters	Jalousie full Louvers Double wooden doors	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Pearlware ceramics Hand-blown glass		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

17. Residence of George and Romalia Smith (Photo 75)

Description:

This building is notable in that it is an example of how an old traditional residence has now been literally absorbed into a more modern house to the point where it is unrecognizable. The contemporary plyboard and modern grooved sidings, accompanied by full and glass louver windows, hide the original building and its associated features.

Two Tamarind trees in the garden are further indication of the site's historical provenance. They are of considerable size and consequently age. The developed yard hides any surface artefacts, but their presence is likely.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.192 W: 064° 19.051	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Field stone/Portland	Main: plyboard Addition: modern grooved siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Modern half and half sash type windows	Metal half jalousie full shutters	Poured rubble rendered x 4
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Stable	Low

18. Residence of Gladys Knight (Photo 76)

Description:

This particular structure started as a traditional Anegada residence, but then over the years the main fabric of the building was replaced by modern materials. The whole house is covered with modern grooved siding, whilst the doors and shutters are similar to older houses but are made from modern timber available at hardware stores.

The house sits on top of loose field stone and has poured concrete steps leading up to the main entrance door which is modern. The rear portion of the hipped roof has been removed to accommodate a gabled addition which also has similar doors, shutters and entrance steps.

GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.287 W: 064° 19.123	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Modern grooved siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main	Additional structure	
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters	Jalousie full shutters Double wooden doors	Poured concrete
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent round plastic cistern
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Stable	Low

19. Residence of Hubert Wells (Photo 77)

Description:		
This house is recorded only because it is assumed that by the time another survey is undertaken, this building will probably not exist since it is already in an advanced state of collapse and has been abandoned by the owner. It does however represent an example of an older Anegada residence constructed upon loose fieldstone using lapboard-and-shingle siding punctuated by window apertures covered with wooden interior and exterior shutters. Artefacts were recorded on the surface adding to the lineage of the site which has been occupied, judging by the surface evidence, for some two centuries.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.294 W: 064° 18.992	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Poured rubble concrete rendered	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors interior/exterior	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Pearlware ceramics Hand-blown glass		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Collapse	Low

20. Residence of Ira Smith (Photo 78)

Description:		
This is the home of notable BVI mariner Ira Smith. The residence is a combination of traditional and modern materials. The steeply pitched roof main house has been surrounded with shed roofed additions which contain both traditional shutters and modern full louver shutters. The property is fenced off and approached by a white wooden picket gate.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.283 W: 064° 19.020	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Main: shingle Addition: lapboard/modern siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Interior: full louver Exterior: wooden shutters	Interior: full louver Exterior: wooden shutters	Poured rubble
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

21. Residence of Ivy Faulkner (Photo 79)

Description:

This beautiful building is clearly very well maintained with only the full lover shutters in the window apertures providing a modern element. The blue siding is board and shingle which supports two hipped roofs joined together with a shed roof addition to the rear.

The steps and foundations are regularly painted white making this aspect of the structure reminiscent of a Greek island cabana. The Faulkner family takes a great deal of pride in their residences, and the area where the family houses are grouped presents a lovely aspect and reminder of how The Settlement would have once looked.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.321 W: 064° 19.243	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Rendered block	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
x 2		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters and double wooden shutters	Double wooden doors and modern single	Rendered block
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Surface rendered block galvanized covered
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

22. Residence of James Pearly White (Photo 80)

Description:

This pleasant modern lapboard structure sits upon rendered fieldstone in a large yard. The main building is hipped roofed with an additional shed roofed structure adjoining it. Modern glass louver windows are protected by wooden shutters with a traditional interior/exterior double wooden door entrance.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.210 W: 064° 19.010	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Field stone/Portland	Lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Additional structure Wooden shutters	Double wooden doors	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

23. Residence of James Potter (Photo 81)

Description:

This beautiful wooden house is original in every way and presents itself as a prime candidate for rehabilitation and display as an old traditional Anegada residence. Although dilapidated, it is still occupied but not maintained, which is unfortunate as it is the only example of its type worthy of preservation since others are in an advanced state of deterioration.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.337 W: 064° 19.164	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Rendered block and fieldstone	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors interior/exterior	Poured concrete
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Unknown
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Degrading	**HIGH**

24. Residence of John and Sesley White (Photo 82)

Description:

This house has been abandoned, but—with its steeply pitched hipped roof, board-and-shingle siding, double wooden doors, and window shutters—it represents a typical, turn-of-the-century Anegada house.

An outstanding feature of this property is the stone oven seen in the bottom left of the photograph, which was the only one of its type recorded in association with the current research.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.288 W: 064° 18.970	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors interior/exterior	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Collapse	Medium

25. Residence of Joseph and Mercedes Fahie (Photo 83)

<table>
<tr><td colspan="3">Description:
Another example of a traditional Anegada residence which has been left to collapse and is not either occupied or maintained anymore. Artefacts in the garden suggest a long period of occupation on this particular plot.</td></tr>
<tr><th>GPS POSITION</th><th>DATUM</th><th>ELEVATION</th></tr>
<tr><td>N: 18° 43.251
W: 064° 19.086</td><td>Puerto Rico</td><td>5-10m</td></tr>
<tr><th>CONSTRUCTION MATERIAL (FOUNDATION)</th><th>CONSTRUCTION MATERIAL (HOUSE)</th><th>CONSTRUCTION MATERIAL (ROOF)</th></tr>
<tr><td>Loose fieldstone</td><td>Board and shingle</td><td>Galvanize</td></tr>
<tr><th>ROOF TYPE (HIPPED)</th><th>ROOF TYPE (GABLED)</th><th>ROOF TYPE (SHED)</th></tr>
<tr><td>Main</td><td>Additional structure</td><td></td></tr>
<tr><th>CONDITION GOOD</th><th>CONDITION FAIR</th><th>CONDITION DILAPIDATED</th></tr>
<tr><td></td><td></td><td>X</td></tr>
<tr><th>CURRENT USE (LIVED IN)</th><th>CURRENT USE (MAINTAINED EMPTY)</th><th>CURRENT USE (DERELICT)</th></tr>
<tr><td></td><td></td><td>X</td></tr>
<tr><th>WINDOW TYPE</th><th>DOOR TYPE</th><th>STEP CONSTRUCTION</th></tr>
<tr><td>Double wooden shutters interior/exterior</td><td>Double wooden doors interior/exterior</td><td>Poured rubble x 5</td></tr>
<tr><th>ARTEFACTS PRESENT</th><th>CONSTRUCTION FEATURES PRESENT</th><th>CISTERN TYPE</th></tr>
<tr><td>Stoneware and brown glass</td><td></td><td>Absent</td></tr>
<tr><th>PRESERVATION VALUE</th><th>LIKELY FUTURE</th><th>SIGNIFICANCE</th></tr>
<tr><td>Medium</td><td>Collapse</td><td>Medium</td></tr>
</table>

26. Residence of Kenneth Faulkner (Photo 84)

Description:

This house is recorded on the basis that it is one of a few examples of an old house that has been completely absorbed into a more modern residence, leaving few original features. The clue to the building's age is in the low pitched hip roof which is of some age. Otherwise, this building displays no other traditional features.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.332 W: 064° 19.283	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Poured rubble concrete rendered	Main: rendered block Addition: modern siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure x 2
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Modern half sash windows Jalousie full shutters	Modern solid wood	Wheel chair ramp/concrete
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Not recorded
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Stable	Low

27. Residence of Leona Faulkner (Photo 85)

Description: The steeply pitched roof on this house has probably been removed at some point; new walls were faced with modern siding and contemporary windows have replaced the traditional board, shingle and field stone construction before the roof was replaced. This process appears to have repeated on a number of houses on the island. A variety of artefacts, including Pearlware, both loose on the floor and incorporated into the steps of the house, were identified, dating c.1780-1839. Likewise, a number of iron work features were indentified, probably the remains of the original house before it was modified. These included a number of fixtures such as hand-forged shutter hinges.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.295 W: 064° 19.293	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Block	Modern siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Glass paned	Wooden panel door	Rendered block
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Creamware and Pearlware ceramics Hand-blown glass		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Stable	Low

28. Residence of Leroy and Henrietta Wheatley (Photo 86)

Description:

A more modern residence based on the traditional style using modern materials. The age of some of the ceramic artefacts on the grounds surrounding the residence suggest a long period of occupation for this site, which has been rebuilt consistently.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.300 W: 064° 19.139	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main	Additional structure x 2	
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters	Jalousie full shutters and double wooden shutters	Concrete x 2
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Pearlware ceramics Hand-blown glass		Independent round plastic cistern
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Stable	Low

29. Residence of Ludwick Varlack (Photo 87)

Description:		
This old residence sits curiously upon a foundation consisting of a truck chassis and blocks as if it was moved to its present position with the intention of being restored. It is consequently out of context to its original position. The entrance steps are absent as is the cistern, flooring planks, most of the windows and a substantial amount of the original board siding. The next serious storm to hit the island will probably eliminate this building.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.300 W: 064° 19.105	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Truck chassis and block	Board	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden shutters interior/exterior	Absent
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Out of context		Absent
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Collapse	Medium

30. Residence of Francis and Mary Potter (Photo 88)

Description:
This lovely example of an Anegada residence has only been modified by placing new doors and windows in a traditional structure which still contains many original features including the steeply pitched hipped roof.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.297 W: 064° 19.210	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Rendered block	Main: board and shingle Addition: Lapboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Main: wooden shutters Addition: jalousie shutters	Wooden half jalousie full shutters half	Rendered fieldstone
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

31. Nurse's Quarters (Photo 89)

Description:		
The development of social welfare in the twentieth century eventually reached Anegada where it was decided a resident nurse should live on the island to care for local residents. A very basic structure was built as a home for the district nurse using board and shingle capped with a steeply pitched hipped roof and punctuated by double wooden shuttered doors and windows. The building is now obsolete but still stands and, to a certain extent, is maintained. This particular structure lends itself to preservation and presentation not only as a traditional Anegada residence but also as a monument to healthcare on the island.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.307 W: 064° 19.044	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
X		
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors interior/exterior	Poured rubble rendered
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Absent
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

32. Residence of Theodolph Faulkner (Photo 90)

Description:

This was the former residence of Theodolph Faulkner who was the Father of modern BVI politics and organiser of "The Great March" in 1949 which was instrumental in the restoration of the Legislative Council a year later.

The building is a museum and sits within a large plot which could be expanded to create further exhibits. The residence consists of a hipped roofed main house with a shed-roofed addition, both of which are sided with board and shingle punctuated by window and door apertures which have double wooden interior and exterior shutters.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.332 W: 064° 19.226	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose field stone coral and shell	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Museum		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors interior/exterior	Concrete
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Within museum		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Museum	**HIGH**

33. Residence of Urias Mistinson (Photo 91)

Description:

A typical traditional residence which has been re-sided and enlarged by adding shed-roofed additions. There are some stoneware artefacts in the garden suggesting the presence of more and a provenance much older than the present house.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.268 W: 064° 19.129	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Modern siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure x 2
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Jalousie full shutters	Metal half Jalousie full shutters	Poured rubble
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Glazed stoneware		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Stable	Low

34. Residence of Valencia Faulkner (Photo 92)

Description:

This well-maintained residence is partially occupied during the year by a New York-resident Anegadian. The original structure has remained unaltered, whilst newer ancillary buildings have been constructed on the property suggesting an owner who is particular about keeping the main house original. The garden is well maintained and the paths are outlined by conch shells which, in the BVI, usually signify the residence of a fisherman.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.389 W: 064° 19.116	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
x 2		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Temporarily		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors interior/exterior	Poured rubble
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Pearlware ceramics		Independent round plastic cistern x 2
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
HIGH	Stable	**HIGH**

35. Residence of Vincent Smith (Photo 93)

Description:

A traditional hipped-roof main house with a large gabled extension sitting on a loose field stone foundation. Modern windows and doors have been added to this residence, but the exterior double wooden shutters are still employed. The main house is shingle and board whilst the extension is lapboard. There are two independent cisterns and five sets of entrance steps illustrating the number of extensions or changes the building has undergone.

GPS POSITION	DATUM	ELEVATION
N: 18° 43.266 W: 064° 18.971	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose fieldstone	Lapboard Board and shingle	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main	Additional structure	
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
	X	
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Occupied		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Modern sash windows Double wooden shutters	Jalousie full shutters Double wooden doors	Poured rubble x5
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Surface finds absent		Independent exterior poured rubble rendered concrete x 2
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

36. Residence of Vernon Vanterpool (Photo 94)

Description:

This modernised structure displays a number of traditional features including a loose fieldstone foundation and hipped roof. The building is a bar/restaurant which hides the former residence that once existed and is a local meeting spot and hence point of cultural interest.

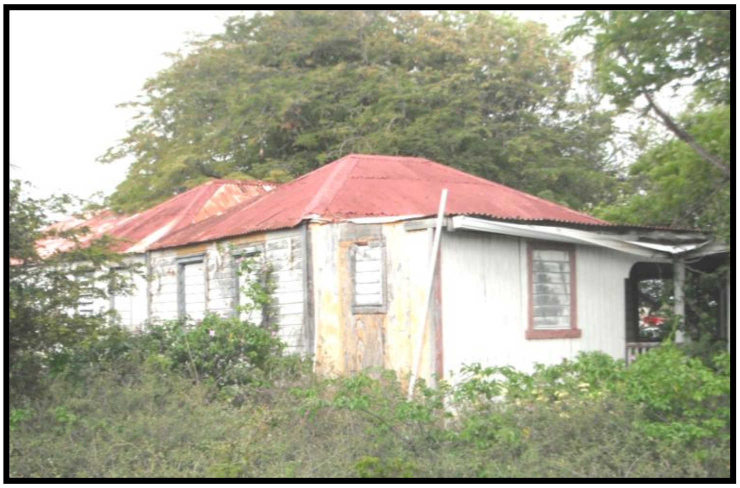
GPS POSITION	DATUM	ELEVATION
N: 18° 43.323 W: 064° 19.117	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Field stone/Portland	Modern siding	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure x 2
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
X		
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
Bar/Restaurant		
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Modern sash pane	Double wooden doors interior/exterior	Poured rubble
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**CISTERN TYPE**
Pearlware ceramics		Not recorded
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Medium	Stable	Medium

37. Residence of William George (Photo 95)

Description:		
The building that sits on this plot is not of enormous value architecturally. It follows the usual pattern of a hipped roof structure with a shed addition and independent cistern, but the materials are relatively modern. The real value of this site is the fertile distribution of artefacts from as early as the late eighteenth century, which suggests that an excavation of the area would be profitable from an academic standpoint. Clearly somebody of some means—judging by the types and patterns of the ceramics—once lived here, and what is on the surface is probably a fraction of the resource lying just beneath at a depth of no more than 0.5m.		
GPS POSITION	**DATUM**	**ELEVATION**
N: 18° 43.244 W 064° 19.021	Puerto Rico	5-10m
CONSTRUCTION MATERIAL (FOUNDATION)	**CONSTRUCTION MATERIAL (HOUSE)**	**CONSTRUCTION MATERIAL (ROOF)**
Loose and rendered fieldstone	Plyboard	Galvanize
ROOF TYPE (HIPPED)	**ROOF TYPE (GABLED)**	**ROOF TYPE (SHED)**
Main		Additional structure
CONDITION GOOD	**CONDITION FAIR**	**CONDITION DILAPIDATED**
		X
CURRENT USE (LIVED IN)	**CURRENT USE (MAINTAINED EMPTY)**	**CURRENT USE (DERELICT)**
		X
WINDOW TYPE	**DOOR TYPE**	**STEP CONSTRUCTION**
Double wooden shutters interior/exterior	Double wooden doors interior/exterior	Poured rubble x 3
ARTEFACTS PRESENT	**CONSTRUCTION FEATURES PRESENT**	**MODERN FEATURES PRESENT**
Fertile distribution of various artefacts		Independent exterior poured rubble rendered concrete
PRESERVATION VALUE	**LIKELY FUTURE**	**SIGNIFICANCE**
Low	Collapse	Low

6.1.2 Unrecorded Vernacular Housing Resources

38. Residence of Elfrieda and Elmore Norman (Photo 96)



39. Residence of Anton Vanterpool (Photo 97)

40. Residence of Harold Vanterpool (Photo 98)

41. Residence of Dozcina Potter (Photo 99)

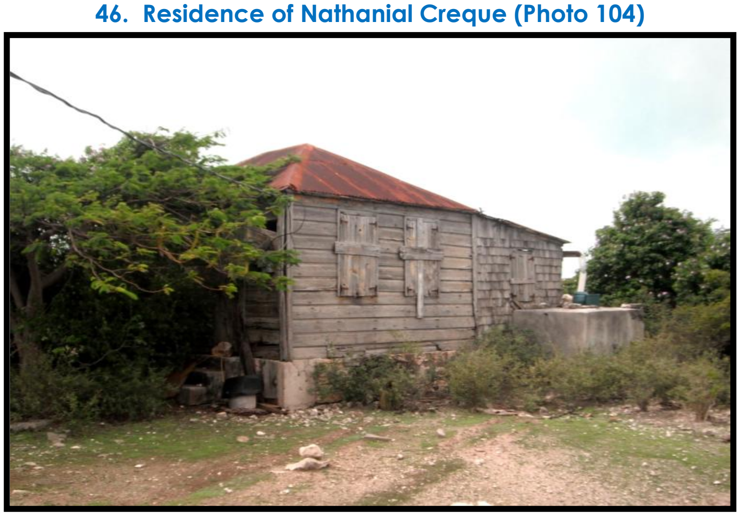
42. Residence of Arnold Wells (Photo 100)

43. Residence of Esther Benders (Photo 101)

44. Residence of Hilda Smith (Photo 102)

45. Residence of Miriam Clarke (Photo 103)

46. Residence of Nathanial Creque (Photo 104)



47. Residence of Anderson George (Photo 105)

48. Residence of Olive Titley (Photo 106)

49. Original Clinic (Photo 107)

50. Residence of Sherman Dunlop (Photo 108)

6.2 Rock Walls

Extending from The Settlement into the interior and at various places throughout the island are a series of loose field stone walls which once marked boundaries and contained livestock during a period in Anegada's history when animal husbandry was an important occupation. Many walls are now only visible as piles of stones as their maintenance dwindled with their importance. Within the local cultural psyche, however, these walls represent an important physical reminder of the past and as such should be studied further and, in places, preserved and interpreted for both school children and visitors.

Recommendations in a 1973 report submitted by a local action group, The Watchful Eye Committee, included one for the creation of an agricultural zone to be used by Anegadians for farming. The report advised, "*The entire walled area representing approximately one third of the island should be declared an agricultural zone*" (Faulkner, 2005:179).

The report also stated that "*Anegadians who can prove recent occupation of plots or walls within the zone should be given Crown grants*." This would suggest that up until the 1970s—only a generation ago—the walls were maintained, considered owned by their constructors, and still used as significant boundary delineators. Then, as now, the walls represent a physical reminder of those who had earlier farmed or occupied a plot of land, sometimes for generations.

The walls observed during the current research (**Photo 109**) were on the road leaving The Settlement heading toward Loblolly Bay. They are lower than originally constructed, which is obvious from the fallen stones found on either side of the remaining structures. Originally, the walls would have been approximately one metre in height.

Photo 109.
Sections of dry field stone wall, leaving The Settlement.

Structurally, their importance is minimal—they are simple, hand-built, loose field stone boundaries. As a cultural artefact, however, their importance is high, and, as such, they should be GPS plotted wherever they are discernible in order to establish their pattern and extent.

6.3 Conch Middens

The Anegada conch middens (**Photo 110**) represent the only visual reminder that Amerindians once occupied the British Virgin Islands. Evidence of settlements has been found on other islands within the Virgin Islands group; however, these are subsurface and have been excavated.

Why the conch middens are there is a mystery. Schomburgk (1832:153) records that originally they were thought to be funerary monuments, but some were dismantled and used for burning lime with no skeletons found inside. He also noted that the shells produced particularly good lime when slaked. The idea that the middens were burial grounds has perpetuated to the modern era and was recorded by Davis and Oldfield as recently as 2003. Consequently, there appears to be some confusion when Anegadians mention an Indian burial ground because they are in fact probably referring to the conch middens.

Photo 110.
Conch middens, Anegada
(photo credit: Nancy Woodfield Pascoe).

The primary factor affecting the feasibility of display and interpretation of the middens is accessibility, which is why they were not visited during the current research. They are located at the eastern most point of the island, which has no road leading to the area. Any attempt to locate them, for example by an inexperienced tourist, could prove potentially hazardous.

As such, until a suitable trail or track has been created which provides visitors with safe access to the middens, it would be irresponsible to promote them as an attraction. They are however a resource which, with proper preparation, could open areas of Anegada's east end, which to date have been ignored. Their inclusion in a guided hiking experience, which also addresses the flora, fauna and ecology of the island, might prove a profitable and worthwhile venture for an entrepreneurial young Anegadian.

6.4 Marine Archaeological Resources: Shipwrecks

The most valuable historic resource remaining at Anegada is the multitude of wreck sites surrounding the Horseshoe Reef. As early as 1523 ships fell afoul of Anegada's reef, a situation that was abrogated by the erection of the Sombrero Lighthouse in 1868. Tage W. Blytmann documents 130 wrecks on his website (Blytmann, 1998), but undoubtedly there are more. An earlier investigation by Schomburgk in 1831 suggested a reason why so many vessels wrecked on the reef.

> *Vessels bound from America to the West Indies, and chiefly St. Thomas, find themselves frequently to the north of the Virgin Islands; and this deviation from their intended course has proved but too often fatal having brought them to the reefs of Anegada when they thought themselves far to the southward of that dangerous island. Nor can repeated occurrences like these be attributed to errors in the observations for determining the latitude, or to false reckoning* (Schomburgk 1832).

Schomburgk listed 53 vessels which were known to have sunk near Anegada between 1808 and 1831; the majority of these foundered between the months of March to June. Probably the most gruesome episode occurring during his stay on the island was that involving the Spanish slave ship *Restauradora*, which wrecked in 1831. Schomburgk visited the site just days after she sank and through the clear waters was able to discern the bodies of many slaves, still in chains, being devoured by the variety of sea life that abounds on the reef. Although modern technology has all but eliminated the threat posed by the reef, charter vessels still occasionally run aground, perpetuating circumstances that have existed for nearly 500 years.

The potential for studying Anegada's wrecks is huge, and the island could become a Mecca for educational and research institutions pursuing programmes in maritime archaeology. Likewise, a maritime museum on Anegada displaying the island's maritime heritage would be sure to attract visitors.

6.4.1 List of Anegada Shipwrecks

The following is a *verbatim* list of the shipwrecks appearing on the website of Tage W. Blytmann: http://www.blytmann.com/wrecks1.htm.

ABBIE C. TITCOMBE, Brig or Brigantine, American, wrecked March 12, 1878, Captain B. Kenney. Ref. St.Th.Tid., 13th March, 1878: "The American Brigte' ABBIE C. TITCOMBE, of Portland, Maine, 394 tons, Captain B. Kenney, which left Glasgow on the 16th January with a cargo of coals for Messrs. Becker & Co., Havana, struck on the Anegada Reef last night at 10:30 o'clock. The captain reports that on the first inst. his vessel was dismasted in a gale and he was proceeding for this port under jurymasts at the time of the disaster. When the vessel struck the boat was got out at once, in which the entire crew embarked reaching here at 3:30 to-day. There is every probability that the vessel will be a total wreck." Penobcot Marine Museum states: "ABBIE C. TITCOMB, brig, Yarmouth, 376 tons, 120.9' x 16.1' x 10.0', billet hd., sq. stern, built Yarmouth, Me., 1863 by Giles Loring. Signal letters HTCG, Official number #1309. Reported wrecked March 31, 1878 near St. Thomas, West Indies."

AFTRIVEDO, Spanish, wrecked July 22, 1810, Captain LaPorta. Ref. Lockwood, 1813 & Admiralty, 1825; also Schomburgk, 1832). Max, 1971 writes "Spanish merchant ship AFTRIVEDO, Captain LaPorta, coming from Tarragona, was lost on July 22 on Anegada Island but part of the cargo was saved and carried to Tortola."

AILSA, Brigantine, Nova Scotia, 219 tons, wrecked February 25, 1886, Captain McLead. Ref. St.Th.Tid., 3rd March, 1886: "Captain McLead, mate and crew of the British brigt. AILSA, 219 tons, of Liverpool, N.S., arrived here on Sunday morning from Tortola in a boat. The captain reports that on the morning of the 25th ultimo the brigantine became a total wreck on a reef at An4egada; she was 12 days out from Savannah, Georgia, bound to Humacao, Puerto Rico with a cargo of P.P. lumber; at the time the vessel struck the reef there was a heavy sea running and as no boat could live alongside, the crew had to swim ashore. The AILSA was built at Port Medway, N.S. in the month of November 1882, classed A1, Amr. Record and owned by J.C. Bartling, Esqr. and others of Liverpool, N.S."

AJAX, Ship, English, wrecked September 21, 1819. Ref. Admiralty, 1825: "AJAX of London, Captain and 3 men drowned, 21st September, 1819"; also Ref. Schomburgk: "AJAX, English Ship, Sept. 1819, captain & three men drowned."

ALSVID, Barque, Norwegian, 366 tons, wrecked April 20, 1881, Captain Tallaksen. Ref. St.Th.Tid: 23 April 1881: "The Norwegian barque ALTING (misspelled) of Risør, Captain Tallaksen, from Newport, G.B., to Galveston with a cargo of iron, was stranded on the 22nd inst. (apparently wrong date) on Anegada Reef. Nothing has been saved, the crew loosing all. Eight men arrived here last night and are now under the care of the Norwegian Consul". A letter from Norsk Sjøfartsmuseum, Oslo, dated April 12th, 1967 states: "ALTING is misspelled, must be ALSVID, because under this name, in a complete list of ships belonging to Risør, it is mentioned that the ship wrecked at Anegada, West Indies 20th April, 1881. Vessel Built in Risør 1872, 366 Reg. tonn, Owner: I.Kildahl and others, Risør, Norway."

ANRORA, Spanish, wrecked November 29, 1813, Captain Alday Turriaga. Ref Max, 1971: "Spanish ship ANRORA (AURORA ?) Captain Aldayturriaga, from Cadiz to VeraCruz, was totally lost on Anegada on November 29th, but the crew was saved."

ARCADIA, Brig, British, wrecked March 4, 1823, Captain Venham. Ref. Admiralty, 1825: "Brig ARCADIA, to Trinidad, 4th March, 1823, part of cargo consisting of cattle, saved". Also Ref. Schromburgk, 1832; and Max, 1971: "British ship ARCADIA, Captain Venham, of and for Trinidad from Puerto Rico, lost on Anegada Shoals on March 4, 1823, only about fifty head of cattle were saved."

ARGUS, Brig, wrecked March 20, 1819, 1820 or 1821. Ref. Schromburgk, 1832; also Admiralty, 1825; also St.Th.Arrvls: "Brig ARGUS ... ført af Captain Thomas ... forliste paa Anegada."

ARK, Ship, Halifax, stranded 1859. Ref St.Th.Tid, 1st Oct., 1859: "Captain Marshall of the British ship JANE, reports having spoken on the 25th ult. the ARK, of Halifax, 36 days out, under jury masts, having experienced a hurricane on the 9th September. It is since stated that the ARK struck on the Anegada reefs on Wednesday last, but has been got off and towed to Tortola leaking badly." In the same paper appears on a later date an auction notice of articles saved from the ARK.

ASTREA, 5th-rate 32-gun Frigate, British, 689 tons, wrecked May 23, 1808, Captain Edward Heywood.

AUGUST, Barque, German, wrecked June 26, 1870, Captain Jacobs. Ref. St.Th.Tid, June, 1870: "North German barque AUGUST, Captain Jacobs, from Hamburg, with assorted cargo bound for St. Thomas, is a total wreck on Anegada Reef. She struck on Sunday night the 26th inst. Part of the cargo will be saved."

BULWARK, Brig, British, wrecked December 13, 1818. Ref. Admiralty, 1825: "Brig BULWARK, from Quebec to Jamaica, December, 1818"; also Ref. Schromburgk, 1832 and Max, 1971: "Year 1818, British ship from New Brunswick to Jamaica wrecked on Anegada on December 13."

BYRON, Brig or Schooner, British, wrecked November 23, 1821, Captain Anderson. Ref Admiralty, 1825; also Schromburgk, 1832;

also Max, 1971: "British ship BRYON, or BYRON, Captain Anderson, of and for Cork from Trinidad, was totally lost on Anegada shoals on November 23, 1821, but the crew and passengers were saved."

CALABASH, wrecked before 1832. Ref. Schromburgk, 1832.

CAROLINE, wrecked November 15, 1814, Captain DaSilva. Ref. Max, 1971: "1814, A ship of unknown nationality, CAROLINE, Captain DaSilva, from Madeira to Jamaica, was lost off Tortola on November 15, but the crew was saved and carried to Puerto Rico."

CAROLINE, Brig, American, wrecked November 7, 1822. Ref. Schromburgk, 1832: "CAROLINE, American Brig, 1822"; also Admiralty, 1825: "Brig CAROLINE, from Boston, 7th November, 1822." Vessel elsewhere reported en route from Boston to Puerto Rico.

CATHARINE, Brig, British, wrecked September 27, 1840. Ref St.Th.Arvls, October 1st, 1840:"Forliste med den engelske CATHARINE af St. Vincent, Søndag den 27. september ..."

CHARLES, Brig, English, wrecked September 25, 1819. Ref. Schromburgk, 1832; also Admiralty, 1825: "Brig CHARLES, from Baltimore, with lumber, cargo saved, 25th September, 1819."

CHILHAM CASTLE, Ship?, English, wrecked May, 1818. Ref. St.Th.Tid, 21st May, 1818: "We are sorry to state that an English and also Spanish ship has wrecked on the 15 (date uncertain due to poor printing) inst. on the reef of Anegada. The name of the English ship is CHILHAM CASTLE, from Liverpool to New Orleans, with dry goods, the former of which port she left on the 1st April. Crew saved, and also some part of the cargo." Ref also Schromburgk, 1832, and Admiralty, 1825.

COLLECTOR, Schooner, American, wrecked 1831. Ref St.Th.Arvls, 12th August, 1831: "Forliste paa Anegada". Also Schromburgk, 1832: "COLLECTOR, American Schooner, 1831."

COLUMBUS, Schooner, American, wrecked before 1832. Ref Schromburgk, 1832.

CONSTANCE, Barquentine, British, stranded November 1890, Captain Zimmer. Ref St.Th.Tid, 8th November, 1890: "The barquentine CONSTANCE of Barbados, Captain Zimmer, from New York, bound to Frederikssted, St. Croix, with a general cargo, struck on Anegada on Saturday last. Through the efforts of the captain and crew she was floated shortly after, and has arrived at destination."

CORSICA, Brig, American, wrecked November 10, 1831. Ref. St.Th.Tid, 16th November, 1831: "Arrived the captain and the crew of the brig CORSICA which was wrecked on Anegada on the night of the 10th inst. on her way from Gibraltar to Vera Cruz, with a most valuable cargo amounting to $200.000. The U.S. schooner PORPOISE, John Persival, Esq., Lt. Commanding, being in this port when the intelligence was received proceeded immediately to the spot to receive any part of the cargo which may have been saved." Also Schomburgk, 1832.

CRUGER, American, wrecked September 1786, Captain Williams. Ref. Max, 1971: "1786. American ship CRUGER, Captain Williams, from Philadelphia to St. Croix, was wrecked on September 3 on Horseshoe Reef of Anegada."

DASH, English, wrecked May 23, 1816, Captain Falls. Ref Max, 1971: "1816. British ship DASH, Captain Falls, of London, from Puerto Rico to Barbados, with 120 head of oxen, was totally lost on May 23 on Anegada Reef, the crew, twenty head of oxen, and some rigging saved."

DESPATCH, Brigantine, Nova Scotia, wrecked July 25, 1863, Captain James C. Bartling. Ref St.Th.Tid, 29th July, 1863: "On the 25th of July at 4 A.M. the British brig'te DESPATCH of and from Liverpool, N.S., with a cargo of spruce scantling destined for Ponce, Puerto Rico, struck the N.E. point of Anegada Reef. Vessel and cargo total loss. Captain James C. Bartling and crew arrived here on the 28th inst."

DETROOP, Galliot, Dutch, wrecked May 5, 1851, Captain K. J. Tolner. Ref. St.Th.Tid., 10th May, 1851: "We regret to learn that another unfortunate vessel has fallen victim to the heartless wreckers of this portion of the British Virgin Islands. The Dutch galliot DETROOP, K.J. Tolner, master, whilst pursuing a voyage from Rotterdam to Puerto Rico, with a cargo of gin, cheese, butter, barley, beef, &c., was stranded on the shoals of Anegada, on the night of the 5th inst., and became a total wreck. On this occasion, however, we opine that the Anegadians will not be allowed to indulge in their wholesale plundering propensities, as formerly, for we understand that Her Britannic Majesty's sloop of War HELENA, Commander DeCourcey, which vessel was at Tortola about the time of the wreck, had repaired to the spot, with the principal officer of Her Majesty's Customs on board, for the purpose of protecting the wrecked property. A quantity of the goods had already been taken to the Queens Warehouse in Road Town, and are advertised to be sold on Wednesday next for the benefit of the underwriters and others concerned."

DIFIANCE, wrecked 1653. Reference "The Memoirs of Prince Rupert" - being a journal of his 1652/53 journey to America where his brother drowned in a shipwreck on Anegada Island; Warburton, 1849.

DONNA DELLA GRACIA, Brig, Spanish, wrecked 1831. Ref. Schromburgk, 1832: "DONNA DELLA GRACIA, Spanish Brig, 1831."

DONNA PAULA, Slaver, Portuguese, wrecked September 3, 1819, Captain Viana. Ref. Anonymous, 1824, 2 reports, 10 pp, map entitled: "Slaves Wrecked in the Portuguese Ship called The Donna Paula". Also Admiralty, 1825: "DONNA PAULA" with slaves, 3rd September, 1819"; also Schromburgk, 1832. There is also a mention of this wreck in the book "Lagooned in the Virgin Islands", Hazel B. Eadie, 1931. Also Max, 1971: "Year 1819. Portuguese ship DONNA PAULA, Captain Viana, of Para, totally wrecked on the Anegada Shoals the night of September 3, 235 African slaves and the crew saved."

EL CESAR, Spanish, wrecked 1757, Captain Josef Bernabe Madero. Ref. Max, 1971: "1757. Spanish merchantman EL CESAR, Captain Josef Bernabe Madero, owned by the Marques de Casa Madrid, was lost on Anegada Island."

EL RAYO, Spanish, wrecked 1790. Ref. Max, 1971: "Year 1790. Spanish ship EL RAYO, sailing from Bilbao to Puerto Rico, ran ashore on Anegada but the crew abandoned her safely."

ELIZA, British, wrecked 1823, Captain Filliul. Ref. Max, 1971: "Year 1823. British ship ELIZA, Captain Filliul, from Liverpool to St. Thomas wrecked on Horseshoe Reef near Anegada, cargo and crew saved."

ESPERANZA, Brig, Spanish, wrecked about 1831. Ref. Schromburgk, 1832 - reference simply states "ESPERANZA, Spanish Brig."

ESPIRITU SANTO, Snow, Spanish, wrecked March 19, 1775. Ref. Max, 1971: "1775. A Spanish snow called SPIRITO SANRO (Spanish spelling would be ESPIRITU SANTO), bound from La Coruna, Spain, to Havana, wrecked night of March 19th on the rocks of Anegada (at the point called the Horseshoe), the people and a great part of the cargo were saved, but the vessel was lost."

FALCON, American, wrecked May 26, 1817, Captain Brothoff. Ref. Max, 1971: "1817. American ship FALCON, Captain Brothoff, wrecked at Anegada on May 26th."

FLEUR DE LA MER, Portuguese, wrecked before 1832. Ref. Schromburgk, 1832: "Fleur de la Mer, under Portuguese colors."

F. MICKELSEN, American, Schooner, stranded August, 1835. Ref. St.Th.Tid, 19th August, 1835: "Extract of a letter from Tortola, dated 16th August, 1835, addressed to Messrs. Haddocks, Phillips & Co. of this island, states that the schooner F. MICKELSEN, of Newburn, was found in an abandoned state on the Anegada Reefs, and carried to that island. In consequence of her being found in that situation, she was taken possession of by the Receiver of Droits. Any information which may be required relative to said vessel may be obtained from the above mentioned Gentlemen, who have delivered a package of letters found on board to the American Consul ..."

FRANCIS, Brig, English, wrecked 1831, Captain Brown. Ref. St.Th.Arvls, 17th March, 1831: "Forliste paa Anegada i briggen FRANCIS, Captain Brown, fra St. Vincent". Also Schromburgk, 1832: "FRANCIS, English Brig, 1831"; furthermore Schromburgk states in his "Remarks on Anegada," page 166: "I conversed with Captain Brown of the English brig FRANCIS, bound from Nassau (New Providence) to Trinidad, who having been prevented by cloudy weather from taking an observation for several days, according to his reckoning was distant from Anegada, and, making land in the evening, considered it to be St. Martin's but was wrecked on the reefs of Anegada at 11:00 the same evening."

GENERAL BROWN, American, wrecked 1821, Captain Godfrey. Ref. Max, 1971: "Year 1821. American ship GENERAL BROWN, Captain Godfrey, from New York to the West End of Puerto Rico, was totally wrecked on Anegada shoals but most of its cargo saved and sold at Tortola."

GOOD HOPE, British, wrecked 1809, Captain Watson. Ref. Max, 1971: "1809. British ship GOOD HOPE, Captain Watson, from London to the Spanish Main, was lost near Anegada but most of the cargo saved." Also Schromburgk, 1832 mentions this vessel, but gives no further information.

HALIFAX LADY, wrecked before 1832. Ref. Schromburgk, 1832.

HEBE, British, wrecked 1795, Captain Gray. Ref. Max, 1971: "1795. British ship HEBE, Captain Gray, from Cork to Jamaica, was lost on the rocks (believed to be Anegada) near Tortola."

HIRAM, Schooner, wrecked February 29, 1840. Ref. St.Th.Arvls, 13th March, 1840: "Forliste paa Anegada i skonnerten HIRAM fra Washington den 29. Februar (1840)."

HOLTINGEN, Barque, Norwegian, 420 tons, wrecked February 2, 1892, Captain Berge. Ref. St.Th.Tid, 6th February, 1892: "Yesterday morning Captain Berge, of the barque HOLTINGEN, presented himself at the Norwegian consulate and reported the loss of his vessel on the Anegada Reefs, on the night of the 2nd inst. At the time of the casualty occurred the weather is said to have been very heavy, and the ship foundered almost immediately on striking. Captain Berge and the crew escaped without being able to save any of their effects, owing to the rapid sinking of the vessel. From Anegada the wrecked hands reached Tortola in a ship's boat, and arrived at St. Thomas last night. The HOLTINGEN was a vessel of 406 tons hailing from Tvedestrand and was bound from Barbados to Charleston, S.C., in ballast." (HOLTINGEN was built in Tvedestrand in 1874, 420 reg. tonn. Owners were A & F Smith, Tvedestrand, Norway).

IDA, Steamer, Spanish, wrecked January 1, 1899, Captain Ceniga. Ref. St.Th.Tid, 4th January, 1899: "A boat arrived here on Monday night with the crew, some 39 in number, and 10 passengers of the wrecked Spanish steamer IDA, which went ashore at Anegada on New Year's morning at 3 o'clock. It appears that the steamer had been in bad weather for three days and had lost her bearings, thus causing the disaster. She was from Coruna, Spain, bound for Puerto Rico, and had a general cargo. It is expected that both the ship and cargo will prove a total loss, as the spot on which she struck is difficult of access by salvors at this time of the year. The captain Ceniga is expected to arrive here today together with some of the officers who remained with the wreck. One of the crew is reported drowned by the smashing of a boat."

IL CANDELIERO, wrecked before 1832. Ref. Schromburgk, 1832.

ISLAM, Brig, American, wrecked October 2, 1852, Captain Young. Ref. St.Th.Tid., 6th October, 1852: "In addition to the marine disasters published in a previous number, we have to notice the wreck at Anegada of the American brig ISLAND (should have been the ISLAM) on Saturday the 2nd inst. Her cargo consisted of wheaten flour and corn meal. She struck on the north side of Anegada where the water is very boisterous."

JAMES BARRON, American, wrecked January 7, 1824. Ref. Max, 1971: "1824. American ship JAMES BARRON, Captain Fisher, from Charleston, South Carolina, to Barbados, was totally lost on January 7 on Anegada Reef."

JAMES EDWARDS. 1819 and/or 1831. See JAMES EDWIN below.

JAMES EDWIN, Schooner, American, wrecked January, 1819 and/or 1831(?). Ref. Schromburgk, 1832 states: "JAMES EDWARDS, American Schooner, 1831". The vessel may have been the JAMES EDWIN, and not as stated by Schromburgk, because St.Th.Arvls, 10th January, 1831 reads: "Forliste paa Anegada i skonnerten JAMES EDWIN, fra New York". Max, 1971 writes: "Year 1819. American Schooner JAMES EDWARDS sank on Anegada." There possibly were two vessels, one wrecked in 1819 and one wrecked in 1831.

JANE, this vessel was wrecked on or near Tortola, not on Anegada as reported in some sources.

KATHERINE, British, wrecked 1751, Captain Richards. Ref. Max, 1971: "1751. KATHERINE, commanded by Captain Richards, sailing from Jamaica to Bristol, was lost on Anegada but the crew was saved."

KONG OSCAR, Barque, Norwegian, 424 tons, wrecked April 1, 1885. Ref. St.Th.Tid, 4th April, 1885: "The Norwegian barque KONG OSCAR, from Cardiff with a cargo of coal for this port, became a total wreck on Anegada on the night of the 1st inst. The captain and crew arrived here yesterday. Norsk Sjøfartsmuseum in Oslo, Norway states: "KONG OSCAR, built in Kragerø, 1859, 424 Reg. Tonn. Owner J. Gundersen, Kragerø, Norway".

L'AIMABLE EULALIE, Ship, French, wrecked May, 1824, Captain Alleame. Ref. Schromburgk, 1832; also Max, 1971: "1824. French ship AIMABLE EULALIE, Captain Alleame, from Guadeloupe to Le Havre, wrecked on Anegada Shoals in May, only a small part of the cargo saved."

LA VICTORIA, Man-of-War, Spanish, wrecked 1738, Captain Don Carlos Casamara.

LE COUNT DE POIX, French, wrecked 1713, Captain Lewis Doyer. Ref. Max, 1971: "Year 1713. Captain Lewis Doyer, of French ship LE COUNT DE POIX, sailing from Santo Domingo to Havre de Grace, France, wrecked on Anegada."

LEWIS, Brig, American, wrecked April 9, 1831, Captain Turley. Ref. Schromburgk, 1832: "LEWIS, American Brig, 1831." On page 166 in his "Remarks on Anegada" Schromburgk states: "The brig LEWIS, Captain Turly, bound from Philadelphia to St. Thomas and Maraibo (sp), was wrecked on the southeastern reef on Anegada, 9th April, 1831. According to his reckoning he was the day previous on a parallel with St. Thomas; and I have been told that a second time he narrowly escaped being wrecked on nearly the same spot where he had thus lost the LEWIS, having discovered the foam of the breakers just in time to bear away."

LIONESS, Brig, American, wrecked 1811. Ref. Schromburgk, 1832.

LONDON, Ship(?), English, wrecked 1810, Captain Cromie. Ref. Schromburgk, 1832. Also Max, 1971: "1810. British ship LONDON, Captain Cromie (Cramie?), from London to Haiti, was lost on Anegada Island."

LORNE, Brigantine, Nova Scotia, 147 tons, wrecked January 24, 1884, Captain Pye. Ref. St.Th.Tid., 26th January, 1884: "The British brigte' LORNE, Captain Pye, of and from Halifax, N.S., bound to San Juan, Puerto Rico with a cargo of fish, etc., struck on the Anegada Reef on the afternoon of the 24th inst. and became a total wreck. The captain and crew arrived here yesterday afternoon." The Marine History Department of the Nova Scotia Museum states: "LORNE, Brigantine, 147 tons, built 1877, Jeddore, N.S., registered Halifax, N.S., Packford and Blake, owners. - Quoted from the American Record of Shipping."

MARIA, Barque, Swedish, stranded May, 1893, Captain Frøberg. Ref. St.Th.Tid., 17th May, 1893: "The Swedish barque MARIA, 310 tons, Captain Frøberg, from Barbados with sugar, bound to West End, St. Croix, to complete cargo for Copenhagen, put in here yesterday morning leaking badly having struck the Anegada Reef. Consignees Bache & Company."

MARIA JESUSA, Brig, Spanish, wrecked January, 1852. Ref. St.Th.Tid., 31st January, 1852: "We learn that another unfortunate vessel has been stranded on the reefs of Anegada during the week. Our correspondent states that she was the Spanish brig MARIA JESUSA, from some port in Spain, bound to the island of Puerto Rico with a cargo of provisions. A portion of the goods has been saved and taken to Tortola."

MARIANA, Schooner, American, wrecked August 11, 1842. Ref. St.Th.Arvls, 12th August, 1842: " ... af den paa Anegada i gaar nat forliste skonnert MARIANA fra Baltimore."

MARQUISE DE VIENNE, wrecked before 1832. Ref. Schomburgk, 1832.

MARTHA, English, wrecked May 25, 1774, Captain McIntosh. Ref. Max, 1971: "Year 1774. MARTHA, Captain McIntosh, sailing from Jamaica to London was lost on May 25th on Anegada."

MARTHA, schooner, wrecked before 1832. Ref. Schomburgk, 1832. Could be same vessel as above.

MARY (1817), wrecked 1817, Captain Autman. Ref. Max,1971: "1817. A ship of unknown nationality, MARY, Captain Autman, from Jamaica to Vera Cruz, was lost on Anegada."

MARY (1821), Brig, American, wrecked February 22, 1821, Captain Hellyer. Ref. Schomburgk, 1831; also Max, 1971: "Year 1821. A (vessel) of unknown nationality, MARY, Captain Hellyer, from New York to St. Thomas, was lost on February 22 on Anegada Shoals, but the crew and cargo were saved."

MARY (1857), Brig, British, wrecked July 20, 1857, Captain Dolbay. Ref. St.Th.Tid., 25th July, 1857: "The English brig MARY, Captain Dolbay, from Halifax bound to Ponce, Puerto Rico ran on Anegada reefs on Monday morning last (20th inst.) at 4 o'clock. Her cargo consisted of fish, hoops, and shingles - the better part of which, it is said, will be saved and taken to Tortola to be sold at auction. The crew composed the captain, mate, four seamen, cook and a boy. Of these, the four seamen and cook have arrived here; the captain, mate and boy, remaining by the wreck until such of the effects as may be rescued are sold."

MARY (1895), Sloop, wrecked November, 1895. Ref. St.Th.Tid., 4th December, 1895: "The sloop MARY, which left here last week for Dominica, has been wrecked at Horseshoe Reef, Anegada. A sailor and a passenger were drowned."

MARY IRVINE, Barque, American, wrecked December 21, 1851, Captain J. Taylor.

MASON'S DAUGHTER, Schooner, American, wrecked before 1832. Ref. Schomburgk, 1832.

MAXWELL, Schooner, American, wrecked 1819. Ref. Schomburgk, 1832; also Max, 1971: "Year 1819. American Schooner MAXWELL sank at Anegada."

MISSISSIPPI, Brig, American, wrecked November 18, 1856, Captain Hathaway. Ref. St.Th.Tid., 3rd December, 1856: "The American Brig MISSISSIPPI, 244 tons, Capt. Hathaway, was wrecked on the night of Tuesday 18th November on the reefs of Anegada. This vessel was bound to Baltimore from St. Eustatius with a cargo of sugar and molasses; she has proved a total wreck; a portion of her cargo, however, has been saved and brought to this port. Captain Hathaway and his crew are here waiting an opportunity to proceed to the United States."

NANCY GAER, wrecked 1769. Ref. Max, 1971: "1769. *NANCY GAER* was lost off Anegada but her crew was saved."

NELIE, Ship, wrecked before 1832. Ref. Schomburgk, 1832.

NEVARRO, Spanish, 1792, Captain Belandia. Ref. Max, 1971: "Year 1792. Spanish ship NEVARRO (NAVARRO ?), Captain Belandia, from St. Andero (Santander), Spain to Havana, was lost at Anegada Island."

NUESTRA SENORA DE LA VICTORIA, Spanish, wrecked December 5, 1812. Ref. Max, 1971: "Year 1812. *N.S. de la VICTORIA*, coming from Malaga was lost on December 5 on Anegada Reef."

NUESTRA SENORA DE LORENTO y SAN FRANCISCO XAVIER, Spanish, armed merchant vessel, wrecked 1730, Captain Juan de Arizon. Ref. Max, 1971: "Year 1730. An English built ship converted to a Spanish treasure galleon, *N.S. de LORENTO* y *SAN FRANCISCO XAVIER*, 212 tons, commanded by Captain Juan de Arizon, coming from Spain and sailing in convoy with a fleet of treasure galleons commanded by General Manuel Lopez Pintado for Cartagena and Porto Bello, sank on Anegada Island."

OCEAN, Ship ?, British, wrecked February, 1812, Captain Stewart. Ref. Schomburgk, 1832; also Admiralty, 1825: "Ship Ocean, from London, 1812." Also Lockwood, 1813. Also Max, 1971: "1812. British ship *OCEAN*, Captain Stewart, from London to Honduras totally lost in February on Anegada Reef but the crew was saved."

OLIVE, Schooner, of Boston, Mass. wrecked on July 7th, 1802, Captain Martin Stetson. George Washington Samson, a seaman on board the *OLIVE* at the time she was wrecked on Anegada island, was born in 1781 and went to sea when he was about fourteen years old in 1789. He wrote an interesting "Sea Log" of his adventures after he retired from the sea in December of 1803. After having served on several different merchant sailing ships as deckhand, he joined the vessel *THOMAS BLACK* bound for London, England in 1800. Three days out they lost a man, Jacob French, overboard and 32 days out their vessel was taken by the French privateer brig *LA SOIR* and brought to France. Subsequently, George Washington Samson shipped onboard the schooner *OLIVE* on June 2, 1802, and he then writes in his journal "the 7th of July (1802) was cast away on the island of Anegada. From there to Tortola (the largest island in the British Virgin Islands, and a few hours sail from Anegada). From there to St. Thomas, and from there to St. Croix (both islands are located in what was then the Danish West Indies - now the United States Virgin Islands. These Danish islands had been taken over by the British in 1801 at the time Admiral Nelson had defeated the Danish navy at the battle of Copenhagen, Denmark). In Christiansted, St. Croix, George Samson joined the brig *JANE* of Portland on August 5th, 1802. Ref. Personal correspondence with Mr. Walter Samson, a direct descendant of George Washington Samson.

OLYMPIA, Schooner, wrecked January 24, 1873, Captain Kennedy. Ref. St.Th.Tid: "The schooner *OLYMPIA*, Captain Kennedy of Turks Islands, employed in the mail service between that place and St. Thomas, nine days out, got ashore on the night of the 24th inst. at 10.50 on the Anegada Reefs, during squally weather. The crew got into the boat and tried to save as much as possible, such as the mails and some provisions, then started for Jos Van Dikes, where they arrived on the night of the 25th. The next morning, the 26th at 7 o'clock they started for St. Thomas and arrived at 11.30 AM. The sails and the spars have been saved but the vessel will be a total loss."

OTTO, Ship, Danish wrecked before 1832. Ref. Schomburgk, 1832.

PARAMATTA, Royal Mail Line Steamer, British, wrecked June 30, 1859.

PARTRIDGE, British, wrecked 1806, Captain Miller. Ref Max, 1971: "Year 1806. British ship PARTRIDGE, Captain Miller, from Bristol and the island of Madeira to St. Thomas, was lost near Tortola but part of her cargo was saved."

PATTERSON, Ship, American, wrecked May 15, 1818. Ref. Schomburgk, 1832; also Admiralty, 1825, stating: "PATTERSON of New Orleans, June 1818." Also St.Reg.Arvls., 27th May, 1818: "Forliste med skibet Patterson fra New Orleans paa Anegada den 15. maj, 1818."

PERSEVERANCE, British, wrecked 1795, Captain Oriel. Ref Max, 1971: "1795. British Ship PERSEVERANCE, Captain Oriel, from Dublin to Jamaica was totally lost on the North side of Anegada near Tortola."

PRINCE FERDINAND, wrecked 1760, Captain Caynoon. Ref. Max, 1971: "1760. PRINCE FERDINAND, Captain Caynoon, sailing from Boston to Jamaica was lost on Anegada Reef, but her crew was saved."

PROTECTOR (?), Bark (?), wrecked March 1838. Ref. St.Th.Arvls, 31st March, 1838: "Forliste med Bark ..PROTECTOR (?) .. paa Anegada .. fra England til St. Thomas." (Very difficult to read original).

REBECCA, Barque/Ship, American, wrecked January 7, 1859, Captain Collins. Ref. St.Th.Tid., 12th January, 1859: " The American barque REBECCA of Brunswick, Maine, Captain Collins, from Newport, bound to Kingston, Jamaica, with a cargo of coals, ran ashore on Anegada reefs on Friday morning 7th inst. at half past 3 o'clock, and will be a total wreck. Twelve men belonging to her arrived here on Monday morning last in an English boat, the Captain and mate remaining with the vessel to save all that is possible." Penobscot Marine Museum of Searsport, Maine, states in a letter: "REBECCA, Ship, Brunswick, 533 tons, 136' x29.3' x 14.7', billet hd., sq stern, built Brunswick, Me., 1849 by Joseph Given. Abel Sawyer, master '49. Owners: Joseph Badger, sole, Brunswick, Maine, 1849. Sometimes referred to as a bark, and reported lost January 7, 1859 on Anegada." See also "Queens of the Western Ocean". pp: 518 and 522.

RENOMINEE, Brig, American, wrecked before 1832. Ref. Schomburgk, 1832.

RESTAURADORA, Schooner/Slaver, Spanish, wrecked 1831. Ref. Schomburgk, 1832: "RESTAURADORA, Spanish Schooner, with slaves, many perished, 1831."

ROSEMLEAU, Sloop, French, wrecked 1790. Ref. Admiralty, 1825: "RESEMLEAU, French sloop privateer, 1790;" also Schomburgk, 1832; also Lockwood, 1813.

RUFUS KING, Schooner, wrecked September 12, 1826, Captain Henry Major. Ref. St.Th.Tid., 20th September 1826: "The schooner RUFUS KING, Henry Major, Master, 29 days from Washington, N.C., was wrecked on the night of the 12th inst. on a reef at the west end of Anegada; her cargo, which consisted of pitch pine scantling, staves, and shingles, was, with the exception of the deck load, saved, and landed at Anegada; from which place vessels are employed in conveying it to Tortola."

SALVATOR MUNDI, Armed Merchant Vessel, Danish, wrecked August 15, 1729. Ref. "The Danish West Indies 1671 - 1917", Westergaard, 1924 (?), page 122: "The SALVATOR MUNDI was wrecked, August 15th, 1729, on Anegada Reef near Virgin Gorda while en route from St. Thomas to Copenhagen with a return cargo." Also Kay Larsen File (Kongelige Bibliotek, Copenhagen): "....SALVATOR MUNDI ... kompagni skib. Laa sejlklar i København i efteraaret 1720 ... Stødte paa Lappen ved Kronborg og maatte vende tilbage ... hjemkom 16 juli 1728, udgik samme aar igen til Vestindien. Forulykkede paa hjemrejsen den 15. august 1729 paa Annegade Rev ved Virgine Gordas."

SAN IGNACIO, 55-gun Gallion, Spanish-Venezuelan, wrecked March 20, 1742. This vessel was owned by the Royal Carraca Company. Contrary to accounts in some popular shipwreck books, the SAN IGNACIO was on a East-West voyage, and not on a West-East voyage carrying silver and gold. The best and most reliable source of information about this vessel can be found in Beatson's Naval and Military Memoirs, Volume I, pp: 148/149 for 1742, which reads as follows: "The Court in Madrid having resolved to reinforce their garrisons on the Spanish Main, embarked the Almanza regiment of dragoons; commanded by Colonel Don

Alonzo de Arcos y Morena, consisting of five hundred and twenty men, and the same number of infantry, being a battalion of the regiment of Portugal, commanded by Don Francisco Villavicencio. They were ordered to Carthagena, where it was apprehended the British would make another attack. The troops were put on board the following ships, belonging to the Royal Caracca Company, viz. El Coro, and the St. Ignatio, of sixty guns each, but which, on this occasion, mounted only forty; the St. Sebastian and St. Joachim, of thirty guns each, and the St. Antonio of twelve guns. Don Joachim de Miranda, the new Governor of Carthagena, embarked on board the El Coro; and from the quantity of rich merchandise shipped, the was supposed the most valuable fleet that ever sailed from Cadiz; which port they left on the 12th of February, and were soon after overtaken by a terrible storm. The St. Ignatio was wrecked on the shoals of Anegada, one of the Caribbee islands; and there the Commandant of the regiment of Portugal, several officers, and one hundred and fifty men were drowned: The St. Antonio was never heard of. The other three ships of this fleet joined company again; made prize of an American vessel; and, on the 12th of April, when off the Virgin Islands; fell in with the Eltham of forty, and the Lively of twenty guns, two British ships of war, commanded by Captains Smith and Stuart, who gave chase to the Spaniards, came up with them, and began a very warm battle. The Spanish Commodore signified his desire to surrender several times, but was always prevented by an Irish officer of the land forces on board. After a severe conflict of some hours, night put an end to the engagement, otherwise all the three ships must have been taken; for the Spanish were so much damaged, that it was with the utmost difficulty they got into Puerto Rico three days afterwards, having had between six and seven hundred men killed and wounded; among the former was the Governor of Carthagena. The loss of men in the British ships was inconsiderable; but their riging had suffered so much, that they could not prevent the enemy from escaping in the night."

SAN JOSEPH, Felucca, Spanish, wrecked August 1818. Ref. St.Th.Arvls., 2nd September, 1818: "Forliste paa Anegada me ... Sant Joseph, Capt ... fra Cadiz ... til LaGuayra." (Original text very difficult to read); also Admiralty, 1825: "Spanish Felucca, cargo lost, September 1818." Also, St.Th.Tid, 28th August, 1818: "By a private letter just received from Tortola, we are informed that a Spanish Feluche from Cadiz, with a very valuable cargo of Wines, Brandy, Oil, &c., was wrecked on the shoals of Anegada some time last week - and on the night of the 21st inst. an American ship, laden with flour, &c., the whole of the cargoes of both vessels saved. As yet we have not learned the name of either of the vessels."

SANTA MONICA, English, 5th rate Frigate, wrecked in 1782, Captain John Linzee. Ref. Max, 1971: "Year 1782. Originally a Spanish ship taken by the British on September 14, 1779, the SANTA MONICA, Captain John Linzee, was lost near Tortola. All of her crew but one were saved, as well as many of her guns, stores and cargo." For a description of the vessel and of her capture from the Spanish see: "Battles of the British Navy", Joseph Allen, 1852, Volume I, pages 285/286.

SANTA ROSA, wrecked 1758. Ref. Max, 1971: "1758. Spanish merchantman SANTA ROSA wrecked on the reefs of Anegada."

SARAH, wrecked before 1832. Ref. Schomburgk, 1832, who simply states: "SARAH".

SECTOR, British, wrecked May 6, 1824. Ref. Max, 1971: "Year 1824. British ship SECTOR, from Trinidad to St. Thomas, wrecked on Anegada Shoals on May 6, crew and some cargo of dry goods saved."

SEXTA, Schooner, wrecked before 1832. Ref. Schomburgk, 1832. (Vessels SECTOR, above, and SEXTA could be the same vessel).

SICILY SUBRETTE, Barque, French, wrecked May 30, 1870, Captain Garbe La Plata. Ref. St.Th.Tid, 8th June, 1870: " The French barque SICILY SUBRETTE of Bordeau, Captain Garbe La Plata, from Philadelphia to this port, in ballast, was totally wrecked on Anegada on the night of the 30th May."

SIX FRERES, Brigantine, British (Newfoundland), wrecked September 29, 1875, Captain Michl. Collins. Ref. St.Th.Tid., 6th October, 1875: "The wreck, which we reported in our last number, on the Anegada Reef, proved to be the British brigte' SIX FRERES of and from St. Johns, Newfoundland, 119 tons, Capt. Michl. Collins with a cargo of fish, bound to St. Johns, Puerto Rico. The vessel got ashore at 4 o'clock on the morning of the 29th ultm. The crew arrived here from Tortola on Saturday afternoon." The History Dept. of the Nova Scotia Museum states: "SIX FRERES, Brigantine, 119 tons, 90' x 23' x 10.8', built 1863 Quebec, reg. Quebec, M. Michon & Others, owners. Also listed in American Record of Shipping, 1873).

SOPHIA, Schooner, British, wrecked or stranded (?) February, 1823. Ref. Schomburgk, 1832; also Admiralty, 1825 stating: "Schooner SOPHIA, cargo saved, hull worked off, 14th February, 1823." Also Max, 1971: "Year 1823. British schooner SOPHIA, of Antigua, bound to Curacao with cargo of mahogany wood, ran on the Anegada Reef and was totally lost, crew, rigging, and part of cargo saved."

SOLEDAD, Galleon, Spanish, wrecked November 14, 1739. Ref. "Sunken Treasure Ships of the World", Rieseberg & Mikalow: "SOLEDAD, Spanish Galleon, 11/14/1739, 6 fath. offshore reefs, 1/2 mile off Anegada Island." (We have found not been able to confirm the accuracy of this information).

SOPHIA SARAH, British, wrecked July, 1822, Captain Stairs. Ref Max, 1971: "Year 1822. British ship SOPHIA SARAH, Captain Stairs, of and from Halifax to Jamaica, was totally lost in July on the Anegada Shoals, but the crew and part of her cargo were saved."

S.P. HALL, Schooner, American, wrecked April 26, 1879, Captain M.T. Smith. Ref. St.Th.Tid., 30th April, 1879: "The American schooner S.P. HALL, 175 tons, of Bucksport, Maine, Captain M.T. Smith, from New York bound to Arroya, P.R., with a cargo of cooperage stranded on the morning of the 26th inst. on the Anegada reefs; the vessel is a total wreck. The captain and crew, numbering six men, were brought here last night in a small boat by Mr. George Varlack, of Anegada. On their arrival the captain reported to the Americal consul, who sent him and his crew to a boarding house, and gave the men who rescued them one hundred and seventy eight dollars. The men will, we understand, be sent to the United States by the first opportunity." Penobscot Marine Museum states: "S.P. HALL, Schooner, Bucksport, 175 tons, 105' x 27.4' x 8.8'. Billet hd., ell. stern, built Bucksport, Maine, 1870 by Wm Beazley. Owners: Hall-Gardner & Co. Signal Letters JHQD, official # 23834, 2 masts. Have no record of her loss."

SURINAM, Schooner, Surinam, wrecked January 15, 1826, Captain Strong. Ref. Schomburgk, 1832; also St.Th.Tid., 25th January, 1826: " The Schooner SURINAM, of Surinam, Captain Strong, sailed from Martinique on the 13th inst. in ballast bound to this island with three passengers, viz. Mr. Charles Philps of Boston, Mr. Garrott and

Mr. Boog of Demerara: - On the night of the 15th inst. she struck the Horse Shoe Reef, three miles east of Anegada, and was entirely lost. The passengers and the crew happily succeeded in landing at Anegada the next morning, where they remained until the 20th inst. when an opportunity presented itself for this place."

TARTAR, Schooner, American, wrecked before 1832. Ref. Schomburgk, 1832.

TASK, Brig, American, wrecked before 1832. Ref. Schomburgk, 1832.

THELCLYDE, Brig, French, wrecked April 24, 1876, Captain Tongearat. Ref. St.Th.Tid., 26th April, 1876: "The French brig THELCLYDE, Captain Tongearat, laden with sugar, rum, and cocao, from Martinique bound to France, got ashore on the NE end of Anegada reef on the morning of the 24th inst., she was floated two hours later, without rudder, on account of which she drifted and struck on the SW end of the reef, and is now a total wreck. As much as can possibly be saved is being landed at Tortola."

UNION, British, wrecked December 12, 1823, Captain Purrington. Ref. Max, 1971: " Year 1823. British ship UNION, Captain Purrington, from Barbados to Bath, was lost on December 12 on Anegada."

UNION, Schooner, America, wrecked before 1832. Ref. Schomburgk, 1832. This vessel could be the one referred to above.

(UNNAMED WRECK - Year 1523), Nao, Spanish, wrecked 1523, Captain Francisco Vara. Ref. Max, 1971: "Two merchant Naos, sailing from Spain for Santo Domingo, one under the command of Capt. Francisco Vara, and the other under Capt. Diego Sanchez Colchero, were lost in the Virgin Islands. The location of Vara's ship was given as on some "shallows", but Colchero's was reported wrecked on the island of Anegada. After several days, Colchero was able to refloat his ship by having its cargo and anchors thrown overboard. Then, going two leagues away, they located Vara's wrecked ship but could save the men only.

(UNNAMED WRECK - Year 1625), English, wrecked 1625. Ref. Max, 1971: "The governor of Puerto Rico wrote the King of Spain stating that an English built ship of 70 tons with eighteen men on it sank at Anegada Island. They had sailed from Virginia for Bermuda to salvage a shipwreck, but the ship was damaged in bad weather and driven onto the reefs og Anegada."

(UNNAMED WRECK - 1731), Spanish, wrecked 1731. Ref. Max, 1971: " Unidentified Spanish Galleon carrying a very valuable cargo of mercury or quicksilver and destined for the silver and gold (mines) of Mexico, was wrecked on the reefs of Anegada."

(UNNAMED WRECK - 1750), Spanish (?), wrecked 1750. Ref. Max, 1971: "Sloop returning from the wreck of the NUESTRA SENORA de SOLEDAD (previously lost on Cape Hatteras, North Carolina) and supposedly carrying the valuables from that ship, wrecked off Anegada."

(UNNAMED STRANDING - 1817), Spanish, stranded 1817. Ref.Max, 1971: "A large unidentified Spanish ship with over 300 african slaves aboard ran aground on the Horseshoe part of Anegada. After throwing many heavy objects overboard she was light enough to be pulled off and proceeded on her voyage."

(UNNAMED WRECK - 1818), Ship, Spanish, wrecked May 15, 1818. Ref. St.Th.Tid., 21st May, 1818: "We are sorry to state that an English and also Spanish ship has wrecked on the reef of Anegada ... We have not been as yet able to learn the name of the Spanish vessel, but we are informed that she was from Bordeau (?) bound to New Orleans, with a valuable cargo consisting of Wine, spices, etc..." (There were no further mentioning of these vessels in the St. Thomas Tidende).

(UNNAMED WRECK - 1818). Feluche, Spanish, wrecked August, 1818. See next entry.

(UNNAMED WRECK - 1818), Ship, America, wrecked August 21, 1818. Ref. St.Th.Tid., 28th August, 1818: "By a private letter just received from Tortola, we are informed that a Spanish feluche from Cadiz .... and on the night of the 21st inst. and American ship laden with flour, & c., the whole of the cargoes of both vessels saved. As yet we have not learned the names of either of the vessels." (There were no further mentioning of these vessels in the St. Thomas Tidende.)

(UNNAMED WRECK - 1827), wrecked July 27, 1827. Ref. St.Th.Tid, 1st August, 1827: "A person recently from Tortola informs that the mailboat which left this (port ?) last week for windward, was wrecked at Anegada on Friday night, and six persons belonging to her drowned."

(UNNAMED WRECK - 1835), wrecked July, 1835. Ref. St.Th.Tid., 18th July, 1835: "We are sorry to announce the loss of the eight day mail boat on the Anegada Reefs on Thursday night last. The letters and papers was saved from the wreck, and brought here yesterday by a sloop from Tortola."

VIGILANT, Schooner, British, wrecked June 1851, Captain Dunscomb.

VOLVART, Brig, Danish, wrecked February, 1819, Captain Kryger. Ref. Schomburgk, 1832; also Admiralty, 1825: "Danish Brig VOLVART, January, 1819" (Probably wrong date); also St.Th.Arvl., 29th Fenruary, 1819: "Strandet paa ... af Anegada med briggen VOSWARTS (?), Capt. Kryger ..."

W.I. WATSON, Brig, American, wrecked December 21, 1851, Captain B. Bunhill. Ref. St.Th.Tid, 27th December, 1851: "By the SEA GULL, from Tortola, last evening, we have received the intelligence of another wreck at Anegada, being the second within the period of three days. The American brig W.I. Watson, of 275 tons, Captain B. Bunhill, left the island of Barbados in balast-trim on her voyage to New Haven, and was cast away on the shoals of Anegada, on the morning of the 21st inst, about a mile from the spot where the MARY IRVINE (see above) was stranded. The crew of the brig immediately quitted her, as there appeared no likelihood of her being got off. They arrived here last evening, and report that when they left the wreck of their vessel there was but the smallest vestige of the barque visible."

WILHAMET (?), Ship, wrecked January, 1850. Ref. St.Th.Arvl., 26th January, 1850: "Forliste paa Anegada i Skibet WILHAMET (spelling uncertain) ... fra Marseille to Nye ... " Most of the names of the rescued crew members are Spanish and/or French.

ØRNEN, Barque, Norwegian, wrecked November 6, 1879, Captain S. Løkke. Ref. St.Th.Tid., 12th November, 1879: "The Norwegian barque "ØRNEN", of Christiana, Captain Løkke, bound to Galveston from Rotterdam, in ballast, stranded on the night of the 6th inst. on the Anegada Reef, and is a total loss. The captain and crew arrived here." Norsk Sjøfartsmuseum states that "ØRNEN, build in Maine, 1856, 426 reg. tonn, appears in the Norwegian Veritas Register first time in 1867. Owner: P. Backer, Kristiana (now Oslo)."

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE ONE The preservation of vernacular architecture in Anegada is primarily threatened by the local population's rejection of traditional residences for homes built from modern materials and the subsequent lack of maintenance and inevitable collapse of neglected structures.	Many traditional homes are still occupied and therefore have a more secure future. However, for those traditional buildings that have been abandoned, storms and vegetation encroachment will accelerate decay and contribute to natural deterioration.	**SHORT-TERM OPTIONS** **1.** Surface artefacts and traditional building materials and fixtures on the grounds surrounding vernacular buildings should be collected and stored, pending proper assessment. The presence of artefacts in yards suggests a long period of occupation and could provide information about the history of the site. **2.** Using the findings from the current 2012 survey and inventory as an initial reference, buildings that have been assessed as having a high preservation value should be formally identified for future rehabilitation. **3.** A more thorough study of the architectural details and techniques associated with Anegadian vernacular architecture should be carried out, employing more extensive photography and documentation. It might be possible to identify a graduate student to undertake this task. **LONG-TERM RECOMMENDATIONS** **1.** Consideration should be given to the creation of a "*Heritage Park*" in the garden of the Theodolph Faulkner property, which is now used as a museum. The Heritage Park could be a celebration of Anegada's vernacular architecture. **2.** Over time, funds should be identified for the removal and relocation of specific vernacular buildings to the Heritage Park. **3.** An interpretation centre could be erected at the Heritage Park to display the history of vernacular architecture on the island.
ISSUE TWO The composition of and techniques used for the construction of Anegada's stone walls dictate that, without regular maintenance, their collapse is inevitable.	The walls are slowly collapsing because they are no longer used as areas of livestock containment or boundary delineation.	**SHORT-TERM OPTIONS** **1.** Given the cultural value of the walls, significant sections of surviving walls need to be identified for possible rehabilitation, perhaps as part of a community-based project under the direction of a preservation specialist. **2.** GPS plotting of all identifiable walls should be carried out for the purpose of mapping the walls of Anegada. **LONG-TERM RECOMMENDATIONS** **1.** Funds need to be identified to rehabilitate certain significant wall sections. The community should be involved in this activity. **2.** Presentation of some wall sections might be made, using interpretation boards.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE THREE The location of the conch middens is remote. Their inaccessibility prohibits any positive exhibition of this particular resource until such time that a navigable trail is cut.	As long as the conch middens are not interfered with, they will remain in their current state. Apart from human intervention, the only other factors that could disturb the site are storms and tsunamis, although the middens have weathered both in the past. The most destructive episode in their history was during the early eighteenth century when some were dismantled for lime burning.	**SHORT-TERM OPTIONS** **1.** The routing of a potential trail needs to be identified and plotted to provide access to the middens. **2.** Additional research on the site is required, similar to research on other midden sites outside of the BVI, such as those on St. Croix, USVI. **LONG-TERM RECOMMENDATIONS** **1.** A permanent, sign-posted trail to the site should be constructed. **2.** Following creation of a trail, Interpretation boards could be erected at a prepared location for the purpose of explaining the history of the middens. **3.** A programme to train local individuals to lead tours to the site should be developed, perhaps by the National Parks Trust. Tour guides need to be conversant with the history of the middens whilst also being able to interpret the botany and wildlife of the area.
ISSUE FOUR The reefs surrounding Anegada make the study of its marine archaeological resources a hazardous undertaking, requiring considerable funding and detailed planning.	As the wrecks are presently undisturbed, it is preferable to leave the sites as they are until they can be studied by experienced professionals who are able to conduct non-intrusive research to establish provenance.	**SHORT-TERM OPTIONS** **1.** Additional research on the vessels wrecked on Anegada's Horseshoe Reef is necessary. Site-specific documentation is difficult to locate but important to moving forward with survey work. **2.** The BVI should reach out to institutions with expertise in the field of maritime archaeology and build collaborative relationships to support development of Anegada's untapped marine archaeological resources. **LONG-TERM RECOMMENDATIONS** **1.** The BVI Government needs to develop a policy to protect its marine archaeological resources, especially those of Anegada. Regulations are needed to address issues such as site protection, search procedures, site registry, salvage activities, artifact ownership/disposition, and guidelines for recreational diving on historic wreck sites (Towle, 1985). **2.** Any survey or excavation of wreck sites surrounding Anegada will be labour and time-intensive and will require considerable financial resources for sophisticated instrumentation. The BVI Government should consider partnerships with private-sector entities to move forward with underwater surveys, but <u>only after</u> adequate legal controls have been put in place. **3.** Eventually, establishment of a maritime museum and research facility for marine archaeology might be considered for Anegada.

7. POLLUTION THREATS

7.1. Solid Waste

Perhaps in no area are the constraints of insularity quite as demanding as they are with regard to waste management. Due to their relative small size, the "environmental dimensions of social and economic actions taken by … society [on small islands] are more immediately evident," and this is particularly the case for the management of waste (Georges, 2002:32).

Waste management is not usually considered a priority development area on islands, and there is generally a lack of institutional resources (human, technical and financial) within the field to handle increasing, and more complex, waste streams. In addition, the small land area of many islands means there are limited disposal options.

Additionally, islands are dependent on external markets and exhibit a high dependence on importations. Poor economies of scale on islands mean the costs for managing relatively small quantities of waste will be high. For example, some islands are isolated from mainland markets, thus rendering the cost of transporting recyclables impractical. Within these constraints however lie opportunities, specific to island communities, to develop innovative solutions to manage increasing waste volumes.

In recent decades, islands in the Caribbean have made more concerted efforts to address waste management issues. In the BVI, The National Environmental Action Plan (NEAP) identifies waste and pollution, amongst others, as issues which are:

> *serious and imminent threats to the Virgin Islands environment and natural resources, which if not immediately addressed could lead to the rapid deterioration of the Virgin Islands product and endanger the economy of the territory* (DCF, *et al.*, 2004:99).

7.1.1 Generation of Solid Waste in Anegada

7.1.1.1 Waste Categories

Volumes and types of waste categories vary significantly, depending on the economic development activities of the region in which the waste occurs. In a study by McDevitt (2008), data from four Caribbean islands was assimilated to provide an insight into the region's waste stream categories and quantities. The organic grouping is consistently the largest waste stream representing 31 percent of all waste. This is followed by paper and cardboard, representing 26 percent. The third largest waste stream is plastic at 14 percent, followed closely by glass at 13 percent. Metals, textiles, construction and demolition waste, and special waste occur in smaller quantities. Although special waste quantities are not large, management of these wastes is important as they can be hazardous in nature.

These figures can be used as a guide to the composition of the waste stream for most of the BVI. In Anegada, however, it is assumed that the organic fraction is significantly lower as there does not appear to be much landscaping activity on the island. Food waste from restaurants will likely comprise the majority of the island's organic waste stream in the peak tourism months between December and May. Another source of organic waste in Anegada is seaweed cleared from beaches, but much of this is dumped into bushes and allowed to compost naturally (**Photo 111**).

Photo 111.
Seaweed left to compost naturally at the
Big Bamboo Restaurant, Anegada.

The BVI's Department of Waste Management (DWM) performed a two-week waste audit in Anegada in July 2012, but the results have not yet been made available. Even if available, the audit was conducted during a time of the year when tourism is slow, and so the results could be deceptive. It is assumed that in Anegada, unlike Tortola and Virgin Gorda, the largest component of the waste stream is not organics but cardboard, plastic, metal and glass (**Photo 112**). No sewage sludge is disposed of at the island's landfill. However, medical waste from the island's clinic and waste oil from restaurants and vehicles are disposed of at the island's sole waste disposal site.

Photo 112.
Cardboard, plastic, metal and glass appear to be the most common waste categories in Anegada.

7.1.1.2 Factors Influencing Waste Volumes

Local population size, the number of visitors, and the spending power and respective wealth of a country will determine the size of its waste volume. The population of the British Virgin Islands has grown in the last decade from a little over 23,000 in 2001 to a projected 27,800 in 2012 (see Chapter 1, Section 1.3.1). This population increase for the territory as a whole has been matched by similar growth in waste volumes.

Anegada however does not follow this broader population growth scenario. According to Darvin Potter, a community elder in Anegada (*pers. comm*., August 2012), there were about 800 people on Anegada when he was a young boy in the 1930s. Although this is not confirmed by government records from that decade, we do know that the island's population in 1911 was recorded at a little less than 500 persons (Chapter 1, Section 1.3.1). Today, approximately 250 people live on the island according to the 2001 census, and a population of a little over 300 people is projected for the 2010 census (official census results not yet available).

Even though there are fewer people on the island, the waste per capita has increased as Anegadians now import the majority of their needs. Waste per capita in the BVI, like the neighbouring USVI, is high due to high importation rates for foodstuffs and other goods, plus associated packaging. The Virgin Islands Recycling Partnership (VIRP) reports that its waste volumes are 5 kg (11 lb) per person per day (VIRP, 2011). This is 2.5 times higher than the average waste generated per person per day for the United States mainland (2 kg/4.43 lb), as cited by the US Environmental Protection Agency (US EPA) in 2010 (US EPA, 2012).

In 2004, approximately 28,997 metric tons (31,964 US tons) of waste was generated in the BVI (McDevitt, 2008). In 2006, the BVI's waste generation amounted to 33,565 metric tons (approximately 37,000 US tons) (DPU, 2007); and in 2008 waste generation for the BVI was 39,013 metric tons (43,005 US tons) (McDevitt, 2008). More current figures for the BVI are not available. Data on waste generated per annum in Anegada are also not available but have been estimated in **Table 18** at approximately 318 metric tons (350 US tons). These figures are based on subjective observations and are not objectively measured.

Calculations for **Table 18** use an estimated weight of approximately 30 pounds for each bag of waste. One Anegada restaurateur estimated he generated 12 bags a day in season, whilst another estimated three bags per day (*pers. comm*., interviews conducted by profile researcher Charlotte McDevitt, August 2012). An average of six bags per day is therefore used for Anegada restaurants in making calculations. In the charter season, boats drop their garbage off at hotels and restaurants for a fee of three dollars, thus contributing to revenue generation.

Table 18.
Approximate estimate of waste generated per annum on Anegada.

Commercial Waste Generation (estimate based on high-season generation)						
Source	**Number of Sources**	**Bags Per Day (average)**	**Total Bags Per Day**	**Bags Per Annum**	**Pounds Per Annum ****	**US Tons Per Annum**
Restaurants *	12	6	72	13,104	393,120	196
Hotels*	4	3	12	2,184	65,520	33
Estimated Total						**229**
Residential Waste Generation (estimate based on twice a week collection)						
Source	**Number of Sources**	**Bags Per Week**	**Total Bags Per Week**	**Pounds Per Week**	**Pounds Per Annum**	**US Tons Per Annum**
Households	40	3	120	3,600	187,200	94
DWM Bins	17	2	34	1,020	53,040	26
Estimated Total						**120**
APPROXIMATE ESTIMATE OF TOTAL WASTE GENERATED PER ANNUM ON ANEGADA						**350**

Source: *Pers. comm., interviews with* restaurant and hotel owners on Anegada, August 2012.

* Restaurants and hotels are calculated for 182 days per annum to account for peak tourist season days only.

** Based on a large bag weighing 30 lb each.

7.1.2 Collection and Disposal of Anegada's Solid Waste

7.1.2.1 Overview

Historically, waste in Anegada has not been a serious management or pollution issue. Before the late 1940s, the island was self-sufficient and produced much of its own food through farming and fishing. Meat and fish were preserved through salting, utilising salt gathered from the island's salt flats. Wastes were predominantly biodegradable or used as a food source for animals, and there were few imported, commercially produced goods on the island. After World War II, the importation of plastic and other commercial products from abroad became more common.

In 1971, the first regulations affecting solid waste were passed in the BVI, requiring households to dispose of "house refuse" in bins with lids and to remove excessive wastes, such as "white goods" (appliances), at the owner's expense. Solid waste management fell under the Division of Environmental Health until 1995 when the Department of Solid Waste was formed. This department was officially renamed the Department of Waste Management (DWM) in July 2012.

The DWM falls under the Ministry of Health and Social Development and is responsible for the placement of dumpsters and bins, overseeing contractors who collect waste from dumpsters and bins, maintenance of road verges, street cleaning, the removal of derelict vehicles, management and maintenance of incinerators and landfills, and waste education activities.

The department on Anegada faces many obstacles such as limited financial, physical, technical and human resources, as well as a lack of adequate environmental monitoring and supporting legislation. This combination of factors prevents the implementation of better waste management practices such as:

- waste reduction initiatives,
- comprehensive hazardous waste management planning, and
- provision of liners and leachate treatment plants for landfills.

There is a general sentiment within the Anegada community that waste management is a low government priority, reflected by the lack of resources. However, responses to the Anegada Community Questionnaires, implemented by the Environmental Profile Programme in 2012, indicated that the issue of solid waste management has a high priority among residents as an issue that needs to be better addressed (see Table 24, Chapter 9).

Photo 113.
One of Anegada's 17 bins overseen by the DWM.

7.1.2.2 Collection

Ninety percent of the collection of waste in the BVI has been outsourced, a practice that is more likely linked to political patronage pressures than to executing the most efficient waste management practices possible. Outsourced contracting is supervised by the Department of Waste Management. Numerous private companies have been established in the territory and, in addition to Government contracts, such companies also serve private businesses and the smaller islands.

Photo 114.
A litter-free Anegada road.

Contractors are awarded tenders to collect waste from dumpsters and bins within their designated areas. Collected waste is then disposed in government-managed facilities. No fee is collected by the government for waste disposal, and waste management in the BVI is financed solely by general revenues generated from taxes.

Residents and smaller commercial enterprises in Anegada place their waste in coloured bins, as shown in **Photo 113**, which are overseen by the DWM and collected by a private waste contractor. Businesses are encouraged to take their own waste to the landfill site, and no waste management services are offered by the DWM to businesses on the western end of the island.

The Department of Waste Management on Anegada consists of one full-time staff member. He is responsible for the maintenance of the 17 bins interspersed between Setting Point and The Settlement. He is also responsible for keeping the verges along the main road litter free (**Photo 114**).

There is one private waste contractor for Anegada, hired by the DWM. The contractor collects the waste twice a week, on Wednesday and Saturday. His collection route runs from Setting Point along the main road and includes The Settlement. The contractor uses a pick-up truck to collect bags of waste left outside homes and businesses and at the DWM bins. The DWM officer ensures that bins are emptied, new garbage bags inserted and full bags left close to the bin for collection by the contractor, as depicted in the two views of **Photo 115**.

Timing of collection is an issue for both the contractor and the DWM officer. The officer sets the bags out in the morning, and the contractor collects them in the late afternoon. The contractor asserts he tends to collect in the afternoon as many people forget to set out their waste in the morning and he then has to collect again in the evening.

Photo 115.
Department of Waste Management bins with bags left by the DWM officer for collection by the private contractor on a Wednesday in August 2012.

The time lag between when bags are set out and when they are collected provides opportunity for animals such as dogs, cats, goats and, notably, cattle to break into the garbage bags in order to eat paper and food waste contained therein. When bags are ripped open by animals, the contained waste becomes a litter problem and has to be collected yet again by the DWM officer as shown in **Photo 116**.

An inventive citizen has created his own "lock" on a bin so that cattle cannot break into the receptacle as shown in **Photo 117**.

Photo 116.
The DWM officer re-collects waste after cattle have ripped open the bag that was stored for collection.

Photo 117.
A home-made "lock" on a waste bin to prevent cattle from eating waste.

7.1.2.3 Disposal

The Department of Waste Management operates all the disposal and treatment facilities within the territory with waste disposed of either in landfills or by incineration. There are four landfill sites, one on each of the four major islands. Open burning, spreading and compacting are the most common practices. All of the BVI's landfills are unlined, and none have leachate treatment plants.

Historically, waste in Anegada was burned or buried in residents' backyards, while local animals such as dogs would eat food waste. Fishing was a way of life, and fish guts were thrown into sink holes that fill with rain water that then seeps back into the ground. Waste that could not be burned or eaten by animals was dumped behind The Settlement along the coastline and can still be found there.

According to a community elder, Darvin Potter, Kenneth Bates of the aborted Bates-Hill Development Project created the landfill site near Nutmeg Point, just off the main road, in 1969. The site, situated on Crown Land, was excavated about 0.6-0.75 metres (2–2.5 feet) down to bedrock—an area of about 1,000 by 500 feet (305 by 152 metres) or approximately 11.5 acres (46.5 hectares). The dirt removed was then used as cover material.

This is still the only site for waste disposal in Anegada. It has been estimated that the site has capacity for another 20 years, although there is public pressure to relocate the site. Similar to commonly held perceptions about landfills worldwide, the Anegada site is not viewed favourably within the local community, with recurrent complaints about the emissions associated with open burning of waste.

The contractor responsible for waste collection is also responsible for consolidating waste at the landfill and setting it alight once a week on Saturdays. He uses a backhoe to pile the waste in a consolidated mass (this vehicle is shown in **Photo 118**).

Photo 118.
Backhoe used to pile waste up so it can be burned.

A separate contractor is hired to compact and cover the site with soil that is trucked in. However, due to departmental budget cuts, the waste at the landfill was leveled and compacted only once in 2011, in early January. Unfortunately by the end of 2011 the department could not afford to repeat the process, and the Anegada landfill was in a sorry state by the end of the year (DSW, 2011). Or, as one Anegadian commented, "*The site had reached a point to where it is disgusting*" (*pers. comm*., interviews conducted by profile researcher Charlotte McDevitt, August 2012).

Cattle are a common sight at the landfill (**Photo 119**). Early in 2012, the site was fenced off and a cattle grid (**Photo 120**) was erected to prevent animals rummaging through the waste. However, a part of the fence is now damaged as shown in **Photo 121**. There have been reports that fighting bulls might have damaged the fence. Furthermore, the site is still accessible from the back, and, therefore, according to a local resident, the fence and cattle grid have not helped. He maintained that the animals should just be allowed to graze (*pers. comm*., interviews conducted by Charlotte McDevitt, August 2012).

Other issues regarding waste disposal:

- The continual presence of flies and vermin, especially during the tourist season when fly bait is scattered by the DWM officer to reduce flies.
- There are currently no disposal options for tyres and they are either buried or burned.
- There is no separation of hazardous or electronic waste (e-waste).
- There are no litter fences surrounding the site, and wind-blown litter is evident.
- No alternative site has been identified.

- Derelict vehicles are not shipped to Tortola as part of the derelict vehicle programme. Instead they are burned and buried, taking up valuable landfill space.

Photo 119.
A common sight: a cow eating paper at the Anegada landfill.

Photo 120.
Cattle grid photographed at the Anegada landfill, designed to prevent cattle entering the site.

Photo 121.
The fence to keep cattle out of the Anegada landfill has been damaged, as seen in this photo.

7.1.2.4 Education

Territory-wide public education initiatives developed by the DWM education officer, using the mediums of television, radio and print, have centred on teaching residents how to dispose of their waste correctly. School education programmes are complemented by competitions and a mascot. A jingle competition held in 2004 proved to be an effective educational tool since the winning jingle was used in subsequent radio advertisements. Community outreach programmes include volunteer cleanups to encourage residents to keep the islands clean.

The Conservation and Fisheries Department assists in highlighting the importance of a clean environment with an annual volunteer beach cleanup as part of the International Coastal Cleanup initiative. The three largest categories of waste collected include plastic bags, plastic utensils, and caps and lids at 14, 13 and 10 percent, respectively, of the total collected (ICC, 2006: 29).

7.1.2.5 Legislation and Policy

There is currently no Solid Waste Management Plan to guide waste management in the BVI. A Request for Proposals for the development of such a territorial plan was issued in 2009. Tenders were submitted and a candidate selected, but a contract was never awarded. However, consultants from Trinidad and Tobago have recently been appointed to draft a Solid Waste Management Strategy, which should be completed by mid-2013.

The Litter Abatement Act was drafted in 1987 and amended in 2004 and 2009. Police officers have been trained to write fines and follow necessary procedures. The 2009 Amendment to the Act makes provision for the appointment of additional, trained litter wardens to be drawn from DWM staff, and public health inspectors, as well as volunteers from community groups. The intention is to issue warnings to perpetrators in an attempt to change behaviour without clogging the legal system. The programme is currently under review to identify ways to make it more effective.

From interviews conducted in Anegada for the Environmental Profile, there seems to be a general sentiment that the litter warden programme could be effective in Anegada. As one Anegadian stated, "If it hits their pocket, they will stop" (*pers. comm*., interviews conducted by profile researcher Charlotte McDevitt, August 2012).

The BVI's Derelict Vehicle Act came into effect in 2003, requiring the collection of derelict vehicles to be outsourced. Ferrous and non-ferrous metals are collected, sorted, compacted and exported from Tortola and Virgin Gorda, but not from Anegada.

7.1.2.6 Recycling

The BVI, like many small islands, lacks the financial and technical resources, as well as the associated industries, to easily recycle materials. The high cost of transportation means that recycling is not practical in many instances and is, therefore, not pursued as enthusiastically as it is in non-insular areas.

In June of 2012, the Ministry of Health and Social Development announced a number of new initiatives for the Department of Waste Management, including commencement of a waste audit and recycling pilot project on the sister islands of Jost Van Dyke and Anegada. According to the Minister:

> *This project aims to assess the volume and type of waste generated on these islands so that it can be prepared for shipment to Tortola for recycling purposes and disposal. In so doing, the Department of Waste Management will cease open burning on the sister islands and reduce the effects of air pollution that affect people suffering from asthma, acute sinusitis and other respiratory illnesses* (BVI Platinum News, 2 July 2012).

The pilot programme began in early July on Anegada, and for two weeks bins were provided to restaurants to separate cans and glass, with an additional two bins placed at the land fill, one for the collection of glass and the other for cans. Although the results of this waste audit are not yet available, the long-term objective is to determine what portion and what kind of waste from the two sister islands will be transported to Tortola for disposal by recycling or incineration.

A private recycler from Virgin Gorda is currently in discussion with the DWM to arrange for glass collected in Anegada to be crushed and then shipped to Virgin Gorda for processing using an industrial glass imploder.

In March of 2013, the BVI began a voluntary programme to ban the use of plastic bags at retail stores. A Memorandum of Understanding has been signed with major retailers on Tortola and Virgin Gorda who will charge customers 15 cents per plastic bag provided. The aim is to encourage shoppers to use their own reusable bags when shopping. It is hoped that Anegadian retailers will soon join the voluntary ban.

7.1.3 Environmental Impacts

Although no specific empirical data exist on the environmental impacts of current waste disposal practices in Anegada, it is generally known that waste management practices contribute to soil, water and air pollution, environmental degradation, and associated health problems.

7.1.3.1 Emissions

Emissions from the open burning of waste have significant potential health implications. Persistent organic pollutants, such as dioxins and furans, are chemical substances that persist in the environment and bio-accumulate in the food chain.

Methane is emitted as part of the decomposition process at landfills and is highly flammable. The risk of landfills catching fire is a common concern as the fire is difficult to extinguish and control. In addition, methane is known to contribute to global warming, and, as it filters up through layers of buried garbage, methane can also pick up carcinogens.

7.1.3.2 Leachate and Runoff

Leachate is the liquid (usually black in colour) that is formed in landfills as rain water (and other liquids) seeps through waste and picks up molecules from discarded items. The toxicity of leachate, and associated runoff, is thus dependent on the waste stream of the landfill.

In Anegada, due to the topography of the island, the water table is high. There is no separation of hazardous waste, so it is most likely that leachate will contain heavy metals (such as mercury, lead and cadmium), major ions and volatile organic compounds, all of which could enter the water table. There are many gaps in available knowledge regarding the long-term implications of leachate and runoff, such as:

- unknown chemical reactions in a landfill over time,
- the difficulty of detecting these compounds, and
- the need to understand how these compounds react with the existing environment.

New sanitary landfills are expensive to construct and manage. Additionally, social perceptions of landfills are one of the main challenges to identifying new sites. NIMBY ("*not in my backyard*") is a popular concept used to garner public opposition to the siting of landfills and incinerators near to communities.

Even if the Anegada landfill was to be redesigned and lined according to sanitary landfill standards with leachate treatment plants, long-term risks would remain, as even the most sophisticated liners will eventually leak. According to one expert, "*State-of-the-art landfills merely delay, rather than eliminate massive pollution to groundwater*" (Royte, 2005:59).

7.1.3.3 Vector and Pest Problems

The presence of vectors and pests—such as flies, rats, mosquitoes, cockroaches and other animals—are common at Anegada's landfill site and around individual waste bins. Fly bait is used during the peak tourist season at the disposal site when the amount of food waste generated from restaurants is higher.

7.1.3.4 Litter and Illegal Dumping

Anegada is generally clean and tidy and, interestingly, although littering is common along the main road into The Settlement, illegal dumping is uncommon. Roadside litter can be intentional and unintentional. For example, drivers often *intentionally* throw waste, such as plastic or glass bottles, out of vehicle windows. But, occasionally, bags of garbage are blown off vehicles *unintentionally* when drivers are transporting them to the landfill site.

Regular cleanups by the DWM have helped to ensure that roadside litter is managed, which caused one Anegadian to reason that littering should be permissible as it creates jobs (*pers.*

comm., interviews conducted by profile researcher Charlotte McDevitt, August 2012). Some problems associated with litter include:

- It is visually unappealing and sends a message that an area is not cared for.
- It decreases the positive perceptions visitors have about the island and may decrease the likelihood of return visits.
- It kills marine life, bird life and animals through strangulation and ingestion.

Aubrey Levon (*pers. comm*., August 2012), the owner of the Big Bamboo Restaurant which faces a windward beach, collects litter from this beach daily. Items range from plastic and glass bottles to food waste such as apple cores and other fruit waste. At times, he finds these in large quantities and assumes that the items must come from cruise ships. He has collected an array of marine paraphernalia that he uses as a garden display and as souvenirs for tourists as shown in **Photo 122**.

Photo 122.
Marine debris (as landscape décor) found on the beach at the Big Bamboo Restaurant, Anegada.

7.1.4 Future Planning for Solid Waste Management

7.1.4.1 Options for Waste Disposal

The BVI Government is currently reviewing Anegada's waste management system with the long-term objective of closing the Anegada landfill site and ceasing to burn waste on the island (see also Section 7.1.2.6). Waste would be barged to Tortola to make use of the extra capacity of a new incinerator at Pockwood Pond on that island. Potential obstacles to implementing this plan include the possibility of excessive costs for barging waste island to island and the unknown capacity of the incinerators in Tortola to accommodate the added waste streams from Anegada.

Some residents in Anegada believe that a new landfill site needs to be identified, one that is sufficiently above the water table and where emissions will not affect residents. However, no new site has been identified.

7.1.4.2 Integrated Waste Management

The process for creating the BVI's National Environmental Action Plan (NEAP) included the convening of a number of focus groups to determine participants' views on the environment. With regard to the disposal of solid and liquid wastes (including waste from yachts and cruise ships), 60 percent of respondents indicated that current waste management in the territory was inadequate (DCF, *et al*., 2004:93).

The NEAP supports policies to provide safe and effective waste management services and standards. Should Government adopt the NEAP, new environmental legislation to measure and monitor pollutants and standards for waste management practices will be required (see also Chapter 2, Section 2.2.5.3).

With respect to waste management, NEAP proposals call for:

- the monitoring and control of pollution from landfills and incinerators;
- early warning systems for potential waste disposal hazards such as oil spills;
- the need for the development of a national strategy for waste management;
- charging a tariff for waste disposal services; and
- the installation of scrubbers on incinerators.

The NEAP is spearheaded by the Department of Conservation and Fisheries as is draft legislation to provide a more comprehensive approach to environmental protection and management. The proposed law, the Environmental Management and Conservation of Biodiversity Bill (see also Chapter 2, Section 2.2.4.5), brings the BVI into conformity with important national, regional and international protocols, treaties and conventions that guide environmental policy.

Provisions under the Bill include mechanisms for a "waste audit" to further understanding about waste generation in the territory. Hazardous wastes would be classified, with licensing and permitting standards implemented to manage wastes safely. Monitoring methods to measure forms of pollution, including those derived from waste management practices, would be established. If the proposed legislation was to become law, its implementation—with respect to solid waste management—would require a greater allocation of resources to, as well as a prioritisation of, waste management within Government.

McDevitt (2008) recommends various short and long term strategies for waste reduction and resource management, which are also in line with recommendations of the NEAP report, the Virgin Islands Recycling Partnership (2012), the Caribbean Environmental Health Institute (CEHI, 2004) and the World Island Network (2006). Recommendations are based on the principal of *utilising waste as a resource*.

7.2 Pollution and Associated Environmental Risks

Amongst the BVI's four primary Islands, Anegada and Jost Van Dyke rank as the least populated (250 persons in Anegada and 244 persons in JVD in 2001, the last officially released census data). Yet Anegada is, by far, the most sparsely populated, with a population density of only seven persons per km^2 (19 persons per mi^2). In contrast, Jost Van Dyke, with a smaller land mass, has a population density of 30 persons per km^2 (81 persons per mi^2).

Anegada's sparse population density, coupled with a slow development pace, has contributed to the island's relatively clean and healthy environment. Visitors from neighbouring islands frequently note that Anegada is the place for a peaceful, quality time and for getting away from it all. Its vast areas of undeveloped space, unspoiled terrain, and tranquil peacefulness are rare attributes that increasingly are of value in our more complicated modern world.

Maintaining this environment and preserving these assets—including the island's wide open landscapes, an extraordinary wetlands system, imposing dunes, miles of white coralline beaches, and aqua-marine waters teaming with marine life—will ensure a quality life for residents while attracting visitors to Anegada's shores. Increasingly, however, this is a challenge for both Anegadians and their government.

Pollution issues are greatly magnified on small islands like Anegada and are compounded by a dependence on tourism. Dealing effectively with environmental concerns related to solid waste, domestic sewage, and other point-source or non-point source pollutants on Anegada will only be intensified by increased coastal development, the growth of tourism, the arrival of more visiting yachts, and the impacts that these added waste streams will have on already stressed disposal systems.

7.2.1 Domestic Sewage and Liquid Waste

Because of its size and low population density, the central government does not maintain any sewage or waste-treatment facilities on the island. All waste water and sewage have traditionally been discharged directly into the ocean or disposed of by use of septic tanks, soakaways, sump holes, or field beds. The septic tank is the most common method of disposal for households and small commercial establishments.

Although practical, septic systems require periodic maintenance and disposal of sludge material. In more recent household development, new and more efficient septic systems are in place. However, older households tend to have malfunctioning soakaways resulting from age and poor soil permeability. This continues to pose problems.

Septic systems often malfunctioned during heavy rain events where rainwater carries unknown quantities of effluent to lower elevations that may eventually reach coastal waters. The increase of effluents and nutrients over time could contribute to a deterioration of Anegada's extensive wetlands and the quality of its coastal waters.

Eutrophication is a process by which wetlands and coastal waters become rich in dissolved nutrients from runoff such as liquid waste and domestic sewage, thereby causing changes in nearby wetlands and marine habitats. Most of these changes are undesirable. Sites most vulnerable to eutrophication and decreased water quality are usually found along developed coastlines where water currents and flushing are weak. An increase in algal blooms from eutrophication has been noted in areas west of Setting Point. The area has a few hotels and restaurants and other commercial activity very near to the shoreline, a nearshore environment that is usually calm with low flushing characteristics.

The disposal of untreated waste water and sewage in coastal waters also poses health-related risks to Anegada's residents and visitors. As both the local population and tourism increase, current disposal practices will need to be modified to prevent a buildup of disease-producing bacteria in nearshore environments and the consequential negative impacts on human health and natural ecosystems.

7.2.2 Coastal and Marine Water Quality

Coastal water quality around Anegada is generally very good, particularly in areas where there is little development and in areas where the seas and currents are more active. This is the case for the entire north coast and most of the west and southeastern coastline. However, coastal development activity is on the rise around Setting Point, the main entry point by sea for the entire island. Here, coastal development—both residential and commercial—is taking place, stimulated by on-shore tourism and recreational yachting activity.

At Setting Point, *ad hoc* small-scale coastal projects, mostly by individuals, is having some visible impact on nearshore water quality. Land clearing for residential expansion, construction of individual docks, and channel dredging through mangroves are becoming all-too-common activities (**Photos 123** and **124**). There is no evidence of best management practices (BMPs) such as erosion and sediment control measures being employed during construction. As a consequence, sediment runoff into marine waters has caused significant turbidity,

Photo 123.
Red Mangroves, located just east of Setting Point, were removed to make way for dredge-and-fill activity.

Photo 124.
A series of landfill groin structures east of Setting Point. Access necessitated clearing through the fringing Red Mangrove forest in the background.

signaling what could be a significant decline of water quality in the area.

The growing number of yachts in the calm waters west of Setting Point (**Photo 125**) is likely to cause an increase in levels of pollution. Nearshore contamination is at least partly the result of sewage and waste water discharges from boats, particularly "live-aboard" vessels. As noted in Section 7.2.1 of this Chapter, the effect of discharging untreated or inadequately treated sewage into the marine environment significantly contributes to nutrient loading (eutrophication) and is known to promote the growth of planktonic algae. This results in increased water turbidity and growth of macro-algae which compete for space with other benthic flora and fauna. The disposal of raw sewage can also lead to unacceptable levels of coliform bacteria, which can have a detrimental impact on human health.

Like most major docks in the territory, the main dock at Setting Point is serviced with electricity, water, and garbage disposal but lacks a sewage pump-out station. Actually, few docks or marinas in the territory have pump-out facilities, despite the increase in vessel activity and the large number of modern vessels sailing BVI waters equipped with holding tanks. Further complicating the issue is the lack of legal requirements for vessels to retain waste in their holding tanks or for the territory to ensure the availability of pump-out and treatment facilities. This has unfortunately encouraged boat operators, intentionally or unintentionally, to discharge vessel wastes while anchored, moored, or navigating territorial waters.

The routine discharge of vessel waste from charter vessels entering BVI waters can be viewed as one consequence of the lack of appropriate legislation. However, recently, the Government of the Virgin Islands an-

Photo 125.
The busy waters west of Setting Point are a favourite anchorage for the yachting community.

nounced its intention to put forward legislation to mandate that yachts be retrofitted with holding tanks and that necessary pump-out stations are available in the territory. The Minister for Natural Resources, Dr. The Honourable Kendrick Pickering, made the disclosure during a sitting of the House of Assembly on 24 July 2012 (http://www.bviplatinum.com/news.php?page=Article&articleID=1343148257).

7.2.3 Other Marine Pollution Issues

In addition to the island's primary community dock at Setting Point, there are a few private, small-marina docks along the southwest coastline, such as the docks servicing the Anegada Reef Hotel (**Photo 126**) and Neptune's Treasure, and others currently under construction.

The only other important marina is the Fishermen's Landing site located about 0.5 km (0.3 mi) due south of The Settlement. The site is sheltered within a Red Mangrove forest and contains a least a dozen boats, either tied to a narrow concrete pathway or anchored at large but within the mangrove lagoon. Access to the site is via a narrow concrete road that ends at the boat ramp and concrete walkway.

Photo 126.
Pictured is the small marina servicing the Anegada Reef Hotel.

The Fishermen's Landing site is in a state of neglect. Many seemingly abandoned boats were noted by profile researchers (**Photos 127** and **128**), including some exhibiting oil leakage. Trash and abandoned outboard motors are also issues impacting water quality at this location.

Photo 127.
A sunken boat along concrete dock at Fishermen's Landing. Note the Red Mangrove seedling growing through the hull, which will make boat removal more difficult.

Photo 128.
A wrecked boat within the mangrove lagoon at the Fishermen's Landing site.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE ONE **Solid Waste Management: Not A Priority Issue** Although Government has recently announced a new pilot project for solid waste management in Anegada and Jost Van Dyke, waste management has not generally been a priority for the island of Anegada.	Without a more targeted focus on improving solid waste management practices for the island of Anegada: – Dissatisfaction and complaints will continue amongst the local population, particularly about open burning at the landfill; – The risks to human and environmental health will continue; and – The ability of DWM staff to effectively carry out departmental responsibilities will be hindered.	**SHORT-TERM OPTIONS** **1.** Government needs to better prioritise its responsibilities for waste management by providing adequate resources for the Department of Waste Management. In Anegada, this would include funding for additional staff and a vehicle for personnel working on the island. **2.** The provision of signage on the island to educate and inform users of proper waste management practices would help consumers to better understand their responsibilities for keeping their island clean and healthy. **3.** Anegadians need to ensure that Government's pilot recycling programme for their island is fully implemented in a timely manner (see Section 7.1.2.6). **LONG-TERM RECOMMENDATIONS** **1.** As part of the Government's pilot project for solid waste management in Anegada, an integrated waste management plan for the island should be developed, based on "*reduce, reuse, and recycle*" management strategies. **2.** A strategy for the rehabilitation of the island's landfill disposal site should be a part of comprehensive waste management planning for Anegada. Consideration should be given to the development of a "materials recovery facility" for Anegada, focusing on receiving, separating and preparing recyclable materials for marketing to end-user manufacturers.
ISSUE TWO **Solid Waste Management: Emissions from Open Burning** Emissions from open burning at Anegada's landfill cause smoke and the release of toxins such as dioxins and furans. Methane, produced by the decomposition process, is not trapped.	Emissions from open burning cause visual and olfactory impacts. These conditions are further exacerbated with toxins such as dioxins and furans that are released through the burning process. These and other chemical compounds bio-accumulate and are linked to an increase in potential health implications such as asthma and cancer.	**SHORT-TERM OPTIONS** **1.** Procedures need to be put in place to measure the emissions from open burning at the Anegada landfill site. There is insufficient data currently available on emissions from open burning at all BVI landfill sites, including the facility on Anegada. **2.** The volume of waste materials subjected to burning at the landfill can be reduced through the design and introduction of a glass and aluminum recycling programme, which is currently a part of a new pilot project for Anegada under the DWM. **3.** The volume of organic waste subjected to burning at the landfill can be reduced through composting. The feasibility of a commercial composting system could be explored by creative entrepreneurs.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
	Methane can cause uncontrollable fires in the landfill and contributes to global warming.	**LONG-TERM RECOMMENDATION** 1. See Long-Term Recommendations under Issue One.
ISSUE THREE **Solid Waste Management: Leachate and Associated Runoff** There is no separation of hazardous waste at Anegada's landfill, and therefore it is likely that leachate will contain heavy metals (such as mercury, lead and cadmium), major ions and volatile organic compounds.	Leachate and associated runoff at Anegada's landfill have the potential to contaminate groundwater supplies. There are many gaps in available knowledge about the implications of leachate and runoff in the Virgin Islands; no data are currently available.	**SHORT-TERM OPTIONS** 1. Groundwater and soil around the landfill should be periodically tested by a designated Virgin Islands Government agency. 2. The BVI needs to develop a hazardous waste management strategy to reduce the toxins being disposed of in its landfills, including the site in Anegada. **LONG-TERM RECOMMENDATION** 1. As recommended in Issues One and Two above, the Virgin Islands needs to draft an Integrated Waste Management Plan, which is approved by Cabinet and implemented across government departments and agencies and in the private sector. The Plan needs to include a rigorous hazardous waste management strategy.
ISSUE FOUR **Solid Waste Management: Vectors and Pests** Vectors and pests such as flies, mosquitoes, cockroaches, rats and other animals are common at Anegada's disposal site and around the island's bins and dumpsters.	The presence of vectors and pests carries health risks and has potential to spread disease. Livestock can die from ingesting waste.	**SHORT-TERM OPTIONS** 1. Every effort should be made at the landfill to compact and cover waste regularly, particularly in the peak tourist months. **LONG-TERM RECOMMENDATION** 1. As part of integrated waste management planning for the island, a commercial composting system might be implemented, in conjunction with home composting education to reduce food waste that attracts vectors.
ISSUE FIVE **Solid Waste Management: Litter** Although not the problem it is in Virgin Gorda, Jost Van Dyke and Tortola, littering is common in certain areas of Anegada, *e.g.*, along the main road leading into The Settlement.	Litter is detrimental to the environment because: • It is visually unappealing and sends a message that an area is uncared for. • It decreases the possibility of returning tourists.	**SHORT-TERM OPTIONS** 1. The design of public bins on the island should be reconsidered. Current bins should eventually be replaced with tamper-proof bins. 2. DWM should explore the feasibility of providing residents with tamper-proof bins. 3. The procurement of a DWM vehicle for the island would help to ensure that garbage bags are collected in a timely manner and not left for cattle and other animals to rip open and scatter waste and debris.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
Illegal dumping is not common but is not unknown and may be on the increase.	• It can block drains and contribute to flooding. • It can kill marine and bird life through strangulation and ingestion.	**4.** The community should support efforts by the Department of Solid Waste to implement waste education strategies, including periodic cleanups and "adopt a spot" campaigns to engage local businesses. **LONG-TERM RECOMMENDATION** **1.** As part of integrated waste management planning for Anegada, educational programmes need to be included, focusing on recycling, home compositing, the litter law, beautification campaigns, and the like.
ISSUE SIX **Pollution Risks: Domestic Sewage and Liquid Waste** Anegada's coastal waters require more protection from land-based sources of pollution. Domestic sewage and liquid waste from households and small commercial units are becoming an increasing threat to coastal water quality, especially as septic systems are aging, dysfunctional and/or improperly maintained. The proper disposal of sewage and liquid waste becomes critical in a tourism-based economy, not only for local public health, but also to preserve a high-quality marine environment that attracts tourists and visitors.	Effluent seepage from household and commercial septic systems will likely cause deteriorating coastal water quality that eventually will impoverish marine biodiversity.	**SHORT-TERM OPTIONS** **1.** Appropriate government agencies with Anegada community groups should undertake public consultations with household residents and commercial outlets to raise awareness about the negative impacts of improperly maintained septic systems. An education programme on topics demonstrating how individual action can make a difference would help increase public understanding of pollution issues, such as septic system design and use, sludge removal and disposal. The Environmental Health Division of the Ministry of Health and Social Development can provide septic tank design options better suited at filtering effluent than older models. **2.** Relevant government agencies will need to develop a process to identify households within critical coastal areas that have aging or malfunctioning septic systems prone to seepage and accidental discharge. Eventually, as the population grows and development expands, the Government will need to identify sludge disposal areas for Anegada. **3.** As Government identifies sludge disposal areas on Anegada, it also needs to encourage the public to use these sites, instead of *ad hoc* disposal around the island. **LONG-TERM RECOMMENDATIONS** **1.** Government should develop guidelines on the proper construction of septic systems and drainage fields and enact regulations for regular inspection. This step should be part of a broader initiative by Government to modernise public health legislation with standards for water quality, pollution control, and waste management.

<table>
<tr><th>Issues, Conflicts, and Areas of Concern</th><th>Impacts of No Action/No Change</th><th>Short-term Options Long-term Recommendations</th></tr>
<tr><td></td><td></td><td>2. As part of this effort, the Department of Town and Country Planning might provide guidelines for ecologically sensitive sewage disposal systems, designed for specific locations based on topography, soil type, soil thickness, and drainage conditions.</td></tr>
<tr><td>ISSUE SEVEN

Pollution Risks:
Pollution Associated with Marine Activity

Anegada has one primary public dock at Setting Point with a growing number of private docks, most of which are concentrated in adjacent bays.

The increase in ferry traffic and charter vessel activity in the Setting Point area has contributed to deteriorating water quality through increased turbidity and disposal of vessel waste in local waters.

The issue is exacerbated because charter vessels entering BVI waters are not required to be equipped with holding tanks for wastes.</td><td>Water quality at Setting point and its adjacent bays will continue to deteriorate due to an increase in vessel anchoring activity, in combination with generally poor flushing capacity especially where anchorage sites are currently located.</td><td>SHORT-TERM OPTIONS

1. Marine industry-funded efforts in collaboration with the BVI Government—such as the BVI Marine Awareness Guides (Gore, 2008, 2011)—have been useful tools in educating visiting boaters and local operators about practices that minimise marine pollution. Such efforts need to be encouraged on a consistent basis by both the private and public sectors.

2. Collaboration between the marine industry and the BVI Tourist Board also needs to be encouraged and strengthened, particularly as each sector is desirous of promoting environmentally friendly attitudes and practices by visiting and local marine resource users.

LONG-TERM RECOMMENDATION

1. In the long term, the BVI needs a major overhaul of its legal framework regulating environmental pollution in the territory. Without this, it will be difficult to effectively move forward to implement a number of other action items required in the near term, such as:

– A comprehensive water quality monitoring protocol for the coastal waters of the BVI needs to be developed and formally approved. Implementation of a water quality monitoring programme for Anegada should focus on priority areas such as the coastal waters at Setting Point and its adjacent bays.

– BVI public policy needs to aggressively discourage the discharge of liquid and solid wastes in nearshore environments and critical marine habitats, including those of Anegada.</td></tr>
</table>

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE EIGHT **Pollution Risks: Coastal Sedimentation** Water quality degradation from sediment runoff associated with coastal development, such as residential and commercial land clearing, is a growing concern for Anegada, particularly in areas around Setting Point. The problem will continue to increase if environmental guidelines and BMPs are not identified and implemented.	Coastal development projects—even for residential construction—tend to leave soils unprotected, which can result in large quantities of sediments washing into coastal waters. Eventually, this contributes to deteriorating water quality and impoverishment of marine ecosystems.	**SHORT-TERM OPTIONS** **1.** The BVI Government needs to adopt erosion and sediment control guidelines that best fit the scale and type of development as well as the natural environment and terrain of each earth-moving activity. Guidance can be drawn from existing documentation already in use in the USVI (UVI, 2002, a/b), and as recommended by UNEP for the insular Caribbean (Anderson, 1994). **2.** An erosion-control handbook is currently being developed by the DCF in cooperation with The Nature Conservancy. The manual will provide BMPs for reducing erosion in the BVI. As it becomes available, the DCF should create an extensive public awareness and education programme for individual land holders, the construction industry, developers, and others, focusing on the detrimental impacts of improper land clearing and construction and encouraging the broader application of BMPs for new construction. **LONG-TERM RECOMMENDATIONS** **1.** The DTCP should require that erosion and sediment control BMPs are addressed in all EIAs that include land clearing (including Government projects). Small-scale construction activities near sensitive areas—such as coastal and wetland areas—also need to include sediment control practices in their construction plans, something that unfortunately has not occurred for many development activities occurring in the area of Setting Point in Anegada. **2.** Additionally, the DTCP should require and enforce the application of erosion and sediment control measures in the environmental monitoring and compliance process for future development in Anegada, particularly for mid-to-large scale development projects.

8. PROTECTED AREAS AND RESOURCE CONSERVATION

The linkages between development and resource conservation are not as obvious on Anegada as on the larger islands of the British Virgin Islands, due primarily to lower population densities and less emphasis on the environment as the basis for the local economy. Conservation and protected area management strategies and interventions reflect this perception of low levels of resource use.

For example, the only internationally-designated protected area in the British Virgin Islands is the Western Ponds of Anegada, a Ramsar Site;* (the Eastern Ponds have been proposed as a Ramsar site). There is no active management of either site, and no management plan. However, increased interest in development activities for Anegada since 2007 has renewed focus on protected areas and resource conservation programming for the island, triggered in part by consultations related to development of the BVI Protected Areas System Plan.

8.1 Management Framework for BVI Protected Areas

The globally-accepted definition of a protected area is:

> *A clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values* (Dudley, 2008).+

The National Parks Act (2006) defines protected area as "*a park or other protected area established under this Act*."

Protected areas in the British Virgin Islands were earlier declared under:

- the Protection of Trees and Conservation of Soil and Water Ordinance (1954),
- the Wild Birds Protection Ordinance (1959),
- the National Parks Ordinance (1961),
- the Marine Parks and the Protected Areas Ordinance (1979), and
- the Fisheries Act (1997).

The National Parks Ordinance (1961) also contained provisions for the establishment of the National Parks Trust (NPT). The National Parks Ordinance and the Marine Parks and the Protected Areas Ordinance were repealed and replaced by the National Parks Act (2006). These laws provide the basis for the establishment of 13 categories of protected areas in the BVI (**Table 19**). Environmental protection areas can also be established under the Physical Planning Act (2004). This legal framework falls within the management purview of several agencies and ministries as detailed in Chapter 2, Section 2.2.3.

The National Parks Act (2006) also mandated the preparation of a protected areas system plan. Pursuant to this requirement, the British Virgin Islands Protected Areas System Plan 2007-2017 was approved by Government in 2008. It provides the policy framework for the development and management of protected areas in the BVI. The System Plan provides:

- A statement of the goals for the system of protected areas;
- An articulation of the institutional arrangements to be established for protected areas management;
- An articulation of the support systems needed for system development and management during the 10-year period;
- A clear statement of priorities in protected areas management for the 10-year period; and

* A Ramsar Site is a protected area designated under the Convention on Wetlands of International Importance especially as Waterfowl Habitat. The convention is commonly referred to as the Ramsar Convention.

\+ The British Virgin Islands Protected Areas System Plan 2007-2017 contains the earlier definition of a protected area as published by IUCN in 1994.

Table 19.
Categories of protected areas in the British Virgin Islands.

Legal Instrument	Category of Protected Area	IUCN Equivalent
National Parks Act, 2006	Strict Nature Reserve	Category Ia: Strict Nature Reserve
	Wilderness Area	Category Ib: Wilderness Area
	National Park	Category II: National Park
	Natural Monument	Category III: Natural Monument or Feature
	Habitat or Species Management Area	Category IV: Habitat/Species Management Area
	Protected Landscape or Seascape	Category V: Protected Landscape/Seascape
	Managed Resource Area	Category VI: Protected Area with sustainable use of natural resources
	Urban Park	none
	Historic Site	none
Fisheries Act, 1997	Fisheries Protected Area	Category IV: Habitat/Species Management Area
Wild Birds Protection Ordinance, 1959	Bird Sanctuary	Category IV: Habitat/Species Management Area
Protection of Trees and Conservation of Soil and Water Ordinance, 1954	Forest Reserve	Category IV: Habitat/Species Management Area
	Water Area	Category VI: Protected Area with sustainable use of natural resources

Source: Adapted from Gardner, *et al*., 2008.

- A process for evaluating progress in protected areas system development over the first five (5) years.

The overall goal for the Protected Areas System Plan for the period 2007-2017 is "to *manage important natural and historical resources in ways that will contribute to an improvement of the quality of life of BVI residents*."

The associated specific objectives are to:

(a) Maintain vital natural areas that are:

i. Important to the productivity of commercial species and other valuable wildlife;

ii. Essential to the protection of endangered species, such as turtles, and to the life patterns of other critical species, such as seabirds; and

iii. Important to retaining representativeness and diversity of the Territory's natural heritage.

(b) Maintain areas that are physiographically, geologically or otherwise aesthetically unique as sources of attraction, recreation, education and research.

(c) Maintain and utilise historical resources, such as wrecks, for recreation and study.

(d) Maintain, where possible, economic uses such as fishing and tourism under the guidance of proper resource management.

(e) Provide for the continued growth of economic and recreational opportunities in a manner that can be sustained by available resources.

(f) Encourage public understanding and enjoyment of the resources contained within protected areas.

8.2 Existing Protected Areas on Anegada

There are two existing protected areas on Anegada (**Table 20** and **Figures 22** and **23**), comprising one fisheries protected area (under the jurisdiction of the Department of Conservation and Fisheries) and one Ramsar Sites (technically under the jurisdiction of the DCF, although the National Parks Trust functions *de facto* as the lead management agency). Flamingo Pond, designated in 1977 as a bird sanctuary, is contained within the Western Ponds Ramsar Site.

8.2.1 Overview of Protected Areas on Anegada

The Western Ponds (**Figure 23**) is a series of interconnected shallow brackish ponds, connected to the sea by one small channel (**Photo 129**). The site was designated in 1999 as a Ramsar Site (**Photo 130**), and the Ramsar Information Sheet (1999) describes the site as the largest wetland in the British Virgin Islands, providing habitat for six endangered species of flora and fauna of global significance, providing recreational opportunities, and supporting a fishery for a local delicacy.

The Eastern Ponds (**Figure 23**)—a proposed Ramsar Site and proposed for inclusion in the BVI's system of protected areas—contain extensive mangrove stands, which the 2004 Ramsar Information Sheet describes as unaltered. In addition to the habitat function of the wetland, it is said to stabilise the shoreline from storm events.

The Horseshoe Reef is part of an extensive reef system that surrounds the entire island of Anegada. The reef system is generally shallow, with most areas less than 10 metres (33 feet) deep. The largest area extends along the south-eastern side of the island, and is designated as the Horseshoe Reef Fisheries Protected Area.

The Horseshoe Reef functions as a habitat for approximately 185 species of reef fish and 30 species of coral, and the protected area was designated primarily to support fisheries management efforts. However, the protected area is also said to "… *play a critical role in shoreline stabilization and coastal protection for the entire island of Anegada, with particular reference to flood control from Atlantic storm swells during the hurricane season*" (Ramsar Information Sheet, 2004).

8.2.1.1 Status of the Resources

Detailed information on the status of the natural resources in the protected areas is generally lacking. Resource conservation interventions on Anegada have focused primarily on conservation of the Anegada Iguana (*Cyclura pinguis*) and monitoring of the Greater Flamingo (*Phoenicopterus ruber*).

In 2001 the National Parks Trust undertook a protected areas management planning workshop for Anegada (National Parks Trust, 2001b), resulting in a decision to continue the Darwin Initiative's 1998-2001 BVI conservation project and to place conservation efforts within the overall context of a biodiversity conservation strategy for Anegada (National Parks Trust, 2001a). The ensuing 2003-2006 Darwin Initiative Project focused exclusively on Anegada's biodiversity. This project carried out a biodiversity inventory for Anegada and resulted in the preparation of an action plan for the island's coastal biodiversity (McGowan, *et al*., 2006).

Table 20.
Existing and proposed protected areas of Anegada.

Name of Site	Date Declared	Category	Size ha. (acres)	Management Institution
Existing Protected Areas				
Western Ponds	1999	Ramsar Site €	1,071 (2,645.4)	National Parks Trust
Horseshoe Reef	2003⊛	Fisheries Protected Area	29,545.5 (79,772.9)	Conservation and Fisheries Department
Proposed Protected Areas				
Western Ponds (also a Ramsar Site)	N/A	Protected Landscape/Seascape	1,071 (2,645.4)	National Parks Trust
Eastern Ponds	N/A	Ramsar Site and National Park	463.7 (1,145.3)	National Parks Trust
Bones Bight to Loblolly	N/A	Protected Landscape/Seascape	N/A	National Parks Trust
Ruffling to Pomato Point	N/A	Protected Landscape/Seascape	N/A	National Parks Trust
Anegada Southwest	N/A	Strict Nature Reserve	N/A	National Parks Trust

€ Flamingo Pond, one of the seven "main" bodies of open water known collectively as the Western Ponds, was designated as a Bird Sanctuary in 1977. Bird Sanctuary (Flamingo Pond, Anegada) Order (SRO 24/1977).

⊛ The Virgin Islands Court of Appeal, in the case of Quorum Island (BVI) Limited vs. the Virgin Islands Environmental Council and the Minister of Planning (HCVAP2009/021), found that protected areas declared under the Fisheries Regulations 2003 were not validly declared, as the correct section of the Fisheries Act was not used as the authority for the Regulations. The Fisheries Regulations 2003 are currently being revised to ensure the validity of declaration of the Fisheries Protected Areas.

Source: Updated from Gardner, *et al*., 2008.

Spearheaded by ongoing research to protect habitat for the Anegada Iguana (see Chapter 4, Box 2), the NPT has proposed to establish a national park on the northern coast of the island (also included in the 2007 Anegada Land Allocation Proposal). Whilst the iguanas serve as a flagship species, the definition of this proposed protected area is also based on an overlay of plant diversity within the dune and pond systems (*pers. comm*., Nancy Woodfield Pascoe, NPT, 9 April 2013).

Although some species have been rated using IUCN Red List criteria (www.kew.org/science/directory/projects/annex/BVIStatusReport.pdf) and a vegetation map now exists showing vegetation communities (Chapter 4, Figure 19), there is no documented information available on the status of specific species in the existing or proposed protected areas (*e.g*., location, density/population, condition, threat, productivity/reproduction, etc.), despite the existence of threats from natural and anthropogenic sources.

8.2.1.2 Resource Use and Demand

There are no data on the pattern and intensity of use of the protected areas on Anegada. The information in the literature is based on very limited consultations, similar to the anecdotal information compiled during consultations on Anegada (15-19 October 2012) for this chapter of the Environmental Profile.

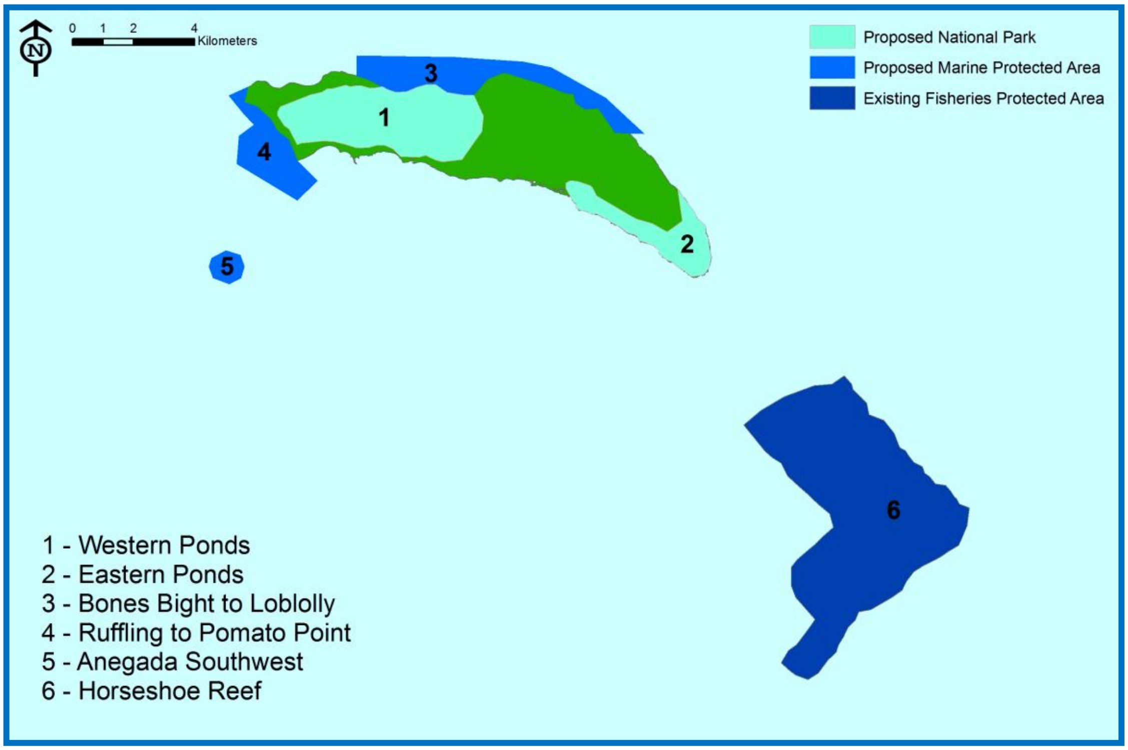


Figure 22.
Protected areas of Anegada, existing and proposed.

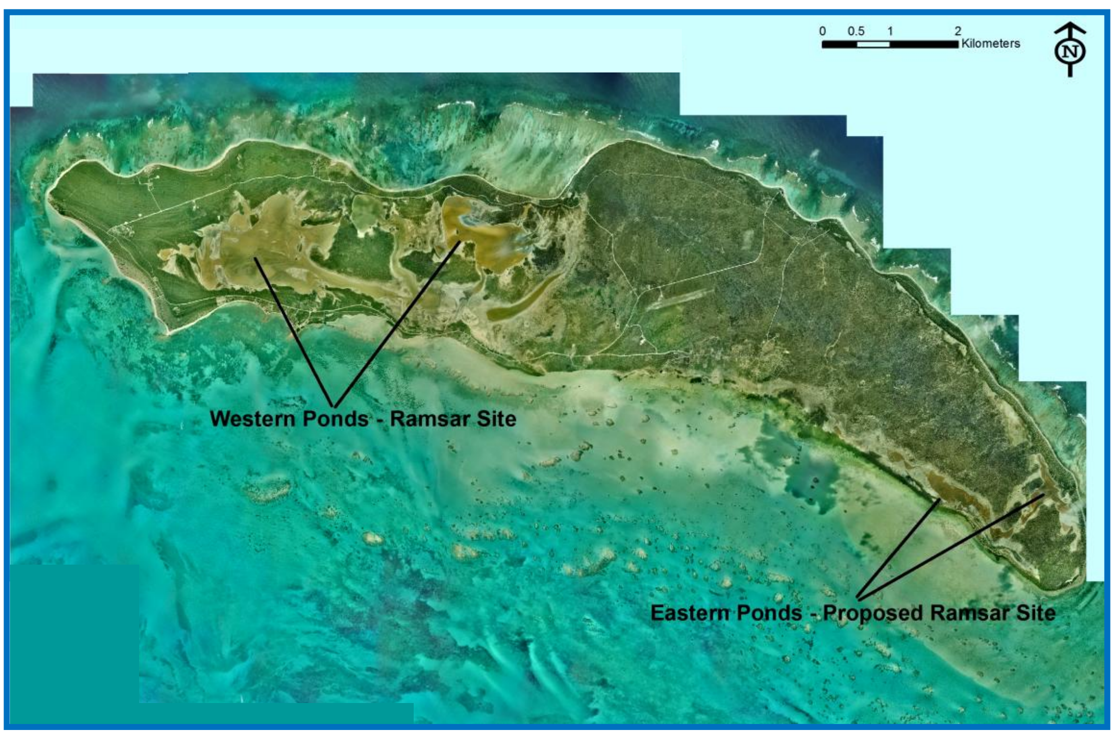


Figure 23.
Anegada's Ramsar Sites, existing and proposed.

Photo 129.
Channel connecting the Western Ponds to the sea.

Photo 130.
Sign marking the Western Ponds Ramsar Site.

Existing and proposed protected areas on Anegada are used in the following ways:

(1) Recreation — Recreational activities are mainly organised around the use of beaches, and users include swimmers, beachcombers, and snorkelers. Loblolly Bay is a major area for snorkeling, with snorkelers leaving from the beach. Usually there is no guide and therefore no orientation for visitors. As a result, snorkelers do not use the best pathways, and often try to climb over the reefs, resulting in damage to corals. Impact from snorkeling, exacerbated by the ongoing events of coral bleaching, has resulted in a steady decline in coral coverage and damage to the reef system in the area. Due to a moratorium on scuba diving on the Horseshoe Reef, the current demand for scuba diving is said to be relatively low, and impact from this activity has decreased in recent years.

Recreational use of the ponds is minimal, primarily due to the relative isolation of the Eastern Ponds and the restrictions against some recreational uses within the Western Ponds (**Photo 131**).

Photo 131.
Sign listing prohibited activities at the Western Ponds Ramsar Site.

(2) Harvesting of Trees — White and Buttonwood mangroves are used for making fish pots, while Torchwood is used as fuel wood for barbeque grills. The anecdotal information does not provide any indication of the scale of the harvesting activities, nor the quantity of wood products generated.

(3) Fishing — Fishing is both artisanal and commercial, and includes the use of fish pots (lobster and finfish), diving (lobster and conch), and long-lining. There is extensive fishing within the Horseshoe Reef Fisheries Protected Area, with the heaviest concentration of traps placed within the area known as Whitehorse Shoal. Fish caught in the waters surrounding Anegada is sold to residents and restaurants on Anegada and sister islands.

Curry-mole (also spelt currimole and curemal) mullet is harvested from the Western Ponds by a few persons during the period November-December, which forms part of the spawning season for the fish. The fish is a local delicacy, and weighs an average of 2-3 pounds when fully grown.

Sportsfishing (catch and release targeting bonefish) is a seasonal activity, with only two operators based on Anegada. Bait (for fishing) is collected from the ponds, though the extent of the practice is unknown (see also Chapter 5, Section 5.2.1).

(4) Research — Researchers have periodically conducted studies of the flora and fauna surrounding the ponds, often in partnership with the NPT, such as the Darwin Initiative projects dating back to 1989, studies of the Anegada Rock Iguana (see Chapter 4, Box 2), and periodic bird counts on the island including participation in the Audubon Society's Christmas bird count.

Threats to protected areas on Anegada include the following:

(a) Development Activity — Clearing of land for residential development in close proximity to the Western Ponds has always been a cause of concern. The 2007 initiative to allocate large acreages for residential development (see Chapter 2, Section 2.1.2 and Section 2.2.6.3) has resulted in an increase in the incidence of land clearing in close proximity to the Western Ponds. The establishment of access ways (**Photo 132**) and additional social infrastructure (**Photo 133**) is indicative of the planned residential developments. This includes clearing of lands within the actual boundary of the protected area. Current and future impacts identified by residents include loss of orchids and other endemic floral species, and the potential impact of sewage effluent on the ecological integrity of the Western Ponds.

(b) Overfishing and Poor Fishing Practices — Fishing activities during the peak tourism season creates seasonal depletion of nearshore fisheries resources (see also Chapter 5, Section 5.2). The curry-mole (currimole or curemal) is also said to be overfished. While harvesting of this fish species is not widespread, the population is very small.

Photo 132.
Land cleared for subdivision road in an area in close proximity to the Western Ponds.

Part of the problem is that the fish is usually harvested during the spawning season. There is an annual closed season for the curry-mole from June to July. The closed season is said to be at the wrong time of year, as the fish is usually caught in November and December, during its migration and spawning aggregation.

Other adverse impacts from fishing activities include:

i. use of mono-filament net for fishing in the Western Ponds and off some beaches;

ii. damage to coral reefs and other benthic communities from fish pots and pot strings;

iii. damage to coral reefs from boat anchors; and

iv. increasing use of spear guns for hunting lobsters and finfish.

Residents indicate that the fishing laws are adequate to address current problems, but the laws are not being enforced.

Photo 133.
Fire hydrant in area near to the Western Ponds.

(c) Scuba Diving — Scuba diving on Anegada is said to be a low-key activity, due mainly to the unpredictability of surf and wave conditions. However, the damage from boat anchors and divers was enough for the Conservation and Fisheries Department to place a moratorium on diving within the Horseshoe Reef Fisheries Protected Area.

(d) Harvesting of Trees — No information is available on the extent and impact of harvesting of mangroves and Torchwood, except that removal of the Torchwood is resulting in loss of wild orchids.

(e) Grazing by Free-roaming Animals — Free-roaming goats, cattle, sheep, and donkeys are said to present a problem, causing damage to crops and vegetation, and being a general nuisance and traffic hazard. Some respondents to the October 2012 community survey opined that the populations of these animals were becoming larger. However, a number of respondents saw the free-roaming animals as part of Anegada's culture, and were willing to accommodate the "slight nuisance" caused by such animals.

(f) Solid Waste Disposal — Solid waste disposal on Anegada is said to be problematic due, in part, to the high water table (see Chapter 7, Section 7.1.3.2). The disposal of waste by open burning attracts feral cats, a primary predator for juvenile iguanas. There is no information on inappropriate disposal practices in the protected areas or other ecosystems, although evidence of solid waste and debris disposal in the Western Ponds was found during a site visit in October 2012 (**Photo 134**).

Photo 134.
Solid waste deposited along the edge of the Western Ponds.

8.2.2 Management of Protected Areas on Anegada

Protected areas in the British Virgin Islands are managed by three different institutions, with several other public and civil society institutions playing supporting roles (Gardner, *et al*., 2008). However, there is no active management of protected areas on Anegada. Management interventions by the National Parks Trust and the Department of Conservation and Fisheries are focused primarily on biodiversity conservation, primarily conservation of the Anegada Iguana (*Cyclura pinguis*) and the Greater Flamingo (*Phoenicopterus ruber*).

During the period 2004-2006, an assessment of potential marine conservation sites was undertaken as part of an Overseas Territories Environment Programme (OTEP) study titled "Assessment and Improved Management of New and Existing Marine Protected Areas (MPAs) in the British Virgin Islands". On Anegada, the assessment focused on the Horseshoe Reef and adjacent areas. Based on that assessment, additional areas were proposed as protected areas (**Table 20** and **Figure 22**).

During 2012, the British Virgin Islands initiated work on the project "Management of Protected Areas to Support Sustainable Economies," funded by the European Union. Information provided by the National Parks Trust states that the "… *purpose of the project is to implement integrated plans for conservation management and sustainable use of protected areas and their surroundings* …." The project is based on the following activity areas:

(a) Establish facilities for conducting ecologically sustainable visitor tours, with trained staff, to generate self-sustaining income.

(b) Provide and implement use of environmental educational and public awareness materials, to involve local people and influence decision makers and developers.

(c) Implement conservation measures to provide increased protection for key vulnerable ecosystems, centering on globally threatened tropical dry forest but linking with the particular features of the territory, and related to visitor facilities and educational and public awareness materials.

(d) Further develop management plans and undertake supporting research for key protected and/or vulnerable areas to address:

- species recovery issues,
- maintenance of biodiversity,
- control of human-introduced exotic/invasive species,
- habitat restoration, and
- management of visitors.

(e) Sharing of expertise and training between the three territories funded by the EU,* to enable efficient and cost-effective implementation of desired outcomes in each territory, integrated with management of the project.

Specific activities to be undertaken on Anegada are:

- Construction of a visitor centre/office for the Anegada Rock Iguana Head-start Facility.
- Production of interpretation materials (signage, brochures etc).
- Updating the draft Species Recovery Plan for the Anegada Iguana (*Cyclura pinguis*).

In addition to the sites identified as proposed protected areas in the BVI Protected Areas System Plan, a number of potential protected areas have been identified by Anegadians based on the perceived ecological or historical value of each site (**Table 21**). These sites were identified by residents during the October 2012 community survey carried out for preparation of the *Anegada Environmental Profile*.

* The three UK territories are the British Virgin Islands, the Cayman Islands, and the Turks and Caicos Islands.

Table 21.
Community perceptions of outstanding features on Anegada needing special protection.

Feature/Location	Rationale for Protection
Western Ponds Ramsar Site	Protection of fragile ecological resources, including the curry-mole (other spellings for the fish are currimole and curemal). The site is perceived to be moderately disturbed, and further disturbance should be prevented.
Eastern Ponds	Pristine area, offering potential for expansion of eco-tourism.
Sand dunes	Necessary for reducing coastal vulnerability, but are being mined.
Coral reefs	Necessary for protection of marine species, particularly those species that support livelihoods.
Remains of slave house, behind the Administration Complex	Historical value. *
East End Indian Reservation	Historical value. *
Old Indian burial ground	Historical value. *
Indian conch shell mounds	Historical value.
Crazy House	Historical value. *
The Old Wall	Cultural significance. All the old walls should be preserved because of their cultural significance, particularly the walls in close proximity to the Administration Complex.
All wells and watering holes	Fresh water supply. Originally used for potable water, and still being used for agriculture.
Keel Point	No rationale provided. Area is deemed to be moderately disturbed.
Cow Wreck	No rationale provided. Area is deemed to be moderately disturbed.

Source: Compiled from October 2012 Anegada community survey questionnaires.

* These sites, identified by community members, have not been confirmed by Dr. Michael D. Kent, historian to the Environmental Profile Programme. Regarding the Indian sites, Dr. Kent reports that the general consensus in available documentation is that Anegada was only visited, rather than settled, by Indians. Any Indian sites close to the Conch Middens may have been camp sites (see Chapter 6, Section 6.3).

8.3 Protected Areas and Development Planning for Anegada

8.3.1 The Development Planning Process

The Government of the BVI prepared a National Integrated Development Plan (NIDP) in 1999, the purpose of which was "*… to establish the broad strategies, policies, and the implementation framework to promote integrated development*" (Development Planning Unit, 1999, page 4).

That plan was not formally adopted as the national development plan for the BVI. However, each ministry and department was responsible for translating the development goals identified in the plan to sector development strategies and plans (*per. comm*., interview with Raymond Phillips, Director of Development Planning Unit on 7 December 2011).

One of the objectives of the NIDP was to ensure greater integration between land use/land development, overall physical development (*e.g.*, social infrastructure and transportation), and economic planning. The National Physical Development Plan (2006) sets the overall framework for land use planning and development control, but there is inadequate correlation with overall development planning (*per. comm*., interviews with Ronald Beard, Deputy Director, Town and Country Planning Department, and Raymond Phillips, Director, Development Planning Unit, November-December 2011).

8.3.1.1 Development Planning for Anegada

A previous development plan for Anegada was prepared in 1993, and has since then been superseded by:

- The National Physical Development Plan (2006) — This plan provides the framework for the preparation of area development plans, which in turn guides the development control process.
- The Land Allocation Proposal (2007) — This plan seeks to finalise the outstanding land claims by Anegadians, while also allocating lands for commercial, resort, and industrial uses, as well as social infrastructure (**Figure 24**).
- The Setting Point Action Plan (2009) — This plan was meant to rationalise land use around Setting Point, improve the port facilities, and use the area as an active corridor to the remainder of the island (**Figure 25**). The Setting Point Action Plan seeks to complement the 2007 Land Allocation Plan.

The 2007 Land Allocation Plan (see also Chapter 2, Section 2.1.2 and Section 2.2.6.3) was primarily prepared to settle claims to public lands on Anegada. This plan also recognised that: "*The allocation & distribution of building sites on Anegada has continued to pose difficulties in Planning due to the existing haphazard development approach,*" and sought to rationalise land use accordingly. The following land use categories were proposed:

- Conservation and preservation areas.
- Land for future airport expansion.
- Land for infrastructure improvements – roads, utilities, portable water, electricity, waste management.
- Commercial use.
- Institutional use – churches, schools, community centres, etc.
- Community and recreational areas.
- Industrial areas.

During profile project consultations with Anegadians (15-19 October 2012), residents indicated that the Land Allocation Plan was experiencing setbacks, but that the subdivision component of the plan (with three designated subdivisions: East End, West End, North Airport) is being implemented.

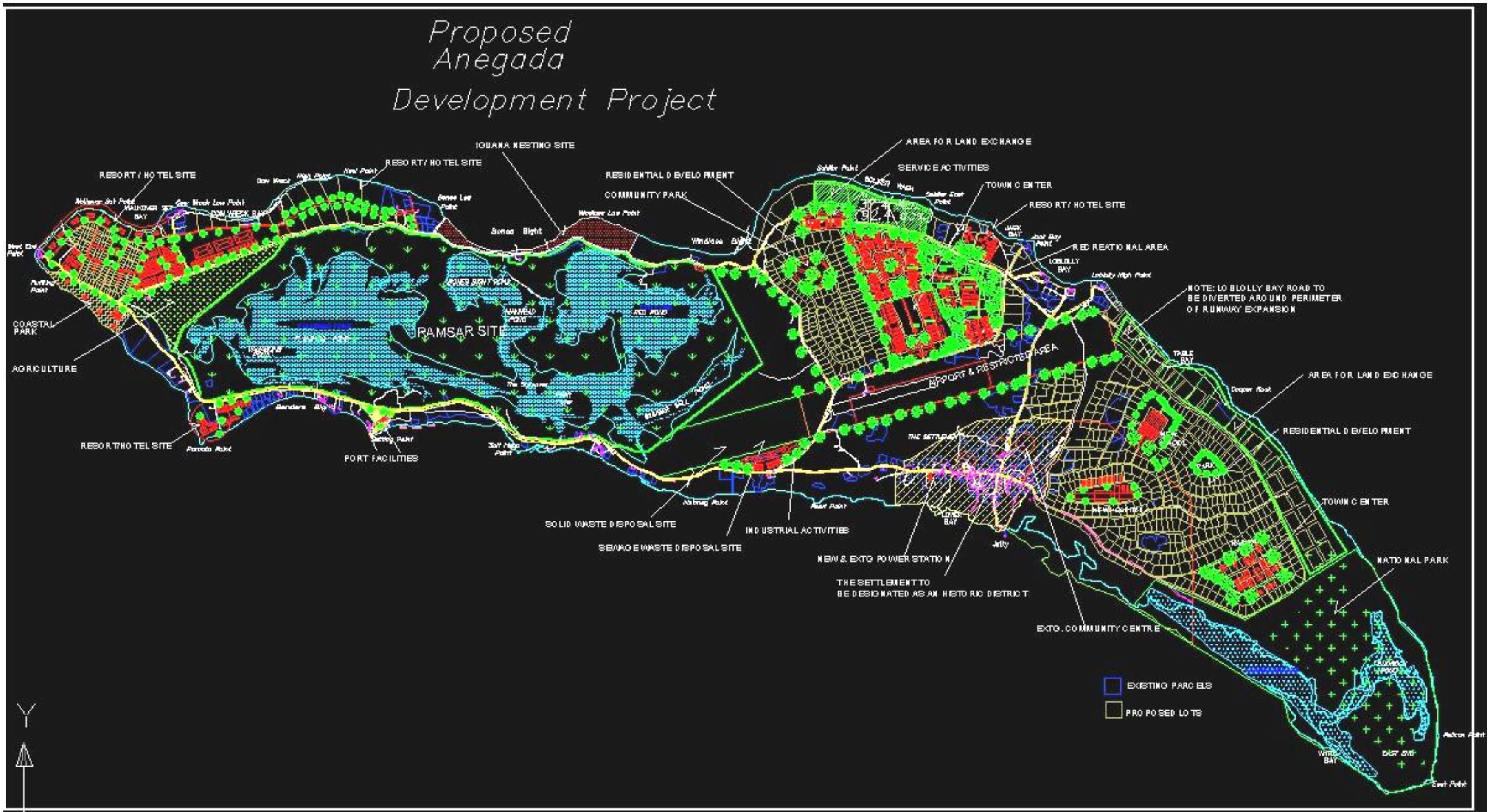


Figure 24.
Land Allocation Plan for Anegada, 2007 (MN&L, 2007).

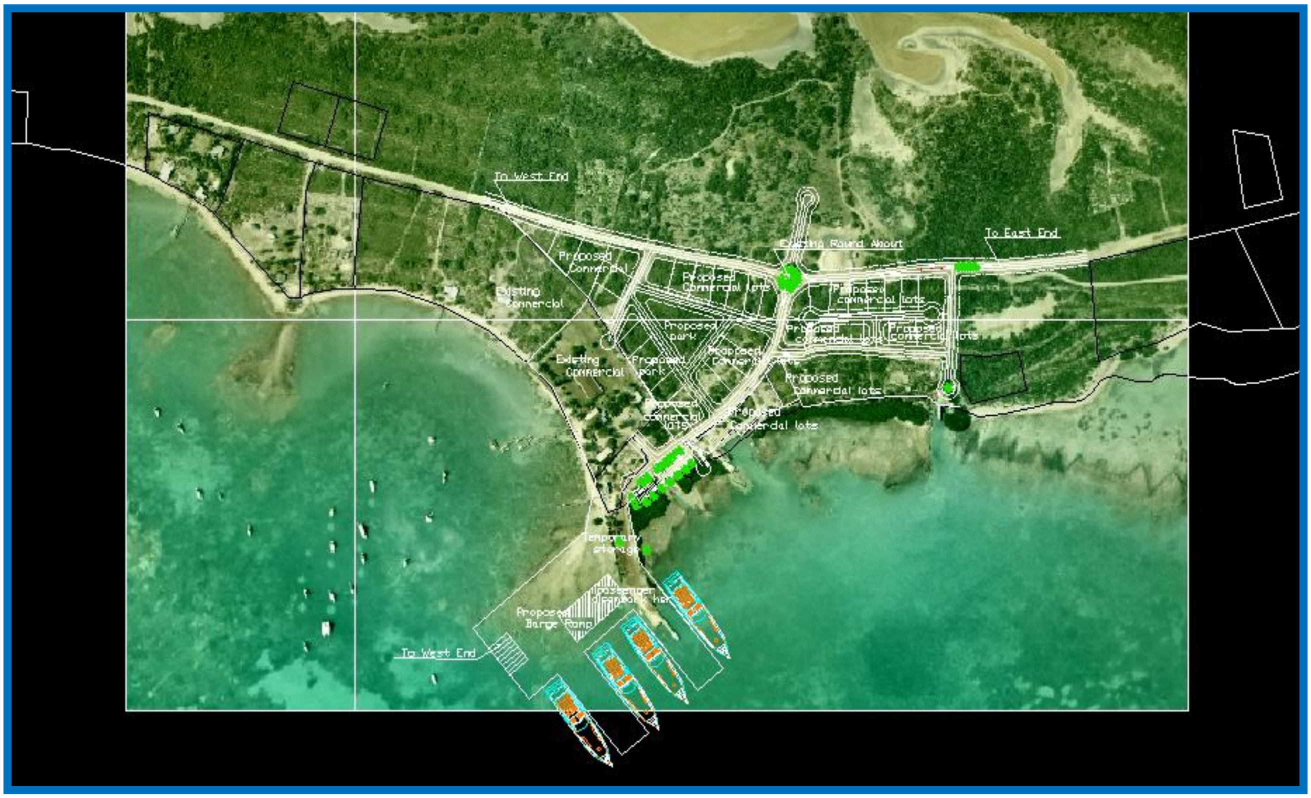


Figure 25.
Proposed layout for the Setting Point Project, Anegada (source: DTCP, 2009).

Environmental planning is integrated into the physical planning process in three basic ways:

(1) Designation of conservation areas by the Department of Conservation and Fisheries and the National Parks Trust, which are then incorporated into land use and development plans;

(2) Requiring environmental impact assessments for selected types of developments; and

(3) Instituting design and planning guidelines to maintain amenity values and reduce environmental problems.

However, residents of Anegada note that development and land management practices routinely ignore planning and environmental management guidelines.

Issues of concern on Anegada regarding the environment and development planning include:

(a) The continuing clearance of land up to the boundaries of protected areas, with increasing occurrences of residential construction within the boundary of the Western Ponds Ramsar Site. The 2007 Land Allocation Plan is increasing residential density adjacent to protected areas, which should increase the urgency for focused protected area planning.

(b) The two new subdivisions will significantly increase loss of vegetative buffers for the protected areas. Additionally, adverse impacts on the wetlands are likely from disposal of sewage effluent and solid waste.

(c) More rigorous environmental analysis is needed in the planning and development control processes applied to Anegada, particularly with reference to environmental sensitivity and site vulnerability. The damage already visible to coastal resources and developments indicates that there is not enough correlation between protecting environmentally sensitive areas and development activities, and not enough project vulnerability assessment.

(d) There are a number of factors that hinder the design and implementation of development plans and projects. Most such factors (*e.g.*, the land title claims, unique to Anegada) are socio-political in nature, hampering not only development planning, but also making it difficult for the community to agree on major issues.

Information gathered during the consultations and community survey conducted in October 2012 for the *Anegada Environmental Profile* indicates that Anegadians want increased development opportunities, but with the proviso that such development will not result in any "significant" change in the character of the island.

Achieving consensus on:

- ***an acceptable ambience for the island,***
- ***types and densities of development,***
- ***acceptable levels and nature of change, and***
- ***which environmental resources are to be protected,***

may be a good starting point for the next step in preparing a development plan for Anegada.

8.3.2 Environmental Management Framework

The environmental management framework for the British Virgin Islands consists of a number of agencies administering a number of laws and programmes (Chapter 2). The 2004 draft National Environmental Action Plan (NEAP) recommended that the institutional framework be reformed, a process that was initiated in 2008 but has not been completed to date.

Environmental management on Anegada is undertaken collaboratively by the National Parks Trust and the Department of Conservation and Fisheries. There is no conservation strategy, and environmental initiatives have traditionally focused on wildlife conservation, particularly the Anegada Iguana (*Cyclura pinguis*) and the Greater Flamingo (*Phoenicopterus ruber*). In 2001, the National Parks Trust drafted a biodiversity conservation strategy for Anegada, which led to the 2003-2006 Darwin Initiative assessment of Anegada's coastal biodiversity. That project produced a Biodiversity Action Plan for the island (McGowan, *et al*., 2006), which calls for the following specific conservation actions:

(a) A protected area network is established that has sufficient representation of key habitats and species.

(b) Land is zoned for appropriate uses, ensuring that critical habitats are protected.

(c) A healthy population of endemic plants is maintained.

(d) Habitat (nesting/feeding areas) for iguanas and turtles is secured.

(e) Populations of iguanas, birds and other species threatened by predation are increased.

(f) Natural resources are sustainably managed.

(g) Impacts of global climate change are monitored and areas of resilience (*e.g.*, adaptability to coral reef bleaching) are identified.

In attempting to implement the biodiversity strategy, the two agencies proposed that an area northeast of the Western Ponds be designated a protected area in order to protect critical habitat for the Anegada Iguana.

The "Management of Protected Areas to Support Sustainable Economies" project initiated in 2012 includes activities focusing on management planning and sustainable use of protected areas (Section 8.2.2). However, the specific activities for

Anegada under the project focus on the Anegada Iguana.

There is no stated intention to prepare a comprehensive environmental management strategy for Anegada, despite an acknowledgement of the need for such a strategy. The protected areas management planning workshop held by the National Parks Trust in January 2001 (National Parks Trust, 2001b) evaluated six aspects of protected areas management, including social and economic aspects. An analysis of the strengths, weaknesses, opportunities, and threats for protected areas management was also carried out. The proposed actions identified by the workshop addressed biological, socio-economic, and sustainable use imperatives, clearly indicating that environmental management on Anegada needed to encompass much more than wildlife conservation.

That sentiment still prevails on Anegada. Residents that participated in the October 2012 community survey were asked to identify and rank the environmental issues of most concern to them. Based on the number of respondents and the rankings, the issues of greatest concern, selected from those enumerated on the Anegada Community Questionnaire, are: (see also Table 24 in Chapter 9):

- The need to expand environmental education in the Anegada Primary School and within the larger Anegada community.
- Uncertainty about land ownership.
- The need for improved solid waste disposal practices and procedures.
- The need for better enforcement of environmental policies and regulations.
- The absence of an approved development plan for Anegada.
- Reduction in the numbers and kinds of marine species.

The concerns ranked next in importance are:

- The harmful effect of invasive (non-native) species of plants (*e.g.*, Australian Pine) and animals (*e.g.*, Lionfish) on the natural environment of Anegada.
- Sand mining and related degradation of coastal environments.
- Over-grazing by free-roaming livestock and feral animals, resulting in a loss of vegetation and damage to gardens.
- Global warming and sea level rise (*e.g.*, increasing number of storms).
- Overfishing.
- Coastal development that results in damage to or loss of coastal wetlands.
- The need for better protection (*e.g.*, stronger legislation) for endangered species of flora and fauna and their habitats.
- Diminishing water quality (*e.g.*, the pollution of coastal waters from land-based sources of pollution or other sources such as visiting yachts).

Anegadians are clear that they want development activity on the island, but that development should not impair the special character of the island and should respect local culture and priorities. During the management planning workshop held by the NPT in 2001, a part of the vision for Anegada was stated as follows:

> *The whole island system would be declared as a World Heritage Site to preserve and maintain its rich biodiversity of species and ecosystems, providing a different experience to all users* (NPT, 2001b, page 9).

The natural and historical resources of Anegada may not satisfy the "*outstanding universal value*" criterion required for the island to be recognised by the United Nations Educational, Scientific and Cultural Organisation (UNESCO) as a World Heritage Site. However, the goal of maintaining the special character of Anegada while undertaking environmentally sensitive development could be achieved by declaring the island a Biosphere Reserve.

Biosphere Reserves are:

> *… places that seek to reconcile conservation of biological and cultural diversity and economic and social development through partnerships between people and nature ….* *

They are nationally established and recognised by UNESCO under its Man and the Biosphere (MAB) Programme. The purpose of establishing Biosphere Reserves is:

> *… to promote sustainable development based on local community efforts and sound science*.

Given that large portions of the terrestrial and marine space of Anegada are already proposed as protected areas, designation of the island as a Biosphere Reserve is an appropriate strategy to try to balance the development and social imperatives of the island. An additional advantage of such designation is that Anegada, as a relatively isolated system, offers a unique opportunity to study the impact of climate change on coastal ecosystems and associated human communities.

8.4 Challenges and Opportunities

The development of a comprehensive resource conservation framework for Anegada, including the development of protected areas, faces a number of challenges. Some of those challenges are inherent to the current management frameworks (policy, legal, and institutional), while some are based on prevailing socio-political dynamics.

These major challenges are summarised in the enumerated sub-sections that follow.

(1) Environmental Management Framework — The current framework for development planning in the BVI does not place protected areas and resource conservation within a cohesive development strategy. In the case of Anegada, there is no overall conservation strategy, despite the fact that a relatively large proportion of the island is proposed for conservation status. The issue of unsettled land claims appears to override all other concerns at the community level, and may even provide a convenient basis for the lack of support for environmental initiatives, which makes it even more important to develop a cohesive environmental management strategy for the island.

(2) Financial Resources for Protected Areas Development — The BVI's Protected Areas System Plan (2007-2017) highlights the need for detailed financial planning for the development and management of the system of protected areas. However, protected area and resource conservation planning for Anegada appears to be based solely on external sources of financing. It is unclear at this time whether the conservation focus is driven by the sources of funding or by a process of priority ranking by BVI resource management agencies.

(3) Institutional Capacity — The two primary institutions responsible for protected area management in the BVI (NPT and DCF) currently lack adequate capacity to carry out the full range of management interventions necessary to protect and promote the protected areas of Anegada.

(4) Climate Change — Climate change impacts could significantly reduce the value of coastal and marine resources in the BVI (ECLAC, 2011). Mitigating those impacts will place additional demands on the resources of the territory's protected areas management institutions. The health impacts will affect both residents and visitors, and impose new operational costs on protected areas management institutions and providers of health services (Ebi, *et al*., 2006 and Ragster, 2010). Anegadians list global warming and sea level rise as an important

* For additional information on biosphere reserves, see: www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/

environmental concern (Anegada Community Survey, October 2012), and given the topography of the island, climate change adaptation will have to be included in future development plans and projects.

(5) Development Plan for Anegada — The 2007 Land Allocation Plan increases potential threats to protected areas and sensitive coastal areas because the plan portends to resolve land ownership claims without establishing mechanisms and processes for improving the development control procedures and protecting critical ecological and heritage resources. This is particularly relevant to land clearing and residential development adjacent to, and within, protected areas.

Issues, Conflicts, and Areas of Concern	Impacts of No Action/No Change	Short-term Options Long-term Recommendations
ISSUE ONE The pace of development activity in Anegada has increased significantly since 2007, guided in part by a proposal to allocate lands for residential and commercial uses and a 2009 "action plan" for Setting Point. However, the development control and resource management agencies of the BVI Government have not increased capacity to manage this surge in development activity. As a result, development activities are taking place adjacent to, and within, the Western Ponds Ramsar Site. Anegadians welcome new development, but some are concerned that the unique character of the island will be changed by future development density and style.	There is heightened concern that the proximity and density of proposed residential development to the Ramsar Site will result in significant impairment of the resources contained within the site. Additionally, commercial and residential development is increasingly being carried out in a way that increases the exposure of the developments to environmental stressors, such as coastal erosion. Continuing current development control and land management practices will result in increased damage to critical ecosystems and continued damage to property and social infrastructure.	**SHORT-TERM OPTIONS** 1. A moratorium on construction activities adjacent to the Western Ponds should be established. 2. A local development advisory committee, possibly chaired by the District Officer, should be established to facilitate coordination of development activities by the various public agencies. **LONG-TERM RECOMMENDATION** 1. The designation of Anegada as a Biosphere Reserve should be considered by Government and the community as one long-term option for the island. To move forward with this option would require that an associated management planning process be put in place, including the preparation of an appropriate development plan and physical plan.
ISSUE TWO There is inadequate enforcement of environmental protection laws on the island of Anegada.	Current patterns of resource use and extraction are generating adverse impacts on natural resources, which not only cause environmental damage, but also reduce the ability of natural systems to respond to natural and man-made perturbations. Continuation of the existing scenario will result in ongoing deterioration of the natural resource base and environmental quality, constraining future development options for Anegada.	**SHORT-TERM OPTION** 1. Monitoring and enforcement efforts should be increased through increased presence of conservation officers on Anegada and improved coordination among conservation agencies. **LONG-TERM RECOMMENDATION** 1. The legal framework and institutional capacity for development control and environmental management in the BVI, including Anegada, need to be strengthened, with a renewed commitment by Government to provide resource management agencies with the tools and resources necessary to execute existing laws and policies and the technical capacity to take on new responsibilities and challenges.

9. DIRECTIONS FOR THE FUTURE

9.1 The Specialness of Anegada

9.1.1 True Belongers

Do you remember taking a boat to Anegada for the very first time? As you anticipate reaching its shores, you do not know quite what to expect—maybe you have seen photos, heard stories or read something about the island. You may have been told that there isn't much there. But nothing prepares you for just how starkly different Anegada is from the rest of the Virgin Islands—this land at the end of the sea, or so it appears. From your perch on the boat, and after what seem to be many long hours getting there, you see not even a spec on the horizon to greet your eyes because the island is so flat—you wonder if the pilot has missed it or the crew might be lost at sea.

Photo 135
A flock of Greater Flamingos sweeps the skies of Anegada.

But soon, upon coming ashore, it becomes clear that this "drowned land" has many special qualities. Here the sky is a rich and mesmerizing blue, like a painting on canvas hung from one end of the horizon to another. The sunlight is so bright that it seems to burn the eyes. No place in the Virgin Islands chain of islands has such crisp light and brilliant days.

Anegada is where the territory's largest flocks of Greater Flamingos find sanctuary (**Photo 135**). It is where field after field abound with the waving Elegant Tetramicra (*T. elegans*) orchid flowers—so enthusiastic for life that they seem to be twirling in excitement. Or where the wild dance of mating Antillean Nighthawks (*C. gundlachii*) can be observed in the spring and summer, their calls echoing across the sky from dusk till dawn. Take a walk among the dunes and stumble onto the Atlantic Ocean and watch the sea roar a ferocious opera, most often only witnessed by the wilderness that is so much a part of this place.

Stay awhile and chat with an Anegadian who calls this island home, know the seemingly simple but yet intricate lives they lead out here at the end of the sea, and feel their deep respect and love of the island. Spend a night gazing up at the endless black and diamond-studded night and get to know the constellations, because it is here that you just may be able to believe that you are seeing to the end of time—the night sky is that clear and boundless.

Know in the end that this land is delicate and yet strong. It has seen millennia of change and renewal. These are the things that make it Anegada, a special island.

9.1.2 Belonger Plants of Anegada

Like its people, many of the plants of Anegada are "belongers," and are considered "*born here*" or, as some may say, "*born ya*."

Why are these "belonger species" so important to this island? The simple answer is that they are collectively unique to the island of Anegada. As such, they are a distinct part of Anegada's natural history narrative, which is only Anegada's to tell. It is a millennia-old tale that speaks of the eons of nature's chronicle on the island, of how species came here and made it their home, and how they possess a uniqueness and stature all their own—as "*belongers*."

What is so special about these plants? The word "special" is used to refer to species of plants that are restricted (endemic) to the West Indies, including some found only on the Puerto Rico and Virgin Islands Banks, as well as at least three species that are found only on Anegada (*Metastelma anegadensis, Varronia rupicola* and *Vachellia anegadensis*). There are at least 65 of these special plants to be found on Anegada, and there may be more (see **Table 22**). These 65 plants are true "*belongers*" of Anegada.

Table 22.
A summary of the 65 Belonger plant species for Anegada.

REGION	SYMBOL	#s
British Virgin Islands Endemics	★ (red)	4
Virgin Island Endemics	★ (green)	1
Puerto Rico Bank Endemics	★ (blue)	8
Greater Antillean Endemics	★ (yellow)	16
West Indian Endemics	★ (dark red)	36

STATUS	SYMBOL	NUMBERS
Endangered	♦ (red)	24
Threatened	♦ (yellow)	7
Vulnerable	♦ (green)	12
Stable/Least Concern	♦ (black)	22

NO.	SPECIES	COMMON NAME	GROWTH FORM	ORIGINS	CONSERVATION STATUS
		DICOTS			
1	*Allotoonia agglutinata*	Spotted Jawfish	Vine	★ (yellow)	♦ (yellow)
2	*Amyris diatrypa*	Hairy Torchwood	Tree	★ (dark red)	♦ (yellow)
3	*Argythamnia candicans*	Sharp Leaf Silverbush	Shrub	★ (dark red)	♦ (green)
4	*Argythamnia stahlii*	Blunt Leaf Silverbush	Shrub	★ (blue)	♦ (yellow)
5	*Chamaecrista glandulosa* var. *glandulosa*	Jamaican broom	Shrub	★ (yellow)	♦ (yellow)
6	*Croton betulinus*	Beechleaf Croton	Shrub	★ (dark red)	♦ (black)
7	*Croton discolor*	Lechecillo	Shrub	★ (yellow)	♦ (black)
8	*Croton fishlockii*	Fishlock's Croton	Shrub	★ (green)	♦ (yellow)
9	*Dendropemon caribaeus*	Four-angle Leechbush	Shrub	★ (yellow)	♦ (black)
10	*Elaeodendron xylocarpum*	Marble Tree	Tree	★ (dark red)	♦ (black)
11	*Erythroxylum brevipes*	Brisselet	Tree	★ (dark red)	♦ (black)
12	*Euphorbia articulate*	Jointed Sandmat; Milk Bush	Shrub	★ (dark red)	♦ (green)
13	*Euphorbia torralbasii*		Herb	★ (yellow)	♦ (red)?
14	*Euphorbia turpinii*	Turpin's Sandmat	Herb	★ (yellow)	♦ (red)?
15	*Euploca microphylla*	Twining Soldier Bush	Herb	★ (dark red)	♦ (red) Extirpated?
16	*Evolvulus squamosus* (**Photo 139**)	Rockyplains Dwarf Morning-glory	Herb	★ (yellow)	♦ (red)
17	*Forestiera eggersiana*	Ink Bush	Tree	★ (dark red)	♦ (green)
18	*Galactia dubia* var. dubia	West Indian Milkpea	Vine	★ (dark red)	♦ (green)?
19	*Gundlachia corymbosa*	Yam Bush	Shrub	★ (dark red)	♦ (black)
20	*Hylocereus trigonus*	Strawberry Pear; Night-blooming Cactus	Cactus	★ (dark red)	♦ (black)

NO.	SPECIES	COMMON NAME	GROWTH FORM	ORIGINS	CONSERVATION STATUS
21	*Jacquemontia cayensis*	Sandyplain Clustervine	Vine	★	♦
22	*Jacquinia arborea*	Braceletwood	Tree	★	♦
23	*Jacquinia berteroi* var. *berteroi*	Bois Bande; Black Barch	Shrub	★	♦
24	*Leptocereus quadricostatus* (**Photo 138**)	Sebucan; pitahaya	Cactus	★	♦
25	*Malpighia infestissima*	Cowhage Cherry	Tree	★	♦
26	*Malpighia linearis*	Bastard Cherry	Tree	★	♦
27	*Malpighia woodburyana*	Bois Bande; Black Barch	Shrub	★	♦
28	*Melocactus intortus* subsp. *intortus*	Turk's Cap	Cactus	★	♦
29	*Metastelma anegadensis*	Wise Wist; Caribbean Swallow-wort	Vine	★	♦
30	*Myriopus microphyllus*	Twining Soldier Bush	Vine	★	♦
31	*Oplonia spinosa* subsp. *Spinosa*	Prickly Bush	Shrub	★	♦
32	*Phyllanthus pentaphyllus* subsp. *polycladus*	Five-petal Leaf-flower	Herb	★	♦?
33	*Pictetia aculeata*	Fustic	Tree	★	♦
34	*Pilea margarettae*	Margarett's Clearweed	Herb	★	♦
35	*Pilosocereus royenii*	Royen's Tree Cactus	Cactus	★	♦
36	*Pisonia subcordata*	Water Mampoo	Tree	★	♦
37	*Plumeria alba*	Wild Frangipani	Tree	★	♦
38	*Polygala hecatantha*	West Indian Milkwort	Herb	★	♦
39	*Randia portoricensis*	Puerto Rico Indigo Berry	Shrub	★	♦?
40	*Reynosia uncinata*	Sloe	Tree	★	♦
41	*Schoepfia obovata*	White Beefwood	Tree	★	♦
42	*Senna polyphylla* var. *neglecta*	Retama Prieta	Tree	★	♦
43	*Senna polyphylla*var. *polyphylla*	Retama Prieta	Tree	★	♦
44	*Serjania lucida*	Basketwood	Vine	★	♦
45	*Sesuvium* sp. (perhaps *S. microphyllum*)	Little-leaf Seapurslane	Herb	★?	♦
46	*Sideroxylon* cf. *horridum* (**Photo 142**)	Bully Tree	Tree	★	♦
47	*Sideroxylon obovatum*	Breakbill	Tree	★	♦
48	*Solanum bahamense*	Bahama Nightshade	Shrub	★	♦
49	*Stenostomum acutatum*	Placa Chiquitu	Shrub	★	♦
50	*Stigmaphyllon emarginatum*	Monarch Amazonvine; Wiss Vine	Vine	★	♦
51	*Tabebuia heterophylla*	White Cedar	Tree	★	♦
52	*Tabebuia lepidota*	French White Cedar	Tree	★	♦
53	*Vachellia anegadensis* (**Photo 141**)	Poke-me-boy; Anegada Vachellia; Blackbrush Wattle	Tree	★	♦
54	*Varronia rupicola* (**Photo 136**)	Puerto Rico Manjack; Anegada Manjack	Tree	★	♦
55	*Ziziphus rignonii* (**Photo 137**)	Soana	Tree	★	♦

NO.	SPECIES	COMMON NAME	GROWTH FORM	ORIGINS	CONSERVATION STATUS
		MONOCOTS			
56	*Agave missionum*	Corita; Virgin Islands Century Plant	H	★	♦
57	*Cyperus unifolius*	Caribbean Flatsedge	Agave	★	♦
58	*Fimbristylis inaguensis*	Bahama Fimbry	Sedge	★	♦
59	*Furcraea tuberosa*	Female Karata	Agave	★	♦?
60	*Psychilis macconnelliae*	Mrs. Macconnell's Psychilis	Orchid	★	♦
61	*Sabal causiarum* (**Photo 140**)	Palmetto; Puerto Rico Palmetto; Puerto Rican Hat Palm	Palm	★	♦
62	*Tetramicra elegans*	Elegant Wallflower; Elegant Tetramicra	Orchid	★	♦
63	*Tolumnia prionochila*	Toothed-lipped Tolumnia	Orchid	★	♦
64	*Uniola virgata*	Limestone Grass	Grass	★	♦
		LICHENS			
65	*Arthonia anegadensis*		Lichen	★?	♦ Extinct?

Note to Table 22. The common name used in the table above refers to an internationally and/or widespread non-scientific label used to identify the plant. Local names have not been used because they are not as widely known, and their use would make identification and association difficult since many local names are often applied to several species, are limited in scope and application, and have complex social and other associations that are not yet studied and understood. This is not to dismiss the value and importance of local names, and it is important that there be more studies and research to document the use of local plant names.

Photo 136.
Varronia rupicola, endemic to Anegada and Puerto Rico.

Photo 137.
Ziziphus rignonii, an endemic of the Greater Antilles, Anguilla, and St. Maarten/St. Martin.

Photo 138.
Leptocereus quadricostatus, endemic to Anegada and to Puerto Rico.

Photo 139.
Evolvulus squamosus, endemic to the Cayman Islands, Bahamas, and Anegada.

Photo 140.
Sabal causiarum, a rare endemic palm of the Virgin Islands, Puerto Rico, and the Lesser Antilles.

Photo 141.
Vachellia anegadensis,
endemic to Anegada.

Photo 142.
Sideroxylon cf. *horridum*, endemic to Cuba, the Cayman Islands, and Anegada.

9.1.3 Critical Protection Priorities

Anegada is recognised for its unique landscape and the richness of its marine and terrestrial biodiversity. The island is known internationally for its important coral reef system, its regionally significant populations of marine turtle, its wetland bird sanctuaries, and the occurrence of many globally important endemic plants (McGowan, *et al.*, 2006). These precious resources form the basis of the livelihoods of most Anegadians. And they are what attract visitors from afar.

Today, many of the island's native species and ecosystems are under threat, primarily because of human activities—historically and to the present. Although local situations and events present the most direct challenge to species, habitats, landscapes and ecological processes, global conditions and events such as climate change and sea level rise increasingly place Anegada at risk.

Too often, It is more convenient to ignore signs of environmental decline, such as when sand is mined from Anegada's dunes for construction. However, the result of this man-made destruction is a decline and even disappearance of critical habitats, the loss of coastal protection, deteriorating landscape beauty, and possibly a diminishing sense of place for residents (see **Photo 143**, **Figure 26** below, and **Photo 4** in Chapter 1).

Photo 143.
Sand mining of a major dune system along the north shore road of Anegada. This photo was taken on top of the dune looking westward, between Bones Bight Pond (at the left) and Bones Bight (right).

9.1.3.1 Plant Species and Habitats of Special Concern

When the term "*special concern*" is used, it refers to plants and animals, habitats and ecosystems that are currently—or potentially will be—at critical conservation levels as a result of an event or an accumulation of events. These events may have happened over dozens or even hundreds of years, although the effects are now being realised. Some events are now being perpetrated and the effects are ongoing, although the eventual outcome may not yet be observable.

Figure 26.
Some of the major sand dune mining pits, all located on the north side of the north shore road of Anegada.

Many plants of special concern on Anegada that are on the decline are restricted to the islands of the West Indies region. Their decline on Anegada is due primarily to habitat destruction, impacts from feral livestock, and overall landscape deterioration as a result of human actions.

A list of Anegada's plant species of special concern is provided in **Table 11** in Chapter 4. Many of these plants are not regional endemics—that is restricted to islands of the West Indies—but they nevertheless are native and are an important component of Anegada's natural heritage and its long-term stability. Some are endemic to the Puerto Rican Bank, including the British Virgin Islands. They are listed in **Table 22** earlier in this chapter, with threatened species shown below in **Figure 27**. **Figure 28** provides key habitats of special concern and the location of additional threatened species of plants.

To determine the status of Anegada's plant species and habitats, the profile's biodiversity team conducted field assessments throughout much of the island, consulted local and international experts, and combed through reports and the results from previous studies. Nevertheless, the profile data and tables are by no means complete, and further research is needed to determine more precisely the conservation needs of the species, the impacts of the threats and how to address them, and the identification of other potentially threatened species.

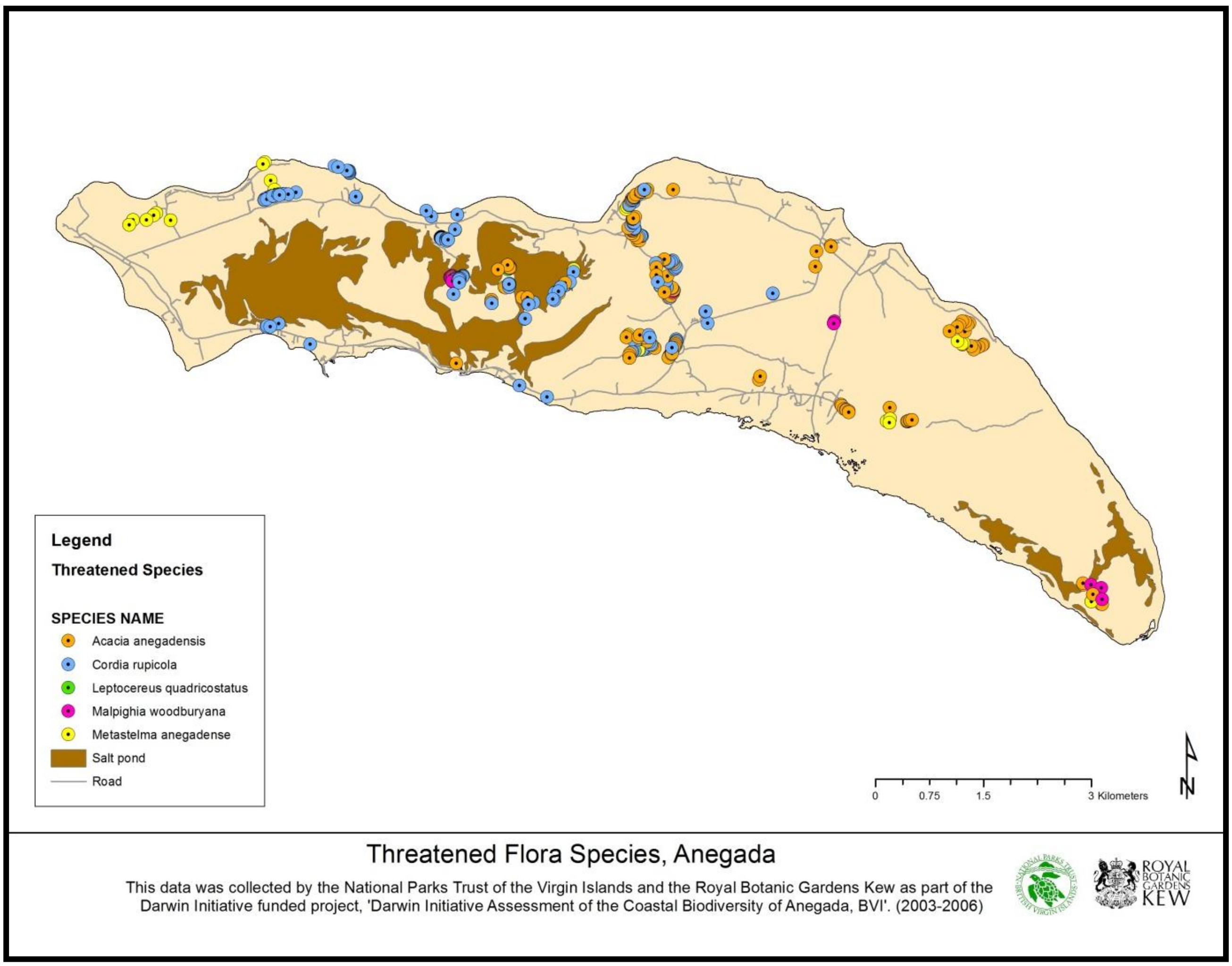


Figure 27.
Locations of threatened flora species recorded for Anegada, 2003-2006 (source: McGowan, *et al*., 2006).

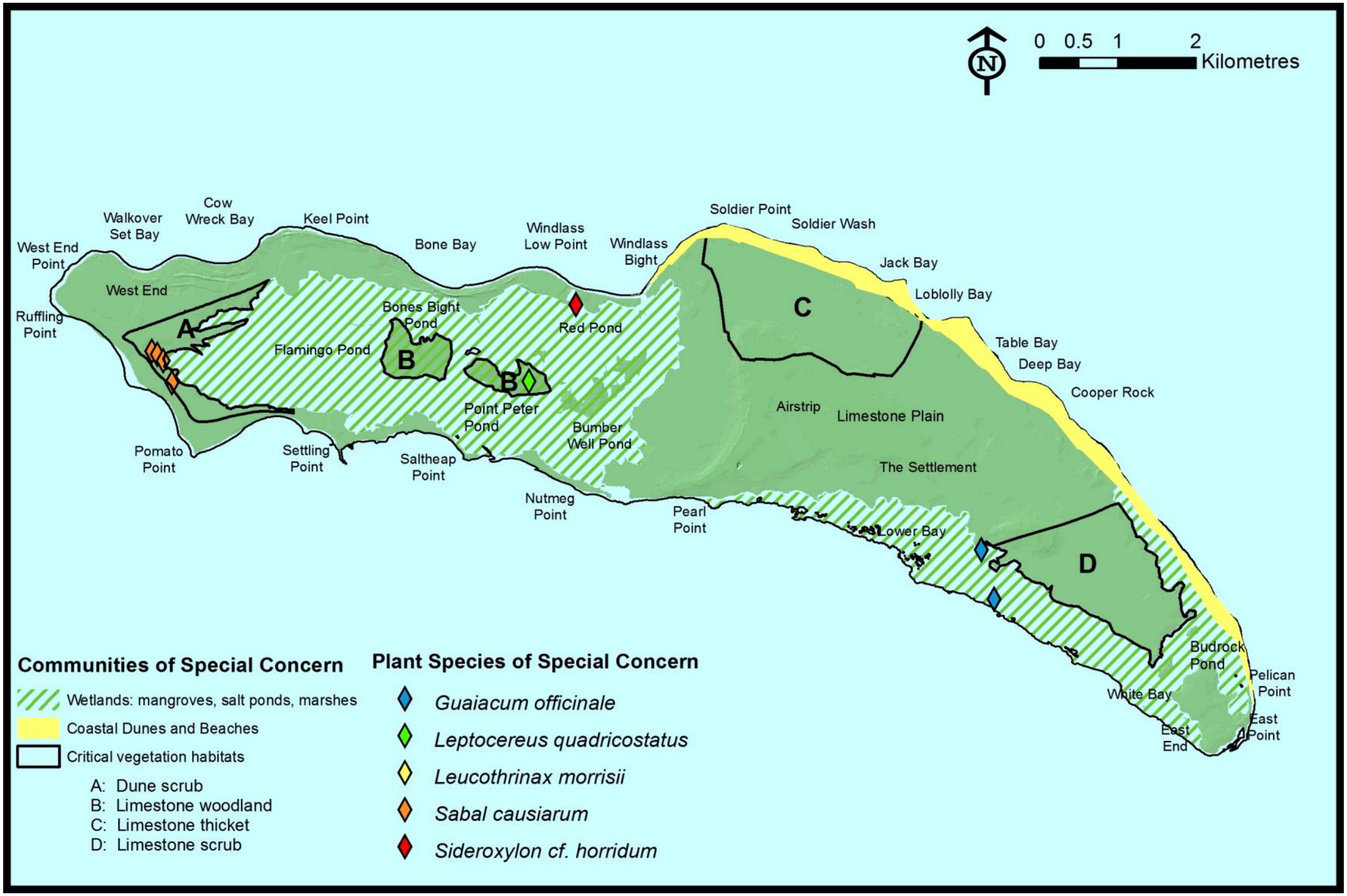


Figure 28.
Plant species and vegetation communities of special concern for the island of Anegada.

9.1.3.2 Fauna and Habitats of Special Concern

As it is for the plant species and their habitats, native fauna and ecosystems are similarly important, and continued efforts are needed to protect and conserve the integrity and value of these species and the systems on which they depend. A list of the native fauna of special concern is provided in **Table 17** (Chapter 4). **Figure 29** of this chapter displays the locations of some of these species and habitats of special concern documented during field surveys carried out by the environmental profile biodiversity team in June and November of 2012. The number of sites and species are likely to increase with future surveys.

Many of the species of native animals listed are widely distributed over the island, moving from place to place, dependent on habitat availability, food, shelter and the need to reproduce. It is for this reason that conservation and management of many of these species is dependent on a multi-disciplinary approach involving critical habitat protection and restoration, population management, invasive species control, captive breeding and species restoration.

There are habitat areas on the island that also require protection, including:

- All wetlands.
- Solution hole communities.
- Freshwater systems.
- Dune vegetation communities (including unique wetlands).
- Forests, woodlands and scrublands on the eastern Limestone Plain.
- Areas north and northeast of The Settlement.
- Woodlands on the west end of the island.
- Inland islands.

Figure 29 provides an overview of some of these areas.

9.1.3.3 Future Protection Priorities

As has been noted throughout this *Anegada Environmental Profile*, there are many areas of Anegada that require careful resource management and protection in order for ecosystems and ecological services, natural aesthetics, historical values, and biodiversity to be sustained.

Table 23 provides a summation of information on those areas with multiple parameters of significance or value on Anegada. These have been identified as priorities by the profile research team.

The cross-referenced format demonstrates that most of areas and sites included have multiple significance, and therefore judicious management and protection of these areas may be important not only to Anegada but to the long-term sustainable development of the British Virgin Islands as well.

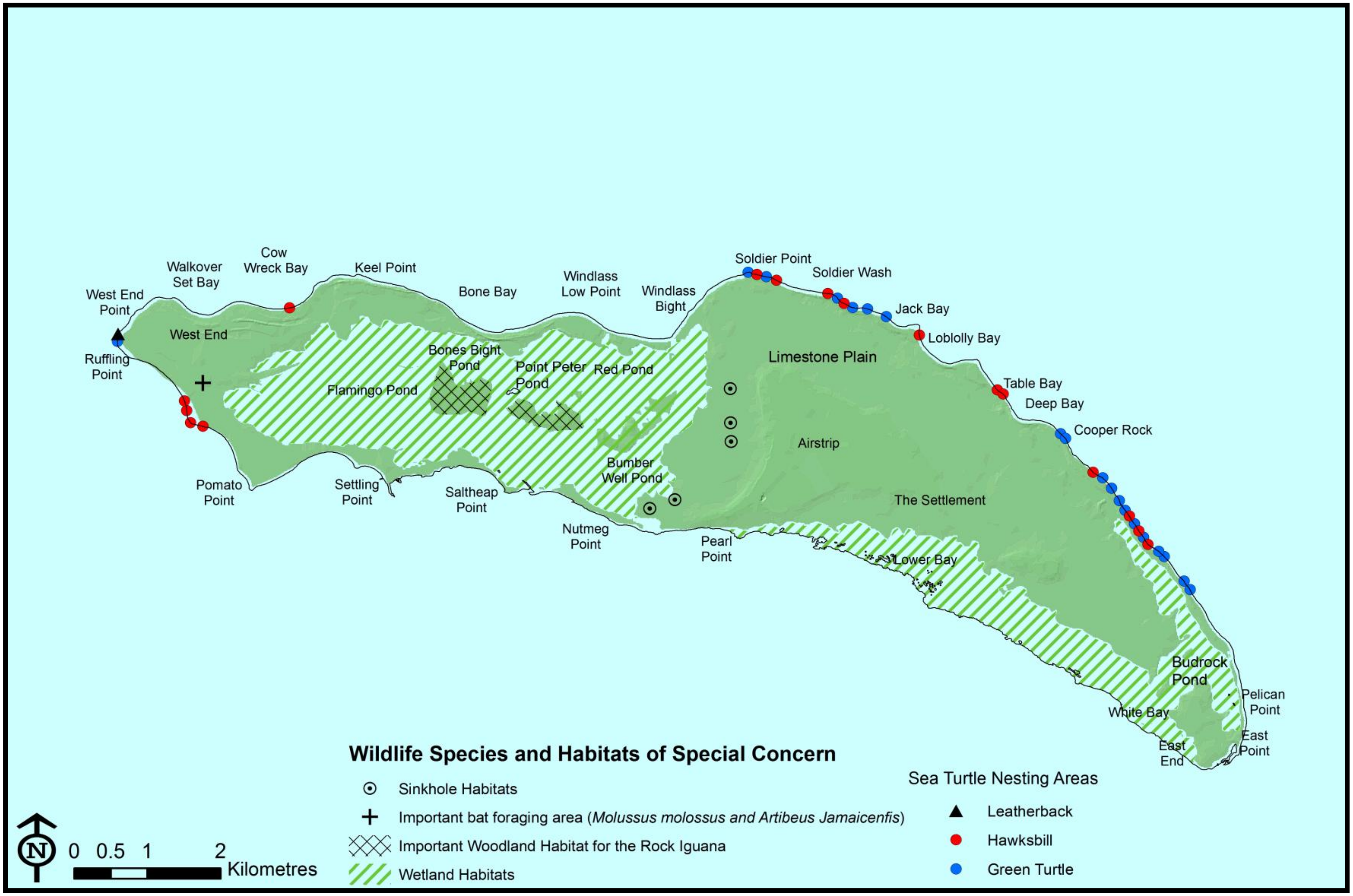


Figure 29.
Wildlife species and habitats of special concern for the island of Anegada.

Table 23.
Multiple parameters of value or significance for the island of Anegada.

Sites, Features, Assets Habitats, and Vegetation Communities	Parameters of Value or Significance																CONSERVATION STATUS
	Protection from Natural Hazard Impacts	Historical and Archaeological	Landscape Scenic Aesthetic	Recreational	Marine	Protected Areas and Reserves	Habitat Restoration and Species Management	Climate Change & Sea Level Rise Amelioration	Beach	Watershed Management	Wetlands	Science and Research	Pollution Control	Biodiversity	Fisheries	Economic	
N A T U R A L A S S E T S																	
Western Ponds				B, C												1, 5	ENDANGERED
Eastern Ponds and Marshes				B, C												1, 5	ENDANGERED
Eastern Coastal Mangroves				B. C, D												1, 5, 7	THREATENED
West End Dunes and Associated Woodlands				A, B, C												1, 5,	THREATENED
Cow Wreck Bay: Windlass Bight Dunes and Associated Woodlands				A, B, C												1, 3, 5, 7	VULNERABLE
Soldier Wash to Loblolly Bay: Landscapes and Woodlands				A, B, C												1, 3, 5, 6, 7	VULNERABLE
Table Bay Dunes, Landscapes and Woodlands				A, B, C												1, 5	VULNERABLE
Freshwater Solution Holes				C												1, 5	ENDANGERED
Inland Islands				A, C,												1, 5	THREATENED
Anegada Rock Iguana				C												1, 5	ENDANGERED
Greater Flamingo				C												1, 5	ENDANGERED
H A B I T A T S																	
Mangroves, Marshes and Salt Ponds				B, C												1, 5	ENDANGERED
Forests, Woodlands, Shrublands, Grasslands, Rocky Coasts				A, B, C													VULNERABLE
Beach Habitats				A,B, C												1, 5	THREATENED
Coral Reefs and Seagrass Beds				B, C, D, F												1, 5, 7	THREATENED
Freshwater Solution				C													ENDANGERED

Sites, Features, Assets Habitats, and Vegetation Communities	Parameters of Value or Significance																CONSERVATION STATUS
	Protection from Natural Hazard Impacts	Historical and Archaeological	Landscape Scenic Aesthetic	Recreational	Marine	Protected Areas and Reserves	Habitat Restoration and Species Management	Climate Change & Sea Level Rise Amelioration	Beach	Watershed Management	Wetlands	Science and Research	Pollution Control	Biodiversity	Fisheries	Economic	
Holes																	
Inland Islands				C													THREATENED
Dunes				A, B, C												1	THREATENED
VEGETATION COMMUNITIES																	
Drought Deciduous Woodland																	VULNERABLE
Drought Deciduous Xeric Coastal Shrubland with Succulents																	VULNERABLE
Evergreen Coastal Shrubland																	VULNERABLE
Deciduous, Evergreen and Mixed Forest and Shrubland with Succulents																	VULNERABLE
Drought Deciduous Young Forest and Forest Shrub																	VULNERABLE
Seasonal Evergreen Forest and Forest Shrub																	VULNERABLE
Pasture, Hay, Abandoned Agriculture or Other Grassy Areas																2	ENDANGERED
Dry Salt Flats																	THREATENED
Emergent Wetland, Salt Pond				C												1, 5	THREATENED
Mangrove				C												1, 5	THREATENED
Coastal Grassland				A, C												1, 5	THREATENED
Coastal Rock				A, B, C												1, 5	THREATENED
Coastal Sand				A, B, C												1, 5	THREATENED
PROTECTED AREAS — Existing																	
Western Ponds (Ramsar)				A, B, C												1, 5	THREATENED
Eastern Ponds (Ramsar)				A, B, C												1, 5	THREATENED

TABLE 23 LEGEND

ECONOMIC:
1=tourism
2=agriculture
3=commercial
4=real estate
5=organised tours
6=vendors
7=fisheries

RECREATIONAL:
A=walking/hiking/running
B=scenic/landscape/aesthetic
C=wildlife viewing/nature watching
D=swimming/snorkeling/diving/boating
E=camping
F=fishing

BIODIVERSITY:
❀=flora
✹=fauna

Conservation Status Definition and Approach

In the definitions below, the term "*area*" refers to *sites/habitats/communities* as provided in the Table. The four categories used to characterise status are ***endangered, threatened, vulnerable*** and ***stable***, defined as follows:

ENDANGERED: An area is considered *endangered* when the best available evidence indicates that it is considered to be facing a very high risk of being totally destroyed, with its systems, structure and functions disrupted and/or disabled in such a way as to render it retarded or irreparably damaged.

THREATENED: An area is considered *threatened* when the best available evidence indicates that it does not yet qualify for the category of *Endangered*. However, it is close to qualifying for or is likely to qualify as being endangered in the near and medium-term.

VULNERABLE: An area is considered *vulnerable* when the best available evidence indicates that it is facing a high risk of threats that may elevate its risk to severe damage and disruption, and may elevate its status to *threatened* or *endangered* in the near and medium-term.

STABLE: An area is considered s*table* when the best available evidence indicates that it does not qualify for *Endangered*, *Threatened*, or *Vulnerable*, and when prevailing circumstances do not or will not immediately cause severe damage or loss to the system.

Note that in the Table, most environmental profile islands, including private ones, are considered at least vulnerable due the inherent risks from natural hazards and the consequent impacts that damage from such hazards may cause, particularly related to the tourism economy.

Habitats and Ecosystems

The habitats and ecosystems listed in this Table are broadly defined and encompass most of the systems found on Anegada, though not all.

9.2 The Way Forward

Despite Anegada's underdevelopment—when contrasted with its sister islands or Tortola—its recent history tells the story of an island that has stepped up to the precipice of change several times, only to learn that, as the Scottish poet Robert Burns wrote,

The best laid schemes of Mice and Men oft go awry,
And leave us nothing but grief and pain,
For promised joy!

Most adult BVIslanders of a certain age can still recall the massive development scheme proposed for Anegada in the late 1960s by the British entrepreneur Kenneth Bates (see Chapter 2, Section 2.2.6.1), including his plan for the island to become the Caribbean hub for Concord aircraft. Today Bates is more likely to be remembered for his early connection to the Wickhams Cay land development scheme in Road Harbour, Tortola, than for his aborted plans in Anegada.

Fewer still remember the development designs that followed Bates in the early 1970s, beginning with an oil storage facility proposed by a USVI-based refinery and later rejected by the BVI Government.

Or a follow-on project to the Bates scheme for yet another major resort-residential development for the island not dissimilar to the Bates plan. This one failed when the sponsor, the Sterling Bank and Trust Company of the Caymans, collapsed, not long after initial feasibility studies had been completed.

Even now, the island is dotted with the structural artifacts of abandoned projects, such as the NASA tracking station (**Photo 144**) built by the US Government in the 1950s at West End Point. The facility was built to track early space rockets, including the *Aurora 7* space capsule in 1962 piloted by American astronaut Scott Carpenter, who splashed down some 60 miles north of Anegada (Whistler, 2011).

By the 1980s, Anegada had settled into less dramatic patterns of development that no longer included big schemes, big plans, or big dreams (see Chapter 1, Section 1.2.2). Today, however, Anegadians are again learning about more multifaceted development planning for their home island, including the Government's Land Allocation Plan for Anegada (MN&L, 2007). Also being discussed are new propositions to enhance Anegada's economic growth such as the following:

Photo 144.
Remains of the long abandoned US tracking station, built at West End Point, Anegada, in the 1950s to track space rockets fired from Cape Canaveral on the Atlantic coast of Florida.

- **Renewable energy *experimentation***, for the development of solar, wind or wave energy on Anegada as a case study for the territory (see: "*Pickering Proposes Anegada as Case Study for Renewable Energy*," *BVI Platinum News*, 22 February 2012).
- ***Increasing the territory's food production on Anegada***, including the transfer of sheep from Tortola, pumpkin and melon farms, and grass production to facilitate livestock rearing (see: "*Pumpkin Soup for All Hotels; Tortola Sheep for Anegada*," *BVI News*, 1 February 2013).
- ***Development of a solar farm***, with a parallel training/research institute focusing on solar energy (see: "*Gov't. May Borrow to Build Solar Farm*," *BVI News*, 4 January 2013).
- ***Development of a golf course***, in fulfillment of the longstanding desire of many BVIslanders to add a golf course to the territory's tourism product (see: "*Golf Course Plan on the Table*," *BVI Platinum News*, 17 December 2012).

- ***Launching of a recycling pilot project*** on Anegada (and Jost Van Dyke) as part of a strategic initiative to solve the territory's solid waste issues (see: "*Anegada & JVD To Be Used for Recycling Pilot Project*," *BVI Platinum News*, 2 July 2012, and Chapter 7 of the Profile, Section 7.1.2.6).

Given the variety of proposed development initiatives now under discussion, the environmental profile team determined it was an opportune time to ask Anegadians what they felt about long-term growth and development planning for their island. We recalled another community survey undertaken more than two decades ago by researcher Dr. Stephen Koester, who had suggested:

> *Anegadians have very definite ideas about how any future developments should proceed. Most Anegadians seem to want development that is compatible with the scale of their community and island. They expressed a desire for a gradual process of development, one that would occur in small stages* (Koester, 1987, p. 24).

With the memory of the large-scale tourism developments planned in the 1960s and 1970s nearer at hand in 1987 than today, one community resident told Dr. Koester:

> *When developers come to other islands … they ask for 10, 15 or 20 acres. For some reason or another they come to Anegada and they want half or the whole thing* (Koester, 1987, p. 25).

Additionally, Koester found that Anegadians in the late 1980s:

- Almost automatically seemed to associate development with tourism.
- Feared large-scale tourist development or too many hotels which could overwhelm the island with outsiders.
- Felt strongly that they should participate fully in any future development, indicating they wanted projects that were dependent on members of the local community for certain inputs and services.
- Did not want development projects that restricted their use of the resources to which they were accustomed to having free access.

How do Anegadians feel about these issues in 2013, a quarter of a century later?

To assist profile researchers in understanding current viewpoints, a community questionnaire was prepared by the profile project team in late 2012. The office of the District Officer in Anegada was instrumental in disseminating and assembling the survey forms when completed. The 7-page questionnaire can be found at the end of this chapter, and a summary of selected information from respondents is provided in **Tables 24** and **25**. Additional data from the survey can be found in Sections 4.3.2.2 and 8.2.2 of this report.

Of the Anegada participants in the community survey, the following population data are noted:

1. A little over 60 percent were male and just under 40 percent were female.
2. 47 percent of respondents were between 31 and 54 years old; another 47 percent were 55 and older; and only 6 percent were 30 years and younger.
3. Two-thirds of participants in the survey represented persons born either in Anegada or elsewhere in the BVI, with a third born on the island of Anegada. Of those born outside of the BVI, one respondent was identified as having parents born in the BVI and one as a Belonger.
4. Of the occupations identified by the respondents:
   - 28% were government employees;
   - 22% worked in the tourism sector;
   - 17% were full- or part-time fishers;
   - 11% were retired;
   - 11% were identified as full- or part-time taxi operators; and
   - 11% were classified as "other."

Thus, the environmental profile team felt that the survey had reached a good cross-section of the Anegada community.

Table 24.
Responses to the Anegada Community Questionnaire regarding Anegada's environment.

ANEGADA's ENVIRONMENT Considering Anegada's environment as a whole, how do you view the overall condition of the environment?				
Excellent	Good	Fair	Poor	Don't Know
0%	38%	38%	24%	0%

ANEGADA's ENVIRONMENT Looking back to Anegada's environment when you were a youth (under 20 years of age), how do view the overall condition of today's environment compared to that time?					
The Same	Significantly Improved	Somewhat Improved	Somewhat Deteriorated	Severely Damaged	Don't Know
13%	6%	6%	56%	6%	13%

ENVIRONMENTAL ISSUES of CONCERN to ANEGADIANS Rank the issues listed in terms of their importance to Anegadians.		
ISSUE [Respondents could rank each issue.]	% of Respondents Ranking Issue VERY IMPORTANT	% of Respondents Ranking Issue NOT IMPORTANT
Need to expand environmental education in the schools and community.	100%	0%
Uncertainty about land ownership.	94%	6%
The need for improved solid waste disposal practices and procedures.	88%	-0-
The need for better enforcement of environmental policies and regulations.	88%	6%
Absence of an approved development plan for Anegada.	88%	13%
Reduction in numbers and kind of marine species.	81%	6%
Harmful effect of invasive species on the natural environment of Anegada.	75%	-0-
Sand mining and related degradation of coastal environments.	75%	13%
Over-grazing by free-roaming livestock and feral animals.	75%	25%
Global warming and sea level rise (example, increasing storms).	69%	-0-
Over-fishing.	69%	6%
Coastal development resulting in damage to or loss of wetlands.	63%	25%
The need for better protection of endangered species and their habitats.	63%	31%
Pollution from domestic septic systems.	56%	31%
Diminishing water quality.	50%	31%
The need to expand protected areas.	38%	38%
Flooding.	38%	50%

Table 25.
Responses to the Anegada Community Questionnaire regarding development options.

DEVELOPMENT OPTIONS for ANEGADA How would you like Anegada to develop in the next ten years?		
ISSUE [Respondents could rank each issue.]	**% of Respondents Ranking Issue VERY IMPORTANT**	**% of Respondents Ranking Issue NOT IMPORTANT**
Additional amenities to attract and interest visitors.	94%	-0-
Expansion of the island's port facilities.	94%	-0-
Pursuit of renewable energy opportunities.	88%	-0-
Improved transportation options from Tortola.	88%	-0-
Improved transportation options from Virgin Gorda.	88%	6%
Improved solid and liquid waste disposal.	88%	6%
Expansion of the island's airport facilities.	88%	13%
Expanded marine recreational opportunities.	81%	-0-
More community parks and recreational sites.	81%	13%
Opportunities for eco-tourism focused on natural sites and protected areas.	75%	-0-
More guesthouses and smaller hotels.	75%	6%
More facilities to attract overnight visitors.	75%	6%
More light industry options.	69%	6%
More facilities to attract yacht-based visitors.	63%	13%
More camping opportunities for visitors.	56%	19%
More residential housing.	50%	25%
More resorts and bigger hotels	31%	69%

9.2.1 Community Perceptions about Anegada's Environment

When asked how they viewed the overall condition of the island's environment (including the sum of its plants and flowers, animals and marine life, beaches and mangroves, salt ponds, the land, coastal waters, and other natural and physical features and ecosystems"), over 60 percent of respondents to the Anegada Community Survey indicated that the state of the environment was "*fair*" to "*poor*." Just under 40 percent of respondents ranked the environment's condition as "*good*," while no participant in the survey selected the "excellent" category when assessing the island's environment (**Table 24**).

From this informal assessment, we can surmise that the majority of Anegadians view the current state of their island's environment as one under stress, but not severely so. This is also reflected in feedback from a survey question that asked participants to assess the condition of today's environment as compared to 20 years ago. Respondents were asked to rank the change they had observed over this timeframe, and the largest number of responses (56 percent) judged the environment to be "*somewhat deteriorated*" (**Table 24**). Given that 12 percent of those participating in the survey indicated the environment had "*significantly improved*" or "*somewhat improved*" in the last two decades, and only six percent felt that the environment had been "*severely damaged*" during the same period, we can again surmise that Anegadians see their environment deteriorating but perhaps not as severely as might Tortola respondents if a similar survey were to be executed on that island.

More detailed information is available in the responses to a survey question that asked participants to rank a series of environmental issues that might be of concern to Anegadians. Each issue was to be ranked as "*very important*" or "*not important*" by respondents, who could also add their own issues if they so desired (although none did).

Table 24 provides interesting information about which issues those participating in the survey ranked of high importance or little importance. For example, "*expansion of protected areas*" was ranked by an equal number of respondents for being both of high importance and low importance, an indication of the community's ambivalence regarding expansion of existing protected areas on the island.

Other interesting observations included:

1. All participants in the survey selected "*expansion of environmental education in the schools and community*" as of high importance for Anegada.
2. Despite ongoing implementation of Government's most recent Land Allocation Plan for the island (MNR&L, 2007), 94 percent of respondents still listed "*uncertainty about land ownership*" as an issue of primary importance when considering Anegada's future. Based on results from the 2012 survey, Anegadians do not feel that the issue is yet settled, and—as illustrated throughout the environmental profile—this uncertainty will continue to have an impact on how Anegadians relate to and interact with commonly shared natural resources.
3. Another issue about which there appears to be some ambivalence is whether "*over-grazing by free-roaming livestock and feral animals*" is an issue of great importance or little importance on Anegada (see also Chapter 4, Section 4.3.2.2). A full three-quarters of respondents noted that it was of high importance as an environmental issue, although a fairly significant percentage (25 percent) indicated that the issue was of little importance. Interestingly, 25 percent is also the percentage of survey participants who indicated they owned some type of livestock.
4. Issues with a high percentage of "*very important*" responses and a corresponding low percentage of "*not important*" responses included:
   - The need for improved solid waste disposal practices and procedures.
   - The need for better enforcement of environmental policies and regulations.
   - The reduction in the numbers and kind of marine species.
   - The harmful impact of invasive species on the natural environment of Anegada.
   - Global warming and sea level rise.
   - Over-fishing.
5. In addition to the over-grazing issue, a few issues ranked high in importance but also had a more significant percentage of responses that ranked the issue of low importance, thus indicating there was not a clear consensus on the subject. These included:
   - "*Absence of an approved development plan for Anegada*" ranked of high importance for 88 percent of the survey population, but also ranked of low importance with a somewhat significant 13 percent.

- "*Sand mining*" also ranked of high importance (75 percent), but another 13 percent of the respondents ranked it of little importance.

6. Issues with a high percentage of "*not important*" responses included:

- Flooding (50 percent).
- The need for better protection of endangered species and habitats (31 percent).
- Pollution from domestic septic systems (31 percent).
- Diminishing water quality (31 percent).
- Coastal development resulting in damage to or loss of wetlands (25 percent).

9.2.2 Community Perceptions about Anegada's Development Options

Table 25 summarises the responses to a question asking survey participants to assess which development options listed on the questionnaire were, in the opinion of those replying, most important for the future development of Anegada and which were least important. Those responding could also provide additional options, which some did but these are not included because the additions were similar to issues already provided on the questionnaire.

The development option that most stands out on **Table 25** is that of "*more resorts and bigger hotels*," which garnered, by a significant number, the largest number of "*not important*" responses. A noteworthy 69 percent of respondents indicated that they would *not* categorise the development of big resorts and big hotels as an important development strategy for Anegada. On the other hand, 75 percent stated that the development of small hotels and guesthouse was an important development option, with only six percent sharing a contrary view, *i.e.*, that the development of small hotels and guesthouses was *not* an important development option.

This in effect brings us full circle back to the study of the Anegada community carried out by Dr. Stephen Koester in 1987. As quoted above in this chapter, Dr. Koester reported that the Anegadians he interviewed had expressed a desire for development that was compatible with the scale of both their community and island. They further expressed a desire for gradual development that would occur in small stages. It appears—based on these results from the 2012 community survey—Anegadians are, in general, of the same opinion some 25 years later. Anegadians apparently have not forgotten the lessons learned from the aborted development projects of the 1960s and 1970s, which foresaw massive residential and resort development for the island.

What Anegadians do want, according to the survey, include:

- Additional amenities to attract and interest visitors.
- Expansion of the island's port facilities.
- Pursuit of renewable energy opportunities.
- Improved transportation options from both Tortola and Virgin Gorda.
- Improved solid and liquid waste disposal systems.
- Expansion of the island's airport facilities (although several individuals mentioned that what was needed was an upgrade of current facilities rather than an extension).
- Expanded marine recreational opportunities.
- Opportunities for eco-tourism focused on natural sites and protected areas.

In addition to the strongly stated antipathy toward development of big resorts and hotels, the following development options had the *least* support among the various options included on the survey:

- More facilities to attract yacht-based visitors.
- More camping opportunities for visitors.
- More residential housing.

In a small island like Anegada, the trade-offs between the long-term benefits of conservation and resource protection and the immediate, shorter-term benefits of resource exploitation for economic growth are not always easy to determine. The role of conservation programmes and environmental protection strategies in defining that delicate balance—*i.e.*, between preserving resources for the future while using resources to meet today's demands—has been examined throughout the development of this *Anegada Environmental Profile*.

It is hoped that the information contained within this document will help Anegada residents and stakeholders, as well as the Government of the Virgin Islands, to make more informed decisions about the island's future and to more fully assess the impact of their actions (or inactions) on the natural and historical resources of Anegada.

ANEGADA COMMUNITY QUESTIONNAIRE

An Opportunity for Community Input for the Anegada Environmental Profile

Please tell us about yourself.

Name: (ignore if you wish to remain anonymous): ______________________________

Where do you live: ☐ The Settlement? ☐ Outside the Settlement? Where? ______________________

Gender: ☐ Male ☐ Female

Age: ☐ Under 30 years old ☐ 31 – 54 years old ☐ 55 years and older

Place of Birth: ☐ Anegada ☐ BVI, not Anegada ☐ Elsewhere, not in BVI

Occupation:

☐ Fishing Sector

☐ Tourism Sector: ☐ Accommodations? ☐ Retail? ☐ Food and Beverage? ☐ Transportation? ☐ Marine Recreational? ☐ Other? ______________________

☐ Services Sector Describe: ______________________

☐ Public Sector (Government Employee)

☐ Housewife ☐ Currently Unemployed ☐ Student

☐ Other: ______________________

❶ Anegada's Environment

(1) Considering Anegada's environment as a whole (including the sum of its plants and flowers, animals and marine life, beaches and mangroves, its salt ponds, the land, the coastal waters, and other natural and physical features and ecosystems), how do you view the overall condition of the environment:

☐ Excellent ☐ Good ☐ Fair ☐ Poor ☐ Don't know

(2) Looking back to Anegada's environment when you were a youth (under 20 years of age), do you think that the overall condition of the environment is:

☐ The same ☐ Significantly Improved ☐ Somewhat Improved
☐ Somewhat Deteriorated ☐ Severely Damaged ☐ Don't know

(3) Please tell us about some of the changes you have observed. ___________

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Environmental Profiles for the BVI

Island Resources Foundation, a BVI environmental organisation, has prepared two Environmental Profiles for the Virgin Islands. Each Profile is the most complete source of information available on the environment of the island studied.

Both the Government of the Virgin Islands (through the Office of the Premier) and the UK Government (through the Office of the Governor) support the Profile Programme.

The two published Profiles are:

An Environmental Profile of the Island of Jost Van Dyke, including Little Jost Van Dyke, Sandy Cay, Green Cay, and Sandy Spit (2009). Download: *www.jvdgreen.org/files/JVD_Environmental_Profile_Final.pdf.*

An Environmental Profile of the Island of Virgin Gorda, including Eustatia, Mosquito, Necker, Prickly Pear, Saba Rock, The Dog Islands, Broken Jerusalem, Fallen Jerusalem, and Round Rock (2012). Download from IRF's home page at *www.irf.org.*

The Profile Team is now researching and writing the ***Anegada Environmental Profile***. We hope you will help us with our research by taking time to complete this questionnaire on environment issues for Anegada.

Please complete as many of the questions as you can, skipping any you do not want to answer.

Please return the questionnaire to the District Officer, Andrea Vanterpool, who will coordinate with the Profile Project's Community Coordinator, Rosemary Delaney-Smith (telephone: 499-8819 or 495-4763; email: *virotechinc@gmail.com*).

October 2012

❷ Environmental Issues of Most Concern to Anegadians

Each Profile chapter has a theme (for example, marine resources, pollution, historic sites, etc.), and at the end of each chapter will be found a table that highlights the environmental issues associated with the chapter's topic.

It would help us to know which environmental issues are of most concern to Anegadians. Please rank the issues listed below (by circling the number you feel most accurately describes the importance of the issue) and then add (and rank) any other issues we have not included but which you feel are of concern to islanders.

TABLE 1.

		Not Important			Very Important	
A	Global warming and sea level rise (example, increasing number of storms).	1	2	3	4	5
B	The absence of an approved development plan for Anegada.	1	2	3	4	5
C	The need for better enforcement of environmental policies and regulations.	1	2	3	4	5
D	Uncertainty about land ownership.	1	2	3	4	5
E	A reduction in numbers and kinds of marine species.	1	2	3	4	5
F	Over-fishing.	1	2	3	4	5
G	Sand mining and related degradation of coastal environments.	1	2	3	4	5
H	Coastal development that results in damage to or loss of coastal wetlands.	1	2	3	4	5
I	Diminishing water quality (ex., the pollution of coastal waters from land-based sources of pollution or other sources such as visiting yachts).	1	2	3	4	5
J	The need for better protection (ex., stronger legislation) for endangered species of flora and fauna and their habitats.*	1	2	3	4	5
K	The harmful effect of invasive (non-native) species of plants (ex., Australian Pine) and animals (ex., Lionfish) on the natural environment of Anegada.	1	2	3	4	5
L	The need to expand environmental education in the Anegada Primary School and within the larger Anegada community.	1	2	3	4	5
M	The need to expand protected areas.	1	2	3	4	5
N	Over-grazing by free-roaming livestock and feral animals, resulting in a loss of vegetation and damage to crops/gardens.	1	2	3	4	5
O	Pollution caused by aging or inadequate domestic septic systems.	1	2	3	4	5
P	Flooding caused by road construction or inadequate storm drainage systems.	1	2	3	4	5
Q	The need for improved solid waste disposal practices and procedures.	1	2	3	4	5
R		1	2	3	4	5
S		1	2	3	4	5
T		1	2	3	4	5

* **Additional information for Item "J" above.** If you selected "J" as a "Very Important" issue, please **list any species you think need better protection**:

____

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~ 2 ~

❸ Environmental Sites or Areas of Most Concern to Anegadians

Profile researchers would also like to know about which **natural sites or areas are of most concern to Anegadians**. List on **Table 2** those sites or areas that you think should be protected, including not only natural sites or areas but also sites of historical or cultural interest. You may also include sites already protected like the Ramsar site.

For each site or area you list below (Column 1), also tell us how you would rank the current condition of the site (Columns 2-4), and what issues you think are important to providing protection for the site (Column 5).

TABLE 2.

Indicate Sites or Areas Needing Protection on Anegada	Site/Area Condition (check one box per site)			Issues Important to Providing Protection for the Site or Area
	Pristine	Moderately Disturbed	Severely Damaged	

❹ Development Issues

One of the purposes of the *Environmental Profile* is to help BVIslanders understand how they want their islands to grow and what they want to protect. In item 3 above, we asked about protected area priorities, and now we would like to ask you about development in Anegada.

(1) Since the 1960s, various development schemes and plans have been proposed for Anegada. Are you aware of **prior development plans for Anegada**? ☐ YES ☐ NO

(2) If yes, which development proposal(s) or plan(s) do you remember? ______________________________

____

____

(3) Most development proposals and plans for Anegada have ***not*** been successfully implemented. Why do you think this is? ____

____

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~ 3 ~

(4) **How would you like Anegada to develop in the next ten years?** We have listed some options in **Table 3** below. Please rank each (by circling the number you feel most accurately describes the importance of the option) and then add (and rank) any other development activities you would like to see pursued for Anegada in the next decade.

TABLE 3.

		Not Important				Very Important
A	More resorts and larger hotels.	1	2	3	4	5
B	More guesthouses and smaller hotels.	1	2	3	4	5
C	More facilities to attract overnight visitors.	1	2	3	4	5
D	More facilities to attract yacht-based visitors.	1	2	3	4	5
E	Improved transportation options from Tortola.	1	2	3	4	5
F	Improved transportation options from Virgin Gorda.	1	2	3	4	5
G	Additional amenities to attract and interest visitors.	1	2	3	4	5
H	More camping opportunities for visitors.	1	2	3	4	5
I	Expanded marine recreational opportunities.	1	2	3	4	5
J	Opportunities for eco-tourism focused on natural sites and protected areas.	1	2	3	4	5
K	More community parks and recreational sites.	1	2	3	4	5
L	Expansion of the port facilities.	1	2	3	4	5
M	Expansion of the airport facilities.	1	2	3	4	5
N	Pursuit of renewable energy opportunities.	1	2	3	4	5
O	Improved solid and liquid waste disposal.	1	2	3	4	5
P	More residential housing.	1	2	3	4	5
Q	More light industry options.	1	2	3	4	5
R		1	2	3	4	5
S		1	2	3	4	5
T		1	2	3	4	5
U		1	2	3	4	5
V		1	2	3	4	5
W		1	2	3	4	5
X		1	2	3	4	5
Y		1	2	3	4	5
Z		1	2	3	4	5

~ 4 ~

(5) Select any three items you have **ranked as a "4" or "5" on Table 3. Place those three items in Column 1 of Table 4.** In Column 2, list the major issues you think are associated with the pursuit of each development option selected, with the most important Issue first and least important issue last.

TABLE 4.

HIGH-RANKED DEVELOPMENT OPTIONS **List three items ranked as "4" or "5" on Table 3.** (*These are development options you have ranked as most important for Anegada.*)	**ISSUES AFFECTING IMPLEMENTATION** *List Issues associated with development options you have ranked as of highest importance. These are issues you think will most affect implementation (positively or negatively) of the development options you have selected. The most important issues should be listed first.*
	1.
	2.
	3.
	1.
	2.
	3.
	1.
	2.
	3.

❺ **Livestock**

On Anegada, the livestock population is primarily comprised of goats, sheep, cattle, and a small number of donkeys. For the most part, livestock is free-roaming and feral and becoming increasingly wild. The following questions ask you about the livestock situation on Anegada.

(1) How do you view the presence of livestock on Anegada? Check all that apply.

- ☐ Part of Anegada's cultural heritage
- ☐ A source of food
- ☐ Population size is about right
- ☐ Population size is getting out of control
- ☐ A general nuisance to neighbours
- ☐ Contribute to property damage
- ☐ Contribute to damage of vegetation
- ☐ Harmful to wildlife (loss of vegetation for food & habitat)

~ 5 ~

(2) **Do you think livestock species are a nuisance or cause damage to property and the environment for Anegada?** Please categorise the following species by checking one of the three boxes for each species.

TABLE 5.

	Not a Nuisance No Damage	Moderate Nuisance and Damage	Major Nuisance and Damage
Goats			
Sheep			
Cattle			
Donkeys			

(3) **Do you think free-roaming and feral livestock are a problem for Anegada?** Check only one box.

- ☐ Yes, a big problem
- ☐ Yes, but only a slight problem
- ☐ No, not really a problem
- ☐ No, not a problem at all
- ☐ Not sure

(4) **Please check one or more boxes to describe the type of problems you think loose livestock can cause.**

- ☐ Destroy crops, damage gardens
- ☐ Road hazard
- ☐ Damage and pollute water catchments and ponds
- ☐ Overgraze and trample natural habitats and wildlife
- ☐ Other (please identify): ______________________
____
____

(5) **Who should be responsible for sorting out the issue of free-roaming livestock on Anegada?**

☐ Livestock owners ☐ Community ☐ Local police ☐ Government

(6) **Do you own livestock?** ☐ **YES** ☐ **NO**

(7) ***If yes to question 6*, which type of livestock do you own and how many of each?** (Complete Table 6)

(8) ***If yes to question 6*, are some of your livestock used for meat consumption?** (Complete Table 7)

(9) ***If yes to question 6*, are most of your livestock confined within your property, or are most of your livestock free-roaming?** (Complete Table 8)

TABLE 6.

[Check appropriate box for # owned]	1-10	11-20	21-30	More [Indicate #]
Goats				
Sheep				
Cattle				
Donkeys				

TABLE 7.

[Check appropriate box]	Yes, Used for Meat Consumption	No, Not Used for Meat Consumption
Goats		
Sheep		
Cattle		
Donkeys		

TABLE 8.

[Check appropriate box]	Confined to Owner's Property	Free Roaming and Feral
Goats		
Sheep		
Cattle		
Donkeys		

~ 6 ~

❻ Fishing

***Only* answer the following questions if you commercially fish in Anegada.**

(1) ☐ Are you a seasonal fisher?
☐ Are you a part-time fisher year-round?
☐ Are you a full-time fisher?

(2) Where do you primarily fish? (Check all that apply)
☐ NW Quadrant ☐ NE Quadrant ☐ SW Quadrant ☐ SE Quadrant ☐ Horseshoe Reef

(3) Do you use traps for fishing? ☐ **YES** ☐ **NO**
If you use traps on a regular basis, please estimate the number of traps you use on a regular basis.
☐ 1 dozen or less ☐ 2 dozen ☐ 3 dozen ☐ more than 3 dozen

(4) Do use other methods of fishing? (Check those that apply)
☐ Seines & Nets ☐ Diving ☐ Snorkeling ☐ Hand Collecting ☐ Offshore Long Line Fishing
☐ Other: ______________________________

(5) What is the usual composition of your catch? (Check all that apply)
☐ Grouper ☐ Snapper ☐ Lobster ☐ Conch
☐ Other (identify): ______________________________

(6) Where do you usually sell your catch? (Check all that apply)
☐ Anegada Restaurants ☐ Anegada Hotels ☐ Anegada Community ☐ Tortola
☐ Anegada—Other Describe: ______________________________
☐ Other markets not indicated above Describe: ______________________________

(7) During the last decade, have you noticed a decline in the catch of grouper? ☐ **YES** ☐ **NO**
During the last decade, have you noticed a decline in the catch of snapper? ☐ **YES** ☐ **NO**
If you answered "*yes*" to either of the last two questions, to what do you attribute this decline? (Check all that apply)
☐ Diminishing coastal water quality ☐ Increased recreational fishing by off-islanders
☐ Increased fishing by Anegadians ☐ Coastal development and loss of wetlands (ex., mangroves)
☐ Loss of traps to marine recreational users
☐ Other ______________________________

(8) Are you optimistic about the future of the Anegada fishery? ☐ **YES** ☐ **NO**
If you are ***not*** optimistic, what are some of the problems confronting the fishery?
1. ______________________________
2. ______________________________
3. ______________________________

What could be done to improve the fishery?
1. ______________________________
2. ______________________________
3. ______________________________

~ 7 ~

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As the Foundation's senior natural resource analyst, Mr. Bacle has facilitated and coordinated IRF's applied research and field activities for over 15 years, primarily in the U.S. and British Virgin Islands. A Canadian national with a degree in geography from the University of Ottawa, Mr. Bacle has been affiliated with IRF since 1986, where he has specialised in resource management studies, environmental impact assessments, endangered species research, air-photo interpretation and natural resource mapping.

For the *Anegada Environmental Profile*, Mr. Bacle is lead author of Chapter 1 (Introduction to Anegada) co-author of Chapter 4 (Terrestrial Biodiversity), co-author of Chapter 7 (Pollution Threats), and a co-author of Chapter 9 (Directions for the Future).

A national of Antigua, **Kevel Lindsay** is a trained forester and biologist, with a degree in biodiversity conservation from Columbia University. He has been attached to the Foundation's regional Biodiversity Conservation Programme (initially based in Antigua) since 1995, currently serving as the programme's regional coordinator. Mr. Lindsay is an expert on Caribbean plant ecology and faunal species, particularly birds and bats. He is a principal contributor to several key biodiversity planning documents prepared by the Foundation, including a vegetation classification system for Antigua and Barbuda, St. Kitts and Nevis, and the U.S. Virgin Islands.

Mr. Lindsay is the principal scientist for the biodiversity components of the BVI Environmental Profile Programme. For the *Anegada Environmental Profile*, Mr. Lindsay is the lead author of Chapter 4 (Terrestrial Biodiversity) and a co-author of Chapter 9 (Directions for the Future).

The president of Island Resources Foundation, **Bruce Potter**, is an expert on small island sustainable development and the principal architect of the Foundation's capabilities in environmental information management. Mr. Potter has 40 years of experience—in both the public and private sectors—in international development, economic development planning, information system design and implementation, project management, and institutional development.

Mr. Potter was a member of the IRF profile team for eight Eastern Caribbean Environmental Profiles, providing economic profiles for several of the targeted islands. He serves as the information technology manager for the BVI Environmental Profile Programme and is the moderator of the project's blog site initiated for the *Virgin Gorda* and *Anegada Environmental Profiles*.

Lloyd Gardner is president of the Foundation for Development Planning. An environmental planner from Jamaica and now resident of the U.S. Virgin Islands, he has more than 30 years of experience in environmental management throughout the Caribbean. He participated in the preparation of the Jamaica Country Environmental Profile, authored the National Environmental Management Strategy for Montserrat and has conducted reviews of national environmental strategies for several countries Mr. Gardner was a member of IRF's Sandy Cay project team for over four years, with specific responsibility for preparing the *British Virgin Islands Protected Areas System Plan, 2007-2017*.

For the *Anegada Environmental Profile*, Mr. Gardner authored Chapter 8 (Protected Areas and Resource Conservation).

Clive Petrovic is a BVI-based marine scientist who formerly headed the Applied Marine Studies Centre at the BVI's H. Lavity Stoutt Community College. Additional BVI experience includes yacht chartering and nautical tourism. He currently heads Econcerns, which has completed Environmental Impact Assessments for several proposed development projects in the BVI. Mr. Petrovic was a member of the IRF profile team that prepared the *Jost Van Dyke* and *Virgin Gorda Environmental Profiles*.

For the *Anegada Environmental Profile*, Mr. Petrovic prepared Chapter 5 (Coastal and Marine Resources).

Cynthia Rolli is an environmental and mitigation planning consultant with considerable BVI experience in all phases of environmental impact assessment, disaster mitigation and planning, and GIS applications. Ms. Rolli was instrumental in drafting the earliest EIA guidelines for the BVI Territory. She has worked as a physical planner with the BVI Department of Town and Country Planning and a senior technical planning manager in the BVI Department of Disaster Management.

For the *Anegada Environmental Profile*, Ms. Rolli served as the project's specialist for geospatial data and, with deputy project director Jean-Pierre Bacle, was responsible for preparation of profile mapping instruments. Ms. Rolli also prepared Chapter 3 (Natural Hazards and Environmental Risks) for the *Anegada Environmental Profile*.

Dr. Michael Kent is affiliated with the Virgin Islands Studies Programme at H. Lavity Stoutt Community College and is a leading expert on Virgin Islands history about which he has written extensively. He is editor-in-chief of *the Journal of Virgin Island Studies*, published by HLSCC. Dr. Kent was a member of the IRF team that prepared the *Jost Van Dyke* and *Virgin Gorda Environmental Profiles*.

For the *Anegada Environmental Profile*, Dr. Kent is the author of Chapter 6 (Historical Heritage Resources) and a contributor to Chapter 1 (Introduction to Anegada), where he provided an overview of the historical development of Anegada.

Charlotte McDevitt is currently the Executive Director of Green VI, a not-for-profit organisation based in the BVI. She completed her Master's Degree in Industrial Administration in 2008, and her dissertation focused on how the BVI can reduce waste and improve resource management. Before relocating to the Caribbean ten years ago, Ms. McDevitt worked for the City of Cape Town, developing strategies to reduce litter, illegal dumping, and waste in landfills.

For the *Anegada Environmental Profile*, Ms. McDevitt was co-author of Chapter 7 (Pollution Threats), with responsibility for the solid waste management sub-section.

Rosemary Delaney-Smith serves as the community coordinator and local liaison for the BVI Environmental Profile Programme, building on her experiences as community coordinator for the "Jost Van Dyke Community-based Programme to Advance Environmental Protection and Sustainable Development," a project that included preparation of the *Jost Van Dyke Environmental Profile*. With a Master's Degree in Marine Resources and Environmental Management from the University of the West Indies, Cave Hill campus in Barbados, Ms. Delaney-Smith has also served as environmental education officer of the BVI National Parks Trust and as fisheries officer with the BVI Department of Conservation and Fisheries.